17 Pollack in Bay of Biscay and Atlantic Iberian waters

pol.27.89a – *Pollachius pollachius* in Subarea 8 and Division 9.a

17.1 General

Type of assessment: the Bay of Biscay and Atlantic Iberian waters pollack is classified as a category 3 stock (this report). LBI (Length Based Indicators) method is used to assess this stock. The advice for this stock is biennial and advice basis the MSY approach.

Until this working group this stock was classified by ICES as a category 5 stock and the latest advice was provided in 2021 (ICES, 2021a) following a precautionary approach. This stock was benchmarked in 2023 (ICES, 2023a),

17.1.1 Stock identity and fishery description

See Stock Annex.

17.1.2 Summary of ICES advice for 2022 and 2023 and management for 2021 and 2022

17.1.2.1 ICES advice for 2022 and 2023

In 2021, ICES advised that when the precautionary approach is applied, commercial catches should be no more than 905 t in each of the years 2022 and 2023.

17.1.2.2 Management applicable for 2022 and 2023

Pollack is managed under a TAC that was set at 1851 t for both 2022 and 2023. The 2023 TAC for pol.27.89.a is set separately for ICES divisions 8.a, 8.b, 8.d, 8.e, Division 8.c, and subareas 9 and 10 (and Union waters of CECAF 34.1.1) and is shown in Table 17.1. The reported landings of pol.27.89.a in 2022 were 65% of the established TAC.

17.2 Fisheries data

17.2.1 Commercial landings

Pollack, *Pollachius pollachius*, is mainly exploited by France and Spain, with minor contribution of landings from Portugal. For the last 10 years, France was responsible for 77% of stock's commercial landings while Spain for 18%. The commercial landing statistics are given in Table 17.2. A more detailed description of the fisheries and biology of the species is provided in the Stock Annex.

The landings by gear submitted to WGBIE are given in Table 17.3. Note that these are not the landings values used in the advice issued in 2015 and 2017 due to numerous data gaps. A new French landings series by *métier* from 2000 to 2014 was available from the ROMELIGO project (Léauté *et al*., 2018a - WD 05 in ICES, 2018a), and these data were used to update the pollack landings for these years. The ROMELIGO data (N. Caill-Milly, Ifremer, pers. comm.) have been used to complete the official information available for this stock.

Annual commercial landings have fluctuated between 1199 and 2313 t since 2000, without a clear trend. Pollack landings decreased from 1535 t in 2020 to 1199 t in 2022, which is an 22% decline. The TAC for 2022 was set at 1851 t, which means that commercial landings have not exceeded this value.

Recreational catches may be considerable (Radford *et al*., 2018) but have not been quantified.

17.2.2 Commercial discards

Discard estimates are available since 2003 for the French fleets, and since 2015 for all relevant fleets (Table 17.4). Discard information from 2003 to 2014 was compiled from data provided by the ROMELIGO project (N. Caill-Milly, Ifremer, pers. comm.) to WGBIE. Most fleets did not report pollack in discards and for Spanish netters discards are considered negligible (less than 0.5% of catch). French netters and liners discarded the 2% and 0.1% of their catches in 2022, respectively.

17.2.3 Length composition

There is a time-series of commercial landings-at-length data for 2010–2022 (Figure 17.2). Length composition sampled were compiled from InterCatch (years > 2015) and the ROMELIGO project (Leauté *et al*., 2018a; 2018b). From 2010 to 2015, the length composition information is only available for the French métiers. From 2015 onwards, Spain provides length information for its *métiers* through InterCatch and Portugal also recently started uploading *métier*-related length information since 2019. The raising procedure used to obtain an aggregated-weighted length composition of landings follows the following strata: country, area, gear type, and year. The average percentage of volume of sampled catches was 35%, with the highest values in 2020 (58%) and 2022 (77%) (Table 17.5).

17.2.4 Commercial abundance indices

17.2.4.1 Commercial LPUE FR-GNS>90mm-8a-2s

A commercial abundance index for pollack is available for the French gillnet fleet in Division 8.a. The index includes information for fishing sequences performed with gillnets of mesh size > 90 mm and acting during the second semester of the year (FR-GNS>90mm-8a-2s). This index value was estimated and provided by Léauté *et al*. (2018a; 2018b) from the ROMELIGO project. A new methodology, based on a conditional decision tree, has been developed to select the information from the FR-GNS>90mm-8a-2s fleet based on logbook records (Caill-Milly *et al*., 2020 - WD11 in ICES, 2020). This methodology has been used to update the abundance index last year (ICES, 2021b). In 2022, the updated time-series of landings, effort and LPUEs have been provided to WGBIE (Caill-Milly, N., Ifremer, pers. comm.) and is summarized in Table 17.6. The FR-GNS>90mm-8a-2s fleet index is available from 2005 to 2021 and represents an average of 7.5% of the total landings of the stock. Landings of this fleet have fluctuated between 52 and 172 t, each recorded in 2006 and 2014, respectively (Figure 17.3). Since 2014, there is a decreasing trend in landings that reached a value of 110 t in 2018 followed by a slight increase since 2019. In 2020, pollack landings were 158 t. The effort unit is the fishing sequence, a combination of vessel, gear, statistical rectangle, and day. After an increasing period between 2011 and 2016, effort of the FR-GNS>90mm-8a-2s fleet has decreased in 2017 and 2018 then increased again in 2019 and 2020. The LPUE showed a decreasing trend from 2012 to 2018, declining from 200 kg/Fs in 2012 to 101 kg/Fs in 2018.

Because this commercial LPUE is not standardized, the WKMSYSPICT1 did not recommend its use for the assessment of the stock (ICES, 2021c).

17.2.4.2 Standardized LPUE France Gillnets

During the last benchmark a new standardized commercial LPUE was presented and it was approved to be used in the assessment of pol.27.89a (ICES 2023a; Sampedro *et al.*, WD2 in this report). A commercial abundance index was provided using the French bottom-sets gillnetters (GNS) fleet, which represents 47% of the French landings for pollack. The vessels included in the fleet were selected applying two filters, vessels with a minimum of 5 years of positive pollack catches and have been catching a minimum of 500 kg of pollack per year. The French database changed in 2009, which led to a change in the repositories of the effort. All declarative variables were impacted by this change in the database. Therefore, the data were split into two series: from 2000 to 2009 and from 2010 to 2021.

Catches were normalized into relative proportions by weight and square-root transformed (Winker, 2013). Principal component scores derived from a Principal Component Analysis (PCA) of the catch data were used as predictor variable in the Generalized Additive Model (GAM) framework. PCs that had an eigenvalue higher than 1, in this case they were four PCs (RS1, RS2, RS3 and RS4), were selected

The model fitting LPUE records was a GAM with a Tweedie distribution, which takes into account high frequencies of zeros in the data. A cyclic-cubic regression spline was chosen to smooth the month predictor, while smoothing of other continuous variables was realized by thin plate regression spline functions. There is a random effect on vessels. Characteristics of vessels (in terms of vessel length) are also included in the model. Effort was estimated using vessel time at sea and is used as an offset in the model.

The final GAM model equation was as follows:

$$\begin{aligned} pollack\_weight \sim\ & offset\ (\log(time_{sea})) + \ as.factor(year) + s(month, bs = \text{cc}, k = 12) \\ & + s(carre.lon, carre.lat, k = 20) + \ s(vessel_{id}, bs \\ & = \text{"re"} + s(rs1) + s(rs2) + s(rs3) + s(rs4) + as.factor(vessel_{length}) \end{aligned}$$

Where s() is spline smoothing; pollack_weight are the landings of pollack; time_sea is the effort in days; year is the year time; month is the month time; lon, lat are the coordinates of ICES rectangle; vessel_id is the vessel identificator; vessel length is the length of the vessel and rs1-4 are the PC scores.

In order to compare the influence of adding the covariates on the predictions the next five models were tested:

1. base: $pollack_{weight} \sim offset\ (\log(time_{sea})) + \ as.factor(year) + s(vessel_{id}, bs = \text{"re"})$

2. mois:

   $pollack_{weight} \sim offset\ (\log(time_{sea})) + \ as.factor(year) + s(month, bs = \text{"cc"}, k{=}12) + \ s(vessel_{id}, bs = \text{"re"})$

3. space: $pollack_{weight} \sim offset\ (\log(time_{sea})) + \ as.factor(year) + s(month, bs = \text{"cc"}, k{=}12) + \ s(vessel_{id}, bs = \text{"re"})$ + s(carre.lon, carre.lat, k=20)

4. carac:

   $$\begin{aligned} pollack_{weight} \sim\ & offset\ (\log(time_{sea})) + \ as.factor(year) \\ & + s(month, bs = \text{"cc"}, k = 12) + \ s(vessel_{id}, bs = \text{"re"}) \\ & + s(carre.lon, carre.lat, k = 20) + as.factor(vessel\_length) \end{aligned}$$

5. tot:

$$pollack_{weight} \sim offset\,(\log(time_{sea})) + as.factor(year) + s(month, bs = \text{"cc"}, k = 12) + s(vessel_{id}, bs = \text{"re"}) + s(carre.lon, carre.lat, k = 20) + s(rs1) + s(rs2) + s(rs3) + s(rs4) + as.factor(vessel\_length)$$

Predictions were made for the five GAM models and with the two periods of the series: 2000-09 and 2010-21 (Figure 17.4). For visualizing, all LPUEs are standardized by its mean.

For this WG, the LPUE was updated to include a new year of data (Vermand, Y., Ifremer, pers. comm.) and the normalised predicted biomass index is shown in Figure 17.5. The predicted values of the index indicated that the abundance has been steadily decreasing since 2013, reaching a minimum of the series in 2021, and with a slight recovery in 2022.

17.3 Scientific surveys

Pollack abundance indices resulted negligible or zero in the groundfish surveys carried out in the distribution area: FR-EVHOE, SP-NSGFS and PT-IBTS. The bottoms preferred for this species (wrecks and rocky bottoms) makes that trawl surveys are not well suited for monitoring this species.

17.4 Life history parameters

Life history parameters for pollack were compiled from literature and working documents. The information was selected considering the quality and extension of the scientific work and the representativeness for pol.27.89a stock. The summary of the life history information is shown in Table 17.7. Von Bertalanffy growth parameters $Linf$ and K are estimated at 98.3 cm and 0.18 year^{-1}, respectively, from a study using samples from ICES subareas 6 and 7. Related to maturity, the $Lmat$ for both sexes together, is at 42.3 cm, corresponding to the estimates from the microscopic study carried out in division 9a (Alonso-Fernández *et al*., 2013), other maturity studies in Subarea 8 confirmed this value (Léauté *et al*., 2018a). The natural mortality is set at 0.34, that corresponds with the results of a metanalysis carried out with different empirical methods to estimate M (ICES, 2023a).

Values of $Linf, Lmat, K$ and M are used as input information for the performance of the assessment and advice.

17.5 Stock assessment

17.5.1 Length based indicators assessment

The assessment of this stock is provided using the Length-based indicators (LBIs), defined at WKLIFE V and VI (ICES, 2015; 2017), as the proposal accepted by this working group (Sampedro *et al*., WD2 –this report).

The LBIs can classify the stocks according to conservation, optimal yield and length distribution relative to expectations under maximum sustainable yield (MSY), providing a perception of the relative stock status (ICES, 2018b).

Length-based indicators are calculated from length-frequency distributions obtained from landings and compared to the reference levels derived from life-history parameters. For the LBI analysis, the further life-history parameters were considered:

- $Linf = 98.3\ cm$ (estimated for pollack in Subarea 6 and 7 (Alemany, 2017)).
- $Lmat = 42.3\ cm$ (for both sexes, microscopic maturity determination (Alonso-Fernández *et al*., 2013)).
- $M/K = 1.868$, derived from $M = 0.34$ (metanalysis with different empirical methods for pollack (ICES, 2023a)) and $K = 0.182$ estimated for pollack in Subarea 6 and 7 (Alemany, 2017).
- Length–weight relationship parameters a = $1.09e^{-5}$ and b = 3.044 (Leauté *et al*., 2018a).

The LBI makes two main assumptions: the population is in equilibrium with total mortality and recruitment have been constant for a period as long as the lifetime of the time-series, and the selectivity follows a logistic curve. For our data, the assumption of a unimodal length distribution that would reflect near-equilibrium conditions was achieved by aggregating the length frequencies distributions in 5 cm length bins (Figure 17.6).

The ratios $Lc/Lmat$ and $L25\%/Lmat$ indicate that immature individuals are not being protected (Figure 17.7 and Figure 17.8). The Lc has varied between 77 and 124% of $Lmat$ in the time series. The $Lmax5\% < 0.8$ *Linf and the Pmega < 0.3 suggest that larger individuals are not being caught. The low values of larger individuals could be explained by the dome-shaped selectivity of some of the fleets targeting pollack. Since 2017 $Lmean$ is equal or above $LF = M$ suggesting that the stock is exploited at or below F_{MSY} level.

The conclusion of the LBI analysis is that the stock in 2022 is exploited below F_{MSY}.

Sensitivity Analysis

The assumed values of life-history parameters in LBI analysis are based on sound scientific studies of the species and their sources are well identified. Nevertheless, the LBI results could be sensitive to assumed values of $Linf$, $Lmat$, and M/K. In order to assess the impact of the values assumed a sensitivity analysis on these parameters was carried out overestimating and underestimating them by 5 and 10%.

The results indicated that LBI ratios for conservation of larger individuals, optimizing yield and MSY are sensitive to the input value for $Linf$ (Figure 17.9). An overestimation of $Linf$ leads to a worst perception of the stock for all the ratios impacted and for the underestimation the opposite is right. However, for the whole range of the simulated $Linf$ values (88-108 cm) the stock would be exploited below the F_{MSY} in 2022.

Although the perception of the conservation of immature gets worst with the increase of the value of $Lmat$, the conclusions are similar to those obtained for the base LBI analysis (Figure 17.10).

The overestimation of M/K produces slight increases in the proportion of mega-spawners (Pmega), the optimizing yield and MSY indicators that would not change the perception of the stock in recent years (Figure 17.11).

Length Based Spawning Potential Ratio (LBSPR)

The overall perception of the stock status provided by LBI was tested using the method Length Based Spawning Potential Ratio (LBSPR). The LBSPR method is focused on the effect of fishing on the spawning biomass per recruit (SBPR) of the stock, considering that without fishing, the population can reach 100% of its spawning potential ratio (SPR). The LBSPR analysis uses maximum likelihood to estimate the size at which individuals in a stock become vulnerable to

capture and the relative fishing mortality (F/M), which are used to calculate the SPR (Hordyk *et al*., 2015a; 2015b).

The values of the life-history parameters derived from a literature review are the following ones:

- M = 0.34 and K = 0.182 (Table 17.7) and, therefore, M/K = 1.868.
- L_{∞} = 98.2 cm (Table 17.7).
- L_{50} = 42.3 cm (Table 17.7).
- L_{95} = 59 cm (calculated from Alonso-Fernandez *et al*. (2013)).

The LFDs are the same used for the LBI method.

The SPR assessment shows that the relative fishing pressure (F/M) is decreasing since 2018, and in 2022 was estimated at 0.83 (Figure 17.12). The SPR shows an overall increasing trend, being in 2022 above 30% for the first time. As in the case of LBI analysis, LBSPR method could be slightly underestimating the SPR for populations caught with gillnets which present a dome-shaped selectivity curve.

17.6 Application of advice rule

The latest advice was provided in 2021 following the framework for category 5 stocks (ICES, 2021a). ICES advised that commercial landings should be no more than 905 t in each of the years 2022 and 2023.

This year, the framework for category 3 stocks (ICES, 2022) was followed to provide the advice for 2024 and 2025. The method 2.1, *rfb* rule, was applied for this stock as the needed information (biomass index, length composition of data and life-history parameters) was available and the growth parameter *K* is below 0.2.

The input data for applying the *rfb* rule are shown in Table 17.8. The time series of commercial landings as calculated by ICES, the indicators derived LBI analysis and the biomass index corresponding to the standardized LPUE FRANCE_GNS.

The estimated components and results of the *rfb* rule are presented in Table 17.9. Because there was a high difference between the recent catches and the previous advice provided as Category 5 stock (905 t), the referenced catch (Ay) was estimated as the average of commercial landings of the last three years (2020-2022) and it is equal to 1369 t. The $I_{trigger}$, was defined as I_{loss} (year 2021 = 0.73) multiply by 1.4, $I_{trigger}$ = 1.0157. The stability clause was not applied as the biomass safeguard (I_{2022} / $I_{trigger}$) is below 1.

The proposal advice resulted from applying the *rfb* rule on the previous advice (1369 t), was 872 t for each of the years 2024 and 2025. The reduction in advice is due to the decreasing trend in the biomass index (0.78), the application of the biomass safeguard (0.79) and the precautionary multiplier (0.95).

17.7 Biological reference points

Based on the current LBI assessment and the biomass index used in the application of the advice rule, the further reference points in the MSY approach framework were defined for pol.27.89a (ICES, 2018b):

Framework	Reference point	Value	Technical basis
MSY approach	MSY $B_{trigger}$ proxy	1.02	Biomass index trigger value (Itrigger), defined as Itrigger = Iloss × 1.4, where Iloss is the lowest observed historical biomass index value (year 2021=0.73)
	F_{MSY} proxy	$\frac{L_{mean}}{L_{F=M}} = 1$	Relative value from LBI analysis, assuming M/K = 1.868. $L_{F=M}$ is based on L_c (Length at 50% of modal abundance) which varies each year.

17.8 Management plans

No management plan is known for pollack in the area.

17.9 References

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17.10 Tables and figures

Table 17.1. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. TAC for pollack for the two ICES divisions (8.a, 8.b, 8.d, 8.e and 8.c) and two subareas (9 and 10) in 2023.

TAC		155		
Species:	Pollack *Pollachius pollachius*		Zone:	8a, 8b, 8d and 8e (POL/8ABDE.)
Spain		252	Precautionary TAC	
France		1 230		
Union		1 482		
TAC		1 482		
Species:	Pollack *Pollachius pollachius*		Zone:	8c (POL/08C.)
Spain		149	Precautionary TAC	
France		17		
Union		166		
TAC		166		
Species:	Pollack *Pollachius pollachius*		Zone:	9 and 10; Union waters of CECAF 34.1.1 (POL/9/3411)
Spain		196 (1)	Precautionary TAC	
Portugal		7 (1)(2)		
Union		203 (1)		
TAC		203 (2)		
(1)	Special condition: of which up to 5% may be fished in 8c (POL/*08C.).			
(2)	In addition to this TAC, Portugal may fish quantities of pollack not exceeding 98 tonnes (POL/93411P).			

Table 17.2. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Commercial landings (in tonnes) by country as estimated by WGBIE. Shaded values come from ICES historical database, FAO FishStat (FAO, 2020), and ROMELIGO project (Léauté *et al*., 2018a; b). Figures from 2015 to 2022 were derived from the InterCatch database.

	Bay of Biscay (Subarea 8)				Atlantic Iberian waters (Division 9.a)				
Year	Belgium	Spain	France	UK	Spain	Portugal	Total	Unallocated	ICES estimates
1979	0	1021	2221	0	0	0	3242	0	3242
1980	1	1576	2158	0	0	0	3735	0	3735
1981	1	902	2326	0	0	0	3229	0	3229
1982	2	85	2185	2	32	0	2306	0	2306
1983	0	581	2652	0	203	0	3436	0	3436
1984	0	1606	2351	1	642	0	4600	0	4600
1985	0	2304	2769	23	636	0	5732	0	5732
1986	0	437	2127	5	237	0	2806	0	2806
1987	0	584	2022	1	308	3	2918	0	2918
1988	3	476	1761	6	329	7	2582	0	2582
1989	13	214	1682	4	57	3	1973	0	1973
1990	14	194	1662	2	27	1	1900	0	1900
1991	1	221	1867	1	76	2	2168	0	2168
1992	2	154	1735	0	65	2	1958	0	1958
1993	3	135	1327	0	47	1	1513	0	1513
1994	3	157	1764	0	28	3	1955	0	1955
1995	6	153	1457	2	59	2	1679	0	1679
1996	8	137	1164	0	43	2	1354	0	1354
1997	2	152	1167	1	54	2	1378	0	1378
1998	1	152	956	0	55	1	1165	0	1165
1999	0	120	n/a	0	36	1	157	0	157
2000	0	121	1294	0	49	15	1479	0	1479
2001	0	346	1278	0	81	41	1746	0	1746
2002	0	170	1722	0	35	45	1972	0	1972
2003	0	142	1450	1	39	31	1663	0	1663
2004	0	211	1343	0	90	12	1656	70	1726
2005	0	306	1552	0	132	0	1990	-4	1986
2006	0	251	1596	171	102	0	2120	6	2126
2007	0	198	1375	62	103	5	1743	104	1847
2008	0	265	1732	64	128	31	2220	93	2313
2009	0	218	1371	41	68	3	1701	111	1812
2010	0	265	1170	44	91	2	1572	110	1682
2011	0	322	1475	27	104	2	1930	102	2032
2012	0	159	1131	2	139	2	1433	87	1520
2013	0	251	1346	8	110	3	1718	93	1811
2014	0	185	1612	19	93	1	1910	49	1959
2015	0	195	1244	37	78	18	1573	37	1610
2016	0	186	1292	25	111	28	1642	19	1661
2017	0	128	1219	0	95	38	1480	1	1481
2018	0	135	1220	0	124	33	1513	0	1513
2019	0	174	1189	0	143	57	1562	0	1562
2020	0	171	1174	0	136	54	1535	0	1535
2021	0	166	987	0	165	54	1372	0	1372
2022	0	189	805	0	157	48	1199	0	1199

Table 17.3. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Commercial landings (in tonnes) from France, Spain and Portugal by country and gear as submitted to WGBIE. Shaded values come from ICES historical database, FAO FishStat (FAO, 2020), and ROMELIGO project (Léauté *et al.*, 2018a) ; b). Non-shaded figures, from 2015 to 2022, were derived from the InterCatch database.

	France				Spain			Portugal	
Year	Nets	Trawl	Lines	Others	Lines	Nets	Others	Others	Trawl
2000	671	353	176	94	-	-	-	-	-
2001	794	271	133	80	31	53	169	-	-
2002	1151	321	170	79	26	28	134	-	-
2003	990	215	182	64	31	35	146	-	-
2004	679	298	292	73	47	36	222	16.5	0.1
2005	801	364	326	62	90	36	161	7.8	0.6
2006	882	395	245	74	48	29	243	6.7	0.3
2007	797	301	228	49	72	51	210	4.5	0.4
2008	1055	267	351	59	147	95	163	33.3	0
2009	829	185	328	30	101	76	97	2.4	0.5
2010	719	128	249	74	167	162	93	1.7	0.1
2011	850	180	357	88	207	199	20	1.2	0.3
2012	631	148	305	46	123	122	53	-	-
2013	756	210	327	52	-	-	-	-	-
2014	925	288	345	55	110	147	103	1	0
2015	766	178	258	42	145	114	14	18	0.2
2016	735	128	399	30	185	87	26	28	0
2017	596	100	486	37	123	91	9	38	0
2018	684	78	405	54	134	120	6	32	0.8
2019	683	76	387	43	152	162	3	55	1.8
2020	670	71	409	24	168	133	7	49	5
2021	510	51	397	29	148	175	8	49	5
2022	455	25	294	30	167	173	6	47	1

Table 17.4. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Discards estimates (in tonnes) from France, Spain and Portugal by country and gear as submitted to WGBIE. Shaded values come from ROMELIGO project (Léauté *et al.*, 2018a; b). Non-shaded figures, from 2015 to 2022, were derived from the InterCatch database.

	France			Spain			Portugal
Year	Nets	Trawl	Lines	Lines	Nets	Trawl	Trawl
2003	0	0	-	-	-	-	-
2004	0	0.2	-	-	-	-	-
2005	11	0	-	-	-	-	-
2006	1.4	13.9	-	-	-	-	-
2007	5.7	0	-	-	-	-	-
2008	35.5	0	0	-	-	-	-
2009	3.2	0	1.5	-	-	-	-
2010	9	0	0	-	-	-	-
2011	2.9	0	6.2	-	-	-	-
2012	13	0	1.2	-	-	-	-
2013	19.4	0.3	6.8	-	-	-	-
2014	63.6	0	1.1	-	-	-	-
2015	28.1	0	0	0	3.5	0	0
2016	83.1	5.4	4.3	0	0.4	0	0
2017	18.6	0	0	0	0	0	0
2018	38.7	0	0	0	0	2.8	0
2019	8.2	0	6.1	0	0	0	0
2020	8.5	0.0	0.6	0.0	0.0	0.0	0.0
2021	12.9	0	3.2	0	0.35	0	0
2022	11.2	0	0.4	0	0	0	0

Table 17.5. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Volume of catches sampled to estimate annual length composition.

Year	%Vol Sampled
2010	35
2011	19.6
2012	23.9
2013	27.7
2014	38.5
2015	19.2
2016	32.8
2017	34.2
2018	15.1
2019	41.1
2020	57.9
2021	66.7
2022	76.7

Table 17.6. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Data for the commercial FR-GNS>90mm-8a-2s fleet index as submitted to WGBIE in 2022 (ICES, 2022). The representativeness of the index related to the total annual stock landings (in kg) is indicated in the last column.

Year	Landings (kg)	Effort (fishing sequence)	LPUE (kg/fs)	% Stock
2005	97484	829	117.6	4.9
2006	51794	669	77.4	2.4
2007	120701	895	134.9	6.5
2008	139003	1036	134.2	6.0
2009	104658	810	129.2	5.8
2010	81178	721	112.6	4.8
2011	142528	654	217.9	7.0
2012	149691	746	200.7	9.8
2013	148872	876	169.9	8.2
2014	171901	1045	164.5	8.8
2015	168819	1051	160.6	10.5
2016	149391	1335	111.9	9.0
2017	133548	1204	110.9	9.0
2018	110553	1095	101.0	7.3
2019	155317	1163	133.5	9.9
2020	157757	1328	118.8	10.0
2021	97339	891	109.2	7.1

Table 17.7. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Life history parameters values selected to be used in the stock assessment of pol.27.89a. Source of the data and areas of study are indicated in the last two columns.

Life history parameter		Value	Sex	ICES Subarea/Division	Source
L_{inf} (cm)	Asymptotic length	98.3	Both	6.7	Alemany (2017)
K (year^{-1})	Von Bertalanffy parameter	0.182	Both	6.7	Alemany (2017)
L_{mat} (cm)	Length-at-maturity	42.3	Both	9a	Alonso-Fernández *et al*. (2013)
a	Length-weight relationship parameter	1.09E-05	Both	8	Léauté *et al*. (2018a)
b	Length-weight relationship parameter	3.044	Both	8	Léauté *et al*. (2018a)
M	Natural mortality	0.34	Both		Metanalysis different empirical methods (ICES, 2023a)
M/K		1.868	Both		

Table 17.8. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Input information used for the application of the *rfb* rule.

Year	Landings	Lc	Lmean	LF=M	Biomass Index
2010	1682	32.5	42.03	46.37	0.82
2011	2032	52.5	58.59	62.15	1.04
2012	1520	47.5	58.67	58.21	1.15
2013	1811	47.5	56.62	58.21	1.25
2014	1959	32.5	52.78	46.37	1.18
2015	1610	27.5	43.10	42.43	1.08
2016	1661	37.5	46.38	50.32	1.04
2017	1481	32.5	49.06	46.37	0.97
2018	1513	32.5	53.37	46.37	1.05
2019	1562	32.5	46.21	46.37	0.98
2020	1535	37.5	50.21	50.32	0.91
2021	1372	32.5	47.09	46.37	0.73
2022	1199	32.5	50.58	46.37	0.80

Table 17.9. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Estimated components and result of the *rfb* rule.

Component	Value
Ay: Mean catch Cy (2020, 2021, 2022)	1369 tonnes
Stock biomass trend	
Index A (2021,2022)	0.76
Index B (2018,2019,2020)	0.98
r: Stock biomass trend (index ratio A/B)	0.78
Fishing pressure	
f: Fishing pressure proxy relative to MSY proxy (Lmean_2022/LF=M_2022)	1.09
Biomass safeguard	
Last index value (I2022)	0.8
Index trigger value (Itrigger = Iloss x 1.4)	1.02
b: index relative to trigger value	0.79
Precautionary multiplier to maintain biomass above Blim with 95% probability	
m: multiplier (K< 0.2)	0.95
RFB calculation (Ay*r*f*b*m)	872
Stability clause (+20%/-30% compared to Ay and b=1)	Not applied
% advice change	-36%

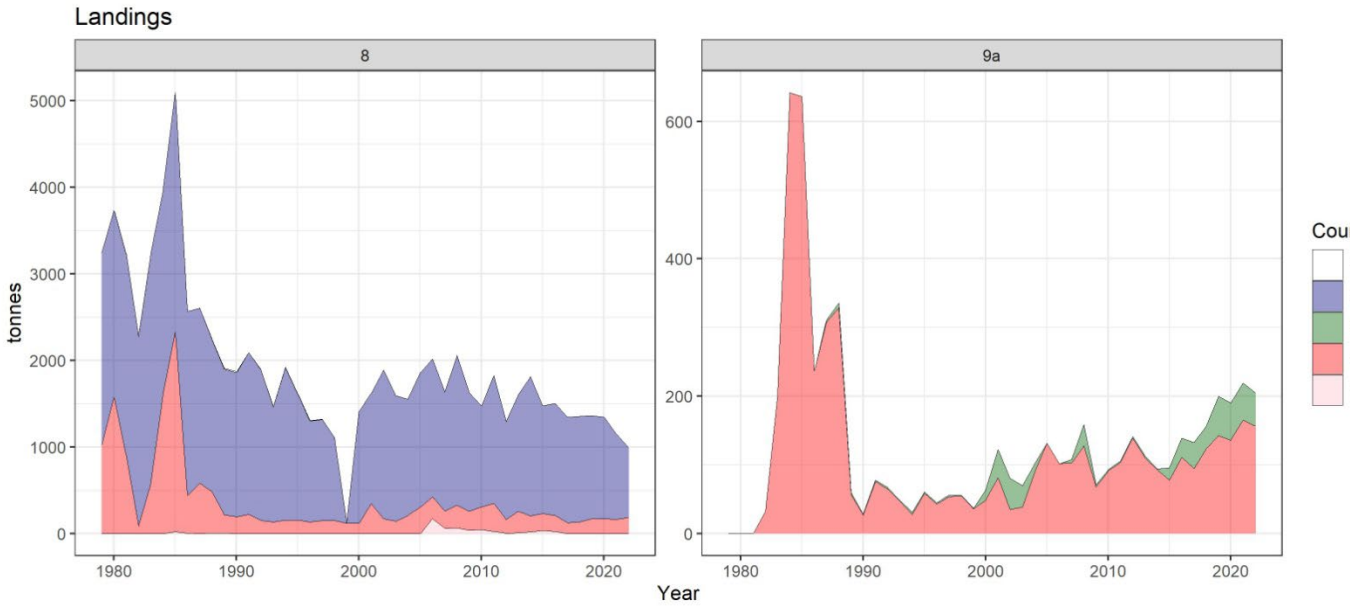

Figure 17.1. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Commercial landings (in tonnes) by country in Subarea 8 (left) and Division 9.a (right). French data are missing for 1999.

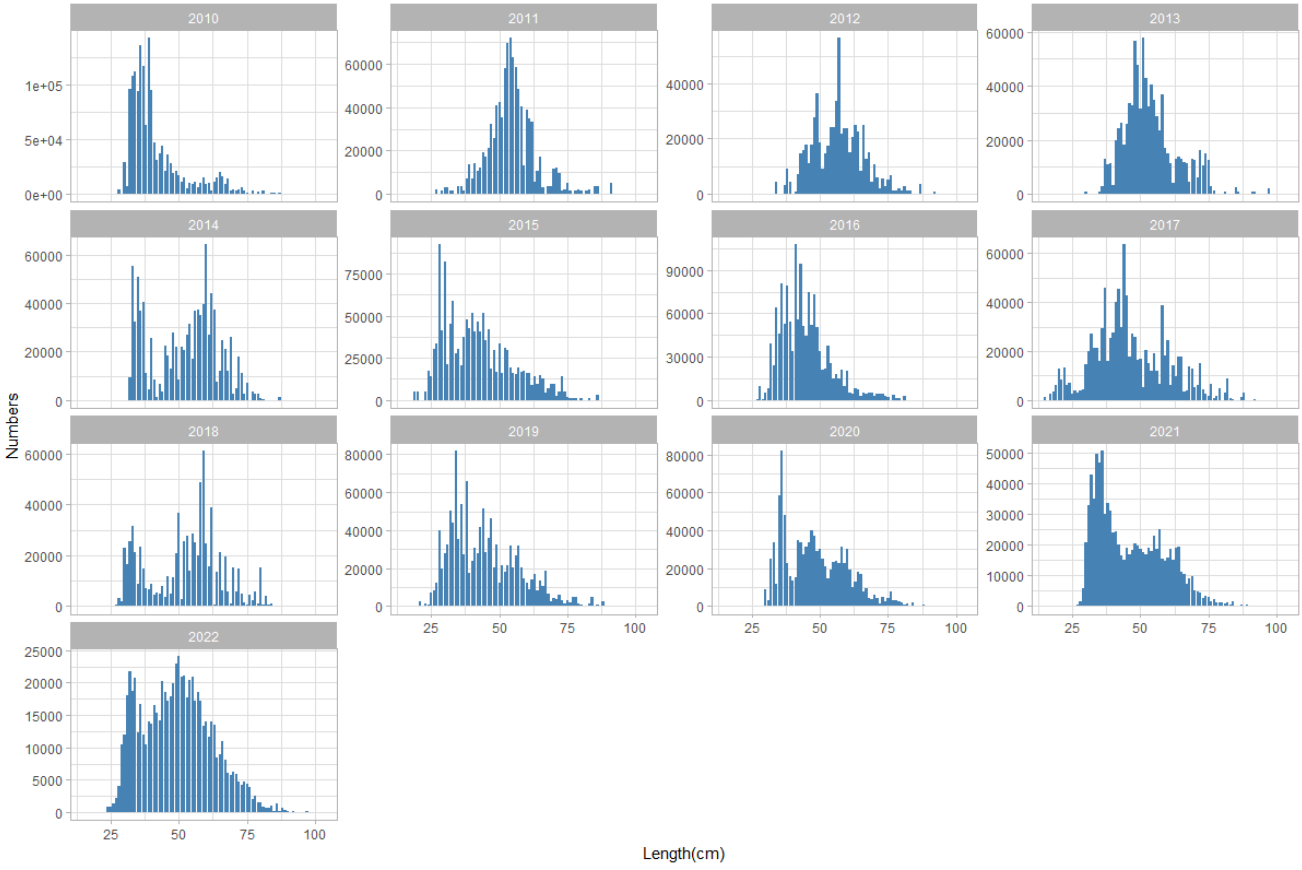

Figure 17.2. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Length composition of landings for the period 2010–2022.

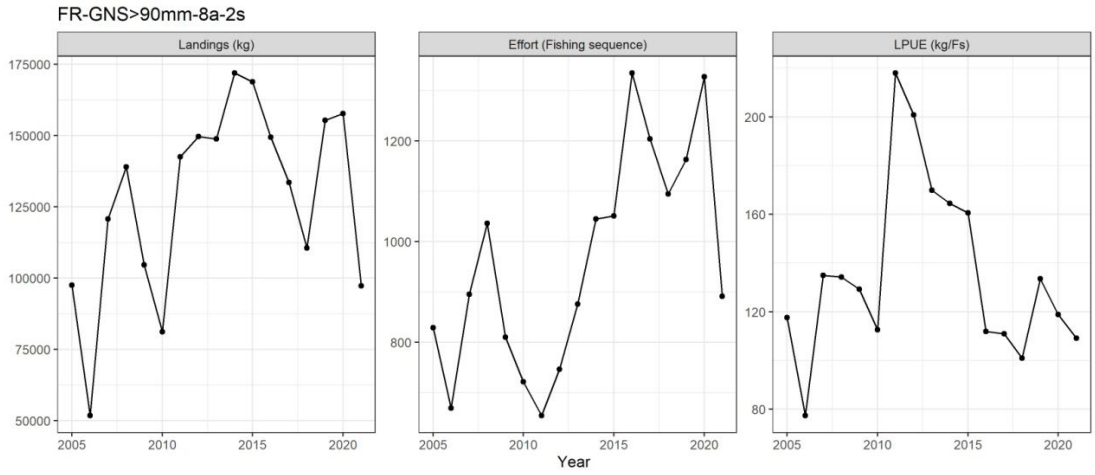

Figure 17.3. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Landings, effort and LPUEs for the FR-GNS>90mm-8a-2s commercial fleet.

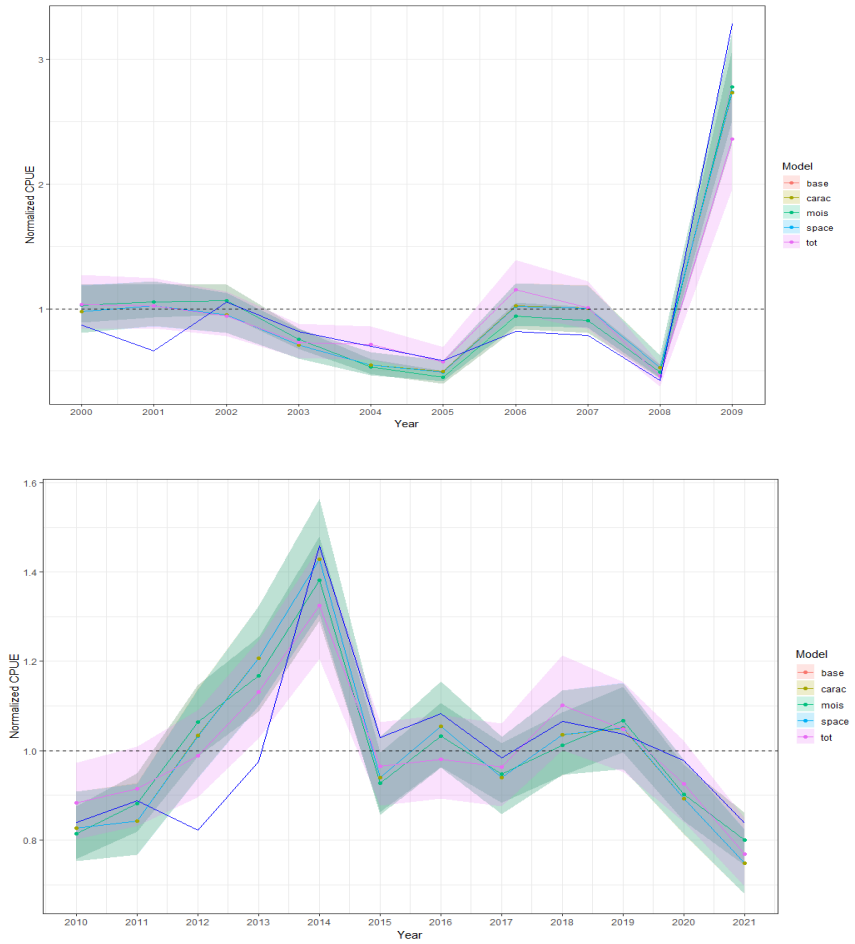

Figure 17.4. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Normalized LPUEs estimated from the 5 GAM models tested and nominal LPUE (blue line) from FRANCE_GNS. The two periods of the abundance index are separately represented: 2000-09 (up) and 2010-21 (bottom).

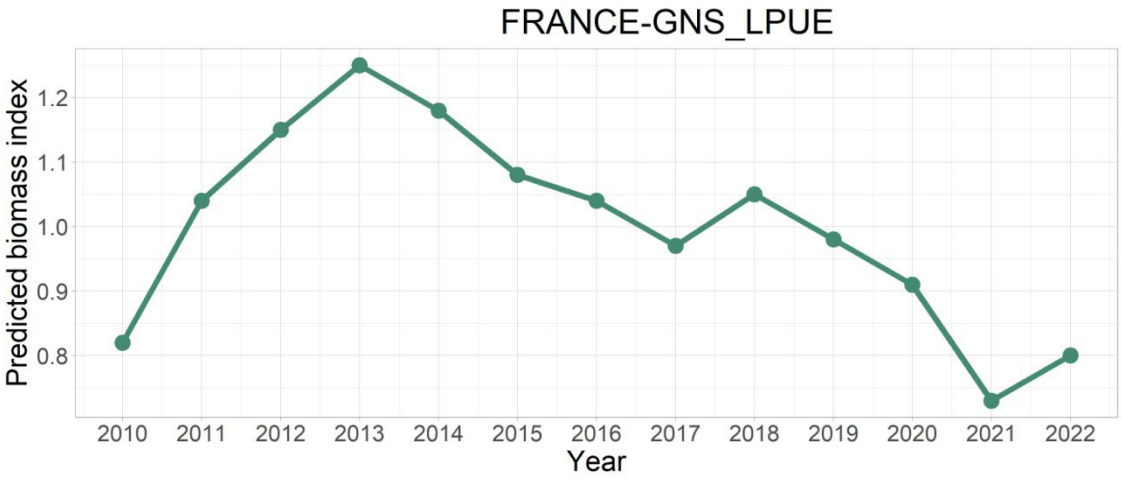

Figure 17.5. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Predicted biomass index from standardized FRANCE_GNS LPUE normalized by its mean for the period 2010-2022.

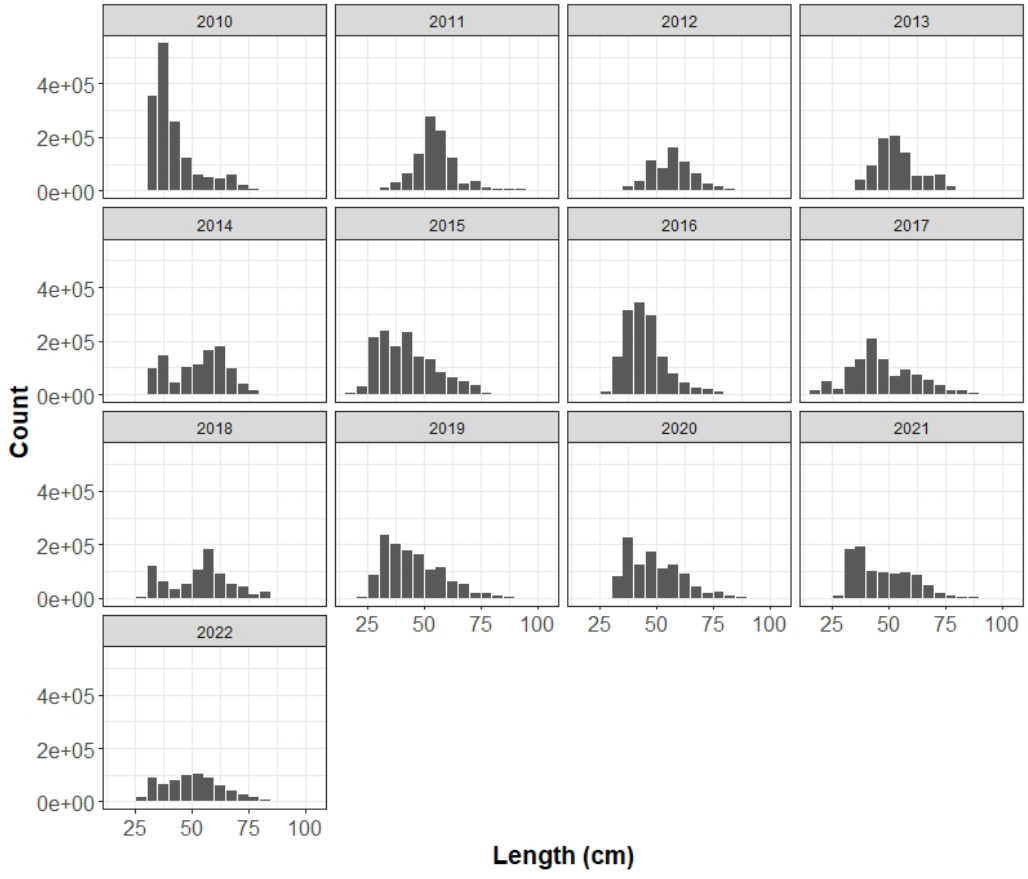

Figure 17.6. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Aggregated (5 cm length bin) length distributions for pollack landings in the period 2010-2022.

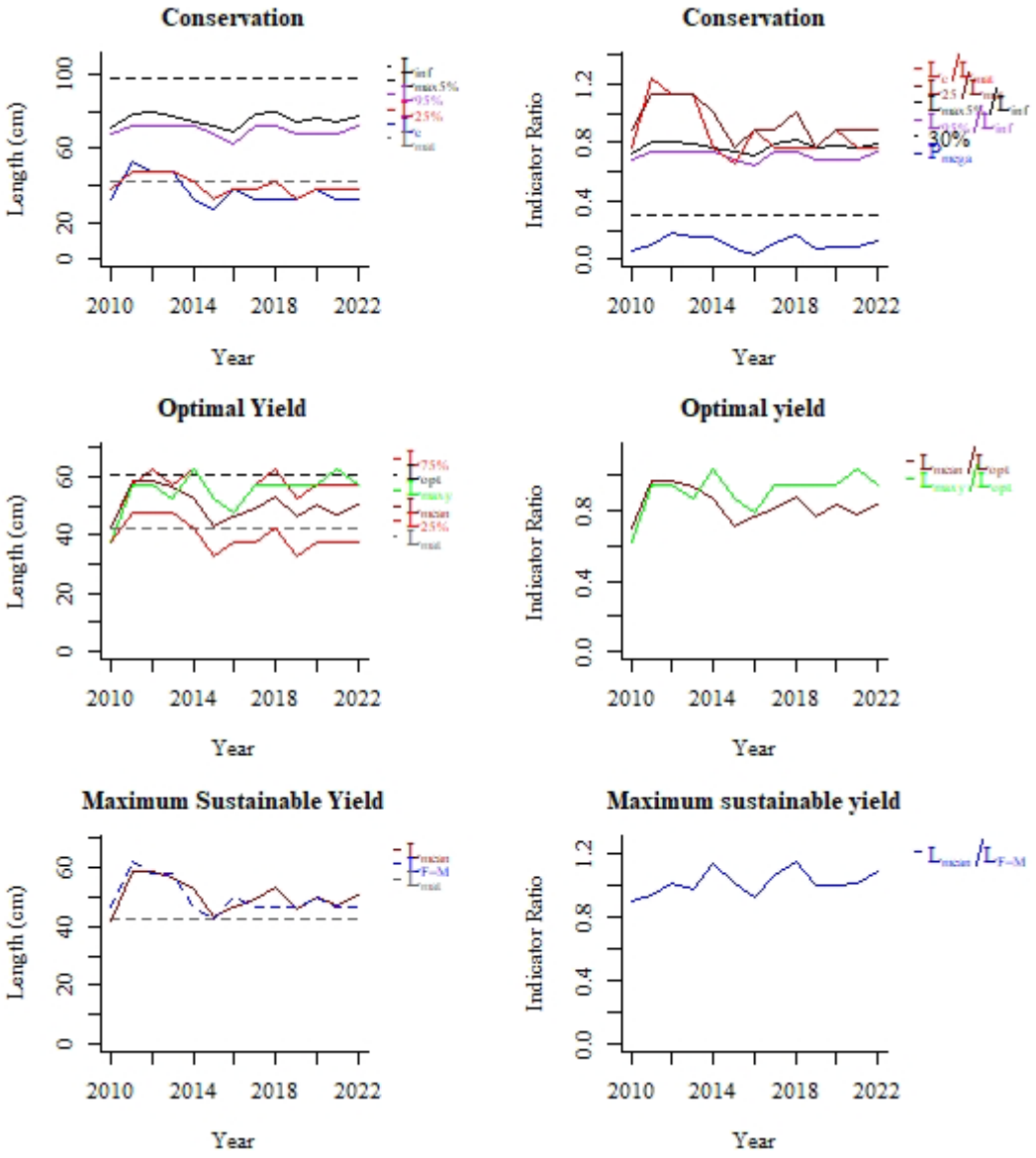

Figure 17.7. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Time series of LBI indicators and ratios.

	Conservation				Optimizing Yield	MSY
Year	L_c / L_{mat}	$L_{25\%} / L_{mat}$	$L_{max\ 5} / L_{inf}$	P_{mega}	L_{mean} / L_{opt}	$L_{mean} / L_{F=M}$
2010	0.77	0.89	0.72	0.06	0.69	0.91
2011	1.24	1.12	0.80	0.10	0.97	0.94
2012	1.12	1.12	0.81	0.19	0.97	1.01
2013	1.12	1.12	0.79	0.16	0.94	0.97
2014	0.77	1.00	0.76	0.15	0.87	1.14
2015	0.65	0.77	0.73	0.07	0.71	1.02
2016	0.89	0.89	0.71	0.04	0.77	0.92
2017	0.77	0.89	0.80	0.12	0.81	1.06
2018	0.77	1.00	0.82	0.17	0.88	1.15
2019	0.77	0.77	0.76	0.08	0.76	1.00
2020	0.89	0.89	0.78	0.09	0.83	1.00
2021	0.77	0.89	0.76	0.09	0.78	1.02
2022	0.77	0.89	0.79	0.13	0.84	1.09

Figure 17.8. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Traffic light table for LBI ratios for years 2010-2022. Conservation of juveniles: Lc/Lmat (Length at 50% of modal abundance/Length of maturity) and L25%/Lmat (25th percentile of length distribution/Length of maturity); Conservation of larger individuals: Lmax 5/ Linf (Mean length of largest 5% / Linf) and Pmega (Proportion of individuals above Lopt + 10%); Optimizing yield: Lmean/Lopt (Mean length

of individuals > Lc / Lopt = 2/3 Linf); MSY: Lmean/LF=M (Mean length of individuals > Lc / LF=M: (1-a)*Lc + a*Linf), being a=1/(2*(M/K)+1)).

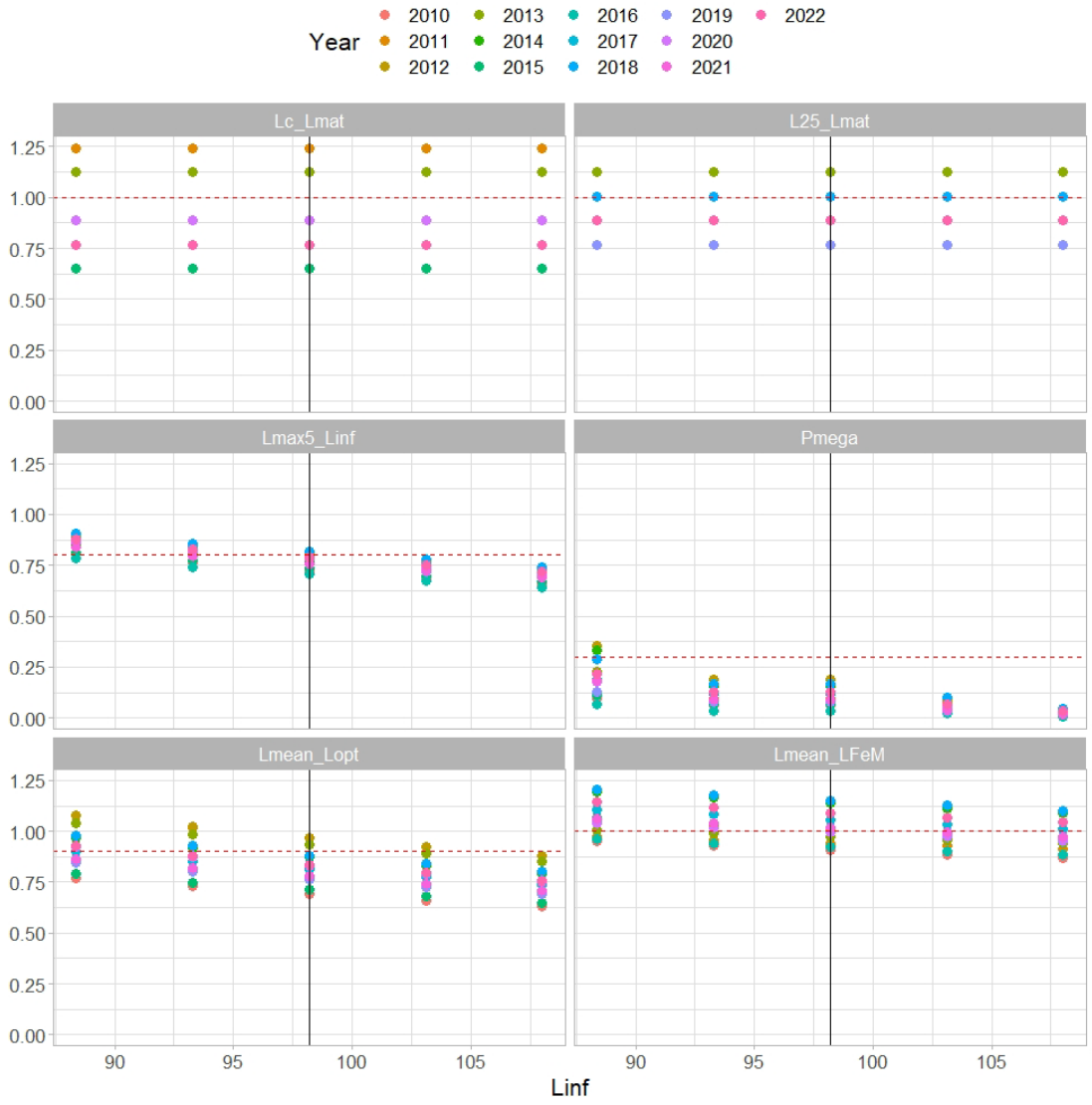

Figure 17.9. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Results from the sensitivity analysis for *Linf*

value in LBI ratios. Vertical line shows the value assumed for the LBI-analysis. The horizontal dashed line indicates the reference value for each ratio.

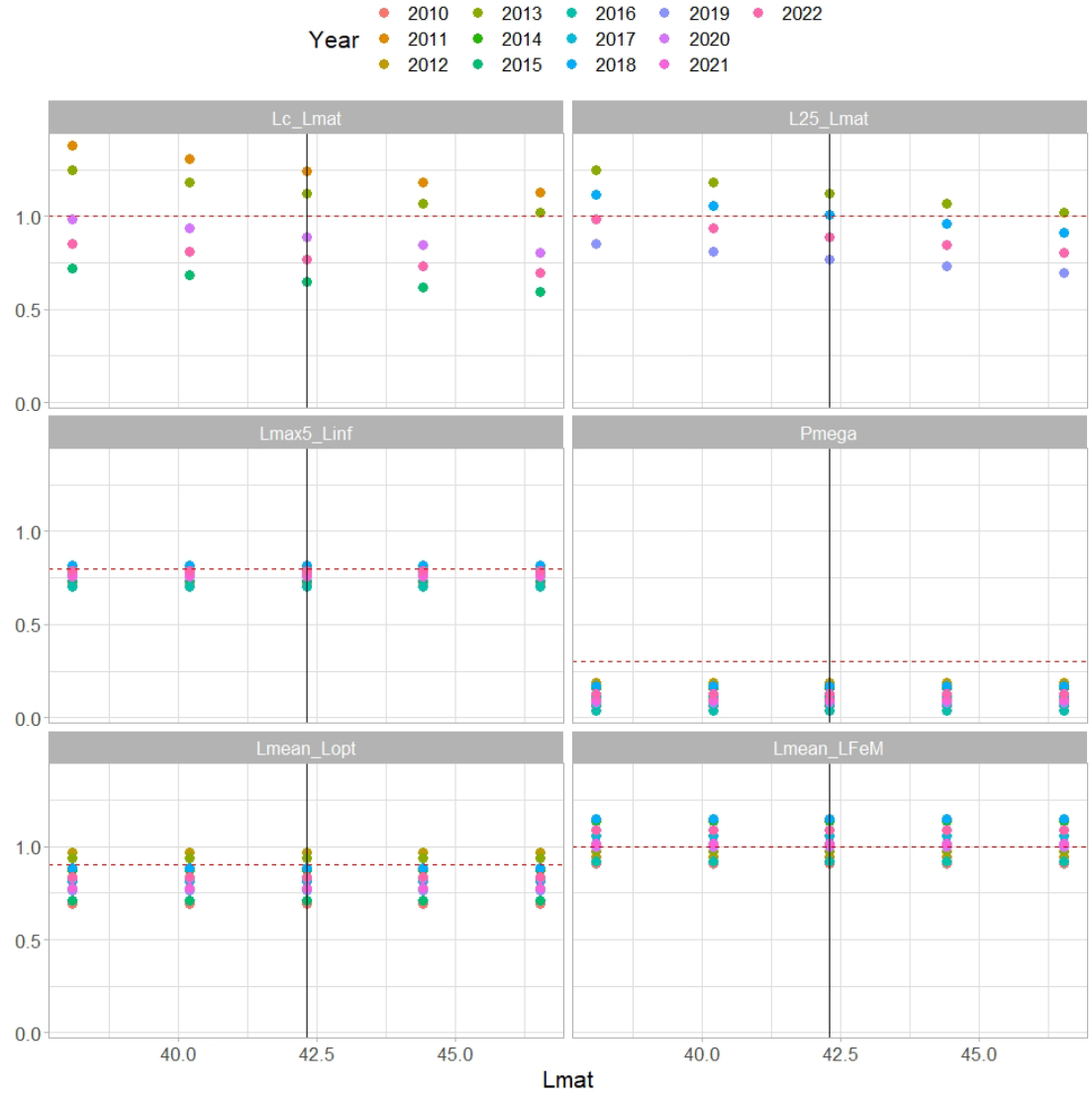

Figure 17.10. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Results from the sensitivity analysis for *Lmat* value in LBI ratios. Vertical line shows the value assumed for the LBI-analysis. The horizontal dashed line indicates the reference value for each ratio.

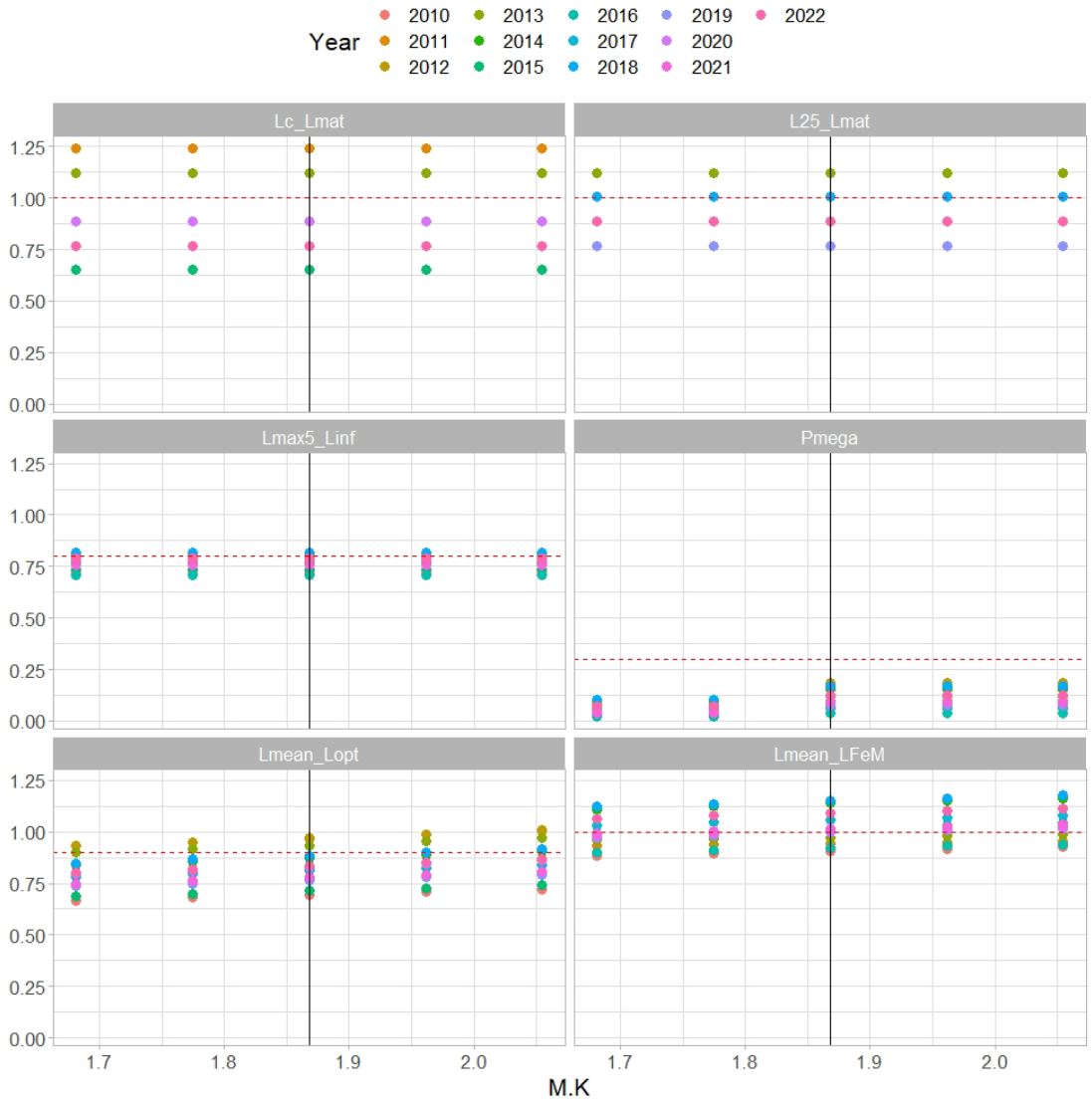

Figure 17.11. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Results from the sensitivity analysis for *M/K* value in LBI ratios. Vertical line shows the value assumed for the LBI-analysis. The horizontal dashed line indicates the reference value for each ratio.

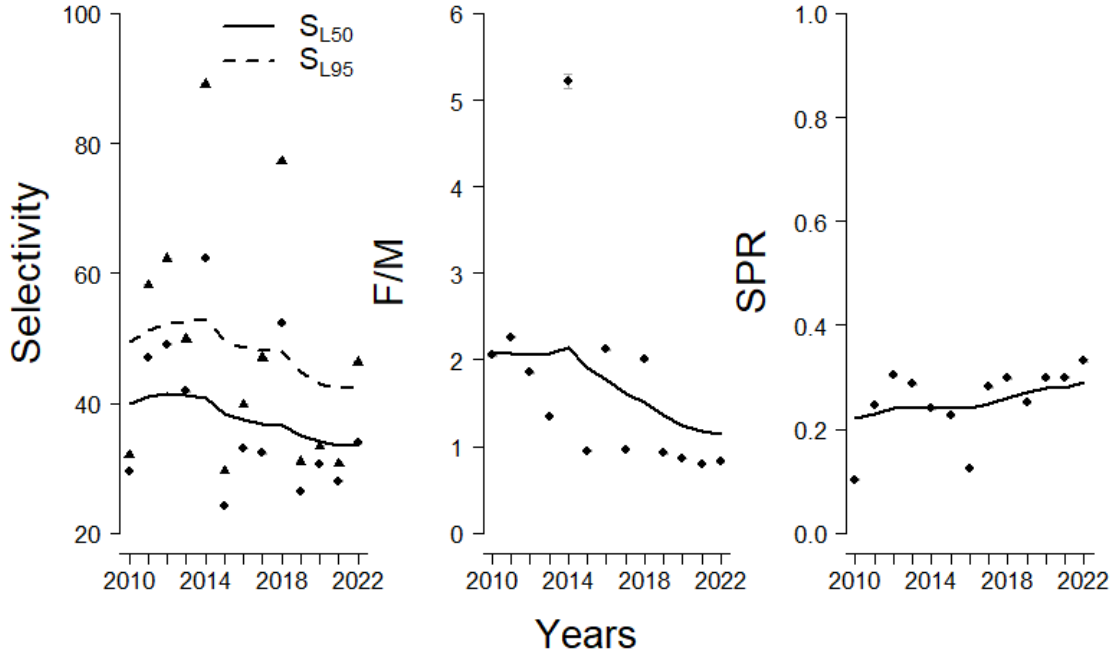

Figure 17.12. Pollack (*Pollachius pollachius*) in Subarea 8 and Division 9.a. Main results of the LBSPR method.

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