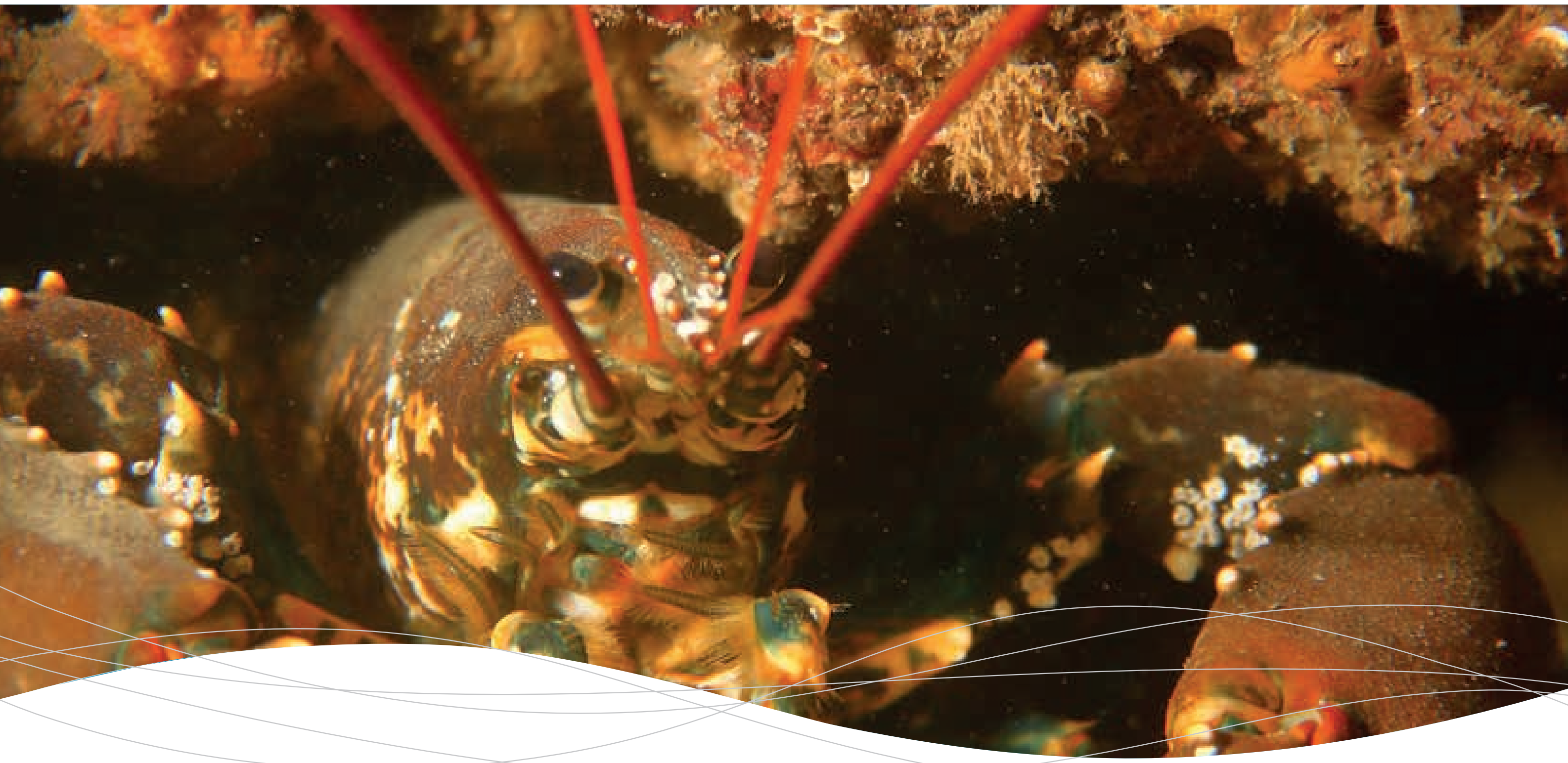
Shellfish Stocks and Fisheries Review 2024



BIM Ireland's Seafood Development Agency

Foras na Mara Marine Institute

Shellfish Stocks and Fisheries

Review 2024

An assessment of selected stocks

The Marine Institute and Bord Iascaigh Mhara

The data that underpins the advice provided in this book is collected under the Data Collection Framework, which is financed by the Irish government and the European Maritime, Fisheries and Aquaculture Fund as part of the EMFAF Operational Programme for 2021-2027.

Arna chomhchistiú ag an Aontas Eorpach

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Photographs on cover by O. Tully (Native oyster – Ostrea edulis), P. Newland (Razor Clam), J. White (Scallop - Pecten maximus) and (Lobster – Homarus gammarus)

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1 Introduction

This review presents information on the status of selected shellfish stocks in Ireland. In addition, data on the fleet and landings of shellfish species (excluding *Nephrops*) are presented. The intention of this annual review is to present stock assessment and management advice for shellfisheries that may be subject to new management proposals or where scientific advice is required in relation to assessing the environmental impact of shellfish fisheries especially in areas designated under European Directives. The review reflects the recent work of the Marine Institute (MI) in the biological assessment of shellfish fisheries and their interaction with the environment.

The information and advice presented here for shellfish is complementary to that presented in the MI Stock Book on demersal and pelagic fisheries. Separate treatment of shellfish is warranted as their biology and distribution, the assessment methods that can be applied to them and the system under which they are managed, all differ substantially to demersal and pelagic stocks.

Shellfish stocks are not generally assessed by The International Council for the Exploration of the Sea (ICES) and although they come under the competency of the Common Fisheries Policy they are generally not regulated by EU TAC and in the main, other than crab and scallop, are distributed inside the national 12 nm fisheries limit. Management of these fisheries is within the competency of the Department of Agriculture, Food and Marine (DAFM).

A co-operative management framework introduced by the Governing Department and BIM in 2005 (Anon 2005), and under which a number of fishery management plans were developed, was, in 2014, replaced by the National and Regional Inshore Fisheries Forums (NIFF, RIFFs). These bodies are consultative forums, the members of which are representative of the inshore fisheries sector and other stakeholder groups. The National forum (NIFF) provides a structure with which each of the regional forums can interact with each other and with the Marine Agencies, DAFM and the Minister.

Management of oyster fisheries is the responsibility of The Department of Environment, Climate and Communications, implemented through Inland Fisheries Ireland (IFI). In many cases, however, management responsibility for oysters is devolved through Fishery Orders or Aquaculture licences to local co-operatives.

The main customers for this review are DAFM, RIFFs, NIFF and other Departments and Authorities listed above.

2 Registered Fishing Fleet

2.1 *Fleet structure*

The Irish fleet is currently divided into 5 segments. Of these five segments (Aquaculture, Specific, Polyvalent, Beam Trawl and refrigerated seawater tanks (RSW) Pelagic) two are broken into sub-segments, namely the Polyvalent and Specific Segments. Aquaculture vessels do not have fishing entitlements. Beam trawl vessels fish mixed demersal fish using beam trawls and RSW vessels are large pelagic vessels which target pelagic species. The Polyvalent Segment is divided into the following four Sub-segments;

(1) Polyvalent [Potting] Sub-segment; vessels of <12 m length overall (LOA) fishing exclusively by means of pots. Such vessels are also <20 Gross Tonnes (GT). Target species are crustaceans and whelk.
(2) Polyvalent [Scallop] Sub-segment; vessels ≥10 m LOA with the required scallop (*Pecten maximus*) fishing history. These vessels also retain fishing entitlements for other species excluding those listed in Determination No. 28/2018 (http://agriculture.gov.ie/fisheries/).
(3) Polyvalent [<18 m LOA] Sub-segment; Vessels with fishing entitlements for a broad range of species other than those fisheries which are authorised or subject to secondary licencing as listed in Determination No. 28/2018
(4) Polyvalent [≥18 m LOA] Sub-segment; Vessels with fishing entitlements for a broad range of species other than those fisheries which are authorised or subject to secondary licencing as listed in Determination No. 28/2018.

The Specific Segment, which entitles vessels to fish for bivalves only, is divided into the following two Sub-segments;

(1) Specific [Scallop] Sub-segment for vessels ≥10 m LOA with the required scallop (*Pecten maximus*) fishing history
(2) Specific [General] Sub-segment for all other Specific vessels irrespective of LOA.

2.2 *Fleet capacity*

The total registered capacity of the Irish fishing fleet, as of December 2024, was 62,165 gross tonnes (GTs) and 1,943 vessels. The polyvalent general segment included 26,163 GTs and 1,363 vessels. The polyvalent potting segment had 307 registered vessels and 647 GTs while the bivalve (specific) segment, including scallop vessels, had 2,240 GTs and 140 vessels. There were 9 beam trawl vessels, 8 scallop vessels over 10 m in the specific segment and 23 RSW pelagic vessels (Table 1).

In 2024 76 % of vessels in the fleet were under 10 m in length. These are typically open or half-decked traditional fishing vessels that fish seasonally in coastal waters. Ninety-four percent of polyvalent potting vessels were less than 10 m in length and all were under 12 m. Approximately 55 % of the specific fleet of 134 vessels were under 10 m.

Table 1. Number of vessels by length category in each segment of the Irish sea fishing fleet in December 2024.

Segment	U10m	10-12m	12-15m	15-18m	O18m	Total
Aquaculture	73	7	1	1	16	98
RSW Pelagic					23	23
Specific [Scallops >=10m LOA]		1			7	8
Beam Trawler					9	9
Polyvalent [Scallops >=10m LOA]		2	1			3
Polyvalent [>=18m LOA]					103	103
Polyvalent [Potting]	290	17				307
Polyvalent [<18m LOA]	1,050	136	60	14		1,260
Specific [General]	72	52	6		2	132
Total	**1,485**	**215**	**68**	**15**	**160**	**1,943**

2.3 *Fleet capacity transfer rules*

The following rules apply to the transfer of capacity within segments;

(1) Polyvalent capacity is privately transferable within its segment. Where an applicant for a polyvalent fishing licence has evidence of holding such capacity (a capacity assignment note) and has an approved fishing vessel then a fishing licence will be issued to such an applicant. Capacity attached to vessels under 18 m cannot be transferred to vessels over 18 m and vice versa.
(2) Excluding the fisheries licenced by secondary authorisation, the polyvalent capacity is not coupled to any given quota or entitlement. The capacity assignment note simply enables the vessel owner to complete the registration of a vessel.
(3) In the case of fisheries fished with a permit or secondary licence, the authorisation to fish such stocks is effectively coupled with the capacity if the capacity is transferred, i.e. this transfer is essentially a transfer of track record in the particular fishery. Such entitlement is, however, also governed by TAC & Quota and any other policies or harvest control rules that might apply to those stocks.
(4) Polyvalent potting capacity is not transferable within its segment other than to first degree relatives of the person to which the capacity was originally assigned. When it is no longer attached to a registered vessel it is negated.
(5) Polyvalent general capacity that is not attached to a registered vessel for a period of more than 2 years expires.

2.4 *Vessels targeting Shellfish*

The shellfish fleet is here defined as vessels under 13m in length, as the vast majority of such vessels depend largely on shellfish. This cut off, however, is not reflective of any licencing or policy condition and many of these vessels also fish for other species. In addition, a number of vessels over 18 m target crab mainly in offshore waters (vivier vessels) and 11 vessels over 10 m in length were registered in scallop specific and polyvalent segments in 2024.

The number of vessels in the shellfish fleet increased significantly in 2006-2007 as a result of the 'Potting Licence Scheme' which regularised many vessels that were operating outside of the registered fleet prior to 2006. The polyvalent potting segment was established at this time. The number of vessels in this segment is declining year on year due to de-registration and movement of vessels into the polyvalent general segment. There were 307 such vessels in 2024 compared to 490 in 2007. The number of vessels in the polyvalent general segment increased year on year between 2006 and 2012 but numbers declined overall from 2012-2024 (Figure 1, Table 2 and Table 3).

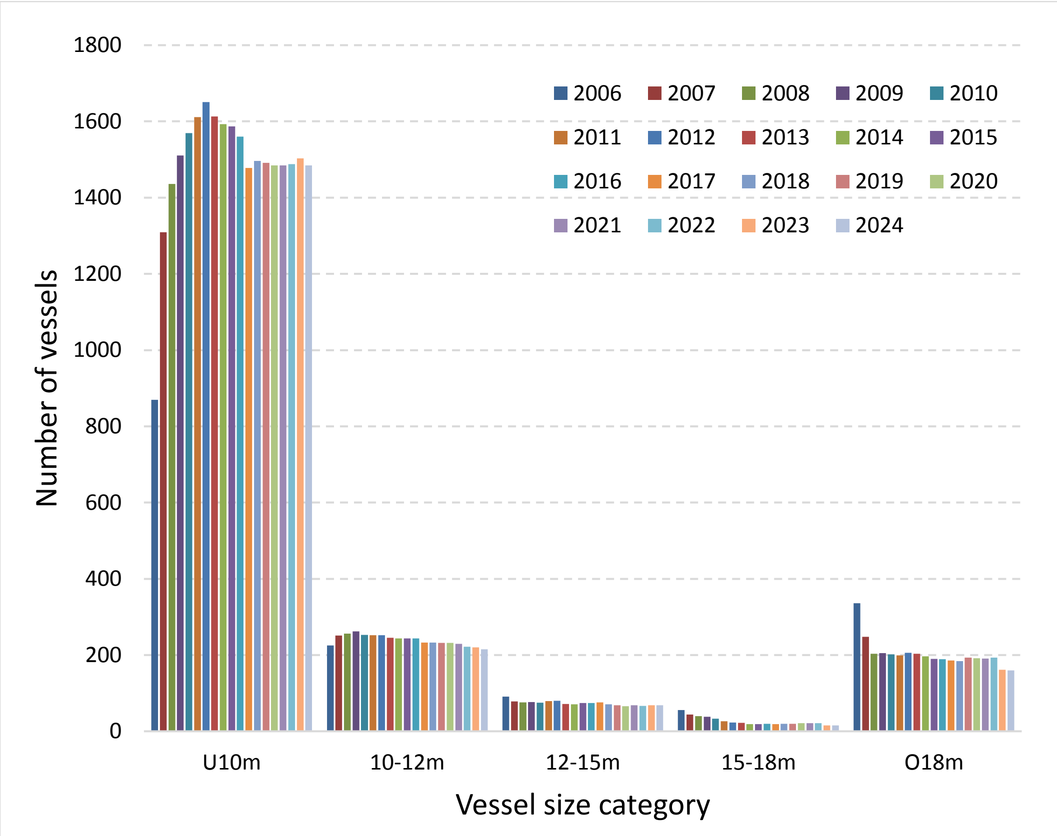

Figure 1. Annual trends in the number of registered sea fishing vessels by length category between 2006-2024.

Table 2. Number of vessels and length of vessels in the Irish shellfish fleet 2006-2024 (<13 m polyvalent, all polyvalent potting, all vessels in specific segment, all aquaculture vessels). Vessels over 18 m fishing for crab and scallop are not included.

Year	Aquaculture	Polyvalent General	Polyvalent Potting	Specific	Total
Number of vessels					
2006	3	953	80	97	1,133
2007	13	999	490	93	1,595
2008	46	1,081	482	115	1,724
2009	60	1,146	474	124	1,804
2010	68	1,198	467	120	1,853
2011	78	1,239	461	118	1,896
2012	85	1,269	460	122	1,936
2013	86	1,233	454	117	1,890
2014	89	1,218	448	112	1,867
2015	89	1,226	426	123	1,864
2016	87	1,218	404	126	1,835
2017	83	1,171	363	125	1,742
2018	84	1,200	337	138	1,759
2019	80	1,204	330	136	1,750
2020	79	1,204	329	127	1,739
2021	80	1,201	330	132	1,743
2022	81	1,203	326	127	1,737
2023	81	1,223	320	128	1,753
2024	81	1,213	307	126	1,729

Table 3. Annual change and percentage change in the numbers of vessels per fleet segment in the under 13 m shellfish fleet between 2006-2024.

Years	Aquaculture	Polyvalent General	Polyvalent Potting	Specific	Total
Change in number of vessels					
2006-2007	10	46	410	-4	462
2007-2008	33	82	-8	22	129
2008-2009	14	65	-8	9	80
2009-2010	8	52	-7	-4	49
2010-2011	10	41	-6	-2	43
2011-2012	7	30	-1	4	40
2012-2013	1	-36	-6	-5	-46
2013-2014	3	-15	-6	-5	-23
2014-2015	0	8	-22	11	-3
2015-2016	-2	-8	-22	3	-29
2016-2017	-4	-47	-41	-1	-93
2017-2018	1	29	-26	13	17
2018-2019	-4	4	-7	-2	-9
2019-2020	-1	0	-1	-9	-11
2020-2021	1	-3	1	5	4
2021-2022	1	2	-4	-5	-6
2022-2023	1	20	-6	1	16
2023-2024	-1	-10	-13	-2	-26
% change in number of vessels					
2006-2007	333	5	513	-4	41
2007-2008	254	8	-2	24	8
2008-2009	30	6	-2	8	5
2009-2010	13	5	-1	-3	3
2010-2011	15	3	-1	-2	2
2011-2012	9	2	0	3	2
2012-2013	1	-3	-1	-4	-2
2013-2014	3	-1	-1	-4	-1
2014-2015	0	1	-5	10	0
2015-2016	-2	-1	-5	2	-2
2016-2017	-5	-4	-10	-1	-5
2017-2018	1	2	-7	10	1
2018-2019	-5	0	-2	-1	-1
2019-2020	-1	0	0	-7	-1
2020-2021	1	0	0	4	0
2021-2022	1.3	0.2	-1.2	-3.8	-0.3
2022-2023	1.2	1.7	-1.8	0.8	0.9
2023-2024	-1.2	-0.8	-4.1	-1.6	-1.5

3 Shellfish Landings 2004-2024

Annual landings of crustaceans and bivalves, excluding *Nephrops* and wild blue mussel (*Mytilus*) seed, which is re-laid for on-growing, landed into Ireland by Irish vessels during the period 2004-2024, varied from a high of 29,000 tonnes in 2004 to a low of 13,790 in 2009. Landings were approximately 19.1 thousand tonnes in 2024 (Table 4). Data in Table 4 has been reviewed, relative to previous annual reports, based on updated logbook and sales note data and also by excluding landings by Irish vessels if they are not landed into Ireland.

A number of species such as lobster, native oyster and shrimp are targeted by vessels under 10 m in length. As these vessels do not report landings capturing these data is difficult due to the large number of vessels and the small daily consignments involved. Prior to 2015 these data were captured by the Sea Fisheries Protection Authority (SFPA) through information gathering from buyers and post 2015 using data collected under the buyers and sellers of first sale fish regulation which obliges buyers to log the purchase of fish at the first point of sale from a fishing vessel.

Landings data for certain species that are subject to management plans (cockle), that are managed locally (oysters), or where SFPA have digitised shellfish registration dockets and consignment data to buyers (cockles, razor clams) provide additional data on landings separate to logbook data or sales notes.

Total value of shellfish (molluscs and crustaceans) landings, excluding periwinkle (no data), mussel seed (fished for re-lay) and *Nephrops*, in 2024 was approximately €63 million.

Table 4. Annual landings (tonnes) and value (€) of crustacean and bivalve shellfish (excl. prawns, mussels and periwinkle) by Irish vessels into Ireland 2004-2024 (source: Logbook declarations, sales notes, co-op data). Unit value (per kilo) from sales note data or other sources.

Year	Edible crab	King Scallop	Lobster	Whelk	Shrimp	Native oyster	Queen scallop	Velvet crab	Surf clam	Spider crab	Crayfish	Razor clams	Shore crab	Cockle	Total tonnage
2004	13,607	2,413	855	2,600	416	543	110	291	28	182	80	401	266	207	23,193
2005	9,840	1,229	644	4,154	153	94	75	253	0	146	31	404	27	107	17,867
2006	9,597	644	611	2,917	312	233	172	270	5	151	34	507	46	7	16,368
2007	7,669	917	297	2,644	324	291	28	138	14	66	16	339	91	643	13,575
2008	7,393	1,217	498	2,097	180	88	4	260	34	148	20	456	72	9	13,254
2009	6,101	2,610	423	2,163	224	327	3	204	26	443	28	229	233	173	13,712
2010	8,382	1,959	470	2,975	134	349	0	342	25	414	30	443	129	5	16,649
2011	6,946	2,612	250	3,174	111	100	0	184	36	303	25	523	74	401	14,682
2012	6,261	2,621	244	3,446	148	100	12	169	16	402	35	465	253	400	14,528
2013	6,339	2,797	367	2,628	172	214	134	366	37	228	34	852	30	374	14,679
2014	7,762	2,597	445	2,180	289	265	80	231	67	137	23	903	50	3	15,358
2015	7,018	2,077	363	5,014	295	153	31	202	49	193	14	1,265	23	0	16,579
2016	9,288	2,237	402	5,822	363	190	201	277	51	161	10	1,127	165	321	20,658
2017	8,763	2,580	415	4,977	281	168	7	313	45	143	10	961	127	442	19,553
2018	7,909	2,301	345	4,638	272	150	4	213	47	119	9	1,041	118	446	17,870
2019	8,218	2,345	488	5,090	430	150	3	253	44	425	30	783	288	595	19,020
2020	6,510	1,940	437	5,302	343		1	240	12	451	15	672	154	1,152	17,126
2021	7,868	2,739	628	5,772	342	250	0	328	0	536	49	759	391	642	17,807
2022	7,383	2,252	612	6,329	300	150	823	305	27	560	73	775	640	0	19,093
2023	7,893	2,470	601	5,021	222	309	3	287	26	423	69	801	658	867	19,650
2024	8,371	2,599	660	4,515	280	220	1	366	24	560	85	856	450	98	19,085
Unit price 2024	€2.20	€3.21	€18.98	€1.79	€16.71	€5.04	€0.92	€2.49	€6.00	€0.42	€35.31	€7.40	€0.61	€1.77	
Value 2024 (million)	€18.42	€8.34	€12.53	€8.08	€4.68	€1.11	€0.00	€0.91	€0.14	€0.24	€3.00	€6.33	€0.27	€0.17	€63.26

4 Legislation and Regulation

The legislation and regulations impinging on the management and operation of shellfish fisheries in Ireland are shown in Table 5. The main legislation relates to the licencing and permitting of fishing vessels, requirements to log the purchase and sale of fish, requirements related to food safety especially for bivalve molluscs, restrictions on where certain fishing gears can be used, management measures as laid out in fishery management plans and technical conservation measures relating to the size and type of fish that can be landed.

The protection of biodiversity within marine protected sites is an important consideration for inshore fisheries generally. Such protection measures are laid out in Fishery Natura Declarations (FNDs). Declarations may include a number of measures set out in Fishery Management Plans or single (usually spatial closure) measures. Measures are developed following appropriate assessment or risk assessment of fishing activities that occur within the protected sites.

Fishery conservation and management measures are legislated for by Statutory Instruments (S.I.) The majority of shellfish species are managed using minimum landing sizes or other restrictions that determine the type of fish (e.g. v-notched lobsters and crayfish, maximum landing size of lobster) that cannot be landed. Statutory Instruments have also been used to legislate for spatial restrictions on where certain fishing gears can operate in order to limit by-catch for instance.

EU measures may also directly manage fishing activity in Irish waters including inshore waters e.g. Effort restrictions on crab and scallop fisheries.

Table 5. Legislation and regulation of fisheries for shellfish fisheries in Ireland. Disclaimer: Whilst every effort has been made to ensure the accuracy of the information presented, MI or BIM assume no responsibility for the accuracy, completeness, or interpretation of the information provided and do not accept any liability whatsoever arising from any errors or omissions.

Species/Fleets	Type of Measure	National legislation	National measure	EU legislation	Geographic area (National limit)
All vessels	Fishing license requirement	Primary Fisheries Licencing (Sea Fisheries and Maritime Jurisdiction Act 2006)		Council Regulation (EC) 2371/2002 (Common Fisheries Policy)	All Irish vessels
All species	To maintain a register of buyers and sellers of fish and to mandate the electronic transmission of data on first point of sale to the competent authority.			Register of Sellers and Buyers 1077/2008/EC 1224/2009/EC	All Irish vessel owners, all buyers.
All mobile bottom gears	Prohibits mobile bottom towed fishing gears	Fisheries Natura Declarations (FNDs)	Specific areas closed to mobile fishing gears		Roaringwater Bay, Hook Head, Saltees Islands, Blacksod Bay, Dundalk Bay, Areas of Irish Sea
Bivalve species	Microbiological classification and control in classified production areas (CPAs). See www.sfpa.ie for further guidance on shellfish safety		Harvesting of bivalves can only be from microbiologically classified areas.	Regulation (EC) No 854/2004	Any area where bivalves are harvested
Shrimp (*Palaemon serratus*)	Closed season	SI 592/2014	Closed March 15th to August 1st		All areas.
Spider crab (*Maja brachydactyla*)	MLS carapace length	S.I. 236/2006	130 mm male		All areas
Lobster (*Homarus gammarus*)	MLS carapace length			87 mm Regulation 2019/1241	All areas
	Maximum size carapace length	S.I. 591/2014	127 mm		All Irish vessels
	V-notched lobsters cannot be landed	S.I. 591/2014			All Irish vessels

Table 5. Legislation and regulation of fisheries for shellfish fisheries in Ireland. (continued)

Species	Type of Measure	National legislation	National measure	EU legislation	Geographic area (National limit)
Brown crab (*Cancer pagurus*)	MLS carapace width	SI 26/2019		140 mm Regulation 2019/1241	Irish waters
	Claw only landing limit			Regulation 2019/1241 Pot fishery: maximum of 1 % by weight of the total catch of edible crab may consist of detached claws. Net fishery: a maximum of 7 kg of detached crab claws may be landed	All areas
	Control of fishing effort (annual kilowatt days)			1415/2004/EC ICES Area V,VI, Vessels over 15 m, 465,000 kw.days	Irish Vessels ICES V and VI
				ICES Area VII, Vessels over 15 m 40,960 kw.days ICES Area VII (Biologically Sensitive Area), Vessels over 10 m, 63,198 kw.days	ICES Area VII Biologically Sensitive Area (Waterford to Donegal Bay)
Crayfish (*Palinurus elephas*)	MLS carapace length	S.I. 232/2006	110 mm	95 mm	All Irish vessels
	Areas closed to fishing with nets for crayfish	S.I. 233/2006			West of Tralee Bay and west of Galway
	Landing of V-notched crayfish prohibited	S.I. 289/2019			All Irish vessels
Native oyster (*Ostrea edulis*)	MLS shell diameter	Bye law no 628/1982	76 mm ring size		Outside of Lough Foyle. 78 mm voluntary agreement Tralee Bay
Surf clam (*Spisula solida*	MLS shell length	S.I. 419/2009	25 mm		All areas
Razor clam (*Ensis spp*)	MLS shell length	FND 3/2014	130 mm shell length		South Irish Sea (Rosslare and Cahore)
	Weekly quota	S.I. 236/2006	2.5 tonnes per week limit		
	Dredge limits	S.I. 431/2017	Max dredge width 122 mm bar spacing not less than 10 mm		

Table 5. Legislation and regulation of fisheries for shellfish fisheries in Ireland. (continued)

Species	Type of Measure	National legislation	National measure	EU legislation	Geographic area (National limit)
Razor clam (*Ensis spp*)	MLS shell length	S.I. 160 of 2018	125 mm		North Irish Sea
	Closure on Sunday	S.I. 207 of 2015			
	TAC		Annual based on scientific advice		
	Weekly quota	S.I. 588 of 2015	600 kg per boat		
	Dundalk Closed area	FND 1/2023			Part of Dundalk Bay closed
	iVMS monitoring	S.I. 206 of 2015	High frequency positional reporting		All Irish razor clam vessels
Cockle (*Cerastoderma edule*)	Fishing permit required	European Union (Birds and Natural Habitats) (Sea-Fisheries) Regulations 2013 (S.I. No. 290 of 2013).	Permit required		Dundalk Bay
	Management plan in place	Fisheries Natura Declaration 1/2024	Biomass limit reference point 1,000 tonnes. Harvest rate 0.33 when biomass > 1,500 tonnes		
	Seasonal closure		Fishery closes by November 1st		
	Tidal restrictions		<0.42 m, one fishing tide per day		
	Daily quota		1,000kgs		
	GPS monitoring		High frequency reporting		
	Dredge width limits		Dredge 0.75-1.0 m		
	TAC		Annually TAC based on June survey		
	Catch rate closure condition		Catch rate <250 kg per day averaged over week		
	MLS shell width		17 mm (22 mm in practice)		
Queen scallop (*Chlamys spp)*	MLS shell length			Regulation 2019/1241; 40 mm	All areas

Table 5. Legislation and regulation of fisheries for shellfish fisheries in Ireland. (continued)

Species	Type of Measure	National legislation	National measure	EU legislation	Geographic area (National limit)
Scallop (*Pecten maximus*)	Fishing permit required	Section 13(15) of the Sea-Fisheries and Maritime Jurisdiction Act 2006 Fisheries Determination 34			Irish vessels over 10 m
	MLS shell length			Regulation 2019/1241; 100 mm	ICES Area VI and VII
				Regulation 2019/1241; 110 mm	ICES Area VIIa (north of 52o30'N), Area VIId
	MLS shell length		120 mm		Kilkieran Bay local agreement
	Control of fishing effort (annual kilowatt days)			1415/2004/EC. Vessels over 15 m, 5,766kw.days ICES Area VII, Vessels over 15m, 525,012kw.days	ICES Area V,VI,
Mussel (*Mytilus edulis*)	Spatial closures	FND 2/2019	Prohibits fishing for seed mussel		Dalkey sound
	Spatial closures	FND 3/2018	Prohibits fishing for seed mussel		Certain Natura 2000 sites (intertidal areas)
	Increased positional reporting	FND 3/2023	Increased GPS reporting frequency by vessels using bottom towed gears in a zone off Wexford		Wexford zone 1
	Spatial closures	FND 3/2023	Prohibits fishing for seed mussel		North Irish Sea and Wexford zone 2
Whelk (*Buccinum undatum*)	MLS shell width	S.I. 237/2006	25 mm shell width	45 mm shell length	All areas

5 Lobster (*Homarus gammarus*)

5.1 *Management*

Lobster stocks are managed using a minimum landing size (MLS) of 87 mm, a maximum landing size (MaxLS) of 127 mm and a prohibition on the landing of v-notched lobsters.

The number of v-notched lobsters released annually was 5,000-11,000 during 2002-2008, 10,000-15,000 during 2010-2013, 25,000-40,000 annually during 2014-2023 and 47,500 in 2024. The MLS, MaxLS, and v-notch conservation measure collectively conserve 25-47 % of the reproductive potential (RP) in the lobster population. This varies regionally and by year. In 2023 34 % of the RP was protected by the conservation measures according to data from the pot fishery.

Nominal stock status indicators, landings per unit effort, discards of undersized lobsters per unit effort, v-notched lobsters per unit effort and discards of oversized lobsters were stable during the period 2013-2023 in most coastal areas.

Conservation measures should be maintained. The MaxLS is a size refuge for lobsters that have previously been v-notched. V-notching should target lobsters over 95 mm to maximise egg production prior to repair of the v-notch and should be directed to coastal areas where the prevalence of v-notched lobsters or lobsters above 127 mm is low. Specific targets should be set for the proportion of the mature female lobster stock to v-notch and achievement of this figure should be monitored through the various sampling programmes.

5.1 *Issues relevant to the assessment of the lobster fishery*

Lobster is the most important species exploited by commercial fishing vessels in Irish inshore waters in terms of number of vessels involved and the high unit value of lobsters.

Lobsters cannot be aged. Size distribution data varies spatially and raising to the size distribution of the landings is difficult due to spatial variability. These data come from observers working on board lobster vessels, mainly between May and October, from the sentinel vessel programme (SVP) and, since 2021 from a Skipper self-sampling programme. There is also some port sampling of landings.

Growth rate data are available for Irish stocks from tag returns and work is ongoing to produce a growth model from these data. Size at maturity has been estimated a number of times; size at 50 % maturity is above the minimum landing size.

Egg per recruit assessments have been used to compare the relative merits of different technical conservation measures; namely size limits and v-notching. Estimating the exploitation status (fishing mortality rate) on the egg per recruit curves is difficult given that this relies on size distribution data and estimates for growth and natural mortality. Reproductive potential of different size components of the stock can be estimated from size distribution, size at maturity and fecundity data. This indicates the relative contribution of different conservation measures to spawning potential and is reported below.

Catch rate indicators are available from the SVP, Skipper self-sampling programme, and the MI observer programme. This coverage is still insufficient to provide precise estimates of catch rates at local level given the variability in these data in time and space.

5.2 *Management units*

Lobsters are probably distributed as regional stocks along the Irish coast. This has been shown by larval dispersal modelling. Juvenile and adult lobsters do not move over large areas and the stock structure is determined mainly by larval dispersal. Genetic and larval dispersal modelling studies are ongoing through a project that will indicate the range of dispersal of progeny from v-notched lobsters released in different areas between Loop Head and Slyne Head.

5.3 *Management measures*

The lobster fishery is managed using technical measures. The minimum landing size is 87 mm carapace length. A maximum size limit of 127 mm was introduced in 2015 following an egg per recruit assessment which showed insufficient protection of spawning potential and to protect v-notched lobsters growing into larger size classes. It is prohibited to land v-notched lobsters. The v-notching of lobsters is voluntary. There is no limit on fishing effort or catch.

5.4 *Contribution of conservation measures to reproductive potential*

5.4.1 Implementation of the v-notched programme

From 2002 to 2008 between 5,000 and 11,000 v-notched lobsters were released annually. This increased to between 10,000 and 15,000 during the period 2010 to 2013. From 2014-2018 releases increased to between 25,000 and 32,000 annually but were lower in 2019 and 2020. Numbers increased from 2020 to record highs of 27.74 tonnes and 40,000 lobsters in 2024 (Figure 2). The average size at release was approximately 0.69 kg in the period 2020-2024.

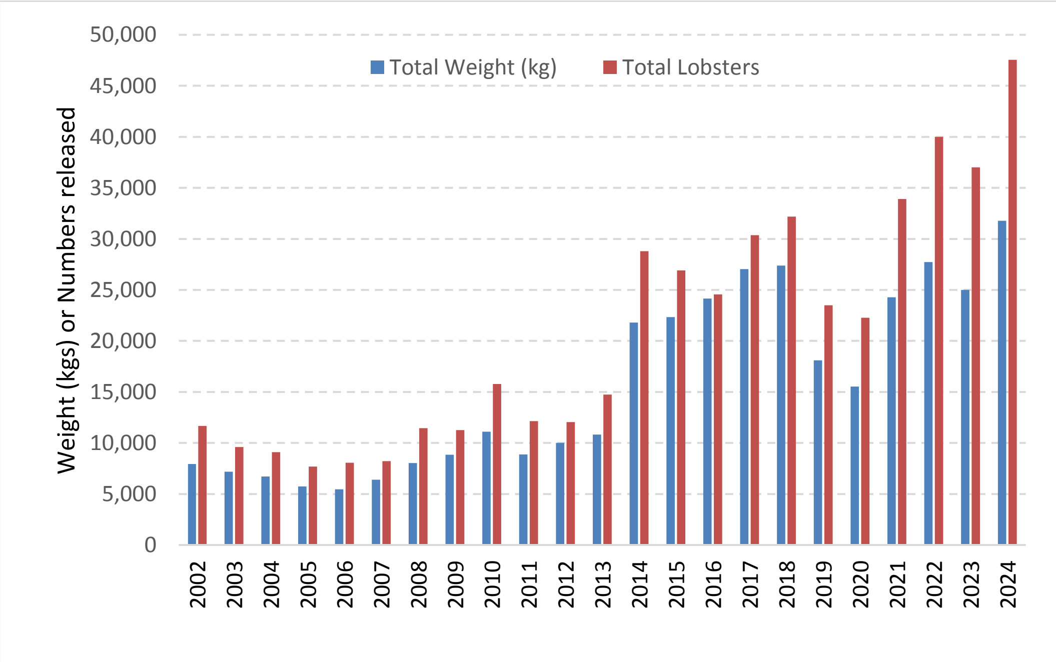

Figure 2. Total number and weight of V-Notched lobsters releases 2002-2024.

5.5 *Reproductive potential (pot data)*

The reproductive potential (RP) of a given size class of lobsters is the product of the number of lobsters in the size class, the probability of maturity, spawning frequency and size related fecundity. It is a measure of the relative contribution of different size classes and v-notched or non-v-notched components of the stock to overall reproduction. An indicator of the implementation and effect of the v-notch programme should be evidenced through changes in RP of the v-notched component of the stock relative to non-v-notched components. Similarly changes in RP of lobsters over the MaxLS may increase over time as lobsters escape fishing mortality and grow above 127 mm.

On average across years, 10-20 % of RP is in lobsters below the minimum landing size of 87 mm (Figure 3, Figure 4, Figure 5). A further 50-75 % is in lobsters between 87-127 mm, which is the size range that is fished. V-notched lobsters generally account for 10-25 % of the RP. In 2023 observer data (from both the MI observer and Skipper self-sampling programmes) showed that lobsters below 87 mm accounted for 11 % of RP, fishable lobsters (not v-notched and between the minimum and maximum landing sizes) accounted for 66 % of RP, v-notched lobsters in that size range accounted for 16 % of RP, and the remainder of reproductive potential was in lobsters over 127 mm (3 % in v-notched lobsters over 127 mm and 4 % in lobsters over 127 mm that are not v-notched). In 2023, the contribution of v-notched lobsters both in the 87-127 mm size range and above the 127 mm maximum size limit is lower than 2022 but relatively high compared with previous years.

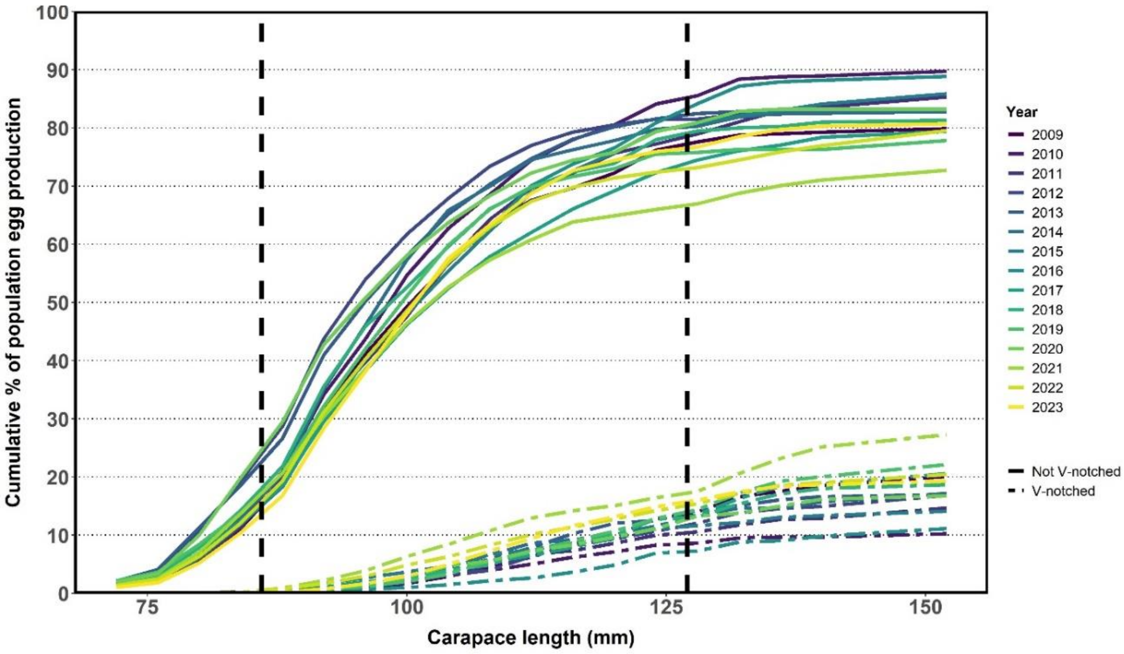

Figure 3. Cumulative distribution of reproductive potential (RP) across size classes of v-notched and non-v-notched lobsters for all regions combined. Source: Marine Institute Observer data (2009-2023) and Skipper self-sampling data (2021-2023).

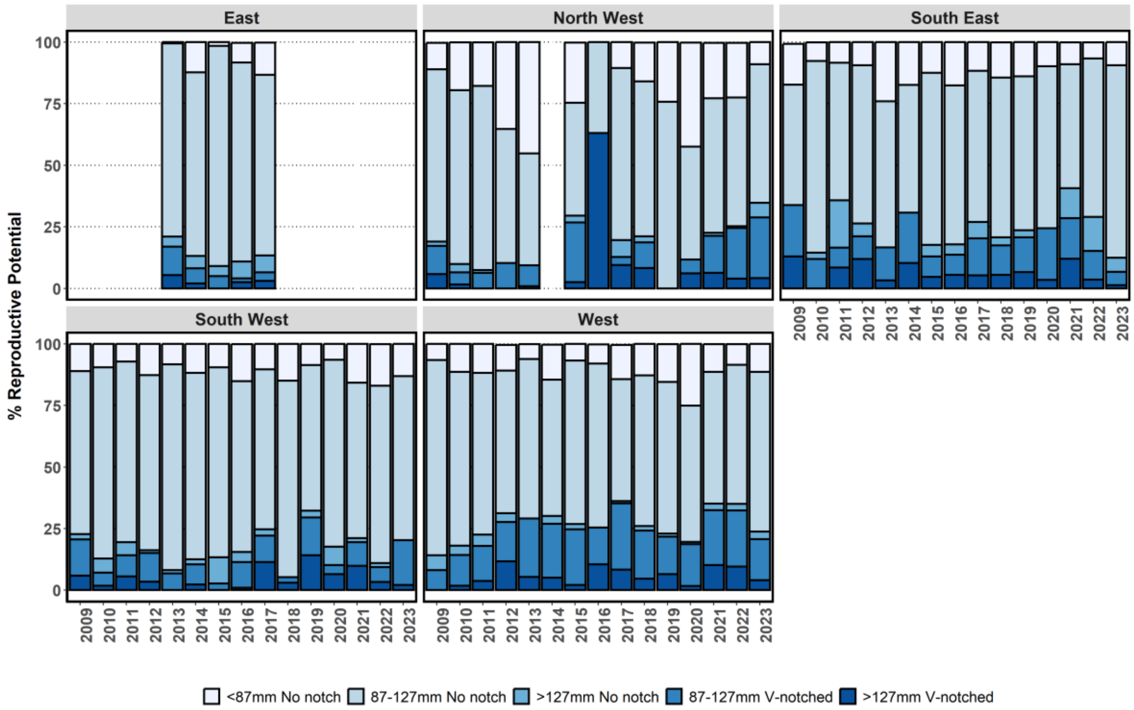

Figure 4. Summary of the distribution of the % reproductive potential in lobster stocks conserved by v-notching, minimum size, and maximum size measures by region. Region/year combinations with only a single sample have been excluded. Source: Marine Institute Observer data (2009-2023) and Skipper self-sampling data (2021-2023).

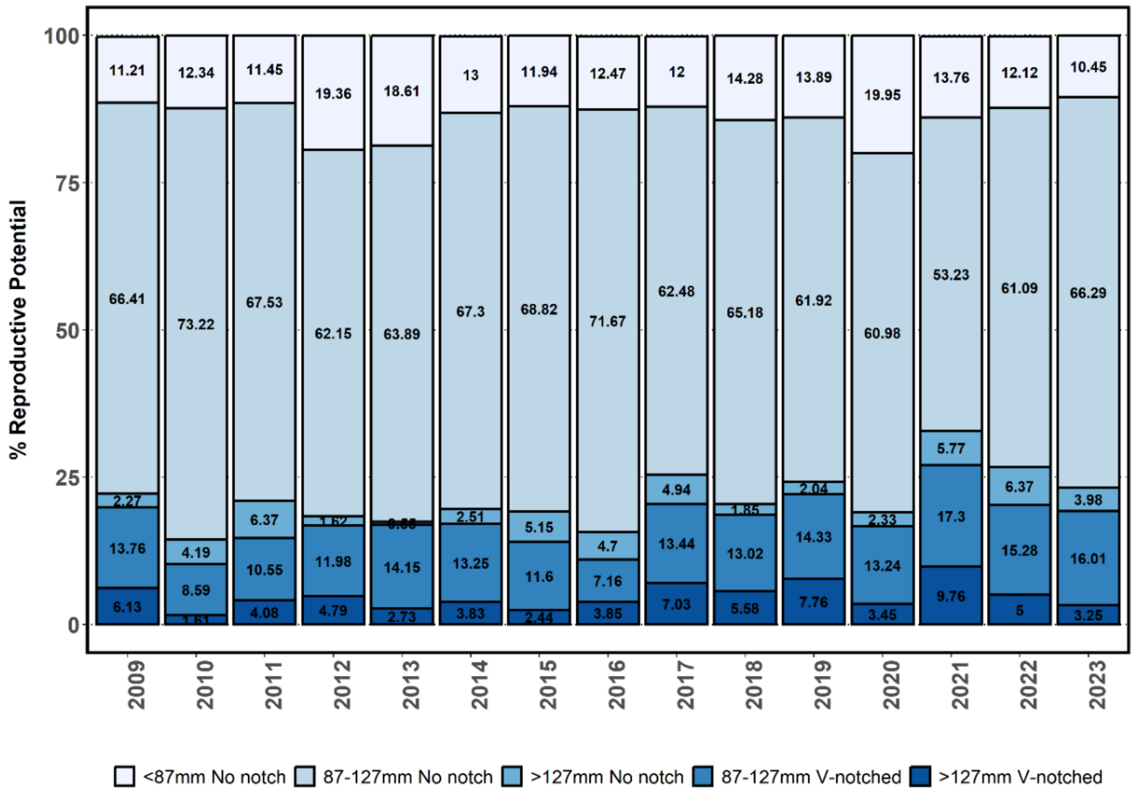

Figure 5. Summary of the distribution of the % reproductive potential in lobster stocks conserved by v-notching, minimum size and maximum size measures for all regions combined. Source: Marine Institute Observer data (2009-2023) and Skipper self-sampling data (2021-2023).

5.6 *Catch rates*

This report includes the SVP data from 2013-2023, the MI observer data from 2014-2023, and the skipper self-sampling data from 2021-2023.

In the SVP, lobsters are generally reported in either numbers or kilograms. Numbers are reported in this analysis. Weights were transformed to numbers based on the mean or modal size of lobsters reported in the observer data. A length-weight relationship from port-processor data was applied ($\mathbf{W}=1.42*10^{-6}\mathbf{L}^{2.84}$) where W is weight and L is carapace length.

The catch rates of legal-sized lobsters (LPUE), undersized discarded lobsters (DPUE), v-notched discarded lobsters (VPUE), and oversized discarded lobsters (OPUE) for combined areas are stable without any clear trends (Figure 6, Figure 7, Figure 8, Figure 9). Skipper self-sampling data are comparable in terms of scale and trends to the SVP and observer datasets, with annual mean per unit effort values within the range of the more established data collection programmes. Observer data generally report higher catch rates, especially for the discarded component of the catch. There is no evidence of increase in abundance of oversized lobsters since legislation was introduced in 2015 to prohibit their landing. The catchability of large lobsters may however be lower than smaller size classes. Seasonally, LPUE generally peaks in quarter 3 and declines in quarter 4. This is probably an effect of reduced catchability related to declining temperatures later in the year.

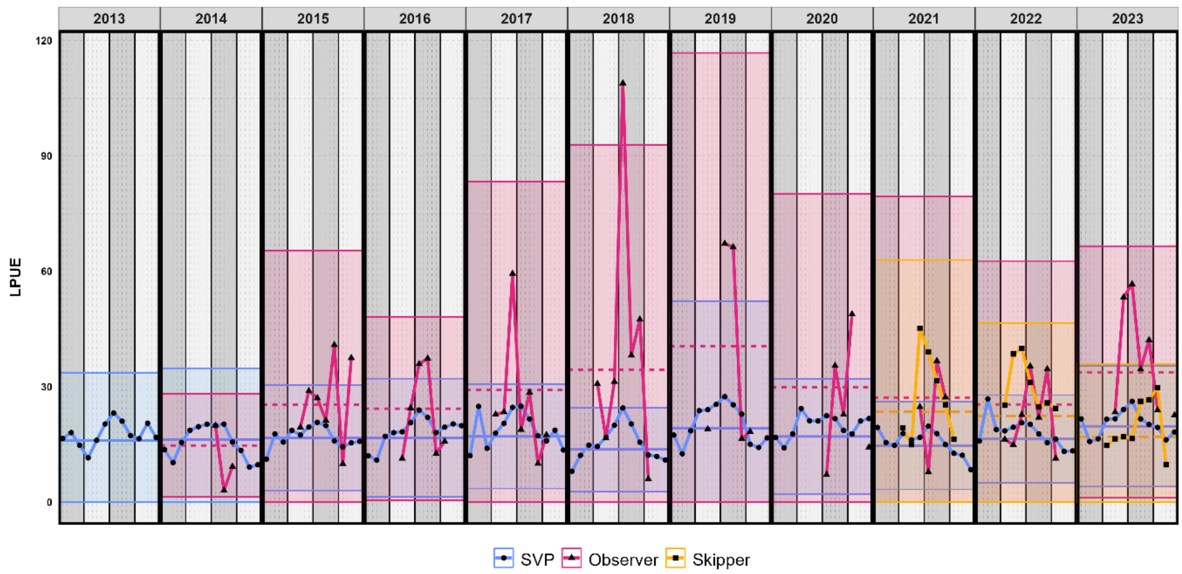

Figure 6. Annual mean landings of lobster per unit effort (LPUE per 100 Pots) for the SVP (2013-2023), MI Observer programme (2014-2023) and Skipper self-sampling programme (2021-2023).

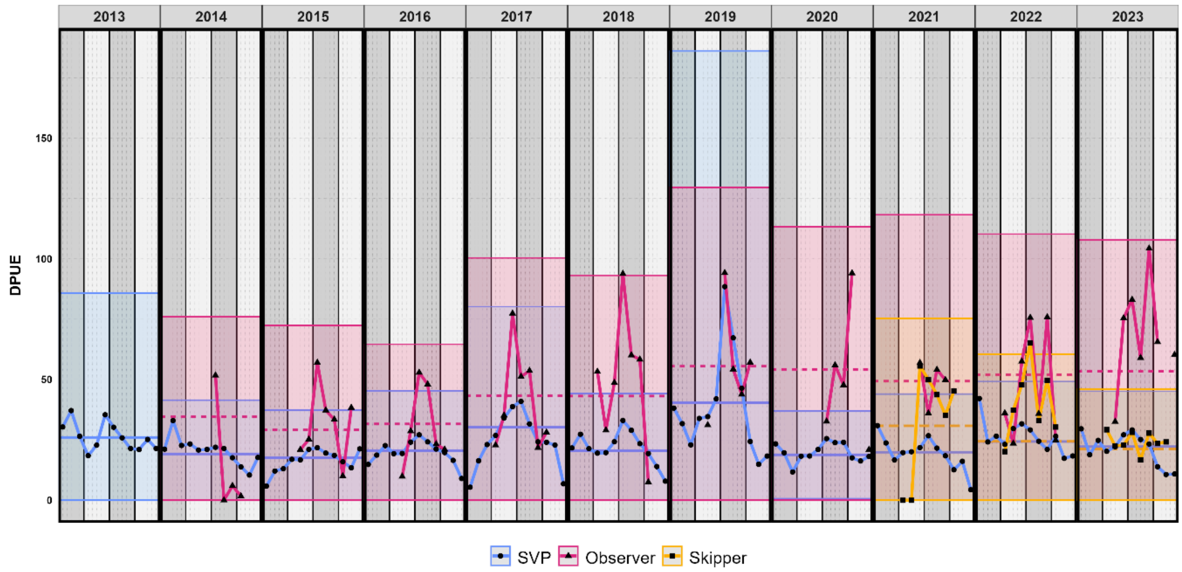

Figure 7. Annual mean undersized discards of lobster per unit effort (DPUE per 100 Pots) for the SVP (2013-2023) and MI Observer programme (2014-2023) and Skipper self-sampling programme (2021-2023).

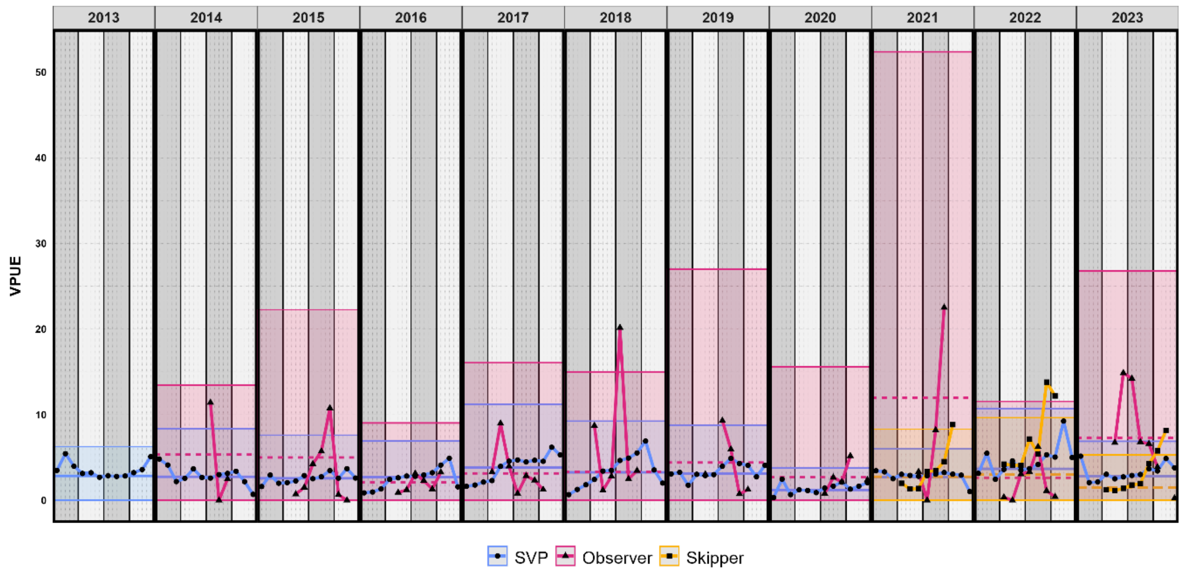

Figure 8. Annual mean v-notched lobster per unit effort (VPUE per 100 Pots) for the SVP (2013-2023) and MI Observer programme (2014-2023) and Skipper self-sampling programme (2021-2023).

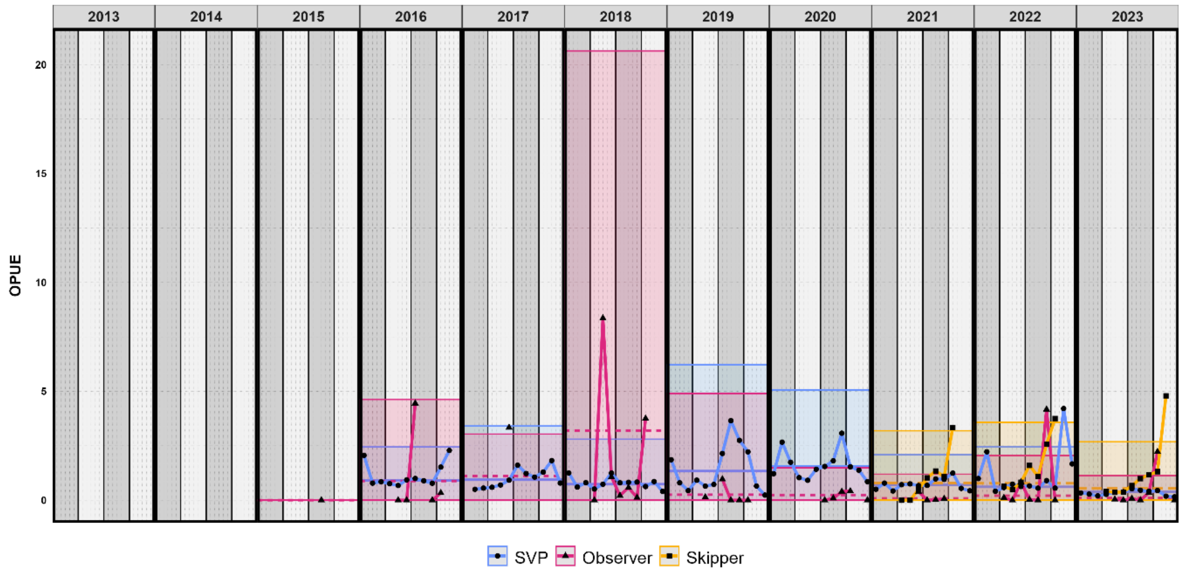

Figure 9. Annual mean oversized (>127mm) lobster per unit effort (OPUE per 100 Pots) for the SVP (2016-2023) and MI Observer programme (2015-2023) and Skipper self-sampling programme (2021-2023).

5.7 *Size composition*

5.7.1 Pots

The annual size composition data of discarded and landed lobsters in pots used to target lobster is stable (Figure 10). The number of lobsters measured in the observer programme has declined in recent years but this has been augmented by a Skipper sampling programme since 2021.

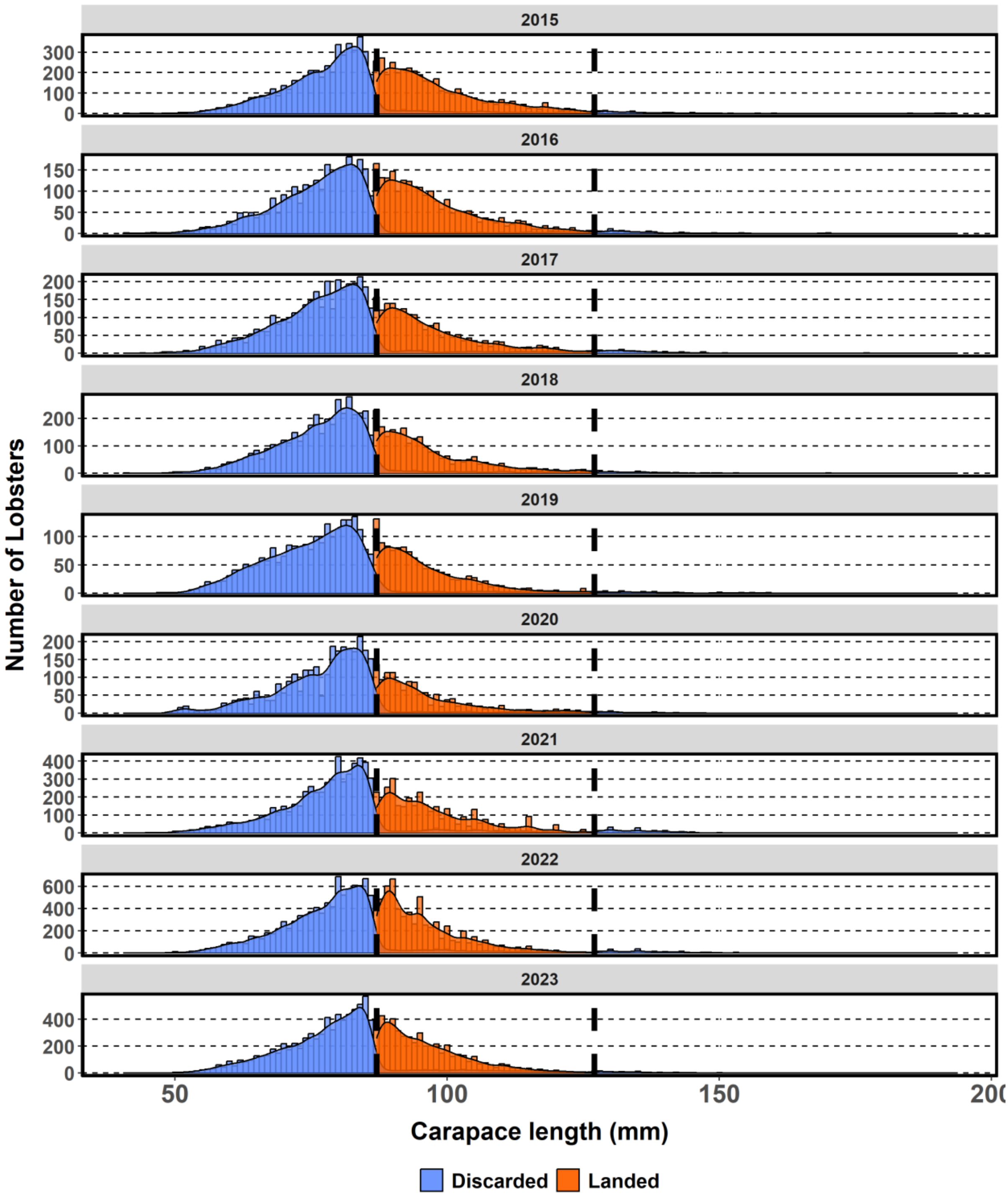

Figure 10. Annual size distributions of discarded (<87 mm, >127 mm) and landed lobsters across all regions. Marine Institute observer data (2015-2023) and Skipper self-sampling data (2021-2023).

6 Crayfish (*Palinurus elephas*)

6.1 *Management advice*

Crayfish are fished with large mesh tangle nets. The fishery is managed using a minimum landing size (MLS) of 110 mm. There are two areas, one off west Galway and a second in Tralee Bay, closed to tangle netting. V-notched crayfish cannot be landed. This measure was introduced to protect tagged crayfish and currently has limited conservation value as there is no v-notching scheme as such. Tagging data suggest a high level of residency of commercial sized crayfish on reef habitat in coastal waters.

Catches of crayfish vary seasonally and are usually between 10-20 fish per nautical mile (nm) of net hauled. In Kerry annual average catch rates increased from ~9 to 18 fish per nm of net between 2017 and 2021, declined slightly in 2022-2023 and increased in 2024 to 24 crayfish per nm of net. National landings increased from about 10 tonnes during 2016-2018 to 83 tonnes in 2024. The number of vessels landing more than 100 kg of crayfish per annum peaked at 108 vessels in 2024. The fishery is primarily off the coasts of Cork and Kerry but also on the south east coast and off Galway and Mayo. Fishing effort is increasing significantly due to recent increases in catch rates, continued high price and declining performance of other fisheries such as brown crab.

Crayfish prices at first point of sale range from €35-50 per kg. About 50 % of the catch is under the MLS but this varies by year. Mortality of crayfish caught in nets can reach 50 % at certain times of year but is usually less than 10 %.

Spider crab, crayfish, brown crab and lobster are the most common commercial species in the tangle net catch. A number of endangered and protected species are caught as by-catch in the tangle net fishery. The fishery off the south west coast in particular overlaps with an area of high diversity of elasmobranch fish (skates and rays) and is close to grey seal haul outs and areas designated for harbour porpoise. Twelve species of elasmobranch fish occur in the by-catch. Of these, white skate, angel shark, and flapper skate are critically endangered. There is a high by-catch of grey seal, relative to the size of the seal population, at the Blasket Islands. Dolphin by-catch is rare.

Critically endangered species cannot sustain by-catch mortality caused by the tangle net fishery. Measures should be introduced to eliminate the by-catch of critically endangered species and to significantly reduce the by-catch of protected species. Alternative fishing practices to reduce by-catch and mortality of crayfish in the catch need to be considered.

6.2 *Issues relevant to the assessment of the crayfish fishery*

Crayfish have, since the mid-1970s, been fished primarily with large mesh (25 cm) entangling nets. Prior to this top entrance pots were the main gear used in the fishery. Fisheries data, other than landings, have not been routinely collected. Data on catch per unit effort could provide indices of biomass but these data and size distribution data are sparse, of variable quality and were not collected systematically prior to 2017. Sampling effects and crayfish movement in and out of sampling areas probably confound these data and their use in estimating fishing mortality rates.

New data on species catch composition in the tangle net fishery, catch rates and size distributions have been obtained recently (2017-2024) off the south west coast and is ongoing. Tag recovery data suggest that mark-recapture methods may be used to estimate the stock size.

6.3 *Management units*

The life cycle of crayfish suggests that there is a single stock in north west Europe where high levels of connectivity may be maintained by larval dispersal. The larvae phase lasts for between 6-9 months and larvae produced off the Irish coast may disperse into oceanic waters to the west of Ireland. Larval behaviour and their possible association with small species of jellyfish may reduce the dispersal scale. The dynamics of larval supply back to coastal reef habitats have not been established and it is also possible that there is a link between larval production and recruitment at smaller spatial scales.

Although crayfish tagged off Brittany have recently been recorded off the west of Ireland, crayfish tagged off the south west coast of Ireland have also been recaptured locally and repeatedly in different years and there are no reported captures over wider areas. Acoustic tagging data for crayfish in the Mediterranean and Cornwall indicate limited movement of adult crayfish and homing to release location. The fishery closest that on the south and west coast of Ireland is at the Scilly Isles and Brittany. Until connectivity relevant to management across these areas is demonstrated, Irish stocks should be managed separately.

6.4 *Management measures*

The minimum landing size in Ireland is 110 mm (compared to 95 mm in EU regulations). France and the UK also use 110 mm. Netting is prohibited in Tralee Bay and in an area off west Galway. It is prohibited to land v-notched crayfish. This measure currently has little conservation effect given that there is no directed v-notching scheme for crayfish. The measure was introduced to protect crayfish that are tagged and enabled multiple mark recapture data to be collected.

6.5 *Landings, effort and catch rates of crayfish*

Reported landings of crayfish increased significantly from lows of 10-30 tonnes in 2014-2020 to 50 tonnes in 2021 and 70-83 tonnes in the period 2022-2024 (Figure 11). The number of vessels targeting crayfish and landings increased in the period 2021-2024 (Figure 12, Figure 13). Targeting is here defined as landing more than 100 kgs per year and likely, therefore, to be using tangle nets. Small quantities may be caught in pots but any significant landings by vessel probably signals use of tangle nets.

Targeted effort increased off Kerry and Cork in particular and also off Mayo and Galway. Targeted fishing effort also re-appeared in Wexford and Waterford from 2020. Historically there were significant landings of crayfish into ports in the south east. Kerry accounted for more than half the national landings in recent years. The increase in fishing effort and landings was probably driven by improved catch rates. Data for north Kerry show that catch rate (standardised per mile of net) doubled between 2017-2021 and increased further in 2024.

The increases in landings and catch rates and presumably higher stock levels is consistent with similar increases in south west England, the Scilly Isles, and northern France in recent years and points to an increase in recruitment of spiny lobster in this region. Tagging data from France and Ireland (Shellfish Stocks and Fisheries Review 2023) also show recruitment of sub-adult lobsters from France and the Celtic Sea onto the Irish coastal reef habitat and high levels of residency of lobster on this reef habitat.

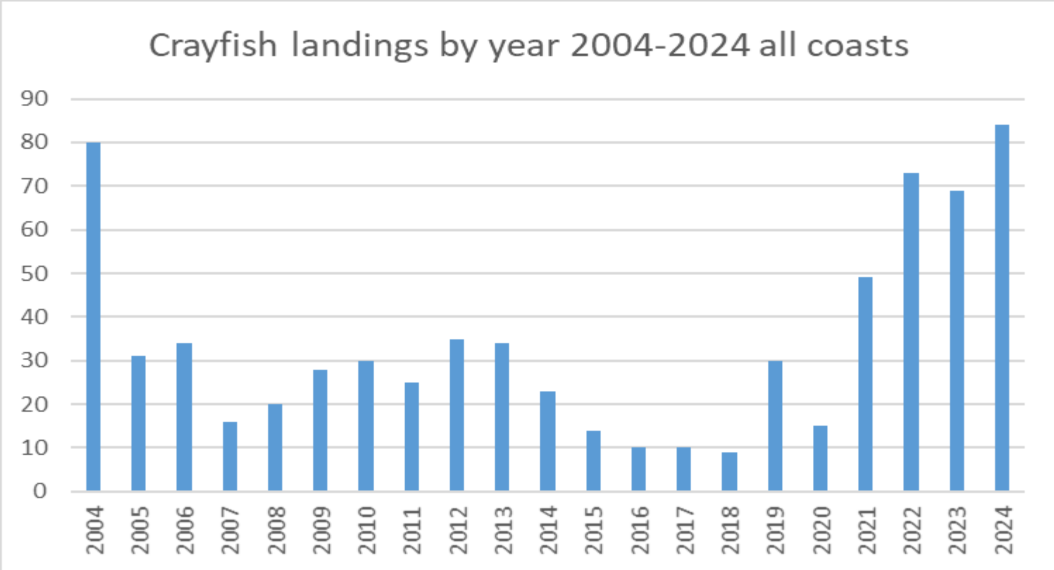

Figure 11. Annual landings (tonnes) of crayfish into Ireland 2004-2024.

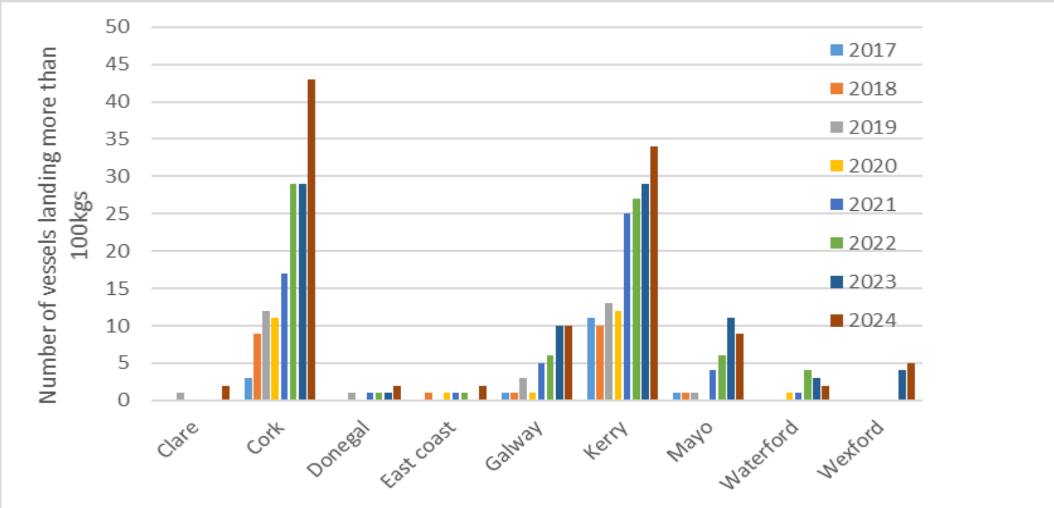

Figure 12. Annual number of vessels targeting crayfish (taken as >100 kg per annum) by county 2017-2024.

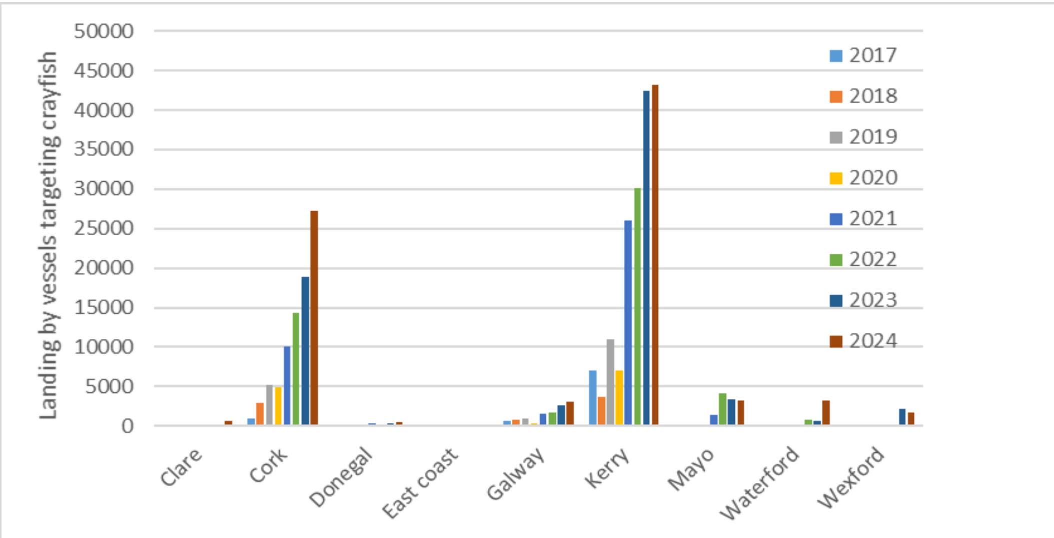

Figure 13. Annual landings by vessels targeting crayfish (taken as >100 kg per annum) by county 2017-2024.

Monthly catch rates (including all sizes) generally varied from 10-20 fish per nautical mile (nm) of net during 2017-2024 (Figure 14). The size distribution data shows variable proportions of the catch are above the minimum size in each year; 30 % in 2017 and 48-57 % in 2018-2024 (Figure 15). This variability in the size composition suggests that there is significant movement of crayfish into or out of the area although this is not borne out by the tagging data which suggests a high level of residency and repeated re-captures of individual crayfish close to release sites. The annual average catch rate increased from 9 to 18 crayfish per nm of net between 2017 and 2021, declined slightly from 2021 and 2023 and increased again in 2024, reaching its highest recorded level of 24 crayfish per nm of net (Figure 16).

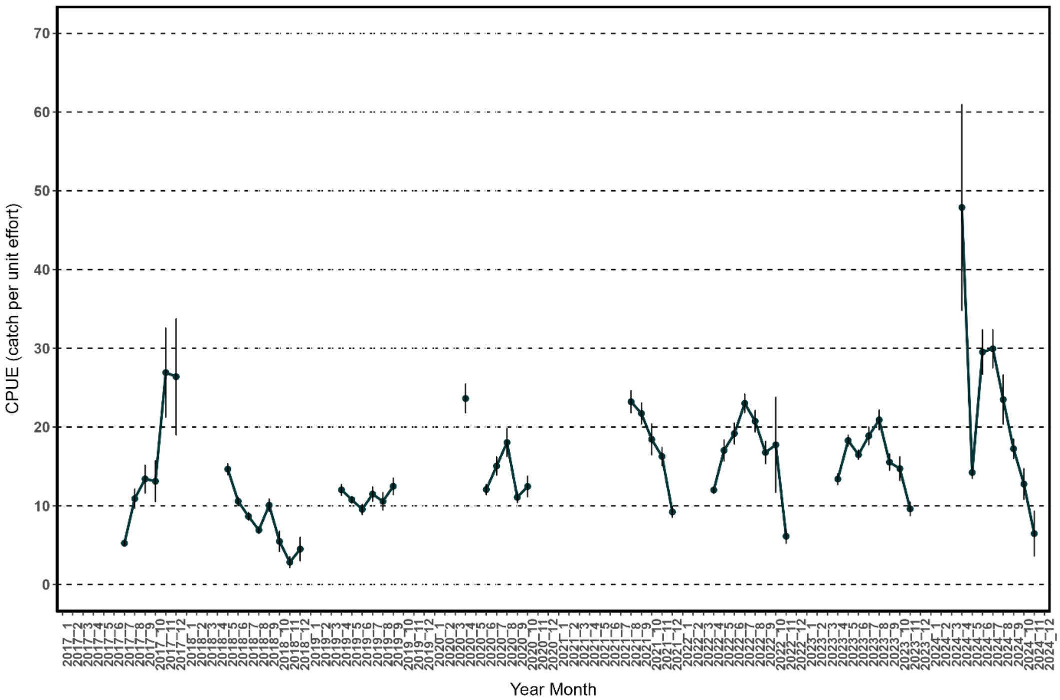

Figure 14. Monthly catch rate (numbers.nmnet^{-1}) of crayfish off the south west coast of Ireland 2017-2024.

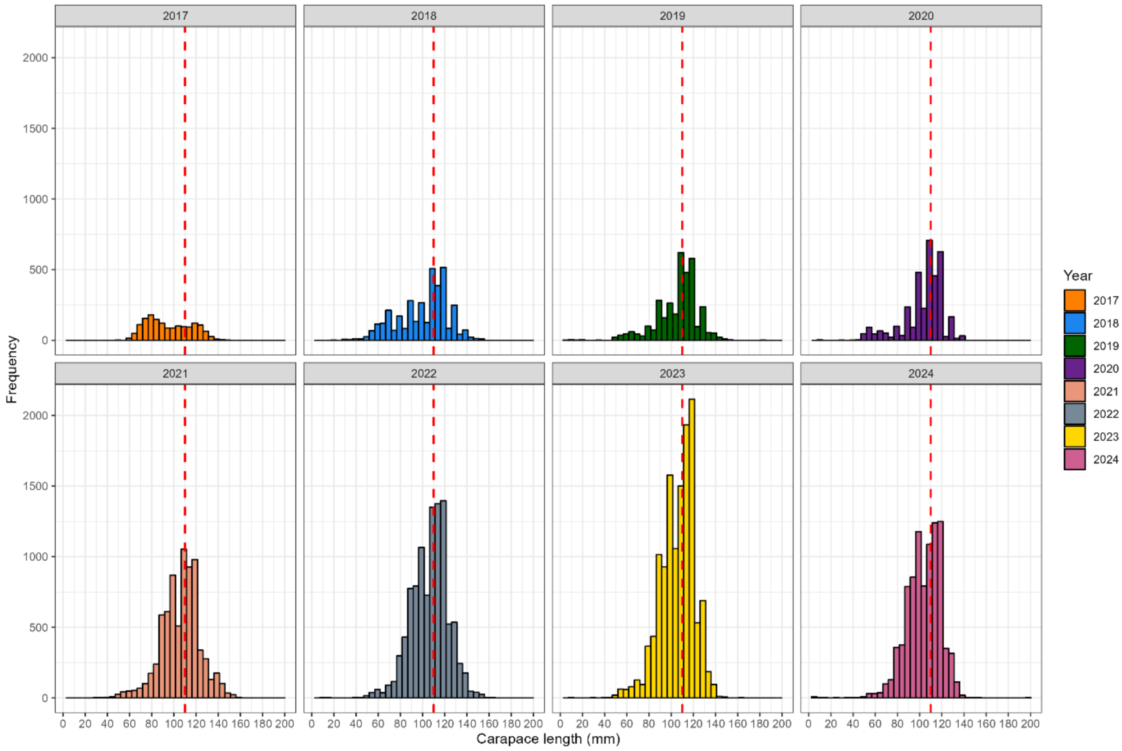

Figure 15. Size distribution of crayfish in the catch off the southwest coast of Ireland 2017-2024. Dashed red line indicates minimum landing size of 110 mm.

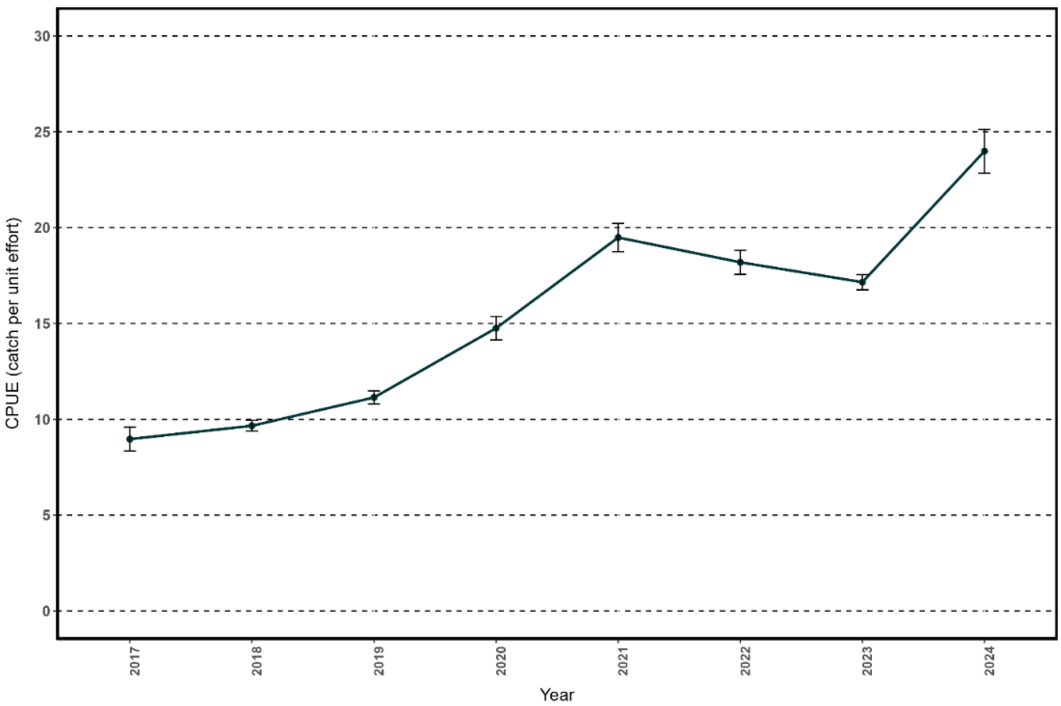

Figure 16. Annual (standard error) average catch rate (numbers.nmnet^{-1}) of crayfish off the south west coast of Ireland 2017-2024.

6.6 *Catch composition tangle nets*

Species catch composition was estimated from observer and skipper sampling data between 2017-2024. Between 300 and 800 nm of net hauls were observed annually. Raised estimates of by-catch for these vessels were obtained by raising the sample data by the ratio of sampling days reported to total days at sea as estimated from the iVMS data for these vessels. These data were also raised to local fleet level by the ratio of their landings to the sampling vessel landings and assuming similar species catch composition in the vessels not sampled.

Crayfish, spider crab and brown crab dominated the catch numerically. Higher numbers of spider crab, brown crab, pollack, monkfish, turbot, spurdog, thornback ray, spotted ray flapper skate, tope, painted ray, sting ray, angel shark, undulate ray and grey seal are caught by the Tralee Bay fleet (Table 6) compared to the Dingle fleet.

Table 6. Species catch composition in tangle nets targeting crayfish off the south west coast of Ireland 2017-2024 raised to the fleet level effort in the area for vessels in Tralee and Dingle Bays.

Species	Tralee					Dingle				
	2021	2022	2023	2024	Total	2021	2022	2023	2024	Total
Spider Crab (*Maja brachydactyla*)	22,065	19,928	21,390	31,422	**94,805**	11,157	9,119	8,026	15,954	**44,255**
Crayfish (*Palinurus elephas*)	15,207	14,842	15,744	17,167	**62,960**	25,504	23,206	19,057	26,934	**94,702**
Brown Crab (*Cancer pagurus*)	12,376	11,135	10,281	11,231	**45,022**	15,282	10,806	9,598	12,126	**47,812**
Lobster (*Homarus gammarus*)	359	590	432	371	**1,752**	2,921	2,021	1,487	1,397	**7,827**
Pollack (*Pollachius pollachius*)	1,160	2,039	2,188	2,399	**7,786**	487	660	339	515	**2,000**
Monkfish (*Lophius spp*)	783	734	696	1,183	**3,396**	324	284	332	352	**1,293**
Turbot (*Scophthalmus maximus*)	312	491	553	512	**1,868**	69	98	126	126	**417**
Black Pollack (*Pollachius virens*)	0	57	0	0	**57**	0	18	0	5	**23**
Spurdog (*Squalus acanthias*)	8,146	6,971	7,133	7,027	**29,276**	782	401	358	195	**1,735**
Thornback (*Raja clavata*)	1,052	1,518	1,709	1,482	**5,760**	239	297	380	283	**1,199**
Dog fish (*Scyliorhinus spp*)	1,277	983	1,242	1,533	**5,035**	1,065	1,063	629	769	**3,527**
Spotted Ray (*Raja montagui*)	870	1017	423	525	**2,835**	93	10	7	19	**128**
Common/Flapper Skate (*Dipturus spp*)	418	437	328	156	**1,338**	82	158	28	106	**374**
Blonde Ray (*Raja brachyura*)	162	185	338	385	**1,070**	196	398	283	261	**1,138**
Grey Seal (*Halichoerus grypus*)	168	230	116	80	**595**	91	245	116	113	**566**
Tope (*Galeorhinus galeus*)	126	89	158	37	**409**	27	25	37	35	**123**
Painted Ray (*Raja microocellata*)	263	55	24	0	**343**	0	0	63	17	**80**
Sting Ray (*Dasyatis pastinaca*)	107	90	67	7	**271**	5	3	16	0	**24**
Angel Shark (*Squatina squatina*)	0	57	9	15	**81**	0	0	0	1	**0**
Undulate Ray (*Raja undulata*)	15	38	0	0	**53**	0	0	0	5	**5**
White skate (Rostroraja alba)	0	0	0	0	**0**	0	0	2	0	**2**
Harbour porpoise (*Phocoena phocoena*)	0	0	0	0	**0**	0	3	0	0	**3**
Common dolphin (*Delphinus delphis*)	0	0	3	0	**3**	0	0	0	0	**0**
Risso's dolphin (*Grampus gripeus*)	0	4	0	0	**4**	0	0	0	0	**0**
TOTAL	**64,864**	**61,489**	**62,835**	**75,533**	**26,4721**	**58,323**	**48,815**	**40,883**	**59,212**	**207,232**

6.7 Bycatch of endangered and protected species

6.7.1 Critically endangered species (Angel Shark and Flapper Skate)

A total of 339 common skates and 24 angel sharks were reported in contracted data during 2021-2024. These catches were all in the Tralee Bay area. One Angel shark was reported by Dingle vessels. Total estimated by-catch, raised to fleet level, was higher (Table 6). Incidental by-catches of Angel shark were also reported in inner Tralee Bay over the oyster bed east of Fenit. Two were captured and released from oyster dredges in 2024.

Common skate by-catches peaked in April-June, with smaller peaks later in the year. The catch rate per mile of net peaked in summer and early winter. Angel shark by-catch peaked in August-October and a smaller peak in March-April. The peaks may reflect times of movements of this species into or out the Bay (Figures 17 and 18). Spatial distribution of Angel shark by-catch was concentrated in a few specific locations. Most of the reported catches were north west of Tralee Bay. Common skates by-catch was broadly distributed from Kerry Head south to the Blaskets and Dingle Bay.

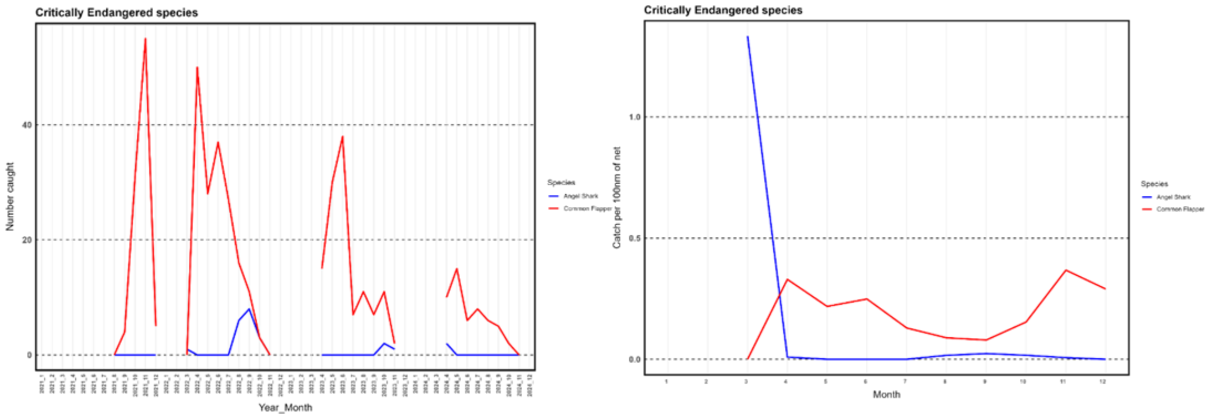

Figure 17. Numbers and catch rate of flapper skate (red line) and angel shark (blue line) reported by Skippers and scientific observers monthly during 2021-2024.

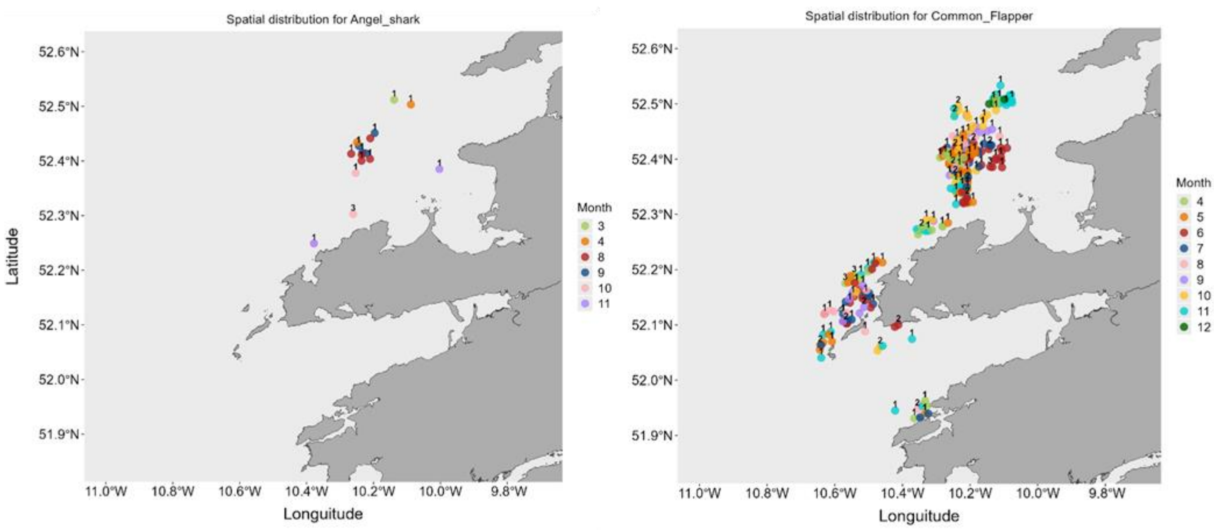

Figure 18. Spatial distribution of reported captures of angel shark and flapper skate by month (2021-2024).

6.7.1.1 The significance of angel shark by-catch

Critically endangered species such as Angel shark continue to be depleted through fishery by-catch mortality in Irish coastal waters which hold the last remnant populations of this species in the Northeast Atlantic. There is a high risk of extinction of this species at local, NE Atlantic, and global level if fishery by-catch generally continues. The Canary Islands is a remaining hotspot for the species in the Atlantic. Historically, and until the 1980s, Tralee Bay was an important and well known centre of distribution in Irish waters (Shepherd *et al*. 2019). It supported an economically important recreational angling sector in inner Tralee Bay. The species also occurred in Clew Bay and Galway Bay and in the Irish Sea in Cardigan Bay (Hiddink *et al*. 2019). The species is a prohibited species in the common fisheries policy meaning that it must be released immediately when captured. However, this protection is not sufficient for critically endangered species where the process of capture can lead to mortality and where the size of the extant population may be extremely low. Although at least some Angel shark caught were released alive (two were tagged with satellite tags) the proportion killed in tangle nets is probably high given the long net soak times used in the tangle net fishery.

6.7.1.2 The significance of flapper skate by-catch

Critically endangered flapper skate is captured in a number of fishing gears in Irish waters including bottom trawls and bottom set nets and is targeted (catch and release) by recreational anglers. It is prohibited to land flapper skate and individuals must be released immediately when captured. Post release survival depends on physical trauma and physiological stress associated with capture. Capture in tangle nets with long multiple day soak times may cause injury and mortality. In outer Tralee Bay injured and stressed fish are often killed by peracarid crustaceans. Depleted populations of skate cannot sustain significant fishing mortality at local level (given high site fidelity) or over wider geographic areas given life history and in particular high age at maturity.

Habitat requirements, especially for egg laying, and the mobility and relative site fidelity of mature female fish are important considerations for conservation management of skate. There is an inverse relationship between body size and depth use and skate move into shallow water over winter months. Large females, are frequently found in shallow waters (25–75 m) and these migrations inshore by large female skate are for egg laying (Thorburn *et al*. 2021). Tangle net bycatch on large skate may therefore have significant negative effects on spawning. Removal of fishing pressure in marine protected areas for skate in Scotland has led to significant recovery of the species in these areas as skate in these sites, at least, show high site fidelity (Regnier *et al*. 2024).

6.7.2 Endangered Species (sting ray and undulate ray)

A total of 83 Stingrays and 16 undulate rays were reported in by-catch during 2021-2024 (Figure 19, Figure 20). Although both are endangered species, stingray are caught more frequently compared to undulate ray. Catches of Undulate ray are generally low throughout the time period, with a peak of 12 individuals caught in April 2022. There was no catch in 2023, and one individual was caught in August 2024.

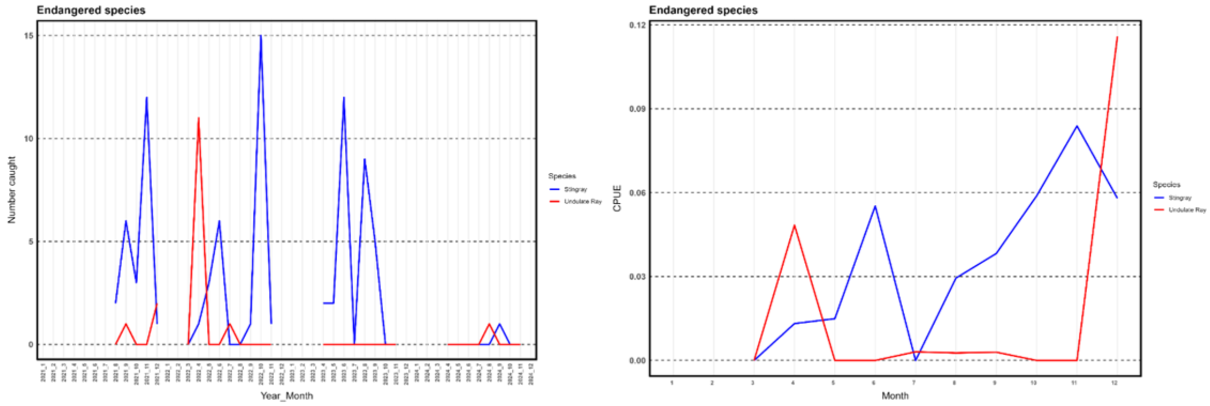

Figure 19. Numbers and catch rate of Sting ray (blue line) and Undulate ray (red line) reported by Skippers and scientific observers monthly during 2021-2024.

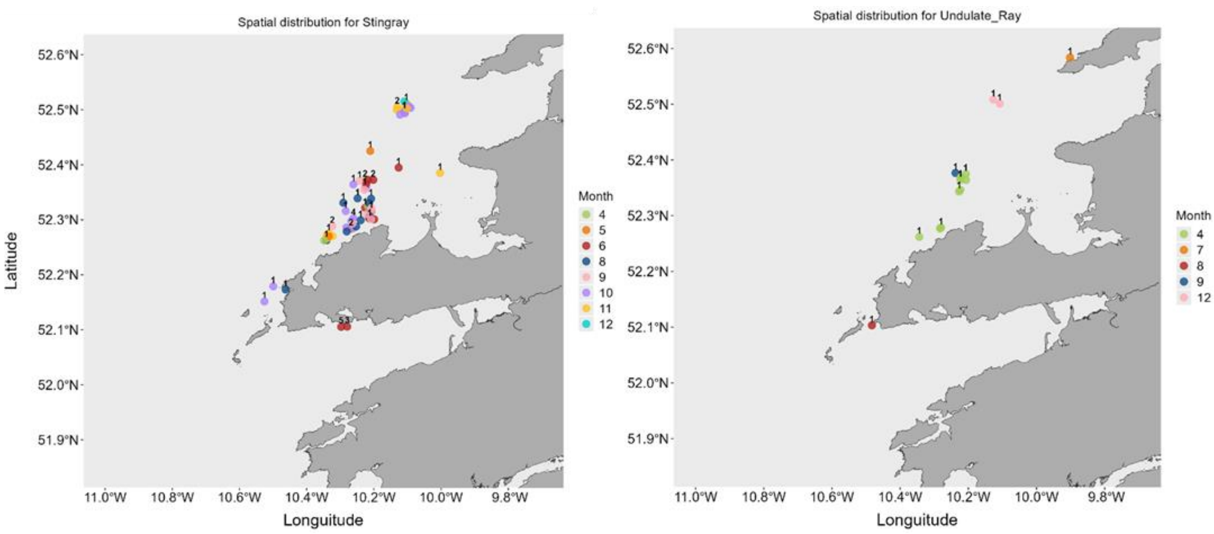

Figure 20. Spatial distribution of reported captures of sting ray and undulate ray by month (2021-2024).

6.7.3 Grey seal by-catch

The total estimated grey seal by-catch raised to the tangle net fleet in the outer Dingle Bay north to Kerry Head was 1,161 seals in the 4 years 2021-2024 (Table 6, Figure 21). A total of 328 grey seals were reported in by-catch during that period by skippers and observers. Seal bycatch estimates over the 4 years 2021-2024 were similar in the Dingle and Tralee tangle net fleets. By-catch was significantly higher in 2022 in both areas.

Grey seal are captured as by-catch in most of the area where fishing events occur. However, the probability of capture was higher where highly suitable seal habitat and high levels of tangle net fishing overlapped (Figure 22, Figure 23).

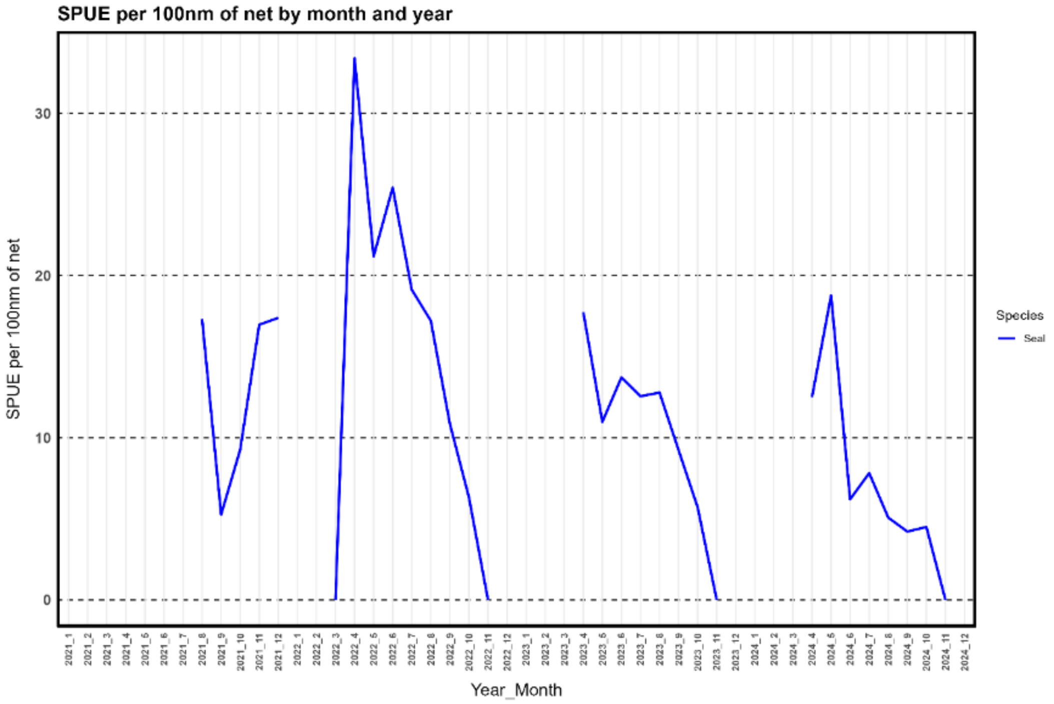

Figure 21. By-catch of grey seal by month and year per 100 nm of net hauled.

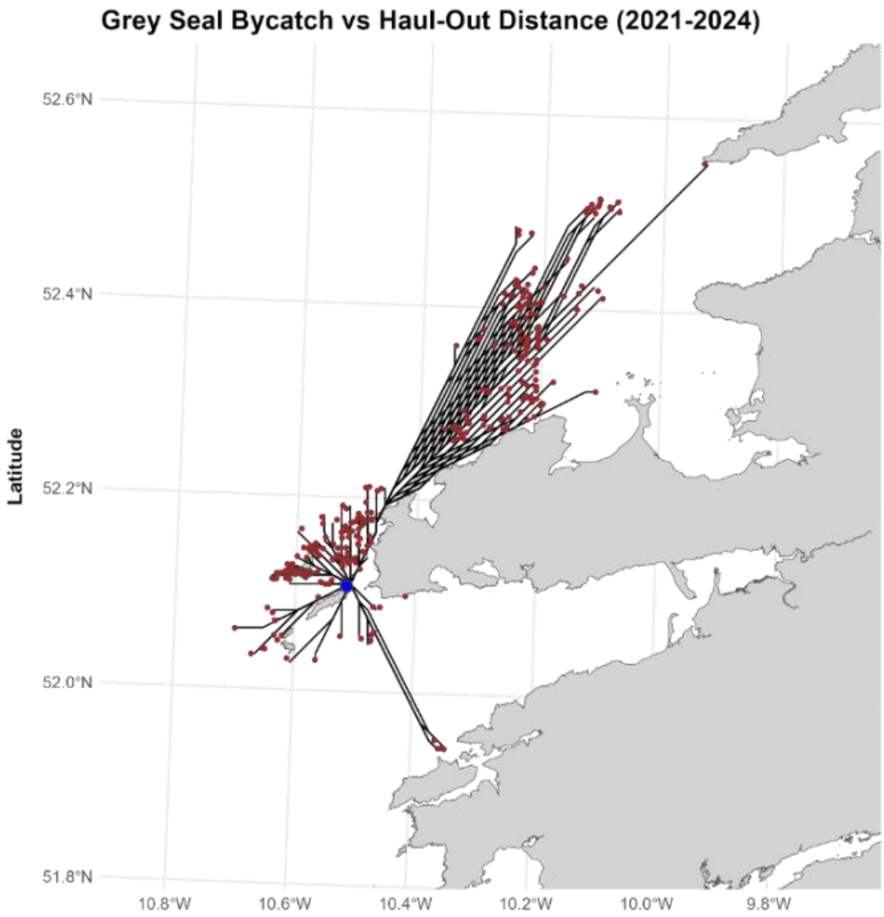

Figure 22. Location of by-catch of grey seal relative to straight line distance to the Blasket Island seal haul out (Blue dot).

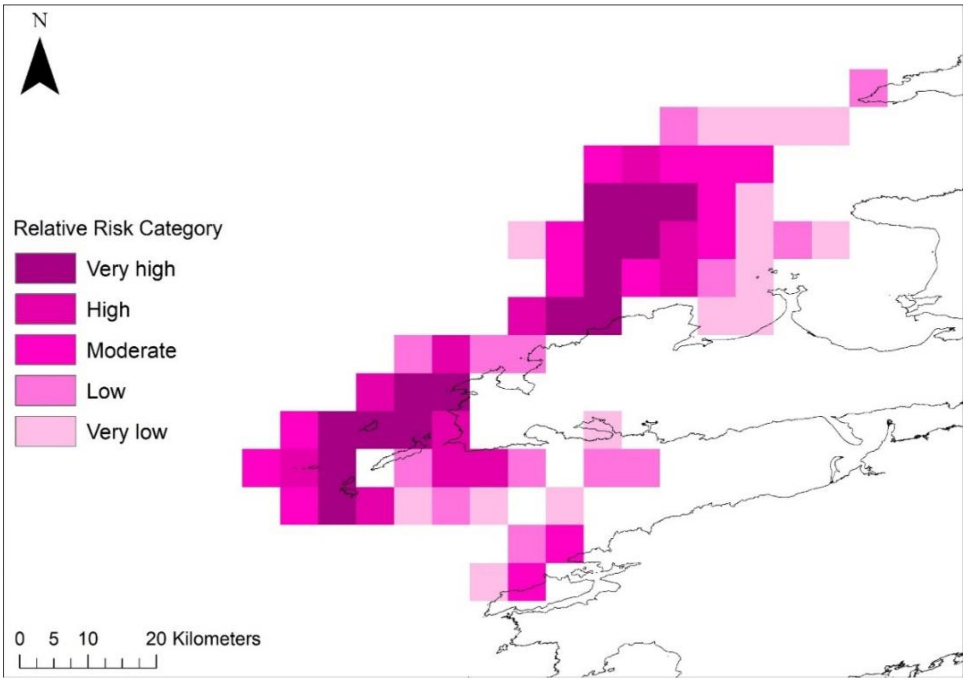

Figure 23. Relative spatial risk of seal bycatch in tangle nets around the Dingle peninsula. Bycatch risk is highest in squares (5 x 5 km resolution) surrounding the Blasket Islands and off the north coast of Dingle peninsula. Risk is a combination of the suitability of a given area for seals (as estimated from a species distribution hazard exposure model; Murphy *et. al*. Marine Institute unpublished) and the level of potential hazard (tangle nets) seals are exposed to.

6.7.3.1 The significance of seal by-catch

This study provides robust estimates of seal by-catch at local level by focusing on fishing gears where the risk of by-catch is high, by concentrating data collection in a local area where seal distribution and habitat use is predicted to be high and where the overlap of high risk fishing gears and seal occurrence is high. Levels of sampling by scientific observers and skippers were used to derive fleet based estimates by using high frequency VMS data to verify the number of days at sea of a high proportion of the tangle net fleet.

The estimated total seal by-catch by the tangle net fleet in the Dingle and Tralee areas are higher than modelled estimates of Luck *et al*. (2020) of annual total seal bycatch in the entire Irish EEZ of between 202 (90 % CI: 263 3-433) and 349 (90 % CI: 6-833). The data show that very high fleet-specific localised by-catch possibly accounts for a high proportion of total fishery seal by-catch. Fishing with large mesh tangle nets also occurs in the proximity to other seal haul out sites in Ireland including west of Mayo (the Iniskeas SAC), Connemara and west Galway (Slyne Head, Duvillaun Is and Inisbofin and Inisark SACs) and on the south coast (Roaringwater Bay SAC). Although factors other than distance to haul out influence catch rate the presence of large mesh set net fisheries in such locations probably constitute a high risk of by-catch.

Population estimates for grey seal in 2005 and 2012 and anecdotal information on the rate of encounter between seals and fishing vessels all indicate that the number of grey seals in Irish waters and at breeding and haul out colonies is increasing. The population is estimated to be between approximately 7000-9000 (O'Cadhla *et al*. 2013). The Blasket Island population increased from 648-833 in 2005 (O'Cadhla *et al*. 2008) to 1099-1413 in 2012 (O'Cadhla *et al*. 2013) representing a 4 % increase per annum. There are no recent estimates. This increase is lower than the maximum density-independent potential population rate increase of 10 % constrained by life history parameters only. Acoustic telemetry data shows extensive migrations of grey seal from French populations to Irish waters which can explain the resilience of the seal population at the Blasket Island haul out and surrounding area to high by-catch mortality. Recent genetic data (Steinmetz *et al*. 2024) show that seals from the island of Ireland are part of a single interbreeding population, with southwest England being a source of migrants to the island of Ireland and the southern North Sea (Germany, Denmark) being either a source or sharing a common source of migrants to the island of Ireland. Based on this observed genetic structure within the northeast Atlantic, the island of Ireland, southwest UK (Cornwall) and France have been proposed as a single management unit. Management of seal fisheries bycatch and other pressures on seals throughout this region, including in particular areas where the population occurs in high numbers and is exposed to high risk or mortality, is therefore important in maintaining the population. The Blasket Islands and other important haul out locations in Ireland are critical locations, therefore, for proactive management and conservation.

7 Brown crab (*Cancer pagurus*)

7.1 *Management advice*

The crab fishery is managed by a minimum landing size of 140 mm carapace width. There are kilowatt day effort limits on vessels over 10 m in the biologically sensitive area which includes coasts from north Mayo south and east to Waterford and on vessels over 15 m in ICES area VI.

Standardised indices of stock abundance declined significantly from 2015-2019 and were stable at low levels during the period 2020-2024. Advice based on the negative trends in stock indices or on the fishing mortality (F/F_{msy}) ratio, in the case of the Malin stock, all indicate the need to reduce fishing mortality. Corresponding landings in 2025 for the Malin Shelf (all fleets combined including UK) is 4,078 tonnes using an ICES advice rule, or 4,336 tonnes at F/F_{msy} = 1.

Although the MLS of 140 mm protects the stock from recruitment overfishing these assessments clearly signal that a decline in stock abundance and a likely decline in recruitment occurred from 2015. Increases in MLS to 150 mm, which corresponds to the MLS in the UK, would increase protection of spawning stock but would also increase discarding by over 20% and further reduce landings per unit effort.

7.2 *Issues relevant to the assessment of the crab fishery*

Assessments based on length data and biological parameters can provide estimates of fishing mortality (exploitation status). However, there are a number of assumptions underlying these methods and estimates are highly sensitive to growth rate parameters, which are poorly estimated. The size composition of crab in the landings also does not seem to change in response to increased effort or landings, therefore these data may not reflect changes in fishing mortality.

Landings per unit effort indicators are compromised by unknown grading practices on vessels. It is important that discard data are also available to construct the total catch if these data are to reflect changes in stock abundance. Given recent increases in fishing effort, gear saturation effects may also be reducing catch per unit effort (CPUE). Standardising the nominal catch rate data for these and other effects is, therefore, important. Capacity to account for spatial and temporal effects in an annual standardised index depends on the spatial resolution of the data in particular.

Catch rates are highly variable between vessels, areas, seasons and years, making it is difficult to identify patterns. An increase in the quantity of catch and effort data reported for the fishery is needed to ensure absence of bias, increased precision, and to take into account geographic, seasonal, and other effects on catch rate.

7.3 *Management units*

Targeted fisheries for brown crab in Ireland developed during the 1960s. The fishery developed off Malin Head in Donegal and along the Donegal coast and, to a lesser extent, on the south coast during the 1970s. The Malin Head fishery accounted for 25 % of national landings during the 1980s. The offshore fishery developed in 1990 and by the mid-1990s had fully explored the distribution of brown crab on the Malin Shelf. This stock, which extends from Donegal to the edge of the continental shelf and south to Galway, is the largest stock fished by Irish vessels. Crab stocks off the southwest and southeast coasts are exploited mainly by Irish vessels <13 m in length inside 12 nm.

ICES (WG Crab) has identified stock units for the purpose of assessment (Figure 24). On the Irish coast these units are identified from tagging data, distribution of fishing activity and larval distribution.

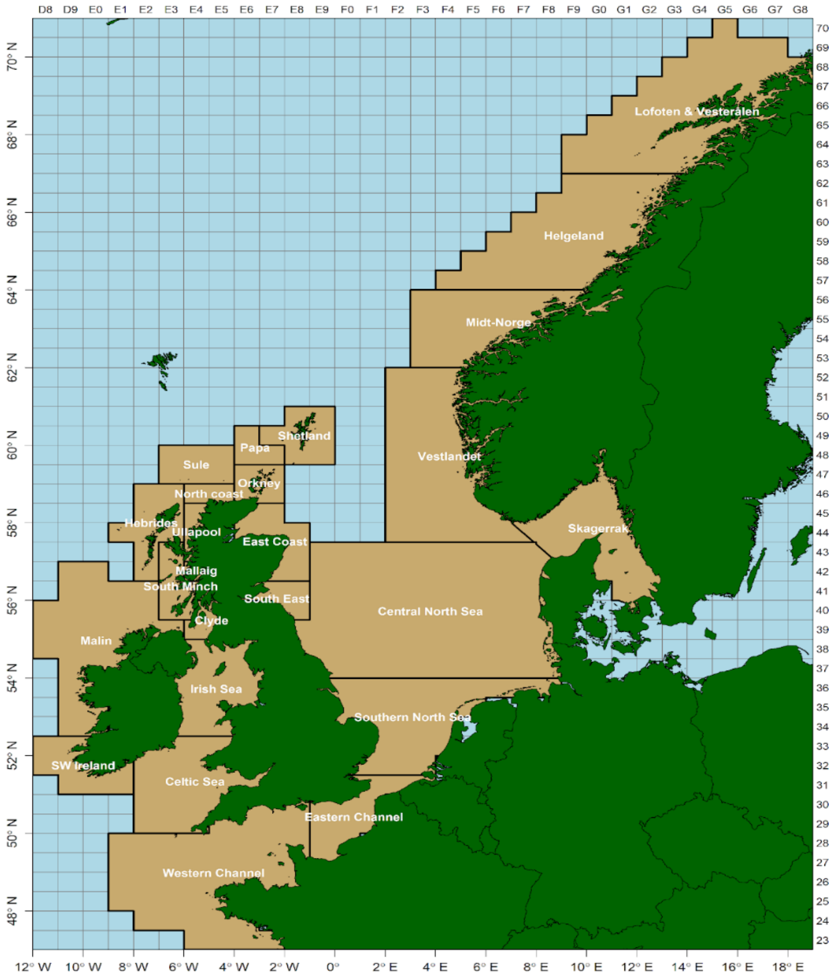

Figure 24. ICES stock assessment units for Brown crab.

7.4 *Management measures*

Crab are managed using a minimum landing size of 140 mm. Annual effort by vessels over 15 m in length is restricted (1415/2004 EC) to 465,000 kw.days in ICES Area VI (north west stock), to 40,960 kw.days in ICES Area VII outside of the Biologically Sensitive Area (BSA) and to 63,198 kw.days in the BSA for all vessels over 10 m in length. These restrictions have resulted in some displacement of effort of offshore vessels (>18 m in length) from the Malin Shelf to the North Sea and on occasion the restrictions may limit fishing activity towards the end of the year by vessels over 10 m. Effort by vessels under 10 m in length is unrestricted in all areas.

7.5 *Catch rates*

Sentinel vessel (SVP) data from 2013-2023 and the MI observer data from 2015-2023 for all coasts are presented here. Data prior to 2014 is presented for the Malin Shelf stock only as data for other areas are still being compiled.

Landings and discards of brown crab in the SVP are reported in different units, i.e. kilograms, boxes, trays and numbers. The data for this review are reported in kilograms. A box of landings/discards was assumed to be approximately 30 kg based on previous reports from observer trips. One tray was assumed to represent half a box.

7.5.1 Annual trends

Landings per unit effort (LPUE) was stable during 2013-2015 in SVP vessels targeting crab with an annual mean of approximately 2.5 Kg/Pot. This declined between 2015 and 2019 from approximately 2.3 Kg/Pot in 2015 to approximately 1 Kg/Pot in 2023. The MI observer data declined from a high of 3 Kg/Pot in 2016 to its lowest value of 1 Kg/Pot in 2021 (Figure 25). The new skipper self-sampling programme reports LPUE and DPUE comparable in scale to the SVP and observers, although only three years of data are available.

Discards per unit effort (DPUE) show decreasing trends in both SVP and MI observer data up to 2019, and have hovered between 0.5 – 1 Kg/Pot in recent years.

LPUE and DPUE of crab caught in gear targeting lobster were relatively stable from 2018 but generally less than 0.5 Kg/Pot. The MI observer data is probably more reflective of mixed targeting of lobster and crab compared to the SVP where the data shows distinctly higher crab catches in pots intended for crab.

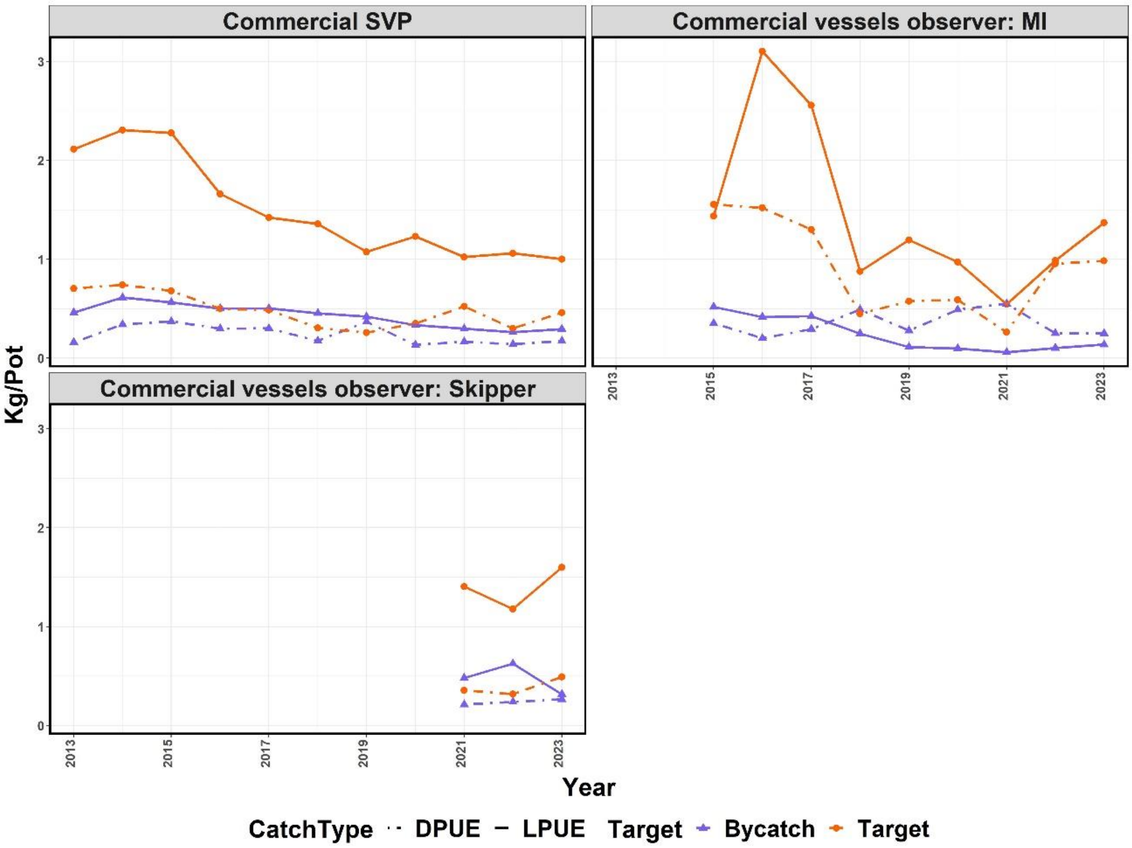

Figure 25. Annual mean LPUE and DPUE (Kg/pot) for SVP, Observer and Skipper self-sampling programme data from trips both targeting brown crab and where brown crab is caught as by-catch during 2013-2023. All stocks are combined.

The decreasing trends in LPUE and DPUE were observed in all stocks (Figure 26), although LPUE has stabilised in the Malin stock since 2019. Data for the Celtic Sea displays higher inter-annual variability than the other two stocks, but the decreasing trend is still pronounced.

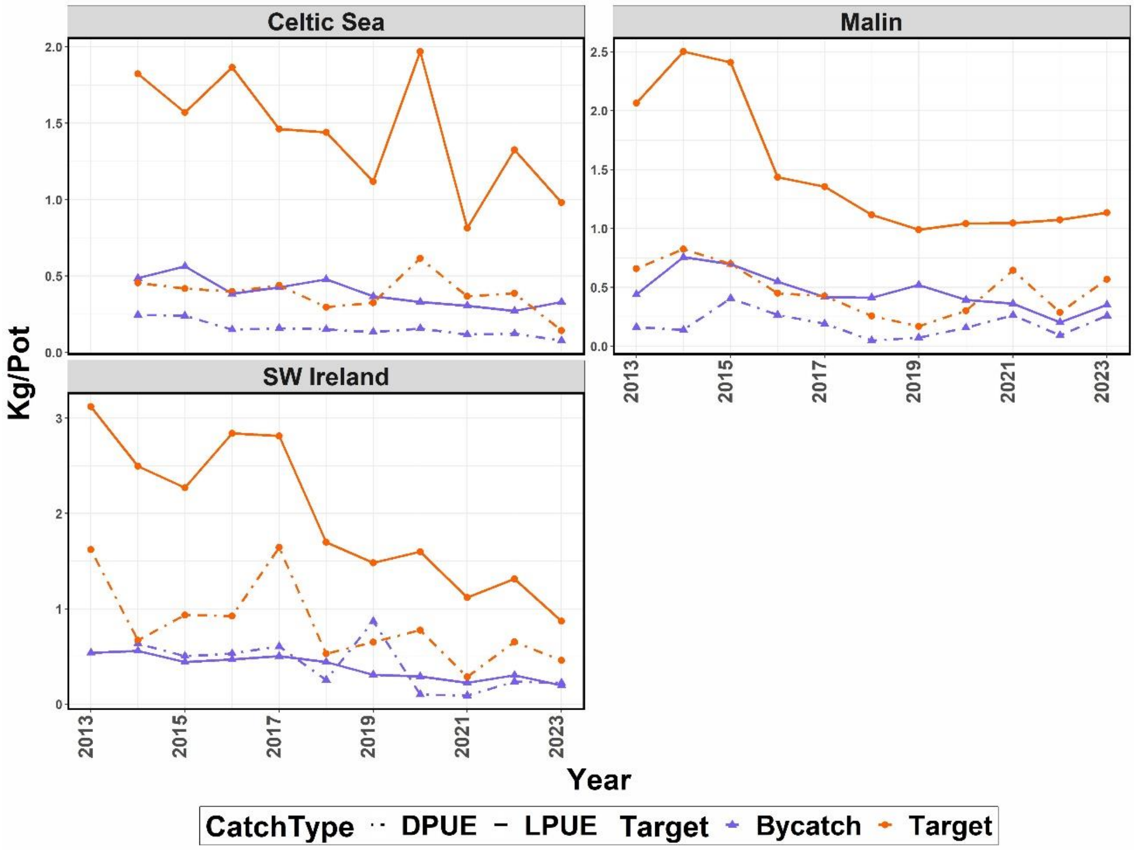

Figure 26. Annual mean LPUE and DPUE (Kg/Pot) by stock area for SVP trips both targeting crab and where crab is caught as bycatch during 2013-2023.

7.5.2 Seasonal trends

Seasonal trends in LPUE in the SVP data are shown in Figure 27. Observer data is not shown as it is considerably less precise given the limited sampling. LPUE in gears targeting crab generally show peaks in Quarter 3 and early Quarter 4 although in 2013-2016 peaks occurred in Quarter 1 and 2. LPUE of brown crab caught in pots targeting lobster generally peaks in Quarter 4.

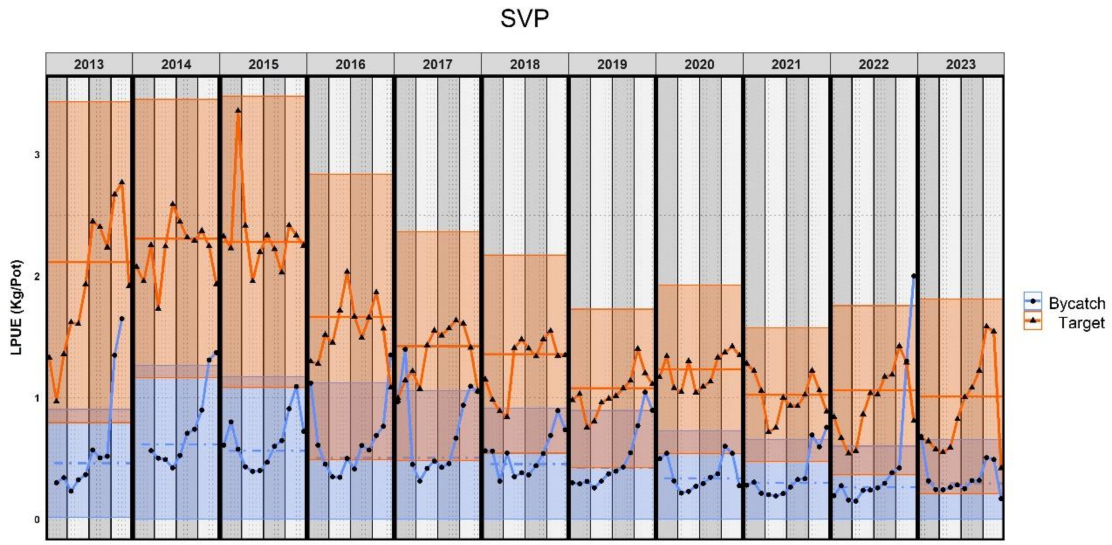

Figure 27. Monthly mean LPUE (Kg/pot) with standard deviation for SVP trips where crab was targeted (orange) and captured as bycatch (blue). Horizontal lines in each year show annual means. Year quarters shaded alternately in grey and white.

7.6 *Assessment of the Malin Stock*

7.6.1 Landings

The northwest crab fishery developed during the 1970s on a small scale and further development occurred during the 1980s in inshore waters especially off Malin Head. In 1990 the offshore vivier fleet was introduced and there was incremental modernisation of the inshore fleet. Throughout the time series, from 1980 to 2023, Irish vessels landed the largest proportion of Brown crab from the Malin stock. Irish landings peaked in 2004 at almost 8,000 tonnes; this peak did not occur in the Scottish or Northern Irish data. Scottish landings remained relatively stable since the early '90s. Northern Irish landings peaked in 2017 and have since fallen to lowest official (not reconstructed) values (Figure 28).

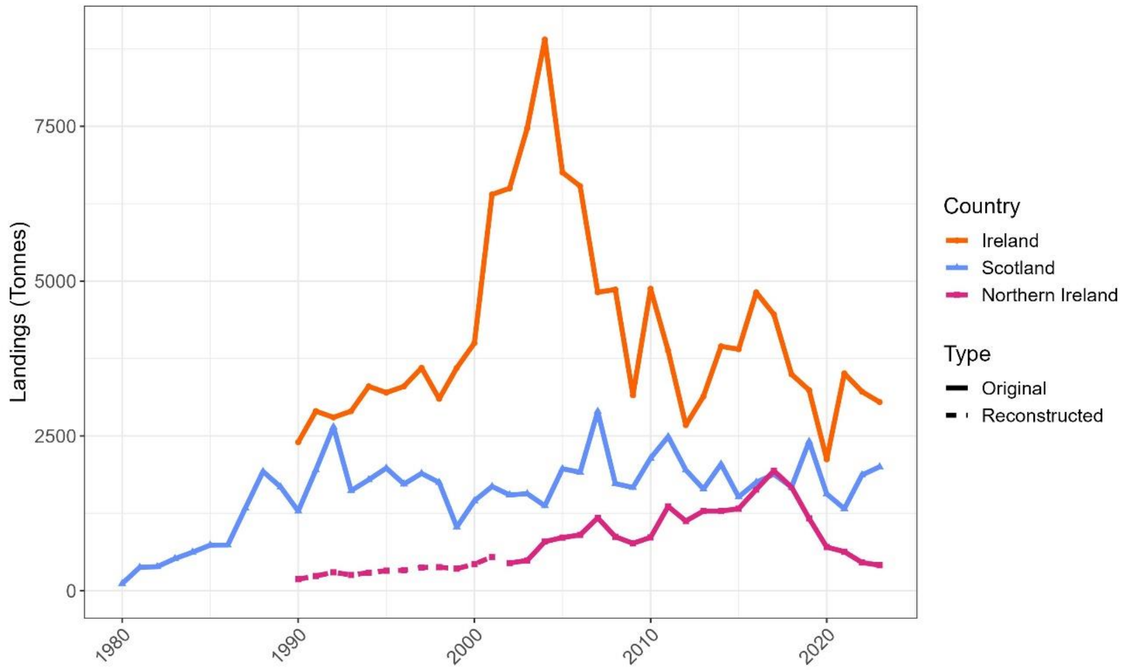

Figure 28. Landings (tonnes) of brown crab (*Cancer pagurus*) in ICES Divisions VIa and VIIb (Malin Shelf stock) 1980-2023 by Irish, Northern Irish, and Scottish vessels. Source: Logbooks data for vessels above 10 m and sales notes data for vessel under 10 m. Dashed line indicates data were reconstructed via a general linear modelling framework using data from 2002-2023.

7.6.2 Biomass indices

Two potential indices of abundance are available for the stock:

1- Daily landings per unit effort (LPUE) collected in the SVP or earlier versions of it from 1996-2023, and
2- Georeferenced haul by haul LPUE (Figure 29), from the Irish offshore vivier crab fleet from 1991-2006.

Additional information available in both datasets include soak times and unique vessel identifiers. Data on discards are available in the SVP programme, but are not always reported and thus not included here.

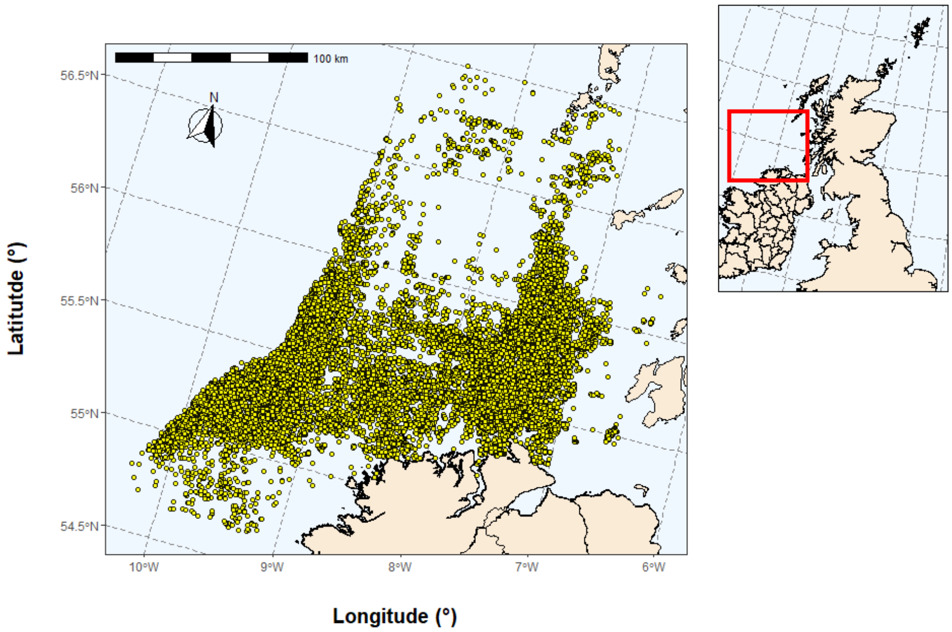

Figure 29. Haul locations for the offshore vivier crab fleet 1991-2006.

Two indices of abundance were created by standardising the catch rates of both data sources using Generalised Additive Models.

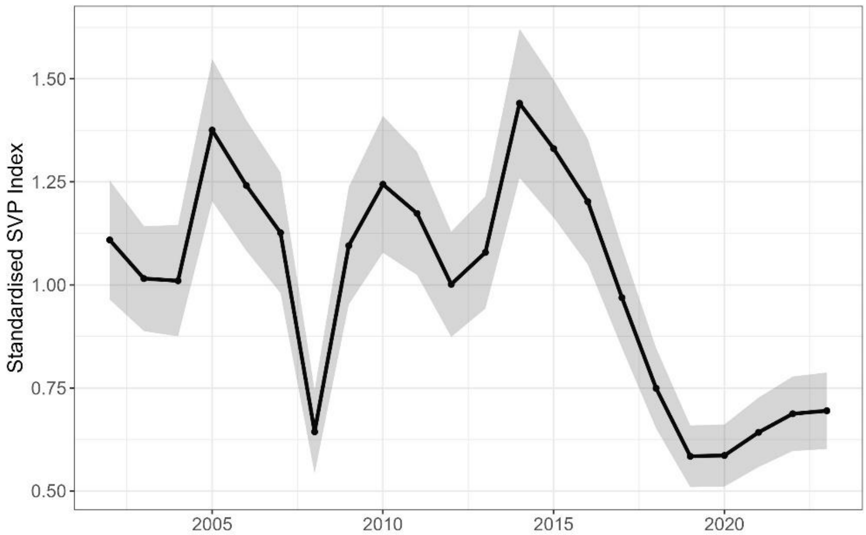

Figure 30. Standardised index of crab abundance from the SVP programme after applying GAM model (2002-2023). Shaded regions indicate approximate 95 % confidence intervals.

The SVP index shows a relative increase in LPUE in the first 10 years of the time series, although inter-annual variability suggest data quality issues in this period (Figure 30). A sharp decrease in the standardized LPUE occurred from 2014 onwards, although there are signs of slight recovery in 2020-2023. The limited sampling in 2008 for the Malin stock (4 vessels only compared to on average 13-15 vessels) are likely to be causing this outlying estimate.

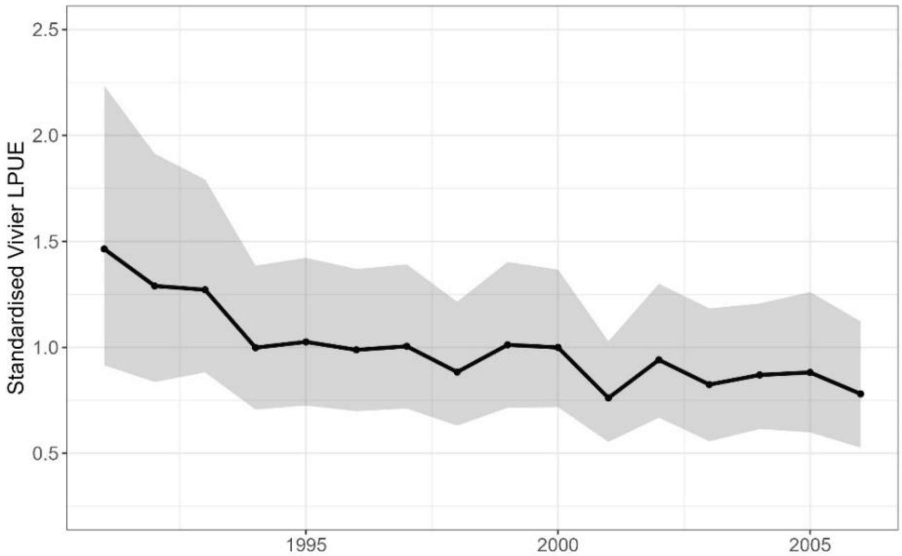

Figure 31. Standardised offshore LPUE time series using a spatial-temporal model (1991-2006).

The offshore vivier standardized index shows a declining trend at the beginning of the time series and stable LPUE between 1994 and 2000 followed by small declines from 2000-2006 (Figure 31).

7.6.2.1 SPiCT assessment

SPiCT (Surplus Production in Continuous Time) is a surplus production model commonly used in fisheries assessments. The model estimates exploitable biomass and fishing mortality, which are indirectly observed via indices of abundance and catch. Process and observation errors are incorporated in the model, which is then reflected in the model uncertainty and projected catch advice.

A number of model scenarios have been tested, which included varying the length of the time series of landings and abundance indices, as well as adjusting initial settings and priors for key model parameters (e.g., symmetry of the production curve, depletion at the beginning of the time series and intrinsic rate of population growth). All configurations of the model setup resulted in consistent trends and outputs, indicating the assessment is robust to various assumptions. For simplicity, only one scenario is reported here.

The SPiCT model indicates that the stock is overfished (biomass below B_{MSY}) and is undergoing overfishing (fishing mortality above F_{MSY}) (Figure 32, Figure 33).

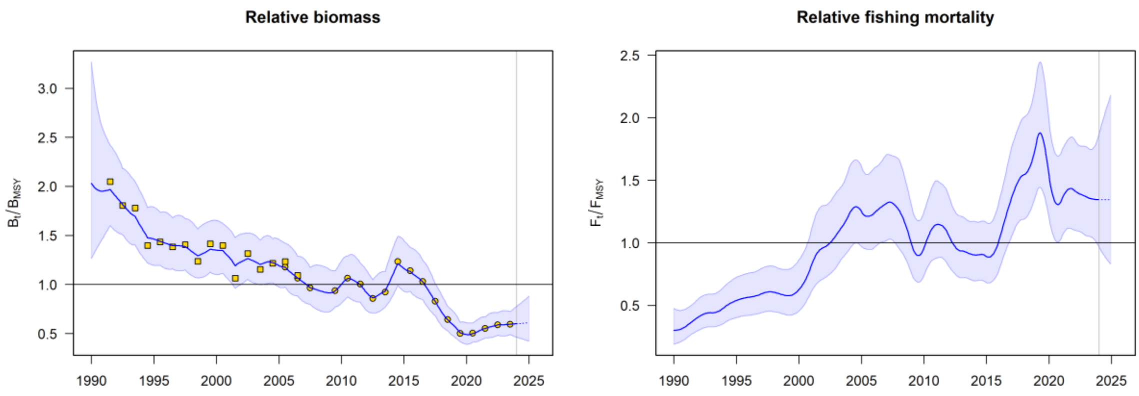

Figure 32. Estimated relative biomass (left) and relative fishing mortality (right) from the SPiCT assessment for brown crab on the Malin shelf.

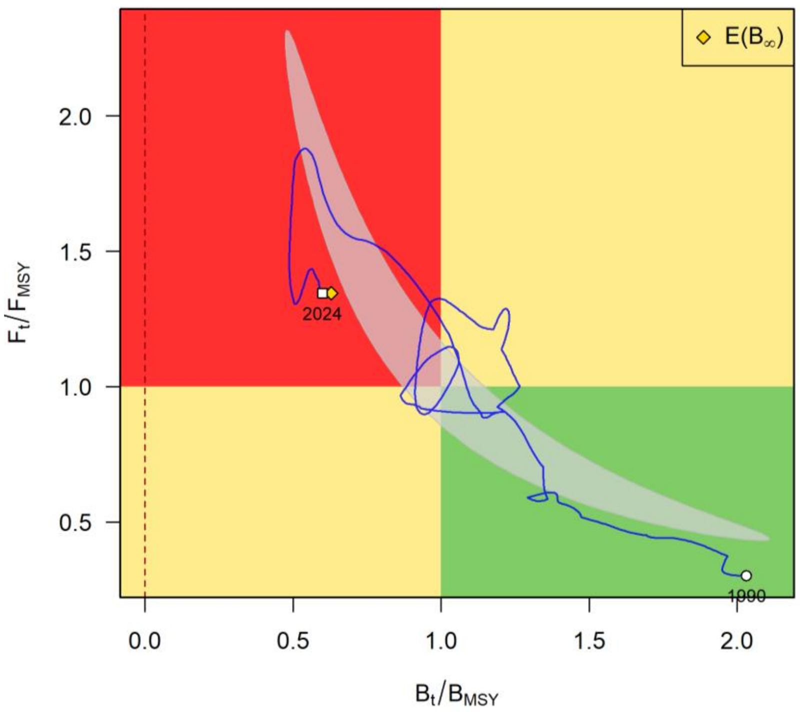

Figure 33. Kobe plot of the stock's estimated exploitation status (F) and population status (B) in relation to estimated F_{MSY} and B_{MSY}.

7.6.3 Catch advice

The assessment indicates that fishing mortality should be reduced. The level of reduction will impact the rate of recovery of the stock biomass. There are a number of harvest control rules that could be adopted; the two suggested rules are the ICES advice rule or fishing at F_{MSY} (numbers 3 and 4 in Table 7 below). The ICES advice rule optimizes yield while maintaining low levels of risk by incorporating the uncertainty in the estimated biomass and fishing mortality into the short-term forecast, using the 35th percentile as opposed to the medians of estimated B/B_{MSY} and F/F_{MSY} distributions (ICES 2024). Implementation of harvest control rules to reduce fishing mortality provides scope for stock recovery but does not guarantee recovery.

Table 7. Projected biomass and fishing mortality in relation to MSY corresponding with catch associated with various harvest strategies.

Harvest Strategy	Catch (tonnes)	B/B_{MSY}	F/F_{MSY}
1. Keep current catch	5,480	0.61	1.33
2. Keep current F	5,544	0.61	1.34
3. Fish at F_{MSY}	4,335	0.67	1
4. ICES advice rule	4,077	0.69	0.93

7.7 *Assessment of changes in minimum landing size*

The minimum landing size (MLS) is currently 140 mm carapace width having increased from 130 mm in 2019. The MLS in the UK is 150 mm. Increase in the MLS to 150 mm to align with the majority of the UK and Northern Ireland and to further protect the reproductive potential of the stock were discussed at management forums in Ireland in 2024.

MLS is usually designed, where possible, to provide parallel protection of spawning potential and to allow sufficient growth before they are first captured. Optimising yield for each crab recruiting to the stock (YPR) is about balancing growth and natural mortality (M). It is a trade-off between expected future gain (in yield) due to growth and expected future loss due to mortality. The odds change depending on the MLS; at higher MLS most of the growth has already occurred even if M remains the same. Reference points that optimise yield at a given MLS are F_{max} (the fishing mortality rate that optimises yield), $F_{0.1}$ (a more conservative lower fishing mortality rate defined as the F at which the marginal increase in equilibrium yield has dropped to one-tenth of its value when the stock was first exploited).

At higher MLS the fishing mortality that provides for optimum yield increases for any value of natural mortality (M) and increases also at higher values of M (Table 8). $F_{0.1}$ values range from 0.65 to 0.81 which are equivalent to annual harvest rates of 47-55 % of the stock biomass above the MLS; i.e. this would allow for removal of half the exploitable biomass annually.

The yield per recruit advice is, therefore, to fish at higher harvest rates as the MLS is increased to avoid losing yield. Current fishing mortality rates estimated from length converted catch curves of port sampling data since 2016 indicated F of 0.68 (at M = 0.2). These are similar to $F_{0.1}$ reference point values for MLS of 140 mm but lower than $F_{0.1}$ for higher MLS suggesting that higher fishing effort would be needed to optimise yield at MLS greater than 140 mm.

Table 8. Fishing mortality rates to achieve maximum sustainable yield and a more conservative proxy for this yield at MLS of 140-160 mm carapace width and using different assumptions about the rate of natural mortality. Growth parameters k = 0.19, L_{inf} 220 mm

YPR reference points	MLS	Natural mortality scenarios			
		0.05	0.1	0.15	0.2
Fmax	**140**	0.746	0.746	0.777	0.826
	150	0.773	0.786	0.832	0.895
	160	0.803	0.832	0.893	1
F 0.1	**140**	0.65	0.664	0.704	0.704
	150	0.718	0.721	0.756	0.807
	160	0.748	0.764	0.814	1

Based on recent length frequency distributions measured by observers across all areas (2019-2023), increasing the MLS from 140 to 150 mm would result in an increased discard rate of 20-25 % by weight and number (Figure 34).

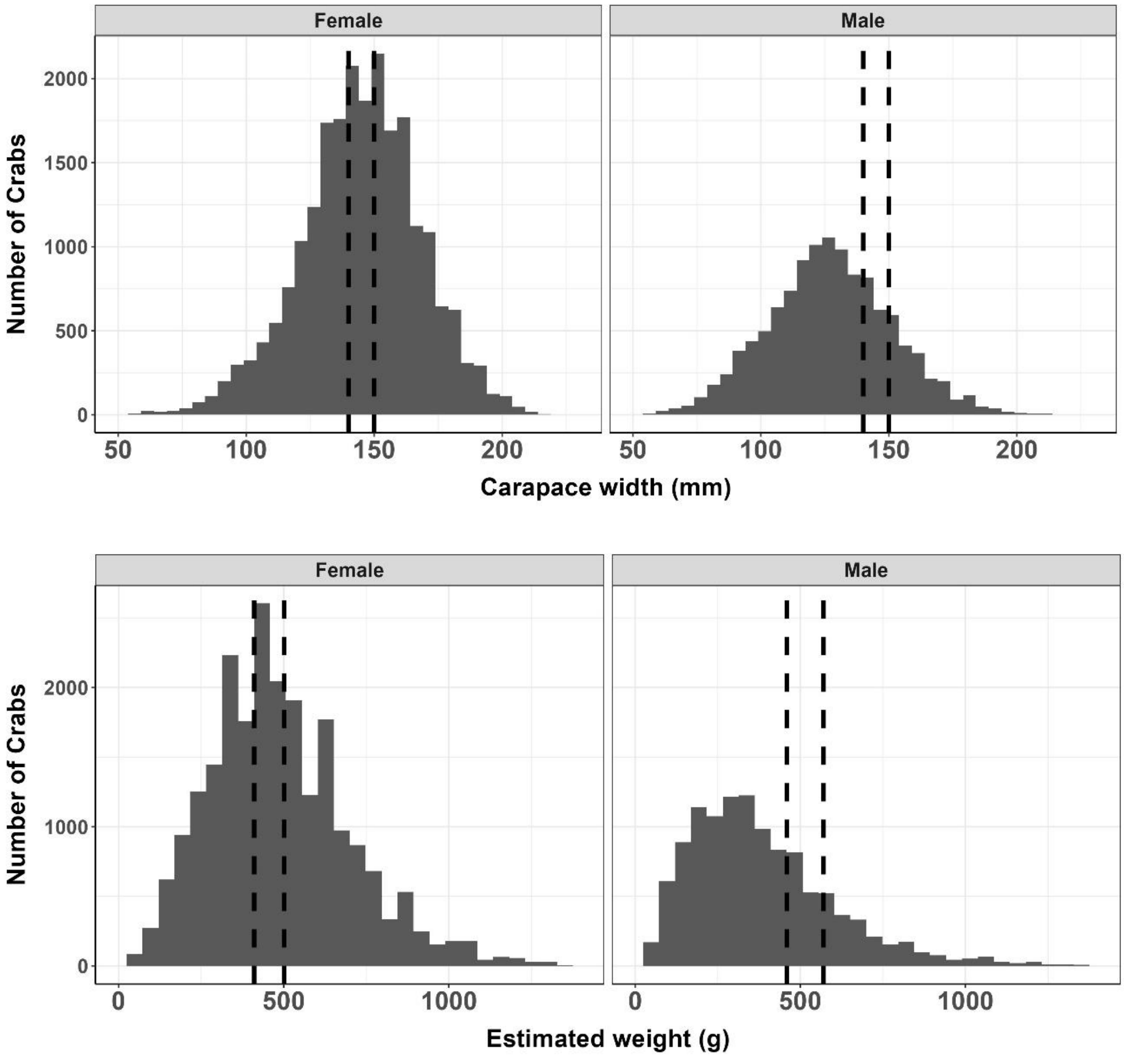

Figure 34. Size (top) and weight (bottom) frequency distributions for crabs in the catch as measured by scientific observers on board commercial vessels 2019-2023. Size was converted to weight using a weight length relationship obtained from sampling at processors.

8 Razor clam (*Ensis siliqua*)

8.1 *Management advice*

Razor clams in the Irish Sea are managed by a minimum landing size, weekly quotas and an annual TAC based on a June survey. The fishery is closed voluntarily in June. All vessels are required to report inshore Vessel Monitoring System (iVMS) data. Smaller scale fisheries on the west coast have operated successfully under voluntary management plans in recent years.

Landings in the North Irish Sea were stable between 500-650 tonnes per annum between 2021-2024. Biomass estimated from June surveys increased from 7,442 tonnes in 2021 to 8,450 tonnes in 2022 but declined to 7,300 in 2024. Using the ICES 2/3 harvest control rule, applied to the survey biomass, with penalty clause limiting annual change in landings to 20 % or less, landings should not exceed 621 tonnes (8.2 % exploitation) in the period July 1st 2024 to May 31st 2025. In Dundalk Bay, the biomass is declining as recruitment appears to be infrequent and at a low level. As exploitation rate is over double that of other production areas, a separate TAC of 144 tonnes (7.9% exploitation rate) is advised.

The South Irish Sea fishery opened in 2010 and expanded up to 2013. A strong recruitment event in Rosslare Bay, which probably occurred in 2014, was observed in the 2017 survey and biomass increased significantly between 2017 and 2020 from 2,000 to 6,300 tonnes. The biomass estimate for 2024 was 5,001 tonnes. A further 1,524 tonnes was estimated in the Curracloe bed in 2023. The ICES 2/3 rule advises landings of 139 tonnes for the period July 2024 to May 2025 when applied to the 2023 landings. This is an exploitation rate of 3.1 %.

Many razor clam fisheries or potential fisheries occur within or close to Natura 2000 sites. The conservation objectives for species and habitats in these areas are integrated into razor clam fishery management advice. In the north Irish Sea bivalve fauna caught as by-catch in the fishery occurs at very low densities in Dundalk Bay SPA relative to other areas. An area of Dundalk Bay was closed to fishing in 2023 to allow monitoring of changes in marine communities following removal of fishing pressure.

8.2 *Issues relevant to the assessment of the razor clam fishery*

Razor clams (*Ensis siliqua*) occur along the east coast of Ireland in mixed sediments from Dundalk to Dublin and from Cahore to Rosslare and in numerous areas along the west coast. A second species, *Ensis magnus*, is abundant in well sorted sands on the west coast. Both species may occur in the same area. The distribution of commercial stocks and fisheries is currently known from high frequency VMS data for the commercial fishery which operates in water depths of 4-14 m. Surveys of small areas along the west coast in 2016 provide further information on distribution of these species. Many of these areas are not currently fished. Fishing depth is limited because of the fishing method which uses hydraulically pressurised water to fluidise sediments in front of the dredge. The distribution of razor clams may extend to deeper water outside of the range of the fishery as the species occur at depths of up to 50 m. However, there is no evidence that significant biomass occurs outside of those areas already fished.

The efficiency of the hydraulic dredge used in razor clam fisheries has been measured at 90 %. The dredge, therefore, is very efficient at removing organisms in the dredge track. This is in contrast to non-hydraulic dredges used in other bivalve fisheries such as scallop and oyster where dredge efficiency may be in the region of 10-35 %. Discard mortality rates are unknown but may be significant given that damage can be observed on the shell of discarded fish and unobserved shell damage may occur at the dredge head.

Ensis siliqua is slow growing, reaches a maximum shell length of approximately 220 mm and has relatively low productivity. The apparent resilience to date of the species in areas subject to persistent fishing by highly efficient gears may possibly be explained by immigration of juvenile and adult razor clams from areas outside of the fishery. Some evidence of size stratification by depth has been shown in Wales and given the known mobility of the species suggests that post settlement movement and recruitment into fished areas may occur. *Ensis magnus* is faster growing, occurs in higher densities and reaches a smaller maximum size than *Ensis siliqua*.

Ecosystem effects of the fishery on the seafloor and on seabirds which feed on benthic bivalves is considered in the assessment advice.

8.3 *Management units*

Stock structure is unknown. Larval dispersal and movement of juveniles and possibly adults suggest that the stock structure is relatively open along the east coast of the north Irish Sea and that individual beds are unlikely to be self-recruiting. Fishing is continuous from north Dundalk Bay south to Malahide. Stocks in the south Irish Sea are likely to be separate to that north of Dublin given the different hydrodynamic and tidal regimes in the two areas.

Other isolated stocks occur in many locations on the south, west and north west coasts. Fisheries occur or have previously occurred in Clifden Bay, Ballinakill Bay, Killary Harbour, Rutland sound Co. Donegal, Waterford estuary and off Iniskea Islands and Inisbofin.

8.4 *Management measures*

New management measures were introduced for the Rosslare - Curracloe fishery in December 2014. These included an increase in MLS from 100 mm to 130 mm, fishing hours from 07:00 to 19:00, 2.5 tonne quota per vessel per week (currently 2,000 kg), 1 dredge per vessel not to exceed 122 cm width with bar spacing not less than 10 mm, prior notice of intention to fish and advance notice of landing, mandatory submission of gatherers docket information on landings, date and location of fishing and a defined fishing area to minimise overlap with Natura 2000 sites. The Rosslare Bay fishery was closed by voluntary agreement in 2017 and 2018.

In the North Irish Sea, the weekly vessel TAC is 600 kg (from January 1st 2016) with a prohibition on landing on Sundays (S.I. 588/2015). The fishery is closed by voluntary agreement in June during the spawning season.

Fisheries on the west coast have voluntary TAC arrangements in place based on survey biomass estimates and an agreed harvest rate based on an agreed protocol for new bivalve fisheries.

All vessels fishing for razor clams must have a functioning iVMS system on board and report GPS position at defined frequencies. Only 1 class of production area (A, B, C) can be fished during a fishing trip (S.I. 206/2015).

8.5 *North Irish Sea*

The North Irish Sea (NIS) fishery began in the early 1980s and quickly developed due to high quality (size) of clams in the Gormanstown bed which attracted premium prices compared to other *Ensis* species fished in Europe. There may have been 50 vessels in the fishery by 1999. Post 2003 beds at Malahide, Skerries and south Dundalk Bay were being fished in addition to the Gormanstown bed. The number of vessels in the fishery, total fishing effort and annual landings expanded significantly between 2014 and 2018. The fishery has supported over 70 vessels in recent years and landings peaked at over 1,100 tonnes and a value of approx. €6.5m in 2015. The catch is exported mainly to Asia. Unit prices vary by grade or shell size from €4-10 per kg. The fishery, relative to other shellfish, could be classed as ‘medium price and medium volume’.

The fishery occurs close to the coast in shallow sub-tidal waters along the east coast from Dundalk south to Malahide.

8.5.1 Landings

Landings increased from 274 tonnes in 2012 to over 1,100 tonnes in 2015. This was paralleled by an increase in the number of vessels from 14 in 2012 to 54 in 2015.

The number of vessels peaked in 2016-2018 to between 71 and 78 but landings declined to 600-700 tonnes in 2016-2019. Landings were ~500 tonnes in 2020 but fishing effort was low (42 active vessels) due to Covid 19 restrictions and poor market conditions. Landings were stable in 2020-2023 at ~500-600 tonnes. The Dundalk Bay and Gormanstown production areas account for most of the landings (Figure 35).

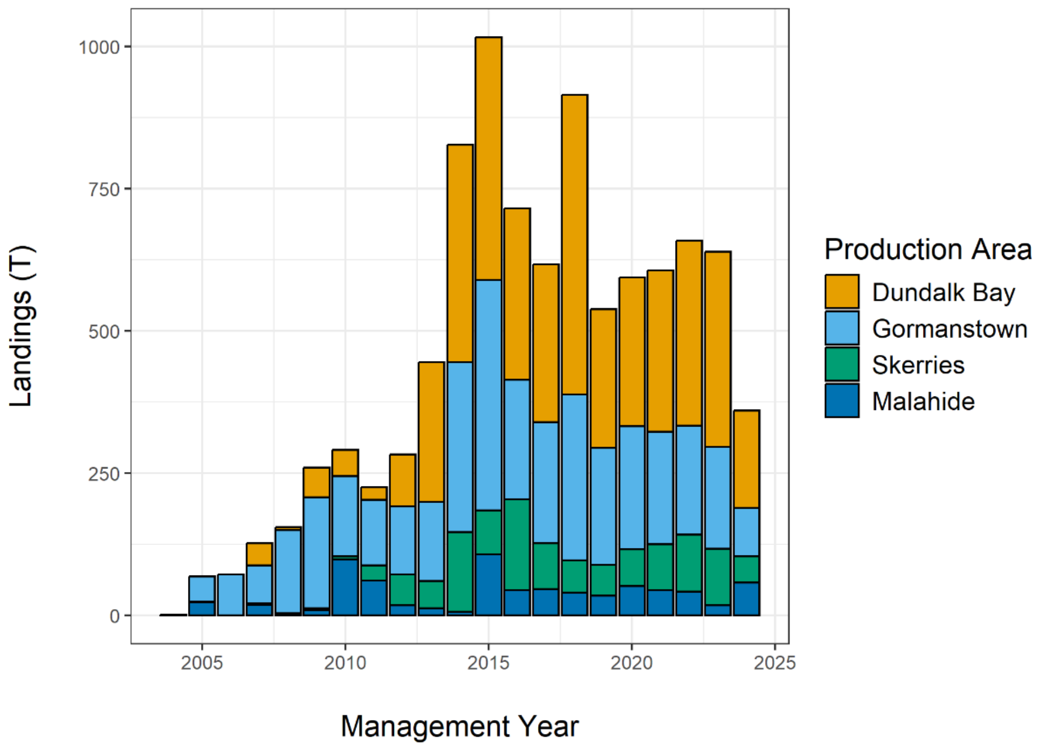

Figure 35. Annual landings of *Ensis siliqua* in the north Irish Sea (NIS) 2013-2024 sourced from SFPA logbook, and sales notes data. Data have been compiled to match the management year (July – June). Figures reported have been updated according to latest sales note data. CPA is assigned by landing harbour. The last column relating to the 2024/2025 management year is incomplete.

8.5.2 Survey 2024

A survey encompassing all of the areas which are commercially fished for razor clams in the north Irish Sea was completed in June 2024. The survey follows the same design to that used in 2017-2023 where survey effort was allocated from an iVMS grid; iVMS activity is seen as a proxy for the abundance of razor clams. The survey domain, which extended from north Dundalk Bay south to Malahide and Lambay, was divided into 5 areas with approximately 160 stations in each area allocated to each of 5 survey vessels. Within each area, 4 iVMS effort strata, of the same surface area, were defined and 50 stations were randomly assigned within each stratum, to ensure an even distribution of randomly assigned grid cells across the range of iVMS effort. The survey was completed over a 4-5 day period, depending on weather.

Biomass at each station was estimated as the product of density (number of individuals caught per meter squared towed area) and mean individual weight calculated from the size distribution at the station and a weight-length relationship. Total biomass was then estimated as the sum of mean estimated biomass, using a geostatistical (kriging) model, raised to the surface area of the cells. Ninety-five percent confidence intervals were estimated based on 250 random realisations of the modelled biomass using conditional Gaussian simulations. This method preserves the spatial structure in the biomass, as described by variograms, which modelled the spatial autocorrelation and spatial structure in the survey data.

A standardised protocol was established and applied to the NIS survey data from 2017-2024 in order to avoid potential differences in biomass estimates from year to year due to the change in the total surveyed area, the geostatistical assessments modelling routines and to control for various issues surrounding the acquisition of accurate GPS data during surveys. In this report, these protocols have been applied retrospectively and biomass estimates may, therefore, be different to those reported in previous years.

8.5.2.1 Biomass 2017-2024

Survey estimates of biomass, since surveys began in 2017, varied from 5,500 to over 9,000 tonnes.

Estimates for 2021 and 2022 were revised downwards in 2023 following a cross check between different analytical methods (Figure 36).

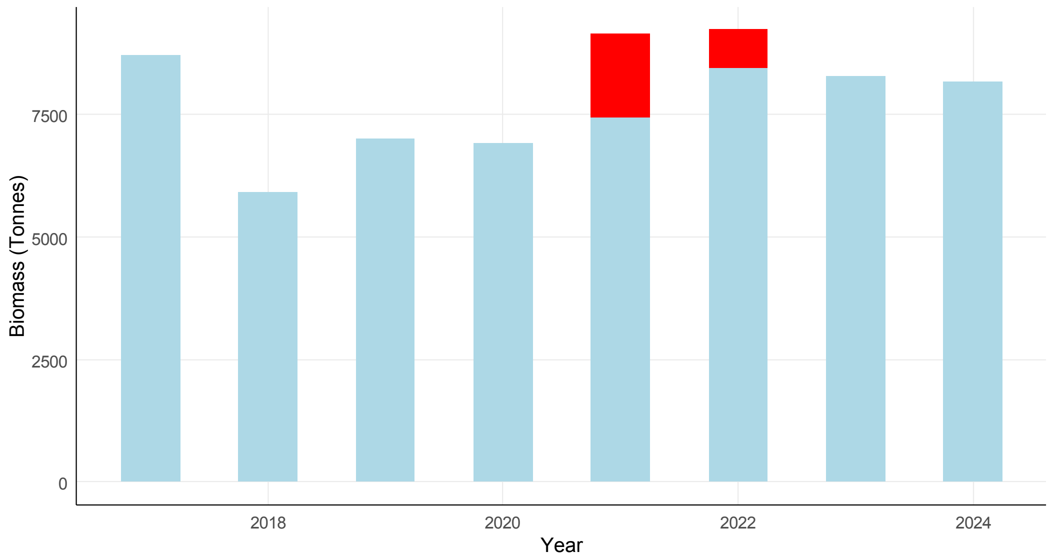

Figure 36. Survey estimates of biomass of razor clams in the north Irish Sea 2017-2024. Revised estimates for 2021-2022 following re-assessment (the revised estimates now exclude the portion shown in red).

The 2024 survey biomass, including all size classes of razors, uncorrected for dredge efficiency and which is presumed to be 100 %, varied from 0-0.82 $kgs.m^{-2}$ (Figure 37). The distribution of high density patches was similar across size ranges up to 160 mm. Razors above 180 mm and 200 mm were more abundant in the northern limit of the survey area in Dundalk and at Gormanstown, just north of Drogheda (Figure 37). The estimated total biomass in 2024 was 7,537 tonnes, with over 90 % of the total biomass above the 130 mm MLS. The trends in stock biomass of razor clams from 2017 to 2024 are displayed in Figure 38.

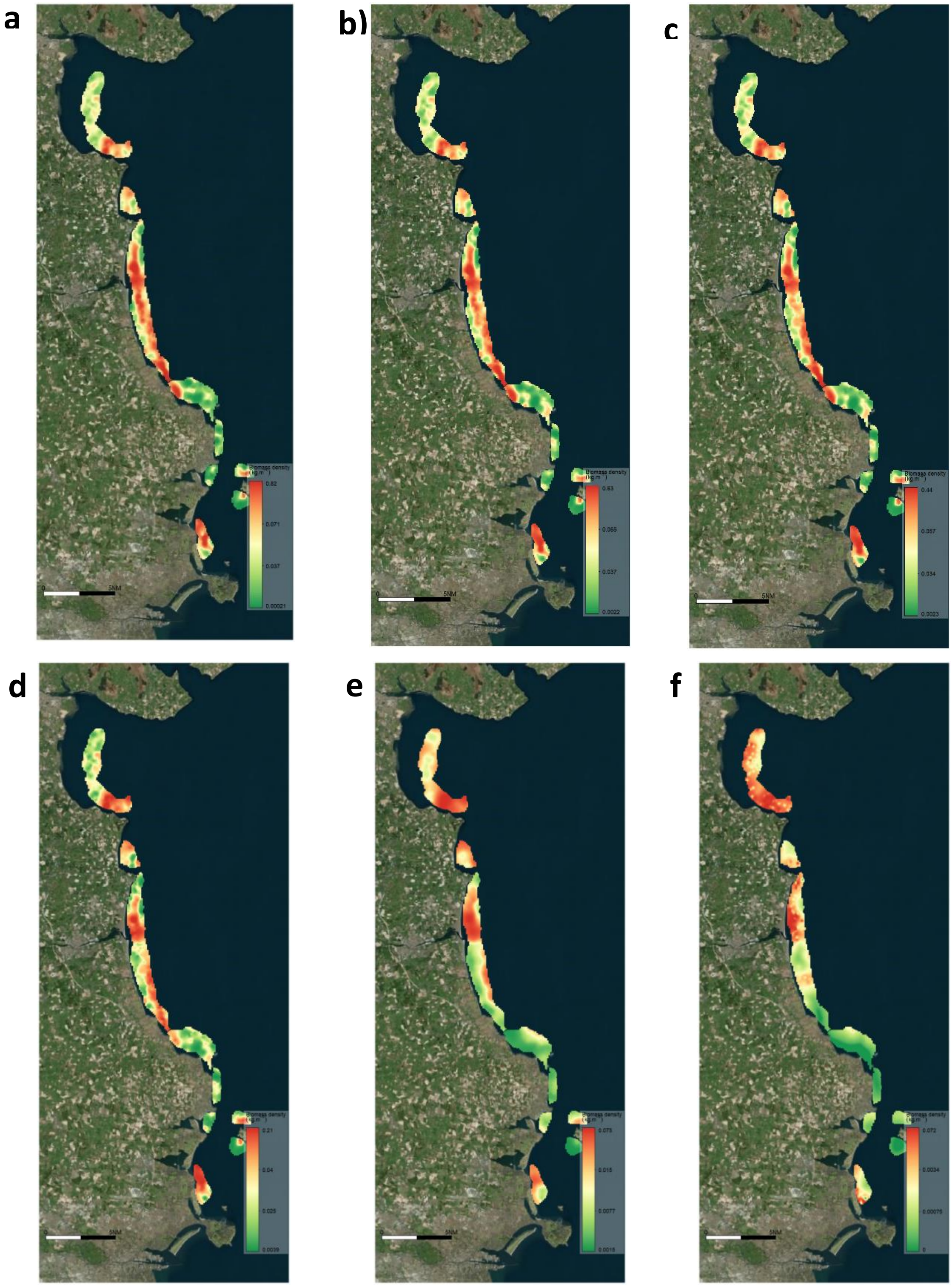

Figure 37. Distribution of *Ensis siliqua* in the North Irish Sea in June 2024 for a) all size class, b) >130 mm, c) >140 mm, d) 160 mm, e) 180 mm, f) 200 mm.

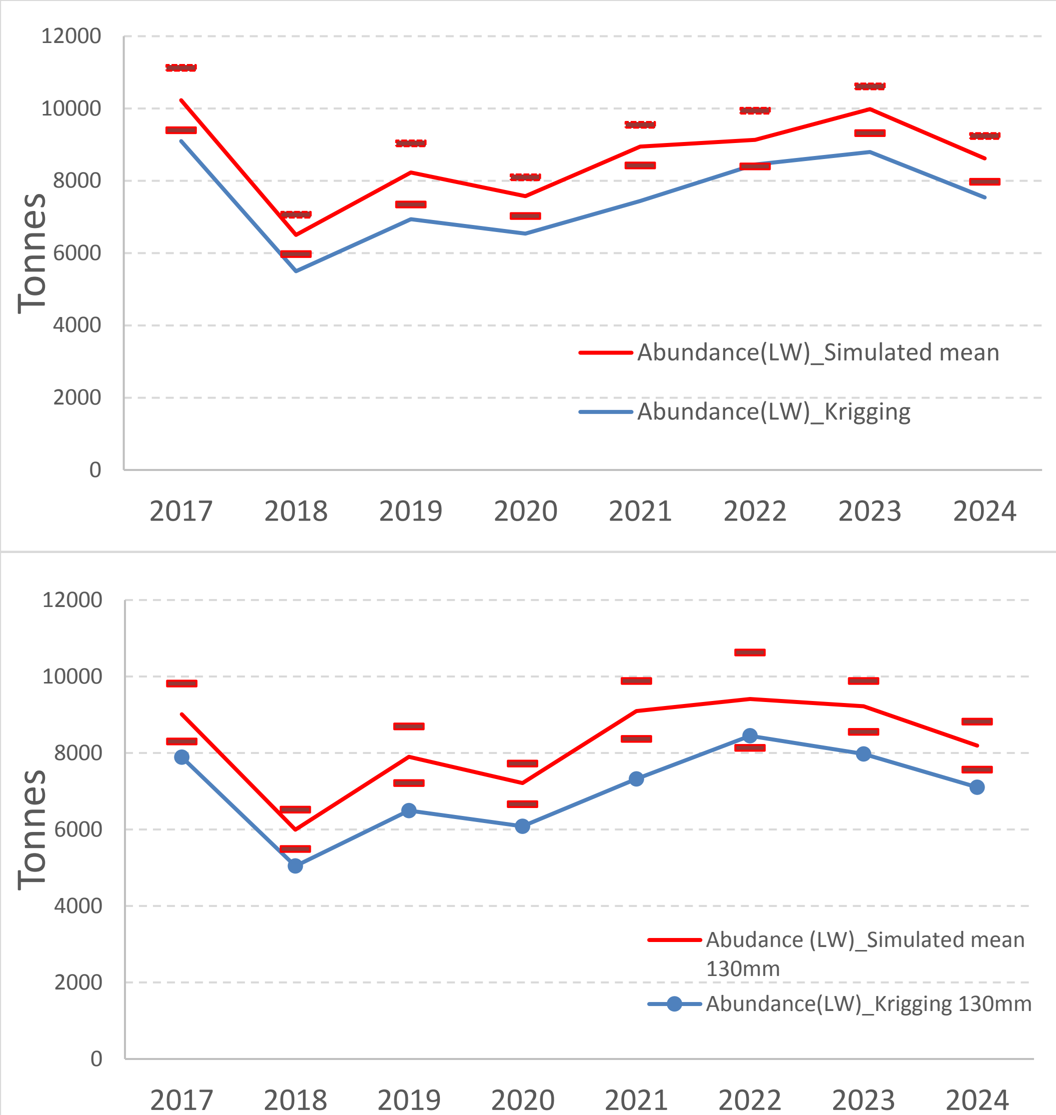

Figure 38. Trends in stock biomass of razor clams 2017-2024 in the north Irish Sea for all size classes (top) and size >130 mm (bottom). Krigging estimates are regarded as more reliable and precautionary.

8.5.2.2 Size distribution

The size distribution of razor clams in the North Irish Sea in 2024 shows a main cohort at ~130 mm as a result of the growth from the prominent 2023 mode at 100-120 mm (Figure 39). Recruitment in 2024 was also detected, although in lower numbers than in the 2023 survey. Densities of razors above the MLS of 130 mm were similar to the 2023 survey, although there was an obvious decrease in razors above 150 mm (Figure 39).

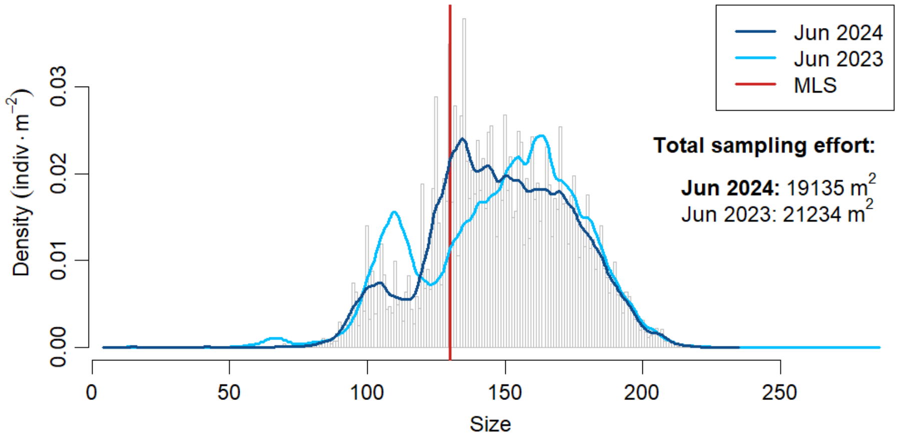

Figure 39. Size distribution of the razor clam, *Ensis siliqua* in the North Irish Sea in June 2024 and June 2023. The red line indicates the MLS of 130 mm.

8.5.3 Catch advice

The harvest control rule currently used for razor clams is the ICES 2/3 rule (ICES 2024). This is the mean survey biomass in the two most recent years (2023, 2024) divided by the mean biomass in 3 years (2020-2022) previous to that. Where this rule allows for greater than 20 % increase in landings over the previous year a 20 % precautionary cap is applied which limits annual change to 20 % of the previous year.

Table 9 shows landings, biomass, exploitation and catch rate indicators for razor clams in the north Irish Sea from 2015 to May 2024 and biomass, exploitation and catch rate indicators until July 2025. The landings in the period July 2023 to May 2024 was 626 tonnes which was 137 tonnes below the advised TAC for 2023-2024. The advised TAC for 2024-2025 is for the period July 2024 to May 2025. The 2/3 rule is applied to the 2023-2024 advice (763 tonnes). As the 2/3 rule allows for a 23 % increase in landings the 20 % cap associated with the 2/3 rule is applied. The advised TAC for 2024-2025 is therefore 621 tonnes. This represents an exploitation rate of 8.2 %.

Table 9. Landings, biomass, exploitation and catch rate indicators for razor clams in the north Irish Sea. The catch advice rules are based on ICES WKLIFE as described above.

Year	Landings (tonnes)	June Biomass (tonnes)	2/3 rule	% Exploitation	SRD data ($kg.day^{-1}$)
2015	1,100				220
2016	700				204
2017	620	9,097		6.82	186
2018	850	5,497		15.46	184
2019	630	6,936		9.08	191
2020	500	6,542		7.64	203
2021	530	**7,442**[1]		7.12	-
2022-2023	767	8,450	636	9.08	201
2023-2024	626	8,794	763	8.68	
2024-2025		7,537	623	8.24	

1: biomass revised in 2023.

The 2/3 advice rule is looking at changes in biomass only and not in size and age structure. As the value of clams is significantly correlated to size (grade) managing outtake so that the biomass of larger size grades is optimised by balancing fishing mortality and growth would be a better basis for advice. Development of this advice will involve obtaining new data on the biological parameters of razor clams.

8.5.1 Production Areas

The area covered by the North Irish Sea Razor Clam fishery is divided into four Classified Production Areas (CPA); Dundalk, Gormanstown, Skerries and Malahide (Figure 40).

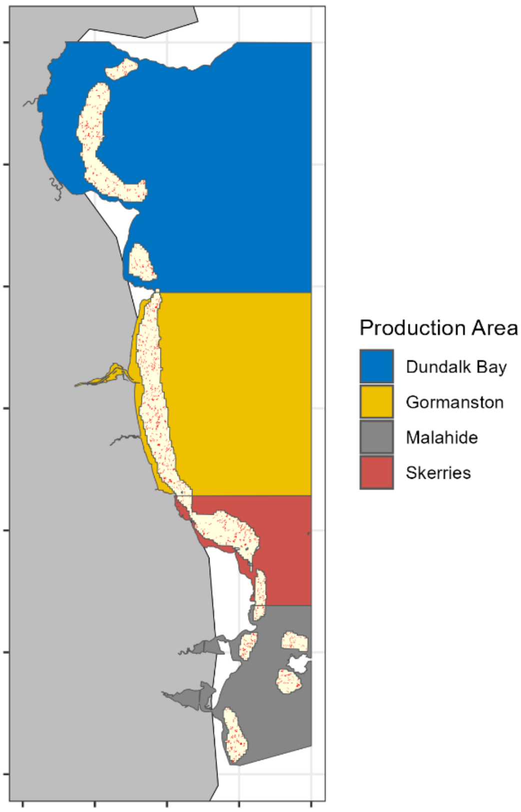

Figure 40. Survey area (yellow) by CPA (filled colours) and GPS tracks (red) in the North Irish Sea in June 2024.

8.5.1.1 Biomass by Classified Production Area (CPA)

Total biomass across all size classes of razor clams increased from 2018-2024 in Skerries and Gormanstown. Biomass in Dundalk decreased from 2022-2024 and decreased in Malahide from 2023 to 2024 (Figure 41). The decrease in Malahide could be a survey effect and future surveys will confirm if that trend continues. Although overall biomass was highest in Gormanstown and Dundalk CPAs, as these are the largest CPAs, densities (clams.kgs.m^{-2}) were highest in Malahide and Skerries for clams up to 180 mm. The estimated total biomass summed across CPAs in 2024 was 8,165 tonnes, 61 % of which was located in Dundalk Bay and Gormanstown CPAs (Table 10). The estimated biomass is higher than the biomass reported from the 2024 survey (Figure 36) because of the inclusion of an area in north Dundalk Bay. The 2024 survey did not include this area in the biomass estimate to allow for comparison with previous years' surveys, 2017-2023.

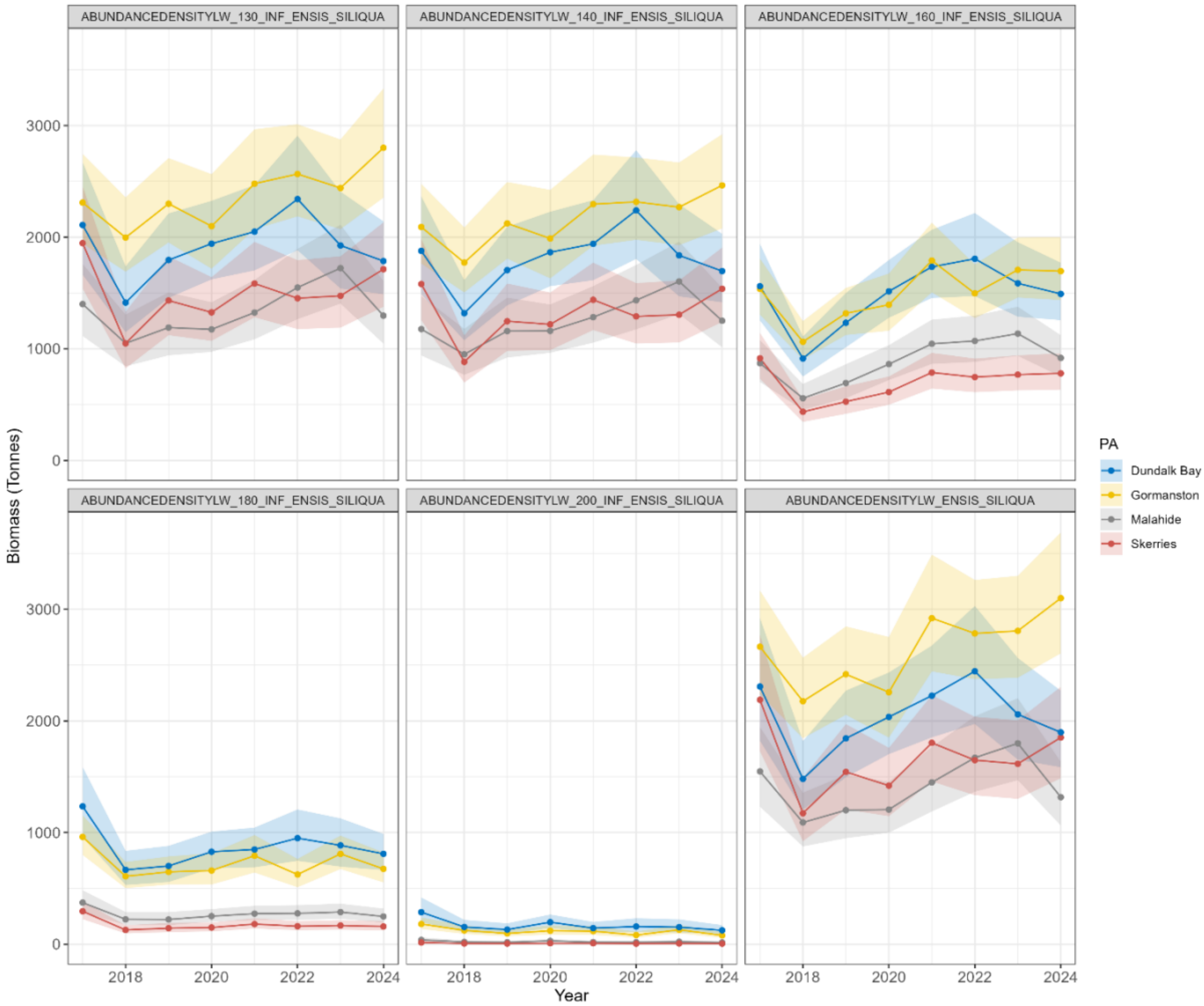

Figure 41. Trends in biomass (tonnes) from the NIS razor clam survey by production area (colours) and grade between 2017-2024.

Table 10. Estimated biomass of razor clams (Tonnes) by year (July/June of each year) and CPA.

CPA	2017	2018	2019	2020	2021	2022	2023	2024
Dundalk Bay	2,308	1,481	1,843	2,036	2,226	2,445	2,059	1,898
Gormanstown	2,664	2,176	2,418	2,257	2,920	2,783	2,806	3,099
Malahide	1,548	1,090	1,200	1,206	1,449	1,670	1,799	1,317
Skerries	2,189	1,173	1,543	1,420	1,803	1,649	1,616	1,851
Total	8,708	5,920	7,005	6,918	8,399	8,547	8,280	8,165

8.5.1.2 Size distribution and recruitment by Classified Production Area

The size distribution data from the surveys shows recruitment of clams into size classes <130 mm is more frequent in Gormanstown than in other CPAs (Figure 42). Significant recruitment was evident in 2024, 2023, 2021 and 2017 in Gormanstown. In contrast, significant recruitment was evident in Dundalk in 2017, 2020 and to a lesser extent in 2023. Malahide and Skerries only showed signs of recruitment in 2021.

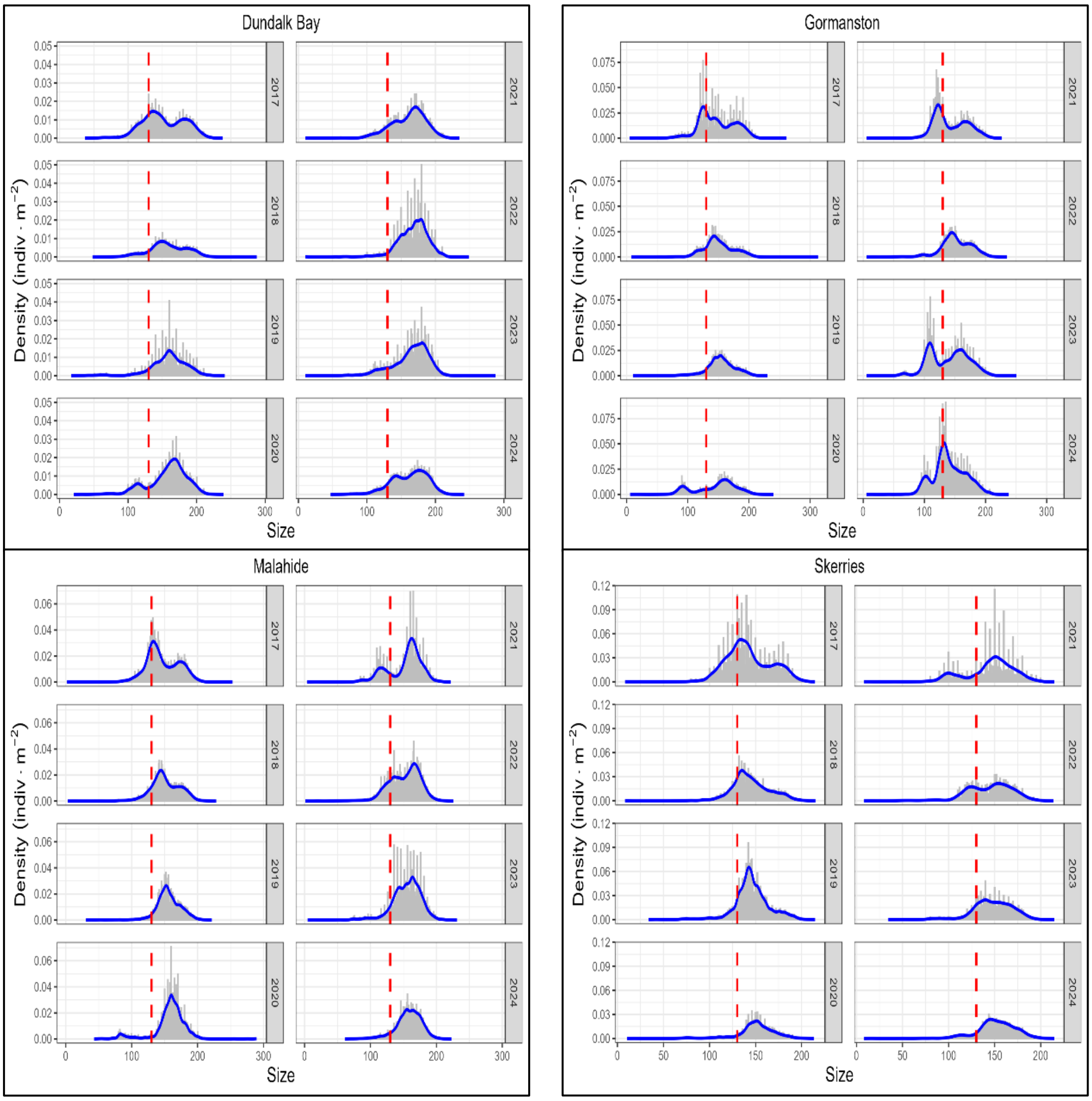

Figure 42. Size distribution (*Individuals.m*$^{-2}$) of the razor clam, *Ensis siliqua* in the north Irish Sea by classified production area (2017-2024). Data are standardised to sampling effort regardless of its spatial distribution. MLS at 130 mm as dashed red line.

8.5.1.3 Landings and Exploitation by Classified Production Area

Landings were collated for 2017-2024 at CPA level from Logbooks (for vessels>10m in length) and Sales Notes (for vessels <10 m in length) (Table 11). The landings data are identifiable to harbour rather than CPA (the CPA is identified in the shellfish registration dockets but these data were not available). Landings into harbours are generally assumed to come from the CPA in which the harbour is located. Landings into Clogerhead, however, which is in Dundalk CPA, could also come from Gormanstown CPA. The iVMS data was used to estimate the proportion of activity of Clogherhead boats in the Dundalk and Gormanstown CPAs. Over the time series, approximately 15 % of the effort of Clogerhead boats occurred in Gormanstown. This percentage of landings into Clogerhead was attributed to Gormanstown CPA and the remaining 85 % was attributed to Dundalk CPA.

Landings are presented per management year, or the period in which the total allowable catch (TAC) applies which is from July of one year to May the next. The fishery is closed in June.

Overall landings peaked in the management year 2019 (July 2018-May 2019) at 912 tonnes with 57 % of the total landings coming from Dundalk CPA. A sharp decrease in landings occurred in

Dundalk CPA from 526 in 2019 to 243 in 2020 but increased from 2021 to 2024. Landings in Gormanstown declined from 2021 and increased in Skerries. Overall landings in Malahide were low (Table 11).

Exploitation rates (proportion of the biomass estimated in June and landed in the subsequent July to May period) were significantly higher in Dundalk compared to other CPAs peaking at 35 % in 2018-2019 and increasing from 11 % to 17 % between 2022 and 2024. By comparison exploitation rates averaged 3-13 % in other areas.

Table 11. Landings (Tonnes) by CPA and management year (July to May). Source: Logbooks (Vessel >10 m) and Sales Notes (Vessels <10 m). 15 % of the landings into Clogerhead port were attributed to Gormanstown CPA based on iVMS effort.

CPA	Management year							
	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
Dundalk Bay	301	278	526	243	265	283	325	339
Gormanstown	210	212	292	204	216	197	189	177
Malahide	44	50	36	34	53	45	41	17
Skerries	160	81	57	54	66	87	101	101
Total	714	621	912	536	600	613	656	634

8.5.1.4 Catch Advice by Classified Production Area

Exploitation rates over the time series were far higher in the Dundalk Classified Production Area than in other CPAs (Table 12). While biomass is stable or increasing in other CPAs, biomass in Dundalk decreased from 2022. Exploitation rate peaked at 35 % in Dundalk Bay in 2019, was stable at about 13 % during 2021-2023 and increased to 16 % in 2024. This compares to an average of 4.8 % in other CPAs during 2022-2024. While the biomass of large razors (>160 mm) is more abundant in Dundalk than in other areas, biomass of razor clam below 160 mm is lower than in all other CPAs and overall biomass is declining. High exploitation rates in Dundalk have been sustained by previous recruitment events but no significant recruitment has been observed in recent years. Considering the unpredictability of recruitment events, the increasing trends in exploitation rates, decreasing survey biomass estimates and the low densities of razors below 160 mm, exploitation rates in Dundalk should be reduced.

Table 12. Exploitation rate by CPA (Landings divided by survey biomass estimate).

CPA	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
Dundalk Bay		12.05	35.56	13.20	13.03	12.71	13.29	16.46
Gormanstown		7.97	13.44	8.45	9.58	6.76	6.78	6.30
Malahide		3.22	3.35	2.87	4.41	3.14	2.45	0.96
Skerries		3.68	4.83	3.49	4.61	4.80	6.12	6.23

The ICES 2/3 harvest control rule for assessment poor stocks with no reference points allows for 300 tonnes landings from Dundalk given a biomass ratio in the last 2 years compared to 3 years prior to that of 0.88. Given the absence of recruitment, declining biomass and reports of significantly lower catch rates in 2024, this does not seem precautionary. Average catch advice based on the average catch in the time series provides similar advice. The average exploitation rate in Gormanstown in the past 5 years of 7.4 % resulted in biomass increase, stability in densities of clams and growth progression into larger grades. Applying this exploitation rate to Dundalk would reduce landings from 339 tonnes in 2023-2024 to 140 tonnes in 2024-2025 (Table 13). Gormanstown would increase from 177 to 229 tonnes. Malahide would increase from 17 to 98 tonnes. Skerries would increase from 101 to 136 tonnes. This rule would therefore implement more even distribution of fishing effort across the stock distribution area and reduce the recent increase in fishing effort in Dundalk Bay. Overall landings would be similar to the management year 2023-2024.

Table 13. Catch advice for the North Irish Sea razor clam fishery by CPA for July 2024 to May 2025 for 3 different harvest control rules.

CPA	Harvest rule		
	2/3 rule	Average catch	7.40% all CPAs
Dundalk Bay	300	320	140
Gormanston	197	212	229
Malahide	19	40	98
Skerries	107	88	137
Total	623	661	604

8.6 South Irish Sea

8.6.1 Landings

The fishery in the south Irish Sea opened in 2010. Landings increased from 50 tonnes to 100 tonnes in management years 2011 and 2012 and peaked at over 200 tonnes in 2016. Landings declined from 2016 to 2019, but increased in 2020 to 150 tonnes, mostly from Curracloe (Figure 43). Landings in 2021 were about 110 tonnes and approximately 80-190 tonnes between 2022 and 2024. The Waterford estuary fishery was closed by court order in 2019.

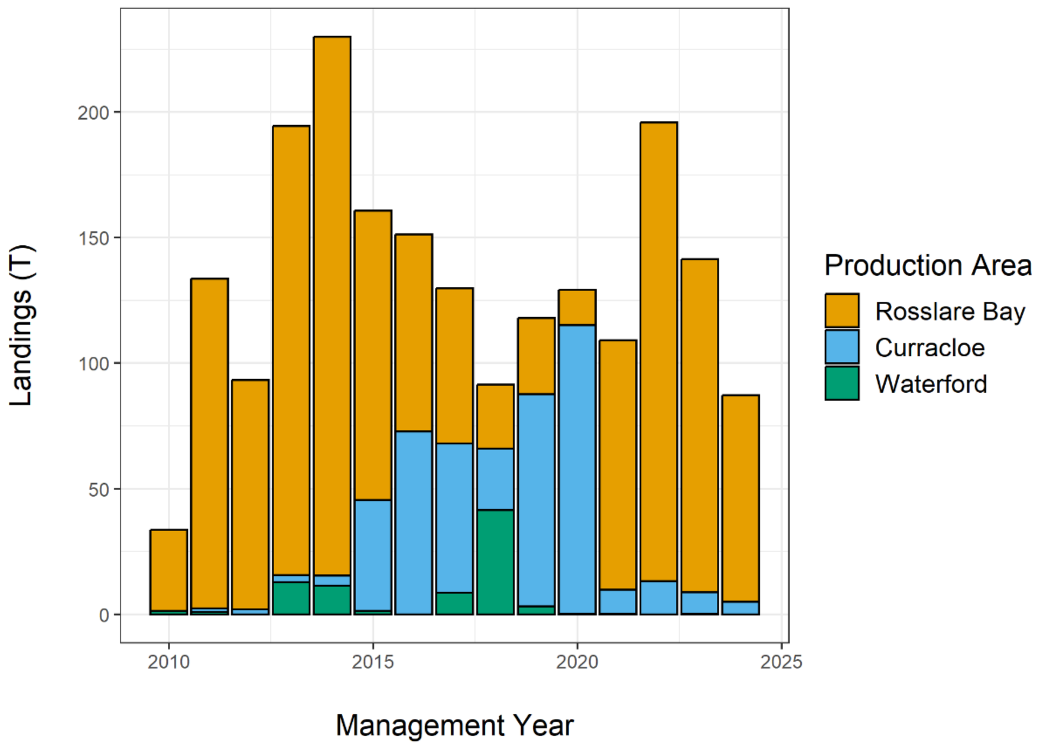

Figure 43. Landings (tonnes) of *Ensis siliqua* in the south Irish Sea (2010-2024) sourced from SFPA logbook and sales notes data. Data have been compiled to match the management year (July – June). Figures reported have been updated according to latest sales note data. CPA is assigned by port of landing. The last column relating to the 2024-2025 management year is incomplete.

8.6.2 Survey data

Stocks of razor clams in the South Irish Sea are distributed in two main beds; Rosslare Bay and north along the east coast of Wexford at Curracloe. With the exception of the southern limit of the Curracloe Bed, the distribution of razor clams is well known, and the full extent of the beds are included in both surveys where possible.

8.6.2.1 Rosslare Bay

The razor bed of Rosslare was surveyed on the 17th September 2024. A total of 43 tows were undertaken, with a single hydraulic dredge of width 1.25 m. The survey encompassed a total area of 11.9 km^2 and a total sampling effort of 1,432 m^2 (Table 14, Figure 44). Biomass of all size classes of razors, assuming a dredge efficiency of 100 %, varied from 0-1.3 $kgs.m^{-2}$. The biomass estimate in 2024 was 3,420 tonnes, the majority of which (91 %) was above the 130 mm MLS.

Table 14. Estimates of biomass of razor clams in Rosslare Bay in September 2024.

Ensis siliqua	Biomass		95% HDI inf	95% HDI sup
	Mean	Median		
Biomass_*Ensis siliqua*	3,420.4	3,411.3	2,873.9	4,047.6
Biomass_>130mm_*Ensis siliqua*	3,130.7	3,136.3	2,546.6	3,795.8
Biomass_>150mm_*Ensis siliqua*	1,041.0	1,049.5	877.4	1,226.9

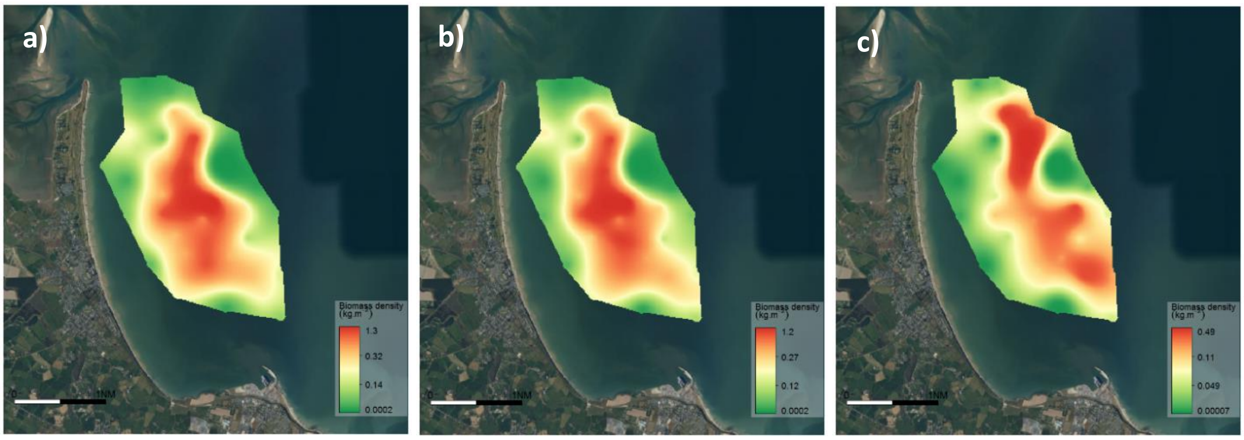

Figure 44. Distribution of *Ensis siliqua* in Rosslare Bay in in 2024, a) all size class, b) >130 mm and c) >150 mm.

The size distribution of razor clams in 2024 showed a decrease in densities and an increase in the modal size compared to the survey carried in 2023 (Figure 45). No evidence of any significant recruitment was found as densities of small razor clams were low. Biomass increased from 2017 to 2019 was stable from 2019 to 2022 and declined between 2022 and 2024 (Figure 46).

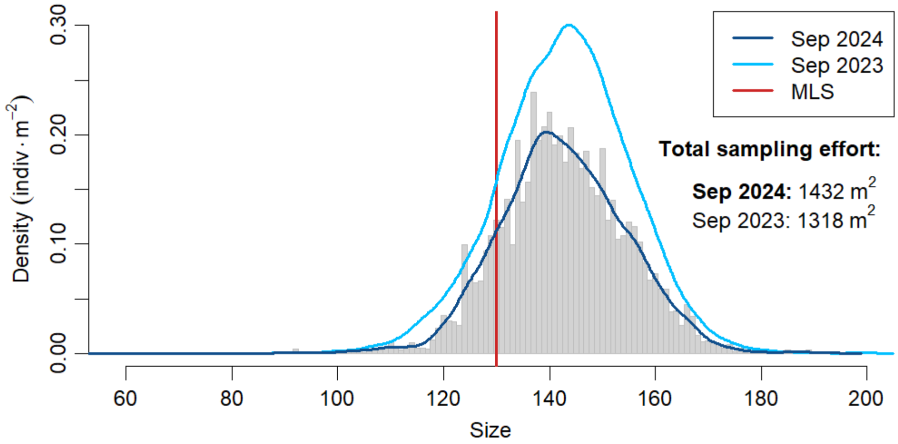

Figure 45. Size distribution of razor clams (*Ensis siliqua*) in the Rosslare Bay 2024 with size data from 2023 for comparison. Data are standardised to sampling effort regardless of its spatial distribution.

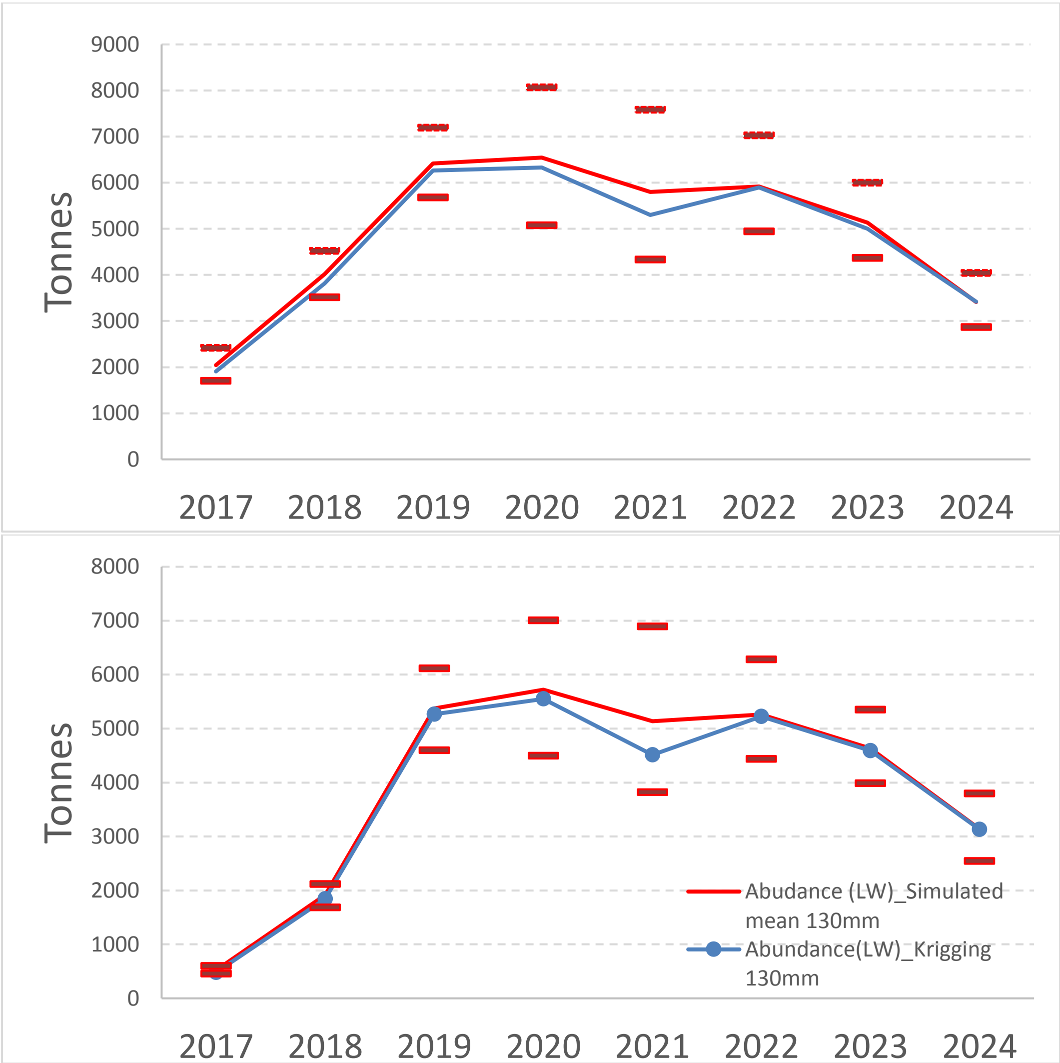

Figure 46. Estimates of biomass of razor clams (*Ensis siliqua*) in Rosslare Bay in 2017-2024 for all size classes (top) and size >130 mm (bottom).

8.6.2.2 Curracloe

The razor bed off Curracloe was surveyed on the 15th and 16th September 2024. A total of 53 tows were undertaken, with a single toothless dredge of width 1.25 m. The survey encompassed a combined area of 16.6 km^2 and a total sampling effort of 2,033 m^2 (Figure 47). The survey area in 2024 is similar to 2021 and 2023. In the 2022 survey, the southern limit of the Curracloe bed could not be sampled, and thus, the biomass estimate from 2022 is not comparable (Figure 49).

Biomass of all size classes of razors varied from 0-0.23 $kgs.m^{-2}$ (Figure 47). Distribution of high density patches is similar across size ranges and occurred in the centre and south limit of the surveyed area (Figure 47). The estimated biomass was 948.9 tonnes, the majority of which (96 %) was above the 130 mm MLS (Table 15).

The size distribution of razor clams in Curracloe in 2024 resembles the size distribution of the 2023 survey, but with lower densities (Figure 48). There was no evidence of recent recruitment.

Table 15. Estimates of biomass of razor clams at Curracloe in September 2024.

Ensis siliqua	**Biomass**		**95% HDI inf**	**95% HDI sup**
	Mean	**Median**		
Biomass_*Ensis siliqua*	948.9	947.7	808.6	1,071.8
Biomass_>130mm_*Ensis siliqua*	913.3	913.7	798.7	1,048.2
Biomass_>150mm_*Ensis siliqua*	731.2	729.7	610.9	855.8

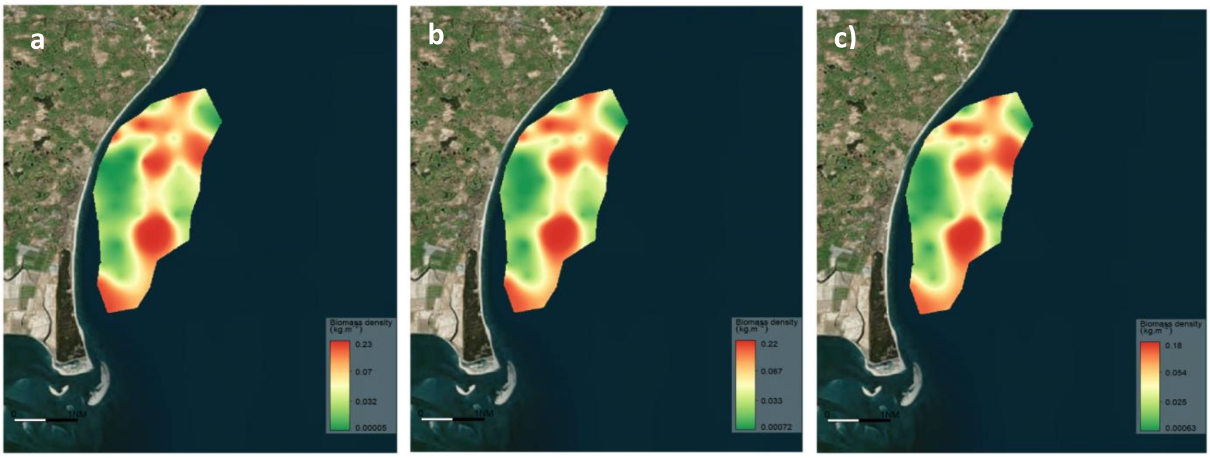

Figure 47. Distribution of *Ensis siliqua* in Curracloe in 2024, a) all size class, b) >130 mm and c) > 150 mm.

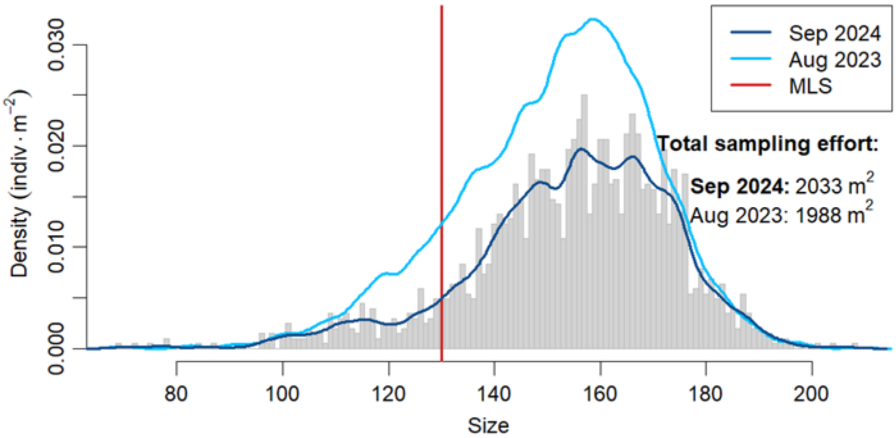

Figure 48. Size distribution of razor clams (*Ensis siliqua*) in Curracloe for 2023 and 2024. Data are standardised to sampling effort regardless of its spatial distribution.

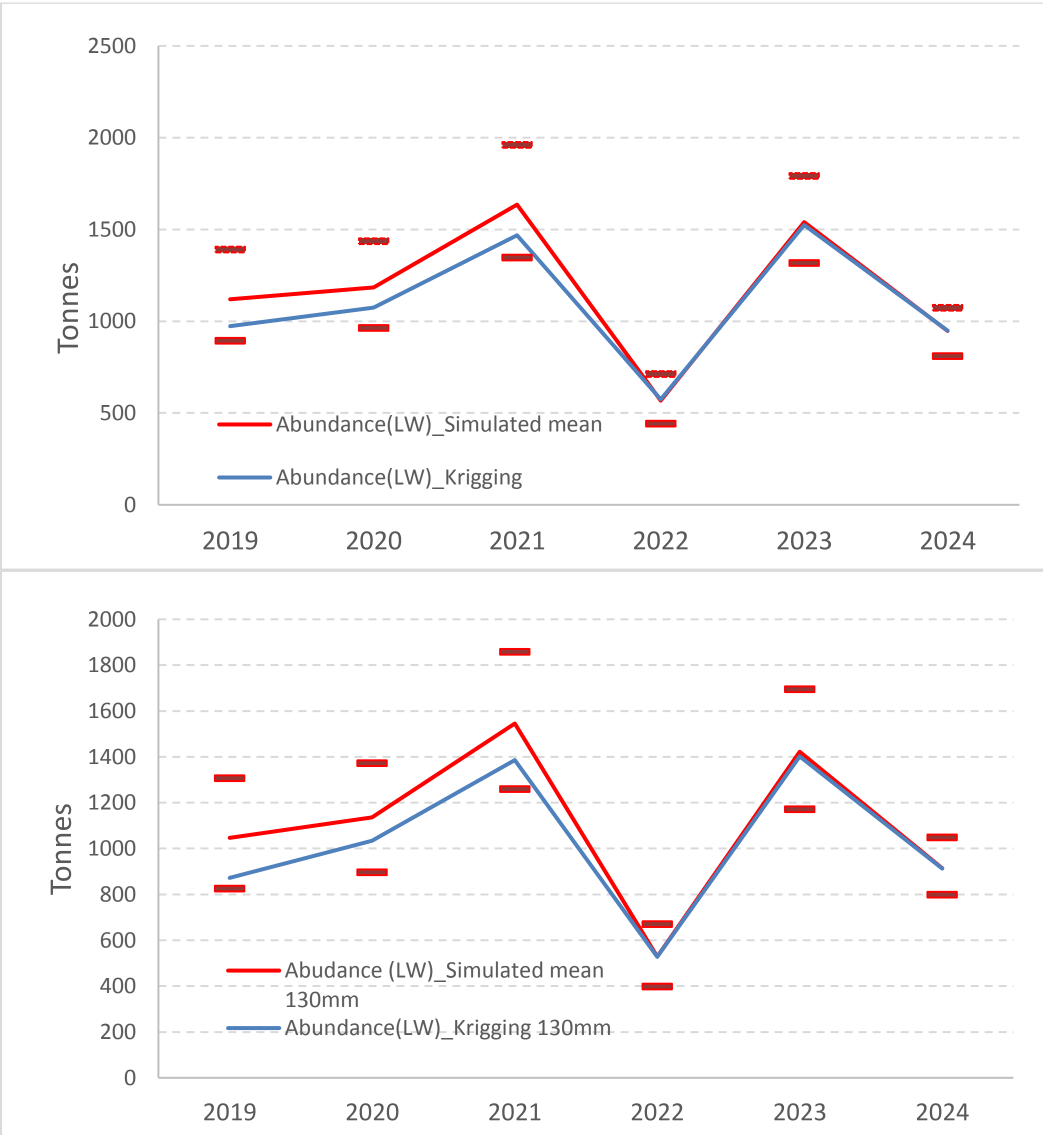

Figure 49. Estimates of biomass of razor clams (*Ensis siliqua*) in Curracloe combined in 2019-2024 for all size classes (top) and >130 mm (bottom). The southern edge of the beds was not surveyed in 2022.

8.6.3 Catch advice

Landings for the previous advice period of July 2023 to May 2024, was 168 tonnes (Table 16) compared to an advised landing of 173 tonnes. The advised landings from the management year 2024-2025 based on the ICES 2/3 rule is 139 tonnes and an exploitation rate of 3.1%. Advised landings are decreasing in line with the decline in biomass.

Table 16. Landings, biomass and exploitation rate of razor clams in the south Irish Sea 2017-2024.

Year	Landings	Total	2/3 catch advice	% Exploitation
2017	130	1,907		6.82
2018	100	3,818		2.62
2019	70	7,240		0.97
2020	160	7,404		2.16
2021	30	6,767		0.44
2022	125	6,463		1.93
Mid 2022-Mid 2023	185	6,463		2.86
Mid 2023-mid 2024	168	6,525	173	2.65
Mid 2024-mid 2025		4,369	139	3.10

9 Cockle (*Cerastoderma edule*)

9.1 *Management advice*

The Dundalk Bay cockle fishery is managed under a Fisheries Natura (management) Plan (FNP) which is a legal mechanism to incorporate environmental protection measures into fisheries management plans when such fisheries occur in Natura 2000 sites.

No fishing occurs at a biomass less than 1,000 tonnes. TACs of 17-33 % of biomass apply when biomass is over 1,000 tonnes. The fishery closes on November 1st or if the average catch per boat per day, over a 5day period, declines below 250 kg. The operational minimum landing size is 22 mm shell width. A quota of 1 tonne per vessel per day, for 28 permit holders, is in force. The permitted vessels carry iVMS on board.

The stock is assessed by annual survey. Trends in other ecosystem indicators (benthic habitats, bird populations) are integrated into management advice and the FNP. The zero TAC at a biomass <1,000 tonnes is to provide spawning stock for the following Autumn and Spring spawning seasons and to protect food sources for overwintering oystercatchers.

Pre-fishery survey estimate of cockle biomass in 2024 was 1,495 tonnes, a decrease of 1,131 tonnes on the 2023 biomass (2,603 tonnes). The TAC was 500 tonnes in 2024 of which ~98 tonnes was landed. In November 2024 a post-fishery survey was undertaken in the highest density areas recorded during the pre-fishery summer survey. Cockle biomass was 202 tonnes in Nov compared to 797 tonnes for the same area in May. This represents a non-fishery related loss of ~459 tonnes.

The harvest control rules in the 2021-2025 FNP should be implemented annually. The FNP will be reviewed in 2025. The estimation of post fishery cockle biomass should continue given the unexpectedly low post fishery biomass in 2024 which suggests that high non-fishing related mortality occurs during the summer and early autumn.

Maintenance of favourable conservation status of intertidal habitats in which cockle fisheries occur is a primary management objective in order to reduce the risk of future recruitment failure and to ensure that conservation objectives for designated habitats and species are protected. Any cockle fisheries in other SACs or SPAs should be subject to management plans before they are opened because of their potential effects on habitats and birds.

9.2 *Issues relevant to the assessment of the cockle fishery*

There are a number of cockle beds around the Irish coast, however, in recent years the main fishery has occurred in Dundalk Bay.

Recruitment of cockles in Dundalk Bay occurs regularly but overwinter survival is highly variable. As a consequence, biomass in some years is insufficient to support a fishery. In most areas growth rates are lower than in Dundalk and cockles need to survive over 2 winters to reach commercial size compared to 1 winter in Dundalk.

Annual surveys, provided they are completed close to the prospective opening date for the fishery, provide good estimates of biomass available to the fishery and the prospective catch rates. Growth and mortality result in significant changes in biomass over short periods of time. Reference points for sustainable outtakes are unknown. In the case of Dundalk the harvest rules applied since 2007 seem to have stabilised stock biomass and maintained productivity.

Dundalk Bay is under a Natura 2000 site management regime and a fishery Natura plan for cockles. Cockle is both a characterising species of designated habitats within these sites and also an important food source for overwintering birds. Management of cockle fisheries takes into account the conservation objectives for these habitats and species.

Continuing commercial fisheries for cockles in Natura 2000 sites will depend on favourable conservation status of designated environmental features that may be affected by this fishing activity or a clear demonstration that changes to designated features are not due to cockle fishing.

9.3 *Management units*

Cockle stocks occur in intertidal sand and mud habitats. These habitats occur as isolated and discrete areas around the coast and as a consequence cockle stocks are probably local, self-recruiting populations.

Although there are many cockle populations around the coast, only Dundalk Bay has supported commercial dredge fisheries in recent years. There is a small scale commercial hand gathering fishery in Castlemaine Harbour (Kerry) and in Drumcliffe Bay (Sligo). Stocks also occur in Tramore Bay and Woodstown (Waterford) and in Clew Bay (Mayo), but these stocks have not been commercially fished in recent years. In addition, cockle stocks occur in Mayo outside of Clew Bay, Kerry, Sligo, and Donegal in particular, but these have not been surveyed and are not commercially fished.

9.4 *Management measures*

The management measures for the Dundalk fishery are described in 5 year Fishery Natura plans (FNPs; 2011-2016, 2016-2020, 2021-2025) and harvest rules are implemented through annual legislation in the form of Natura Declarations (www.fishingnet.ie). These plans were subject to screening and appropriate assessment as required by the EU Habitats Directive Article 6 and the EU Birds and Habitats Regulations (S.I. 290 of 2013).

In Dundalk Bay a cockle permit is required to fish for cockles either by vessel or by hand gathering. The number of vessel permits is limited to 28 (formerly 33).

Annual TAC is set according to harvest control rules set out in the FNP and based on the biomass estimated from a mid-summer survey. The fishery closes if the average catch per boat per day declines to 250 kg even if the TAC is not taken. This provides additional precaution given uncertainty in the survey estimates. Opening and closing dates are specified annually. The latest closing date of November 1st is implemented even if the TAC has not been taken or if the catch rate remains above the limit for closure. Vessels can fish between the hours of 06:00 and 22:00. Maximum landing per vessel per day is 1 tonne. Dredge width should not exceed 0.75 m in the case of suction dredges and 1.0 m for non-suction dredges. The national minimum legal landing size is 17 mm but operationally and by agreement of the licence holders the minimum size landed in Dundalk Bay is 22 mm. This is implemented by using 22 mm bar spacing on drum graders on board the vessels.

Environmental performance indicators are reviewed periodically as part of the management plans and the prospect of an annual fishery depends on evidence that there is no causal link between cockle fishing and in particular the abundance of oystercatcher and other species of bird that feed on bivalves and the status of characterising bivalve species in intertidal habitats.

9.5 Dundalk Bay

9.5.1 Biomass and landings 2007- 2024

Biomass estimates from annual surveys in 2007-2024 are not strictly comparable because of differences in the time of year in which surveys were undertaken (Table 17). The annual biomass estimates are sensitive to the timing of in-year settlement and seasonal mortality of established cohorts relative to the time in which the surveys are undertaken. Nevertheless, since 2009 surveys have been undertaken either in May, June or July.

Biomass has varied from a low of 814 tonnes in 2010 to 3,790 tonnes in 2019. Biomass increased annually between 2014 and 2017 from 972 tonnes to 2,316 tonnes and was between 3,420-3,790 tonnes in 2019-2020. The biomass in 2022 decreased by 100 tonnes on the previous year of 2021. The 2023 biomass increased by approximately 800 tonnes on the 2022 biomass. In May 2024 the cockle biomass was estimated to be 1,495 tonnes. No fishery occurred when the biomass was less than 1,200 tonnes (e.g. 1,032 tonnes in 2015). In years when the fishery is opened the TAC uptake has varied from 15 % (2009) to 100 % (2017-2021). This depends on distribution of biomass and the commercial viability of fishing and market prices. The TAC was lower than allowed for in the fishery plan in 2020 by agreement with industry.

Table 17. Annual biomass, TAC and landings of cockles in Dundalk Bay 2007-2023.

Year	Survey Month	Biomass (tonnes)		TAC (tonnes)	Landings (tonnes)	
		Mean	95% CL		Vessels	Hand gatherers
2007	March	2,277	172	950	668	Unknown
2008	August	3,588	1,905	0	0	0
2009	June	2,158	721	719	108	0.28
2010	May	814	314	0	0	0
2011	May	1,531	94	510	325	0.25
2012	May	1,234	87	400	394	9.4
2013	June	1,260	99	416	343	0
2014	June	972	188	0	0	0
2015	June	1,032	100	0	0	0
2016	July	1,878	87	626	410	0
2017	June	2,316	95	772	775	0
2018	June	1,785	175	542	446	0
2019	July	3,790	110	600	594	0
2020	June	3,420	810	1,128	1,128	0
2021	June	1,927	406	642	638	0
2022	May	1,826	375	608	0	0
2023	May	2,603	527	867	867	0
2024	May	1,495	487	500	98.3	0

9.5.2 Pre fishery Survey in 2024

9.5.2.1 Biomass

A pre-fishery survey was completed in late May 2024. The survey area was 30.4 km^2. Total biomass was 1,495 tonnes (Table 18) based on a geostatistical model. Biomass of cockles over 22 mm was 1,043 tonnes (Figure 50).

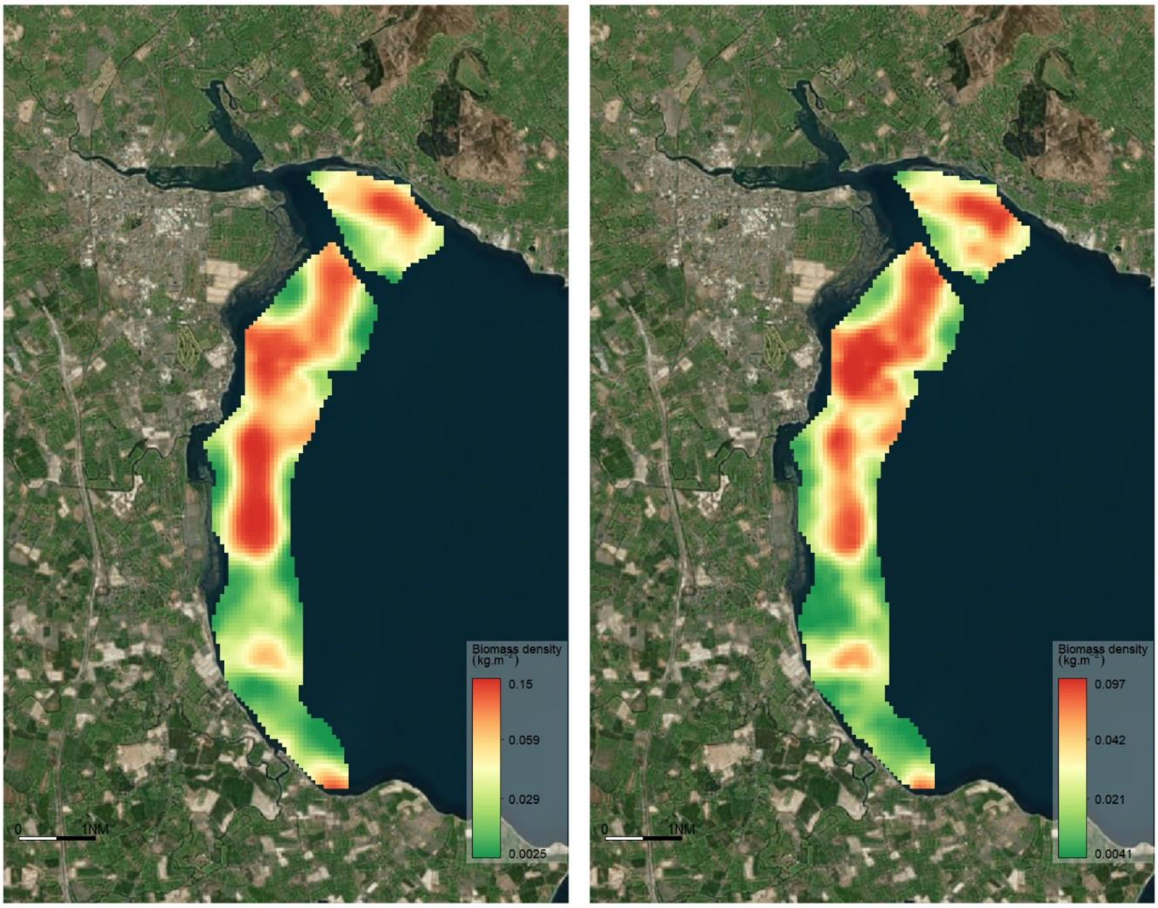

Figure 50. Distribution and density (kgs.m^{-2}) of all cockles (left) and commercial cockles (>22 mm shell width) (right) in Dundalk Bay in May 2024.

Table 18. Biomass of cockles in Dundalk Bay in May 2024.

	Biomass (tonnes)		95% HDI inf	95% HDI sup
	Mean	Median		
Biomass All sizes	1495	1807	1642	1982
Biomass (tonnes) > 22mm	1043	1296	1158	1452
Biomass (tonnes) > 18mm	1329	1636	1459	1793
Biomass (tonnes) < 18mm	151	184	161	208

9.5.2.2 Size distribution and recruitment

The majority of cockles (74.9 %) sampled during the 2024 Dundalk cockle survey were estimated to be 1 to 4 years old. The highest percentage of these (24.8 %) were 3+ year olds (see the bottom graph in (Figure 51). The main cohort had a modal size of 19.86 mm, which resulted from the smaller size cohort recorded, at approximately 8 mm shell width, during the 2023 survey (Figure 51). Although a smaller cohort at an average size of 6.29 mm shell width (Figure 51) was also recorded from the 2024 survey, no significant recruitment (spat settlement) was detected.

The age of cockles at the overall modal size of 17.27 mm was estimated to be 2.4 years old, which indicates a slow growth rate of cockles from 2023 to 2024.

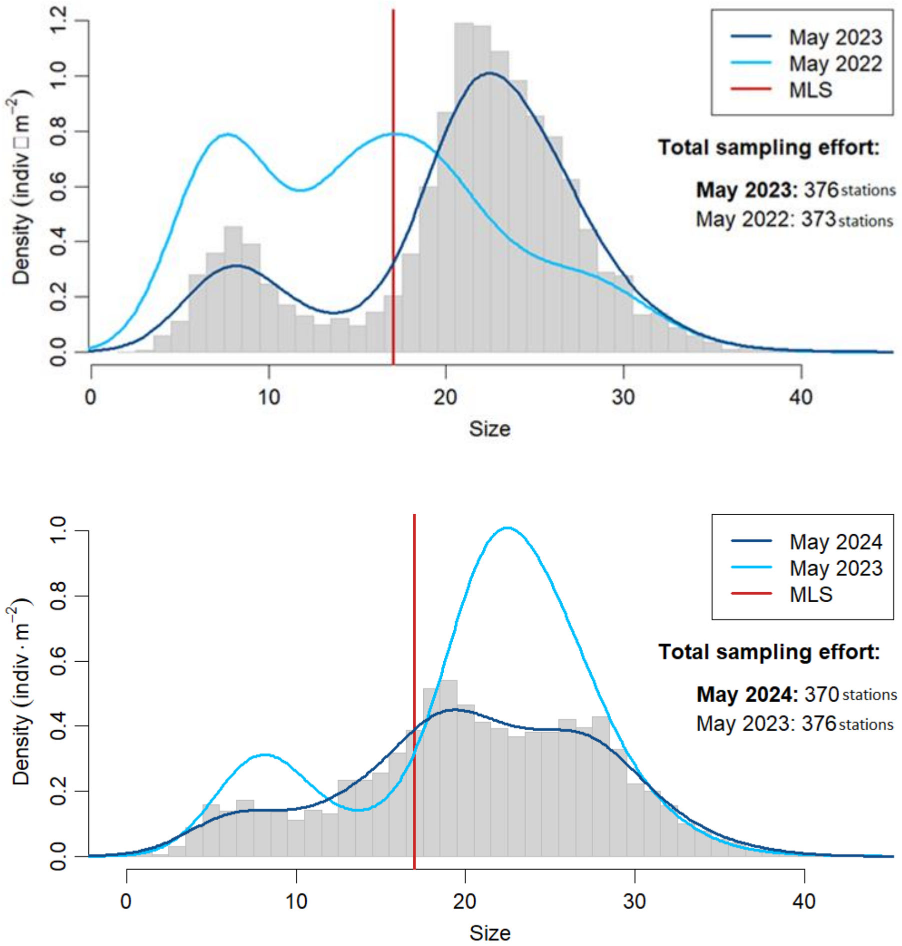

Figure 51. Size distribution of cockles in Dundalk bay in May 2022 and 2023 (top), May 2023 and May 2024 (bottom).

9.5.3 Post Fishery in 2024

A post-fishery cockle survey was undertaken in Dundalk Bay on the 11th and 12th of November 2024. The post-fishery survey was carried out in areas where the biomass was found to be highest during the May survey, between the Castletown and Fane Rivers and south of the Fane River. The post-fishery survey area was approximately 10 km^2 (Figure 52).

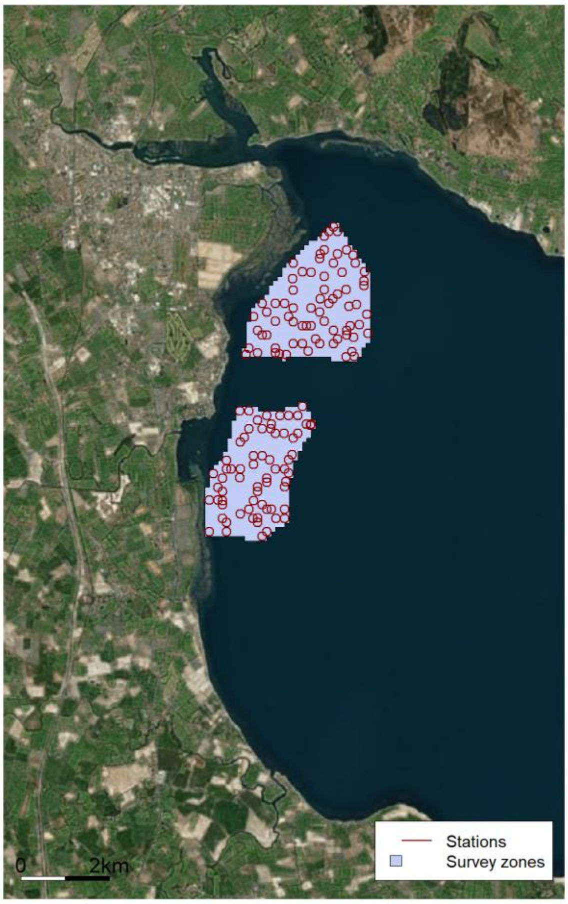

Figure 52. Survey area undertaken in November 2024 (Post-fishery).

9.5.3.1 Biomass pre and post fishery

The corresponding biomass for the reduced post-fishery survey area in May 2024 was estimated at 759 tonnes with the biomass of cockles over 22 mm being 491 tonnes (Table 19, Figure 53). The total biomass from the same area in November 2024 after the cockle fishery took place was 202 tonnes (Table 20, Figure 54). The biomass of cockles over 22 mm post-fishery was 138 tonnes (Table 20).

Table 19. Biomass of cockles in the Post-Fishery Area of Dundalk Bay in May 2024.

	Biomass (tonnes)		95% HDI inf	95% HDI sup
	Mean	Median		
Biomass All sizes	759	903	780	1,032
Biomass (tonnes) > 22mm	376	515	428	597
Biomass (tonnes) > 18mm	599	750	653	883
Biomass (tonnes) < 18mm	85	85	74	97

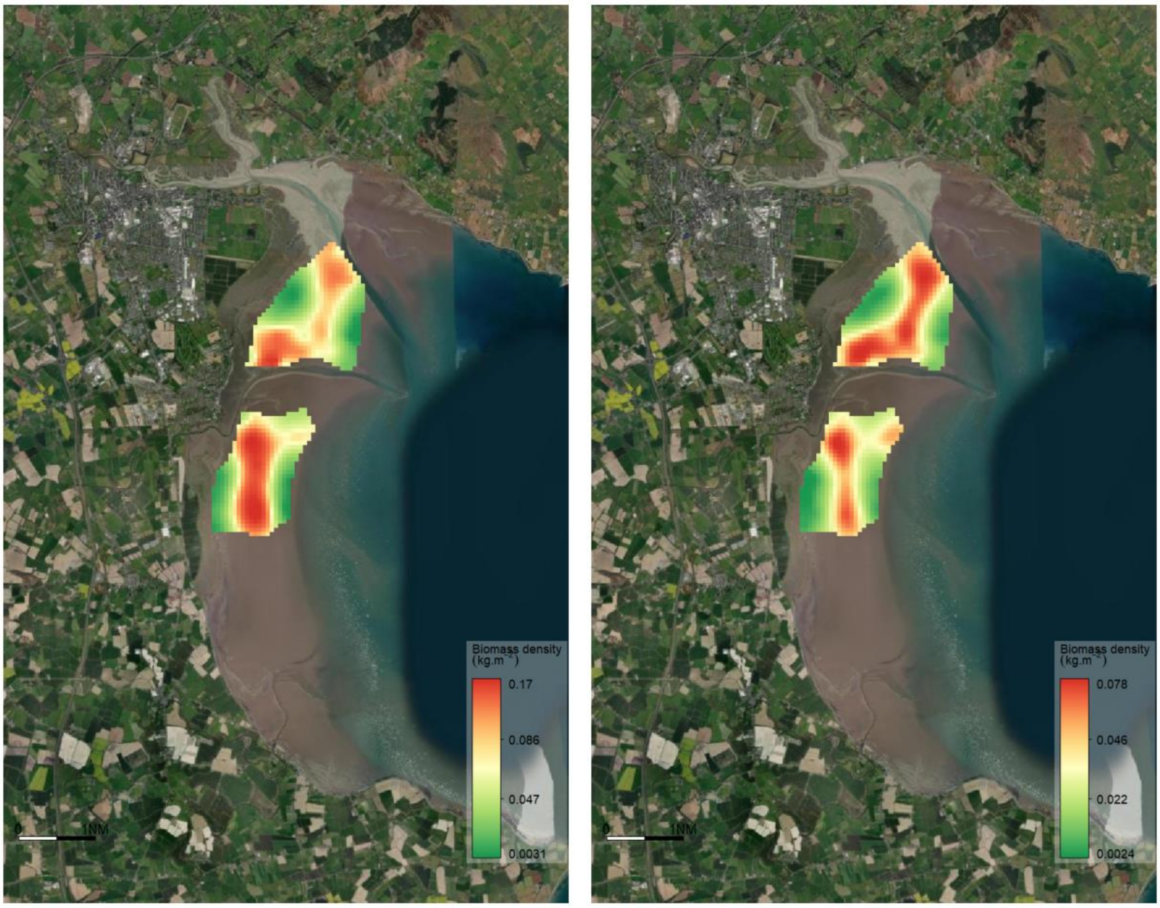

Figure 53. Distribution and density (kgs.m^{-2}) of all cockles (left) and commercial cockles (>22 mm shell width) (right) in the reduced survey area in May 2024.

Table 20. Biomass of cockles in Dundalk Bay in November 2024 (Post-Fishery).

	Biomass (tonnes)		95% HDI inf	95% HDI sup
	Mean	Median		
Biomass All sizes	202	246	213	281
Biomass (tonnes) > 22mm	138	176	133	230
Biomass (tonnes) > 18mm	181	225	190	271
Biomass (tonnes) < 18mm	15	21	14	29
Biomass (tonnes) > 30mm	57	67	39	107

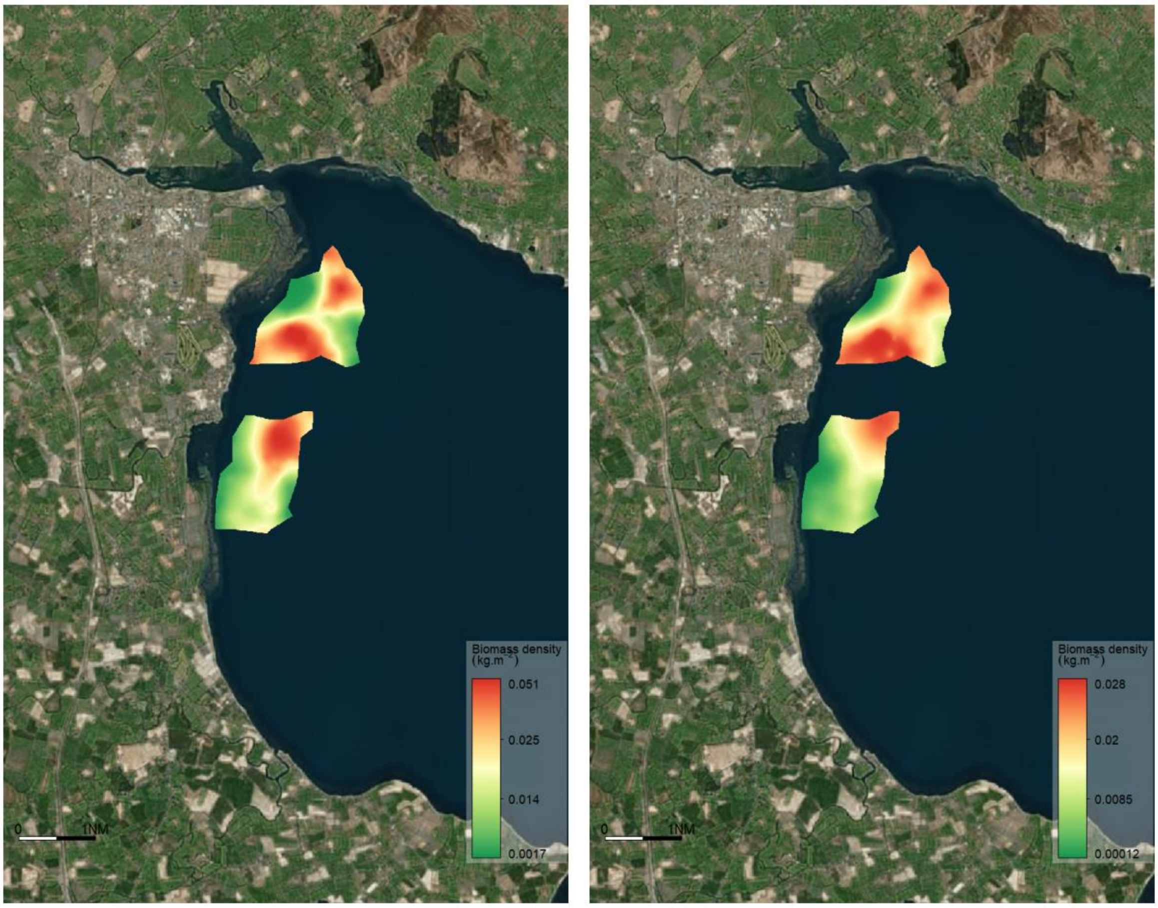

Figure 54. Distribution and density (kgs.m^{-2}) of all cockles (left) and commercial cockles (>22 mm shell width) (right) in the post-fishery area of Dundalk Bay in November 2024.

9.5.3.2 Size distribution

Size distribution pre and post fishery in 2024 showing substantial reduction in all cockle size classes above 10mm (Figure 55). The MLS is 17mm but operationally it is 22mm (based on mechanical graders on board the vessels.

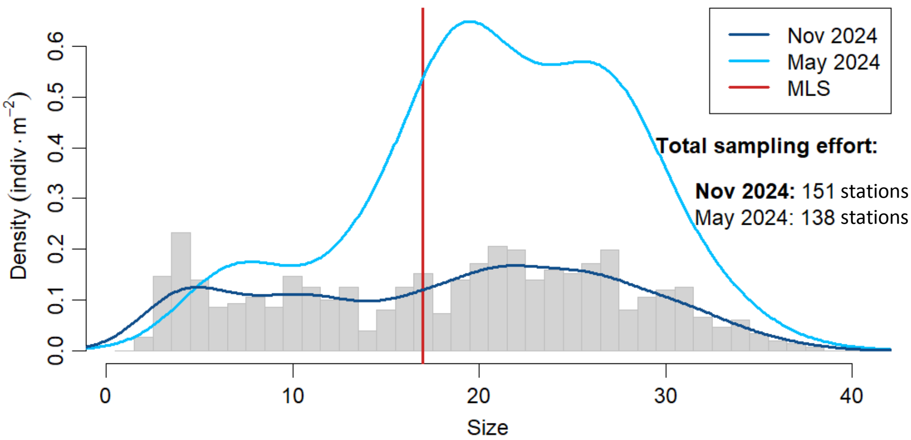

Figure 55. Size distribution of cockles in a reduced area of Dundalk Bay in May and November 2024.

9.5.4 Review of ecosystem effects

Two five-year Fishery Natura Plans (FNP) (2011-2015 and 2016-2020) for cockles (*Cerastoderma edule*) in Dundalk Bay SAC and SPA have been implemented and a new FNP for the period 2021-2025 was established prior to the fishery in 2021. The FNPs include a requirement to monitor effects on the environment and the ecological features for which the Bay was designated under the Habitats and Birds Directives. Data on characterising species in intertidal habitats which are disturbed by cockle fishing and overwintering water birds are reported here.

9.5.4.1 Intertidal habitats

The three numerically dominant species of bivalve in the intertidal habitat of Dundalk Bay are *Cerastoderma edule* (cockles), *Angulus tenuis* and *Macoma balthica*. The Baltic clam, *Macoma balthica,* is more abundant on the upper shore, cockles mainly occur along the mid shore and *A. tenuis* is dominant from the mid to lower shore. The distribution of all 3 species overlap. Previous studies in Dundalk Bay shows that cockle dredging causes mortality of *Angulus* in particular as its shell is more fragile compared to the other two species. However, its overall sensitivity to abrasion pressure is low given its short life cycle and high recoverability. *Macoma* is much less exposed to the cockle fishery as it is distributed on the upper shore. Counts of the casts of the polychaete worm, *Arenciola marina* have been recorded since 2013.

The distribution of these species is estimated during the annual summer surveys carried out from 2007-2024. Both *A. tenuis* and *M. balthica* can occur in high densities (Table 21, Figure **56**). The average densities (m^{-2}) of *Angulus tenuis* increased from 2018 to 2022 were lower in 2023 and increased again in 2024. Average densities of *Macoma balthica* per m^2 generally declined from 2018 to 2024.

Table 21. Mean density (m^{-2}) of the bivalves *Angulus tenuis*, *Macoma balthica* and the polychaete worm *Arenicola marina*, along with the average Redox potential discontinuity layer in intertidal habitats during the mid-summer cockle surveys 2011-2024.

Year	*Angulus tenuis*		*Macoma balthica*		*Arenicola marina*		Redox Potential Discontinuity (RPD) layer	
	Mean	S.d.	Mean	S.d.	Mean	S.d.	Mean	S.d.
2011	26.14	38.74	13.98	36.25			9.43	4.63
2012	55.35	62.18	17.74	41.21				
2013	95.43	89.82	28.10	57.49	6.43	8.10	12.74	7.08
2014	91.61	83.19	18.53	42.23	11.62	9.18	18.66	10.8
2015	70.56	76.90	18.80	40.06	6.08	5.33	9.34	6.00
2016	83.33	75.07	19.41	51.29	6.26	4.82	11.21	6.28
2017	67.89	90.11	12.39	30.15	5.58	4.45	10.11	4.43
2018	77.89	88.09	24.64	51.15	4.35	3.10	10.27	6.81
2019	84.66	86.40	22.91	48.60	5.26	3.27	10.43	6.13
2020	87.51	99.59	18.72	42.77	3.49	3.15	9.98	7.29
2021	88.27	85.2	14.56	28.73	4.27	3.65	10.44	4.96
2022	101.22	96.55	13.41	30.24	3.43	3.01	10.50	4.07
2023	98.31	97.96	14.27	33.15	3.06	3.04	10.37	5.19
2024	110.39	102.87	11.20	27.03	1.51	2.51	9.96	5.19

Average densities of the lugworm, *Arenicola marina* decreased from 2014 when the highest densities of 11.62 m^{-2} were recorded. In 2021, average densities increased slightly, however further declines occurred from 2021-2024 (Table 21, Figure 56).

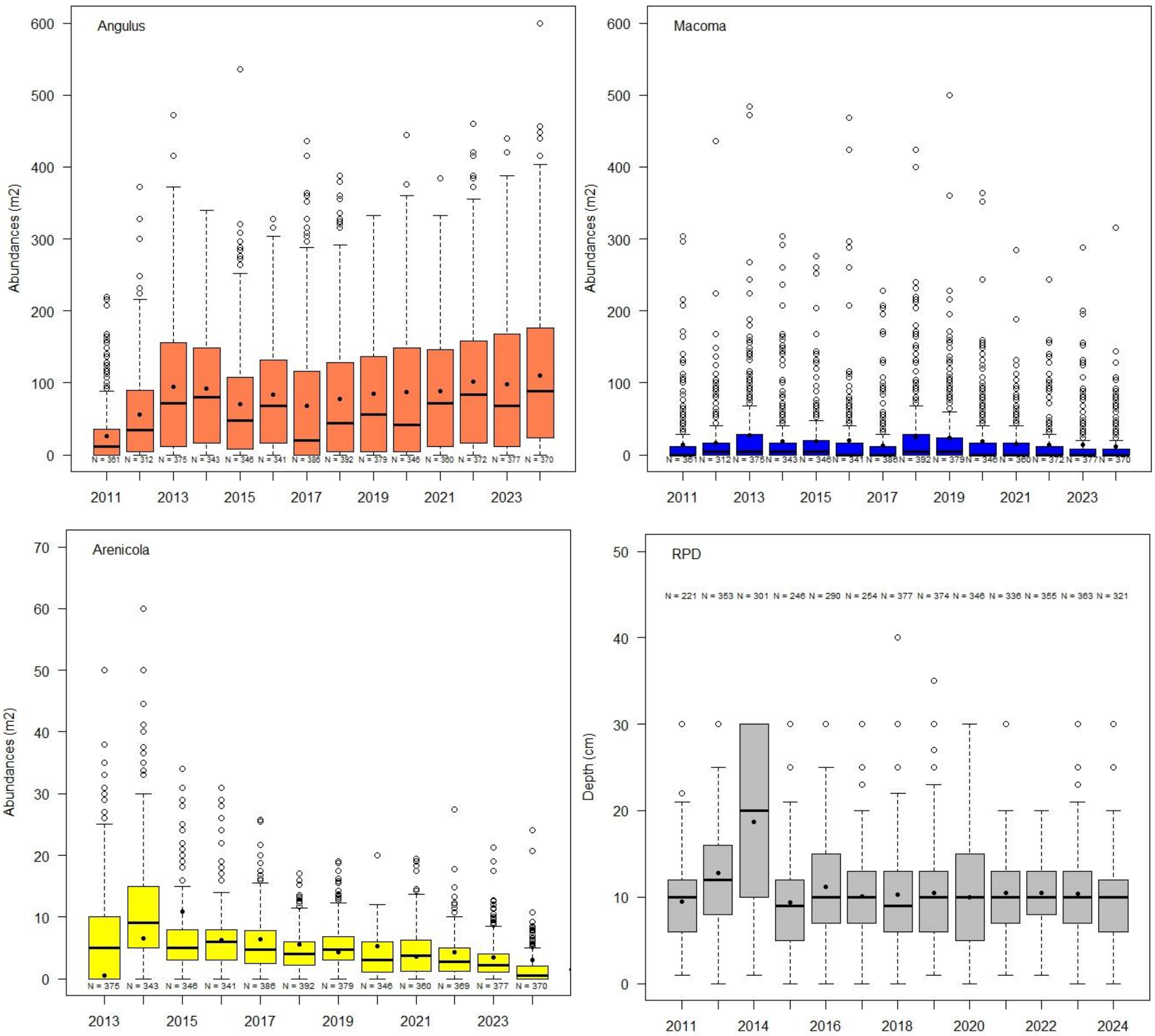

Figure 56. Median abundances (m²) of *Angulus tenuis*, *Macoma balthica* (2011-2024) and *Arenicola marina* (2013-2024) and median depth of the redox potential discontinuity layer (RPD) (2013-2024) across intertidal sediments in Dundalk Bay. The mean values for each year are indicated by the black dots.

The divide between the surface oxygenated and sub-surface anaerobic sediment is known as the redox potential discontinuity (RPD) layer. This divide appears as a grey layer of sediment above the black deoxygenated sediment below. Sediment mobility and biological bioturbation caused by feeding of infaunal deposit feeders increases oxygen supply to sediments and thus makes the oxygenated surface layer of sediment deeper. Eutrophication and increased biological oxygen demand in the sediment reduces oxygen availability and the RPD layer can then occur very close to the sediment surface. Filter feeding bivalves such as cockles occur above the RPD or at least must reach the aerobic layer when feeding. The depth of the RPD was measured during the summer surveys from 2011 to 2024 (Table 21, Figure 56). It has been consistent at an average depth of between 9 and 10 cms since 2015.

The distribution of *Angulus tenuis* and *Macoma balthica* from the 2022, 2023 and 2024 cockle surveys is shown in Figure 57.

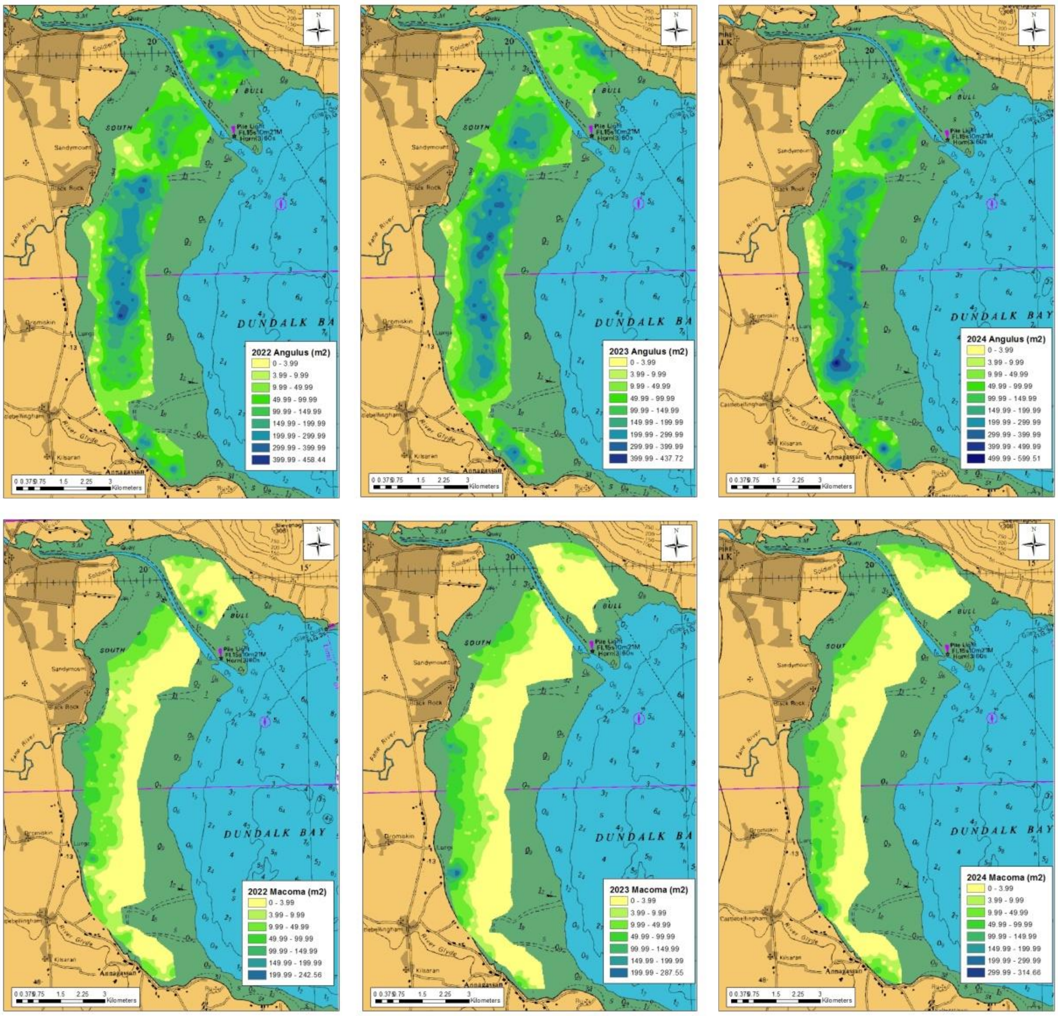

Figure 57. Annual distribution of *Angulus tenuis* (top) and *Macoma balthica* (bottom) during summer surveys undertaken in Dundalk Bay 2022-2024.

9.5.5 Waterbirds

Overwintering birds in Dundalk Bay have been monitored since the mid-1990s by iWeBs (Irish Wetlands Bird Survey). Counts are taken at key roost locations at high tide. Additional low tide counts have been undertaken periodically by the National Parks and Wildlife Service and the Marine Institute. The highest numbers of birds (all species, 61,255) in Dundalk Bay were recorded in winter 2003/2004. The long term trend (1994-2023) varies but is stable. The 2021/2022 winter season saw the lowest ever recorded total since the beginning of the survey at 21,583. It is difficult to ascertain to what degree the avian influenza or COVID survey restrictions might have affected this number.

There has been no change in the structure, function or distribution of intertidal habitats which support these bird populations in Dundalk Bay since 2007 and no significant effects of cockle fishing on habitats has been found. Bird populations not relying on cockle as a food source are unlikely to be impacted by the fishery.

9.5.5.1 Oystercatcher

The number of oystercatchers overwintering in Dundalk Bay has a slightly positive correlation with the presumed post fishery cockle biomass (Figure 58). This is the biomass that is available in autumn when the fishery is closed but is estimated only by subtracting the landings from the summer survey biomass. Biomass ranges mostly between 500 and 2,000 tonnes with exceptional years over 3,000 tonnes. The minimum cockle biomass to open the cockle fishery is 1,000 tonnes. Usually the fishery does not open for economic reasons if the biomass is not greater than 1,300 tonnes thereby conserving a minimum biomass for overwintering birds. In 2024 however the post fishery survey indicated that unexpectedly high cockle biomass may occur during the summer and that late autumn biomass may not be correlated with biomass in May. Further post fishery survey work is needed to assess this.

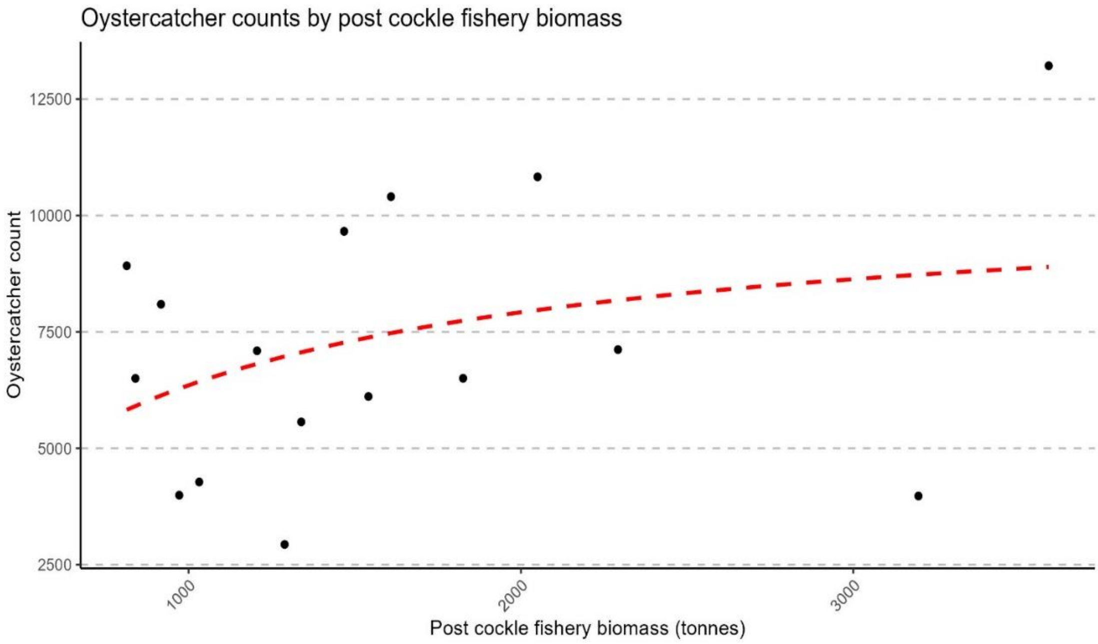

Figure 58. Relationship between oystercatcher (*Haematopus ostralegus*) numbers (iWeBs data) and estimated post-fishery cockle biomass in Dundalk Bay 2007-2023. The fitted curve is a Beverton and Holt stock (cockle) and recruitment (oystercatcher) function R=aS/(b+S), a = 10,519 (the asymptote of the curve) and b = 655 (steepness) or the cockle biomass required to recruit 0.5 of the asymptotic value.

10 Oyster (*Ostrea edulis*)

10.1 *Management advice*

With some exceptions oyster stocks are managed locally by oyster Co-operatives who have delegated authority to manage oysters in specific areas through fishery orders or aquaculture licences. Minimum sizes of 76-78 mm apply. Local quotas or TACs may be in force. The number of dredge permits issued annually is limited by stock area.

Stocks are assessed by annual surveys which provide biomass estimates, although dredge efficiency (catchability) is uncertain. Stock biomass is generally low in all areas, except inner Tralee Bay, and management measures to re-build spawning stocks and habitat for spat settlement are necessary. Various threats to native oyster productivity include naturalisation of Pacific oyster (*Magallana gigas*), *Bonamia ostreae* infection, unfavourable habitat conditions for settlement and low spawning stocks. Pacific oyster has naturalised in Lough Swilly in recent years and supports a commercial fishery.

Fishery management plans and oyster restoration plans should be developed in order to restore productivity of oyster beds. Currently bivalve shell is used, at limited scale, to increase spat fall in areas of Galway Bay, Kilkieran Bay and Clew Bay.

Oyster beds are constituents of habitats designated under the Habitats Directive in many areas and are a component habitat of 'shellfish beds' which are priority habitats under the Nature Restoration Law (NRL). Specific conservation objectives have been defined for oyster habitats in some special areas of conservation.

10.2 *Issues relevant to the assessment of the oyster fishery*

A number of native oyster beds occur as separate stocks in Bays around the coast. Biomass is currently low, compared to historic levels, in most areas. Inner Tralee Bay holds the majority of the national biomass of native oyster.

Recruitment is variable in most areas from year to year. Larval production and settlement is conditional on density of spawning stock, high summer temperatures and the availability of suitable settlement substrate.

The fishery is managed primarily by a minimum landing size (MLS) of 76-78 mm. The minimum size is generally reached at age 4-5. Oysters generally mature well below the MLS.

Oyster stocks face a number of threats including *Bonamia ostreae* infection, which decimated stocks in the 1970s, and is prevalent in a number of beds today including in the previously *Bonamia* free Cill Chiaráin Bay where it was detected in 2017. Native oyster is also competing for habitat with naturalised Pacific oyster in some areas such as Lough Swilly. Poor substrate conditions for settling oysters may be limiting recruitment and low stock density may also be reducing reproductive output. Increases in freshwater inflows to estuaries in inner Galway Bay reduces the area of suitable oyster habitat.

Management authority has been devolved to local co-operatives through fishery orders issued in the late 1950s and early 1960s or through 10-year Aquaculture licences. Although conditions, such as maintaining oyster beds in good condition or having management plans in place, attach to these devolved arrangements, in most cases management objectives and management measures are not sufficiently developed. In Lough Swilly and the public bed in inner Galway Bay, all management authority rests with the overseeing government department rather than with local co-operatives. Since 2022, new management plans have been drafted with some of the oyster co-operatives in order to secure any improvements in stock status resulting from restoration actions and to ensure adequate conservation of spawning stock and spawning potential in areas closed to fishing. These plans, and the objectives and strategies described in them, have become the focus of monitoring, research and management initiatives.

Although management may be devolved through the fishery orders or aquaculture licences, vessels fishing for oysters must be registered on the sea fishing vessel register (DAFM) and operators must also hold a dredge licence which is issued by Inland Fisheries Ireland (IFI). The oyster co-operatives operate seasonal fisheries and may also limit the total catch. The TACs may be arbitrary or based on the annual surveys.

All the main oyster beds in Ireland occur within Natura 2000 sites. Oyster is a characterising species of sedimentary habitats of large shallow inlets and bays. It can also be a key habitat forming species in conditions where recruitment rates are high and where physical disturbance is low. Seagrass and maërl or other sensitive reef communities are commonly found on oyster beds in Galway Bay, Cill Chiaráin Bay, Tralee Bay and Clew Bay. Dredging may damage these communities. Management of oyster fisheries needs to consider the conservation objectives for oyster and its associated habitats and communities.

Annual surveys provide biomass indices or absolute biomass estimates and size structure of oyster stocks annually. Poor information on growth rate, which varies across stocks, limits the assessment of mortality rates and yield predictions.

10.3 *Management units*

Oyster stocks occur as discrete stock units in a number of bays around the coast. Although native oysters were historically widespread in many areas, including offshore sand banks in the Irish Sea and along the south east coast, their distribution is now reduced. The main stocks occur in inner Tralee Bay, Galway Bay, Cill Chiaráin Bay and Beirteach Buí in Connemara, Clew Bay, Blacksod Bay and Lough Swilly.

10.4 *Survey methods*

Oyster beds are surveyed annually by dredge. Dredge designs vary locally and these locally preferred dredges are used in the surveys. Dredge efficiencies were estimated in 2010 by comparison of the numbers of oysters caught in the dredge and the numbers subsequently counted on the same dredge track by divers immediately after the dredge tow had been completed. Separate estimates were obtained in 2021 in Lough Swilly by quantitative quadrat sampling at low tide followed by dredge sampling in the same area at high water. Biomass is estimated using a geostatistical model accounting for spatial autocorrelation in the survey data.

10.5 *Inner Tralee Bay*

10.5.1 Stock trends

Biomass estimates, standardised to a dredge efficiency of 35 %, varied from a low of 409 tonnes in 2015 to a high of over 1,000 tonnes in 2014, 2018 and 2020. The area surveyed usually contains the entire stock which is distributed over approximately 4 km^2 (Table 22). The biomass reported in 2020 was the highest in the time series. The larger area sampled along with the considerably shorter haul lengths recorded and the distribution of the tracks over the survey area in 2020 compared to other years suggest that the 2020 estimate may not be comparable to other years. A different pattern in haul lengths was also observed between 2017 and 2018, which may also have affected density and biomass estimates. Other than 2020 annual biomass estimates for all size classes of oysters corrected for dredge efficiency has varied from just over 600 tonnes to over 1,000 tonnes.

Table 22. Stock biomass trends for native oyster in Inner Tralee Bay 2010-2024.

Year	Month of survey	Survey Area (km^2)	Biomass (tonnes)	Biomass km^{-2}
2010	September	4.26	982	230.54
2011	September	3.57	631	87.03
2012	February	3.8	655	85.02
2013	September	3.76	506	66.33
2014	September	3.8	1,265	164.16
2015	September	4.51	409	44.78
2016	September	3.66	901	121.44
2017	September	4.28	843	197.08
2018	September	3.92	1,161	296.17
2019	October	3.7	879	237.57
2020	September	5.32	1,618	304.14
2021	September	4.05	617	152.35
2022	September	4.55	801	176.04
2023	September	4.49	891	198.44
2024	September	4.96	503	101.41

10.5.2 Survey September 2024

A pre fishery survey was carried out on 17th and 18th September 2024 in Inner Tralee Bay. A total of 72 tows were completed, with a single toothless dredge of width 1.22 m. GPS data for each tow track was recorded on a Trimble GPS survey unit and the swept area for each tow was estimated. The survey encompassed an area of 4.96 km^2 east of Fenit pier (Figure 59). Longer haul lengths were recorded during the 2024 survey increasing the total effort by over 2,000 m^2 in comparison to the 2023 survey.

10.5.2.1 Distribution and Biomass in 2024

Biomass of oysters uncorrected for dredge efficiency varied from 0-0.77 kgs.m^{-2} (Figure 59). Biomass of oysters over 76 mm ranged from 0-0.1 kgs.m^{-2}.

Total biomass of oysters, assuming a dredge efficiency of 35 %, was 503 tonnes (Table 23). The equivalent biomass of oysters 76 mm or over was 121 tonnes or approximately 24 % of the total biomass. The location of the higher densities of oysters during the 2024 survey is similar to the 2023 survey.

Table 23. Distribution of oyster biomass in Inner Tralee Bay in September 2024.

	Mean	Median	95% HDI inf	95% HDI sup
Uncorrected for efficiency				
Biomass_Ostrea_edulis	190.54	194.24	147.05	258.11
Biomass_>76mm_Ostrea_edulis	42.24	55.16	40.67	74.35
Corrected_35% Dredge Efficiency				
Biomass_Ostrea_edulis	502.83	544.43	406.03	735.78
Biomass_76_Inf_Ostrea_edulis	120.78	125.01	99.26	161.59

Figure 59. Distribution and biomass of native oyster in Inner Tralee Bay from the September 2024 survey (uncorrected for dredge efficiency).

10.5.2.2 Size distribution 2024

The size distribution of oysters caught during the survey showed a strong mode at 71 mm, which was similar to the 2023 survey. There was a smaller mode at 31 mm (Figure 60). Higher densities of oysters in the 10-40 mm size category occurred in 2024 compared to 2023.

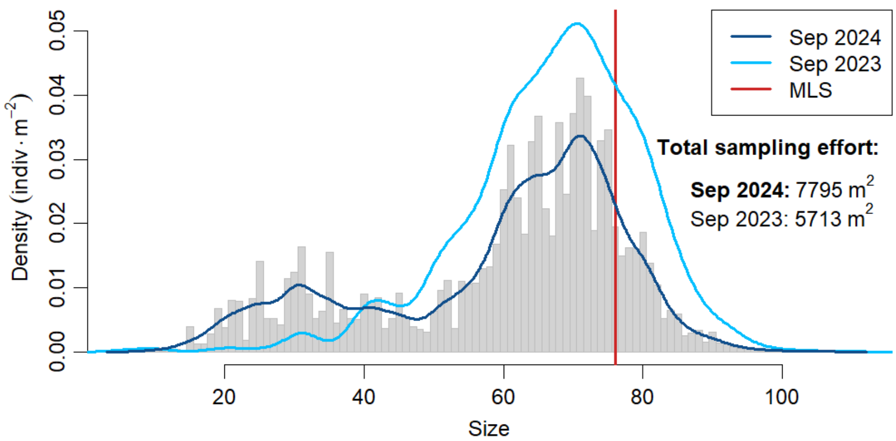

Figure 60. Size distribution of native oysters on the Inner Tralee oyster bed in September 2024. The MLS (76 mm) is also shown. Data are standardised to sampling effort regardless of its spatial distribution.

Future prospects for the stock remain strong given that all size classes from 60-78 mm are well represented in the stock.

10.6 *Lough Swilly*

A survey of native (*Ostrea edulis*) and Pacific oysters (*Magallana gigas*), consisting of 152 dredge hauls, was undertaken in Lough Swilly between 2nd-3rd April 2024 using a single toothless dredges of width 1.5 m. GPS data for each tow track was recorded on a Trimble GPS survey unit and the swept area for each tow estimated.

10.6.1 Native Oyster (*Ostrea edulis*)

10.6.1.1 Stock trends

The area covered by the surveys and the time of year the surveys were conducted has varied significantly during the time series which compromises inter year comparisons (Table 24).

Table 24. Stock biomass trends for native oyster in Lough Swilly 2011-2024.

Year	Month	Survey Area (km^2)	Biomass km^{-2}	Biomass
2011	March	1.56	25.64	40
2011	November	13.07	9.52	124
2012	October	11.48	15.46	177
2013	October	5.96	14.14	84
2014	October	13.19	15.85	209
2015	August	5.19	6.50	33
2016	August	5.58	17.40	97
2017	September	7.19	43.99	316
2018	April	7.81	26.48	207
2020	July	10	31.78	318
2021	Nov-Dec	8.1	13.64	110.5
2022	Nov-Dec	8.2	31.6	259.1
2024	April	8.46	13.12	111

Surveys from 2011-2024 standardised for survey area show that native oyster biomass per square kilometre of survey area varied from 6-44 tonnes. The biomass.km^{-2} (26 - 43 tonnes) was higher in 2017, 2018, 2020 and 2022 than previous years, however a lower estimate of ~13 tonnes.km^{-2} was recorded in 2021 and 2024.

10.6.1.2 Distribution and Biomass in 2024

Biomass of oysters, uncorrected for dredge efficiency, varied from 0-0.00015-0.016 kgs.m^{-2} (Figure 61). These estimates were higher in the south part of the study region. Biomass of oysters over 76 mm ranged from 0-0.0093 kgs.m^{-2} and showed a similar spatial pattern.

The biomass of native oysters, assuming a dredge efficiency of 35 % was 110 tonnes (Table 25). The equivalent biomass of oysters 76 mm or over was 10.5 tonnes or approximately 9.5 % of the total biomass. The 2024 survey was conducted at the beginning of April. The native oyster fishery is open from Sept 2023 to end of April 2024 so the survey biomass is post-fishery.

Table 25. Distribution of oyster biomass, corrected for a dredge efficiency of 35 %, in Lough Swilly, April 2024.

	Mean	Median	95% HDI inf	95% HDI sup
Uncorrected for Dredge Efficiency				
Biomass_Ostrea_edulis	38.7	48.5	41.3	57.8
Biomass_>76mm_Ostrea_edulis	3.69	3.7	3.4	4.1
Corrected_35% Dredge Efficiency				
Biomass_Ostrea_edulis	110.7	139	115	162
Biomass_>76mm_Ostrea_edulis	10.5	10.6	9.7	11.7

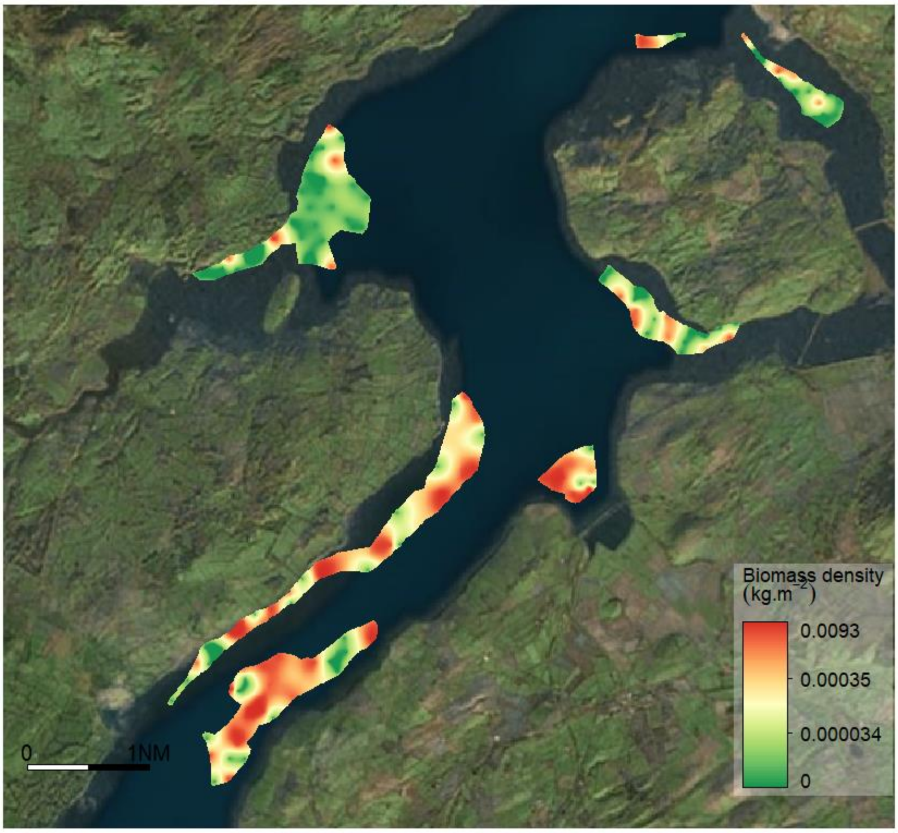

Figure 61. Distribution and biomass of native oyster in Lough Swilly in April 2024 (uncorrected for dredge efficiency).

10.6.1.3 Size distribution

The size distribution of oysters caught during the survey showed most of the individuals are between 40-80 mm with a peak at 60 mm, slightly larger than the main peak in the 2022 survey, ~50 mm (Figure 62). Few individuals above the 76 mm minimum landing size were found. No strong indication of recruitment (spat) was observed.

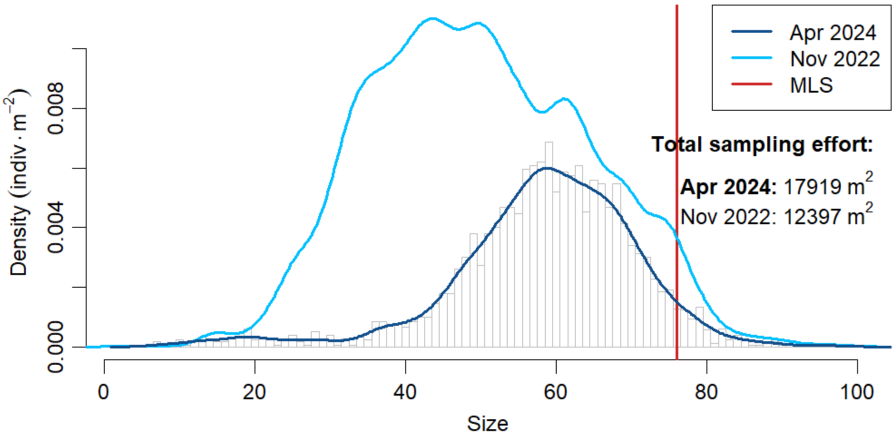

Figure 62. Size distribution of native oysters on the Lough Swilly oyster beds in April 2024. The MLS (76 mm) is also shown. Data are standardised to sampling effort regardless of its spatial distribution.

10.6.2 Pacific Oyster (*Magallana gigas*)

10.6.2.1 Stock Trends

The area covered by the surveys and the time of year the surveys were conducted has varied significantly during the time series which compromises inter year comparisons (Table 26).

Table 26. Trends in stocks of pacific oyster in Lough Swilly 2018-2024. DE = dredge efficiency.

Year	Month	Survey Area (km^2)	Number of *M. gigas* (millions) (No DE)	Biomass km^{-2}	Biomass
2011	March	1.56	1.1	-	-
2011	November	13.07	5.6	-	-
2012	October	11.48	1.4	-	-
2013	October	5.96	0.5	-	-
2014	October	13.19	3.3	-	-
2015	August	5.19	1.3	-	-
2016	August	5.58	1.15	-	-
2017	September	7.19	-	-	-
2018	April	7.81		151.1	1,180
2020	July	10.0		171.8	1,718.3
2021	December	8.1		92	745.5
2022	December	8.18		400.5	3,275.9
2024	April	8.46		181.9	1,538.9

Weight-length data was not available for pacific oysters between 2011-2016 so numbers of oysters were estimated. Surveys from 2011-2016 show that the estimated number of pacific oysters in Lough Swilly raised to the survey area varied from 0.5-5.6 million oysters. The biomass of pacific oysters was calculated from 2018-2024 and the standardised biomass per square kilometre of area surveyed varied between 92-400 tonnes.

10.6.2.2 Distribution and Biomass in 2024

Biomass of pacific oysters (*Magallana gigas*), uncorrected for dredge efficiency, varied from 0.00061- 0.34 kgs.m^{-2}, with the highest biomass occurring in the north west (Delap Bay) of the survey area (Figure 63).

The biomass of pacific oysters, assuming a dredge efficiency of 35 % was 1,538.9 tonnes (Table 27). The previous estimate in 2022 was 3,275.5 tonnes.

Table 27. Distribution of pacific oyster biomass, uncorrected and corrected for a dredge efficiency of 35 %, Lough Swilly, April 2024. Data from all oyster beds were combined.

	Biomass (tonnes)		95% HDI inf	95% HDI sup
	Mean	Median		
Uncorrected for Dredge Efficiency				
Biomass_Magallana gigas	538.6	596.3	526.3	678.3
Corrected for 35% Dredge Efficiency				
Biomass_Magallana gigas	1,538.9	1,707.7	1,525.4	1,895.3

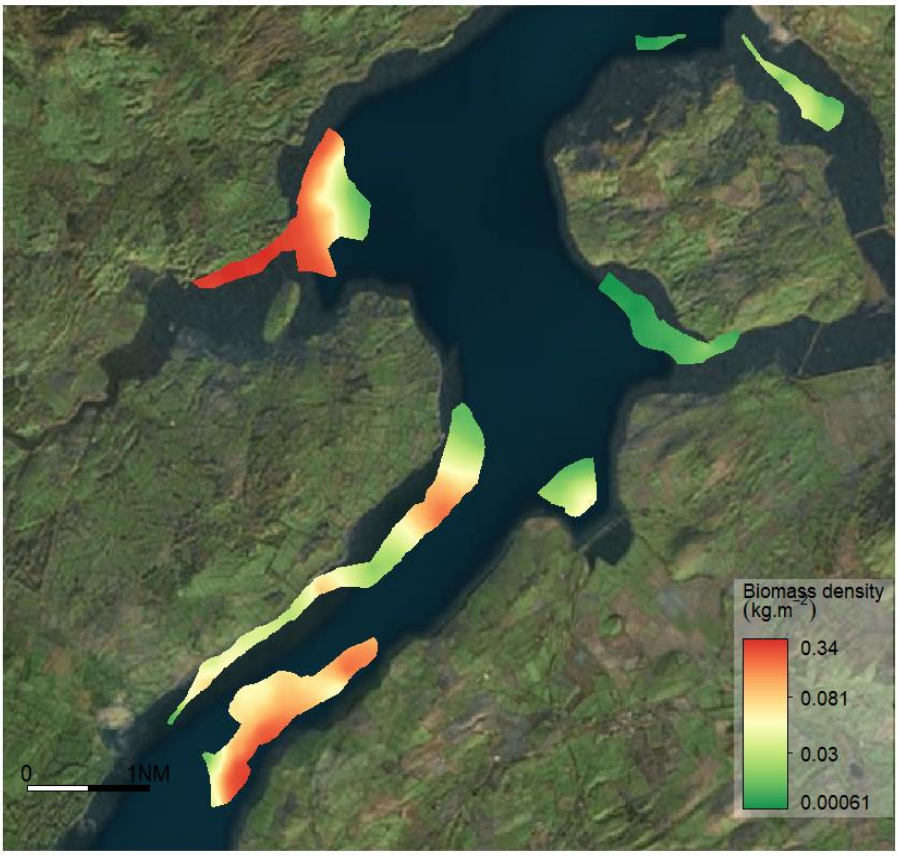

Figure 63. Biomass of pacific oysters in Lough Swilly, April 2024 (uncorrected for dredge efficiency).

10.6.2.3 Size distribution

The size distribution of pacific oysters caught during the survey showed one strong mode at ~80 mm. The significantly higher densities estimated from the 2022 survey and the differences in the size distribution suggest changes in survey catchability across years. No strong sign of recruitment was observed in 2024 compared with 2022 but the survey was conducted at a different time of the year (Figure 64).

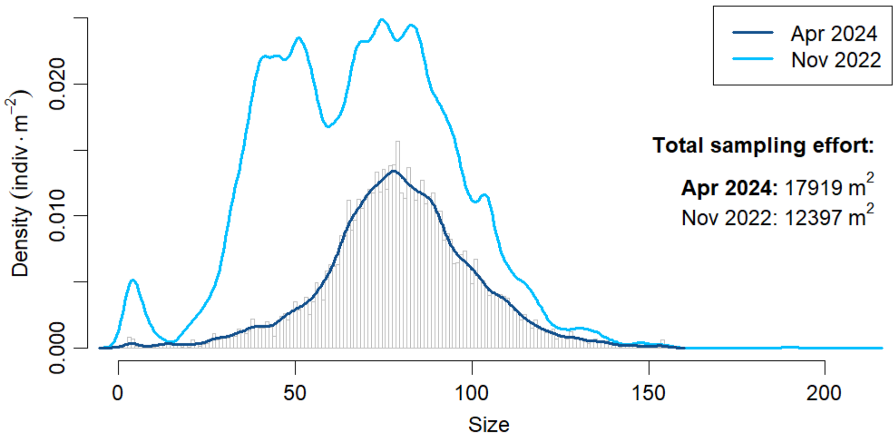

Figure 64. Size distribution of Pacific oyster in November-December 2022 and April 2024, Lough Swilly.

10.7 *Native Oyster Restoration – case studies using cultch*

Oyster spat require 'clean' hard substrate on which to settle. Any bivalve shell and many artificial substrates are suitable for oyster settlement. Productive oyster beds produce new shell through recruitment and growth. In cases where fishing is absent or well managed, limited amounts of shell (live oysters) are removed and the shell budget is positive i.e. more shell is produced than is lost through removal or fragmentation caused by dredging or natural disturbance from wave action. This may not be the case where fishing is uncontrolled and where recruitment declines. Wave action and fishing can both bury shell and upturn new shell that may be suitable for settlement. In estuarine conditions in particular where the siltation rate may be high new shell may be covered by silt, rendering it unsuitable for oyster spat settlement.

Spreading of clean bivalve shell (cultch) is one method of providing new clean substrate to increase the shell budget and to enhance spat fall, especially where there is evidence of low shell cover on the seabed which may be causing a bottleneck to recruitment. Surveys undertaken in Galway Bay, Cill Chiaráin Bay and Clew Bay indicate poor shell availability in many areas within the bays.

10.7.1 Galway Bay

Two sites in Galway Bay were chosen to deploy whole, clean scallop shells on the seabed. In June 2021, 200 tonnes of scallop shell were deployed in the south St. Georges fishery order area in Galway Bay (Figure 65). The area of deployed cultch is approximately 900 m x 500 m. In July 2024, a further 28 tonnes of clean scallop shell were deployed in the north St Georges fishery order area in Galway Bay. The area of deployed clutch is approximately 300 m x 300 m (Figure 65).

Sampling of scallop cultch was used to estimate the total number of native oyster spat that settled on the cultch each year (Table 28). In St Georges South, settlement has been recorded on the cultch every year since deployment in 2021.

The 2021 year class was the strongest year class, with approximately 10 million spat recorded in October 2021. In 2023, poor settlement was recorded. This may be attributed to unfavourable environmental conditions during the summer of that year. A strong settlement year was recorded in the St Georges North area in 2024, with an estimated 1.7 million native oyster spat settling on 28 tonnes of cultch.

Both areas of cultch will continue to be monitored. The successful settlement of spat on cultch in the second area of the bay shows that there is good recruitment within inner Galway Bay. This study also shows that provision of shell substrate is a feasible method of increasing settlement and recruitment of oysters, and that it can be used at a scale that would have significant population level benefits.

Figure 65. Cultch deployment sites in Inner Galway Bay. Cultch in St Georges South area was deployed in 2021 and cultch in St Georges North area was deployed in 2024.

Table 28. Native oyster spat population estimates on scallop cultch deployed in St Georges South fishery order between 2021-2024 and St Georges North fishery order in 2024.

Year Class	Sample Site	Sample Month	Spat Estimate (million)
2021	St Georges South	October 2021	10.4
2022	St Georges South	January 2023	7.08
2023	St Georges South	October 2023	0.75
2024	St Georges South	October 2024	3.15
2024	St Georges North	December 2024	1.69

10.7.2 Cill Chiaráin Bay

Surveys were conducted in Cill Chiaráin Bay, Co. Galway to assess the type of habitats on and surrounding several native oyster (*Ostrea edulis*) beds and to determine the suitability of habitat in Cill Chiaráin Bay for spat settlement. The distribution of current and historic oyster beds in Cill Chairáin Bay were outlined on admiralty charts by local fishermen. A total of 17 native oyster beds were surveyed using a remote underwater video between October 2023 and July 2024 (Figure 66). This work was carried out in collaboration with the shellfish co-operative Comharchuman Sliogéisc Chonamara Teó.

Footage from the camera drops was classified with a description of habitat/seabed, species present, the range of shell cover on the seabed, and if there were (live or dead) native oysters present on the seabed. The main habitat types identified included seagrass, maërl, reef/laminaria, sand, soft sediment and mixed sediment.

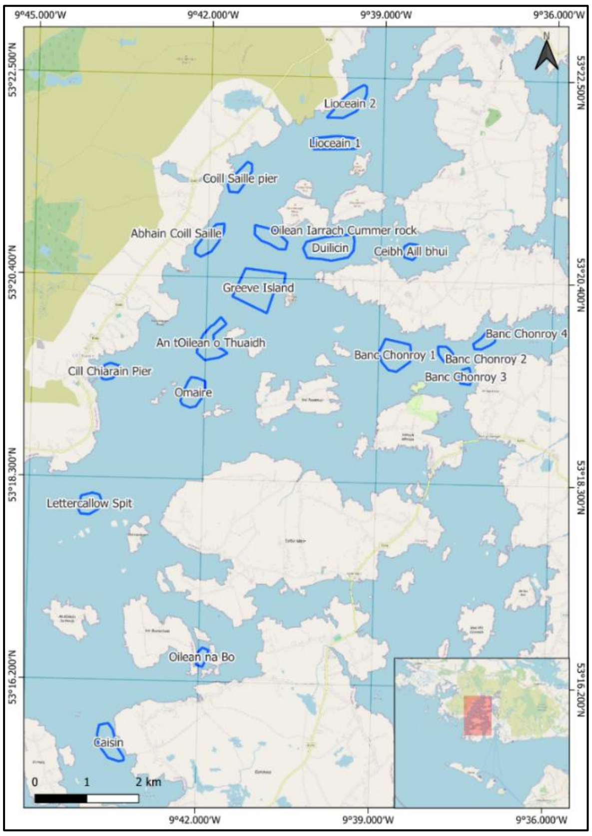

Figure 66. Current and historic native oyster beds outlined by local fishermen in Cill Chiaráin Bay.

Potentially suitable areas for cultch deployment to increase the substrate available for native oyster spat settlement were identified from the drop-down camera survey in combination with NPWS (2014) and MERC (2022) data. Two areas of mixed sediments with low to medium shell cover and with some native oysters present were chosen to be suitable for the deployment of cultch (Figure 67). The areas of the Duilicín and Greeve Island marked in yellow are approximately 1.2 and 1.9 hectares, respectively.

A total of 20 tonnes of weathered scallop shell were deployed in June 2024 across these two areas. Approximately 15 tonnes on Duilicín and 5 tonnes on Greeve Island. In July 2024, video surveys were carried out to assess the presence and distribution of the cultch in the selected areas. The cultch was generally well distributed but with some aggregations of shell (Figure 68).

In November 2024, cultch samples were collected using a small dredge but there was no sign of settlement on the shells. Environmental conditions in the bay seemed suitable for settlement in 2024. Broodstock of native oysters in the bay is low however and very dispersed. Larval production levels are unknown. Cultch will be monitored again in 2025.

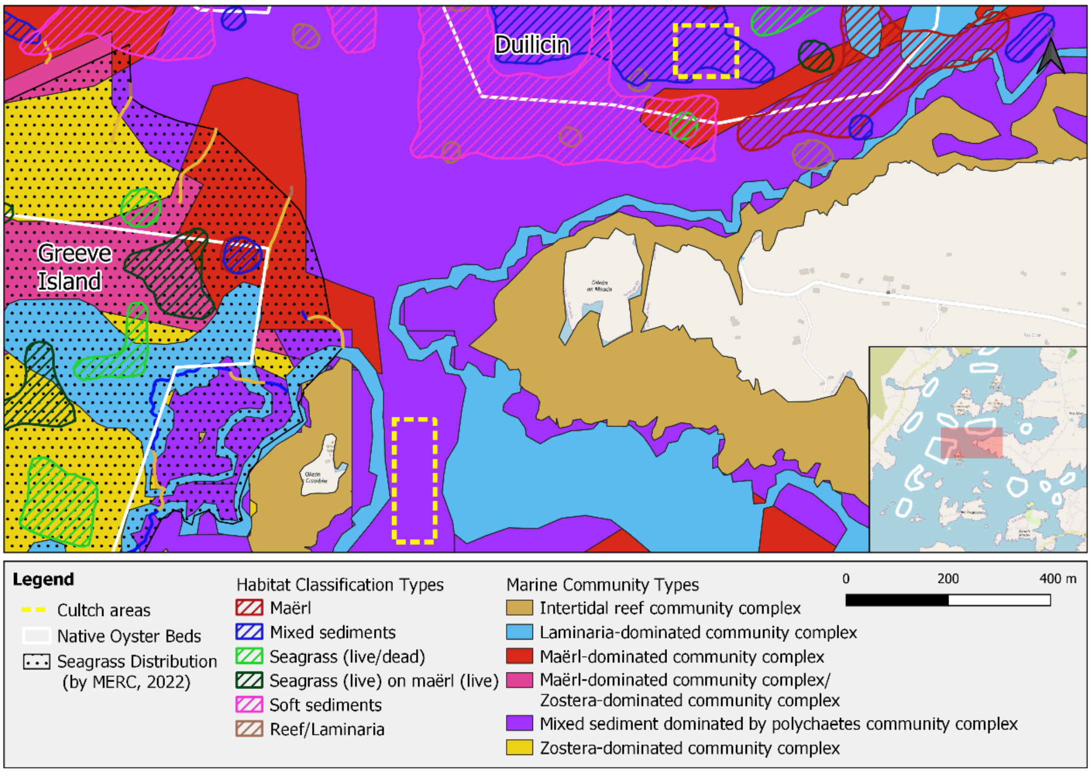

Figure 67. Areas identified as suitable for cultch deployment in Cill Chiaráin Bay. Cultch areas are outlined by dashed yellow lines.

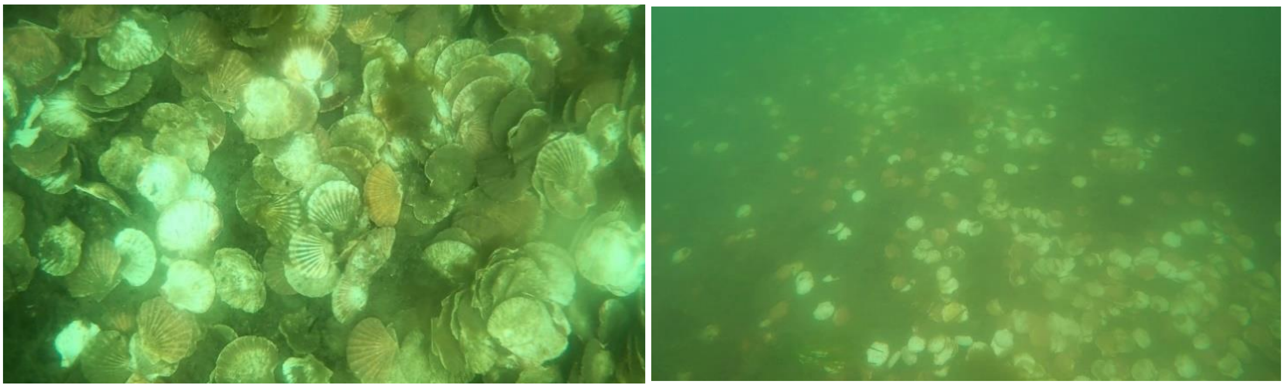

Figure 68. Distribution of cultch (scallop shell) in the Duilicín and Greeve Island cultch areas in Cill Chiaráin Bay.

10.7.3 Clew Bay

In Clew Bay, Co. Mayo, over 100 tonnes of cultch was deployed across six areas within the bay in May 2024 (Table 29, Figure 69). The cultch was a mix of weathered king scallop shell and Pacific oyster shell. Deployment was carried out by the Clew Bay Oyster Co-operative Society.

In August 2024, camera drops were carried out at some of the cultch deployment sites to assess how the cultch had settled on the seabed. In some areas, it was difficult to find the shell, these may have been muddy areas and the shell could have been buried over the summer. At other sites, the cultch was evenly spread and should provide a suitable substrate for native oyster spat settlement (Figure 70). Cultch was deployed over large areas resulting in low ground cover.

Table 29. Location and quantity of scallop and oyster cultch deployed in Clew Bay, in May 2024.

Location	Area (hectares)	Cultch (tonnes)	Cultch Density (tonnes/ha)
Westport Bay			
Middle Channel	69.6	29	0.4
Inishgowla South	12.9	24	1.9
Newport Bay			
Rostouhey South	9.7	12	1.2
Inishcottle North	2.6	12	4.6
Inishloy North	6.4	12	1.9
Roslynagh	8.2	12	1.5

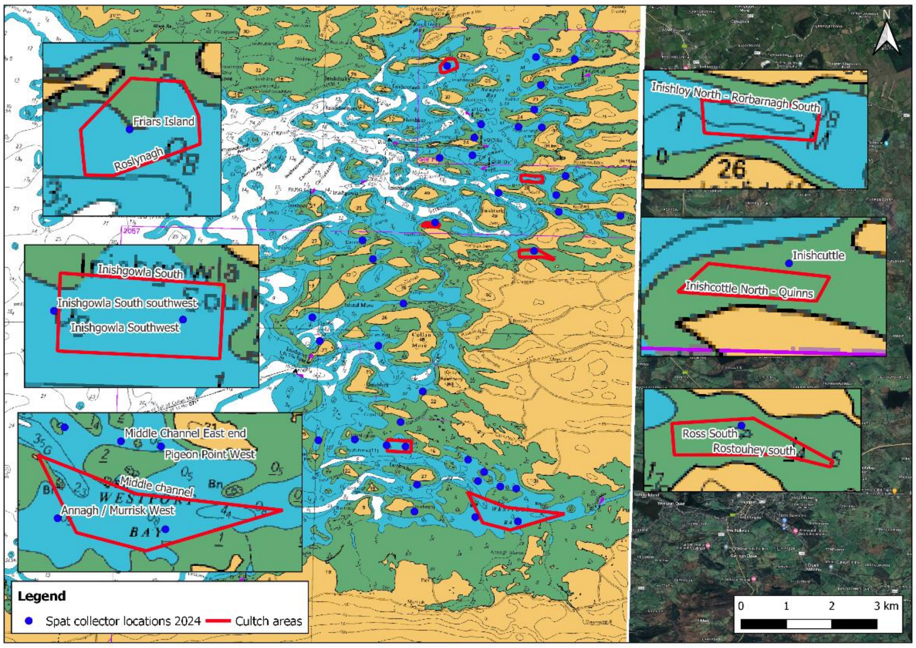

Figure 69. Location of cultch deployment in Clew bay, May 2024 and the locations of the 2024 spat collectors.

Figure 70. Scallop shell deployed at Roslynagh, Clew Bay in May 2024.

The Co-Op also deploys cultch in spat collector bags and uses spat catcher frames at a number of stations spread across Clew Bay. This work has been conducted annually since 2020 (Table 30). A total of 40 spat collector bags with whole Pacific oyster shell were deployed in 2024 (Figure 69).

This work in Clew Bay continues to increase the amount of substrate available for native oyster spat to settle on and contributes towards the restoration of the native oyster population in the bay.

Table 30. Total cultch and total area of frames deployed as spat settlement substrate.

Year	Number of sites	Total Wt of cultch (kg)	Subsample Wt of cultch (kg)	Sampled Area of frames (m^2)
2020 (pilot)	4	29.5	29.5	-
2021	10	-	61.1	4.3
2022	27	172.5	89	20.5
2023	25	323.5	135	15.6
2024	40	400	-	

10.8 *Inner Galway Bay - Mortality Study*

Annual survey data shows that mortality rates of native oyster in Galway Bay and particularly in oysters over 60mm in size are very high. High mortality is presumed to be caused mainly by the parasite *Bonamia ostreae*. However, significant mortality events are not usually evident and *Bonamia* prevalence and intensity can be very low although variable throughout the year. It is difficult, therefore, to directly link mortality to *Bonamia*.

In this study repeat surveys were completed twice per month in May, July and August near Mweenish Point in Inner Galway Bay (Figure 71) to observer any reductions in density of oysters that would indicate mortality events or reductions in particular of large oysters which suffer higher mortality rates from *Bonamia* infection. Bonamia prevalence was estimated at the beginning and at the end of the survey time series in the same location. A total of 16 tows were completed with a single dredge of 1.2 m width which covered an area of 2,244 m^2. For each track, oysters were counted and measured and returned to the sea in the same area to avoid depletion of densities due to the survey. A total of 3,043 oysters were measured.

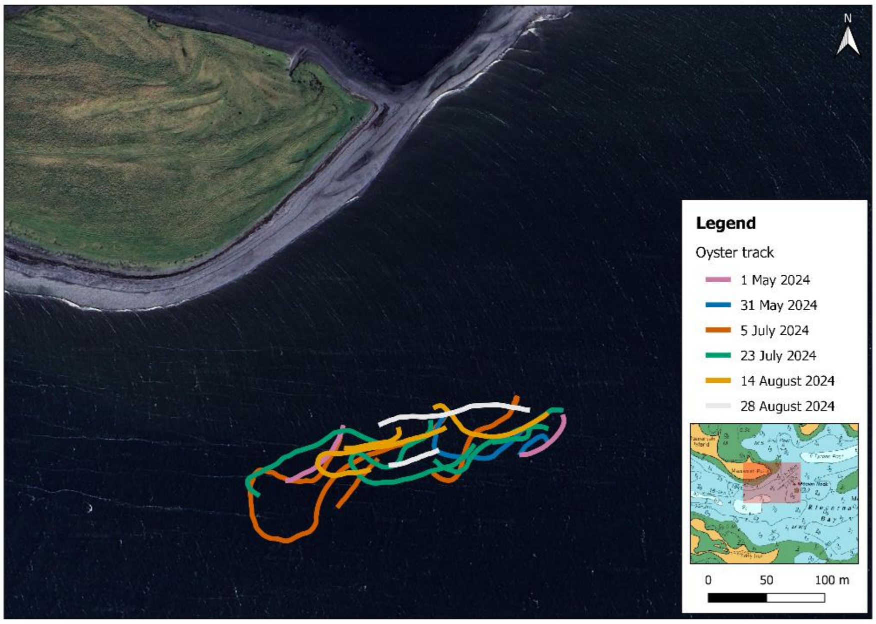

Figure 71. Survey tracks carried out near Mweenish Point in Inner Galway Bay.

The swept area varied from 146 to 664 m^2 between surveys. The density of oysters standardised by sampling effort decreased by 78 % between 31st May 2024 and 5th July 2024. Densities remained low until the 14th August 2024 but increased on the 28th August 2024 (Table 31).

Table 31. Track lengths, and oyster densities each survey day in Mweenish Point in Inner Galway Bay May to August 2024

Date	Haul Length (m)	Total Area (m^2)	Number of Oysters	Density (indiv/m^2)
01/05/2024	121	146	519	3.549
31/05/2024	153	183	600	3.263
05/07/2024	543	651	478	0.733
23/07/2024	553	664	518	0.779
14/08/2024	327	393	389	0.989
28/08/2024	170	204	539	2.638
Total	1,870	2,244	3,043	

Oyster size distribution in May, prior to the drop in density, compared to July and August after the drop in density, showed some decrease in the proportion of oysters over 60 mm from 20 % in May to 15 % in July-Aug (Figure 72). Smaller oysters below 35 mm were also more prevalent in May. Changes in these smaller size classes between May and July may be due to growth.

Bonamia prevalence decreased from 17 % in early May to 9 % in late August. Furthermore, the percentage of infected oysters with Level 3 & 4 infections, which are lethal, declined from 53 % in early May to 22 % in late August.

The data shows evidence of a mortality event in June. This is the usual time of spawning, based on cumulative degree days, and post spawning mortality in combination with *Bonamia* infection may be the cause given there was also a drop in *Bonamia* prevalence and intensity between May and August.

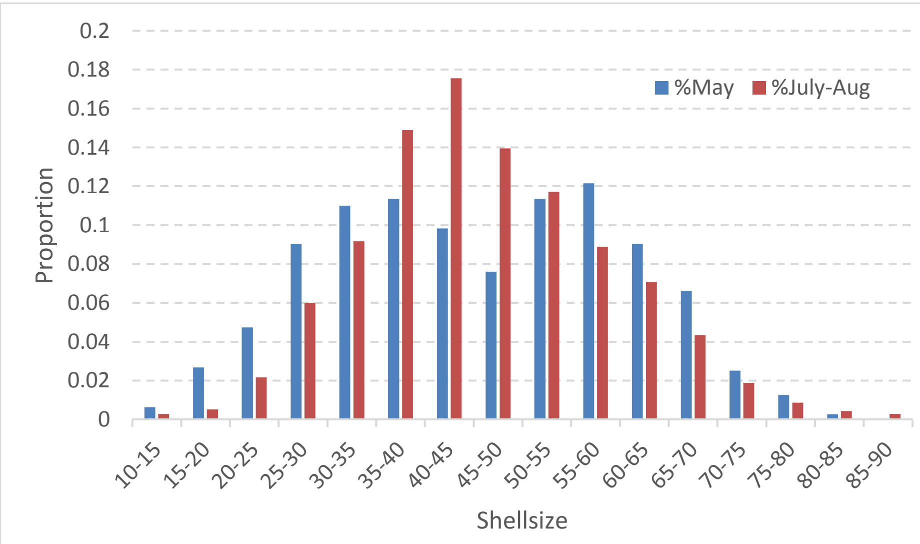

Figure 72. Mean lengths of oysters for each survey day near Mweenish Point in Inner Galway Bay.

11 Scallop (*Pecten maximus*)

11.1 *Management advice*

The scallop fishery is managed by a minimum landing size of 100-110 mm shell height. There are kilowatt day effort limits in ICES area VII. Seasonal closures apply in the eastern Irish Sea and English Channel. Additional measures may apply locally to inshore stocks.

Offshore scallop stocks in the Irish Sea, Celtic Sea and English Channel are fished by Irish, UK and French fleets. The eastern Channel, Celtic Sea and Cardigan Bay were the most important areas for the Irish fleet in 2023.

There is currently no integrated international stock assessment or advice for offshore scallop stocks. In Ireland spatially referenced catch rate indicators have been developed for the Irish fleet in the Celtic Sea, Irish Sea and English Channel. Some inshore stocks are assessed by survey. A new offshore survey in the Celtic Sea in 2024 is reported here.

Effort distribution across stocks varies annually. From 2006–2012, catch rates increased for most stocks but declined in the period 2013–2016 in the Celtic Sea and Irish Sea. In recent years catch rates have been highest in the eastern Channel. Generally, there is a lot of variability in annual catch rates within and between stocks.

Fishing effort/landings should be managed at the stock level in proportion to changes in spatially referenced standardised catch rate indicators, using data for all fleets, until more comprehensive assessments are developed.

Scallop fisheries can have significant negative effects on marine habitats including sedimentary habitats and biogenic reef. Spatial management of scallop fishing should be used to protect habitats within Natura 2000 sites.

11.2 *Issues relevant to the assessment of scallop*

There are currently no assessments or advice for offshore scallop stocks that are fished by Ireland, UK and France. Size and age data are available from opportunistic sampling of landings from Irish vessels, and annual surveys were completed in 2003−2005 and 2018 and 2019 in the Celtic Sea and Tuskar area. A recent survey of the inshore and offshore Celtic Sea scallop beds was undertaken in 2024. Annual surveys are generally undertaken by Northern Ireland, Isle of Man, Scotland, England, Wales and France.

Spatial variability in growth rates in particular, indicates the need for a spatially explicit approach to assessment and, therefore, the need for spatially explicit and systematic sampling programmes.

The main uncertainty in survey estimates is catchability which varies according to ground type. Surveys carried out in the Celtic Sea show that scallops are present in densities up to five times higher on coarse sediments, comprised mainly of gravel, compared to sand sediments. Geostatistical analysis of survey data can allow these differences across ground types to be taken into account, but only when a complete seabed/substrate map is available for the surveyed area.

A number of other approaches to assessment have been explored, including depletion assessment of commercial catch and effort data, with variable success. Age-based stock assessment methods are used in some countries for the assessment of scallop. However, these methods rely on the collection of accurate age data which is difficult to obtain for some stocks, such as the Celtic Sea. Catch rate indicators derived from logbook and VMS data offer scope for future assessment using production models.

11.3 *Management units*

Offshore scallop stocks in the Irish Sea, Celtic Sea and Western and Eastern English Channel are spatially discrete (Figure 73), but some can be variously interconnected during larval dispersal. Larval dispersal simulations show connectivity between the south Irish Sea and north east Celtic Sea, but limited east-to-west connectivity across the south Irish Sea between stocks in Cardigan Bay and off the Irish coast. There is also a general separation of stocks in the Northern Irish Sea and around the Isle of Man from stocks further south.

Inshore stocks are small and limited in distribution within bays on the south west and west coasts and are regarded as separate populations to the offshore stocks.

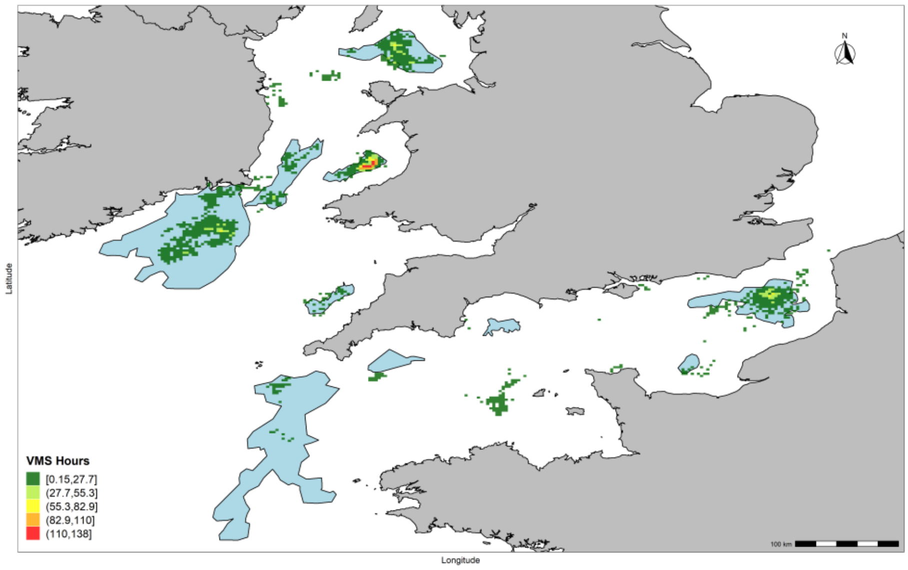

Figure 73. Scallop grounds fished by the Irish fleet in the Irish Sea, Celtic Sea and English Channel. Boundaries are defined from the distribution of fishing activity by the Irish fleet 2000–2015 as shown by VMS data and some UK VMS data. The stock boundary limits are likely to be larger particularly in inshore areas of the Irish Sea and English Channel considering that the UK and French fleets fish mainly in these areas. VMS data from the offshore Irish fleet for 2021 (raster 3 km^2 grid) are shown relative to the spatial extent of the stocks that are fished.

11.4 *Management measures*

In Ireland the capacity of the scallop fleet over 10 m in length has been limited (ring fenced) since 2006 and an authorisation is required to fish for scallop. The total annual effort (kW days) of the fleet is also capped by the Western Waters agreement (EC 1415/2004). Given the relationship between vessel length and dredge number, the number of dredges in the fleet can be predicted annually from the length of the vessels authorised. Since 2012 the number of dredges in the fleet varied from 198-230 compared to the estimated 522 dredges prior to the decommissioning of part of the fleet in 2006.

The minimum landing size (MLS) is 100 mm shell width for most of the offshore stocks other than those in the Irish Sea north of 52.5°N where the MLS is 110 mm. For some inshore stocks, MLS of up to 120 mm are used locally by agreement or as conditions established by shellfish co-operatives that may have aquaculture licences to manage scallop stocks locally e.g. Cill Chiaráin Bay, Co. Galway.

Scallop fishing is excluded from areas supporting sensitive habitats. These include seagrass, maerl and reef communities in Roaringwater Bay, Co. Cork and Blacksod Bay, Co. Mayo, as well as the SACs at the Saltee Islands and Hook Head, Co. Wexford.

11.5 *Offshore scallop fisheries*

11.5.1 Landings

Landings increased from 1995–2004 due to expansion of the geographic areas fished, particularly in the Celtic Sea (Figure 74). The Irish fleet also target scallop in the north east Irish Sea around the Isle of Man and in the Western Approaches to the English Channel. The fleet was partly decommissioned in 2006 and restricted in capacity thereafter and landings consequently declined. New vessels entered the fleet after 2006 and landings increased to an all-time high by 2013. Other than in 2015 and 2020 total landings have remained above 2,000 tonnes per annum since 2011 (Figure 74).

The majority of landings by Irish vessels are usually from the Celtic Sea, although the Eastern English Channel has become an increasingly important area for the fleet in recent years (Figure 74). The increase in landings from the Eastern English Channel since 2016 is correlated with a decline in landings from the Celtic Sea (Figure 74).

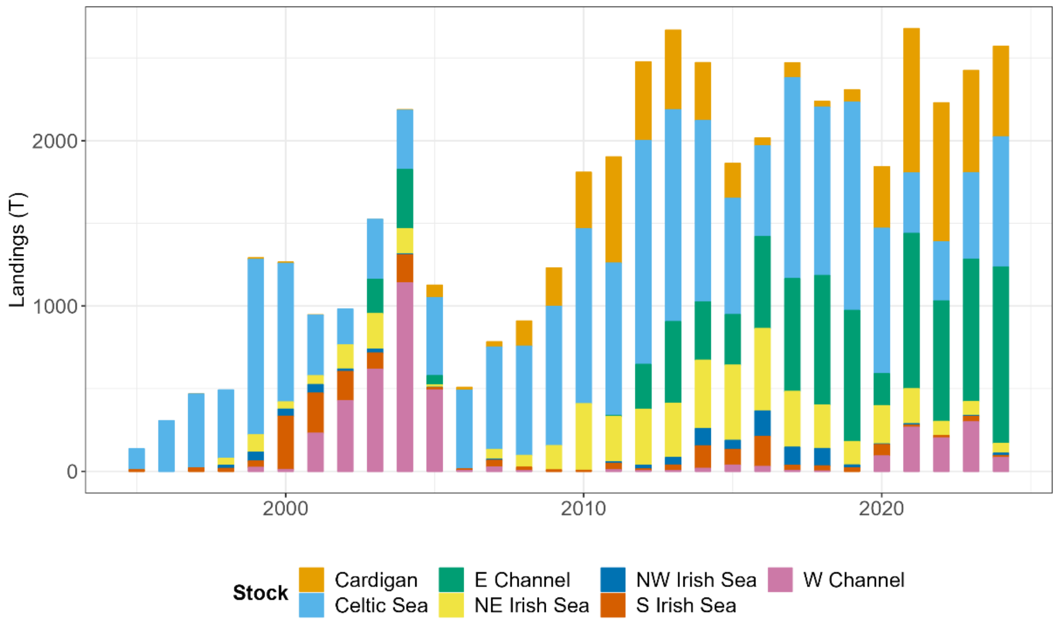

Figure 74. Annual landings of scallop by the Irish fleet from stocks in the Celtic Sea, Irish Sea and English Channel areas 1995–2024.

11.5.2 Catch rate indicators

Catch rates are highly variable between years in each stock area. In the Celtic Sea, catch rates ranged from 20–60 kgs.dredge^{-1}.day^{-1} up to 2006 and increased to 80 kgs.dredge^{-1}.day^{-1} from 2010–2012 (Figure 75). Catch rates declined between 2010 and 2016 in most areas. Catch rates declined substantially in the Western English Channel between 2014 and 2018, although landings and effort in this area were negligible since 2006. Catch rates in this area increased up to to 2020 before decreasing again in 2023. In the Eastern English Channel catch rates peaked at 160 kgs.dredge^{-1}.day^{-1}

in 2016 (Figure 75) which is more than double that of any other area prior to 2019. Despite a decline in the 2019 catch rates in the eastern English Channel have trended upwards in recent years. This area is an extension of the highly productive stocks in French waters. The Cardigan Bay area and western Channel also yielded high catch rates up to 2023 when catch rates from both areas decreased. The Irish fleet fish in the eastern Channel during winter months (November–February), which was previously the time when the fleet targeted the north east Irish Sea area south of the Isle of Man. The degree to which these nominal indicators reflect changes in stock status is unclear. Technology creep based on improved seabed discrimination methods may have contributed to better catch performance in recent years. Some expansion of the fishing grounds in the Celtic Sea have also occurred recently.

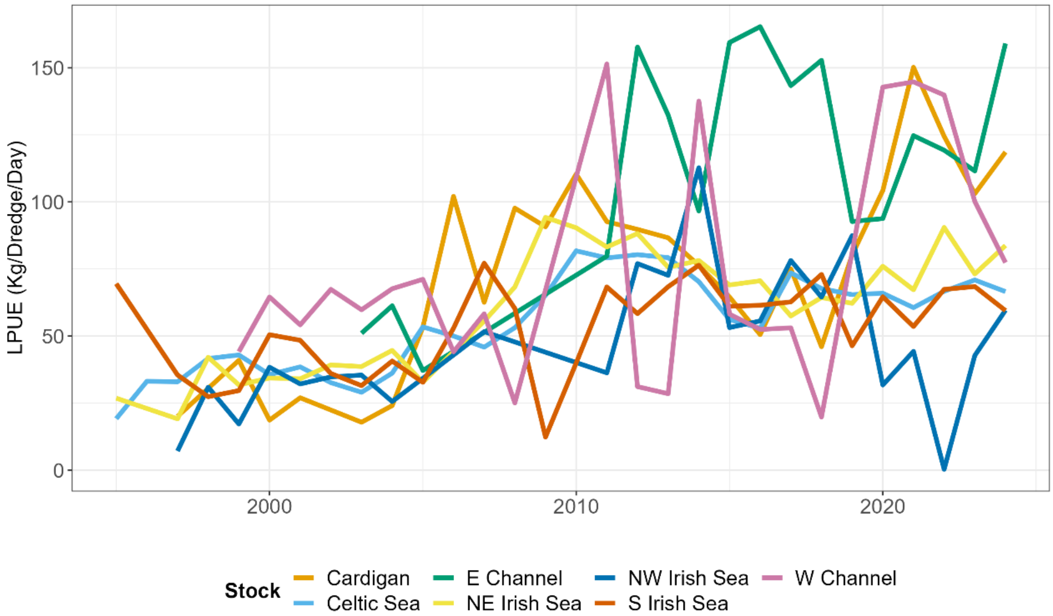

Figure 75. Annual average catch rate (kgs.dredge^{-1}.day^{-1}) from the main scallop stocks fished by the Irish fleet 1995–2024.

11.6 *Scallop surveys and Biomass Assessment*

11.6.1 Celtic Sea

Scallop grounds in the Celtic Sea have been sporadically surveyed, with previous surveys being carried out in 2003-2005 and 2018 and 2019. In 2024, the survey area was re-defined based on analysis of the most recent VMS data from the commercial Irish scallop boats, which showed activity further south than the area covered during the survey in 2019. This report summarizes the outputs from the 2024 survey

11.6.1.1 Biomass in 2024

Total biomass estimates of scallops without taking into account the effects of dredge efficiency and selectivity was 1,065.5 and 456.2 tonnes for the offshore and inshore areas of the Celtic Sea, respectively (Table 32). In the offshore area 76 % of the biomass consisted of commercial size scallops (above 100 mm shell width) while commercial sized scallops make up 42 % in the inshore area. Ground type (coarse sediment vs sand) was found to be an influential factor when modelling scallop densities, with higher densities of scallops found on coarser ground as previously reported in earlier surveys. In the inshore area, higher densities of scallops were found towards the northern limit of the study region, closer to the coastline (Figure 76a). Areas inshore of this limit are closed to scallop dredging to protect reef habitat.

In the offshore region, scallop densities were higher in the south of the survey area, and would suggest that scallops could be found beyond the south margin of the survey area although VMS data does not show significant fishing activity in this area (Figure 76b).

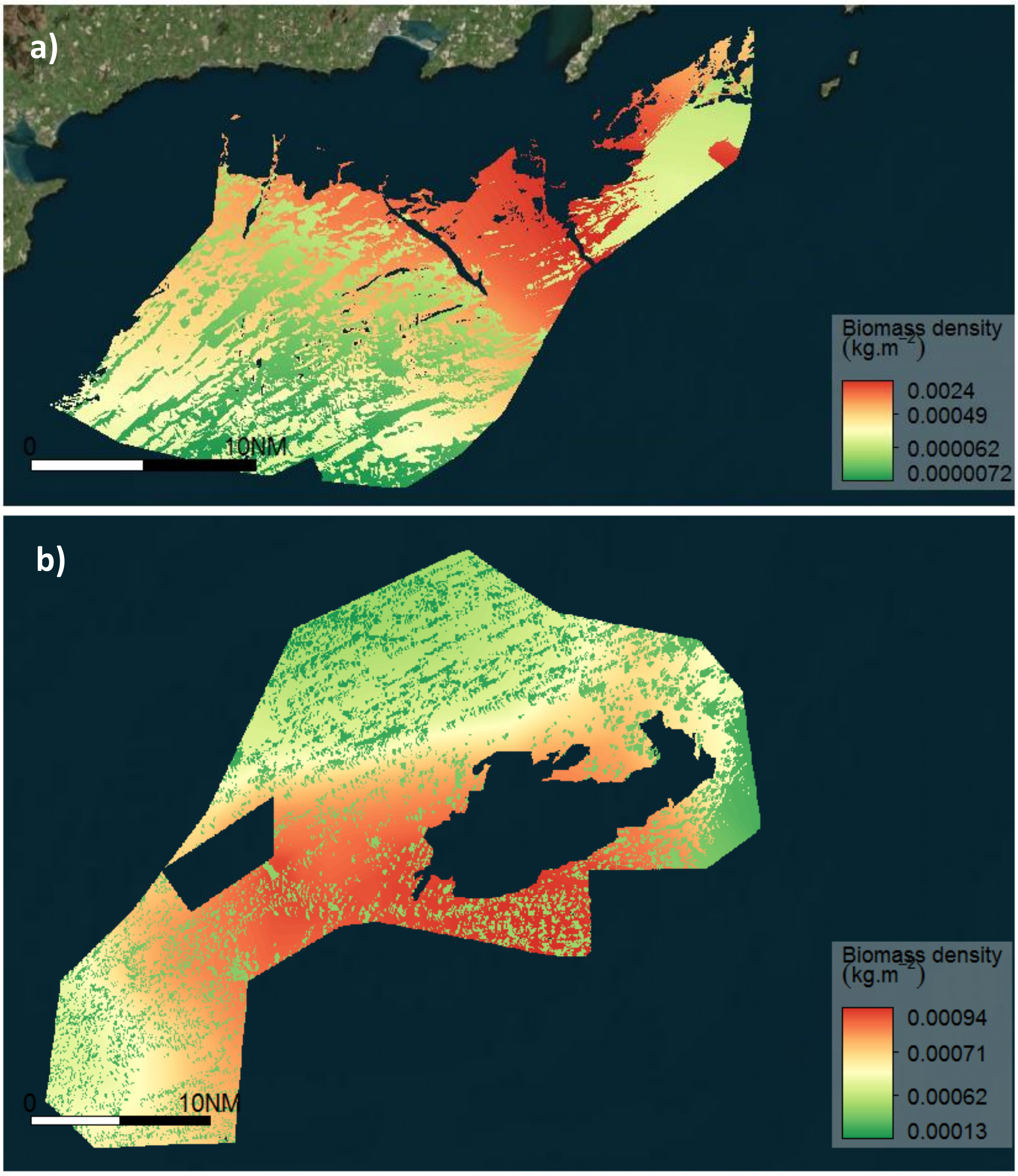

Figure 76. Spatial distribution of estimated total biomass of scallop (*Pecten maximus*) (uncorrected for dredge efficiency) in a) inshore and b) offshore Celtic Sea survey area in April 2024.

Table 32. Estimates of scallop biomass (uncorrected for dredge efficiency) in the offshore and inshore areas of the Celtic Sea, April 2024.

	Offshore			Inshore		
	Mean	95 % inf	95% sup	Mean	95 % inf	95% sup
Total Biomass (tonnes)	1,065.5	957.2	1,186.1	456.2	358.6	580.4
Biomass > 120 mm MLS (tonnes)	810.1	675.4	971.8	195.6	146.5	262.1

11.6.1.2 Size distribution

The size distribution of scallop in the Celtic Sea is shown in Figure 77. The size distribution is unimodal in both inshore and offshore areas. Inshore 2024 data was really similar to that of the 2019 survey. Offshore densities were lower in 2024 and with fewer smaller scallops suggesting weak recruitment in recent years in this area. The slope of the right hand side of the distributions are similar suggesting no change in mortality rates.

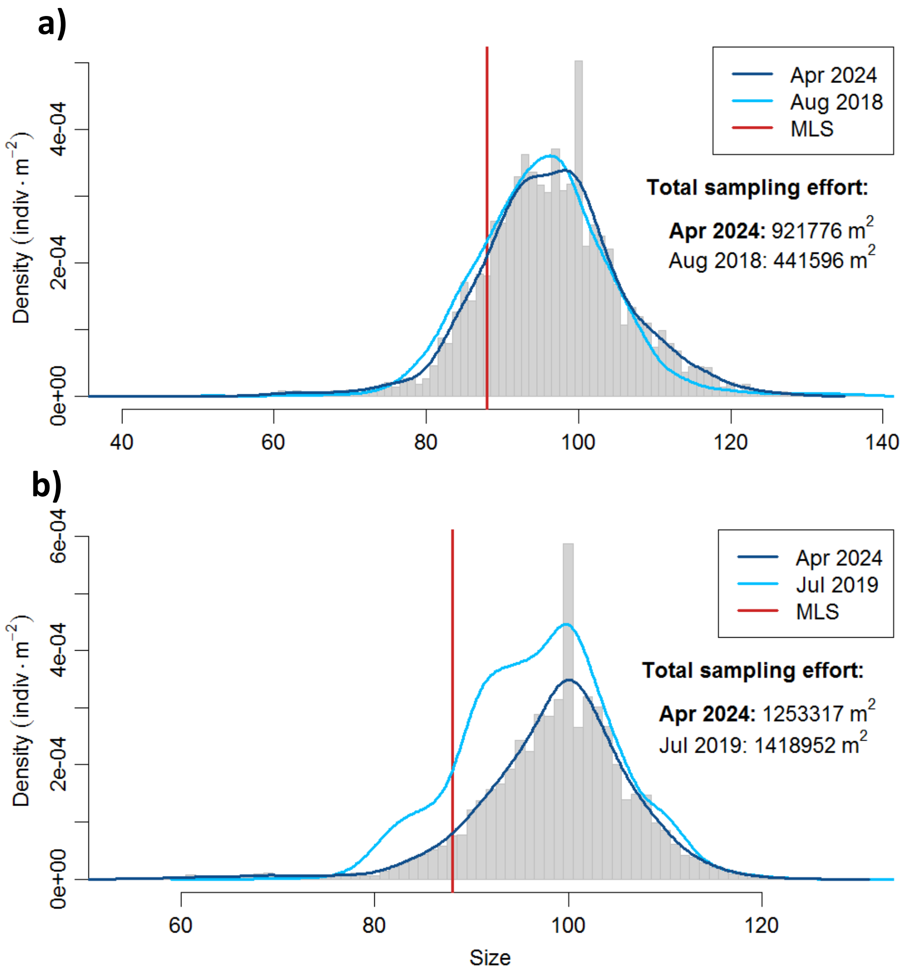

Figure 77. Size distribution and densities of scallop in the a) Inshore and b) Offshore area of the Celtic Sea in April 2024. The size data presented here are measurements of scallop shell height (mm). Vertical red line at 88 mm corresponds to the MLS of 100 mm shell width. Data are standardised to sampling effort regardless of its spatial distribution.

11.6.2 Comharchumann Sliogéisc Chonamara (Galway) Survey 2024

A survey was carried out on the 27th November and 4th December on the scallop (*Pecten maximus*) beds of Cill Chiaráin and Caisín Bays. A total of 46 tows were completed in Cill Chiaráin and Caisín Bays using 3 x 0.75 m wide spring-loaded scallop dredges. Scallop catch and bycatch were recorded, weighed and measured on board from each tow. The local shellfish co-operative, Comharchumann Sliogéisc Chonamara (CSC), minimum landing size for scallop is 120 mm shell width which is equivalent to 104 mm shell height. The survey dredges use commercial ring sizes and are, therefore, unlikely to retain 1 or 2-year-old scallops or to provide evidence of recent recruitment.

Lobster and shrimp pots in both locations hampered accessibility to the scallop beds during the survey.

11.6.2.1 Biomass in 2024

Density of all scallops and scallops over 120 mm shell width (104 mm equivalent in shell height) in Cill Chiaráin Bay, uncorrected for catchability, varied from 0.0042-0.044 kgs.m^{-2} and 0.0031-0.041 kgs.m^{-2}, respectively (Figure 78).

The total biomass of scallops and scallops over 120 mm shell width in the survey area of 2.43 Km^2, uncorrected for catchability, was estimated to be 49.2 tonnes and 39.9 tonnes (81 % of total biomass), respectively (Table 33). This was a decrease on the biomass estimate from the 2023 survey of 2.8 tonnes. The lower sampling effort in 2024 resulted from issues accessing the scallop bed due to potting gear, however, uncertainties about the efficiency of the gear can also result in inter-annual variability in the biomass estimates.

Table 33.Estimates of scallop biomass (uncorrected for dredge efficiency) in Cill Chiaráin Bay survey area, November/December 2024.

	Biomass (tonnes)		95% HDI inf	95% HDI sup
	Mean	Median		
Uncorrected for Dredge Efficiency				
Biomass_*Pecten maximus*	49.18	57.15	45.23	69.49
Biomass_>120mm_ *Pecten maximus*	39.92	45.61	35.71	55.94

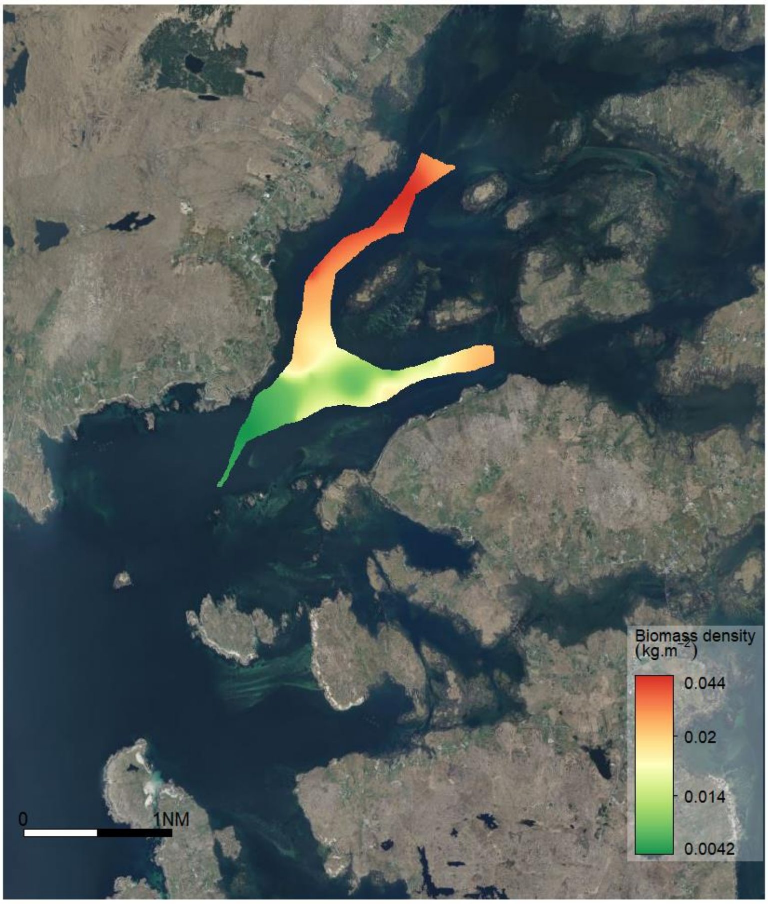

Figure 78. Distribution and biomass of all sizes of scallop (uncorrected for dredge efficiency) in Cill Chiaráin Bay, November/December 2024.

Density of all scallops and scallops over 120 mm shell width in Caisín Bay, uncorrected for catchability, varied from 0.00006- 0.017 kgs.m^{-2} and 0.000044-0.011 kgs.m^{-2}, respectively (Figure 79).

The total biomass of scallops and scallops over 120 mm shell width in the survey area of 1.25 Km^{2}, uncorrected for catchability, was 7.38 tonnes and 5.06 tonnes (68.6 % of total biomass), respectively (Table 34). A decrease of approximately 4 tonnes from the 2023 survey. This decrease can be partly explained by the slightly smaller area surveyed in 2024.

Table 34. Estimates of scallop biomass (uncorrected for dredge efficiency) in Caisín Bay survey area, December 2024.

	Biomass (tonnes)		95% HDI inf	95% HDI sup
	Mean	Median		
Uncorrected for Dredge Efficiency				
Biomass_ *Pecten maximus*	7.38	7.39	5.47	9.60
Biomass_>120mm_ *Pecten maximus*	5.06	4.97	3.69	6.37

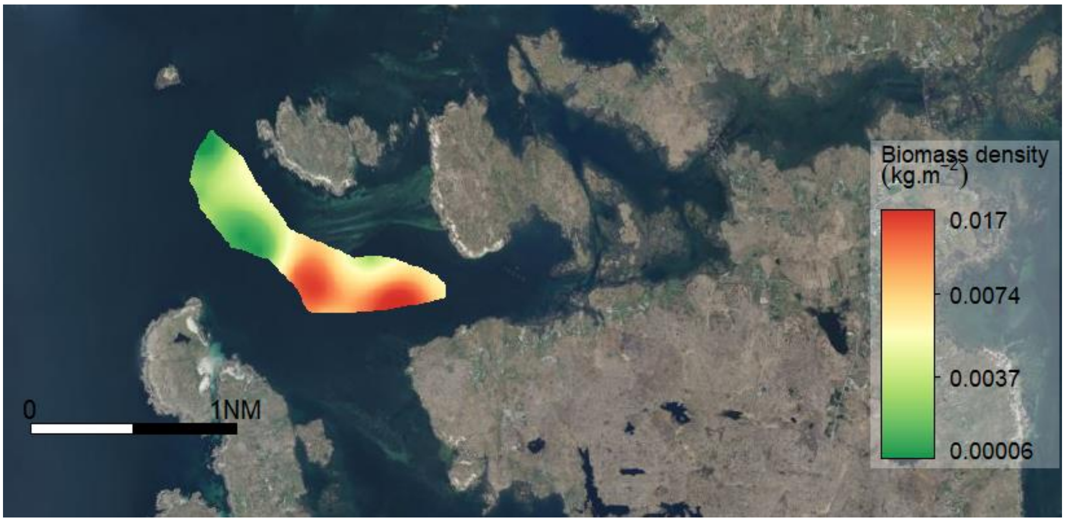

Figure 79. Distribution and biomass of all sizes of scallop (uncorrected for dredge efficiency) in Caisín Bay, December 2024.

11.6.2.2 Size distribution

The size distribution of scallop in Cill Chiaráin Bay showed a strong mode at 116 mm shell height (Figure 80). A smaller cohort with a mode of 78 mm shell height was also recorded. There was no sign of the larger cohort of ~123 mm shell height recorded in 2023 during the 2024 survey.

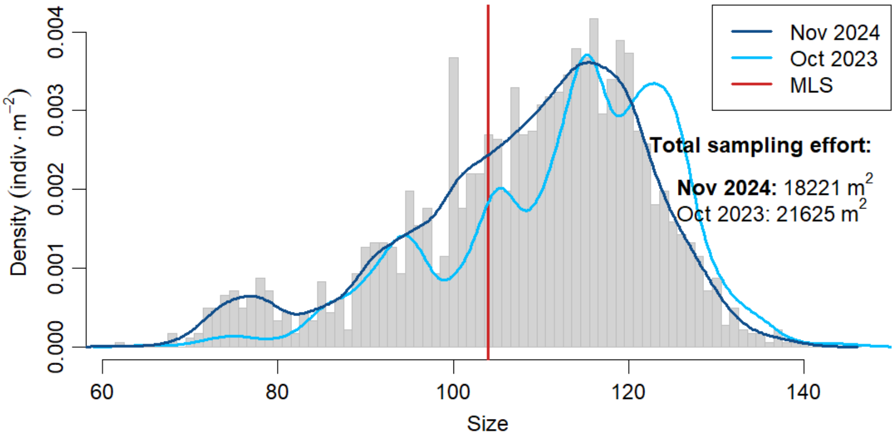

Figure 80. Size distribution and densities of scallop in Cill Chiaráin Bay, November/December 2024. The size data presented here are measurements of scallop shell height (mm). Vertical red line corresponds to the CSC MLS of 120 mm shell width (104 mm shell height). The size distribution of scallop from the October 2023 survey is included for comparison.

The size distribution of scallop in Caisín Bay showed a mode at ~108 mm (Figure 81). Two smaller size cohorts can be seen at ~86 mm and ~95 mm shell height. Although some small scallop between 60-70 mm shell height were caught, it should be noted that the commercial gear employed during the survey is unlikely to effectively sample the smaller size classes of scallop.

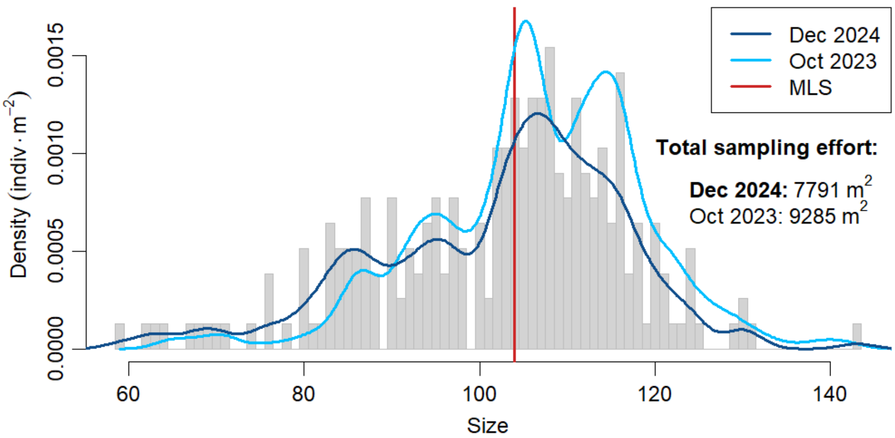

Figure 81. Size distribution and densities of scallop in Caisín Bay, December 2024. The size data presented here are measurements of scallop shell height (mm). Vertical red line corresponds to the CSC MLS of 120 mm shell width (104 mm shell height). The size distribution of scallop from the October 2023 survey is included for comparison.

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13 Glossary

Accuracy A measure of how close an estimate is to the true value. Accurate estimates are unbiased.

Benthic living in or relating to the lowest levels of the sea and sea floor.

***Bonamia* (*ostreae*)** A parasite of native oyster which infects the blood cells and causes mortality of oysters.

Biomass Measure of the quantity, e.g. metric tonne, of a stock at a given time.

Bivalve A filter feeding mollusc with two shells e.g. scallops, cockles.

Cohort (of fish) Fish which were born in the same year.

Cultch Shell material deposited on the seabed to provide settlement surface for oyster larvae.

Ecosystems are composed of living animals, plants and non-living structures that exist together and 'interact' with each other. Ecosystems can be very small (the area around a boulder), they can be medium sized (the area around a coral reef) or they can be very large (the Irish Sea or even the eastern Atlantic).

Exploitation rate The proportion of a population at the beginning of a given time period that is caught during that time period (usually expressed on a yearly basis). For example, if 720,000 fish were caught during the year from a population of 1 million fish alive at the beginning of the year, the annual exploitation rate would be 0.72.

Fishing Effort The total fishing gear in use for a specified period of time.

Fishing Mortality Deaths in a fish stock caused by fishing usually reported as an annual rate (F).

Fishery Group of vessel voyages targeting the same (assemblage of) species and/or stocks, using similar gear, during the same period of the year and within the same area (e.g. the Irish flatfish-directed beam trawl fishery in the Irish Sea). Also referred to as a metier.

Fishing Licences A temporary entitlement issued to the owner of a registered fishing vessel to take part in commercial fishing.

Fleet Capacity A measure of the physical size and engine power of the fishing fleet expressed as gross tonnage (GTs) and kilowatts (KWs).

Fleet Segment The fishing fleet register, for the purpose of licencing, is organised in to a number of groups (segments).

Growth overfishing Reduced yields of fish due to reduction in average size/weight/age caused by fishing mortality and indicating that the rate of fishing is higher than the rate at which fish grow to given sizes to replace those being removed

Management Plan is an agreed plan to manage a stock. With defined objectives, implementation measures or harvest control rules, review processes and usually stakeholder agreement and involvement.

Management Units A geographic area encompassing a 'population' of fish de-lineated for the purpose of management. May be a proxy for or a realistic reflection of the distribution of the stock.

Minimum Landing Size (MLS) The minimum body size at which a fish may legally be landed.

Natura A geographic area with particular ecological features or species designated under the Habitats or Birds Directives. Such features or species must not be significantly impacted by fisheries.

Natural Mortality Deaths in a fish stock caused by predation, illness, pollution, old age, etc., but not fishing.

Polyvalent A type of fishing licence. Entitlements associated with these licences are generally broad and non-specific. Vessels with such licences are in the polyvalent segment of the fishing fleet.

Precision A measure of how variable repeated measures of an underlying parameter are.

Quota A portion of a total allowable catch (TAC) allocated to an operating unit, such as a Vessel class or size, or a country.

Recruitment The amount of fish added to the exploitable stock each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to the fishing gear in one year would be the recruitment to the fishable population that year. This term is also used in referring to the number of fish from a year class reaching a certain age. For example, all fish reaching their second year would be age 2 recruits.

Recruitment overfishing The rate of fishing, above which, the recruitment to the exploitable stock becomes significantly reduced. This is characterised by a greatly reduced spawning stock, a decreasing proportion of older fish in the catch, and generally very low recruitment year after year.

Reference points Various reference points can be defined for fished stocks. These can be used as a management target or a management trigger (i.e. point where more stringent management action is required). Examples include fishing mortality rate reference points, biomass reference points, indicator eg catch rate reference points or those based on biological observations.

Sales Notes Information on the volume and price of fish recorded for all first point of sale transactions.

Special Area of Conservation (SAC) Site designated by the government under the Habitats Directive 92/43/EEC which seeks to safeguard the long-term survival of valuable and threatened species and habitats.

Special Protection Area (SPA) Site designated by the government under the Birds Directive 79/409/EEC which seeks to safeguard sites that are important to bird species.

SFPA Sea Fisheries Protection Authority. The independent statutory body responsible for the regulation of the sea-fisheries and the seafood production sectors.

Shellfish Molluscan, crustacean or cephalopod species that are subject to fishing.

Size composition The distribution, in size, of a sample of fish usually presented as a histogram.

TAC Total Allowable Catch

Vivier A fishing vessel, usually fishing for crab, with a seawater tank(s) below decks, in which the catch is stored live.

VMS Vessel Monitoring System. Vessels report GPS position periodically when fishing

V-notch A conservation measure used in lobster fisheries in Ireland and elsewhere whereby lobsters marked with a v-notch are protected from fishing

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