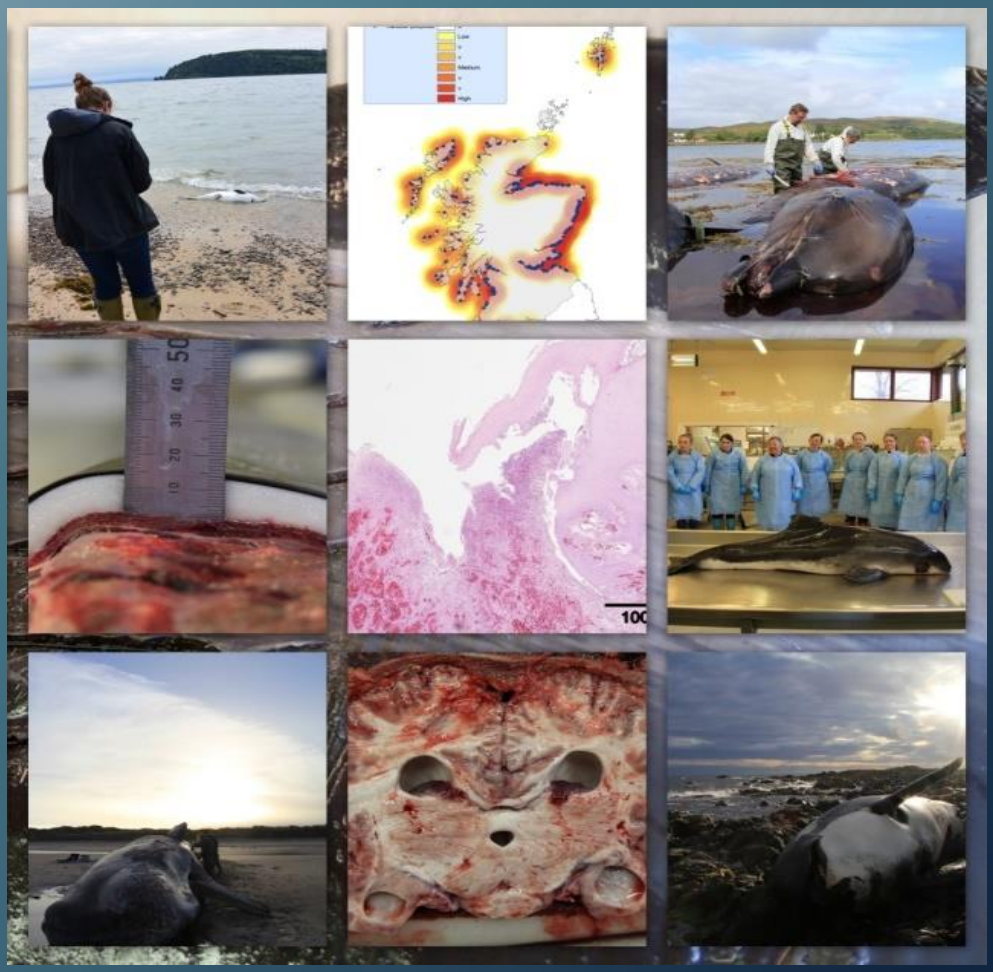
Scottish Marine Animal Stranding Scheme

Final Contract Report

1 April 2015 to 31 March 2018

for Marine Scotland, Scottish Government



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SRUC

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Executive Summary

From 1 April 2015 to 31 March 2018, 1949 marine animals were reported to the Scottish Marine Animal Stranding Scheme (SMASS); comprising of 1107 seals, 827 cetaceans, eight sharks and seven marine turtles. Of these, 211 cases (10.8%), comprising 160 cetaceans, 47 seals, two marine turtles and two sharks underwent a detailed necropsy to establish a cause of death. An additional 186 (9.5%) animals were tissue sampled, comprising 146 cetaceans, 37 seals, and three basking sharks.

There was a 32.9% increase in the number of cetaceans reported to the scheme compared to the last reporting period. This is most likely attributed to increased reporting effort, rather than mortality, as the surveillance operated by the scheme has become more visible this reporting period, particularly through social media and outreach initiatives. The harbour porpoise, (*Phocoena phocoena)*, was the most commonly reported species, representing 47.5% (n=393) of all cetacean strandings. This is consistent with previous years and most plausibly reflects the abundance and coastal distribution of this species. In subsequent, decreasing, order of incidence are the short-beaked common dolphin (*Delphinus delphis*) 11.6% (n=96); long-finned pilot whale (*Globicephala melas*) 8.7% (n=72), and minke whale (*Balaenoptera acutorostrata*) 5.5% (n=46). This is a change to the previous three year period where after harbour porpoise, long-finned pilot whale, short- beaked common dolphin and white-beaked dolphin were the most commonly recorded animal. Compared to the rest of the UK, Scotland sees a significantly higher number of pelagic dolphin and whale species than other regions. There is one occasional exception to this:- a cluster of common dolphin strandings in south-west England due to bycatch.

This reporting period saw a 28% increase in seal carcasses from the previous year, (28%), also likely attributed to and increase in reporting effort, rather than mortality although this picture is less clear. Grey seals (*Halichoerus grypus*) made up the majority of reports representing 59.5% (n=659) of all seal strandings, while harbour seals (*Phoca vitulina*) represented 17.9% (n=199). A further 249 (22.4%) seals were either too decomposed or data deficient to be identified to species level. No other seal species were reported to the scheme in this reporting period. Physical trauma, including sympatic trauma by grey seals, or infectious disease, primarily verminous pneumonia, were the most commonly observed causes of death for pinnipeds. For cetaceans the picture is more complex and cause of death is species dependent, although live strandings, pneumonia and generalised bacterial infections are commonly diagnosed.

During this reporting period, significant effort has been put into increasing the reporting of strandings to the scheme and availability of strandings data to both the scientific community and members of the public. Since 2014 a succession of

volunteer training courses have been run with the aim of providing a network of trained volunteers able to visit strandings and accurately collect photographs, data and samples from animals not deemed suitable or inaccessible for collection and necropsy. This 'citizen science' programme has proved very useful and its development is ongoing. By the end of this period SMASS have a total of 190 trained stranding volunteers.

Section 1: History of the project

Information on UK stranded cetaceans has been routinely collected in the UK by the Natural History Museum (NHM).. In 1988 a large number of dead or moribund harbour seals were found around the coast of the UK. The Sea Mammal Research Unit (SMRU led studies into this for the UK. At that time the SAC Veterinary Centre in Inverness became involved in the seal investigation in collaboration with SMRU and the Scottish SPCA.

In 1990 The Institute of Zoology (IOZ) in London was awarded a research contract to investigate stranded marine mammals for the UK, with SAC contracted in 1992 to coordinate and investigate marine mammal strandings in Scotland.

In 2000, the separate projects were amalgamated into a single UK strandings investigation programme under the aegis of the CSIP (Cetacean Strandings Information programme).

In addition to the cetacean stranding investigation undertaken as part of the CSIP, Scotland is unique in investigating mortalities and undertaking necropsies on dead or euthanased seals. The SRUC run Scottish programme (which has become known as the Scottish Marine Animal Stranding Scheme (SMASS)) is therefore the most extensive marine stranding surveillance in the UK. Marine Scotland funds the major part of the SMASS and the seal surveillance in its entirety. This work is in strong collaboration with other Scottish marine science institutions and provides data to inform policy, adhere to monitoring directives and assist with the implementation of the Marine Strategy Framework Directive (MSFD) in the UK.

Section 2: Project overview

The principal requirement of this project is to provide a co-ordinated approach to surveillance of marine species (e.g. cetaceans, seals, basking sharks and marine turtles) strandings and to investigate major causes of death of stranded marine animals in Scotland. In addition, the project works towards increasing awareness of the research in order to improve reporting and investigations of strandings in Scotland with the ultimate purpose of further developing a Scotland wide strandings network. Details about the Scottish Scheme can be found at strandings.org. This work builds

on the work undertaken in Scotland by the UK CSIP. Detailed information about the CSIP, including access to stranding records, can be found at ukstrandings.org

2.1 Details of work

- To continue to 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.
- To undertake approximately 70 necropsies on cetaceans and seals stranded around the Scottish coast (approximately 20-30 cetaceans and 40-50 seals) to determine major causes of death, including by-catch, physical trauma and the incidence of disease. A wide geographical spread of necropsies should be achieved unless specified otherwise.
- To provide an overall sample of both species of seal in Scotland, including areas of harbour seal decline, to determine cause of death and any potential contributing factors.
- Continue to support relevant research organisations (e.g., SMRU, The Scottish Association for Marine Science (SAMS), University of Aberdeen) and ongoing research to investigate the occurrence of seals exhibiting spiral seal lacerations. This will involve, but not be limited to, undertaking necropsies (in accordance with established criteria), working with SMRU on field trials, and scrutinising the current scheme in terms of its ability to effectively locate, monitor and respond to strandings of seals exhibiting spiral lesions across Scotland.
- Continue to expand and maintain a Scotland-wide volunteer network to assist with identification, triage and possible measurement and sampling of cases reported to the stranding scheme and include a range of individuals and organisations. This should allow for improved depth, accuracy and efficiency in the information recoverable from strandings.
- Continue to provide training courses and necropsy 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.
- Continue working towards developing a monitoring protocol for targeted areas of marine renewable activity, (e.g., Pentland Firth) which will aim to collect baseline data on marine animal strandings in the region. This should incorporate partnerships and volunteers developed in the current contract, as

well as industry and conservation advisors (e.g., Scottish Natural Heritage (SNH), JNCC).

- To investigate specific cases of strandings/causes of death as requested by Scottish Government.
- To provide scientific advice to the Scottish Government as necessary about major causes of death in stranded marine mammals, including any trends or unusual events.
- To maintain a standard Scottish database for seal strandings which brings together accurate and geo-referenced information on both strandings and necropsy data. Any cetacean data should be fed into the cetacean database for the “UK Cetacean Strandings Investigation Programme” which is held by the Institute of Zoology (IoZ).Contribute to the production of strandings training material and workshop events and raise awareness through publicity.
- Ongoing review of techniques used to determine the causes of death aimed at improving their accuracy, efficiency and cost-effectiveness.
- Review options for developing an online, secure searchable archive for data derived from the necropsies and ancillary tests
- Maintain a public-facing website to provide relevant information about reported cases back to the public to maintain interest.

Section 3: Volunteer network

3.1 Section 1: Summary of volunteer programme

Since 2014, SMASS have operated a citizen science programme whereby members of the public are trained to safely and accurately take measurement sand samples from cases which are logistically or scientifically unsuitable for collection or beach necropsy. Details of the course are given in Appendix 3. As of the end of 2017, SMASS have a total of 183 trained stranding volunteers providing almost complete coverage around the Scottish coastline and volunteers on the islands of Eigg and Tiree, Mull, Islay, Colonsay, St Kilda and good coverage throughout Orkney and Shetland and the Uists, Benbecula and Harris and Western Isles. Some gaps remain, notably Lewis, Jura and some of the smaller islands along with some of the remoter areas of the West Highlands During this reporting period SRUC ran eight training courses taking the number of trained volunteer to 183. Volunteers come from quite a wide range of backgrounds and 70% have some affiliation to NGO's, statutory body or education institutions.

Managing the volunteer network takes staff time, equipment and resources but delivers a definite net benefit to SMASS. Some of the main benefits are:

- A higher resolution and breadth of strandings data collection, including photographs from almost all reported cases.
- Cases can be more rapidly triaged to ensure cases suitable for necropsy are collected or secured for on-site examination by SMASS team.
- Assistance from trained, engaged volunteers has been invaluable at several beach necropsies, providing logistical help, sample collection and crowd control.
- Several volunteers have expressed a sense of pride and engagement with their role and this has led to a more general engagement of the public in marine ecology and citizen science.

3.1.1 *Engagement with volunteer network.*

Since attending a course 120 different volunteers (66.6%) have been asked to attend a stranding. Of those 106 (88.3%) were able to go and of those, 66 (62.2%) actually sampled an animal. 60 (33.3%) volunteers have yet to be asked to attend a stranding, largely due to no cases being reported in their area of coverage. A number of volunteers have helped recover carcasses.

Engaging volunteers to attend a case has been relatively straightforward; a private group on Facebook is the usual way of contact followed up by email and text

messages. A small minority of volunteers have proved difficult to contact post training either due to a reluctance to be on social media or moving and not informing the scheme, however only one volunteer has had no contact with the scheme since their training day.

It appears that the most enthusiastic volunteers are those that already volunteer with other organisations such as BDMLR. Volunteers from WDC, HWDT and the countryside ranger service have also been very willing to attend a stranding.

Following feedback from the volunteers a “WhatsApp” messaging network was set up in 2017. These consist of one national group to be used only when a mass stranding (MSE) or similar event of great importance happens. There are also eight regional groups for contacting volunteers about strandings in their area. They are:

1. Shetland
2. Orkney
3. Western Isles
4. North west Scotland (Duncansby head to Oban including Skye and the small isles)
5. South west Scotland (Oban to the Solway Firth including, Mull, Tiree, Coll, Islay, Jura and Arran).
6. South east Scotland (Borders to the River Tay including Edinburgh and the Firth of Forth).
7. East Scotland (River Tay to Fraserburgh).
8. Moray Firth (Fraserbrugh to Ducansby Head).

3.1.2 *Health and safety*

Involving members of the public in tissue sampling of wild animals presents a number of potential health and safety risks. The importance of strict adherence to H&S protocols is made paramount in the lecture, demonstration and support documentation. To date there has been only one incident with a volunteer inflicting a minor cut to their finger before there was any contact with the animal. They were not wearing the cut resistant glove issued at the time.. The volunteer was told to monitor the cut and go to the GP if any symptoms of infection occurred. No symptoms occurred and the cut healed normally.

3.1.3 *Carcass collection*

Several volunteers have assisted with the collection of carcasses for necropsy, mostly in Orkney and Shetland through the use of courier boxes for onward transport to Inverness. Several volunteers have transported carcasses to Hessilhead Wildlife Rescue Trust for freezer storage pending collection others have collected and

delivered carcasses direct to us particularly the Rangers in the North West or to SRUC Aberdeen.

In addition to the volunteer network, we are particularly grateful to continued collaborative help from SMRU whose students and staff have examined collected carcasses and frozen carcasses for later collection.

3.1.4 *Future work*

There are still some gaps in the networks coverage which are being filled in, and several areas will need refresher courses in 2018/19. We also hope to quantify and expand the use of the samples taken by the network, for example by making more use of genetic and stable isotope analysis from the skin and muscle samples collected from cases not suitable for full necropsy.

Figure 1: Map showing strandings volunteer network as of March 2018. Volunteers that have been out to sample are marked in red (n=78), volunteers that have not sampled but helped with carcass collection are marked in green (n=1), volunteers that have been out but have not sampled but have been collecting metadata are marked in yellow (n=17), and the remaining marked in blue (n=87)

Section 4: Marine species strandings around the Scottish coast (2015-2018)

4.1 Strandings overview

From 1st April 2015 to 31st March 2018, 1949 marine animals were reported to SMASS comprising of 1107 seals, 798 cetaceans, eight sharks (of which five were basking sharks) and seven marine turtles. This is a 25.7% increase on the last reporting period. Of these, 211 cases (10.8%), comprising 160 cetaceans, 47 seals, and two marine turtles and two sharks underwent a detailed necropsy to establish a cause of death. An additional 183 (9.3%) animals were sampled by members of the volunteer network, comprising 144 cetaceans, 36 seals, and three basking sharks.

4.2 Necropsies

Carcases are subjected to a standardised cetacean necropsy within 24 hours of being reported wherever possible. Those that cannot be examined within that period are either chilled or frozen at -20°C. Freezing carcases is avoided wherever possible as the freeze-thaw process can significantly compromise pathology diagnostics. The large majority of post-mortem examinations covered in this report were undertaken by Dr Andrew Brownlow, an experienced veterinary pathologist and the gross findings augmented with a range of ancillary rests such as histopathology, bacteriology, toxicology and virology. An example of the data collected during a standard necropsy is given in Appendix 8: Necropsy report form

4.3 Selection of samples for necropsy

Figure 2 shows the spatial distribution of those strandings which were taken for necropsy or sampled by trained volunteers. Strandings are triaged based on carcase condition (Table 1) and the logistics for recovery. Carcasses with condition score 3 or greater, indicating a significant amount of autolysis with the carcass bloating and skin peeling, are not routinely collected as the additional value added from necropsy is considered to be limited. In these cases photographs, morphometrics and in some cases samples for genetic and contaminant analysis are sought. See section on volunteer network above

Whilst significant effort is made to minimise the bias to the data of convenience, of sampling those carcasses easy to collect on account of location or logistics, there are regions of the country where fewer necropsies have been undertaken. Regions with a good proportion of cetacean recoveries include Highland, Strathclyde and Fife. Not surprisingly, more inaccessible regions fare less well, in specific the west coast, Orkney and the Uists. The number of seal necropsies tend to be lower than

cetaceans which is largely attributable to a greater number of autolysed carcasses unsuitable for necropsy.

Live (becomes code 2 at death) **2a) Extremely fresh** (as if just died, no bloating, meat is considered by most to be edible) **2b) Slight decomposition** (slight bloating, blood imbibition visible) **3) Moderate decomposition** (moderate bloating, skin peeling, penis may be extended in males, organs still intact, excluding postmortem damage)	**4) Advanced decomposition** (major bloating, skin peeling, penis extended in males, organs beyond recognition, bones exposed due to decomposition) **5) Indeterminate** (mummified carcass or skeletal remains, no organs present)

Table 1: Condition codes used for necropsy triage

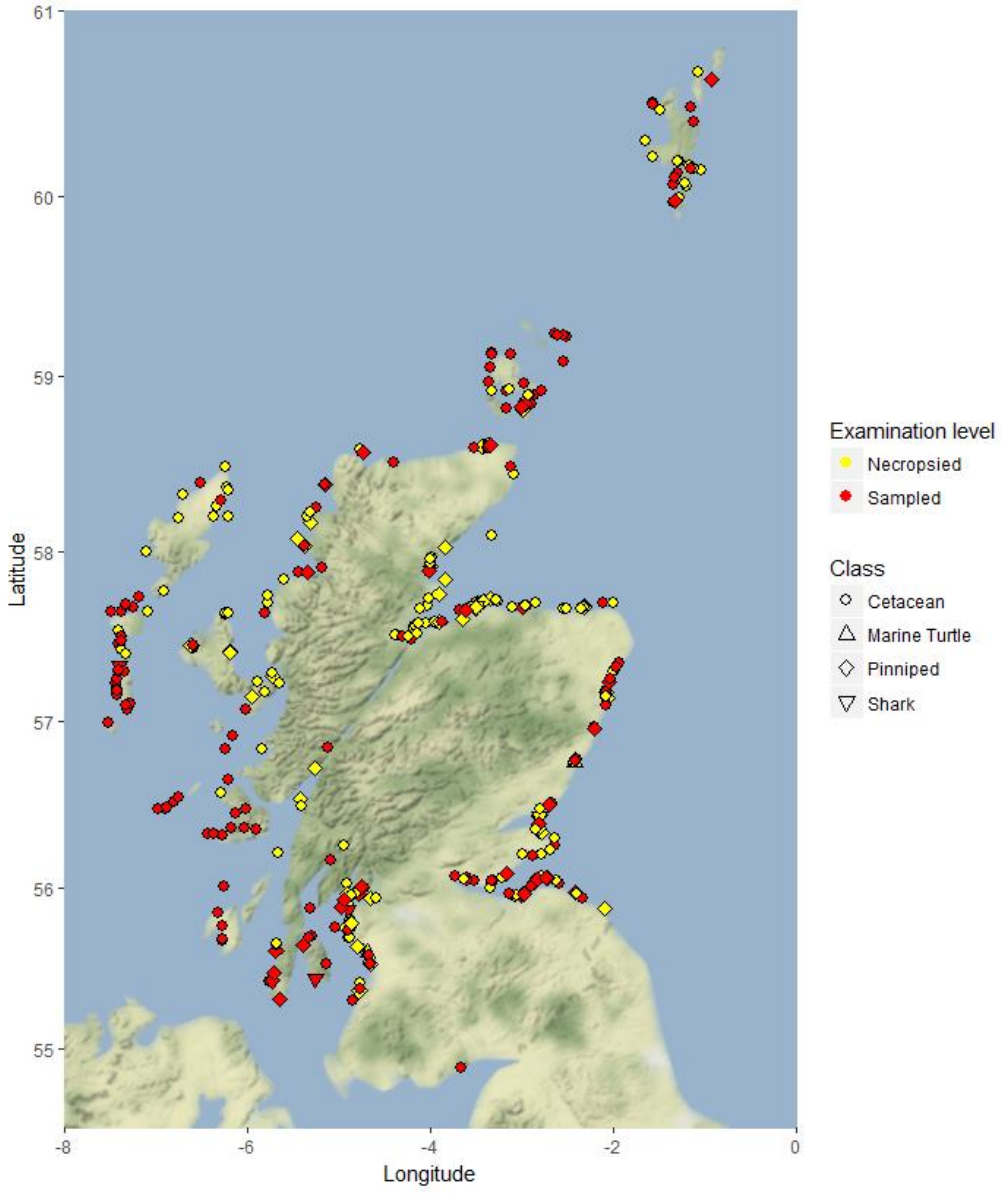


Figure 2: Map showing strandings sent for necropsy or for which tissue were sampled by species class.

Table 2: Number of animals reported to SMASS 1st April 2015 – 31st March 2018. Partial years shown in shaded columns)

Species	2015 (Apr – Dec)	2016	2017	2018 (Jan – Mar)	TOTAL
Cetaceans					**827**
Harbour porpoise (*Phocoena phocoena*)	48	138	151	56	**393**
Short-beaked common dolphin (*Delphinus delphis*)	17	25	39	15	**96**
Long-finned pilot whale (*Globicephala melas*)	43	12	14	3	**72**
Minke whale (*Balaenoptera acutorostrata*)	12	15	17	2	**46**
White-beaked dolphin (*Lagenorhynchus albirostris*)	12	15	15	2	**44**
Risso's dolphin *(Grampus griseus*)	4	8	9	1	**22**
Striped dolphin (*Stenella coeruleoalba*)	6	6	5	1	**18**
Bottlenose dolphin (*Tursiops truncatus*)	1	2	7		**10**
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	1	2	4	2	**9**
Cuvier's beaked whale (*Ziphius cavirostris*)	4	1	3	1	**9**
Sperm whale (*Physeter Macrocephalus)*	1	3	4	2	**10**
Killer whale (*Orcinus orca*)	1	1	4	1	**7**
Humpback whale (*Megaptera novaeangliae*)	1	4	3		**8**
Sowerby's beaked whale (*Mesoplodon bidens*)	2	1	2	1	**6**
Fin whale (*Balaenoptera physalus*)		2	1		**3**
Northern bottlenose whale (*Hyperoodon ampullatus*)			1		**1**
Pygmy sperm whale (*Kogia breviceps*)		1			**1**
Cetacean (indeterminate species)	6	13	12	5	**36**
Short-beaked common dolphin/striped dolphin (indeterminate species)	3	8	8	4	**23**
Dolphin (indeterminate species)	1	4	3	1	**8**
Baleen whale (indeterminate species)	1	3	2	1	**7**
Beaked whale (indeterminate species)				1	**1**
Pinnipeds					**1107**
Grey seal (*Halichoerus grypus*)	142	255	205	57	**659**
Harbour seal (*Phoca vitulina*)	38	74	70	17	**199**
Seal (indeterminate species)	55	75	87	32	**249**
Others					**15**
Basking shark (*Cetorhinus maximus*)	3	1	1		**5**
Blue shark (*Prionace glauca*)		1	1		**2**
Porbeagle shark (*Lamna nasus*)		1			**1**
Leatherback turtle (*Dermochelys coriacea*)		1	5		**5**
Loggerhead turtle (*Caretta caretta*)	1				**1**
GRAND TOTAL	**403**	**672**	**670**	**204**	**1949**

Table 3: Summary of stranded animals showing total necropsied, sampled and not necropsied. (April 2015 – March 2018)

Species	Sent for necropsy	Sampled	Not Examined	TOTAL
Cetaceans				**827**
Harbour porpoise (*Phocoena phocoena*)	78	64	251	**393**
Short-beaked common dolphin (*Delphinus delphis*)	18	23	55	**96**
Long-finned pilot whale (*Globicephala melas*)	16	13	43	**72**
Minke whale (*Balaenoptera acutorostrata*)	8	6	32	**45**
White-beaked dolphin (*Lagenorhynchus albirostris*)	10	11	23	**44**
Risso's dolphin *(Grampus griseus*)	5	8	9	**22**
Striped dolphin (*Stenella coeruleoalba*)	8	3	7	**18**
Bottlenose dolphin (*Tursiops truncatus*)	3	5	2	**10**
Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	3	1	5	**9**
Cuvier's beaked whale (*Ziphius cavirostris*)	1	1	7	**9**
Sperm whale (*Physeter Macrocephalus)*	1	2	7	**10**
Killer whale (*Orcinus orca*)	3	3	1	**7**
Humpback whale (*Megaptera novaeangliae*)	1	2	2	**8**
Sowerby's beaked whale (*Mesoplodon bidens*)	2	2	2	**6**
Fin whale (*Balaenoptera physalus*)	1	1	1	**3**
Northern bottlenose whale (*Hyperoodon ampullatus*)	1			**1**
Pygmy sperm whale (*Kogia breviceps*)	1			**1**
Cetacean (indeterminate species)			36	**36**
Short-beaked common dolphin/striped dolphin (indeterminate species)			23	**23**
Dolphin (indeterminate species)			8	**8**
Baleen whale (indeterminate species)			7	**7**
Beaked whale (indeterminate species)				**1**
Pinnipeds				**1107**
Grey seal (*Halichoerus grypus*)	15	23	621	**659**
Harbour seal (*Phoca vitulina*)	32	14	153	**199**
Seal (indeterminate species)			249	**249**
Others				**15**
Basking shark (*Cetorhinus maximus*)		3	2	**5**
Blue shark (*Prionace glauca*)	2			**2**
Porbeagle shark (*Lamna nasus*)			1	**1**
Leatherback turtle (*Dermochelys coriacea*)	1		5	**5**
Loggerhead turtle (*Caretta caretta*)	1			**1**
GRAND TOTAL	**211**	**186**	**1552**	**1949**

4.4 Necropsy overview 2015 to 2018

Between April 2015 and March 2018, 211 cases underwent necropsy to establish a cause of death. This comprised of 160 cetaceans (17 species), 47 seals (32 harbour seals, 15 grey seals), two marine turtles (one leatherback and one loggerhead) and two sharks (both blue sharks). This is a very similar number of cetacean necropsies as in the previous reporting period. There was a decrease in the number of seal necropsied compared to the last period although there is a 19 % increase in the number of harbour seals necropised. Table 2 shows the number of strandings necropsied by species. This pattern reflects the increased efforts to examine as many as practicably possible of this species to try and gain some insight as to the reasons for this species' decline.

4.5 Cause of death categories

The following diagnostic categories are used to partition the primary cause of death for cases examined by post-mortem examination.

4.5.1 *Live stranding*

Evidence from clinical history or pathology suggesting the animal was alive when it stranded. Stranding and loss of buoyancy confers a range of pathological changes including impaired respiration, tissue trauma, hyperthermia and metabolic acidosis. Lung congestion and hyperinflation, muscle bruising and necrosis, metabolic acidosis and renal failure are usual pathological indicators. Simple external indicators for those not seen to live strand include abrasions to the beak, leading edge of the pectoral fins and tail flukes, beach material in mouth oesophagus and stomach, ventral bruising and rigor if really fresh.

4.5.2 *Bycatch*

Death due to incidental capture in fishing gear. Pathology 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. Sometimes net marks visible on fins, flukes or flank occasionally trauma to beak, removal of tail flukes and rarely fractures to vertebrae.

4.5.3 *Entanglement*

Usually only applies to large whales (particularly minke and other mysticetes) and leatherback turtles. Animals are often seen with gear still wrapped around their bodies, usually flukes and fins but occasionally through baleen plates in the mouth. Acute cases similar to bycatch, sub-acute cases result in exhaustion and impaired

feeding. Chronic cases often very thin and debilitated and show chronic wounds caused by abrasion and pressure from entangled equipment.

4.5.4 *Bottlenose Dolphin (BND) attack*

Usually seen in porpoise from in regions with sympatric bottlenose dolphin *(Tursiops truncatus)* and is characterised by extensive trauma, rake marks on epidermis, fractured ribs or axial skeleton and/or internal injuries such as ruptures to internal organs. This cause of death is also documented in neonatal/juvenile bottlenose dolphin (commonly referred to as infanticide) and other cetacean species.

4.5.5 *Grey seal attack (cetaceans). Acute, primary trauma cases suspected to be seal predation on harbour porpoise*

Seen in harbour porpoise from regions with large sympatric grey seal *(Halichoerus grypus)* populations and is characterised by extensive trauma to blubber and underlying musculature. Often large sections of tissue (both blubber and muscle) are removed particularly the back muscle either side of the spine. Puncture marks through blubber often around the head and throat area. Blubber and skin often stripped of resulting in missing tissue and flaps of blubber. The internal organs and skeleton are often intact in very fresh cases. Rake marks in blubber and micro haemorrhages in the tissue also indicators.

4.5.6 *Grey seal attack (cetaceans). Chronic, secondary infection possibly due to seal bite lesions on harbour porpoise*

Seen in harbour porpoise from regions with large sympatric grey seal *(Halichoerus grypus)* populations and is characterised by infected bite wounds to body particularly, pectoral fins, tail fluke and tailstock. The animal survives the initial attack only to die later from sepsis from the infected bite wound. The causative organism varies but all are known to be known seal pathogens often found in the mouth. Examples are *Streptococcus phocae, Actinomyces marimammalium, Arcanobacterium phocae, Streptococcus halichoeri, Neisseria anamoloris* and most notably *Mycoplasma phocicerebrale* which is the recognised cause of seal finger in humans.

4.5.7 *Grey seal attack (pinnipeds), spiral or "corkscrew" seals.*

A diagnosis of corkscrew trauma is confirmed by the presence or absence of a number of attributes; a single linear lesion (one or more rotations), areas of skin or tissue missing, evidence of skeletal trauma and avulsion of one or both scapula. The lesion typically begins at the mouth with punctate lesions on muzzle. Rake marks in blubber and/or undermining of blubber are particular features and need to be distinguished from necropsy scavenging.

4.5.8 *Meningoencephalitis*

A diagnosis reached by histopathological examination of the brain showing lesions consistent with either suppurative or non suppurative meningoencephalitis or meningitis. This can have either a bacterial, viral or unknown aetiology.

4.5.9 *Pneumonia*

A broad diagnosis meaning that death was predominantly caused by severe lung pathology and consequent respiratory compromise as a result of one or several respiratory pathogens. Either one or several bacterial, fungal, or parasitic (verminous) respiratory pathogens can be involved occasionally the aetiology is unknown.

4.5.10 *Generalised bacterial infection*

Isolation of one or more bacterial pathogens by microbiological culture from one or more organ systems

4.5.11 *Starvation*

Starvation is diagnosed when there is evidence that recent feeding activity or fat stores were inadequate to provide sufficient energy, resulting in physiological compromise and death. Adequate fat stores are essential for buoyancy, thermoregulation and hormone physiology, so starvation also includes cases where impairment of these factors appear to have been significant contributors to the death.

4.5.12 *Not established*

Insufficient data to reliably come to a single diagnosis, reasons include an incomplete sample range, carcass autolysis, inconclusive test results or simply the case did not display known patterns of pathology.

4.1 Necropsy protocol

Examination of all cetacean or seal carcasses was conducted to a standardised protocol (Kuiken T. & Hartman M.G. 1991). Establishing a cause of death was attempted on every case taken to necropsy The final diagnosis was made by a veterinary surgeon with experience of marine pathology and is based on the findings of gross necropsy supported in most cases by ancillary serological, bacteriological and histopathological tests.

The necropsy provides the gross pathology data used to establish a cause of death and quantify burden of disease and various additional samples are collected as part of the protocol. In addition to tissues taken for bacteriology and histopathology, a standardised array of tissue samples are archived at -20^{0}C. Gonadal tissues, teeth

(for age determination) and stomach contents are collected and used by other research projects. Skeletal material from all marine carcasses necropsied in Scotland is donated to National Museum of Scotland (NMS) for inclusion in the research collection. This all supports a broad range of multidisciplinary scientific research activities and collaborations, maximising the information gained from each stranding incident.

The necropsy protocol is currently undergoing a revision; this process was started during this reporting period following a workshop held at the European Cetacean Society conference in Madeira in 2016.

Section 5: Cetacean species found stranded in Scotland

The atlas of cetacean distribution in north-west European waters (Reid et al 2003) lists 25 species of cetacean that occur or have occurred in this region. There were 827 stranded cetaceans reported to SMASS comprising 17 species from along the Scottish coastline during the period of this report. This includes both dead stranded and live refloated cases. Cetacean abundance estimates from the SCANS III survey area is given in Table 4 below Seventy-five animals (9%) could not be identified to species level. Details of the species stranded are given below together with a notable single strandings. These are notable for reasons either of species, pathology or because they highlight a particular issue.

It is clear that the strandings dataset and tissue archive is has an important role in answering both specific questions on cetacean and seal biology but also questions about general ecosystem health, new and emerging diseases and the impact of climate change. SMASS are therefore committed to building collaborations with institutions working in these fields.

Species	Abundance	Density	CV	CL low	CL high
Harbour porpoise	466,569	0.381	0.154	345,306	630,417
Bottlenose dolphin	27,697	0.015	0.233	17,662	43,432
Risso's dolphin	13,584	0.008	0.441	5,943	31,047
White-beaked dolphin	36,287	0.020	0.290	18,694	61,869
White-sided dolphin	15,510	0.009	0.717	4,389	54,807
Common dolphin	467,673	0.261	0.264	281,129	777,998
Striped dolphin	372,340	0.208	0.329	198,583	698,134

Table 4: Estimates of total cetacean abundance and density (animals/km2) in the whole SCANS survey area (SCANSIII report).

5.1 Harbour porpoise (*Phocoena phocoena*)

This is the most commonly stranded cetacean in Scotland with a total of 393 cases in this reporting period. This species comprises 47.5% of the total cetaceans reported. This is an increase of nearly 29% on the number from the previous reporting period (2011-2015).

The 2017 SCANS III (Small Cetacean Abundance in the North Sea and Adjacent waters study (SCANS) estimated a North Sea population of approximately 345,000 harbour porpoises (CV 0.18) making it the most numerous cetacean species. Harbour porpoise are typically 1.4m to 2m in length and are most often seen in small groups close to shore. They tend to be inconspicuous and don't often approach

boats. Additionally most will float if they die at sea, which is a likely contributing factor to the high frequency of reported strandings for this species. Figure 4 shows the distribution of harbour porpoise strandings during this reporting period.

Characteristics:

- Feed on small fish such as gadoids, whiting, herring and sand eels.
- Calves born April to August
- Strand all year round with an increase from February towards a peak in March and April
- The most common cause of death in Scottish waters is BND attack

There usually is a consistent seasonality in numbers of strandings with increasingly more strandings between February and April, after which numbers decrease throughout the summer months to a more constant low level between September and January. A small increase is also observed in June and July, which coincides with the calving season and is likely due to the contribution of neonate mortality which is largely absent throughout the rest of the year. While the previous reporting period (2012 – 2015) followed this pattern very closely, in this reporting period the pattern appears to be different. This was mainly due to a high number of strandings being observed in some months in particular years, a boxplot of monthly variation in numbers of harbour porpoise strandings can be found in Figure 3, with an inset of the previous reporting period. In 2017 higher numbers were reported for July, September and October, whereas in the previous year higher numbers were in reported for October and November. These anomalies were assessed in light of the three components of the strandings process (physical processes, reporting effort, biological characteristics). There was no common factors found that would indicate that there is an increase in mortality from a single source for any of these anomalies, and the causes were mainly attributable to an increase in reporting effort in the Strathclyde region following a training course, and persistent onshore winds during some periods. Detailed descriptions of these investigations can be found in the quarterly and annual reports of these years.

In the previous reporting period, 78 individuals were sent for necropsy (19.8%) and another 64 were sampled by trained stranding volunteers (16.2%). Of the remaining 251, two were successfully refloated. Six cases could be attributed to BND attack by photographs alone. Twenty- nine had lesions suggestive of an attack by a grey seal the rest were too inaccessible, too badly damaged by scavengers or too decomposed for any further examination to be carried out. The most commonly observed cause of death was BND attack, with 24 of the necropsied cases (33%) attributable to this category of physical trauma, an example case presentation given in Figure 5 Sex was determined for 191 carcasses (48.6%), with 80 female and 111 male individuals.

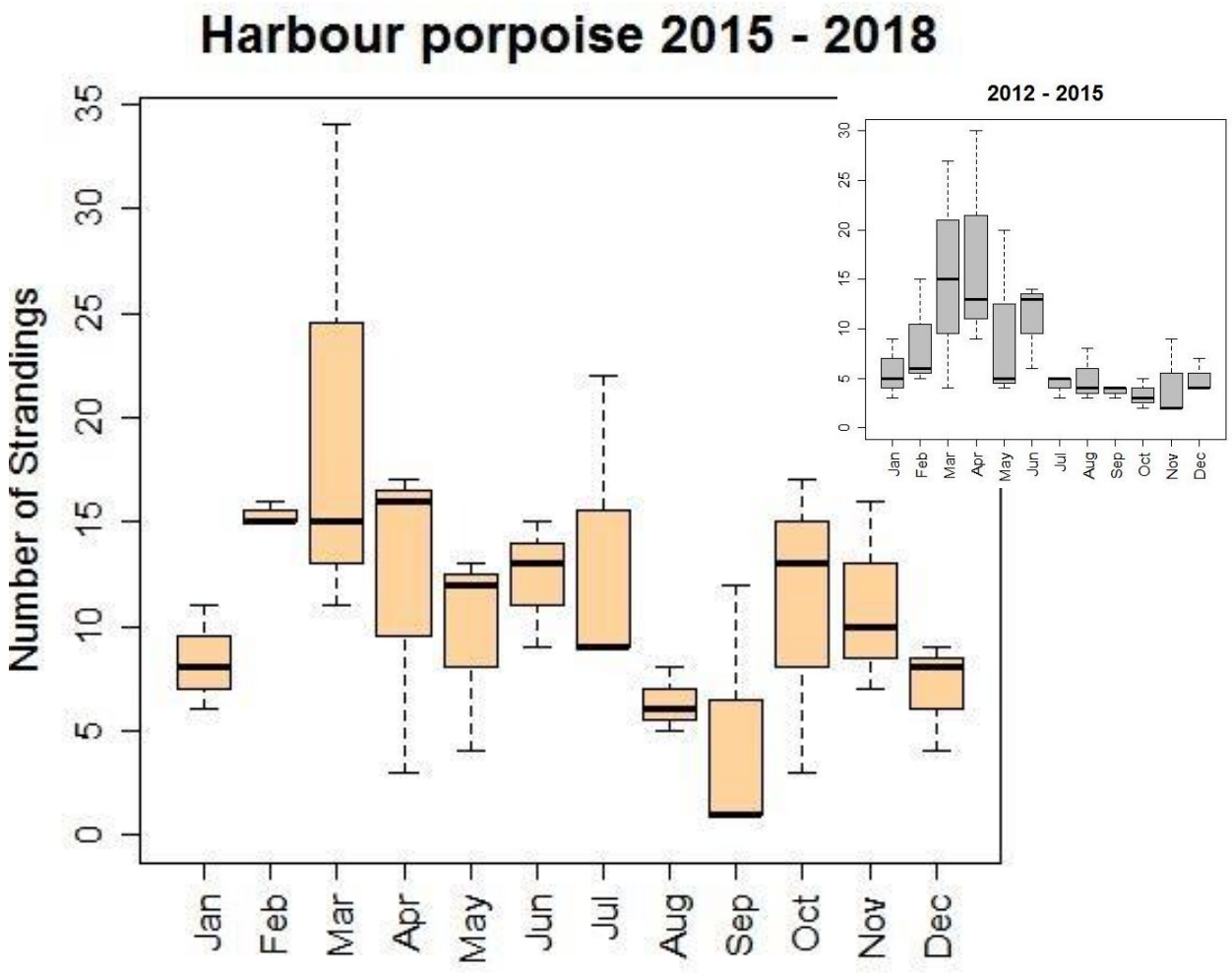


Figure 3 Boxplot of monthly variation in numbers of Harbour porpoise (*Phocoena phocoena*) strandings reported from April 2015 – March 2018. Top right shows the same for the previous reporting period (2012 – 2015)

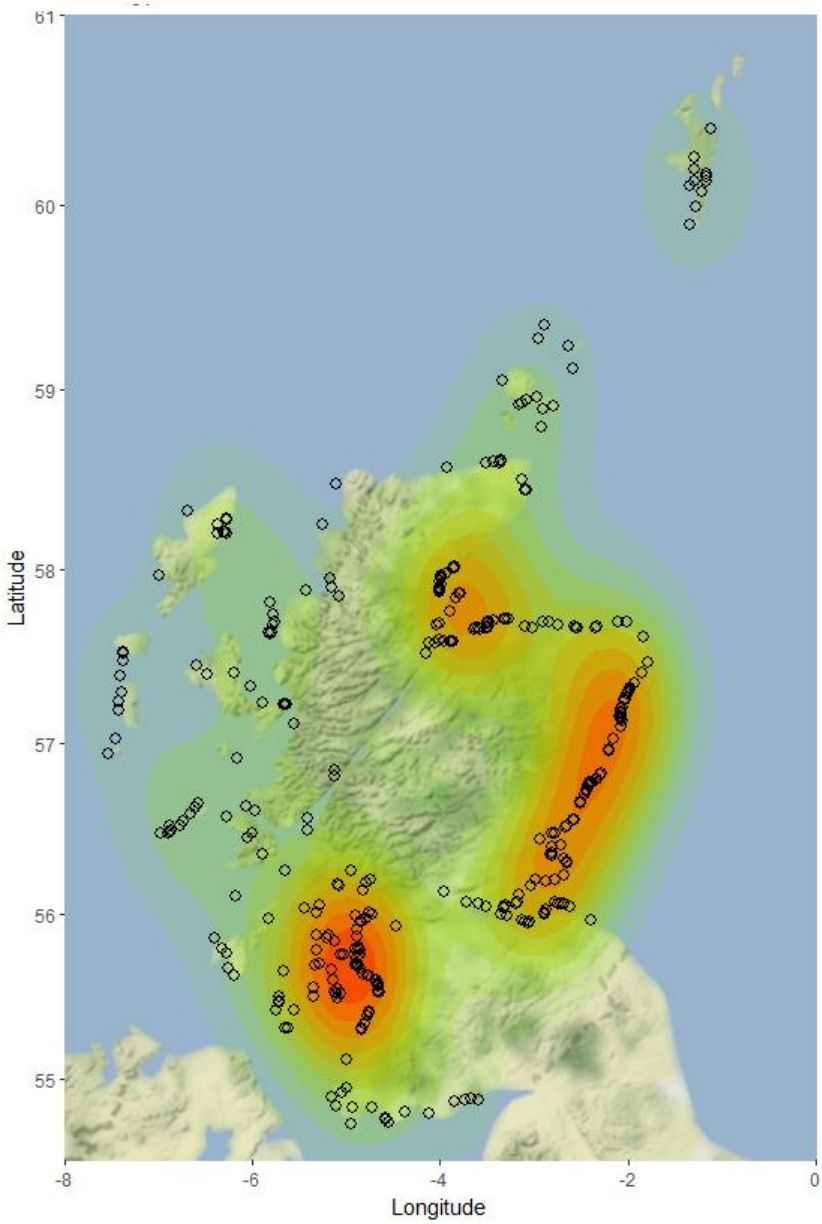


Figure 4: Heat density map of Harbour porpoise (Phocoena phocoena) strandings April 2015 – March 2018. Areas high stranding density are shown as orange-red

The harbour porpoise dataset is unique amongst stranding species in that it is large enough to enable valid inference about the traumatic, toxic, metabolic and infectious processes at work on both this species and, potentially, coastal marine species in general. In this regard the use of porpoise as disease sentinels of marine health is potentially very valuable. Initial data inspection shows a clear spatial heterogeneity of cause of death, although much less of a temporal tend over time. This is being analysed in more detail and collaborations developed to incorporate the strandings data, pathology and disease burden analysis with life history and ecological parameters to investigate trends in more detail.

Table 5: Causes of death of harbour porpoises (*Phocoena phocoena*) examined at necropsy (April 2015 – March 2018)

Cause of death	2015	2016	2017	2018	Grand Total
Infectious Disease	**1**	**7**	**8**	**1**	**17**
(Meningo)encephalitis		2	1		3
Generalised Bacterial Infection/Septicaemia	1	1	3	1	6
Generalised Fungal Infection			1		1
Pneumonia: Parasitic		3	3		6
Pneumonia: Unknown Aetiology		1			1
Not Established			**3**		**3**
Not Established			3		3
Other	**5**	**10**	**7**	**3**	**25**
Dystocia/Stillborn			1		1
Live Stranding	1	2		1	4
Neoplasia	1				1
Generalised Chronic Debilitation		2	2		4
Starvation (Neonate)	3	3	3		9
Starvation/Hypothermia		3	1	2	6
Trauma	**4**	**11**	**13**	**2**	**30**
Physical Trauma: Bottlenose Dolphin Attack	2	9	11	2	24
Physical Trauma: Bycatch	1		1		2
Physical Trauma: Likely Grey Seal Attack	1	2			3
Physical Trauma: Other			1		1
Grand Total	**10**	**28**	**31**	**3**	**71**

Figure 5: M205/17 Harbour porpoise (*Phocoena phocoena*) from Lossiemouth showing external lesions typical of a BND attack.

5.2 Bottlenose dolphin (*Tursiops truncatus*)

This species accounted for 1.2% (n=10) of the cetaceans reported, similar to the previous reporting period. Photo-identification studies indicate a resident population of around 195 animals on the East coast of Scotland (Lighthouse Field station data). There is also a second smaller population on the west coast of around 45 animals and a small population of around a dozen animals centred on Barra with movement between these populations and outside these regions (reference). The individuals in the bottlenose dolphin population surrounding Scotland are the biggest of any population of bottlenose dolphins, with the largest animals reaching 3.5 metres in length and approaching 300kg in weight.

Characteristics:

- Feed on fish such as mackerel, tuna, mullet but also squid with a tendency to take the most abundant prey
- Calves born between the months of May and October, with a peak during August
- There is no observed seasonality to their strandings
- There is no common cause of death in this species

In contrast to several other species, bottlenose dolphins tend not to be positively buoyant when freshly dead, so most cases are either live strandings or autolysed. Three animals were sent for necropsy (30%), five were sampled (50%), and the remaining two (20%) were not further examined, one of which was successfully refloated. Sex was determined in nine animals (90%), with two female and seven male individuals.

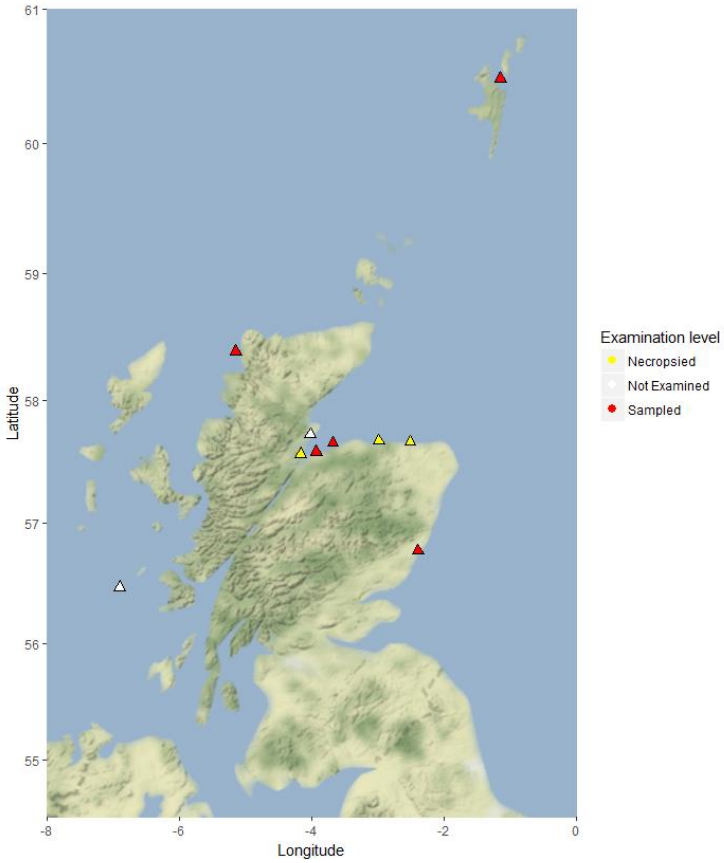


Figure 6: **Distribution of Bottlenose dolphin (*Tursiops truncates)* strandings April 2015 – March 2018**

Example case: M635/17 bottlenose dolphin (*Tursiops truncatus*). This juvenile male bottlenose dolphin was found dead stranded in Macduff and was chilled prior to necropsy. It was estimated to be less than a year old as foetal folds were clearly visible and no teeth had erupted. There was some evidence for agonal live stranding including submandibular bruising and a bilateral non-turbid hematogenous transudate in the plural space; this may be due to agonal water aspiration. Of most significance was a diffuse haemorrhage/bruising around the rete, lung and thoracic inlet, and significant diffuse intracranial, brainstem and meningeal haemorrhages, likely a result of generalised sepsis but possible exacerbated by stranding trauma. There was no indication of conspecific BND trauma and the animal was in general in moderate body condition suggesting a reasonably acute process. No parasite burden was noted and the stomach was empty excepting sand and some seaweed debris, however the lower GIT contents indicated the animal had reasonably recently suckled. Bacterial cultures from this animal produced a profuse culture of *Yersinia pseudotuberculosis* from all sites. This would indicate a sepsis due to this organism. We believe this may be the first such isolation of *Y.pseudotuberculosis* from a cetacean.

Figure 7: M635/17 bottlenose dolphin calf (*Tursiops truncatus*) Macduff, Moray.

5.3 Long-finned pilot whale (*Globicephala melas*)

This species accounted for 8.7% (n=72) of the cetaceans reported. This was the third most commonly reported cetacean after the harbour porpoise which was attributed to two mass stranding events (MSE) involving this species during this period; one at Staffin, Skye involving 21 individuals, and one in Inverness involving two animals. Despite the bias introduced by the two MSE events, this is a small increase in numbers compared to the previous contract period (although a lower percentage) when only 69 were reported in total. This species of dolphin is one of the largest with males exceeding 6m in length. The species inhabits the deep waters north of Scotland and south-east of the Faroes with most records from water deeper than 200m. They are the species most likely to mass strand.

Characteristics:

- Feed on squid, particularly *Todarodes sagittatus*, *Gonatus sp*. and *Illex sp*, and occasionally fish such as Mackerel
- Calving occurs in the summer months
- There is no obvious seasonality to their strandings in Scotland
- The most common cause of death in Scottish waters is live stranding

Of the 21 animals involved in the mass stranding at Staffin; 14 were refloated and 7 were subject to necropsy. The two animals from Inverness where found in an advanced state of decomposition and were only sampled (see detailed information in notable mass strandings section below). Nine of the single stranded cases were subject to necropsy (12.5%), 13 were sampled (18%), and the remaining 43 were not further examined (59.7%).

Sex was determined in 27 of the single stranded cases (with 14 female and 13 male individuals), and nine of the individuals involved in the mass strandings (with eight females and one male).

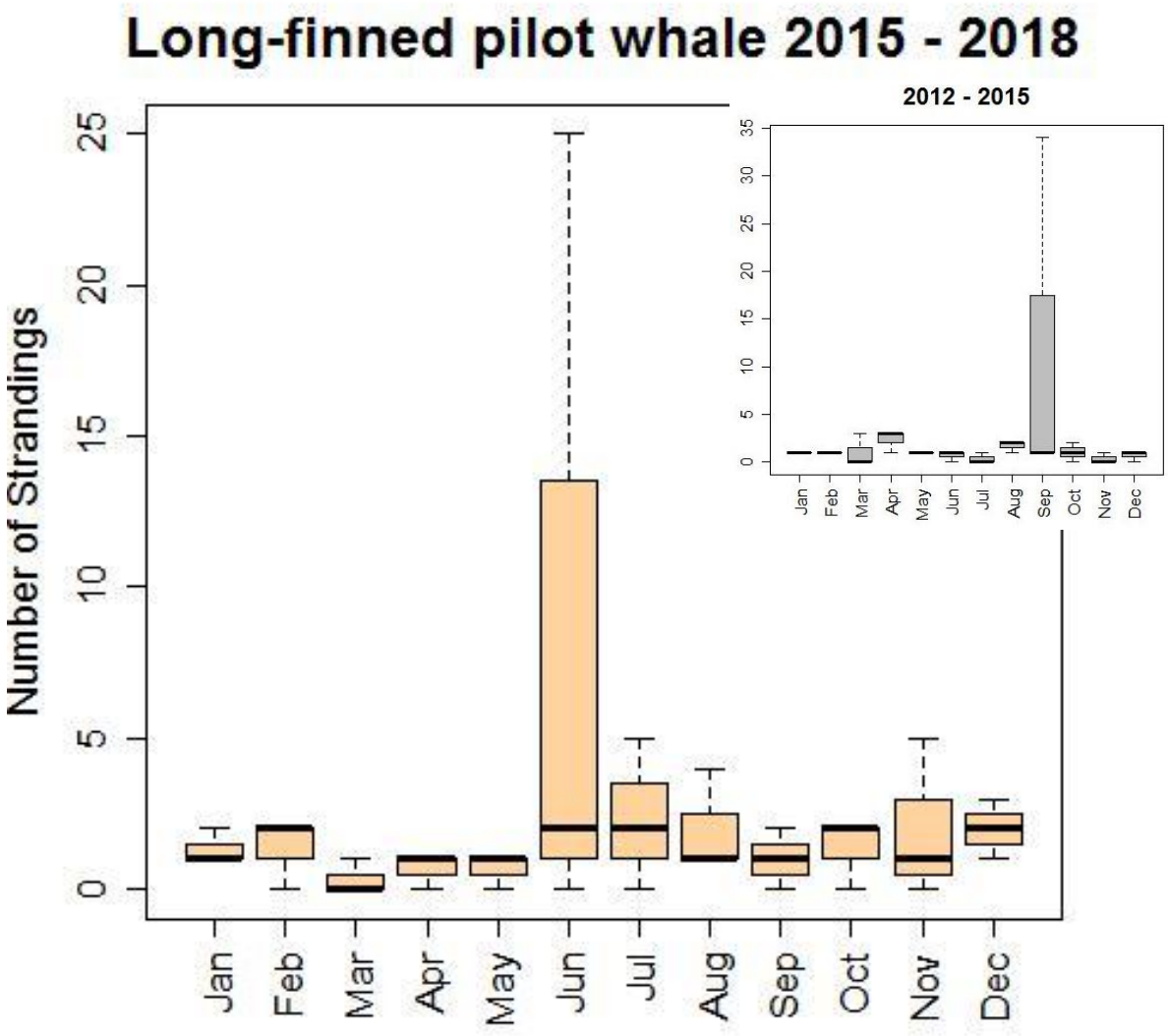


Figure 8: **Boxplot of monthly variation in total number of single stranded Long-finned pilot whales (*Globicephala melas*) reported from April 2015 – March 2018. Top right inset shows the same for the previous reporting period (2012 – 2015).**

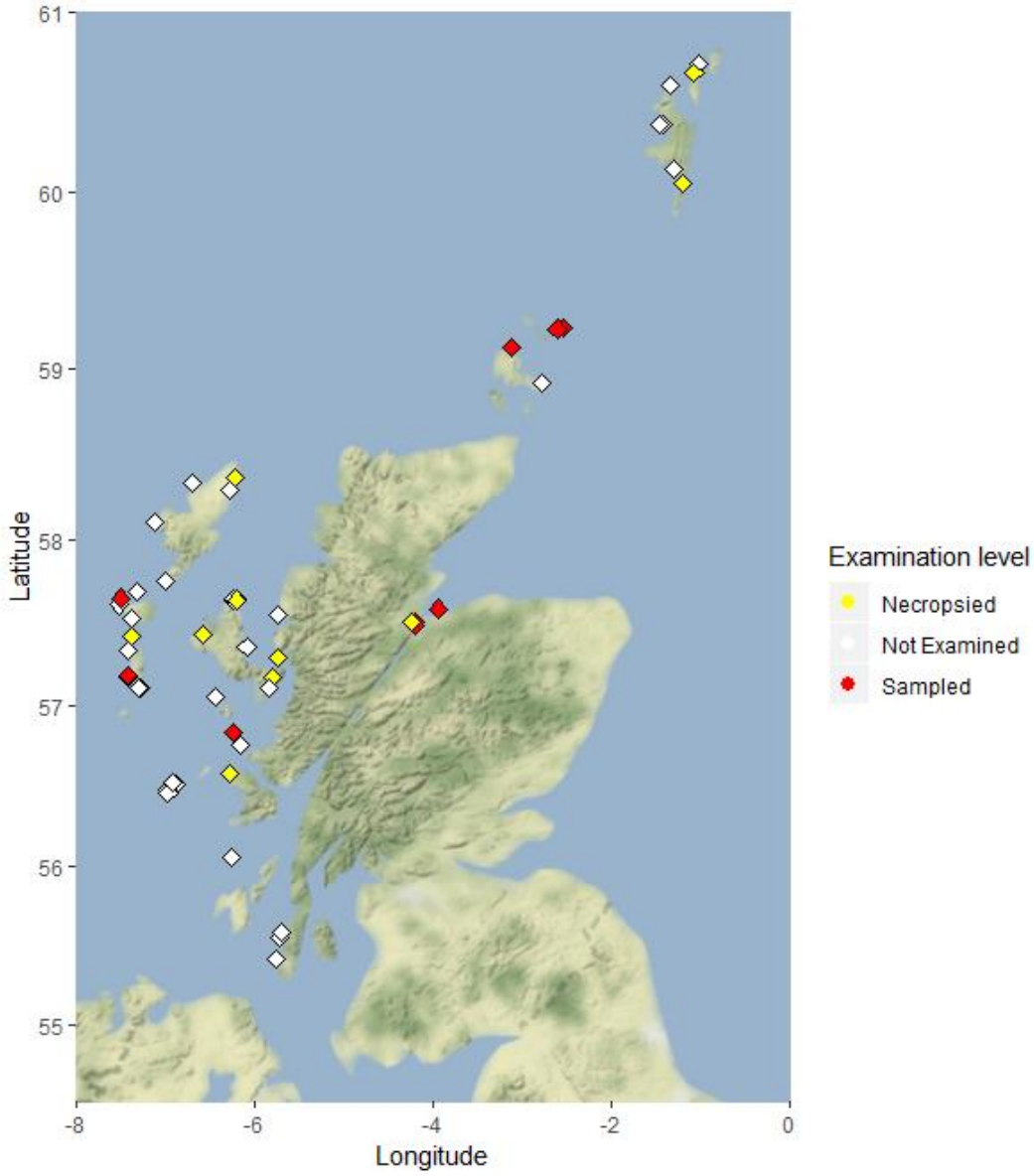


Figure 9: **Distribution map of Long-finned pilot whale (*Globicephala melas*) strandingsfrom April 2015 – March 2018**

Example case: M341/17– long-finned Pilot whale *(Globicephala melas)*

This adult female was found live stranded on the upper third of the tidal range on a stony shingle beach in North Kessock near Kilmur. A number of other animals had been observed around the Moray Firth region since 28th July, and in the Beauly Firth the previous day. The pod had been observed showing normal feeding behaviour in the outer Moray Firth. This animal was the only one to strand and had been out of the water since 2:00am based on the position on the tideline. It displayed a respiratory rate of 10-15 breaths per minute and widespread persistent bilateral muscle fasciculation . It had been out of the water for nine hours and on this basis of both the clinical picture of this individual and the possibility of a refloated but compromised animal invoking a mass stranding, it was elected to euthanase this

animal. It was shot with a 0.270 calibre rifle using soft point ammunition. Initial shot was midline at 45’ caudal from the blowhole and this fractured the frontal region of the skull and caused extensive trauma and haemorrhage to the cortex. This shot initially appeared to render the animal insensate a second lateral shot was required due to increasing developed tail movements. The animal was necropsied at the DSC in Inverness within four hours. On examination, the animal was aged, with worn teeth and in thin but not emaciated condition. There was no evidence of recent feeding however the liver did not show evidence of any significant fatty change, indicative of an acute catabolic state. There was ballistic damage to the cortex and generalised cerebral haemorrhage but most brain architecture was intact. There was a notable increase in white matter in the brain, suggesting an aged, possibly senescent animal however the ventricles and cerebro-spinal fluid (CSF) were grossly unremarkable. There was a significant tetraphylidean parasite burden in the caudal abdomen and mesentry, and a notable hyperplasia of the pyloric stomach, producing cauliflower–like partially ulcerated masses. These appeared to be in response to a chronic stomach fluke infestation, likely *Pholeter gastrophilus*, and partially occluded the sphincter. The lung parenchyma showed some focal pale regions or possibly infarcts but neoplasia is a possibility; however histology showed a severe, sub-acute, multifocal becoming generalised, granulo-suppurative broncho-pneumonia. Severe, chronic-active, locally extensive, necro-suppurative verminous gastritis. Bacteriology proved sterile on all organs cultured. The pulmonary lesions, if representative of the whole lung field, would be clinically significant especially when combined with any reduction in feeding due to gastric emptying problems caused by the very severe gastric pathology.

Notably, the pathological findings support the decision not to refloat this animal and risk it, with and potentially other members of the pod, from subsequently mass stranding. The ‘sick-leader’ hypothesis, where the pod of animal remain close to shore to support an ill member of their group is documented in this species and a factor in the decision to euthanize this case. Following euthanasia of this case, the other members of the pod left the region and were last sighted the following day swimming strongly out to sea.

Figure 10: M341/17 long-finned pilot whale (*Globicephala melas*).

5.4 Sperm whale *(Physeter macrocephalus)*

This species accounted for 1.2% (n=10) of the cetaceans reported. This was the tenth most commonly reported species along with bottlenose dolphins during this reporting period. All the animals for which a sex has been recorded in the database have been male. Male sperm whales occur in deep waters north and west of Scotland and sightings are usually between July and December. Adult males can measure over 18m and weigh 57,000kg. The longest in the SMASS database was measured as 14.3m, and only one animal has ever been weighed at 26.600kg. Sperm whales are large and very iconic animals and they present quite a logistical problem as they decompose very rapidly inside once dead, this and there size often means a cause of death is often difficult to establish.

Characteristics:

- Feed primarily on mesopelagic squid, *Gonatus fabricii* is the most important prey item in the North Sea but octopus also has featured
- Calving, which does not occur in Scottish waters, is in the summer months

- There is no obvious seasonality to their strandings
- The most common cause of death is the significant crushing injuries sustained by live stranding

One animal was necropsied during this contract period (10%), another two were sampled (20%), and the remaining seven cases (70%) were too decomposed for further examination.

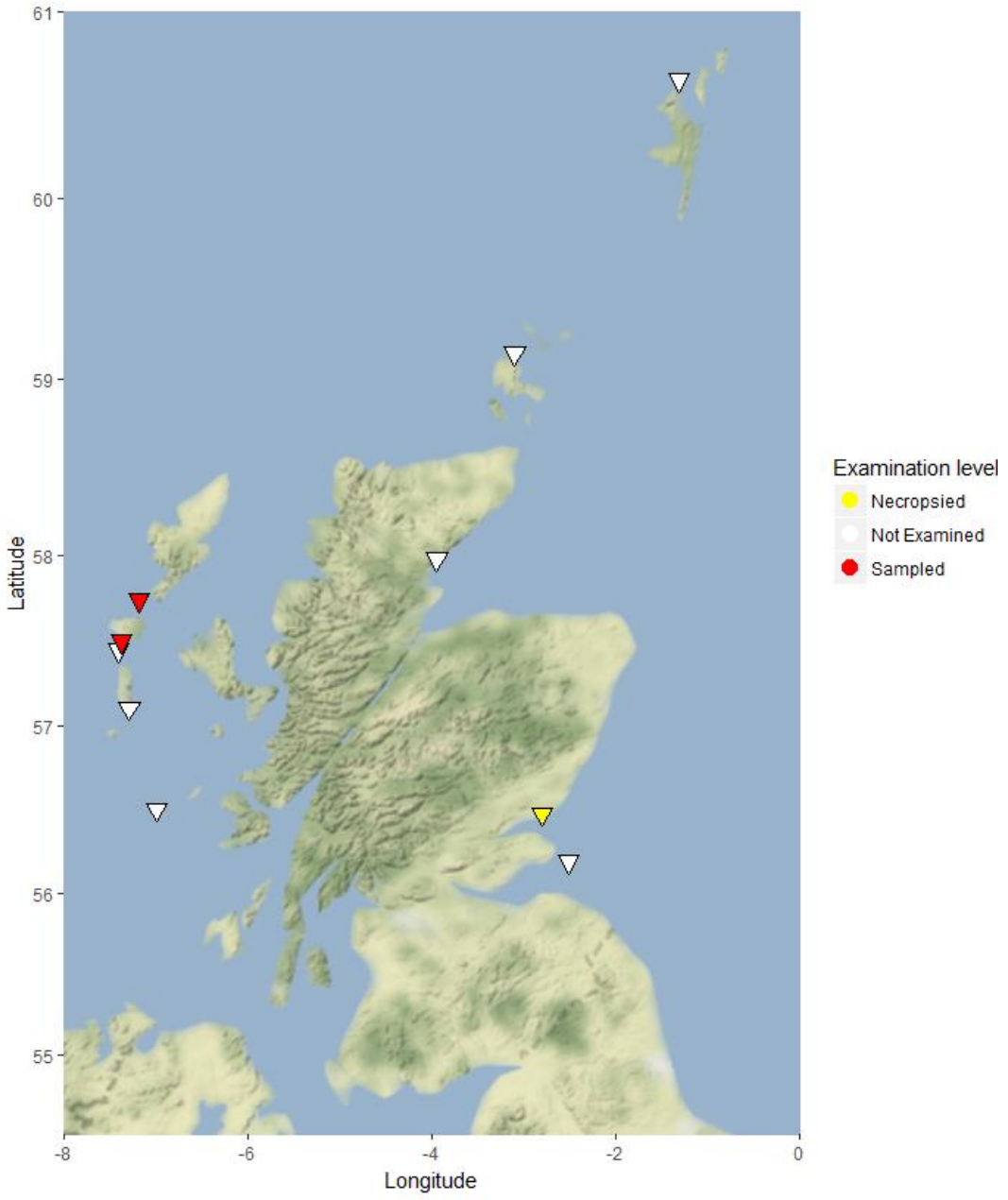


Figure 11: Distribution of Sperm whale (*Physeter macrocephalus)* strandings and examination level April 2015 – March 2018

Example case: M181/18 – Sperm whale (*Physeter macrocephalus*)

This adult male sperm whale was found dead stranded on a very tidal region of the Tay estuary. It was reported to have died on the 21/03/18 and was initially examined two days later, however due to issues moving the animal most of the visceral sampling occurred on 60 hours post-mortem, by which time the carcass was showing indications of significant autolysis. There was clear evidence of live stranding, including severe ventral bruising, antemortem excoriations and approximately 300 litres of seawater in the cardiac stomach. There were rake marks on the head likely to be from conspecific fighting, and several healed marks on the fluke which indicated past healed trauma. The animal was in good condition, with around 14cm of blubber thickness and evidence for recent feeding based on a sample of fish jaw bones and squid beaks detected in the stomach. Due to the logistics of sampling, the stomach contents were only samples, not examined entire. In addition there were three coproliths in the rectum, these objects were not causing an obstruction and were surrounded by liquid faeces, but there did appear to be dilation of the rectum around these objects. The visceral tissues were significantly autolysed, and thus detailed examination was not reliable, but did not show overt indications of disease or parasite burden. The head was removed and a sample of brain tissue and CSF collected through the foramen magnum. This tissue was autolysed but again was sufficient for sampling. Bacteriology produced a mixed bag of isolates including an α-haemolytic *Streptococcus sp*. with a profile that matches an isolate from the liver of a fin whale from Devon. The significance of this isolate is at present uncertain. The cause of death is live stranding, and it is plausible that, given the location, time of year and stomach contents, that this is a generally healthy animal which entered the North Sea from the north and entered the firth on the east coast of Scotland in an attempt to head further west.

Figure 12: M181/18 sperm whale (*Physeter macrocephalus*).

5.5 Pelagic delphinids (excluding long-finned pilot whales)

This group, excluding long-finned pilot whales, accounted for 34.7% (n=287) of the cetaceans reported. Figure 13 shows the number of strandings per month by species and provides a summary overview of the pelagic delphinids (excluding long-finned pilot whales) sent for necropsy. Figure 21 shows the spatial distribution of strandings per species around the coast of Scotland.

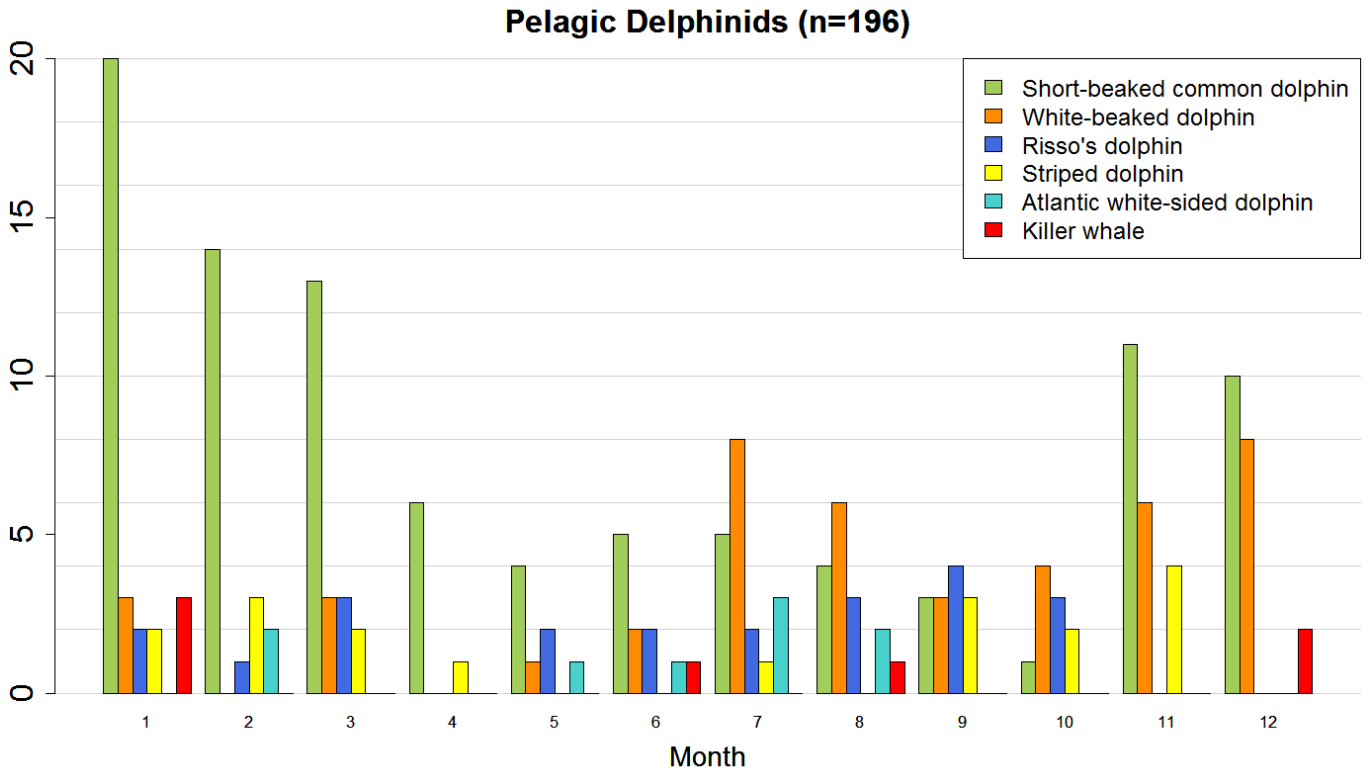


Figure 13: Number of pelagic delphinids (excluding long-finned pilot whales) strandings per month by species from April 2015 – March 2018

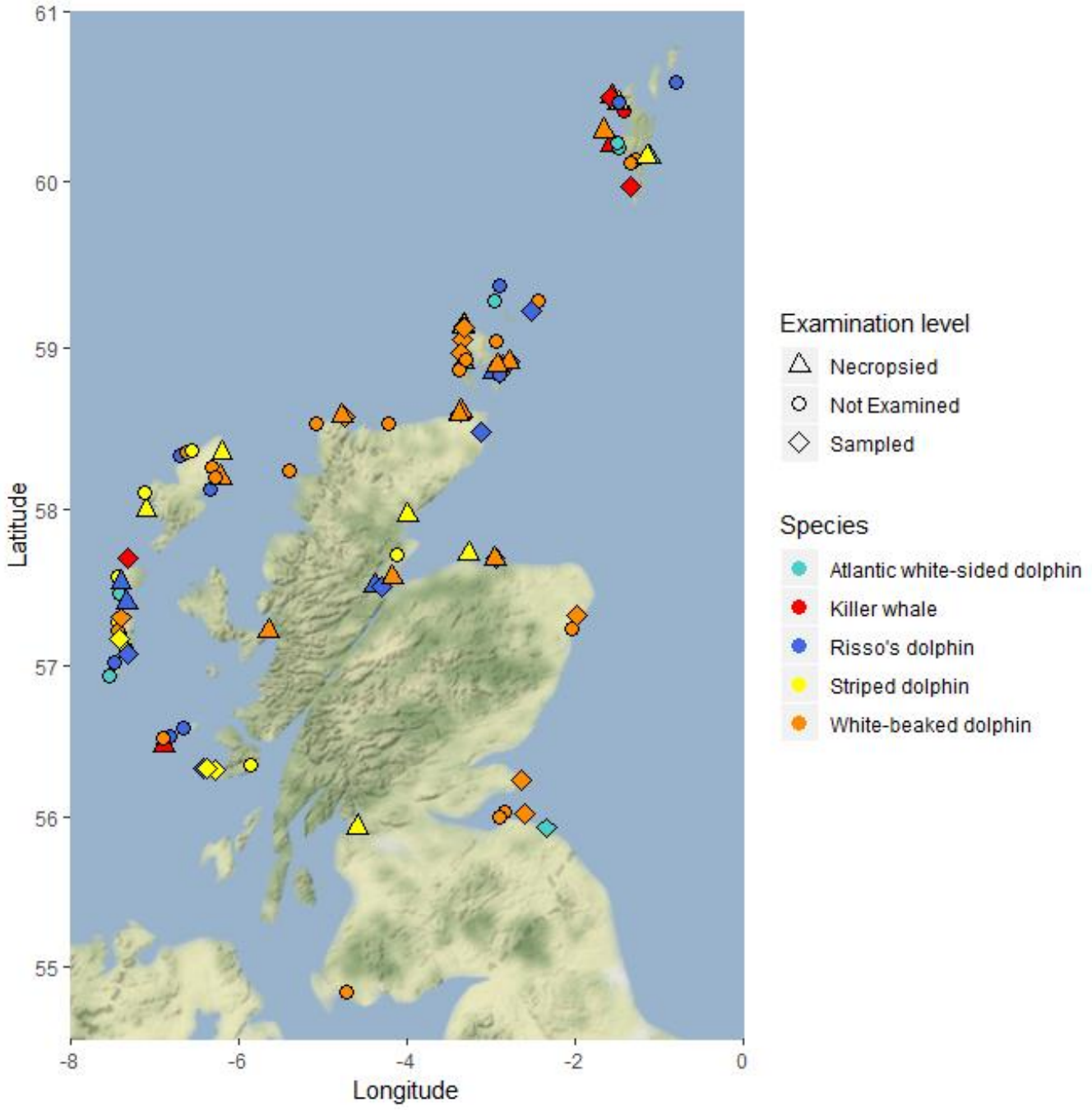


Figure 14: Distribution of Pelagic delphinid strandings (excluding long-finned pilot whales) from April 2015 –March 2018

Table 6: Summary overview of pelagic delphinids (excluding long-finned pilot whales) sent for necropsy from April 2015 to March 2018

M ref	Species	Date found	Location	Sex	Age Group	Findings
M299/16	*Lagenorhynchus acutus*	27/06/2016	Highland	M	adult	Other
M298/17	*Lagenorhynchus acutus*	18/07/2017	Shetland	M	juvenile	Physical Trauma: Other
M129/18	*Lagenorhynchus acutus*	25/02/2018	Orkney	F	adult	Meningoencephalitis
M4/16	*Orcinus orca*	01/01/2016	Argyll and Bute	F	adult	Physical Trauma: Entanglement
M32/17	*Orcinus orca*	12/01/2017	Shetland	F	adult	Infectious Disease: Other
M602/17	*Orcinus orca*	13/12/2017	Shetland	M	juvenile	Live Stranding
M25.1/16	*Grampus griseus*	08/01/2016	Highland	F	adult	Gastritis and/or Enteritis
M157/16	*Grampus griseus*	25/03/2016	Orkney	M	juvenile	Meningoencephalitis
M396/16	*Grampus griseus*	11/09/2016	Orkney	M	juvenile	Developmental abnormality
M155/17	*Grampus griseus*	22/03/2017	Western Isles	F	subadult	Meningoencephalitis
M459/17	*Grampus griseus*	17/10/2017	Western Isles	M	juvenile	Gastritis and/or Enteritis
M134/15	*Delphinus delphis*	26/04/2015	Western Isles	F	juvenile	Live Stranding
M267.2/15	*Delphinus delphis*	08/08/2015	Fife	F	juvenile	Live Stranding: Unsuccessful refloat
M360.1/15	*Delphinus delphis*	08/11/2015	Highland	F	adult	Live Stranding
M1/16	*Delphinus delphis*	01/01/2016	Highland	F	juvenile	Pneumonia: Parasitic
M409/16	*Delphinus delphis*	30/09/2016	Western Isles	F	adult	Generalised Bacterial Infection
M420/16	*Delphinus delphis*	08/10/2016	City of Edinburgh	F	adult	Live Stranding
M495/16	*Delphinus delphis*	16/11/2016	Fife	F	adult	Live Stranding
M555/16	*Delphinus delphis*	26/11/2016	Highland	F	juvenile	Pending
M31.1/17	*Delphinus delphis*	13/01/2017	Highland	M	juvenile	Live Stranding
M31.2/17	*Delphinus delphis*	13/01/2017	Highland	F	adult	Live Stranding
M37/17	*Delphinus delphis*	16/01/2017	Highland	F	adult	Live Stranding
M146/17	*Delphinus delphis*	09/03/2017	Argyll and Bute	M	juvenile	Generalised Bacterial Infection
M247/17	*Delphinus delphis*	17/06/2017	Highland	M	neonate	Not Established
M537/17	*Delphinus delphis*	18/11/2017	Highland	M	juvenile	Live Stranding
M563/17	*Delphinus delphis*	30/11/2017	Moray	M	juvenile	Pneumonia: Parasitic
M601/17	*Delphinus delphis*	13/12/2017	Highland	M	juvenile	Live Stranding
M173/18	*Delphinus delphis*	19/03/2018	Highland	M	juvenile	Live Stranding
M190/18	*Delphinus delphis*	26/03/2018	Fife	F	juvenile	Starvation/Hypothermia
M338/15	*Stenella coeruleoalba*	25/10/2015	Orkney	M	juvenile	Meningoencephalitis
M388/15	*Stenella coeruleoalba*	24/11/2015	Shetland	M	juvenile	Meningoencephalitis
M40/16	*Stenella*	13/01/2016	Shetland	M	adult	Live Stranding

M ref	Species	Date found	Location	Sex	Age Group	Findings
	coeruleoalba					
M63/16	*Stenella coeruleoalba*	26/01/2016	Moray	M	juvenile	Live Stranding
M485/16	*Stenella coeruleoalba*	06/11/2016	Western Isles	M	juvenile	Meningoencephalitis
M156/17	*Stenella coeruleoalba*	24/03/2017	West Dunbartonshire	M	juvenile	Live Stranding
M449/17	*Stenella coeruleoalba*	09/10/2017	Western Isles	F	juvenile	Meningoencephalitis
M94/18	*Stenella coeruleoalba*	13/02/2018	Highland	M	juvenile	Pending
M393/15	*Lagenorhynchus albirostris*	25/11/2015	Highland	F	juvenile	Starvation/Hypothermia
M449/15	*Lagenorhynchus albirostris*	17/12/2015	Highland	M	juvenile	Pneumonia: Unknown Aetiology
M497/15	*Lagenorhynchus albirostris*	29/12/2015	Western Isles	F	adult	Generalised chronic debilitation
M267/16	*Lagenorhynchus albirostris*	13/06/2016	Highland	M	adult	Meningoencephalitis
M344/16	*Lagenorhynchus albirostris*	29/07/2016	Highland	M	neoanate	Physical Trauma: Other
M385/16	*Lagenorhynchus albirostris*	01/09/2016	Highland	M	adult	Live Stranding
M448/16	*Lagenorhynchus albirostris*	27/10/2016	Orkney	M	juvenile	Meningoencephalitis
M464/16	*Lagenorhynchus albirostris*	01/11/2016	Shetland	F	juvenile	Generalised Bacterial Infection
M350.1/17	*Lagenorhynchus albirostris*	11/08/2017	Orkney	M	subadult	Live Stranding
M496/17	*Lagenorhynchus albirostris*	30/10/2017	Moray	M	adult	Meningoencephalitis

Figure 15: **Total number of pelagic delphinid strandings, including both single strandings and mass stranding events, per month stacked for findings (April 2012 – March 2015).**

5.5.1 Short-beaked common dolphin *(Delphinus delphis)*

Short-beaked common dolphins were the most commonly reported pelagic delphinids with a total of 93 reports involving 96 individuals. The species accounted for 11.6% of the total amount of cetaceans reported, and was therefore the second most commonly reported species during this period. This species has had a nearly 35% increase in numbers compared to the previous period. Short-beaked common dolphins are most commonly found off the west coasts of Britain and Ireland, notably in the western approaches and the Celtic sea. In Scotland they are most often seen in the sea of the Hebrides and the Minch during the summer months, though they occasionally appear in the North Sea. The population in the Celtic sea is estimated

to be approximately 75,500 individuals. Most of the strandings for this species are recorded on the West coast and the Western isles.

Characteristics:

- Feed on schooling fish gadoid fish (*Trisopterus* sp.), gobies and mackerel (*Scomber scombrus*)
- Calves are born in the summer months (June to August)
- Most strandings occur in the winter months (December, January and February)
- Live stranding is the most common cause of death

Eighteen individuals were sent for necropsy (18.7%) and 23 sampled by trained stranding volunteers (23.9%). The remaining 55 were either refloated or too inaccessible or decomposed for any further examination to be carried out. Sex was determined for 53 carcasses (55.2%), with 30 female and 23 male individuals. Strandings were more common in winter months (December to February) which is consistent with the pattern observed in the previous reporting period (Figure 16).

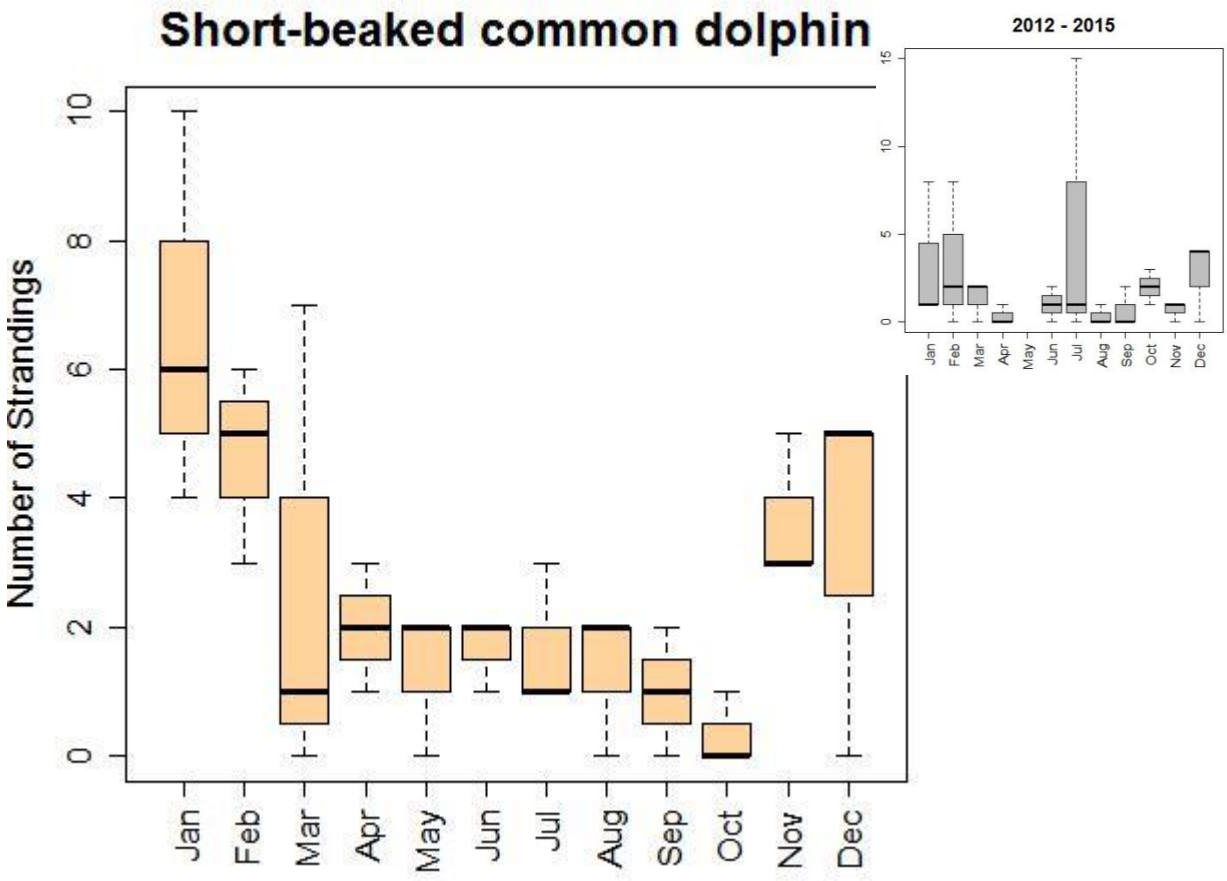


Figure 16: Boxplot of monthly variation in numbers of Common dolphin (*Delphinus delphis*) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

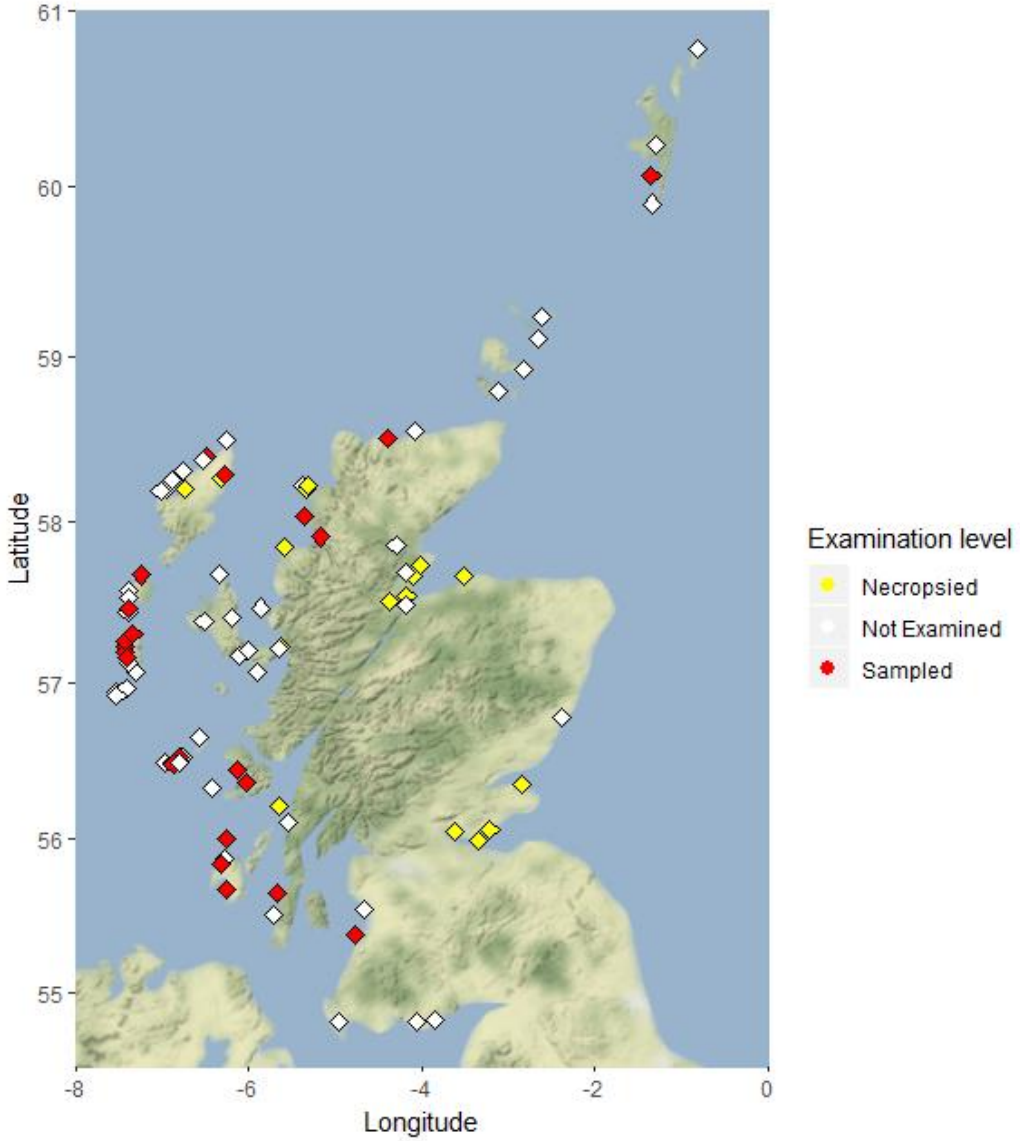


Figure 17: Distribution of Common dolphin standings (*Delphinus delphis*) April 2015 –March 2018

Example case: M146/17 – short-beaked common dolphin *(Delphinus delphis)*

This juvenile male common dolphin was found dead stranded on the isle of Luing. It was recovered by a SMASS volunteers for necropsy. There were numerous lesions over much of the epidermis; these lesions were suggestive of a viral dermatitis such as a herpes virus. There were bottlenose dolphin rake marks on the dorsal surface of the right tail fluke and over right dorsal and left ventral tail stock (Figure 18). There were haemorrhages in blubber, also indicative of bottlenose dolphin rake marks. Both lungs were hyperinflated with very mild evidence of parasitism. The liver was slightly pale and friable; the spleen was enlarged and autolysed. There was a length of approximately 60cm of distal intestine that was distended and full of greyish fluid, possibly indicating enteritis. The brain appeared normal however the CSF was turbid but of normal volume. Bacteriology revealed a pure growth of *Streptococcus phocae*

from all sites but one cultured. Histopathology showed a severe, chronic-active, multifocal verminous pneumonia plus severe, acute to sub-acute, multifocal, predominantly suppurative broncho-pneumonia and moderate, acute to sub-acute, multifocal necro-suppurative hepatitis. These findings support a diagnosis of systemic bacterial infection with severe, acute to sub-acute, multi-organ, sepsis. This would appear to be a case of sepsis in a compromised animal that was attacked by bottlenose dolphins.

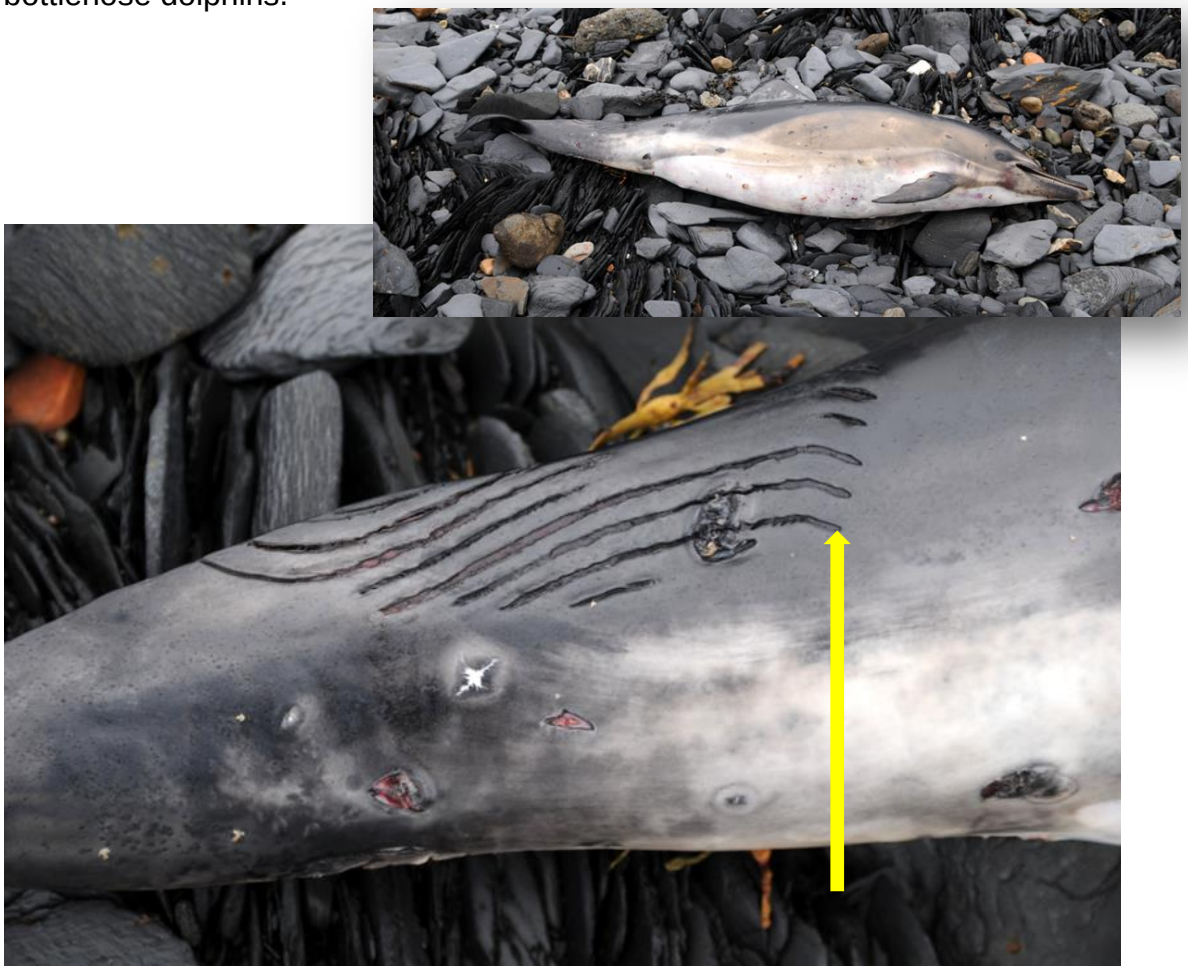


Figure 18: M146/17 short-beaked common dolphin (*Delphinus delphis*) from Luing, showing bottlenose dolphin rake marks arrow.

5.5.2 *Striped dolphin (Stenella coeruleoalba)*

There were 18 reports of striped dolphins accounting for 2.1% of the cetaceans reported. This was the seventh most commonly reported species during this reporting period numbers have decreased by nearly 15% compared to the previous reporting period. Striped dolphins are wide ranging throughout tropical and temperate waters. Sightings in UK coastal waters normally occur during the warmer summer months and tend to be in the southwest approaches and Celtic sea, where

they are sometimes found with common dolphins. Sightings of striped dolphins are rare and usually off the west coast of Scotland.

Characteristics:

- Feed on a variety of small pelagic, mid water and bentho-pelagic fish including Pout, Blue whiting, cod and sand smelt
- Elsewhere there appear to be one or two calving peaks from summer to winter, calving has not been recorded in Scotland.
- Most strandings occur in the autumn and winter months (September-March)
- Live stranding is the most common cause of death closely followed by meningoencephalitis

Eight animals were sent for necropsy (44.4%), three animals was sampled (16.6%), and the remaining seven (38.8%) were either too inaccessible or decomposed for further examination to be carried out. Sex was determined in 14 animals (77.7%), with two female and 12 male individuals. There is no clear seasonality to strandings of striped dolphins in Scotland, which was also concluded for the previous reporting period (Figure 26)

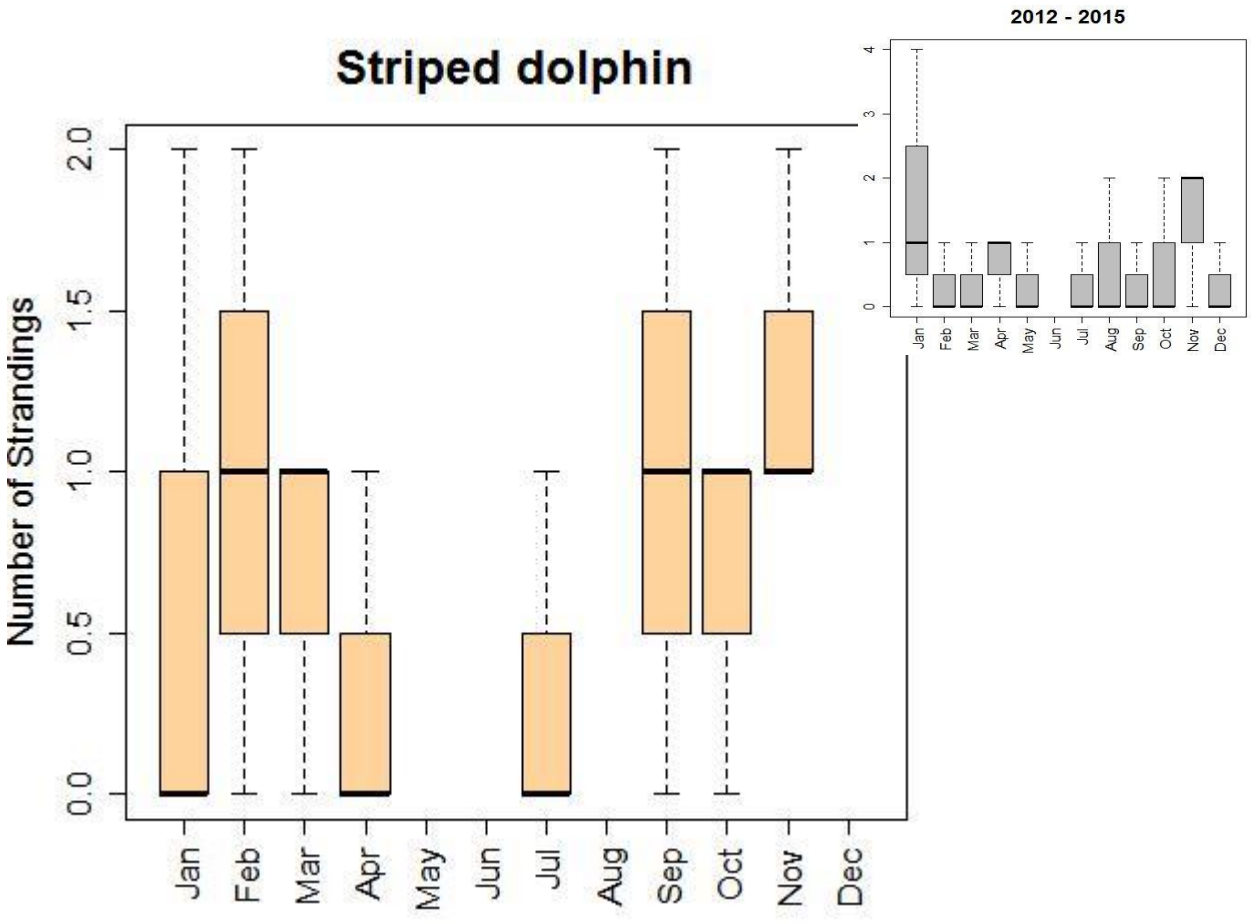


Figure 19: Boxplot of monthly variation in numbers of striped dolphin (*Stenella coeruleoalba*) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

Example case: M485/16 – striped dolphin (*Stenella coeruleoalba*)

This juvenile male striped dolphin was found dead stranded at Triagh Mhor Isles of Lewis. It was in moderate body condition but did not show signs of recent feeding and the stomach and entire gastro-intestinal tract were largely empty apart from some scant faeces, nematodes and ingested water. The lungs and upper respiratory tract contained fluid and sand, respectively consistent with live stranding. Of most significance were notably dilated cerebral ventricles containing an excess of pink, turbid cerebral spinal fluid (CSF), the choroid plexus also appeared inflamed. *Brucella ceti* was isolated in pure culture from both CSF and from the parasitic cyst abscess from around the reproductive tract. This latter isolation may have been a source of infection. Histology showed a very severe, sub-acute to chronic, generalised lymphocytic meningitis and ventriculitis. This pathology was consistent with a meningoencephalitis due to B. *ceti* infection. This is a common cause of death for this species.

Figure 20: Brain from M485/16 striped dolphin (Stenella coeruleoalba) showing ventricular dilation and excess CSF, typical of meningoencephalitis due to neurobrucellosis.

5.5.3 White-beaked dolphin *(Lagenorhynchus albirostris)*

There were 43 reports of 44 white-beaked dolphins accounting for 5.3% of the cetaceans reported. This was the fifth most commonly reported species during this reporting period and has seen a 14% increase in numbers compared to the previous period. The species prefers the temperate and sub-arctic waters of the North Atlantic. In the Hebrides, they are usually seen in open waters further from the coast though they have been seen in the Minch as well. They also occur in the waters around Shetland and Orkney.

Characteristics:

- Feed on a wide range of prey items from sand eels and herring to larger bottom-dwelling fish including cod, whiting and haddock. They are also known to eat molluscs, squid, octopus and some crustaceans
- Calves are born between May and September
- Most strandings occur predominantly in the second half of the year (July – December)
- The most commonly observed cause of death is live stranding

A total of ten animals were necropsied (22.7%), 11 animals were sampled (25%), and the remaining 23 animals (52.2%) were either refloated or too inaccessible or

decomposed for further examination. Sex was determined in 25 animals (56.8%), with eight female and 17 male individuals.

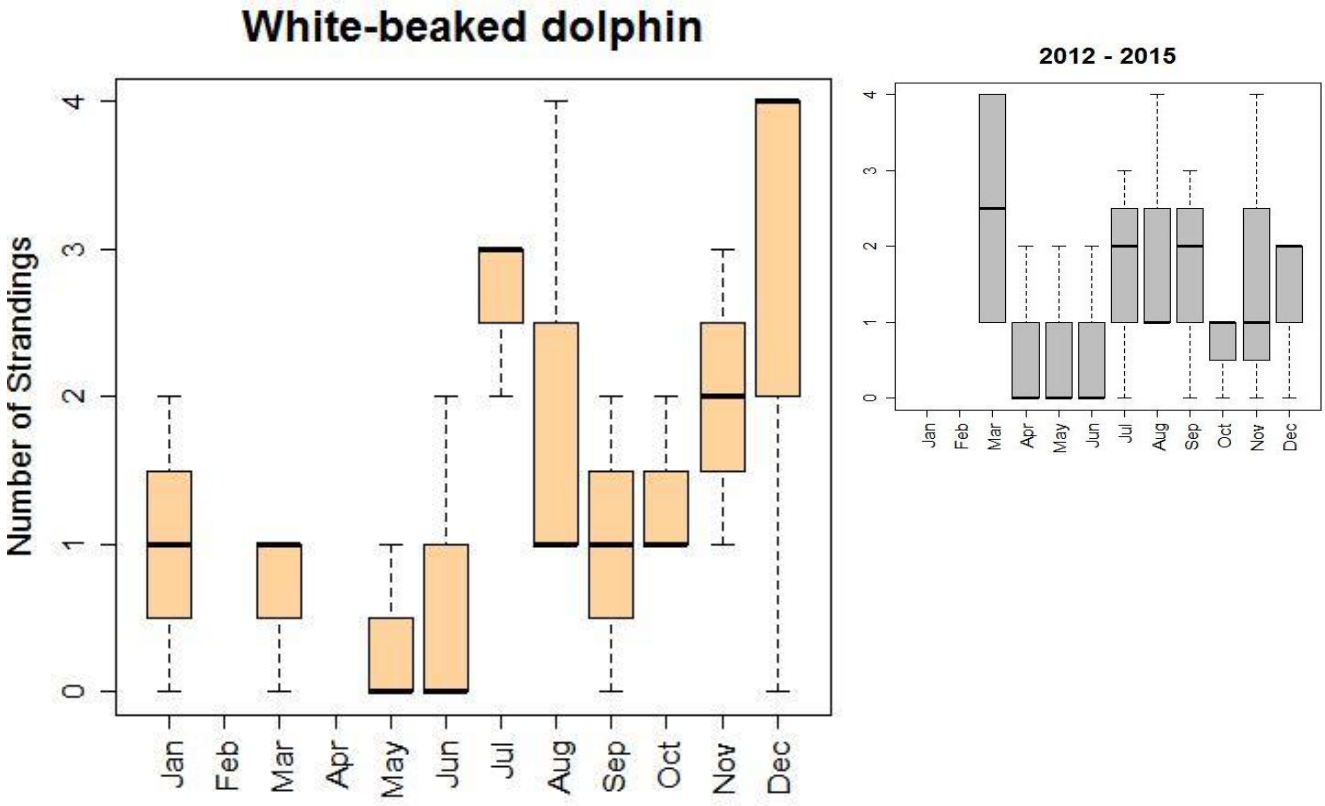


Figure 21: Boxplot of monthly variation in numbers of white-beaked dolphin (*Lagenorhynchus albirostris*) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

Example case: M267/16 – White beaked dolphin (*Lagenorhynchus albirostris*)

This aged adult male white-beaked dolphin was found dead stranded on Dunnet bay. The animal was in good condition with good muscle mass. There were several "tattoo" like lesion around the left eye. The animal had numerous missing teeth and those that were present were extremely worn. There were areas of hyper pigmented skin on both pectoral fins and tail flukes. All this would suggest quite an aged animal. The animal had mature and active testes, with sperm present in the epididymis. Both the cardiac and fundic stomachs were distended and full of fish bones and otiliths possibly to the point of impaction. No digesta was present in the pyloric stomach, duodenum or proximal SI. The enteric vasculature appeared distended. The lungs were asymmetric with the right lung hyper inflated, both trachea and bronchi contained stable foam, suggesting live stranding and agonal water aspiration. The brain had slightly dilated cerebral vessels and dry meninges. There was a normal amount of CSF and the cerebral ventricles were not dilated. The bacteriology did not

reveal any significant isolates, though a group C *Streptococci* sp. isolated in pure growth from a pharyngeal lymph node. Histology showed a severe, sub-acute to chronic-active, focally extensive and multi-focal, primarily lymphocytic meningitis and necro-suppurative thrombotic vasculitis. The lesions in the brain would have severely compromised this animal and probably led to the live-stranding.

Figure 22: M267/16 white-beaked dolphin (*Lagenorhynchus albirostris*) from Dunnet Bay

5.5.4 Atlantic white-sided dolphin *(Lagenorhynchus acutus)*

This species accounted for 1% (n=9) of the cetaceans reported. This was the ninth most commonly reported species during this reporting period with a drop in numbers by nearly 18% when compared to the previous reporting period. This species is highly gregarious; groups of tens to hundreds are regularly seen on the Atlantic side and super pods of over a thousand individuals are often seen offshore. The species tend to prefer the continental shelf, so are more often seen to the west of the Hebrides and North and west of Shetland and Orkney.

Characteristics:

- Feed on a wide range of prey items including cod, whiting, blue whiting, hake, herring and mackerel
- Calves are born in the summer months with apparent peaks in June and July
- Most strandings occur between May and August
- There is no obvious common cause of death in this species during this reporting period

Three animals were necropsied (33.3%), two animals were sampled (22.2%), and the remaining four animals (44.4%) were either successfully re floated (2 animals) or too inaccessible or too decomposed for further examination. Sex was determined in seven animals (66.6%), with two female and five male individuals.

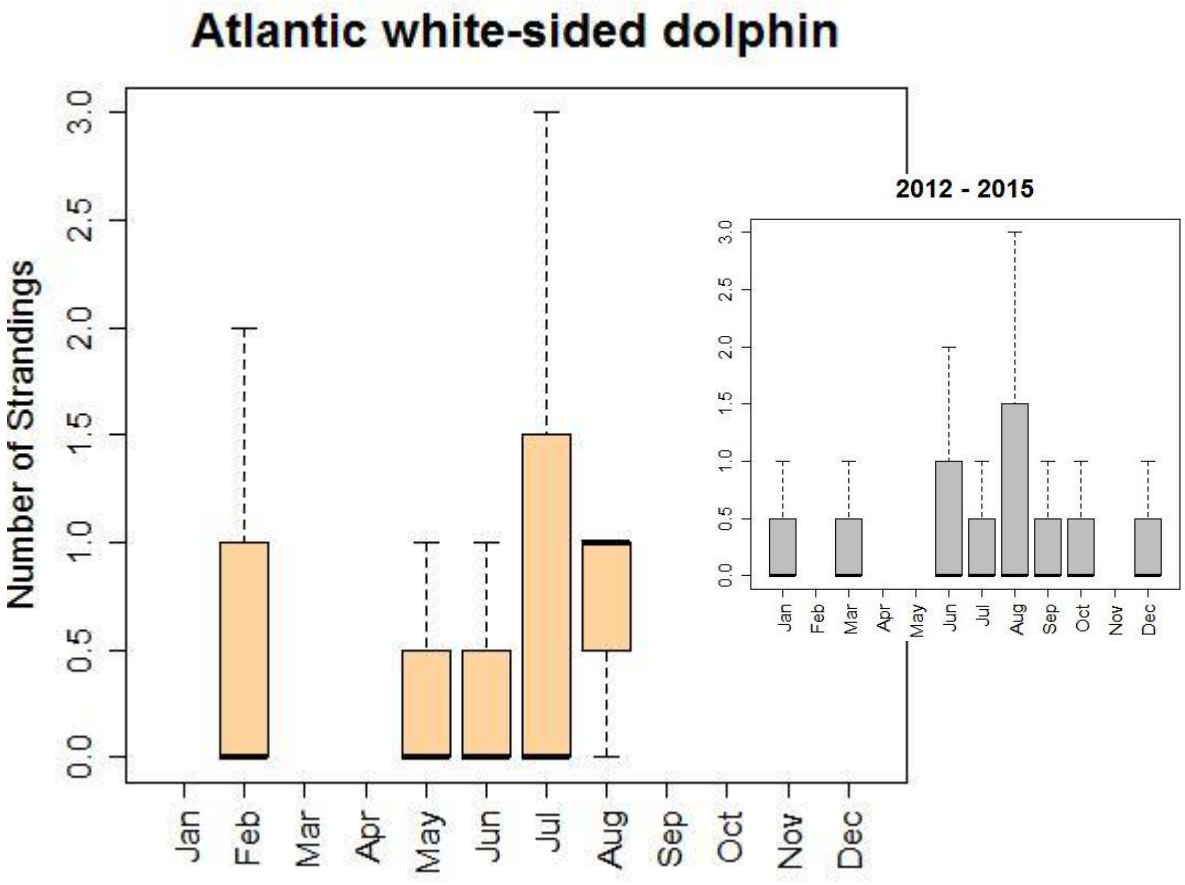


Figure 23: Boxplot of monthly variation in numbers of white-sided dolphin (*Lagenorhynchus acutus*) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

Example case: M129/18 – Atlantic white-sided dolphin (*Lagenorhynchus acutus*)

This adult female Atlantic white-sided dolphin was found dead stranded on Hoy, Orkney. It was chilled and transported to Inverness for examination. It was in moderate nutritional condition with no evidence of recent successful feeding. Gross examination of the liver did not indicate any acute blubber catabolism. The animal was pregnant, unusually in the right uterine horn, with a mid-term foetus which appeared to have been viable up to maternal death. Other visceral organs were unremarkable, the lungs indicating possible agonal water aspiration and terminal live

stranding, although there was no indication of any prolonged time spent alive on the beach. The brain exhibited pathology classically associated with neurobrucellosis; increased volume of CSF, dilated ventricles and hyperaemic choroid plexus. Bacteriology revealed pure growths of *Brucella ceti* from the CSF taken from the ventricles and the atlanto-occipital joint, the same organism was found in all sites of the spinal cord cultured. Histopathological analysis confirmed a severe, sub-acute to chronic, locally extensive to generalised, lymphocytic meningitis consistent with neuro-brucellosis.

Figure 24: M129/18 Atlantic white-sided dolphin (*Lagenorhynchus acutus*) from Hoy, Orkney.

5.5.5 Risso's dolphin *(Grampus griseus)*

This species accounted for 2.6% (n=22) of the cetaceans reported. This was the sixth most commonly reported species during this reporting period; this is a 36.4% increase on the previous reporting period. Most of the sightings of this species are from waters surrounding the Western Isles, though there are also sightings from around Shetland and Orkney. The population in Scotland represents the northern limit for this species.

Characteristics:

- Feed mainly on octopus, squid and cuttlefish, though occasionally fish maybe taken
- Calving occurs in the summer months
- There does not appear to be any clear seasonality in their strandings

- There is no obvious common cause of death in this species during this reporting period

Five animals were necropsied (22.7%), eight were sampled (36.3%), and the remaining nine animals (40.9%) were either too inaccessible or too decomposed for further examination. Sex was determined in 15 animals (68.1%), with six female and nine male individuals.

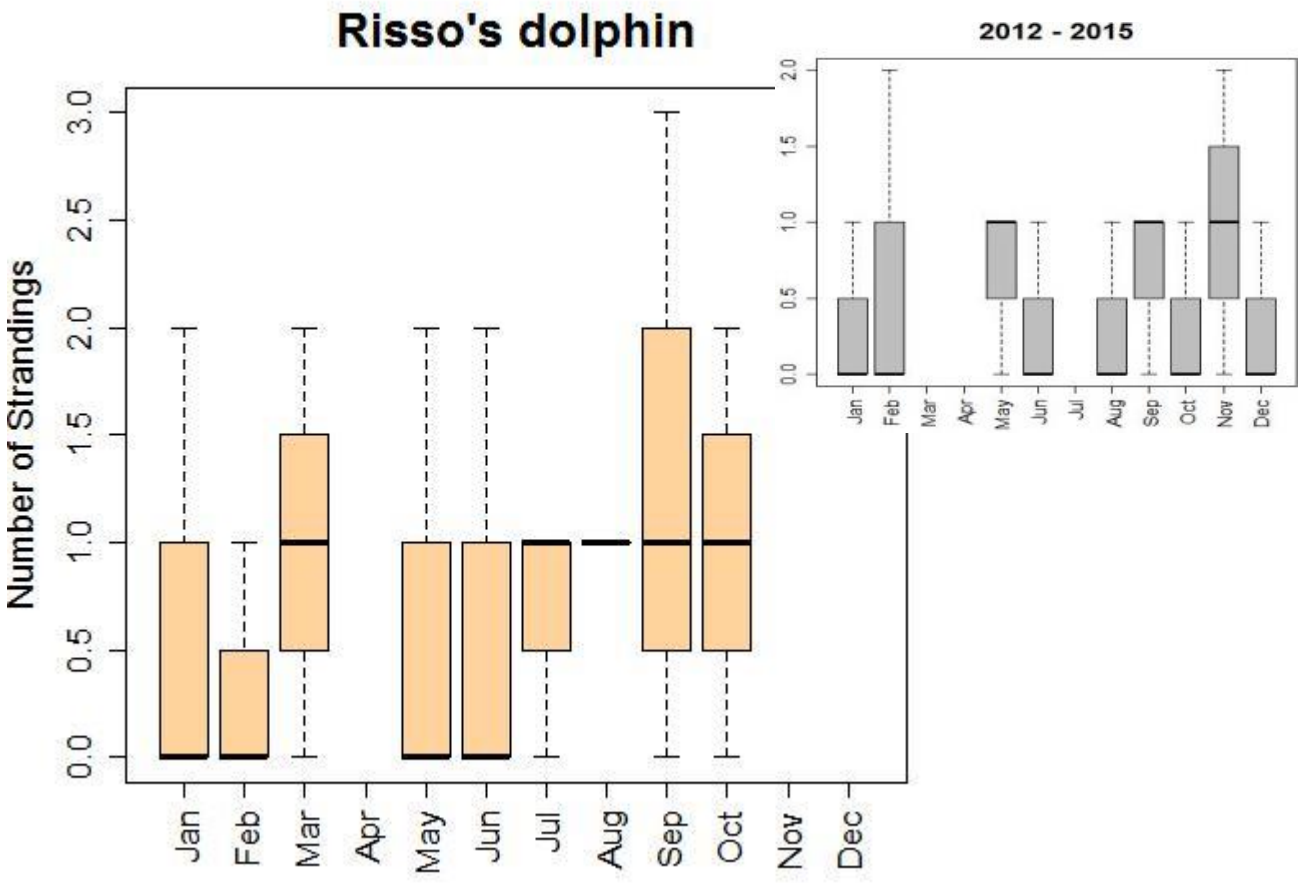


Figure 25: Boxplot of monthly variation in numbers of Risso's dolphin (Grampus griseus) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

Example case: M459/17 Risso's dolphin (*Grampus griseus*)

This juvenile male Risso's dolphin was found live stranded by the causeway between Benbecula and South Uist. It was euthanased by a local vet with 100ml IM Pentobarbitone. It was in very poor nutritional condition and showed clear evidence of a recent and reasonably prolonged live stranding. There was no evidence of recent feeding with only scant squid beaks and seaweed fragments present in the cardiac stomach section. Of most interest in the visceral organs was a generalised

and significant lymphadenopathy especially in the cranial and pulmonary nodes. With the exception of a single *Stenurus* minor nematode found in the cochlea there were no other parasites noted in any systems. The brain was slightly congested and there was an excess of clear CSF, but no classic neurobrucellosis lesions were evident. Bacteriology revealed a mixed growth of *Vibrio alginolyticus* and *Photobacterium damselae*, histology showed a mild, sub-acute, multifocal, mixed, predominantly suppurative, broncho-pneumonia. Severe, sub-acute, generalised, reactive lymphadenopathy. Severe, sub-acute to chronic-active, locally extensive, predominantly granulomatous, enteritis. Further investigation of the intestine sample from this case by Ziehl Neelsen (ZN) staining showed an exceptionally large number of ZN positive coccobacilli within the cytoplasm of the activated macrophages within the lamina propria. These same organisms were demonstrated in a ZN stained smear of the faeces from this animal. This suggests a Mycobacteria infection and would have certainly contributed to the animal's demise. There have been very few reports of Mycobacterial infections in cetaceans. Those that have been reported are usually cases of dermatitis and panniculitis due to either *M. marinum* or *M.chelonae.* The mycobacterium species in this case will be sequenced as mycobacterial infections in the gastrointestinal tract of cetaceans is a novel and potentially significant finding.

Figure 26: M459/17 Risso's dolphin (Grampus griseus) was found live stranded by the causeway between Benbecula and South Uist.

5.5.6 Killer whale *(Orcinus orca)*

This species accounted for 0.8% (n=7) of the cetaceans reported, this is a 57.2% increase on the previous reporting period. This species is the most widespread of any cetacean. The group around the Western Isles (7 or less individuals) previously referred to as Type 2 or the 'West Coast Community' are genetically and morphologically distinct from killer whales found elsewhere in the British Isles. These northern North Sea and the Northern Isles populations are themselves genetically

differentiated although they occupy similar ecological spreads. Both northern populations comprise individuals that feed on fish or fish and seals.

Characteristics:

- Feeds on fish and or marine mammals depending on ecotype/form
- Calving occurs in Autumn and winter (though not recently recorded)
- Strand all year round but with a peak in the winter months
- There is no common cause of death in this species

Three animals were necropsied (42.8%), three were sampled (42.8%), and the remaining animal was too inaccessible or too decomposed for and inaccessible further examination. Sex was determined in three animals (42.8%), with two female and one male individuals.

Example case: M6/12 "Lulu" Killer whale (*Orcinus orca*)

This adult female killer whale was found dead stranded on the rocky foreshore of Tiree. It was approximately four days post stranding before it was possible for us to necropsy and as a result most of the internal organs were in a moderate to severe state of autolysis. The animal was in moderate body condition; however the tissues indicating moderate dehydration. Back muscle mass was good. There was evidence of reasonably chronic entanglement, characterised by an encircling lesion over the tailstock and twin linear abrasions on the ventral surface of the tailstock consistent with entanglement with 10-15mm rope, e.g. a creel (crab pot) line. The epidermis around the tailstock was thickened on the left side with irregular structure to the skin in cross section and there appeared to be areas of pressure necrosis over the tailstock, although interpretation of this is hampered by subsequent autolysis. There were areas of abrasion possibly due to entanglement on leading edge of pectoral fins at junction with axilla; however the possibility that these are post-mortem trauma cannot be wholly excluded. Visceral organs were autolysed beyond the state of useful interpretation but there was no gross evidence of a significant co-existing disease process. The liver was congested and the lungs were symmetrical and also congested, although no clear indication of water aspiration could be detected. The stomach contained an excess of fluid, most likely sea water. No other contents were seen, no food, otiliths or other ingesta. The intestines were also largely empty with scant faeces in the rectum. A small area of the tailstock appeared to show bruising, however it is interesting there was no clear indication of other subcuticular bruising or haemorrhage which would support ante mortem rope trauma. Nonetheless the chronicity of the epidermal lesions on the tailstock and the fluid in the stomach strongly supported a diagnosis of entanglement. Histology revealed a moderate,

sub-acute, multifocal suppurative dermatitis. These findings are suggestive of a localised bacterial infection and would not be inconsistent with a relatively recent rope entanglement with subsequent dermal abrasion. It is possible this animal suffered a two-stage entanglement, with a chronic, but non-fatal original entanglement responsible for the chronic tailstock lesions followed several days later by a terminal event which resulted in the ingestion of significant volumes of seawater. Analysis of the teeth would suggest that the animal was at least 20 years old and examination of the ovaries suggests that she's never been pregnant. Additionally, genotyping of Lulu using microsatellites showed she was homozygote for the seven markers used so far. This is unprecedented in any other killer whale population, and suggests this individual was highly inbred. Toxicological analysis for PCB's on the blubber, conducted by CEFAS according to standardised protocols, showed this animal to have a level of 957 ppm lipid weight of sum 25 congeners. This the highest ever level found in this species in the Eastern Atlantic and raises significant questions about the potential viability of this population. We will be undertaking additional work to better understand the potential distribution of contaminants in these apex populations.

Figure 27: M4/16 "Lulu" Killer whale (*Orcinus orca*) stranding, Crossapol, Tiree.

5.6 Beaked whales

This group accounted for 5.1% (n=16) of the cetaceans reported. Figure 35 shows the number of strandings per month by species based on the three year contract period. A summary overview of cases examined at necropsy can be found in table 8.

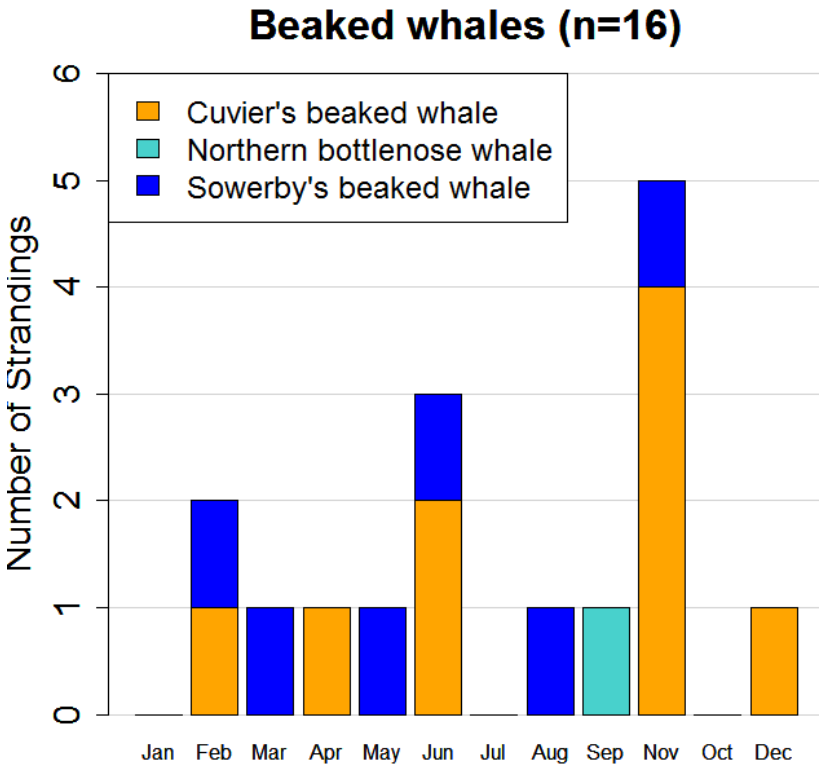


Figure 28: Total number of beaked whale strandings, including both single strandings and mass stranding events, per month stacked for species (April 2015 – March 2018

Table 7: Beaked whale cases sent for necropsy (April 2015 – April 2018)

M Ref	Species (Scientific)	Date Found	Location	Sex	Age Group	Cause of Death category
M187/15	Mesoplodon bidens	22/06/2015	Western Isles	M	Subadult	Infectious Disease: Meningoencephalitis
M407/15	Ziphius cavirostris	03/12/2015	Highland	M	Adult	Other
M565/16	Mesoplodon bidens	13/06/2013	Highland	M	Subadult	Live stranding
M418/17	Hyperoodon ampullatus	22/09/2017	Argyll & Bute	M	Juvenile	Physical Trauma: Entanglement

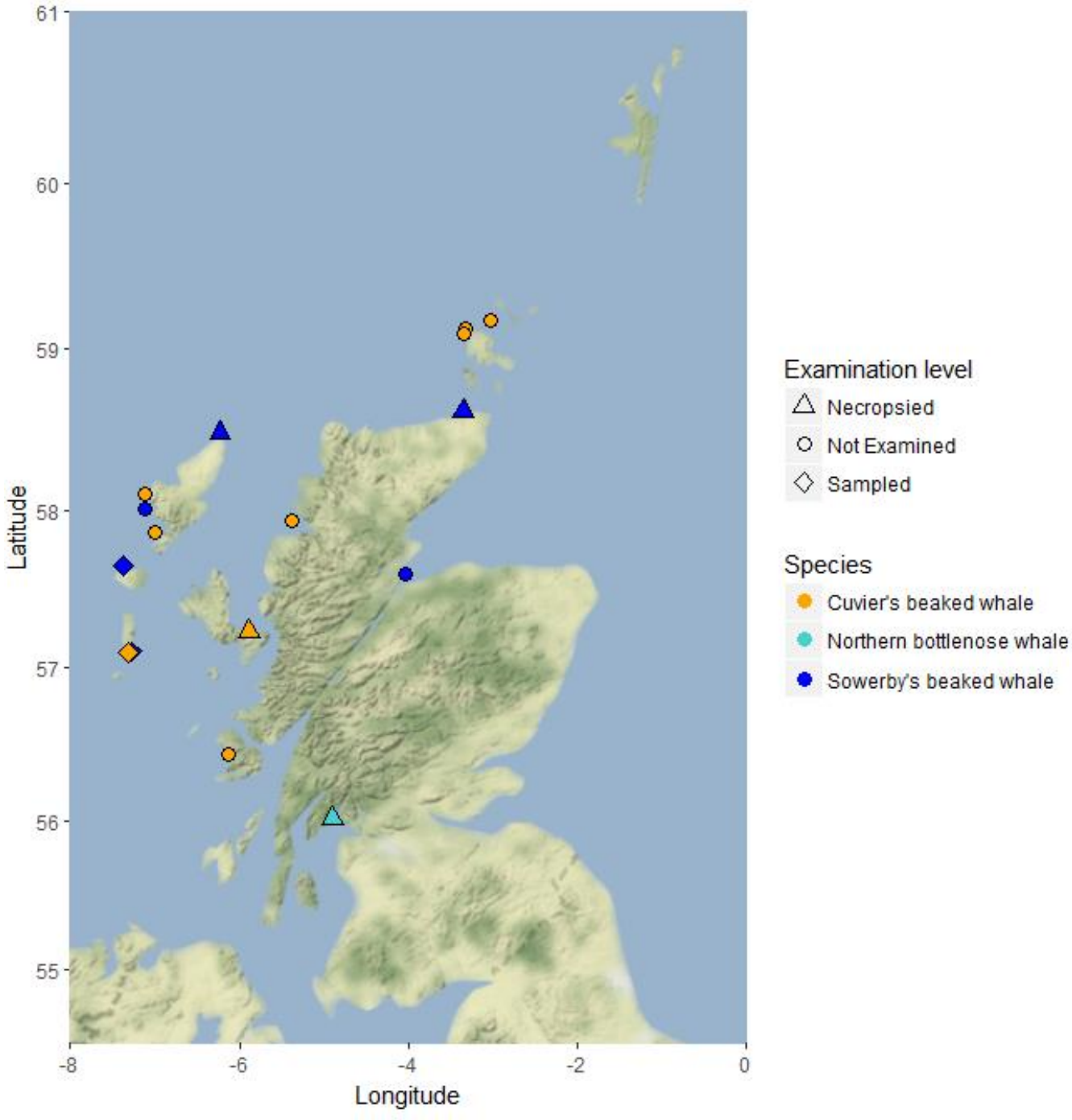


Figure 29: Distribution of beaked whale strandings from March 2015 to April 2018

5.6.1 *Cuvier's beaked whale (Ziphius cavirostris)*

This species accounted for 1.0% (n=9) of the cetaceans reported. This was the ninth most commonly reported species during this reporting period which is a 10% decrease in numbers compared to the previous reporting period.

There have only been two confirmed live sightings of this species in Scotland; once off Orkney and the other off the Western Isles, both in the summer months. They have a preference for deep water greater than 200m.

Characteristics:

- Feed mainly on Squid, although they also consume fish and crustaceans
- Calving period is not known
- Most often strand during the winter months (November and February)
- There was no common cause of death in this species for this reporting period.

One animal was sent for necropsy (11.1%), one animal was sampled (11.1%), and the remaining seven (77.7%) were too decomposed for further examination. Sex was determined in two animals (22.2%) both males.

Example case: M407/15 – Cuvier's beaked whale (*Ziphius cavirostris*)

This adult male Cuvier's beaked whale was found live stranded in shallow water off Harrapool, near Broadford, Skye. It was euthanased by high-velocity rifle. The animal was partially submerged during the necropsy which made a comprehensive necropsy challenging. The most notable pathology was multiple purulent foci associated with a nematode burden in the renal parenchyma and a severe impaction of plastic debris, mainly bags, was observed in all stomach compartments and significantly through the pyloric sphincter and into the proximal duodenum. This was diphtheritic and showed significant associated mucosal pressure necrosis. The gastric mucosa was generally irritated and inflamed. The brain showed dilated ventricles and contained a notable volume of CSF which was slightly turbid. The choroid plexus were pronounced. Cultures from the kidney lesion produced a profuse growth of *Clostridium sordellii* and a few *E. coli*. The significance of the Clostridium isolate is uncertain. The cultures from the remaining tissues were unremarkable. Histopathology revealed a severe, sub-acute, generalised gastritis/enteritis and a severe, chronic-active, focally extensive necro-suppurative nephritis.

There were many disease processes occurring in the animal, however the primary cause of death was ingestion and subsequent impaction from the 4kg of plastic litter found in the stomach. It is of significant note however noting that, in the 1786 necropsies undertaken by SMASS since 1992, this is the only case where death was primarily due to ingestion of plastic marine debris.

Figure 30: M407/15 live stranded Cuvier's beaked whale (*Ziphius cavirostris*) image credit © Sam Harrild Nicholson.

Figure 31: Volume of plastic sheeting ingested by, and impacted in the stomach of, M407/15 Cuvier's beaked whale (*Ziphius cavirostris*)

5.7 Sowerby's beaked whale (*Mesoplodon bidens*)

This species accounted for 0.7% (n=6) of the cetaceans reported. This was the eleventh most reported species during this reporting period which is a drop of 25% on the previous reporting period. This species is rarely sighted at sea, but when it is they are usually seen alone or in pairs though very occasionally groups of up to ten are reported. They prefer deep water trenches of greater than 1000m. Rare sightings occur of the North and West coasts of Scotland.

Characteristics:

- Feed on squid and small fish
- Calving period is not known; but from SMASS data two cow calf pairs with the calves close to the birth length stranding alive in September suggest a late summer early autumn calving period
- There was no seasonality to the strandings in this reporting period.
- There was no common cause of death in this species for this reporting period.

Two individuals were sent for necropsy (33.3%), a further two animals were sampled (33.3%) the remaining two (33.3%) were either taken by the tide or too decomposed for further examination. Sex was determined for four cases with four animals (66.6%) two female and two male individuals.

Example case: M187/15 – Sowerby's beaked whale (*Mesoplodon bidens*)

This sub-adult male Sowerby's beaked whale was found freshly dead, stranded on Port Ness beach, Isle of Lewis on 22nd June. It was necropsied 40 hours later, by which time significant epidermal loss from avian predation had occurred. The animal was in good nutritional condition. The lower left jaw was fractured on the mid horizontal ramus and associated haemorrhage indicated this was ante-mortem. There was however no swelling or remodelling of the tissues observed, indicating this was likely a peri-mortem event (within 24 hours). There was no evidence of recent feeding, however the blubber and muscle condition was good and the liver did not indicate prolonged anorexia. The visceral organs were very congested, including the lungs. The brain had extremely dilated ventricles which contained in excess of 150 ml of turbid cerebral spinal fluid (CSF). *Brucella ceti* was isolated from the CSF, ventricles and choroid plexus. Histology revealed a severe, sub-acute to chronic, focally extensive lymphocytic encephalitis and mild meningitis. These findings are consistent with neurobrucellosis reported in other species of cetacean. This is the first case of this condition in this species and genus.

Figure 32: M187/15 Sowerby's beaked whale (*Mesoplodon bidens*) from Port of Ness, Lewis.

5.7.1 *Northern bottlenose whale (Hyperoodon ampullatus)*

This species accounted for 0.1% (n=1) of the cetaceans reported. This was the fourteenth most reported species during this reporting period and numbers dropped by 75% when compared to the previous reporting period. North Atlantic sightings surveys suggested a population of 40,000 in the North Atlantic. Most of the sightings in Scotland have been made along the continental shelf edge with a water depth of 1000m. Most sightings occur between June and August in Scotland. They usually occur in groups of four to ten individuals.

Characteristics:

- Squid is their preferred prey species however their diet is apparently very varied, probably according to area and season, and may include fish (such as herring) and invertebrates (such as prawns and sea cucumbers)
- Calving period is spring to early summer (April to June)
- Strandings are most common between August and October
- There was no common cause of death in this species for this reporting period.

A single juvenile male animal was reported and subjected to necropsy during this period.

Example case: M418/17 – northern bottlenose whale (*Hyperodon ampullatus*)

This sub-adult male northern bottlenose whale was found dead stranded on the shore at Loch Long in a moderate state of decomposition. Logistical constraints meant that examination was delayed for three days, and as a result most of the visceral organs were in a moderate to severe state of autolysis. The animal was in moderate – good body condition with good blubber thickness and muscle mass. There was evidence of recent feeding with a large amount of squid beaks in the stomach and the intestines were filled. The tailstock exhibited significant damage characterised by an encircling lesion over the dorsal edge of the tailstock and several linear abrasions on the ventral surface of the fluke, with a width of approx. 10-15mm. This finding is consistent with entanglement in free lines of rope. There was a substantial amount of fluid present in both the cardiac and fundic stomach, most likely sea water. These findings are consistent with a diagnosis of an acute entanglement, which, based on lesion morphology, was most probably in creel lines. We believe this to be the first case of entanglement in this of any other species of beaked whale.

Figure 33: M418/17 northern bottlenose whale (*Hyperoodon ampullatus)* field necropsy Loch Long, Argyll and Bute.

5.8 Mysticetes

This group accounted for 6.5% (n=54) of the cetacean species reported during the period which is a 43% increase on the previous reporting period. The majority of these animals were minke whales.

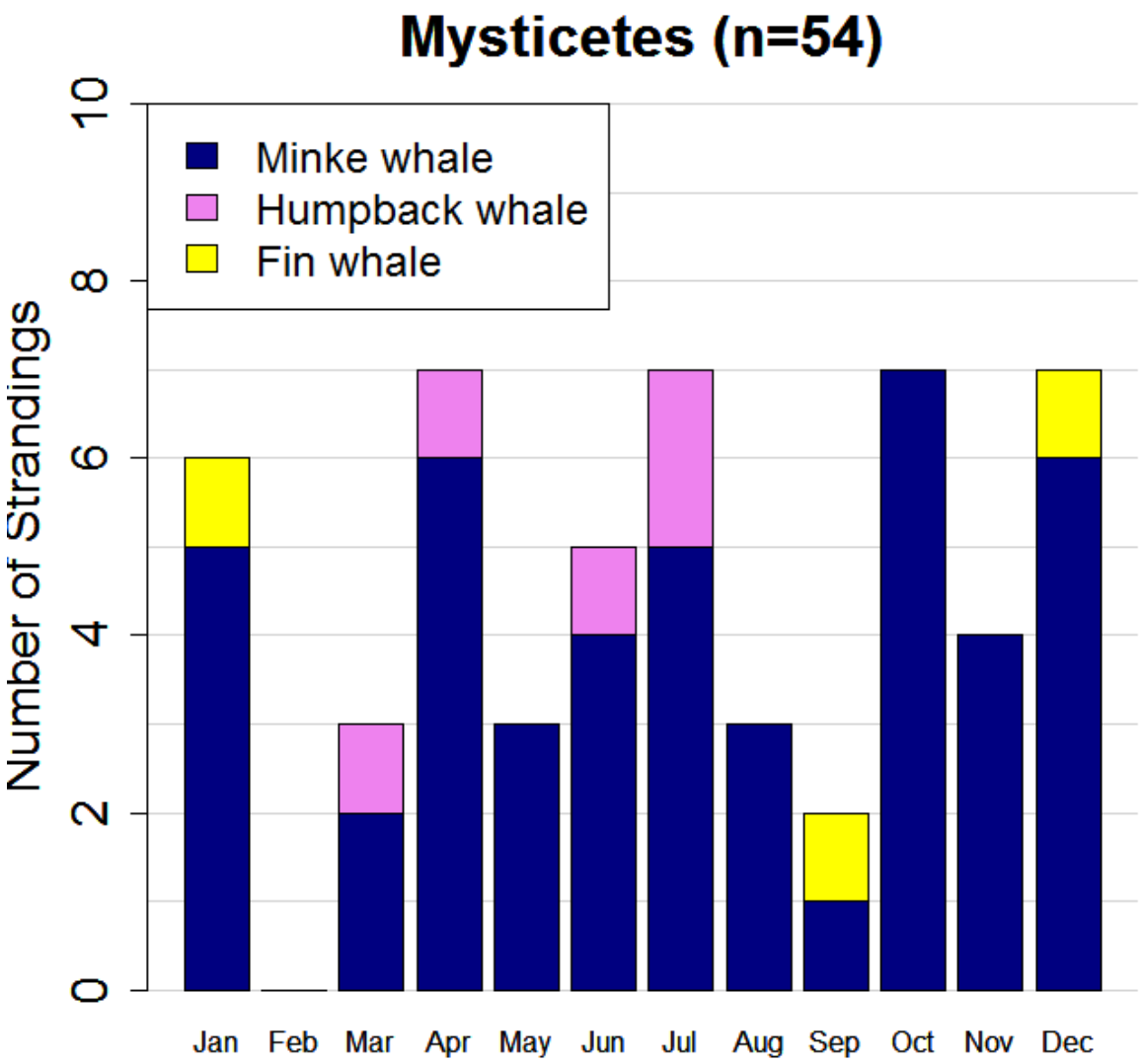


Figure 34: Number of Mysticete strandings per month by species from April 2015 – March 2018

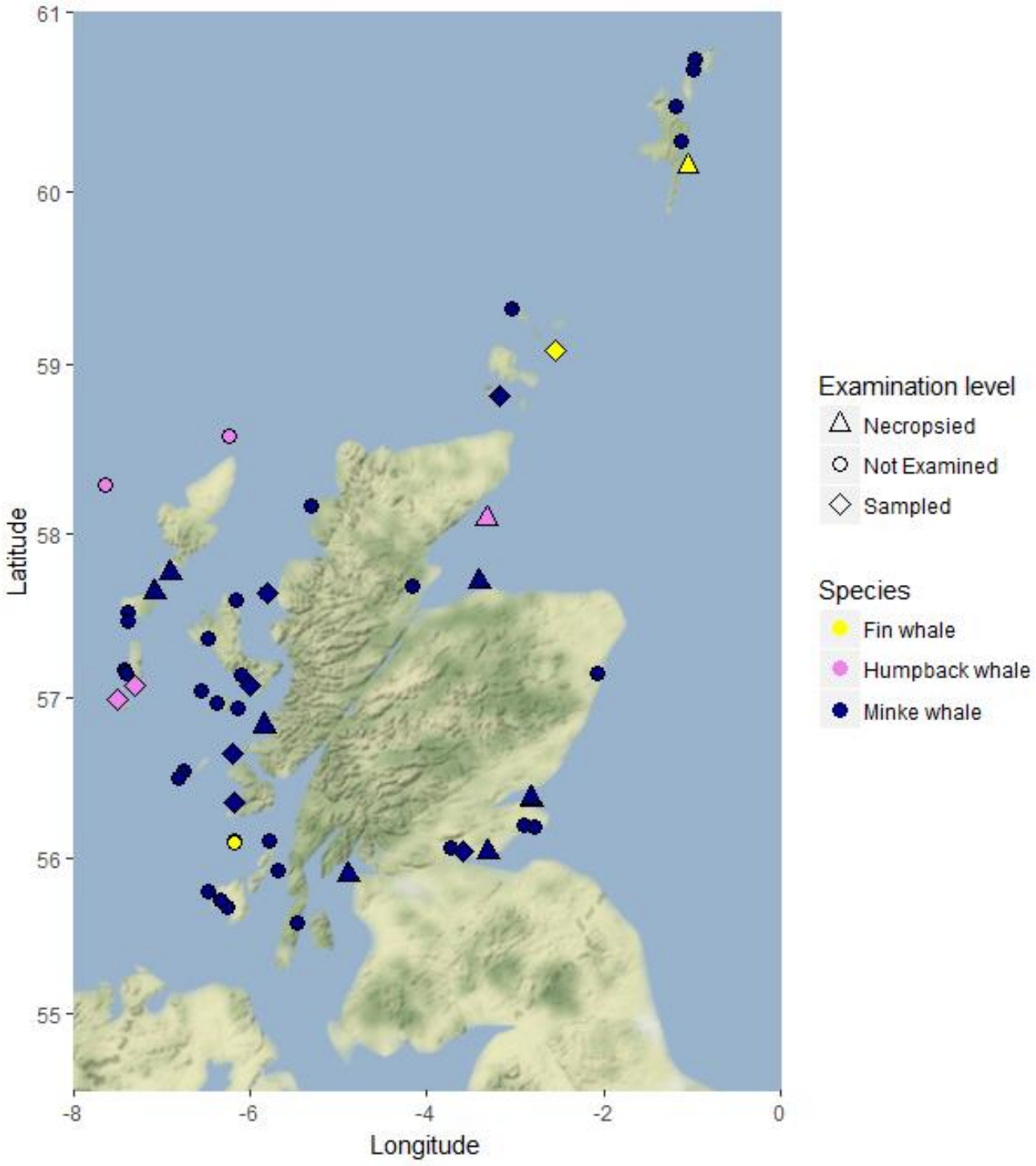


Figure 35: Distribution of Mysticete strandings from April 2015 to March 2018

Table 8: Mysticetes examined at necropsy (April 2015 – March 2018)

M ref	Species common	Date Found	Local Authority	Sex	Findings
M400/16	Fin whale	14/09/2016	Shetland	M	Live Stranding
M163/15	Humpback whale	04/06/2015	Highland	F	Physical Trauma: Entanglement (known)
M180/15	Minke whale	16/06/2015	Western Isles	M	Physical Trauma: Entanglement (known)
M285/15	Minke whale	26/08/2015	Highland	F	Physical Trauma: Entanglement
M319/15	Minke whale	10/10/2015	Moray	M	Gastritis and/or Enteritis
M396/15	Minke whale	27/11/2015	Inverclyde	F	Physical Trauma: Entanglement
M251/16	Minke whale	01/06/2016	Fife	M	Physical Trauma: Entanglement
M166/17	Minke whale	02/04/2017	Western Isles	F	Infectious Disease: Other
M200/17	Minke whale	05/05/2017	Fife	F	Meningoencephalitis
M447/17	Minke whale	09/10/2017	Fife	F	Gastritis and/or Enteritis

5.8.1 Minke whale *(Balaenoptera acutorostrata)*

This species accounted for 5.5% (n=46) of the cetaceans reported. This was the fourth most commonly reported species during this reporting period and the most commonly reported mysticete. There has seen a 42% increase in numbers compared to the previous reporting period. This species is widespread around the northern and western UK. They tend to inhabit the continental shelf in waters of around 200m or less in depth but can also be seen close to shore where the sometimes enter estuaries, bays or inlets. They are present all year round but most sightings are between May and September.

Characteristics:

- Feed on a variety of fish including; herring, cod, mackerel, haddock and sand eel
- Calving period is during the Winter
- There was no seasonality to the strandings in this reporting period.
- The most commonly observed cause of death is entanglement

Eight animals were sent for necropsy (17.3%), six were sampled (13%), and the remaining 32 animals (69.5%) were not examined either due travel difficulties or they

were at sea or too decomposed. However two of these animals were either reported as entangled or had entanglement lesions present. Sex was determined in 22 animals (47.8%) with 15 female and seven male individuals.

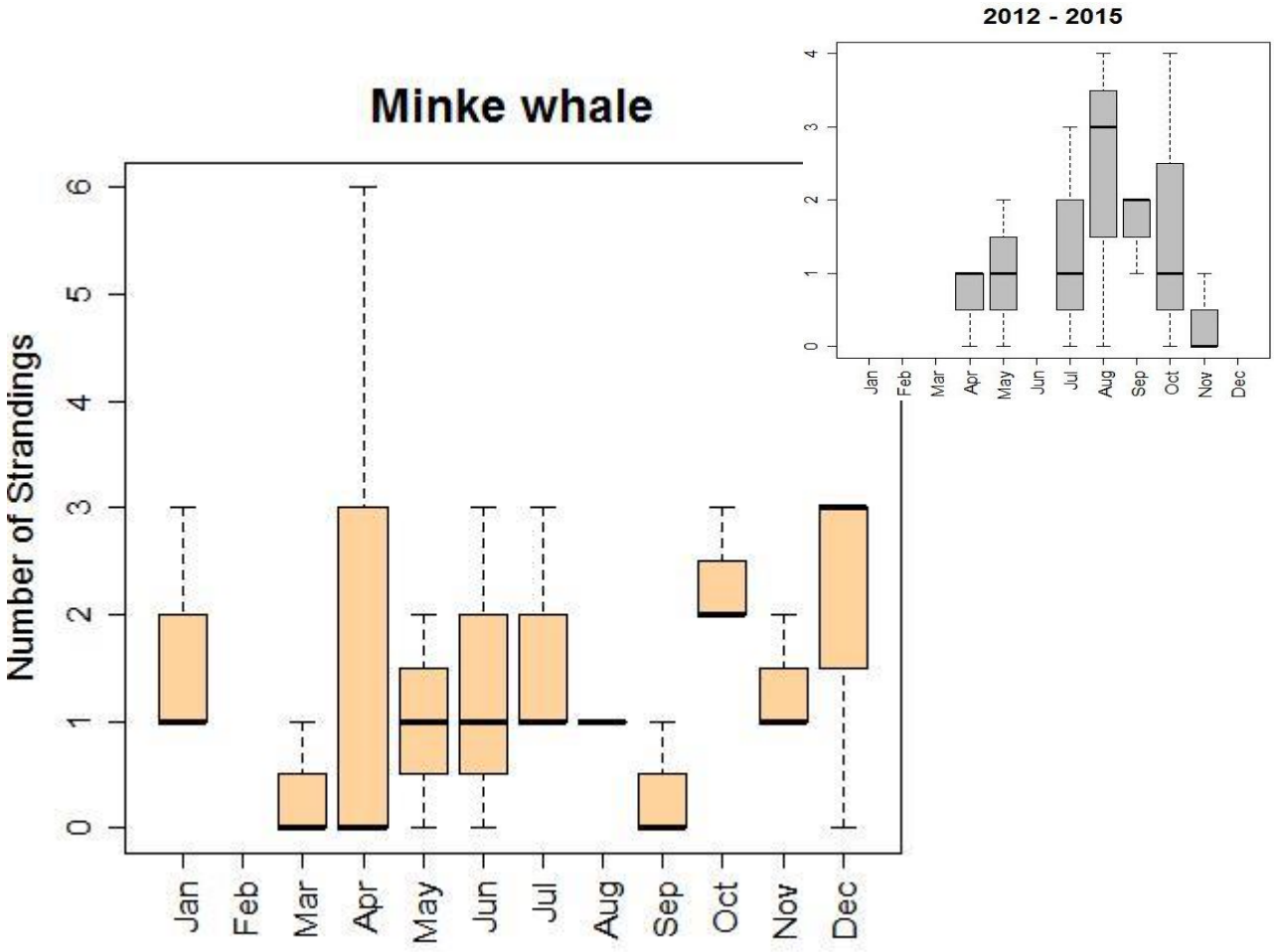


Figure 36: Boxplot of monthly variation in numbers of Minke whales (*Balaenoptera acutorostrata*) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

Example case M251/16 – Minke whale (*Balaenoptera acutorostrata*)

This sub-adult male minke whale was found dead stranded on West Sands beach, St. Andrews on 01/06/2016. It was in good body condition, with adequate blubber reserves and the carcase was fresh. It was necropsied on site and showed linear abrasions on the fluke, and tailstock. There was linear bruising over the thorax. The thoracic cavity was filled with fluid and both lungs were congested and fluid filled, with no asymmetry. The animal was moderately autolysed but appeared otherwise in good condition with recent fish digesta and bones in the cardiac stomach. Bacteriological cultures of lung, liver and spleen did not reveal any significant isolates. These findings are consistent with entanglement and subsequent drowning.

Based on data from the UK CSIP database, entanglement is the most common cause of death for this species.

Figure 37: M251/16 minke whale (*Balaenoptera acutorostrata*) St. Andrews.

5.8.2 Fin Whale *(Balaenoptera physalus)*

This species accounted for 0.3% (n=3 of the cetaceans reported. This is a 66.6 % increase on the previous reporting period. This species generally inhabits the waters beyond the 500m depth contour. When it is seen over the continental shelf it tends to be near the shelf edge in Northern Scotland. They usually occur between June and December. Sighting surveys suggest a population in the North Atlantic of around 47,000.

Characteristics:

- Feeds mainly on planktonic cructacea, Euphausids (Krill) and copepods but also fish such as Mackerel, herring and sand eel
- Calving occurs in midwinter (not occurring in Scotland)
- There was no seasonality to the strandings in this reporting period.
- Live stranding is the most common cause of death (single case)

A single animal was sent for necropsy (33.3%), one was sampled (33.3%), and the remaining animal (33.3%) was too decomposed for examination. Sex was determined in all 3 animals (100%) with one female and two male individuals.

Example case M400/16 – fin whale (*Balaenoptera physalus*)

This recently weaned male fin whale live stranded on rocks off Noss, Shetland, died overnight and finally made landfall for necropsy on 20/09/16. It was necropsied on site in a remote area with no access to plant machinery, As the animal was partially submerged even at low tide the necropsy was largely done underwater so only a limited sample range could be collected. Of note was a verminous thrombus containing numerous *Crassicauda boopis* in the renal arteries, comprising a plicated semi-ordered soft clot within the artery around the caudal pole of the right kidney *Crassicauda sp*. ova along with *Cestode sp*. ova were also noted in the urine of this animal. There was also a moderate to high *Bolbosoma balaenopterae* burden in the GIT. Histology confirmed a severe, chronic-active, multifocal nematode parasite infestation of the kidney and intestine. This would explain the thin condition of the animal. It is possible this animal was suckling, likely socially dependent and high parasite burden all led to the debilitation, possible group separation and terminal live stranding. No evidence for entanglement was seen.

Figure 38: M400/16 live stranded fin whale (*Balaenoptera physalus)* Noss, Shetland

5.8.3 Humpback whale *(Megaptera novaeangliae)*

This species accounted for 0.6% (n=5) of the cetaceans reported. This is a 60% increase on the previous reporting period. Photo Identification of the North West Atlantic population suggests that there are around 10, 600 individuals. Most sightings in the UK have come from the Northern Isles, but more recently animals have been spotted in the Moray Firth and the Minch as well as the Hebridean Sea. Most sightings occur between May and September.

Characteristics:

- Feed mainly on krill, herring and cod when in British waters.
- Calving occurs in winter (not occurring in Scotland).
- Most strandings occur in spring and summer.
- The most common cause of death is entanglement (single case).

A single animal was sent for necropsy (20%), two were sampled (40%), and the two remaining animals (40%) were both found at sea. Sex was determined in all 3 animals (60%) with one female and two male individuals.

Example case M163/15 – Humpback whale (*Megaptera novaeangliae*)

This sub-adult female humpback whale was seen alive entangled in creel ropes on 04/06/2015. It was found dead floating at sea on 06/06/2015. It was in moderate body condition and moderately fresh at the point of necropsy. There was evidence of chronic entanglement around the pectoral fins, including deep necrotic regions where rope had embedded within the tissue, and an acute entanglement around the tail stock. There was significant skin remodelling around the chronic sites though there was no indication of chronic debilitation, emaciation or infection as a result of the previous entanglement. The visceral tissues were grossly unremarkable apart from the lungs which indicated water aspiration. The cause of death was confirmed as drowning

Figure 39: M163/15 Humpback whale (*Megaptera novaeangliae*), members of SMASS and CSIP being filmed by Big Wave productions for an ITV documentary

5.9 *Kogia sp*.

Pygmy sperm whale (*Kogia breviceps*)

This species accounted for 0.01% (n=1) of the cetaceans reported. There are very few records of sighting of this species in the European waters; those that are there are from the Bay of Biscay and the South Western approaches to the channel, though the species has also been reported in the North sea. This species occurs mainly in deep oceanic waters beyond the continental shelf edge. There are no estimates of abundance for this species.

Characteristics:

- Feeds predominantly on mesopelagic squid and occasionally fish and crustacean
- Calving occurs from March to August
- Strandings occur September to December with a peak in October
- Live stranding is the most common cause of death (single case)

A single animal male was sent for necropsy. See below.

Example case M576/16 – pygmy sperm whale *(Kogia breviceps)*

This juvenile male pygmy sperm whale was found dead stranded on a rocky beach just east of Thurso, Caithness. There was skin loss to the leading edge of the tail flukes and extensive ventral bruising and excoriations. There was sand and gravel in the trachea and stable foam in the trachea and bronchi. The lungs were symmetrical and exhibited congestion, possibly indicative of water aspiration. The liver was also congested. There was no evidence of recent feeding but faecal matter in the smaller distal intestine suggests a period of anorexia prior to stranding. The cerebral vasculature was also congested, but did not show gross indications of sepsis although there was some indication of intracranial haemorrhage, possibly associated with the stranding process. Bacteriology did not reveal any significant isolates. Histopathology showed a moderate to severe, acute, generalised systemic congestion and moderate, acute to sub-acute, generalised indications of hepatic fatty change. This is indicative of a period of insufficient feeding which ultimately led to the animal live stranding. There was no evidence of any other infectious process

Figure 40: M572/16 Pygmy sperm whale (Kogia breviceps) from Thurso.

Section 6: Mass stranding events (MSE's) multiple strandings and unusual mortality events (UME's)

A mass stranding event (MSE) is defined as two or more animals that are not a cow/calf pair.

Cetacean MSE's elicit much interest from both the public and scientific community but the underlying reasons largely remain a mystery. Live stranding events and more specifically mass live stranding events are extreme situations in which public safety, animal welfare and conservation science issues have to be managed with an clear perception of priorities. Thorough investigation of these events usually requires the consideration of a number of natural and anthropogenic factors. The investigations are multidisciplinary and include not only the examination of the animals themselves but also of the environment they inhabit, so, climatic conditions, seismic activity (both natural and man-made), shipping and naval activities and natural predators are all included. Examination of the carcasses themselves is

extensive with gross pathology, bacteriology, virology, histopathology and toxicology all essential in reaching a diagnosis for each individual but also for the group as a whole. Additional assessment of age and sexual maturity and stomach contents is also conducted. Despite all this it is not always possible to establish a cause in all cases. There were eight MSE's during this period. Seven out of the eight cases were of two animals only. No unusual mortality events (UME's) or cow/calf pairs where reported during this period.

6.1 M161/15 – long-finned pilot whales (*Globicephala melas*)

6.1.1 *Stranding overview*

On the evening of 01/06/2015 a number of long finned pilot whales were reported swimming close to shore off Brogaig beach, Skye. Around high tide at 03:00h on 02/06/2015, 21 animals stranded in the bay. One of the animals stranded was observed to be a pregnant female in apparent distress. Medics from BDMLR and members of the public managed to refloat 18 individuals of the initial stranding. Two animals died on Brogaig beach and a female animal was left stranded by the falling tide and was seen to be in respiratory distress. Palpation by local veterinarian indicated a dystocia with a dead calf in utero. Following assessment by the same veterinarian, the animal was euthanised by a marksman on welfare grounds. Eleven of the refloated animals appeared to restrand on the south west side of Staffin Island (NG493688) a short while later (04:30h). This added obvious logistical complications to the rescue. Assistance was provided by local wildlife tour operators and crew from Marine Scotland's vessel 'Hirta' who provided vessel support to transport BDMLR medics and volunteers onto Staffin island to provide first aid to the stranded animals. SMASS arrived on site around 12.30h. By this time there were 11 animals on Staffin Island, nine of them still alive. Two juvenile animals were dead, apparently crushed by a larger animal during the stranding process. Of the nine live animals, one was in the water being held upright by BDMLR medics and eight were fully stranded on the kelp covered rocky foreshore. Detail flowchart is given in Figure 41 The tidal range on that day was 4.1m with most animals stranded at the top of the tide cycle. SMASS assessed the health of the remaining stranded animals and the decision was made to euthanase two animals on welfare grounds. This was due to significant evidence of distress, symptoms include prolonged elevated respiratory rate, vomiting or severe muscular spasms and hence a very poor prognosis of survival. Euthanasia was carried out by a trained marksman under direction from SMASS consisted of a single lateral shot through the cranial cortex. Death appeared to be immediate. The remaining six animals were successfully refloated from the rocks by BDMLR on the rising tide around 18:00h that evening. A single adult animal was tagged through the

dorsal fin with a *Sirtrack*™ satellite tag, this was unfortunately dislodged by the animal rolling over a skerry as the animal regained balance during the refloat.

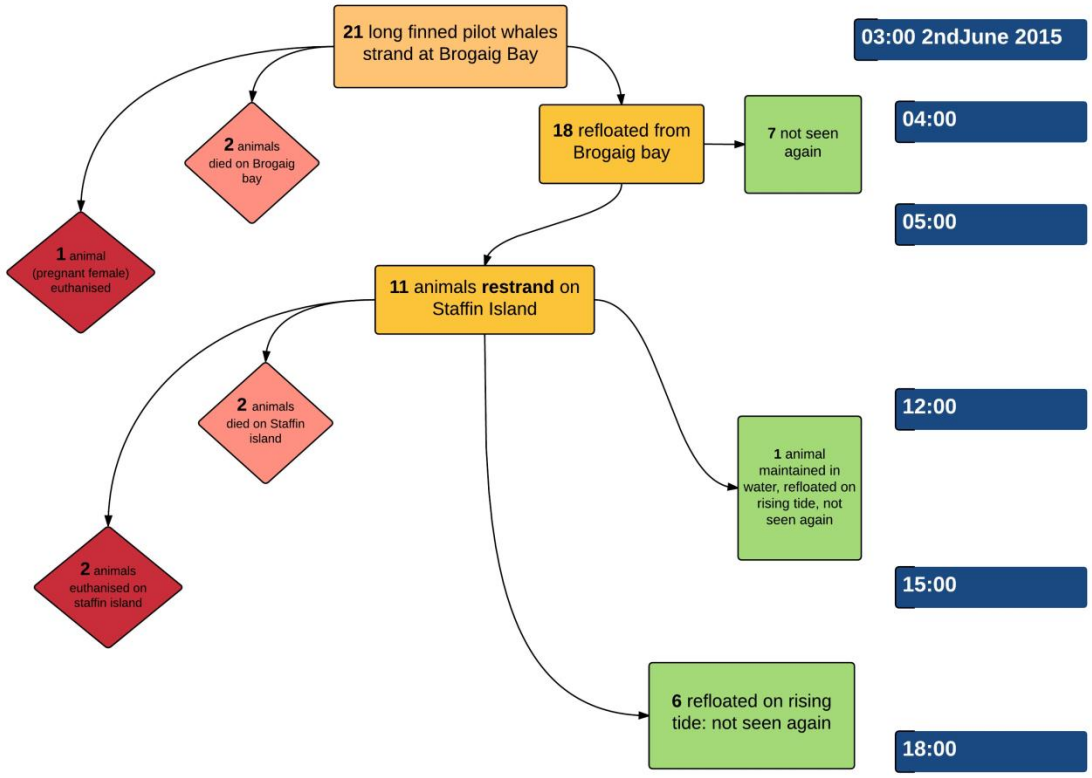


Figure 41: Flowchart showing events during Staffin MSE

Figure 42: Initial mass stranding location Brogaig Beach, Staffin (photo Steph Waterston BDMLR)

Figure 43: Primary necropsy site Garafad, Staffin

6.1.2 *Summary*

Subsequent teeth aging of the stranded animals indicated the pregnant female (M161.6/15) was 19-20 years old. Sexual maturity in females of this species is around 8 so it is unlikely this was her first calf. Nonetheless, in the absence of evidence for other significant factors, it is plausible that this animal was having difficulty giving birth and this dystocia was a trigger for the stranding event. This is supported the behavioural observations from members of the public made prior to the stranding, of an animal in apparent distress being circled by other members of the pod. A specific report on this mass stranding event can be found in the annual report for 2015 here:

http://www.strandings.org/smass/publications/reports/SMASS_Annual_Report_2015.pdf

6.2 M242 /15 – long-finned pilot whales (*Globicephala melas*)

On 24/07/2015 a report was received of two dead long-finned pilot whales (*Globicephala melas*) found close together on a beach near to the Longman landfill site Inverness. They had been reported to the SeaWatch foundation on 20/07. SMASS visited the site on 24/07 and found two adult animals, a male and female. Both animals were in a very advanced state of decomposition so necropsies were not undertaken, but accurate measurement and samples of skin and muscle were taken. Earlier in the month (02/07) a single dead female long-finned pilot whale was seen floating approximately half a mile east of the Kessock Bridge in the Moray Firth, eventually coming ashore at Rosemarkie. This animal was also in an advanced state of decomposition so a necropsy wasn't undertaken. On 07/07 another single dead adult male long-finned pilot whale was reported at Nairn on the south coast of the Moray Firth in an advanced state of decomposition. Both of these animals were sampled by SMASS. There had been no reports of pods of long-finned pilot whales in the area prior to or after these strandings. Clearly all the animals had been dead for some time so it was neither possible to tell whether the animals found close to Inverness had live stranded or just washed up together already dead, nor if any of these stranding events are related, however due to the relative unusual nature of this species in this location, this was recorded as a potential UME.

Figure 44: M242.2 /15 long-finned pilot whale (*Globicephala melas*) one of the animals from Inverness.

6.3 M267/15 – short-beaked common dolphins (*Delphinus delphis*)

On 08/08/2015 two short-beaked common dolphins live stranded on mud flats close to Burntisland, Fife. They were attended to by a BDMLR vet and three medics. Both animals were found to be juvenile females. One animal had a superficial wound to the right eye and both were thought to be in good condition and were refloated. Both animals swam of strongly however one did come close to the shore before heading out to deeper water. A single animal was found stranded dead close to the area on 9th August animal was confirmed by BDMLR as one of the live stranded animals. The animal exhibited indications of a second live stranding: notably aspirated beach debris in airways, hypostatic congestion and asymmetry of lungs, ventral bruising and abrasions to flukes and fins. There was also notable intracranial haemorrhage but no subdural bleeding. This could be agonal or indicated a neurological cause to the original stranding. There was no evidence of recent feeding and the parasite burden was low. All the visceral organs were largely unremarkable. Bacteriology did not reveal any significant isolates. Histology showed a mild to moderate, sub-acute, multifocal verminous/ granulomatous broncho-pneumonia. Mild, sub-acute, multifocal verminous lymphadenitis. No of these findings are severe enough to account for the

animals death. However, the morphology of the pneumonia is unusual so we will undertake morbillivirus screening on this animal to rule it out.

Note: this animal had been decapitated by council workers prior to collection.

Figure 45: M267.2/15 the second juvenile female short-beaked common dolphin (*Delphinus delphis*) live stranded at Burntisland, Fife.

6.4 M25/16 – Risso's dolphin (Grampus griseus)

Two female Risso's dolphins were found live stranded on the Beauly Firth on 08/01/2016. By the time rescuers arrived at the scene one animal was already dead. This animal was recovered for necropsy. The second animal, a similar sized female Risso's dolphin pictured below was refloated on the incoming tide after several hours, but turned up dead a month later at Munlochy on the Moray Firth and not in a suitable condition for necropsy. The animal necropsied had evidence for agonal water aspiration and successive strandings based on the bruising to the rib cage and scapula and mud/silt present throughout the entire respiratory system. It was debilitated, likely due to an active peritonitis originating from a large, 12-15 cm in diameter invasive mass containing friable, dry, yellow/green plicated tissue, characteristic of a neoplastic or fungal mass. Similar tissue invasion was seen in the spleen and throughout the liver. The lesions were chronic but could have caused a more acute colic, possibly causing the live stranding. Cultures did not reveal any fungal isolates; however *Brucella ceti* was isolated in mixed culture from the hepatic mass. Histology on the fibrous tissue (hepatic and splenic mass) contained relatively large amounts of acellular tissue which was bi-refingent with polarised light (suggestive of amyloid deposition). Large numbers of macrophages were present

with large amounts of cytoplasm containing yellow/green pigment. Variable numbers of lymphocytes and plasma cells were present, sometimes with haemorrhage and notably very small numbers of neutrophils. This animal had a severe, chronic, bacterial peritonitis with systemic effects. The hepatic mass was a chronic lesion due to *Brucella ceti* which may have caused an acute colic leading to the live stranding of this individual. We believe this to be the first isolation of this organism from this species.

Figure 46: M25.1/16 adult Risso's dolphin (*Grampus griseus*) from the Beauly Firth.

6.5 M31/17 – short-beaked common dolphins (*Delphinus delphis*)

Two common dolphins were seen to live strand on the morning of 13/01/2017 in the Cromarty Firth near Jemimaville. The juvenile died on the beach with the second animal, thought to be an adult female animal refloating on the rising tide. This second animal was subsequently found dead on the other side of the firth at Nigg several days later. A third common dolphin (M37/17) was also recovered dead from this area on 16/01 (see section 5). The juvenile animal was in good body condition and, excepting the pathology associated with live stranding (water aspiration, lung asymmetry), appeared in good body condition with no indication of significant underlying disease process. It had not recently fed, but the stomach contained a significant number of otoliths indicating past successful foraging. Bacteriology did not reveal any significant isolates with most sites cultured proving sterile. The adult

female common dolphin was found dead on Nigg saltmarsh, approximately 10 days after being seen stranding alive with M31.1/17. Given the carcass condition it is likely to have died soon after the original refloat on 13/01. There was evidence of live stranding, with lung hyperinflation and intercostal muscle hypertrophy, suggesting the animal was likely left by a receding tide in this very shallow area. Otoliths indicate past feeding success but not very recently. No evidence for significant infectious processes was found. Histology and bacteriology did not have any significant findings and live stranding remains the most likely cause of death. Due to the fresh nature of the first animal, the ears were extracted and fixed for a collaboration developing techniques to quantify auditory pathology due to sound overexposure.

Note: the role of a underwater munitions disposal explosion carried out on 11/1/17 is unclear in these stranding series (M31.1, M31.2, M37); however the Cromarty firth is not a common place for *Delphinus delphis* and the possibility that this acoustic trigger lead to this group entering the firth and subsequent stranding and/or the animals being acoustically compromised cannot be ruled out.

A data request was made to the Royal Navy regarding the MOD disposal work, and the following details were provided by Rod Jones, on 16th February

- The time and location of the detonation: Detonation took place in position 57 41.708N, 003 29.992W. Time of detonation was 11:10 (18/01/17).

- The depth of the detonation and approx. depth of water at the time: At time of detonation, water depth was 6m. Munition was detonated on the seabed.

- Estimated size of the high order explosion: Exact size of explosive contained is unknown but observations by disposal team estimated that the explosive component was less than 20Kg.

- The environmental mitigation employed during the task: Mitigation was in accordance with MOD instructions (BR5063) which are based on JNCC guidance.

- Marine mammal observations were made 30 minutes prior to, during and after underwater detonation out to 1km. No mammals were sighted.

- No other explosive detonation since 01/12/16

Further clarification was sought regarding anecdotal reports of underwater noise generated by the disposal team prior to the MSE, on the 7th January and the following data was provided:

Clarifications provided by Royal Navy

“On the 7th Jan the original attempts to move the munition failed. Compressed air from a lifting equipment malfunction caused gas to be expelled in the water at regular intervals (most likely through a pressure relief valve lifting). I do not have full times or durations of this malfunction. This would have been audible underwater for those close enough but probably not above water. As part of the preparations for initial disposal on the 7th Jan, 2 x diver recall signals (like thunderflash) were deployed approximately 2 hours apart at around midday. Several seals were spotted during the day but not within 1km in the 30 minutes before each of the recall signals were deployed. On the 18th, no recall signals were deployed and the only detonation would have been the demolition charge and simultaneous high order explosion, circa 20kg NEQ.”

The role of a underwater munitions disposal explosion, carried out on 7th and 18th January 2017, is unclear in these stranding series (M31.1, M31.2, M37); however the Cromarty firth is not a common place for *Delphinus delphis*. Whilst the possibility remains that that the diver recall signals or compressed air may have provided some acoustic stimulus, leading to this group entering the firth and subsequent stranding, the magnitude and duration of underwater noise does not seem excessive compared to usual activity in the Firth. There was some public concern that these stranding events may have been caused by the activity of the naval divers, however, based on the information provided, it does not seem plausible that the stated level of activity could have caused sufficient acoustic compromise to animals in the vicinity to lead to the stranding. Nonetheless, it does highlight the importance of monitoring and mitigating sources of underwater noise in these regions.

Figure 47: M31.1/17 Juvenile common dolphin (*Delphinus delphis*) from the Cromarty Firth.

6.6 M350/17 – white beaked dolphin (*Lagenorhynchus albirostris*)

Two white-beaked dolphins were observed to live strand at St Mary's Holm, Orkney on the 11/08/2017. One animal was refloated by members of the public the second animal died on the beach. The dead animal, a sub adult male, was couriered to Inverness and arrived on the 14/08, hence the animal was reasonably autolysed on arrival. There was evidence for live stranding, but no significant discernible pathology likely to explain the stranding. No recent feeding, moderate body condition, and low gross parasite burden were noted. The liver did not show recent catabolism and there was no jaundice. The heart did not exhibit gross signs of stress and the brain was autolysed but grossly unremarkable. Bacteriology was unrewarding producing either gross mixed flora or *Aeromonas sp*. Histology showed severe, acute, multifocal to locally extensive, suppurative broncho-pneumonia. Severe, chronic-active, focal, suppurative, ulcerative, verminous gastritis. Severe, chronic, generalised eosinophilic mesenteric lymphadenitis. A bacterial pneumonia was the most plausible cause of death in this case.

Figure 48: **M350.1/17 white beaked dolphin (*Lagenorhynchus albirostris*) one of two that stranded on Orkney.**

Section 7: Seal species found stranded in Scotland

Two species of seal live and breed in UK waters: grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*). Other species occasionally occur in UK coastal waters, including ringed seals (*Phoca hispida*), harp seals (*Phoca groenlandica*), bearded seals (*Erignathus barbatus*) and hooded seals (*Cystophora crystata*) all of which are Arctic species. There was also a live Walrus (*Odobendus rosmarus*) recorded on Orkney during this reporting period.

There were 1107 seals dead stranded along the Scottish coastline seals and reported to SMASS during the period of this report. These were the two native species; grey seals (n=659), harbour seals (n=199). Two hundred and forty-nine animals (22.5%) could not be identified to species level.

Of the 41 reported animals, 30 harbour seals and 11 grey seals, were subject to necropsy[1]. Table 9 shows an overview of the causes of death diagnosed, separated by species. A further 14 harbour seals and 23 grey seals were sampled by trained volunteers. Trauma was the most common cause of death with 21 cases (51.2%), the majority being likely- or possible Grey seal attacks (n=10). The category “physical trauma: other” included possible boat strike, foreign body ingestion, and blunt trauma of unknown origin. More details on the seals with corkscrew lesions can be found in section 11 of this report.

[1] These numbers do not include seals reported in under seal management (n=6, five grey seals and one harbour seal

Details of the species stranded are given below, together with a more detailed overview of the individual necropsied cases, and notable single strandings. These are notable for reasons either of species, pathology, or because they highlight a particular issue.

Table 9: Causes of death for harbour seals (*Phoca* vitulina) and grey seals (*Halichoerus grypus*), excluding corkscrew and seal management cases, reported between April 2015 and March 2018 Note 2015 and 2018 are partial years.

	2015	2016	2017	2018	Grand Total
Infectious Disease	**2**	**4**	**3**	**1**	**10**
Generalised Bacterial Infection/Septicaemia			**1**		**1**
Harbour seal			1		1
Grey seal					
Pneumonia: Parasitic	**2**	**4**	**2**	**1**	**9**
Harbour seal	2	4	2	1	9
Grey seal					
Trauma	**11**	**5**	**5**		**21**
Entanglement		**1**			**1**
Harbour seal		1			1
Grey seal					
Physical Trauma: Likely Grey seal attack	**4**	**1**	**2**		**7**
Harbour seal	3	1	2		6
Grey seal	1				1
Physical Trauma: Possible Grey seal attack		**2**	**1**		**3**
Harbour seal					
Grey seal		2	1		3
Physical Trauma: Shot (diagnosed)	**4**				**4**
Harbour seal					
Grey seal	4				4
Physical Trauma: other	**3**	**1**	**2**		**6**
Harbour seal	2	1	1		4
Grey seal	1		1		2
Not Established					**3**
Harbour seal			2	**1**	**3**
Grey seal					
Other					**7**
Starvation/Hypothermia	**1**	**1**	**2**		**4**
Harbour seal	1	1	2		4
Grey seal					
Grand Annual Total	**14**	**10**	**12**	**5**	**41**

7.1 Harbour seal (*Phoca vitulina*)

Harbour seals have a circumpolar distribution in the Northern Hemisphere and are divided into three sub-species. The population in European waters actually represents one subspecies, the Eastern Atlantic common seal, or harbour seal (*Phoca vitulina vitulina*). This species accounted for 17.9% (n=199) of the seals reported. This this is almost exactly the same percentage as reported in the previous reporting period. Adult harbour seals typically weigh 80-100 kg. Males are slightly larger than females. Harbour seals are long-lived with individuals living up to 20-30 years. Approximately 30% of European harbour seals are found in the UK and in certain areas have experienced steep population declines. Harbour seals are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles.

- They take a wide variety of prey including sand eels, gadoids, herring and sprat, flatfish, octopus and squid. Diet varies seasonally and from region to region.
- Pups are born June and July.
- Most strandings occur December and January with another peak in July possibly reflecting the pupping season.
- The most common cause of death in Scotland is physical trauma
- The second most commonly observed cause of death (when corkscrew and seal management cases are not considered) is infectious disease, mostly parasitic pneumonia.

Thirty-two animals were sent for necropsy (16%), 14 were sampled (7%), and the remaining 153 animals (76.8%) were not examined either due travel difficulties, they were at sea, too decomposed, data deficient or there was a delay in reporting. However 30 (15%) were identified as possible grey seal predation cases based on photographs. A single animal was also identified as entangled by photographs. A further animal was reported a shot by a marksman but was not recovered. Sex was determined in 48 animals (24.1%) with 21 female and 27 male individuals. The seasonal pattern was very similar to that from the previous reporting period. Table 10 summarises the cases examined on necropsy excluding grey seal predation cases and animals reported under seal management.

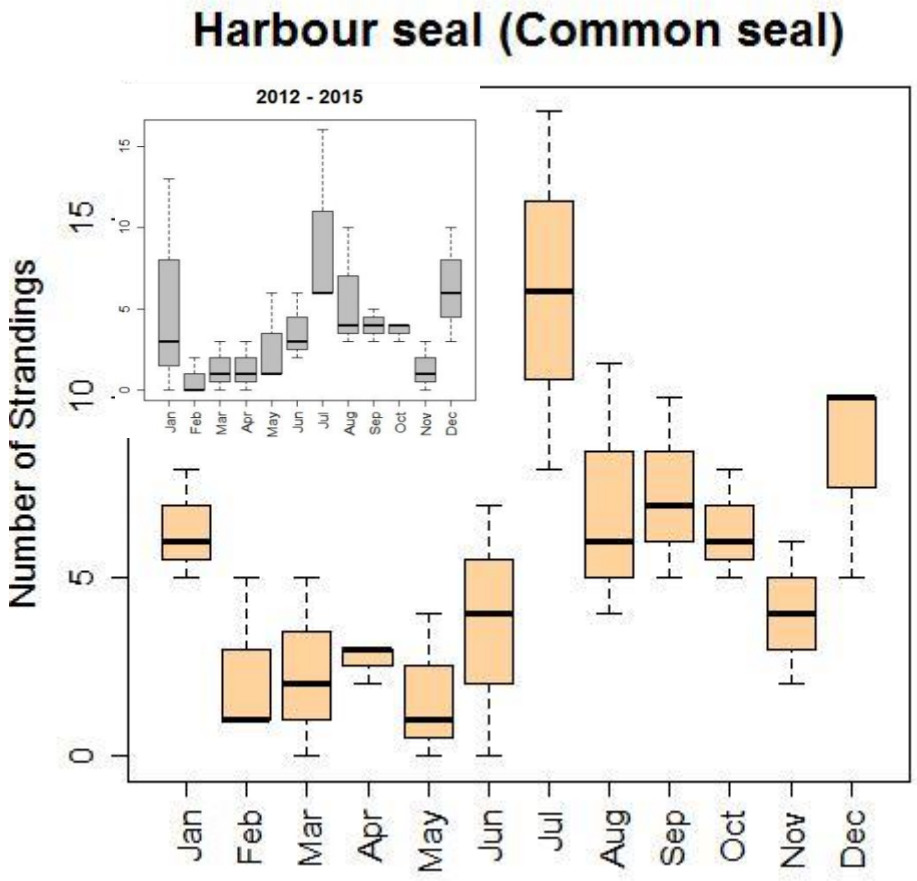


Figure 49: Boxplot of monthly variation in number of harbour seal(*Phoca vitulina*) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

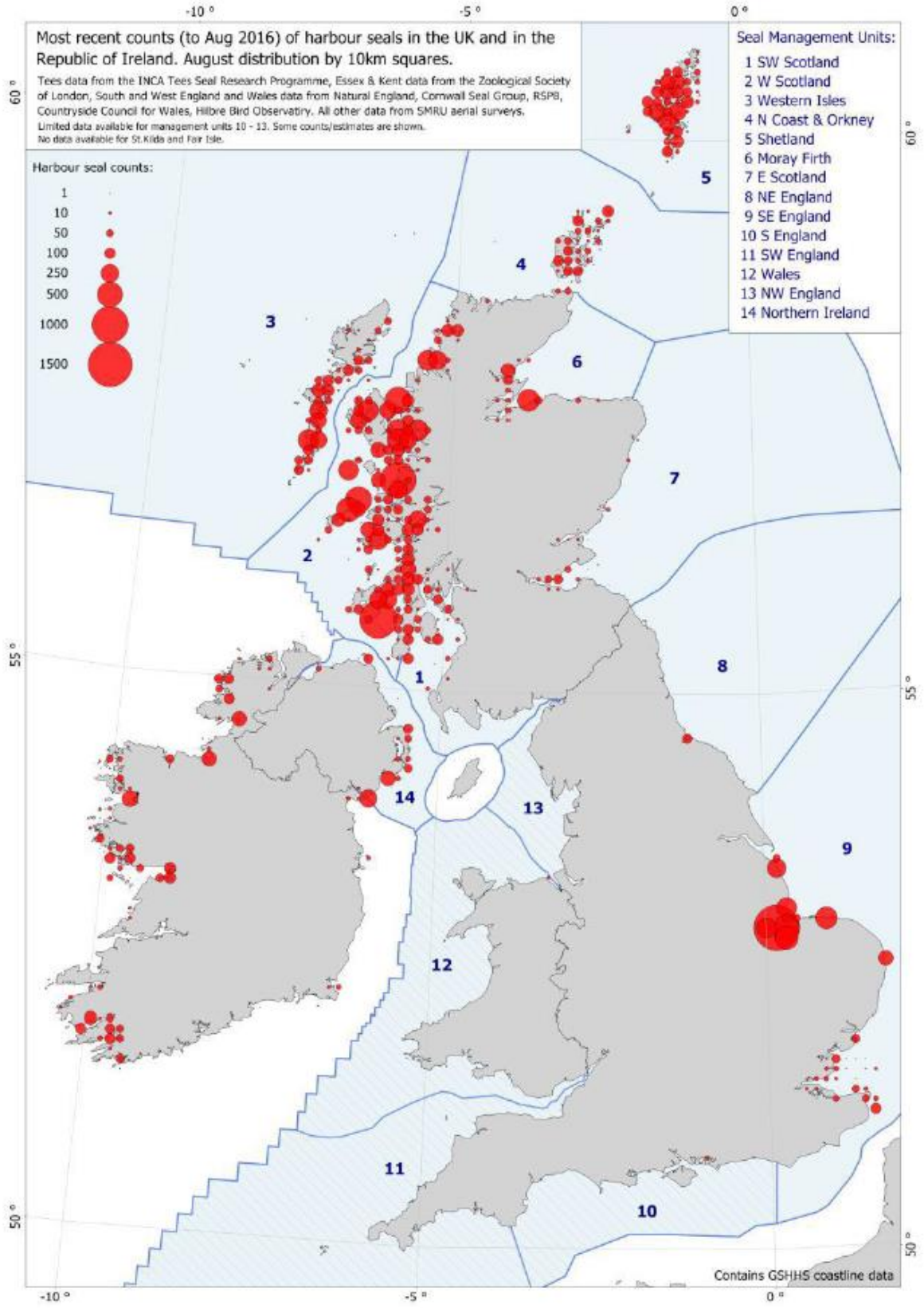


Figure 50 August distribution of harbour seals (Phoca vitulina) around the British Isles. Very small numbers of harbour seals (<50) are anecdotally but increasingly reported for the West England & Wales management unit, but are not included on this map SCOS 2017.

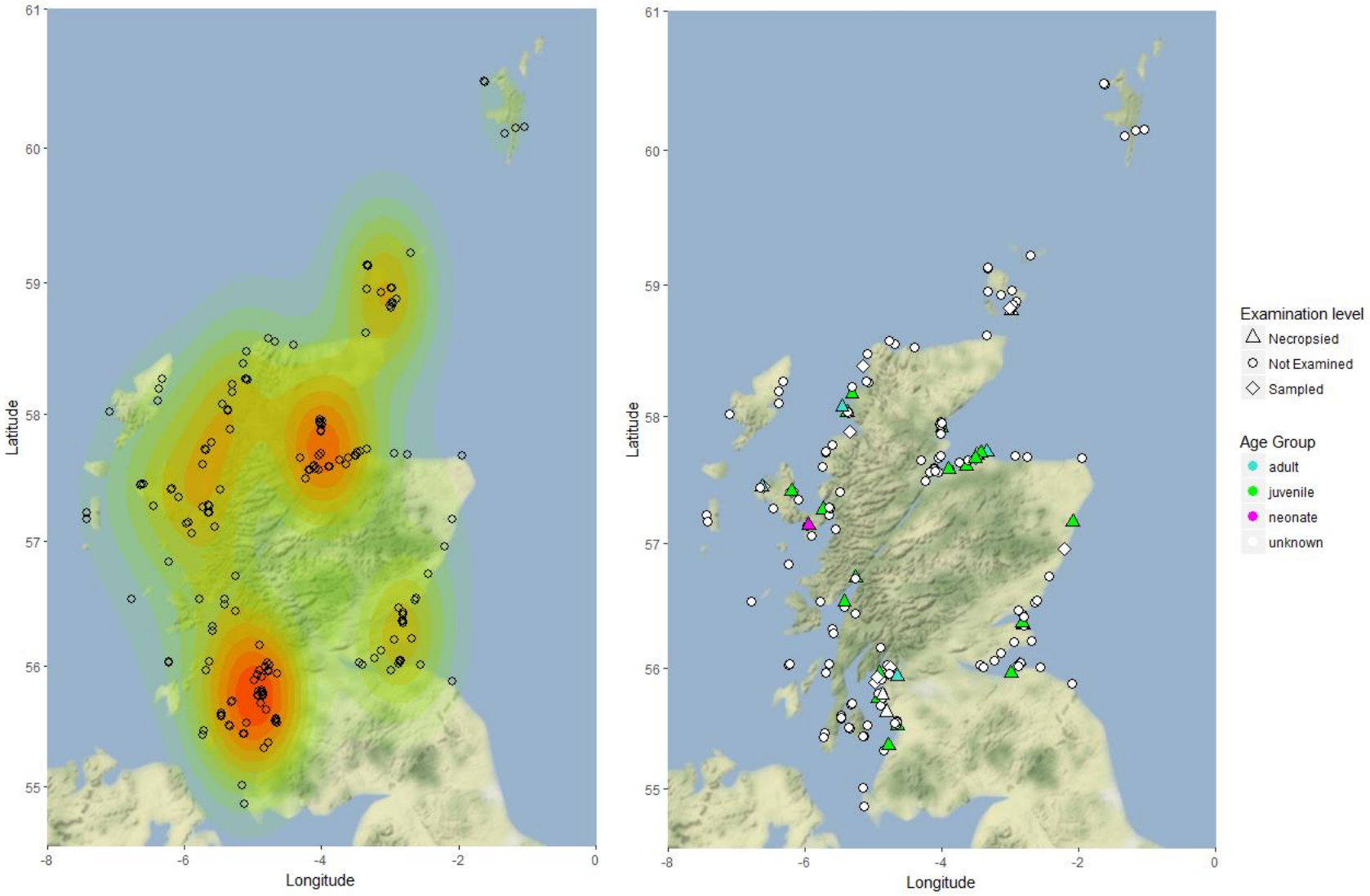


Figure 51: Distribution (right) and heat density map (left) of harbour seal (*Phoca vitulina*) strandings April 2015 – March 2018.

Table 10: Harbour seal (*Phoca* vitulina) cases at necropsy (excluding corkscrew and seal management cases) reported between April 2015 and March 2018

M ref	Species	Date found	Location	Sex	Age Group	Findings
M137/15	Harbour seal	27/04/2015	Highland	M	juvenile	Starvation/Hypothermia
M147/15	Harbour seal	14/05/2015	Strathclyde	M	adult	Physical Trauma: Other
M246/15	Harbour seal	27/07/2015	Highland	M	juvenile	Physical Trauma: Other
M321/15	Harbour seal	13/10/2015	Highland	F	juvenile	Pneumonia: Parasitic
M334/15	Harbour seal	24/10/2015	Grampian	M	unknown	Pneumonia: Parasitic
M54/16	Harbour seal	19/01/2016	Grampian	M	juvenile	Physical Trauma: Other
M64/16	Harbour seal	26/01/2016	Highland	F	juvenile	Pneumonia: Parasitic
M307/16	Harbour seal	03/07/2016	Orkney	M	unknown	Physical Trauma: Entanglement
M317/16	Harbour seal	13/07/2016	Highland	F	neonate	Starvation/Hypothermia
M438/16	Harbour seal	20/10/2016	Lothian	M	juvenile	Pneumonia: Parasitic
M492/16	Harbour seal	14/11/2016	Strathclyde	F	juvenile	Pneumonia: Parasitic
M618/16	Harbour seal	16/12/2016	Strathclyde	M	juvenile	Pneumonia: Parasitic
M662/17	Harbour seal	03/03/2017	Highland	M	adult	Physical Trauma: Other
M283/17	Harbour seal	17/07/2017	Strathclyde	M	juvenile	Not Established
M373/17	Harbour seal	29/08/2017	Strathclyde	M	juvenile	Not Established
M386/17	Harbour seal	05/09/2017	Strathclyde	M	juvenile	Starvation/Hypothermia
M446/17	Harbour seal	09/10/2017	Grampian	F	juvenile	Starvation/Hypothermia
M553/17	Harbour seal	24/11/2017	Strathclyde	F	juvenile	Pneumonia: Parasitic
M593/17	Harbour seal	10/12/2017	Grampian	F	juvenile	Generalised Bacterial Infection or Septicaemia
M624/17	Harbour seal	21/12/2017	Highland	F	juvenile	Pneumonia: Parasitic
M6/18	Harbour seal	02/01/2018	Highland	M	adult	Not Established
M27/18	Harbour seal	11/01/2018	Highland	F	juvenile	Pneumonia: Parasitic
M64/18	Harbour seal	24/01/2018	Strathclyde	U	unknown	Pneumonia: Parasitic
M128/18	Harbour seal	25/02/2018	Strathclyde	U	unknown	Pneumonia: Parasitic

Example case M334/15 – harbour seal (*Phoca vitulina*)

This juvenile female harbour seal was found alive but moribund at Burghead and was attended by BDMLR. It died in transit to a rehabilitation centre. It was moderately to severely dehydrated, and had a severe verminous pneumonia, characterised by a high parasite burden in bronchi, severe interstitial emphysema, areas of congestion and pulmonary haemorrhage with frank blood clots within the parenchyma. There was evidence of coughed up blood in the oesophagus and stomach. The animal was also thin and did not show evidence of recent feeding. Nematodes were also noted in the heart and pulmonary vessels, and dilated vasculature in the brain possibly suggestive of concurrent sepsis. Unfortunately the cultures from the brain and CSF proved contaminated. Histology revealed a severe, sub-acute, multifocal verminous pneumonia with severe pulmonary haemorrhage that had drained to bronchial lymph node.

Figure 52: M334/15 harbour seal (*Phoca vitulina*), Burghead

7.2 Grey seal (*Halichoerus grypus*)

Grey seals only occur in the North Atlantic, Barents and Baltic Sea. Their main concentrations are on the east coast of Canada and United States of America and in north-west Europe. This species accounted for 59.5% (n=659) of the seals reported. Grey seals are the larger of the two resident UK seal species. Grey seals are generalists, feeding mainly on the sea bed at depths up to 100m although they are probably capable of feeding at all the depths found across the UK continental shelf. Approximately 38% of the world's grey seals breed in the UK and 88% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. There are also breeding colonies in Shetland. There are approximately 111,300 grey seals in the UK. The seasonal pattern was very similar to that from the previous reporting period. Table 11 summarises the cases examined on necropsy excluding grey seal predation cases and animals reported under seal management.

- They take a wide variety of prey including sand eels, gadoids (cod, whiting, haddock, ling), and flatfish (plaice, sole, flounder, dab). Diet varies seasonally and from region to region
- Pups are born mainly between September and late November
- Most strandings occur in winter months (November to January)
- The most common cause of death observed in Scotland is physical trauma

There were 659 grey seals reported between April 2015 and March 2018. Eleven animals were sent for necropsy (1.6%), 23 were sampled (3.4%) two of these were thought to be grey seal predation events by photographs. Four seals were reported under seal management. The remaining 621 animals (94.2%), 139 (22.3%) of these animals were able to be confirmed as physical trauma cases; 14 (2.2%) cases were anthropogenic, either shot or entangled and 125 (20%) showed lesions consistent with Grey seal predation. The remaining 482 (77.6%) were not examined either due too advanced decomposed, data deficiency or there was a delay in reporting or were not considered a priority (still born white coat pups). Sex was determined in 77 animals (11.6%) with 38 female and 39 male individuals.

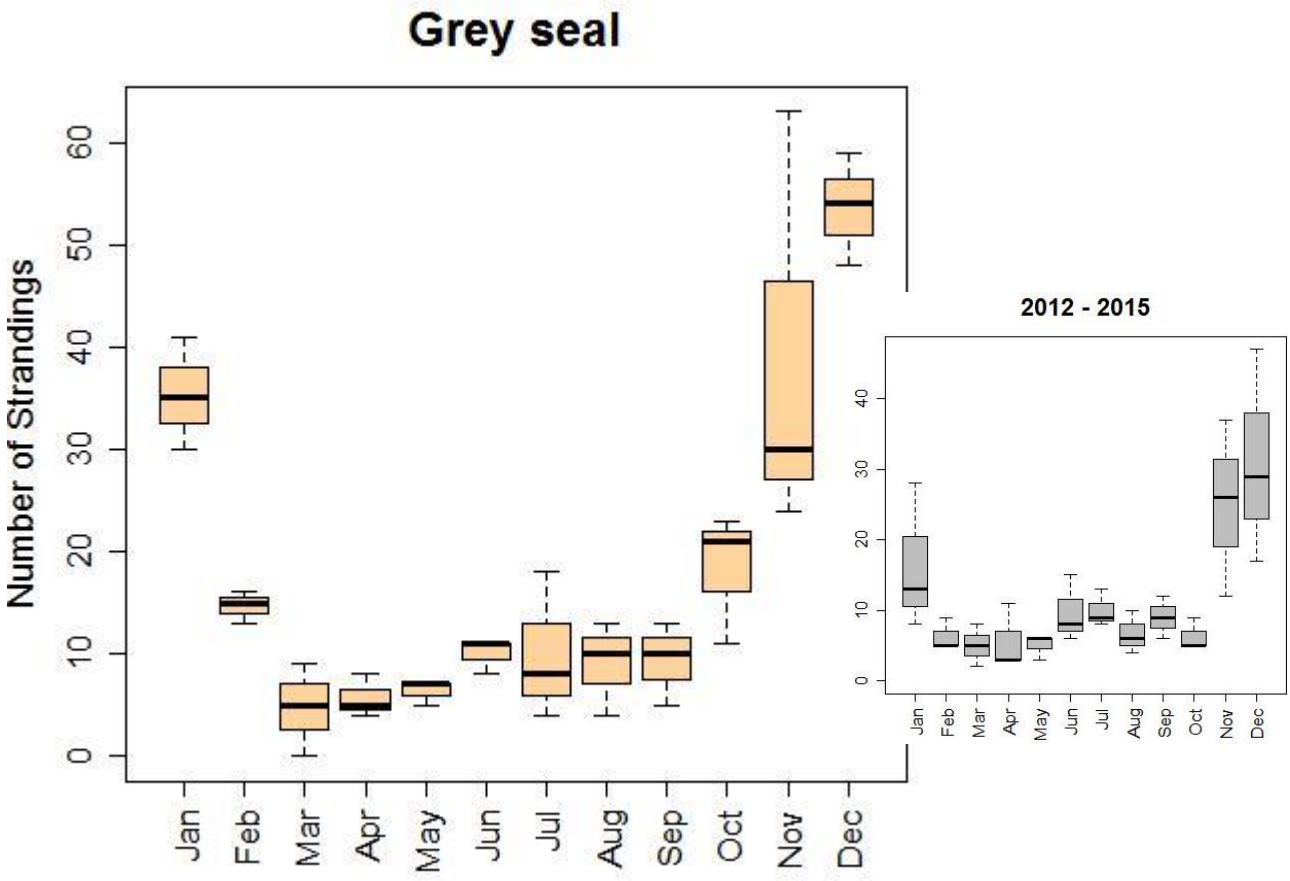


Figure 53: Boxplot of monthly variation in grey seal (*Halichoerus grypus*) strandings reported from April 2015 – March 2018. Inset shows the same for the previous reporting period (2012 – 2015).

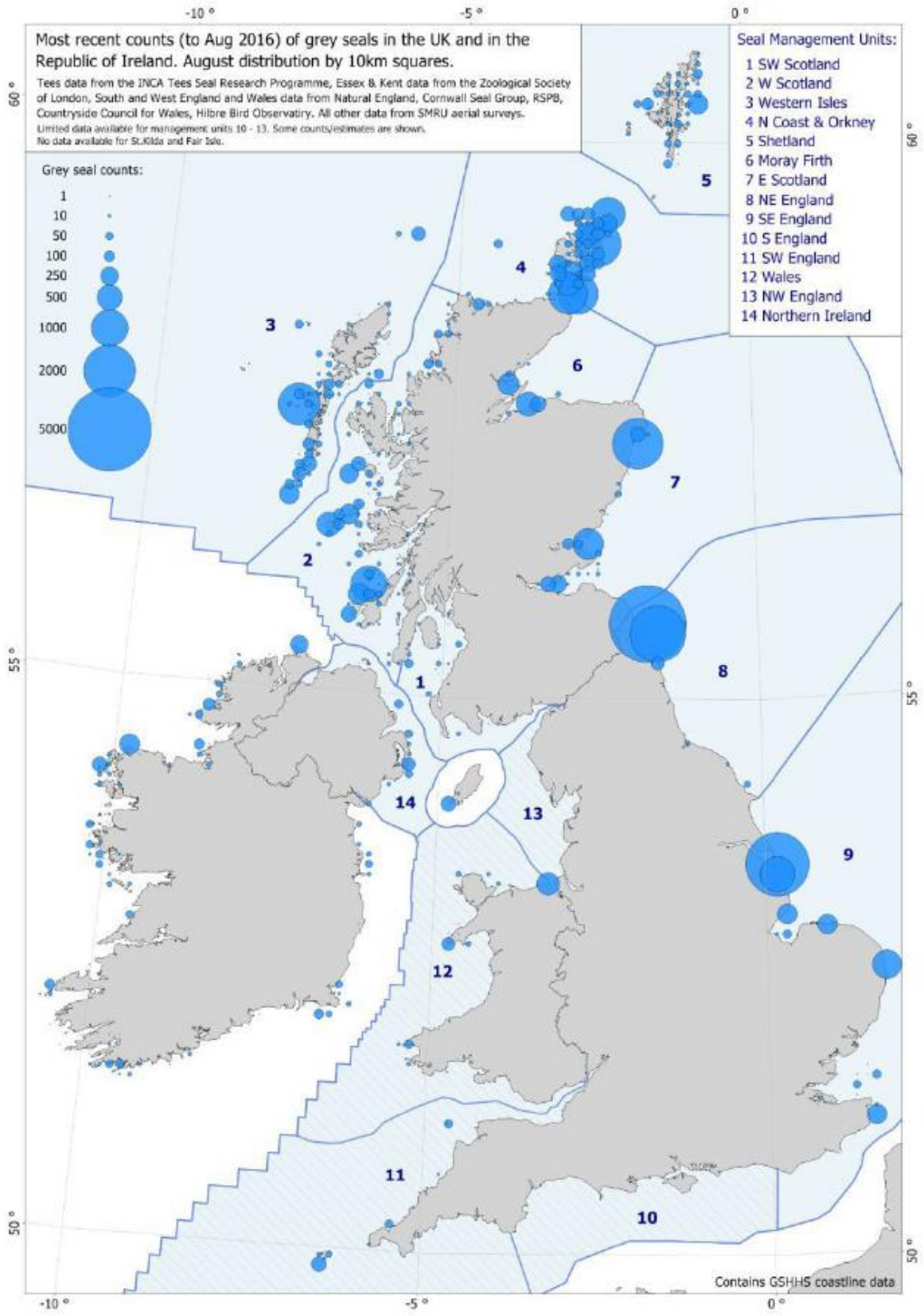


Figure 54: August distribution of grey seals (*Halichoerus grypus*) around the British Isles. Only few August counts are available for grey seals in the West England & Wales management unit. Current estimates would add approximately 1,300 animals for this unit, but these are not included on this map SCOS 2017.

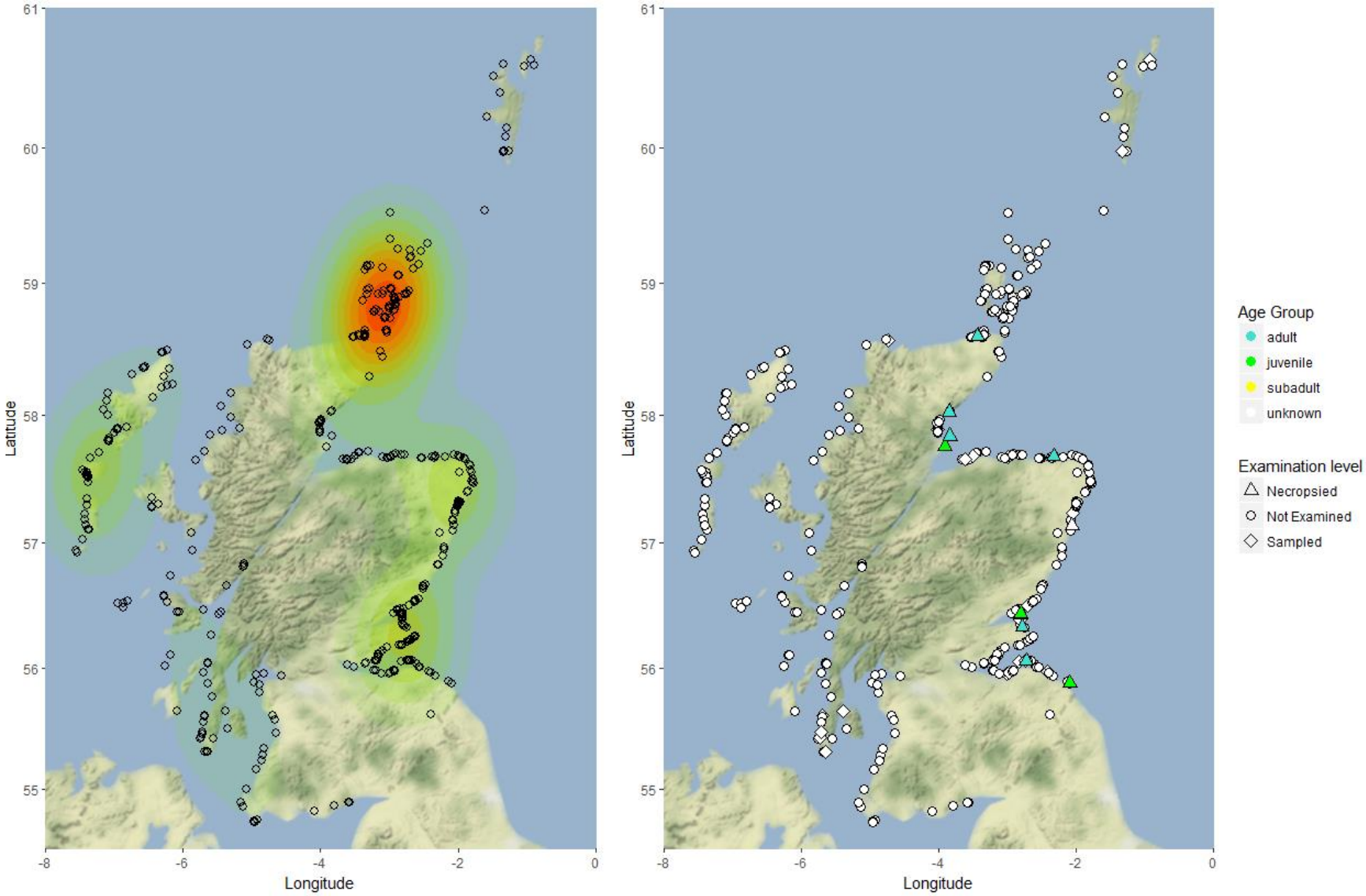

61
60
59
58
57
56
55
Latitude
-8
-6
-4
-2
0
Longitude
Age Group
adult
juvenile
subadult
unknown
Examination level
Necropsied
Not Examined
Sampled

Figure 55: Distribution (right) and heat density map (left) grey seal (*Halichoerus grypus*) strandings April 2015 – March 2018.

Table 11: Grey seal (*Halichoerus grypus*) cases at necropsy (excluding grey seal seal management cases) reported between April 2015 and March 2018.

M ref	Species	Date Found	Region	Sex	Age Group	Findings
M244/15	Grey seal	27/07/2015	Fife	F	adult	Physical Trauma: Other
M403/17	Grey seal	17/09/2017	Lothian	F	adult	Physical Trauma: Other
M93/18	Grey seal	09/02/2018	Grampian	U	unknown	Pneumonia, bacterial

Example case M403/17 – grey seal (*Halichoerus grypus*)

This female adult grey seal was found on 17/09/2017 in moderate condition on West beach, North Berwick and kept cool at around 10'C for 72 hours prior to necropsy, although some autolysis was present in this case. It was in good body condition and was not gravid or showing evidence of lactation or recent pregnancy. It showed evidence of blunt trauma to the flank and abdomen, resulting in hepatic rupture with frank haemorrhage in the abdomen, bruising in the renal capsule at the cranial pole of the right kidney, gelatinous oedema and haemorrhage in the subcuticular tissues and focal bruising in the peri-lumbar blubber. There was no palpable evidence for skeletal trauma. The brain also showed indication of intracranial haemorrhage, with dilated cranial vasculature and frank haemorrhage around the brainstem. There was no evidence of ballistic trauma. The stomach was empty and contained refluxed bile and the lungs were congested, hyperaemic and showed a mild parasite burden. There was no evidence for stable foam or water aspiration. Bacteriology produced a pure growth of *Pasteurella multocida* from the lung, liver, spleen, kidney and brain, although there was no histological evidence for sepsis. This degree of haemorrhage and bruising would be consistent with severe focal blunt trauma, for example boat strike or entanglement in fishing equipment.

Figure 56: M403/17 grey seal (*Halichoerus grypus*) West beach, North Berwick.

Section 8: Investigation into ‘corkscrew’ lesions

In total, 199 animals were reported as having trauma consistent with spiral injuries which represents a 61.4% increase on the previous period. These cases were reported from most regions. Appendix 7: Scoring of suspected spiral trauma cases shows the cases reported during this period the details for all pinniped cases considered to be 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 evidence emerged in 2014, how likely is it that the lesions could be due to grey seal predation. Investigation of this phenomenon continues to be conducted in collaboration with the SMRU and identification of cases as spiral trauma is scored on a number of pathological attributes from either necropsy examination or photographs.

Figure 57 M385/17 Harbour seal (Phoca vitulina) grey seal predation Tentsmuir 31st August 2017.

Section 9: Sharks and marine turtles

9.1 Overview

Marine turtles became part of the strandings project in 2001 and basking sharks were included in 2007. During this reporting period several other species of shark have been included.

9.2 Sharks

There were eight sharks of three species reported to the standing scheme during this reporting period.

9.2.1 *Basking shark (Cetorhinus maximus)*

The basking shark (*Cetorhinus maximus*) is the second largest living fish, after the whale shark, and one of three plankton-eating shark. It is a cosmopolitan migratory species, found in all the world's temperate oceans. Adults typically reach 6-8 m (20-26 ft.) in length. Basking sharks are believed to overwinter in deep waters. In Scottish waters, basking sharks are seen most Harbourly off western coasts, and especially around the outer Firth of Clyde. Recent studies funded by SNH, collating data collected by the Wildlife Trusts, have confirmed two other hotspots for basking sharks: in Gunna Sound, between Coll and Tiree, and around the rocky islet of Hyskeir, southwest of Canna.

- Filter feed on zooplankton, small fish, and invertebrates
- Believed to give birth to live young though this has not yet been observed.
- Strandings occur primarily in the summer and autumn months.
- There is no common cause of death in this species.

There were five reported basking shark (*Cetorhinus maximus*) strandings in during the report period. None were necropsied, three were sampled. All but one were on the west coast.

Three animals were reported in 2015; one in September in South Uist, two in October; one near Helmsdale, Highland the other on the Isle of Arran.

There was only one reported basking shark stranding in 2016, in January floating just of shore at Skelmorlie North Ayrshire. Tissue samples were taken by volunteers.

Only one reported basking shark stranding occurred in 2017, on the in July at Rubha Hunish Isle of Skye. Only the remains of the head were present, which was identified by the National Museum of Scotland. There were none reported in the first three months of 2018.

Figure 58 M57/16 Basking shark (Cetorhinus maximus) Skelmorlie North Ayrshire January 2016.

9.2.2 *Blue shark (Prionace glauca)*

The blue shark is a species of requiem shark, in the family Carcharhinidae, that inhabits deep waters in the world's temperate and tropical oceans, preferring cooler waters. They migrate long distances. The species is listed as Near Threatened by

the IUCN. They are viviparous. Maximum lifespan is still unknown, but it is believed that they can live up to 20 years.

- They feed primarily on small fish and squid, although they can take larger prey.
- Give birth to live young though with large litter of up to 100 pups observed.
- Strandings occur primarily in the autumn months.
- There is no common cause of death in this species.

Two blue sharks reported during this period. Both were female a cause of death was not established in either animal though they are thought to be discards from fishing vessels.

Example case M523/16 Blue shark (Prionace glauca).

This juvenile female blue shark was found dead stranded on Tentsmuir beach in Fife. There was digesta present in the stomach. There was no significant pathology observed, although autolysis (likely due to the freeze-thaw processes) may have hampered diagnosis. No direct evidence for- or lesions associated with bycatch/entanglement were seen, yet given its location and evidence for recent feeding this animal was likely incidentally caught and discarded. Samples for genetics and toxicology were collected and the remainder of the carcass was collected for the Natural Museum of Scotland.

Figure 59: M523/16 Blue shark (Prionace glauca) from Tentsmuir beach, Fife.

9.2.3 *Porbeagle shark (Lamna nasus)*

The porbeagle shark is a species of mackerel shark in the family Lamnidae, distributed widely in the cold and temperate marine waters of the North Atlantic and Southern Hemisphere. They are fast and highly active, with physiological adaptations that enable them to maintain a higher body temperature than the surrounding water. Direct commercial fishing for the species, principally by Norwegian long-liners, led to stock collapses in the eastern North Atlantic in the 1950s, and the western North Atlantic in the 1960s. They continue to be caught throughout its range, both intentionally and as bycatch, with varying degrees of monitoring and management. The International Union for Conservation of Nature (IUCN) has assessed them as Vulnerable worldwide, and as either Endangered or Critically Endangered in different parts of its northern range.

- They feed on bony fishes and cephalopods.
- Give birth to live young usually four pups per year.
- Only a single stranding in December during this reporting period.

We had a single report of this species during this reporting period a female on the 24th of December 2016 at Reiss beach Caithness it was not recovered for necropsy. It was thought to be a discard from a fishing vessel.

Figure 60: M635/16 Porbeagle shark (Lamna nasus) from Reiss beach, Caithness.

9.3 Marine turtles

There were seven marine turtles reported during this period; one marine turtle was reported in 2015, a loggerhead turtle (*Caretta caretta*) found alive just south of Irvine North Ayrshire on 5th December this animal died and was later necropsied (see below). A single leatherback turtles (Dermochelys coriacea) stranding was reported in 2016 at St Cyrus Nature Reserve, Aberdeenshire onh 8th January was later necropsied (see below). Five leatherback turtles were reported in 2017 one in August, floating off Raasay, two in September one floating off Arbroath the other, a decomposed animal on Vatersay. There were two in December, one decomposed on the island of Gometra, the other released alive after entanglement in creel lines in Orkney. No turtles were reported in the first three months of 2018.

9.3.1 Loggerhead turtle *(Caretta Caretta)*

The loggerhead turtle (*Caretta caretta*), is distributed throughout the world. At maturity it measures around 90 cm long and averaging 135 kg though larger specimens have been recorded. Loggerhead turtles generally prefer warm waters in

the Atlantic, Pacific, and Indian Oceans, as well as the Mediterranean Sea with surface temperatures ranging from 13.3–28 °C. Female loggerheads are capable of reproduction between the ages of 17 and 33. Their estimated maximum lifespan is 47–67 years in the wild. They nest over the broadest geographical range of any sea turtle.

- Omnivorous, including; gastropods, bivalves, decapods, sponges, algae, corals, jellyfish,hatchling turtles (including members of its own species).
- Nesting occurs June to July in the Mediterranean (not Scotland).
- Strandings occur primarily in the winter months.
- Cold stunning/hypothermia is the most common cause of death.

A single female animal was reported during this period it was sent for necropsy, see below.

Example case M408/15 Loggerhead turtle (*Caretta Caretta*)

This sub-adult female loggerhead turtle was found alive but moribund on Irving beach in early December. It was taken to rehab, given fluids, but died overnight. The animal was then frozen. Internal pathology was unremarkable, with moderate to good body condition yet no evidence of recent feeding. The fight flipper was malformed being much smaller than the contralateral and with much reduced flexion and rotation. No joint capsule fibrosis or articular pathology was noted, indicating this was likely a developmental abnormality rather than a result of trauma or disease. This deformity however appeared to have led to impaired propulsion, with a very heavy goose barnacle burden attached to the right side of the animal. This burden appeared to have caused some exfoliation of the underlying carapace scutes. Bacteriology did not reveal any significant isolates. Histology did not show any significant lesions. Given this, cold shock is the most plausible cause of death with impaired mobility a likely factor in its presence in Scotland in December.

Figure 61: M408/15 sub-adult female loggerhead turtle was found alive but moribund on Irving beach in early December 2015.

9.4 *Leatherback turtle* (Dermochelys coriacea)

The leather back turtle is the largest of all living turtles and is the fourth-heaviest modern reptile behind crocodilians. It is the only living species in the genus Dermochelys and family Dermochelyidae. It can easily be differentiated from other modern sea turtles by its lack of a bony shell. Instead, its carapace is covered by skin and oily flesh. D. coriacea is the only extant member of the family Dermochelyidae. The leatherback turtle has the widest distribution of any marine turtle, reaching as far north as Alaska and Norway and as far south as Cape Agulhas in Africa and the southernmost tip of New Zealand. The leatherback is found in all

tropical and subtropical oceans, and its range extends well into the Arctic Circle. Adults average 1–1.75 m in curved carapace length (CCL), 1.83–2.2 m in total length, and 250 to 700 kg in weight. Leatherbacks have been viewed as unique among reptiles for their ability to maintain high body temperatures using metabolically generated heat, or endothermy. Initial studies on leatherback metabolic rates found leatherbacks had resting metabolisms around three times higher than expected for a reptile of their size. Rather than use a high resting metabolism, leatherbacks appear to take advantage of a high activity rate. Studies on wild D. coriacea discovered individuals may spend as little as 0.1% of the day resting. This constant swimming creates muscle-derived heat. Coupled with their counter-current heat exchangers, insulating fat covering, and large size, leatherbacks are able to maintain high temperature differentials compared to the surrounding water. Adult leatherbacks have been found with core body temperatures that were 18 °C (32 °F) above the water in which they were swimming. Leatherback turtles are one of the deepest-diving marine animals. Individuals have been recorded diving to depths as great as 1,280 m (4,200 ft.) Typical dive durations are between 3 and 8 minutes, with dives of 30–70 minutes occurring infrequently.

- Feeding almost exclusively on Jellyfish occasionally on tunicates and cephalopods.
- Nesting occurs between October and April in Africa (not Scotland).
- Strandings occur primarily in the summer and autumn months.
- Entanglement is the most common cause of death.

Six leatherback turtles were reported during this period. One animal (16.6%) was sent for necropsy, see below.

Example case M24/16 Leatherback turtle (*Dermochelys coriacea*)

This, likely immature/sub-adult, male leatherback was found dead stranded on St Cyrus Nature Reserve. It was in moderate to thin condition and the carcass was reasonably fresh at the time of necropsy. There were indications of previous, chronic entanglement on the pectoral fins, but no recent rope marks and no indication of other significant trauma. The lungs were however congested, suggesting agonal water aspiration may have occurred. There were two plastic fragments in the oesophagus; a 30cm² plastic bag and a crisp packet. Neither was associated with

any impaction and the rest of the gastro-intestinal tract was clear of other debris. Mucoid melena in the stomach indicates some likely feeding but probably not at a sufficient rate, given the much dilated gall bladder, lack of notable abdominal fat reserves, and general thin body condition. The brain contained a large amount of CSF and appeared to be vestigial tissue 2-3cm^3 within a hydrocephalic membrane- however uncertain if this is normal or not. The significance of an isolation of a *Pseudomonas sp.* from the CSF is uncertain. Histology on the brain showed a severe, generalised congestion. A single, medium sized focal area of lymphoplasmacytic infiltration within the meninges, although the significance of this is not clear and this is a likely hypothermia case".

Figure 62: M24/16 leatherback turtle (Dermochelys coriacea) from St. Cyrus nature reserve Aberdeenshire.

Section 10: Knowledge exchange and outputs

Since 2009, there has been an increased effort to improve public awareness of the stranding project. This has involved a number of methods, firstly through the design and distribution of a new poster and the launch of a website (www.strandings.org) which provides users with the opportunity to view strandings data in a graphical or tabulated format, or spatially using Google Maps. The website also provides users with a method for reporting strandings online, in specific an upload function to send digital images which has proved very useful. Since 2012 there have also been a programme of talks and demonstrations and in in 2014 the recruitment of volunteers to help collect data and samples from stranded animals not suitable for necropsy started. This has resulted in 181 trained stranding volunteers during this period (see section 4). Facebook and Twitter pages were set up in October 2012, with regular stranding reports, selected photos and requests for information on strandings posted on both. Facebook in particular has proved useful in receiving stranding reports. In June 2014 a Facebook group specifically for the stranding volunteers was set up allowing the easy flow of information between them and ourselves.

All publications, conference presentations and posters are listed in Section 14, conferences and meetings attended during this reporting period are listed in Appendix 1.

All media interest in the scheme during this reporting period are listed in Appendix 2.

10.1 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. The feedback has been good and both media prove a valuable resource for the reporting of strandings to the scheme as well as a means to contact and update the trained stranding volunteers.

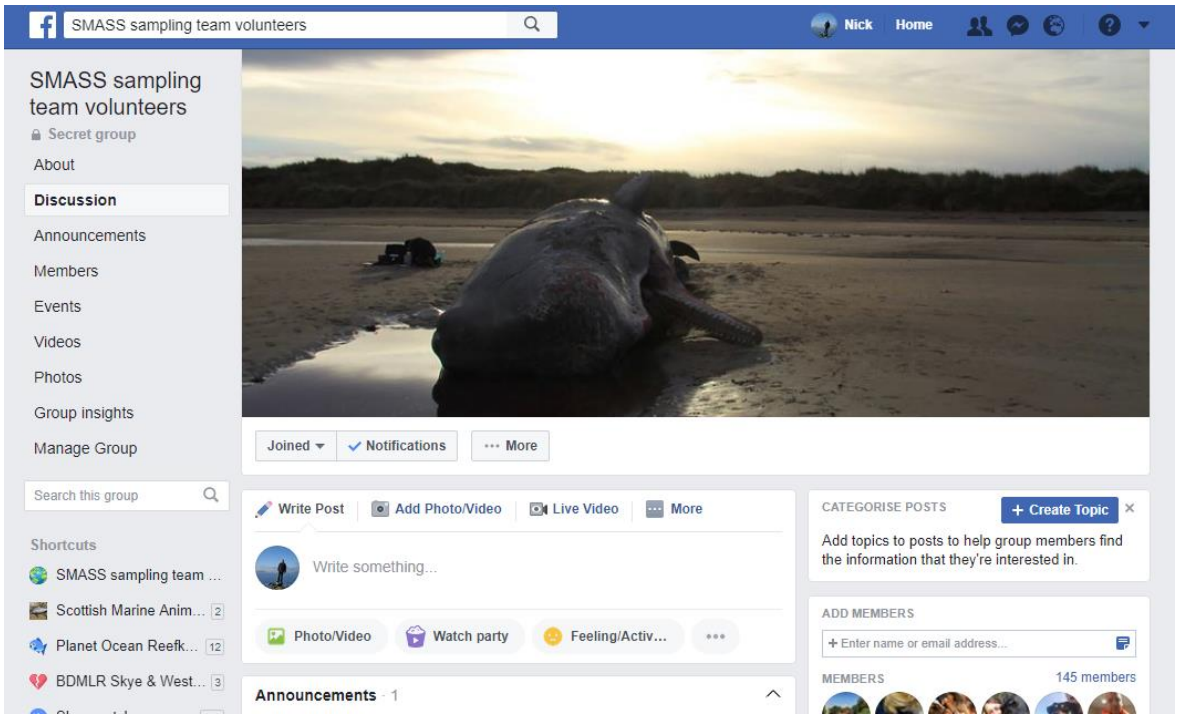


Figure 63: SMASS Volunteers Facebook page

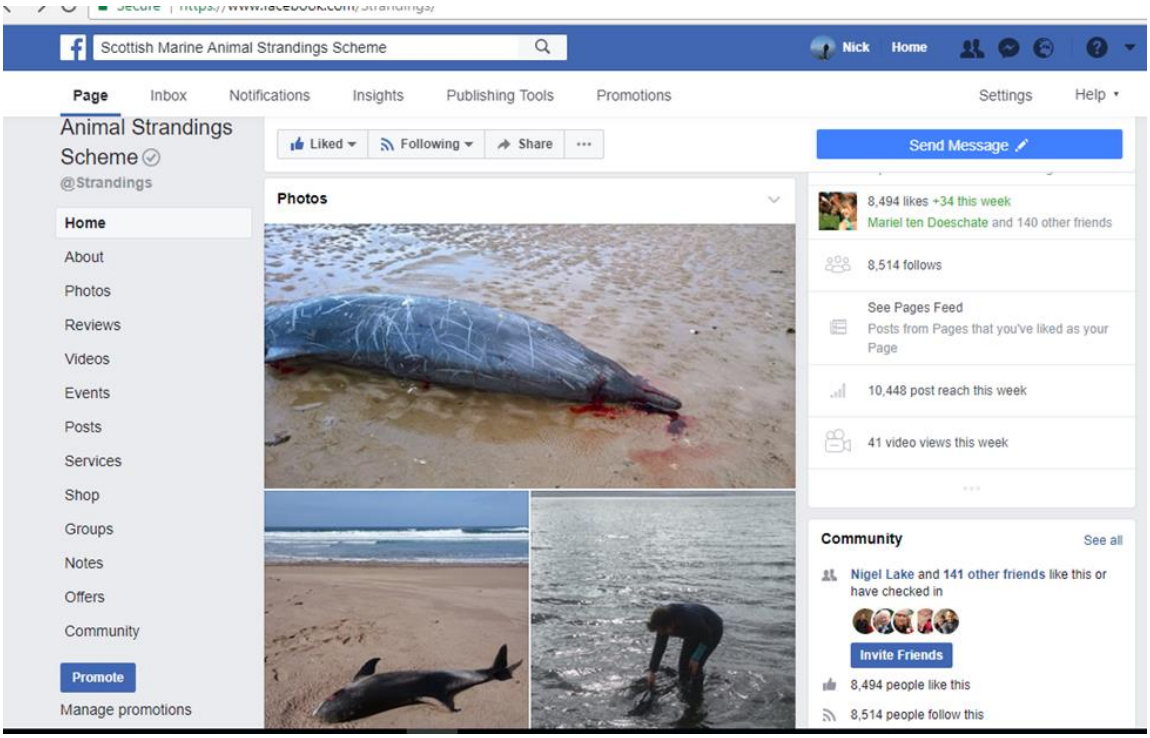


Figure 64: SMASS Facebook page

Section 11: Staff

SMASS is based at the SRUC Wildlife Unit, Inverness and currently has three members of staff. Dr Andrew Brownlow is a veterinary pathologist and epidemiologist and has managed the scheme since 2009. Nick Davison joined in October 2012 as strandings coordinator and brought with him over 25 years of cetacean pathology experience assisting the CSIP veterinarians at the Animal Health and Veterinary Laboratories Agency. Mariel ten Doeschate joined as a part time marine strandings administration assistant in September 2014 after completing a Masters in Applied Marine and Fisheries Ecology.

Appendix 1: Outputs

Between April 2015 and March 2018, SMASS staff generated or contributed to a total of 26 peer reviewed papers, 19 conference presentations, and three conference posters. Two further papers are currently in submission.

11.1 Publications

- James Barnett, Akbar Dastjerdi, **Nick Davison**, Rob Deaville, David Everest, Julie Peake, Christopher Finnegan, Paul Jepson, Falko Steinbach. 2015. Identification of Novel Cetacean Poxviruses in Cetaceans Stranded in South West England PLoS ONE 10(6): e0124315.

- Fernández, R., Schubert, M., Vargas-Velázquez, A.M., **Brownlow, A.,** Vikingsson, G.A., Siebert, U., Jensen, L.F., Øien, N., Wall, D., Rogan, E., Mikkelsen, B., Dabin, W., Alfarhan, A.H., Alquraishi, S.A., Al-Rasheid, A.S., Guillot, G., Orlando, L., 2015. A genomewide catalogue of single nucleotide polymorphisms in white-beaked and Atlantic white-sided dolphins. Molecular Ecology Resources, doi: 10.1111/1755-0998.12427.
- Sinéad Murphy, Jonathan L Barber, Jennifer A. Learmonth, Fiona L. Read, Robert Deaville, Matthew W. Perkins, **Andrew Brownlow, Nick Davison,** Rod Penrose, Graham J. Pierce, Robin J. Law, Paul D. Jepson. 2015 Reproductive Failure in UK Harbour Porpoises Phocoena phocoena: Legacy of Pollutant Exposure? PLOS ONE | DOI:10.1371/journal.pone.0131085 July 22, 2015.

- **Geoffrey Foster**, Adrian M. Whatmore, Mark P. Dagleish, Johanna L. Baily, Rob Deaville, **Nicholas J. Davison**, Mark S. Koylass, Lorraine L. Perrett, Emma J. Stubberfield, Robert J. Reid, and **Andrew C. Brownlow**. 2015 Isolation of Brucella ceti from a Long-finned Pilot Whale (Globicephala melas) and a Sowerby's Beaked Whale (Mesoploden bidens) DOI: 10.7589/2014-04-112 Journal of Wildlife Diseases, 51(4).

- Sílvia S. Monteiro, Paula Méndez-Fernandez, Stuart Piertney, Colin F. Moffat,

Marisa Ferreira, José V. Vingada, Alfredo López, **Andrew Brownlow**, Paul Jepson,
Bjarni Mikkelsen, Misty Niemeyer, José Carlos Carvalho, Graham J. Pierce. 2015 Long-finned pilot whale population diversity and structure in Atlantic waters assessed through biogeochemical and genetic markers. Marine Ecology Progress Series Vol. 536: 243–257 doi: 10.3354/meps11455

- Monteiro, Sílvia, Marisa Ferreira, José V Vingada, Alfredo López, **Andrew Brownlow**, and Paula Méndez-fernandez. 2015. "Application of Stable Isotopes to Assess the Feeding Ecology of Long-Finned Pilot Whale (*Globicephala melas*) in the Northeast Atlantic Ocean." Journal of Experimental Marine Biology and Ecology 465: 56–63.

- Jensen, Silje-Kristin, Jean-Pierre Lacaze, Guillaume Hermann, Joanna Kershaw, **Andrew Brownlow**, Andrew Turner, and Ailsa Hall. 2015. "Detection and Effects of Harmful Algal Toxins in Scottish Harbour Seals and Potential Links to Population Decline." Toxicon 97: 1–14.

- Karen B. Register, Yury V. Ivanov, Eric T. Harvill, **Nick Davison** and **Geoffrey Foster**. (2015) Novel, host-restricted genotypes of *Bordetella bronchiseptica* associated with respiratory tract isolates. Microbiology 161, 580-592

- **Nicholas J. Davison, Andrew Brownlow, Barry McGovern**, Mark P. Dagleish, Lorraine L. Perrett, Emma-Jane Dale, Mark Koylass, **Geoffrey Foster**. 2015 First report of Brucella ceti-associated meningoencephalitis in a long-finned pilot whale *Globicephala melas.* Diseases of Aquatic Organisms 116;237-241 doi:10.3354/dao02926 27/10/15

- Zuzana Gajdosechova, **Andrew Brownlow**, Nicolas T. Cottin, Mariana Fernandes, Fiona L. Read, Dagmar S. Urgast, Andrea Raab, Jörg Feldmann, Eva M. Krupp 2016. Possible link between Hg and Cd accumulation in the brain of long-finned pilot whales *(Globicephala melas)* in Science of the Total Environment 545-546:407-413.

- Zuzana Gajdosechova, **Andrew Brownlow**, Nicolas T. Cottin, Mariana Fernandes, Fiona L. Read, Dagmar S. Urgast, Andrea Raab, Jörg Feldmann, Eva M. Krupp 2016. Possible link between Hg and Cd accumulation in the brain of long-finned pilot whales *(Globicephala melas)* in Science of the Total Environment 545-546:407-413.

- Johanna L. Baily, **Geoffrey Foster**, Derek Brown, **Nicholas J. Davison**, John E Coia,
  Eleanor Watson, Romain Pizzi, Kim Willoughby, Ailsa J. Hall and Mark P. Dagleish (2016) Salmonella infection in grey seals (Halichoerus grypus), a marine mammal sentinel species: Pathogenicity and molecular typing of Salmonella strains compared with human and livestock isolates. Environmental Microbiology DOI: 10.1111/1462-2920.13219.

- Paul D. Jepson, Rob Deaville, Jonathan L. Barber, Àlex Aguilar, Asunción Borrell,
  Sinéad Murphy, Jon Barry, **Andrew Brownlow**, James Barnett, Simon Berrow,
  Andrew A. Cunningham, **Nicholas J. Davison, Mariel ten Doeschate**, Ruth Esteban,
  Marisa Ferreira, Andrew D. Foote, Tilen Genov, Joan Giménez, Jan Loveridge,
  Ángela Llavona, Vidal Martin, David L. Maxwell, Alexandra Papachlimitzou,
  Rod Penrose, Matthew W. Perkins, Brian Smith, Renaud de Stephanis, Nick Tregenza,
  Philippe Verborgh, Antonio Fernandez & Robin J. Law. (2016) PCB pollution continues to impact populations of orcas and other dolphins in European waters. Nature Scientific Reports 6:18573 DOI: 10.1038/srep18573 Published 14 January 2016.

- **Andrew Brownlow**, Joseph Onoufriou, Amanda Bishop, **Nicholas Davison**, Dave Thompson (2016) Corkscrew Seals: Grey Seal (Halichoerus grypus) Infanticide and Cannibalism May Indicate the Cause of Spiral Lacerations in Seals. PLoS ONE 11(6): e0156464. doi:10.1371/journal.pone.0156464

- Sílvia S. Monteiro , José V. Vingada , Alfredo López , Graham J. Pierce , Marisa Ferreira , **Andrew Brownlow**, Bjarni Mikkelsen, Misty Niemeyer, Robert J. Deaville, Catarina Eira, Stuart Piertney (2016). Major Histocompatibility Complex (MHC) class II sequence polymorphism in long-finned pilot whale (Globicephala melas) from the North Atlantic. Marine Biology Research doi: 10.1080/17451000.2016.1174266

- Zuzana Gajdosechova, Mohammed M. Lawan, Dagmar S. Urgast, Andrea Raab, Kirk G. Scheckel, Enzo Lombi, Peter M. Kopittke, Katrin Loeschner, Erik H. Larsen, Glenn Woods, **Andrew Brownlow**, Fiona L. Read, Jörg Feldmann & Eva M. Krupp (2016) In vivo formation of natural HgSe nanoparticles in the liver and brain of pilot whales. Nature Scientific Reports 6, 34361; doi: 10.1038/srep34361

- Norbert van de Veldea, Brecht Devleesschauwer, Mardik Leopoldd, Lineke Begeman, Lonneke IJsseldijk, Sjoukje Hiemstra, Jooske IJzer, **Andrew Brownlow, Nicholas Davison**, Jan Haelters, Thierry Jauniaux, Ursula Siebert, Pierre Dorny, Stéphane De Craeye (2016) Toxoplasma gondii in stranded marine mammals from the North Sea and Eastern Atlantic Ocean: Findings and diagnostic difficulties. Veterinary Parasitology 230 25–32

- Michaël C. Fontaine, Oliver Thatcher, Nicolas Ray, Sylvain Piry, **Andrew Brownlow, Nicholas J. Davison,** Paul Jepson, Rob Deaville, Simon J. Goodman. (2017) Mixing of porpoise ecotypes in south western UK waters revealed by genetic profiling. Royal Society Open Science. 4: 160992. http://dx.doi.org/10.1098/rsos.160992

- Michaël C. Fontaine, Oliver Thatcher, Nicolas Ray, Sylvain Piry, **Andrew Brownlow, Nicholas J. Davison,** Paul Jepson, Rob Deaville, Simon J. Goodman. (2017) Mixing of porpoise ecotypes in south western UK waters revealed by genetic profiling. Royal Society Open Science. 4: 160992. http://dx.doi.org/10.1098/rsos.160992

- Maria Morell, **Andrew Brownlow, Barry McGovern**, Stephen A. Raverty, Robert E. Shadwick, and Michel André. 2017. “Implementation of a Method to Visualize Noise-Induced Hearing Loss in Mass Stranded Cetaceans.” Scientific Reports 7 (February). Nature Publishing Group: 41848. doi:10.1038/srep41848.

- **Nicholas J. Davison**, Lorraine L. Perrett, Claire Dawson, Mark P. Dagleish, Gary Haskins, Jakub Muchowski, Adrian M.Whatmore. (2017) Brucella ceti infection in a Harbour minke whale (Balaenoptera acutorostrata) with associated pathology. Journal of Wildlife Diseases Vol. 53, No. 3, pp. 572-576. https://doi.org/10.7589/2016-08-200

- **Ten Doeschate, M., Brownlow, A., Davison, N.,** & Thompson, P. (2017). Dead useful; methods for quantifying baseline variability in stranding rates to improve the ecological value of the strandings record as a monitoring tool. Journal of the Marine Biological Association of the United Kingdom, 1-5. https://doi.org/10.1017/S0025315417000698

- Joanna L. Kershaw, Meredith Sherrill, **Nicholas J. Davison, Andrew Brownlow**, Ailsa J. Hall. (2017) Evaluating morphometric and metabolic markers of body condition in a small cetacean, the harbor porpoise (*Phocoena phocoena*). Ecology and Evolution. http://onlinelibrary.wiley.com/doi/10.1002/ece3.2891/full

- Adrian Whatmore, Claire Dawson, Jakub Muchowski, Lorraine L. Perrett, Emma Stubberfield, Mark Koylass**, Geoffrey Foster**, **Nicholas J. Davison**, Christine Quance, Inga F. Sidor, Cara L. Field, Judy St. Leger (2017) Characterisation of North American Brucella isolates from marine mammals. PLOS ONE https://doi.org/10.1371/journal.pone.0184758

- Kieran M. Tierney , Graham K.P. Muir, Gordon T. Cook, Johanna J. Heymans, Gillian MacKinnon , John A. Howe , Sheng Xu , **Andrew Brownlow, Nicholas J. Davison, Mariel ten Doeschate** , Rob Deaville (2017) Nuclear reprocessing-related radiocarbon (14C) uptake into UK marine mammals. Marine Pollution Bulletin https://doi.org/10.1016/j.marpolbul.2017.07.002

- Kershaw J., Stubberfield E., **Foster G. , Brownlow A.,** Hall A. J., Perrett L. Exposure of harbour seals (Phoca vitulina) to Brucella in declining populations across
  Scotland. Diseases of Aquatic Organisms.
  http://www.int-res.com/abstracts/dao/v126/n1/p13-23/

- Lonneke L. IJsseldijk, **Mariel ten Doeschate, Nicholas J. Davison**, Andrea Gröne, **Andrew C. Brownlow**. Crossing boundaries for cetacean conservation: setting research priorities to guide management of harbour porpoises. Marine Policy (2018) 95 77-84. 10.1016/j.marpol.2018.07.006

11.2 Publications (submitted or in press 2018)

- Milaja Nykanen, Kristin Kaschner, Vincent Ridoux, Willy Dabin, **Andrew Brownlow, Nicholas J. Davison**, Rob Deaville, Rod Penrose, Valentina Islas-Villanueva, Nathan Wales, Simon N. Ingram, Emer Rogan, Marie Louis, Andrew D. Foote. Post-glacial Colonisation History of Bottlenose Dolphins at the Northern Extreme of Their Range: A Marine Leading-edge Expansion? Systematic Biology

11.3 Conference presentations

- **Mariel ten Doeschate, Andrew Brownlow, Nick Davison**, Rob Deaville, Paul Jepson, Graham Pierce, Fiona Read, Paul Thompson. “The pathology of strandings data: methods to improve the ecological value of the strandings record as a monitoring tool”. at ICES in Copenhagen, Denmark 24/09/2015.
- Rob Deaville, James Barnett, **Andrew Brownlow,** Molly Clery, **Nicholas Davison,** Rebecca Lyal, Roderick Penrose, Perkins Matthew, Brian Smith, Ruth Williams, Paul Jepson. 100 not out- a century of strandings monitoring in the UK. At the 21ST Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015
- Maria Morell, **Andrew Brownlow, Barry McGovern**, Robert Shadwick, Michel André Acoustic trauma compatible lesions in a long-finned pilot whale

mass-stranded individual. At the 21st Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015

- Dave Thompson, Joseph Onoufriou, Amanda Bishop, **Andrew Brownlow**. Not ships or sharks? Predation by grey seals may explain corkscrew seal deaths. At the 21st Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015
- Joseph Onoufriou, Dave Thompson, Simon Moss, **Andrew Brownlow**. Pathological assessment of damage to grey seal carcasses inflicted by a tidal turbine blade. At the 21st Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015
- Milaja Nykanen, Marie Louis, Kristin Kaschner, Simon Ingram, Valentina Islas-Villanueva, Klaas Post, Henry Van der Es, Nathan Wales, **Andrew Brownlow, Nicholas Davison**, Rob Deaville, Vincent Ridoux, Willy Dabin, Emer Rogan, Andrew Foote. Reconstructing the post-glacial colonization of the northern extreme of the range of a top marine predator, the bottlenose dolphin. At the 21st Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015.
- Joanna Kershaw, **Andrew Brownlow, Nicholas Davison**, Ailsa Hall. The Pleiotropic Role of Cetacean Blubber. At the 21st Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015.
- Paul Jepson, Rob Deaville, Jonathan Barber, Alex Aguilar, Asunción Borrell, Sinead Murphy, Jon Barry, **Andrew Brownlow**, James Barnett, Simon Berrow, Andrew Cunningham, **Nicholas Davison**, Ruth Esteban, Marisa Ferreira, Andrew Foote, Tilen Genov, Joan Giménez, Jan Loveridge, Angela Llavona, Vidal Martin, David Maxwell, Alexandra Papachlimitzou, Roderick Penrose, Matthew Perkins, Brian Smith, Renaud de Stephanis, Nick Tregenza, Philippe Verborgh, Antonio Fernández, Robin Law. Toxic legacy? Severe PCB pollution in European dolphins. At the 21st Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015.
- **Andrew Brownlow**, Joseph Onoufriou, **Nicholas Davison, Mariel ten Doeschate**, Steve Bexton, Dave Thompson. Emergence of the grey seal as a potentially significant predator of marine mammals. At the 21st Biennial Conference on the Biology of Marine Mammals San Francisco 13-18th December 2015.
- **Andrew Brownlow**, Paul Jepson. IWC workshop 2015 Small cetacean mass strandings UK. Andrew was an invited speaker at an IWC workshop on

investigations of large mortality events, mass strandings, and international stranding response. San Francisco from 11/12/15 - 12/12/15

- **Andrew Brownlow, Nick Davison, Mariel ten Doeschate**, Rob Deaville, Paul Jepson.
  SMM workshop 2015 G. melas MSE, Staffin, Skye 13/12/15 Andrew presented a talk on the UK mass stranding response at a workshop prior to the Society for marine Mammalogy Biennial conference, San Francisco.
- "CSI of the sea - investigating UK strandings over the last 25 years".
  Robert Deaville, **Andrew Brownlow**, James Barnett, **Nicholas Davison**, Robin Law, Rebecca Lyal, Ruth Williams, Rod Penrose, Matthew Perkins, Brian Smith, **Mariel ten Doeschate**, Paul Jepson. Presentation: European Cetacean Society Annual Conference in Funchal, Madeira, Portugal 14th March 2016
- Reconstructing the post-glacial colonization of the northern extreme of the range of a top marine predator, the bottlenose dolphin. Milaja Nykanen, Marie Louis, Kristin Kaschner, Simon Ingram, Valentina Islas, Post Klaas, Henry Van Der Es, Nathan Wales, **Andrew Brownlow**, Rob Deaville, Emer Rogan, Andrew Foote. Presentation: European Cetacean Society Annual Conference in Funchal, Madeira, Portugal 14th March 2016
- Ecological insights from long-term trends in cetacean stomach contents. Graham Pierce, M. Begoña Santos, Okka Jansen, **Andrew Brownlow**, Alfredo López, Emer Rogan, Gema Hernandez-Milian, Fiona Read, Ruth Fernandez, Camilo Saavedra, Mardik Leopold. Presentation: European Cetacean Society Annual Conference in Funchal, Madeira, Portugal 15th March 2016.
- **Andrew Brownlow, Nick Davison, Mariel ten Doeschate** , Russell Leaper, Conon Ryan , Noel Hawkins, Stephen Marsh, Mark Dagleish. Knot a problem? Distribution and pathology of fatal entanglements in large marine animals in Scotland. Presentation: European Cetacean Society Annual Conference in Middelfart, Denmark, 1St -3rd May 2017
- **Andrew Brownlow**. "Grey seal predation cases in the UK". Presentation: ECS/WKPIGS workshop, Middelfart, Denmark, 30th April 2017.
- **Mariel ten Doeschate**. "PCB levels in UK stranded Harbour porpoise" Presentation: ECS workshop on the effects of PCB exposure in killer whales and other threatened toothed whale species of the North Atlantic, Middlefart, Denmark, 30th April 2017.

- **Andrew Brownlow**, Maria Morell, **Nick Davison, Mariel ten Doeschate**, Rob Deaville, Mark Dagleish, Matt Perkins, Rod Penrose, Paul Jepson.
  Pilot error: Investigation into three Globicephala melas mass stranding events in Scotland Presentation: the biennial SMM conference in Halifax Nova Scotia, Canada 23-27th October 2017.
- **Mariel ten Doeschate, Nicholas J. Davison, Andrew Brownlow**
  Eyes and Knives Everywhere; Citizen Science Strategies for Strandings Monitoring.
  Video Presentation: the biennial SMM conference in Halifax Nova Scotia, Canada 23-27th October 2017.

11.4 Poster Presentations

- *The first report of the isolation of Brucella ceti associated meningoencephalitis in a Sowerby's beaked whale (Mesoplodon bidens).* **Nicholas J. Davison, Andrew Brownlow**, Mark P. Dagleish. Lorraine L. Perrett, Claire Dawson, Sarah J. Dolman, Nicola Hodgins. Poster presentation: European Cetacean Society Annual Conference in Funchal, Madeira, Portugal 14th-16th March 2016.
- *Size matters: Assessing the ecological variability in strandings data at a relevant spatial scale.* **Mariel ten Doeschate, Andrew Brownlow, Nicholas Davison**, Rob Deaville, Paul Jepson, Matthew Perkins, Lonneke Ijsseldijk. Poster presentation: European Cetacean Society Annual Conference in Funchal, Madeira, Portugal 14th-16th March 2016.
- **Nicholas J. Davison, Mariel ten Doeschate,** Mark P. Dagleish, Lorraine L. Perrett, Claire Dawson, Jakub Muchowski, **Andrew Brownlow.** The first report of the isolation of Brucella ceti in a Risso's dolphin (*Grampus griseus*). Poster presentation: European Cetacean Society Annual Conference in Middelfart, Denmark, 1St -3rd May2017.

Appendix 2: Conference attendance/Meetings

Staff from the Scottish Marine Animal Strandings Scheme attended and or spoke at 28 meetings or conferences.

- 05/05/15 Andrew gave an invited presentation Marine Scotland Science at the Marine lab Aberdeen on how the Stranding Scheme could contribute to the Monitoring in the Pentland Firth and the MeyGen Site.
- 15/06/15 Members of the SMASS team met with representatives from SMRU, Aberdeen University and SAMS to discuss future collaborations and necropsy sample collection procedures.
- 16/06/15 Meeting with members of the UK CSIP, SMASS, Edinburgh University staff and the Dutch Stranding scheme with aim of revising the European necropsy procedure and foster closer links between the UK and Dutch Schemes.
- Andrew and Mariel attended the ICES in Copenhagen, Denmark 24/09/2015, Where Mariel gave a talk on the ecological value of the strandings record as a monitoring tool
- Andrew was an invited speaker at an IWC workshop on investigations of large mortality events, mass strandings, and international stranding response. San Francisco from 11/12/15 - 12/12/15
- 14-16/04/16 Andrew, Nick and Mariel, attended the European Cetacean Society Annual Conference in Funchal Madeira and a workshop on pathology
- 17/03/16 Andrew, Nick and Mariel together with Lonneke Ijsseldijk of the Dutch stranding scheme organised a one day pathology workshop after the ECS to update the strandings protocol for Europe at the European Cetacean Society Annual Conference in Funchal Madeira.
- 24/03/16 Andrew and Nick attended a workshop on large whale entanglements organised by WDC and Onekind in Edinburgh.
- Andrew Brownlow gave two talks entitled “Mass strandings” and “ Single strandings, public engagement and volunteer network” at the IWC technical workshop- developing practical guidance for the handling of cetacean stranding events: Skukuza Rest Camp, Kruger National Park, South Africa 3-6 May 2016

- Andrew Brownlow; Mass strandings, Presentation: 25th Anniversary or the Cetacean Strandings Investigation Programme (CSIP) at the Institute of Zoology, Regent's Park, London 17TH May 2016.

- Andrew Brownlow; Grey seal predation, Presentation: 25th Anniversary or the Cetacean Strandings Investigation Programme (CSIP) at the Institute of Zoology, Regent's Park, London 17th May 2016.

- Mariel ten Doeschate; Entanglement, Presentation: 25th Anniversary or the Cetacean Strandings Investigation Programme (CSIP) at the Institute of Zoology, Regent's Park, London 17th May 2016.

- Nick Davison; Interspecific Aggression in Cetaceans Presentation: 25th Anniversary or the Cetacean Strandings Investigation Programme (CSIP) at the Institute of Zoology, Regent's Park, London 17thMay 2016.

- Mariel ten Doeschate gave a talk on the Scottish Marine Animal Stranding Scheme (SMASS) to Bangor University undergraduates at the Aberdeen University Lighthouse Field station Cromarty on the 14th of June 2016

- Andrew Brownlow Nick Davison and Mariel ten Doeschate attended Special Committee on seals (SCOS) meeting at the Sea Mammal Research Unit (SMRU) St Andrews on the 13th of September 2016.
- Andrew gave a talk at the Underwater Sound Forum at IOZ, ZSL on the 7th of November2016.

- Nick and Andrew attended a Seal predation meeting at SMASS with members of SMRU and Abbo van Neer of the University of Veterinary Medicine Hannover on the 14th of November2016.

- 18th of November 2016 Lonneke IJsseldijk, Project coordinator Cetaceans at Utrecht University started a 4 month internship with SMASS to gain more experience with different species of cetacean.

- 22nd of December 2016 Nick and Geoff took part in a Skype meeting with Jaap Wagenaar, Maarten Gilbert and Lonneke IJsseldijk from Utrecht University to discuss seal bite infections in porpoise.

- 01/04/2017 – 08/04/2017 Andrew assisted with a potential UME in Cape Cod USA at the request of the IFAW Stranding Scheme.

- 30/04/17 Andrew co-chaired and Nick attended the workshop by the working group on predator interactions with Grey Seals in Middelfart, Denmark.

- 30/04/17 Mariel attended the ECS workshop on the effects of PCB exposure in killer whales and other threatened toothed whale species of the North Atlantic, Middelfart, Denmark.

- 01/05/17-03/05/17 Andrew, Nick and Mariel, attended the European Cetacean Society Annual Conference in Middelfart, Denmark.

- 17/05/17 Andrew, Nick and Mariel met with Owen McGrath and Katie Gillham from SNH regarding strandings monitoring app development, Great Glen House SNH Inverness.

- 29/05/17 Andrew and Nick met with Alisa Hall SMRU to discuss the review of SMASS.

- 09/08/2017 Mariel and Andrew met Andrew Dale at SAMS to discuss further work on strandings in relation to ocean currents.

- 23/10/2017 to the 27/10/17 Mariel and Andrew attended the bi-annual SMM conference in Halifax Nova Scotia, Canada.

- 23/11/17 Andrew, Nick and Mariel attended the RSPB Nature in Scotland awards ceremony. SMASS were shortlisted for the volunteer scheme.

Appendix 3: Media coverage

There was a large amount of media interest in the mass stranding event involving 21 pilot whales at Staffin on the Isle of Skye on 1st and 2nd June 2015. Though there seemed to be some confusion on the number of animals that actually died at the scene, which was seven. Both SMASS and CSIP team members attended along with volunteers from SMRU, Aberdeen University lighthouse field station and BDMLR.

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-32973059

http://www.telegraph.co.uk/news/earth/wildlife/11645760/Three-pilot-whales-die-in-mass-stranding-off-Skye.html

https://www.pressandjournal.co.uk/fp/news/599570/hopes-rise-for-pilot-whales-after-stranding/

http://news.stv.tv/scotland/1322129-rescue-launched-by-bdmlr-after-pilot-whales-stranded-at-staffin-near-skye/

http://www.dailymail.co.uk/news/article-3107532/Desperate-rescue-effort-launched-save-nine-beached-pilot-whales-seven-die-rocks-Isle-Skye.html

http://www.ibtimes.co.uk/rescuers-race-against-time-save-pilot-whales-stranded-off-isle-skye-1504100

http://www.thetimes.co.uk/tto/news/uk/article4458448.ece

http://www.dailystar.co.uk/news/latest-news/445839/Nine-whales-die-twelve-rescued-off-coast-Isle-Skye

http://thehighlandtimes.com/news/2015/06/02/eight-whales-dead-after-mass-stranding-on-skye/

http://www.whaledolphintrust.co.uk/news_article.asp?news_id=433

The following week (4th of June 2015) a juvenile female Humpback whale became entangled in some creel lines of Helmsdale and died despite efforts of BDMLR to try and release the animal. This attracted quite a bit of media attention too as the carcass is to be used in an ITV documentary entitled “whale fall” by Bigwave productions. Members of both SMASS and CSIP attended.

http://news.stv.tv/highlands-islands/1322372-rescue-launched-after-humpback-whale-tangled-in-rope-in-helmsdale/

http://news.stv.tv/highlands-islands/1322503-humpback-whale-found-tangled-in-rope-near-helmsdale-dies/

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-33019949

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-33046344

https://www.pressandjournal.co.uk/fp/news/islands/shetland/603616/humpback-whale-dies-caught-ropes-off-north-east-coast/

10/06/15 A live stranded pilot whale that was succesfully refloated by some of our volunteers on Orkney attracted some media interest.

http://www.bbc.co.uk/news/uk-scotland-north-east-orkney-shetland-33087422

http://www.orcadian.co.uk/2015/06/stranded-whale-rescue-at-dingieshowe/

https://whalesandmarinefauna.wordpress.com/2015/06/10/team-battles-to-save-beached-whale-on-orkney-beach-scotland-usa/

On the 2nd of June 2015 the possible closure of the SAC Veterinary services Disease Surveillance centre Inverness was announced by SRUC management. The implications for SMASS, farm animal and terrestrial wildlife diease surveillance attrached considerable media coverage.

http://www.thenational.scot/news/whales-and-wildlife-under-threat-if-highland-lab-closes.4826

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-33061146

http://www.robedwards.com/2015/07/whales-and-wildlife-under-threat-if-highland-animal-lab-closes.html

https://www.pressandjournal.co.uk/fp/news/inverness/620762/msps-voice-concern-alternative-specialist-vet-centre/

http://www.thescottishfarmer.co.uk/news/vets-under-threat.27117218

https://wpcluster.dctdigital.com/pressandjournal/fp/business/farming/623719/undefined-headline-1058/

https://www.pressandjournal.co.uk/fp/business/farming/628367/undefined-headline-1180/

http://www.himsps.org.uk/2015/06/highland-msp-sets-up-i-petition-to-garner-support-for-rural-college-in-inverness/

http://www.heraldscotland.com/business/farming/farmers-fight-proposed-closure-of-inverness-veterinary-surveillance-centre.130869940

http://www.fginsight.com/news/farmers-and-vets-warn-inverness-lab-closure-could-compromise-animal-health-4591

http://www.fwi.co.uk/news/plea-to-save-animal-vet-lab-from-closure.htm

http://www.highland-news.co.uk/News/Calls-for-Inverness-veterinary-disease-lab-to-be-saved-22062015.htm

http://mrcvs.co.uk/en/news/13333/Scottish-surveillance-centre-may-close-in-2015

http://www.thescottishfarmer.co.uk/mobile/news/sruc-urged-to-re-think.27294662

https://www.prospect.org.uk/news/id/2015/June/29/Coordinated-effort-needed-defeat-vet-lab-closure-plans

The publication on the 24th of June 2015 of the report into the Pilot MSE at the Kyle of Durness on the 24th of June also attracted quite a lot of media attention. Some of the reporting was not entirely accurate.

http://www.theguardian.com/environment/2015/jun/24/royal-navy-bomb-explosions-mass-whale-deaths-report

http://news.stv.tv/highlands-islands/1323562-navy-bombs-at-cape-wrath-caused-mass-kyle-of-durness-whale-stranding/

http://www.telegraph.co.uk/news/earth/wildlife/8656327/Stranded-whales-return-to-open-water-at-Kyle-of-Durness.html

http://us.whales.org/news/2015/06/military-activity-probable-cause-of-mass-uk-whale-stranding-says-new-government-report

http://www.dailyrecord.co.uk/news/scottish-news/navys-underwater-bombs-a-major-5950953

http://www.dailystar.co.uk/news/latest-news/450152/Royal-Navy-bomb-explosions-killed-deafened-pilot-whales

https://www.pressandjournal.co.uk/fp/news/highlands/620302/underwater-bombs-caused-death-of-pilot-whales-report-confirms/

http://www.heraldscotland.com/news/home-news/animal-welfare-experts-call-for-changes-as-royal-navy-bomb-blasts-blamed-for-mass-wha.130153052

http://www.express.co.uk/scotland/586734/Whales-beaching-Scotland-deaths-Department-for-Environment

Towards the end of June 2015 a number of seals shot by licenced marksman from both the North and East coast some of which were submitted to SMASS made the local & national news.

https://www.pressandjournal.co.uk/fp/news/north-east/627329/seal-reportedly-shot-at-crovie/

http://www.dailymail.co.uk/news/article-3028571/Hundreds-seals-secretly-shot-British-coasts.html

http://aberdeenvoice.com/2014/04/usanscottish-wild-salmon-co-closer-look/

http://www.robedwards.com/2015/06/charges-looming-in-impassioned-battle-to-save-seals-from-being-shot.html

http://www.heraldscotland.com/news/home-news/seal-shooting-wars-reports-sent-to-fiscal.1435498698

http://www.express.co.uk/news/uk/586495/Seal-shooting-marksman-Crovie-Sea-Shepherd

The stranding in January 2016 of Lulu, one of the few remaining members of the west coast community of killer whales attracted a lot of media attention.

https://www.pressandjournal.co.uk/fp/news/scotland/796330/killer-whale-washes-dead-scottish-beach/

https://www.pressandjournal.co.uk/fp/news/islands/798663/killer-whale-found-dead-on-scottish-beach-was-killed-by-fishing-gear/

http://www.dailymail.co.uk/news/article-3391416/Death-Lulu-one-killer-whales-British-waters-point-no-return.html

http://www.express.co.uk/news/nature/632002/beautiful-creature-Dead-Killer-Whale-beach-Britain

http://www.bbc.co.uk/news/uk-scotland-glasgow-west-35244417

http://www.itv.com/news/2016-01-06/killer-whale-lulu-found-dead-off-scottish-island-sparking-fears-for-orca-future/

http://www.earthtouchnews.com/oceans/whales-and-dolphins/scotlands-unique-orca-lulu-found-dead-on-local-beach

http://www.scotsman.com/regions/inverness-highlands-islands/killer-whale-from-scotland-s-only-native-pod-found-dead-on-beach-1-3992397

http://www.independent.co.uk/environment/nature/lulu-whale-s-death-may-mean-the-end-for-britains-orcas-a6803011.html

http://www.ibtimes.co.uk/uk-population-killer-whales-could-become-extinct-lulu-dies-after-becoming-entangled-1536984

http://www.scotlandnow.dailyrecord.co.uk/news/killer-whale-lulu-found-dead-7132106

http://www.natureworldnews.com/articles/19223/20160107/orca-whale-rare-group-scotland-found-dead.htm

http://www.countryfile.com/explore-countryside/wildlife/extinction-fears-grow-killer-whale-found-dead-tiree

http://stv.tv/news/highlands-islands/1338262-killer-whale-drowned-after-becoming-tangled-in-fishing-gear/

https://whalesandmarinefauna.wordpress.com/2016/01/04/fears-for-orca-population-after-killer-whale-found-dead-on-tiree-scotland-uk/

http://whaledolphintrust.co.uk/news_article.asp?news_id=466

http://awesomeocean.com/2016/01/06/scottish-killer-whale-found-dead/

http://thirdforcenews.org.uk/tfn-news/dead-orca-is-one-of-scotlands-last-says-charity

http://ecowatch.com/2016/01/07/lulu-found-dead/

http://www.heraldscotland.com/news/homenews/14186383.display/

https://www.eveningexpress.co.uk/pipe/news/scotland/fears-for-killer-whale-pod-after-female-found-dead-on-tiree/

http://www.north-star-news.co.uk/News/Orca-whale-Lulu-drowned-by-fishing-gear-08012016.htm

http://www.hebrides-news.com/orca-survival-fears-4115.html

http://www.hebrides-news.com/killer-whale-10116.html

http://hebridestoday.com/2016/01/stranded-scottish-orca-identified-as-lulu/

http://forargyll.com/?p=103935

In January 2016 SMASS helped out the Dutch stranding scheme during a sperm whale MSE on Texel, Netherlands involving five animals.

http://www.dutchnews.nl/news/archives/2016/01/beached-sperm-whales-die-on-dutch-island-overnight/

In January 2016 the publication of a paper by the CSIP and involving SMASS entitled “PCB pollution continues to impact populations of killer whales and other dolphins in European waters”. In Nature Scientific Reports also attracted media coverage.

http://www.bbc.co.uk/news/science-environment-35302957

http://www.telegraph.co.uk/news/science/12100161/British-whales-at-threat-of-extinction-because-of-banned-toxic-chemicals.html

http://www.theguardian.com/environment/2016/jan/14/uks-last-resident-killer-whales-doomed-to-extinction

https://www.sciencenews.org/article/pcb-levels-still-high-europes-killer-whales-smaller-dolphins

http://phys.org/news/2016-01-chemicals-threaten-europe-killer-whales.html

http://ecowatch.com/2016/01/17/whales-dolphins-pcbs/

http://sciencenordic.com/why-are-banned-chemicals-still-killing-killer-whales

http://www.enn.com/pollution/article/49313

http://news.discovery.com/animals/whales-dolphins/europes-orca-pods-under-threat-from-banned-chemicals-160114.htm

In January 2016 a live stranded striped dolphin at Lossiemouth on the Moray coast also made the local newspaper.

https://www.pressandjournal.co.uk/fp/news/816003/dolphin-rescue-drama-ends-in-misery/

In January 2016 SMASS made it into Science! Well not quite; the 'corkscrew' seal issue was covered by a news blog from Science for Students.

https://student.societyforscience.org/article/seals-catching-%E2%80%98corkscrew%E2%80%99-killer

In February 2016 the publication of Jo Bailys paper "Salmonella infection in grey seals (*Halichoerus grypus*), a marine mammal sentinel species: pathogenicity and molecular typing of Salmonella strains compared with human and livestock isolates" also generated media attention.

http://www.heraldscotland.com/news/homenews/14245510.Seal_pups_found_with_Salmonella_bacteria/

https://www.pressandjournal.co.uk/fp/news/822100/pollution-concerns-voiced-as-salmonella-found-in-scottish-grey-seal-pups/

http://mrcvs.co.uk/en/news/14136/Salmonella-in-seals-raises-environmental-concerns

In February 2016 the publication of Zuzana Gajdosechova's paper "*Possible link between Hg and Cd accumulation in the brain of long-finned pilot whales (Globicephala melas)*" generated significant media interest, coming close to the news release by IOZ of the PCB paper (see above)

http://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-35550927

http://www.theguardian.com/environment/2016/feb/11/toxic-chemicals-found-in-beached-pilot-whales-in-soctland

http://www.theecologist.org/News/news_round_up/2987145/heavy_metal_poisoning_in_scotlands_beached_whales.html

http://baleinesendirect.org/en/accumulation-of-heavy-metals-in-a-group-of-stranded-long-finned-pilot-whales-in-scotland/

http://www.thenational.scot/news/whales-stranded-on-scottish-beaches-had-high-levels-of-toxic-metals.13625

In February 2016 the grey seal infanticide and cannibalism cases in Scotland made it into the New Scientist.

https://www.newscientist.com/article/2077441-first-video-footage-of-seal-drowning-and-eating-a-pup/?utm_source=NSNS&utm_medium=SOC&utm_campaign=hoot&cmpid=SOC%7CNSNS%7C2016-GLOBAL-hoot

In March 2016 a case of entanglement involving a humpback whale on the island of Barra also generated some media interest.

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-35707248

https://www.pressandjournal.co.uk/fp/news/islands/inner-hebrides/850402/humpback-whale-painfully-killed-off-scottish-coast-fishing-ropes/

http://www.hebrides-news.com/humpback-whale-2316.html

A Risso's dolphin that originally live stranded on the Beauly Firth on the 9th of January 2016, washed up dead several weeks later at Munlochy on the Moray Firth was reported by the local press.

https://www.pressandjournal.co.uk/fp/news/inverness/841828/rare-dolphin-washed-up-in-highlands-weeks-after-rescue/

The humpback whale that was found entangled in creel lines of Helmsdale last year features along with a very brief appearance of Andrew and even briefer glimpses of Nick and Rob in Big Waves Britain's Whales on ITV /STV that aired on 25th March 2016 at 8pm.

http://www.itv.com/presscentre/ep1week12/britains-whales

"Spirtle" one of the Moray Firth bottlenose dolphin population was found live stranded on the mud flats at Nigg Bay on 30th May 2016. Andrew was the only vet available to assess the animal and he elected to refloat the dolphin on the next incoming tide. By that time she had spent around 24 hours out of the water, most of that period in strong sun. Despite evidence of severe muscle cramp and skin blistering, she eventually swam off strongly. She was later spotted in July, exhibiting normal behaviour but with severe skin defect on her right flank where the blistered skin had sloughed off. She was however behaving reasonably normally and seems to be recovering well. This story, and her subsequent resighting, produced quite a bit of media attention.

http://www.express.co.uk/news/nature/675842/bottlenose-dolphin-saved-good-samaritans-nigg-rossshire-nature

http://www.dailymail.co.uk/news/article-3620214/Bottlenose-dolphin-stranded-sand-retreating-tide-saved-volunteers-incredible-overnight-rescue-effort.html

http://www.huffingtonpost.co.uk/entry/stranded-dolphin-rescued-after-womans-sat-nav-messed-up-and-led-her-to-it-in-scotland_uk_574ead08e4b0089281b4ead0

http://www.thetimes.co.uk/article/lost-driver-rescues-stranded-dolphin-hqfghlgvr

http://metro.co.uk/2016/06/01/stranded-dolphin-wrapped-in-damp-blankets-by-caring-volunteers-5917720/

http://www.deadlinenews.co.uk/2016/06/01/dolphin-rescued-certain-death-thanks-satnav-blunder/

http://www.forres-gazette.co.uk/News/Findhorn-crew-help-save-stranded-dolphin-13062016.htm

http://ever4online.com/2016/06/01/bottlenose-dolphin-stranded-on-sand-by-retreating-tide-is-saved-by-volunteers-incredible-overnight-rescue-effort/

http://www.inverness-courier.co.uk/News/Tide-turns-in-favour-of-beached-Moray-Firth-dolphin-02062016.htm

http://www.newstoday.co.uk/2016/06/touching-pictures-show-dolphin-wrapped-towels-rescue/

http://www.eveningtimes.co.uk/news/14528154.Stranded_dolphin_named_Spurtle_saved_by_couple_s_faulty_sat_nav/

In June 2016 a juvenile male minke whale that stranded due to entanglement next to the St Andrews golf club also attracted significant attention

https://www.thecourier.co.uk/fp/news/local/fife/184619/st-andrews-whale-died-due-to-recent-acute-entanglement/

http://www.dailymail.co.uk/news/article-3623699/Scientists-perform-seaside-post-mortem-22-ft-long-dead-minke-whale-remove-LUMPS-washed-dead-Scottish-beach.html

http://stv.tv/news/tayside/1356142-a-dead-whale-washed-up-on-a-beach-had-its-tail-entangled/

http://www.dailyrecord.co.uk/news/scottish-news/dead-whale-found-washed-up-8100696#u9YhjWCGkIugaiyM.97

http://www.fifetoday.co.uk/news/local-headlines/speculation-over-whale-death-points-to-creel-lines-1-4145396

In July 2016 the continued recovery of “Spirtle” one of the Moray Firth bottlenose dolphin population was found live stranded on the mud flats at Nigg Bay continues to make the news

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-36865435

In August 2016 SMASS ran two volunteer training course and necropsy demonstrations at Hillswick Wildlife Sanctuary, Hillswick, Shetland, to Train Volunteers from Shetland. This was picked by several local news outlets including BBC radio Shetland

http://www.shetnews.co.uk/news/13193-volunteers-flock-to-help-strandings-scheme

https://www.facebook.com/bbcradioshetland/photos/a.165839823448801.36200.125030350863082/1261148410584598/?type=3&theater

In September 2016 a Juvenile Fin whale that live stranded and died on the shore of Noss Island in Shetland also attracted some media attention.

https://www.pressandjournal.co.uk/fp/news/islands/shetland/1029074/fin-whale-dies-stranding-shetland/

http://www.shetlandtimes.co.uk/2016/09/16/rare-fin-whales-found-stranded-on-noss

http://stv.tv/news/north/1367312-huge-whale-dies-after-stranding-at-shetland-nature-reserve/

In November 2016 three much decomposed cetacean carcasses that were washed ashore in Colonsay were mistakenly identified as a family of polar bears by a local wildlife expert.

http://www.dailymail.co.uk/sciencetech/article-3937794/Polar-bears-did-not-wash-Scotland-Mystery-carcasses-likely-WHALES-says-marine-expert.html

In December 2016 the stranding or a Sowerby's beaked whale and a pygmy sperm whale on the north coast of Scotland within a week of each other attracted some media attention.

http://www.johnogroat-journal.co.uk/News/Mystery-surrounds-deaths-of-whales-on-Caithness-coastline-09122016.htm

http://www.deadlinenews.co.uk/2016/12/02/different-species-rare-whale-washed-beach-day/

https://www.facebook.com/seawatchfoundation/posts/1166234130158359

In December 2016 a number of porpoises that had been bitten by grey seals but escaped only to later die of infection from the bite also made the news

http://www.thetimes.co.uk/article/grey-seals-blamed-for-vicious-attacks-on-porpoises-hlqgvnj6d

The stranding of a killer whale on an uninhabited island in Shetland on the 12th of January 2017 attracted some media attention. It even made it onto a Dutch website.

https://stv.tv/news/north/1378009-killer-whale-washes-up-dead-on-small-shetland-island/

http://www.shetnews.co.uk/newsbites/13874-orca-washed-up-near-walls

http://www.shetnews.co.uk/news/13909-dead-killer-whale-to-remain-in-shetland

https://www.sott.net/article/339584-Killer-whale-found-dead-on-island-in-Shetland-Scotland

http://www.dailymail.co.uk/news/article-4132008/Marine-experts-perform-gruesome-autopsy-killer-whale.html

https://www.zeezoogdieren.org/wordpress/2017/01/14/dode-orka-shetlands/

http://orcazine.com/necropsy-orca-shetland/

http://myshetland.co.uk/the-orca-autopsy/

29th March 2017 Andrew was filmed at NMS about Lulu for BBC Newsnight .

The stranding of a sperm whale at stinky bay Benebcula 5th of April attracted some local media attention.

http://www.hebrides-news.com/sperm-whale-washed-ashore-12417.html

https://www.pressreader.com/uk/the-press-and-journal-inverness/20170412/281556585689665

in April 2017 the live stranding and successful refloat of a minke whale by BDMLR in Fife attracted quite a bit of media attention.

http://www.telegraph.co.uk/news/2017/04/22/minke-whale-stranded-scottish-beach-refloated-rescuers/

http://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-39675201

http://www.scotsman.com/news/video-minke-whale-stranded-on-beach-in-elie-refloated-1-4426917

https://stv.tv/news/east-central/1386414-rescuers-attend-minke-whale-stranded-on-fife-beach/

In May 2017 another much decomposed sperm whale that was spotted floating in a cove on Shetland somewhat surprisingly made it into the Sun newspaper and others.

https://www.thesun.co.uk/news/3602588/sperm-whale-trapped-shetland-cove/

https://www.newsflare.com/video/125500/other/dead-sperm-whale-off-shetland

https://www.sott.net/article/351479-Dead-sperm-whale-found-in-a-remote-cove-in-Shetland-Scotland

https://www.earthtouchnews.com/oceans/whales-and-dolphins/dead-sperm-whale-floats-into-uk-cove-but-remains-out-of-reach-video/

13th of April 2017 Sky News as part of the campaign "Sky Ocean Rescue" produced a short film called "the plastic whale" as part of this Andrew and Nick filmed regarding plastic found inside a Cuvier's beaked whale in 2015. Broadcast 9pm 21st June 2017.

http://news.sky.com/feature/sky-ocean-rescue-a-plastic-whale-10917187

Following this article, a number of newspapers additionally published articles including the Daily Mail (online and in print) in June 2017.

http://www.dailymail.co.uk/sciencetech/article-4622564/Cuvier-s-beaked-whale-4kg-plastic-bags-stomach.html

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-40354561

16th May 2017; Andrew filming for the One Show at the National Museum of Scotland, broadcast date to be announced.

5th June 2017; Andrew filming for CountryFile on the bottlenose dolphin Spirtle, that live stranded and was refloated by Andrew and members from BDMLR and the general public

In August 2017 an adult female Long finned pilot whale that live stranded near North Kessock and was euthanased received media attention from several agents, some of which attended the stranding:
http://www.inverness-courier.co.uk/News/Pilot-whale-stranded-at-North-Kessock-has-to-be-put-down-07082017.htm
http://www.bbc.co.uk/news/uk-scotland-highlands-islands-40849669
https://www.pressandjournal.co.uk/fp/news/inverness/1304151/pilot-whale-put-down-after-stranding-on-black-isle-shore/
https://stv.tv/news/north/1395151-pilot-whale-euthanized-after-becoming-stranded-on-beach/

In September 2017 a Northern bottlenose whale that stranded with entanglement lesions at Ardentinny, near Dunoon attracted some media attention.

http://www.deadlinenews.co.uk/2017/09/28/whale-died-getting-caught-rope-off-scottish-coast-reveals-report/

The story of 'Lulu' the stranded killer whale from the west coast community was also part of a two part piece on the BBC's One Show broadcast on the 12th and 13th of September 2017.

http://www.bbc.co.uk/iplayer/episode/b094fmh5/the-one-show-12092017

In September 2017 the SMASS volunteer network has been shortlisted for the 2017 Nature of Scotland Awards

https://ww2.rspb.org.uk/about-the-rspb/at-home-and-abroad/scotland/nature-of-scotland-awards/winners-and-finalists/2017-shortlist/

In October 2017 an adult male white beaked dolphin was found swimming in Buckie harbour on the 30th of October. The animal live stranded and died despite attempts by BDMLR medics to herd it back to sea http://www.bbc.co.uk/news/uk-scotland-north-east-orkney-shetland-41805596

A blue shark that was found on the 18th of November 2017 at Roseisle beach on the Moray Firth attracted some media interest.
http://www.bbc.co.uk/news/uk-scotland-north-east-orkney-shetland-42087405

In December 2017 the announcement that SMASS would hold its first annual forum in January 2018 was picked up by the BBC.
http://www.bbc.co.uk/news/uk-scotland-highlands-islands-42439945

In December 2017 a Killer whale calf that was found stranded quite a way from the sea in Shetland, caused a minor storm…
https://www.thesun.co.uk/news/5188482/killer-whale-dead-scottish-field-storm-caroline/

The adult male long-finned pilot whale that live stranded and died on Calgary beach, Mull, on the 19/01/18 received media attention.

https://www.pressandjournal.co.uk/fp/news/islands/1399315/needs-pic-long-finned-pilot-whale-dies-stranding-mull/

The forum SMASS held on the 20th January 2018 received some coverage.

http://www.bbc.co.uk/news/uk-scotland-highlands-islands-42439945

http://www.invernesscampus.co.uk/news/2018/a-first-for-scottish-marine-stranding-forum/

A BBC radio Scotland interview with Andrew was recorded on the 19th January, and broadcasted on the 20th January 2018.

The live stranding of a sperm whale at Buddon Ness in Angus on the 21/03/18 attracted quite a bit of media coverage

https://www.thecourier.co.uk/fp/news/local/angus-mearns/624009/video-watch-as-complex-operation-to-probe-death-of-and-bury-tay-sperm-whale-gets-under-way/

https://www.scotsman.com/news/environment/autopsy-to-be-performed-on-sperm-whale-found-on-scottish-beach-1-4713004

http://www.dailymail.co.uk/news/article-5531375/A-12-metre-sperm-whale-dies-washing-Scottish-beach.html

https://www.mirror.co.uk/news/uk-news/heartbreaking-drone-footage-shows-body-12231698

https://www.eveningexpress.co.uk/fp/news/scotland/watch-sadness-as-massive-40ft-whale-washed-up-at-scottish-beach-dies/

Appendix 4: Volunteers, necropsy demonstrations and outreach

11.1 Training courses

11.1.1 *Techniques and approach of the stranding volunteer course.*

11.1.1.1 Course aims and objectives

The purpose of the training day is to demonstrate how to safely and accurately collect information and samples from stranded marine animals. This involves a cetacean necropsy which we is used to demonstrate what samples to take and show how we conduct a full necropsy examination. There is no expectation for the volunteers to attempt examinations at this level of detail but we hope to show how even basic sampling and data collection can be of great benefit to the scheme.

The day has a set of modules and usually run in this order;

- Arrival and HSE brief.
- 45-50 minute talk on the stranding scheme and what is expected of those who sign up as a “SMASS Stranding Volunteer”
- Post mortem examination demonstration and sampling techniques.
- Hand out certificates and provision of sampling kits.

Health and safety documentation is supplied to the attendees via email beforehand and they are expected to have read and understood them all before attending the course. They sign a document to confirm this prior to entering the post-mortem room or observing the necropsy. During the necropsy demonstration each potential volunteer will be given the opportunity to take samples and measurements from the animal as they would do when asked to attend a stranding on the beach. Each

potential volunteer is assessed on their abilities and only if deemed competent will a stranding kit be issued.

11.1.1.2 Kit contents

All those that pass the assessment will be issued a stranding kit which consists of:

- Lunch box containing:
- PM knife
- Sampling pots
- Sampling bags
- Rule
- Measuring tape
- Cut proof gloves
- Disposable gloves
- Scale bar
- Pen
- Pencil
- Pliers
- Biobottle (for sending samples)
- Field sampling guide (report form)
- Stranding posters
- Prepaid postage labels
- Reference guides for sampling and posting
- CSIP leaflet (to aid with species identification)

These kits cost around £24-26 each in materials and are designed to be small enough to be easily carried and stored in the volunteer's car. With the exception of the gloves, biobottle and cut proof gloves, most components are sourced from supermarkets or basic hardware stores. We have discontinued the issue of tags as they are plastic until such time we can source a biodegradable substitute.

Figure 65: Sampling kit cut resistant glove not shown.

11.2 Volunteer trainng courses run from April 2015 to March 2018

1. 26th June 2015 course at Thurso SAC to Highland Council Countryside Rangers, Scottish SPCA and BDMLR medics. This was particularly useful as we were able to train most of the Highland Ranger service in this region.

2. 9th December 2015 at Hessilhead Wildlife Rescue Trust near Beith, North Ayrshire. Hessilhead deserve particular thanks as they not only sample cases for SMASS but have made space for a freezer and will collect and store carcasses waiting for necropsy. Given the travel time from Inverness to Ayrshire we are particularly grateful for this assistance

3. 7th April 2016 SMASS ran a volunteer training course and necropsy demonstration at Inverness to Train Volunteers from Skye, Wester Ross and the Western Isles.

4. 25th July 2016 Andrew Brownlow ran a volunteer training course and necropsy demonstration at the Hebridean Whale and Dolphin Trust (HWDT) to train members of staff to become volunteers.

5. On 21st and 22nd August 2016 Andrew Brownlow and Nick Davison ran two volunteer training course and necropsy demonstrations at Hillswick Wildlife Sanctuary, Hillswick, Shetland to train volunteers from Shetland.

6. 24th March 2017 volunteer training course and Necropsy Demonstration at Ocean lab Aberdeen University.

7. 17th August 2017 volunteer training course at Skye, Wester Ross, Western Isles and Moray Firth at Inverness.

8. 15th October 2017 volunteer training course at Glasgow vet school, South West Scotland Including, Arran and Cumbrae.

Staff at the Scottish Marine Animal Strandings Scheme presented 13 necropsy demonstrations to collaborating institutions, ran 9 volunteer training days, gave 9 seven talks to interested groups.

- 26/6/15 Andrew gave a stranding volunteers training course on data collection and sampling for Volunteers at Thurso SAC to Highland Council Countryside Rangers, SSPCA and BDMLR medics.
- 27/6/15 Andrew gave a talk to the residents of Sanday Orkney followed by a necropsy demonstration on the following day 28/06/15.
- 22/07/15 Necropsy demonstration to Catarina Fogaça a Vet from Portugal working with the CRRU visited us for advice on setting up a stranding network in Portugal.
- 04/08/15 Necropsy demonstration for the Cetacean Research and Rescue Unit (CRRU).
- 11/9/15 Talk on the strandings project at the Black Isle sea kayak symposium hosted by the Aberdeen University lighthouse field station.
- 23/10/15 Necropsy demonstration for SMRU Masters students at Inverness.
- 9th December 2015 volunteer training at Hessilhead Wildlife Rescue Trust near Beith, North Ayrshire.
- 21/01/16 Necropsy demonstration annual SMM UK & Ireland regional chapter student conference at SMRU
- 30/01/16 Necropsy demonstration for the annual meeting of the Northern Veterinary Student Zoological symposium at Glasgow Vet School.
- 17/2/16 Necropsy demonstration for Aberdeen University Masters students at Inverness.
- 09/03/16 Necropsy demonstration for SAC Countryside management students at Inverness.
- 7th of April 2016 SMASS ran a volunteer training course and necropsy demonstration at Inverness to Train Volunteers from Skye, Wester Ross and the Western Isles.

- Andrew Brownlow attended the Royal Highland Show at Edinburgh on the 24th June 2016 to help the Scottish Marine Animal Stranding Scheme.
- 25th of July Andrew Brownlow ran a volunteer training course and necropsy demonstration at the Hebridean Whale and Dolphin Trust (HWDT) to train members of staff to become volunteers.

- On the 21st and 22nd of August Andrew Brownlow and Nick Davison ran two volunteer training course and necropsy demonstrations at Hillswick Wildlife Sanctuary, Hillswick, Shetland to Train Volunteers from Shetland.
- Andrew Brownlow gave a talk on the work of SMASS at the North West Highlands Cetacean Week organised by the Scottish Wildlife trust at Ullapool Ferry Terminal on the 14th of September 2016, Mariel ten Doeschate also attended
- 16th November 2016 Andrew gave a talk to the Scottish beach managers forum, at the Keep Scotland Beautiful event at Burntisland, Fife http://www.keepscotlandbeautiful.org/
- Andrew gave a talk on the Scheme to the Wildlife information centre Falkirk on the 26th of November 2016. http://www.wildlifeinformation.co.uk/
- November 2016 Andrew gave a talk on the Scheme to a marine life stranding awareness day for Police Scotland hosted by SMRU.
- 3/2/17 Necropsy demonstration for Aberdeen University Masters students at Inverness.
- 03/03/17 Andrew gave a talk to the Institute of Comparative Biology in Glasgow.
- 24/03/17 Volunteer training course and Necropsy Demonstration at Ocean lab Aberdeen University.
- 27/04/2017: Presence through posters and leaflets and presentations by BDMLR at the Scottish Fisheries Conference at Eden Court, Inverness
- 14/06/2017; Necropsy Demonstration of a harbour porpoise (SW2017/321) for the team and students of the Cetacean Research and Rescue Unit (CRRU).

- 09/08/2017: Andrew gave a talk on the stranding scheme for CoCoast volunteers at SAMS in Oban. https://www.youtube.com/watch?v=9Ljc-v78qcY
- 17/08/2017: Volunteer training course at Skye, Wester Ross, Western Isles and Moray Firth at Inverness.
- 06/09/2017: Nick gave a talk on the stranding scheme to the Kiltarlity Women's Institute, near Beauly.
- 16/09/2017: Presence though video footage and leaflets by WDC at Oceans film festival Eden Court Inverness.
- 30/09/2017: Presence though leaflets by Lighthouse Field Station at Royal Society of Edinburgh's "meet the experts" event at Eden Court Inverness.
- 04/10/2017: Necropsy demonstration for SAMS at Inverness
- 13/10/2017: Necropsy demonstration for Glasgow vet students at Glasgow vet School.
- 14/10/2017: Andrew gave a talk about SMASS to Biological Recording in Scotland (BRIS) group at Millport, Isle of Cumbrae.
- 15/10/17 Volunteer training course at Glasgow vet school, South West Scotland Including, Arran and Cumbrae.
- On the 20th of January 2018 SMASS held the first of what we hope to be an annual forum at the University of the Highlands and Islands Campus Inverness. It was well attended with over 100 volunteers and public listening to talks in the morning and taking part in workshops in the afternoon.

Appendix 5: Data and sample requests

These are either part of ongoing collaborations or one off requests for data and or samples from SMASS's fixed, frozen tissue or data archive.

11.3 Samples provided to collaborators

- 23/04/15 Porpoise Blubber samples for PCB analysis with a view to future collaboration on those species not routinely tested by CEFAS. Nickolette Varga Stirling University.
- 16/06/15 Skin/Muscle/Blubber samples for ongoing study into biopsy biochemistry. Jo Kershaw SMRU
- 16/06/15 Faeces and Urine for algal toxin work. Ailsa Hall SMRU.
- 13/10/2015 parasitic worms ex minke whale M319/15. Eileen Harris Senior Curator
- Parasites & Vectors Division Department of Life Sciences Natural History Museum Cromwell Road London SW7 5BD
- 26/10/2015 Harbour porpoise blubber and Liver samples for PCBS and HBCDs. Jon Barber CEFAS
- 29/10/2015 Tissue sample from basking shark M332/15. Cath Jones Senior Lecturer,Institute of Biological and Environmental Sciences, School of Biological Sciences,University of Aberdeen, Zoology Building, Tillydrone Avenue, Aberdeen, AB24 2TZ.
- 18/11/2015 Pilot whale MSE muscle samples for DNA extraction. Rachel Ball Chester University
- 03/03/16 Harbour porpoise skin samples to Tom Bean at University of Aberdeen for stable isotope analysis.
- 12/05/16 Cuvier's beaked whale skin sample to Morton Olsen at University of Copenhagen for DNA analysis.
- 11/07/16 GIT's from Marine mammals for micro plastic examination, Sarah Nelms PhD student, University of Exeter and Plymouth Marine Laboratory
- 08/09/16 Stomachs and stomach contents, Natalie Ward and Fiona Coyle Aberdeen University undergraduate project.
- 27/09/16 C. boopis worms for morphological and molecular identification Miguel Grilo Research Assistant University of Veterinary Medicine Hannover, Foundation institute for Terrestrial and Aquatic Wildlife Research Büsum Germany.

- 09/11/16 C. boopis worms for morphological and molecular identification Miguel Grilo Research Assistant University of Veterinary Medicine Hannover, Foundation institute for Terrestrial and Aquatic Wildlife Research, Büsum, Germany.
- 07/03/2017 skin and blubber samples for POPS and stable isotopes Alethea Madgett PhD student Marine Scotland.
- 16/08/17 Skin samples from beaked whales for genetic analysis to Emma Carroll (SMRU) as part of Morten Olsen's work
- 24/01/2018 skin samples from grey and harbour seals for genetic analysis. Kristina Steinmetz student GMIT Galway, Ireland.
- 06/03/2018 fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.
- 07/03/2018 fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.
- 13/03/2018 faeces and urine for domoic acid analysis, ongoing collaboration with Ailsa Hall SMRU.
- 13/03/2018 cetacean stomach contents for prey analysis, new collaboration with Simon Northridge SMRU.
- 14/03/2018 fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.
- 19/03/2018 fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.
- 27/03/2018 fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.

11.4 Data provided to collaborators

- 07/04/15 Data on Tursiops porpoise kills up to 2014, Kevin Robinson CRRU.
- 29/04/15 Data on the blubber thickness of Sowerby's beaked whales for biopsy depth determination. Patrick Miller, SMRU.
- 29/04/15 Data on potential samples for virus work (influenza, herpes etc.). Dave Everest APHA, Weybridge.

- 27/05/15 Data on killer whale strandings on the North and East coasts. Kevin Robinson CRRU.
- 14/10/15 Photos and PM reports on shot seals. Rob Harris SMRU.
- 09/11/15 Metadata on samples sent to National Museum of Scotland. Zena Timmons NMS
- 18/11/2015 Pilot whale MSE metadata. Rachel Ball Chester University.
- 13/01/16 Photos of the Risso's dolphin (M25/16) from the Beauly Firth, Nicola Hodgins WDC.
- 03/02/16 Meta data on specimens sent to the NMS, Zena Timmons National Museum of Scotland
- 08/02/16 Data on striped dolphin strandings to compare with recent strandings in the Netherlands Lonneke Ijsseldijk University of Utrecht.
- 22/02/16 Data on seal strandings in Orkney for 2015 for Brian Ribbands Orkney Field Club.
- 01/03/16 Preliminary necropsy report on the leatherback turtle (M24/16) Therese Alampo SNH St. Cyrus nature reserve.
- 23/03/16 Data on Tursiops kills up to 2015 Kevin Robinson CRRU.
- 30/03/16 Data on Atlantic white-sided dolphin and white-beaked dolphin strandings Chiara Bertulli University of Iceland.
- 21/04/2016 Alethea Madgett PhD student Marine Scotland Data on blubber samples for POPS study.
- 30/06/2016 Andrew Reid Response Coordinator Marine Animal Response Society NS Museum Halifax, NS Canada Data on the Sowerby's beaked whale blubber measurements.
- 11/07/16 Sarah Nelms PhD student, University of Exeter and Plymouth Marine Laboratory: data on GIT's from Marine mammals for micro plastic examination.
- 08/09/16 Natalie Ward and Fiona Coyle Aberdeen University: data on Stomachs contents for Aberdeen undergraduate project.
- 08/09/16 Lonneke Ijsseldijk Utrecht University: data on Harbour Dolphins (length, sex, age class), to compare to findings in recent stranding of Common dolphin male in the Netherlands.
- 12/01/2017 Data on seal Strandings Skye, Kintyre, Orkney Monica Arso SMRU

- 18/01/2017 Killer whale teeth photos to assess patterns of wear from all ecotypes as a function of their ecology, Audrey Granger masters student at Edinburgh Napier University.
- 08/02/2017 Data on Kogia strandings for proposed paper Georg Hanke National Museum of Scotland.
- 16/02/2017 Data on Seal Strandings Orkney Brian Ribbands Orkney Field Club.
- 16/02/2017 Data on Strandings Mull & Iona for Wild Mull magazine Steve & Linda Littlewood
- 03/03/2017 Data on specimens sent to NMS Zena Timmons National Museum of Scotland
- 22/03/2017 Data on seal Strandings Skye, Kintyre, Orkney Monica Arso SMRU.
- 03/04/2017 Myles O'Reilly Biologist / SEPA. Data and images on barnacle samples in archive for publication on Goliath Anchorworms (Copepoda: Penellidae) and barnacles (Cirripedia: Coronulidae, Lepadidae, & Platylepadidae) from whales and turtles in Scottish waters.
- 19/06/17 Monica Arso SMRU. Data on seal Strandings Skye, Kintyre, Orkney for Harbour Seal Population study.
- 19/06/17 Data on Minke whale strandings Scotland for MSc thesis project on Minke whale distribution in the North Sea, Carolin Philipp ITAW Hannover.
- 18/07/2017 Details of BND strandings Scotland 1992 – present Barbara Cheney, University of Aberdeen Lighthouse field station Cromarty.
- 16/08/17 data on skin samples from beaked whales for genetic analysis to Emma Carroll (SMRU) as part of Morten Olsen's work
- 28/09/17 Copy of Lulu's PM report to Robb Lott, WDC policy manager.
- 18/10/17 Alisa Hall SMRU Data on seal Strandings Skye, Kintyre, Orkney for Harbour Seal Population study.
- 07/12/17 Sean O'Callaghan Honours student GMIT Galway Ireland, Photos of dorsal fins from pelagic delphinids for morphometrics/photogrammatry project.
- 08/12/17 Monica Arso SMRU. Data on seal Strandings Skye, Kintyre, Orkney for Harbour Seal Population study.
- 25/01/2018 data on skin samples from grey and harbour seals for genetic analysis. Kristina Steinmetz student GMIT Galway, Ireland.
- 22/02/2018 data on Orkney seal strandings, Brian Ribbands Orkney Field Club.

- 26/02/2018 Data on harbour seal strandings 1992-2017 for population model. Monica Arso/ Ailsa Hall SMRU.
- 06/03/2018 data on fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.
- 09/03/2017 Data on seal Strandings Skye, Kintyre, Orkney Monica Arso SMRU
- 14/03/2018 data on fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.
- 19/03/2018 data on fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.
- 19/03/2018 data on turtle strandings for 2017 Rod Penrose MEM Wales
- 27/03/2018 data on fixed helminths sent for identification. Natalia Fraija-Fernandez NHM London helminth post doc research.

Appendix 6: Collaborations between SMASS and external organisations

- Dr Mark Dagleish & Johanna Baily Moredun Research Institute, Pentlands Science Park, Bush Loan, Penicuik, Midlothian, EH26 0PZ, Scotland. Histopathological studies on cetacean tissues from Scottish cetaceans.
- 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.
- Joanna Kershaw, SMRU. Harbour porpoise and large cetacean blubber samples.
- Michael Beddington, SAMS. Strandings location details for tidal drift modelling.
- 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.
- Dr. Graham Pierce and Fiona Read University of Aberdeen, Oceanlab, Main Street, Newburgh, Aberdeenshire, Scotland, AB41 6AA, UK Collaboration on

life history, dietary and toxicological studies of harbour porpoises and other cetaceans stranded in Scotland.

- Prof. Paul Thompson, University of Aberdeen, School of Biological Science, Lighthouse Field Station, George Street, Cromarty, Ross-shire IV11 8YJ. Collaboration on biological and genetic studies of harbour porpoises and bottlenose dolphins.
- Prof. Christina Fossi University of Siena Via Banchi di Sotto, 55, 4, 53100 Siena SI, Italy Samples sent for comparison of micro plastics and pollutants in baleen whales in the Mediterranean and NE Atlantic.
- Roger Ayling, BAC5 Mycoplasma dept., Animal and Plant Health Agency, New Haw, Addlestone, Surrey, KT15 3NB. Identification of *Mycoplasma sp*. isolates from marine mammals
- Lorraine Perrett, BAC3 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, Laboratori d'Aplicacions Bioacústiques. Examination of ear bones using scanning and transmission electron microscopy for indirect quantification of hearing ability in mass stranded pilot whale.
- Erasmus Medical Centre, Rotterdam, the Netherlands – bacteriological culture of samples collected following necropsy of marine mammals.
- James Barnett, CSIP stranding work, SW England– bacteriological culture of samples collected following necropsy of marine mammals. Following the loss of marine mammal bacteriology experience in APHA, SMASS now undertake bacteriology from most strandings necropsied in SW England.
- Scottish Salmonella Reference Laboratory – perform typing of *Salmonella* isolates
- Lesley Hoyles, Department of Food and Nutritional Sciences, University of Reading, Whiteknights, Reading – performs sequencing of bacterial isolates.
- Lilian Lieber University of Aberdeen, Skin & muscle from Basking sharks for DNA analysis.
- Sinead Murphy Marie Curie Research Fellow, Institute of Zoology. Reproductive failure in UK harbour porpoises and common dolphin blubber samples for Cetacean-Stressor project.
- Norbert Van De Velde University of Ghent, Toxoplasma studies.

- Milaja Nykanen, PhD Candidate School of BEES University College Cork Ireland. Bottlenose dolphin mitogenome work.
- Dr Conor Ryan HWDT. Ghost gear study.
- Chiara Giulia Bertulli, PhD student, University of Iceland. Project on body colouration patterns in white-beaked dolphins.
- Kieran Tierney, Scottish Universities Environmental Research Centre (SUERC) & the Scottish Association for Marine Science (SAMS). Transportation and Bioaccumulation of Sellafield-derived radiocarbon (14C) in the Marine Environment: Analysing 14C in Marine Mammals.
- Dr. Kevin Robinson, CRRU. Bottlenose dolphin kills on harbour porpoises in Scotland.
- Rob Harris SMRU, Analysis stomach contents from seal management cases.

Appendix 7: Scoring of suspected spiral trauma cases

SMASS ID	Species (Common)	Date found	GR100km	Sex	Grey seal predation?	Identifiable as a 'corkscrew' lesion'
M8/15	Grey seal	**05/01/2015**	HY	**U**	**Possible**	**Unlikely**
M12/15	Grey seal	**07/01/2015**	ND	**U**	**Possible**	**Unlikely**
M29/15	Grey seal	**14/01/2015**	ND	**U**	**Possible**	**Unlikely**
M40/15	Harbour seal	**19/01/2015**	NS	**U**	**Possible**	**Likely**
M54/15	Grey seal	**26/01/2015**	NH	**U**	**No data**	**No data**
M77/15	Grey seal	**11/02/2015**	HY	**M**	**Likely**	**Possible**
M94/15	Grey seal	**02/03/2015**	NC	**U**	**Possible**	**Possible**
M227/15	Harbour seal	**17/07/2015**	NO	**M**	**Likely**	**Possible**
M251/15	Harbour seal	**26/07/2015**	NC	**F**	**Likely**	**Possible**
M249/15	Harbour seal	**27/07/2015**	NC	**F**	**Likely**	**Possible**
M259/15	Grey seal	**30/07/2015**	NO	**F**	**Likely**	**Likely**
M509/15	Grey seal	**14/08/2015**	HY	**U**	**Unknown**	**Unknown**
M288/15	Seal (indeterminate species)	**04/09/2015**	NC	**U**	**Possible**	**Unlikely**
M290/15	Seal (indeterminate species)	**04/09/2015**	NH	**U**	**Possible**	**Possible**
M349/15	Harbour seal	**26/10/2015**	NR	**U**	**Likely**	**Likely**
M374/15	Grey seal	**14/11/2015**	NF	**U**	**Likely**	**Likely**
M368/15	Harbour seal	**15/11/2015**	HY	**U**	**Likely**	**Likely**
M400/15	Grey seal	**15/11/2015**	NG	**U**	**Unknown**	**Unknown**
M381/15	Grey seal	**21/11/2015**	HY	**U**	**Likely**	**Likely**
M441/15	Grey seal	**13/12/2015**	HY	**U**	**Unknown**	**Unknown**
M442/15	Grey seal	**13/12/2015**	HY	**U**	**Unknown**	**Unknown**
M443/15	Grey seal	**13/12/2015**	HY	**U**	**Unknown**	**Unknown**
M444/15	Seal (indeterminate species)	**13/12/2015**	HY	**U**	**Unknown**	**Unknown**
M446/15	Grey seal	**13/12/2015**	HY	**U**	**Unknown**	**Unknown**

M448/15	Grey seal	**13/12/2015**	HY	**U**	**Unknown**	**Unknown**
M456/15	Grey seal	**13/12/2015**	ND	**U**	**Unknown**	**Unknown**
M489/15	Seal (indeterminate species)	**20/12/2015**	HY	**U**	NO DATA	NO DATA
M490/15	Seal (indeterminate species)	**20/12/2015**	HY	**U**	NO DATA	NO DATA
M491/15	Seal (indeterminate species)	**20/12/2015**	HY	**U**	NO DATA	NO DATA
M464/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M467/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M476/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M477/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M480/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M483/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M484/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M485/15	Grey seal	**26/12/2015**	HY	**U**	**Unknown**	**Unknown**
M488/15	Grey seal	**27/12/2015**	ND	**U**	**Unknown**	**Unknown**
M505/15	Grey seal	**27/12/2015**	HY	**U**	**Unknown**	**Unknown**
M493/15	Grey seal	**28/12/2015**	ND	**U**	**Unknown**	**Unknown**
M18/16	Seal (indeterminate species)	**04/01/2016**	NO	**U**	**Unknown**	Unlikely
M20/16	Grey seal	**04/01/2016**	ND	**U**	Possible	Possible
M21/16	Grey seal	**05/01/2016**	NO	**U**	Possible	Possible
M22/16	Grey seal	**05/01/2016**	ND	**U**	Likely	Likely
M55/16	Grey seal	**07/01/2016**	NR	**U**	Possible	Unlikely
M30/16	Grey seal	**09/01/2016**	NO	**U**	Possible	Unlikely
M172/16	Grey seal	**11/01/2016**	NO	**M**	Possible	Unlikely
M42/16	Grey seal	**14/01/2016**	NO	**U**	Possible	Unlikely
M68/16	Grey seal	**16/01/2016**	HY	**U**	Unlikely	Unlikely
M53/16	Grey seal	**19/01/2016**	NF	**U**	Possible	Possible
M83/16	Grey seal	**03/02/2016**	ND	**U**	Possible	Unlikely
M89/16	Grey seal	**08/02/2016**	HY	**U**	**Unknown**	Unknown
M93/16	Grey seal	**09/02/2016**	HY	**U**	**Unknown**	Unlikely
M94/16	Grey seal	**09/02/2016**	HY	**U**	Possible	Unlikely
M95/16	Grey seal	**09/02/2016**	HY	**U**	Possible	Unlikely
M120/16	Seal	**12/02/2016**	NC	**U**	**Unknown**	Unknown

	(indeterminate species)					
M138/16	Grey seal	**05/03/2016**	HY	**U**	Possible	Unlikely
M147/16	Grey seal	**12/03/2016**	NO	**U**	Possible	Unlikely
M160/16	Grey seal	**28/03/2016**	NO	**F**	Likely	Likely
M176/16	Grey seal	**05/04/2016**	NK	**U**	Likely	Likely
M258/16	Grey seal	**08/06/2016**	NO	**M**	Likely	Likely
M259/16	Grey seal	**08/06/2016**	NO	**M**	Likely	Likely
M260/16	Seal (indeterminate species)	**08/06/2016**	NO	**U**	no data	no data
M262/16	Harbour seal	**08/06/2016**	HY	**U**	Likely	Likely
M270/16	Harbour seal	**10/06/2016**	NO	**U**	**Unknown**	Possible
M271/16	Grey seal	**10/06/2016**	NO	**U**	**Unknown**	Possible
M272/16	Grey seal	**10/06/2016**	NO	**U**	**Unknown**	Unknown
M275/16	Grey seal	**16/06/2016**	NO	**F**	Possible	Likely
M297/16	Harbour seal	**25/06/2016**	NH	**F**	Likely	Possible
M314/16	Harbour seal	**11/07/2016**	NR	**U**	Likely	Possible
M315/16	Harbour seal	**12/07/2016**	NR	**U**	Likely	Unlikely
M342/16	Harbour seal	**26/07/2016**	NH	**U**	Possible	Possible
M346/16	Harbour seal	**29/07/2016**	NF	**U**	Possible	Unlikely
M405/16	Grey seal	**25/09/2016**	NK	**U**	Unlikely	Unlikely
M415/16	Harbour seal	**04/10/2016**	NO	**M**	Likely	Likely
M444/16	Grey seal	**26/10/2016**	NT	**U**	Possible	Unlikely
M451/16	Grey seal	**28/10/2016**	NF	**U**	Possible	Unlikely
M479/16	Grey seal	**04/11/2016**	NF	**U**	Possible	Unlikely
M488/16	Grey seal	**08/11/2016**	NJ	**U**	Likely	Likely
M484/16	Harbour seal	**10/11/2016**	NK	**U**	Likely	Possible
M494/16	Grey seal	**13/11/2016**	NO	**U**	**Unknown**	Possible
M506/16	Grey seal	**18/11/2016**	NF	**U**	Likely	Likely
M507/16	Grey seal	**18/11/2016**	NF	**U**	Possible	Possible
M509/16	Grey seal	**18/11/2016**	NF	**U**	Possible	Possible
M512/16	Grey seal	**18/11/2016**	NF	**U**	Possible	Possible
M516/16	Grey seal	**19/11/2016**	NG	**U**	Possible	Possible
M526/16	Grey seal	**19/11/2016**	NR	**U**	Possible	Unlikely
M527/16	Grey seal	**20/11/2016**	ND	**U**	Unlikely	Unlikely
M528/16	Grey seal	**20/11/2016**	ND	**U**	Possible	Possible
M529/16	Grey seal	**20/11/2016**	ND	**U**	Possible	Possible
M530/16	Grey seal	**20/11/2016**	ND	**U**	Possible	Unlikely
M531/16	Grey seal	**20/11/2016**	ND	**U**	Possible	Possible

M532/16	Grey seal	**20/11/2016**	ND	**U**	Possible	Unlikely
M664/16	Grey seal	**20/11/2016**	NR	**U**	Possible	Unlikely
M542/16	Grey seal	**23/11/2016**	ND	**U**	Possible	Possible
M544/16	Grey seal	**23/11/2016**	NT	**U**	Likely	Unlikely
M551/16	Grey seal	**24/11/2016**	NB	**U**	Possible	Unlikely
M566/16	Grey seal	**29/11/2016**	NG	**U**	Possible	Possible
M577/16	Grey seal	**03/12/2016**	ND	**U**	Possible	Unlikely
M578/16	Grey seal	**03/12/2016**	ND	**U**	Unlikely	Unlikely
M579/16	Grey seal	**03/12/2016**	HY	**U**	Possible	Likely
M580/16	Grey seal	**04/12/2016**	NT	**U**	Likely	Likely
M584/16	Grey seal	**04/12/2016**	NL	**U**	Possible	Unlikely
M590/16	Grey seal	**05/12/2016**	NF	**U**	Unknown	Unknown
M591/16	Grey seal	**05/12/2016**	NF	**U**	Possible	Likely
M592/16	Grey seal	**05/12/2016**	NF	**U**	Possible	Unknown
M593/16	Grey seal	**05/12/2016**	NF	**U**	Possible	Possible
M594/16	Grey seal	**05/12/2016**	NF	**U**	Possible	Possible
M666/16	Grey seal	**05/12/2016**	NR	**U**	Possible	Unlikely
M601/16	Grey seal	**07/12/2016**	NG	**U**	Possible	Possible
M602/16	Grey seal	**07/12/2016**	NG	**U**	Possible	Possible
M612/16	Harbour seal	**10/12/2016**	HY	**U**	Likely	Likely
M667/16	Grey seal	**10/12/2016**	NR	**U**	Possible	Unlikely
M627/16	Grey seal	**18/12/2016**	HY	**U**	Possible	Unlikely
M628/16	Harbour seal	**18/12/2016**	NH	**U**	Likely	Unlikely
M640/16	Grey seal	**29/12/2016**	ND	**U**	Possible	Unlikely
M659/16	Grey seal	**29/12/2016**	HY	**U**	Possible	Unlikely
M652/16	Grey seal	**30/12/2016**	NF	**U**	Possible	Unlikely
M3/17	Grey seal	**01/01/2017**	NO	**U**	Likely	Likely
M21/17	Grey seal	**09/01/2017**	ND	**U**	Possible	Possible
M22/17	Grey seal	**09/01/2017**	ND	**U**	Possible	Unlikely
M27/17	Grey seal	**09/01/2017**	NO	**U**	Possible	Unlikely
M34/17	Grey seal	**15/01/2017**	ND	**U**	Possible	Unlikely
M42/17	Grey seal	**15/01/2017**	ND	**U**	Likely	Possible
M35/17	Grey seal	**16/01/2017**	ND	**U**	Possible	Unlikely
M59/17	Grey seal	**20/01/2017**	ND	**U**	Unlikely	Unlikely
M61/17	Grey seal	**20/01/2017**	ND	**U**	Possible	Unlikely
M63/17	Grey seal	**20/01/2017**	ND	**U**	Possible	Unlikely
M70/17	Grey seal	**29/01/2017**	NJ	**U**	Unlikely	Unlikely
M71/17	Harbour seal	**29/01/2017**	NG	**U**	no data	no data
M72/17	Grey seal	**30/01/2017**	HU	U	Possible	Possible
M74/17	Grey seal	**30/01/2017**	NK	U	Likely	Likely

M80/17	Grey seal	**01/02/2017**	HU	U	Likely	Likely
M88/17	Harbour seal	**05/02/2017**	NG	U	Possible	Unlikely
M93/17	Seal (indeterminate species)	**05/02/2017**	ND	U	Possible	Unlikely
M96/17	Seal (indeterminate species)	**09/02/2017**	NH	**U**	no data	no data
M97/17	Seal (indeterminate species)	**09/02/2017**	HP	**U**	no data	no data
M109/17	Grey seal	**14/02/2017**	NO	**U**	Likely	Unlikely
M113/17	Grey seal	**16/02/2017**	ND	**U**	Possible	Unlikely
M241/17	Harbour seal	**12/06/2017**	NH	**U**	Likely	Likely
M258/17	Harbour seal	**22/06/2017**	NH	**U**	Likely	Likely
M256/17	Harbour seal	**23/06/2017**	NH	**F**	Likely	Likely
M272/17	Harbour seal	**09/07/2017**	HU	**U**	Possible	Unlikely
M274/17	Harbour seal	**10/07/2017**	NS	**U**	Possible	Unlikely
M286/17	Harbour seal	**12/07/2017**	NM	**U**	Likely	Likely
M287/17	Harbour seal	**12/07/2017**	NM	**U**	Likely	Likely
M302/17	Seal (indeterminate species)	**20/07/2017**	HY	**U**	Possible	Unlikely
M319/17	Harbour seal	**25/07/2017**	NO	**U**	Likely	Likely
M326/17	Grey seal	**26/07/2017**	NH	**U**	Possible	Possible
M333/17	Harbour seal	**28/07/2017**	NG	**U**	Possible	Unlikely
M337/17	Harbour seal	**01/08/2017**	HU	**U**	Likely	Likely
M346/17	Harbour seal	**09/08/2017**	NO	**M**	Likely	Likely
M663/17	Harbour seal	**10/08/2017**	NO	**F**	Likely	Likely
M352/17	Harbour seal	**11/08/2017**	NM	**U**	Possible	Unlikely
M377/17	Grey seal	**30/08/2017**	NK	**U**	Likely	Likely
M385/17	Harbour seal	**31/08/2017**	NO	**U**	Likely	Likely
M465/17	Grey seal	**18/09/2017**	NM	**M**	Possible	Unlikely
M469/17	Grey seal	**21/10/2017**	NK	**U**	Possible	Unlikely
M486/17	Grey seal	**27/10/2017**	NR	**U**	Likely	Likely
M489/17	Grey seal	**29/10/2017**	NK	**U**	Possible	Possible
M490/17	Grey seal	**29/10/2017**	NG	**U**	Possible	Possible
M534/17	Grey seal	**29/10/2017**	NR	**F**	Possible	Unlikely
M523/17	Grey seal	**13/11/2017**	NC	**U**	Possible	Unlikely
M556/17	Grey seal	**21/11/2017**	HY	**U**	Likely	Likely

M557/17	Grey seal	**21/11/2017**	HY	**U**	Unlikely	Unlikely
M558/17	Grey seal	**22/11/2017**	HY	**U**	Likely	Likely
M568/17	Grey seal	**01/12/2017**	NK	**U**	Possible	Unlikely
M580/17	Grey seal	**07/12/2017**	NX	**U**	Possible	Unlikely
M591/17	Harbour seal	**09/12/2017**	NG	**U**	Possible	Unlikely
M606/17	Grey seal	**18/12/2017**	ND	**U**	Unlikely	Unlikely
M609/17	Grey seal	**18/12/2017**	ND	**U**	Unlikely	Unlikely
M652/17	Grey seal	**23/12/2017**	ND	**U**	Possible	Possible
M653/17	Seal (indeterminate species)	**23/12/2017**	ND	**U**	no data	no data
M654/17	Seal (indeterminate species)	**23/12/2017**	ND	**U**	no data	no data
M655/17	Seal (indeterminate species)	**23/12/2017**	ND	**U**	no data	no data
M656/17	Seal (indeterminate species)	**23/12/2017**	ND	**U**	no data	no data
M547/17	Seal (indeterminate species)	**28/12/2017**	HY	**U**	no data	no data
M644/17	Grey seal	**28/12/2017**	HY	**U**	Possible	Unlikely
M645/17	Grey seal	**28/12/2017**	HY	**U**	Possible	Unlikely
M646/17	Seal (indeterminate species)	**28/12/2017**	HY	**U**	no data	no data
M647/17	Seal (indeterminate species)	**28/12/2017**	HY	**U**	no data	no data
M637/17	Seal (indeterminate species)	**30/12/2017**	NJ	**U**	Unlikely	Unlikely
M648/17	Grey seal	**31/12/2017**	ND	**U**	no data	no data
M649/17	Grey seal	**31/12/2017**	ND	**U**	Likely	Possible
M18/18	Grey seal	**07/01/2018**	ND	**U**	Possible	Unlikely
M15/18	Grey seal	**08/01/2018**	NT	**M**	Likely	Likely
M24/18	Grey seal	**10/01/2018**	NO	**U**	Likely	Likely
M49/18	Grey seal	**11/01/2018**	HY	**U**	Possible	Unlikely

M52/18	Seal (indeterminate species)	**13/01/2018**	HY	**U**	Unlikely	Unlikely
M50/18	Grey seal	**14/01/2018**	HY	**U**	no data	no data
M48/18	Grey seal	**17/01/2018**	HY	**U**	Unlikely	Unlikely
M51/18	Grey seal	**17/01/2018**	NT	**U**	Possible	Unlikely
M56/18	Grey seal	**17/01/2018**	NC	**U**	Unlikely	Unlikely
M58/18	Grey seal	**18/01/2018**	NT	**F**	Possible	Possible
M61/18	Harbour seal (Harbour seal)	**18/01/2018**	NR	**U**	Possible	Unlikely
M62/18	Seal (indeterminate species)	**21/01/2018**	NT	**U**	Possible	Unlikely
M63/18	Grey seal	**21/01/2018**	NT	**U**	Possible	Unlikely
M67/18	Grey seal	**26/01/2018**	NS	**U**	Possible	Possible
M74/18	Seal (indeterminate species)	**27/01/2018**	HY	**U**	no data	no data
M75/18	Seal (indeterminate species)	**27/01/2018**	HY	**U**	no data	no data
M76/18	Seal (indeterminate species)	**27/01/2018**	HY	**U**	no data	no data
M97/18	Grey seal	**09/02/2018**	NH	**U**	Likely	Possible
M104/18	Grey seal	**17/02/2018**	NK	**U**	Possible	Possible
M139/18	Harbour seal	**25/02/2018**	NG	**U**	Possible	Unlikely
M154/18	Harbour seal	**09/03/2018**	NH	**F**	Possible	Likely
M206/18	Grey seal	**02/04/2018**	NH	**U**	Possible	Unlikely
M236/18	Grey seal	**15/04/2018**	NO	**U**	Likely	Likely
M324/18	Harbour seal	**14/06/2018**	NH	**F**	Likely	Likely
M331/18	Seal (indeterminate species)	**14/06/2018**	NH	**U**	No data	No data
M347/18	Harbour seal	**30/06/2018**	NH	**F**	Possible	Possible

Appendix 8: Necropsy report form

CETACEAN POSTMORTEM REPORT FORM

NATIONAL REFERENCE NUMBER: SW2018/
POST MORTEM NUMBER: M /18
HISTOLOGY NUMBER:
SPECIES:
SEX:
AGE GROUP:
DATE FOUND:
LOCATION FOUND:
NATIONAL GRID NUMBER:

DATE OF POSTMORTEM:
PATHOLOGIST:

BODY CONDITION USING CONDITION CODE:

Live (becomes code 2 at death)

2a) Extremely fresh (as if just died, no bloating, meat is considered by most to be edible)

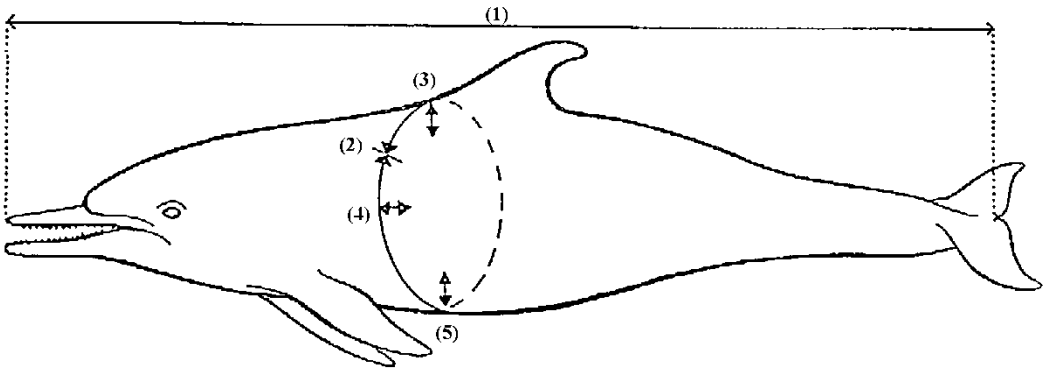
2b) Slight decomposition (slight bloating, blood imbibition visible)

3) Moderate decomposition (moderate bloating, skin peeling, penis may be extended in males, organs still intact, excluding postmortem damage)

4) Advanced decomposition (major bloating, skin peeling, penis extended in males, organs beyond recognition, bones exposed due to decomposition)

5) Indeterminate (mummified carcass or skeletal remains, no organs present)

Morphometric Data
BODY CONDITION CODE :
FROZEN:
BODY WEIGHT: Kg
LENGTH, GIRTH AND BLUBBER THICKNESS:
-tip upper jaw to tail notch: cm
-girth in front of dorsal fin: cm
-blubber thickness in front of dorsal fin: mm
-blubber thickness lateral mid-line: mm
-blubber thickness ventral mid-line: mm
6) -blowhole to dorsal fin: cm



GROSS PATHOLOGY

NAD: No Abnormalities detected **NE**: Not Examined

1. Body condition

External examination

2. Body orifices: NAD
3. Ectoparasites: NAD
4. Fins and flukes: NAD

Integument

5. Epidermis: NAD
6. Blubber: NAD
7. Subcutaneous tissue: NAD
8. Mammary glands: NAD

Musculoskeletal system

9. Skull: NAD
10. Other bones: NAD
11. Back muscle mass: NAD
12. Other muscles: NAD

Nervous system

13. Brain: NAD
14. Spinal cord: NAD
15. Peripheral nerves: NAD
16. Eyes: NAD

Cardiovascular system

17. Pericardial sac: NAD
18. Myocardium: NAD
19. Valves: NAD
20. Arteries, veins: NAD

Respiratory system

21. Nasal cavity: NAD
22. Sinuses: NAD
23. Trachea, bronchi: NAD
24. Lungs: NAD
25. Pleura/pleural cavity: NAD

Alimentary system

26. Mouth: NAD
27. Oesophagus: NAD
28. Cardiac section stomach: NAD
29. Fundic section stomach: NAD
30. Pyloric section stomach: NAD
31. Duodenum/small intestine: NAD
32. Large intestine: NAD
33. Anus: NAD
34. Liver: NAD
35. Pancreas: NAD
36. Peritoneum/peritoneal cavity: NAD

Urogenital system

37. Ovaria/testes:
38. Uterus: NAD
39. Vagina/penis: NAD
40. Kidneys: NAD
41. Adrenals: NAD
42. Ureters: NAD
43. Urinary bladder: NAD
44. Urethra: NAD

Lymphatic and endocrine systems

45. Thyroid: NAD
46. Spleen: NAD
47. Thymus: NAD
48. Lymph nodes: NAD

CHECKLIST OF STANDARD SAMPLES

In each square, enter: *X = sample taken*

Blank = sample not taken or not present

Record any extra samples taken in section 4.

Weights

left testis (g):

right testis (g):

heart (g):

Freeze at -20^{0}C

☐ epidermis	4 cm^2
☐ blubber	2 x 20g
☐ liver	2 x 20g
☐ muscle	2 x 20g
☐ serum or PCF	to 20 ml
☐ teeth	>4
☐ baleen plates	>4 plates
☐ urine	up to 10 ml
☐ faecal material	up to 50 ml
☐ scapula	whole
☐ skull	whole

Bacteriology

☐ brain	swab/block
☐ CSF	swab/fluid
☐ kidney	swab/block
☐ liver	swab/block
☐ lung	swab/block
☐ spleen	swab/block

Virology (freeze at -80^{0}C)

☐ brain	1 cm^3
☐ spleen	1 cm^3
☐ lung	1 cm^3
☐ brain (RNAlater)	0.5 cm^3
☐ spleen (RNAlater)	0.5 cm^3
☐ lung (RNAlater)	0.5 cm^3

10% Formalin

☐ adrenal glands	both
☐ bladder	1 cm^3
☐ brain	whole

☐ heart 1 cm^3

☐ kidney 1 cm^3

☐ liver 1 cm^3

☐ lung 1 cm^3

x …

☐ mammary gland 1 cm slice

☐ mesenteric ln. 1 cm slice

☐ pancreas 1 cm^3

☐ pulm. ass. ln. 1 cm slice

☐ skin and blubber 1 cm^3

☐ spinal cord 1 cm^3

☐ spleen 1 cm^3

☐ testes both/slices

☐ thymus 1 cm^3

☐ thyroid 1 cm^3

☐ uterus 1 cm^3

☐ ovaries both

Ethanol

☐ Parasites from

-

-

STOMACH CONTENTS

Food remains cardiac section stomach (g): . . . . . .

☐ No food remains

Stomach contents were:

☐ Sieved stomach contents through a 425 micron mesh and store in ethanol?

☐ Stomach contents frozen directly ay -20OC

OTHER SAMPLES COLLECTED

Extra samples for histological examination:	Extra samples for bacteriological examination:	Other extra samples taken (list):
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
		-

Optional (if time and storage allows)

Freeze at -20^{0}C

☐ foetus/placenta whole

☐ milk up to 20 ml

☐ eyes both

Virology (freeze at -80^{0}C) or RNAlater (freeze at -20^{0}C)

☐ pituitary section

☐ cranial nerve section

Fixed tissue

☐ pituitary whole

☐ tympanic bullae/cochlea both (only in 2a cases, perfused according to Morell☐ et al)

☐ *longissimus dorsii* muscle slice (held under tension)

☐ *rectus abdominus* muscle slice (held under tension)

BACTERIOLOGY REPORT

HISTOPATHOLOGY REPORT

OBSERVATIONS/COMMENTS:

Significant diseases or conditions thought to contribute to the death of the animal

Incidental diseases or conditions not thought to contribute to the death or condition causing it

DIAGNOSIS:

CAUSE OF DEATH:

CAUSE OF DEATH CATEGORY:

CAUSE OF DEATH CLASS:

CONFIDENCE IN DIAGNOSIS:

Scottish Marine Animal Stranding Scheme

SAC Veterinary Services

Inverness

Scotland

Report last modified: 25/03/2019 12:08 by