

Overview of landings and catches of cephalopods in the Danish fisheries.

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Abstract

Danish landings of cephalopods have increased from less than 50 tonnes per year for the period 2011-2014 to more than 430 tonnes in 2020. The main catch areas are in Skagerrak and the northern North Sea where most of the landings are taken by bottom trawl, using a wide range of mesh sizes. Cephalopod species were recorded in 12.8 % of the commercial hauls monitored by observers from DTU Aqua, indicating that cephalopods are quite commonly caught by the Danish fisheries. Around 94% of the total monitored cephalopod catches were landed.

More than 99% of the official landings weight of cephalopods is recorded using the common name “Blæk-sprutte” (cephalopods). Only a very small fraction of landings have been recorded at species level. The same lack of species identification is obvious from the observer sampling schemes performed by DTU Aqua. As a consequence, the species composition of Danish cephalopods landings must be considered as practically unknown or at least not documented.

Data and methods.

1. Data on official landings of cephalopods by the Danish commercial fisheries are available from the Danish AgriFish Agency. Data are based on landings declaration/sales slips from first-hand buyers (census data) and from samples from industrial landings where the catches may not be fully sorted and recorded by species.

2. Landings, by gear and geographical position are obtained by a merge of data from sales slips, data from logbooks (catch per haul or area), data from the vessel register (vessel size and type) and from VMS (geographical tracking of vessel and its activity). This merge of data results in a detailed dataset for each fishing trip with information on species landings, catch position and time, and vessel and gear characteristics. Ideally, in the merge, landings from sales slip are distributed on hauls according to information on the catches recorded in the logbook. The geographical positions of the individual haul catches are likewise obtained from allocation of VMS data to the catch positions from logbook information. However, catches per haul of cephalopods are often quite small, such that information on the individual cephalopods species is not included in the logbook, however registered in sales slips. For such cases, assumptions are made to split the recorded landings from sales slips on logbook and geographical position (see e.g. ICES, 2019 for further details on data compilations). This means that the quantity landed by vessel is certain (even though species identification may be wrong) but the geographical distribution of the individual species catch may have a larger uncertainty.

Landings of by-catch species (e.g. cephalopods) landed for industrial purposes are not fully recorded by species. It has not been possible to allocate by-catch species of cephalopods to the individual trips in the industrial fisheries, such that the detailed data set does only include landings for human consumption purposes.

3. Data on landings and discards from observer trips are obtained from DTU Aqua observers on board fishing vessels during commercial fishery from hauls where the full catch of all species have been recorded. The focus has been on sampling from the fisheries with high discards of commercially important species and includes mainly mobile gears with bottom contact. Data presented include the period 2011-2020 with a total of 4937 hauls (Table 1).

Table 1. Number of samples (hauls) by year and gear from the Danish observer program 2011-2020 where the full catch has been recorded by species.

	GNS	GTR	LLS	OTB	OTT	PTB	SDN	SSC	TBB	all
2011	24	11	5	96	149	3	39	2	21	350
2012	51	9	6	87	183	0	53	0	28	417
2013	42	5	3	69	249	0	34	7	48	457
2014	30	17	3	119	241	7	18	10	63	508
2015	18	31	6	109	269	0	7	10	78	528
2016	25	28	3	150	214	0	5	23	57	505
2017	40	15	3	135	213	1	13	7	50	477
2018	19	5	9	154	357	0	30	16	54	644
2019	5	0	6	158	377	0	23	56	17	642
2020	0	3	0	91	231	0	22	26	36	409
all	254	124	44	1168	2483	11	244	157	452	4937

GNS=Set gillnets; GTR=Trammel nets; LLS=Set longlines; OTB=Otter bottom trawls; OTT=Otter twin trawls; PTB=pair bottom trawls; SDN=Danish seines; SSC=Scottish seines; TBB=beam trawls.

Results

1. Official landings, including landings for human consumption and industrial purposes are presented in Table 2 for the period 2011-2020. There is an increase on landings of cephalopods over time, ranging from less than 50 tonnes per year in the beginning of the time series to 430 tonnes in 2020. The Danish landings statistics use the common name “Blæksprutte” (Cephalopods) for almost all cephalopods recorded. For most recent years less than 1% of landings from this group has been split into “Ottearmet blæksprutte” (eight-armed octopuses) and “Tiarmet blæksprutte” (ten-armed squids and cuttlefishes). Only one named species *Todarodes sagittatus* (European flying squid, Flyveblæksprutte) has been recorded from industrial landings. Recorded landings of cephalopods from industrial fisheries have increased significantly in recent years (Table 3) and constitute 17% of the total landings in 2020. Appendix 1 shows the sum of all landings, 2011-2020, by species sorted by landings place. The Danish harbors Hanstholm, Thyborøn, Hirtshals and Skagen have the largest landings of cephalopods.

2. Landings, by gear and geographical position (Table 4) include around 80% in weight of the total official cephalopod landings, both by individual year and for the sum of landings.

The highest landings of cephalopods are taken by bottom trawl (Table 5) followed by other mobile gears like pelagic trawls and Danish seine. Landings by mesh size (Table 6) show that large mesh (e.g. larger than 120 mm) gear have a rather high proportion of the total cephalopod landings, which indicates that size selection for cephalopods differs from size selection for fish. It would be expected that the (small) circumference of the cephalopods would allow the animal to escape through the (larger) meshes, however circumference is related to size of the animal and no size information is available.

Figure 1 shows the distribution of landings by recorded species group. The main catch areas are in Skagerrak and the northern North Sea, but there are also landings from Kattegat and the western Baltic Sea, even though the landings from the southern part of the western Baltic might be due to misreporting or uncertainties in the method applied.

3. Data on landings and discards from observer trips include more than 5 tonnes of cephalopods (Table 7). The discard rates are highly variable between years but large catches are landed, such that the average discard percentage for all catches combined is 6%. Catches are not normally separated by species, but recorded as Blæksprutte" (Cephalopods) (Table 8). Species name is however recorded for 4 species where each species is present in 0.02% of the hauls. This corresponds to that the species was recorded in one haul out the total 4937 hauls. Due to this low rate, recorded species catches are lumped into the group of cephalopods for further analysis.

Cephalopod species were recorded in 12.8 % of the observed hauls, indicating that cephalopods are quite commonly caught by the Danish fisheries. The highest presence of cephalopods is observed from the deeper part of the North Sea and Skagerrak along the deeper parts of the Norwegian trench (Figure 3), but cephalopods are also found in more coastal and shallow waters. No cephalopod species was found in the brackish water, subdivisions 22 - 25 (Table 9), but some species have been recorded in both the northern and southern Kattegat (subdivision 21). The presence of cephalopods are higher in the northern North Sea (4a) than in the central North Sea (4b), however this result might be biased from the sampling method and effort.

Table 2. Official Danish commercial landings (tonnes) by recorded species group and year.
“0.0” indicates a positive catch smaller than 50 kg.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	all
Cephalopoda (Cephalopods, Blæksprutte)	57.7	33.3	47.6	49.6	206.5	86.4	278.9	120.4	289.8	427.3	1597.6
Octopoda (Octopus, Ottearmet blæksprutte)	-	-	-	-	0.0	-	-	-	-	1.1	1.1
Teuthida (Squids-cuttlefishes, Tiarmet blæksprutte)	-	-	-	-	-	-	-	-	0.0	-	0.0
Todarodes sagittatus (European flying squid, Flyveblæksprutte)	-	-	-	-	-	-	-	-	0.2	1.8	2.0
all	57.7	33.3	47.6	49.6	206.5	86.4	278.9	120.4	290.0	430.1	1600.6

Table 3. Official Danish commercial landings (tonnes) from the industrial fisheries by recorded species group and year.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	all
Cephalopoda (Cephalopods, Blæksprutte)	0.1	0	0	0	0	11.4	14.1	16.4	32.1	71.9	146.0
Todarodes sagittatus (European flying squid, Flyveblæksprutte)	-	-	-	-	-	-	-	-	0.2	1.7	1.9
all	0.1	0	0	0	0	11.4	14.1	16.4	32.3	73.6	148.0

Table 4. Danish commercial landings (tonnes) with information on gear and catch positions by recorded species group and year.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	all
Cephalopoda	42	23	42	35	169	68	224	93	226	322	1244
Octopoda	-	-	-	-	-	-	-	-	-	0	0
Teuthida	-	-	-	-	-	0	0	0	0	14	14
Todarodes sagittatus	-	-	-	-	-	-	-	-	-	0	0
all	42	23	42	35	169	68	224	93	226	336	1258

Table 5. Danish commercial landings (tonnes) with information on gear and catch positions, summed over the period 2005-2020, by recorded species group and gear.

	Beam-trawl	Bottom trawl	Danish seine	Pelagic trawl	setnet	all
Cephalopoda	8	1369	110	129	2	1618
Octopoda	-	0	-	-	-	0
Teuthida	-	8	-	6	-	14
Todarodes sagittatus	-	0	-	-	-	0
all	8	1377	110	135	2	1632

Table 6. Danish commercial landings (tonnes) with information on gear and catch positions, summed over the period 2005-2020 for gear equal to bottom trawl, by recorded species group and mesh size (mm).

	[0,32)	[32,70)	[70,100)	[100,120)	[120,150)	[150,400)	all
Cephalopoda	23	3	516	84	743	0	1369
Octopoda	-	-	-	-	0	-	0
Teuthida	8	0	0	0	0	-	8
Todarodes sagittatus	-	0	-	-	-	-	0
all	31	3	516	84	743	0	1377

Table 7. Landings and discards (kg) and discard percentage of cephalopod species as recorded from observer trips in the Danish fisheries, 2011-2020.

	Discards	Landings	All	Discard %
2011	25	14	39	64
2012	17	23	40	42
2013	5	91	96	6
2014	6	167	172	3
2015	24	383	407	6
2016	31	55	86	36
2017	31	732	763	4
2018	93	203	296	31
2019	37	2765	2801	1
2020	27	582	609	4
all	295	5015	5310	6

Table 8. Presence of cephalopod species in a haul as recorded from observer trips in the Danish fisheries, 2011-2020.

Species	Presence of species (%)
Cephalopoda (Cephalopods, Blæksprutte)	12.82
Illex coindetii (broadtail shortfin squid, Rød blæksprutte)	0.02
Loligo forbesii (long-finned squid, Loligoblæksprutte)	0.02
Octopus vulgaris (common octopus, Almindelig Ottearmet Blæksprutte)	0.02
Sepia officinalis (Common cuttelfish, Sepiablæksprutte)	0.02
Sepiolidae (Cuttelfish, Sepiolidae)	0.02

Table 9. Presence of cephalopods species in a haul in percentage of the total number of hauls by area as recorded during observer trips in the Danish fisheries.

	22	23	24	25	3an	3as	4a	4b
Cephalopoda	0	0	0	0	17.58	7.65	20.3	10.67
number of hauls	318	9	179	300	1365.00	562.00	1192.0	1012.00

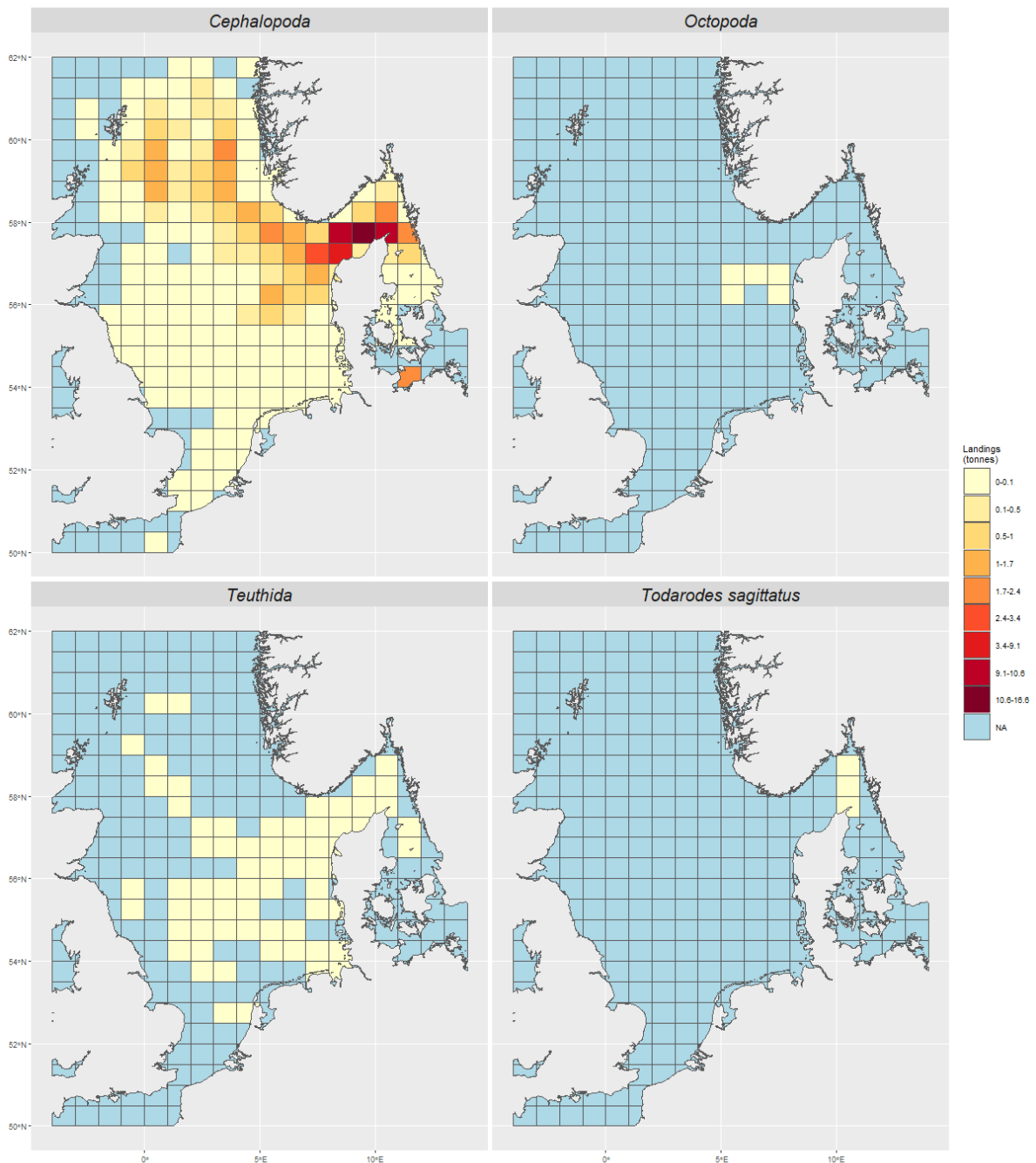


Figure 1. Average annual landings (2005-2020) of cephalopods by Danish fisheries.

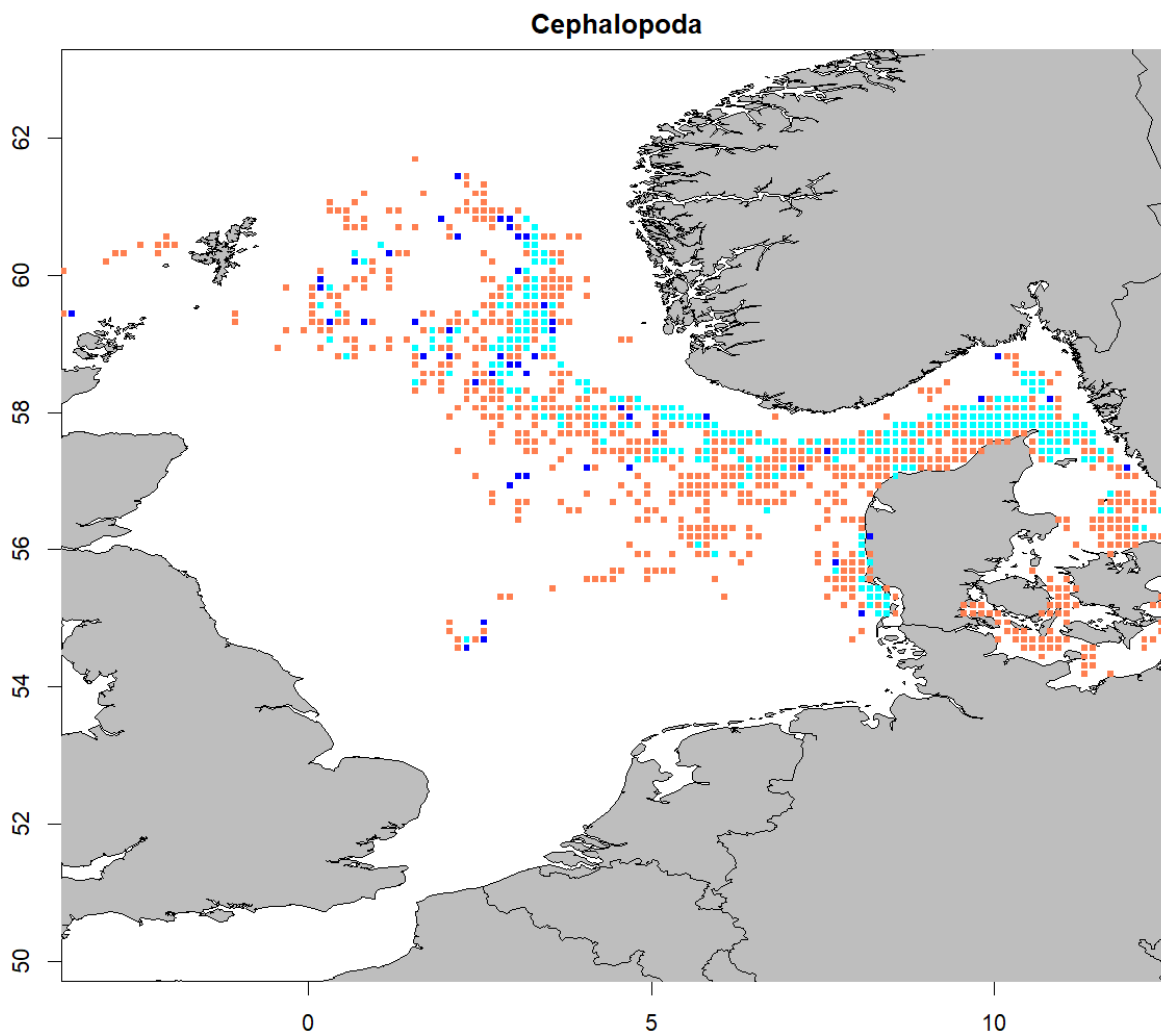


Figure 2. Presence/absence of species by observer haul. Absence in all hauls within a grid cell is shown with orange, blue shows presence of the species in all hauls and cyan show cells with hauls with and without the species.

Discussion

More than 99% of the official landings weight of cephalopods is recorded using the common name “Blæk-sprutte” (cephalopods). Only a very small fraction of landings have been recorded at species level. The same lack of species identification is obvious from the observer sampling schemes performed by DTU Aqua. Consequently, the species composition of Danish cephalopods landings must be considered as practically unknown or at least not documented. DanBif, Danish Biodiversity Information Facility (<https://danbif.dk/>), lists 22 species of cephalopods (Appendix 2) as known from Danish waters. Only 11 of the species have Danish names, indicating that the group is not commonly observed or publicly known in general.

The ICES Working Group on Cephalopod Fisheries and Life History, “WGCEPH” (ICES, 2020) notes that landings and discards by country of cephalopods are most often recorded by family or order rather than by species. In lack of species information, WGCEPH group landings where possible into:

- 1) Sepiida: **Cuttlefish** (Sepiidae) and Bobtail Squid (Sepiolidae). Probably dominated by the species *Sepia officinalis* in Danish fisheries.

- 2) Loliginidae: Loliginid squids or **long-finned squids**). Mainly *Loligo forbesii* and *Loligo vulgaris*, but also *Alloteuthis subulata* is reported from Danish waters.
- 3) Ommastrephidae: Ommastrephid squids or **short-finned squids**. Reported landings of *Todarodes sagittatus* from the Danish fisheries, and WGCEPH consider also *Todaropsis eblanae*, *Todarodes sagittatus*, *Ommastrephes caroli* and other less frequently captured families and species as present in the North Sea and Skagerrak.
- 4) Octopodidae: **Octopuses**. Probably dominated by the species *Octopus vulgaris* and *Eledone cirrhosa* in the Danish fishing area.

The WGCEPH estimate of landings by group of species (Figure 3) shows that long-finned squids are the main catch in the northern and central North Sea (area 4a and 4b) where the main fishing nation for cephalopods is Scotland (Figure 4). Landings from the southern North Sea are a mix of cuttlefishes, long-finned and short-finned squids. Octopuses are recorded in a small amount for all the sub-areas of the North Sea.

The presently used identification for Danish landings, 1) “Blæksprutte” (Cephalopods), 2) “Ottearmet blæksprutte” (eight-armed octopuses) and 3) “Tiarmet blæksprutte” (ten-armed squids and cuttlefishes) does not fit into the grouping used by ICES not even if group 1) was identified into 2) and 3). The problem with the Danish grouping is that the presently used “Tiarmet blæksprutte” (ten-armed squids and cuttlefishes) includes 3 of the ICES grouping. Cuttlefishes are easy to distinguish from other squids, and long-finned and short finned squids are also easy to split, and should as a minimum be recorded separately. However a full species identification of all landings would be preferable.

References

ICES. 2020. Working Group on Cephalopod Fisheries and Life History (WGCEPH; outputs from 2019 meeting). ICES Scientific Reports. 2:46. 121 pp. <http://doi.org/10.17895/ices.pub.6032>

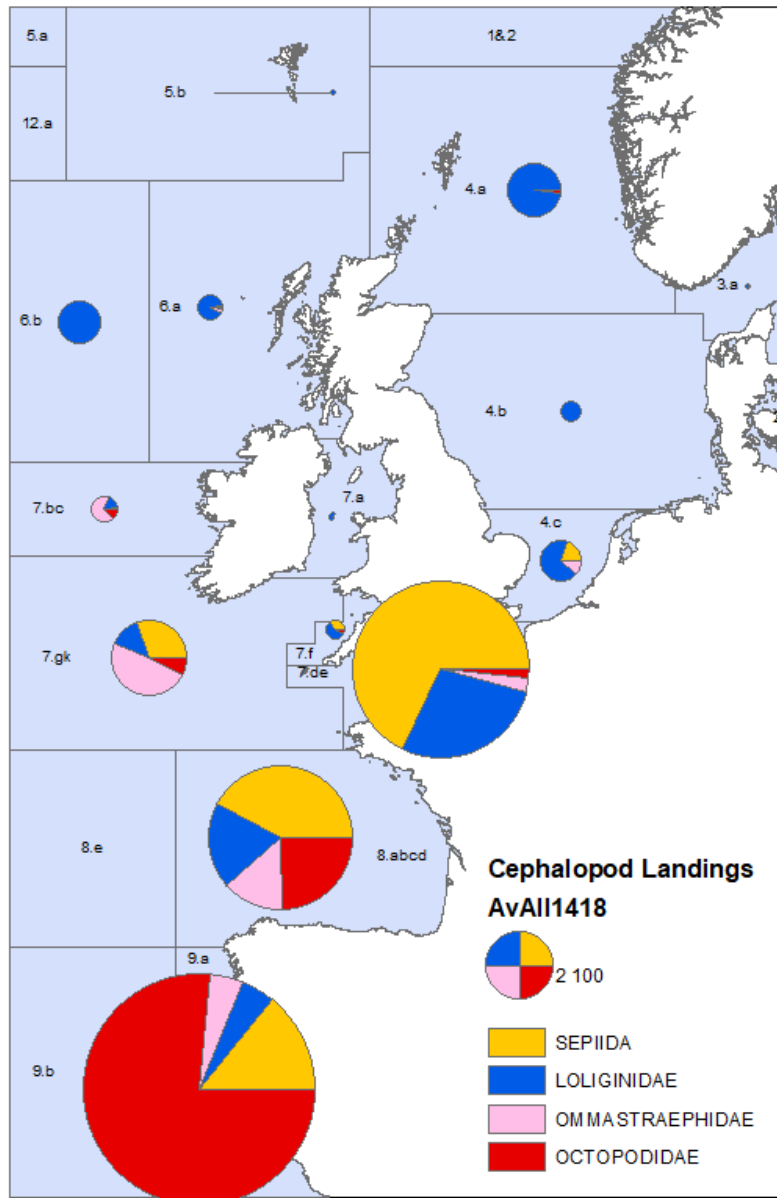


Figure 3. Cephalopod landings (average annual landings for the period 2014-2018) by group of species. Source: ICES, 2019.

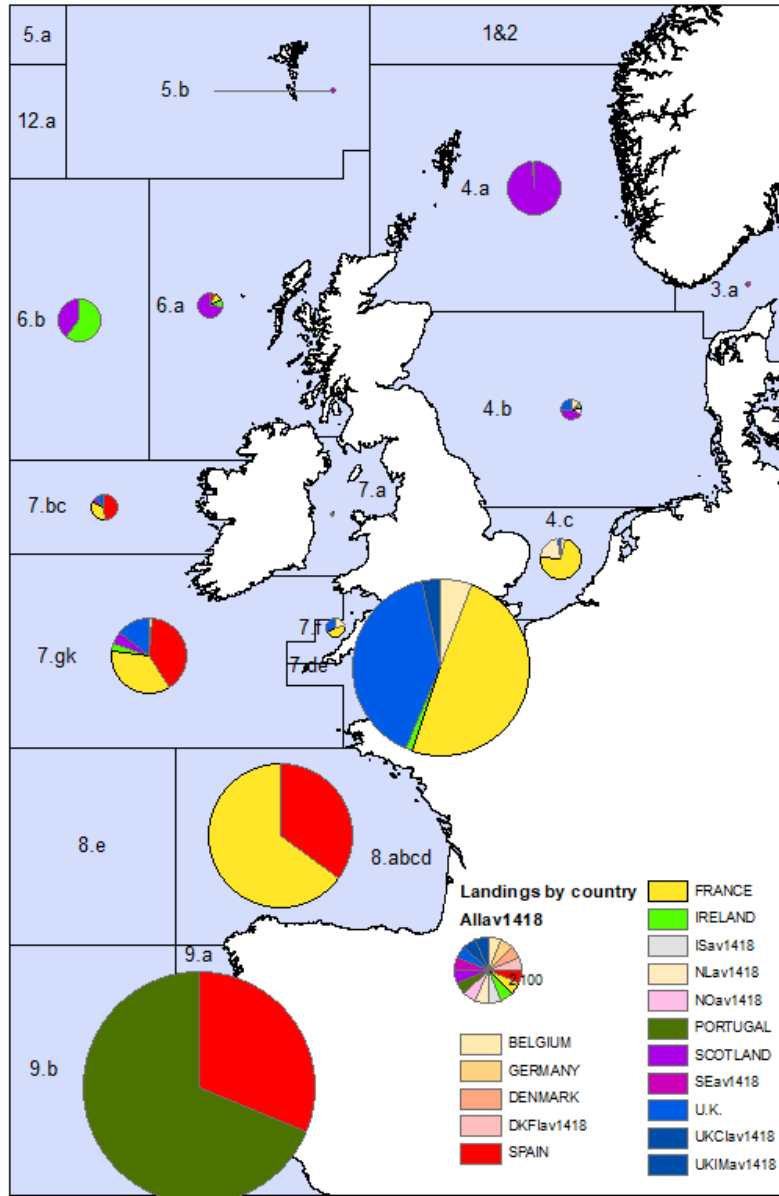


Figure 4. Cephalopod landings (average annual landings for the period 2014-2018) by country. Source: ICES, 2019.

Appendix

Appendix 1. Official landings, 2011-2020, with the top 10 landings place by species.

Species	Landings place	Landed weight (kg)
Cephalopoda	Hanstholm	587361
Cephalopoda	Thyborøn	333613
Cephalopoda	Hirtshals	317191
Cephalopoda	Skagen	108933
Cephalopoda	Hvide sande	84552
Cephalopoda	Killy begs	77629
Cephalopoda	Strandby (nordjylland)	39665
Cephalopoda	Østerby	13621
Cephalopoda	Kopervik	9812
Cephalopoda	Karmøy	3728
		-
Octopoda	Thyborøn	1065
Octopoda	Hanstholm	2
		-
Teuthida	Thyborøn	15
		-
Todarodes sagittatus	Hanstholm	1721
Todarodes sagittatus	Norrsundet	200
Todarodes sagittatus	Skagen	21
Todarodes sagittatus	Smøgen	14
		-

Appendix 2. Cephalopods found in Danish waters. Source: DanBif, Danish Biodiversity Information Facility (<https://danbif.dk/>).

Scientific name	Autor	Danish name	Family	Order
<i>Alloteuthis subulata</i>	(Lamarck, 1798)	Dværgeblæksprutte	Loliginidae	Myopsida
<i>Architeuthis dux</i>	Steenstrup, 1857	Kæmpeblæksprutte	Architeuthidae	Oegopsida
<i>Bathypolypus arcticus</i>	(Prosch, 1849)	-	Bathypolypodidae	Octopoda
<i>Eledone cirrhosa</i>	(Lamarck, 1798)	Eledoneblæksprutte	Octopodidae	Octopoda
<i>Gonatus fabricii</i>	(Lichtenstein, 1818)	-	Gonatidae	Oegopsida
<i>Haliphron atlanticus</i>	Steenstrup, 1861	-	Alloposidae	Octopoda
<i>Illex coindetii</i>	(Vérany, 1839)	Rød blæksprutte	Ommastrephidae	Oegopsida
<i>Loligo forbesii</i>	Steenstrup, 1856	Loligoblæksprutte	Loliginidae	Myopsida
<i>Loligo vulgaris</i>	Lamarck, 1798	Europæisk loligo	Loliginidae	Myopsida
<i>Octopus vulgaris</i>	Cuvier, 1797	Almindelig ottearmet blæksprutte	Octopodidae	Octopoda
<i>Ommastrephes bartramii</i>	(Lesueur, 1821)	-	Ommastrephidae	Oegopsida
<i>Onychoteuthis banksii</i>	(Leach, 1817)	-	Onychoteuthidae	Oegopsida
<i>Rossia macrosoma</i>	(Delle Chiaje, 1830)	Ross's blæksprutte	Sepiolidae	Sepiida
<i>Rossia palpebrosa</i>	Owen, 1834	-	Sepiolidae	Sepiida
<i>Sepia elegans</i>	Blainville, 1827	-	Sepiidae	Sepiida
<i>Sepia officinalis</i>	Linnaeus, 1758	Sepiablæksprutte	Sepiidae	Sepiida
<i>Sepia orbignyana</i>	Férussac, 1826	-	Sepiidae	Sepiida
<i>Sepietta oweniana</i>	(d'Orbigny, 1841)	-	Sepiolidae	Sepiida
<i>Sepiola atlantica</i>	d'Orbigny, 1845	-	Sepiolidae	Sepiida
<i>Sepiola rondeleti</i>	Leach, 1817	Sepiola	Sepiolidae	Sepiida
<i>Todarodes sagittatus</i>	(Lamarck, 1798)	Flyveblæksprutte	Ommastrephidae	Oegopsida
<i>Todaropsis eblanae</i>	(Ball, 1841)	-	Ommastrephidae	Oegopsida