10 Anglerfish in ICES subareas 1 and 2

10.1 General

Our present knowledge of anglerfish (*Lophius spp*.) in ICES subareas 1 and 2 is based on two master theses (Staalesen, 1995; Dyb, 2003), a report from a Nordic project (Thangstad *et al.*, 2006), working documents to the ICES ASC, WGNSDS and WGCSE, and more recent catch data collected by the Norwegian Reference Fleet since 2006 (Anon, 2013). In February 2018, anglerfish in ICES subareas 1 and 2 was subject for a benchmark assessment (WKANGLER 2018). After this benchmark assessment, ICES suggests that this stock (or rather a stock component and a management unit) is considered as a Category 3 stock, for which survey or other indices are available that provide reliable indications of trends in stock metrics, such as total mortality, recruitment, and biomass.

Species composition

Two European anglerfish species of the genus *Lophius* are distributed in the Northeast Atlantic: white (or white-bellied) anglerfish (*L. piscatorius* L.) and black (or black-bellied) anglerfish (*L. budegassa* Spinola). *Lophius budegassa* are rarely caught in Nordic waters. In Norwegian waters, 1 out of about 2600 anglerfish landed from the Møre coast north of 62°N (2.a) and 1 out of about 1000 from the North Sea were *L. budegassa* back in 2003 (Dyb, 2003; K. Nedreaas, pers. comm.). In recent years (2010-2017) this ratio has increased to about 1 out of 300 anglerfish being *L. budegassa* in Norwegian waters.

Stock description and management units

The WGNSDS (Northern Shelf Demersal Stocks) considered the stock structure on a wider European scale in 2004, and found no conclusive evidence to indicate an extension of the stock area northwards to include Division 2.a. Anglerfish in 2.a has therefore been treated and described separately by the Celtic Sea Ecoregion working group (WGCSE) who is now assessing the anglerfish in the neighbouring areas. Currently, anglerfish on the Northern Shelf are split into Subarea 4 (including 5.b(EC), 12, and 14) and the North Sea (and 2.a (EC)) for management purposes. However, genetic studies have found no evidence of separate stocks over these two regions (including Rockall) and particle-tracking studies have indicated interchange of larvae between the two areas and further towards ICES divisions 2.a, 5.b and 5.a (Hislop *et al.*, 2001). So, at previous WGs, assessments have been made for the whole Northern Shelf area combined, but exclusive ICES divisions 2.a, 5.b and 5.a. In fact, both microsatellite DNA analysis (O'Sullivan *et al.*, 2006) and particle tracking studies carried out as part of EC 98/096 also suggested that anglerfish from further south (Subarea 7) could also be part of the same stock. Hislop *et al.* (2001) simulated the dispersal of *Lophius* eggs and larvae using a particle tracking model. Their results also show the likelihood for *Lophius* at both Iceland (Solmundsson *et al.*, 2007), Faroe Islands (Ofstad, 2013) and Norwegian waters north of 62°N (i.e. Subareas 1 and 2) to be recruited from the area west of Scotland including Rockall. This is also supported by research survey data as a migration east-/northeastwards with size is seen in the IBTS- and other survey data (e.g. Dyb, 2003).

Recent results from the use of otolith shape analysis in stock identification of anglerfish (*L. piscatorius*) in the Northeast Atlantic (Cañás *et al.*, 2012) and previous references on *L. piscatorius* stock identification find no biological evidence to support the current separation of *Lophius* stocks in the Northeast Atlantic, but find substructures within the area.

Anglerfish were tagged during two IBTS surveys in the North Sea and five one-day trips using a small (15 m) Danish seiner off the Norwegian coast at around 62°40'N (Møre) (Thangstad *et al.*, 2006; Otte Bjelland, IMR, Norway, pers. comm.). A total of 872 individuals were tagged with conventional Floy dart type tags, 123 in the North Sea (25-78 cm) and 749 at Møre (30-102 cm). Some of this is further described in Thangstad *et al.* (2006). Figure 10.12 shows the tagging locations and the hitherto recaptures. There are migrations in all directions, i.e. recaptures from the southern North Sea, at the Shetland/Faroes and northwards to Lofoten. Most of the recaptures were done at Møre where most of the fish were tagged.

In 2000–2001 a total of 1768 trawl caught *L. piscatorius* was tagged using conventional dart tags and released on inshore fishing grounds at Shetland (Laurenson *et al.*, 2005). Anglerfish of between 25 and 83 cm total length were tagged. The overall recapture rate was 4.5% and times at liberty ranged from 5 to 1078 days. After this publication, Dr Laurenson reported to www.fishupdate.com about a 104 cm anglerfish caught off the Norwegian coast near Ålesund in 2006. The fish had been tagged and released in the Scalloway Deeps on 13 September 2000 when it was 45 cm long, and had hence been at liberty for five years and nine months. This is of particular importance as it may indicate a wider mixing of stocks and validate the growth rate of anglerfish.

WKAngler (2018) considered that most recruitment in subareas 1 and 2 is from the more southerly stock unit, and this would require further R&D work in collaboration with ICES 3.a.46 looking at egg and larval dispersion and transportation as well as tagging and genetic studies. To address, stock structure, mixing rates, and growth estimates, WKAngler (2018) recommends a tagging program coordinated between all countries harvesting *Lophius*. Align tagging methods, measurement protocols and outreach to industry. Recommend a shared site for *Lophius* tagging data and other applicable research projects concerning *Lophius*. Until the true biological stock structure is better understood, WKAngler (2018) recommends keeping the anglerfish in subareas 1 and 2 as a separate management unit for time being.

Fishery

In autumn 1992 a direct gillnet fishery for anglerfish (*L. piscatorius*) started on the continental shelf in ICES Division 2.a off the northwestern coast of Norway. The anglerfish had previously only been taken as bycatch in trawls and gillnets. Until 2010-2011 there was a geographical expansion of the fishery which was largely due to a northward expansion of the Norwegian gillnet fishery (Figure 10.2). It is not known to what extent this northwards expansion of the fishing area is caused by an expansion of favourable environmental conditions for the anglerfish or the fishers discovering new anglerfish grounds. At Iceland, Solmundsson *et al.* (2007) concluded that changes in the distribution of anglerfish and increased stock size have co-occurred with rising water temperatures that have expanded suitable grounds for the species. Another observed feature of the fisheries is that regional peaks in the catches of anglerfish often culminate after a couple of years' fishing (Figure 10.2).

Norway is by far the largest exploiter of the anglerfish in subareas 1 and 2 accounting for 96–99% of the official landings (Table 10.1). The coastal gillnetting accounts for more than 90% of the landings (Table 10.2). The landings of anglerfish in subareas 1 and 2 have been about 1/4-1/3 of the total landings from the other Northern Shelf areas (3.a, 4, and 6), but was in 2017 only 7% of the total landings in these areas.

No TAC is given for subareas 1 and 2, Norwegian waters. Catches of anglerfish in Division 2.a, EC waters, are taken as a part of the EC anglerfish quota for ICES areas 3, 4, and 6, or as part of the Norwegian 'Others' quota in EC waters. The Norwegian fishery is regulated through:

- A discard ban on anglerfish regardless of size;

- A prohibition against targeting anglerfish with other fishing gear than 360 mm (streched mesh) gillnets;
- A minimum catch size of 60 cm in all gillnet fisheries, and a maximum permission of 5% anglerfish (in numbers) below 60 cm when fishing with gillnets;
- 72-hour maximum soak time in the gillnet fishery;
- A maximum of 500 gillnets (each net being maximum 27.5 m long) per vessel;
- A closure of the gillnet fishery from 1 March to 20 May. This closure period was expanded to 20 December-20 May in the areas north of 65°N in 2008 and further expanded southwards to 64°N since 2009.
- A maximum of 15% bycatch of anglerfish in the trawl- and Danish seine fisheries, and maximum 10% bycatch of anglerfish in the shrimp trawl fishery. When fishing for argentines and Norway pout/sandeel a maximum of 0.5% bycatch is allowed within a maximum limit of 500 kg anglerfish per trip
- A maximum of 5% bycatch of anglerfish in gillnets targeting other species.

10.2 Data

Landings

The Norwegian statistical areas and locations used by the fishers for reporting their catches are shown in Figure 10.1. A very small fraction of the catches (3 tonnes in 2018) are taken in the Norwegian statistical area 03 which falls within ICES Subarea 1, and in Division 2.b (less than 1 tonne in 2018). The official landings for each country are shown in Table 10.1, and Norwegian landings by gear and fisheries in Table 10.2. Landings as reported to ICES for subareas 1 and 2 decreased rapidly from 2011 to 2015, to the lowest since 1997, but showed a small increase in 2016–2018 caused by an increase in the southern part of the area. Taken into account the expansion of the fishing area towards the margins of this species' distribution, and that we don't expect to discover more new fishing grounds, the rapid decline in catches per year gives reasons for concern. No information suggests that the official landing figures from Norway give a biased estimate of the actual landings, and no new regulations have been enforced that could explain the decrease.

Discards

The absence of a TAC in Norwegian waters probably reduces the incentive to underreport landings. Anecdotal evidence from the industry, observer trips and data from the self-sampling-fleet (the Norwegian reference fleet; Anon, 2013) suggest that up to 8–9% of the catch (not marketable) is discarded. This happens when the soaking time is too long, mostly due to bad weather. The average percentage discarded anglerfish was higher south of 62°N (ICES 3 and 4) than north of 62°N (ICES 2). Average length of discarded anglerfish equals the length of the landed anglerfish. Work is ongoing to estimate discards based on data from the Reference fleet on a more regular basis, and WKAngler recommends a gillnet discard mortality study.

Biological

Length distributions are available from the directed gillnet fishery during the period 1992–2018, but data are lacking for 1997–2001 (Figure 10.3a,b). The length data indicate a drop in mean length of 15–20 cm occurring during the period without length samples (Figure 10.4). Since then the mean length increased steadily during the last decade to about 95 cm (about 10 years old and 12 kg) in 2014-2016, i.e. the same size level as seen during the 1990s (Figure 10.4). One third of the anglerfish measured during the 1990s were above 100 cm, this proportion was between 1and 6% for the early 2000s and between 12 and 17% in 2006–2010. This indicates recruitment into

Subarea 2 during 1997–2001 which has not been observed until 2017–2018 when a new drop in mean length is seen, again indicating some recruitment of smaller sized anglerfish to the area. For 2006–2011 and 2016, some length data from anglerfish caught as bycatch in other fisheries are presented in Figure 10.5a,b. This shows some promising recruitment of small anglerfish (40-50 cm) in 2016 not yet big enough for the large-mesh gillnets used in the directed anglerfish fishery. These recruits correspond to the promising year classes seen further south in the North Sea. Such recruitment is, however, not seen from the data collected in 2018.

Sex ratios in Subarea 2 show that females outnumber males above approximately 75 cm, and above 100 cm all fish were females (Thangstad *et al.*, 2006). This is very similar to sex ratios reported from distant Portuguese and Spanish waters (Duarte *et al.*, 1997) and hence supports a sex growth difference independent of latitude.

Spawning has been documented to occur in ICES Division 2.a in spring, but the present abundance of anglerfish in subareas 1 and 2 seems to be dependent on influx or migration of juveniles from ICES subareas 4 and 6. Estimation of GSI (gonad-somatic index) for females in Division 2.a, indicates developing ovaries from January to June. The highest values of GSI were found in June when some of the ovaries were 20–30% of the round weight. Only females bigger than 90 cm had elevated GSI values indicating developing ovaries. Dyb (2003) found that the length at which 50% of the females were mature (L_{50}) was between 60–65 cm, and that all females above 80 cm were mature.

Some age readings exist of anglerfish in Division 2.a, and comparative analyses of different structures, preparations and methods used for age readings were done by Staalesen (1995) and Dyb (2003). The Norwegian Institute of Marine Research adopted the ICES age reading criteria using the first dorsal fin ray (illicium) as its routine method, but few fish have been aged since the above-mentioned projects. The material collected and read was, however, considered sufficient for yield-per-recruit estimations (Figure 10.11). As a very simplified 'rule of thumb' one may divide the fish length by 10 to get an approximate age, i.e. a fish of 100 cm is approximately 10 years old and 13 kg while a fish of 70 cm is about 7 years old and 7 kg.

Figure 10.6 shows that a fishery using 300 mm mesh size will exploit males and females in a more equal ratio than 360 mm gillnets (Dyb, 2003). However, a change to lower mesh size will, without additional regulations, not decrease the effort, but rather increase it, at least towards younger fish. A mesh size of 300 mm will catch more anglerfish down to 50 cm, i.e. more immature fish. Preliminary analyses have also shown that maximum yield-per-recruit will be 22% less using 300 mm instead of 360 mm gillnets (Staalesen, 1995). A possible sudden increase in catch rates when going from 360 mm to 300 mm would therefore be of short duration. A mesh size of 360 mm is also more in line with the minimum legal catch size of 60 cm, the length at first maturity of females and the utilization of the species' (especially the females') growth potential.

Surveys

Anglerfish appears in demersal trawl surveys along the Norwegian shelf, but in very small numbers. There has been a change in the surveys, going from single species- to multispecies surveys, during recent years. The procedures for data collection on anglerfish have varied and, at present, no time-series from surveys in Division 2.a yields reliable information on the abundance of anglerfish.

Commercial CPUE

Since late 2005, 10-13 gillnetters have been included in a self-sampling scheme established along the Norwegian coast within Division 2.a. Detailed information about effort and catch is provided through this scheme. Figure 10.7 shows standardized average CPUE (kg per 100 gillnet day) for all vessels in the Norwegian reference fleet fishing directly for anglerfish using large-meshed

gillnets (360 mm), with and without precision measures. The figure shows that the catch rates have decreased by about 50% in recent years. The current catch rates, i.e. about 0.3 kg per gillnet soaking day, are, however, and for time being, at about the same level as the catch rates seen after the "Klondyke" fishing period during 1992–1994 in the southern area of Division 2.a (Figure 10.9).

Figure 10.8 shows that the effort in the large meshed gillnet fishery in the Coastal Reference fleet decreased by 50% from 2007–2011 to 2012–2016, but increased from 2016 to 2017–2018.

WKAngler (2018) suggests investigating a better standardization of the commercial CPUE index. There is evidence of spatio-temporal changes in distribution that should be accounted for in index standardization.

Yield-per-recruit estimations

Based on preliminary analyses and yield-per-recruit estimations done back in 2006 (Thangstad *et al.,* 2006), the fishing mortality in Norwegian waters at that time seemed to be too high to secure a high, sustainable and stable long-term yield, while the fishing pattern achieved when mostly using large meshed gillnets seems to be rather good concerning the net growth potential of the species. This is illustrated in Figure 10.10. Input data to the Y/R estimations are given in Table 10.3. The fishing mortality was estimated from catch curves (assuming M = 0.15) and also by combining equations from the fishery population dynamics (Thangstad *et al.,* 2006). These Y/R estimations must be considered very preliminary and approximate, and indicative rather than accurate, a.o. since the catch-at-age data available for anglerfish were too limited to follow a cohort through the fishery, i.e. the age distribution of catches is from one particular year (2002) to represent a single cohort's development.

Historical stock development

Anglerfish in subareas 1 and 2 have never been assessed quantitatively and besides the presented catch, CPUE and catch mean length series it is not possible to describe the historical stock development. Some very preliminary attempts to fit the Gadget model to the anglerfish data were done by Dyb (2003), but this need to be revisited and much more work is necessary before it can be properly evaluated. Former ICES-RG has recommended using the available catch data to perform a Depletion-Corrected Average Catch (DCAC) analysis and compare the results with possible trends in the other time-series (ICES CM 2012/ACOM:68).

At present, anglerfish in subareas 1 and 2 falls into ICES Category 3 – stocks for which survey or other indices are available that provide reliable indications of trends in stock metrics, such as total mortality, recruitment, and biomass (ICES 2018). There are four methods approved by ICES for calculation of MSY reference points for category 3 and 4 stocks. These are:

- Length based indicators (LBI);
- Mean length Z (MLZ);
- Length based spawner per recruit (LBSPR);
- Surplus Production model in Continuous Time (SPiCT). This method was tested by WKAngler (2018) on anglerfish in subareas 3,4, and 6, and was considered not suitable or recommended to be used for either these subareas or subareas 1 and 2.

Work should hence be done to investigate the usefulness of the three first methods (LBI, MLZ and LBSPR) prior to next year's AFWG.

10.3 Management considerations and future investigations

The present abundance of anglerfish in subareas 1 and 2 seems to be dependent on influx or migration of juveniles from ICES subareas 4 and 6. It is therefore expected that an effective discard ban on anglerfish in these areas will have a positive impact on the abundance north of 62°N, as will also a reduced discarding in this area. Signs of smaller anglerfish recruiting to the bycatch in less selective gears may be a first indication of future improved recruitment to the directed fishery. This may have been a short lasting happening since such recruitment is not seen in 2018. Hence, monitoring of the fishery will be important in near future to protect the young specimens from recruitment- and growth overfishing. The AFWG has previously recommended that the anglerfish stock component in subareas 1 and 2 is annually monitored and a 20% reduction in fishing effort per year (also as an uncertainty cap) should be imposed until the decrease in CPUE is stopped. Despite that the decrease in CPUE may have stopped, the current increase in effort, which seem to have stopped in 2018, is not a vice long-term management strategy. Managers should halt any effort increase north of 62°N until new recruitment to the fishable biomass (by large meshed gillnets) has been documented.

The AFWG supports that ICES subareas 1, 2, 3, 4, and 6 should be investigated together to get a more complete understanding of migrations and distributions.

The ICES WKAngler (2018) recommends that anglerfish in ICES subareas 1 and 2 for time being continues as a separate management unit, and that improved information on stock identities is needed. To address stock structure, mixing rates, and growth estimates, WKAngler recommends a tagging program coordinated between all countries harvesting Lophius, and to align tagging methods, measurement protocols and outreach to industry. WKAngler recommends a shared site for Lophius tagging data and other applicable research projects concerning Lophius. This would also require further R&D work in collaboration with 3.a.46 looking at egg and larval dispersion and transportation as well as tagging and genetic studies.

WKAngler further recommends investigating a more formal assessment model for this stock component (ref. category 3 tools above), and to validate age-determination using tagging study data.

Table 10.1. Nominal catch (t) of Anglerfish in ICES subareas 1 and 2, 1999-2018, as officially reported to ICES

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Denmark	+	+	2	+	-	1	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Faroes	+	-	1	1	2	5	11	4	7	4	2	1	+	+	1	+	+	1	1	+
France	-	-	-	-	-	-	-	1	-	-	-	-	1	3	2	-	4	2	4	3
Germany	4	17	65	59	55	70	55	+	+	0	+	82	70	0	-	+	+	+	1	1
Iceland	-	-	-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	-	-
Norway	1733	2952	3554	2000	2405	2907	2650	4257	4470	4007	4298	5391	5031	3758	2988	1655	933	1355	1473	1884
Portugal	-	-	-	-	-	-	-	-	-	2	6	1	+	-	-	-	-	-	-	-
UK	6	30	2	11	15	18	19	86	114	138	152	40	3	3	111	2	105	76	5	15
Others														1	1	-	-	+	-	+
Total	1743	2999	3624	2071	2477	3001	2735	4348	4591	4151	4458	5515	5112	3765	3103	1657	1043	1435	1484	1903

*Preliminary

Table 10.2. Anglerfish in ICES subareas 1 and 2. Norwegian landings (tonnes) by fishery in 2006–2018. The coastal area is here defined as the area inside 12 nautical miles from the baseline.

Fleet NORWAY	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Coastal gillnetting	4039	3574	3934	4806	4557	3521	2758	1506	829	1231	1320	1727
Offshore gillnetting	204	240	171	391	319	115	158	95	52	62	87	68
Offshore dem trawling	65	34	36	48	19	11	8	7	3	5	6	10
Coastal Danish seine	63	75	68	40	26	16	19	11	12	17	23	28
Other gears	98	84	89	106	83	96	45	36	37	40	31	51
Total	4470	4007	4298	5391	5031	3759	2988	1655	934	1355	1468	1884

Table 10.3. Input data to the yield-per-recruit calculations based on (A) the exploitation pattern of the Norwegian gillnet (360 mm) fishery only, and (B) on the present exploitation pattern for the total fishery for anglerfish in the NEZ (incl. gillnet, trawl, Danish seine). In both cases the exploitation pattern has been scaled so that the average for the age group 7-10 becomes equal to 1.0 ($F_{7\text{-}10}$ = 1.0). As a simplification, a knife-edged maturity-at-age 8 has been used. See Thangstad *et al.* (2006).

Age	Natural mortality	Maturation	Individual weight in stock and catch (kg)	Exploitation pattern (**A**)	Exploitation pattern (**B**)
1	0.15	0	0.53	0.0004	0.109
2	0.15	0	0.88	0.0040	0.180
3	0.15	0	1.70	0.035	0.239
4	0.15	0	3.16	0.106	0.250
5	0.15	0	3.97	0.171	0.350
6	0.15	0	5.75	0.266	0.408
7	0.15	0	7.44	0.564	0.677
8	0.15	1	9.37	0.829	0.832
9	0.15	1	11.08	1.188	1.182
10	0.15	1	13.12	1.420	1.310
11	0.15	1	17.24	1.539	1.462
12	0.15	1	21.12	1.121	1.439

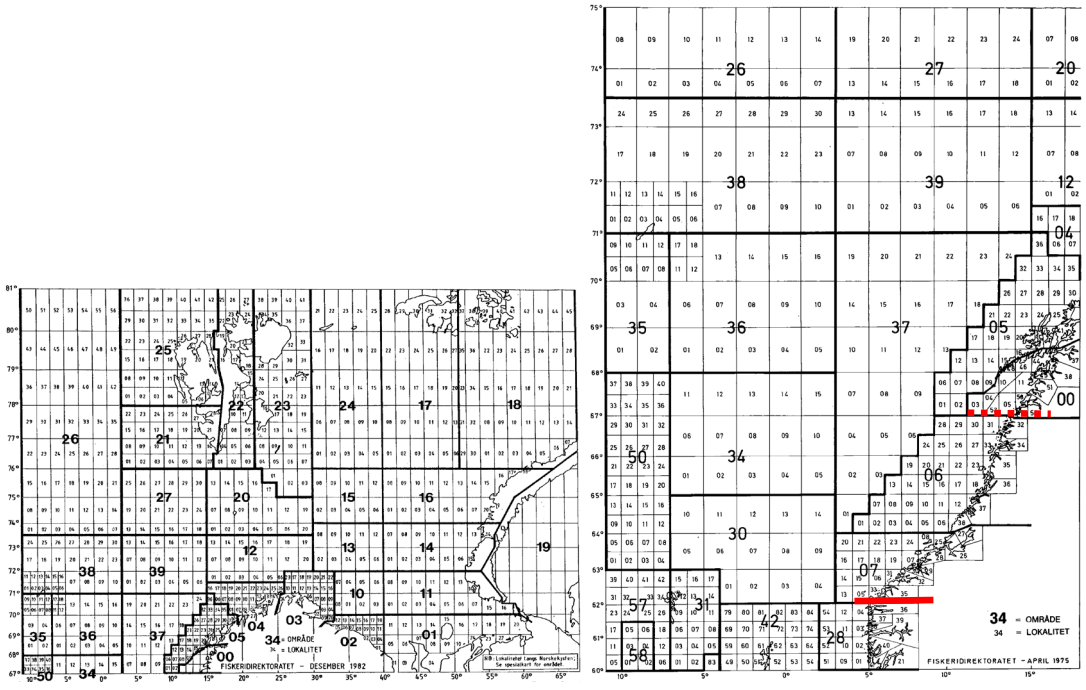

Figure 10.1. Norwegian statistical areas and locations used by the fishers for reporting their catches. The 62°N and 67°N (stippled) latitudes are marked.

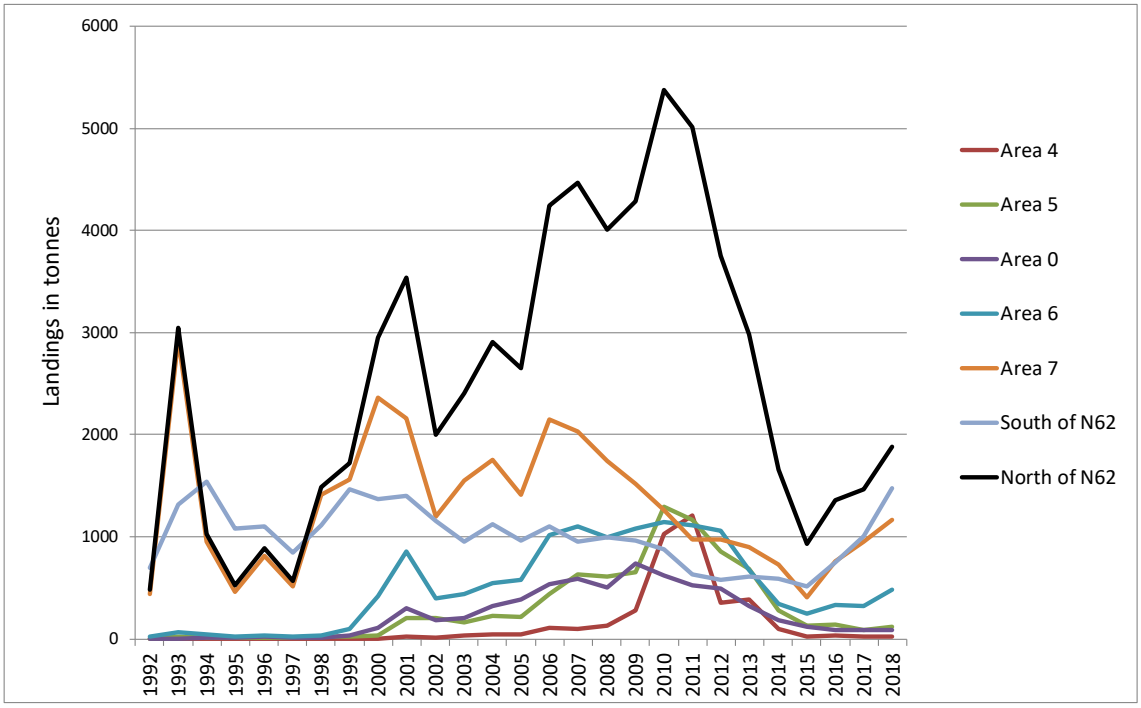

Figure 10.2. Norwegian official landings (in tonnes) of anglerfish (*Lophius piscatorius*) per statistical area (see Figure 10.1) within ICES areas 1 and 2 during 1992–2018. Norwegian landings from the area south of 62°N (ICES 4 and 3) are shown for comparison.

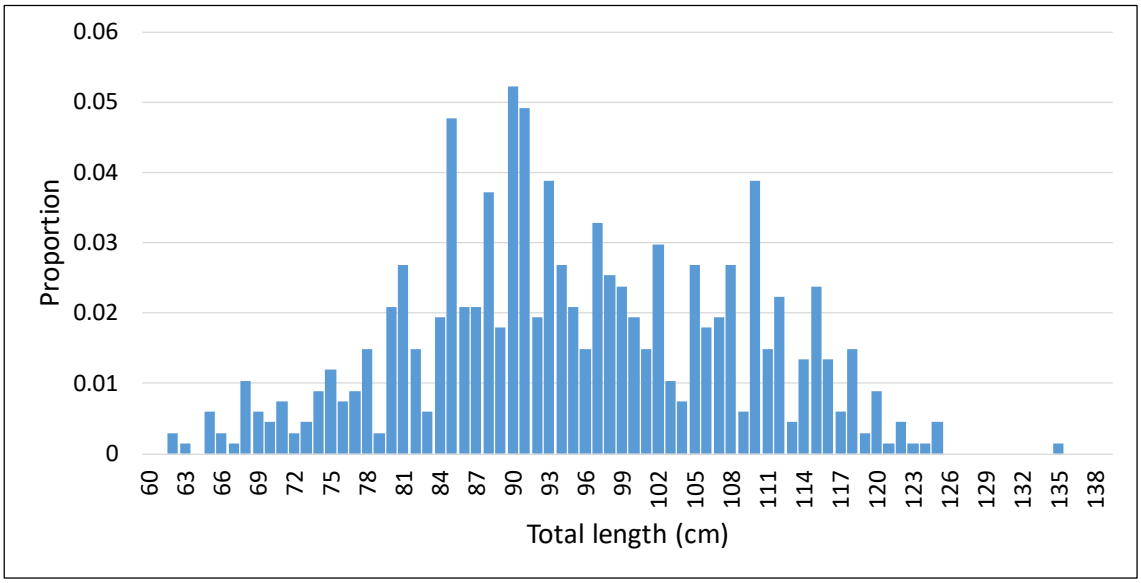

Figure 10.3a. Anglerfish (*Lophius piscatorius*) in 2.a. Total lengths in directed gillnetting, 2016. Based on 61 samples from 4 vessels (N = 671).

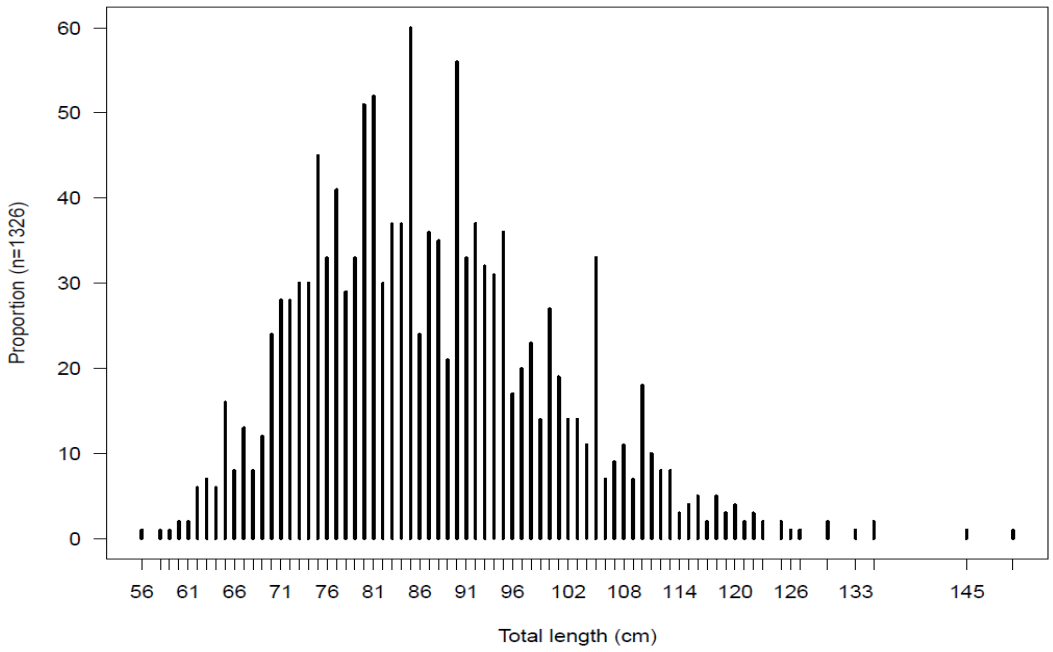

Figure 10.3a. Anglerfish (*Lophius piscatorius*) in 2.a. Total lengths in directed gillnetting, 2018 (N = 1326).

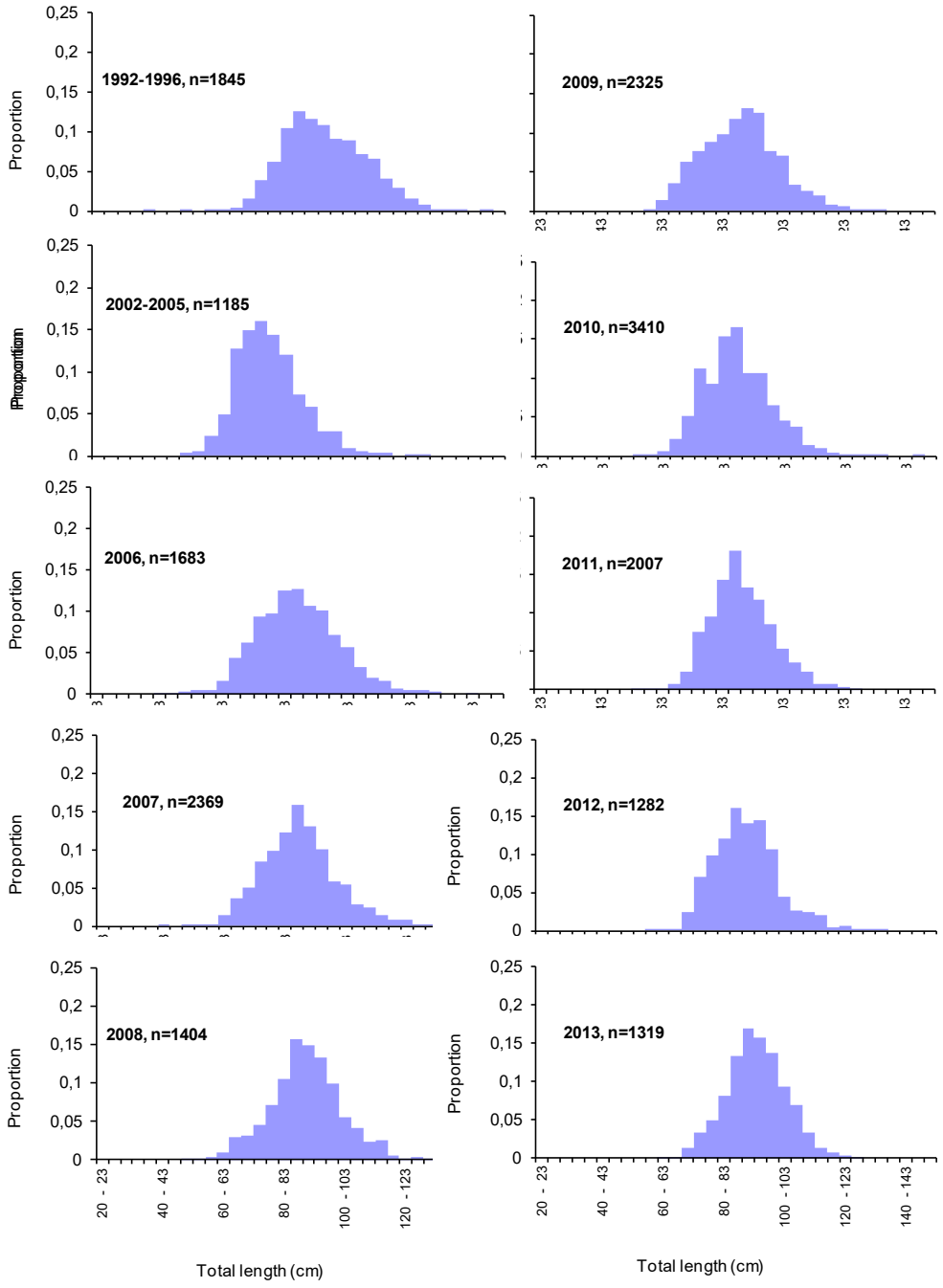

Figure 10.3b. Anglerfish (*Lophius piscatorius*) in 2.a. Length distributions for anglerfish caught in the directed coastal gillnetting in Division 2.a during 1992–2013. Note that data are lacking for 1997–2001.

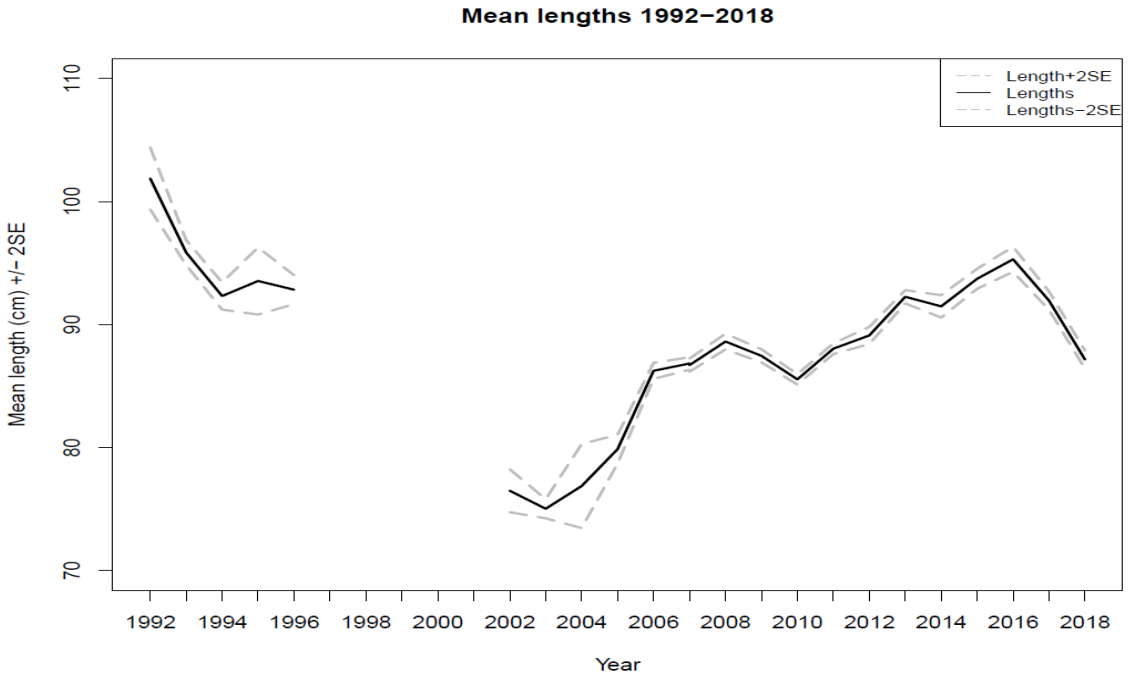

Figure 10.4. Anglerfish (*Lophius piscatorius* in subareas 1 and 2. Mean lengths for anglerfish caught in the directed coastal gillnetting in Division 2.a during 1992–2018, dotted lines represent ±2SE of the mean. Note that data are lacking for 1997–2001. This illustrates pulses of new recruitment entering Division 2.a from subareas 4/6 – last time during 2002–2003.

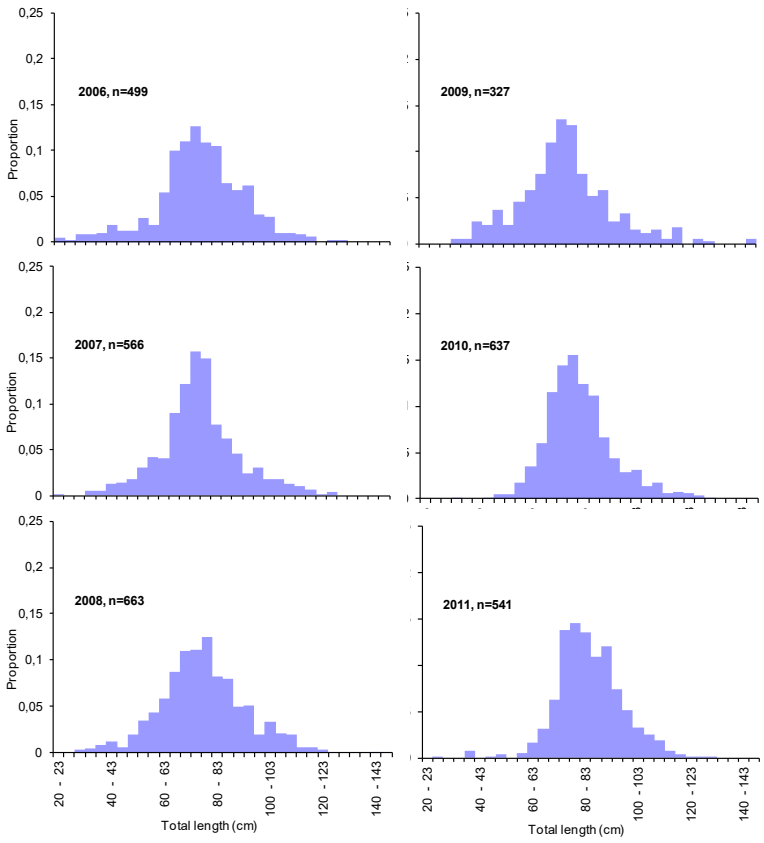

Figure 10.5a. Anglerfish (*Lophius piscatorius*) in subareas 1 and 2. Length distribution for anglerfish caught as bycatch by other gears (smaller meshed gillnets and longline) in Division 2.a in 2005-2011.

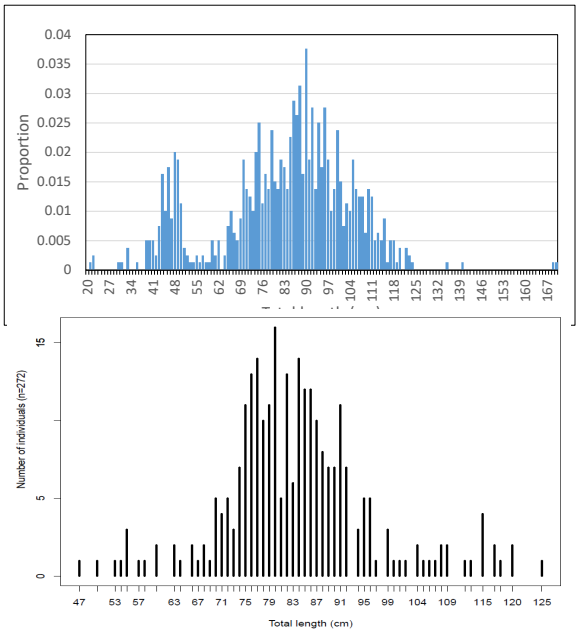

Figure 10.5b. Anglerfish (*Lophius piscatorius)* in 2.a. Total lengths, other smaller meshed gillnets and longline 2016 (N = 799, left) and 2018 (N = 272, right). Note the small (40–50 cm) anglerfish recruiting to these gears in 2016 but not in 2018.

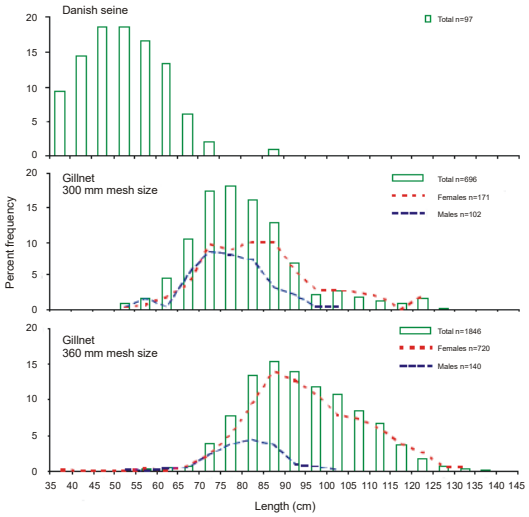

Figure 10.6. Length distributions of commercially landed catches of anglerfish from the Møre coast (ICES 2.a; Norw stat.area 07), 1992–1997, illustrating the fishing gears' different selectivity and the sex differences.

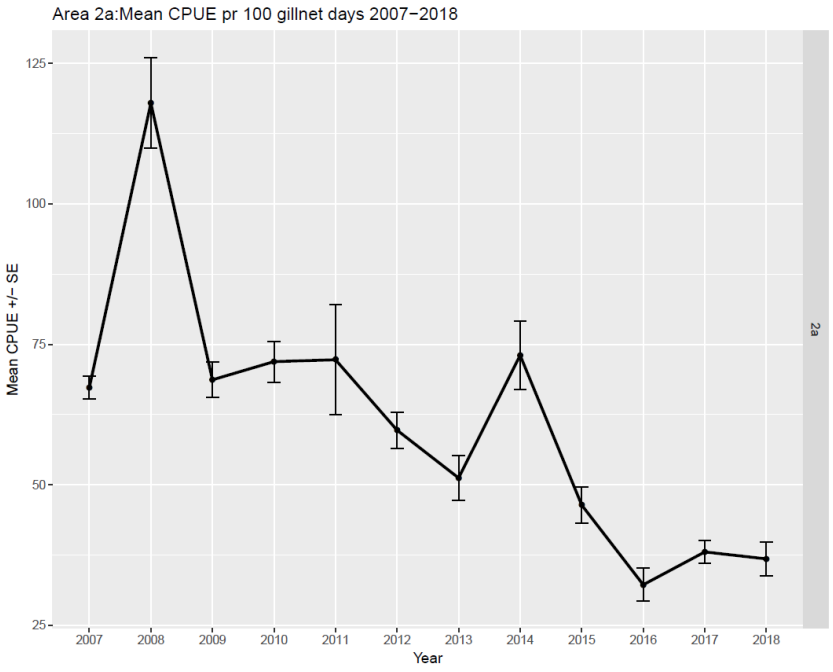

Figure 10.7. CPUE (kg per gillnet day) +/- SE of the mean of anglerfish for vessels in the Norwegian reference fleet in ICES Subarea 2.a targeting anglerfish with large meshed gillnets.

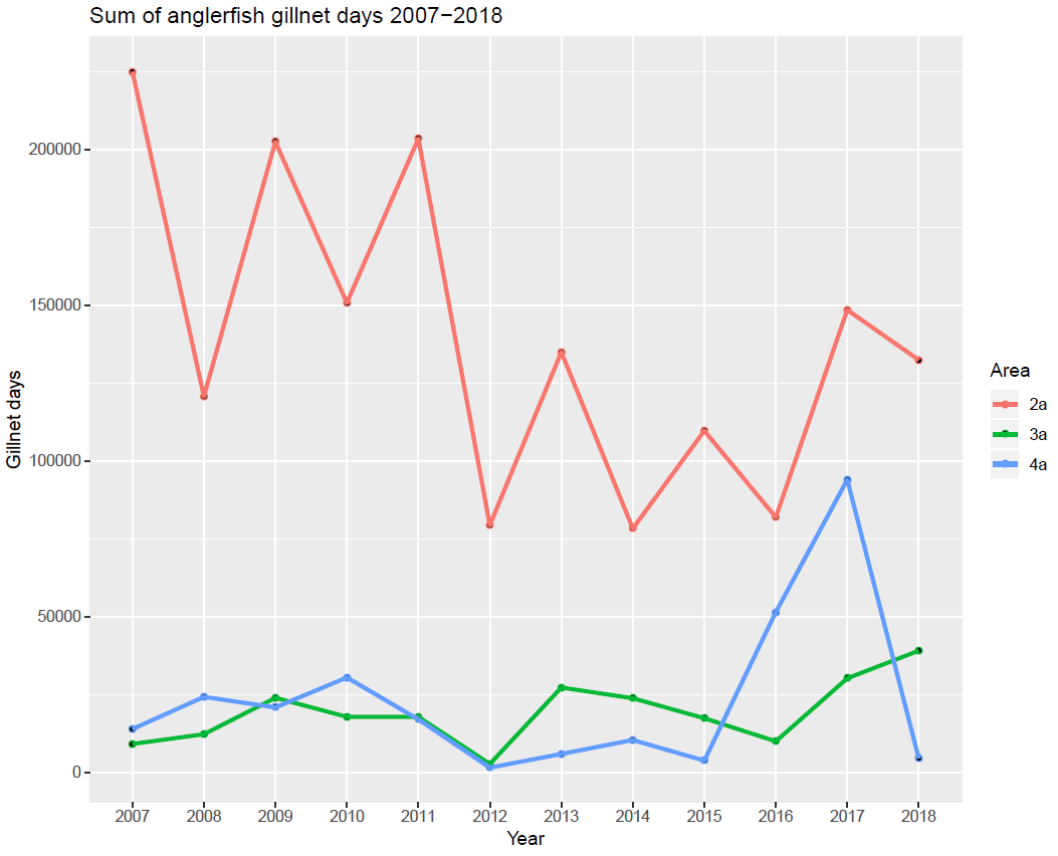

Figure 10.8. Fishing effort – sum of anglerfish gillnet days per year and ICES area for the entire Norwegian Coastal Reference fleet targeting anglerfish with large meshed gillnets.

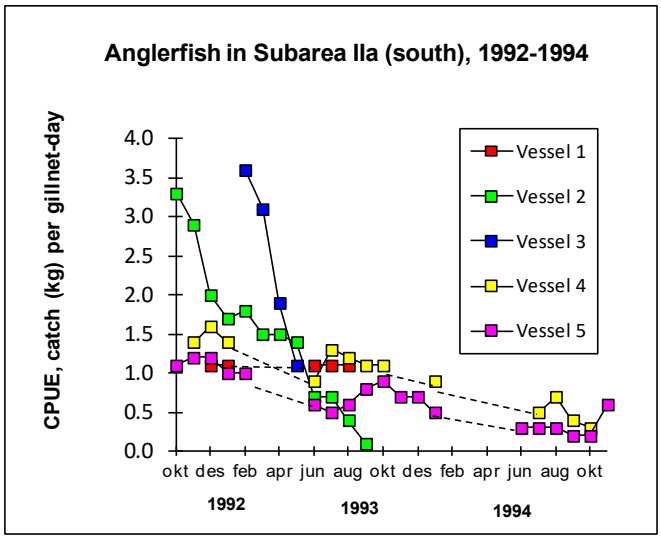

Figure 10.9. Catch per unit of effort for five boats in the gillnet fishery for anglerfish in Møre and Romsdal (the same area as vessel A in Figure 8 is fishing in) in the period October 1992 - October 1994. Boats 1 >25 m; Boats 2 ca. 20 m; Boat 3 ca. 10 m; Boat 4 and 5 ca. 16 m. Boats 1-4 were fishing with gillnet 360 mm nesh size, boat 5 with 300 mm mesh size.

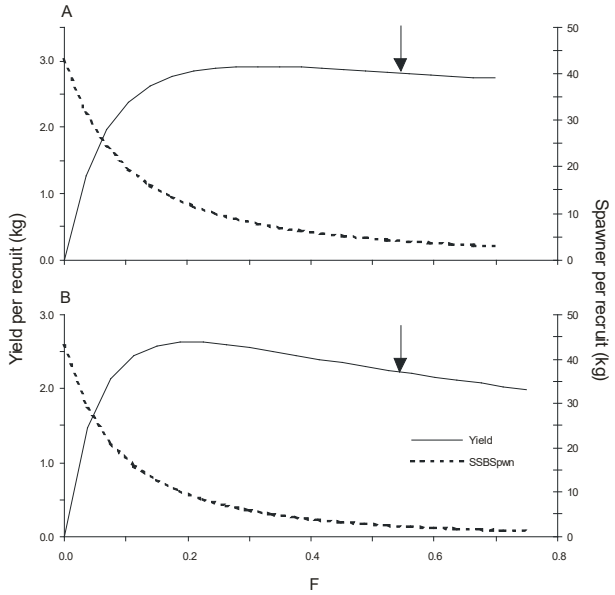

Figure 10.10. Yield- and spawning stock per 1-year old recruit as estimated in 2006 and (A) based on the exploitation pattern representative of the Norwegian gillnet (360 mm) fishery, and (B) based on the present exploitation pattern for the total fishery for anglerfish in the NEZ (incl. gillnet, trawl, Danish seine). M = 0.15, and the age range for the reference F includes ages 7-10. Input data are given in Table 10.3. See Thangstad *et al.* (2006) for information about the input data.

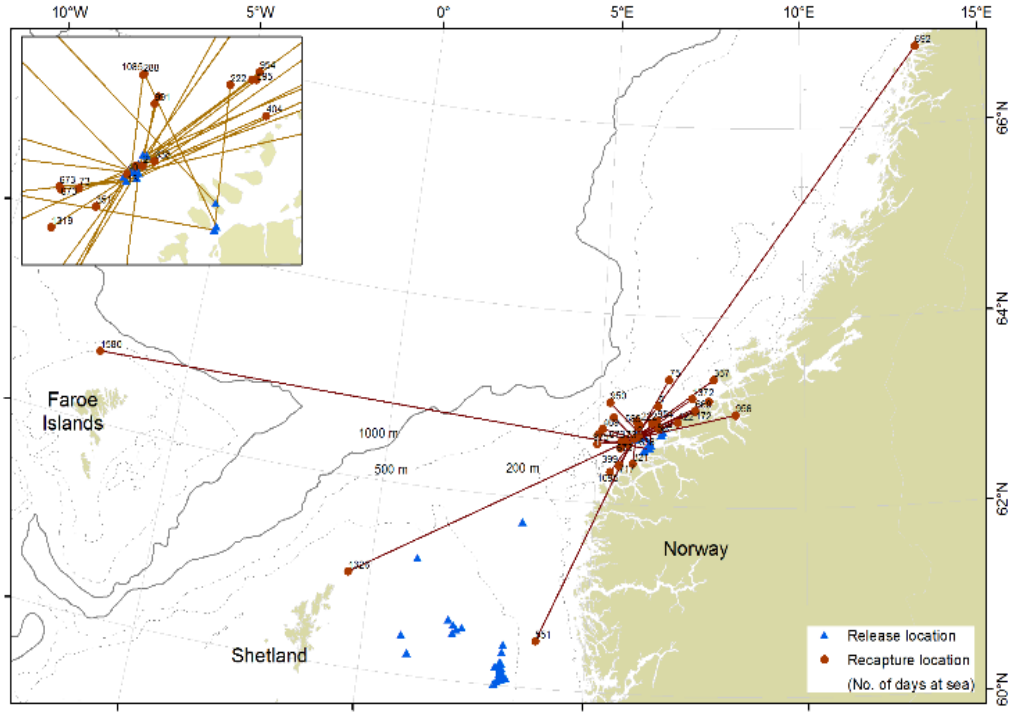

Figure 10.11. Anglerfish tagging locations 2003–2005 on the coast of western Norway in ICES 2.a and during the North Sea IBTS surveys, and recapture locations (to date) with number of days at sea.