10 Striped red mullet in Subareas and Divisions 6, 7a–c, e–k, 8, and 9a

10.1 General biology

Striped red mullet (*Mullus surmuletus*) is a predominantly benthic species found along the coasts of Europe, southern Norway, and northern Scotland (northern Atlantic, Baltic Sea, North Sea, and the English Channel), up to the Northern part of West Africa, in the Mediterranean Basin, and in the Black Sea (Mahe *et al.*, 2005). Young fish are distributed in lower salinity coastal areas, while adults have a more offshore distribution.

Adult red mullets feed on small crustaceans, annelid worms, and mollusks, using their chin barbels to detect prey and search the mud. As a consequence, striped red mullets are typically found on sandy, gravelly and shelly sediments where they can excavate sediment with their barbels and dislodge the small invertebrates. The main natural predators of striped red mullet are sea basses, pollacks, barracudas, monkfish, congers, and sharks (Caill-Milly *et al.*, 2017).

Sexual maturity is reached at the beginning of the second year for males, followed by a marked decrease in growth rates, and at the end of the second or beginning of the third year for females which therefore continue their rapid growth a little longer (Déniel, 1991). In the English Channel, this species matures at approximately 16 cm (Mahe *et al.*, 2005), while in the Bay of Biscay, the sizes of first sexual maturity are given by Dorel (1986) as males 16 cm, females 18 cm and a length at which 50% of the individuals are mature (the distinction between the two sexes is not mentioned) of 22 cm.

Spawning occurs in the spring and early summer (May to June) according to Desbrosses (1933)-with a spawning peak in June in the northern Bay of Biscay (N'Da and Déniel, 1993). Eggs and larvae average 2.8mm and are pelagic (Sabatés *et al.*, 2015). The hatching takes place after three days at 18°C and after eight days at a temperature of 9°C (Quéro and Vayne, 1997) After metamorphosis juveniles become first demersal then benthic. At the age of one month, they measure about 5cm and weigh 0.9 to 1.6g. They show rapid growth during their first four months of life between July and October. Increases in length and mass are about 7cm and 25g on average during this period (N'Da and Déniel, 2005). The rate of growth declines sharply in October due to the cooling of water and the scarcity of trophic resources in the environment. These conditions contribute to the initiation of migration of red mullets to greater depths offshore. Until the age of two, there is no significant difference in size between males and females; they then measure 20-23cm. Sexual dimorphism is observed from the age of first maturity due to growth rates that will then differ between the two sexes. From age three, females exceed males in length by 4 cm on average and 7cm beyond 5 years (N'Da *et al.*, 2006).

The maximum reported age of the striped red mullet is 11 years (Quéro and Vayne, 1997; ICES, 2012), while the maximum length given is 44.5cm in the Bay of Biscay (Dorel, 1986) and 40cm elsewhere (Whitehead *et al.*, 1984; Fischer *et al.*, 1987). The maximum reported mass is 1kg (Muus and Nielsen, 1999).

10.2 Management regulations

Prior to 2002, France enforced a minimum landing size of 16 cm. Since 2013 minimal size requirement has been established to 15 cm (France, 2013). There is no TAC for this stock.

10.3 Stock ID and possible management areas

In 2004 and 2005, a study using fish geometrical morphometry was carried out in the Eastern English Channel and the Bay of Biscay. It pointed out a morphological difference on striped red mullets between those from the Eastern English Channel and those from the Bay of Biscay (Mahe *et al.*, 2014). Benzinou *et al.* (2013) conducted stock identification studies based on otolith and fish shape in European waters and showed that striped red mullet can be geographically divided into three zones:

- The Bay of Biscay (Northern Bay of Biscay – NBB, and Southern Bay of Biscay - SBB)

- A mixing zone composed of the Celtic Sea and the Western English Channel (CS + WEC)

- A northern zone composed of the Eastern English Channel and the North Sea (EEC + NS)

The distinction between the putative Biscay and Western Channel/Celtic Sea populations is supported by the distribution of landings at a statistical rectangle level (Figure 10.1). Examination of catch from surveys suggests striped red mullet in Div. 9a are geographically distinct, with an area of higher abundance between Cabo Sao Vicente and the Tagus estuary, and an area where this species is mostly absent to the north (Fig. 10.2). This assessment treats these putative components as one population. At present there are no management measures in place, however this structuring should be taken into account if measures are considered.

10.4 Fisheries data

Official landings have been recorded since 1975 and after early increases they have declined in recent years. Landings are mainly taken from Subarea 7 and 8 and France accounts for the majority of removals (Table 10.1). The striped red mullet is one species among set of benthic (demersal) species targeted by the French fleet, and is mainly caught by bottom trawlers with a mesh size of 70-99mm. In the Western English Channel striped red mullet is also caught by gillnets. Danish seine appeared in 2008 as a result of some trawlers converting to use seine gears.

The average characteristics of vessels in French fleets that caught red mullet from 2000 to 2015 are: 41.1 GRT, 191.1kW engine power, 12.9m length and 22 years of service. Net vessels are made up of the smallest units (85% are less than 12m long), while 52% of bottom trawlers are less than 15m; the seiners are by far the largest and the oldest vessels (Caill-Milly *et al.*, 2017).

The French activity on this species differs between the area composed by West Scotland/Celtic sea (including West Channel) and the area comprising the Bay of Biscay. In the first one, landings are mainly taken by bottom trawlers, followed by gillnet. In the second one, they are mainly done by bottom trawls, seine and nets. French activity in the Atlantic Iberian waters remains limited. The Spanish activity is located in the north (8.a,b) and the south (8.c) of the Bay of Biscay.

Discarding represented between 3% and 18% of the total catches in 2014–20 (Table 10.2). Since 2018, the discard rates are reported below 5%. However, there are concerns about how these discards have been estimated due to the lack of discards data for some countries. From the data provided to InterCatch in 2020, discards are essentially composed of individuals measuring less than 18 cm (Figure 10.2).

10.5 Survey data, recruit series

Exchange data is available in DATRAS during 1997-2020 for the French EVHOE survey, covering the Bay of Biscay and Celtic Sea, during 2001 – 2016 for the northern Spanish groundfish survey (SP-NSGFS), and from 2002 onwards for the Portuguese groundfish survey (PT-IBTS), covering

the Portuguese coast. Relative total biomass in the EVHOE survey are variable around the series mean between 1997–2011, before falling to a lower level thereafter. Similarly, catch rates in the PT-IBTS are at a low level in 2005, peak in 2010, before falling back to near the series mean in recent years (Figure 10.3). The mean stratified abundance from Spain NSGFS follows a similar trend: high variability around the mean before 2017, then low level since 2017. (Figure 10.4) Biological sampling in the Bay of Biscay sexual maturity and length measures were taken in 2009 by AZTI. French samplings started in 2004 in the Eastern Channel and in the south North Sea, and since 2008 in the Bay of Biscay. Biological parameters and other research Since 2004, data (age, length, sexual maturity) are usually collected by France for the Eastern English Channel and the southern North Sea. France started to collect data for 8a,b at the end of 2007. In 2007—2008, the striped red mullet otolith exchange had for goal to optimize age estimation between countries. In 2011, an Otolith Exchange Scheme was carried out, which was the second exercise for the Striped red mullet (*Mullus surmuletus*). Four readers of this exchange interpreted an images collection coming from the Bay of Biscay, the Spanish coasts and the Mediterranean coasts (Spain and Italy). A set of *Mullus surmuletus* otoliths (N=75) from the Bay of Biscay presented highest percentage of agreement (82%). On 75 otoliths, 34 were read with 100% agreement (45%) and thus a CV of 0%. Modal age of these fishes was comprised between 0 and 3 years (Mahe *et al.*, 2012).

10.6   Analysis of stock trends/ assessment

Currently, an age structured analytical stock assessment has not been developed due to a short time-series of available data. Data requirements Regular sampling of biological parameters of striped red mullet catches must be continued under DCF. Sampling in the Celtic Sea and in the Bay of Biscay started in 2008. In 2010 and 2011, sampling for age and maturity data was reduced compared to 2009, due to the end of the Nespman project. Since 2009, a concurrent sampling design carried out, should provide more data (length compositions) than in recent years.

10.7   References

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Table 10.1: Striped red mullet in Subareas and Divisions 6, 7a-c, e-k, 8 and 9a. Official landings by country in tonnes.

Year	Belgium	France	Guernsey	Ireland	Jersey	Netherlands	Portugal	Spain	UK	Total
2006	33	1947	8	16	1	115	10	387	170	2688
2007	43	1941	9	23	1	148	222	398	194	2978
2008	26	1394	9	22	0	165	169	394	165	2345
2009	20	1562	5	16	0	110	199	520	134	2567
2010	20	1743	5	8	0	128	276	479	133	2793
2011	21	1740	0	8	0	130	245	508	155	2806
2012	37	1342	0	7	1	125	217	332	122	2183
2013	28	932	5	4	0	50	187	246	71	1522
2014	12	926	5	2	0	2	221	265	53	1487
2015	23	1215	5	3	0	111	282	248	102	1989
2016	28	1179	0	4	0	69	204	194	83	1761
2017	36	997	0	10	0	13	154	327	64	1601
2018	37	896	0	0	0	95	122	321	67	1538
2019	30	1358	0	12	0	91	159	267	55	1973
2020	50	965	0	6	0	82	109	261	89	1562

Table 10.2: Striped red mullet in Subareas and Divisions 6, 7a-c, e-k, 8 and 9a. Official discards by country in tonnes. Total is presented with the total discards rates in %

Year	UK	France	Belgium	Portugal	Spain	Ireland	Netherlands	Total
2013	0							0 (0%)
2014		98						98 (6.2%)
2015	77	115						192 (8.8%)
2016	171	213	1	0	8			394 (18.3%)
2017	11	74	2	0	0	0		87 (5.1%)
2018	14	35	3	0	2	0		53 (3.3%)
2019	29	67	3		1	0		100 (4.8%)

Year	UK	France	Belgium	Portugal	Spain	Ireland	Netherlands		Total
2020	39	28	4		1	9	0	82 (5%)	

Table 10.3: Striped red mullet in Subareas and Divisions 6, 7a-c, e-k, 8 and 9a. Official landings by area in tonnes

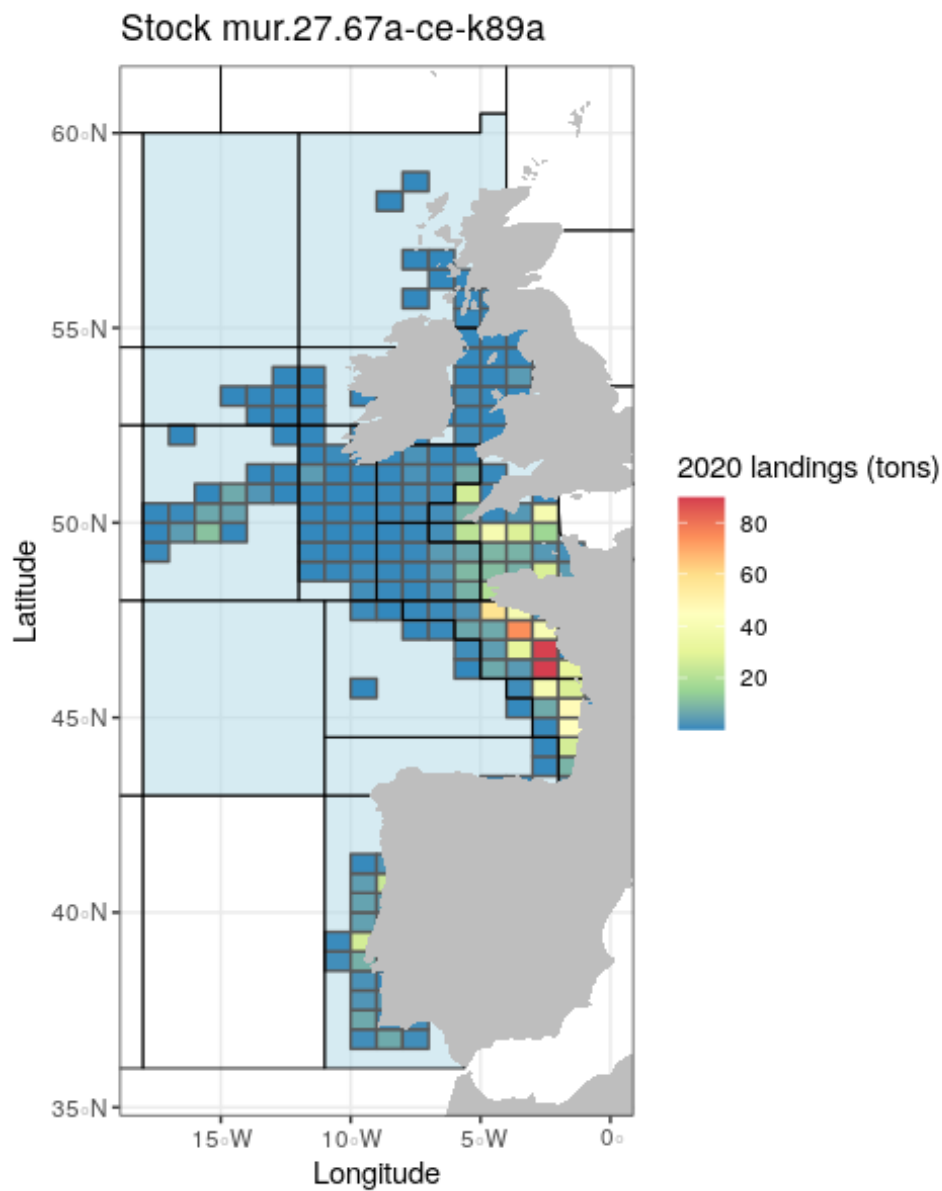| Year	6.a	7.a	7.b	7.c	7.e	7.f	7.g	7.h	7.j	7.k	8.a	8.b	8.c	8.d	9.a	8.e	6.b	Total
2006	0	1	1	0	869	50	24	103	11	0	1023	468	71	28	39	0	0	2688
2007	1	1	1	1	1047	54	22	104	24	0	861	473	90	32	267	0	0	2978
2008	0	1	1	0	880	46	16	72	26	0	639	246	86	35	296	0	0	2345
2009	2	1	2	2	592	25	9	74	35	0	879	460	156	88	243	0	0	2567
2010	2	1	3	2	642	26	10	59	32	1	1033	467	146	38	331	0	0	2793
2011	1	1	0	0	665	20	10	55	11	0	970	513	214	35	310	0	1	2806
2012	0	0	0	0	493	23	7	34	9	0	696	387	200	53	280	0	0	2183
2013	0	0	1	0	232	23	7	36	4	0	473	328	166	12	241	0	0	1522
2014	1	0	0	0	192	15	3	40	3	0	523	240	151	23	297	0	0	1487
2015	0	0	1	0	595	10	2	36	2	0	506	327	126	15	369	0	0	1989
2016	0	0	2	0	417	21	7	35	5	0	548	311	117	21	277	0	0	1761
2017	0	0	1	0	277	27	21	37	3	0	514	324	160	5	231	0	0	1601
2018	0	0	0	0	361	26	7	39	1	0	453	276	144	2	226	0	0	1538
2019	0	1	1	0	377	23	20	35	1	0	770	388	123	4	229	0	0	1973
2020	0	2	1	0	386	43	18	40	4	0	502	265	128	3	170	0	0	1562

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Figure 10.1: Striped red mullet in Subareas and Divisions 6, 7a-c, e-f, 8 and 9a. Landings by statistical rectangle for BEL, FRA, IRE, PT, UK (E&W), UK (SCO) in 2020.
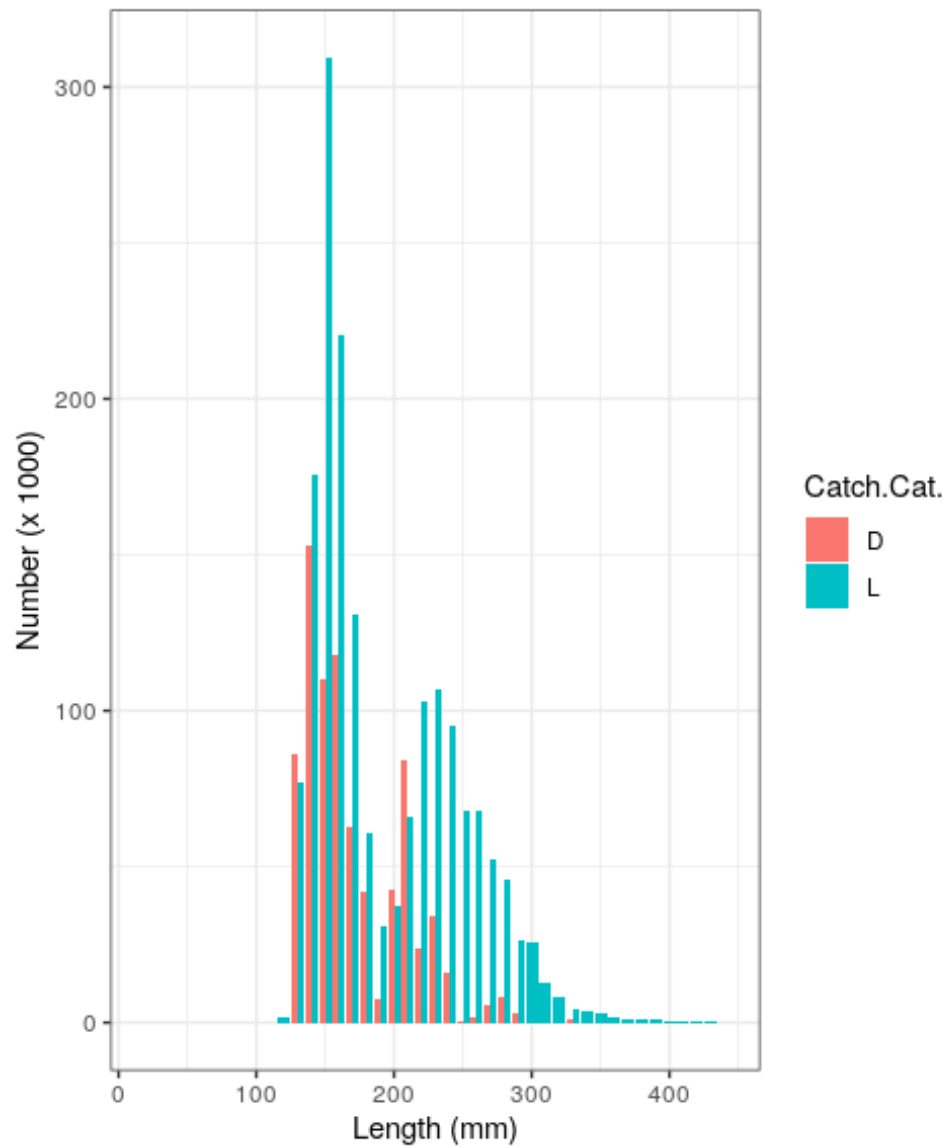
Figure 10.2: Striped red mullet in Subareas and Divisions 6, 7a-c, e-f, 8 and 9a. Length distribution in 2020 from Intercatch (D: Discards, L: Landings)
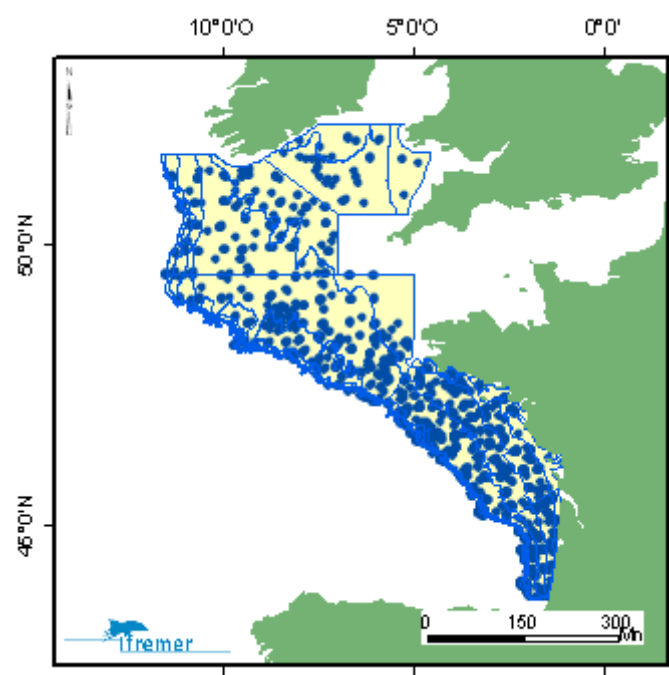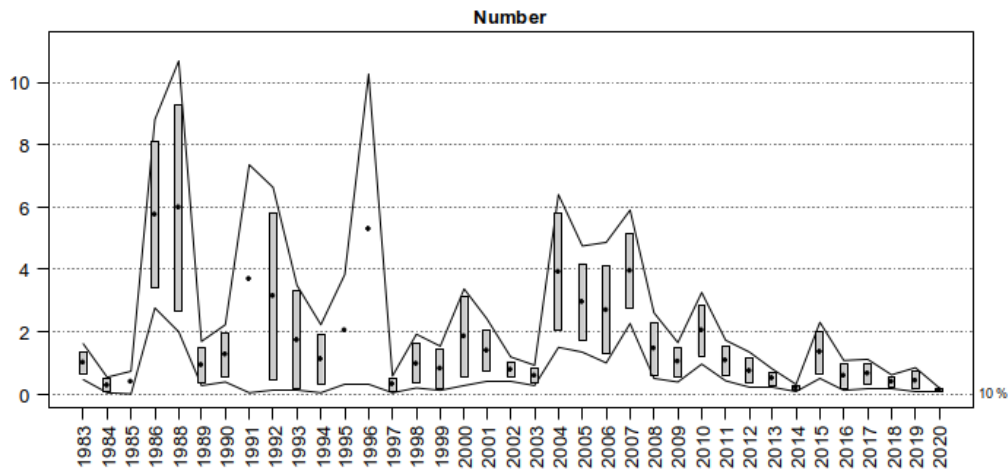
Figure 10.3: EVHOE survey station map

Figure 10.4: Striped red mullet in Subareas and Divisions 6, 7a-c, e-f, 8 and 9a. Spain NSGFS mean stratified abundance in northern Spanish Shelf 1983-2020
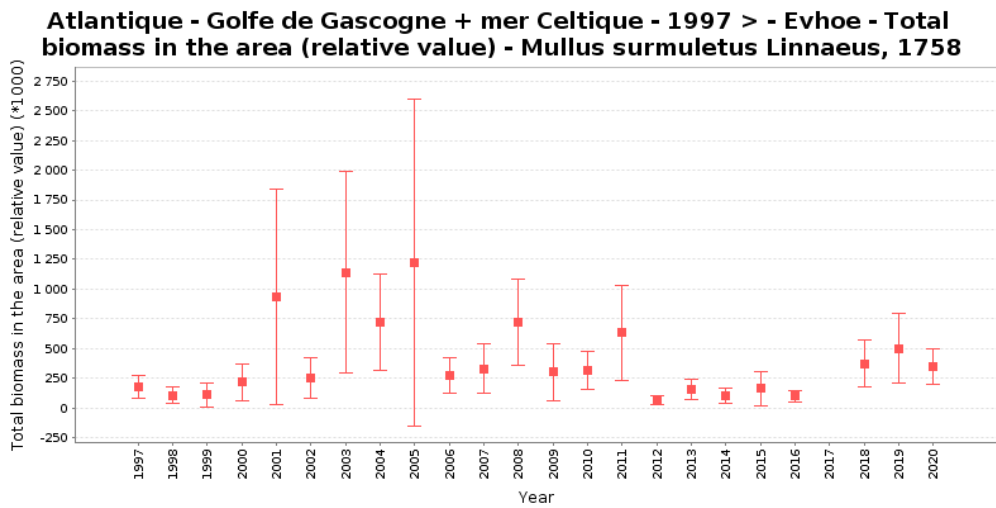

Figure 10.5: Striped red mullet in Subareas and Divisions 6, 7a-c, e-f, 8 and 9a. EVHOE total biomass in the area (relative value) 19972020