WP4 Joint cross-border strategy for the management of skates and rays fisheries

Local context baseline

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Introduction to skates and rays

Skates and rays are elasmobranchs, (fish with a cartilaginous rather than a bony skeleton), and typically have a dorsoventrally flattened body that is disk shaped with long tail.
Skates and ray species, belong to the order Rajiformes and are typically slow growing, have a late age-at-maturity, low reproductive capacity, are relatively large in size and have an aggregating behaviour. Thornback ray (*Raja clavate*) is probably the most important commercially fished species within the North Sea and Eastern Channel, however because of their life history traits skates and rays are considered to be vulnerable to over-exploitation.

Skates and rays tend to feed primarily on the sea floor and use their teeth, arranged in several rows, one behind the other forming a kind of pavement to crush their prey. Many skate and ray species show a change in diet from predominantly feeding on small crustaceans as juveniles to bony fish, crabs and shrimps as adults (Moura et al., 2008) (Ellis et al, 2005). There are also differences in the growth of the different skates and rays: smaller-bodied species such as spotted ray and cuckoo ray grow to about 70–80cm in length; thornback ray and blonde ray grow to 110–120cm, whilst common and white skate grow to more than 200cm.

Table 1. Analysis by Lancaster and Lart (2015) of the length of maturity for key Skate and Ray species. The table uses published (MacCully et al, 2012) and unpublished information (Lancaster, 2009). The 'Length at first maturity' is the length at which mature fish are observed and the 'Largest immature' is the length of the largest immature fish observed in the data. Generally, the L50 is considered an index of length at maturity.

Common name	Scientific name	Length at first maturity (cm)		Largest immature (cm)		Length at 50% mature (cm)	
		Male	Female	Male	Female	Male	Female
Blonde ray	*Raja brachyura*	55	60	91	93	78	76.6
Thornback ray *	*Raja clavat*	47	47	88	90	66.6	76.6
	(range)	*(47-56)*	*(47-57)*	*(76-88)*	*(82-90)*	–	*(73-78)*
Small eyed ray	*Raja microocellata*	66	73	74	83	68.9	77.9
Spotted ray	*Raja montagui*	40	49	66	70	50.8	62.5
Shagreen ray	*Leucoraja fullonica*	75	–	82	–	–	–
Common skate	*Dipturus batis*	115	125	98	97	–	–
Starry ray	*Amblyraja radiata*	30	32	44	46	36.2	38.4
Cuckoo ray *	*Leucoraja naevus*	48	45	64	65	56.4	59.4
	(range)	*(48-49)*	*(45-51)*	*(57-64)*	*(58-65)*	*(51-57)*	*(54-60)*

** Combined North & Celtic sea data data* *– No or insufficient data available*

Skates and rays typically mature relatively late in their life cycle at between 5 and 10 years of age and smaller-bodied species are thought to mature earlier (Table 1). Males and females are easily identified, as males have a pair of claspers (used in copulation) alongside the pelvic fins.
Reproduction takes place via internal fertilisation but females lays eggs that then develop outside the parent until ready to hatch (oviparous). The females lay fewer than 100 eggs per year, on the sea floor (compared to cod, for example, which may each shed millions of eggs every year), and these hatch after four to six months (Ellis & Shackely, 1995). Little is known about the presence of

egg-laying grounds for most skates, although parts of the southern North Sea (e.g. the Thames area) are known to have large numbers of juvenile *R. clavata* (Ellis et al., 2005) and egg-laying is thought to occur in both the inshore grounds of the Outer Thames estuary and the Wash.

The juveniles of inshore species (such as thornback, spotted, blonde and small-eyed rays) occur in bays and coastal waters and are generally considered non-migratory, inhabiting inshore nursery grounds; in the Bay of Douarnenez (France) they are found to remain in shallow waters for at least 2 years (Rousset 1990) and move into deeper water as they grow. Adult fish move over wider areas, though they may return to certain areas to feed or breed (Hunter et al, (2005) Hunter, et al, (2005b)).

Distribution of skates and rays

Introduction

Around 200 different species of skates and rays are found throughout the world's oceans, from Arctic to Antarctic waters, and from shallow coastal shelves to open seas and abyssal regions. A few are found in rivers and some in estuaries, but most are marine, living near the sea bed at depths down to 3,000 m. A large number of different skates and rays species are commonly found across the greater North Sea ecoregion (Fig. 1) as well as more specifically the ICES areas 4c and 7d (SUMARiS project area).

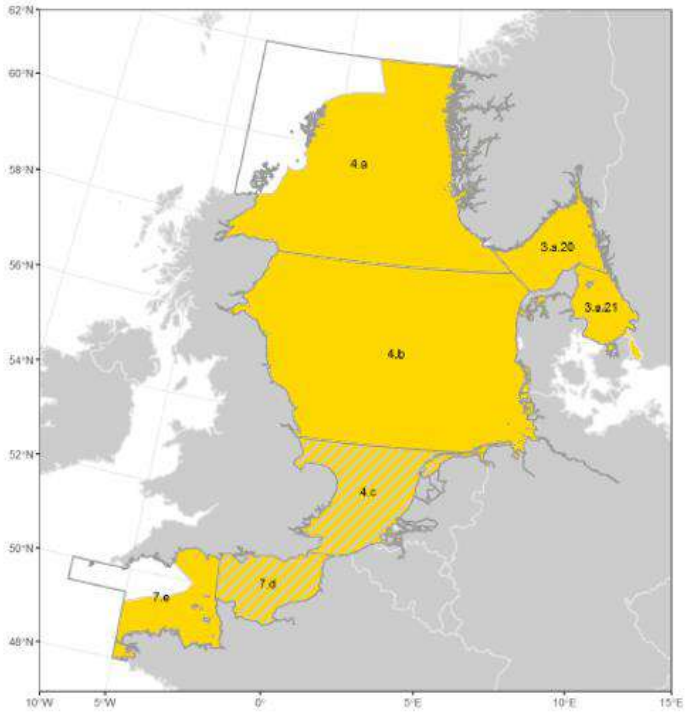


Fig. 1 The Greater North Sea ecoregion (orange) as defined by ICES. The relevant ICES statistical areas are shown. The diagonal hatching highlight the SUMARiS project area.

The main commercial species caught within northern European waters are the true skates, which have common names that generally distinguish the large species with long snouts (skates), from the smaller species with short snouts (rays).

The most abundant species in inshore waters are thornback ray (*Raja clavata*), blonde ray (*Raja brachyura*) and spotted ray (*Raja montagui*). Cuckoo ray (*Leucoraja naevus*), shagreen ray (*Leucoraja fullonica*) and common skate (actually two biological species: *Dipturus intermedia* and *Dipturus flossada*) are found further offshore, with long-nosed skate (*Dipturus oxyrinchus*) and sandy ray (*Leucoraja circularis*) occuring along the edge of the continental shelf.

In the central and northern North Sea, starry ray (*Amblyraja radiata*) occurs, although it is of little commercial importance due to its small size. Small-eyed ray (*Raja microocellata*) and undulate ray (*Raja undulata*) are most frequently found in the Bristol and English Channels respectively. White (*Rostroraja alba*) skate occur in coastal and shelf seas and black skate (*Dipturus nidarosiensis*) in fjords and deeper waters further offshore although both these species are currently considered rare. Long nosed skates (*Dipturus oxyrinchus*) occur in deeper waters of the continental slope.

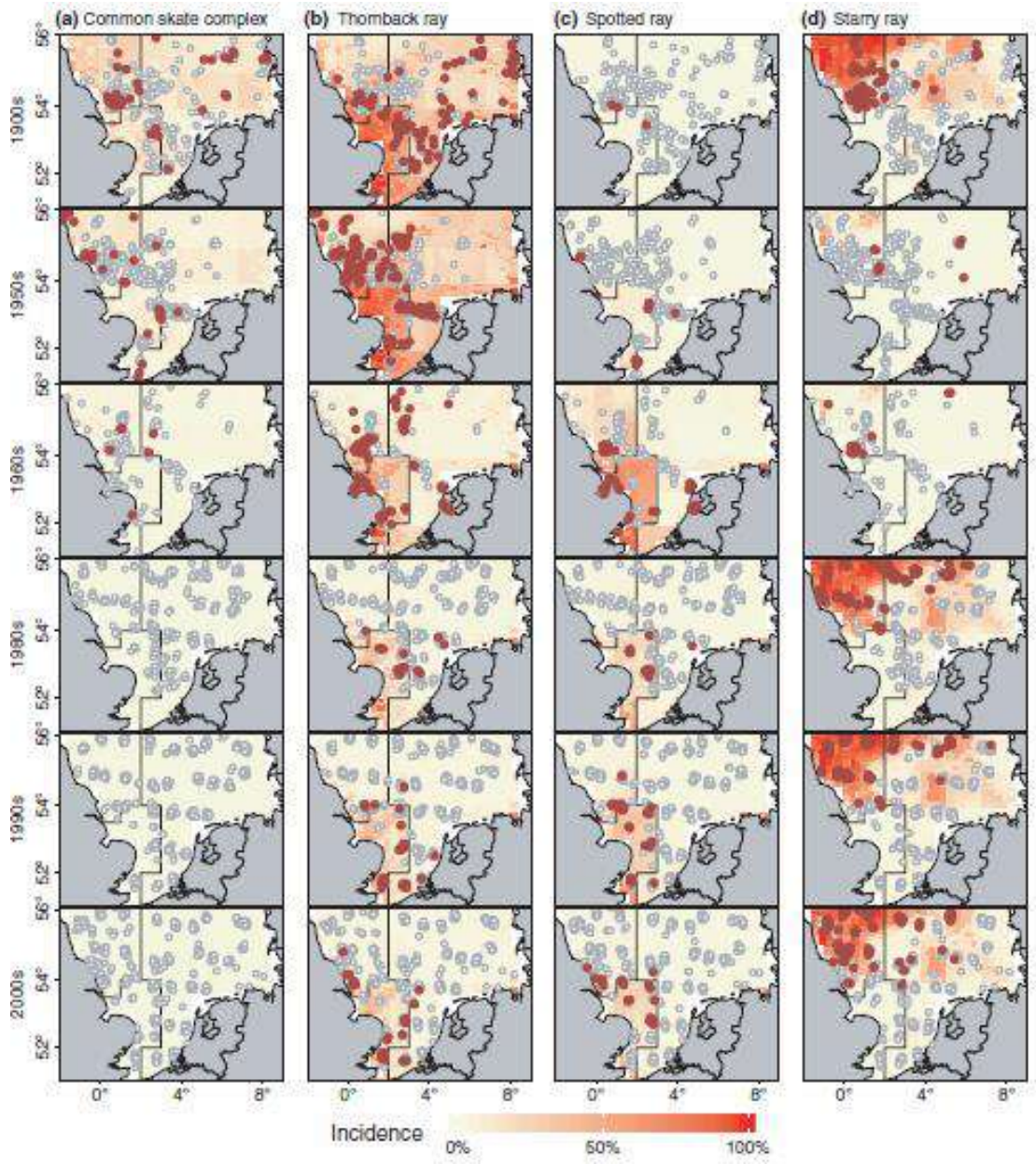


Fig.2 Changes in modelled spatial distribution of four North Sea skate species (a) common skate complex, (b) thornback ray, (c) spotted ray, and (d) starry ray. Maps show predicted distribution patterns in six well-sampled decades: symbols represent survey hauls (filled red if at least 1 individual was observed, otherwise unfilled) and graded background colours indicate predicted incidence. Chart from Sguotti et. al. (2016)

Long term distribution changes

Understanding the range and distribution of different skates and ray species can be challenging as species distributions are dynamic and can change in the long and short-term in response to

environmental and anthropogenic changes; increasing and decreasing water temperature, habitat extent and health or exploitation levels. Sguotti et. al. (2016) analysed the relative populations and their distributions of four species of skates and rays over a century long time series (1902–2013) in the North Sea (Fig. 2). The analysis showed that species distribution changed noticeably over this extended period with the largest species studied (the common skate complex) showing a massive decline from an average incidence of ~30% in the early 20th century to <5% in the 1960s, to local extirpation from the southern North Sea during the early 1970s.

The records also showed that historically thornback ray distribution was far more widespread across the southern North Sea and was considered common off the Dutch coast in the early 1940s. However, in the 1960s the population became increasingly restricted to the west of the North Sea, before contracting mainly to the areas outside the Thames and Humber estuaries in the 1980s.

The analysis of spotted ray and starry ray distributions showed more fluctuating distributions over the 111-year period with increases as well as decreases in population and extent. Population responses to changes in sea surface temperature, and potential advantages of being smaller bodied compared to the larger bodied thornback ray and common skate could have played a role in these trends (Sguotti et. al. 2016).

Current stock distribution and status

Studies focusing on current distributions (Machado et al., 2004; Silva et al., 2012) have shown that species composition of skates, can vary both seasonally and spatially (Fig. 3). Some areas, such as the southern North Sea, have a comparatively low species richness of skates, and thornback ray (*R. clavate*) is by far the main species encountered (Ellis et al., 2008; Silva et al., 2012;). In contrast, other regions (e.g. Celtic Sea) have a greater range of skate taxa (ICES f 2017).

From work undertaken by Walker et al., (1997) and Ellis et al., (2008b) the thornback ray (*R. clavata*) current stock distribution is relatively well understood and is concentrated in the Greater Thames Estuary (southern part of Division 4.c) but its distribution also extends into the Eastern Channel. Survey catch trends in Divisions 4.c and 7.d have been increasing in recent years (ICES f 2017), however the status of thornback ray (*R. clavata*) in divisions 4.a-b is uncertain (ICES f 2017). Studies from the Thames Estuary have shown the thornback ray to be seasonally migratory, spending the winter in deeper water and tending to return to specific shallower areas in the late spring and summer to breed (Hunter et al., 2005).

Unfortunately for most other demersal species in the North Sea ecoregions, stock boundaries are less well known, however encouragingly the stock trends identified by ICES (2017) seem to have remained consistent for the last 6-7 years. Blonde ray (*Raja brachyura*) has a patchy distribution, being recorded in the Eastern English Channel and Southern North Sea and several surveys have shown increased catch rates in the last 15 years (ICES f 2017). Encouragingly the spotted ray (*R. montagui*) population seem to be stable or increasing with abundance in the North Sea is increasing since 2000 whilst, in the eastern Channel a slight increase has been recorded during recent years. Stocks of cuckoo ray (*Leucoraja naevus*), are considered stable (ICES f 2017) and their distribution has fluctuated, but without a distinct trend. Abundance has decreased since the early 1990s, and in recent years catch rates in the International Bottom Trawl Survey (IBTS) have increased, while they have been stable/decreasing in the Beam Trawl Surveys (BTS) Tridens survey.

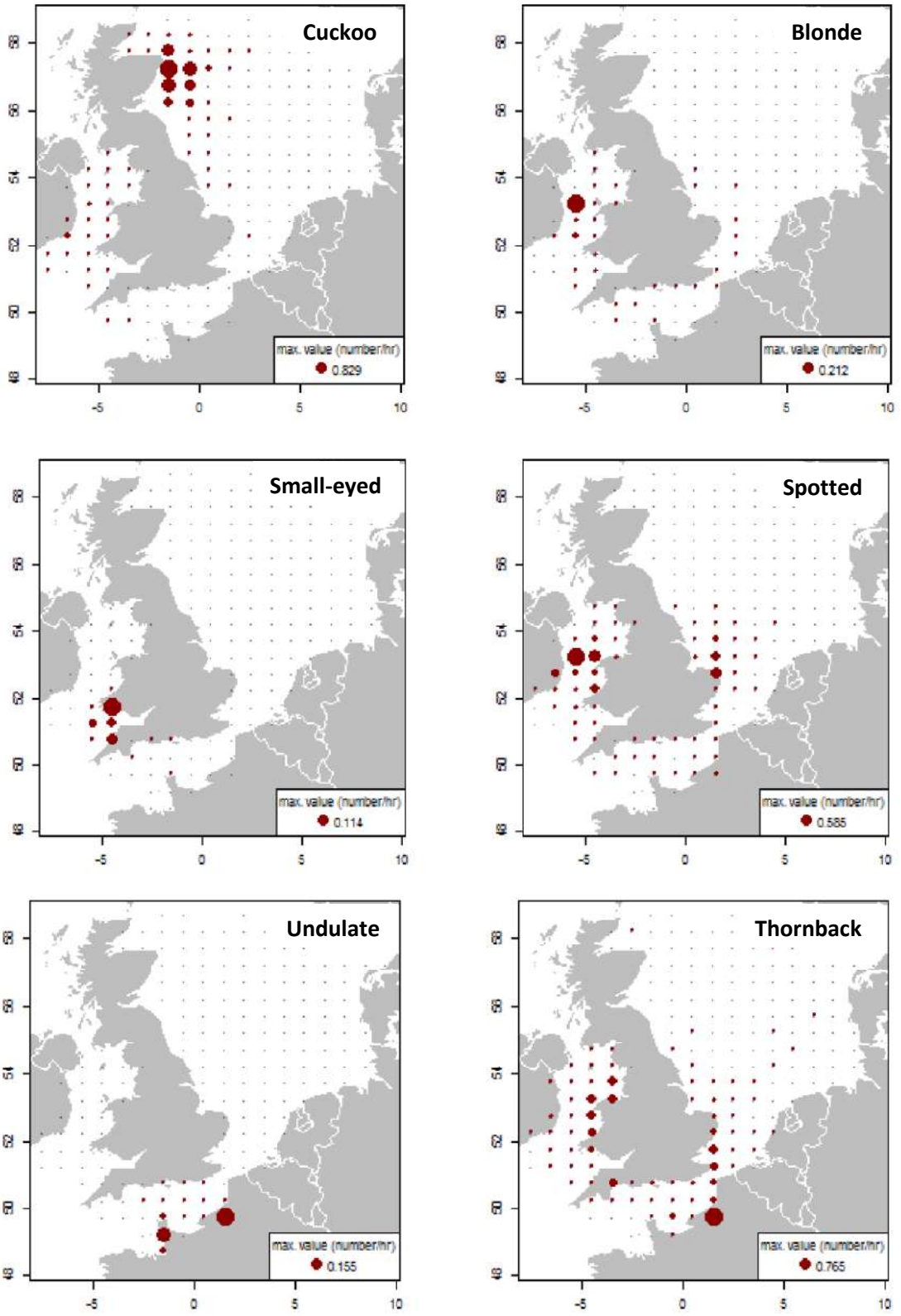


Fig. 3. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and Eastern Channel: Spatial distribution data received on from WGBEAM, derived from all beam trawl surveys (ICES 2017).

Fishing

Overview

The Greater North Sea ecoregion includes the North Sea, English Channel, Skagerrak, and Kattegat and for the most part is a relatively shallow productive sea on the European continental shelf. Commercial fishing in the region is complex with around 6600 vessels from 9 different countries catching over 100 different fish stocks (ICES 2017g). Within this fleet there are a wide range of different sized fishing vessels (5m – 30m+), fishing for different durations (from day boats to boats that regularly undertake 7-10 day trips), supporting a wide range of different business models (from specialising in a small number of fin fish species to targeting a range of fin fish and shell fish) and different sized business (from one person companies to multi-national corporations).

Within the fleet a range of different fishing gears are used (> 25) in different but overlapping areas across the region (Fig. 4). Static gear is used most frequently in the English Channel, the eastern part of the Southern Bight, the Danish banks, and in the waters east of Shetland. Bottom trawls are used throughout the North Sea, with lower use in the shallower southern North Sea where beam trawls are most commonly used. Pelagic gears are used throughout the North Sea but are excluded from this review as they rarely catch skates and rays.

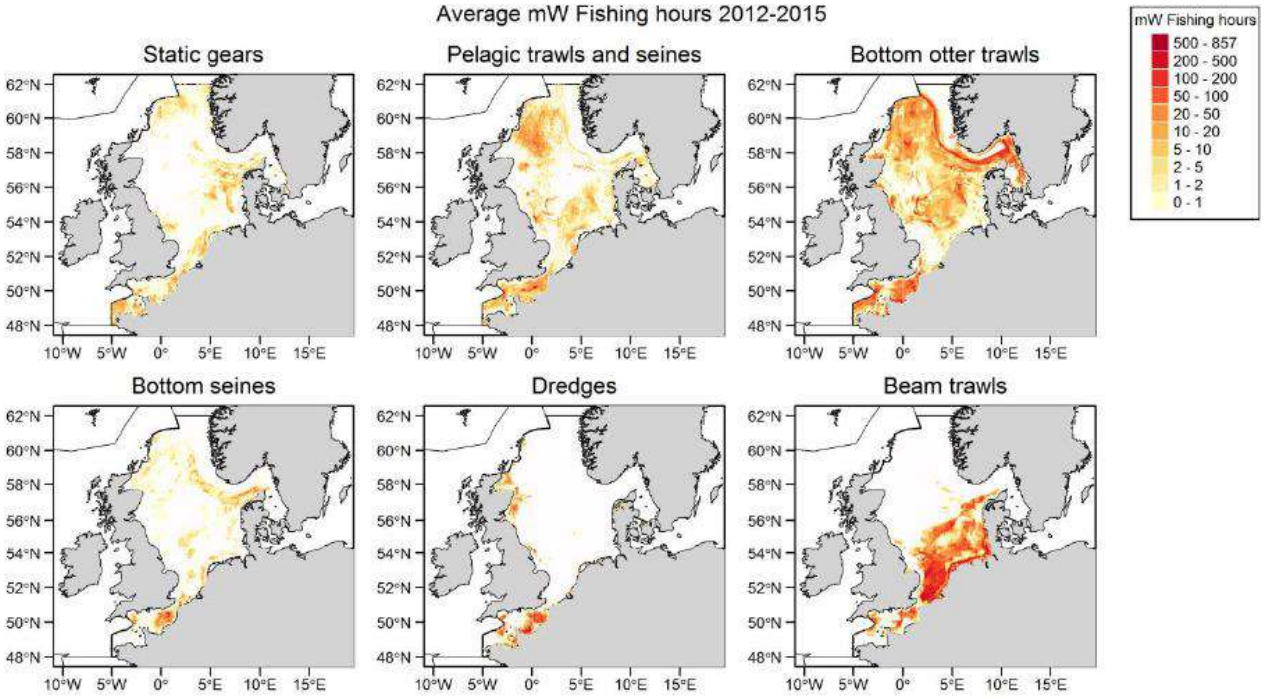


Fig.4 Spatial distribution of annual fishing effort (mW fishing hours) in the Greater North Sea during 2012-2015, by fishing type. Fishing effort data are only shown for vessels >12m having Vessel Monitoring Systems (VMS). From ICES 2017b.

Overview of demersal fleets in the SUMARiS project area (ICES 2017g)

Netherlands

The Dutch fleet in the Greater North Sea consists of about 500 vessels. The main demersal fleet is the beam trawl fleet (275 vessels, of which 85 are >24 m and 190 are < 24 m) that operates in the southern and central North Sea, targeting sole (highest value) and plaice (highest volume) as well as other flatfish species. Many of these beam trawlers now use pulse trawls. Most of the smaller beam trawlers ("Eurocutters") seasonally target shrimp or flatfish.

Belgium

The Belgian fishing fleet is composed of about 75 vessels, primarily beam trawlers both above and below 24 m in length. Few vessels are smaller than 12 m. Most of the catch is demersal species; sole is the dominant species in value, and plaice the dominant species in volume. Other important species include lemon sole, turbot, anglerfish, rays, cod, shrimp, and scallops.

France

The French fleet in the North Sea is composed of more than 600 vessels. The demersal fisheries operate mainly in the eastern English Channel and southern North Sea and catch a variety of finfish and shellfish species. The largest fleet segments are gill- and trammel netters (10–18 m) targeting sole, demersal trawlers (12–24 m) catching a great diversity of fish and cephalopod species, and dredgers catching scallops. Smaller boats operate different gears throughout the year and target different species assemblages. There is also a fleet of six large demersal trawlers (>40 m) that target saithe in the northern North Sea and to the west of Scotland.

UK (England)

The English fleet in the Greater North Sea has more than 1120 vessels. Medium-size demersal trawlers (80 vessels, 18–24 m and 24–40 m) primarily target *Nephrops*, cod, and whiting. The small vessel (< 10 m) fleet (around 1000 active vessels) operates in the eastern English Channel and coastal North Sea and catches a diversity of fish and shellfish species. Medium and large beam trawlers (about 40 vessels) account for the major share of the plaice landings.

Overview of the gears that catch skates and rays

Of the targeted commercial skates and ray fisheries in area 4c and 7d (the SUMARiS project area), gillnets (mainly trammel nets) and longline gear tends to be the most commonly used gear and primarily target thornback rays (STEFC 2017a and STEFC 2017b). Other ray species can also form targeted fisheries (e.g. Blonde rays) however, these fisheries tend to be in specific areas and times when they are locally abundant. Species like small-eyed ray and spotted ray are generally a more minor component of commercial fisheries and are generally caught as bycatch.

Understanding these main target fisheries in the southern North Sea and the east of the Channel is then important in understanding the catch and landing profile of skates and rays (Table 2). ICES landing estimates (Table 3 and Fig. 5) indicate that the large majority of skates and rays are mainly caught as a bycatch in mixed bottom-trawl fisheries for roundfish and flatfish across the SUMARiS project area. The size and shape of skates and rays can mean that they can be difficult to avoid by a trawler especially as once inside the net they have little chance to escape (Kynoch et. al. 2015).

Table 2. A summary of the main gears used in the North Sea and Eastern Channel that can catch skates and rays as a by-catch (STEFC 2017a) .

Gear	Main area of use	Target fisheries
Otter trawls >100 mm		haddock, cod, whiting, anglerfish, megrim, and plaice, with important bycatch of nephrops and some flatfish species
Otter trawls <100 mm	*muddy areas*	nephrops
	North Sea *eastern English Channel*	a mix of fish and shellfish (including cephalopods – cuttlefish Eastern Channel)
Bottom seine >100 mm	*central North Sea* *southern North Sea*	haddock, cod, whiting, anglerfish, megrim, and plaice, with important bycatch of nephrops and some flatfish species
Bottom seine <100 mm		a mix of fish and shellfish (including cephalopods)
Beam and pulse trawl 80 mm	*shallow parts of the southern and central North Sea (southern Bight)* *eastern English Channel*	sole and plaice in terms of value and volume, respectively, with other flatfish (e.g. turbot and brill) valued species
Small beam trawlers 20–25 mm	*southern North Sea and coastal areas*	brown shrimp
Gillnet mesh sizes 90 mm	*southern North Sea*	flatfish (sole) and demersal fishes
Longline	*northern North Sea*	saithe, cod, haddock, ling and tusk
	south-western North Sea	cod, bass
Scallop dredge	*North Sea* *eastern English Channel* *(Sand- gravel ground)*	scallops

Table 3. ICES Landings distribution estimates by fleet and by species for skates and rays within the SUMARiS project area. Estimates are from current ICES advice sheets (2015-17) and are for thornback ray and spotted ray subarea 4 and divisions 3a and 7d; blonde ray divisions 4c and 7d; cuckoo ray subarea 4 and division 3a; small-eyed ray and undulate ray divisions 7d and 7e).

		Thornback	Spotted	Blonde	Cuckoo	Small-eyed	Undulate
Trawls	Beam trawl	72%	47%	67%	-	9%	2%
	Bottom trawl		43%	18%	93%	57%	74%
Nets	Bottom nets	18%	-	-	-	-	-
	Fixed nets	-	-	-	-	26%	-
	Nets	-	-	-	-	-	11%
Lines		-	-	-	-	-	11%
Other gears		10&	9%	15%	7%	9%	2%

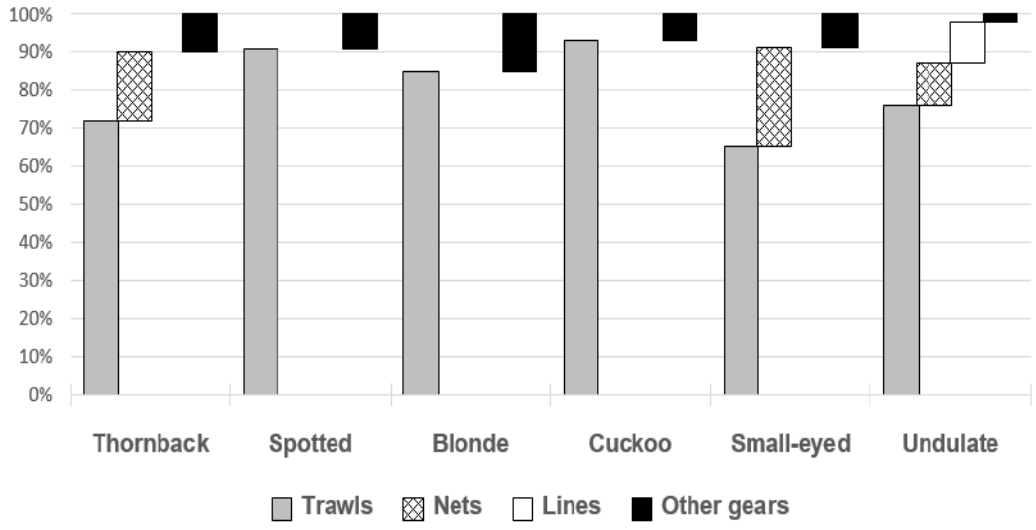


Fig. 5. A summary of the ICES Landings distribution estimates by generic fleet and by species for skates and rays within the SUMARiS project area. Estimates are from current ICES advice sheets (2015-17) and are for thornback ray and spotted ray subarea 4 and divisions 3a and 7d; blonde ray divisions 4c and 7d; cuckoo ray subarea 4 and division 3a; small-eyed ray and undulate ray divisions 7d and 7e).

The fishing fleets of the SUMARiS partners

FROM NORD

FROM Nord is one of sixteen fisheries professional Producers Organisations (PO) in France and represents a fleet of 169 vessels and supports about 960 commercial fishermen (Table 4 and Fig. 6). Its main role is to accurately manage the quota, valorise the fisheries products and represent its members' interests in the national and EU institutions. FROM Nord is an association (national law from 1901), recognised at a national level to manage a part of the French quotas allocated each year. FROM Nord are organised with an "administration council" which represents the vessels within the PO. The general assembly members are elected by the members of the PO, separated in different sections (harbour of reference). Then, in the general assembly, the administration council is elected for three years. The president of the PO is elected among the members of the administration council, for three years also. FROM NORD has ten permanent employees that work on everyday management and specific projects.

Table 4 The breakdown of fishing vessels in the FROM NORD PO.

	No. vessels	Gear used	Size of vessels	Area fished	Species targeted	Estimated employed at sea
artisanal fleet	72	netters, lines, pots	6-15m	*Eastern Channel*	sole / plaice / lobster / crab / seabass (before – for lines only today)	**632**
	9	netters	27m	*Bay of Biscay*	hake / monk	
	73	trawlers	15-30m		whiting, red mullet, squid, mackerel, herring, scallops	
	4	longliners	30m		hake, lingue	
high sea fleet	7	freezer vessels	>50m	*high sea*	cod, blue whiting, horse mackerel, herring, mackerel	**330**
	4	non-freezer vessels	>50m	*high sea*	saithe	

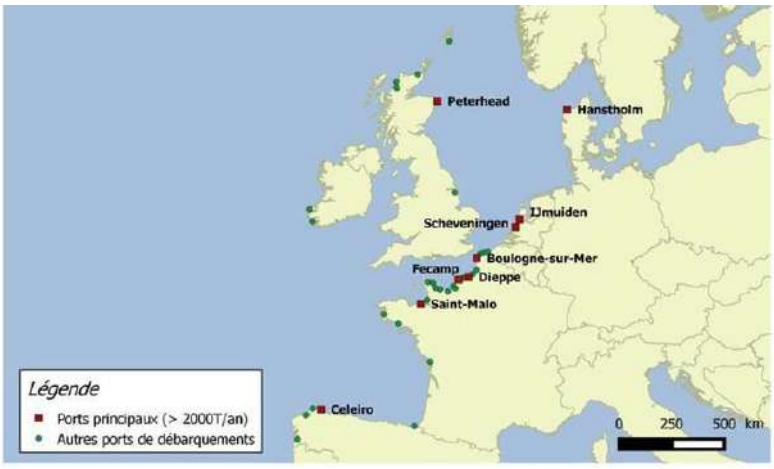


Fig. 6. A chart of the key FROM NORD landing ports

Belgium - Rederscentrale

Rederscentrale represents 420 fishermen and is both the only recognised Belgian fish Producers Organisation (PO) and a recognised Federation of Fishing Vessel Owners. Primarily Rederscentrale acts as a link between the fisheries sector and the different authorities involved in fisheries. As a PO the focus lies on the production and marketing planning related to the members fishing activities. As an Owners Federation the Rederscentrale represents the employers within the sea fisheries related social dialogue.

Through a customised service, the Rederscentrale defends the interests of its members. Every company operating a fishing vessel under Belgian flag from all the ports of registry is a member of the Rederscentrale. Providing information, lobbying, project coordination and providing advice to the members on how to structure their company's administration are important aspects on the activity list of Rederscentrale. Furthermore, through proactive thinking and negotiating Rederscentrale contributes to the policy making on items that may have an impact on fisheries on European, Belgian federal and Flemish regional level.

The Belgian fishing fleet consists of vessels of either ≤ or > 221 kW engine power and is therefore segregated into a small (KVS) and large (GVS) fleet segment, respectively. These two segments are further subdivided according to the type of fishing gear (ILVO, 2016). The Belgian fleet has 67 active vessels. Thirty four vessels are part of the large fleet segment (>221 kW) and 33 vessels are part of the small scale segment (coastal fleet and Eurokotters) (Rederscentrale, 2017).

Both the small and large segments of the Belgian fishing fleet are dominated by beam trawlers (Table 5). The large fleet segment consists of larger vessels in terms of length, tonnage and engine power and generally fish with beam trawls throughout the year (ILVO, 2016). These vessels make multi-day trips and are active on the fishing grounds that are located further away from the Belgian coast (ILVO, 2016). The other vessels in the large fleet segment use bottom otter trawls, or carry out the flyshoot fishery (ILVO, 2016). Each of these fleets has a distinct fishing pattern: for instance, coastal vessels of the small fleet segment spend ≤48 hours at sea fishing targeting demersal fish between March and June (70-99 mm mesh size), off the Belgian coast in the southern North Sea.

Table 5. Division of Belgian vessels according to fishing technique (Rederscentrale, 2017).

Vessel type	No. Vessels
Beam trawl	48
Beam trawl and otter trawl	9
Otter trawl	4
Passive fishing	2
Flyshoot	2
Beam trawl and dredging	2

Key target species

Today, european plaice (*Pleuronectes platessa*) and common sole (*Solea solea*) dominate the landings, namely 8.946 tonnes and 2.481 tonnes, respectively (Departement Landbouw & Visserij, 2017) (Table 6). However, in terms of value, sole is clearly the main target species of the Belgian fleet.

Table 6. The fishing campaigns of the Belgian fleet through-out the year

Period	Area	Target species
April – December	*southern North Sea*	sole and plaice
April – October	*central North Sea and Danish coast*	nephrops
April – May **November – January**	*Celtic Sea and Bristol channel*	sole (transported from the UK)
May – October	*eastern North Sea*	plaice (transported from Denmark)
June – September	*Bay of Biscay*	sole (transported from France)
July – October	*Belgian and Dutch coast*	shrimp
October - March	*English Channel*	sole and plaice (transported from France)

Important ports/ markets

Belgium has four coastal ports (Nieuwpoort, Oostende, Zeebrugge and Blankenberge), although historically the fishing communities of Heist, Blankenberge, De Panne, Oostduinkerke and Koksijde, and the locations along the Scheldt estuary harboured an important number of vessels (Lescrauwaet et al. 2013). Besides the fish auctions located in Oostende, Zeebrugge and Nieuwpoort there are no other dispersed landing points today (Lescrauwaet et al. 2013).

The main foreign harbours for Belgians are Le Havre and La Rochelle in France. Den Helder, Eemshaven, Lauwersoog, and Harlingen in the Netherlands. Milford, Swansea, Newlyn, Plymouth, Shoreham in the UK. Thyboron and Hanstholm in Denmark. In these ports, the Belgian vessels moor and land the fish, after which the catch is transported to Belgium via refrigerated transport.

England - KEIFCA

Kent and Essex Inshore Fisheries and Conservation Authority (KEIFCA) was set up as part of the UK 2009 Marine and Coastal Access Act to manage the exploitation of sea fisheries resources in its district (0-6nm). KEIFCA holds quarterly meetings where Authority members (local councillors and local stakeholders, including fishermen and NGOs) can make fisheries and marine protected area byelaws. Within the district of KEIFCA there is not a significant regional PO (24 POs in the UK) with most of the around 200 vessels in the English non-quota <10m pool. The fishermen within the district can belong to local fishing associations based primarily around harbours, however the associations tend to vary considerably in size and scope with some meeting regularly and inputting to national fisheries policy and marine infra-structure developments (wind farms, inter connector cables, aggregate dredging etc), while others are mustered only when specific issues need to be discussed.

Over 95% of vessels based and working in the KEIFCA district have an engine size below 221kW and are under 10 metres in length (Fig. 7), with 99.5% of the vessels under 14m overall length. Nearly all (>90%) of the vessels working in the district are regarded as ‘day boats’; returning and landing to the same harbour or beach as they began their trip (main ports include, Dungeness, Folkestone,

Ramsgate Whitstable, Leigh-on-sea, West Mersea, and Harwich). The vast majority of fin fish landings within the district are sold on the Boulogne-sur Mer market.

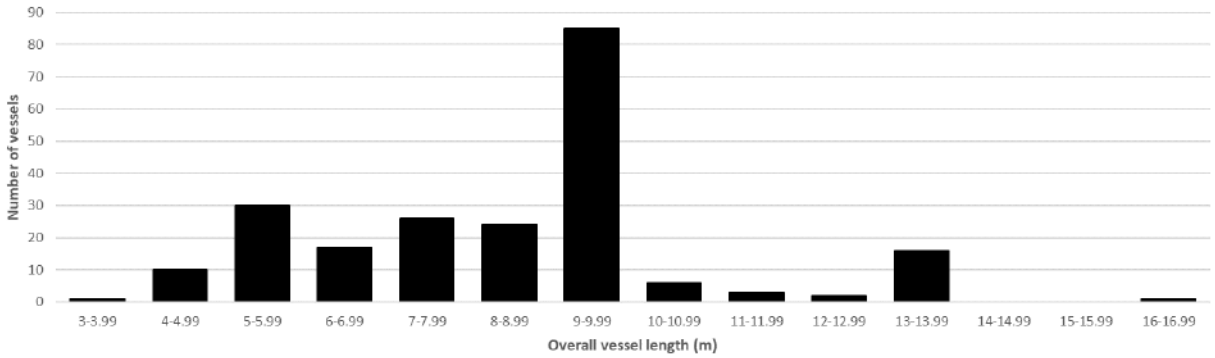


Fig.7. The overall vessel length distribution of licenced fishing vessels in the KEIFCA district. The data has been taken from the published 2018 MMO vessel list and includes vessels based in Rye.

With the usual exception of the Thames cockle fleet (14-30) and some of the Essex oyster boats (5-10) most of the fishing vessels in the district (about 200 boats) target a range of species throughout the year and adopt a very flexible approach as they have a limited range (15-18nm) and generally rely on the shellfish within the district and the finfish that live or migrate into the district. Reflecting this need for flexibility, inshore netting boats can move between targeting finfish and potting (whelks, crabs, lobsters) although some do specialise almost exclusively. The other significant section of the fleet generally uses otter trawls to target finfish but depending on stocks and prices can focus on shellfish stocks like oysters (in the Thames) and scallops (Folkestone and south in to the channel). The main fin fish targeted in the district traditionally are cod in the winter, dover sole in the spring and autumn, thornback rays in the spring and summer and bass from spring to late autumn. Due to the cod not returning to the Thames in serious numbers over the winter, and the introduction of very significant bass management measures the fin fish fleet now rely a lot more heavily on dover sole and thornback ray stocks to remain viable.

Landings Analysis

Using landings data

With the introduction of quota as a management tool there came a divergence between what fishermen caught and what fishermen were allowed to land. Previously, the commercial viability of selling the fish caught tended to determine the quantities of landings (certain fish or sizes of fish were not profitable to land). As fishing capacity has reduced in the mid-1990s and quota management measures became more restrictive (mid 2000s for skates and rays) more tightly regulated landing data is now a reflection of the application of management measures combined with stock populations. Under the new Common Fisheries Policy (CFP 2014) and the landings obligation requirement, landings of over minimum conservation reference size and under minimum conservation reference size should give a clearer picture of actual catches at sea. Given these caveats, landings data can be a useful tool in understanding how the skate and ray fishery works.

Skate and ray landings in context

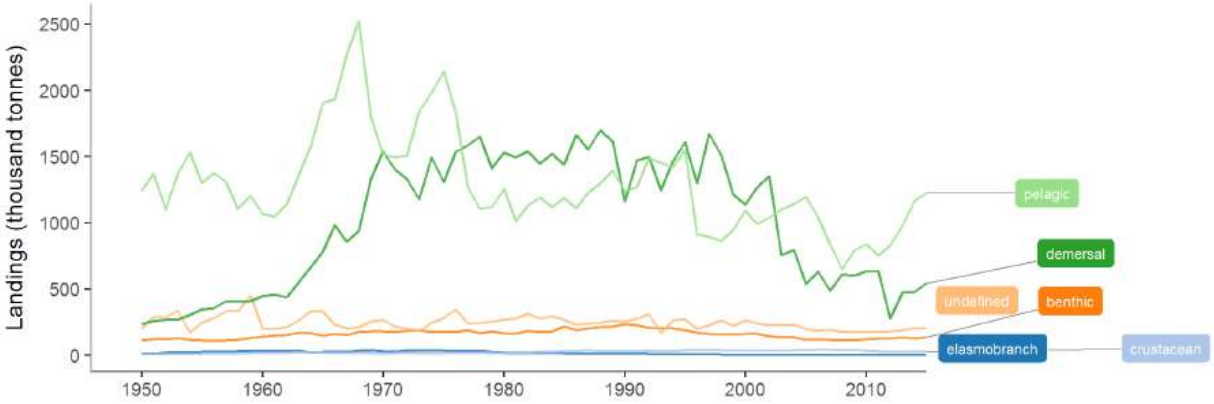


Fig. 8. Landings (thousand tonnes) from the Greater North Sea in 1950-2015, by fish category. Official Nominal catches 2006-2015. Accessed 2017/July. ICES, Copenhagan. From ICES 2017b.

Compared to other fisheries in the North Sea elasmobranchs landings (including sharks, skates and rays) consistently make up a relatively small component of overall landings (Fig. 8) in the North Sea Ecoregion. Comparing the TAC for thornback ray to cod and sole (Table 7) gives an indication of the relative size of the thornback ray fishery compared to two other key commercial species in the southern North Sea and eastern channel.

Table 7. A comparison of ICES TAC tonnages for key finfish species in the SUMARiS project area.

Species	Tonnes	Stock
cod (*Gadus morhua*)	**53 058**	*Subarea 4, Division 7.d, and Subdivision 20*
sole (*Solea solea*)	**15 726**	*Sub area 4*
thornback ray (*Raja clavate*)	**2 110**	*Subarea 4, Divisions 3,a and 7.d*

A long-term perspective - Historic UK landings

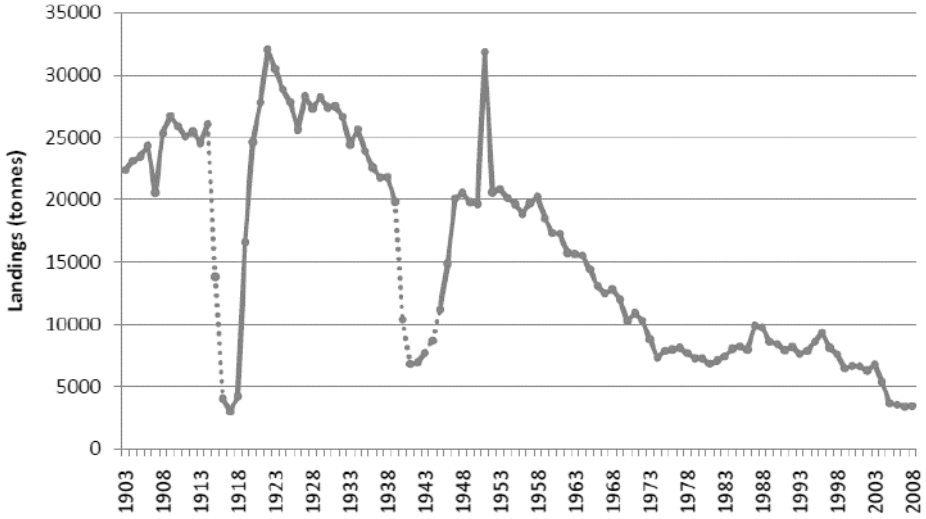


Fig. 9. Landings of skates and rays (Rajidae) in UK fisheries from ICES 2010

Traditionally, in the UK skates were of limited market value, and those that were landed in the early 1800s were generally for use as either pot bait or for fishermen's families (ICES 2010). However, certain markets (the French white skate market), skates were an important commercial catch.

From the late 1880s to the early 1900s, the commercial market began to grow for skates and Day (1880–1884) stated that "*now they are consigned to the London markets*". Historic KEIFCA records from 1903 suggest that rays in the Thames and along the Kent coast were regarded as a minor and relatively unprofitable commercial fishery, however fishermen from Dungeness, Folkestone and Margate got good catches in the summer months (Murie 1903).

The increasing fishing industrialisation and effort during the first part of the 20th century (Fig. 9), resulted in a steady increase in skate landings; in the region of 25–30,000 tonnes per year between 1908 and the mid-1930s (with the exception of the First World War). However, skate landings began to decline in the late 1930s and, after the Second World War, landings had reduced to about 20,000 tonnes per year. Reports from within the Thames in the mid-1950s (Newell 1954) suggested that thornback ray was extremely common in the Thames, was found all along the coast at Whitstable and was abundant in the summer especially off the Essex coast from Harwich to Southend-on-Sea. Since 1958, UK landings have declined steadily and have been <5,000 tonnes per year since 2005.

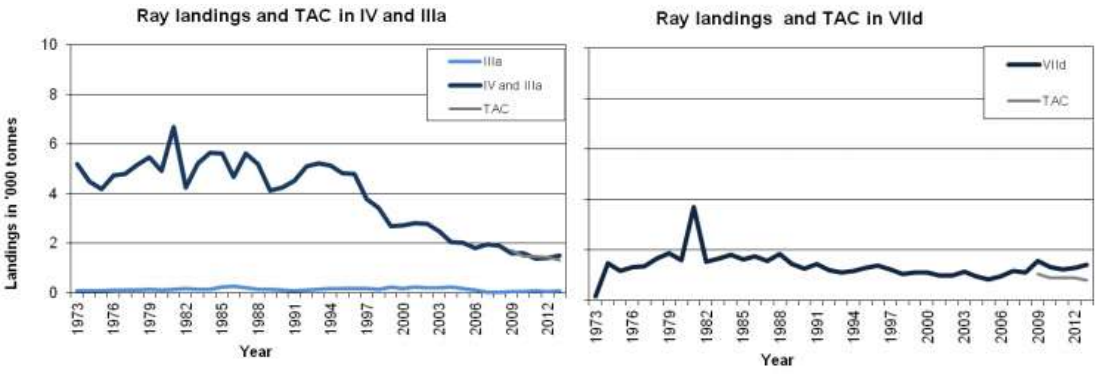


Fig. 10. Demersal elasmobranchs in the North Sea, Skagerrak, Kattegat and the eastern Channel: total international landings of rays and skates in 3a and 4, and in7d since 1973, based on WG estimated. TAC for both areas is added. From ICES 2014

Research shows that landings of skates and rays over the last 40 years (Fig. 10) in the North Sea (ICES subarea 4) have seen a decline from relatively consistent levels of between 4-6,000 tonnes from the 1970s to the early 1990s, to 3,000 tonnes and below after the turn of the millennium. Landings of skates and rays in division 7d have remained relatively consistent over the 40-year study period ranging from 2,000 to 1,000 tonnes. Both charts highlight the introduction of TAC measures in 2008 and the levels of TAC set compared to current and historic landings.

Current Landings

Analysis of ICES landings (Fig. 11) highlights the consistently large percentage of thornback ray that ais landed compared to the other five skates and ray species. Fig. 11 also shows the relatively low landings of small-eyed and undulate rays (stock area 7d and 7e) in the SUMARiS project area and that the estimated landings of spotted, blonde and cuckoo ray have been relatively consistent since 2010.

Breaking down the catches by species and country in the SUMARiS project area indicates that the percentage landed per country (Fig. 12) does not follow a recognisable pattern and varies considerably between species. Belgium, France, the UK and the Netherlands all land varying percentages of thornback, spotted and blonde rays, while cuckoo (UK), small-eyed (France and UK) and undulate (France) rays tend to be predominantly landed by one or two countries.

Fig. 11. A comparison of the total ICES landing estimates 2010-2016 per species in the SUMARiS project area. (= No available data) Estimates are from current ICES advice sheets () and a for thornback ray and spotted ray subarea 4 and divisions 3a and 7d; blonde ray divisions 4c and 7d; cuckoo ray subarea 4 and division 3a; small-eyed ray and undulate ray divisions 7d and 7e).*

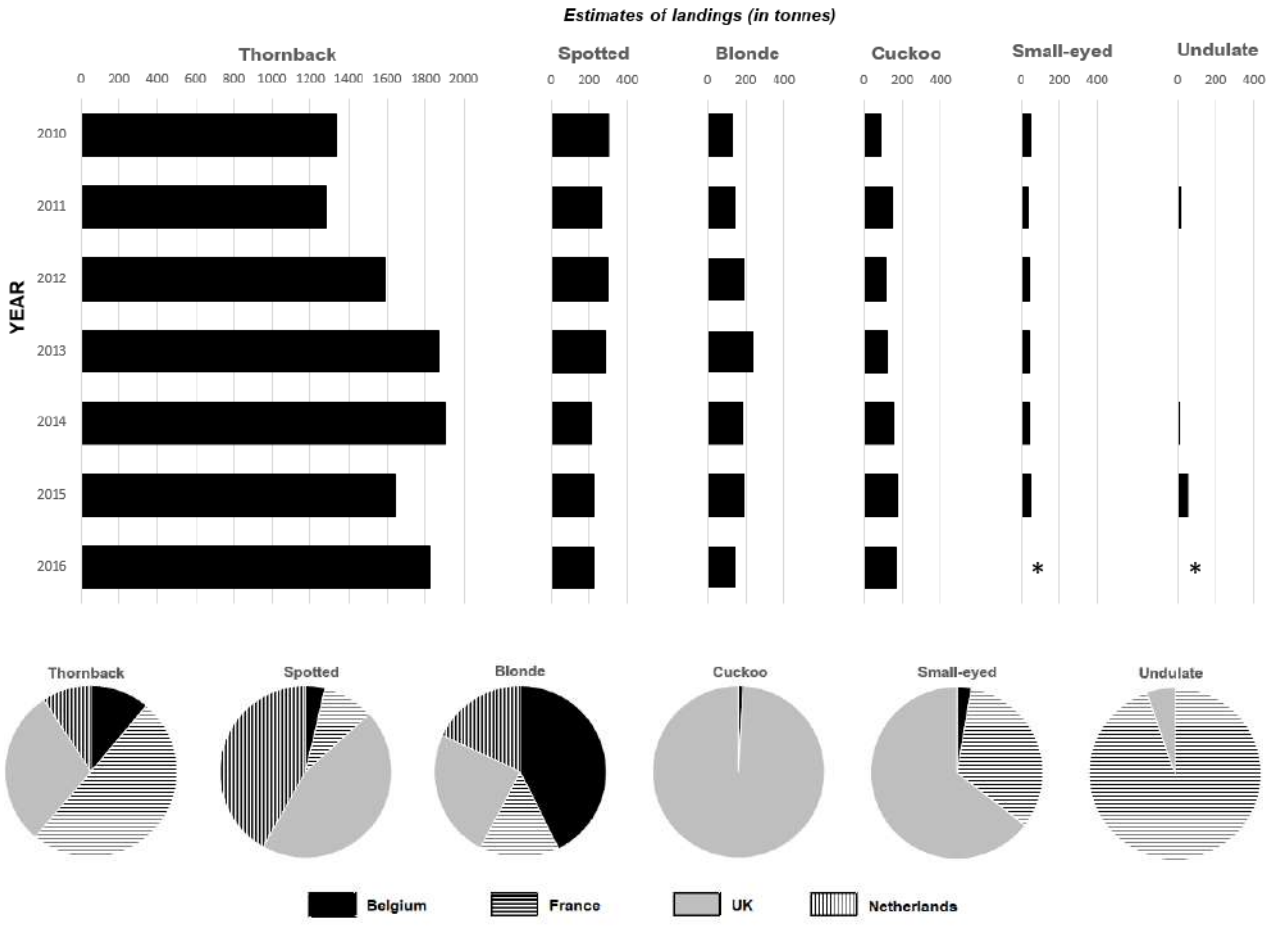


Fig. 12. A species by species breakdown of the mean percentage total ICES estimated landings per country over a 5-year period in the SUMARiS project area. Countries with a mean percentage estimated landings of <1% (Germany, Denmark, Norway and Sweden) were not included. Estimates are from current ICES advice sheets (2015-17) and are for thornback ray and spotted ray subarea 4 and divisions 3a and 7d; blonde ray divisions 4c and 7d; cuckoo ray subarea 4 and division 3a; small-eyed ray and undulate ray divisions 7d and 7e. Landings estimated from 2012-16 were used apart from small-eyed ray and undulate ray where the available data meant that estimated landings from 2011-2015 were used.

Value of landings

The value of skate and rays, like any other product, vary with market conditions (supply and demand) as well as the condition of the fish (prices can vary from vessel to vessel and from gear to gear). Depending on the market skates and rays can be sold whole or winged, with some markets reporting sales in the Fishing News as individual species and others as a combination. Using whole skates and ray prices from the Fishing News over a 2-year period the price varied from 0.58 £/kg to 2.91 £/kg, multiplying these figures by the 2018 TAC for Subarea 4 and 2a, division 7d (including undulate rays) gives a range of between £1.71 million and £8.58 million with a mean price of £3.13 million (Fig. 13).

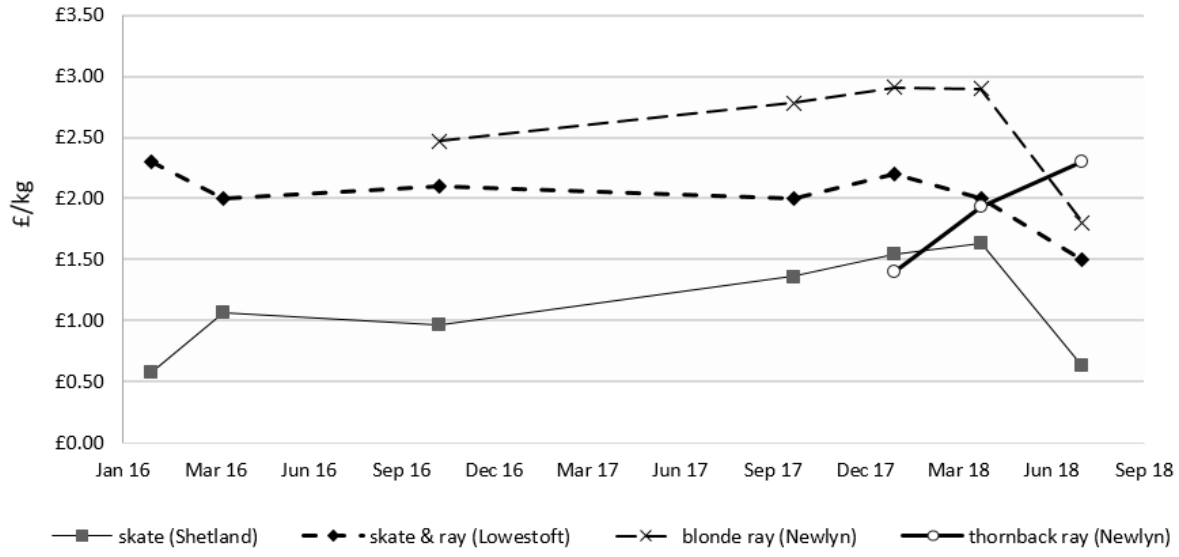


Fig. 13 A comparison of prices for skate & ray landed at UK ports 2016-2018 (prices taken from Fishing News)

Developing and introducing management for skates and rays

Background

The process for developing and updating EU fisheries legislation for the greater North Sea Ecoregion involves a number of different actors; including scientists, national regulators, the fishing industry and NGOs from 9 different countries as well as the European Commission, the European parliament and the council of the EU. The EU management system regulates the large majority of these waters with national governments and regional regulators able to regulate on top of the EU regulations. The process of developing policy and legislation (Fig. 14) is heavily based on scientific advice and data, however the final decisions are taken at a political level.

Fig. 14. The EU process of using fisheries data to inform and develop fisheries policy and legislation

Scientific Advice

ICES

The International Council for the Exploration of the Sea (ICES) is an intergovernmental body founded in 1902 to conduct and coordinate research into the marine ecosystems of the North Atlantic. ICES provides advice to a number of governments and regional fisheries management organisations, including the EU. It publishes popular advice by fish species and by region on its website.

Historically, ICES used to publish generic advice for skates and rays. Increased scientific knowledge of the distribution and range of various species, has allowed for the provision of advice at a more detailed level. Advice is biennial, with new advice published in October 2017. Although ICES is publishing more detailed advice on individual skates and rays stocks, some are still considered data-limited stocks.

STECF and JRC

The Scientific, Technical and Economic Committee for Fisheries (STECF) was set up in 1993 to advise the Commission on fisheries management. It is not a permanent body, but a pool of experts who contribute to its work either on a temporary basis as members, or on a demand basis as experts in working groups. STECF members are appointed by the Commission for their expertise in marine biology and ecology, fisheries science, gear technology, aquaculture and fisheries economics. STECF reports directly to the Commission (Fig. 15).

Skates and rays are caught in both targeted fisheries and as a by-catch in multiple fisheries and are important species for many Member States. As such, there have been previous requests to the STECF to evaluate possible management approaches and changes to TAC calculation (STECF 15-01), as well as on a specific bycatch provision for undulate ray (*Raja undulata*) (STECF 15-03).

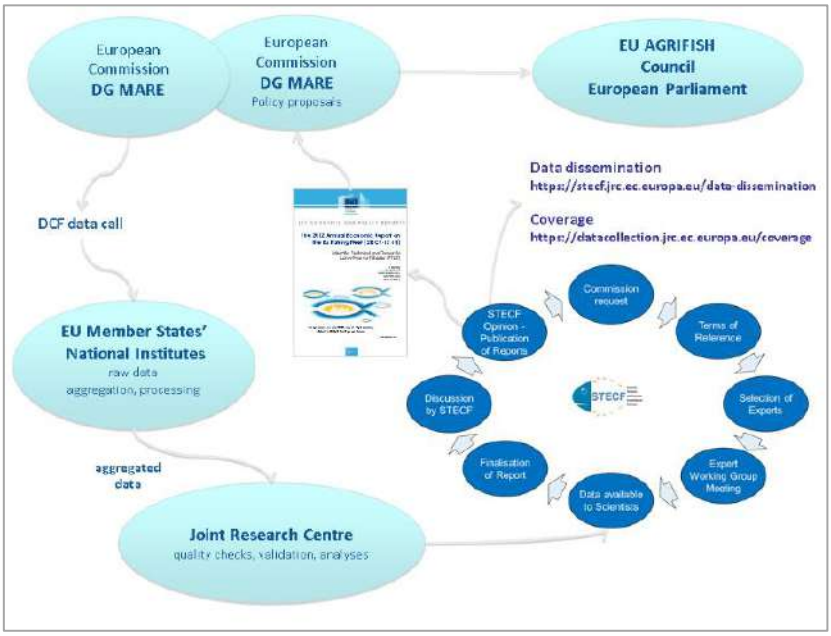


Fig. 15. The role of the Scientific, Technical and Economic Committee for Fisheries in developing advice for the European Commission.

The Commission's Joint Research Centre (JRC) complements the advisory bodies' work by supporting the coordination and management of the Scientific, Technical and Economic Committee for Fisheries and the implementation of the data collection regulations. It also conducts studies on fisheries management issues relevant to the implementation of the Common Fisheries Policy (stock assessment and Management Strategy Evaluation (MSE) to fish habitat and genetics for fish traceability to aquaculture and economic analysis of the fisheries sector).

A new regional process for developing fisheries policy and legislation

As part of the updating and regionalisation of the CFP, member states in a region have been encouraged to work together to develop draft multi-annual plans for joint recommendation and agree detailed technical rules to meet strategic objectives.

One of the main elements of the reform of the 2014 Common Fisheries Policy (CFP) is the gradual introduction of landing obligations for all catches taken from stocks subject to catch limits. To this end, Regulation (EU) no. 1380/2013 (the "Basic Regulation") sets out the timeframes for the relevant fisheries as well as provisions for possible exemptions. At the same time this regulation defines the general framework for regional cooperation on conservation measures.

Member States may cooperate in accordance with Article 18 in drawing up Joint Recommendations (JR) for "discard plans". These are to contain details of the implementation of the landing obligation, and may be adopted on a temporary basis for no more than three years, where no multiannual plan has been adopted for the fishery in question. Upon agreeing a JR the Member States may propose them to the Commission for them to be adopted as a delegated Act. If Member States cannot reach agreement on a JR that is in line with the objectives of the CFP then the Commission is empowered to adopt delegated Acts for discard plans containing only provisions for *de minimis* exemptions.

Member States Regional groups

In 2013 the Fisheries Directors of the North Sea (ICES subareas 4, and divisions 3a (and 2a where relevant) Member States (Belgium, Denmark, France, Germany, the Netherlands, Sweden and the United Kingdom) established the Scheveningen a High Level Group (HLG). An equivalent group has also been set up for the North Western Waters (ICES Areas 5, 6 and 7), the North Western Waters Member State Group (UK, France, Ireland, Spain, Belgium and the Netherlands). Rather than a standing permanent group, the country chairing the group leads and facilitates the group, being the main point of contact. The responsibility of chairing the group rotates around the group on an annual basis.

Advisory councils

Two advisory councils have been created in the North Sea Eco region, the North Sea Advisory Council (NSAC) and the North Western Waters Advisory Council (NWWAC). The advisory councils role is to prepare and provide strategic advice on the management of the fisheries on behalf of stakeholders (fishing industry and civil society) to the European Commission and the Member States in fisheries management, in order to promote the objectives of the Common Fisheries Policy. This is done within the general aim of attaining the sustainable management of fisheries, incorporating an ecosystem based approach and based on the precautionary principle. Advisory councils work with both the regional Member States groups and the European Commission, helping to inform policy and legislation by facilitating meetings and developing advice and options.

The process for developing Joint Recommendations

The Member States groups seek to consult and develop Joint Recommendations that the relevant member states agree with and work within the CFP framework and conditions. In the development of the Joint Recommendations advice from the relevant advisory councils, the guidance produced by the Scientific, Technical and Economic Committee for Fisheries (STECF) as well as views expressed by

the Commission will be included. The final submission of joint recommendations to the Commission will be made after the draft text is agreed by the relevant Member States and their Ministers.

Where agreement of specific proposals or actions by the Group requires specific measures, these measures can be put into legal and/or practical effect through various means:

1. The Commission may be asked to consider proposals with a view to bringing forward legislation under delegated or implementing powers (where appropriate), or with a view to bringing forward a proposal for the ordinary legislative procedure;

2. In the case of joint recommendations under article 18 of the CFP basic regulation, the Commission, or Member States, may be empowered in a Union conservation measure to give the measures legal effect in line with the provisions of the regionalisation process.

3. Member States can agree to implement management measures themselves, in line with their domestic management framework and subject to the provisions of the CFP.

The history of EU level skate and ray management

Although mesh size and species composition regulations for those fisheries targeting skates and rays were introduced in 1998 (EC - No 850/98), skates and rays are primarily managed at a European level under five regional generalised TACs. The TAC for skates and rays was introduced in 1999 and as a precautionary management measure due to the lack of reliable stock data, quota levels progressively reduced and have only started increasing over the last few years. From 2008 onwards, the EC has obliged Member States to provide species-specific landings data for the major North Sea skates and ray species which has helped form the framework for the more specific species based management. In addition to TAC measures a list of prohibited species was also introduced as an EU fisheries regulation.

In 2016 the Commission proposed a change to skates and rays TAC management for 2017, with several new sub-TACs proposed for different species. The proposal used the existing "SRX" quota allocation key, applying the same sharing mechanism to the individual sub TACs. Feedback from stakeholders and Member States raised concerns that such an allocation did not reflect current fishing activity and the overlap between regional fisheries and the distribution of species within the management area, and so would create significant socio-economic impacts on fishermen and not provide any extra protection for sensitive species. Therefore, at the December Fisheries Council, it was agreed by Member States to revert back to the 2016 TACs with a joint declaration from Member States and the Commission to further explore skates and rays quota management.

Future skates and ray management is also going to be significantly impacted by the requirements of the Landing Obligation as skates and rays have been identified as a ‘choke’ species. The landing obligation requirements will apply to skates and rays from the 1 January 2019 and significant work is being undertaken by all the key parties to develop a workable package of new management measures enabling a smooth introduction of this policy.

ICES advice

The current ICES stock-specific advice (ICES 2015a,b; 2016a,b; 2017a,b,c,d,e) divides the skates and ray stock into separate species and provides a specific 3-10 page advice package, with analysis of stock development over time (including landings and stock size indicator, stock and exploitation status, catch options, information from stakeholders and history of advice as well as catch and landings).

A summary of the ICES advice for the (Table 8) species of skates and ray in the North Sea Ecoregion (Table 8) separates into 3 main categories;

Individual species advice that applies a precautionary approach and indicates a landings TAC over a two year period. For this group thornback ray TAC is by far the most significant and is a factor greater than the other five TAC species (thornback ray account for 73–77% of the landings reported to species level in the last three years in this area. (ICES 2017).

Advice for individual species that there should not be a targeted fishery for this stock and measures should be taken to reduce bycatch (2016-19 advice period). This advice applies to the common skate complex (Dipturus batis-complex) and the starry ray (Amblyraja radiata), and highlights a significant drop in relative abundance in starry ray since the early 1990s.

For the 7 species where ICES cannot provide advice on the status of these stocks due to a lack of reliable survey and catch data (ICES advises that collection of species-specific landings data for more species of rays and skates should be introduced to help inform on the status of these stocks).

The advice also reflects that historically there was insufficient information to present species-specific landings prior to 2008 when legal obligations to report the main commercial skates to species level were introduced. A greater proportion of data has been reported to the species level since 2008, but data remains incomplete and fishery-independent trawl surveys provide the longest time-series of species-specific information and cover most of the stock area.

The advice also recognises that although species specific landings data has improved, reliable catch data is still a major challenge and that while discarding is known to occur, it has not been quantified. Available onboard observer data indicates that discarding rates are increasing, due to restrictive quota and increasing stock size (ICES, 2017). Improved estimates of discard rates and discard survival are thus required to better understand and predict the stocks.

Table 8. Summary of ICES advice for skates and rays in the North Sea Ecoregion

	Species specific ICES advice								**Other rays and skates (Rajidae) – data limited no species-specific advice**	
Species	. A precautionary approach and indicates a landings TAC over a two-year period						Should not be a targeted fishery for this stock and measures should be taken to reduce bycatch		● Arctic skate- *Amblyraja hyperborea* ● Norwegian skate- *Dipturus nidarosiensis* ● longnosed skate- *Dipturus oxyrinchus* ● sandy ray- *Leucoraja circularis* ● shagreen ray- *Leucoraja fullonica* ● round skate- *Rajella fyllae* ● sailray- *Rajella lintea*	
	Thornback Ray *Raja clavata*	**Spotted Ray** *Raja montagui*	**Blonde Ray** *Raja brachyura*	**Cuckoo ray** *Leucoraja naevus*	**Small-eyed Ray** *Raja microocellata*	**Undulate ray** *Raja undulata*	**Starry ray** *Amblyraja radiata*	**Common skate** *Dipturus batis-complex*		
Stock	Subarea 4 Divisions 3.a, 7.d	Subarea 4 Divisions 3.a, 7.d	Divisions 4.c, 7.d	Subarea 4 Division 3.a	Divisions 7.d, 7.e	Divisions 7.d, 7.e	Subareas 2, 4 Division 3a	Subarea 4 Division 3a	Subarea 4 Divisions 3.a , 7.d	
estimates of landings **2014**	1905	214.0	181.4	153.5	48.9	2.7	0.3	0.67	317.9	generic reported landings (indeterminate Rajiformes)
2015	1645	225.3	191.1	172.5	56.0	10.1	-	-	241.4	
2016	1825	223.2	147.2	169.7		54.1	-	-	266.6	
Advice for	*2018-2019*	*2018-19*	*2018-19*	*2018-19*	*2017-18*	*2017-18*	*2016-19*	*2016-19*	*2016-19*	
Landings should be no more than (tonnes)	**2574**	**291**	**195**	**116**	**36**	**65**	There should not be a targeted fishery for this stock and measures should be taken to reduce /minimize bycatch.		ICES cannot provide advice on the status of these stocks due to a lack of reliable survey and catch data. ICES advises that collection of species-specific landings data for more species of rays and skates should be introduced to help inform on the status of these stocks.	
Stock over time	The stock has strongly increased in recent years.	The stock size indicator has increased during the last decade and has been above the long-term average since 2011.	The stock abundance has increased in recent years.	The stock size indicator has increased after 2003 and has been above the long-term average in the last two years	Landings (2009-2015) have ranged between 27 and 56 tonnes. There are currently no stock size indicators.	Restrictive management measures over the time period for which there are species-specific landings data means that reported landings are not informative of either stock dynamics or catch. The stock size indicator has increased since 2009.	The stock size indicator has continuously declined since the 1990s.	The available information does not change the previous perception that the common skate (*Dipturus batis*) complex is depleted in the North Sea.	The available survey and abundance data are insufficient to assess these species individually. There is insufficient information to present trends in species-specific landings.	

Current legislation – EU

Table 9. Technical conservation measures (850/98) relating to fishing gears that can target or catch skates and rays.

Division 4c		Area 7d	
Fixed	***Towed***	***Fixed Gear***	***Towed***
850/98 Article 11 - fixed nets have a bycatch of no more than 30%. 850/98 Annex VI - a minimum of 220mm is needed to target skate and rays	850/98 Annex I - a minimum of 80mm is needed to target skate and rays. 2056/2001 - a square mesh panel of 90mm is needed to be placed in the trawl to allow 80mm-99mm trawl to target skate and rays unless 40% of the target is Dover soles.	850/98 Article 11 - fixed nets have a bycatch of no more than 30% 850/98 Annex VI - a minimum of 220mm is needed to target skate and rays	850/98 Annex I - a minimum of 80mm is needed to target skate and rays.

Underpinning the current EU legislation that sets the annual fishing opportunities (COUNCIL REGULATION (EU) 2018/120 of 23 January 2018) are technical measures for the protection of juveniles that create a standard framework of measures across the North Sea ecoregion (Table 9). Whilst the technical conservation measures have stayed relatively constant over the last 30 years the setting of TAC happens annually and comes into force in January each year. Each member state then enforces this legislation through its appropriate enforcement body.

COUNCIL REGULATION (EU) 2018/120 – Extracts concerning skates and ray species from the SUMARiS project area have been included.

10) *For some years, certain TACs for stocks of elasmobranchs (skates, sharks, rays) have been set at zero, with a linked provision establishing an obligation to immediately release accidental catches. The reason for that specific treatment is that the conservation status of those stocks is poor and, because of their high survival rates, discards will not raise fishing mortality rates for them, but are deemed as beneficial for the conservation of those species. As of 1 January 2015, however, catches of those species in pelagic fisheries have to be landed, unless they are covered by any of the derogations from the landing obligation provided for in Article 15 of Regulation (EU) No 1380/2013. Article 15(4)(a) of that Regulation allows such derogations for species in respect of which fishing is prohibited and which are identified as such in a Union legal act adopted in the area of the CFP. Therefore, it is appropriate to prohibit the fishing of those species in the areas concerned.*

17) *In order to guarantee full use of fishing opportunities, it is appropriate to allow for the implementation of a flexible arrangement between some of the TAC areas where the same biological stock is concerned. In addition to existing inter-area flexibilities, it is appropriate, in particular, to introduce a limited inter-area flexibility for ling from ICES subareas 6 to14 to Union waters of subarea 4 and for skates and rays between division 7d and Union waters of division 2a and subarea 4.*

Article 13 - Prohibitions

1) *It shall be prohibited for Union fishing vessels to fish for, to retain on board, to tranship or to land the following species:*

   (a) starry ray (Amblyraja radiata) in Union waters of ICES divisions 2a, 3a and 7d and ICES subarea 4;

(h) common skate (Dipturus batis) complex (Dipturus cf. flossada and Dipturus cf. intermedia) in Union waters of ICES division 2a and ICES subareas 3, 4, 6, 7, 8, 9 and 10;

(q) thornback ray (Raja clavata) in Union waters of ICES division 3a;

(s) undulate ray (Raja undulata) in Union waters of ICES subareas 6 and 10;

2) *When accidentally caught, species referred to in paragraph 1 shall not be harmed. Specimens shall be promptly released.*

ANNEX IA

Species:	Skates and rays *Rajiformes*	**Zone:**	Union waters of 2a and 4 (SRX/2AC4-C)
Belgium	278 (1) (2) (3) (4)		
Denmark	11 (1) (2) (3)		
Germany	14 (1) (2) (3)		
France	44 (1) (2) (3) (4)		
The Netherlands	237 (1) (2) (3) (4)		
United Kingdom	1 070 (1) (2) (3) (4)		
Union	1 654 (1) (3)		
TAC	1 654 (3)		Precautionary TAC

(1) Catches of blonde ray (*Raja brachyura*) in Union waters of 4 (RJH/04-C.), cuckoo ray (*Leucoraja naevus*) (RJN/2AC4-C), thornback ray (*Raja clavata*) (RJC/2AC4-C) and spotted ray (*Raja montagui*) (RJM/2AC4-C) shall be reported separately.

(2) By-catch quota. Those species shall not comprise more than 25 % by live weight of the catch retained on board per fishing trip. This condition applies only to vessels over 15 metres' length overall. This provision shall not apply for catches subject to the landing obligation as set out in Article 15(1) of Regulation (EU) No 1380/2013.

(3) Shall not apply to blonde ray (*Raja brachyura*) in Union waters of 2a and small-eyed ray (*Raja microocellata*) in Union waters of 2a and 4. When accidentally caught, those 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.

(4) Special condition: of which up to 10 % may be fished in Union waters of 7d (SRX/*07D2.), without prejudice to the prohibitions set out in Articles 13 and 45 of this Regulation for the areas specified therein. Catches of blonde ray (*Raja brachyura*) (RJH/*07D2.), cuckoo ray (*Leucoraja naevus*) (RJN/*07D2.), thornback ray (*Raja clavata*) (RJC/*07D2.) and spotted ray (*Raja montagui*) (RJM/*07D2.) shall be reported separately. This special condition shall not apply to small-eyed ray (*Raja microocellata*) and undulate ray (*Raja undulata*).

Species:	Skates and rays *Rajiformes*	Zone:	Union waters of 7d (SRX/07D.)
Belgium	115 (1) (2) (3) (4)		
France	963 (1) (2) (3) (4)		
The Netherlands	6 (1) (2) (3) (4)		
United Kingdom	192 (1) (2) (3) (4)		
Union	1 276 (1) (2) (3) (4)		
TAC	1 276 (4)		Precautionary TAC

(1) 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.) and small-eyed ray (*Raja microocellata*) (RJE/07D.) shall be reported separately.

(2) Special condition: of which up to 5 % may be fished in Union waters of 6a, 6b, 7a-c and 7e-k (SRX/*67AKD). Catches of cuckoo ray (*Leucoraja naevus*) (RJN/*67AKD), thornback ray (*Raja clavata*) (RJC/*67AKD), blonde ray (*Raja brachyura*) (RJH/*67AKD) and spotted ray (*Raja montagui*) (RJM/*67AKD) shall be reported separately. This special condition shall not apply to small-eyed ray (*Raja* microocellata) and to undulate ray (*Raja undulata*).

(3) Special condition: of which up to 10 % may be fished in Union waters of 2a and 4 (SRX/*2AC4C). Catches of blonde ray (*Raja brachyura*) in Union waters of 4 (RJH/*04-C.), cuckoo ray (*Leucoraja naevus*) (RJN/*2AC4C), thornback ray (*Raja clavata*) (RJC/*2AC4C) and spotted ray (*Raja montagui*) (RJM/*2AC4C) shall be reported separately. This special condition shall not apply to small-eyed ray (*Raja microocellata*).

(4) Shall not apply to undulate ray (*Raja 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, by-catch of undulate ray in the area covered by this TAC may only be landed whole or gutted. The catches shall remain under the quotas shown in the table below. The former provisions are without prejudice to the prohibitions set out in Articles 13 and 45 of this Regulation for the areas specified therein. By-catches of undulate ray shall be reported separately under the following code: (RJU/07D.). Within the limits of the abovementioned quotas, no more than the quantities of undulate ray given below may be taken:

Species:	Undulate ray *Raja undulata*	Zone:	Union waters of 7d (RJU/07D.)
Belgium	2		
France	14		
The Netherlands	0		
United Kingdom	3		
Union	19		
TAC	19		Precautionary TAC

Special condition:

of which up to 5 % may be fished in Union waters of 7e and reported under the following code: (RJU/*07E.). This special condition is without prejudice to the prohibitions set out in Articles 13 and 45 of this Regulation for the areas specified therein.

Regional and PO management measures of SUMARiS partners

*"Rays and skates offer a unique opportunity to institute spatial, seasonal, and technical measures that can be used to improve stock status and regulate fishing mortality. This is because they have defined spatially discrete life history stages, and because stock–recruitment relationships are believed to be very strong." (*ICES 2012*)*

As well as EU legisation there are a number of good examples of skate and ray management measures that work in addition to these measures and are used by regional fisheries managers and POs. Although the measures do not apply consistently across the SUMARiS project area and are not necessarily legislative they can be very powerful and effective as they include and engage the fishermen catching the fish which can dramatically increase compliance. Regional and technical management measures might also have a place in the future management of skates and rays as outlined in the:

French PO management measures

French industry has proposed that they use 90% of their quota in the eastern channel to fish thornback ray and 10% for other species and have introduced a daily catch limit for some fisheries and implemented a Minimum Conservation Reference Size (MCRS) of 45cm Total Length (TL) for all species (NWWAC 2017).

In 2017 the French PO FROM NORD enforced a limitation of landings for rays per week, based on the size of the vessel (Table 10).

Table 10. FROM NORD skates and rays landing limitations

Metier	Vessel size	kg/week
Trawlers	≥25 m	250
	20 -25 m	200
	15 - 20 m	150
	< 15 m	100
Netters	all sizes	50

FROM NORD adds a tax for all landings of rays at 1€ / kg. If the vessel respected and kepts within the limitation, the vessel received all his money back. If the vessel exceeded it, the FROM Nord keeps the tax and gave it to potential vessels who weren't allowed to fish their "part of the quota" before closing. In an extreme situation that the regulation wasn't followed at all, then the vessel could be expelled from FROM Nord, based on the decision of the general assembly. FROM NORD have two permanent employees at the fish auction every day, looking at the landings, and both explaining and reinforcing the importance of the regulation.

Belgium PO management measures

Belgium applies a MCRS of 50cm TL for all species and the Producers Organisation (PO) applies a penalty system for rays landed under 1kg, in order to protect young individuals (NWWAC 2017)..

To provide advice on the fishing opportunities (quota), there is an advisory body within the Rederscentrale called the Quota Committee. The Quota Committee consists of shipowners of each fleet segment and fishery type, a representative of the Flemish Government and sometimes a scientist of ILVO. The Quota Committee meets monthly and formulates advice on possible quota measures based on the state of catches, fishing effort and the planned quota exchanges with other member states. The developments in the implementation of the Common Fisheries Policy (CFP) are also taken into account. The regular presence of ILVO during meetings helps to bring up-to-date information on the objectives of the CFP. The Quota Committee aims to keep all fishing areas open during the year despite quota limitations. For the areas and species applicable, a distribution key between the small fleet segment (SFS) and large fleet segment (LFS) is determined of the effective landings during the past three years (Table 11).

Table 11 Quota measures taken in 2017 for rays in the North Sea (IV) and Eastern English Channel (VIId) (Rederscentrale, 2017).

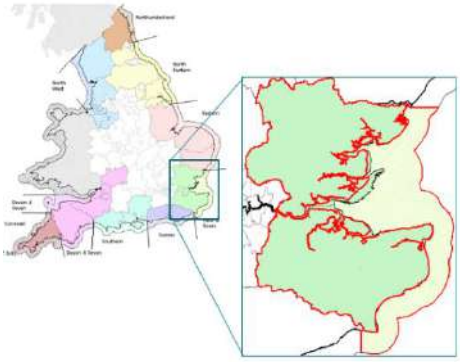
	01/01/2017	**01/05/2017**	**01/11/2017**	**25/11/2017**
Ray IV	SFS: 100 kg/day	SFS: 125 kg/day	SFS: 150 kg/day	SFS: 300 kg/day
	LFS: 200 kg/day	LFS: 250 kg/day	LFS: 300 kg/day	LFS: 600 kg/day
Ray VIId	SFS: 50 kg/day		Closed	
	LFS: 100 kg/day			

Since 2016, the Rederscentrale set up a PO measure specific for ray. Concretely, this means that members of the Rederscentrale (all fishing vessels under the Belgian flag) that land ray < 1 kg are charged by the PO with a tax of 4 euros per kilogram. Since August 2017 this measure also applied to ray from abroad. In 2017, legislation was published to extend the measure to all landings (included foreign landings) in the Belgian ports (Rederscentrale, 2017).

English regional management measures

KEIFCA (formerly Kent and Essex Sea Fisheries Committee), enforce a byelaw that requires a minimum landing size of 40 cm disc width for all skates and rays (Fig. 15). The byelaw applies to recreational as well as commercial fishermen catching skates and rays within the district and is enforced by KEIFCA officers on land and at sea (with the potential penalty of an unlimited fine). A similar byelaw also applies in the districts of southern IFCA and off the coast of Cumbria in the North Western IFCA.

No person shall take from the fishery in any part of the District any of the under mentioned species that measure less than the size prescribed below:-



Skate and rays, 40cm being the measurement taken from the extreme tips of the wings: when winged no wing shall measure less than 19cm in a straight line from the tip of the wing to the centre of the cut edge when detached from the body.

The byelaw was subsequently amended in 2015 to become compliant the Landing Obligation.

"This byelaw does not apply where the landing obligation under Article 15 of Regulation (EU) 1380/2013 requires the fish to be landed.".

	Disk width (cm)	Equivalent Total Length (cm)	Equivalent Total Weight (kg)
Blonde ray	40.0	56.6	1.4
Thornback ray	40.0	59.5	1.4
Small eyed ray	40.0	56.9	1.3
Spotted ray	40.0	60.1	1.4
Shagreen ray	40.0	68.4	1.8
Starry ray	40.0	60.5	1.9
Cuckoo ray	40.0	70.2	2.2

Fig. 15. A conversion of 40cm disk width to length and weight for key skate and ray species (Lancaster and Lang, 2015).

Other skates and ray management measures

Outside the SUMARiS project partners there are some really good examples of very effective skate and ray management measures:

- The North Devon Fishermen's Association have developed a wide range of management measures, including operating a seasonal ray box in the Bristol Channel on a voluntary basis, to protect juvenile ray and spawning stocks.

- Dutch POs (mainly in the North Sea) have introduced a MCRS of 55cm TL for all species and a limit of 125kg by week or by voyage taking longer than a week (NWWAC 2017).

- As part of the first tranche of the English MPA network implementation a there has been a very significant increase in the areas restricting demersal fishing (trawling) in inshore waters. Although the restrictions are primarily aimed at conserving inshore habitats, excluding trawling will also stop the possibility of skates and rays being caught as by-catch from these areas and as (Fig. 16) shows trawling accounts for the highest percentage of landings. In additional further increases in the area of restricted to demersal gear are likely to be a result of Tranche 2 and 3 MPA roll out.

Fig. 16. Byelaws restricting demersal fishing around the UK coast as a result of MPA management. Restricted areas in blue hatching. https://map.mpa-reality-check.org/

SUMARiS Vision

The SUMARiS Interreg project uniquely brings together regional fishermen, scientists and fisheries managers from France, England, Belgium and the Netherlands to discuss and develop future cooperative sustainable management of the shared rays and skates' stocks. Species like Thornback Ray are found throughout the waters of the partner countries and move between the English and continental coasts to spawn and feed throughout their life. The project is developed by and for the regional communities that harvest this stock and aims to build long-term cross-border community links that will underpin future sustainable management; helping both the fish, the fishermen and the environment.

The SUMARiS project aims to

- Improve the underpinning scientific stock data for rays and skate so more informed stock decisions can be made.
- Develop the understanding and the evidence base for rays and skates survivorship.
- Develop a common management strategy
- Incentivise fishermen to develop and adopt best practice
- Protect the data limited or vulnerable species
- Obtain fisheries possibilities that reflect the true state of the stock

By

- Fishermen, scientists and fisheries managers working closely together in new ways to deliver a shared vision.
- Collating over 90 observer days' worth of rays and skates fisheries, covering ICES areas 7d and 4c, with three different gear types to help fill in knowledge gaps
- Conducting at sea and in laboratory survival assessments and using these to help inform future management and best practice
- Identifying best practice in species identification and handling and helping to communicate and train fishermen and the wider industry
- Developing a shared database to help develop better stock data for better advice
- Putting fishermen at the heart of the solution by facilitating meetings to include what fishermen see and know and involving them with every step of the project.
- Partners working together to address the requirements of the Landing Obligation as well as the current method of setting Total Allowable Catch (TAC).
- Engaging in possible shared future opportunities and management solutions, by reviewing in detail the current regional management and exploring the potential of a range of different management solutions, from technical measures to changing how the TAC for rays and skates is structured.

When

- June 2020
- However, the philosophy and structure of the project mean that as the findings and the best practice identified they can quickly be disseminated and translated into action.
- The project also leaves a legacy of a framework of cooperation that can live well beyond the project.

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