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 (Hureau, 1986; Mahé *et al.*, 2005). Young fish are distributed in lower salinity coastal areas, while adults have a more offshore distribution.

Adult red mullet feed on small crustaceans, annelid worms and molluscs, using their chin barbels to detect prey and search the mud. As a consequence, striped red mullet 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 (Mahé *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 22cm.

Spawning occurs in the spring and early summer (May to June according to Desbrosses, 1935) with a spawning peak in June in the northern Bay of Biscay (N'Da & Déniel, 1993). Eggs and larvae average 2.8mm and are pelagic (Jones, 1972; Russell, 1976). The hatching takes place after three days at 18°C and after eight days at a temperature of 9°C (Quéro & 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 & 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 & Déniel, 2006).

The maximum reported age of the striped red mullet is 11 years (Quéro & Vayne, 1997; ICES, 2012), while the maximum length given is 44.5cm in the Bay of Biscay (Dorel, 1986) and 40cm elsewhere (Hureau, 1986; Bauchot, 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 16cm. Since this minimal size requirement has been removed, immature individuals (< 14cm) have been recorded in landings. 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.

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 (Fig. 10.1). 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 (Table 10.1). Landings are mainly taken from Subarea 7 and 8 (Table 10.2) and France accounts for the majority of removals. 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 15 m; 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.

Prior to 2015 this species was not recorded as being discarded by French or Portuguese vessels and was infrequent in Spanish sampling. Discarding represented between 9% and 68% of UK catches in 2014 - 17 (Table 10.3), however there are concerns about how

these discards have been estimated – the 2016 figure is based on a sample of 2 fishes. French discard estimates for 2017 represented 7% of catch. For French demersal trawls (70-99mm mesh size), discards are essentially composed of individuals measuring between 8 and 17cm (Fig. 10.2).

10.5 Survey data, recruit series

Exchange data is available in Datras since 1997 for the French EVHOE survey, covering the Bay of Biscay and Celtic Sea, and from 2002 onwards for the Portuguese groundfish survey (PT-IBTS), covering the Portuguese coast. Standardised catch rates 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 (Fig. 10.3).

Abundance indices per size class during EVHOE-WIBTS-Q4 show mainly fish between 8 and 17 cm (TL).

Data was provided separately for the northern Spanish groundfish survey (SP-NSGFS), showing a similar variable trend to the EVHOE survey in the early part of the series, followed by a decline to lower levels in recent years (Fig. 10.4).

10.6 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.

10.7 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 (Mahé *et al.*, 2012).

10.8 Analysis of stock trends/ assessment

Currently, age structured analytical stock assessment is not possible due to a too short time-series of available data.

10.9 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.

10.10 References

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10.11 Tables

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	Spain	France	Guernsey	Ireland	Jersey	Netherlands	Portugal	UK	Total
2006	33	379	1944	8	15	1	115	11	170	2675
2007	43	390	1926	9	17	1	148	222	193	2949
2008	26	379	1384	9	17	0	165	169	164	2314
2009	20	490	1539	5	10	0	110	199	131	2504
2010	20	465	1725	5	5	0	128	276	132	2756
2011	21	504	1722	0	5	0	130	245	154	2782
2012	37	328	1318	0	4	1	125	217	122	2152
2013	28	245	925	5	3	0	50	187	70	1514
2014	12	265	914	5	2	0	1	221	53	1474
2015	23	248	1207	5	3	0	110	282	102	1980
2016	28	194	1166	0	4	0	69	204	83	1748
2017*	35	118	988	5	10		16	157	64	1393
2017**	36	328	997	0	10		13	154	64	1602

*** Preliminary Data**

**** Intercatch Data**

Table 10.2 Striped red mullet in Subareas and Divisions 6, 7a–c, e–k, 8, and 9a official landings by area in tonnes

Year	6a	6b	7a	7b	7c	7e	7f	7g	7h	7j	7k	8a	8b	8c	8d	8e	9a	Total
2006	0	0	1	1	0	869	50	24	103	5	0	1023	468	71	14	0	39	2668
2007	1	0	1	1	1	1047	54	22	104	12	0	861	473	90	16	0	267	2949
2008	0	0	1	1	0	880	46	16	73	13	0	639	246	87	18	0	296	2314
2009	2	0	1	2	1	592	25	9	74	17	0	879	460	156	44	0	243	2504
2010	2	0	1	3	1	642	26	10	59	16	1	1033	467	146	19	0	331	2756
2011	1	1	1	0	0	665	20	10	55	6	0	970	513	214	17	0	310	2782
2012	0	0	0	0	0	493	23	7	34	4	0	696	387	200	27	0	280	2152
2013	0	0	0	1	0	232	23	7	36	2	0	473	328	166	6	0	241	1514
2014	1	0	0	0	0	192	15	3	40	1	0	523	240	151	12	0	297	1474
2015	0	0	0	1	0	595	10	2	35	1	0	506	327	127	7	0	369	1980
2016	0	0	0	2	0	417	21	7	35	3	0	549	311	117	10	0	277	1748
2017*	0	0	0	1	0	283	26	21	36	0	0	505	244	82	5	0	185	1393
2017**	0	0	0	1	0	277	27	21	37	3	0	514	324	160	5	0	231	1601

*** Preliminary Data**

**** Intercatch Data**

Table 10.3 Striped red mullet in Subareas and Divisions 6, 7a–c, e–k, 8, and 9a discards (t) by country in 2012-2016

Country	2012	2013	2014	2015	2016	2017
BE						2
ES			4	5	8	0
FR				115	213	74
IE						0
PT	0.0	0.0	0.0		0	0
UK	2	1	5	77	171	11
Total	2	1	9	197	392	87

10.12 Figures

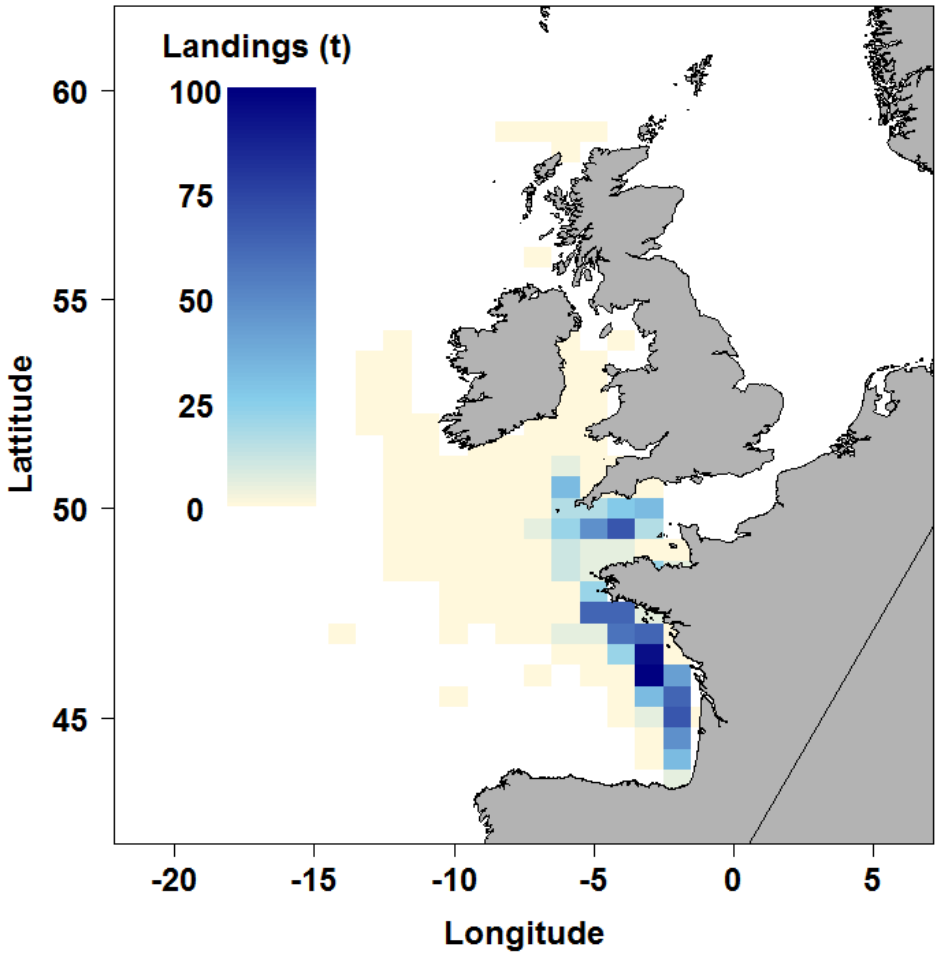

Figure 10.1. Striped red mullet in Subareas and Divisions 6, 7a-c, e-k, 8 and 9a. Landings by statistical rectangle in 2017 for BEL, FRA, IRE, UK (E&W) & UK (SCO).

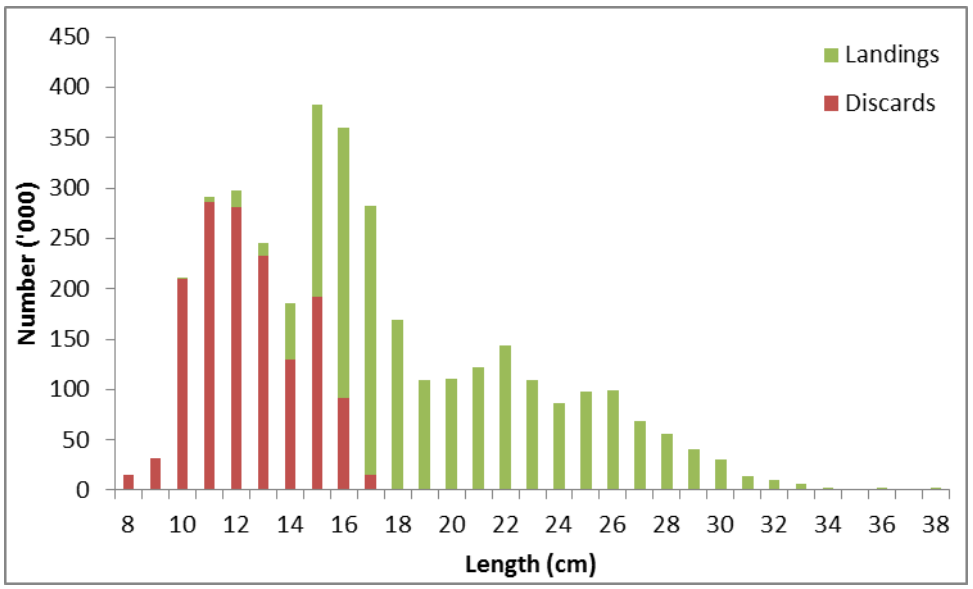

Fig 10.2. Striped red mullet in Subareas and Divisions 6, 7a-c, e-k, 8 and 9a. Length distribution of French catches from OTB_DEF_70–99.

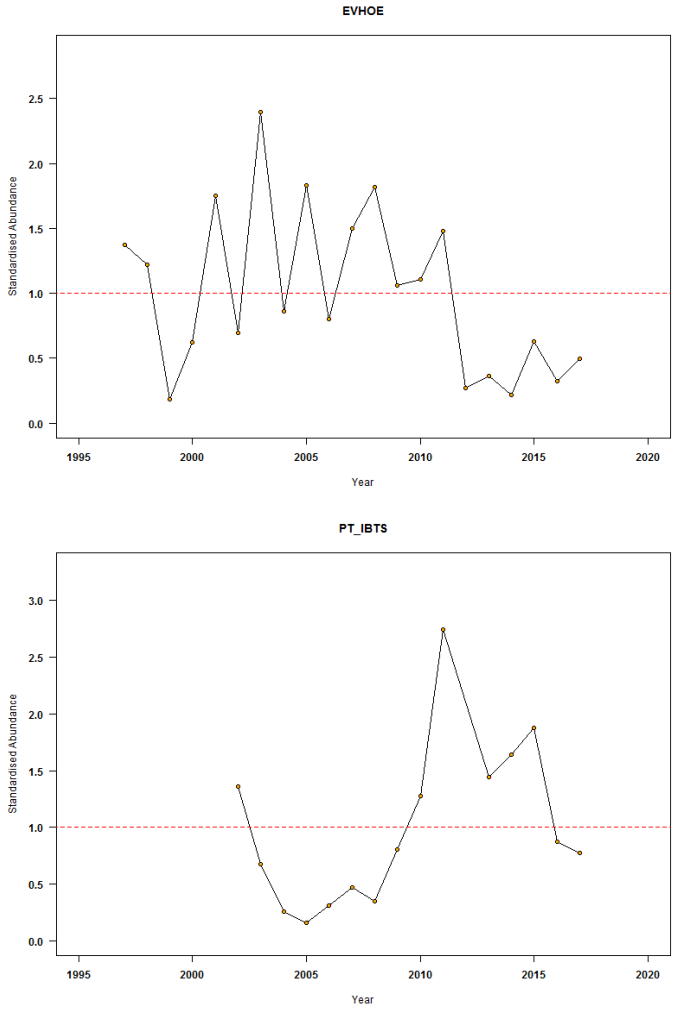

Figure 10.3. Striped red mullet in Subareas and Divisions 6, 7a-c, e-k, 8 and 9a. Standardised survey abundances for EVHOE (1997–2017) and Portuguese IBTS (2002–2017) surveys.

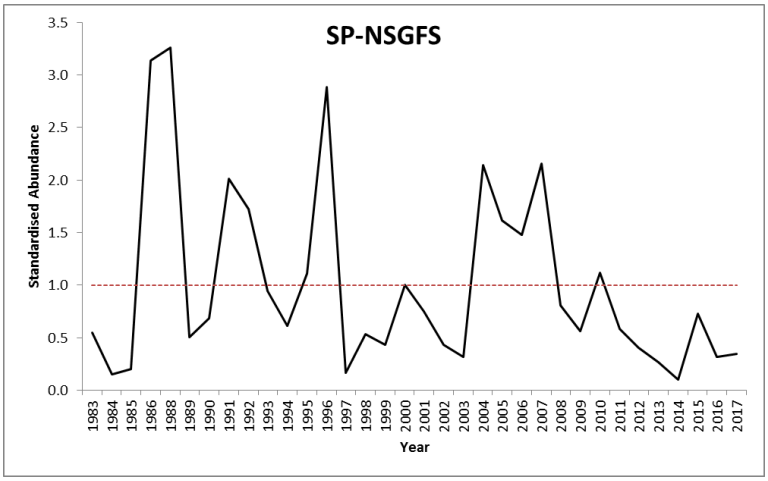

Figure 10.4. Striped red mullet in Subareas and Divisions 6, 7a-c, e-k, 8 and 9a. Standardised survey abundances for SP-NSGFS (1983–2017).