18 Skates and rays in the Celtic Seas (ICES subareas 6 and 7 (except Division 7.d))

18.1 Ecoregion and stock boundaries

See Stock Annex.

18.2 The fishery

18.2.1 History of the fishery

See Stock Annex.

18.2.2 The fishery in 2021

Although so far unquantified, as in 2020 COVID-19 is expected to have affected fishing activity in 2021, with national or local restrictions on fishing activity reducing fishing effort for at least some of the year.

TAC and quota regulations were restrictive or near-restrictive for most nations and fisheries. The inclusion of common skate (*Dipturus batis*-complex) on the prohibited species list has resulted in increased discarding or misreporting of this species, especially in areas where they are locally common.

18.2.3 ICES advice applicable

ICES provided advice for several species/stocks in this region in 2020 as summarized in Table below.

Stock	Stock code	Assessment category	Advice basis	Advised Landings in 2021 and 2022
Blonde ray *Raja brachyura* Divisions 7.a and 7.f-g	rjh.27.7afg	5.	Precautionary approach	716 t
Blonde ray *Raja brachyura* Division 7.e	rjh.27.7e	5.	Precautionary approach	266 t
Thornback ray *Raja clavata* Subarea 6	rjc.27.6	3	Precautionary approach	137 t
Thornback ray *Raja clavata* Divisions 7.a and 7.f-g	rjc.27.7afg	3	Precautionary approach	1663 t
Thornback ray *Raja clavata* Division 7.e	rjc.27.7e	5	Precautionary approach	212 t
Small-eyed ray *Raja microocellata* Bristol Channel (Divisions 7.f-g)	rje.27.7fg	3	Precautionary approach	123 t
Small-eyed ray *Raja microocellata* English Channel (Divisions 7.d-e)	rje.27.7de	5	Precautionary approach	40 t

Stock	Stock code	Assessment category	Advice basis	Advised Landings in 2021 and 2022
Spotted ray *Raja montagui* Subarea 6 and Divisions 7.b and 7.j	rjm.27.67bj	3	Precautionary approach	51 t
Spotted ray *Raja montagui* Divisions 7.a and 7.e-h	rjm.27.7ae-h	3	Precautionary approach	1033 t
Cuckoo ray *Leucoraja naevus* Subareas 6–7 and Divisions 8.a-b and 8.d	rjn.27.678abd	3	Precautionary approach	3150 t
Sandy ray *Leucoraja circularis* Celtic Seas and adjacent areas	rji.27.67	5	Precautionary approach	34 t
Shagreen ray *Leucoraja fullonica* Celtic Seas and adjacent areas	rjf.27.67	5	Precautionary approach	168 t
Undulate ray *Raja undulata* Divisions 7.b and 7.j	rju.27.7bj	6	Precautionary approach	zero
Undulate ray *Raja undulata* Divisions 7.d-e (English Channel)	rju.27.7de	3	Precautionary approach.	183 t
Common skate *Dipturus batis*-complex (flapper skate *Dipturus intermedius* and blue skate *Dipturus batis*) Subarea 6 and Divisions 7.a–c and 7.e–j	rjb.27.67a-ce-k	6	ICES was not requested to provide advice on fishing opportunities for these stocks.	NA
White skate *Rostroraja alba* in the north-east Atlantic	rja.27.nea	6	Precautionary approach	zero
Other rays and skates (Rajiformes) in Subarea 6 and divisions 7.a–c and 7.e–k (Rockall, West of Scotland, Celtic Sea and western English Channel)	raj.27.67a-ce-k	6	Insufficient data to provide advice	NA

18.2.4 Management applicable

A TAC for skates in Subarea 6 and divisions 7.a–c and 7.e–k was first established for 2009 and set at 15 748 t. Since then, the TAC has been reduced by approximately 15% (in 2010), 15% (in 2011), 13% (in 2012), 10% (in 2013) and a further 10% (in 2014). In 2017, the TAC was increased by 5%, (including separate TAC for *R. microocellata*), and in 2018, this was increased by a further 15% (including separate TAC for *R. microocellata* and *R. undulata*). In 2020, the TAC was set and reset because of negotiations between the UK and the EU. In April 2021, the TAC was set at 3882 tonnes, excluding an as yet to-be-determined UK quota. In June 2021, an agreement was reached between the EU and UK. The figures below refer to this agreement.

The history of the regulations are as follows:

Year	TAC for EC waters of 6a-b and 7a–c, and 7.e–k	Other measures	Regulation
2009	15 748 t	1,2	Council Regulation (EC) No. 43/2009 of 16 January 2009
2010	13 387 t	1,2,3	Council Regulation (EU) No. 23/2010 of 14 January 2010
2011	11 379 t	1,2,3	Council Regulation (EU) No. 57/2011 of 18 January 2011
2012	9915 t	1,2,3	Council Regulation (EU) No. 43/2012 of 17 January 2012

Year	TAC for EC waters of 6a-b and 7a–c, and 7.e–k	Other measures	Regulation
2013	8924 t	1,2,3	Council Regulation (EU) No. 39/2013 of 21 January 2013
2014	8032 t	1,3,4	Council Regulation (EU) No. 43/2014 of 20 January 2014
2015	8032 t	1,3,5	Council Regulation (EU) No. 2015/104 of 19 January 2015, and amended in Council Regulation (EU) No. 2015/523 of 25 March 2015
2016	8032 t	1,3,6,7	Council Regulation (EU) No 2016/72 of 22 January 2016, and amended in Council Regulation (EU) No. 2016/458 of 30 March 2016
2017	8434 t	1,3,6,8	Council Regulation (EU) No 2017/127 of 20 January 2017,
2018	9699 t	1,3,6,8,9	Council Regulation (EU) No 2018/120 of 23 January 2018,
2019	10 184 t	1,3,6,7,10,11	Council Regulation (EU) No 2019/124 of 30 January 2019,
2020	10 184 t	1,3,6,7,10,11	Council Regulation (EU) No 2020/123 of 27 January 2020
2021	9675 t	1,3,6,7,10,11,12,13	Council Regulation (EU) No 2021/703 of 26 April 2021, amending Council Regulations 2021/91 and 2021/92 and Written record of fisheries consultations between the United Kingdom and the European Union for 2021
2022	9482 t	1,3,6,7,14,15,16	COUNCIL REGULATION (EU) 2022/515 of 31 March 2022 amending Regulation (EU) 2022/109 fixing for 2022 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in Union waters and for Union fishing vessels in certain non-Union waters.

[1] Catches of cuckoo ray *L. naevus*, thornback ray *R. clavata*, blonde ray *R. brachyura*, spotted ray *R. montagui*, small-eyed ray *R. microocellata* sandy ray *L. circularis*, shagreen ray *L. fullonica* should be reported separately.

[2] Does not apply to undulate ray *R. undulata*, common skate *D. batis*, Norwegian skate *D. nidarosiensis* and white skate *Rostroraja alba*. Catches of these species may not be retained on board and shall be promptly released unharmed to the extent practicable. Fishers shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species.

[3] Of which up to 5% may be fished in EU waters of Division 7.d.

[4] Shall not apply to undulate ray *R. undulata*, common skate *D. batis* complex, Norwegian skate *D. nidarosiensis* and white skate *Rostroraja alba*. When accidentally caught, these species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species.

[5] Shall not apply to undulate ray *Raja undulata*. This species shall not be targeted in the areas covered by this TAC. Bycatch of undulate ray in area 7.e exclusively may be landed provided that it does not comprise more than 20 kg live weight per fishing trip and remain under the quotas shown [TAC = 100 t]. This provision shall not apply for catches subject to the landing obligation.

[6] Shall not apply to small-eyed ray *R. microocellata*, except in Union waters of 7.f and 7.g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7.f and 7.g provided below may be taken [TAC = 188 t]

[7] Shall not apply to undulate ray *R. undulata*. This species shall not be targeted in the areas covered by this TAC. In cases where it is not subject to the landing obligation, bycatch of undulate ray in area 7.e may only be landed whole or gutted, and provided that it does not comprise more than 40 kilograms live weight per fishing trip. The catches shall remain under the quotas shown [TAC = 100 t]. Bycatch of undulate ray shall be reported separately under the following code: RJU/67AKXD.

[8] Shall not apply to undulate ray *R. undulata*. This species shall not be targeted in the areas covered by this TAC. In cases where it is not subject to the landing obligation, bycatch of undulate ray in area 7.e may only be landed whole or gutted. The catches shall remain under the quotas shown [TAC = 161 t]. Bycatch of undulate ray shall be reported separately under the following code: RJU/67AKXD (2017) RJU/07E (2018).

[9] Shall not apply to small-eyed ray (*Raja microocellata*), except in Union waters of 7f and 7g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7f and 7g (RJE/7FG.) provided below may be taken [TAC = 154 t].
[10] Shall not apply to small-eyed ray (*Raja microocellata*), except in Union waters of 7f and 7g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7f and 7g (RJE/7FG.) provided below may be taken [TAC = 192 t].
[11] Shall not apply to undulate ray (*Raja undulata*).
[12] Shall not apply to small-eyed ray (*Raja microocellata*), except in Union waters of 7f and 7g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7f and 7g (RJE/7FG.) provided below may be taken [TAC = 123 t].
[**13]** Special condition: of which up to 5 % may be fished in Union waters of 7d (SRX/*07D.), without prejudice to the prohibitions set out in Articles 20 and 57 of the EU TAC and Quota Regulation 2021 and relevant prohibitions in UK law for the areas specified therein. Catches of cuckoo ray (Leucoraja naevus) (RJN/*07D.), thornback ray (Raja clavata) (RJC/*07D.), blonde ray (Raja brachyura) (RJH/*07D.), spotted ray (Raja montagui) (RJM/*07D.), sandy ray (Raja circularis) (RJI/*07D.) and shagreen ray (Raja fullonica) (RJF/*07D.) shall be reported separately. This special condition shall not apply to small-eyed ray (Raja microocellata) and undulate ray (Raja undulata).
[14] Shall not apply to small-eyed ray (*Raja microocellata*), except in Union waters of 7f and 7g. When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species. Within the limits of the abovementioned quotas, no more than the quantities of small-eyed ray in Union waters of 7f and 7g (RJE/7FG.) provided below may be taken [TAC = 123 t].
[15] Shall not apply to undulate ray (*Raja undulata*). [TAC= 234t].
[16] Special condition: of which up to 5 % may be fished in 7d and reported under the following code: (RJE/*07D.). This special condition is without prejudice to the prohibitions set out in Articles 18 and 56 of this Regulation and in the relevant provisions of the United Kingdom law for the areas specified therein.

Raja microocellata in Union waters of Subarea 6 and divisions 7.a–c and 7.e–k were initially subject to strict restrictions at the start of 2016, with Council Regulation (EU) 2016/72 of 22 January 2016 stating that: "*When accidentally caught, this species shall not be harmed. Specimens shall be promptly released. Fishermen shall be encouraged to develop and use techniques and equipment to facilitate the rapid and safe release of the species*". However, this was subsequently updated in Council Regulation (EU) 2016/458 of 30 March 2016, whereby the prohibition in landings was revoked for Union waters of 7.f–g, with a precautionary TAC of 188 t being set for this species, within the total skate and ray quota.

A sub TAC of 154 t was similarly applied in 2017 and in 2018, while this was set at 192 t for 2019 and 2020. In 2021 and in 2022, this was set at 123 t.

The previous interdiction to retain skates and rays caught on the Porcupine Bank from 1 May–31 May was not continued in 2020 and 2021.

There are also mesh-size regulations for target fisheries, the EC action plan for the conservation and management of sharks (EC, 2009), and some local bylaws and initiatives, which were detailed in ICES (2010).

18.2.5 Other management issues

The requirement for EU negotiations with the UK for the first time in 2020/2021 meant that final TAC agreements were not complete at the time by mid-June 2021. A draft agreement was completed in January 2021. In 2022, initial TACs for the first part of the year were proposed, with final TACs not being agreed until April.

A high-survivability exemption to the Landings Obligation was provided for skates and rays in the Celtic Seas ecoregion until 31 December 2021, with *L. naevus* only exempted until

31 December 2019. An extension to the exemption would only be possible with additional supporting information being provided by the NWWAC. This particularly applies to *L. naevus*, which had a shorter deadline for the provision of evidence of high-survivability than the other species. Several meetings have been held by the NWWAC to discuss and advance this. Best practice guides and measures have been circulated to NWWAC members (2020). The *L. naevus* exemption has been extended to 21 December 2022.

Alternatives to the current TAC system are being explored by the European Commission. A meeting to set Terms of Reference for an STECF request to propose alternatives was held in May 2017. This follows on from proposals by the NWWAC.

Fishermen off North Devon have a voluntary seasonal closed area over what they consider to be a nursery ground.

There are several French measures designed to regulate fishing for *R. undulata* in the English Channel (7.d and 7.e). These measures include: trip limits, closed seasons, restricted licensing of vessels and in 2017 a minimum size of 78 cm (described in Gadenne, 2017, WD).

The French regulation stipulates a minimum landing size of 45 cm for all Rajiformes and 78 cm for undulate ray.

There was a change in Belgian fisheries with the introduction of a Producer Organisation (PO) measure from 1st January 2021 to exclude landings of other species than thornback ray, blonde ray and spotted ray. This measure may have affected some stocks where Belgium is one of the main contributors in terms of a reduction in landings such as *R. microocellata* in 7.d-e and in 7.f-g. Meanwhile, landings for other stocks may have increased with fishing opportunities focusing on other species such as *R. montagui* in 7.ae-h.

18.3 Catch data

A data-call in 2017 again followed the procedures recommended by WKSHARK2 (ICES, 2016). This meeting had recommended that recent landings of all elasmobranch species be resubmitted by all ICES members. These landings would be re-evaluated, and declared landings from unlikely locations or species be reassessed or reassigned as required. Decision trees on how to treat problematic records were provided in the workshop report. An ICES data call was issued following this meeting requesting all elasmobranch landings from 2005–2015. The 2017 data call requested a resubmission of final 2015 and preliminary 2016 landings data.

These data were examined by WGEF prior to and during WGEF 2016. Tables 18.1 and 18.2 provides the re-assessed landings by stock for this ecoregion. Some data were resubmitted in 2017, therefore there may be slight differences in landings figures between this and previous reports.

The 2018 and 2019 data calls followed the procedures above.

In 2020, data were provided by means of the ICES InterCatch system for the first time. Further details can be found in Section 1. Intercatch has been used from 2020 onwards.

18.3.1 Landings

Landings data for skates (Rajidae) were supplied by all nations fishing in shelf waters within this ecoregion. Data for 2021 are considered provisional. Landings data prior to 2005 are considered variable and uncertain.

Landings by nation are given in Table 18.1. Landings for the entire time-series are shown in Figure 18.1a–c. Where species-specific landings have been provided they have also been included in the total for the relevant year. Although historically there have been around 15 nations

involved in the skate fisheries in this ecoregion, only five (France, Great Britain, Belgium, Ireland, and Spain) have in recent years been the major contributors.

18.3.2 Skate landing categories

Historically, most skate landings were reported under a generic landing category. There has been a legal requirement to report most skate landings to species level throughout this ecoregion since 2010. On average, 99% of the 2019 landings were reported to species level, with a continuous decline in landings declared in generic categories since 2011. Earlier reports have highlighted various issues regarding the quality of these data (ICES, 2010; 2011; 2012), and this is further discussed in Section 18.4.3.

A study by Silva *et al.* (2012) examined the species-specific data recorded by the UK (England and Wales). Although there were some erroneous or potentially erroneous records, the regional species composition was broadly comparable to that recorded by scientific observers on commercial vessels, and data quality seemed to be improving. Comparable studies to critically evaluate other national data and identify potential errors are still required, to better identify where improved training and/or market sampling may improve data quality.

18.3.3 Discards

WKSHARK3 met in Nantes in February 2017 (ICES, 2017). The objective of the meeting was to examine national discard data and to assess their suitability for use by WGEF.

It was decided that combining national data together to estimate international discards is not suitable. However, if discard data are first raised at national level, it may be possible to combine estimates. However, there are differences in raising methodologies e.g. by fleet, metier, etc., and these must be fully reported and accounted for.

For elasmobranchs, discards are not equivalent to dead catch, as there is some survival, which is probably high for some stocks and fleets. However, survival rate is not accurately known for most species.

Discard data for WGEF were included in the 2018–2021 data calls. Most countries provided raised discards. Raising methodology was considerably different, both between countries and within countries. Raised discard estimates varied by over 200% in some cases, depending on whether they were raised by vessel, fleet or landings. Therefore, discard estimates have not been calculated for skates and rays in this ecoregion.

COVID-19 affected the placing of discard observers on board commercial fishing vessels in 2020 and 2021. Social distancing regulations meant that observers could not be placed on many vessels, particularly small ones. Therefore, the number of discard samples is likely down on previous years. Fishing activity may also have decreased. In Ireland, a self-sampling scheme was put in place, where discard samples were brought ashore for analysis.

See Stock Annex for historic discard discussions.

18.3.4 Discard survival

There are several ongoing studies on discard survival, e.g, SUMARIS, BIM.

Cuckoo ray has shown high post-capture condition by otter-trawls in the Celtic Sea (BIM, 2019), with 84% showing 'Excellent' condition. This may indicate high survivability post-release.

Although the existing European project INTERREG 2 Seas SUMARiS (Sustainable Management of Rays and Skates), is mainly focus on the North Sea and English Channel, results from this project may be applicable to three species with stock units straddling Division 7.d (rju.27.7de, rje.27.7de and rjn.27.678abd). SUMARIS project showed preliminary high survival rates for all species, however the final report is not yet available.

The RAYWATCH project is examining beam trawl-caught species for discard survivability in the Celtic Sea from 2020–2022.

See Stock Annex for further information on discard survivability.

18.3.5 Quality of catch data

Although so far unquantified, COVID-19 is expected to have affected fishing activity in 2020 and 2021, with national or local restrictions on fishing activity reducing fishing effort for at least some of the year. Discard sampling was likely affected in most countries.

See Stock Annex.

18.4 Commercial catch composition

18.4.1 Size composition

The ICES RFB rule was applied to several stock assessments from this ecoregion in 2022. See individual stock sections for further details.

18.4.2 Quality of data

See Stock Annex.

18.5 Commercial catch and effort data

A case study using French on-board observer data is provided in the stock annex discussing several stocks. The trend for *L. fullonica* is used as supporting information in the advice in 2020, therefore it is retained here. For all others, refer to the stock annex.

Shagreen ray: *Leucoraja fullonica*

rjf.27.67 (Figure 18.2): The species was caught in a relatively high proportion of OTT_DEF. The indicator suggested stability.

18.6 Fishery-independent surveys

Groundfish surveys provide valuable information on the spatial and temporal patterns in the species composition, size composition, sex ratio and relative abundance of various demersal elasmobranchs. Several fishery-independent surveys operate in the Celtic Seas ecoregion. It is noted that these surveys were not designed primarily to inform on the populations of demersal elasmobranchs, and so the gears used, timing of the surveys and distribution of sampling stations may not be optimal for informing on some species and/or life-history stages. However, these surveys provide the longest time-series of species-specific information for skates for many parts of the ecoregion. The distribution of selected skate species caught in surveys coordinated by the IBTS group (see Table 18.4 in the Stock Annex), are shown in the annual IBTS reports.

Descriptions of existing, previous and short-time-series surveys are provided in the Stock Annex.

Updated survey analyses were provided for five surveys in 2022: French EVHOE Groundfish Survey (EVHOE-WIBTS-Q4; Figures 18.3a–d and 18.4f), Irish groundfish survey (IGFS-WIBTS-Q4; Table 18.4a–b; Figures 18.4a, b and f), Spanish Porcupine Groundfish Survey (SpPGFS-WIBTS-Q4; Figures 18.4f and 18.5a–i), the UK (England) beam trawl survey (EngW-BTS-Q3; Figures 18.4c-e and 18.6a-e), the UK (England) Q1 Southwest ecosystem beam trawl survey (Q1SWECOS previously described as Q1SWBeam[1]; Figures 18.4f and 18.7a–e) and the UK (Scotland) West CGFS survey (IGFS-WIBTS-Q1-Q4, Figure 18.4f).

The list of fishery-independent surveys undertaken in this area include (with additional details and information on the history provided in the Stock Annex):

- French EVHOE Groundfish Survey (EVHOE-WIBTS-Q4): 1995–present in Celtic Sea (survey did not take place in 2017).
- Irish Groundfish Survey (IGFS-WIBTS-Q4): 2003–present.
- Spanish Porcupine Groundfish Survey (SpPGFS-WIBTS-Q4): 2001–present.
- UK (Northern Ireland) Groundfish Survey – October (NIGFS-WIBTS-Q4): 1992–present.
- UK (Northern Ireland) Groundfish Survey – March (NIGFS-WIBTS-Q1).
- Scottish West Coast Groundfish Survey Q4 (ScoGFS-WIBTS-Q4): 1990–present.
- Rockall survey (Rock-IBTS-Q3): 1991–present.

Three beam trawl surveys currently operate in this ecoregion (see Stock Annex), surveying the Irish Sea, Bristol Channel, western English Channel and the West of Ireland (additional details and information on the history are provided in the Stock Annex):

- UK (England and Wales) Irish Sea and Bristol Channel beam trawl survey (EngW-BTS-Q3 or UK(E&W)-BTS-Q3): 1993–present. The 2020 survey data were not used in most assessments, excluding *R. microocellata* in 7.f-g, as survey coverage was limited to the Bristol Channel (divisions 7.f-g) with the Irish Sea (Division 7.a) not being sampled (Silva, 2022a). Survey index estimates provided to WGEF 2022 have been revised for the entire time-series, with these now based on ICES DATRAS (contrary to previous meetings, when indices were estimated using data held on a national database) (Silva, 2022a).
- UK (England) beam trawl in western English Channel (Q1SWECOS – previously named Q1SWBeam[2]): 2006–present. This survey extended from the western English Channel (Division 7.e) to the wider Celtic Sea (Divisions 7.f-j) in 2013, however data from those Divisions used as supporting information on species spatial distribution only relates to data from 2014 onwards (Silva *et al.*, 2020). It should be noted that in 2020 the survey occurred in June instead of Q1 and only covered the western Channel survey area due to the COVID-19 pandemic (Silva, 2022b).
- Irish monkfish beam trawl survey – IRL-IAMS surveys: 2016 onwards. This beam trawl survey for monkfish and megrim takes place in Q1 and Q2, to the west and northwest of Ireland. Elasmobranchs are caught during this survey, and in future may provide additional indices once a suitable time series is available.

[1] In other ICES documents also referred as 'UK-Q1-SWBeam', 'Eng-WEC-BTS-Q1' or 'BTS-UK-Q1'.

[2] See footnote above.

Historical surveys which have been undertaken in the area and can provide past data on elasmobranchs include (with additional details and information on the history provided in the Stock Annex):

- UK (England and Wales) Western Groundfish Survey (EngW-WIBTS-Q4): 2004–2011.
- UK (England) beam trawl in Start Bay, Division 7.e (Eng-WEC-BTS-Q4): 1989–2010.
- Irish maturity survey for commercially important demersal fish: spring 2004–2009.
- Irish deep-water (500–1800 m) trawl survey to the west of Ireland: 2006–2009
- UK Portuguese high headline trawl 1Q (PHHT-Q1): 1982–2003.

18.6.1 Temporal trends in catch rates

The statuses of skates in this ecoregion are based primarily on the evaluation of fishery-independent trawl surveys. The available survey data have been used to evaluate the status of the stocks in 2022 under the ICES approach to data-limited stocks (Section 18.9).

18.6.2 Quality of data

18.6.2.1 Species identification in surveys

There are identification problems with certain skate species that may increase uncertainty in the quality of survey data. *Raja montagui* and *R. brachyura* may be confounded occasionally, and the identification of neonatal specimens of *R. clavata*, *R. brachyura* and *R. montagui* can also be problematic. Recent data are considered more reliable.

Many recent surveys in the ecoregion have attempted to ensure that data collected for the common skate complex be differentiated. In many cases national experts have confirmed which species have been caught in recent years. However, for some past data recorded as *Dipturus batis*, it is uncertain which of the two species (*D. batis* and *D. intermedius*) was caught. It is yet unclear how to clarify for which years and surveys records as *D. batis* refer to the actual species or to the complex.

Several skate species, including some coastal species, occur sporadically in the Celtic Seas ecoregion and may have certain sites where they are locally abundant (e.g. *Raja brachyura*). These may be under-represented in existing surveys (see Stock Annex).

18.6.3 New data

No additional data were provided in 2022. See previous reports for details of ongoing projects.

18.7 Life-history information

See Stock Annex.

18.7.1 Ecologically important habitats

See Stock Annex.

18.8 Exploratory assessment models

18.8.1 Productivity-Susceptibility Analysis

See Stock Annex

18.8.2 Previous assessments

See Stock Annex

18.9 Stock assessment

The following stocks were assessed in 2022. For Category 5 and 6 stocks there were no changes to the assessment methods. Category 3 stocks were assessed using the new ICES framework (rfb rule, method 2.1, ICES, 2022a).

Following the new rfb methodology also means that average comparisons in indices has changed from the mean values of the previous two years over the preceding five year (2/5 rule) to the mean values of the previous two years to the over the preceding three years (2/3 rule).

18.9.1 Blonde ray *Raja brachyura* in Subarea 6 and Division 4.a

Raja brachyura has a patchy distribution in Subarea 6. It is not encountered in sufficient numbers in surveys to derive trends in abundance/biomass. The stock is considered to extend to the north western North Sea (Division 4.a) and will be next assessed in 2023. It may also extend along the west coast of Ireland. This Subarea 6 and Division 4.a stock is assessed in North Sea biennial advice years (2015, 2017 and 2019), and was last assessed as a Category 5 stock, using landings data only. WKSKATE (ICES, 2021) examined this stock as a case-study and determined that there was no suitable survey or combination of surveys that could be used in a Category 3 assessment.

18.9.2 Blonde ray *Raja brachyura* in Divisions 7.a and 7.f-g

Raja brachyura has a patchy distribution, and can be locally abundant in some parts of the Irish Sea and Bristol Channel, including off southeast Ireland. Mean catch rates in the Irish Sea and Bristol Channel (e.g. as observed in the UK beam trawl survey) are low and variable. While there was a decrease in abundance in 2015, the stock has been showing an overall increasing trend in the survey (Silva, 2022a). However, it is important to note that this survey does not sample this species effectively, and the survey is not used to provide advice for the stock.

With no reliable survey trend for this stock, it has been assessed since 2016 as a Category 5 stock using landings data. Landings were relatively stable at 1000–1200 t between 2011–2018, however there was a marked increase thereafter to 1600–1700 t until 2021, when it decreased slightly to 1465 t.

18.9.3 Blonde ray *Raja brachyura* in Division 7.e

Raja brachyura has a patchy distribution in the western English Channel, and is locally abundant on certain grounds, such as sandbank habitats in and around the Channel Islands, Normano-Breton Gulf and Lyme Bay. The trawl-survey length–frequency data examined for this stock showed a peak for juvenile fish (< 25 cm L_T), with no fish recorded between 24–31 cm L_T and occasional records of larger specimens > 70 cm L_T (Silva *et al*. 2020 WD).

Mean catch rates in a previous beam trawl survey in Great West Bay (Burt *et al.*, 2013) were low, as *R. brachyura* was caught in a relatively low proportion of tows (See Stock Annex).

With no reliable survey trend for this stock, it has been assessed since 2016 as a Category 5 stock using landings data. These reached a peak in 2015 (708 t), dropped to around 500 t per year in 2016 and 2017, but are now at over 800 t per year.

18.9.4 Thornback ray *Raja clavata* in Subarea 6

This stock was assessed using the new ICES rfb rules in 2022. Following an examination of length-data provided by member states using Accessions and Intercatch it was determined that insufficient length-samples to be useful on their own were collected in 2020 and 2021. It is presumed that this is related to lower sampling levels due to COVID-19. Therefore, length data from 2019–2021 were combined.

Full details of the rfb method are provided in Appendix 1. of this chapter. The stock index has decreased by 51% (2/3 rule).

18.9.5 Thornback ray *Raja clavata* in Divisions 7.a and 7.f-g

This stock was assessed using the new ICES rfb rules in 2022. Following an examination of length-data provided by member states using Accessions and Intercatch it was determined that insufficient length-samples to be useful on their own were collected in 2020 and 2021. It is presumed that this is related to lower sampling levels due to COVID-19. Therefore, length data from 2019–2021 were combined.

Full details of the rfb method are provided in Appendix 1. of this chapter. The stock has increased by 15% (2/3 rule, excluding the 2020 survey).

18.9.6 Thornback ray *Raja clavata* in Division 7.e

The UK beam trawl survey of the western English Channel (Q1SWECOS or UK-Q1-SWBeam, 2006-present) has shown most *R. clavata* to be captured in Lyme Bay with fewer records elsewhere (Figure 18.7a). Length–frequency showed a peak in the captures of presumably 0-group fish ≤ 20 cm (Silva *et al.*, 2020 WD). Although this survey could provide some preliminary estimates of total biomass for Division 7.e, these should be viewed only as 'qualitative assessments'. It shows an increasing trend over the longer time-series, with a recent decrease in 2018 following a peak in abundance during 2014–2017 and, thereafter showing a sharp increase (Figure 18.7a). These analyses were consistent with the survey random stratified design and did not consider the potential effects of catchability and selectivity towards the outputs. Therefore, exploratory analyses were conducted to better evaluate and quantify the uncertainty and risks if to use this survey for future quantitative assessment and advice (Silva, 2022b). Such analyses provided an alternative estimate for the exploitable biomass based on the approach described in Berg *et al.* (2014) using 'surveyIndex' R package (Berg, 2022). However, they were not considered in the advice process in 2022, with further work to be undertaken and reviewed during a dedicated workshop on surveys in the Celtic Seas ecoregion following similar process of WKSKATE in 2020.

This stock is currently assessed as a Category 5 stock, using landings data. Landings increased steadily since 2009, peaking at 423 t in 2016, followed by a decrease to 372 t in 2017. In recent years, landings have been above the observed in 2016 and were at their highest level of 538 t in 2021.

18.9.7 Small-eyed ray *Raja microocellata* in the Bristol Channel (Divisions 7.f-g)

Although occasional specimens of *R. microocellata* are caught in Division 7.a, the main concentration of this species is in Division 7.f, with larger individuals occurring slightly further offshore (Division 7.g). The youngest size class is not often taken in surveys, as 0-group fish tend to occur in very shallow water. This species may also occur in some inshore areas of southern and south-western Ireland, although data are limited for these areas.

The UK (England and Wales) beam trawl survey in the Bristol Channel (only those data from stations in 7.f–g were used) has previously indicated stable catch rates. Estimates are currently at low levels compared to earlier years, due to a decline in biomass of individuals ≥50 cm L_T (Figure 18.4e and Figure 18.6d). Although the index used in the assessment is based on biomass ($kg.hr^{-1}$), it is worth noting that this decline is also reflected on the decrease in numbers of individuals ≥50 cm L_T (Silva, 2022a WD). The stock index has decreased by 72% (2/3 rule). This index was updated in 2022, with estimates now based on data held within DATRAS contrary to previous assessments where estimates were calculated using data held on a national database (Silva, 2022a).

This stock was assessed using the new ICES rfb rules in 2022, with full details provided in Appendix 1 of this chapter.

Higher than expected numbers of *R.microocellata* were reported from a managed crayfish fishery in 27.7.j. (Marine Institute 2021). This may indicate that the current stock area is not correct. This issue will be further examined as part of future benchmark process.

18.9.8 Small-eyed ray *Raja microocellata* in the English Channel (Divisions 7.d-e)

There are also localized concentrations of *R. microocellata* in the English Channel, including around the Channel Islands (Ellis *et al.*, 2011) and Baie of Dournanenez, Brittany (Rousset, 1990), with small numbers taken elsewhere.

Preliminary analyses of data from beam trawl surveys in the western English Channel (particularly in the Great West Bay area) were provided in 2012 (See Stock Annex). The low catch rates are probably related to the patchy distribution of the species in this area. Similarly, Silva *et al.* (2020 WD) identified only a few records of this species in the western English Channel beam trawl survey, with smaller size groups likely to occur in waters shallower than can be surveyed by the research vessel.

With no adequate survey trends available, this stock is assessed under Category 5, using landings data. Landings show a stable trend from 2009–2015, followed by a decrease in 2016 that remained stable for 3 years (ca. 36 t), followed by an increase to around 50 t since 2019. Although changes in Belgian fisheries may have contributed to a decline in landings in 2021 (see Section 18.2.5), these have remained stable with the increase of landings from France relatively to 2020.

18.9.9 Spotted ray *Raja montagui* in Subarea 6 and Divisions 7.b and 7.j

This stock was assessed using the new ICES rfb rules in 2022. Following an examination of length-data provided by member states using Accessions and Intercatch it was determined that insufficient length-samples to be useful on their own were collected in 2020 and 2021. It is

presumed that this is related to lower sampling levels due to COVID-19. Therefore, length data from 2019–2021 were combined.

Full details of the rfb method are provided in Appendix 1. of this chapter. The stock has decreased by 49% (2/3 rule). This is reflected in the steady downward trend in the index since 2016.

18.9.10 Spotted ray *Raja montagui* in Divisions 7.a and 7.e-h

This stock was assessed using the new ICES rfb rules in 2022. Following an examination of length-data provided by member states using Accessions and Intercatch it was determined that insufficient length-samples to be useful on their own were collected in 2020 and 2021. It is presumed that this is related to lower sampling levels due to COVID-19. Therefore, length data from 2019-2021 were combined.

Full details of the rfb method are provided in Appendix 1. of this chapter. The stock has decreased by 17% (2/3 rule, excluding the 2020 survey).

18.9.11 Cuckoo ray *Leucoraja naevus* in Subareas 6 and 7 and Divisions 8.a-b and 8.d

Leucoraja naevus is a widespread and small-bodied skate that is taken in reasonable numbers in a variety of surveys in the ecoregion, especially on offshore grounds. The stock structure of this species is insufficiently known, which makes the interpretation of catch rates in the various surveys more problematic.

The combined index used in the Category 3 assessments until 2020, used the French EVHOE survey and the Irish Groundfish Survey, and indicates that the stock increased following low stock levels in 2012–2013.

A new index integrating data from six surveys was accepted at the benchmark workshop WKelasmo 2022. Swept are indices of the exploited biomass (individuals ≥ 50 cm total length) from the six surveys are presented in figure 18.4f, the combined index is presented in figure 18.4g. These indices were calculated by raising swept area fished to the total sampled area, so that indices are provided in absolute values in tonnes.

18.9.11.1 Benchmark assessment

A benchmark assessment of this stock took place in 2022 (WKELASMO 2022 (ICES, 2022b)). The results are outlined below and in the Stock Annex. They indicate that the stock is underexploited, with F well below Fmsy.

The application of the SPiCT model allowed estimation of relative reference points F_{2020}/F_{MSY} and B_{2021}/B_{MSY}. The definition of these reference points resulted in the upgrade of the stock to Category 2. Similarly, as for porbeagle in the north-east Atlantic and undulate ray in the English Channel, a more precautionary approach than the ICES default method for catch advice derivation (based on the 35th percentile of the expected catch distribution under FMSY) was adopted. The choice of the 15th percentile was justified by the need for a more precautionary management for long-lived species such as elasmobranchs, especially where advised catch are much larger than catch in the previous years.

The assessment, even at its most precautionary, indicates an underexploited stock, with low F relative to F_{MSY} and B much greater than B_{MSY}. This leads to catch advice ~2.5 times greater than in previous years (7826t in 2023 and 8064t in 2024).

18.9.12 Sandy ray *Leucoraja circularis* in the Celtic Seas and adjacent areas

Leucoraja circularis is a larger-bodied, offshore species that may be distributed outside some of the areas surveyed during internationally coordinated surveys, and the distribution of what is assumed to be a Celtic Sea stock will extend into the northern North Sea (Division 4.a) and parts of the Bay of Biscay (Subarea 8). This species is taken only infrequently in most surveys, such as the EVHOE survey (Figure 18.3a) with some nominal records considered unreliable.

Only the Spanish Porcupine Bank survey covers an important part of the habitat of *L. circularis* and catches this species in any quantity (Figure 18.5a). Peak catches were observed in 2007–2008, with a decline following, but catches steadily increased returning to the higher levels observed in this time series, until 2016–2017 when the biomass decreased. Overall, the time-series shows low and variable catch rates, with an increasing trend until 2015, followed by a decrease in recent years (Figure 18.5b). This survey catches a broad size range, with both smaller (< 20 cm L_T) and some larger (> 100 cm L_T) specimens sampled (Figure 18.5c).

Given that the only survey that samples this species effectively only covers a small proportion of the broader stock range, it is not known whether the survey index would be appropriate for the overall stock. Consequently, this stock is assessed as a Category 5 stock, using landings data. Landings of this species are at a low level and have fluctuated between highs of 77–78 t in 2009, 2016 and 2018 and lows of 36–38 t in 2015, 2019 and 2020.

The landings estimated by WGEF are lower than national estimates, as WGEF consider nominal landings of 'sandy ray' from outside their main range to refer to *R. microocellata.*

18.9.13 Shagreen ray *L. fullonica* in the Celtic Seas and adjacent areas

Leucoraja fullonica is a larger-bodied, offshore species that may be distributed outside some of the areas surveyed during internationally coordinated surveys, and the distribution of what is assumed to be a Celtic Sea stock will extend into the northern North Sea (Division 4.a) and parts of the Bay of Biscay (Subarea 8).

This species is taken in small numbers in the EVHOE survey (Figure 18.3b), with catch rates declining. There is a lack of survey for most other parts of the stock area, although the increase in beam trawl surveys in the Celtic Sea may provide more data in the future.

The lack of appropriate survey coverage across the stock range and low, variable catch rates of this species means that a Category 5 assessment using landings data is currently used. Landings were at their highest of ≥250 t between 2009–2013 (peaking at 301 t in 2010) subsequently declining to their lowest level of 186 t in 2016, 2020 and 2021.

18.9.14 Common skate *Dipturus batis*-complex (flapper skate *Dipturus intermedius* and blue skate *Dipturus batis*) in Subarea 6 and divisions 7.a–c and 7.e–j

Although common skate *D. batis* has long been considered depleted, on the basis of its loss from former habitat and historical decline (Brander, 1981; Rogers and Ellis, 2000), this species has recently been confirmed to comprise two species, and longer term data to determine the extents to which the two individual species have declined are lacking. The nomenclature of the common skate complex was stabilised by Last *et al.* (2016). the smaller species (the form described as *D. flossada* by Iglésias *et al.*, 2010) is now named common blue skate, *Dipturus batis* and the larger species flapper skate, *D. intermedius.*

Common blue skate *Dipturus batis* occurs in most parts of the stock range and is the predominant member of the complex in the Celtic Sea (divisions 7.e–k) and in Rockall bank. Flapper skate shows a northern distribution, it occurs primarily in division 6.a and in the northern North Sea (Griffith *et al.*, 2010; Frost *et al.*, 2020; Fernández-Zapico *et al.*, 2021 WD; Ellis and Silva, 2021 WD; Barreau and Iglesias, 2021 WD, Baulier and Rimaud, 2022 WD).

Both species may occur in the intervening areas of divisions 7.a–c, but it is less clear as to which species predominates. In 7.c, *Dipturus batis* seems to predominate at Porcupine Bank, with no records of *D. intermedius* in 2021 (Fernández-Zapico *et al.*, 2022 WD). The documented loss of the common skate complex from parts of their former range (e.g. Division 7.a) suggested the complex to be depleted in the Celtic Sea ecoregion.

From available data, flapper skate seems to have a larger bathymetric range with individuals caught near the coast, the shallower depth being 17 m and up to 1000 m deep in 6.a. Meanwhile, bathymetric range for common blue skate is from 66 m to 630 m (Pinto *et al.*, 2016; Barreau *et al*., 2016; Barreau and Iglesias, 2021 WD).

Given that much of the data prior to 2010 refer to the species-complex, both species are currently treated together until a suitable time-series of species-specific data are available. Species distinction is improving since 2011 in scientific surveys although misidentification may still occur (Barreau and Iglesias, 2021 WD). Number of common blue skate and flapper skate caught show an increasing trend since 2010 and some surveys may be able to provide a stock size indicator in the future such as EVHOE [G2917], IE-CGFS [G7212] or SCOROC [G4436] (Barreau and Iglesias, 2021 WD; Baulier and Rimaud, 2022 WD).

Within the stock range, four species of the gender *Dipturus* can be encountered in landings. Recent prohibitions on landings of *D. batis* complex, and *D. nidarosiensis*, have resulted in increases in reported landings of *D. oxyrinchus*. Landings figures and advice refer to *Dipturus* spp., as landings of these species are believed to be confounded.

Particularly high levels of *D. oxyrinchus* were reported in 2019. It is not known whether these reflect an increase in catches of this species, or whether they are confounded with catches of other *Dipturus* species. A revision of the landings table in the 2020 Working Group noted discard information from Spain in the period 2015–2017 were erroneously included in the landings. In addition, Danish landings data for 2017 and 2018 were updated. As such a noticeable change in the landings presented in the current advice and report (Table 18.1 and 18.2) occurred.

In 2022, ICES was requested to advise of this stock unit, as a complex of two species. Given the lack of robust survey data over the stock range, and lack of landings data (due to their prohibited status), a Category 6 assessment was applied to this stock, and trends in stock size or indicator cannot be evaluated.

18.9.15 Undulate ray *Raja undulata* in divisions 7.b and 7.j

This isolated stock has a very local distribution, mainly in Tralee Bay on the Southwest Irish coast.

There are no trawl surveys that can be used to assess this stock. However, data supplied by Inland Fisheries Ireland (Wögerbauer *et al.*, 2014 WD*)* shows that tag and recapture rates for *R. undulata* in Tralee Bay (Division 7.j) have significantly declined since the 1970s. Although these data do not allow for potential changes in tagging effort, it suggests that this stock is overexploited (Figure 18.8).

Given the lack of survey data over the coastal habitat for this stock, and a lack of landings data (due to management measures), a Category 6 assessment was applied to this stock, and trends in stock size or indicator cannot be evaluated.

18.9.16 Undulate ray *Raja undulata* in Divisions 7.d-e (English Channel)

ICES considers one stock unit of undulate ray in the English Channel (divisions 7.d–e), with the main part of the range extending from the Isle of Wight to the Normano-Breton Gulf. This stock is sampled by two different beam trawl surveys: the Channel beam trawl survey (see Chapter 15) and the western English Channel beam trawl survey (UK-Q1-SWBeam, Silva *et al.*, 2020 and Silva, 2022b WD), as well as the French Channel Groundfish survey FR-CGFS (see Chapter 15). The FR-CGFS and UK-Q1-SWBeam surveys provide indices of exploitable biomass for undulate ray in divisions 7.d and 7.e respectively (Table 18.4b). Both indices are considered representative for the whole stock. The spatial distribution of *R. undulata* caught in the western English Channel survey is provided in the Stock Annex. Catch rates are generally variable, partly due to the patchy distribution of this species. The surveys with the best coverage of this stock area are the French Channel Groundfish Survey (FR-CGFS) in Division 7d, and UK-Q1-SWBeam in Division 7e. Indices of exploitable biomass from both surveys suggest a rapid increase in stock biomass from the mid-2010s.

The stock of undulate ray in the English Channel is managed under a specific TAC. This precautionary TAC has been increasing since 2016 following the biomass index but it is constraining, resulting in high discard rates (0.94 on average in 2017–2021).

Between 2018 and 2022, the advice was based on catches while it was previously based on landings (see stock annex). The benchmark workshop WKelasmo including this stock took place in 2022 (ICES 2022b). It led to the adoption of a surplus production model (SPiCT, Pedersen and Berg, 2017) to assess this stock. This resulted in moving this stock from the ICES stock category 3 to Category 2. The SPiCT-based assessment entailed a great increase of the advice, from 2552 tonnes (total catch) for 2021 and 2022 to 6716 and 6339 tonnes for 2023 and 2024 respectively.

18.9.16.1 Benchmarked assessment following WKELASMO

Details of input data and specification of priors on model parameters are provided in the stock annex.

The application of the SPiCT model allowed estimation of relative reference points F_{2020}/F_{MSY} and B_{2021}/B_{MSY}. The definition of these reference points resulted in the upgrade of the stock to Category 2. Similarly, as for porbeagle in the north-east Atlantic and cuckoo ray in subareas 6 and 7 and divisions 8.a-b and 8.d, a more precautionary approach than the ICES default method for catch advice derivation (based on the 35th percentile of the expected catch distribution under FMSY) was adopted. The choice of the 15th percentile was justified by the need for a more precautionary management for long-lived species such as elasmobranchs, especially where advised catch are much larger than catch in the previous years. The stock was estimated depleted at the beginning of the longer biomass index available (1990) and survey indicators suggest it remained in such a state until the implementation of a landing ban (2009–2014). The stock biomass estimated from SPiCT reflect the same trend (Figure 18.9). The mean estimated F in 2020, was estimated around 0.010, leading to a diagnosis of underexploitation since $F_{2020}/F_{MSY}=0.086$. The assessment also suggested that the stock has recovered a healthy state, as indicated by the estimated relative stock biomass in January 2021: $B_{2021}/B_{MSY}=1.697$.

The SPiCT-based assessment entailed a great increase in the advice, from 2552 tonnes (total catch) for 2021 and 2022 to 4836 and 4675 tonnes of exploitable removals (landings and dead discards ≥ 50 cm TL) for 2023 and 2024 respectively. This level of catch is unprecedented since

1990. This is due to the combination to the depleted state of the stock until the 2010s not allowing a comparable level of landings and the fishing ban followed by the very restrictive TAC set since 2015 associated with a high survival rate of discarded fish.

18.9.17 Other skates in subareas 6 and 7 (excluding Division 7.d)

This section relates to skates not specified elsewhere in the ICES advice. This includes skates not reported to species level and some other, mainly deep-water species throughout the region. It also applies to *R. clavata, R. brachyura,* and *R. microcellata* outside the current defined stock boundaries (Table 18.3).

No specific assessment can be applied to this species group, and nominal landings have been shown to have declined dramatically to just 178 t in 2021, primarily as a result of improved species-specific reporting of the main commercial skate stocks.

18.10 Quality of assessments

Length data for many assessments have insufficient samples in a single year to be used on their own. COVID-19 reduced sampling levels in 2020 and 2021, therefore combined indices (2019–2021) were used in most assessments.

There are several other issues that influence the evaluation of stock status:

1. The stock identity for many species is not accurately known (although there have been some tagging studies and genetic studies to inform on some species, and the stocks of species with patchy distributions can be inferred from the spatial distributions observed from surveys). For inshore, oviparous species, assessments by ICES Division or adjacent divisions may be appropriate, although for species occurring offshore, including *L. naevus*, a better delineation of stock boundaries is required;
2. Age and growth studies have only been undertaken for the more common skate species, although IBTS and beam trawl surveys continue to collect maturity information. Other aspects of their biology, including reproductive output, egg-case hatching success, and natural mortality (including predation on egg-cases) are poorly known;
3. The identification of skate species is considered to be reliable for recent surveys, although there are suspected to be occasional misidentifications;
4. Although fishery-independent surveys are informative for commonly occurring species on the inner continental shelf, biomass indicators provided by these surveys are highly uncertain for lesser abundant stocks or those which distribution is not well covered by surveys as being inter-alia too coastal or having patchy distribution. This applies for example to blonde ray, which none of the three stock has a survey indicator, shagreen ray which is distributed on the offshore shelf but at low density and sandy ray, which occur mostly near the shelf break and at the upper slope.

For the two benchmarked stocks (rju.27.7de and rjn.27.678abd) SPiCT was adopted as assessment model. These new assessments resulted in moving the two stocks from the ICES stock category 3 to Category 2 and in a major increase in advised catch. Increased advice following the stock category change is expected as advice under the precautionary approach (ICES category 3) are calculated with a method aiming at being precautionary to prevent stock depletion in the lack of sufficient data for a quantitative assessment. For these two stocks, the magnitude of the increase in advised catch is considerable. It is explained by the particularly precautionary previous advice and restrictive TAC adopted for undulate ray in the English Channel and the expected healthy status of cuckoo ray following the long-term increase in biomass indices and one previous study (Marandel *et al.*, 2019). Nevertheless, because of the large advice increase, a precautionary

approach, similarly to that adopted for porbeagle in the north-east Atlantic, was adopted where the catch advice was derived for the of the 15th percentile of the catch distribution instead of the standard 35th percentile. This approach is justified by the magnitude of the change in the advice, which imply that the stock reaction to the forecast catch is uncertain and the relatively short time-series used in these assessments.

18.11 Reference points

No reference points have been adopted for any stock that has not been through the benchmark process. The two benchmark stocks have now Fmsy and Bmsy reference point. Proxy reference points are now calculated for Category 3 stocks that use the ICES rfb method.

18.12 Conservation considerations

In 2015, the IUCN published a European Red List of Marine Fisheries updated in 2021 (Nieto *et al.*, 2015; Ellis *et al.*, 2021bc). It should be noted the listings below are on a Europe-wide scale for each species, and these listings are not stock-based.

Species	IUCN Red List Category
Amblyraja radiata	Least concern
Dipturus batis	Critically Endangered
Dipturus intermedius	Critically Endangered
Dipturus nidarosiensis	Near Threatened
Dipturus oxyrinchus	Near Threatened
Leucoraja circularis	Endangered
Leucoraja fullonica	Vulnerable
Leucoraja naevus	Least concern
Raja brachyura	Near Threatened
Raja clavata	Near Threatened
Raja microocellata	Near Threatened
Raja montagui	Least concern
Raja undulata	Near Threatened
Rajella fyllae	Least concern
Rostroraja alba	Critically Endangered

In 2016, a red-list for Irish cartilaginous fish (Clarke *et al.*, 2016) was published. This assessed and rated the following species in Irish waters:

Species	Irish red-list category
Dipturus flossada (~batis)	Critically endangered
Dipturus intermedia (~batis)	Critically endangered
Dipturus nidarosiensis	Near Threatened
Dipturus oxyrinchus	Vulnerable
Leucoraja circularis	Near Threatened

Leucoraja fullonica	Vulnerable
Leucoraja naevus	Vulnerable
Raja brachyura	Near Threatened
Raja clavata	Least concern
Raja microocellata	Least concern
Raja montagui	Least concern
Raja undulata	Endangered
Rajella fyllae	Least concern
Rostroaja alba	Critically endangered

18.13 Management considerations

A TAC was only introduced in 2009 for the main skate species in this region. Reported landings may be slightly lower than the TAC, but this can be influenced by various issues (e.g. quota allocation and poor weather). There was evidence that quota was restrictive for some nations from at least 2014.

Raja undulata and *R. microocellata* are currently subjected to limited fishing opportunities, which may disproportionally impact upon some coastal fisheries.

Currently, fishery-independent trawl survey data provide the best time-series of species-specific information. Technical interactions for fisheries in this ecoregion are shown in the Stock Annex.

Main commercial species

Thornback ray, *Raja clavata,* is one of the most important commercial species in the inshore fishing grounds of the Celtic Seas (e.g. eastern Irish Sea, Bristol Channel). It is thought to have been more abundant in the past, and more accurate longer-term assessments of the status of this species are required.

Blonde ray, *Raja brachyura,* is a commercially valuable species. The patchy distribution of *R. brachyura* means that existing surveys have low and variable catch rates. More detailed investigations of this commercially valuable species are required.

Cuckoo ray, *Leucoraja naevus,* is an important commercial species on offshore grounds in the Celtic Sea. Further studies to better define the stock structure are required to better interpret these contrasting abundance trends.

The main stock of small-eyed ray, *Raja microocellata,* occurs in the Bristol Channel, and is locally important for coastal fisheries. Similarly, the English Channel stock of undulate ray *Raja undulata* is also important for inshore fleets.

Spotted ray, *Raja montagui,* is also commercially important, although a higher proportion of the catch of this small-bodied species is discarded in some fisheries. Commercial data for *R. brachyura* and *R. montagui* are often confounded.

Other species

Historically, species such as *L. circularis* and *L. fullonica* may have been more widely distributed on the outer continental shelf seas. These species are now encountered only infrequently in some surveys on the continental shelf, though they are still present in deeper waters along the edge of the continental shelf, and on offshore banks. Hence, studies to better examine the current status of these species in subareas 6–7 should be undertaken.

The larger-bodied species in this area are from the genus *Dipturus*, and data are limited for all species. *Dipturus batis*-complex were known to be more widespread in inner shelf seas historically, and whilst locally abundant in certain areas, have undergone a decline in geographical extent.

18.14 References

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Table 18.1. Skates and rays in the Celtic Seas. Regional total landings (ICES estimates, tonnes) of Celtic Seas skate stocks by nation. Some of these stocks extend outside the Celtic Seas ecoregion and data for these divisions are reported in relevant report chapters.

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
BEL	raj.27.67a-ce-k	1568	1328	1405	413	416	333	227	74	8	1	1	3	3	0	8	7	
	rjb.27.67a-ce-k				0	0	0			0	0				0	0	0	
	rjc.27.7afg			0	328	216	197	302	441	391	240	350	241	212	197	339	314	265
	rjc.27.7e				5	2	8	3	4	4	3	9	14	21	14	13	9	35
	rje.27.7de						3	5	5	7	7	9	9	12	15	16	15	0
	rje.27.7fg						37	117	124	99	83	106	123	116	121	137	94	
	rjf.27.67														0.01			
	rjh.27.4a6					0	0											
	rjh.27.7afg				166	170	210	313	404	406	351	359	313	338	348	520	721	442
	rjh.27.7e				7	6	3	5	5	6	3	6	11	9	14	10	23	18
	rji.27.67							0	0	0	0	0	0	2	2	1	1	
	rjm.27.67bj						0											
	rjm.27.7ae-h				78	63	55	120	70	3	0	1	7	2	16	15	44	124
	rjn.27.678abd			0	78	81	70	112	93	97	48	51	27	26	28	25	18	0
	rju.27.7de												5	24	15	0	0	
BEL Total		1568	1328	1405	1075	953	917	1204	1219	1022	737	893	753	763	768	1084	1246	883
DE	raj.27.67a-ce-k	39	7	26	60	2	4	3	1						0.5			
0	rjf.27.67															13		2
DE Total		39	7	26	60	2	4	3	1						0.5	13		2
DK	rjh.27.4a6											0				0	0	0
DK Total												0				0	0	0
ES	raj.27.67a-ce-k	2231	2568	2340	1946	206	52	23	15	9	12	45	61	62	357	135	17	20
	rjb.27.67a-ce-k	24	6	11	28	5	0.2	1	5	23	80	214	232	256		0		

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	rjc.27.6					16	2	10	6	23	21	12	12	48	43	69	60	57
	rjc.27.7afg											5	6	9	0.1	0.0	0.1	2
	rjc.27.7e						0	0										
	rjf.27.67					62	42	29	20	33	20	13	15	22	20	14	14	14
	rjh.27.4a6					0												
	rji.27.67	86	74	40	7	30	16	22	8	10	5	3	3	11	9	5	2	2
	rjm.27.67bj				7	7	10	5	0	0	0	1				0.3		
	rjm.27.7ae-h						0				0	0						
	rjn.27.678abd				1	778	480	387	311	373	300	343	372	305	335	295	192	145
ES Total		2341	2648	2392	1986	1103	603	477	365	471	438	635	701	712	763	520	285	241
FRA	raj.27.67a-ce-k	2048	1740	1757	1669	548	314	174	160	139	128	123	130	193	126	31	34	22
	rjb.27.67a-ce-k	351	295	308	414	68	30	15	23	21	32	33	17	19	25			
	rjc.27.6	64	78	73	82	39	24	19	39	28	10	2	1	1	3	13	17	15
	rjc.27.7afg	379	264	238	181	147	131	133	106	95	107	70	121	147	101	117	80	106
	rjc.27.7e	95	86	82	64	122	101	114	108	181	224	225	213	176	212	263	264	289
	rje.27.7de	21	19	19	22	32	28	28	24	26	24	24	8	8	11	15	14	23
	rje.27.7fg	27	23	18	21	29	21	16	30	30	65	31	5	56	69	92	69	42
	rjf.27.67	32	25	33	28	144	150	152	147	127	131	151	130	125	129	124	132	138
	rjh.27.4a6					1					1	1	1	0	1	1	1	0
	rjh.27.7afg					36	73	131	87	52	170	218	275	257	172	295	277	264
	rjh.27.7e					56	148	205	169	191	281	304	223	242	396	450	538	539
	rji.27.67	199	152	185	178	46	35	25	35	26	33	34	37	34	35	25	24	28
	rjm.27.67bj	13	7	3	4	2	4	7	5	17	53	43	47	40	23	8	1	1
	rjm.27.7ae-h	1080	902	833	870	785	934	1062	1135	899	912	745	819	717	834	814	576	556
	rjn.27.678abd	3164	2565	2575	2507	3217	3069	2909	2571	2195	2515	2621	2233	2144	2288	2398	1984	2151
	rju.27.7bj					0				0		0	1	1	0	0	0.3	

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	rju.27.7de					19	9	20	6	3	10	50	58	79	86	181	159	152
FRA Total		7473	6157	6123	6041	5291	5071	5010	4646	4031	4695	4674	4319	4239	4511	4828	4170	4326
GBR	raj.27.67a-ce-k	2773	2454	2398	1478	508	290	168	153	101	77	46	34	34	30	45	56	46
	rjb.27.67a-ce-k				96	22	1	19	12	1	63	118	116	113	210	146	5	5
	rjc.27.6				1	56	61	57	67	120	120	114	147	114	201	233	167	141
	rjc.27.7afg			0	204	300	371	384	483	416	252	309	274	277	324	322	322	449
	rjc.27.7e	0	0		3	82	98	98	129	151	151	158	195	173	206	212	189	214
	rje.27.7de				4	18	40	28	33	32	36	39	19	15	12	20	24	28
	rje.27.7fg			0	91	157	214	189	208	117	79	78	69	30	55	83	67	68
	rjf.27.67				13	44	108	97	79	85	55	25	39	21	14	18	17	16
	rjh.27.4a6				7	5	7	17	4	0	1	3	2	1	3	1	0.3	1
	rjh.27.7afg		0	0	97	138	226	273	261	262	229	245	245	272	328	404	322	405
	rjh.27.7e		0		32	159	215	204	175	222	295	396	352	251	323	435	451	434
	rji.27.67				0	2	0	0	3	25	22	25	35	23	31	4	9	17
	rjm.27.67bj				5	16	27	32	30	27	29	43	49	43	62	58	1	31
	rjm.27.7ae-h	0		0	12	38	102	88	85	90	80	70	80	89	93	118	82	95
	rjn.27.678abd				225	321	421	402	306	269	262	266	254	260	272	289	186	166
	rju.27.7de				2	2			0			5	22	36	43	63	66	52
GBR Total		2773	2454	2399	2270	1868	2179	2056	2031	1919	1752	1917	1933	1752	2208	2452	1965	2168
IRL	raj.27.67a-ce-k	2117	1728	1581	1283	1007	547	394	410	243	219	227	230	284	188	148	87	90
	rjb.27.67a-ce-k			0		2	4	17	1	0	0	9	7	9	9	7	0	0
	rjc.27.6					3	33	56	69	71	85	87	99	130	90	101	70	54
	rjc.27.7afg					8	80	126	134	146	191	169	220	232	219	182	192	149
	rjc.27.7e									0		2		2	4	2	1	0
	rje.27.7de													2				
	rje.27.7fg						0	0	0	0	0	0	0			0		0

Country	ICES Stock Code	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	rjf.27.67						1	6	7	6	4	2	2	49	63	38	23	15
	rjh.27.4a6					0	4	1	1	24	9	9	11	5	23	33	20	14
	rjh.27.7afg	3	6			5	402	382	407	377	420	351	171	154	228	396	383	353
	rjh.27.7e								0			2		2		0.4	0.7	
	rji.27.67						0	4	0									5
	rjm.27.67bj					1	20	18	25	24	43	28	20	12	19	12	3	4
	rjm.27.7ae-h					0	19	63	53	40	49	48	41	10	58	64	41	46
	rjn.27.678abd					12	55	106	108	93	83	79	69	69	114	103	73	55
	rju.27.7bj														3			
IRL Total		2120	1734	1581	1283	1038	1165	1173	1218	1025	1104	1012	871	961	1019	1088	895	784
NLD	raj.27.67a-ce-k	0	1	0	0	0	0	0	0	0								
	rjc.27.7afg												0					
	rjc.27.7e					0	2	1	0	2		0	0	0	0	1	1	1
	rjh.27.7e								0	0				0		0	1	1
	rjm.27.7ae-h					0		0		0			0			0	0.1	0
	rjn.27.678abd						0			0	0			0				
NLD Total		0	1	0	0	1	2	1	1	2	0	0	0	0	0	2	2	2
NOR	raj.27.67a-ce-k	50	86	85	77	96	131	62	107	99	157	272	312	153	30	274	331	
NOR Total		50	86	85	77	96	131	62	107	99	157	272	312	153	30	274	331	
Grand Total		16364	14429	14016	12800	10355	10071	9986	9587	8568	8883	9740	9208	8524	9311	10259	8892	8408

Table 18.2. Skates and rays in the Celtic Seas. Regional total landings (ICES estimates, tonnes) of Celtic Seas skate stocks by stock. Some of these stocks extend outside the Celtic Seas ecoregion and data for these divisions are reported in relevant report chapters.

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
raj.27.67a-ce-k	BEL	1568	1328	1405	413	416	333	227	74	8	1	1	3	3	0	8	7	

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	DE	39	7	26	60	2	4	3	1						1			
	ES	2231	2568	2340	1946	206	52	23	15	9	12	45	61	62	357	135	17	20
	FRA	2048	1740	1757	1669	548	314	174	160	139	128	123	130	193	126	31	34	22
	GBR	2773	2454	2398	1478	508	290	168	153	101	77	46	34	34	30	45	56	46
	IRL	2117	1728	1581	1283	1007	547	394	410	243	219	227	230	284	188	148	87	90
	NLD	0	1	0	0	0	0	0	0	0								
	NOR	50	86	85	77	96	131	62	107	99	157	272	312	153	30	274	331	
raj.27.67a-ce-k Total		10826	9911	9593	6928	2783	1671	1052	919	600	594	714	770	729	731	641	532	179
rjb.27.67a-ce-k	BEL				0	0	0			0	0				0	0	0	0
	ES	24	6	11	28	5	0.21	1	5	23	80	214	232	256	0	0	0	0
	FRA	351	295	308	414	68	30	15	23	21	32	33	17	19	25	0	0	0
	GBR				96	22	1	19	12	1	63	118	116	113	210	146	5	5
	IRL			0		2	4	17	1	0	0	9	7	9	9	7	0	0
rjb.27.67a-ce-k Total		375	301	319	538	97	35	52	42	45	175	375	373	395	245	153	5	5
rjc.27.6	ES					16	2	10	6	23	21	12	12	48	43	69	60	57
	FRA	64	78	73	82	39	24	19	39	28	10	2	1	1	3	13	17	15
	GBR				1	56	61	57	67	120	120	114	147	113	201	233	167	141
	IRL					3	33	56	69	71	85	87	99	130	90	101	70	53
rjc.27.6 Total		64	78	73	82	114	120	141	181	241	236	213	260	293	337	416	315	267
rjc.27.7afg	BEL			0	328	216	197	302	441	391	240	350	241	212	197	339	314	265
	ES											5	6	9	0	0.1	0.1	2
	FRA	379	264	238	181	147	131	133	106	95	107	70	121	147	101	117	80	106
	GBR			0	204	300	371	384	483	416	252	309	274	277	324	322	322	448
	IRL					8	80	126	134	146	191	169	220	232	219	182	192	149
rjc.27.7afg Total		379	264	238	713	671	780	944	1165	1048	790	903	861	878	840	960	909	971
rjc.27.7e	BEL				5	2	8	3	4	4	3	9	14	21	14	13	9	35

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	ES						0	0										
	FRA	95	86	82	64	122	101	114	108	181	224	225	213	176	212	263	264	289
	GBR	0	0		3	82	98	98	129	151	151	158	195	173	206	212	189	214
	IRL									0		2		2	4	2	1	
	NLD					0	2	1	0	2		0	0	0		1	1	1
rjc.27.7e Total		95	86	82	71	206	208	216	242	339	379	395	423	372	437	490	464	538
rje.27.7de	BEL						3	5	5	7	7	9	9	12	15	16	15	0
	FRA	21	19	19	22	32	28	28	24	26	24	24	8	8	11	15	14	23
	GBR				4	18	40	28	33	32	36	39	19	15	12	20	24	28
	IRL													2				
rje.27.7de Total		21	19	19	26	50	70	61	62	65	67	72	36	36	38	50	53	51
rje.27.7fg	BEL						37	117	124	99	83	106	123	116	121	137	94	
	FRA	27	23	18	21	29	21	16	30	30	65	31	5	56	69	92	69	42
	GBR			0	91	157	214	189	208	117	79	78	69	30	55	83	67	68
	IRL						0	0	0	0	0	0	0			0.1		0
rje.27.7fg Total		27	23	18	112	187	272	323	362	247	227	216	198	201	245	313	230	110
rjf.27.67	DE															13	0	2
	BEL														0	0	0	
	ES					62	42	29	20	33	20	13	15	22	20	14	14	14
	FRA	32	25	33	28	144	150	152	147	127	131	151	130	125	129	124	132	138
	GBR				13	44	108	97	79	85	55	25	39	21	14	18	17	16
	IRL						1	6	7	6	4	2	2	49	63	38	23	15
rjf.27.67 Total		32	25	33	41	250	301	283	253	251	211	212	186	217	225	207	185	186
rjh.27.4a6	BEL					0	0										0.1	0
	DK											0						
	ES					0												

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	FRA					1					1	1	1	0	1	1	1	0
	GBR				7	5	7	17	4	0	1	3	2	1	3	1	0.3	1
	IRL					0	4	1	1	24	9	9	11	5	23	34	20	13
rjh.27.4a6 Total					7	6	10	17	5	24	10	14	14	6	27	35	21	15
rjh.27.7afg	BEL				166	170	210	313	404	406	351	359	313	338	348	520	721	441
	FRA					36	73	131	87	52	170	218	275	257	172	295	277	264
	GBR		0	0	97	138	226	273	261	262	229	245	245	272	328	404	322	405
	IRL	3	6			5	402	382	407	377	420	351	171	154	228	396	383	353
rjh.27.7afg Total		3	6	0	263	350	910	1099	1160	1097	1170	1172	1004	1020	1077	1616	1703	1465
rjh.27.7e	BEL				7	6	3	5	5	6	3	6	11	9	14	10	23	18
	FRA					56	148	205	169	191	281	304	223	240	396	450	538	539
	GBR		0		32	159	215	204	175	222	295	396	352	251	323	435	451	434
	IRL								0			2		2		1	1	
	NLD								0	0				0		1	1	1
rjh.27.7e Total			0		39	221	365	414	349	419	579	708	587	504	732	896	1014	991
rji.27.67	BEL							0	0	0	0	0	0	2	2	1	1	
	ES	86	74	40	7	30	16	22	8	10	5	3	3	11	9	5	2	2
	FRA	199	152	185	178	46	35	25	35	26	33	34	37	34	35	25	24	28
	GBR				0	2	0	0	3	25	22	25	35	23	31	4	9	17
	IRL						0	4	0							0	0	5
rji.27.67 Total		285	226	226	185	78	51	51	46	61	61	63	75	69	77	36	36	52
rjm.27.67bj	BEL						0											
	ES				7	7	10	5	0	0	0	1	0	0	0	0.3	0	1
	FRA	13	7	3	4	2	4	7	5	17	53	43	47	40	23	8	1	
	GBR				5	16	27	32	30	27	29	43	49	44	62	58	1	31
	IRL					1	20	18	25	24	43	28	20	12	19	12	3	3

ICES Stock Code	Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
rjm.27.67bj Total		13	7	3	16	27	62	63	61	68	125	114	116	96	104	79	5	37
rjm.27.7ae-h	BEL				78	63	55	120	70	3	0	1	7	2	16	15	44	124
	ES						0				0	0						0
	FRA	1080	902	833	870	785	934	1062	1135	899	912	745	819	717	834	814	576	557
	GBR	0		0	12	38	102	88	85	90	80	70	80	89	93	118	82	95
	IRL					0	19	63	53	40	49	48	41	10	58	65	41	46
	NLD					0		0		0			0			0.2	0.1	1
rjm.27.7ae-h Total		1080	902	833	960	887	1110	1332	1344	1032	1042	864	947	818	1001	1012	741	821
rjn.27.678abd	BEL			0	78	81	70	112	93	97	48	51	26	26	28	25	18	1
	ES				1	778	480	387	311	373	300	343	372	305	335	295	192	145
	FRA	3164	2565	2575	2507	3217	3069	2909	2571	2195	2515	2621	2233	2144	2288	2398	1984	2151
	GBR				225	321	421	402	306	269	262	266	254	259	272	289	186	166
	IRL					12	55	106	108	93	83	79	69	69	114	103	73	55
	NLD						0			0	0	0	0	0	0	0	0	0
rjn.27.678abd Total		3164	2565	2575	2811	4408	4096	3916	3388	3028	3209	3360	2955	2804	3037	3111	2453	2517
rju.27.7bj	IRL														2.6	0	0	
	FRA					0				0		0	0.9	1.3	0.3	0.3	0.3	0
rju.27.7bj Total						0.4				0		0	0.9	1.3	2.8	0.3	0.3	0
rju.27.7de	BEL												5	24	15	0.2	0.1	
	FRA					19	9	20	6	3	10	50	58	79	86	181	159	152
	GBR				2	2			0			5	22	36	43	63	66	52
rju.27.7de Total					2	21	9	20	6	3	10	55	84	139	143	244	225	204
Grand Total		16364	14429	14016	12800	10355	10071	9986	9587	8568	8883	9740	9208	8524	9311	10259	8892	8408

Table 18.3. Skates and rays in the Celtic Seas. ICES Estimates of landings for other skates and rays in subareas 6–7 (excluding Division 7.d) by species, country, and year (in tonnes). Data revised in 2021.

Country	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
BEL	*Raja brachyura*	0.01	0.01	0.00	0.04	0.00	0.39	0.47	1	2				
	Raja clavata	0.01	0.02	0.00	0.03		0.02	1	0.03	0.08				
	Raja undulata								1	0.23				
	Rajiformes (indet)	416	333	227	74	8	0.46	0.03	1	0.30	0.18	8	7	0
BEL Total		**416**	**333**	**227**	**74**	**8**	**1**	**1**	**3**	**3**	**0.18**	**8**	**7**	**0**
DEU	Rajiformes (indet)	2	4	3	1						1			
DEU Total		**2**	**4**	**3**	**1**						**1**			
ESP	*Raja brachyura*	1			0.21	1								1
	Raja clavata	65	23	13	6	5	10	44	59	62	18	14	16	20
	Raja montagui		3											
	Rajiformes (indet)	139	26	11	9	4	2	1	1		338	121	1	1
ESP Total		**206**	**52**	**23**	**15**	**9**	**12**	**45**	**61**	**62**	**357**	**135**	**17**	**20**
FRA	*Amblyraja hyperborea*				3	0.48	2	18	10	7				
	Amblyraja radiata					4	8	5	9	9				
	Raja brachyura	2	5	6	27	31	25	29	45	62				
	Raja clavata	82	92	45	53	61	46	42	36	27				
	Raja microocellata	0.23	2	0.13	0.15	1	1	2	0.16	1				
	Raja montagui	0.01	0.01	0.11		0.00	0.04	0.02	0.04	58				
	Raja undulata		0.03		0.00			0.04	0.06					
	Rajidae									0.00	4	0.00		
	Rajiformes (indet)	463	215	123	77	42	46	28	31	30	122	29	33	22
FRA Total		**548**	**314**	**174**	**160**	**139**	**128**	**123**	**130**	**193**	**126**	**29**	**33**	**22**
GBR	*Amblyraja hyperborea*					0.11	0.11						1	
	Amblyraja radiata			0.05	0.03	1		0.23			0.49			
	Raja brachyura	10	5	4	11	1	1	3	2	2	3	2	1	2
	Raja clavata	30	55	58	58	35	14	20	27	24	12	18	21	23
	Raja microocellata	6	8	4	2	11	16	18	1	0.25	1	2	0.3	1
	Raja montagui											0.03		
	Raja undulata								0.17	0.01	0.19	0.36	0.1	1
	Rajiformes (indet)	463	223	102	83	54	45	6	4	8	13	23	32	21
GBR Total		**508**	**290**	**168**	**153**	**101**	**77**	**46**	**34**	**34**	**30**	**45**	**56**	**46**
IRL	*Amblyraja radiata*	0.08			0.04		0.05							
	Raja brachyura	5	36	46	47	53	53	40	45	47	40	56	35	39
	Raja clavata	18	81	88	127	111	117	133	147	151	89	71	39	37
	Raja microocellata		0.15				0.06		0.30					
	Raja montagui						1	1	0.03	42	0	0	0.3	0
	Rajella fyllae		1		1									
	Rajiformes (indet)	983	429	259	236	79	49	53	38	43	59	21	14	14

Country	Species	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
IRL Total		**1007**	**547**	**394**	**410**	**243**	**219**	**227**	**230**	**284**	**188**	**148**	**87**	**89**
NLD	*Raja clavata*			0.05										
	Raja montagui		0.10											
	Rajiformes (indet)	0.39		0.08	0.11	0.02								
NLD Total		**0.39**	**0.10**	**0.14**	**0.11**	**0.02**								
NOR	Rajiformes (indet)	96	131	62	107	99	157	272	312	153	30	274	331	
NOR Total		**96**	**131**	**62**	**107**	**99**	**157**	**272**	**312**	**153**	**30**	**274**	**331**	
Grand Total		2783	1671	1052	919	600	594	714	770	729	731	639	531	178

Table 18.4a. Skates and rays in the Celtic Seas. Biomass estimates (kg per km²) of assessed stocks each survey used in the 2022 *Leucoraja naevus* benchmark assessment. The Stock is the combined total used as the stock index.

Year	EVHOE	IGFSw	SP_PORC	NIGFS	SCOWCGFSn	Q1SWECOS	comb7gj	comb6a	Stock
2005	3014.88	656.41	298.62	148.56	476.64	244.94	232.86	412.32	5485.23
2006	1966.78	273.60	315.16	98.55	316.17	244.94	185.77	320.02	3720.99
2007	3910.04	641.37	330.05	186.38	597.98	284.18	297.09	611.39	6858.50
2008	4573.19	621.81	206.65	195.03	625.73	673.23	475.92	181.08	7552.64
2009	3266.91	1408.97	159.00	175.83	564.11	935.70	356.95	270.16	7137.62
2010	3472.23	650.27	229.77	171.31	525.14	510.56	213.12	519.23	6291.63
2011	5315.22	762.59	86.20	93.46	564.11	955.89	448.46	251.22	8477.15
2012	3359.69	548.13	120.10	77.13	848.75	1239.52	201.84	496.69	6891.85
2013	5050.91	481.75	80.27	242.06	818.02	1188.01	144.41	344.56	8349.99
2014	8897.90	488.96	180.26	432.05	1330.85	583.45	661.15	463.14	13037.74
2015	8877.80	1548.71	273.35	497.56	976.68	993.67	692.34	184.51	14044.62
2016	4325.24	1030.40	79.29	548.90	1560.28	151.78	704.44	544.97	8945.30
2017	7717.27	848.47	181.69	451.96	1618.16	663.25	550.57	307.09	12338.45
2018	7282.01	656.27	257.19	94.90	728.76	379.01	1048.30	339.96	10786.40
2019	10384.06	177.05	433.62	61.80	974.79	551.38	881.33	141.48	13605.51
2020	8687.95	563.50	136.01	113.57	483.67	881.02	447.10	176.04	11488.86
2021	9737.74	432.98	322.11	228.55	380.47	722.42	809.35	61.59	12695.22

Table 18.4b. Skates and rays in the Celtic Seas. Exploitable biomass estimates (relative, expressed in tonnes based on swept area) for each survey used in the 2022 SPiCT assessment for *Raja undulata* in the English Channel (rju.27.7de).

Year	FR-CGFS	UK-Q1-SWBeam
1990	235.21	
1991	138.20	
1992	209.78	
1993	0.00	
1994	626.01	
1995	150.21	
1996	28.56	
1997	145.94	
1998	356.78	
1999	71.30	
2000	97.14	
2001	143.22	
2002	60.97	
2003	0.00	
2004	93.41	
2005	108.15	
2006	330.66	120.04
2007	383.97	256.48
2008	158.93	859.34
2009	367.01	460.75
2010	251.73	1551.98
2011	147.88	1267.66
2012	518.01	397.66
2013	587.29	497.91
2014	765.19	1442.06
2015	1305.64	803.55
2016	1207.90	985.98
2017	1715.61	2449.01
2018	1663.04	1120.23
2019	3506.81	1821.83
2020	3841.49	305.97*
2021	3272.34	2710.37

***Not used in the assessment (survey conducted in a different quarter)**

Figure 18.1a. Skates and rays in the Celtic Seas. Total landings (tonnes) of skates (Rajidae) in the Celtic Seas (ICES subareas 6–7 including 7.d), from 1903–2015 (Source: Official nominal catches https://www.ices.dk/data/dataset-collections/Pages/Fish-catch-and-stock-assessment.aspx).

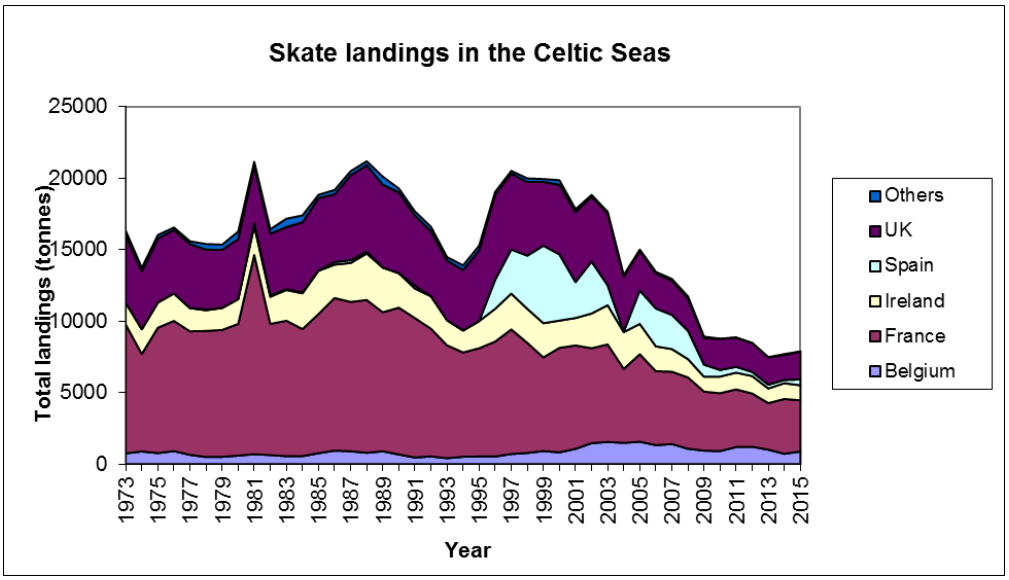

Figure 18.1b. Skates and rays in the Celtic Seas. Total landings (tonnes) of skates (Rajidae) by nation in the Celtic Seas from 1973–2015 (Source: Official nominal catches https://www.ices.dk/data/dataset-collections/Pages/Fish-catch-and-stock-assessment.aspx).

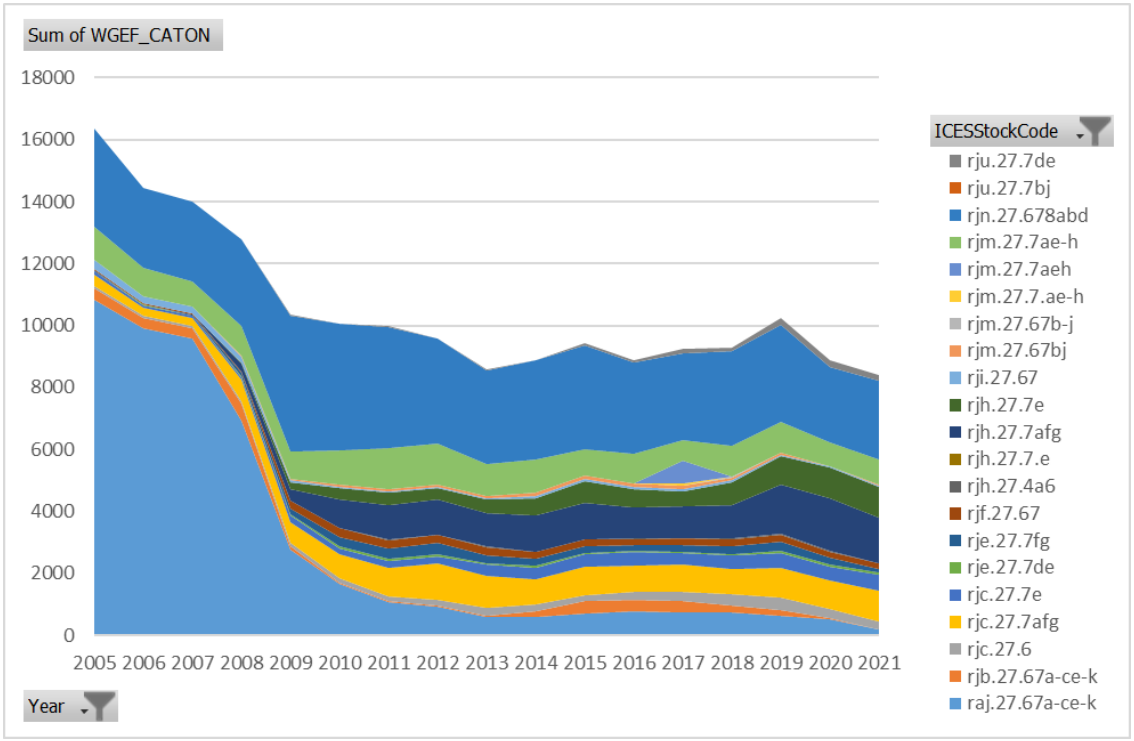

Figure 18.1.c Skates and rays in the Celtic Seas. Total landings (tonnes) of skates (Rajidae) by stock in the Celtic Seas from 2005–2021 (Source: ICES).

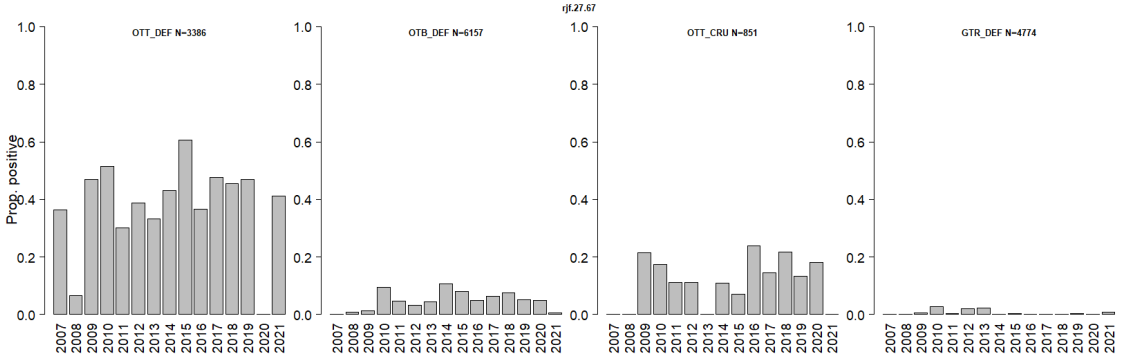

Figure 18.2 Skates and rays in the Celtic Seas. Temporal trends in the proportion of hauls encountering individuals of the stock rjf.27.67, based on French on-board observer trips carried out in application of EU data collection programmes (the zero value in 2020 for OTT-DEF was due to COVID-19 disruption of the sampling.

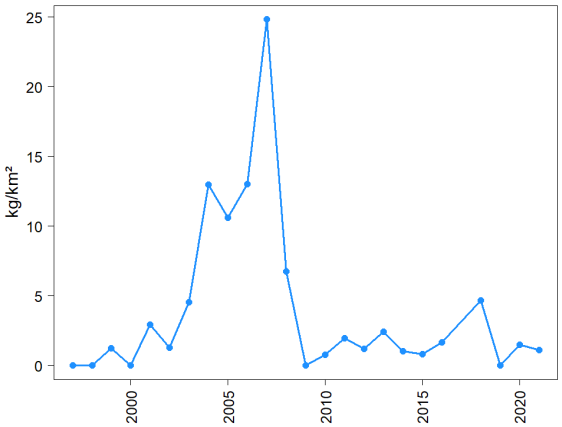

Figure 18.3a. Exploitable biomass (individuals >= 50 cm TL) per km² of *Leucoraja circularis* in Subarea 7 (stock rji.27.67) from the EVHOE survey (1997–2021, no survey in 2017).

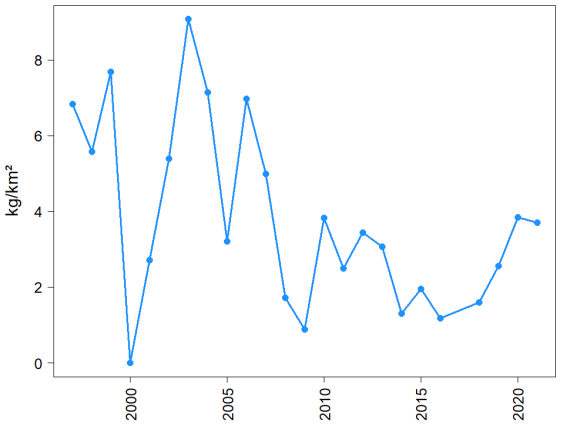

Figure 18.3b. Exploitable biomass (individuals >= 50 cm TL) per km² of *Leucoraja fullonica* in Subarea 7 (stock rjf.27.67) from the EVHOE survey (1997–2021, no survey in 2017).

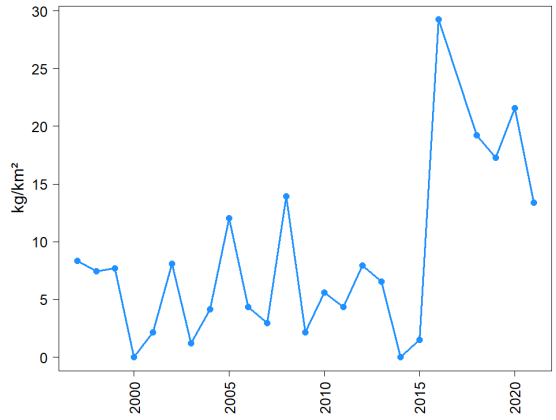

Figure 18.3c. Skates and rays in the Celtic Seas. Exploitable biomass (individuals >= 50 cm TL) per km² of *Raja clavata* in areas of the stock rjc.27.7afg covered by the VHOE survey (1997–2021, no survey in 2017).

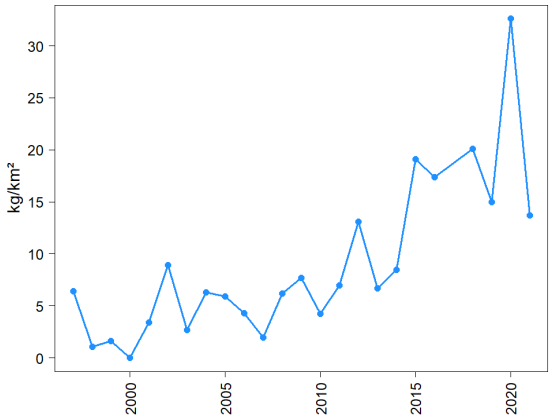

Figure 18.3d. Skates and rays in the Celtic Seas. Exploitable biomass (individuals >= 50 cm TL) per km² of *Raja montagui* in Subareas 7 (stock rjc.27.7ae-h) from the EVHOE survey (1997–2021, no survey in 2017).

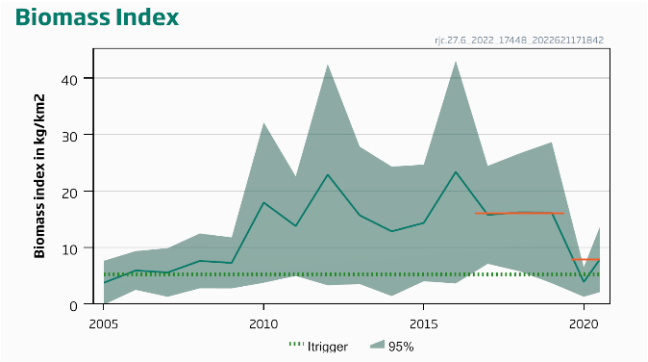

Figure 18.4a. Skates and rays in the Celtic Seas. Irish Groundfish Survey (IGFS-WIBTS-Q4) biomass index of *Raja clavata* in Division 6.a for 2005–2021. Red lines give average for 2017–2019 and for 2020–2021.

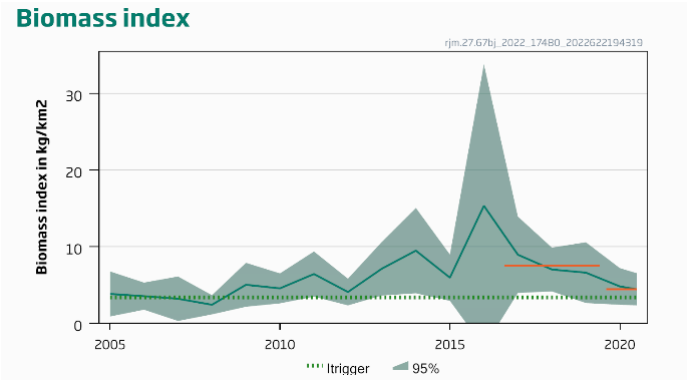

Figure 18.4b. Skates and rays in the Celtic Seas. Irish Groundfish Survey (IGFS-WIBTS-Q4) mean CPUE of *Raja montagui* in divisions 6.a and 7.b-c for 2005–2021. Red lines give average for 2017–2019 and for 2020–2021.

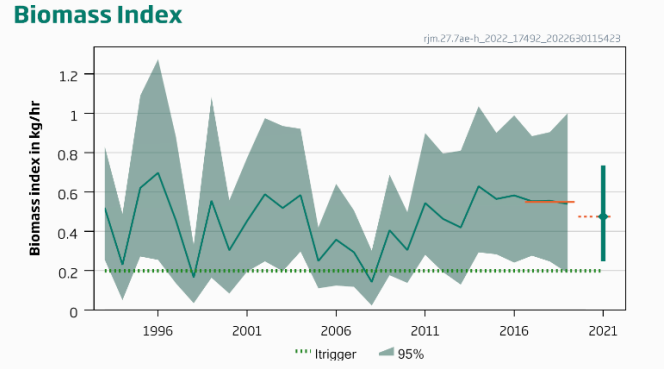

Figure 18.4c. Skates and rays in the Celtic Seas. UK (England and Wales) Irish Sea and Bristol Channel beam trawl survey (EngW-BTS-Q3) mean CPUE (individuals of ≥ 50 cm in total length) of *Raja montagui* in divisions 7.a, e-h for 1993–2021. Red lines give average for 2017–2019 and for 2021. The 2020 survey was not included in the assessment as it did not cover the usual range (Silva, 2022a).

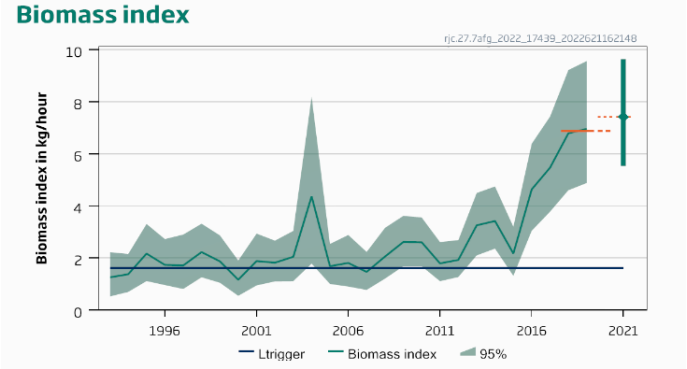

Figure 18.4d. Skates and rays in the Celtic Seas. UK (England and Wales) Irish Sea and Bristol Channel beam trawl survey (EngW-BTS-Q3) mean CPUE (individuals of ≥ 50 cm in total length) of *Raja clavata* in divisions 7.a, f-g for 1993–2021. Red lines give average for 2017–2019 and for 2021. The 2020 survey was not included in the assessment as it did not cover the usual range (Silva, 2022a).

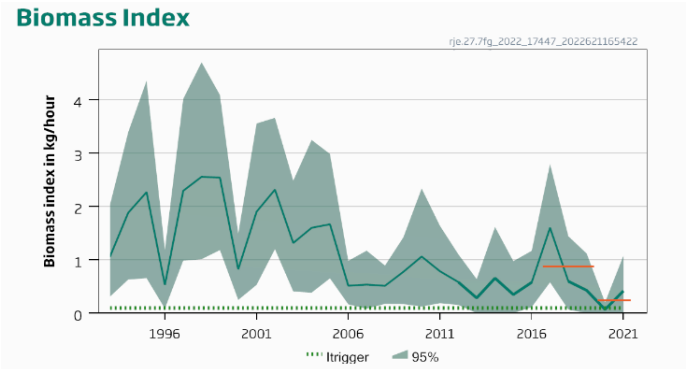

Figure 18.4e. Skates and rays in the Celtic Seas. UK (England and Wales) Irish Sea and Bristol Channel beam trawl survey (EngW-BTS-Q3) mean CPUE (individuals of ≥ 50 cm in total length) of *Raja microocellata* in divisions 7.f-g for 1993–2021. Red lines give average for 2073–2019 and for 2020–2021.

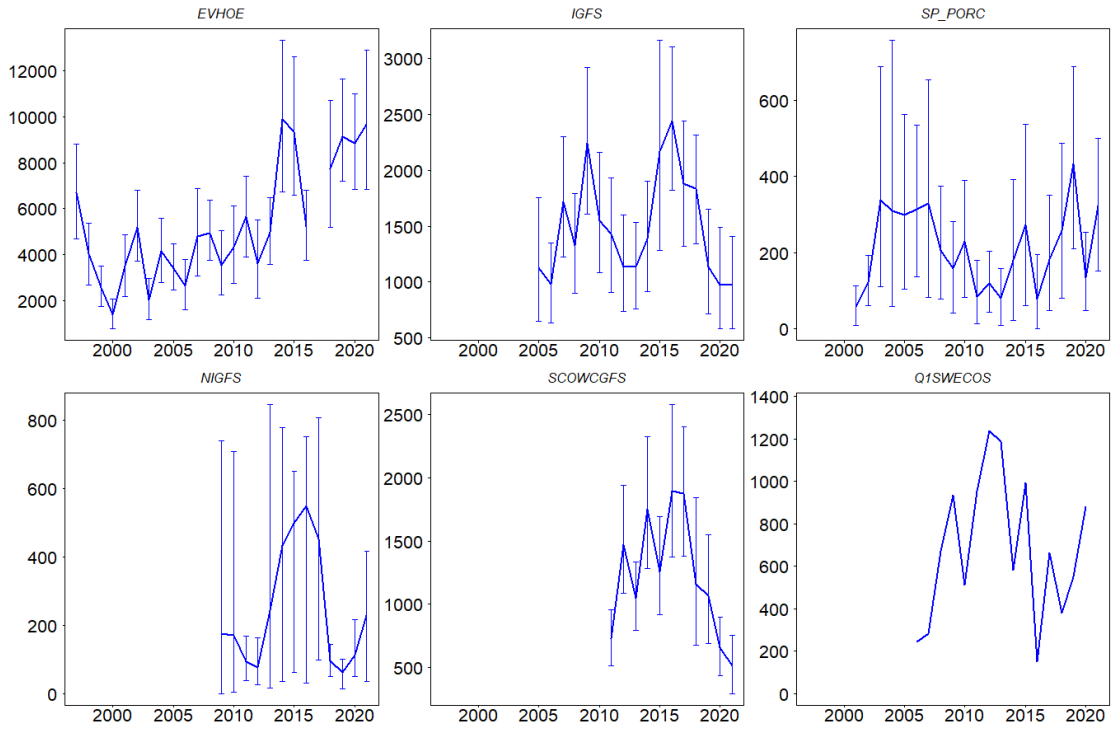

Figure 18.4f. Skates and rays in the Celic Seas. Indices of the exploited biomass (individuals of ≥ 50 cm in total length) of cuckoo ray (*Leucoraja naevus*) from the six survey where individuals from the stock rnj.27.678abd are caught from 1997 (only EVHOE started in this year) to 2021. No EVHOE survey carried out in 2017.

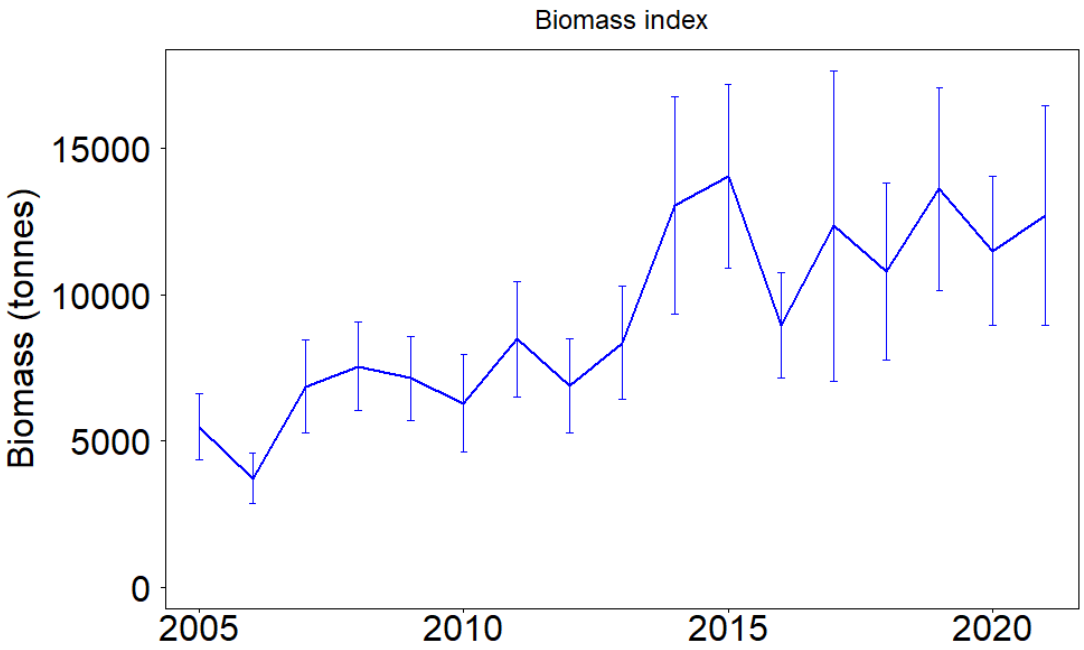

Figure 18.4g. Skates and rays in the Celtic Seas. Combined index of the exploited biomass (individuals of ≥ 50 cm in total length) of cuckoo ray, stock rnj.27.678abd used for the assessment (years 2005–2021).

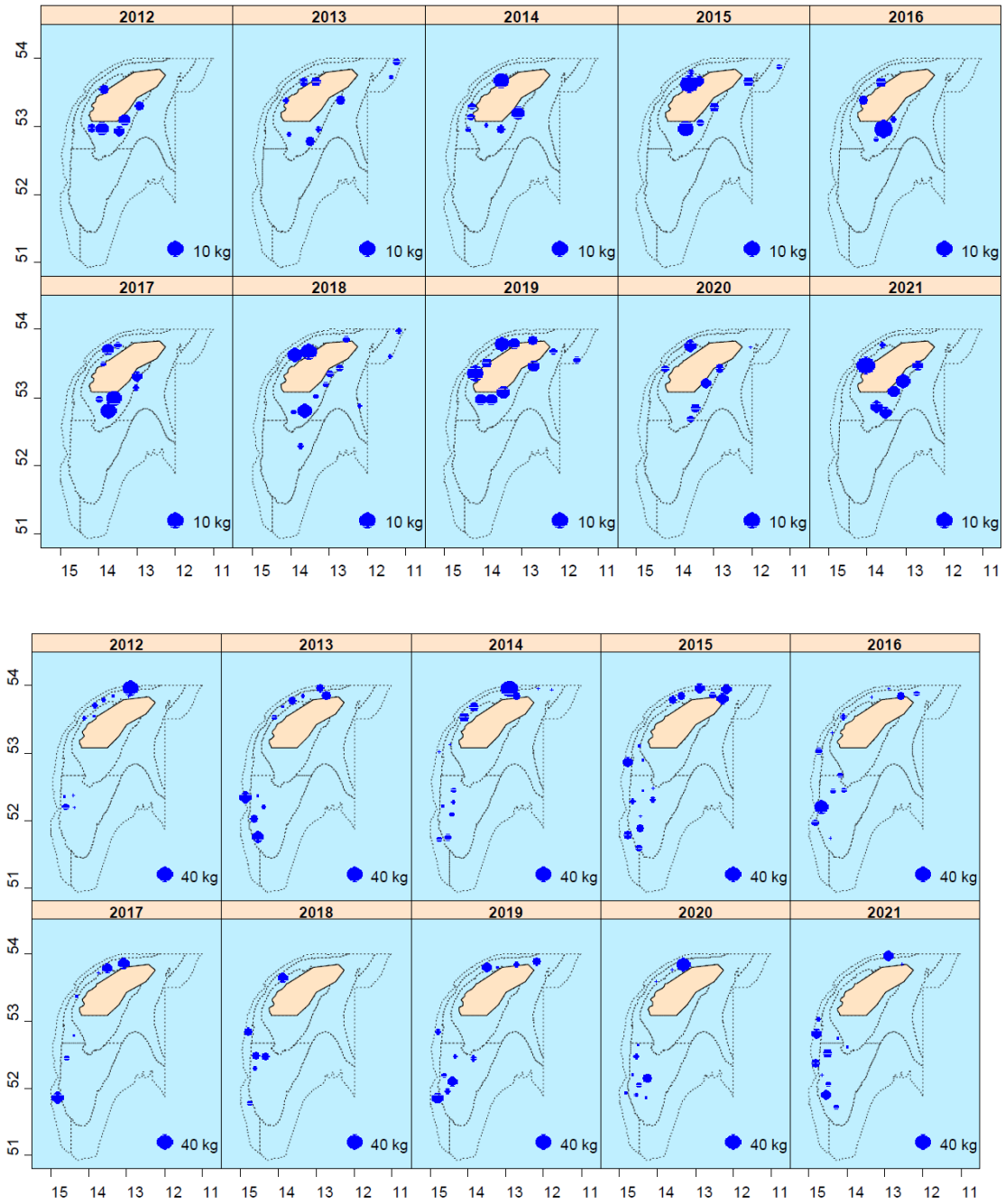

Figure 18.5a. Skates and rays in the Celtic Seas. Geographical distribution of cuckoo ray *Leucoraja naevus* (top) and sandy ray *Leucoraja circularis* (bottom) catches (kg haul^{-1}) in Porcupine survey time-series (2012–2021) (WD06 - Fernández-Zapico *et al.*, 2022).

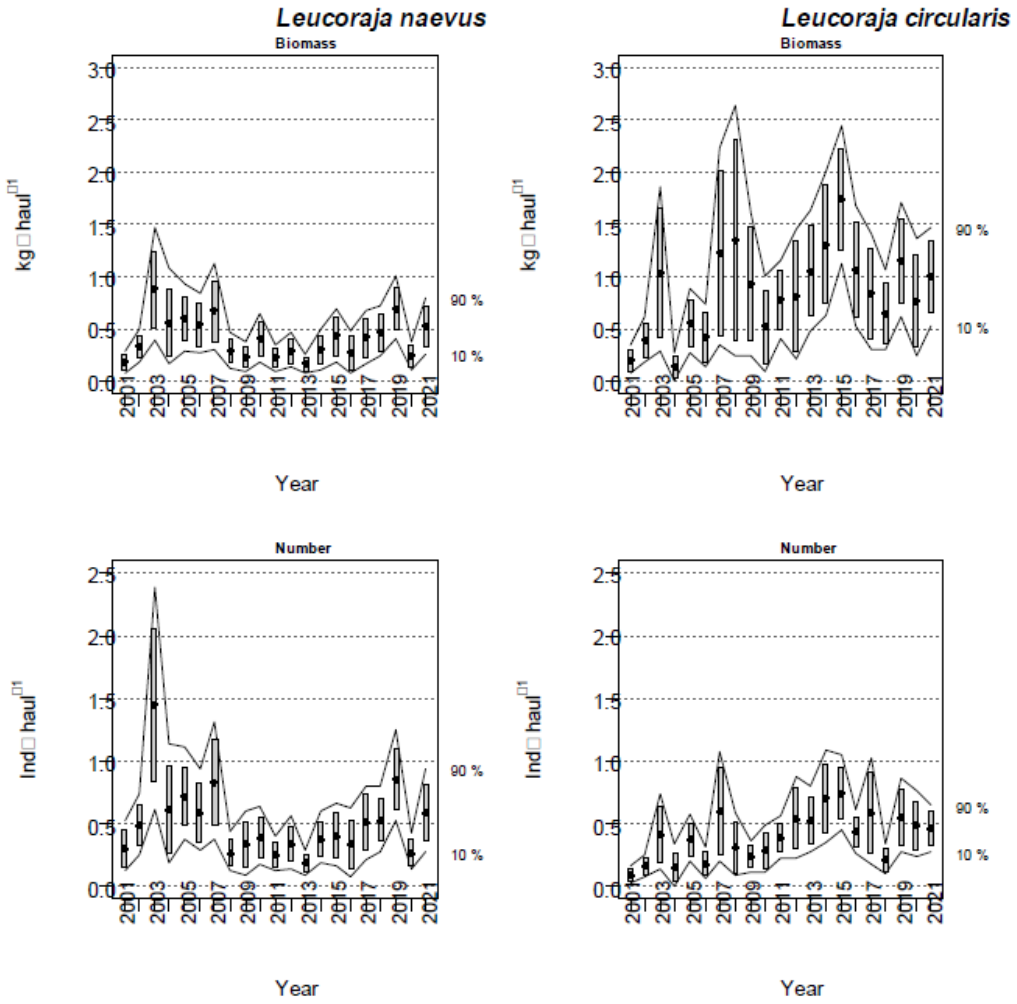

Figure 18.5b. Skates and rays in the Celtic Seas. Temporal changes of cuckoo ray *Leucoraja naevus* and sandy ray *Leucoraja circularis* biomass index (kg haul^{-1}) during Porcupine survey time-series (2001–2021). Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000) (WD06 - Fernández-Zapico *et al.*, 2022).

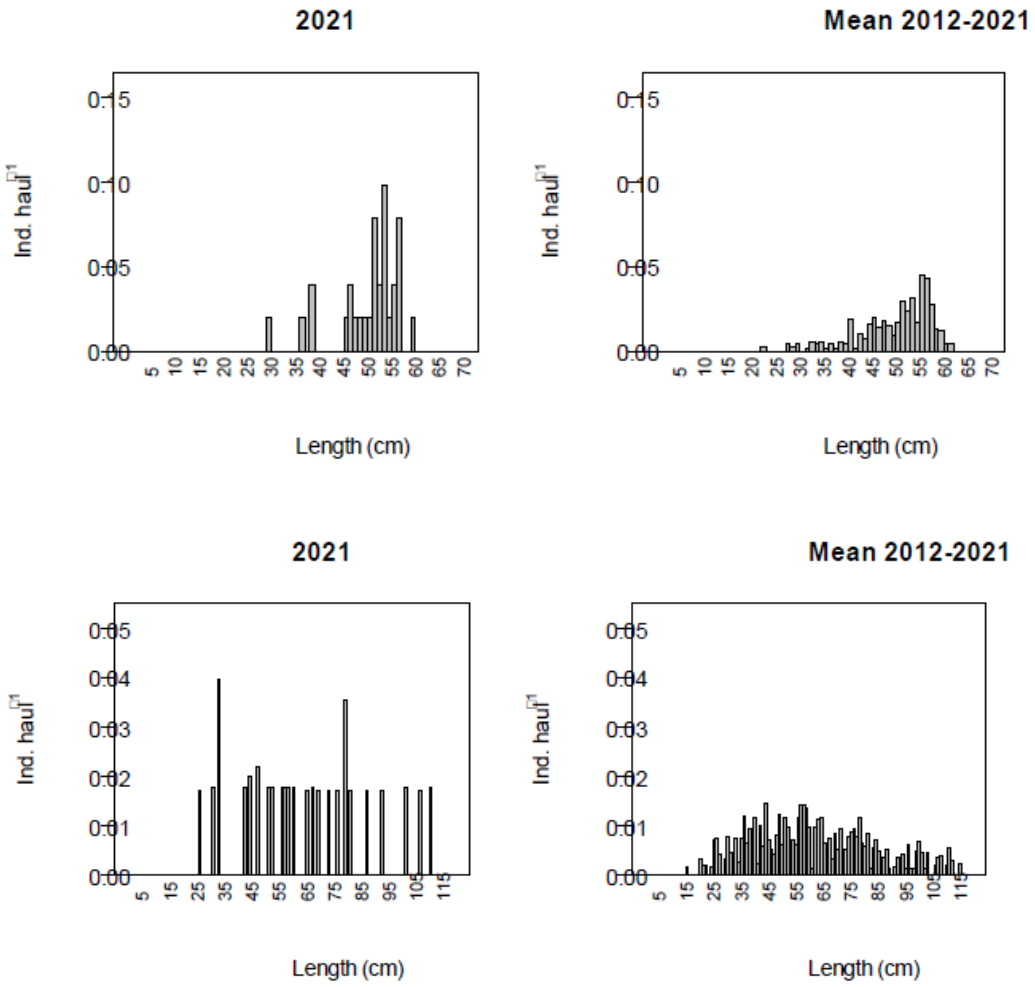

Figure 18.5c. Skates and rays in the Celtic Seas. Stratified length distributions of cuckoo ray *Leucoraja naevus* (top) and sandy ray *Leucoraja circularis* (bottom) in Porcupine survey 2012–2021 (WD06 - Fernández-Zapico *et al.*, 2022).

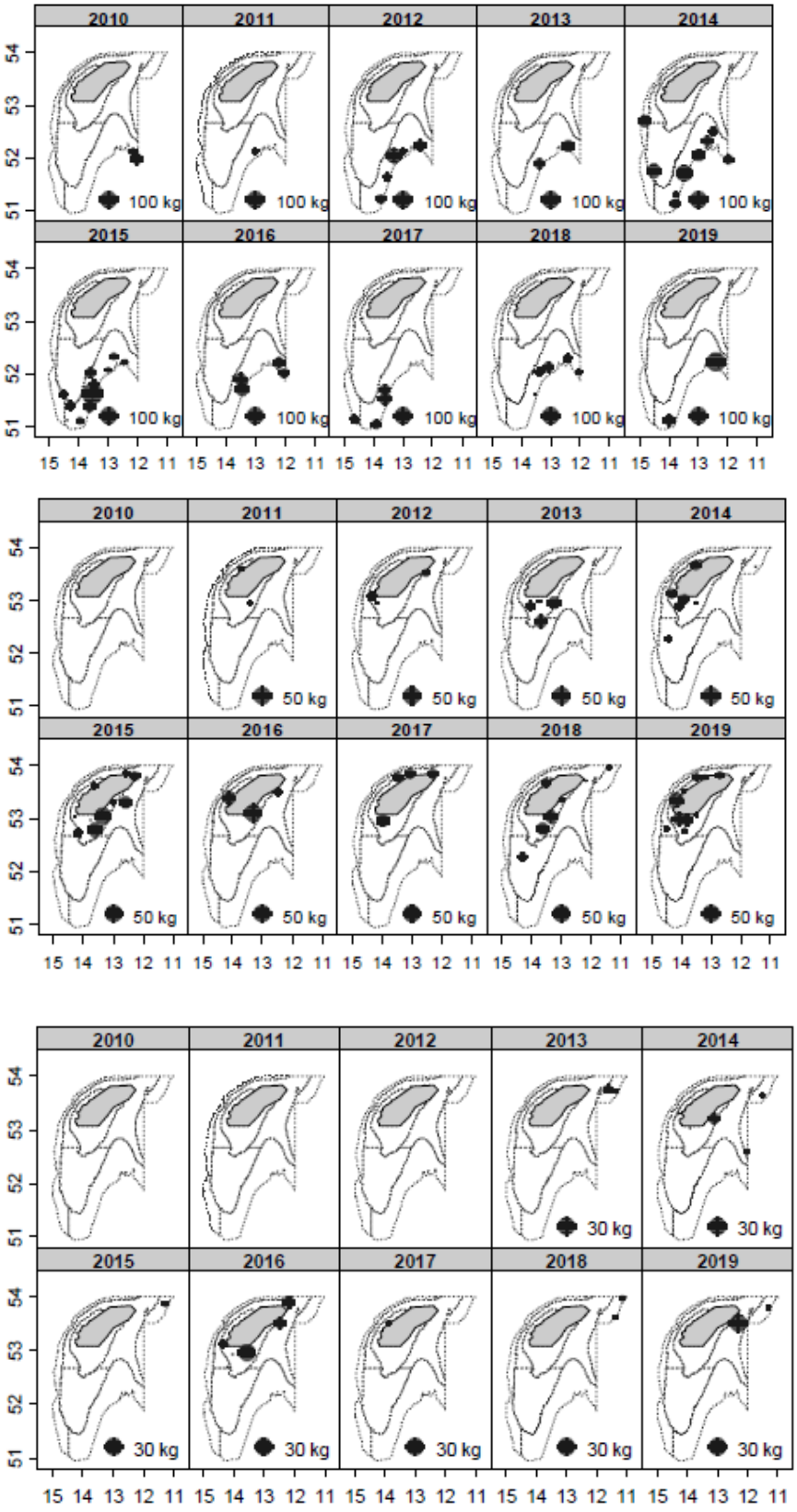

Figure 18.5d. Skates and rays in the Celtic Seas. Geographical distribution of *Dipturus nidarosiensis* (top), *D. batis* (middle) and *D. intermedius* (bottom) (kg haul^{-1}) in Porcupine survey time-series (2008–2019) (WD02 - Ruiz-Pico *et al.*, 2020).

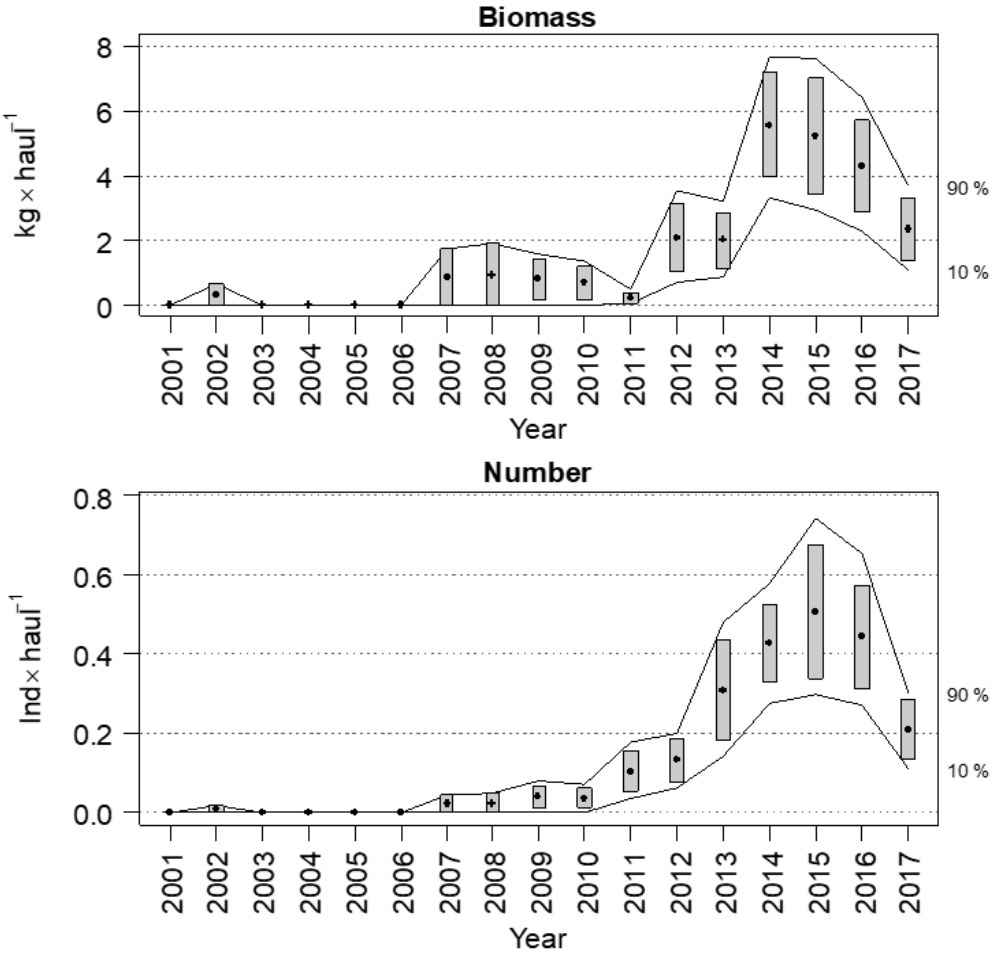

Figure 18.5f. Skates and rays in the Celtic Seas. Changes in *Dipturus* spp. biomass index (kg·haul^{-1}) during Porcupine survey time-series (2001–2017). Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000) (WD02 - Ruiz-Pico *et al.*, 2020).

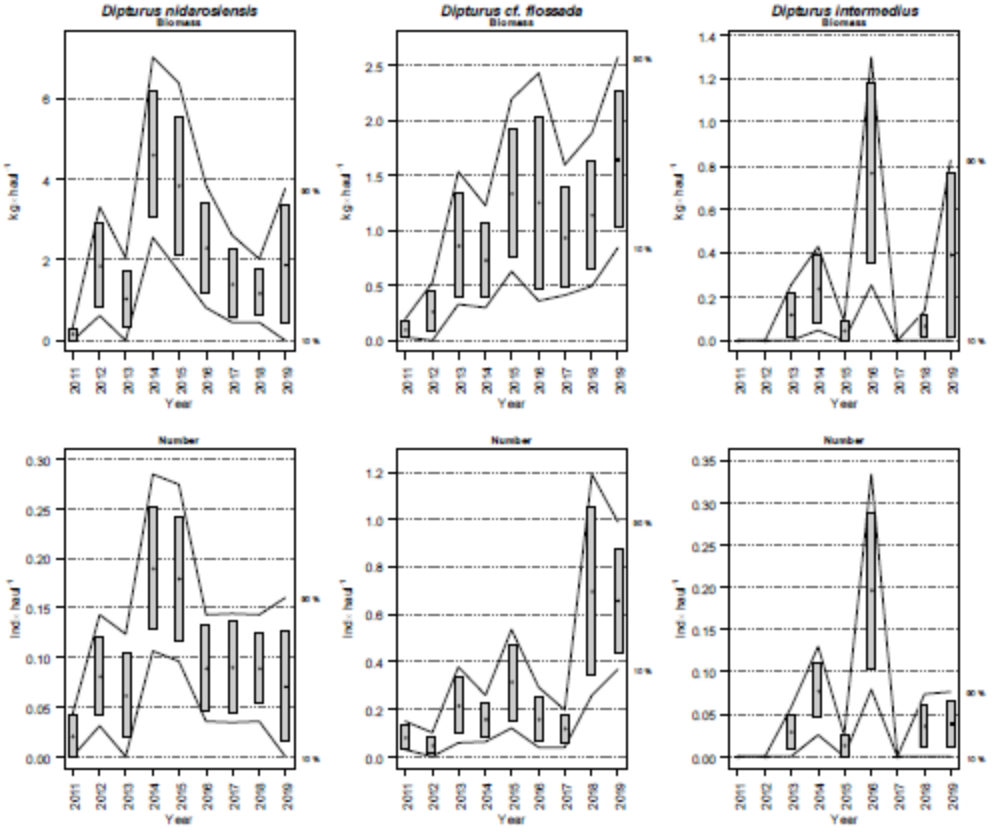

Figure 18.5g. Skates and rays in the Celtic Seas. Changes in *Dipturus nidarosiensis*, *Dipturus batis* (labelled *Dipturus* cf. *flossada*) and *Dipturus intermedius* (labelled *Dipturus* cf. *intermedia*) biomass index (kg haul^{-1}) during Porcupine survey time-series (2011–2019). Boxes mark parametric standard error of the stratified index. Lines mark bootstrap confidence intervals (a = 0.80, bootstrap iterations = 1000) (WD02 - Ruiz-Pico *et al.*, 2020).

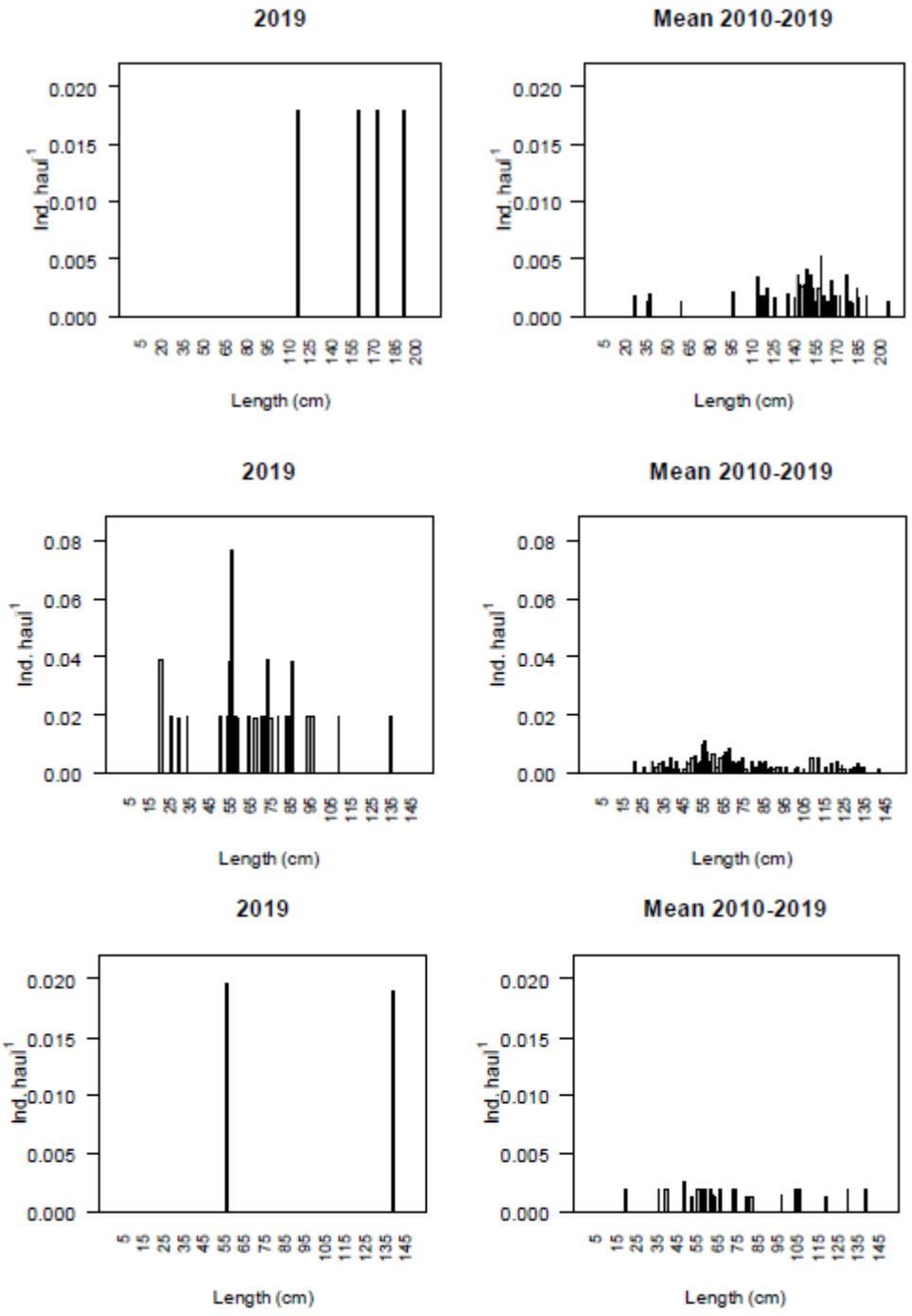

Figure 18.5h. Skates and rays in the Celtic Seas. Mean stratified length distributions of *Dipturus nidarosiensis* (top) and *Dipturus batis (*middle) and *D. intermedius* (bottom) from 2019 Porcupine surveys (WD02 - Ruiz-Pico *et al.*, 2020).

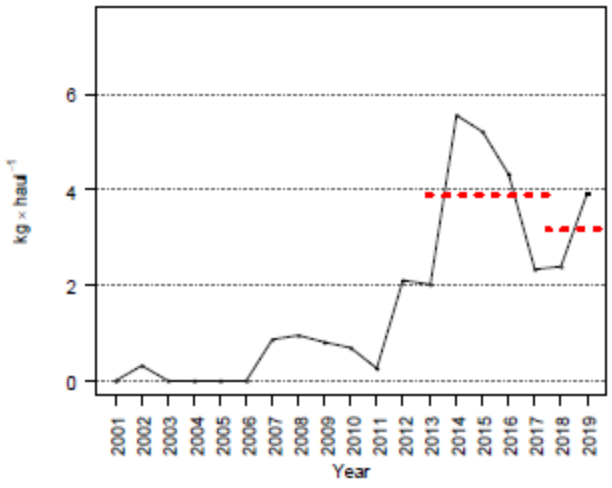

Figure 18.5i. Skates and rays in the Celtic Seas. Changes in *Dipturus* spp. biomass index during Porcupine survey time series (2001–2019). Dotted lines compare mean stratified biomass in the last two years and in the five previous years. (WD02 - Ruiz-Pico *et al.*, 2020).

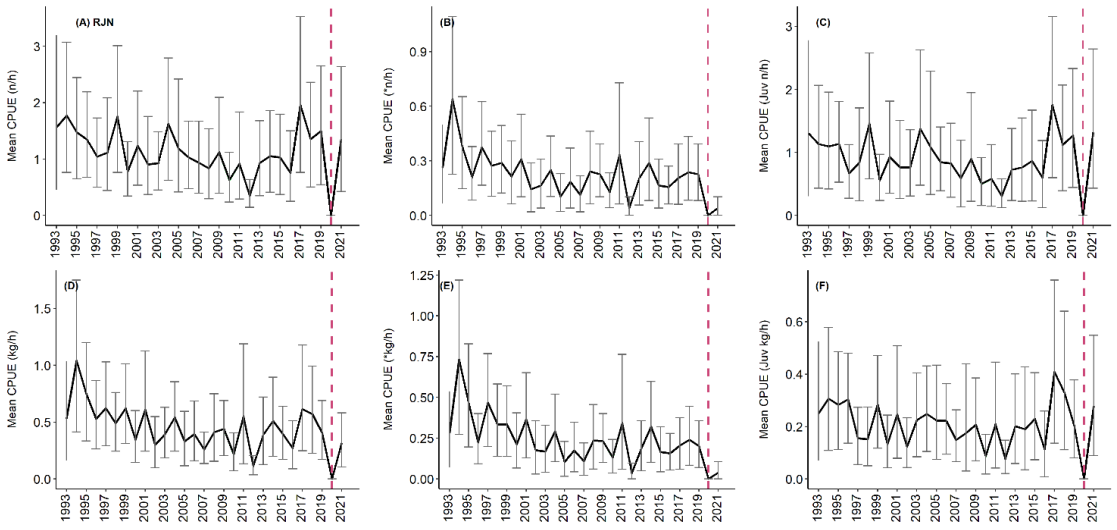

Figure 18.6a. Skates and rays in the Celtic Seas. Temporal trends (1993–2021) in the mean CPUE and associated confidence intervals (95%CI) by (A) individuals (n.h^{-1}), (B) individuals ≥50 cm L_T (*n.h^{-1}), (C) individuals <50 cm L_T (Juv n.h^{-1}), (D) biomass (kg.h^{-1}), € biomass ≥50 cm L_T (*kg.h^{-1}) and (F) biomass <50 cm L_T (Juv kg.h^{-1}) of cuckoo ray *L. naveus* in the 7.af-g beam trawl survey ((EngW-BTS-Q3). Note: Index covers divisions 7.a.f-g. Comparison between index based on DATRAS (black line) and national database (green line, not visible due to data harmony). Dashed line represents year when survey area limited to 7.f-g. Different y-axis (Source: Silva, 2022a).

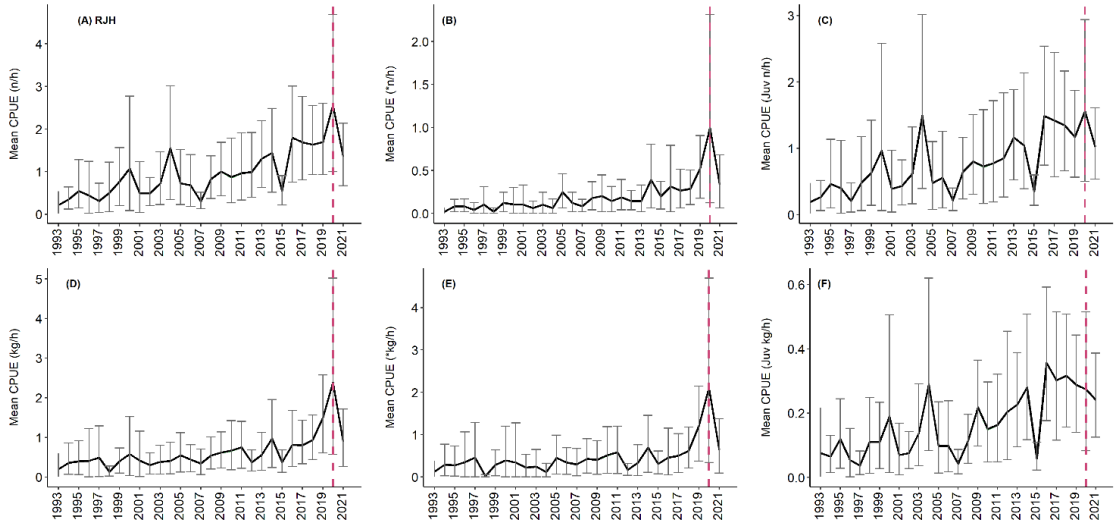

Figure 18.6b. Skates and rays in the Celtic Seas. Temporal trends (1993–2021) in the mean CPUE and associated confidence intervals (95%CI) by (A) individuals (n.h^{-1}), (B) individuals ≥50 cm L_T (*n.h^{-1}), (C) individuals <50 cm L_T (Juv n.h^{-1}), (D) biomass (kg.h^{-1}), (E) biomass ≥50 cm L_T (*kg.h^{-1}) and (F) biomass <50 cm L_T (Juv kg.h^{-1}) of blonde ray *R. brachyura* in the 7.af-g beam trawl survey ((EngW-BTS-Q3). Note: Index covers divisions 7.a.f-g. Comparison between index based on DATRAS (black line) and national database (green line, not visible due to data harmony). Dashed line represents year when survey area limited to 7.f-g. Different y-axis (Source: Silva, 2022a).

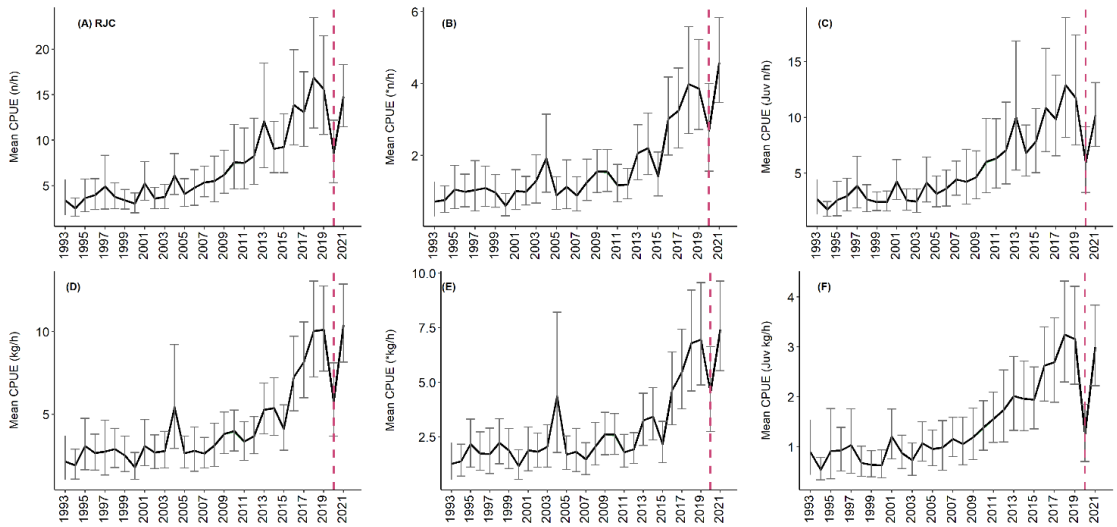

Figure 18.6c. Skates and rays in the Celtic Seas. Temporal trends (1993–2021) in the mean CPUE and associated confidence intervals (95%CI) by (A) individuals (n.h^{-1}), (B) individuals ≥50 cm L_T (*n.h^{-1}), (C) individuals <50 cm L_T (Juv n.h^{-1}), (D) biomass (kg.h^{-1}), (E) biomass ≥50 cm L_T (*kg.h^{-1}) and (F) biomass <50 cm L_T (Juv kg.h^{-1}) of thornback ray *R. clavata* in the 7.af-g beam trawl survey ((EngW-BTS-Q3). Note: Index covers divisions 7.a.f-g. Comparison between index based on DATRAS (black line) and national database (green line, not visible due to data harmony). Dashed line represents year when survey area limited to 7.f-g. Different y-axis (Source: Silva, 2022a).

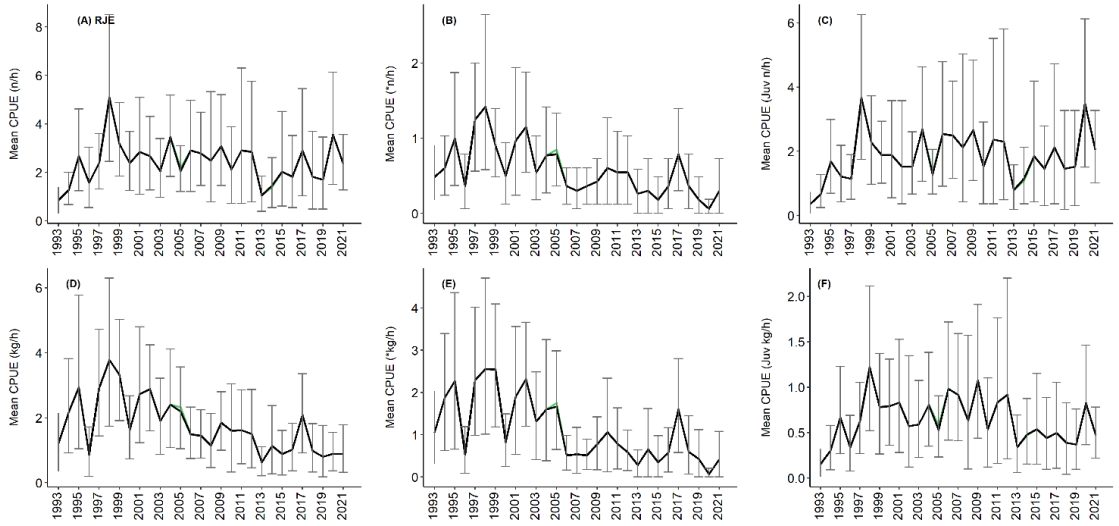

Figure 18.6d. Skates and rays in the Celtic Seas. Temporal trends (1993–2021) in the mean CPUE and associated confidence intervals (95%CI) by (A) individuals (n.h^{-1}), (B) individuals ≥50 cm L_T (*n.h^{-1}), (C) individuals <50 cm L_T (Juv n.h^{-1}), (D) biomass (kg.h^{-1}), (E) biomass ≥50 cm L_T (*kg.h^{-1}) and (F) biomass <50 cm L_T (Juv kg.h^{-1}) of small-eyed ray *R. microocellata* in the 7.af-g beam trawl survey ((EngW-BTS-Q3). Note: Index covers only divisions 7.f-g. Comparison between index based on DATRAS (black line) and national database (green line, negligible and only visible in 2005). Different y-axis (Source: Silva, 2022a).

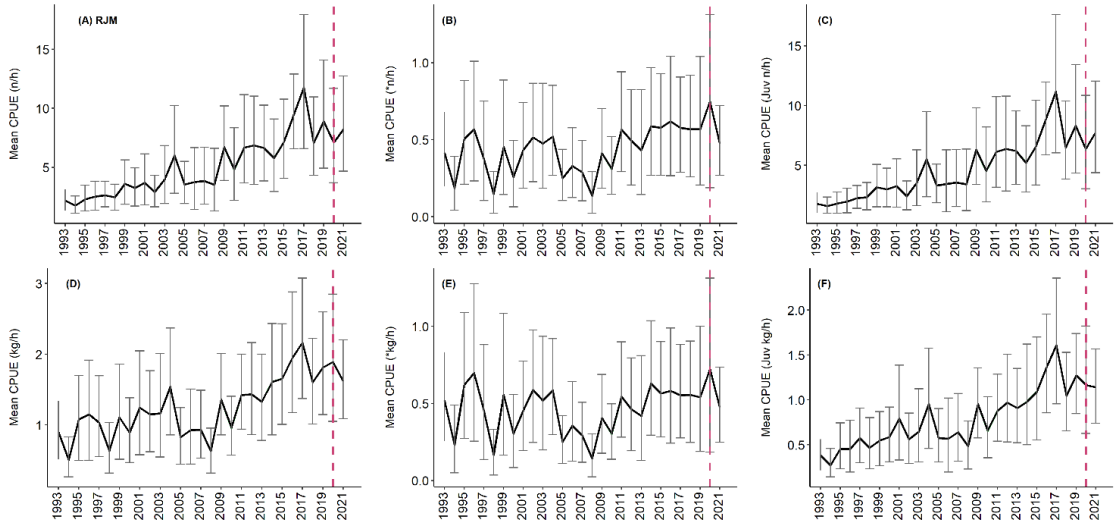

Figure 18.6e. Skates and rays in the Celtic Seas. Temporal trends (1993–2021) in the mean CPUE and associated confidence intervals (95%CI) by (A) individuals (n.h^{-1}), (B) individuals ≥50 cm L_T (*n.h^{-1}), (C) individuals <50 cm L_T (Juv n.h^{-1}), (D) biomass (kg.h^{-1}), (E) biomass ≥50 cm L_T (*kg.h^{-1}) and (F) biomass <50 cm L_T (Juv kg.h^{-1}) of spotted ray *R. montagui* in the 7.af-g beam trawl survey ((EngW-BTS-Q3). Note: Index covers divisions 7.a.f-g. Comparison between index based on DATRAS (black line) and national database (green line, not visible due to data harmony). Dashed line represents year when survey area limited to 7.f-g. Different y-axis (Source: Silva, 2022a).

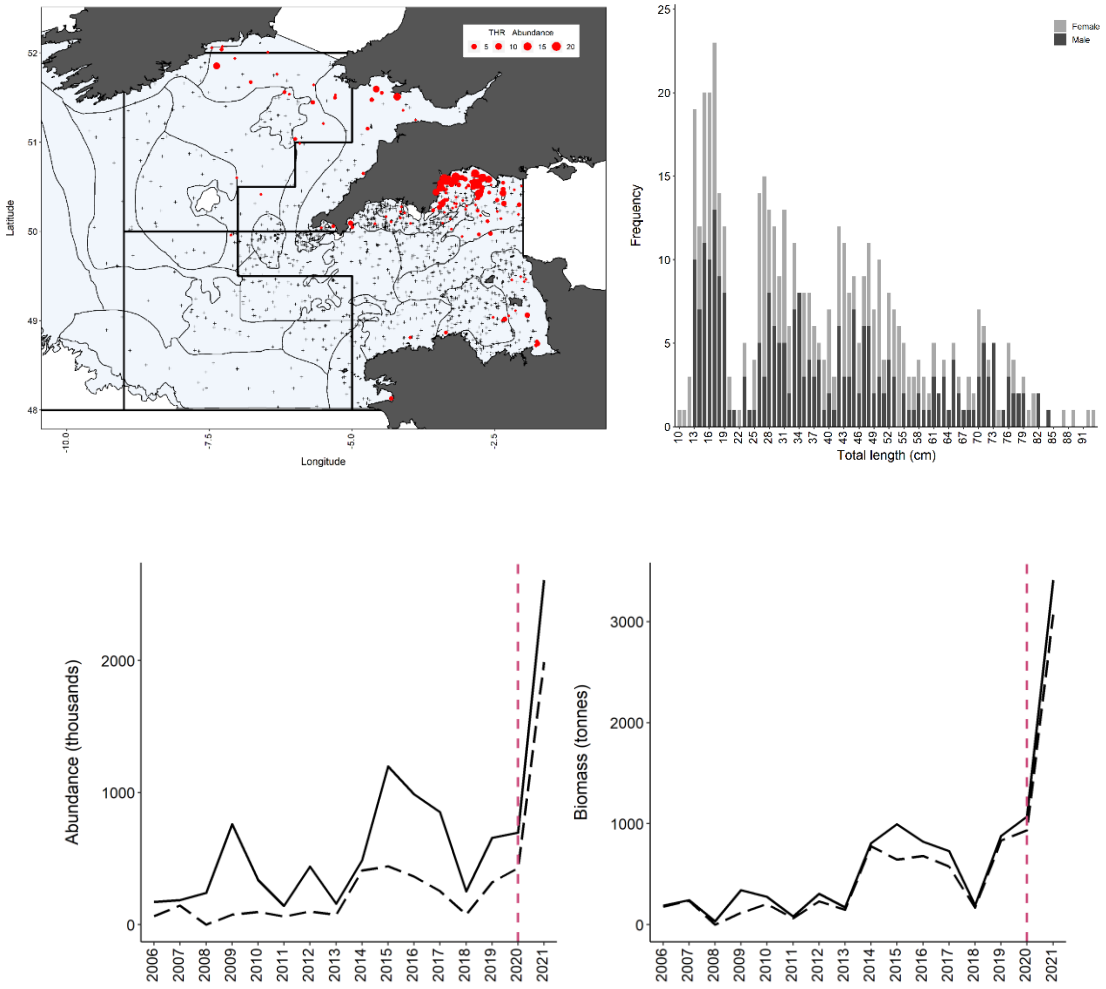

Figure 18.7a. Skates in the Celtic Sea. Distribution and relative abundance (top left) and length-frequency by sex (top right) of thornback ray *Raja clavata* in the Q1SWECOS trawl survey. Preliminary estimates of total abundance (numbers in thousands) and total biomass (tonnes) for *R. clavata*. Note: Different y-axes. Continuous line relates to all specimens, black dashed line relates to individuals ≥50 cm L_T. Dashed vertical line represents year when survey was conducted in June instead of Q1 (Source: Silva *et al.,* 2020 and Silva, 2022b).

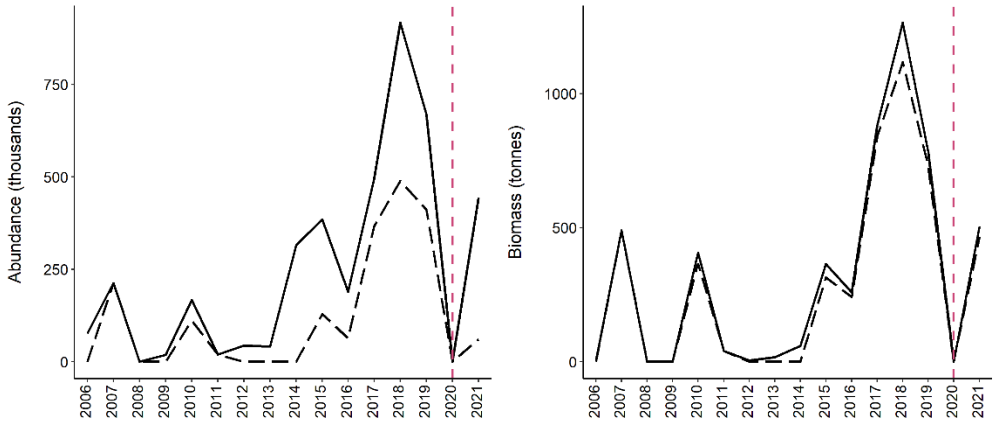

Figure 18.7b. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers in thousands) and total biomass (tonnes) for common skate *Dipturus batis*-complex. Note: Different y-axes. Continuous line relates to all specimens, black dashed line relates to individuals ≥50 cm L_T. Dashed vertical line represents year when survey was conducted in June instead of Q1 (Source: Silva, 2022).

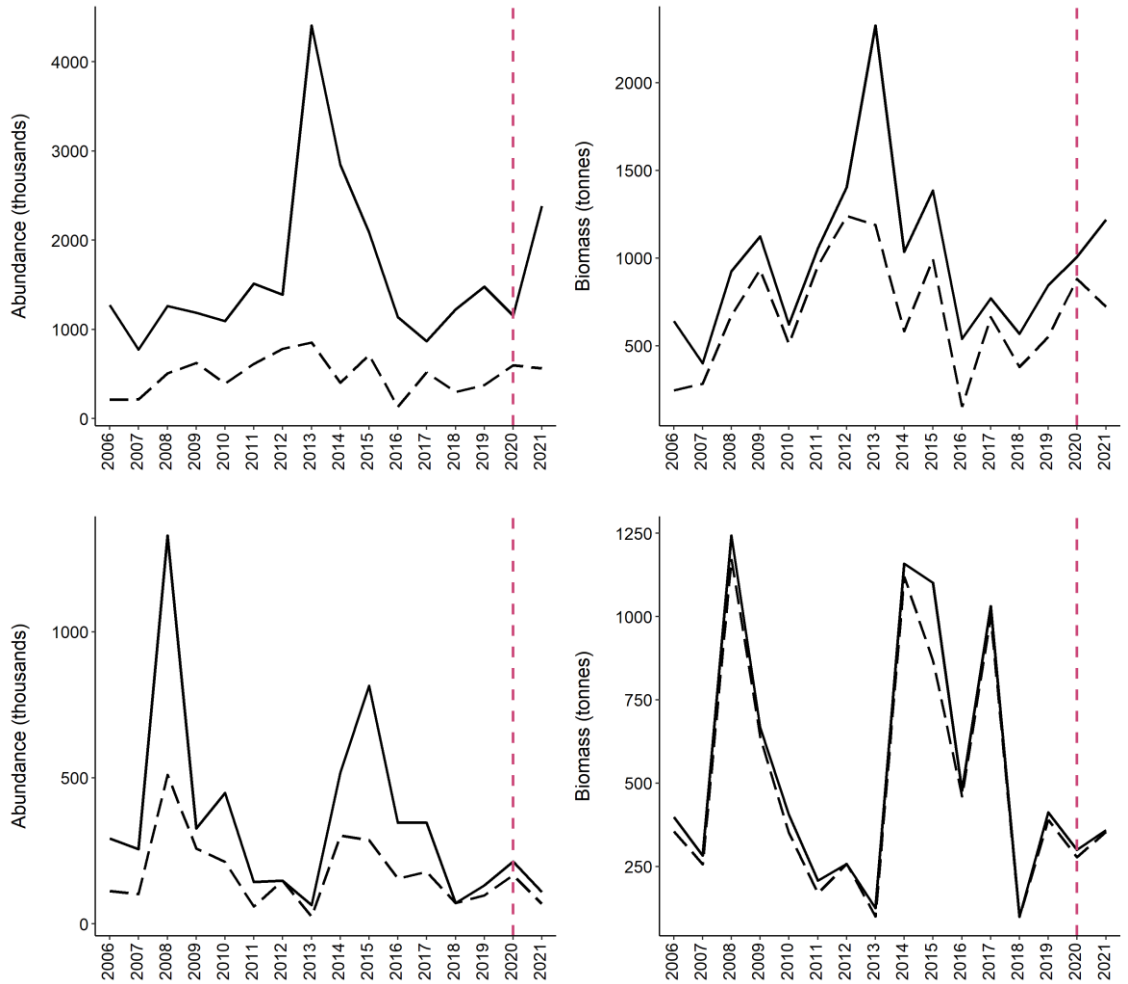

Figure 18.7c. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers in thousands) and total biomass (tonnes) for (top) cuckoo ray *Leucoraja naevus* and (bottom) blonde ray *Raja brachyura*. Note: Different y-axes. Continuous line relates to all specimens, black dashed line relates to individuals ≥50 cm L_T. Dashed vertical line represents year when survey was conducted in June instead of Q1 (Source: WD02 - Silva, 2022).

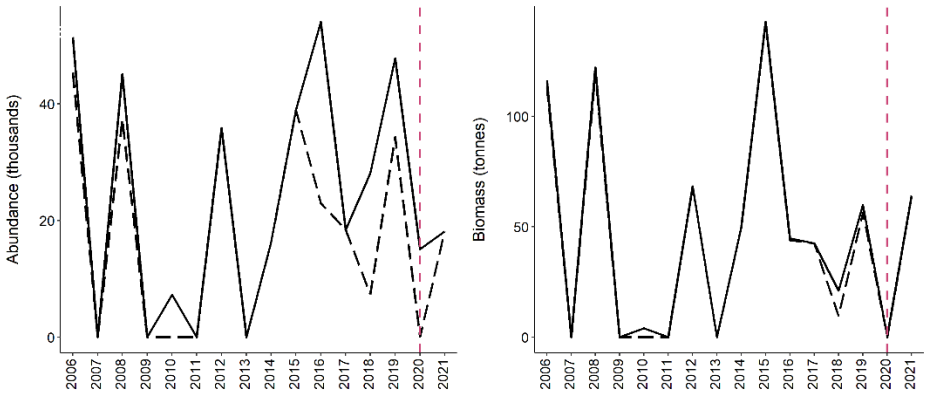

Figure 18.7d. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers in thousands) and total biomass tonnes) for small-eyed ray *Raja microocellata*. Note: Different y-axes. Continuous line relates to all specimens, black dashed line relates to individuals ≥50 cm L_T. Dashed vertical line represents year when survey was conducted in June instead of Q1 (Source: WD02 - Silva, 2022).

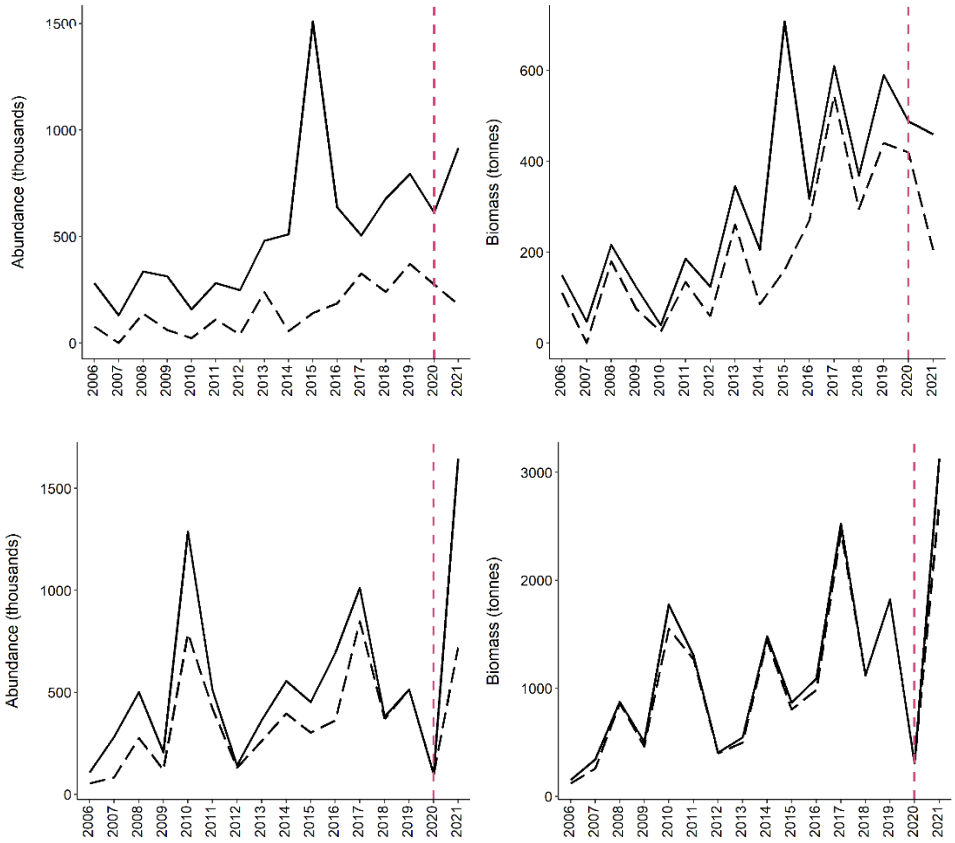

Figure 18.7e. Skates in the Celtic Sea. Demersal elasmobranchs in the Q1SWECOS indicating preliminary estimates of total abundance (numbers in thousands) and total biomass (tonnes) for (top) spotted ray *Raja montagui* and (bottom) undulate ray *Raja undulata*. Note: Data for 2020 for undulate ray showed only for illustrative purposes and should be viewed with caution. Different y-axes. Continuous line relates to all specimens, black dashed line relates to individuals ≥50 cm L_T. Dashed vertical line represents year when survey was conducted in June instead of Q1 (Source: WD02 - Silva, 2022).

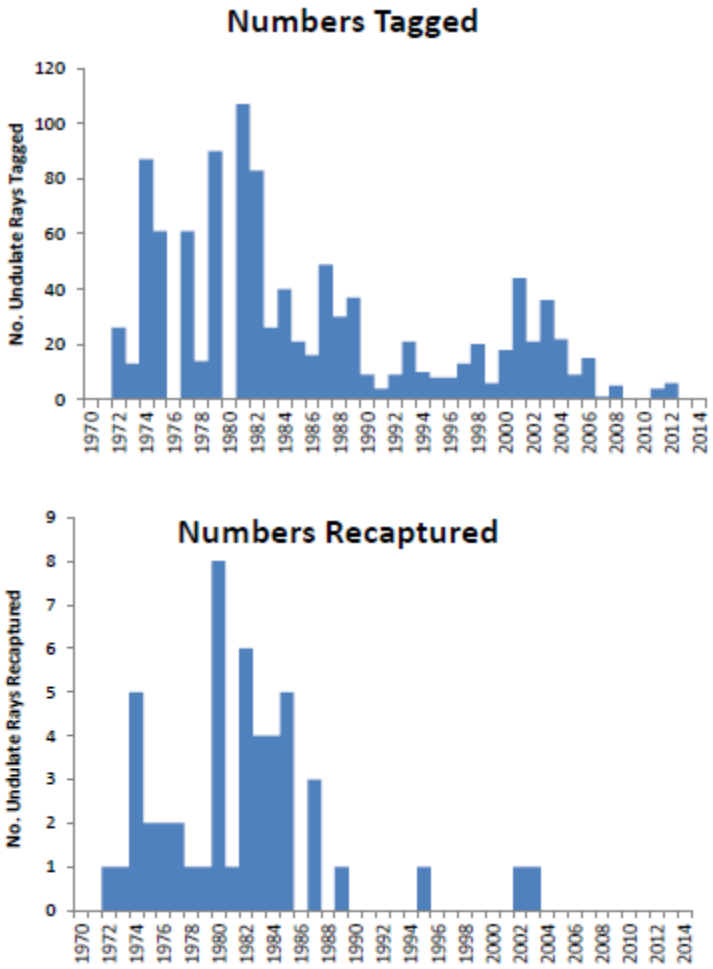

Figure 18.8. Skates in the Celtic Seas. Numbers of *Raja undulata* tagged (top) and recaptured (bottom) in Tralee Bay and surroundings, 1970–2014. Source: Wögerbauer *et al.*, 2014 WD.

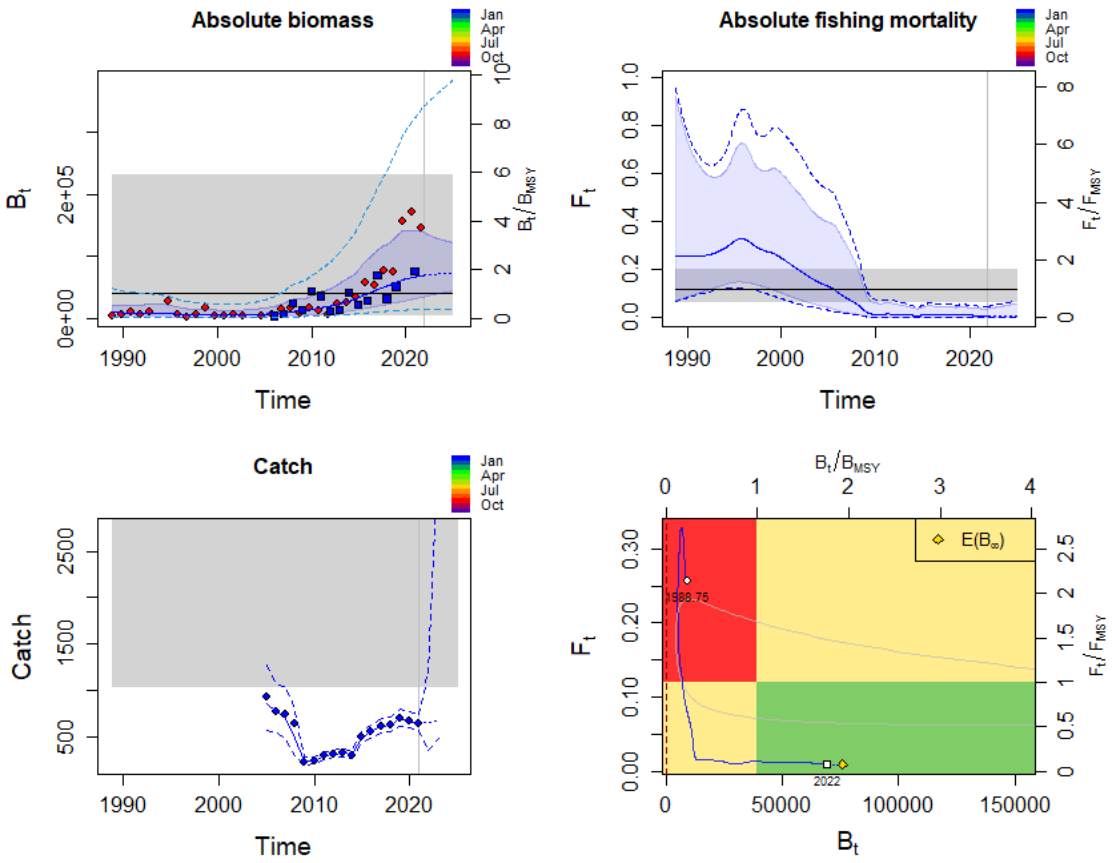

Figure 18.9. Time series of biomass, fishing mortality and catch, as well as Kobe plot estimated from the SPiCT assessment of undulate ray (rju.27.7de). Envelopes represent 95% confidence intervals around estimated values.

18.15 Appendix 1 – rfb method calculations by stock

18.15.1 Rjc.27.6

Length frequencies from 2019-2021 were examined. As there were limited lengths sampled in 2020 and 2021, the length samples from 2019-2021 were combined into one length frequency.

Survey index

rjc.27.6	kg per hour	CI lower	CI higher	Landings	advised landings
2005	3.743457	-0.14978	7.636691		
2006	5.918033	2.479871	9.356196		
2007	5.566723	1.25586	9.877586		
2008	7.614717	2.756651	12.47278		
2009	7.268841	2.749677	11.78801		
2010	17.95365	3.744648	32.16265		
2011	13.78083	4.955622	22.60604		
2012	22.89845	3.28423	42.51268		
2013	15.6807	3.511421	27.84999		
2014	12.8471	1.374992	24.3192		
2015	14.33994	4.008358	24.67153		
2016	23.36949	3.616883	43.12209		
2017	15.76918	7.09373	24.44464	294	
2018	16.21579	5.760897	26.67069	337	
2019	16.16309	3.661064	28.66511	416	174
2020	3.886069	1.260858	6.511279	315	137
2021	11.84196	2.905287	20.77863	267	137
2	7.864014		2	7.864014	
3	16.04935		5	17.1715	
2/3	0.489989			0.457969	
	67.12855			62.74176	

Length Frequency (Combined 2019–2022)

19	29300	63	6749.982
20	43949	64	3199.577
21	29301	65	26903.65
22	51278	66	34693.06
23	14733	67	33104.76
24	31418	68	50212.96
25	3240	69	4331.292
26	31040	70	13640.82
27	16818	71	7727.899
28	4394	72	5330.169
29	46859	73	8006.133
30	11173	74	13965.28
31	61588	75	2549.515
32	14936	76	6003.917
33	22332	77	4678.595
34	74498	78	732.6479
35	16842	79	1628.294
36	46797	80	8275.352
37	36470	81	3095.56
38	6227	82	2253.995
39	31159	83	1724.059
40	49457	84	4017.964
41	113728	85	1970.538
42	19242	86	3274.693
43	76258	87	938.6542
44	24117	88	1922.316
45	5958.995	89	1719.303
46	68209	90	2239.355
47	108703	91	775.4059
48	19340.82	92	2495.52
49	6166.208	93	1218.436
50	33277.62	94	516.1464
51	16949.13	95	2581.095
52	62334.22	96	677.1341
53	45159.4	97	2717.034
54	113489.8	98	1405.129
55	28108.21	99	372.0338
56	60224.13	100	0
57	2226.131	101	333.162
58	48439.27	102	1096
59	60586.57	103	
60	13501.38	104	0
61	48002.06	105	115
62	18495.58		

18.15.2 Rjc.27.7afg

Length frequencies from 2019-2021 were examined. As there were limited lengths sampled in 2020 and 2021, the length samples from 2019-2021 were combined into one length frequency. The UK (E&W)-BTS-Q3 survey estimate for 2020 was excluded from the analysis, as due to the COVID-19 this survey did not cover the usual area (Silva, 2022a).

	20 biomass	low	high	Landings	advised landings
1993	1.259082	0.523207	2.226098		
1994	1.379068	0.698069	2.157471		
1995	2.170724	1.113965	3.310895		
1996	1.736846	0.962005	2.729211		
1997	1.715405	0.812168	2.901939		
1998	2.229719	1.260557	3.321314		
1999	1.872977	1.049409	2.87207		
2000	1.166849	0.548378	1.906961		1.330208
2001	1.885366	0.948295	2.939187		
2002	1.821736	1.101814	2.669355		
2003	2.049649	1.11311	3.043905		
2004	4.367254	1.784021	8.203029		
2005	1.687769	1.005088	2.543209		
2006	1.811835	0.904253	2.886878		
2007	1.468422	0.775855	2.236111		
2008	2.056207	1.208563	3.16073		
2009	2.616179	1.684092	3.620236		
2010	2.607674	1.684575	3.560831		
2011	1.794635	1.109941	2.614238		
2012	1.929077	1.271588	2.691027		
2013	3.255876	2.100519	4.498588		
2014	3.421425	2.360788	4.748925		
2015	2.175107	1.315911	3.204408		
2016	4.635301	3.045555	6.390153		
2017	5.470325	3.777486	7.431976		

	20 biomass	low	high	Landings	advised landings
2018	6.790722	4.60328	9.218335	878	
2019	6.958808	4.880343	9.56529	840	
2020				960	
2021	7.416985	5.533825	9.634845		
					1596
2	7.416985		2	7.416985	
3	6.406618		5	5.206052	
2/3	1.157707			1.424685	
	158.6058			195.1818	

Length frequency (2019–2022 combined)

10	3490	65	26695.49
11	15629	66	29070.11
12	14382.3	67	34588.3
13	9783.513	68	34848.67
14	10471	69	30296.31
15	14728.89	70	34732.43
16	7709.241	71	28252.41
17	9423.122	72	29681.08
18	3257.093	73	30377.79
19	3133.882	74	31465.05
20	2511.887	75	30553.62
21	7539.077	76	28087.95
22	6405.662	77	29473.25
23	11998.2	78	11523.82
24	17986.09	79	22412.45
25	17227.02	80	31211.25
26	4614.669	81	18111.55
27	11313.12	82	17210.16
28	1544.972	83	4658.413
29	16184.66	84	21527.29
30	11991.61	85	7454.733
31	11574.68	86	5660.708
32	14699.34	87	3333.864
33	25437.84	88	3909.533
34	24357.74	89	3586.109
35	26341.8	90	2282.122
36	13808.98	91	807.9283
37	14897.79	92	724.4002
38	21737.47	93	763.722
39	13484.61	94	346.4358
40	25575.84	95	838.6487
41	25485.56	96	107.7146
42	26554.33	97	109.283
43	25294.89	98	177.5057
44	29073.32	99	
45	23848.54	100	17.97517
46	20158.35	101	77
47	28067.1	102	73.33269
48	24119.59	103	62.0367
49	42489.18	104	11.29599
50	21032.27		
51	28823.04		
52	22732.03		
53	20683.95		
54	14902.34		
55	18859.03		
56	18888.61		
57	11149.18		
58	22151.42		
59	11724.74		
60	26211.24		
61	31539.84		
62	43634.94		
63	36444.71		
64	25584.74		

modal length in catch L	62.00
Lc ("Length of first capture" = length at 50% of modal abundance)	33.00
Mean length in catch y-1 (L_{y-1})	60.05
$L\infty$	118.00

Target reference length (LF=M)	54.25
Fishing proxy (f)	1.11
Biomass safeguard (b)	1.00

A2022	1596
r	1.15
f	1.11
b	1
m	0.9
A2023	1833.565

18.15.3 Rjm.27.7ae-k

Length frequencies from 2019-2021 were examined. As there were limited lengths sampled in 2020 and 2021, the length samples from 2019-2021 were combined into one length frequency. Lengths above 90 cm total length were excluded as considered likely to relate to *R. brachyura*.
The UK (E&W)-BTS-Q3 survey estimate for 2020 was excluded from the analysis, as due to the COVID-19 this survey did not cover the usual area (Silva, 2022a). As data for 2020 data were not used in the assessment the stock biomass trend is based on the index A of one year (2021) over Index B of the three preceding years (2017, 2018 and 2019).
The life-history parameter on L∞ used and available in FishBase of 78.4 cm (Gallagher *et al.*, 2005) is lower than the maximum length considered on the length data used in the assessment. However, the quality of data may have been hampered by confounding issues of *R. montagui* with *R. brachyura* within the dataset, and reallocation of these may be difficult to ascertain.

From fishbase	**k=0.3**	**Linf=78.4**			
rjm.27.7ae-k	**Survey index**				
Year	kg per hour	conf. upper	conf. lower	Landings	Landings advice
1993	0.520218	0.833299	0.256498		
1994	0.230353	0.489615	0.050651		
1995	0.620751	1.090486	0.27243		
1996	0.697684	1.274918	0.255047		
1997	0.456072	0.881297	0.135929		
1998	0.166452	0.331423	0.034785		
1999	0.555816	1.083023	0.164258		
2000	0.304455	0.558103	0.084054		
2001	0.453343	0.774532	0.195512		
2002	0.588692	0.975249	0.247739		
2003	0.518746	0.935565	0.197653		
2004	0.584669	0.921326	0.297399		
2005	0.249555	0.420365	0.110807		
2006	0.358055	0.641858	0.124639		
2007	0.293934	0.506956	0.118301		
2008	0.143003	0.302032	0.023276		Lowest value
2009	0.405701	0.688557	0.177109	887	
2010	0.305287	0.497979	0.138179	1110	

From fishbase	k=0.3	Linf=78.4			
rjm.27.7ae-k	Survey index				
2011	0.54408	0.899833	0.28103	1332	
2012	0.463807	0.795408	0.19322	1343	
2013	0.419967	0.810387	0.129293	1032	
2014	0.629325	1.035834	0.293421	1042	
2015	0.564608	0.90081	0.283519	864	
2016	0.582809	0.989462	0.241381	947	
2017	0.552998	0.883882	0.276405	762	
2018	0.555856	0.904436	0.247025	1001	1296
2019	0.539682	0.999911	0.188507	1011	1296
2020				741.483	1041
2021	0.475057	0.735405	0.248601	820.766	1041

Length Frequency (Combined 2019–2021) Lengths >90cm removed

6	2049.954	46	96485.92	86	466.4508
7		47	92841.62	87	21.05693
8	2049.954	48	35413.7	88	126.6555
9		49	54695.45	89	492.9206
10		50	66243.79	90	256.7371
11	3444.037	51	211550.8		
12	5047.312	52	118490.8		
13	2049.954	53	82994.88		
14	3841.274	54	86700.87		
15	4730.202	55	98108.78		
16	2150.573	56	91893.27		
17	5093.256	57	114106.1		
18	7199.036	58	95737.94		
19	4709.554	59	56052.51		
20	7494.279	60	61581.35		
21	7912.086	61	37374.97		
22	16434.71	62	63656.36		
23	20958.43	63	39737.81		
24	11302.24	64	44332.83		
25	40332.93	65	31578.49		
26	30199.64	66	25249.96		
27	35323.38	67	29872.08		
28	70482.6	68	18538.04		
29	56645.85	69	20997.88		
30	83684.48	70	8818.08		
31	97847.73	71	11969.73		
32	35637.8	72	22394.79		
33	61015.91	73	3746.63		
34	31807.52	74	3211.664		
35	96273.25	75	1620.305		
36	58520.07	76	3280.058		
37	26297.11	77	2087.485		
38	87212.47	78	1367.08		
39	114713.9	79	2204.513		
40	90716.45	80	302.885		
41	115933.2	81	519.946		
42	106961.5	82	508.9988		
43	139963.4	83	1016.181		
44	127745.3	84	218.5471		
45	164171.8	85	404.5641		

modal length in catch L (ICES, 2018b).	51.00
Lc ("Length of first capture" = length at 50% of modal abundance)	39.00
Mean length in catch y-1 (L_{y-1})	51.83
L_∞	78.40
Target reference length (LF=M)	48.85
Fishing proxy F	1.09

A_2022	1041
r	0.86
f	1.06
b	1
m	0.90
A_2023	860

18.15.4 Rjm.27.67bj

Length frequencies from 2019-2021 were examined. As there were limited lengths sampled in 2020 and 2021, the length samples from 2019-2021 were combined into one length frequency

Survey index

Series	Lower limit	higher limit	Landings	Landings advice
3.820364	0.876142	6.764587		
3.531714	1.758609	5.30482		
3.196319	0.291253	6.101384		
2.407975	1.153045	3.662905		
5.01776	2.14584	7.889679		
4.548864	2.588672	6.509055		
6.419649	3.468341	9.370957		
4.072012	2.323	5.821023		
7.123465	3.618573	10.62836		
9.474577	3.900799	15.04836		
5.944108	2.918739	8.969477		
15.32489	-3.16907	33.81885		
8.93665	3.949908	13.92339		
7.010963	4.151409	9.870516	96	
6.600154	2.634099	10.56621	104	80
4.80208	2.406143	7.198017	79	80
4.054243	2.254747	5.853739		51
				51
4.428162		2	4.428162	
7.515922		5	8.763352	
0.589171		2/5	0.505305	

Length Frequency (Combined 2019–2021) Lengths >90cm removed

10	0	50	498.1303	90	0
11	3365	51	117146.1		
12		52	53536.61		
13		53	4058.912		
14		54	818.8523		
15		55	4600.443		
16	331.845	56	21004.5		
17	627.868	57	6120.353		
18	1295.741	58	6614.26		
19	1644.613	59	3577.008		
20	5343.78	60	3257.858		
21	746.652	61	4901.409		
22	248.884	62	4493.636		
23	248.884	63	1924.427		
24	995.536	64	3625.559		
25	922.612	65	2502.196		
26	1836.368	66	3822.853		
27	4390.202	67	1159.596		
28	10403.35	68	987.4568		
29	3243.686	69	853.835		
30	19960.51	70	479.8773		
31	23886.86	71	899.3972		
32	5839.067	72	82		
33	9933.61	73	690.578		
34	12498.93	74	4		
35	60660.59	75	346		
36	13453.1	76	0		
37	3617.524	77	0		
38	20897.79	78	283.814		
39	31756.64	79	632.443		
40	28444.2	80	8		
41	40318.49	81	210.814		
42	35441.81	82	277.9402		
43	92887.24	83	488.367		
44	60433.6	84	0		
45	73591.62	85	4.387215		
46	53050.13	86	0		
47	35902.39	87	0		
48	6704.029	88	0		
49	17409.02	89	0		

modal length in catch L	62.00
Lc ("Length of first capture" = length at 50% of modal abundance)	45.00
Mean length in catch y-1 (L_{y-1})	56.75
$L\infty$	78.40

Target reference length (LF=M)	53.35
Fishing proxy (f)	1.06

modal length in catch L	41.00
Lc ("Length of first capture" = length at 50% of modal abundance)	31.00
Mean length in catch y-1 (L_{y-1})	51.05
$L\infty$	118.00

Target reference length (LF=M)	52.75
Fishing proxy (f)	0.97
Biomass safeguard (b)	1.00

A_2022	137
r	0.49
f	0.97
b	1
m	0.9
A_2023	58.60449

18.15.5 rje.27.7fg rfb rules

The fishery-independent survey UK(E&W)-BTS-Q3 [B6596] is used in the assessment of small-eyed ray *Raja microocellata* in divisions 7.f-g (rje.27.7fg), with input data applicable to the exploitable biomass (individuals ≥50 cm total length, L_T; Table 18.15a and Figure 18.4.e, Silva, 2022a).

Table 18.15a. Small-eyed ray in divisions 7.f and 7.g. Time-series of survey index used for the advice. Series are the mean biomass per hour (for specimens ≥ 50 cm total length) from the UK (E&W)–BTS–Q3 [B6596]. Note: ICES rounding rules applied.

Year	Biomass index (kg.hr^{-1})	High 95% CI	Low 95% CI
1993	1.05	2.0	0.31
1994	1.88	3.4	0.63
1995	2.3	4.4	0.66
1996	0.53	1.19	0.084
1997	2.3	4.0	0.98
1998	2.6	4.7	1.01
1999	2.5	4.1	1.18
2000	0.82	1.49	0.25
2001	1.90	3.6	0.53
2002	2.3	3.7	1.20
2003	1.32	2.5	0.41
2004	1.60	3.2	0.38
2005	1.67	3.0	0.65
2006	0.51	0.98	0.165
2007	0.54	1.17	0.084
2008	0.51	0.89	0.174
2009	0.77	1.42	0.170
2010	1.06	2.3	0.124
2011	0.79	1.64	0.187
2012	0.58	1.11	0.154
2013	0.28	0.64	0.00
2014	0.66	1.62	0.00
2015	0.35	0.98	0.00
2016	0.58	1.17	0.113
2017	1.60	2.8	0.58
2018	0.60	1.44	0.066
2019	0.43	1.12	0.00
2020	0.068	0.20	0.00
2021	0.42	1.08	0.00

The quality of commercial data may be hampered due to confusion over the local name "sandy ray", with landings and discards from sandy ray *Leucoraja circularis* in divisions 7.a, 7.f, and 7.g

considered to refer to small-eyed ray *Raja microocellata* for most countries. The extent of these confounding issues between the two species has not been considered (or quantified) in relation to the length data used to apply WKLIFE methods, due to the lack of information on the fishing area associated with most records.

Length data from 2019 to 2021 were available for UK (E&W), Belgium and France, and thus considered for the initial ICES Category 3 rfb exploratory analysis including years when only landings and/or discards were available for a given country. Although the units of the Belgian length data available on the Accessions database (AC) for 2020 relate only to the raw numbers measured, contrary to the raised numbers provided by the UK (E&W) and France, these were still included as Belgium is one of the main countries contributing to the landings of this species in these divisions. In 2021, there were no raised Belgian and French length data available for rje.27.7fg through Intercatch. It should be noted that the decrease in Belgian landings in 2021, is due to the introduction from the 1st of January 2021 of a Producer Organisation (PO) measure to exclude landings of this species. Data from UK (E&W) were available from 2016 to 2021 via Accessions, though only the more recent data were considered in the assessment.

Data were presented at the meeting, and the EG considered that the high levels of discards in 2021 for specific length classes (ca. 39 and 41 cm total length, L_T) would not be realistic and thus, would skew the perception of the length frequency (Figure 18.15a). Hence, length data used for the assessment only included 2019–2020 as considered the more reliable available data (Table 18.15b and Figure 18.15b).

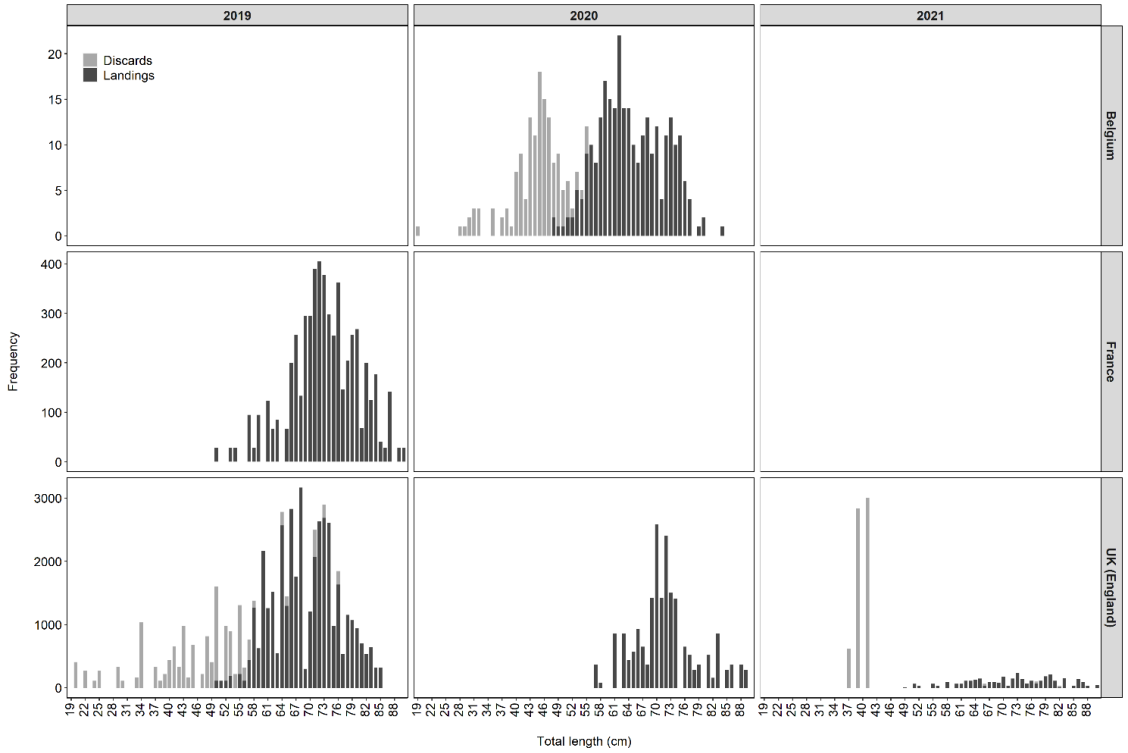

Figure 18.15a. Small-eyed ray in divisions 7.f and 7.g. Length data of commercial landings and discards from 2019–2021 available to WGEF 2022.

Table 18.15b. – Small-eyed ray in divisions 7.f and 7.g. Length data of commercial landings and discards from 2019–2020 used in the assessment of rje.27.7fg. Note: Numbers rounded to two decimal places.

Length (cm)	Number	Length (cm)	Number	Length (cm)	Number
19	1.00	47	230.83	70	4096.45
20	408.44	48	824.88	71	4312.40
22	272.29	49	417.44	72	5451.03
24	108.92	50	1634.43	73	4790.49
25	272.29	51	114.92	74	4329.75
28	1.00	52	983.25	75	1241.38
29	327.75	53	931.57	76	2862.31
30	110.92	54	251.16	77	1202.72
31	3.00	55	1319.00	78	1641.86
32	3.00	56	331.33	79	1687.53
33	163.38	57	1228.04	80	1209.42
34	1034.71	58	1497.13	81	1290.84
35	3.00	59	735.92	82	889.26
37	328.75	60	2183.29	83	1623.47
38	111.92	61	2250.79	84	498.82
39	218.83	62	1608.06	85	646.04
40	442.67	63	1497.85	86	390.98
41	662.50	64	3234.77	87	141.62
42	330.75	65	2090.36	88	362.65
43	993.25	66	3969.64	89	313.09
44	174.38	67	2674.55	90	28.32
45	698.73	68	3675.73		
46	15.00	69	2026.53		

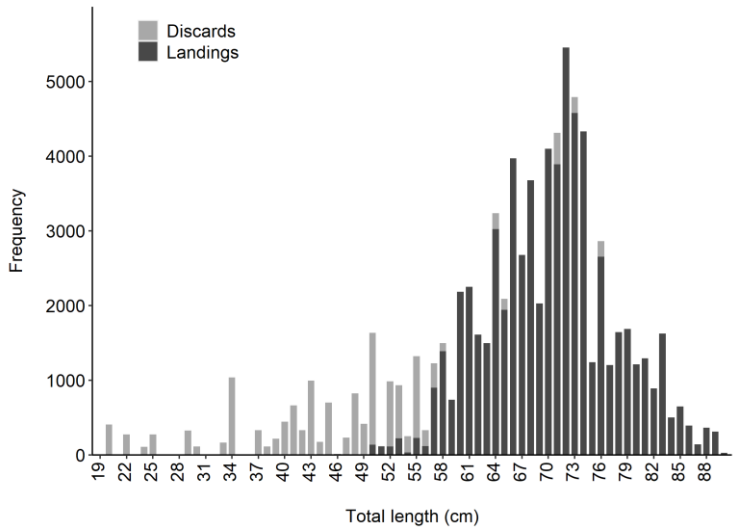

Figure 18.15b. – Small-eyed ray in divisions 7.f and 7.g. Length data of commercial landings and discards from 2019–2020 used in the assessment of rje.27.7fg.

Following the rfb rules, the advice is based on the recent advised landings, multiplied by the ratio of the mean of the last two index values (index A) and the mean of the three preceding values (index B), a ratio of observed mean length in the catch relative to the target mean length, a biomass safeguard, and a precautionary multiplier. The decrease in advice is driven by the low exploitable biomass in the more recent years of the UK (E&W)-BTS-Q3 survey. Therefore, the stability clause was considered and applied to limit the reduction in landings advice to -30%. Details on the data input used in the assessment are described in Table 18.15c.

Table 18.15c. Small-eyed ray in divisions 7.f and 7.g. Components of the rfb rule.

Components	Estimate	Input data	Comment
r: Stock biomass trend	0.28	Index A/Index B Index A = 0.24 kg.hr^{-1} Index B = 0.87 kg.hr^{-1}	The stock trend shows a decline comparatively to the earlier years within the time-series and, currently at low levels.
b: Biomass safe-guard min {$I_{2021}/I_{trigger}$, 1}	1	I_{loss} = 0.068 kg.hr^{-1} $I_{trigger}$ = 0.095 kg.hr^{-1} I_{2021} = 0.42 kg.hr^{-1}	I_{loss} - minimum estimate in 2020 $I_{trigger} = I_{loss} \times \omega$, considering ω=1.4 $I_{2021}/I_{trigger}$ = 4.4
m linked to von Bertalanffy k	0.95	k <0.20	Estimates of k = 0.086 (Ryland and Ajayi, 1984). However, the only age and growth study may have confounded 0 and 1 group (Brander and Palmer, 1985).
f: Fishing proxy $L_{mean}/L_{F=M}$	1.02	Length data used from 2019–2020 L_c = 64 cm L_T L_{mean} = 72.989 cm L_T L_{inf} = 93.7 cm L_T $L_{F=M}$ = 71.425 cm L_T	Length data for 2021 excluded from assessment. N_{max}= 5451.03 (at 72 cm L_T) L_{mean} – considered only length classes > 64 cm L_T (L_c) $L_{F=M}$ = 0.75 L_c + 0.25 L_{inf} Available L_{inf} from the literature of 137 cm L_T is not biologically plausible given the maximum observed length of 91 cm L_T (Ryland and Ajayi, 1984). The only published study on age and growth study may have confounded 0 and 1 group (Brander and Palmer, 1985). FishBase provided also another L_{inf} of 89.7 cm L_T based on L_{max} of 87 cm L_T from Dorel (1986). However, given the observed length observed on commercial length data up to 90 cm L_T to be used in the rfb, this L_{inf} estimate was considered an underestimate. Thus, L_{inf} was recalculated using FishBase – popdyn and L_{max} of 91 cm L_T, resulting on L_{inf} of 93.7 cm L_T.
$A_{y+1} = A_y \times r \times f \times b \times m$	33 tonnes	$A_y \times r \times f \times b \times m$ A_y = 123 tonnes	More than 30% decrease relative to previous landings advice of 123 tonnes for 2021 and 2022. Therefore, stability clause was applied to limit decrease, see below.
Stability clause	86 tonnes	min{max(0.7A_y,A_{y+1}), 1.2 A_y}	Final landings advice for 2023/24.