

CHAPTER 7: Flooded by herring:

**Downs herring fisheries in the southern North Sea during
World War II**

CHAPTER 7: FLOODED BY HERRING: DOWNS HERRING FISHERIES IN THE SOUTHERN NORTH SEA DURING WORLD WAR II

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Abstract

During the Second World War (1939-1945) herring fishing effort in the North Sea was greatly reduced. The traditional autumn herring fisheries by Belgian fishers on the Flemish banks around the spawning areas in the southern North Sea however, continued during WWII. Data presented here show a 10-fold increase in the Belgian 'autumn spawning herring' catches and a 5-fold increase in landings per unit of effort of Downs herring during WWII. It is argued that these increased catches are explained by a combination of factors including the sustained effect of a major increase in catch power, the effects of strong pre-WWII year classes and the effects of decreased fishing mortality during the 6-years cessation in fishing on the herring feeding grounds in the central North Sea and in the English Channel. The data and information presented here represent a period in which a gap exists in time-series of herring catches from the North Sea and in the stock assessment time series which currently go back to 1947. The results are also discussed in the context of the recovery of the autumn-spawning Downs herring. The recovery of stock components and the spatial diversity in the spawning areas of the herring stock in the North Sea is a crucial aspect of fisheries management that aims to enhance stock resilience to changes in environmental conditions and direct effects of anthropogenic activities.

Key words:

Downs herring, autumn-spawners, North Sea, Second World War,

7.1 INTRODUCTION

In the 20th century, the Belgian 'spent herring' fisheries were seasonal and took place on the Flemish banks in the southern North Sea between November and March, with peaks in January (Gilson 1931-1939, Gilis 1942-1962). With the large-scale introduction of engine-powered vessels between the First World War (WWI 1914-1918) and WWII, Belgian herring fisheries switched from using driftnets to otter trawls as the main fishing gear (Lescrauwaet et al. 2012). In the years before WWII, Belgian fishers landed approximately 40,000 tonnes (t) of fish and other seafood per year, a quarter of which consisted of herring. Herring was fished mainly in the coastal waters of the Belgian part of the North Sea and across the border in French waters (spent herring), while smaller quantities were also caught in the southern North Sea and Fladen (East of Scotland) (Lescrauwaet et al. 2010a).

In Belgium, WWII started on May 10, 1940 and ended on October 1, 1944. At the outbreak of WWII, the Belgian fleet consisted of 460 motor trawlers – 201 had engines less than 80 PK (Dutch Horse Power) – and 14 steam trawlers. Most of the fleet fled to the UK or was set to service military purposes and no fishing took place from the end of 1939 (Lescrauwaet et al. 2012). In 1941 a limited part of the fleet was allowed to fish under close surveillance by the occupying forces (De Mulder 1984). In practice the 'coastal waters' was the only fishing area to which access for fishing was granted after 1940 and before 1945. This area is not distinguished separately as one of the ICES reporting/fishing areas and landings from coastal waters are reported to ICES as part of 'Southern North Sea' (ICES area IVc). Local historical sources mention how unprecedented catches of 'spent herring' in Belgium during WWII provided protein that saved the Belgian population from starvation and how processing and distribution systems in Belgium were not able to cope with these unexpected catches in 1942-1943 (Henau 1983, Balthazar et al. 1984). Unusually high herring catches were also reported for the ports of Dunkerque and Gravelines in the north of France where, in spite of WWII restrictions on fishing effort, Gravelines increased landings of herring by 1028% in 1942 compared to 1938 just before WWII (Oddone 1987). Few sources however contain detailed quantitative information on landings, CPUE of the fisheries, or age structure of herring catches during WWII.

The North Sea herring (*Clupea harengus* Linnaeus 1758) is a demersal spawner and most herring spawn for the first time at the age of three or four years. Herring stocks in the North Sea are generally described in terms of four spawning components: the Shetland/Orkney, the Buchan, the Dogger or Banks, and the Downs herring, each with different growth rates, migration routes, and recruitment patterns (Bjerkas 1917, Cushing and Bridger 1966, Harden Jones 1968). These spawning components migrate to their separate spawning areas to spawn at different times (Maucorps 1969, Heath et al. 1997, Corten 2001): the Orkney-Shetland herring spawn off the Shetlands (August-September), the Buchan off the eastern Scottish coasts and the Dogger or Bank herring off the English Coasts in the central North Sea (September-October), while the Downs herring spawns in the English Channel and the southern bight of the North Sea (November-January) (Figure 7.1.). After hatching, the larvae of different components drift in a counter clock movement towards nursery areas in the central North Sea (Burd 1962, Maucorps 1969).

The spawning components also face different fishing pressures in their respective spawning or resting (post-spawning) areas. In each annual cycle, adult Downs herring recovered on the Flemish banks after spawning in autumn and before returning to the northern feeding grounds in spring where large drift net fisheries take place on mixed schools of the different stock components. The traditional driftnet fisheries in Belgium (pre-20th century), later replaced by trawl fisheries (after WWI), were based on the knowledge of the location and timing of these concentrations of spent herring. The commercial herring trawl fisheries were conducted with the otter trawl, and fishing trips were one day of length as fishers would return to the nearby ports the same day to land their fresh catches. The fisheries would start off each year to the west of the Belgian coastline or even just across the border in the territorial sea of France and move eastwards along the coast as the season progressed, targeting the eastbound schools of spent herring (Gilson 1939).

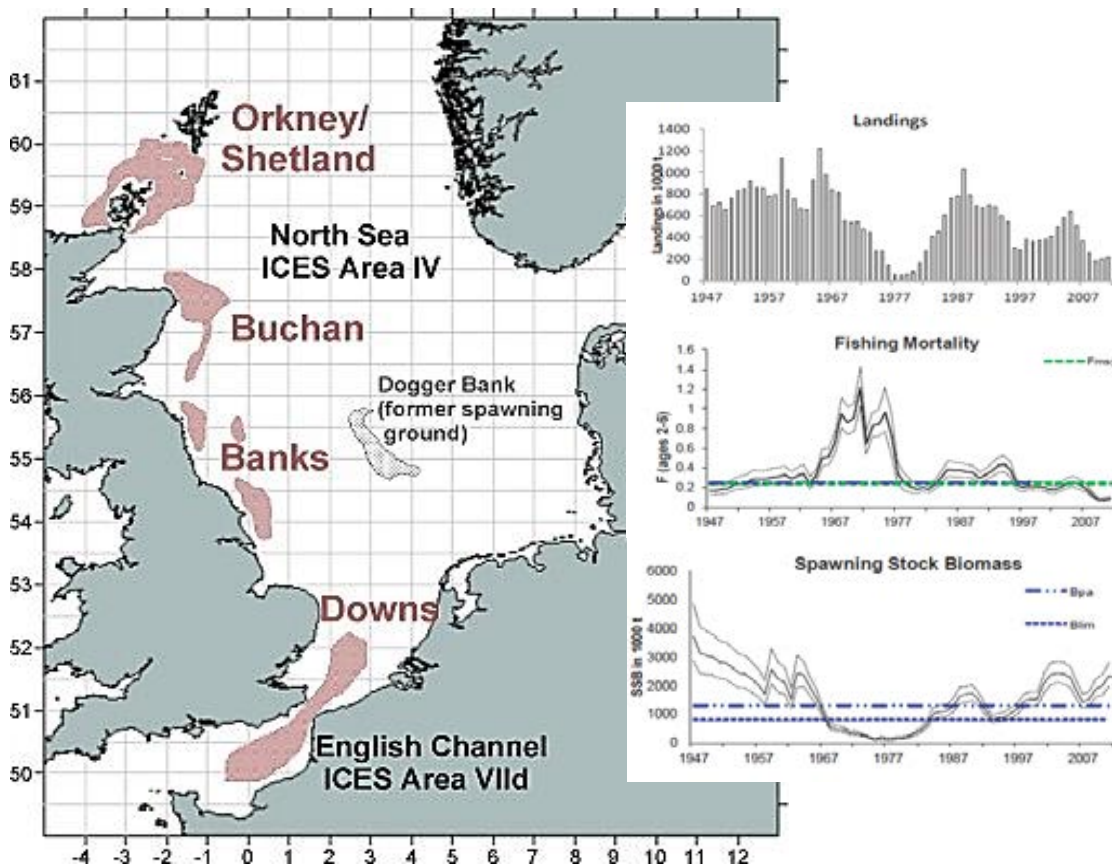


Figure 7.1.: North Sea herring: Generalised major spawning grounds (after Dickey-Collas 2010). The inset shows the time-series of the Landings (top), Fishing Mortality (middle) and Spawning Stock Biomass SSB (bottom) of herring in subarea IV and Divisions IIIa and VIId (North Sea autumn spawners) source: ICES HAWG 2012.

Before WWII, reported annual landings of herring fisheries fluctuated around 300,000-500,000 t (ICES landing statistics Fishstat). This compares to the minimum acceptable spawning stock biomass B_{lim} that was set at 800,000 t at the end of the 20th century (Dickey-Collas et al. 2010, ICES Advice 2012). During WWII, the larger fishing nations in Northwest Europe were forced to drastically reduce their fishing effort in the North Sea because of the war hazards (Baerends 1947, Gilis 1947) and because many fishing vessels were required to serve in the naval forces. The large-scale (drift net) fishery for Atlantic herring on adult feeding grounds was one of the affected commercial fisheries in the North Sea.

In the current paper we present unpublished data collected during WWII on the landings of Atlantic (Downs) herring in the coastal waters of Belgium and the North of France. The wide-scale effort to reconstruct and integrate historical fisheries data (HiFiDatabase) in Belgium uncovered previously neglected paper copies of official statistical tables for the WWII period (Lescrauwaet et al. 2010a) and a description of material and methods for the reconstruction of time-series is included in Lescrauwaet et al. (2010b). These data collected during the WWII period of restricted fishing were previously unknown in national and international reporting. The data refer to the commercial fishing fleet's activities in coastal waters and provide detailed accounts of landings by species, by month, by fishing area and by port of landing during a period for which limited or no information exists in neighbouring countries in the North Sea. Data on the small-scale fisheries (*strandvisserij*, or beach-based fisheries) for herring from small open boats with passive gear are also included in the reconstruction. The data presented here refer to a period in which a gap exists in time-series of herring catches and herring stock assessments from the North Sea. We explore potential causes for the sudden increases in

catches of the Downs herring in its spawning areas by analysing data on catches, landings per unit of effort LPUE, and age structure of the catches from the commercial Belgian herring fishery.

7.2 MATERIALS AND METHODS

The data presented here are obtained from different sets of data sources. The first data were obtained from official national landing statistics and were used to reconstruct the total landings of herring (t) and the effort by the herring fisheries (number of vessels, days at sea, engine power HP), as well as to calculate the LPUE. In Belgium, a centralised statistical data collection system on sea fisheries was in place by 1929, which collected monthly value and composition of landings by species in the 4 fishing ports in Belgium (Lescrauwaet et al. 2010a). Belgian autumn spent herring fisheries were located each season in the same restricted area of high concentrations of herring which congregated after spawning, and within a restricted season of 3 months time. A second source of data was the scientific reports and unpublished manuscripts of Gilson (1931-1939) and Gilis (1942-1962) which contain detailed annual accounts of the seasonal 'spent herring surveys' (November-March). The time-series covers 31 years of systematic monitoring of the commercial fleet activities and the biological conditions of the herring concentrations in the 'Sandettie area' during each winter from 1930 to 1960. The Sandettie area makes reference to the sandbank of the same name. It extends 15 nm from the shoreline, stretching from the northern French coasts along the Channel towards the Belgian-Dutch border, and it corresponds to the broader spawning area of the Downs herring component. Between 1930 and 1952, these surveys were conducted from the second half of December - when most of the herring had spawned - to the end of the spent herring season (March). From 1953 onwards, the surveys were extended to cover November-March. All original survey reports were inventoried and described in the Integrated Marine Information System IMIS of the Flanders Marine Institute VLIZ, and made available in full text (pdf). The list of herring-related publications by Charles Gilis and by Gustave Gilson are disclosed on the IMIS webpages.

Finally, for the reconstruction of the time-series of Belgian herring landings for the 18th -20th century, a thorough literature study was conducted and the City archives of Oostende, Brugge and Antwerpen and the State Archives in Brugge and Brussels, were consulted. Since fish landings in the 18th and 19th century were often reported in ancient units of weight or in economic values, the reported commercial value of landings were standardized and reconverted to units of weight based on equations of value per kg obtained from literature references for that period (Cloquet 1842, De Zuttere 1909). The sources for this reconstruction are available from the supporting material Table II. For the sake of completeness, it should be noted that accidentally, minor proportions of sprat may have been caught within the herring schools, and erroneously reported as herring. However, sprat and herring were reported separately at least since 1929.

To provide a proxy of the herring concentrations and to allow for comparison between consecutive seasons, the landings of spent herring were divided by the number of fishing days and total developed horsepower HP and expressed as commercial landings per unit of effort (LPUE in kg/day*HP). To explore whether increases in LPUE were due to the presence of strong year classes incorporating into the spawning population from age 3 onwards, we reconstructed the age structure of spent herring landings in post-spawning areas off the Belgian coast from 1930 to 1960 based on the data reported by Gilis (1942-1962).

Mean length of herring specimens calculated per 1000 sampled herring for the period 1930-1939 and for the second period 1941-1950, is included in the result section.

To explore the effect of the reduced fishing effort on the adult herring feeding grounds during WWII and its possible causal relation with increased catches in Belgium, catch ratios were calculated from the age structure. The catch ratios measure the rate of decrease of a catch of one age-class over two successive years, for all fully recruited ages. From the catch ratio, mean total mortality Z ($Z = \text{Fishing mortality } F + \text{Natural mortality } M$) was

calculated for the grouped ages 3-9 years ($a=3-9$). Natural mortality M was assumed to remain stable, and changes in Z to be a reflection of changes in fishing mortality F .

7.3 RESULTS

Fishing effort and spent herring catches during WWII

The data collected from the statistical tables show that the 10,878 t of landings obtained from coastal waters in 1939 consisted mainly of sprat (*Sprattus sprattus*) and brown shrimp (*Crangon crangon*). No data are available for 1940 which confirms sources stating that no fishing could take place that year (De Mulder 1984). In 1941 the total landings of 3,867 t consisted mainly of brown shrimp but important herring catches were landed in December (Figure 7.2.). The year 1942 benchmarked the first of four consecutive years 1942-1945 with unprecedented herring catches: respectively 18,470t (or 80% of the total landings), 58,080t (93%), 49,002t (97%) and 31,958 t (74% herring). The monthly landings available for this period are represented in Figure 7.2. No monthly landing statistics were available for 1945.

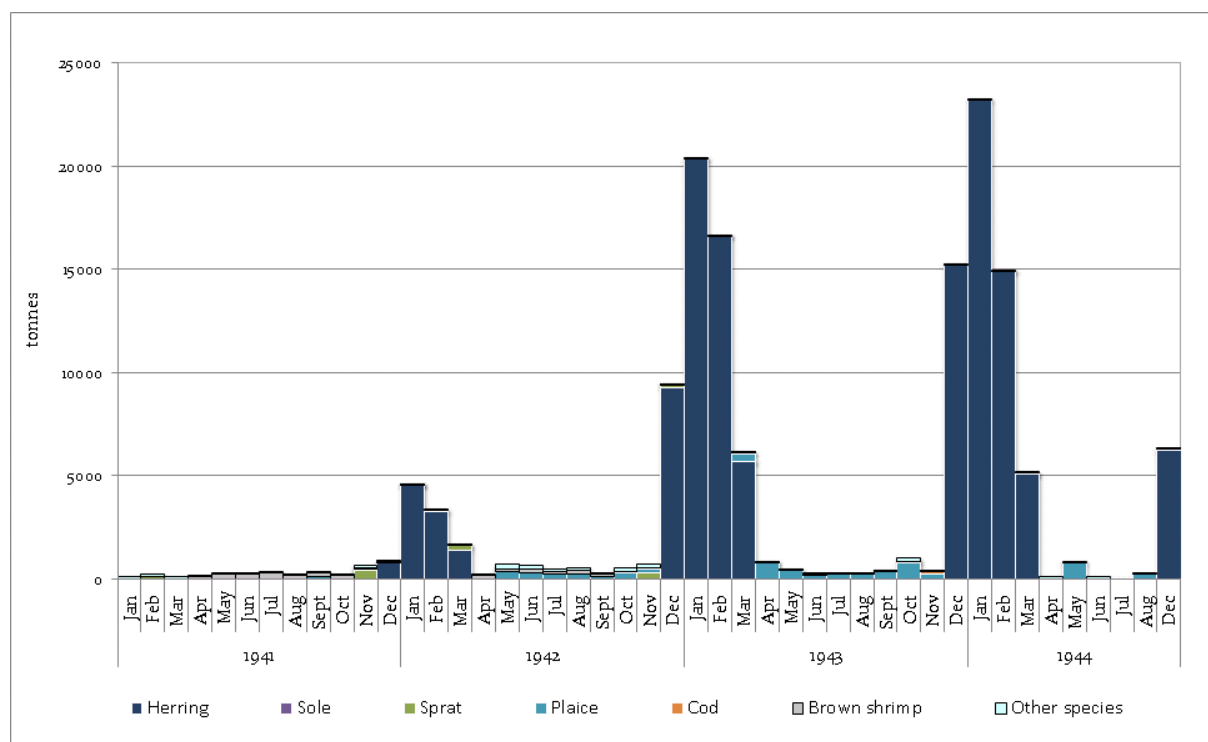


Figure 7.2: Monthly distribution of fish species landings from the (restricted) fishing activities in Belgian coastal waters during the WWII by Belgian fishermen, 1941-1944 (no monthly data for September-November in 1944).

Expressed as 'spent herring seasons' (November-March), the catches were rearranged and compared to Gilis (1947a) who reported aggregated landings of spent herring per 'herring season' (supporting material Table I).

Although commercial catch per unit of effort (CPUE) is widely used as an index of abundance, the factors that may potentially bias this index are well documented (Hilborn and Walters 1992). The present study – in particular the years of the WWII - covers a delimited and well-defined area and period during which fishing gear and bycatch rates are expected to have remained relatively stable. In the years after the WWII, the

average engine power, technological developments (e.g. fish finder) and other factors that positively affect catchability, took a further increase. After 1950, the more selective pelagic trawl was increasingly used for herring and sprat fisheries (Gilis 1962).

The landings of spent herring from the Sandettie area increased from 10,031 t in the season 1941-1942 to 58,120 t in 1943-1944 (Figure 7.3.). The number of trawlers fishing during daytime in the Sandettie area increased from 161 to 337 in the same period. After the season 1944-1945 both the landings and the LPUE declined quickly, although the number of trawlers dedicated to the seasonal spent herring fisheries remained high (346) until 1946-1947, i.e. two seasons after the LPUE had declined by >60% from 160 kg/day*HP to 50kg/day*HP. The average LPUE for the 4 herring seasons during WWII (1941-1945) was 143 kg/day*HP compared to an average of 26 kg/day*HP for the 4 herring seasons 1949-1953.

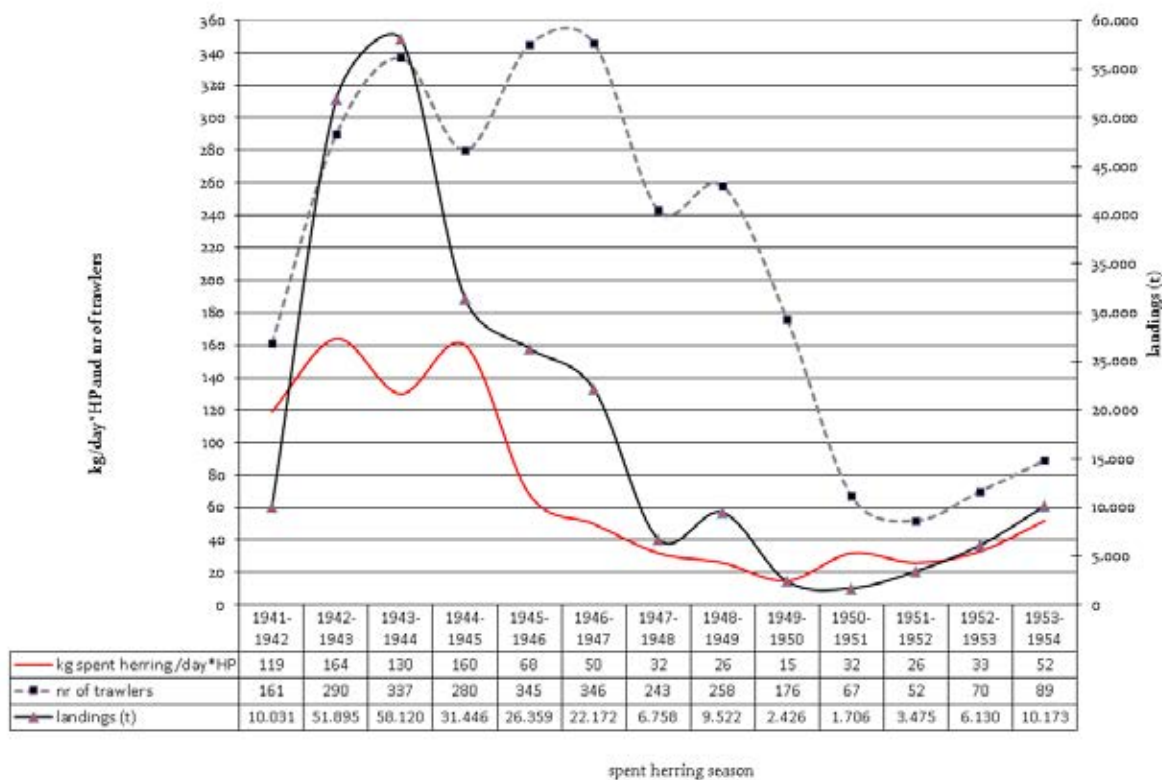


Figure 7.3: Landings (kg) per unit of effort (day*HP) of spent herring fisheries for the seasons 1941-1942 to 1953-1954.

Biological parameters of the spent herring catches during WWII

Large year classes can dramatically change the dynamics of a herring population, as was shown for the year classes 1998 and 2000 (Dickey-Collas et al. 2010). Year-class strength in the North sea autumn spawning herring stock may be determined by larval survival, and some of the hypotheses suggested by Payne et al. (2009) explore the effects of local changes in temperature, salinity, water column stability, turbulence, primary production and zooplankton community, on the survival rate of herring larvae (Fassler et al. 2011).

The data represented in the age structure graph (Figure 7.4.) show that year class 1936 and 1938 are strong year classes present throughout the period under study that can be traced through the cohorts e.g. as the age 3 and age 5 groups in 1941 in Figure 7.4. (for numbers see supporting Table III), before they combine in age

classes 10+ in 1947. The age structure in Figure 7.4. shows that the increased LPUE during WWII can at least in part be explained by an increased proportion of older and larger specimens of spent herring. In fact, during WWII the age classes 6 and older represented approximately 80% (1944) of the catch composition whereas after WWII, these groups would represent around 40% of the observed frequencies and in 1959 - in the absence of any of the war year classes - they composed less than 5% of the catch.

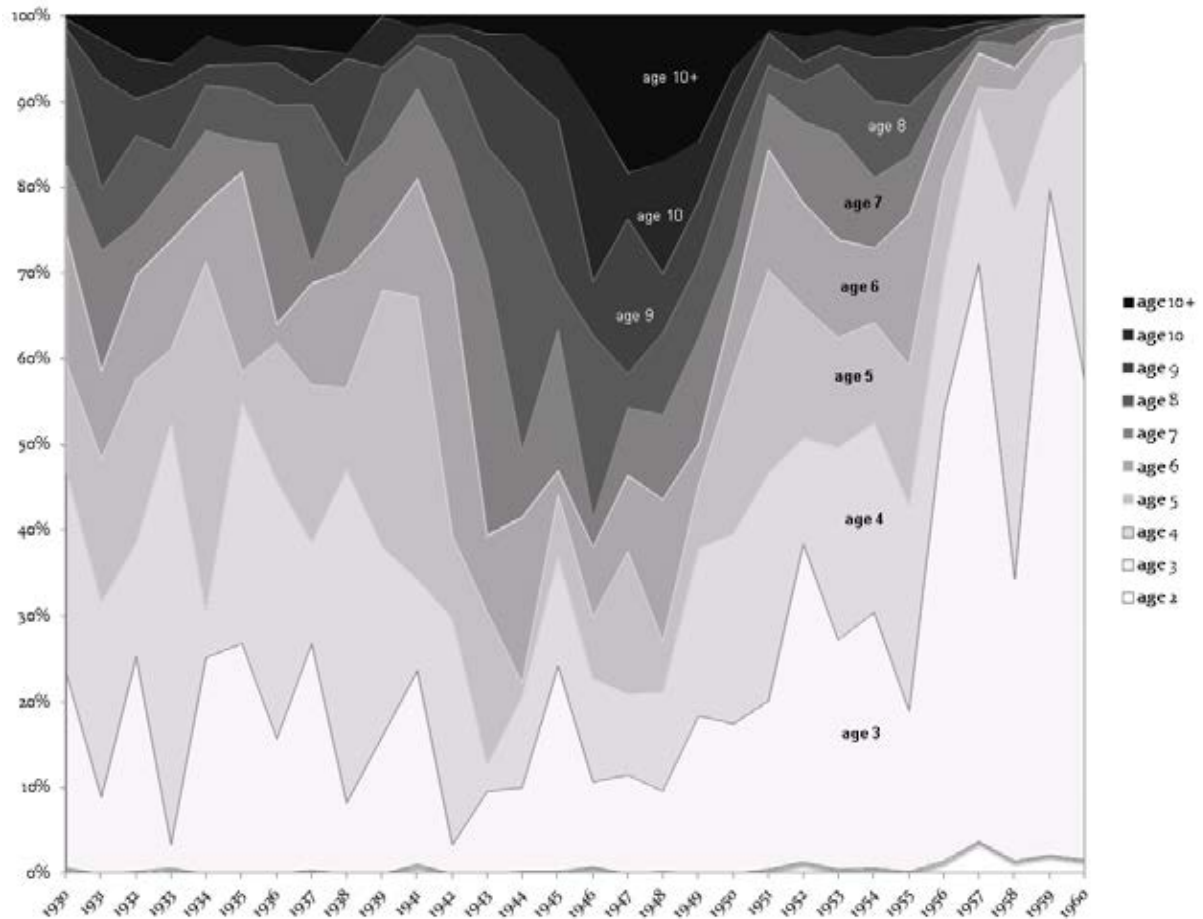


Figure 7.4.: Reconstruction of the age structure of sampled spent (Downs) herring catches from 1930-1960, by the Belgian sea fisheries in post-spawning areas off the Belgian and northern French coasts. Based on data reported by Gilis (1942-1962).

Interestingly, the effect of strong year classes also seems to have determined this ratio between age groups 6 and older, and those younger than 6, e.g. in 1931, 1953 and 1955. The effect of the latter however coincides with a modest increase in LPUE if compared to the increase in LPUE during WWII. Based on the frequency distribution of age classes in the sampled catch, Gilis (1962) reported another 14 stronger year classes in the period 1930-1960.

Based on 31 years of sustained morphological studies of catch samples, Gilis (1962) observed a significant increase in the average length by sampled age classes of spent herring catches from the commercial fleet over the three decades, in particular in the third decade from 1951-1960. This increase in length and size at age (in mm) by decade evidences an increase in size at age in the last decade (Table 7.1.; annual data in supporting material Table IV). Gilis (1962) also reported increases in the size at age for herring for the last decade 1951-1960, based on the observed length and growth rings of scales. Mean length per 1000 sampled herring increased from 245,5mm before WWII (1930-1939) to 257,6mm during the period 1941-1950 (supporting

material Table IV). In spite of the reported increase in size at age of individual herring in the period 1951-1960, the mean length of the sample in that period decreased to 255,1mm. The latter is explained by the decrease in the proportion of older herring compared to the decade 1941-1950.

Table 7.1.: Mean length (mm) by sampled age classes, and growth in mm between consecutive years of age (between brackets) for three consecutive decades 1930-1960. Source: Gilis 1962.

Decade	Age 3 years	4 years	5 years	6 years	7 years	8 years
1930-1939	219	235 (+16)	248 (+13)	257 (+9)	262 (+5)	266 (+4)
1941-1950	230	247 (+17)	256 (+9)	263 (+7)	267 (+4)	271 (+4)
1951-1960	239	259 (+20)	272 (+13)	278 (+6)	284 (+6)	286 (+2)
1930-1960	229	247 (+18)	259 (+12)	266 (+7)	271 (+5)	274 (+3)

Total Mortality

To look at the effect of the reduced fishing effort on the adult herring feeding grounds during WWII and its possible causal relation with increased catches in Belgium, catch ratios were calculated from the age structure (Figure 7.5.).

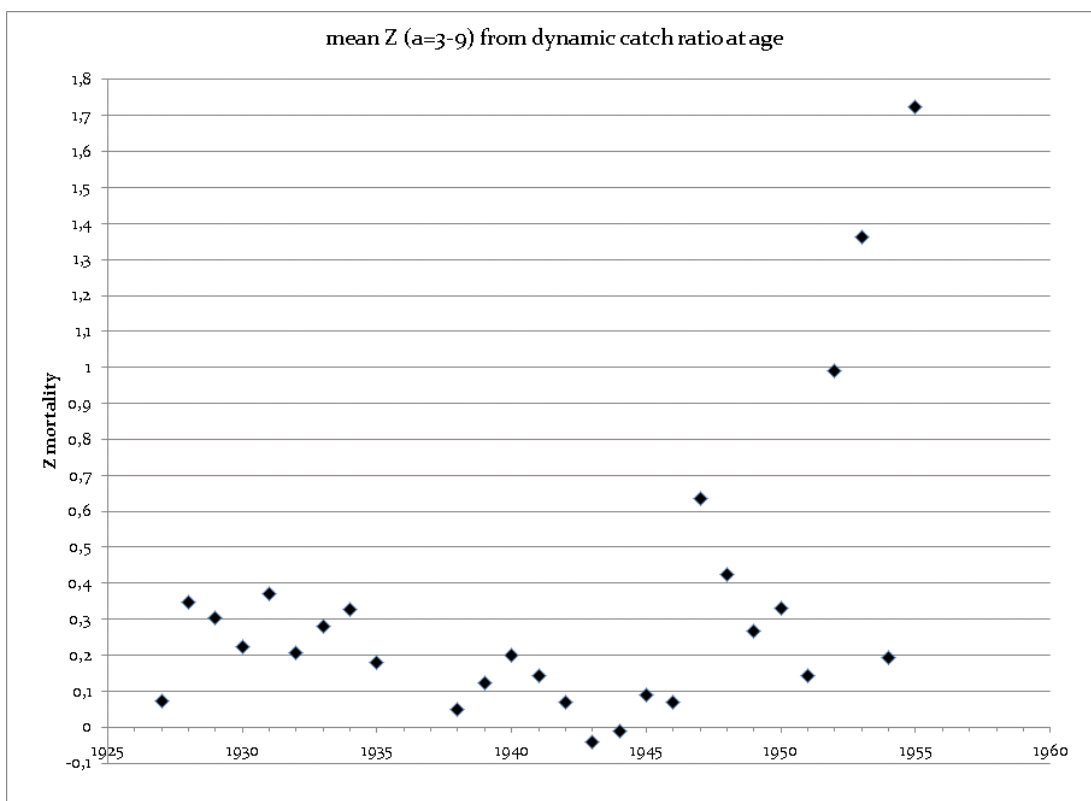


Figure 7.5: Mean mortality Z of spent Downs herring for grouped ages 3-9 years, calculated from dynamic catch ratio at age. Based on data reported by Gilis (1942-1962).

Although patterns are not clearly identified, comparison of mean mortality Z over time in Figure 7.5. suggests a decrease in total mortality Z for the cohorts reaching age 3 up to age 9 during WWII. Between 1940 and 1943 lower Z values can be observed. The lower Z values start in 1941 (which may reflect the reduced fishing pressure on year class 3) and continues to decrease up to 1943 (when year-classes 3 up to 6 are incorporated in the pooled age group 3-9). The trends in Z in the WWII period may be explained by the cumulative effect of decreasing fishing pressure on an increasing number of age

classes. After the 1950s, when the industrial herring fisheries started at a larger scale, the Z values show a steep increase (Figure 7.5.)

7.4 DISCUSSION

Various authors studied the effects of WWII on fish stocks and their recovery during and after WWII. The relation between the reduced fishing effort and the increase in mean sizes and catch rates of haddock as compared to pre-war times was explicated by Baerends (1947). Similar conclusions were drawn for the demersal fisheries off the UK and Dutch coasts and the Danish seine-net fishery, indicating an increase in stock density of three times the pre-war level (Baerends 1947). The effects of WWI and WWII on increases in catch per unit of effort of North Sea plaice (*Pleuronectes platessa*) were illustrated by Rijnsdorp and Milner (1996). Graham (1949) and Wimpenny (1953) examined the effects of WWII on plaice populations in the Southern North Sea. Beare et al. (2010) looked at the effects of WWII on gadoid species in the Buchan area (East coast of Scotland) and reported an increase in catch per unit effort CPUE of haddock (*Melanogrammus aeglefinus*) from 11 to 59 kg h⁻¹ of fishing between 1939 and 1945, while the CPUE of cod (*Gadus morhua*) increased nearly ten times from 4 kg h⁻¹ in 1939 to 36 kg h⁻¹ in 1945. Based on an analysis of age structure, Beare et al. (2010) concluded that - if supported by good recruitment - wild fish stocks may respond rapidly and positively to reductions in harvesting rates.

Poulsen (2008) reconstructed herring landings from the North Sea for the Dutch, English, Scottish and Danish fleets between 1600-1860. According to the author, it was not until the introduction of the motor engine after WWI and the increasingly efficient catch technology (purse seine and pelagic trawls) that fishing significantly impacted the reproduction potential of the herring stocks in the North Sea, with catches reaching levels of up to 1,000,000 t per year from a total estimated SSB of 1,500,000 t (Poulsen 2008). The Dutch and UK fleet maintained relatively high catch levels of herring during the first part of WWI (approximately 150,000t in 1915 and 1916) and joint Dutch and UK annual herring catches amounted up to 300,000 t in e.g. 1929 and 1937 (ICES Fishstat) while in contrast, catches dropped to near zero during WWII.

To put the WWII herring landings by the Belgian fleet in a wider historical context, the authors reconstructed the time-series for Flemish herring landings from the North Sea from 1767-2010. The time-series (Figure 7.6.) shows that Flemish herring production fluctuated around 1,000-2,000 t in the 18th and 19th century. The data also suggest that – similar to the findings of Poulsen (2008) - the introduction of engine powered vessels equipped with otter trawls from WWI onwards, may partly explain the unprecedented herring catches during WWII, for Flemish herring fisheries.

A strong increase in catching capacity in the Belgian fleet took place in the inter-war period. Figure 7.6. shows important increases in spent herring catches of up to 18,000 t in the years following WWI with the implementation of new technologies based on engine power. In 1925 about half of the fleet (excluding the smaller open boats) used motor or steam engines as propulsion and by 1929 nearly the entire fleet was motorized (steam or engine) (Lescrauwaet et al. 2012). The otter trawl gradually replaced the traditional drift nets as fishing gear in the first half of the 20th century. Throughout WWII only the otter trawl was used and after 1950 the -more selective- pelagic trawl was the main fishing gear for catching herring.

The North Sea herring stock has shown large fluctuations in spawning stock biomass SSB since its collapse from more than 5 million t in the late 1940s to a low of 50,000 t in the 1970s (ICES HAWG 2012), see also inset Figure 7.1.). In June 1977 a ban was set on directed herring fisheries in the North Sea, which was however not fully respected in the Channel area where smaller quantities of spawning herring were still caught (Dickey-Collas et al. 2010). The ban was lifted in June 1983 and the SSB had partially recovered to 1.8 million t in 2004 (Dickey-Collas et al. 2010). A recent stock assessment (ICES 2012) estimated the North Sea herring SSB is now at >2million t and total biomass is >4 million t.

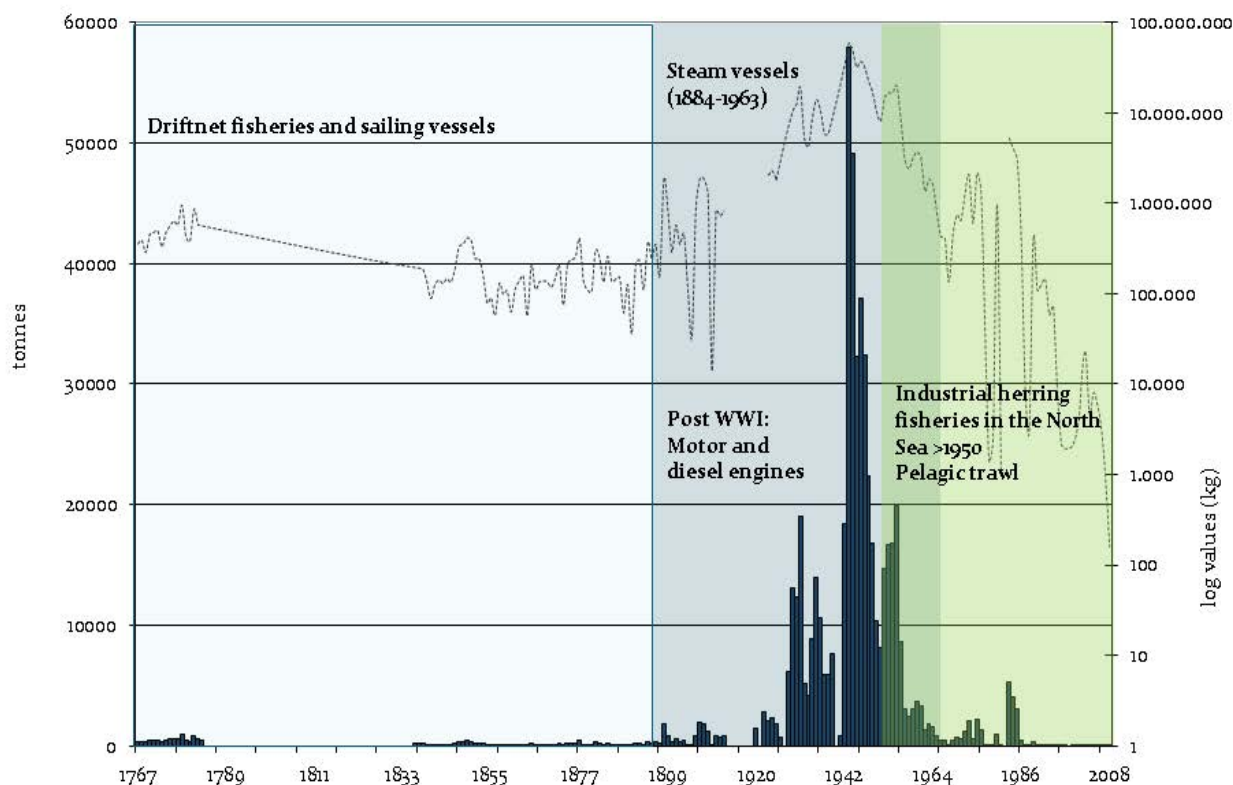


Figure 7.6.: Reconstruction of landings (x1000kg, bar chart left-hand axis) of the Flemish herring fisheries in the 18th-20th century. The 18th and 19th century estimates are based on literature sources while 20th century data are provided by the HiFiDatabase. Blanks before the 20th century indicate absence of data (both for reported nominal landings or estimates). The time-series is expressed as log values on the right-hand axis (dotted lines) to improve reading and comparison for landings below 10,000t.

However, as Schmidt et al. (2009) indicated, a recovery in the total SSB does not necessarily indicate full recovery of the individual components of a stock and of the number and distribution of their spawning sites (Saville and Bailey 1980). Payne (2010) demonstrated that although the total North Sea herring SBB recovered relatively quickly after the 1970s collapse, the component diversity of the stock was not fully re-established before the mid-2000s. The patterns of collapse and recovery have been different for the distinct spawning components: based on mainly qualitative information it has been suggested that the Downs component collapsed as early as the 1950s and its recovery is only of recent years (Cushing 1992, Payne 2010). Currently, upon ICES stock management advice, the Downs herring IVc-VIId TAC is set at 11% of the total North Sea TAC to conserve the spawning aggregation of Downs herring, at least until the uncertainty about the contribution of the Downs herring to the total herring catch in the North Sea is reduced.

The results presented here show that the Belgian fisheries benefited a 10-fold increase in catches and 5-fold increase in LPUE of Downs herring during WWII. It is argued that these increased catches are explained by a combination of factors including the a) sustained effect of a major increase in catch power thanks to improved technologies that were implemented after WWI, and b) the effects of strong pre-WWII year classes (e.g. 1936 and 1938) which joined the adult Downs herring during WWII on the post-spawning resting areas that were targeted by the Belgian fisheries. This was associated with a period with an apparent almost zero mortality Z. It must be noted that, because of the 6-years cessation in fishing efforts on the herring feeding grounds in the central North Sea, an increased number of individuals aged 3-4 and older, would arguably also be able to join

the spawning areas as war progressed. These age classes were subject to a decreased fishing mortality in the drift net and pelagic trawl fishery on the adult feeding grounds in the central North Sea and during their migration to the spawning grounds in the Southern North Sea. Although it is difficult to quantify their proportional importance, it is argued that both factors positively affected the proportion of older age classes as well as the observed increase in LPUE and overall landings in Belgian commercial herring fisheries. In spite of the existence of other strong year classes previous to, and after WWII, these could not be related to increased landings or LPUE on the post-spawning areas of the Downs herring.

The data presented here suggest the presence of increased abundance of spent herring during the cessation of fishing activities and before large-scale herring fisheries in the North Sea resumed again after 1945. Belgian fishermen that fished the coastal waters during the WWII were to witness the most productive herring seasons documented in Belgium since the 18th century. In spite of the severe damage that the fishing fleet suffered during the WWII, the Belgian fisheries benefited economically from this unintended 6-year temporary closure to fisheries in the North Sea and this success triggered a period of rapid expansion and investments in the Belgian fleet in the years to follow.

Acknowledgements

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Supporting material

Table I: landings during the ‘spent herring seasons’ based on monthly landings (HiFiDatabase Figure 7.2.) and compared to the aggregated landings per ‘spent herring’ season in Gilis 1946, 1947

<i>Season</i>	<i>Landings (x1000kg) (HiFiDatabase)</i>	<i>Landings (x1000kg) (Gilis 1946, 1947)</i>
1941-1942	9,982	10,007
1942-1943	51,929	51,895
1943-1944	58,445	58,119
1944-1945	No monthly data for 1945	31,847

Table II: Average annual landings of herring (kg) over periods (column 1) in the 19th and 20th century, and data source.

<i>Period</i>	<i>Average Annual Belgian landings of Atlantic herring (kg)</i>	<i>Source</i>
1767-1783	512,684	Cloquet 1842
1836-1905	221,645	Cloquet 1842, Dezuttere 1909
1906-1928	1,709,200	ICES, Dezuttere 1909
1929-1940	9,718,716	VLIZ, HiFiData
1941-1950	27,782,058	VLIZ, HiFiData
1951-1960	9,718,163	VLIZ, HiFiData
1961-1970	1,106,165	VLIZ, HiFiData
1971-1980	918,602	VLIZ, HiFiData
1981-1990	1,477,163	VLIZ, HiFiData
1991-2000	46,263	VLIZ, HiFiData
2000-2009	6,418	VLIZ, HiFiData; Flanders Fisheries Service

Table III: Distribution (number per 1000 sampled herring) of age class, 1930-1960. Source: Gilis 1962.

Distribution of age class per 1000 sampled herring										
year	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10	age 10+
1930	5	228	236	126	150	82	125	34	11	3
1931		88	229	167	102	140	71	132	45	26
1932	1	252	133	191	120	61	102	43	48	49
1933	5	29	491	87	126	72	32	76	26	56
1934		251	55	407	68	84	53	25	34	23
1935		268	282	36	232	36	60	30	21	35
1936		157	301	162	20	210	45	50	21	34
1937	3	265	118	184	118	23	186	23	40	40
1938		82	389	95	137	108	14	125	7	43
1939		160	220	300	70	100	80	10	60	
1940	No data reported									
1941	9	227	107	329	138	106	49	13	9	13
1942		33	264	97	303	136	114	31	14	8
1943		95	32	178	88	311	142	112	21	21
1944	2	98	106	16	193	77	307	117	64	20
1945	1	241	128	72	27	165	57	188	74	47
1946	7	99	121	73	81	34	212	63	200	110
1947		115	94	167	88	79	40	180	55	182
1948	2	94	116	59	165	98	95	70	132	169
1949		184	195	75	46	124	88	72	70	146
1950		174	222	187	84	65	103	60	43	62
1951	4	197	266	237	140	65	32	39	4	16
1952	12	372	124	153	120	95	46	24	30	24
1953	4	268	225	128	114	122	82	23	18	16
1954	6	298	222	116	87	82	90	51	24	24
1955	2	203	259	176	190	73	65	63	36	14
1956	13	524	164	111	69	35	20	28	21	15
1957	37	674	183	23	39	14	5	9	9	7
1958	14	328	430	141	25	28	21	5	4	4
1959	21	776	103	70	16	6	3	4	1	
1960	15	561	372	33	15	3				1

Table IV: Average length in mm at age 3-8 for the period 1930-1960, and average length in mm of 1000 sampled herring (Source: Gilis 1962).

	Age (years)							Average Length in mm/1000 herring
Seasons	3	4	5	6	7	8	Year Classes	
1930	215	229	249	254	262	263	1927-1922	241
1931	220	233	241	257	260	267	1928-1923	251
1932	211	226	237	245	256	260	1929-1924	238
1933	222	234	243	251	257	264	1930-1925	245
1934	217	233	247	255	258	261	1931-1926	242
1935	217	236	250	257	262	265	1932-1927	243
1936	219	238	249	259	262	266	1933-1928	247
1937	223	242	256	259	265	268	1934-1929	250
1938	223	237	253	263	265	275	1935-1930	252
1939	224	237	250	266	269	270	1936-1931	246
1930-1939	219	235	248	257	262	266		245,5
1941	235	248	254	261	266	268	1938-1933	248
1942	226	249	258	259	266	269	1939-1934	254
1943	234	249	257	267	264	270	1940-1935	258
1944	228	239	255	256	264	264	1941-1936	252
1945	229	248	260	266	264	273	1942-1937	254
1946	228	246	257	265	273		1943-1938	263
1947	231	248	256	265	270	273	1944-1939	260
1948	233	249	255	264	267	273	1945-1940	264
1949	223	246	254	266	268	272	1946-1941	256
1950	236	245	257	264	269	274	1947-1942	254
1941-1950	230	247	256	263	267	271		257,6
1951	235	251	260	265	270	276	1948-1943	254
1952	239	255	268	271	276	279	1949-1944	258
1953	240	261	270	277	280	283	1950-1945	270
1954	242	261	276	281	286	286	1951-1946	265
1955	246	262	275	283	288	290	1952-1947	271
1956	238	260	272	283	289	295	1953-1948	251
1957	239	258	276	283	289	283	1954-1949	244
1958	242	260	274	284	290	299	1955-1950	257
1959	233	261	274	283	288	286	1956-1951	234
1960	239	258	272	277	283		1957-1952	248
1951-1960	239	259	272	278	284	286		255,1

ADDITIONAL NOTES TO SUBCHAPTER 7**Belgium flooded by herring: local historical sources on the miraculous catches of fish in Belgian waters during the Second World War (1940-1945)**

Much has been written in local Belgian historical sources about the so-called 'miraculous' catch of sea food during the Second World War (WWII, 1940-1945) by the Belgian fleet. During our search effort for historical fisheries statistics we uncovered official statistical tables that give account of monthly landings by species and by fishing area for the WWII period. Although a well-coordinated and centralised statistical national and international (to ICES) reporting on sea fisheries was in place in Belgium by 1929 (Lescrauwaet et al. 2010) quantitative datasets on the total fishery production collected locally during the WWII period of restricted fishing are scarce and the data presented here were previously unknown in national and international reporting. These data cover particular interest because for most countries around the North Sea (UK, NL) no detailed quantitative data are available for this period (Baerends 1947), because current stock assessments on North Sea herring go back to 1947, and therefore information on the period before this reference year are very useful for herring biologists. The information on landings, LPUE and age structure is analysed in the publication included in chapter 7. A number of local historical sources were consulted that are of relevance for the Belgian context, and are not included in the article, since they are more of a local relevance. These references are included in the present short introduction note.

Fisheries in Belgium at the outbreak of the WWII

The WWII started in Belgium on May 10, 1940 and ended on October 1, 1944. Until the outbreak of the First World War (WWI, 1914-1918), annual landings from the Belgian fleet originated mainly from the 'North Sea' and fluctuated between 10,000 and 15,000 t (Lescrauwaet et al., unpublished data HiFiDatabase). After the WWI, landings from the North Sea quickly increased again to pre-war levels (12,000-15,000 t). From 1928 onwards the importance of the nearby fishing areas (North Sea south) gradually declined and Iceland and the 'western waters' (West-Scotland, South-and West-Ireland, the Bristol Channel) gained importance (see Chapter 4). The diversification of fishing grounds is especially evident from these statistics between 1934 and 1939, at the outbreak of the WWII (1940). The Belgian fleet counted 460 motor trawlers - 201 had engines less than 80 PK or Dutch Horse Power- and 14 steam trawlers (Lescrauwaet et al. 2012). At that time, approximately 40,000 t were landed annually mainly in Oostende which was the most important fishing port and fish auction of the 4 operational fishing ports at the Belgian coast.

An overview of historical references to (semi) quantitative data on landings during the Second World War

A first category of screened sources consists of local newspapers and magazines that published about aspects of daily life (Oostende newspaper, Visserijblad, Dagblad van Noord-Brabant en Zeeland) or specifically on the commercialisation of fish products (Vischhandel) before, during and after the WWII. Although these sources tend to be fragmentary and selective in reporting quantitative data on fisheries or fish landings, most of them make reference to the particularly high catches of herring. The 'Vischhandel' (1942, 1943) published quantitative data based on the official government statistics, on each of the herring fisheries seasons that Flemish fishermen achieved during the WWII from the northern French coastal ports and from the Belgian ports. Interestingly the July 1943 publication (Vischhandel Nr. 7, 1943) which reports on the 'record' herring landings from the previous season (winter 1942-1943) also raises the question as to why there is no (other) fish in the fishing areas.

Recent publications interested in pricing mechanisms of food items during wartimes mentioned that the processing and distribution systems in Belgium were not able to cope with the unexpectedly high landings of herring in 1942-1943 (Henau 1983, Gobyn 1984, Balthazar et al. 1984) and that the sudden increases caused herring prices on the black market to drop even below those on the formal market (Beke 1984). Other recent authors give account of unusually high herring catches in Belgium and the North of France (Jansoone 2010, De Mulder 1984, Henau 1983) but few contain quantitative data on landings. Similar accounts are available for the

ports of Duinkerke and Grevelingen in the north of France. In spite of restrictions on fishing effort during wartimes, Grevelingen increased landings of herring by 1028% in 1942 compared to 1938 (Odonne 1987). However, for the WWII period no data were published so far that give account of all species landings, by species, by month, by fishing area and by port of landing, as according to the reporting format applied before and after the WWII.

The quantitative data of fishing productivity during the WWII

According to De Mulder (1983) no fishing took place in Belgium from the end of 1939 until in the course of 1941 a limited part of the fleet was allowed to fish, under close surveillance by the occupying forces. In practice the 'coastal waters' was the only fishing area to which access for fishing was granted after 1940 and before 1945. This area is not part of the geographical ICES reporting/fishing areas. The data collected from the national statistical tables (uncovered in the present exercise) show that in 1939 the total landings of 10,878 t from coastal waters consisted mainly of sprat (*Sprattus sprattus*) and brown shrimp (*Crangon crangon*). Overall, during the war period for which monthly landings are available (1941-1944), 82% of the landings consisted of herring, 7% of plaice (*Pleuronectes platessa*), 2% of sprat and 2% of brown shrimp. In terms of economic benefits, the spent herring catches during WWII (1942-1945) represented an annual average income of 4.9 million euro direct sale value, compared to 0.2 million euro before WWII (1936-1939). The increase by four, in the average price of herring from 0.03 euro/kg to 0.13 euro/kg – mostly effect of the war economy- explains part of this 24-fold increase in overall value of landings. Inflation indexes to calculate and compare prices in current values, are not available for the WWII period.

Compared to North Sea fishing nations with large herring fisheries, the Belgian herring fisheries were not significant. The Dutch and UK fleet maintained relatively high catch levels of herring during the first part of WWI (approximately 150,000t in 1915 and 1916) and joint Dutch and UK annual herring catches amounted up to 300,000 t in e.g. 1929 and 1937 (ICES Fishstat) while in contrast, their catches dropped to near zero during WWII, at times when Belgian landings of spent herring from the coastal waters experienced a 5-fold increase.

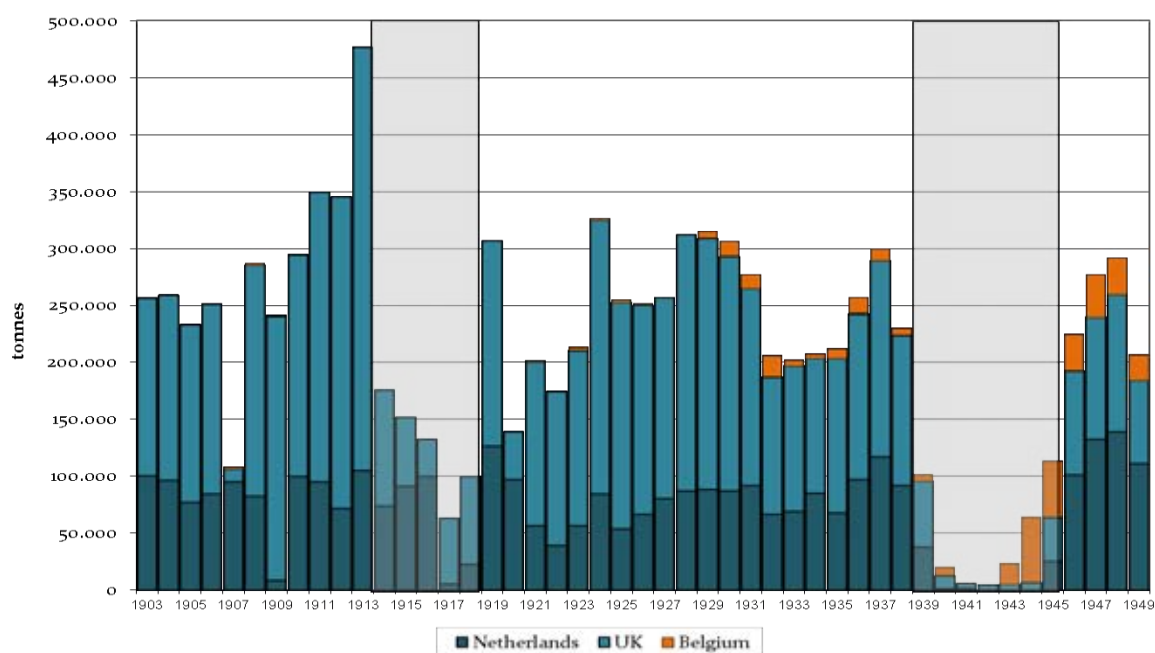


Figure 7.6.: A comparison of landings of herring from the UK, Netherlands and Belgium. Before, during and after WWI and WWII (grey bars).

The scientific reports of Gilis (1946, 1947) contain detailed accounts of the seasonal (Nov-March) landings and indices of catch per effort for the 'spent herring' fisheries. There is a good correspondence between the few locally published numerical data (Vischhandel) and the scientific reports (Gilis 1946, 1947) related to the herring catches.

The smaller vessels that stayed in Belgian ports to fish the Belgian coastal waters during the WWII were to witness what would turn out to be the most productive herring seasons documented in our country since the 15th century. In spite of the severe damage that the coastal fishing fleet suffered during the WWII, this success triggered an expansion from 217 vessels at the end of 1941 to 323 at the beginning of 1944 (Poppe 1977) and the onset of the large expansion and technological increase in the Belgian fleet in the years to follow.

