Scottish Marine Animal Stranding Scheme

Annual Report 2020

1 January to 31 December 2020

for Marine Scotland, Scottish Government

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Section 1: Executive Summary

The Covid 19 pandemic and the lockdown earlier in the year and the tier system later in 2020 affected the ability of the scheme to operate during much of the year. Despite this, more strandings were reported the Scottish Marine Animal Stranding Scheme (SMASS) compared to 2019. From the 1st January to 31st December 2020, SMASS received 770 reports of 795 marine animals, comprising 478 seals, 315 cetaceans, a single basking shark and a single marine turtle. The pandemic meant that a reduced number of animals were examined at necropsy however, 38 cases (4.8%), comprising 32 cetaceans and 6 seals were necropsied to establish a cause of death. We also received a further 42 (5.2%) samples from animals, comprising 37 cetaceans, and 5 seals. Some of these samples were unsolicited, as for a large part of the year the SMASS volunteer network was also stood down. In those cases not necropsied, Covid restrictions, advanced autolysis or carcase accessibility were the most common reasons precluding further examination.

There were six mass stranding events (MSE), most of which of these involved only two animals: Four pairs of short beaked common dolphin (*Delphinus delphis*), MSE's in Eriskay, North Uist, Falkirk and Sanday. Twenty long-finned pilot whales (*Globicephala melas*) at Lochboisdale South Uist in June. Three bottlenose dolphins (*Tursiops truncatus*) stranded together on the intertidal zone between North Uist and Benbecula at Ardnastruban sands on the Western Isles. This is a highly unusual event and the first report of a MSE involving this species in the UK. Investigations are ongoing as to the cause of this event.

Seals exhibiting lesions consistent with grey seal predation continue to be reported with 58 cases, mostly from Orkney and Highland. The majority were grey seal juveniles (weaners) (*Halichoerus grypus*) reported in the winter months, although harbour seals (*Phoca vitulina*) were also reported, as were suspected seal attacks on harbour porpoise (*Phocoena phocoena*). The impact of grey seal predation on sympatric species is being investigated as part of a PhD in collaboration with SMRU, St Andrews.

In February, SMASS held the third SMASS forum in conjunction with Whale and Dolphin Conservation (WDC) at the Centre for Health Studies in Inverness. It was well attended with over 120 volunteers and public attending a programme of morning talks and afternoon workshops including one by Doug Allen wildlife cameraman from the BBC Blue Planet series.

The necropsy site, at Alcaig near Conan Bridge site, finally became operational in February 2020.

Strandings continue to attract significant media attention and effort has been maintained to provide strandings and case updates through social media channels. There was media interest in live stranding of a sperm whale close to Inverness at the beginning of the year. Media interest in SMASS continued to grow during the year with the pilot whale MSE in Lochboisdale in June. Later in the year the UME's, involving a Sowerby's beaked whales and northern bottlenose whales in October attracted the most attention.

1.1 Project overview

This work is delivered under the Scottish Marine Animal Strandings Research Programme, issued on 28th May 2018 by Scottish Ministers, with work running for between 8th June 2018 and 28th February 2021. The project is currently managed by SRUC and, until May 2019, was run from their Veterinary Disease Investigation Centre, Drummondhill, Inverness. The principal aim of the project is to provide a coordinated approach to surveillance of cetacean, seal, basking shark and marine turtle strandings, and to investigate major causes of death of stranded animals in Scotland. Where required, efforts should be made to expand and develop the established volunteer network to improve reporting and strandings investigations. This project therefore has the following objectives:

1.2 Contract specification

i. Collate, analyse and report data for all cetacean, seal, basking shark and marine turtle strandings across the Scottish coast. This will include determination of cause of death and surveillance of the incidence of disease where possible. It will also involve an ongoing review of techniques used to determine the causes of death aimed at improving their accuracy, efficiency and cost-effectiveness.

ii. A small number of priority species should be identified in each year of the project for more in depth and targeted studies, which will involve additional analysis and testing (e.g. age, diet, contaminant and toxin exposure and reproductive state). The number of individuals and species will be determined in collaboration with the steering group, but it is likely to involve 20/25 individuals and primarily focus on the following species: harbour seals, harbour porpoise, bottlenose dolphins and minke whales.

iii. Undertake post mortem examinations on marine wildlife (e.g., cetaceans, seals, turtles and sharks) stranded around the Scottish coast to determine major causes of death, including by-catch, physical trauma and the incidence of disease. A wide species and geographical spread of post mortems should be achieved, and this will be informed by decisions within the project steering group.

iv. Increased efforts should be made to collect data (via the stranding network or post mortem) from harbour seals reported stranded around the Scottish coast to inform current work investigating harbour seal decline in Scotland. Seals in all stages of decomposition should be targeted.

v. Provide scientific advice to the Scottish Government as necessary about major causes of death in stranded marine mammals, including any trends or unusual events.

vi. Maintain the database for all Scottish strandings, which brings together accurate and geo-reference data on both strandings and necropsy data. All data should be fed into the cetacean database for the "UK Cetacean Strandings Investigation Programme" (UKCSIP) which is held by the Institute of Zoology (IoZ).

vii. Maintain and expand the Scotland-wide volunteer network to assist with identification, triage and possible measurement and sampling of cases reported to the stranding scheme. This should allow for improved depth, accuracy and efficiency in the information recoverable from strandings.

viii. Provide training courses and refresh training courses, and post mortem demonstrations to teach volunteers how to accurately and safely collect skin and blubber tissue samples from cases otherwise unsuitable for recovery. In addition to samples, volunteers will be trained to collect morphometric and locational data and a series of digital photographs.

ix. Support relevant research organisations (e.g. SMRU, SAMS, University of Aberdeen) and ongoing research streams in relation to marine mammals. This will involve, but not be limited to, undertaking post mortems, working with SMRU on field trials, and scrutinising the current scheme in terms of its ability to answer questions that are identified through collaborative research programmes (e.g. harbour seal decline and interactions between marine mammals and marine renewable energy devices).

x. Investigate opportunities to form collaborations with new academic and scientific partners. This objective should involve biannual workshops/meetings with appropriate research institutes to investigate opportunities for collaborative working as well as identifying new research streams and funding opportunities.

xi. Increase awareness of the project through ongoing publicity. Contribute to the production of strandings training material and workshop events, and maintain a public facing website and social media presence.

xii. Maintain the tissue archive for all samples collected under the current and previous projects, to ensure that there is a time series of samples for all individuals sampled or necropsied.

xiii. A review of archived samples should be undertaken as part of the project and in partnership with relevant organisations to determine future storage options. This should be undertaken with input from the wider UK and Scottish steering groups.

xiv. Ensure that the catalogue of data and samples is or can be made readily accessible on request. The appropriate detail on what data are available should be clearly stated and should be accessible either through the project's website or through meta data archives. Advertise the holdings in the scientific community to widen the access and the potential for collaboration.

xv. Contribute to existing Scottish Government, and wider marine mammal projects as required.

xvi. To make information on strandings and post mortems results available to the Scottish Government on a quarterly basis and publicly available by annual reports.

Section 2: Strandings

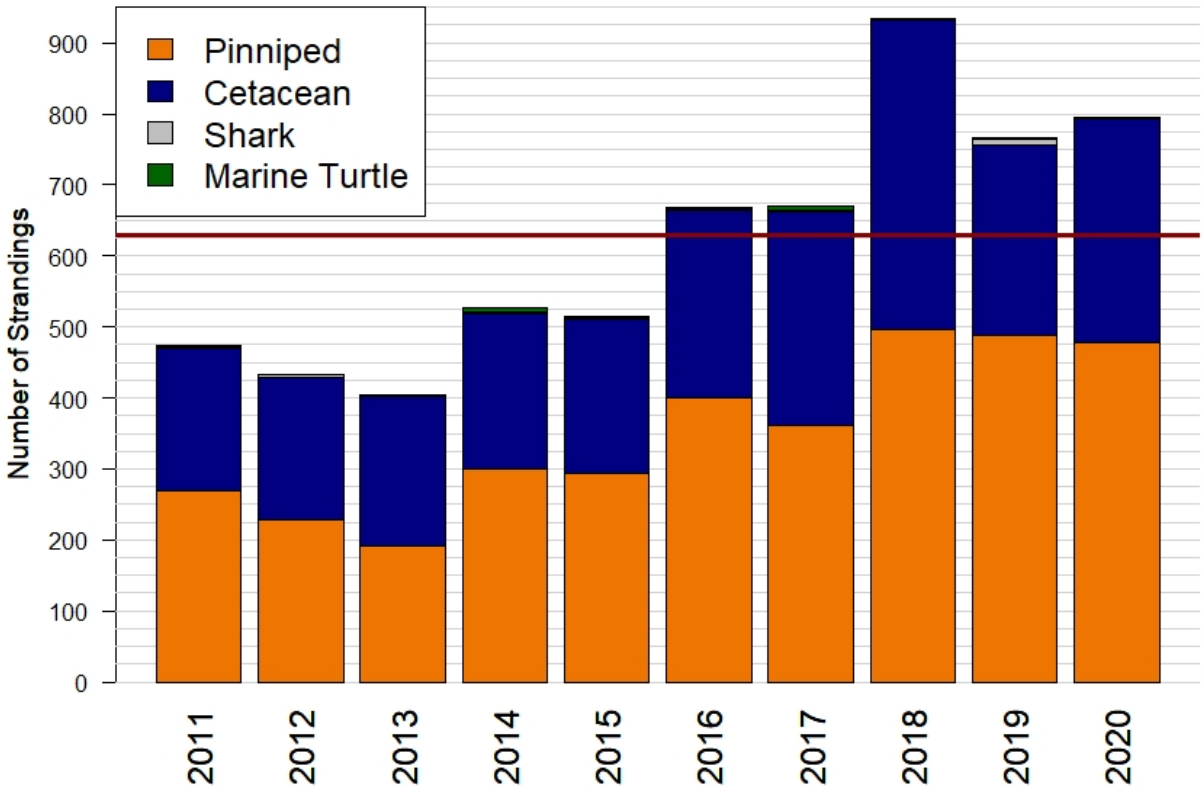

Figure 1: Total number of strandings reported 2011 – 2020. Red line shows the mean number of strandings over this 10-year period (619)

2.1 Strandings overview

From the 1st January to 31st December 2020, 795 marine animals were reported to the Scottish Marine Animal Stranding Scheme (SMASS), comprising 478 seals, 315 cetaceans, one shark and one marine turtles (Table 1). Thirty-eight cases (4.8%), comprising 32 cetaceans and 6 seals, were necropsied to establish a cause of death. A further 42 (5.2%) animals, comprising 37 cetaceans and 5 seals, were sampled by trained volunteers. Compared to 2019 these numbers are relatively low, which is due to the Covid19 pandemic restricting SMASS activities between March and December this year. Thirty-two reported cases would have been suitable for necropsy and a further 61 would have been suitable for sampling by trained volunteers but could not be further examined to ensure compliance with government guidelines. An overview of the number of animals reported, along with the examination level SMASS achieved or would have aimed to achieve under normal circumstances, can be found in Table 1. Please note that in some cases- animals that would have gone for necropsy were sampled instead.

In those cases not necropsied, advanced autolysis was the most common reason precluding further examination with 321 (40.4%) cases being too decomposed to allow further examination. Figure 1 shows the total number of animals per species class for 2020, and shows that the annual total still follows a trend of gradual increase compared to the previous years (with the exception of 2018, where the unusual mortality event of beaked whales was

responsible for an unusual spike in reported strandings). This is likely due to reporting effort, although the increasing population of grey seals may account for the increased number of mortalities in that species. Figure 2 shows the breakdown of strandings by subclass for 2020. Figure 3 shows the cumulative number of strandings by month for each individual year since 2016, and shows that there was no significant deviation from the baseline pattern observed in other years, which would indicate a change in reporting or mortality rate.

Table 1: Summary of stranded animals reported to SMASS in 2020. This shows the total number of animals reported per species along with of those, the number of cases that have been necropsied (third column), the cases that would have been necropsied (fourth column), the cases that have been sampled (fifth column), and the cases that would have been sampled (sixth column). Please note that in some cases- animals that would have gone for necropsy were sampled instead hence the total in column two is not necessarily a sum of column 3 – 6).

Species	Total number of cases reported	Number of cases necropsied	Number that would have been necropsied	Number of cases sampled	Number that would have been sampled
Cetaceans	**315**	**32**	**26**	**37**	**24**
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	4				2
Bottlenose dolphin (*Tursiops truncatus*)	8	4	2		
Cuvier's beaked whale (*Ziphius cavirostris*)	3	1			1
Fin whale (*Balaenoptera physalus*)	1	1			
Harbour porpoise (*Phocoena phocoena*)	109	8	13	3	13
Long-finned pilot whale (*Globicephala melas*)	31		9	12	2
Minke whale (*Balaenoptera acutorostrata*)	20	1	2		1
Northern bottlenose whale (*Hyperoodon ampullatus*)	5	4			1
Risso's dolphin (*Grampus griseus*)	4			1	1
Short-beaked common dolphin (*Delphinus delphis*)	61	4		19	4
Sowerby's beaked whale (*Mesoplodon bidens*)	8	5		2	1
Sperm whale (*Physeter macrocephalus*)	6	1			
True's beaked whale (*Mesoplodon mirus*)	1	1			
White-beaked dolphin (*Lagenorhynchus albirostris*)	5	2			
Cetacean (indeterminate species)	22				
Dolphin (indeterminate species)	18				
Baleen whale (indeterminate species)	9				
Pinnipeds	**478**	**6**	**16**	**5**	**27**
Grey seal (*Halichoerus grypus*)	306		4	2	20
Harbour seal (*Phoca vitulina*)	87	6	12	3	7
Harp seal (*Pagophilus groenlandicus*)	1				
Seal (indeterminate species)	84				
Basking shark (*Cetorhinus maximus*)	**1**				
Loggerhead turtle (*Caretta caretta*)	**1**				
GRAND TOTAL	**795**	**38**	**32**	**42**	**61**

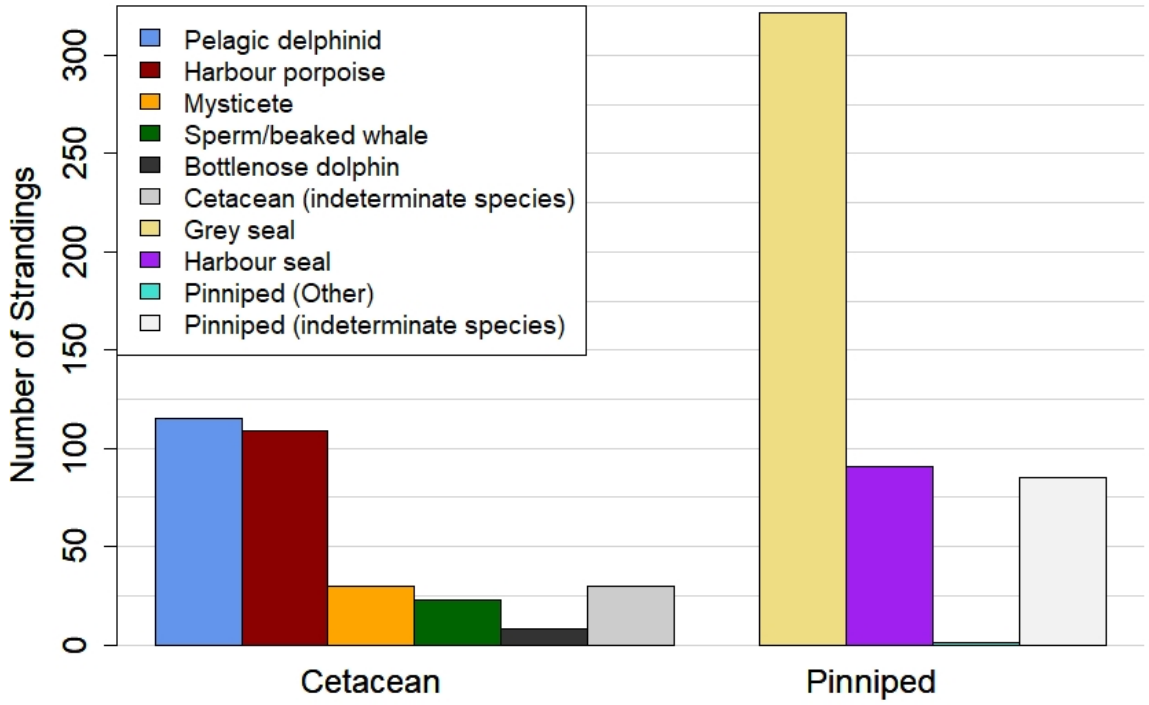

Figure 2: Total number of species reported in 2020, by subclass

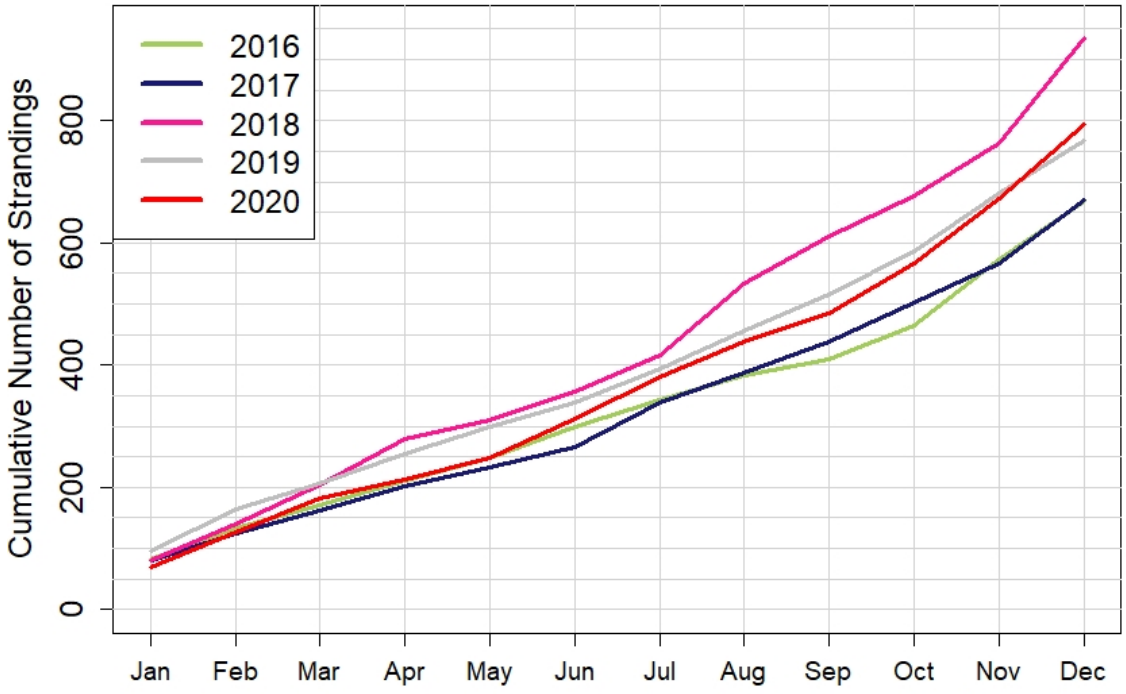

Figure 3: Cumulative number of cases all species by month for 2016 - 2020

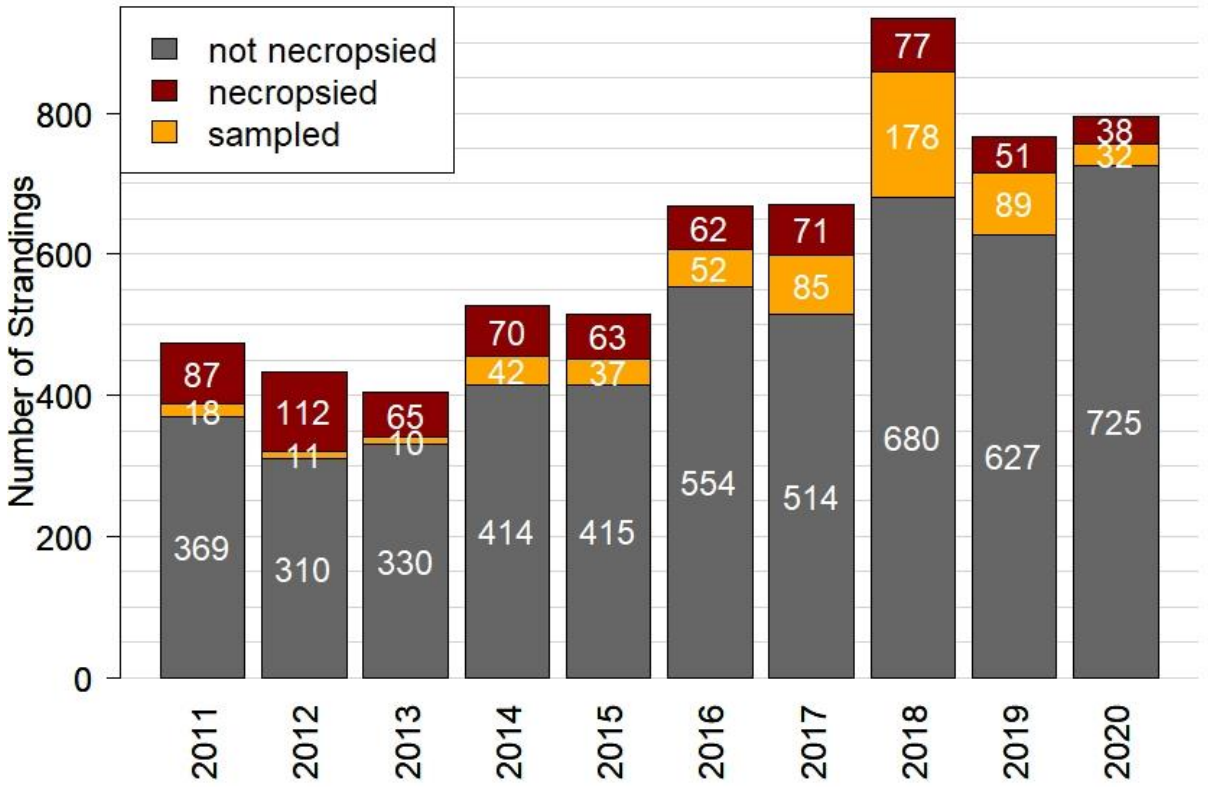

Figure 4: Cases necropsied and sampled 2011-2020

Figure 4 shows the number of cases necropsied, sampled, and not necropsied respectively during 2020 compared to the past ten years. These numbers are lower when compared to previous years, due to the Covid19 pandemic restricting SMASS activities between March and December. Eighty-six reported cases would have been suitable for necropsy or sampling by trained volunteers, which, if these numbers were indeed achieved, would mean an increase in suitable cases for necropsy and a similar number of sampled cases compared to previous year. Cases may be unsuitable for collection for a number of factors, with autolysis being the most common reason. A more detailed overview of this, as well as other findings, can be found in Section 3 of this report.

2.2 Spatial distribution of strandings

There were cases reported in all coastal regions, although higher density of strandings was recorded around Fife and the southeast, Orkney and the southwest (Clyde area). In addition, a high number of strandings were observed on the Western Isles, likely due to a combination of the MSE of pilot whales that happened on South Uist (see section 4), and this island chain catching any carcases from the Atlantic. Government restrictions were relaxed a lot sooner on the western isles compared to the rest of Scotland; hence, a number of animals could be sampled from this area despite the pandemic.

Continued and hugely valued assistance from a number of our trained volunteers around the coastline, the Hessilhead Wildlife Rescue Trust (North Ayrshire), National Museum of Scotland (NMS), Hillswick Wildlife Sanctuary (Shetland), and NatureScot (SNH) on Shetland has enabled animals suitable for necropsy from more remote locations to be recovered, stored frozen temporarily pending collection/necropsy, or stranding morphometrics to be recorded.

The maps below show the spatial distribution of strandings and the examination level SMASS managed to achieve (**Error! Reference source not found.**) and **Error! Reference source not fo und.** is a density map showing areas, in red, of high stranding reports for all species. A density plot is a surface calculated from individual stranding points using a kernel function to fit a smoothly tapered surface, and is a way of visualising areas, which receive a higher number of strandings compared to others.

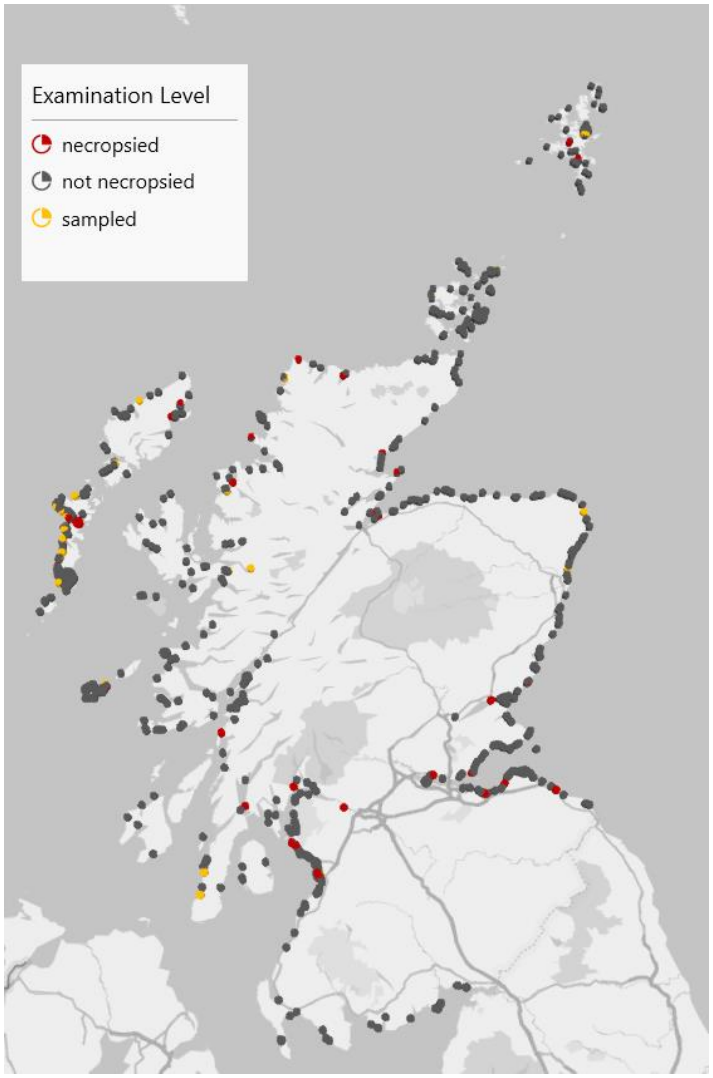

Figure 5: All strandings reported to SMASS in 2020, per achieved examination level

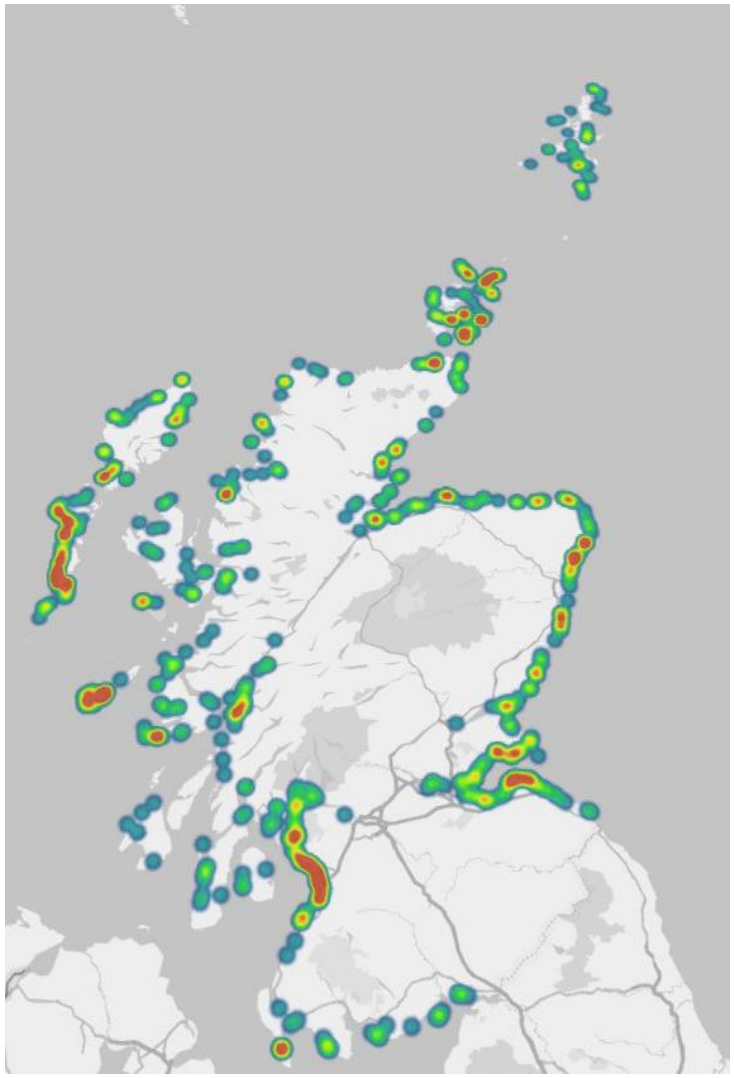

Figure 6: Kernel density plot of all strandings reported to SMASS in 2020. Colour spectrum from blue (low) to red (high) indicating the number of strandings per km_2 of coastline

2.3 Pinniped strandings

Four hundred and seventy-eight seals were reported to SMASS in 2020 comprising of 306 grey seals (*Halichoerus grypus*), 87 harbour seals (*Phoca vitulina*), a single harp seal (*Pagophilus groenlandicus*) and 84 pinnipeds that were too autolysed or data deficient for accurate speciation (Table 1). Of those reported, the majority (98.7%) were not recovered for necropsy, mainly due to the carcase being an advanced state of autolysis, insufficient information available when the case was reported, or Covid restrictions. Six cases (1.3%) were recovered for necropsy. It is seldom a pinniped carcase is discovered in a suitable state of preservation to make it justifiable to recover for necropsy. Nevertheless, this statistic is even higher than in previous years, when approximately 5 - 10% of the cases are recovered for necropsy. Five cases (1%) were sampled by trained volunteers, as opposed to the usual 6-7% achieved in previous years. This due to the Covid19 pandemic restricting the activity of SMASS and the volunteer network between March and December this year. Forty-three seals (19 harbour seals and 24 grey seals) would have either been collected for necropsy, or sampled by trained volunteers, had the restrictions not been in place. Given the importance of investigating the harbour seal decline around Scotland, maximum efforts are made to recover or obtain as much information about these strandings as possible. In previous years, this is hugely helped by the volunteer network, which provides data on metrics such as length, blubber thickness (indicative of nutritional condition) and age group, and basic samples of cases, which are too decomposed for full necropsy.

For those cases where a finding indicative of cause of death could be determined, physical trauma attributable to grey seal predation was the most common finding for both grey (n=45) and harbour (n=11) seals. Two grey seals died due to entanglement. For those cases necropsied (all harbour seals), one was diagnosed as being shot, one died due to starvation, and one was found to have died as a result of a parasitic pneumonia. Three harbour seals recovered in December and due to Covid restrictions are still stored frozen pending necropsy (one at SMRU, and two at Hessilhead Wildlife Rescue Centre in Beith).

This report does not include the detail on cases reported as shot under seal management licences (n=21). Information regarding these cases is available from Marine Scotland or online at:

http://www.scotland.gov.uk/topics/marine/licensing/seallicensing.

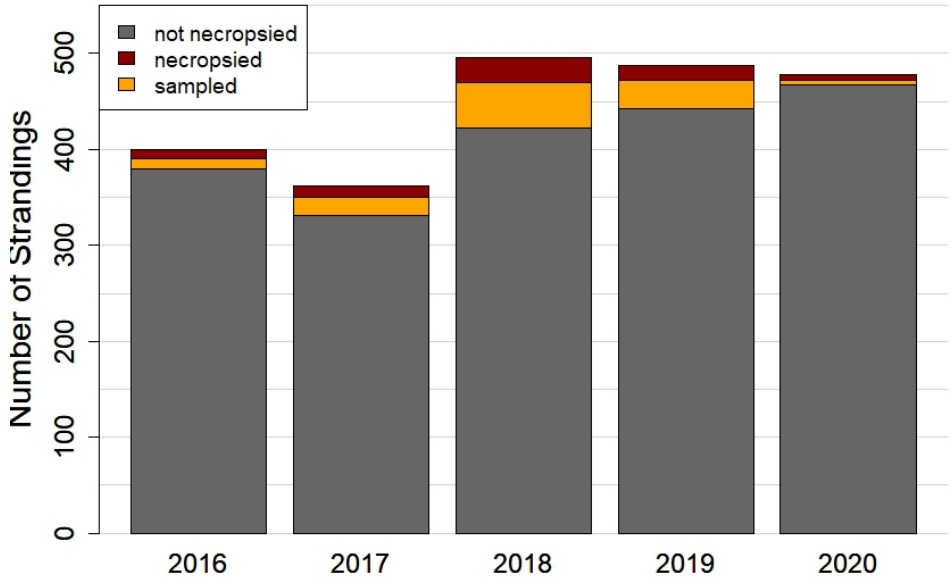

Figure 7: Pinniped strandings (all species) separated by level of examination 2016– 2020

2.3.1 'Corkscrew' or spiral trauma cases

Fifty-eight seals were reported as having trauma consistent with spiral or corkscrew injuries, comprising 45 grey seals, 11 harbour seals and two animals too decomposed or incomplete to be identified to the species level. These cases were reported from eight different regions of Scotland, including Dumfries & Galloway, Strathclyde, Western Isles, Highland, Grampian, Orkney, Fife, and Lothian. The lesions observed in these animals are highly consistent with an attack and predation by adult male Grey seals, more detail can be found in Section 6.

2.4 Pinniped age structure & spatial distribution

In 2020, the age class could not be established for only 30.8% of the 478 reported strandings. Where age class could be ascertained, 19.8% were pups; 33.3% were juveniles and 16.1% adults. By species, adults made up 21.2% of grey seals and 8% of harbour seal strandings.

Error! Reference source not found. shows the seasonal distribution of total numbers and age c lass structure for Grey seal and Harbour seals individually, as reported in 2020. For both species, there is an increase in strandings around the harbour seal and grey seal breeding seasons in early summer and late autumn/winter respectively. Figure 9 to Figure 11 to shows the spatial distribution of pinniped strandings by species and show the majority of harbour seal strandings are in the west, with grey seal strandings mainly found along the entire east coast and Orkney. There was an increase in reports of grey seal strandings on the western isles compared to previous years, with 43 animals being reported from this region compared to 28 in 2019 and 20 in 2018.

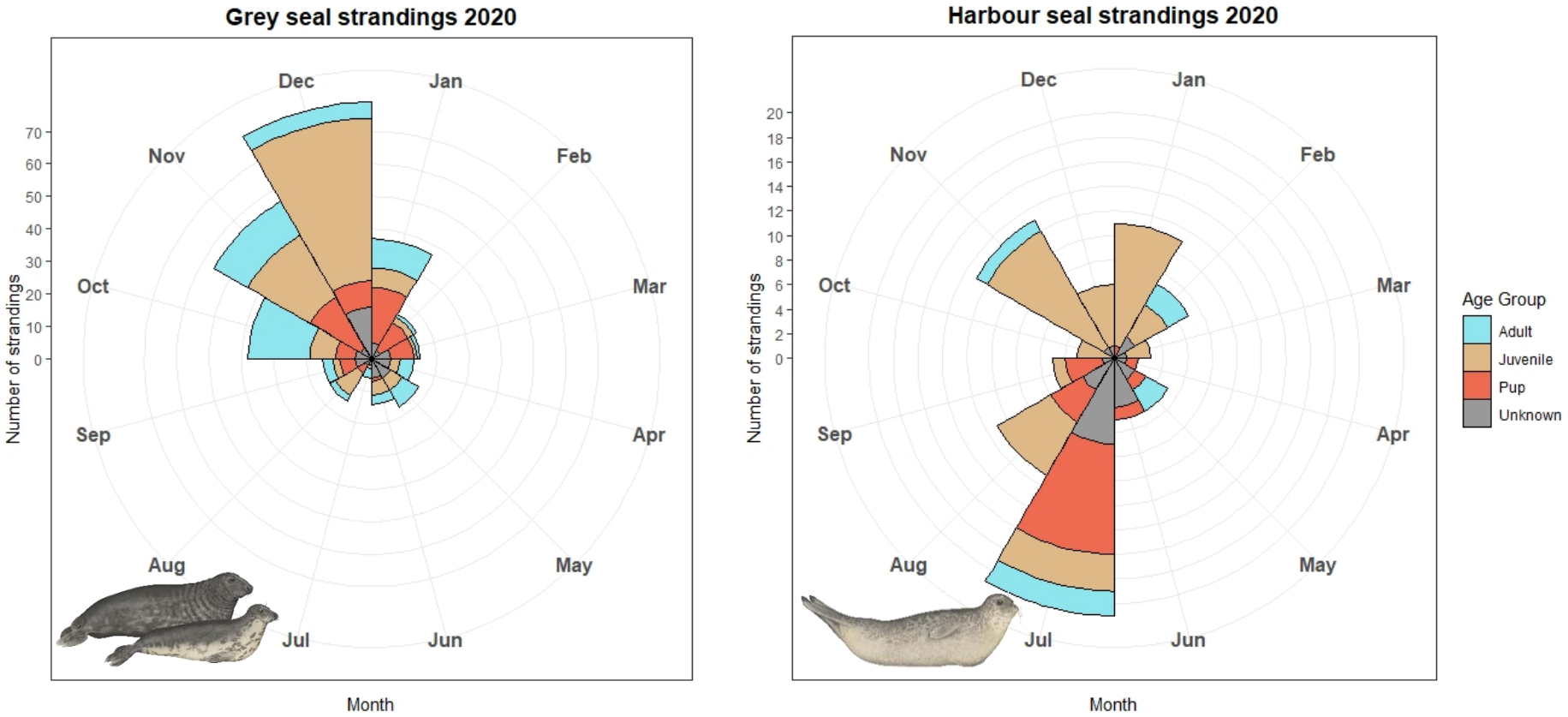

Figure 8: Seasonal age class distribution for left: Grey seals and right: Harbour seals, reported to SMASS in 2020

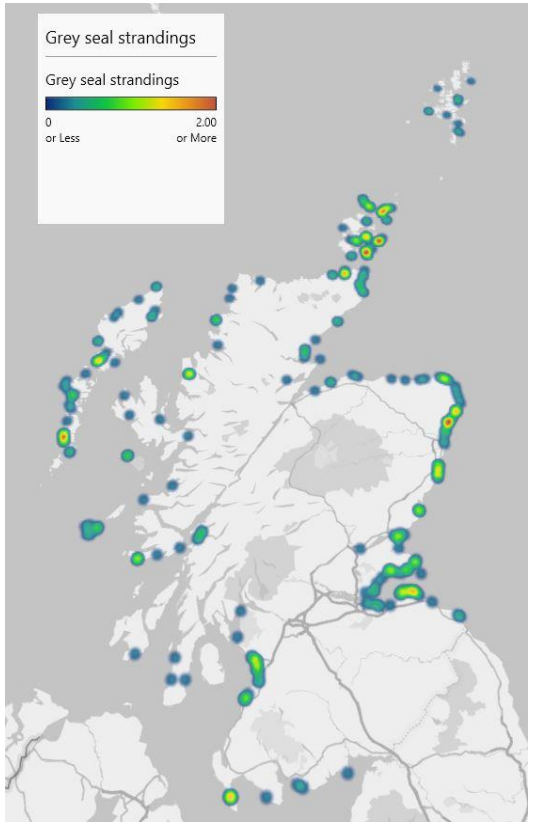

Figure 10: Grey seal strandings density 2020

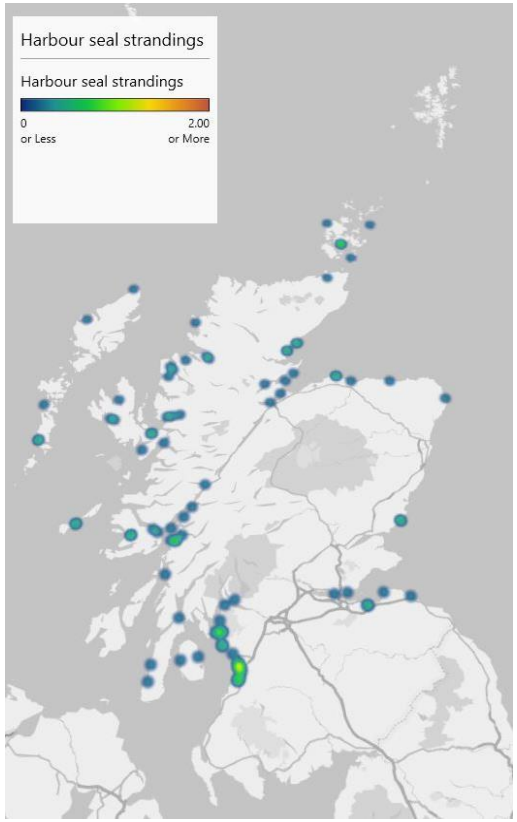

Figure 11: Harbour seal strandings density 2020

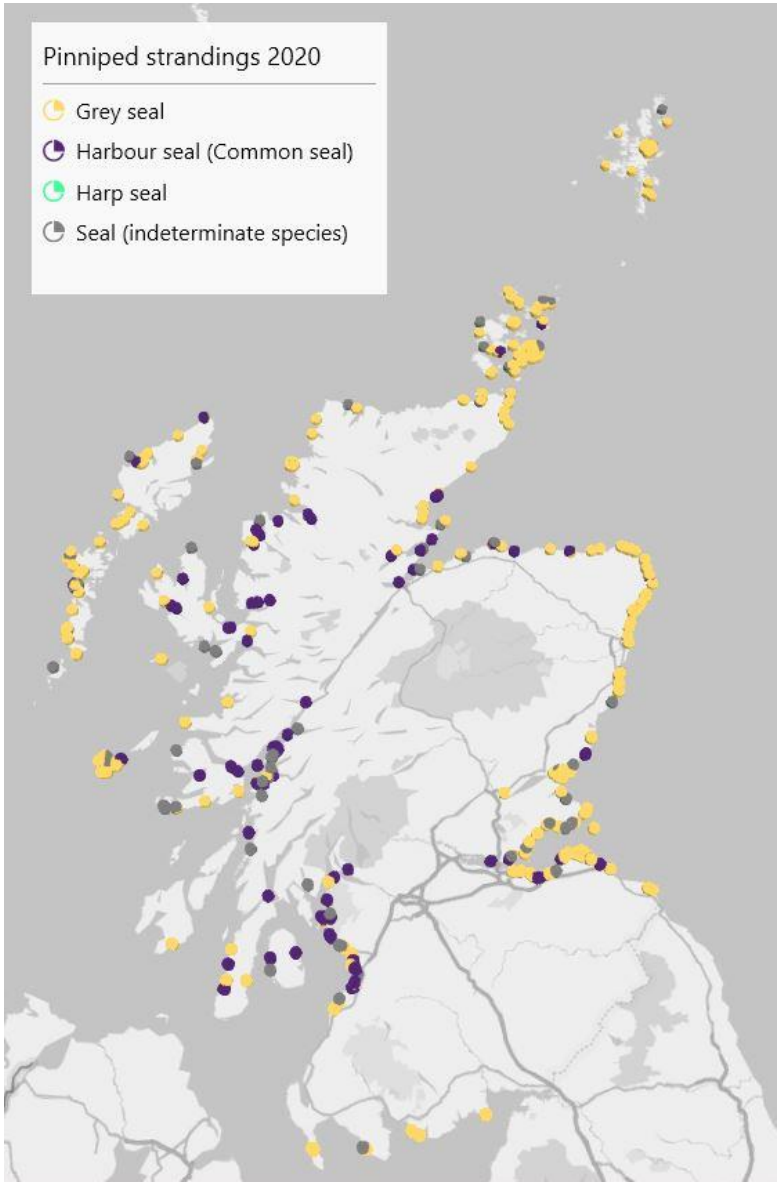

Figure 9 Pinniped strandings 2020

2.5 Cetacean strandings

Three-hundred-fifteen cetaceans, comprising of 14 different species were reported to SMASS in 2020. The most frequently reported species as in most years was the harbour porpoise (*Phocoena phocoena*) (n=109, 34.6%), although with this number normally making up almost half of the cetacean strandings this is a decrease on numbers reported in 2019. Given the coastal distribution of this species, it is unsurprising there was no geographical bias to strandings. Short-beaked common dolphins (*Delphinus delphis*) were the second most commonly reported species with 61 cases (19.4%), which is again an increase on the previous year, and strandings of this species appear to be gradually increasing every year. Long-finned pilot whales (*Globicephala melas*) where the next most commonly reported species (n=31, 9.8%), which is mainly the result of the mass stranding that occurred on the western isles in June (see section 4). There were 20 (6.3%) minke whales (*Balaenoptera acutorostrata*) reported, and as in previous years this makes them, the most commonly reported mysticete. Bottlenose dolphin (*Tursiops truncatus*) and Sowerby's beaked whale (Mesoplodon bidens) were reported in equal numbers (n=8, 2.5%) the increase in strandings in the former is in part due to the MSE on North Uist (see section 4). Sperm whale (*Physeter macrocephalus*) was the next most commonly reported cetacean with six (1.9%), White beaked dolphins (*Lagenorhynchus albirostris*) and northern bottlenose whale (*Hyperoodon ampullatus*) were reported in equal numbers (n=5, 1.5%). Atlantic white-sided dolphin (*Lagenorhynchus acutus*) and Risso's dolphin (*Grampus griseus*) were also reported in equal numbers (n=4, 1.2%). Cuvier's beaked whale (Ziphius cavirostris) accounted for three (0.9%) strandings. Fin whale (*Balaenoptera physalus*) and True's beaked whale (*Mesoplodon mirus*) strandings were each a single cases (0.3%) the latter being the first ever stranding of this species in the UK (see section 7).

Of the 315 animals, 32 cases (10.2%) were necropsied and a further 27 (8.6%) were sampled by volunteers. This is a lower percentage than has been achieved in previous years, due to the Covid19 pandemic restricting the activity of SMASS and the volunteer network between March and December this year. A total of 43 cetaceans (26 harbour porpoise, four minke whales, four common dolphins, two pilot whales, two Atlantic white-sided dolphins, one Sowerby's beaked whale, one Northern bottlenose whale, one Cuvier's beaked whale, one Risso's dolphin, and one bottlenose dolphin) would have either been collected for necropsy, or sampled by trained volunteers, had Covid 19 restrictions not been in place.

As in previous years, the most common cause of death for cetaceans was found to be live stranding. This is defined as morbidity and eventual mortality as a result of the sequence of physical processes invoked by becoming stranded. This diagnosis is attributed to cases where there is good clinical or pathological evidence of live stranding and no other cause can be identified which would otherwise explain the stranding, for example trauma, poor body condition or concurrent infectious disease. A number of animals are still awaiting results from histopathology or bacteriological examination, which could update the cause of death from live stranding to the ultimate reason for the live stranding, at the time this report was written. A detailed overview of the findings/cause of death of all cetaceans necropsied, sampled and not necropsied in 2020 can be found in Section 3 of this report.

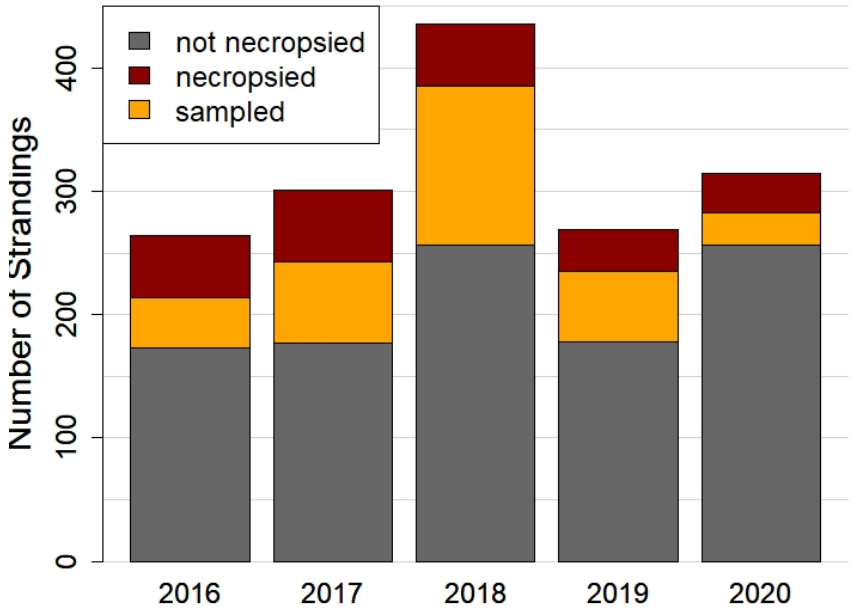

Figure 12: Cetacean strandings (all species) separated by level of examination 2016 – 2020

Figure 13 shows the spatial distribution (excluding harbour porpoise) of cetaceans reported in 2020. Harbour porpoise cases are addressed separately in section 2.6 below.

The majority of pelagic delphinid species were found across the west coast and western isles, as well as Orkney. Mysticetes are found all around the coastline, the western isles, Orkney, and Shetland. The southern island chain of the western isles received the highest strandings density in 2020, though this is largely caused by the MSE of pilot whales, which occurred here in June.

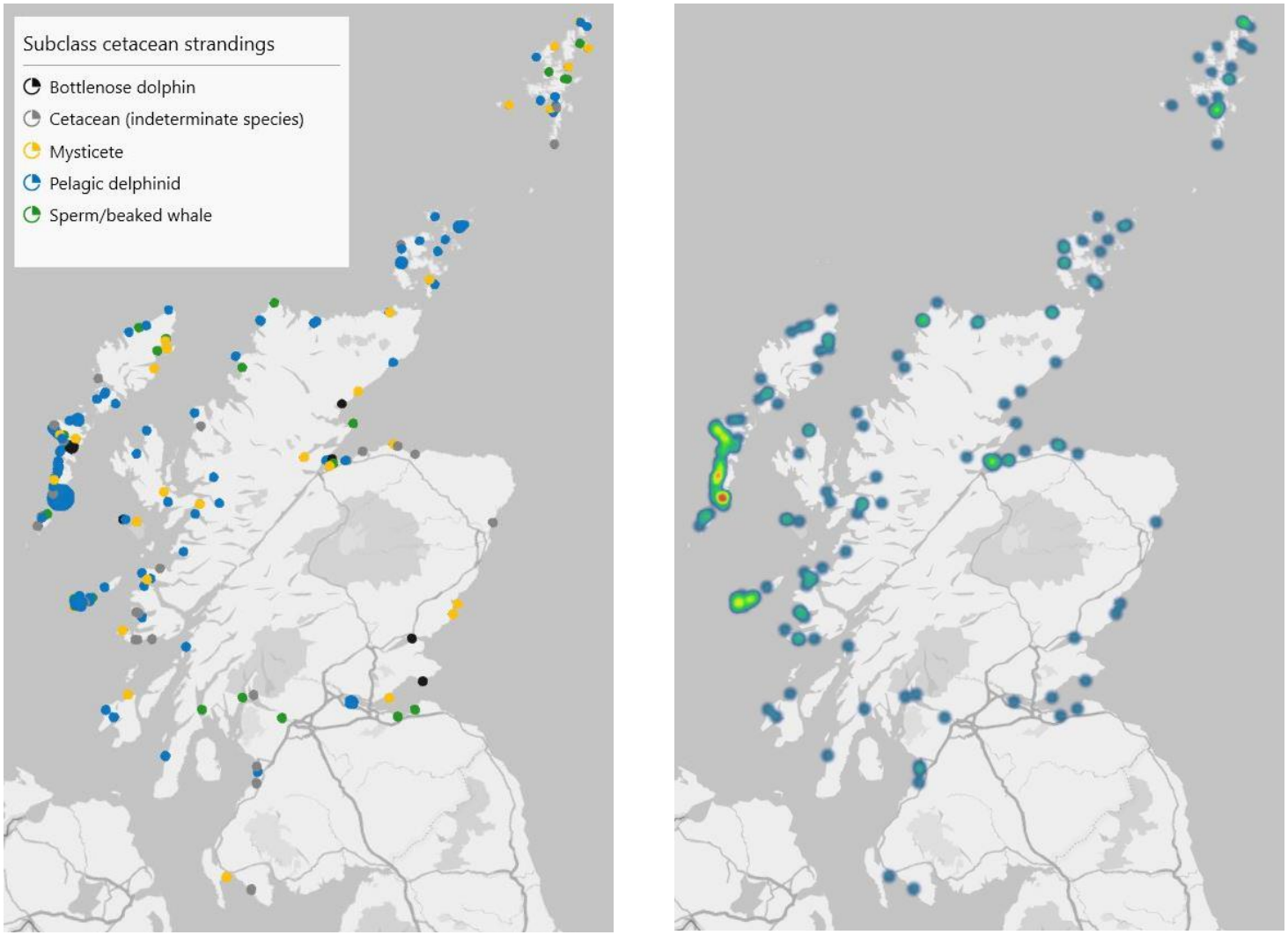

Figure 13: All cetacean strandings excluding harbour porpoise 2020, by species subclass (left) and density (right)

2.6 Harbour porpoise strandings 2020

There were 109 harbour porpoise strandings in 2020. This comprises of 34.6% of the total cetacean strandings for the year, and is a lower percentage than recorded in previous years where harbour porpoise made up approximately half of the cetacean strandings. Figure 14 shows the incidence of harbour porpoise cases in 20120 by age group and Figure 15 the spatial distribution of reported cases. Juveniles were found throughout the year, though in slightly higher numbers in April, which is consistent with previous years. Unlike previous years, a higher number of strandings was also recorded for October. Neonates are obviously only found during the calving season between June and October. Adults strand regularly throughout the year although with the highest incidence between July and October during/subsequent to the calving season. Fewer animals were reported in the winter months, which has also been the case in previous years.

Eight harbour porpoise were subjected to necropsy, comprising 21% of the total number of cases necropsied by SMASS in 2020, and three animals were sampled by trained volunteers. A further 26 animals were fresh enough for either necropsy or sampling by trained volunteers, but this was not possible due to the restrictions associated with the covid19 pandemic. There were 13 animals where a cause of death could be attributed upon either necropsy, or where lesion patterns were sufficiently pathognomonic to enable reliable diagnosis from examination of photographs. The most common causes of death in these animals were bottlenose dolphin attack (n=4), followed by grey seal attack (n=3), live stranding (n=2), bycatch (n=1), boat/ship strike (n=1) and gastritis/enteritis (n=1). One animal that was found live stranded showed lesions consistent with a violent attack by white-beaked dolphins (see section 7). Two animals are still stored frozen pending necropsy at the time of writing this report.

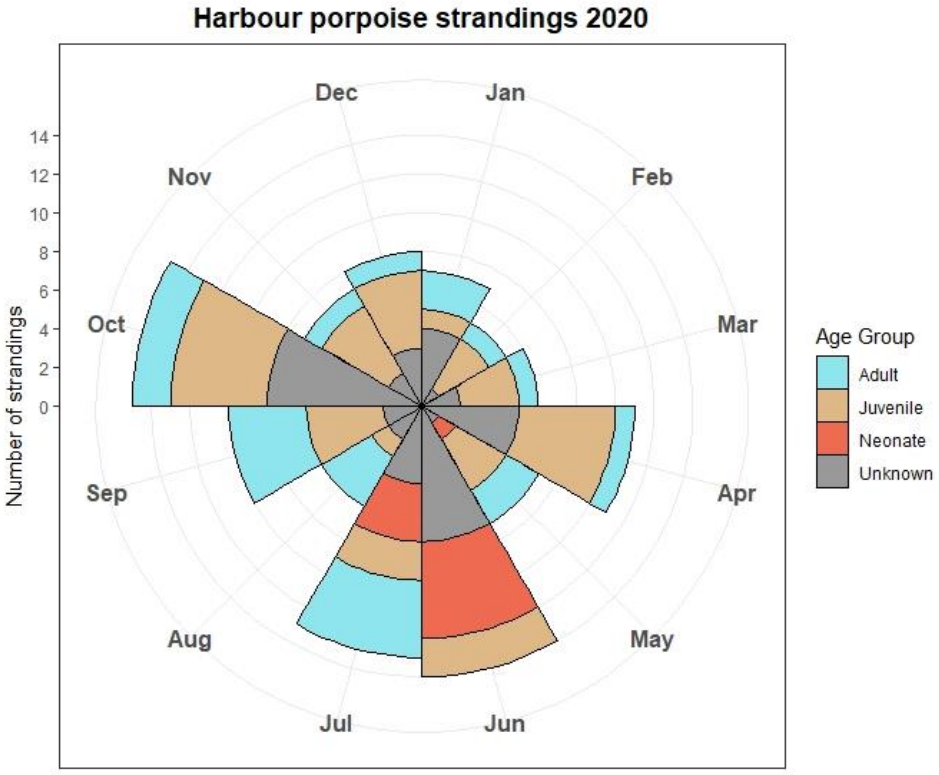

Figure 14: Seasonal age class distribution of harbour porpoise strandings in 2020

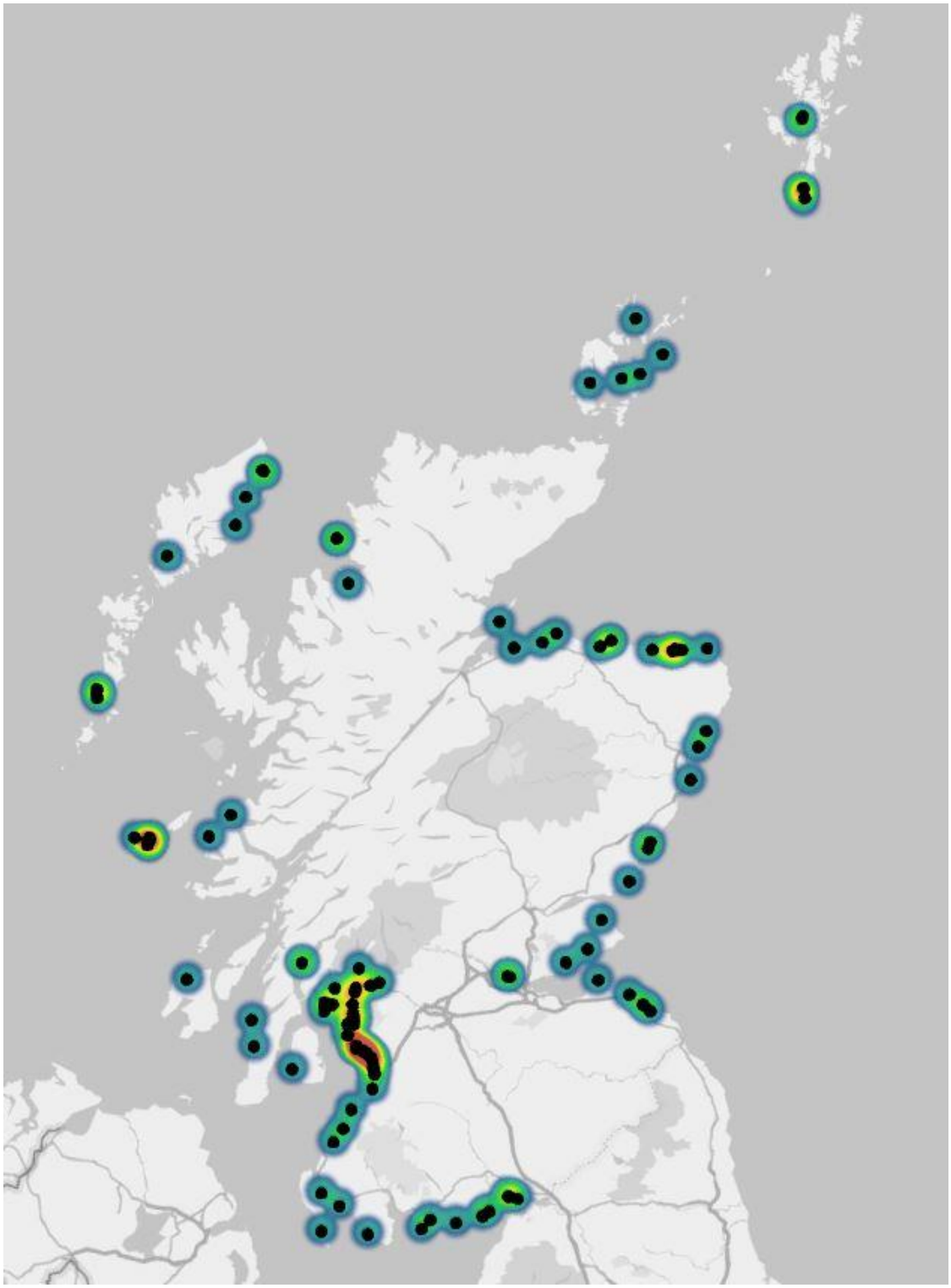

Figure 15: Spatial distribution of Harbour porpoise strandings, by age class, and density 2020

Section 3: Cause of death/findings summary tables

Table 2: Cetaceans where a finding/diagnosis could be assigned, 2020. Please note that cetaceans with a finding/diagnosis could additionally have been sampled.

		Dystocia/stillborn	Gastritis and/or Enteritis	Live Stranding	Live Stranding: Successful refloat	Maternal Separation/Starvation	Meningoencephalitis	Physical Trauma: Boat/Ship Strike	Physical Trauma: Bottlenose dolphin attack	Physical Trauma: Bycatch	Physical Trauma: Entanglement	Physical Trauma: Other	Physical Trauma: Possible Grey Seal Attack	Pending	Not Established	Not Examined: Samples Taken	Grand Total
Bottlenose dolphin				4											1		**5**
Harbour porpoise			1	2	1			1	4	1		1	3	2	1	3	**20**
Minke whale											3			1			**4**
Pelagic delphinids	**Long-finned pilot whale**			10	11											1	**22**
	Risso's dolphin															1	**1**
	Short-beaked common dolphin	1		3	7	1			1							18	**31**
	White-beaked dolphin	1		1	1	1											**4**
sperm/ beaked whale	**Cuvier's beaked whale**			1													**1**
	Northern bottlenose whale			3											1		**4**
	Sowerby's beaked whale			5												2	**7**
	Sperm whale						1										**1**
	True's beaked whale			1													**1**
Grand Total		2	1	30	20	2	1	1	5	1	3	1	3	3	3	25	101

Table 3: Cetaceans where a diagnosis/finding could not be assigned, and reasons for this and/or why carcases were NOT taken for necropsy, 2020

		Advanced Autolysis	At Sea	Carcase Incomplete/Scavenger Damage	Insufficient Data	No volunteers available	Removed by Tide	Weather/travel difficulties	Morphometrics Taken	Covid19 restrictions	Grand Total
Bottlenose dolphin		2								1	**3**
Harbour porpoise		33	1	17	1	1	7	2	1	26	**89**
Mysticete	**Fin whale**									1	**1**
	Minke whale	7	5	1						3	**16**
Pelagic delphinid	**Atlantic white-sided dolphin**	2								2	**4**
	Long-finned pilot whale	6	1							2	**9**
	Risso's dolphin	2								1	**3**
	Short-beaked common dolphin	14	1	2		3		4	2	4	**30**
	White-beaked dolphin	1									**1**
sperm/beaked whale	**Cuvier's beaked whale**	1								1	**2**
	Northern bottlenose whale									1	**1**
	Sowerby's beaked whale									1	**1**
	Sperm whale	4		1							**5**
Indeterminate Species	**Baleen whale (indeterminate speci**	7	1	1							**9**
	Dolphin (indeterminate species)	18									**18**
	Cetacean (indeterminate species)	14		5	3						**22**
Grand Total		**111**	**9**	**27**	**4**	**4**	**7**	**6**	**3**	**43**	**214**

Table 4: Cause of death/findings for pinnipeds, basking sharks and marine turtles reported 2020. This excludes pinnipeds shot under licence. Please note that animals with a finding/diagnosis could additionally have been sampled.

	Grey seal	Harbour seal	Harp seal	Seal (indeterminate species)	Loggerhead turtle	Basking shark	Grand Total
Cases with findings	**48**	**17**		**2**			**67**
Dystocia/Stillborn	1						**1**
Physical Trauma: Entanglement	2						**2**
Physical Trauma: Possible Grey Seal Attack	45	11		2			**58**
Physical Trauma: Shot		1					**1**
Pneumonia: Parasitic		1					**1**
Starvation/Hypothermia		1					**1**
Pending		3					**3**
Not Examined: Samples Taken	**2**	**3**					**5**
Not Examined	**256**	**67**	**1**	**82**	**1**	**1**	**408**
Advanced Autolysis	152	24		32	1	1	**210**
At Sea	3	2		1			**6**
Carcase Incomplete/Scavenger Damage	35	8	1	10			**54**
Carcase Not Found		1					**1**
Delay in Reporting	1	3					**4**
Insufficient data				8			**8**
Insufficient Data	4			30			**34**
Morphometrics Taken	2						**2**
No volunteers available	4	5					**9**
Not Priority	21						**21**
Removed by Tide	2	3		1			**6**
Staff Shortage	1						**1**
Weather/travel difficulties	7	2					**9**
Covid19 Restrictions	24	19					**43**
Grand Total	**306**	**87**	**1**	**84**	**1**	**1**	**480**

3.1 Cause of death; direct anthropogenic versus other causes of death.

Cause of death (COD) findings were usually determined following a full necropsy examination. In the case of grey seal predation and bottlenose dolphin attacks, some of these cases had lesion patterns sufficiently pathognomonic to enable reliable diagnosis from examination of photographs. Total number of cases with an assigned diagnosis at publication of this report was 73 cetaceans (excluding animals that live stranded and were successfully refloated), and

64 pinnipeds. Three cetaceans and three pinnipeds are still pending either necropsy, or histopathology results required to confirm a diagnosis.

Figure 16 shows the monthly distribution of cases for which a cause of death could be diagnosed, divided in four main categories based on if their likely cause of death was due to direct human impact, infectious disease, all other causes of death, or whether it was not established despite an animal having gone for necropsy. There is a separate graph for pinnipeds and cetaceans, and these exclude cases that are still pending necropsy, pending histopathology to attribute a diagnosis, as well as pinnipeds shot under licence and cetaceans that were found alive and were successfully refloated.

In 2020, the direct anthropogenic causes comprised entanglement, bycatch, boat/ship strike, and seals diagnosed to have been shot out with a licence. The infectious category includes animals that died of gastritis and/or enteritis, meningoencephalitis, and parasitic pneumonia. The remaining causes of death were categorised under "other", and include starvation/hypothermia, maternal separation/starvation, live stranding, (possible) grey seal attack, bottlenose dolphin attack, and a single case of white-beaked dolphin attack. There were three cases, all cetaceans, which were examined but for which the cause of death could not be established.

For cetaceans stranded in 2020, mortality due directly to anthropogenic activity comprise five animals, or about 6.8%, of the cases with a diagnosis, and for pinnipeds, three animals or 4.7%, of cases. Together this means there are eight, or about 5.8%, of the total number of cases, which are finalised where the cause of death is directly attributable to human impact. This is a significant decrease compared to 2019, where 13.6% of cases were diagnosed to have a direct anthropogenic cause of death, with as many as 25% for cetaceans and 9% for pinnipeds. It should be noted that this is a crude level overview; and is likely biased towards cases that can be diagnosed from photographs (like bottlenose dolphin and grey seal attacks) due to the lower number of animals examined upon necropsy following the Covid19 pandemic. This does not account for indirect anthropogenic impact, or mortality due to chronic or cumulative effects, for example due to contaminant exposure, prey depletion or disturbance. Six cases are still pending a final diagnosis.

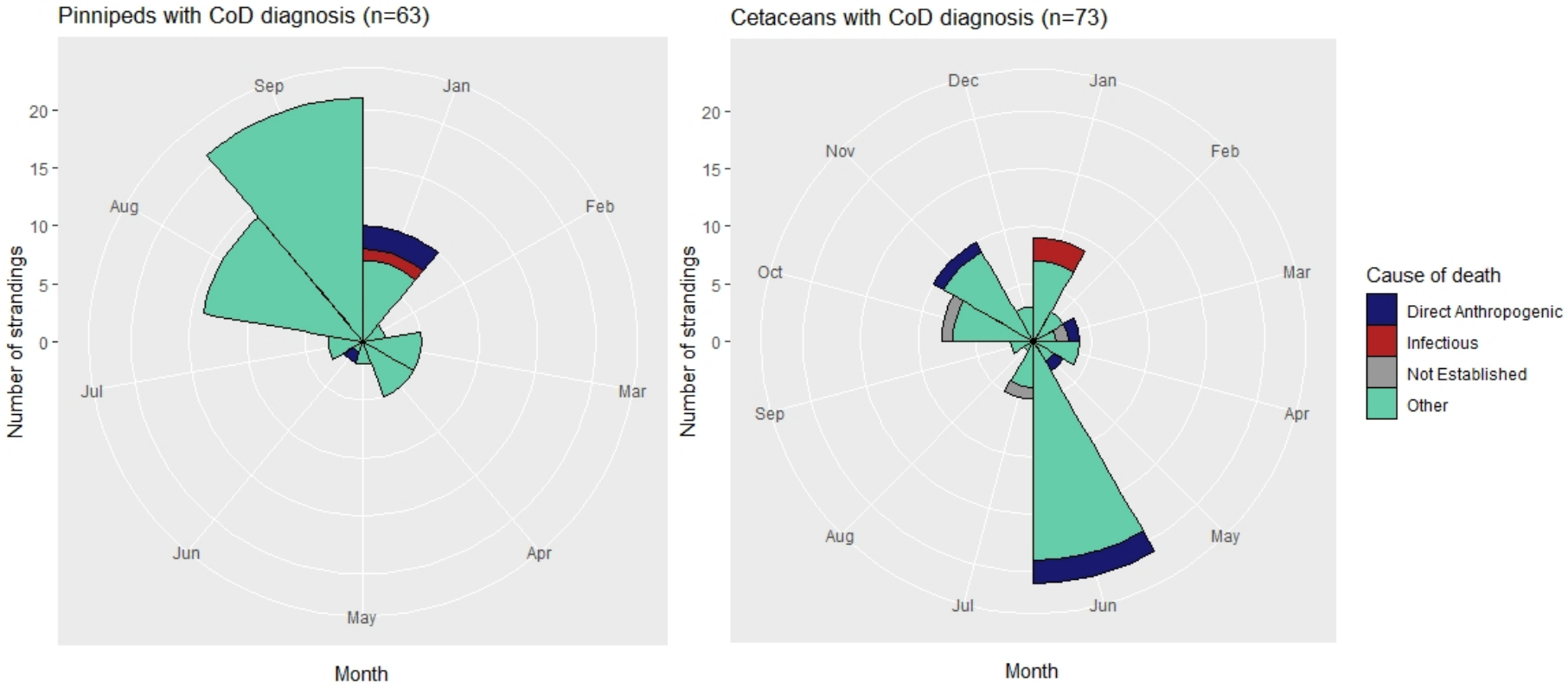

Figure 16: Monthly distribution of cause of death findings for *left:* pinnipeds and *right:* cetaceans reported to SMASS in 2020; divided by direct anthropogenic, infectious, and other causes of death as well as cases necropsied but not established.

Section 4: Mass stranding events (MSE's) and unusual mortality events (UME's).

4.1 Mass stranding events (MSE's) multiple strandings and unusual mortality events

A mass stranding event (MSE) is defined as two or more animals that are not a cow/calf pair. There were six MSE's during 2020 involving 30 animals of three different species. An unusual mortality event (UME) is usually defined as a stranding that is unexpected; involves a significant die-off of any marine mammal population; and/or demands immediate response. There were two UME's during 2020, both involving beaked whale species.

(https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-unusual-mortality-events)

4.2 Mass Stranding Events

There were six MSE's during 2020 involving 30 animals of three different species.

4.2.1 M209.1- M209.2/20 – short-beaked common dolphin (Delphinus delphis)

Two juvenile common dolphins were discovered live stranded in shallow water in the Sound of Eriskay near South Glendale, South Uist, on the 6th of April. Both animals were successfully refloated by members of the public and not seen again.

Figure 17: M209.1- M209.2/20 short-beaked common dolphin (*Delphinus delphis*) MSE Sound of Eriskay, South Uist, Western Isles.

4.2.2 M280.1- M280.19/20– long-finned pilot whale (Globicephala melas)

On the 11th of June At 3.29pm in the afternoon, a member of the local public contacted SMASS to report what he thought was a group of bottlenose dolphins (Tursiops truncatus) behaving oddly and perhaps in trouble in Lochboisdale South Uist. This report was passed on to British Divers Marine Life Rescue (BDMLR) for further investigation. It was later reported by a member of the Coastguard that these animals had first been spotted in the morning. Later that afternoon BDMLR contacted us to report that the animals in Lochboisdale were actually a group of long-finned pilot whales (*Globicephala melas*). The animals at that time

where in deep water and were milling around in the area and “spy hopping” but did not look like they were likely to strand at that time. The group was estimated to be between 15 and 20 animals. It was hoped that the animals would leave the loch overnight.
The following day the 12th of June at 9.56am, Dan Jarvis from BDMLR rang to advise that some of the pilot whales had live stranded and some were dead on the shore 250m to the west of Rubha Bhuailt, and just to the South West of the ferry terminal in Lochboisdale. At time, 15 others were still in the water in two groups, some in shallow water. Members of the local public, led by Uist Sea tours, local fish farm employees, and SMASS volunteers and guided by BDMLR, refloated a number of animals and attempted to herd the pod out of the Loch. Six animals died on the shore and one animal was deemed not a suitable candidate for refloating and was shot by a licenced marksman using a 30-calibre rifle with 150 grain shot under guidance from the BDMLR vet. Death was instantaneous, however; a second shot was administered to be certain of death. At the time the seventh stranded animal was shot there was a juvenile whale (possibly distressed) close to the stranded whales (100m -200m away) continuously circling in shallow water. It was separate from the main pod of nine animals, which were swimming in an area about 1.5km away on the other side of Lochboisdale. The separated individual remained circling in the same area for a total of about 24hrs (Friday to Saturday morning) based on a number of different observations. It was hoped that the 10 refloated animals would not return. SMASS volunteers, (Gwen Evans & Peter Keiller) saw, from the causeway, a pod of approximately nine swimming west through the channel south of Rubha Bhuailt and gathered, spy hopping at NF801181 a single individual was circling in a small area of shallow water closer to Rubha Bhuailt at NF78961912.
On the 13th of June at 11.05 am BDMLR advised us that the 10 animals that were in the Loch the day before had all returned, and nine had stranded on the south side of Eilean Iasgaich about grid ref NF 790 183. The juvenile was still in the shallow water as it was the previous evening. When this separated juvenile whale was “herded" towards the main pod on Saturday morning after the other animals had been refloated for a second time it appeared to be the trigger for the pod to move out of the area and return to the Minch. BDMLR medics from Lewis and Ullapool attended with equipment and again with the help of the local public, Uist Sea tours, Mowi fish farm employees and SMASS volunteer Chris Brooks managed to refloat all these animals and guide them into deeper water with boats. Later that evening at low tide SMASS volunteers (acting on their own cognisance) Peter Keiller, Gwen Evans, Chris Brooks and Bill Neill attended the dead stranded animals to collect location, morphometrics and photos. Locational and morphometric data was collected from all seven animals.
No Killer whales were seen in the area prior to the MSE. Coastguards present at during the MSE said they had been told by their Ops Room that submarines were “working off Uist” that day, though the Navy have told us they did not have any operations in the area at the time.
Of the dead animals, one animal was presumed to be juvenile based on length at 380 cm, the remainder were all classed as adults. There were two animals confirmed as male, both adult, and four confirmed females, all adults. It was not possible to confirm the sex of the juvenile animal. The animal that was euthanased was an adult female with milk extruding from the mammary slits. This would indicate that there was a dependant calf present within the pod, possibly the dead juvenile or the live animal that was shepherded to join the refloated pod.
One female had a swollen genital opening and was examined by Peter Keiller, retired GP and SMASS Volunteer, and he reported “For what it’s worth I put my hand in the genital opening of no. 5 up to about 25cms (the one with the swollen genital opening). All I could feel was poorly defined and indistinct soft tissue. There were no identifiable foetal parts presenting.

I felt a possible cervical opening around my fingertips, which was very soft. The opening was about 5cms (2 fingerbreadths +) across. Based on my knowledge of humans it made me think it could be a postpartum cervix. That is supported by the lack of any presenting part. It does not support an obstructed labour. The caveat of course is that I know next to zero about the genital anatomy of whales and even less about the process of parturition in these animals." This suggests that this animal had recently calved, new-borns of this species are distinctively lighter in colour than adults however and there were no reports of such an animal within the pod alive. However, a foetus in still with umbilicus attached and with amniotic sack around its tail was found near animals 5 and 6, by SMASS volunteers Mary Harman and Chris Brooks, on the 16th of June. Number 5 was the animal with a swollen genital opening suggestive of a recent birth and would suggest that this animal may have aborted fairly recently possibly during the MSE or possibly causing the MSE.

On the 18th of June a single female pilot whale was found dead stranded in the surf a Gerinis on the west coast of South Uist, given its location and state of decomposition of the animal it's possible that it may have been one of the animals refloated in Lochboisdale on the 13th of June. This animal was pregnant with a full term foetus in a breach presentation present suggesting that this was a dystocia case. Whether this animal was part of the MSE is open to question but it is certainly possible. During removal of the dead animals from close to the village of Lochboisdale to a more remote area, an eighth dead animal was discovered taking the total number of dead animals to nine, including the foetus at the MSE location. There was an unconfirmed report of a whale seen in Locheport on the East coast of North Uist but no animal was seen when the area was visited by locals using boats to search the area. Two further foetuses were found when the decomposition site was visited by Chris Brooks to examine the eight dead animal on the 23rd. These two foetuses from two animals that had been sampled and the body cavity opened by Mary Harman, the combination of decomposition and moving the animals resulted in them being pushed out of the abdomen along with the intestines.

Figure 18: M280.1-19/20 long-finned pilot whale (*Globicephala melas*) MSE 12th June Lochboisdale, South Uist, Western Isles photo credit Chris Brooks.

Figure 19: M280.1-19/20 long-finned pilot whale (*Globicephala melas*) MSE 12th June Lochboisdale, South Uist, Western Isles photo credit Peter Keiller.

Figure 20: M280.1-19/20 long-finned pilot whale (*Globicephala melas*) MSE 12th June Lochboisdale, South Uist, Western Isles photo credit Peter Keiller.

4.2.3 M580.1- M280.2/20– short-beaked common dolphin (Delphinus delphis)

Two short-beaked common dolphins live stranded at Bo'ness Falkirk in the Firth of Forth on the 4th of November. They may have been a cow and calf pair- but this was not confirmed. Both animals were successfully re-floated by members of the public.

Figure 21: M580.1-2/20 short-beaked common dolphins (*Delphinus delphis*) MSE 4th November Bo'ness Falkirk.

4.2.4 M637.1- M637.2/20– short-beaked common dolphin (Delphinus delphis)

Two short-beaked common dolphins live stranded at Clachan sands North Uist on the 22nd of November. Despite several attempts to refloat, one animal died at the scene the second was successfully re-floated. The dead animal was not recovered due to logistical reasons, which included having to respond to a bottlenose dolphin MSE two days later (see below).

Figure 22: M637.1/20 one of the short-beaked common dolphins (*Delphinus delphis*) involved in the MSE at Clachan sands North Uist.

4.2.5 M639.1- M639.3/20– bottlenose dolphin (Tursiops truncatus)

Three bottlenose dolphins were found stranded Ardnastruban sands between North Uist and Benbecula on the 24th of November. All three animals were recovered for necropsy. This is the first ever record of a bottlenose dolphin MSE; there have been no others reported since the stranding scheme began in 1992. In fact, there has been no reported MSE involving this species in the UK at least since 1989. The MSE involved a sub adult female, an adult male, and an adult female that was lactating; all were found dead stranded in an intertidal shallow area to the east of the causeway between Benbecula and North Uist. The animals were all in good to moderate nutritional condition. There was some evidence of recent feeding, with a few squid beaks and lenses present in the cardiac section of the stomachs of two of the animals. There was also a light Anasakis burden in the cardiac and fundic sections of the stomachs in all three. There was clear evidence that all the animals had live stranded, as the lungs were asymmetric with one lung congested and full of fluid, and large amount of stable foam were present in the trachea and bronchi of all three. Parasites were recorded in the lungs of one of the animals. Bacteriology did not find any significant isolates and histology is pending. Based on the size and development of the uterine vasculature in the lactating female, it appears that this animal had carried a foetus to, or close to term. The cervix was closed. It is plausible that this dolphin had recently given birth. Although no calf was found in association with this MSE, there is a possible scenario where a lost or ill calf may have brought the group into this shallow region and they were left stranded by the receding tide. In conclusion, there is no clear reason for the stranding so at present, the proximal cause of death is live stranding. Photos of the dorsal fins of these individuals were shared with the appropriate individuals maintaining the catalogues for this species in the UK; no match to a known individual was made at the time of production of this report.

Figure 23: M639.1/20 Bottlenose dolphin (Tursiops truncatus) from Ardnastruban sands North Uist image credit Peter Keiller.

Figure 24: M639.2/20 & M639.3/20 Bottlenose dolphin (Tursiops truncatus) from Ardnastruban sands North Uist image credit Peter Keiller.

4.2.6 M664.1- M664.2/20– short-beaked common dolphin (Delphinus delphis)

Two short-beaked common dolphins possibly a cow and calf pair but this could not be confirmed live stranded at Kettletoft bay, Sanday Orkney on the 30th of November. It is, both animals were successfully re-floated by medics from BDMLR.

Figure 25: M664.1/20 & M664.2/20 short-beaked common dolphins (*Delphinus delphis*) MSE at Kettletoft, Sanday, Orkney.

4.3 Unusual Mortality events (UME's)

There were two UME's in 2020; both involving beaked whales in October.

4.3.1 M514 & M517-20 Sowerby's beaked whale (Mesoplodon bidens)

Two juvenile Sowerby's beaked whales (M514 &M517-20) animals stranded within 8 miles and 24 hours of each other on the southern coast of the Firth of Forth. M514/20 stranded at Musselburgh on the 13th of October; was in decomposition code 2 at the point of necropsy however, some tissues were more autolysed than expected, likely due to stranding hyperthermia. The animal was known to have live stranded and this was supported by the observed gross pathology. It was in good body condition and had evidence of historic, but not recent feeding. There was no indication of entanglement, bycatch or marine debris ingestion, and aside from some significant trauma associated with the stranding and carcase recovery, only the linear mark on the flank, likely from lying on a length of rope, no other trauma was noted. Of most note was emphysema in the rete and thymic tissue which seemed excessive given the only slight state of decomposition There were also gas emboli noted in the mesenteric vascular however, not in the perivascular mesentery. However, the isolation of *Clostridia perfringens* may indicate these were due to autolysis. Haemorrhage was noted within thymic and lymph node tissues. The brain showed some haemorrhage around the brainstem. It is not clear if these observed gas emboli are the results of emphysema as a

result of the stranding event, decomposition, produced by *Clostridia* post mortem, or indicative of gas emboli as a result of decompression sickness, at the time of production of this report. M517/20 stranded at Gosford Bay on the 14th of October. It was in a more autolysed state at the point of necropsy, and the findings are likely hampered due to this. The animal appeared to show some indications which would support live stranding, but the profile was not clear and an at sea or surf death cannot be ruled out. It was in good body condition and had evidence of historic, but not recent feeding. There was no indication of entanglement, bycatch or marine debris ingestion, and aside from trauma associated with the stranding and carcase recovery, little evidence of significant trauma. Of most note were bubbles in the lung and mesenteric veins, which seemed excessive, given the state of decomposition. There was an unusual high density of small bubbles <3mm in diameter within the visceral pleura of the lung in a diffuse to coalescing pattern. There were also gas emboli noted in the mesenteric vascular and, unusually, in the perivascular mesentery. There was also haemorrhage noted in the pancreas, focused around the main vascular region, and bubbles in the thoracic rete and thymic tissue associated with the pericardium. It is not clear if these observed gas emboli are the results of emphysema as a result of the stranding event, decomposition or indicative of gas emboli as a result of decompression sickness at time of production of this report, although the isolation of *Clostridia perfrigens* may indicate decomposition.

A request was made to the UK MOD for activities within 100NM of the stranding location for the 10 days prior to the 13th October 2020. There was an activity reported on the 12th October of airborne ASW active sonar within an area 56 o 20’ to 56 o 30’N and 000 o 40’W and 000o. This entailed 4 x individual transmissions totalling 55 minutes active, all between 0930 and 1100. This location is around 80nm of the stranding location and is notable in being the first deployment of ASW in the east coast region for several years.

The unusual patterns of having two animals strand close, but not close enough to indicate a behavioural/group response, in good body condition with apparently little underlying pathology which may explain the stranding, yet exhibiting atypical number of bubbles or gas emboli in the rete and mesentery and the haemorrhage noted in a lymph node is possibly indicative of DCS. Given the tempo-spatial proximity to naval sonar deployment, this has to remain a differential for the stranding in both these cases. Further Histology for lipid emboli is awaited. At present, the proximal cause of death of both animals is live stranding.

Figure 26: M514/20 Sowerby's beaked whale (Mesoplodon bidens) Musselburgh credit Corinne Gordon.

Figure 27: M514/20 Sowerby's beaked whale (Mesoplodon bidens) Gosford bay, East Lothian credit Corinne Gordon.

4.3.2 M530, M534 & M548-20 northern bottlenose whale (Hyperoodon ampullatus)

M530/20 a sub adult male northern bottlenose whale was found stranded Gairletter, Strone upper Clyde sea loch, on the 14th of October. It was identified as one of the animals known to have been seen in the Clyde region since early August and, despite herding efforts, had remained in the region for over two months. The carcase was significantly autolysed, hampering interpretation of gross pathology. Overall, there was clear indication of trauma associated with live stranding but no indication of an underlying infectious or traumatic cause. There was no indication of trauma from bycatch, entanglement, ship strike or marine debris ingestion and the animal was in moderate body condition and did not appear dehydrated, and whilst there was no indication of significant recent feeding, it is likely it had been able to forage successfully in whilst in this region. Histopathology did not appear to identify evidence for any significant pathology other than a tentative indication of a pneumonia. It is possible this contributed to the animal's stranding. Nevertheless, as with most of the other animals identified in this region; it is plausible that as the prey density, which may have brought or at least supported the animals in the loch system, began to diminish at the end of summer, this increased the likelihood of live stranding given animals needed to forage into more hazardous bathymetry. Bacteriology proved unrewarding with post mortem invaders recovered from most sites. This was identified to be the likely case for M534/20; a sub adult female at Portavadie. It is not possible due to the decomposition state of this case to indicate if underwater noise played any role in this stranding event or the initial occurrence of these animals in this area, but it cannot be ruled out given what is known about the susceptibility of these species to disturbance. In the absence of other information, live stranding as a result of entering shallow and likely acoustically difficult to navigate territory, remain the most likely cause of death. M548/20; a sub adult male northern bottlenose whale that live stranded near Glasgow Airport, Renfrewshire, was also one of the animals identified around the sea lochs of the Clyde for several weeks, prior to it being sighted way up a Clyde tributary river. It was seen partially stranded and after several hours and BDMLR support it died. It was recovered and necropsied on site at Glasgow airport within 24 hours of death. There were notable scratches and bruising associated with the agonal stranding but no indication of other significant trauma, entanglement or boat strike. The animal was in good body condition and adequately hydrated, but the blubber was slightly jaundiced and the liver had a tan colour and a mottled, slightly 'nutmeg' appearance indicative of some hepatopathy. There were multiple coalescing petechial to eccymotic perivascular haemorrhages, notably around the mesenteric border of the intestines, myocardium, rete and pancreas, associated with mild to moderately extensive emphysema. The kidneys showed frank sub capsular haemorrhage. The pericardium and thymus also exhibited emphysema. The lungs were asymmetric, with the left side exhibiting severe blood congestion and the right evidence of agonal water aspiration. The oesophagus contained various leaf debris and the stomach contained leaf material 5g of squid flesh, 10g of plastic debris comprising two clear plastic bags and 65g of tree leaf litter. The plastic was likely incidental and had not caused any obstructions in the pylorus, however the fundic stomach appeared slightly inflamed, but not ulcerated. The spleen was unremarkable and there were no clear indication of cavitation lesions to any examined organs. The brain was moderately autolytic, with a thick, haemorrhagic meninges but no indication of gas bubbles or aneurisms in the cerebral vasculature. The ventricles and choroid plexus were unremarkable and a normal volume of straw coloured CSF was recovered

for bacteriological culture. No parasite burden was detected in any examined tissues. The stomach contents and icteric liver and blubber is indicative of an animal, which had been likely hungry and actively foraging but for some reason was not able to successfully forage enough prey. Given it had been actively suction feeding, this suggests the animal was capable of feeding but was in a location where prey density was insufficient, and the agonal live stranding in the river system may be a result of foraging. The gas bubbles in several tissues are of interest, but are likely not extensive enough to suggest DSC; yet possibly indicative of a degree of gas bubble formation. It is possible this is linked to an increase in the frequency and decreased surface interval of unsuccessful foraging dives. Bacteriology revealed a mostly post mortem invaders as evidenced by the isolation of *Clostridia perfringens* and *Proteus sp*. form many sites and may account for the gas bubbles. The significance of the isolation of *Streptococcus agalactiae* from the spleen is uncertain but is probably a post mortem invader. Histology showed significant post-mortem change with bacterial invasion and emphysematous change within a number of tissues making full interpretation difficult. The close association of bacteria and emphysema suggest post-mortem gas production as opposed to an ante mortem event. Lung changes support the necropsy findings with variable congestion and in one section marked autolysis with abundant protein rich oedema consistent with hypostatic change. Splenic congestion would represent agonal events. There is multifocal mild to moderate haemorrhage involving the vascular rete, which again can be associated with hypoxia, trauma and terminal vascular events. The ventral skin shows a moderate subacute dermatitis with subjacent panniculitis. This is most likely to be associated with superficial trauma leading to a degree of excoriation, and reactive change, and may well have occurred because of abrasion in an unfamiliar environment for the animal prior to stranding. No underlying pathological changes were identified that may have predisposed to live strand.

Figure 28: M530/20 northern bottlenose whale (*Hyperoodon ampullatus*) Gairletter, Strone, Argyll and Bute.

Figure 29: M534/20 northern bottlenose whale (*Hyperoodon ampullatus*) Portavadie, Argyll and Bute.

Figure 30: M548/20 northern bottlenose whale (*Hyperoodon ampullatus*) Glasgow Airport, Renfrewshire.

Entanglement cases

The term entanglement usually only applies to large whales (particularly mysticetes), leatherback turtles and occasionally basking sharks. More recently, the term entanglement has also been applied to pinnipeds that have become entangled in fishing gear or other marine debris.

Animals are occasionally seen alive with gear attached, usually flukes and fins but occasionally through baleen plates in the mouth. Over 70% of dead stranded cases are discovered with no material remaining on the animals and diagnosis is made by lesion pattern and pathological evidence supportive of entanglement. Acute cases similar to bycatch, sub-acute cases result in exhaustion and impaired feeding and evidence of water aspiration or drowning. Chronic cases are arguably the most significant anthropogenic welfare issue and animals are often very thin and debilitated and show chronic wounds caused by abrasion and pressure from entangled equipment.

4.4 Cetacean entanglement cases.

During 2020 three minke whale were diagnosed as entanglement cases. This diagnosis was given through assessment of photographs; none of the animals was necropsied. Two were at sea (one of the coast of Lewis the other in the Cromarty Firth), and one came ashore in May, and was sampled.

4.4.1 M239/20– minke whale (Balaenoptera acutorostrata)

A female juvenile minke whale was found dead entangled on the shore at Dalcross near Inverness on the 11th of May. The animal had net stuck in its baleen and entangled around its rostrum with associated deep linear lesions. The net was also wrapped entangled around the tailstock and flukes. Although though necropsy was performed due to Covid restrictions samples were collected.

Figure 31: M239/20 minke whale (Balaenoptera acutorostrata) at Dalcross, Highland.

4.5 Pinniped entanglement cases

Two grey seals were reported as either entangled or have lesions suggestive of previous entanglement. None was subjected to necropsy due to logistical reasons of getting to or recovering the carcase. One on the Isle of Skye and other on the Isle of May, Fife.

4.5.1 M71/20 – grey seal *(Halichoerus grypus)*

This grey seal pup was found at Halistra, Isle of Skye on the 28th of January with an encircling net around its thorax.

Figure 32: M71/20 grey seal (*Halichoerus grypus*) from Halistra, Isle of Skye with net entanglement.

4.5.2 M439/20– grey seal (Halichoerus grypus)

This adult grey seal was found dead on the Isle of May on the 1st of September. There was a chronic encircling lesion consistent with historical entanglement around its neck. Due its location, it was not recovered for necropsy. It is possible confirm entanglement as the cause of death.

Figure 33: M439/20 grey seal (*Halichoerus grypus*) from the Isle of May with lesions are consistent with entanglement.

Section 5: Bycatch

The diagnosis of bycatch is given to animals whose death is caused by incidental capture in fishing gear. Pathology is usually characterised by healthy animals in good condition, evidence of recent feeding with lung pathology consistent with anoxic drowning (stable foam in bronchi and trachea) and congestion of several organs. Net marks may be visible on fins, flukes or the flank, occasionally trauma to beak, removal of tail flukes and rarely fractures to vertebrae. There was a single case attributed to bycatch during 2020; a harbour porpoise from Reiff, Highland.

5.1 M613/20 – harbour porpoise (Phocoena phocoena)

This juvenile female harbour porpoise was found dead stranded in Reiff, Assynt Highland on the 18th of November. It was in very fresh condition and necropsied within 24 hours of recovery. It was in good to fat body condition, with excellent lipid reserves in blubber however had not recently fed, with both stomach and GIT empty of contents. Parasite burden was very low and overall the animal appeared healthy and the cause of death was likely acute. The liver was slightly pale, consistent with a catabolic state but it was neither fatty nor oedematous. The bronchial tree contained a large volume of stable white foam and the lungs were slightly asymmetric with the right congested. In conjunction with blood in the right eye, bruising to the rostrum and a small volume of frank intracranial haemorrhage would suggest bycatch as a differential, however there was neither recent feeding nor evidence of net marks, to further support this diagnosis. Bacteriology revealed a light growth of *Pseudomonas putida* from some sites and an unidentified CO2 dependant gram-negative coccobacilli from the lung; the significance of these isolates is uncertain. Histopathology is awaited to assess is there is any likely evidence of hepatopathy however. The proximal cause of death is bycatch.

Figure 34: M613/20 harbour porpoise (*Phocoena phocoena*) close up of lungs showing stable foam in the trachea and bronchi typically associated with bycatch.

Section 6: Grey seal predation (cetaceans).

This recently described phenomenon has so far only been seen on harbour porpoise from regions with sympatric grey seal populations. It is characterised by extensive trauma to blubber and underlying musculature, tissue loss and puncture marks around the head and around wound margins. Often large sections of tissue (both blubber and muscle) are removed, assumed predated, particularly the back muscle either side of the spine. Puncture marks through blubber often around the head and throat area. Blubber and skin commonly stripped resulting in missing tissue and flaps of blubber. Internal organs and skeleton are normally intact in very fresh cases. In some situations, the porpoise initially escapes the seal only to die of bacterial sepsis arising from bite wounds. There were three animals suspected as seal predation cases, of these three were classified as probable and one as possible primary trauma cases. There were no cases due to secondary infection originating from a seal bite in this reporting period. Primary trauma cases are given an adjectival score based on pathological assessment of lesion patterns and exclusion of other causes of trauma:

- Unlikely: Lesion pattern is inconsistent with cases of seal predation or other causes of death are more likely.
- Possible : Lesion pattern is consistent with cases of seal predation but other causes of death cannot be excluded
- Probable: Lesion pattern is consistent with cases of seal predation and significantly more likely than any other cause of death
- Definite: Cases observed to be victims of conspecific seal predation

6.1 Primary trauma cases suspected to be seal predation on harbour porpoise

1. M56/20, 21/01/2020 Ettrick Bay Beach, Argyll and Bute. Photograph provided show just the tailstock. **Possible seal predation case.**
2. M203/20, 07/04/2020 Kilchoan, Ardnamurchan, Highland. Photograph provided show a freshly dead animals with skin and blubber missing from the thoracic area and rib cage. **Probable seal predation case.**
3. M743/20, 21/12/2020 Meigle bay, North Ayrshire. Photograph provided show a freshly dead animals with skin and blubber missing from the thoracic area and rib cage. **Probable seal predation case.**

Figure 35: M203/20 harbour porpoise (*Phocoena phocoena*) at Kilchoan, Ardnamurchan, Highland, showing lesions typical of grey seal predation.

Section 7: Other notable single cetacean strandings

7.1 M19/20 – sperm whale (*Physeter macrocephalus*)

This sub-adult male was observed to live stand on rocky foreshore in Arderseir in strong winds and died around 11.30am on the 7th January- approximately 3-6 hours after first stranding. It was recovered to the foreshore, necropsied, and buried on site the following day. The necropsy took place within 24hours of death so the carcase was fresh. All organs were well preserved with congestion associated with the stranding, and there was a notable amount of seawater both aspirated and ingested. Visceral organs were otherwise unremarkable, with no indication of infectious disease, trauma or metabolic pathology beyond that caused by the stranding event. The animal was in moderate body condition, with evidence of intra-abdominal fat deposit, but there was little free lipid on cut section and no indication of recent feeding, with the intestines and pylorus mainly containing bile Cardiac and fundic stomach contained many hundred squid beaks, no otoliths, fish lenses or debris of any kind however. This is all indicative of an animal who had not fed recently, but had been feeding well in the past. The brain in this case was removed largely intact and showed thickening of the meninges some dilatation of the cerebral ventricles and hypertrophy of the choroid plexus. CSF was slightly turbid; however, there was also some PM contamination. Gross mixed flora was

isolated from most sites cultured suggesting PM contamination; however, Edwardsiella tarda was isolated in pure culture from the liver, hepatic lymph node and in light culture from the lateral ventricles of the brain. The significance of this isolate is uncertain. Histopathology showed mild, acute, and multifocal to locally extensive, angiocentric, lymphocytic meningoencephalitis. There was also a mild, acute, generalised, lymphocytic, portal hepatitis. Moderate, sub-acute, generalised, suppurative lymphadenitis. The meningoencephalitis and hepatitis are suggestive of a systemic infectious process, probably viral rather than Brucella. Molecular diagnostics for primarily herpesviruses but also morbillivirus will be undertaken.

Figure 36: M19/20 necropsy of sperm whale (Physeter macrocephalus) from Ardesier, Highland.

7.2 M25/20 – Sowerby's beaked whale (*Mesoplodon bidens)*

This juvenile male Sowerby's beaked whale was found dead stranded on the 8th of January at Portmahomack, Highland. It was in poor nutritional condition, bordering on emaciated with clear indications it had live stranded. Possibly, because of winter storms prior to the stranding. There was no indication of plastic or marine debris ingestion and the GIT was largely empty apart from bile and a few parasitic worms. The liver was jaundiced and fatty- indicative of catabolism due to no recent successful foraging. Other underlying hepatic pathology a possibility as there was also a moderate to high fluke burden. The brain was congested, with some areas of meningeal opacity, but there was no indication of ventricular dilation or gross meningoencephalitis. Clostridia perfrigens was isolated in pure growth from the liver, kidney and CSF; this would appear to be a post mortem invader. Histology did not reveal any significant findings to account for the ill thrift and live stranding.

Figure 37: M25/20 Sowerby's beaked whale (*Mesoplodon bidens*) from Portmahomack, Highland.

7.3 M44/20 – Cuvier's beaked whale (*Ziphius cavirostris*)

This sub adult male Cuvier's beaked whale was found dead stranded on Baleshare, North Uist on the 16th of January. It was in moderate decomposition status- and necropsied 7-10 days post=mortem. The animal was in moderate body condition, with little free lipid in blubber but indications of past, but not very recent feeding. There were clear indications of live stranding and significant bruising to the head and mandible indicative of ante mortem trauma. The right lung also showed significant interstitial emphysema, but as this was clearly unilateral, this was likely related to live stranding rather than DCS. There was no indication of significant bacterial or viral pathology; however, there was a high nematode burden in the kidneys and a thickening of the renal, caudal aortic and mesenteric vasculature consistent with a chronic active verminous arteritis most probably due to Crassicauda spp. Bacteriology revealed a pure growth of Edwardsiella tarda from most sites, the significance of which is uncertain. Unfortunately, autolysis precludes histological evaluation of many of the tissues submitted and there is extensive emphysematous change in many organs associated with bacterial proliferation as a result of post-mortem invasion. Given the bad weather in the days prior to this stranding, it is plausible this was an older, reasonably debilitated animal, which live stranded possibly due to storm trauma.

Figure 38: M44/20 Cuvier's beaked whale (*Ziphius cavirostris*) from Baleshare, North Uist.

7.4 M73/20 – True's beaked whale (*Mesoplodon mirus*)

This adult female beaked whale was found dead stranded at Kervaig beach, Cape Wrath on the 29th of January. It was originally identified as a Cuvier's beaked whale (Ziphius cavirostris). However, it was later identified as a True's beaked whale (Mesoplodon mirus) based on skull morphology by the National Museum of Scotland. Genetic confirmation is pending but awaited with great interest. It was sampled and subsequently necropsied on site approximately 10-14 days post mortem. There was significant trauma noted to the dermis and skeleton- the majority of it suspected to be post mortem. However, intracranial and intraventricular cerebral haemorrhage, alongside focal subdural bruising, indicated severe ante mortem trauma to the skull. There was no frank haemorrhage associated with the cochlea. Other bones showed multiple fractures, including ribs and the spine was fractured around T1. There was no clear haemorrhage associated with this, suggesting these were post mortem. The carcase was otherwise in moderate to thin condition, had not recently fed and showed indications of live stranding, including mild lung asymmetry and sand ingestion. There was no indication of ingestion or entanglement in marine debris and the parasite burden was negligible. Given the severe cranial trauma and the topography of the beach, this would be consistent with a live stranding in winter storms. The role of acoustic trauma cannot be ruled out and given the species and stranding location and this deserves careful consideration. However. It is our understanding the range was not active in the weeks prior to this stranding and there was no indication of haemorrhage around the cochlea. Given the autolysed and bruised nature of the carcase, definitive assessment of the role of anthropogenic trauma in this stranding is however likely to be challenging. Bacteriology on the brain proved sterile.

Histology, autolysis precludes evaluation of many of the tissues and there is extensive post-mortem bacterial invasion with emphysema formation. Brain haemorrhage was noted histologically supporting the gross necropsy findings however, this was relatively mild. There is no accompanying neuroparenchymal change and as such would represent an acute event. There is no evidence of peri-vascular haemorrhage throughout the remainder of the neuroparenchyma which is a feature seen with acoustic injury (along with non-bacterial associated emphysematous change) and as such, taking into account the distribution of the haemorrhage, trauma would seem the most likely cause. Whether this is happened prior to stranding or not cannot be ascertained.

Figure 39: M73/20 True's beaked whale (*Mesoplodon mirus*) from Kearvaig, Cape Wrath, Highland.

Figure 40: Skull of M73/20 True's beaked whale (middle) compared with Sowerby's beaked whale skull (left) and Cuvier's beaked whale (right) photo credit Georg Hantke National Museum of Scotland.

7.1 M79/20 – Sowerby's beaked whale (*Mesoplodon bidens)*

This aged female Sowerby's beaked whale was found dead stranded on Gott bay, Tiree on the 6th of February. It was necropsied six days later due to travel difficulties around Storm Ciara. It was in a poor nutrition condition, with significant loss of back muscle mass. There were multiple healed dermal scars over the flank but no indications of recent trauma or entanglement. The liver was diffusely congested, with a 'nutmeg' appearance and friable on cut section, suggestive of moderate to severe hepatopathy. The adrenals were enlarged, with an apparent hypertrophic cortex and petechial haemorrhages noted at the C:M border. A viral hepatitis is a differential in this case. There was little fatty change noted and the animal did not appear jaundiced nor were there ascites in the abdomen or thorax. There was no indication of recent feeding, with fluid and scant nematodes in the primary stomachs and reflux bile in the pylorus. No otoliths, squid beaks, marine litter or other ingesta noted. GIT parasite burden was low. Kidneys and vasculature did not show evidence of verminous arteritis, and urine was unremarkable, however there were proteinaceous deposits in the renal hilus possibly indicative of dehydration. Lungs were congested and slightly asymmetric, suggestive of agonal live stranding. Brain showed an increase in white matter but ventricles were otherwise unremarkable. Histology revealed emphysematous change noted in 2 of the lymph nodes (at least one of which appears to be abdominal). No bacteria are evident within these foci and tissue preservation is very good and as such autolytic change would seem unlikely. Interestingly occasional multinucleate giant cells are present within or immediately adjacent to affected areas-this raises the possibility of subacute emphysema formation as an antemortem event. This has been associated with decompression syndrome in cetaceans especially deep diving species. No other evidence of emphysema was identified in other tissues. Within the brain, there is mild peri-vascular haemorrhage within the neuroparenchyma, which has been seen in decompression cases however, it is a non-specific

change that can also be the result of trauma, hypoxia, disseminated intravascular coagulation, sepsis and other causes of shock. The absence of emphysema within the CNS makes a diagnosis of decompression syndrome equivocal however it is possible to undertake further assessment through the evaluation of lung tissue for lipid emboli although in the subacute phase these may have dispersed. A number of other findings were present including variable pulmonary atelectasis, congestion, oedema and haemorrhage, which is suggestive of change associated with compression and hypostasis due to live stranding. There is a mild subacute interstitial pneumonia indicative of a systemic inflammatory reaction the aetiology of which has not been established on histological examination of the above tissues. This is also supported by the presence of mild sinusoidal leucocytosis in the liver and a multifocal minimal subacute hepatitis, which may be related to bacteraemic events however bacteriology proved sterile from all sites cultured. Proximal cause of death is live stranding.

Figure 41: M79/20 female Sowerby's beaked whale (*Mesoplodon bidens*) from Gott Bay, Tiree Photo credit Catriona Spink.

7.2 M265/20 – harbour porpoise (Phocoena phocoena)

A male freshly dead harbour porpoise was found dead stranded at Largs, North Ayrshire on the 3rd of June. The animal had regular spaced deep lacerations on the dorsal left side consistent with propeller damage. There were reports of a porpoise being hit by a speedboat in the area. Due to Covid restrictions, this animal although suitable, was not collected for necropsy.

Figure 42: M265/20 harbour porpoise (*Phocoena phocoena*) at Largs, North Ayrshire, showing lesions typical of propeller damage.

7.3 M331/20 – fin whale (*Balaenoptera physalus*)

A single adult female fin whale was found live stranded at Hunda sound, Orkney, on the 9th of July. The animal died on site. It was approximately 21m long. Due to Covid restrictions, no examination was undertaken however, samples were taken.

Figure 43: M331/20 fin whale (*Balaenoptera physalus*) Hunda sound, Orkney.

7.4 M432/20 – bottlenose dolphin (*Tursiops truncatus*)

A single adult male bottlenose dolphin was found dead floating in the River Tay at Dundee on the 27th of August. This aged male bottlenose dolphin was identified as 'Spike' AU/WDC cat number #49 and was found dead in the Tay Estuary. This animal was first seen as adult in 1989, hence was at least 33 years old. He was recovered and frozen at SMRU prior to necropsy. The carcase was in moderate body condition, was slightly dehydrated and there was little free lipid in blubber, however the cardiac stomach contained almost 4kg of salmonid prey indicating recent feeding. There were some significant age related changes, namely increased white matter in brain and generalised fibrosis throughout connective tissue and there was indication of agonal live stranding based on submandibular bruising and lung asymmetry. In addition, frank haemorrhage was noted in the right lung in the airways, possibly a pulmonary aneurism as a result of the stranding. The heart also showed significant asymmetry in ventricular wall thickness and it is possible there was a degree of DCM in the right ventricle. The left adrenal showed a well described smooth ovoid mass possibly neoplastic but no other metastatic lesions were found. The liver was greasy and pale in colour, possibly fatty change but also could just be autolysis. The skeleton showed significant long-

term lateral scoliosis and some arthritic changes but this is not thought to have been causal to the death. Bacteriology produced growths of *Clostridia perfringens* from the lung brain and CSF; this is a post mortem invader. Histology showed multifocal, chronic, moderate, myocardial fibrosis, patchy marked pulmonary oedema and moderate to marked atelectasis. Multifocal, mild, segmental, glomerulosclerosis (age-related change). Multifocal, gastritis with intralesional nematodes and trematodes. Mild adipose tissue atrophy, mild anthracosis and adrenal adenoma. These are benign and have been previously reported in dolphin species (Newman and Smith 2006). The significance of this finding is unknown and is dependent upon whether or not the mass is functional producing cortisol and other adrenal hormones-the latter can only be assessed accurately through blood biochemistry. Overall, there was no clear traumatic, systemic infectious process, which would explain the death other than that of agonal live stranding. It is however likely that underlying neurological and metabolic senescence/ age related change is the ultimate reason for this stranding.

Reference: Newman and Smith (2006) Marine mammal neoplasia: A review. Vet Path, 43, 865-880

Figure 44: M432/20 bottlenose dolphin (*Tursiops truncatus*) being recovered from the River Tay.

7.5 M454/20 – harbour porpoise (*Phocoena phocoena*)

This juvenile harbour porpoise was observed to live strand in distress at Aith, Shetland on the 9th of September. The animal died after several failed refloating attempts. There were multiple rake mark to both pectoral fins and tail flukes and 18 separate sets of rake marks on the rest of the carcase. There was evidence of blunt force trauma with significant haemorrhage within the blubber and extensive bruising of the left side of the thorax and longissimus dorsi muscles. Most of the ribs on the left arcade were fractured, some twice. Haemothorax and haemopercardium was present, likely due to the rib fractures, causing direct trauma and adhesions to the left ventricle. The animal had not fed recently but did not appear to be in a catabolic state. The rake marks on this animal were measured at between 6-7 mm apart, which is consistent with the interdental spacing of Lagenorhynchus species and not bottlenose dolphins. There was no indication of any underlying pathology. The proximal cause of death is physical trauma due to an attack by white beaked dolphins, rather than Atlantic white sided dolphins. Observations on Shetland of interactions between white beaked dolphins and other cetacean species would suggest this is the most likely species.

Figure 45: M454/20 harbour porpoise (*Phocoena phocoena*) from Aith, Shetland.

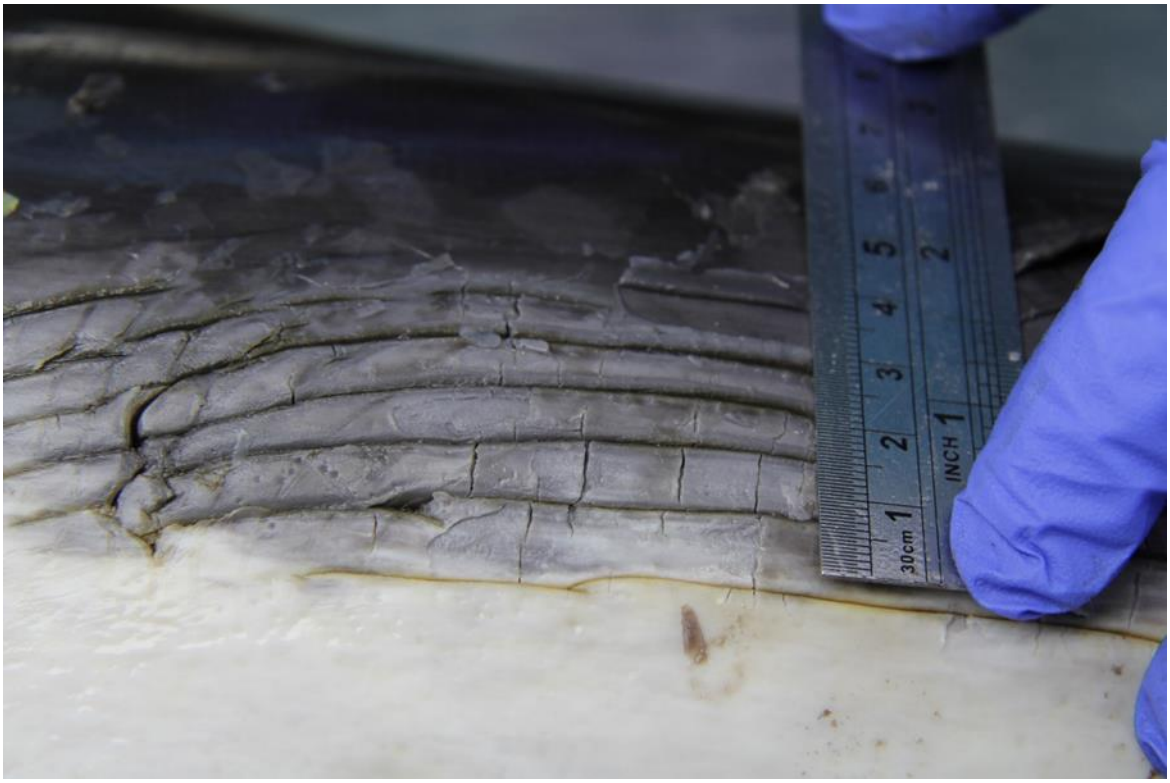

Figure 46: M454/20 close up of rake marks on harbour porpoise measured at between 6-7 mm apart.

7.6 M516 /20– northern bottlenose whale (*Hyperoodon ampullatus*)

This sub adult female northern bottlenose whale was observed to live strand on rocky foreshore close to Stornoway harbour on the 14th of October. It was recovered to the landfill site and necropsied 48-60h post mortem. There was significant autolysis and interpretation was hampered by this this process. Aside from clear evidence of live stranding, comprising significant lung asymmetry with congestion in the right lung and acute lacerations and excoriations to the epidermis, there was no clear evidence of a traumatic or infectious process, which could have led to the live stranding. The animal had been feeding, as evidenced by several hundred squid beaks in the cardiac and fundic stomach, but there was no evidence of recent feeding and the intestines largely contained bilious fluid. The animal was in good nutritional condition, with good blubber and muscle reserves. There was no indication of gross trauma potentially associated to acoustic trauma, and no evidence for DCS in the tissues such as gas bubbles or frank haemorrhage. Unfortunately, the severity of the autolysis in this case precludes any histological evaluation of many of the tissues submitted. In those that were less affected no lesions were detected. Bacteriology is pending but due to the state of preservation is unlikely to prove diagnostic. This was one of four beaked whales stranded in a 7-day period and whilst not pathologically similar the role of underwater noise in this case has to be considered as a possible behavioural modifier to these events, however there is no pathological evidence for that being a differential in this case.

Figure 47: M516/20 northern bottlenose whale (Hyperoodon ampullatus) from Stornoway, Lewis.

7.7 M716 /20– Sowerby's beaked whale (Mesoplodon bidens)

This adult male Sowerby's beaked whale was observed to live stand at Gress beach on Lewis on the 12th of December. The animal was in good nutritional condition with good blubber deposits and back muscle mass. There was evidence of live stranding with ventral bruising and bilateral congestion and stable foam in the lungs. The liver was congested and fibrous. There was no evidence of recent feeding with only one small single otolith found in the cardiac section of the stomach. There was a mild/moderate worm burden of thin nematodes associated with some small stomach ulcers in the first section of the stomach. The proximal intestine had a moderate (suspect) Bolbosoma burden, but the distal intestine appeared normal. The brain had a significant amount of white matter and the meninges was thickened- other systems were unremarkable. These are most likely age related changes, histology and bacteriology are pending. Proximal cause of death is live stranding.

Figure 48: M716/20 Sowerby's beaked whale (*Mesoplodon bidens*) adult male from Gress, Lewis.

Section 8: Spiral "corkscrew" trauma seal cases

Fifty-eight seals were reported as having trauma consistent with spiral or corkscrew injuries. This is an increase in reports compared to 2019. These cases were reported from 11 local authorities. Most reports were from Orkney and Highland with 13There were also reports from other areas including Aberdeenshire (4), Fife and the Western Isles (6), Argyll and Bute (8), City of Edinburgh East Lothian and South Ayrshire (2), and one each for Dumfries and Galloway and North Ayrshire. The majority of these were grey seals (*Halichoerus grypus*) (n=45; 77.5%). Harbour seals (*Phoca vitulina*) (n=11; 18.9%) and those too decomposed or data deficient to be identified (n=2; 3.4%). It is now considered highly plausible that the majority of spiral trauma or "corkscrew" cases can be attributed to grey seal predation, which would make this the most common identifiable reason for seal mortality in Scotland. Research is still ongoing by SMRU in collaboration with SMASS.

Table 6 shows the details for all pinniped cases considered potential spiral trauma cases. The final two columns display an adjectival description of a) how likely it is that the case matches the archetypal spiral 'corkscrew' lesion and b) given the recent new evidence, how likely is it that the lesions could be due to grey seal predation. As in section 6, the following criteria were used and Figure 50 below shows the spatial distribution of cases across Scotland.

- Unlikely: Lesion pattern is inconsistent with cases of seal predation or other causes of death are more likely.
- Possible : Lesion pattern is consistent with cases of seal predation but other causes of death cannot be excluded
- Probable: Lesion pattern is consistent with cases of seal predation and significantly more likely than any other cause of death

- Likely : Lesion pattern is consistent with cases of seal predation and evidence is sufficient to rule out other causes of death
- Definite: Cases observed to be victims of conspecific seal predation

Figure 49: M175/20 harbour seal (*Phoca vitulina*) from Achnacloich, Skye, Highland showing typical corkscrew/spiral grey seal predation lesions

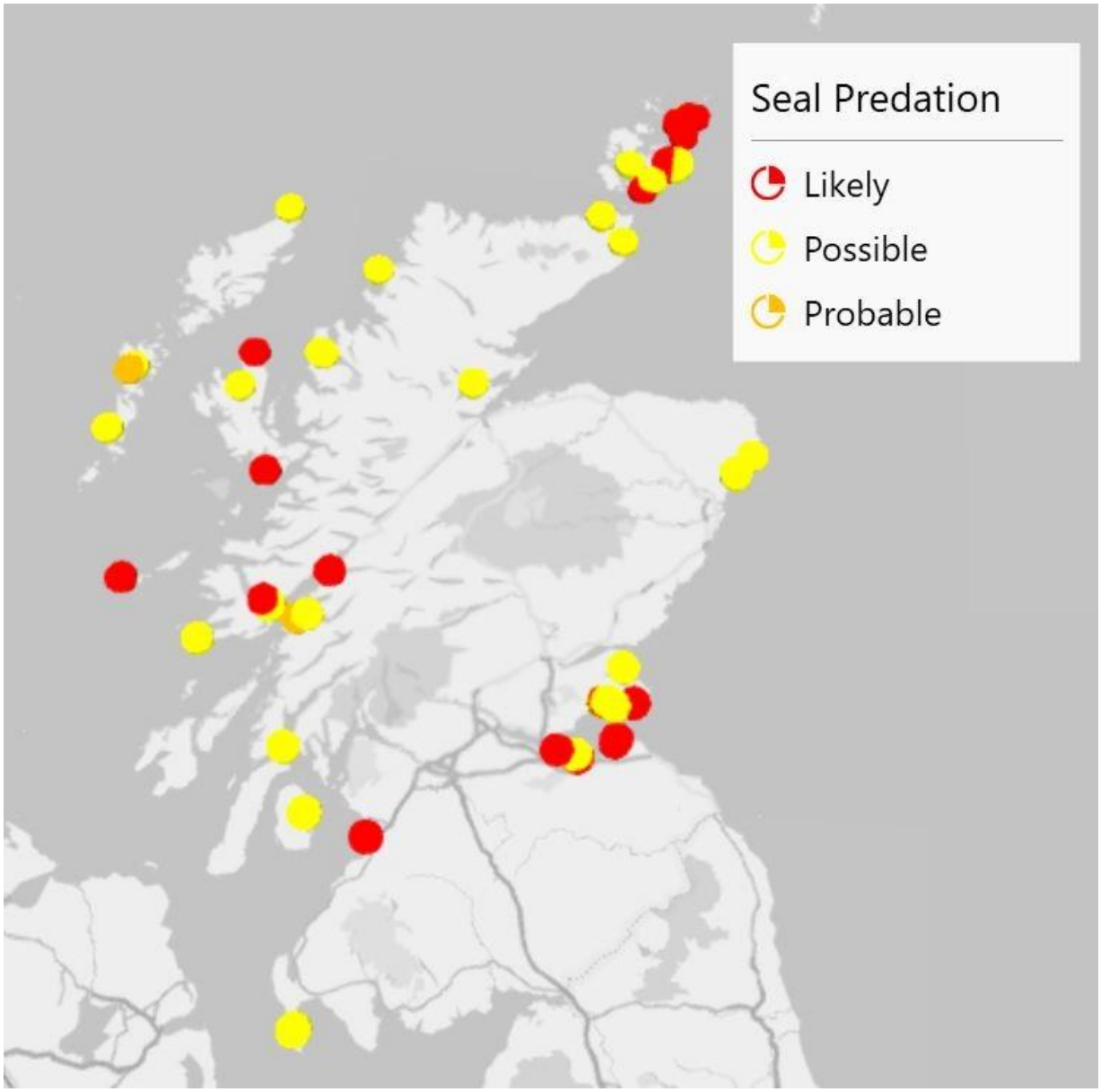

Figure 50:- Distribution of seal predation cases 2020; there were no cases reported from Shetland

Table 5: Scoring of suspected spiral trauma cases 2020

SMASS ID	Species	Date found	Region	Sex	Age Group	Likelihood of (grey) seal predation	Would lesions fit with the archetypal 'corkscrew' pattern?
M7/20	Grey seal	05/01/2020	Orkney	U	juvenile	Likely	Unlikely
M16/20	Grey seal	05/01/2020	South Ayrshire	U	juvenile	Likely	Unlikely
M15/20	Grey seal	06/01/2020	Highland	U	juvenile	Possible	Unlikely
M17/20	Grey seal	06/01/2020	Orkney	U	pup	Possible	Unlikely
M30/20	Grey seal	10/01/2020	Fife	U	juvenile	Possible	Unlikely
M31/20	Harbour seal (Common seal)	10/01/2020	North Ayrshire	U	juvenile	Possible	Unlikely
M57/20	Harbour seal (Common seal)	22/01/2020	Argyll and Bute	U	juvenile	Possible	Unlikely
M92/20	Grey seal	14/02/2020	Highland	U	unknown	Possible	Unlikely
M127/20	Seal (indeterminate species)	25/02/2020	Highland	U	unknown	Likely	Unlikely
M137/20	Grey seal	04/03/2020	Aberdeenshire	U	pup	Unlikely	Unlikely
M146/20	Grey seal	05/03/2020	Argyll and Bute	U	unknown	Likely	Unlikely
M142/20	Grey seal	06/03/2020	Aberdeenshire	U	unknown	Possible	Unlikely
M175/20	Harbour seal (Common seal)	22/03/2020	Highland	U	juvenile	Likely	Unlikely
M190/20	Grey seal	31/03/2020	Aberdeenshire	U	unknown	Possible	Possible
M317/20	Harbour seal (Common seal)	03/07/2020	Argyll and Bute	U	Unknown	Possible	Unlikely
M337/20	Harbour seal (Common seal)	09/07/2020	Argyll and Bute	U	juvenile	Unlikely	Unlikely
M340/20	Harbour seal (Common seal)	14/07/2020	Highland	U	juvenile	Possible	Unlikely
M353/20	Harbour seal (Common seal)	19/07/2020	Highland	U	juvenile	Likely	Unlikely
M351/20	Harbour seal (Common seal)	19/07/2020	Highland	U	Unknown	Possible	Possible
M388/20	Harbour seal (Common seal)	03/08/2020	Argyll and Bute	U	juvenile	Possible	Possible
M389/20	Harbour seal (Common seal)	04/08/2020	Argyll and Bute	U	juvenile	Likely	Possible
M555/20	Grey seal	27/10/2020	South Ayrshire	U	unknown	Unlikely	Unlikely
M556/20	Grey seal	27/10/2020	Argyll and Bute	U	juvenile	Possible	Unlikely
M582/20	Grey seal	05/11/2020	Orkney	U	juvenile	Likely	Possible

SMASS ID	Species	Date found	Region	Sex	Age Group	Likelihood of (grey) seal predation	Would lesions fit with the archetypal 'corkscrew' pattern?
M586/20	Grey seal	08/11/2020	Western Isles	U	juvenile	Possible	Possible
M590/20	Grey seal	08/11/2020	Argyll and Bute	U	pup	Probable	Possible
M604/20	Grey seal	15/11/2020	Highland	U	juvenile	Possible	Possible
M608/20	Grey seal	16/11/2020	Dumfries and Galloway	U	juvenile	Possible	Unlikely
M609/20	Grey seal	16/11/2020	Fife	U	juvenile	Likely	Possible
M623/20	Grey seal	20/11/2020	Highland	U	juvenile	Possible	Possible
M628/20	Harbour seal (Common seal)	22/11/2020	Orkney	U	juvenile	Likely	Possible
M633/20	Grey seal	14/11/2020	Highland	U	juvenile	Possible	Possible
M647/20	Grey seal	26/11/2020	Western Isles	U	pup	Possible	Possible
M648/20	Grey seal	26/11/2020	Western Isles	U	juvenile	Probable	Possible
M649/20	Grey seal	26/11/2020	Western Isles	U	unknown	Possible	Possible
M667/20	Grey seal	30/11/2020	Orkney	U	juvenile	Unlikely	Unlikely
M679/20	Grey seal	02/12/2020	East Lothian	U	juvenile	Likely	Possible
M686/20	Grey seal	03/12/2020	Orkney	U	juvenile	Possible	Possible
M688/20	Grey seal	03/12/2020	Orkney	U	juvenile	Likely	Possible
M694/20	Grey seal	05/12/2020	Western Isles	U	juvenile	Likely	Possible
M697/20	Grey seal	05/12/2020	City of Edinburgh	U	juvenile	Likely	Possible
M706/20	Grey seal	07/12/2020	East Lothian	U	unknown	Likely	Unlikely
M708/20	Grey seal	06/12/2020	City of Edinburgh	U	juvenile	Possible	Possible
M712/20	Grey seal	08/12/2020	Highland	U	juvenile	Possible	Unlikely
M723/20	Grey seal	13/12/2020	Fife	U	juvenile	Possible	Unlikely
M726/20	Grey seal	15/12/2020	Western Isles	U	juvenile	Possible	Unlikely
M732/20	Grey seal	15/12/2020	Aberdeenshire	U	unknown	Possible	Possible
M734/20	Grey seal	16/12/2020	Fife	U	juvenile	Likely	Possible
M740/20	Grey seal	18/12/2020	Fife	U	juvenile	Possible	Possible

SMASS ID	Species	Date found	Region	Sex	Age Group	Likelihood of (grey) seal predation	Would lesions fit with the archetypal 'corkscrew' pattern?
M745/20	Grey seal	22/12/2020	Orkney	U	unknown	Possible	Unlikely
M746/20	Seal (indeterminate species)	22/12/2020	Orkney	U	unknown	Likely	Unlikely
M764/20	Grey seal	21/12/2020	Orkney	U	juvenile	Likely	Unlikely
M765/20	Grey seal	21/12/2020	Orkney	U	juvenile	Likely	Possible
M767/20	Grey seal	21/12/2020	Orkney	U	juvenile	Likely	Possible
M780/20	Grey seal	29/12/2020	Fife	U	juvenile	Possible	Unlikely
M781/20	Grey seal	29/12/2020	Highland	U	juvenile	Possible	Possible
M787/20	Grey seal	31/12/2020	Highland	U	juvenile	Possible	Possible
M596/20	Grey seal	12/11/2020	Orkney	U	unknown	Possible	Unlikely

Section 9: Other single pinniped strandings

9.1 M60/20– harbour seal (*Phoca vitulina vitulina*)

This juvenile male common sea was found alive but injured at Poolewe, Little Loch Ewe on the 13th of January. It was euthanased by shooting on request of the SSPCA by a local marksman from the Mowi aquaculture unit, due to a 'substantial wound to the rear flipper' and submitted for necropsy as a fresh case. The animal was in thin condition and appeared to have been shot with a single bullet to the top of the skull, which obliterated the cranial vault and caused severe trauma to the brain. Death was likely almost instantaneous. The wound in the left hind flipper was a superficial skin defect, 12-14mm square across in the webbing, with indication of tissue healing but no unusual inflammatory reaction or indication of infection. Draining lymph nodes from the left flipper were unremarkable. There was indication of pneumonia with congestion and focal consolidation to the lungs. There was no patent parasite burden detected grossly but a verminous pneumonia will be assessed histologically. Bacterial examination did not reveal any significant isolates. The animal otherwise appeared healthy and there was indication of successful feeding, however the absence of ingesta in the stomach suggests the animal did not feed for a few hours prior to death.

Figure 51: M60/20 harbour seal (*Phoca vitulina vitulina*) from Poolewe Highland.

9.2 M64/20– harbour seal (*Phoca vitulina vitulina*)

This juvenile male harbour seal was found dead stranded at Barassie, North Ayrshire on the 24th of January. The animal was in moderate nutritional condition with an adequate blubber layer. There was a severe and extensive verminous pneumonia with a high nematode burden and extensive haemorrhage into the lung parenchyma and loss of approximately 70% of the functional lung. There was an extensive interstitial and pleural emphysema extending around the heart and through the thoracic inlet into the facia of the neck. The animal had also ingested some blood likely coughed up and swallowed. There was no evidence of recent feeding. Bacteriology revealed a light growth of Streptococcus phocae from the lung only. This is likely secondary infection following damage to the lung from the verminous pneumonia. This is a severe case of verminous pneumonia which was acute underlying virus involvement will be undertaken especially for morbillivirus.

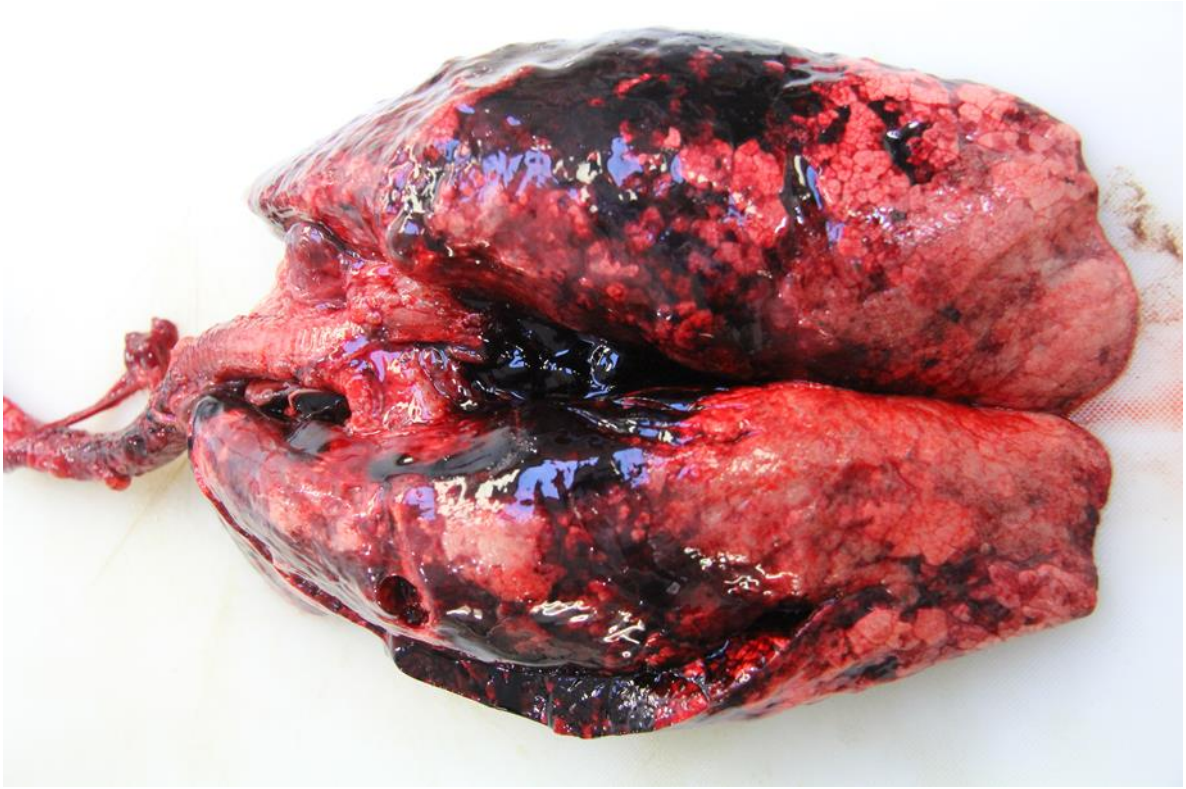

Figure 52: M64/20 harbour seal (*Phoca vitulina vitulina*) lungs showing extensive pneumonia from Barrasie, North Ayrshire.

9.3 M442/20– harbour seal (*Phoca vitulina vitulina*)

This juvenile common seal female was found dead stranded on the 6th of September in fresh condition and was chilled prior to necropsy. The carcase exhibited almost no fat reserves, with <3mm blubber and notable cachexia of muscle groups. There was no indication of gross pneumonia; however, the lungs appeared congested and partially consolidated, so a larval verminous pneumonia is a possible differential. Distal intestines contained dark melenic contents, but the upper GIT was unremarkable, again supportive of possible haemoptysis. The brain was unremarkable. Proximal cause of death was likely starvation hypothermia however underlying cause for a failure to thrive is awaited from histopathology and bacteriology.

Figure 53: M442/20 harbour seal (*Phoca vitulina vitulina*) at Fairle North Ayrshire.

Section 10: Sharks and marine turtles

10.1 Basking sharks (*Cetorhinus maximus*)

There was a single report of a basking shark in 2020 a single decomposed animal near Brora Highland on the 5th of October. It was too decomposed for examination or samples. Interestingly we had a basking shark strand further down the coast at Brora in September 2019.

Figure 54: M496/20 Basking shark (Cetorhinus maximus) from near Brora, Highland.

10.2 Marine turtles

There was single marine turtle reported during 2020. A loggerhead turtle (*Caretta caretta*) was found on the uninhabited island of Papa, Shetland on the 10th of August it was in a very poor state of preservation.

Figure 55: M407/20 remains of a loggerhead turtle (*Caretta caretta*) found on Papa, Shetland.

Section 11: Bacteriology

11.1 *Clostridia sp*.

Clostridia perfrigens was isolated in pure growth from the liver, kidney and CSF of a juvenile male Sowerby's beaked whale, the significance of this isolate is uncertain. This same organism was isolated from the spleen, peritoneal fluid, mesenteric lymph node and intestine of an old male harbour porpoise with enteritis. This isolate may be significant in this case. It was also isolated from multiple organs from several Sowerby's beaked whales and was possibly significant in some cases. *Clostridia perfrigens* was also isolated from several tissues of a northern bottlenose whale this was thought to be a result of decomposition.

11.2 *Streptococcus* sp.

Streptococcus phocae was isolated in pure growth from the lung of a harbour seal; this was thought to be a contributing factor in the pneumonia of this animal. *Streptococcus agalactiae* was isolated from the spleen of a northern bottlenose whale it was not thought to be significant.

11.3 *Vibrio sp*.

Photobacterium damselae was isolated in mixed culture from the lung of a Cuvier's beaked whale. The significance of this isolate is at present uncertain. It was also recovered from the lung of a white-beaked dolphin but was not thought significant. An unidentified *Vibrio sp.* was isolated from the lung of a northern bottlenose whale its significance is uncertain. An unidentified *Vibrio sp.* was isolated from the lung and brain of a common dolphin its significance is uncertain.

11.4 Edwardsiella sp.

Edwardsiella tarda was isolated in pure culture from the liver kidney and brain of a Cuvier's beaked whale. The significance of this isolate is at present uncertain. This same organism was isolated from the liver, hepatic lymph node and brain of a live stranded sperm whale. The isolate in this case is thought just to be a post mortem invader.

Section 12: Outreach and Volunteers

12.1 SMASS Forum

On the 29th of February, SMASS held the third annual forum at the Centre for Health Studies in Inverness. As last year, it was jointly held with Whale and Dolphin Conservation (WDC). It was well attended with over 150 volunteers and other members of the public listening to talks in the morning and taking part in workshops in the afternoon.

Bringing together representatives from a number of research organisations, higher education institutes, NGO's and marine industries with policy makers and members of the public, the forum provides a unique opportunity for the exchange of ideas between researchers, citizen scientists and other stakeholder groups concerned with the conservation of the marine environment. This year the event focussed on voicing marine conservation priorities, recognizing barriers to action, and developing solutions to tackling some of the big environmental issues facing marine ecosystems. What became apparent from previous SMASS/WDC forum events is that the people attending are a unique group of individuals, characteristically passionate about the marine environment and willing to go that extra mile to contribute to conservation. This year we therefore wanted to provide all attendees with opportunities to join in on discussions around timely marine conservation issues. Through a number of activities, attendees were encouraged to share their thoughts and perspectives on various marine conservation concerns, and what they thought were the most prominent barriers to change.

More details about the event, speakers, workshops, and preliminary findings from the dedicated workshop on audience perspective, can be found in the marine forum proceedings report, available for download following this link: https://osf.io/83vtj/ or doi:10.31219/osf.io/83vtj

Special thanks to Alice Walters, Katie Dyke and Sarah Dolman of WDC for their tireless help with the organisation.

Figure 56: Wildlife film Cameraman Doug Allan delivering a keynote presentation at SMASS/WDC Marine Forum 2020

Figure 57: Selection of images from the SMASS/WDC Marine Forum 2020

Figure 58: Dr Simon Allen, University of Bristol & Shark Bay Dolphin Alliance Project, delivering a keynote presentation at the SMASS/WDC Marine Forum

Figure 59: Delegates at the 2020 SMASS/WDC Marine Forum.

12.2 Volunteer training

Due to the Covid 19 pandemic, no training courses were run during 2020.

Section 13: Outputs

13.1 Overview

In 2020, staff at the Scottish Marine Animal Strandings Scheme published seven peer-reviewed papers and submitted three more. Nick master's thesis was also published.

13.2 Publications

- **Nicholas J Davison, Andrew Brownlow, Mariel ten Doeschate**, Emma-Jane Dale, **Geoffrey Foster**, Jakub Muchowski, Lorraine L Perrett†, Mara Rocchi, Adrian M Whatmore and Mark P Dagleish. (2021) Neurobrucellosis due to Brucella ceti ST26 in Three Sowerby's Beaked Whales (Mesoplodon bidens). Journal of Comparative Pathology 2021, Vol.182, 1-8 https://authors.elsevier.com/a/1c7vD506oOYrV
- Rosie Williams, **Mariel ten Doeschate**, David J. Curnick, **Andrew Brownlow**, Jonathan L. Barber, **Nicholas J. Davison**, Robert Deaville, Matthew Perkins, Paul D. Jepson, and Susan Jobling (2020) Levels of Polychlorinated Biphenyls Are Still Associated with Toxic Effects in Harbor Porpoises (Phocoena phocoena) Despite Having Fallen below Proposed Toxicity Thresholds. Environmental Science & Technology 2020 54(4), 2277-2286 DOI: 10.1021/acs.est.9b05453
- Kitchener, A.C., Hantke, G., Herman, J.S., **ten Doeschate, M.T.I. & Brownlow, A.C.** (2020) First record of True's beaked whale, *Mesoplodon mirus*, in Britain. Mammal Communications 6: 29-33.
- **Foster, G.,** Robb, A. and Paterson, G. K. (2020) Isolation and genome sequencing of *Staphylococcus schleiferi* subspecies *coagulans* from Antarctic and North Sea seals. Access Microbiology https://doi.org/acmi.0.000162#
- Lonneke L. IJsseldijk, **Mariel T.I. ten Doeschate, Andrew Brownlow, Nicholas J. Davison**, Rob Deaville, Anders Galatiu, Anita Gilles, Jan Haelters, Paul D. Jepson, Guido O. Keijl, Carl Chr. Kinze, Morten Tange Olsen, Ursula Siebert, Charlotte Bie Thøstesen, Jan van den Broek, Andrea Gröne, Hans Heesterbeek (2020) Spatiotemporal mortality and demographic trends in a small cetacean: Strandings to inform conservation management. Biological Conservation 249 (2020) https://doi.org/10.1016/j.biocon.2020.108733
- **Foster, G**., Baily, J. L., Howie, F., **Brownlow, A. C.,** Wagenaar, J. A., Gilbert, M. J., Miller, W. G., Byrne, B. A., Clothier, K. A., Schmitt, T., Patterson, T., Reid, R. J. and Dagleish, M. P. (2020) Campylobacter pinnipediorum subsp. caledonicus and Campylobacter pinnipediorum subsp. pinnipediorum recovered from abscesses in pinnipeds. Diseases of Aquatic Organisms 142:41-46. https://doi.org/10.3354/dao03544
- Sinéad Murphy, Marie A. C. Petitguyot, Paul D. Jepson, Rob Deaville, Christina Lockyer, James Barnett, Matthew Perkins, Rod Penrose, **Nicholas J. Davison** and Cóilín Minto. (2020) Spatio-temporal variability of harbour porpoise life history parameters in English and Welsh waters. Frontiers in Marine Science. Front. Mar. Sci. 7:502352. doi: 10.3389/fmars.2020.502352

13.3 Publications (Submitted)

- **Nicholas J. Davison,** Mark P. Dagleish, **Mariel ten Doeschate,** Jakub Muchowski, Lorraine L. Perrett, Mara Rocchi, Adrian M. Whatmore, **Andrew Brownlow**. Meningoencephalitis in a common minke whale (Balaenoptera acutorostrata) associated with Brucella pinnipedialis and alpha-herpesvirus infection. Submitted to Diseases of Aquatic Organisms.
- Rosie S. Williams, David J. Curnick, **Andrew Brownlow**, Jonathan L. Barber, James Barnett, **Nicholas J. Davison**, Robert Deaville, **Mariel ten Doeschate**, Matthew Perkins, Paul D. Jepson, Susan Jobling. Polychlorinated biphenyls are associated with reduced testes weights in harbour porpoises (Phocoena phocoena). Submitted to Environment International.
- M.P. Dagleish, A. Perri, M. Maley, K.T. Ballingall, J.L. Baily, **N.J. Davison, A.C. Brownlow** & M.S. Rocchi Novel dermatitis and relative viral nucleic acid tissue loads in a fin whale (*Balaenoptera physalus*) with systemic cetacean morbillivirus infection. Submitted to Journal of Comparative Pathology.

13.4 Other peer reviewed Publications

- **Davison NJ** (2020) the lesion profile of cetaceans diagnosed with neurobrucellosis in Scottish waters 1990 to March 2019. Master's Thesis University of Edinburgh

13.5 Non Peer reviewed publications

- **Mariel T.I. ten Doeschate**, **Ellie Maclennan,** Katie Dyke, Alice E.M. Walters, & **Andrew C. Brownlow**. (2020, June). SMASS/WDC Marine Forum 2020 Proceedings Report. https://doi.org/10.31219/osf.io/83vtj

13.6 Media

A sperm whale that live stranded and died at Ardeseir, Highland on the 7th of January, just down the road from the SMASS office received a lot of media interest in January.

https://www.bbc.co.uk/news/uk-scotland-highlands-islands-51019282

https://www.bbc.co.uk/news/uk-scotland-highlands-islands-51033092

https://metro.co.uk/2020/01/07/sperm-whale-dies-getting-stranded-scotland-12019837/

https://www.sundaypost.com/fp/sperm-whale-dies-after-becoming-stranded-off-ardersier-on-the-moray-firth/

https://www.inverness-courier.co.uk/news/video-beached-sperm-whale-feared-dead-near-inverness-189141/

https://www.belfasttelegraph.co.uk/news/uk/sperm-whale-dies-after-becoming-stranded-in-moray-firth-38841222.html

https://www.scotsman.com/news/scottish-news/sperm-whale-which-died-after-stranding-highlands-may-have-had-brain-problem-1397940

https://www.mirror.co.uk/news/uk-news/sperm-whale-dies-after-washing-21232537

https://www.heraldscotland.com/news/18143028.sperm-whale-dies-scottish-beach-washing-ashore-highlands/

https://www.thescottishsun.co.uk/news/5153700/sperm-whale-incredible-picture-scots-biologist/

https://news.stv.tv/highlands-islands/sperm-whale-dies-after-becoming-stranded-in-moray-firth?top

https://news.stv.tv/video/sperm-whale-stranded-close-to-shore-of-moray-firth?top

https://www.thetimes.co.uk/article/dead-sperm-whale-guarded-over-fears-of-tooth-looters-dnt5q2vtr

https://www.pressandjournal.co.uk/fp/news/highlands/1937831/sperm-whale-beaches-near-ardersier/

https://www.pressandjournal.co.uk/fp/news/highlands/1941569/highland-council-assist-in-clearing-up-beached-sperm-whale-in-ardersier/

https://www.scubadivermag.com/dead-scottish-sperm-whale-put-under-guard-to-stop-tooth-looters/

A mass stranding of long-finned pilot whales in Lochboisdale, South Uist attracted quite a bit of media attention unfortunately investigations were hampered by Covid restrictions and SMASS could not attend.

https://www.bbc.co.uk/news/uk-scotland-highlands-islands-53049659

https://www.scotsman.com/news/desperate-rescue-launched-scottish-islanders-save-pod-15-whales-stranded-shore-2883104

https://news.stv.tv/highlands-islands/five-pilot-whales-stranded-on-shore-of-scottish-island?top

https://www.fishfarmingexpert.com/article/mowi-salmon-farmers-help-save-stranded-whales-on-uist/

http://www.hebrides-news.com/whales-die-after-mass-stranding-13620.html

A harbour porpoise found at Largs, North Ayrshire that showed lesions consistent with a propeller strike was also quite widely reported.

https://www.dailyrecord.co.uk/news/scottish-news/porpoise-sliced-open-killed-speedboat-22233775#:~:text=A%20helpless%20porpoise%20was%20mowed,around'%20at%20speeds%20of%2080mph.

https://www.heraldscotland.com/news/18533404.call-jet-ski-ban-speedboat-propeller-kills-young-porpoise-popular-scots-shorefront/

https://www.scotsman.com/news/crime/shocking-photos-show-porpoise-which-was-killed-speedboat-scottish-waters-2891838

https://www.largsandmillportnews.com/news/18513305.campaigners-fury-animal-killed-speedboat/

The live stranding and subsequent death of a fine whale in Orkney attracted some local media attention.

https://www.orcadian.co.uk/burray-whale-dies/

A sunfish washing up at Rosemarkie beach near Inverness is September attracted quite a bit of media attention despite not being part of the strandings scheme.

https://www.bbc.co.uk/news/uk-scotland-highlands-islands-54264401

https://news.stv.tv/highlands-islands/experts-amazed-by-discovery-of-giant-sunfish-on-beach?top

https://www.pressandjournal.co.uk/fp/news/highlands/2512846/villagers-stunned-as-huge-tropical-fish-washes-ashore-on-north-beach/

The stranding of two Sowerby's beaked whales within 24 hours in close proximity on East Lothian beaches in October attached some media attention.

https://news.stv.tv/east-central/distressed-whale-dies-after-washing-ashore-on-beach?top

https://www.thescottishsun.co.uk/news/6173402/whales-dead-scots-beaches-east-lothian/

https://www.edinburghnews.scotsman.com/heritage-and-retro/heritage/edinburghs-relationship-whale-3011834

https://www.dailyrecord.co.uk/news/scottish-news/tragedy-second-whale-dies-scots-22860510

https://www.edinburghnews.scotsman.com/news/people/marine-experts-ask-ministry-defence-if-naval-sonar-could-have-been-responsible-lothian-whale-strandings-3015706

https://www.eastlothiancourier.com/news/18803427.two-rare-sowerbys-beaked-whales-wash-die-two-beaches-east-lothian/

https://www.eastlothiancourier.com/news/18830663.military-exercises-may-played-part-death-two-rare-whales-study-suggests/

https://www.edinburghlive.co.uk/news/edinburgh-news/whale-tragically-dies-after-washing-19097202

During October, the live stranding of a northern bottlenose whale in the River Clyde near Glasgow airport also attracted media attention.

https://www.bbc.co.uk/news/uk-scotland-glasgow-west-54705567

https://www.dailyrecord.co.uk/news/scottish-news/dramatic-whale-rescue-launched-near-22907966

https://www.dailyrecord.co.uk/authors/paisley-daily-express/breaking-news-whale-trapped-near-22908536

https://www.glasgowtimes.co.uk/news/18823286.whale-sadly-dies-becoming-stranded-water-close-glasgow-airport/

https://www.heraldscotland.com/news/18820857.glasgow-northern-bottlenose-whale-spotted-river-clyde/

https://www.inverclydenow.com/whale-dies-after-getting-stuck-in-river-near-glasgow-airport/

https://www.greenocktelegraph.co.uk/news/18824630.greenock-coastguard-rescue-team-drafted-save-stricken-whale/

https://www.thescottishsun.co.uk/news/6206561/glasgow-river-clyde-whale-dies/

https://www.glasgowlive.co.uk/news/glasgow-news/bottlenose-whale-confirmed-mystery-animal-19163661

The live stranding of another northern bottlenose whale near Stornoway also attracted the media's attention.
https://metro.co.uk/2020/11/02/mysterious-deaths-of-whales-off-scottish-coast-linked-to-mod-war-games-13523293/

https://www.northern-times.co.uk/news/ministry-of-defence-asked-for-naval-sonar-data-after-whales-stranded-216492/

https://www.dailymail.co.uk/news/article-8903809/MOD-faces-questions-war-games-exercise-Scottish-coast-whales-washed-dead.html

13.7 Conferences/meetings

- 14/01/2020 Ellie presented SEA findings at the West Coast Regional Inshore Fisheries Group meeting.
- 21/01/2020 Ellie presented SEA findings to Marine Scotland 21./01/2020.
- 04/02/2020 Andrew attended Workshop at University of Aberdeen Lighthouse Field Station regarding future of the University of Aberdeen Lighthouse Field Station. Scope the evolving landscape of marine top predator ecosystem research in order to identify opportunities and options for the future.
- 14/02/2020 Ellie presented SEA findings at the Scottish Creel Fishermen's Federation AGM, Glasgow.
- 14/02/2020 Andrew met with PhD candidate Tessa Plint at Heriot Watt University regarding stable isotope analysis of cetacean teeth.
- 21/02/2020 Andrew met with PhD candidate Rosie Williams and Jon Barber in connection with analysis of the latest batch of cetacean contaminant work to come out of CEFAS.

- Between the 17th and 28th of February 2020. Mariel was invited to a number of meetings with Jason Matthiopoulos, to progress the strandings process surveillance model, at the Institute of Biodiversity Animal Health & Comparative Medicine, Glasgow University.

13.8 Website and digital media

Facebook and Twitter pages were set up in October 2012. We post regular stranding reports, selected photos and requests for information on strandings on both. Feedback has generally been good, at the end of February 2020 Facebook has nearly 18300 likes, and Twitter has over 1400 followers. Facebook is still a valuable resource for the reporting of strandings to the scheme and both are useful for the disseminating information.

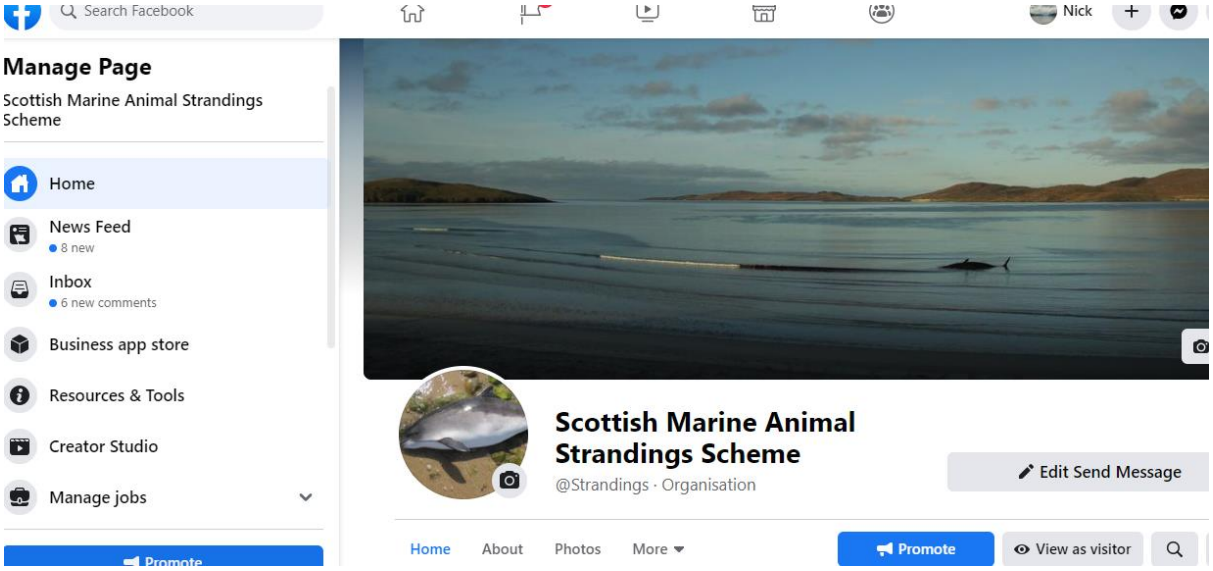

Figure 60: Facebook front page, Jan 2021.

13.9 Database development

SMASS is developing a relational database management system to obtain a flexible database which holds not only the baseline level strandings data (currently held within the online the UK Cetacean Strandings Investigation Programme (CSIP) database), but also data on ancillary test results and sample availability.

A relational database is a collection of data items, organised as a set of tables. Each table holds a particular kind of information about the objects represented in the database. Rows in these tables are marked with a unique identifier, which links cases and relates data among the multiple tables, allowing these data to be accessed and queried in many different ways without reorganising the database tables themselves. Structured Query Language (SQL) is the primary interface used to communicate with the system, and allows the user to manage easily all aspects of the database including the addition of or updating data, and retrieving subsets for analysis. Each unique identifier relates to an individual stranding with separate tables storing baseline information as well as data on ancillary tests such as bacteriology, virology,

toxicology, life history and stomach content analysis. Each new collaboration or test result can be stored as a separate table, which will be easily linked to individual cases to provide a comprehensive overview and easy interrogation and analysis of the entire dataset.

The first stages of this database development process have already been made by an external database developer (Numeriq software system development). To ensure timely progress and completion of this endeavour the development of the database will be moved forward within SRUC's Epidemiology Research Unit (ERU) in Inverness. This involves the migration of documentation from Numeriq to ERU, who will adapt the current coding to fit within a PostgreSQL framework and further develop the system so it is ready for the SMASS data to be uploaded. To facilitate this process and ensure the initial data upload will be as straightforward as possible SMASS has collated all available data, previously stored across several different folders and spreadsheets into one large data spreadsheet (Figure 22).

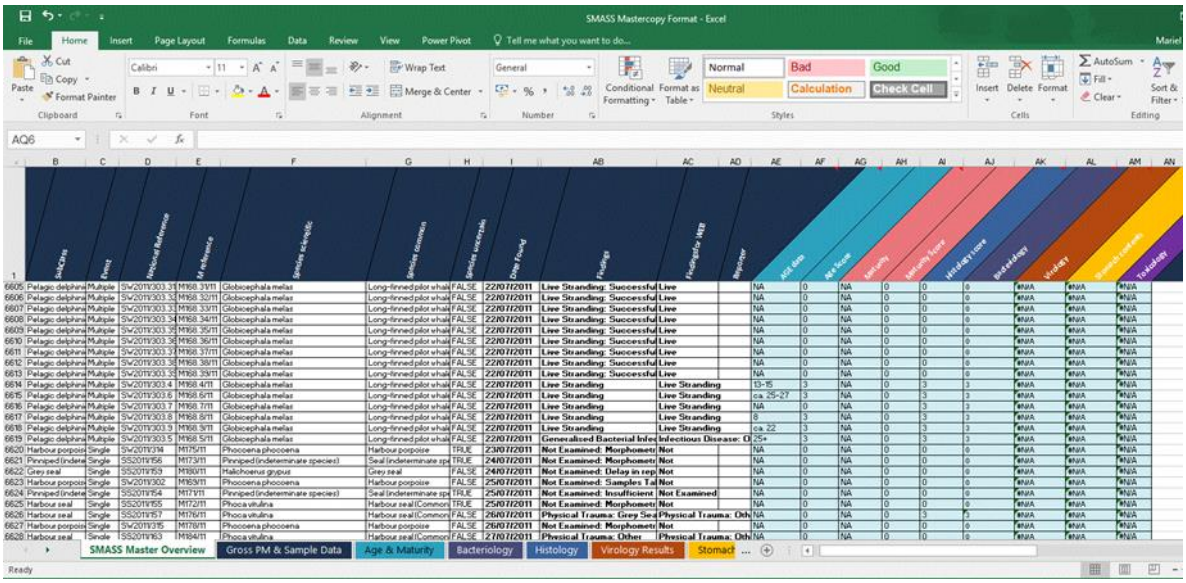

Figure 61: SMASS database spreadsheet.

13.10 Data and sample requests

These are either part of on-going collaborations or one off requests for data and or samples.

13.10.1 Samples sent

- 02/10/2020 Davina Derous University of Aberdeen samples for blubber "omics" work.
- 06/10/2020 Rob Ogden University of Edinburgh Lagenorhynchus sp. liver and muscle for DNA sequencing.
- 17/12/2020 Annika Jahnke Berger Helmholtz Centre for Environmental Research - UFZ Blubber sample from Lulu (the NMS sample)
- 04/12/2020 Sinead Murphy GMIT Galway Life history studies on cetaceans
- 01/12/2020 Mara Rocchi Moredun Virology samples of 118 individuals - frozen at -80
- 17/11/2020 Alexander Badry German Environment Agency / LIFE APEX project Liver samples for LIFE APEX project

13.10.2 Data sent

- 06/01/2020 Data on harbour seal strandings Skye, Kintyre, Orkney. Monica Arso/ Ailsa Hall SMRU
- 03/02/2020 Data on seal management cases Elaine Tait, Marine Scotland.
- 11/02/2020 Data on harbour seal strandings for the harbour seal decline project. Jo Kershaw SMRU
- 17/02/2020 Data on Killer whale M205/19. Roisin Pinfield, University College, Cork, Ireland.
- 23/03/2020 Data on seal strandings on Orkney for 2020. Brian Ribbands Orkney Field Club.
- 26/03/2020 Data on beaked whale strandings for 2019, Georg Hantke, National Museums of Scotland.
- 03/04/2020 Data on common dolphin and striped dolphin strandings + morphometric and PM data for both Scotland and UK wide. Marie Petitguyot Instituto de Investigaciones Marinas, Centro Superior de Investigaciones Científicas (IIMCSIC) Spain.
- 06/04/2020 Data on beaked whale strandings for 2019. Georg Hankte, National Museum of Scotland.
- 08/04/2020 Data on True's beaked whale stranding. Georg Hankte, National Museum of Scotland.
- 24/04/2020 Data on bottlenose dolphin attacks from the west coast of Scotland. Sarah Dolman Whale and Dolphin Conservation (WDC).
- 25/06/2020 Strandings data for MSc project on geophysical features of stranding locations. Sara Wallave / Iain Adderton, Napier University.
- 17/07/2020 Data on seals shot under licence, Jayne Burns/ Lily Burke Marine Scotland
- 04/08/2020 Data on the pilot whale stranding (December 2018, Firth of Forth) Jack Lucas Marine Scotland.
- 13/08/2020 Data on beaked whale strandings for 2020, Wojtek Bachara Independent beaked whale specialist.
- 06/10/2020 Georg Hankte NMS Data on Kogia M572/26 and Humpback M159/15
- 07/10/2020 Clare Fischer Marine Conservation Society images of Sunfish
- 28/10/2020 Sarah Dolman WDC Images of entangled cetaceans
- 20/10/2020 Wojtek Bachara Independent beaked whale specialist Data on recent beaked whale strandings
- 21/10/2020 Tessa Plint HERRIOT- WATT University Data for cases PhD Tessa
- 11/12/2020 Sonja (Pine)Eisfeld-Pierantonio WDC Information on NBW stranding M548/20 including stomach contents
- 16/12/2020 Marc Gose Edinburgh University Data on Lagenorhynchus cases associated with samples collected Oct 2020
- 08/12/2020 Steven Benjamins SAMS Anisakis sample availability
- 17/12/2020 Scott Lawton SRUC Parasite sample archive overview

13.11 Collaborators

- Dr Mark Dagleish Moredun Research Institute, Pentlands Science Park, Bush Loan, Penicuik, Midlothian, EH26 0PZ, Scotland. Histopathological studies on cetacean tissues from Scottish cetaceans.
- Dr Mara Rocchi, Virus surveillance unit Moredun Research Institute, Pentlands Science Park, Bush Loan, Penicuik, Midlothian, EH26 0PZ, Scotland. Virus surveillance.
- Dr Andrew Kitchener, Royal Museum of Scotland, Edinburgh, Scotland. Recording all marine mammal stranding events in Scotland. Marine mammal skulls and scapulae are sent to Dr Kitchener for marine mammal morphometric studies.
- Professor Ailsa Hall SMRU. Biotoxin screening for levels of domoic acid
- Dr Eva Krupp, Aberdeen University. Metal residue analysis of tissues collected at necropsy
- Dr Barbara Cheney, Aberdeen University. Bottlenose dolphin necropsy details for comparison with photo-id catalogue.
- Mycoplasma dept., Animal and Plant Health Agency, New Haw, Addlestone, Surrey, KT15 3NB. Identification of *Mycoplasma sp*. isolates from marine mammals.
- Andrew Taylor Brucella Reference Laboratory, Animal and Plant Health Agency, New Haw, Addlestone, Surrey, KT15 3NB. Serological studies to assess exposure to *Brucella spp*. and typing of *Brucella* isolates.
- Dr. Maria Morell Institute for Terrestrial and Aquatic Wildlife Research (ITAW)
- University of Veterinary Medicine Hannover, Germany. Examination of ear bones using scanning and transmission electron microscopy for indirect quantification of hearing ability in mass stranded pilot whale.
- Scottish Salmonella Reference Laboratory – perform typing of *Salmonella* isolates
- Milaja Nykanen, PhD Candidate School of BEES University College Cork Ireland for bottlenose dolphin mitogenome work.
- Eileen Harris Senior Curator Parasites & Vectors Division Department of Life Sciences Natural History Museum Cromwell Road London SW7 5BD
- Natalia Fraija-Fernandez Cetacean helminth post doc research Parasites & Vectors Division Department of Life Sciences Natural History Museum Cromwell Road London SW7 5BD
- Kristina Steinmetz student grey and harbour seals for genetic analysis GMIT Galway Ireland.
- Kerri Smith Smithsonian Institution Predoctoral Fellow Wildlife Ecology and Conservation Lab Environmental Science and Engineering Program University of Texas at El Paso Sowerby's beaked whale tissues for stable isotope analysis
- Monica Arso/ Ailsa Hall SMRU harbour seal declines.
- Emma Carroll / Aubrie Onoufriou / Morten Olsen SMRU beaked whale genetic analysis.
- Mark Wessels BVetMed, FRCPath, MRCVS Deputy Head of Histopathology, Finn Pathologists, One Eyed Lane, Weybread, Diss, Norfolk, IP21 5TT. Histopathological studies on cetacean tissues from Scottish cetaceans.

Section 14: Staff and facilities

As off the end of December 2020 SMASS has two members of staff. Nick Davison is the stranding coordinator. He joined the team in October 2012 and has been involved with marine mammal pathological investigation for 34 years. Mariel ten Doeschate joined as a marine strandings administration assistant in September 2014 after completing a Master's degree at the University of Aberdeen.

14.1 Ellie MacLennan

Ellie MacLennan, who has worked with us managing the Scottish Entanglement Alliance (SEA) project for the last 2 years, left us on the 30th of September. She is furthering her career by doing a PhD with St. Andrews University, based on the work started by the entanglement project. Ellie quickly became part of the team, where she assisted with necropsies and helped with the organisation the annual marine forums, additional to her role as coordinator for the SEA project. We will miss her in the team, but luckily, she will remain one of our stranding volunteers. We wish Ellie well in her studies and future endeavours.

Figure 62: Ellie MacLennan with part of sperm whale brain 8th of January 2020.

Section 15: Acknowledgments

The SMASS volunteer programme was stood down after the middle of March 2020, and no volunteers were asked to attend any strandings after this period due the Covid 19 pandemic restrictions. However, particular thanks are due to the staff at Hessilhead Wildlife Rescue

Trust, Karen Hall and the Scottish Natural Heritage team on Shetland, the National Museum of Scotland, who did assist in the recovery of animals at the beginning and end of the year. Particular thanks to Mary Harman, Walter Innes, Monika Carrie, Ellie MacLennan, Gwen Evans, Hayley Douglas, Sally Nicholson, Kerry Harris, Bill Neill, Chris Brooks, Peter Keiller, Reuben Brown, David Nairn, Sara Wood-Kwasniewski and Pete Bevington for sampling and or collecting animals. Special thanks to the MOD Cape Wrath Rangers for helping us access the True's beaked whale at Kearvaig, Cape Wrath, for necropsy. However, we are immensely grateful to Peter Keiller, Gwen Evans, Mary Harman, Chris Brooks, and Bill Neill who took it upon themselves to gather data and information on the long-finned pilot whale MSE in June at Lochboisdale, South Uist. We would also like to thank Dan Jarvis, Julia Cable and Noel Hawkins from British Diver's Marine Life Rescue (BDMLR) for keeping us updated during the ongoing rescue. We are also immensely grateful to Ryan Milne and Steven Balfour from SMRU who recovered the bottlenose dolphin from the river Tay for us. Also to Jan and Pete Bevington at Hillswick Wildlife Sanctuary who recovered the harbour porpoise from Aith. Georg Hankte of the National Museum of Scotland for his help and initiative in recovering the Sowerby's beaked whale from Musselburgh and assistance with the necropsy. Janet Marshall for her assistance with the necropsies of both the northern bottlenose whale and Sowerby's beaked whale on Lewis. BDMLR, Glasgow airport crew, and the coastguard for their assistance with the northern bottlenose dolphin at Glasgow airport. Many thanks also to the guys at Shearwater Marine and Clyde Wreckspeditions, who recovered the northern bottlenose whale to Strone point so it could be examined. Special thanks go out to Samantha MacFarlane, who provided invaluable assistance with the logistics of recovery, and necropsy, of both these northern bottlenose whales.

15.1 Dr Mark Dagleish

We would especially like to thank Dr Mark Dagleish Head of Pathology at the Moredun Institute, who has done all of the histopathology for the Scheme since 2008. He left this post at the Moredun on the 17th of April, after 18 years of service to farm animals and wildlife both nationally and internationally. He has increased the knowledge of the pathology of marine mammals, has authored, and co-authored numerous scientific papers, and provided significant support to SMASS during his time at the Moredun. We wish him well and hope that he can continue to be involved in the work of the scheme.

Figure 63: Mark Dagleish examining a pilot whale during the 2012 MSE.

15.2 Harry Ross 1942-2020

It was with great sadness that we learned of the death of our former colleague Harry Ross on the 22nd of June in a care home at Grantown-on-Spey. Born in Edinburgh in 1942, Harry graduated as a vet from the University of Edinburgh in 1965. He immediately started work in rural veterinary practice based in Grantown-on-Spey. In 1971, Harry adjusted the direction of his career with a move to the North of Scotland College of Agriculture Veterinary Centre at Aberdeen. There, using his practical knowledge and experience he worked industriously as an Assistant Veterinary Investigation Officer before promotion to become Senior Veterinary Investigation Officer at Drummondhill, Inverness in 1977. In 1988, Harry had his first involvement with marine mammals when he performed post-mortem investigations on seals that were found to be dying due to an emergent seal morbillivirus (PDV) epidemic. It should be said that this was against the wishes of management, however, that view changed when the Inverness Centre received significant charitable monies to support work on wildlife disease. This was later sustained with continuous government funding. He developed an extensive network of collaborators such as the University of Aberdeen Lighthouse Centre, the Zoological Society of London (ZSL) and the Sea Mammal Research Unit (SMRU). At the seventh annual European Cetacean Society Conference (ECS) in 1993 held in Inverness. Harry reported that based upon his post-mortem examinations harbour porpoises were dying because of violent attacks by bottlenose dolphins, a theory greeted with significant scepticism by the conference until it was proven later when a kill was filmed from a local boat. Later together with other colleges from SAC/SRUC and Aberdeen University, they reported infanticide in bottlenose dolphins as a possible explanation for this. A humble man, Harry was

always extremely enthused about his work but usually shied away from the limelight. Harry's positive example had a real influence on many others, both within and beyond SRUC, as he encouraged them to follow their interests and develop their skills. A lot of his effort was to the ultimate benefit of the current SRUC but because of his premature retirement perhaps has gone under recognised. Above all, it was the good fortune of those who worked in Inverness to have a manager that inspired and permitted the opportunity to develop an ongoing legacy from Inverness. Following retirement, Harry developed and enjoyed his interest in fiddle music and art and is survived by his wife Alison and children Catherine, Annabel and Donald.

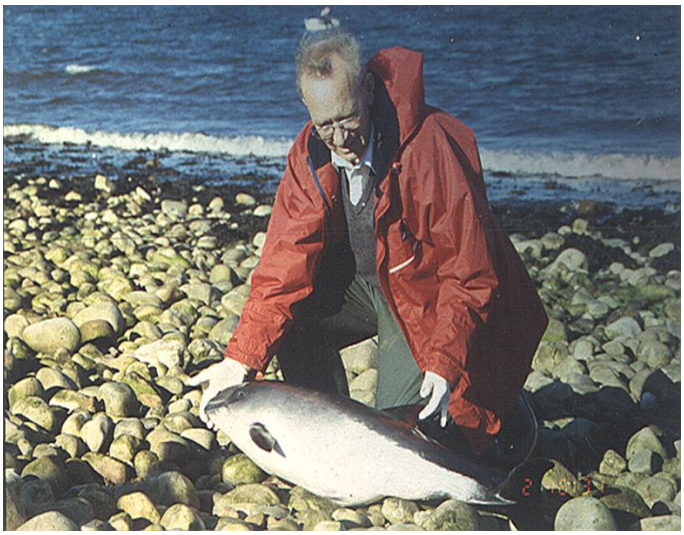

Figure 64: Harry Ross examining a stranded harbour porpoise in the early 1990's