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# Collaborative UK Marine Mammal Project: summary of data produced 1988-1992

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# 1. INTRODUCTION
***Robin J. Law (MAFF)***

The seal epidemic of 1988 caused by phocine distemper virus led to the death of over 17 000 common (harbour) seals (*Phoca vitulina*) around the coasts of Europe (Dietz et al., 1989). Media reports at the time (and subsequent papers — see Brouwer *et al*., 1989; Simmonds and Johnston, 1989) suggested that the severity of the outbreak was the result of North Sea pollution, and that high contaminant concentrations in the tissues of the seals weakened their resistance to disease. Subsequent analyses of blubber of seals from eastern and north-eastern England showed that concentrations were at the lower end of the range reported for seals from the North and Baltic Seas (Law *et al*., 1989(a)). The discovery of high organochlorine concentrations in the blubber of a bottlenose dolphin (*Tursiops truncatus*) calf from Cardigan Bay which died in 1988 raised the level of concern (Morris *et al*., 1989). Cardigan Bay is home to a resident population of bottlenose dolphins, and is generally regarded as a relatively clean area. Within the UK analyses of marine mammal tissues (mainly seals and porpoises) had been conducted in the 1970s and 1980s on samples collected in the 1970s, but at the time of the seal epidemic no data had been published for animals sampled later than 1978. There was therefore approximately a ten year gap in knowledge of contaminant concentrations for UK marine mammals, and no basis on which to assess possible effects. Accordingly a rapid, but somewhat piecemeal, programme of marine mammal analysis was undertaken within the laboratories of the Ministry of Agriculture, Fisheries and Food (MAFF) and the Scottish Office Agriculture and Fisheries Department (SOAFD). Although the data obtained made it clear that contaminants were not the cause of death, it was evident that a wider and more collaborative approach was required in order to establish the possible role of contaminants in promoting the susceptibility of marine mammals to disease. This programme, co-ordinated and partially funded by the Department of the Environment (DoE), started in 1990. It combines information on strandings with the provision of samples for pathological and chemical analyses. Primarily covering England and Wales, it involves staff from the Institute of Zoology (IOZ), the National Environmental Research Council (NERC) Sea Mammal Research Unit (SMRU), the Natural History Museum (NHM), the MAFF Fisheries Laboratory at Burnham-on-Crouch, and the SOAFD Marine Laboratory in Aberdeen. The addresses of these institutes are given in Section 8.

The main findings of this collaborative programme are being published elsewhere, in papers in the open scientific literature. The aim of this report is to make the contaminant dataset and relevant biological information available to other researchers, in a way that is usually impossible for a dataset of this size within the space available for a journal article. The report includes details of the methodology employed, and in the case of the methods for the determination of trace metals and organochlorine compounds, of the associated analytical quality control (AQC) procedures. In the case of trace metal analyses undertaken by MAFF, we have also presented results obtained for standard materials during the period of study. Data are presented here for metals and/or organochlorines in tissues from 275 marine mammals; 205 cetaceans of nine species (comprising 137 harbour porpoises (*Phocoena phocoena*), 44 common dolphins (*Delphinus delphis*), 7 striped dolphins (*Stenella coeruleoalba*), 6 bottlenose dolphins, 4 white-sided dolphins (*Lagenorhyncus acutus*), 3 white-beaked dolphins ( *Lagenorhyncus albirostris*), 2 long-finned pilot whales (*Globicephala melas*), 1 minke whale (*Balaenoptera acutorostrata*) and 1 Risso's dolphin (*Grampus griseus*); and 70 seals (40 grey seals *Halichoerus grypus* and 30 common seals).

# 2. GUIDELINES FOR THE POSTMORTEM AND TISSUE SAMPLING OF CETACEANS
***Thijs Kuiken (IOZ) and John R. Baker (University of Liverpool (UL))***

## 2.1 Preface

The postmortem examination of marine mammal carcases is undertaken to determine the presence of diseases, if possible to establish the cause of death, and to collect tissue samples for a variety of laboratory analyses. Written guidelines help to ensure that all steps of the examination are carried out and that all the necessary samples are taken. They also serve to standardise the methods, and minimise the variation resulting from different people conducting postmortem examinations and collecting samples.

The diagnosis of a disease — loosely defined as any deviation from the normal structure or function of any part of the body — is often based on the combined results of gross examination of organs, microscopical examination of diseased tissues, and other laboratory analyses, such as bacteriological examination. Once these results have been integrated and an overview has been obtained of the disease processes that are present in a marine mammal carcase, one can attempt to establish the cause of death. In some cases this is straightforward, for example when an animal has bled to death from a stomach ulcer and the intestines are filled with blood. In other cases it is not possible to determine which of the diseases found, if any, caused the animal's demise.

Postmortem examinations on cetaceans and seals were carried out according to protocols written by Kuiken and Baker (1991(a), 1991(b)). Several veterinary surgeons, based in different parts of the UK, undertook examinations for this programme and we acknowledge these in Section 7. To conform with a European protocol published by the European Cetacean Society (Kuiken and Garcia Hartmann, 1993), the guidelines for cetaceans have been revised and updated (Kuiken and Baker, 1993). These revised guidelines are reproduced in full below (Sections 2.2 and 2.3).

## 2.2 Postmortem

### *2.2.1 Introduction*

These guidelines are meant primarily as an aid to veterinary surgeons carrying out postmortem examinations on stranded cetaceans in the UK, as a part of the DoE-funded marine mammal projects in England, Wales, and Scotland. They are based partly on guidelines written by Dr John Baker, University of Liverpool, and partly on the protocol produced at the European Cetacean Society workshop on cetacean pathology, held in Leiden, The Netherlands, in September 1991 (Kuiken and Garcia Hartmann, 1993).

All structures must be examined visually and by palpation, making incisions into the organs. A full postmortem record must be kept, preferably on the standard 'cetacean postmortem report' form (see Appendix 1).

Lesions in any organs should be described, photographed and sampled. The description should include the size, location, colour, texture, shape, and the nature of the transition from normal to abnormal tissue. Photographs should include a ruler or similar object to indicate the size of the lesion. According to the suspected aetiology of the lesion, samples should be collected for bacteriological examination (especially if the lesion is of a purulent nature), for virological examination, and for parasitological examination. In all cases, a sample of the lesion should be preserved for histopathological examination.

Any parasites found, regardless if they are associated with pathological lesions or not, should be preserved in 70% ethanol for identification. An attempt should be made to estimate the total number of parasites. Some predilection sites for parasites are indicated in the text.

If the state of decomposition of the carcase is advanced (condition code 4 or 5, see below), only the basic measurements, organ weights (when possible), and a limited number of samples (epidermis, skull, teeth, food remains, gonads) should be taken.

The postmortem examination need not take place in the order described below. However, samples for bacteriological and virological examination need to be taken as early as possible. Also, examination of the gastrointestinal tract should be left until last to prevent cross-contamination with enteric micro-organisms.

### *2.2.2 Basic measurements*

Photographs should be taken of the lateral views of the whole body, from both sides. Particularly in bottlenosed dolphins, photographs should be taken of the dorsal fin, also from both sides. In baleen whales, the ventral side of the tail flukes should be photographed.

Estimate the body condition, that is the state of decomposition of the carcase, using the categories of the condition code[1].

Weigh the carcase. If this is not possible, the body weight can be estimated from the heart weight[2].

Measure the body length by placing the carcase on its belly, holding a measuring tape or ruler next to the carcase in a straight line parallel to the longitudinal body axis and measuring the distance between the notch in the tail flukes and the tip of the upper jaw. Measure the body girth at the level of the anterior insertion of the dorsal fin.

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*Notes:*

[1] *The body condition, or state of decomposition of a carcase, can be described using the following condition code:*

- *1)* ***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*** *(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 carcase or skeletal remains, no organs present)*

[2] *The body weight can be estimated from the heart weight using the formula*
$\log W = (\log H + 2.2) / 0.984$, *with H = heart weight and W = body weight, both in kg.*

### 2.2.3 External examination

Indicate the nutritional state of the carcase, using one of the following 3 categories:

- good: the aspect of the upper flanks on either side of the dorsal fin is rounded;
- moderate: the aspect of the upper flanks on either side of the dorsal fin is sloping;
- poor: the aspect of the upper flanks on either side of the dorsal fin is hollow (in these animals, one can make out the transverse processes of the lumbar vertebrae, and there is an indentation dorsally just behind the head).

Examine the body orifices (mouth, eyes, ear openings, blow-hole, anus, genital slit and mammary slits) for lesions and any discharge.

Examine the animal for external lesions and sample these accordingly. Examine the skin carefully for any ectoparasites. These are most likely to be found in or near the body orifices and next to the fins and flukes. Take a 4 $cm^2$ piece of epidermis down to the blubber for DNA-studies, and freeze.

Massage the skin in the area cranial to the mammary slits in a caudal direction to express any fluid present in the mammary glands. If fluid can be pressed out, collect a sample for organochlorine analysis in a hexane-washed glass container and freeze. If the lid is made of plastic, separate the sample from this with aluminium foil. Note the volume, colour, and consistency of the fluid.

Cut a transverse strip of blubber about 2 cm wide from the anterior insertion of the dorsal fin, from the mid-dorsal to the mid-ventral region. Make sure to cut at right-angles to the surface of the skin. Measure the thickness of the blubber strip with a ruler 2 cm lateral to the dorsal mid-line, mid-laterally, and 2 cm lateral to the ventral mid-line. (Using this method, the tension of the blubber tissue is relieved before measuring.) In the harbour porpoise, take about 20 g of the lateral part of the blubber strip (preferably with some muscle tissue and the skin attached) and freeze. This sample is for lipid analysis.

Cut a strip of blubber a few cm wide and a few cm long at the level of the caudal insertion of the dorsal fin. Make sure to cut at right-angles to the surface of the skin. Measure the thickness of the blubber strip 2 cm lateral to the dorsal mid-line. From this blubber strip, take 2 x 20 g cross-sectional samples of blubber for organochlorine analysis. It is important to take samples of the whole layer, from the skin to the muscle. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes.

Take 2 x 20 g muscle samples for toxicological analysis, at the same location as and directly below the blubber sample, at the level of the caudal insertion of the dorsal fin. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes.

With the animal on its right side make a mid-line ventral incision from the symphysis of the mandible to a short distance posterior of the anus, circumventing the genital slit and anus. From the posterior end of the ventral incision make a second one almost to the dorsal mid-line. Reflect the skin and blubber off the uppermost side. Any parasites in the blubber should be noted and collected. They may occur as white cysts less than 1 cm in diameter, often in the ano-genital region or the dorsal aspect of the chest wall.

In females, examine the mammary gland for pathological changes and parasites. Collect a cross-sectional slice of about 1 cm thick from halfway along the length of the left mammary gland for histopathological examination, and place in 10% formalin.

Examine the subcutaneous tissue for the presence of bruises and parasites.

Remove the left scapula for (future) radionuclide analysis and freeze.

### 2.2.4 Examination of abdominal organs (except gastro-intestinal tract, pancreas, and spleen)

Remove the left abdominal wall, freeing the testis or ovary and uterus. Any parasites in the abdominal wall (for instance cysts under the peritoneum) should be collected. Remove the left thoracic wall, for example with bone shears. Remove the fifth left rib and freeze a 15 cm section of it for (future) lead analysis.

Before handling the internal organs, take a 1 $cm^3$ sample of lung tissue from the cranio-ventral part of the left lung and a 1 $cm^3$ sample of kidney tissue from the left kidney for virological examination. Also take a sample of lung tissue from the cranio-ventral part of the left lung, a sample of kidney tissue from the left kidney, a sample of liver tissue from the left lobe of the liver, and a sample of heart blood from the right ventricle, for bacteriological examination.

Sever the intestine close to the anus and the oesophagus close to the diaphragm. Working forward along the dorsal aspect of the abdominal cavity, remove the stomach, intestines, pancreas, spleen and mesenteric lymph node, attached to each other, from the carcase. Leave the examination of the G.I. tract to the end of the postmortem examination to prevent cross-contamination of other tissues with enteric micro-organisms.

Open and examine the bladder *in situ*, noting the contents, if any.

In females remove the entire reproductive tract, open the vagina and uterus, note any corpora lutea, corpora albicantia or follicles on each ovary and then place the ovaries in 10% formalin for reproduction studies.

If a foetus is present of sufficient size to examine the individual organs, a postmortem examination and tissue sampling of the foetus can take place in the same way as for cetaceans after birth. If it is too small for a full postmortem examination, the whole foetus and its placenta can be wrapped in hexane-washed aluminium foil and stored frozen for organochlorine analysis.

In males remove the testes and weigh them separately after removing the epididymis. After incision and examination, place the testes in 10% formalin for reproductive studies. If they are heavier than about 50 g each, place a cross-sectional slice about 1 cm thick from mid-way along the length in 10% formalin. Examine the penis and preputium.

Remove and examine the adrenal glands, and place them separately in 10% formalin for morphometrics studies.

Remove the kidneys from the body cavity. Incise both kidneys longitudinally, and if possible, strip the capsule. Then, take 2 x 20 g samples for toxicological analysis from halfway the length of the left kidney. These samples should be cross-sectional and include both medullary and cortical tissue. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes. Preserve 1 $cm^3$ from a kidney in 10% formalin for histopathological examination.

Remove the liver, examine both surfaces and make multiple incisions into the substance. Examine the bile ducts for parasites. Then, take 2 x 20 g for trace metal analysis. These samples should include approximately equal amounts of tissue from the edge of the left lobe, the edge of the right lobe, and the hilus of the liver. Wrap them in hexane-washed aluminium foil, place them in 25 ml Universal tubes, and freeze. Alternatively, they can be placed in Sovirel glass tubes. Place 1 $cm^3$ of liver tissue in 10% formalin for histopathological examination.

### *2.2.5 Examination of organs of head, neck and thorax*

Carefully remove the superficial muscles overlying the trachea and larynx, so exposing the thyroid gland. Examine this tissue.

Incise along the internal aspects of both mandibles and free the tongue. Once the tongue is free reflect it backwards and cut the hyoid bones close to the skull.

Free the larynx from the sphincter muscle holding it in place and pulling the tongue backwards incise along the neck to free the trachea and oesophagus. Then, incising dorsally and ventrally in the thoracic cavity, free the heart and lungs. Note any attachments of the lungs to the thoracic walls. This procedure should give you the tongue, larynx, trachea, oesophagus, thymus, heart and lungs all still fastened together.

Examine the surface of the tongue.

Open the oesophagus longitudinally and check for lesions or parasites.

Open the larynx, trachea and major bronchi longitudinally. Make multiple incisions into the substance of both lungs. Any parasites should be collected. Two pieces of lung (about 1 $cm^3$) from the hilus and periphery of the left lung, and the same from the right lung, should be collected in 10% formalin for histopathological examination. The samples should include part of the major bronchial tree. Repeat this procedure, placing the second set of samples in a separate container with 10% formalin for morbillivirus detection using an immunoperoxidase test. Open all major branches of the pulmonary veins and examine for the presence of parasites. Examine the bronchial and so-called ‘pulmonary associated’ lymph nodes. The latter can be found about halfway along the ventral edges of each lung. Cut a 1 cm thick cross-sectional slice from the middle of the left pulmonary associated lymph node, and place it in 10% formalin for histopathological examination.

Examine the thymus, if present and place 1 $cm^3$ in 10% formalin for histopathological examination. Freeze another 1 $cm^3$ of the thymus for immunocytological examination, if the carcase is very fresh (condition code 2).

Collect any blood present in the heart lumen, to obtain serum for serological examination. The serum, acquired by centrifugation, should be stored frozen. Even if it is haemolytic, it is still of value.

Separate the heart from the lungs by cutting through the major blood vessels where they enter the heart. Open the left and right ventricles and atria for examination and to take out any blood clots present. Any parasites should be collected. Weigh the heart. Cut a 1 cm thick slice of heart tissue, to include a piece of the wall of the left ventricle and of the atrioventricular septum, and place it in 10% formalin for histopathological examination.

With a saw or bone shears break open the tympanic bullae (which in cetaceans are not part of the skull but lie free just behind the mandibles). With forceps examine the internal cavity to recover any nematodes present.

If possible, remove at least 4 teeth from the middle of the lower jaw for aging, and store frozen. (In baleen whales, cut off 2 baleen plates as near as possible to their basis and store frozen.)

In freshly dead carcases (condition code 2), open the skull, and examine the brain.

The skull can be opened by making a vertical cut parallel and about 2 cm posterior to the transverse dorsal ridge which is clearly visible and palpable on top of the skull. The second cut should be made in the horizontal plane, through the occipital condyles, making sure to leave the posterior portion of the condyles on the skull, so that the condylo-basal length can still be measured. Both cuts should be extended until they meet each other. The separated piece of skull can then be pried loose using a chisel or flat-bladed screwdriver, and the brain can be removed.

Take a 1 $cm^3$ sample of brain for virological examination. Place the rest of the brain in 10% formalin for at least a week. To allow faster fixation, a longitudinal incision can be made in the cerebrum to expose the lateral ventricles. When it is fixed, make multiple slices into the tissue to look for pathological lesions, including the presence of parasites. Take 1 $cm^3$ samples of the cortex, midbrain, cerebellum, and medulla, for histopathological examination.

In more decomposed carcases, leave the skull intact. Both opened and completely intact skulls should be stored frozen for morphometrics studies.

### *2.2.6 Examination of the gastro-intestinal tract, pancreas and spleen*

Examine the spleen and put a piece (about 1 $cm^3$), including a section of capsule, in 10% formalin for histopathological examination. One often finds smaller accessory spleens near to the main spleen.

Examine the pancreas. Look for parasites, particularly in the pancreatic ducts. Place a 1 $cm^3$ piece of pancreas tissue in 10% formalin for histopathological examination.

Examine the mesenteric lymph node and put a 1 cm thick cross-sectional slice from halfway along its length in 10% formalin for histopathological examination.

Open the cardiac section of the stomach. Weigh any fish bones, otoliths and other food remains and preserve in 70% ethanol or freeze for prey studies. Any parasites should be collected. Describe any lesions, including the distribution and size of any ulcers.

Open the fundic and pyloric sections of the stomach. Any food material and parasites should be preserved as for the cardiac section. Any nodules in the walls of the fundic and pyloric sections should be noted and, if they are found, attempts should be made to express the contents. Any parasites found in the contents should be collected.

Free the intestine from the mesentery and open the entire length of the organ collecting any contents in a bucket. The contents should be diluted with water and sieved through a 500 µm sieve to collect otoliths and other recognisable food remains. These should be stored in 70% ethanol (or alternatively stored frozen). Any parasites should be collected.

## 2.3 Collection, storage and despatch of samples

### *2.3.1 Labelling of samples*

As the samples from each animal are to be examined by a number of people, it is very important that the samples are properly labelled. This means that:

(i) each sample should have a label which is <u>securely</u> fastened to it.

(ii) <u>indelible</u> ink or pencil should be used to write on the labels.

(iii) the label should include the <u>Natural History Museum reference number of the carcase</u> (if not available your own reference number) and the <u>name of the sample</u> (e.g. SW1990/56 aqueous humour).

### *2.3.2 Blubber, liver and kidney samples for organochlorine and heavy metal analyses*

*Collection*
It is important to take the blubber sample of the whole layer, from the skin to the muscle.

Blubber samples should only come into contact with stainless steel, aluminium, glass or teflon. The glass Sovirel tubes provided by the MAFF laboratory in Burnham-on-Crouch have tops with a teflon lining on the inside. Make sure this lining is in place before use. The glass has been washed in hexane to remove any remains of plastics.

If Sovirel tubes are not available, the blubber, liver and kidney samples can also be wrapped in aluminium foil.

*Storage and package*
If samples are sent by post directly after collection, they do not need to be cooled. Otherwise, they should be frozen at -20°C and not thawed during storage, otherwise the tissue will break down. To send by post, the tubes should be suitably wrapped to prevent breakage and placed in an insulating container, such as polystyrene. They should be sent by a fast postal service (e.g. Redstar, Datalink), at the beginning of the week.

## 2.3.3 Histological Samples

*Fixation*

10% neutral-buffered formalin should be used as a fixative. This can be made as follows: dissolve 3.31 g $NaH_2PO_4.H_2O$ and 33.77 g $Na_2HPO_4.7H_2O$ in 1 l distilled water. To 1 part of concentrated formalin (= 40% formaldehyde solution) add 9 parts of this buffer.

As a rule, formalin will only penetrate about 1 cm in any direction, so inject or cut samples larger than 2 cm in diameter to expose more tissue to the formalin. Also remember to try to have 10 times the volume of 10% formalin to tissue when fixing.

*Storage and package*

Once fixation has taken place, the samples can be stored in a smaller volume of 10% formalin. Samples should be posted in well-sealed plastic vials.

## 2.3.4 Parasites

*Fixation*

Live specimens should be immersed for about 1 minute in Berland's fluid (19 parts pure glacial acetic acid + 1 part concentrated formalin (= 40% formaldehyde solution)) and then stored in 70-80% ethanol. Dead specimens can be put in 70-80% ethanol straightaway.

*Storage and package*

Specimens should be stored in 70% ethanol, and sent by post in strong, well-sealed plastic vials.

## 2.3.5 Teeth

*Collection*

Most toothed cetaceans can be aged by examining the growth layers of the teeth, so it is always worthwhile to collect teeth for age determination. At least 2, and preferably 4, teeth should be collected from each individual[3]. From the common porpoise, teeth can easily be extracted by inserting a sharp knife or scalpel, firstly on one side of the gum in between the teeth and the connective tissue, and then on the other side. With a little pulling an entire string of teeth can be removed. In species such as the bottlenose dolphin, the teeth can be loosened by prying in between the space between the tooth and the socket with a sharp pointed instrument. If this is not possible, a piece of mandible containing at least 4 teeth can be sawed off. It doesn't matter which teeth are taken, as long as they are damaged or worn as little as possible. It is important to extract the tooth in its entirety, i.e., including all the root.

*Storage and package*

Loose teeth and jaw sections can be stored frozen. Alternatively, they can be fixed in 70% alcohol or 10% neutral-buffered formalin. They should not be stored dry as this may lead to cracking of the teeth. The samples can be sent by post in well-sealed plastic vials, or wrapped in wet tissue-paper and then placed in a plastic bag.

## 2.3.6 Aqueous humour

*Collection*

Put pressure on one corner of the eye with a finger. Using a syringe and thin hypodermic needle (i.e. 23 gauge), puncture the eye bulb at the other corner of the eye and extract the aqueous humour. (In porpoises, approximately 0.75 ml of fluid can be collected from each eye in this manner.)

*Storage and package*

Store frozen. Samples should be posted in well-sealed plastic vials, placed in a suitable isolating container.

## 2.3.7 Despatch of pathological specimens by post

In order to assure rapid and safe delivery of samples and to comply with Post Office rules, the following points should be adhered to:

Only first-class letter post or data post may be used. Parcel post must not be used.

Every specimen must be enclosed in a primary container which is securely sealed.

The primary container must be wrapped in sufficient absorbent material to absorb all possible leakage in the event of damage.

The container and absorbent material must be sealed in a leakproof plastic bag. In the case of frozen specimens, this package should be placed in a suitable isolating container, such as polystyrene.

This must then be placed in a strong box or case in such a way that it cannot move about. If necessary the box/ case should be placed in a stout envelope or padded bag.

The completed package must be clearly marked 'Pathological Specimen - Fragile. With Care' and show the name and address of the sender to be contacted in case of leakage.

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*Note: [3] With beaked whales it may only be possible to collect one tooth*

A statement detailing the nature of the contents must accompany all specimens. The statement must be so concealed as to easily allow the consignor to identify the nature of the specimen before breaking into the inner protective packaging.

# 3. ANALYTICAL METHODS AND QUALITY CONTROL INFORMATION

## 3.1 Determining the age of marine mammals
***Christina Lockyer (SMRU)***

Whenever possible at least 4 teeth were removed from the middle of the lower jaw for aging purposes, and stored frozen (see Section 2.2.5 above). The teeth were decalcified, sectioned, stained and mounted on microscope slides. The sectioned and stained teeth were then examined under a binocular microscope and the growth layers in dentine and / or cementum counted. A fuller outline of the procedure can be found in Lockyer (in press).

## 3.2 Trace metals in liver
***Bryn R. Jones (MAFF) and John Pirie (SOAFD)***

The majority of the trace metal analyses (all but twenty samples) were conducted by MAFF, the remainder by SOAFD.

### *3.2.1 Summary of MAFF analytical methods and quality control data*

Samples of marine mammal liver are weighed into a microwave digestion vessel, (~2.5 g wet), and the sample is dried at 102°C for 12 hours. After cooling the sample is reweighed and the weight of dry material determined. 4 $cm^3$ of concentrated nitric acid and 4 $cm^3$ distilled water are added to the vessel, then the vessel is closed and the sample digested in an analytical microwave oven (Model MDS-2000, CEM Corporation, Matthews, North Carolina, USA) for 25 minutes, during which the temperature and pressure in the digestion vessels reach 120°C and 120 psi respectively. After cooling, the samples are quantitatively transferred to polypots and made up to 25 $cm^3$ volume using distilled water.

Most of the batches of sample were analysed by the following procedures:

Prior to analysis hydroxylammonium chloride was added to the digest in order to remove excess nitric acid. For all instrumental analysis, suitable external calibrations are made and the digests diluted to read within the calibration range. Samples were analysed for nickel, copper, cadmium and zinc by atomic absorption spectrophotometry (AAS) with an air/acetylene flame (Varian SpectrAA-400P flame instrument; Varian Ltd., Walton-on-Thames, Surrey). Chromium was analysed using the same instrument with a nitrous oxide/acetylene flame. Lead was analysed by electrothermal AAS using a Pye-Unicam SP9 spectrophotometer with graphite furnace employing pyrolytic graphite coated tubes. Mercury was analysed by atomic fluorescence following reduction by tin II chloride using a dedicated system (Merlin; P. S. Analytical Ltd., Sevenoaks, Kent).

The determination of arsenic requires the use of a separate digestion procedure. Samples for arsenic were digested using the procedure for arsenic in fish tissue given by Harper *et al*. (1989), the final analysis being carried out using the Varian instrument described above in conjunction with a Varian VG 76 continous flow hydride generator.

The determination of selenium also requires a separate digestion procedure. 1.5 g of liver was weighed into an open beaker. Concentrated nitric and hydrochloric acids were added (10 $cm^3$ each) and the samples were heated on hot plates until a clear digest was obtained (4 - 8 hours). Samples were quantitatively made up to volume with 10% hydrochloric acid. The instrumentation used for the final analysis was as for arsenic above.

Following the purchase of new instrumentation and appropriate method development the final batches of samples were analysed for metals other than mercury by means of inductively-coupled plasma/mass spectrometry (ICP/MS) (VG PlasmaQuad PQ2+; FI Elemental, Winsford, Cheshire). In this technique the standard nitric acid digest is suitable for all elements, and external calibration is used in conjunction with internal standards to compensate for instrumental drift and matrix interferences. Arsenic and selenium also require corrections to be made for chloride interferences.

No significant biases have been observed between data generated using AAS and ICP/MS techniques. Prior to the commencement of analyses of marine mammal tissue we participated successfully in an international intercomparison exercise in which narwhal liver was analysed for trace metals (Wagemann and Armstrong, 1988). All analyses reported here were conducted under a Quality Assurance (QA) programme under which standard materials and procedural blanks were included in each batch of samples analysed. The results obtained from analyses of certified reference materials analysed in 1991 and 1992 are summarised in Appendix 2. Full details of the current methodology and the associated AQC procedures will be given in Jones and Laslett (in prep.).

A number of kidney samples from a range of marine mammals, and a number of stomach content samples from common dolphins were also analysed in conjunction with studies of a mass mortality in the south-west of England that occurred early in 1992. These samples were treated in essentially the same way as the liver samples.

### 3.2.2 *Summary of SOAFD analytical methods and quality control*

Tissue samples (0.5 - 1.0 g wet weight) were digested in silica flasks with 10 $cm^3$ of concentrated nitric acid (Aristar grade). The acid volume was reduced to 5 $cm^3$, and the digest allowed to cool before being quantitatively transferred to a 25 $cm^3$ calibrated plastic vial and made up to volume with distilled water. Analyses for copper and zinc were by AAS with an air/acetylene flame (model 5000; Perkin Elmer, Beaconsfield, Bucks.). Cadmium, chromium, lead and selenium were analysed by electrothermal AAS with heated graphite atomisation (Perkin Elmer Zeeman 3030). Pyrolytic graphite coated tubes with a L'Vov platform, in conjunction with a matrix modifier and thermal programme, were employed to effect atomisation. Mercury was determined by cold vapour AAS (Data Acquisition Mercury Flow Meter) following reduction with tin II chloride. All instruments were calibrated using acid matrix matched standards, with a minimum of five standards per line. The methods were validated by analysis of appropriate reference materials, and participation in intercalibration exercises. Quality control was maintained by analysis of the certified reference material DOLT-1 — all the samples reported here were run in a single batch.

## 3.3 Organochlorines in Blubber *Colin R. Allchin (MAFF)*

Blubber samples were taken according to the protocol in Section 2.2.3. Cross-sectional samples of blubber adjacent to the dorsal fin were collected with a stainless steel knife, placed in a hexane-washed glass container (generally a Sovirel tube) with a PTFE- or aluminium-lined cap, and stored at -20°C until analysis was carried out. The concentrations of the following contaminants were determined according to the procedures outlined by Allchin *et al.* (1989): hexachlorobenzene (HCB), α-HCH (hexachlorocyclohexane), γ-HCH (lindane), *p,p'*-DDE, *p,p'*-TDE, *p,p'*-DDT, dieldrin, and 25 individual chlorobiphenyl congeners numbered according to Ballschmiter and Zell (1980), and listed in Table 1. To obtain the desired chromatographic separations analyses were routinely conducted on two columns of differing polarity and selectivity: 50 m x 0.2 mm ID HP-5 (5% phenyl methylsilicone; film thickness 0.33 µm) and 50 m x 0.25 mm ID CP-Sil 19-CB (film thickness 0.25 µm). In both cases hydrogen was used as the carrier gas, and detection was by means of an electron-capture detector. The columns were mounted in HP5890 gas chromatographs, and injections were made automatically by means of HP7673a autosamplers. A range of alkyl substituted dichlorobenzylethers ($C_6$, $C_7$, $C_{14}$ and $C_{16}$) were used as internal standards, and were added to the samples prior to GC analysis of the extracts. Some confirmatory analyses were also conducted by coupled gas chromatography/mass spectrometry using a Finnigan-MAT ITS-40 instrument.

***Table 1. List of chlorobiphenyl congeners analysed in blubber samples***

| Congener number | | Structure |
|---|---|---|
| CB18 | | 2,2',5-trichlorobiphenyl |
| CB28 | * | 2,4,4'-trichlorobiphenyl |
| CB31 | | 2,4',5-trichlorobiphenyl |
| CB44 | | 2,2',3,5'-tetrachlorobiphenyl |
| CB47 | | 2,2',4,4'-tetrachlorobiphenyl |
| CB49 | | 2,2',4,5'-tetrachlorobiphenyl |
| CB52 | * | 2,2',5,5'-tetrachlorobiphenyl |
| CB66 | | 2,3',4,4'-tetrachlorobiphenyl |
| CB101 | * | 2,2',4,5,5'-pentachlorobiphenyl |
| CB105 | | 2,3,3',4,4'-pentachlorobiphenyl |
| CB110 | | 2,3,3',4',6-pentachlorobiphenyl |
| CB118 | * | 2,3',4,4',5-pentachlorobiphenyl |
| CB128 | | 2,2',3,3',4,4'-hexachlorobiphenyl |
| CB138 | * | 2,2',3,4,4',5'-hexachlorobiphenyl |
| CB141 | | 2,2',3,4,5,5'-hexachlorobiphenyl |
| CB149 | | 2,2',3,4',5',6-hexachlorobiphenyl |
| CB151 | | 2,2',3,5,5',6-hexachlorobiphenyl |
| CB153 | * | 2,2',4,4',5,5'-hexachlorobiphenyl |
| CB156 | | 2,3,3',4,4',5-hexachlorobiphenyl |
| CB158 | | 2,3,3',4,4',6-hexachlorobiphenyl |
| CB170 | | 2,2',3,3',4,4',5-heptachlorobiphenyl |
| CB180 | * | 2,2',3,4,4',5,5'-heptachlorobiphenyl |
| CB183 | | 2,2',3,4,4',5',6-heptachlorobiphenyl |
| CB187 | | 2,2',3,4',5,5',6-heptachlorobiphenyl |
| CB194 | | 2,2',3,3',4,4',5,5'-octachlorobiphenyl |

*The suite of CBs comprises 3 trichlorobiphenyls, 5 tetrachlorobiphenyls, 4 pentachlorobiphenyls, 8 hexachlorobiphenyls, 4 heptachlorobiphenyls and 1 octachlorobipenyl. The seven congeners comprising the ICES primary list are indicated by asterisks*

Sample preparation and fractionation were conducted at SMRU, with the chromatographic analysis and interpretation being undertaken at MAFF. Procedural blanks were run with all sample batches, and in addition all the solvents and reagents (alumina, silica, anhydrous sodium sulphate) were checked for contamination prior to use. A reference fish-oil (SOAFD LRM-1) was also analysed with each batch to provide AQC information on the performance of the methods, and two certified reference materials (CRM 349 and 350: cod liver and mackerel oils respectively) from the EC Community Bureau of Reference were analysed periodically.

A number of stomach content samples from common dolphins were also analysed in conjunction with studies of a mass mortality in the south-west of England. These were treated in essentially the same way as the blubber samples.

# 4. RESULTS

## 4.1 Biological data
### *Thijs Kuiken, Peter M. Bennett (IOZ), Christina Lockyer (SMRU), Sarah Phillips and Chris Spurrier (NHM)*

The basic information for each of the animals for which data are reported is given in Tables 2 and 3. Age, where given, is in years. The body length is given in cm, and was defined as the straight length measurement from the tip of the upper jaw to either the tip of the tail (for seals), or to the tail notch (for cetaceans). Table 2 includes information for all animals other than harbour porpoises, and Table 3 that for porpoises alone. The main identifier for animals used is the NHM number (Natural History Museum stranding incident reference number) whenever possible, as this provides a link to other information. Where no NHM number was assigned another unique identifier has been created. The basic information comprises species, sex, age, length, and date and location where found, where each of these pieces of information is known. Dashes indicate where information is unavailable. Table 3 also indicates the probable cause of death as established by postmortem investigations of harbour porpoise carcases.

## 4.2 Trace metals in liver, kidney and stomach contents
### *Bryn R. Jones (MAFF) and John Pirie (SOAFD)*

Table 4 lists the trace metal concentrations observed in samples of liver tissue, Table 5 those for kidney tissue, and Table 6 to analyses of stomach contents from a particular group of common dolphins. In all cases the concentrations are given in units of mg kg$^{-1}$ wet weight, although the percentage dry matter in the samples is also given to facilitate conversion to dry weight if desired. In all tables the reference numbers are given for each animal in order to provide a link to Tables 2 and 3. In Table 4 two dolphins are listed with the same reference number (IC1991/1); the animal was a pregnant female and the suffix A refers to the mother, suffix B to her foetus (as in Table 2).

## 4.3 Organochlorines in blubber and stomach contents
### *Colin R. Allchin (MAFF) and Mike Walton (SMRU)*

Sample preparation, extraction and fractionation were conducted at SMRU, whilst all instrumental analyses were carried out by MAFF. The basic procedures are outlined in Section 3.3 above. The organochlorine data are given in Tables 7 - 10. Tables 7 - 9 relate to analyses of blubber, and Table 10 to analyses of stomach contents from a particular group of common dolphins. Table 7 presents data for total chlorobiphenyls (both the sum of the 7 ICES congeners, and the sum of the 25 CBs determined in this study; see Table 1 for the identity of the 25 congeners analysed) and for a range of organochlorine compounds including pesticides. Priority in this study was given to analysis of chlorobiphenyls, and in many cases the fraction containing the majority of the pesticides was not analysed. Dashes in the relevant columns indicate where data are unavailable for this reason — where analyses were conducted but the concentration was below the limit of detection ‘nd’ (not detected) is displayed.

The ICES 7 congeners were selected by the International Council for the Exploration of the Sea as a basic list for monitoring purposes (Anon., 1986) and comprise CBs 28, 52, 101, 118, 138, 153 and 180. Tables 8 and 9 present the data for the 25 individual CB congeners, in their order of elution from a low-polarity (5% phenylmethyl silicone) stationary phase. In all these tables the data are reported in units of mg kg$^{-1}$ wet weight, but the content of hexane-extractable lipid is also given so that concentrations can be recalculated on a lipid basis if required, and the reference numbers are given for each animal in order to provide a link to Tables 2 and 3.

# 5. SUMMARY AND CONCLUSION
### *Thijs Kuiken (IOZ) and Robin J. Law (MAFF)*

Through this project detailed postmortem examinations were carried out on more than 300 marine mammal carcases from around the coast of the UK. As a result of the co-operative effort of a number of institutes, it was possible to attribute the cause of a mass mortality of common dolphins around the south-west of England to accidental capture in fishing gear (Kuiken *et al*., 1994(a)). Recommendations were made on how to assess the importance of this cause of death for the common dolphin population in these waters. Accidental capture in fishing gear was also the single most important cause of death for harbour porpoises from British waters (Kuiken *et al*., 1994(b)). The first cases of morbillivirus infection in harbour porpoises in Great Britain were diagnosed (Kennedy *et al*., 1992), and several marine mammal species found stranded on the coast of England and Wales had serological evidence of infection with a morbillivirus (Visser *et al*., 1993) and a newly discovered virus with a rhabdovirus morphology (Osterhaus *et al*., 1993). Bacterial and parasitic infections were found regularly in harbour porpoises and common dolphins, and were occasionally fatal (Kuiken *et al*., 1994(a) and (b)).

***Table 2. Basic information for animals other than harbour porpoises***

| Reference No. | Species | Sex | Age (yrs) | Length (cm) | Found | Location | County / Region |
|---|---|---|---|---|---|---|---|
| LAW-19 | H. grypus | M | - | - | 22/10/88 | Donna Nook | Lincolnshire |
| LAW-20 | H. grypus | M | - | - | ??/10/88 | Cardigan Bay | Dyfed |
| LAW-21 | H. grypus | - | - | - | ??/10/88 | Cardigan Bay | Dyfed |
| LAW-22 | H. grypus | M | - | 215 | 06/12/88 | Ceibwr Bay | Dyfed |
| LAW-23 | H. grypus | F | < 1 | - | 23/12/88 | River Tees | Cleveland |
| LAW-24 | H. grypus | F | - | 100 | 10/01/89 | Portaferry | Co. Down |
| LAW-25 | H. grypus | F | - | 99 | 05/02/89 | Portrush | Co. Antrim |
| LAW-26 | H. grypus | M | - | 189 | 19/05/89 | West Kirby, Wirral | Merseyside |
| LAW-27 | H. grypus | F | - | - | 01/06/89 | Portrush | Co. Antrim |
| LAW-28 | H. grypus | M | - | 212 | 02/06/89 | West Kirby, Wirral | Merseyside |
| LAW-29 | H. grypus | M | - | 188 | 27/06/89 | Mostyn | Clwyd |
| LAW-30 | H. grypus | F | - | 168 | 01/07/89 | River Dee | Clwyd / Merseyside |
| LAW-31 | H. grypus | M | - | 209 | 10/07/89 | West Kirby, Wirral | Merseyside |
| LAW-32 | H. grypus | F | - | 183 | 28/09/89 | New Quay | Dyfed |
| LAW-33 | H. grypus | M | - | - | 18/10/89 | Portstewart | Co. Antrim |
| LAW-34 | H. grypus | M | - | 97 | 25/01/90 | Llandudno | Gwynedd |
| LAW-35 | H. grypus | F | - | 145 | 11/06/90 | Dove Point, Hoylake | Merseyside |
| LAW-36 | H. grypus | F | - | - | 09/07/90 | Formby | Merseyside |
| LAW-37 | H. grypus | M | - | 182 | 10/07/90 | Formby | Merseyside |
| LAW-38 | H. grypus | M | - | 115 | ??/07/90 | Port Erin | Isle of Man |
| LAW-39 | H. grypus | M | - | 208 | 02/10/90 | West Kirby, Wirral | Merseyside |
| SS1990/3 | H. grypus | F | | 183 | 08/11/90 | New Quay | Dyfed |
| SS1990/7 | H. grypus | F | | 165 | 23/11/90 | Druidston Haven | Dyfed |
| SS1990/11 | H. grypus | F | | 102 | 02/12/90 | St Ives | Cornwall |
| SS1990/12A | H. grypus | M | | 116 | 10/12/90 | Beadnell | Northumberland |
| SS1990/12B | H. grypus | F | | 108 | 10/12/90 | Beadnell | Northumberland |
| SS1990/16 | H. grypus | F | 2 | - | 24/12/90 | Gweek (seal sanctuary) | Cornwall |
| SS1991/1A | H. grypus | M | | 109 | 01/01/91 | Hayle Towan | Cornwall |
| SS1991/1B | H. grypus | M | - | 107 | 04/01/91 | St.Michael's Mount | Cornwall |
| SS1991/9 | H. grypus | F | - | 96 | 21/01/91 | Unknown | Devon |
| SS1991/23 | H. grypus | F | | 160 | 09/04/91 | Blackpool | Lancashire |
| SS1991/27 | H. grypus | M | - | 178 | 17/05/91 | Formby | Merseyside |
| SS1991/28 | H. grypus | M | | 206 | 22/05/91 | Wirral | Cheshire |
| SS1991/30A | H. grypus | M | | 155 | 18/06/91 | Caldy | Merseyside |
| SS1991/41 | H. grypus | F | | 191 | 27/08/91 | Hoylake | Merseyside |
| SS1991/50 | H. grypus | F | - | 92 | ??/10/91 | Ramsey | Dyfed |
| SS1991/55 | H. grypus | M | | 107 | 12/11/91 | Borth | Dyfed |
| SS1991/58 | H. grypus | M | | 180 | 15/11/91 | Llangranog | Dyfed |
| SS1991/73 | H. grypus | M | - | 100 | 20/12/91 | Llandanwg | Gwynedd |
| SS1992/9 | H. grypus | F | - | 178 | 25/03/92 | Llanon | Dyfed |
| LAW-40 | P. vitulina | M | 5 | - | 25/08/88 | Blakeney Point | Norfolk |
| LAW-41 | P. vitulina | M | 2 | - | 25/08/88 | Blakeney Point | Norfolk |
| LAW-42 | P. vitulina | F | 1 | - | 25/08/88 | Blakeney Point | Norfolk |
| LAW-43 | P. vitulina | M | 1 | - | 25/08/88 | Blakeney Point | Norfolk |
| LAW-44 | P. vitulina | M | 6 | 152 | 31/08/88 | River Humber | Humberside |
| LAW-45 | P. vitulina | F | - | 130 | 12/09/88 | Blakeney Point | Norfolk |
| LAW-46 | P. vitulina | F | 4 | - | 12/09/88 | Blakeney Point | Norfolk |
| LAW-47 | P. vitulina | M | 2 | 122 | 13/09/88 | Blakeney Point | Norfolk |
| LAW-48 | P. vitulina | F | 14 | 131 | 14/09/88 | Blakeney Point | Norfolk |
| LAW-49 | P. vitulina | F | 2 | 120 | 15/09/88 | Blakeney Point | Norfolk |
| LAW-50 | P. vitulina | F | 8 | 142 | 16/09/88 | Blakeney Point | Norfolk |
| LAW-51 | P. vitulina | M | - | - | 16/09/88 | Strangford | Co. Down |
| LAW-52 | P. vitulina | M | 6 | 149 | 18/09/88 | Blakeney Point | Norfolk |
| LAW-53 | P. vitulina | F | - | - | 23/09/88 | Blakeney Point | Norfolk |
| LAW-54 | P. vitulina | M | - | - | 26/09/88 | Newcastle | Co. Down |
| LAW-55 | P. vitulina | M | - | - | 29/09/88 | Unknown | Co. Down |
| LAW-56 | P. vitulina | M | - | - | 29/09/88 | Unknown | Co. Down |
| LAW-57 | P. vitulina | M | - | 105 | 03/10/88 | Ballykinlar | Co. Down |
| LAW-58 | P. vitulina | M | - | - | 06/10/88 | Annalong | Co. Down |
| LAW-59 | P. vitulina | M | - | - | 17/10/88 | Unknown | Co. Down |
| LAW-60 | P. vitulina | F | - | 147 | 24/10/88 | Whiteabbey | Co. Antrim |
| LAW-61 | P. vitulina | M | - | 100 | 26/10/88 | Whitehead | Co. Antrim |
| LAW-62 | P. vitulina | F | - | - | 26/10/88 | Blakeney Point | Norfolk |
| LAW-63 | P. vitulina | F | - | - | 04/11/88 | Blakeney Point | Norfolk |
| LAW-64 | P. vitulina | F | - | 165 | 09/11/88 | Kilkeel | Co. Down |
| LAW-65 | P. vitulina | F | - | 144 | 22/11/88 | Rathlin Island | Co. Antrim |
| LAW-66 | P. vitulina | M | < 1 | - | ??/12/88 | River Tees | Cleveland |
| LAW-67 | P. vitulina | F | - | 70 | 05/05/89 | Unknown | Co. Down |
| LAW-68 | P. vitulina | M | < 1 | - | 15/07/89 | River Tees | Cleveland |
| LAW-69 | P. vitulina | M | - | - | 18/10/89 | Portaferry | Co. Down |
| SW1991/2 | B. acutorostrata | F | - | - | 02/01/91 | Carmarthen Bay, Pembrey | Dyfed |

***Table 2. (continued)***

| Reference No. | Species | Sex | Age (yrs) | Length (cm) | Found | Location | County / Region |
|---|---|---|---|---|---|---|---|
| SMRU90-73 | D. delphis | - | - | - | ??/??/90 | Unknown | Unknown |
| IC1990/4 | D. delphis | M | - | - | ??/10/90 | Seaton | Cornwall |
| IC1991/1A | D. delphis | F | - | 194 | 07/01/91 | Porthcawl | Mid Glamorgan |
| IC1991/1B | D. delphis | F | foetus | 39 | 07/01/91 | Porthcawl | Mid Glamorgan |
| SW1990/5A | D. delphis | F | - | 167 | 19/01/90 | Langness | Isle of Man |
| SW1990/20A | D. delphis | - | - | - | ??/??/90 | Unknown | Unknown |
| SW1990/26 | D. delphis | F | - | 162 | 05/03/90 | Carmarthen Bay | Dyfed |
| SW1990/45 | D. delphis | F | - | 168 | 21/05/90 | Swansea | West Glamorgan |
| SW1990/46 | D. delphis | M | - | - | 22/05/90 | Lambeth Bridge | Greater London |
| SW1990/47 | D. delphis | F | - | 190 | 23/05/90 | Wapping | Greater London |
| SW1990/68 | D. delphis | F | 17 | 194 | 01/09/90 | Stoke Beach | Devon |
| SW1990/78 | D. delphis | M | 18 | 220 | 26/09/90 | Seaton Beach, Downderry | Cornwall |
| SW1990/81 | D. delphis | F | - | 162 | 02/10/90 | Caer-fai Bay | Dyfed |
| SW1990/87 | D. delphis | M | ?5 | 176 | 16/10/90 | Caerthilian Cove | Cornwall |
| SW1990/88 | D. delphis | - | ?6 | 197 | 22/10/90 | Truro | Cornwall |
| SW1990/90A | D. delphis | - | 9 | - | 24/10/90 | Helford River | Cornwall |
| SW1990/97 | D. delphis | M | 1 | 132 | 16/11/90 | Porthmeor | Cornwall |
| SW1990/101(1) | D. delphis | M | ?13 | 206 | 25/11/90 | Bexhill on Sea | East Sussex |
| SW1990/101(2) | D. delphis | F | 4-5 | 181 | 25/11/90 | Bexhill on Sea | East Sussex |
| SW1990/103 | D. delphis | F | 6 | 167 | 26/11/90 | Eastbourne | East Sussex |
| SW1990/104 | D. delphis | F | ?9 | 178 | 26/11/90 | Cuckmere Haven | East Sussex |
| SW1990/108 | D. delphis | M | 14 | 212 | 07/12/90 | Gorran Haven Beach | Cornwall |
| SW1991/7 | D. delphis | F | - | 226 | 10/01/91 | Banjo Groyne, Brighton | East Sussex |
| SW1991/10 | D. delphis | M | - | 174 | 09/01/91 | Harlech | Gwynedd |
| SW1991/37 | D. delphis | F | 3 | 239? | 16/04/91 | Aberavon Sands, Port Talbot | West Glamorgan |
| SW1991/40 | D. delphis | F | - | 187 | 12/04/91 | Seaton | Cornwall |
| SW1991/46 | D. delphis | M | - | 210 | 28/04/91 | Lansallos | Cornwall |
| SW1991/83 | D. delphis | F | ?10 | 198 | 18/07/91 | Cemaes Head | Dyfed |
| SW1991/129 | D. delphis | M | < 1 | 125 | 06/10/91 | Lawrenny Quay | Dyfed |
| SW1991/137 | D. delphis | F | 20+ | 205 | 27/10/91 | Swanage | Dorset |
| SW1992/1 | D. delphis | F | - | 191 | 02/01/92 | Looe Beach | Cornwall |
| SW1992/2 | D. delphis | M | - | 205 | 07/01/92 | Penzance | Cornwall |
| SW1992/3 | D. delphis | F | - | - | 08/01/92 | Porthleven Harbour | Cornwall |
| SW1992/4 | D. delphis | M | - | 195 | 14/01/92 | Praa Sands | Cornwall |
| SW1992/10 | D. delphis | F | - | 183 | 02/02/92 | Penzance | Cornwall |
| SW1992/11 | D. delphis | F | - | 184 | 02/02/92 | Porthtowan | Cornwall |
| SW1992/12 | D. delphis | M | - | 220 | 02/02/92 | St Keverne | Cornwall |
| SW1992/14 (1) | D. delphis | F | - | - | 07/02/92 | Falmouth | Cornwall |
| SW1992/14 (2) | D. delphis | F | - | - | 07/02/92 | Falmouth | Cornwall |
| SW1992/19 (1) | D. delphis | F | - | 171 | 13/02/92 | Bigbury | Devon |
| SW1992/19 (2) | D. delphis | F | - | | 13/02/92 | Bigbury | Devon |
| SW1992/20 | D. delphis | F | - | 204 | 13/02/92 | Kingsbridge | Devon |
| SW1992/172 (1) | D. delphis | F | 28 | 205 | 03/08/92 | Newport | Dyfed |
| SW1992/172 (2) | D. delphis | F | 2 - 3 | 150 | 03/08/92 | Newport | Dyfed |
| | | | | | | | |
| SW1990/70 | G. griseus | F | - | 161 | 03/09/90 | Porthmadog | Gwynedd |
| | | | | | | | |
| SW1990/88A | G. melas | M | - | 190 | 20/10/90 | Maenporth Beach | Cornwall |
| SW1991/55 | G. melas | M | - | 588 | 20/05/91 | Redcar | Cleveland |
| | | | | | | | |
| LAW-70 | L. acutus | - | - | - | 02/03/89 | Unknown | Co. Sligo |
| SW1989/88B | L. acutus | M | - | | 03/11/89 | Unknown | Shetland |
| SW1990/114 | L. acutus | M | < 1 | 158 | 27/12/90 | Beadnell | Northumberland |
| SW1991/9 | L. acutus | F | 10 | 217 | 11/01/91 | Saunton Sands | Devon |
| | | | | | | | |
| SW1989/49 | L. albirostris | F | - | 255 | 28/06/89 | West Kirby, Wirral | Merseyside |
| SW1991/108 | L. albirostris | F | - | 217 | 04/09/91 | Cayton Bay, Osgodby | North Yorkshire |
| SW1991/126 | L. albirostris | M | - | 249 | 30/09/91 | Withernsea | Humberside |
| | | | | | | | |
| SW1990/4 | S. coeruleoalba | M | - | 186 | 22/01/90 | Carmarthen Bay | Dyfed |
| SW1990/20 | S. coeruleoalba | M | - | 185 | 14/02/90 | Aberstwyth | Dyfed |
| SW1990/57 | S. coeruleoalba | M | - | 166 | 09/07/90 | Brighton Marina | East Sussex |
| SW1991/11 | S. coeruleoalba | M | 6 | 187 | 13/01/91 | Mill Haven | Dyfed |
| SW1991/18 | S. coeruleoalba | M | 3 | 157 | 06/02/91 | Aldeburgh | Suffolk |
| SW1991/26 | S. coeruleoalba | M | - | 190 | 20/02/91 | Talacre | Clwyd |
| SW1991/122 | S. coeruleoalba | M | - | 235 | 27/09/91 | Port Soif | Guernsey |
| | | | | | | | |
| LAW-71 | T. truncatus | F | - | 271 | 25/06/89 | Tenby | Dyfed |
| SW1989/47 | T. truncatus | - | - | 217 | 26/06/89 | Pen-y-Bryn, New Quay | Dyfed |
| SW1991/42 | T. truncatus | M | 23 | 342 | 17/04/91 | Upper Borth | Dyfed |
| SW1991/115 | T. truncatus | F | - | 154 | 13/09/91 | Beaumaris | Gwynedd |
| SW1991/130 | T. truncatus | F | - | 322 | 07/10/91 | Bognor Regis | West Sussex |
| SW1992/25 | T. truncatus | M | - | 183 | 19/02/92 | Harlech | Gwynedd |

***Table 3. Basic information and probable cause of death for harbour porpoises***

| Reference No. | Species | Sex | Age (yrs) | Length (cm) | Found | Location | County / Region | Probable Cause of Death |
|---|---|---|---|---|---|---|---|---|
| IC1990/1 | P. phocoena | F | 1 | 128 | 20/04/90 | Usk mouth | Gwent | by-catch |
| IC1990/2 | P. phocoena | F | 1 | 117 | 20/08/90 | Puffin Island | Gwynedd | by-catch |
| IC1990/3 | P. phocoena | F | - | 118 | 15/10/90 | Caernarfon | Gwynedd | starvation |
| IC1990/4 | P. phocoena | M | - | 108 | ??/??/90 | Caernarfon Bay | Gwynedd | by-catch |
| IC1991/2 | P. phocoena | M | 0 | 78 | 15/07/91 | Anglesey | Gwynedd | starvation (neonate) |
| 91L-2947 | P. phocoena | M | - | 84 | 22/06/89 | Swansea Bay | West Glamorgan | physical trauma |
| SMRU90-01 | P. phocoena | M | 10 | 145 | 06/12/89 | Unknown | Shetland | physical trauma, by-catch* |
| SMRU90-04 | P. phocoena | M | 1 | 119 | ??/??/?? | Teesside | Cleveland | no post-mortem done |
| SMRU90-02 | P. phocoena | F | 6 | 157 | 02/12/89 | Unknown | Shetland | by-catch |
| SMRU90-03 | P. phocoena | M | 11 | 143 | 06/12/89 | Unknown | Shetland | by-catch |
| SMRU90-05 | P. phocoena | M | 4 | 141 | 13/10/89 | Unknown | Shetland | by-catch |
| SMRU90-06 | P. phocoena | F | 2 | 133 | 30/08/89 | Unknown | Shetland | by-catch |
| SMRU90-07 | P. phocoena | F | 5 | 150 | 02/10/89 | Unknown | Shetland | by-catch |
| SMRU90-08 | P. phocoena | F | 4 | 152 | 20/10/89 | Unknown | Shetland | by-catch |
| SMRU90-09 | P. phocoena | M | 1 | 114 | 24/08/89 | Unknown | Shetland | by-catch |
| SMRU90-10 | P. phocoena | M | 3 | 142 | 24/08/89 | Unknown | Shetland | by-catch |
| SMRU90-11 | P. phocoena | F | 2 | 147 | 23/08/89 | Unknown | Shetland | by-catch |
| SMRU90-12 | P. phocoena | F | 10 | 153 | 24/08/89 | Unknown | Shetland | by-catch |
| SMRU90-13 | P. phocoena | F | 3 | 148 | 27/07/89 | Unknown | Shetland | by-catch |
| SMRU90-14 | P. phocoena | F | 1 | 123 | 14/10/89 | Unknown | Shetland | by-catch |
| SMRU90-15 | P. phocoena | M | 9 | 139 | 01/11/89 | Unknown | Shetland | by-catch |
| SMRU90-16 | P. phocoena | M | 5 | 145 | 28/07/89 | Unknown | Shetland | by-catch |
| SMRU90-17 | P. phocoena | M | 5 | 142 | 20/07/89 | Unknown | Shetland | by-catch |
| SMRU90-18 | P. phocoena | M | 8 | 140 | 05/08/89 | Unknown | Shetland | no post-mortem done |
| SMRU90-19 | P. phocoena | M | 9 | 146 | 11/07/89 | Unknown | Shetland | by-catch |
| SW1989/43A | P. phocoena | F | - | 171 | 19/06/89 | Hoylake | Merseyside | not established |
| SW1989/51 | P. phocoena | F | - | 75 | 03/07/89 | Swansea Bay | West Glamorgan | not established |
| SW1989/89 | P. phocoena | F | - | 173 | 05/11/89 | Newport | Dyfed | parasitic pneumonia |
| SMRU90-51 | P. phocoena | F | 3 | 157 | ??/??/?? | River Blackwater | Essex | parasitic pneumonia |
| SMRU90-55 | P. phocoena | M | 1 | 113 | ??/??/?? | River Blackwater | Essex | *Streptococcus* pneumonia |
| SMRU90-56 | P. phocoena | F | 4 | 156 | 13/05/90 | Unknown | Western Isles | not established |
| SMRU90-58 | P. phocoena | M | 3 | 151 | 07/06/90 | Unknown | Shetland | by-catch |
| SMRU90-59 | P. phocoena | M | 2 | 125 | ??/??/90 | Unknown | Shetland | by-catch |
| SMRU90-60 | P. phocoena | M | 2 | 143 | ??/??/90 | Unknown | Shetland | by-catch |
| SMRU90-61 | P. phocoena | M | 4 | 137 | 19/07/90 | Dysart | Fife | not established |
| SMRU90-72A | P. phocoena | F | - | - | 12/09/90 | Mablethorpe | Lincolnshire | no post-mortem done |
| SMRU90-75 | P. phocoena | - | - | - | ??/??/?? | Clyde Estuary | | no post-mortem done |
| SMRU90-75A | P. phocoena | - | - | - | 01/12/88 | Unknown | Scotland | no post-mortem done |
| SMRU90-76 | P. phocoena | M | - | - | ??/??/?? | Holkham & Wells | Norfolk | no post-mortem done |
| SW1990/31 | P. phocoena | F | - | 133 | 25/03/90 | St David's | Dyfed | peritonitis, gastritis (pyloric section) |
| SW1990/39 | P. phocoena | F | 1 | 105 § | 08/04/90 | Tenby | Dyfed | bacterial pneumonia |
| SW1990/50 | P. phocoena | F | - | 138 | 20/06/90 | Carmarthen Bay | Dyfed | *Pasteurella* septicaemia |
| SW1990/50A | P. phocoena | M | 0 | 73 | 24/06/90 | Ynyslas, Borth | Dyfed | physical trauma |
| SW1990/51(1) | P. phocoena | F | - | 165 | 28/06/90 | Pembrey | Dyfed | dystocia |
| SW1990/51(2) | P. phocoena | M | 0 | 80 | 28/06/90 | Pembrey | Dyfed | dystocia |
| SW1990/54 | P. phocoena | M | 0 | 87 | 02/07/90 | Newport | Gwent | starvation |
| SW1990/65 | P. phocoena | M | 8 | 148 | 14/08/90 | Aberdyfi | Gwynedd | bacterial pneumonia |
| SW1990/66 | P. phocoena | M | - | - | 18/08/90 | Redruth | Cornwall | no post-mortem done |
| SW1990/71 | P. phocoena | F | 4 | 146 | 14/08/90 | Aberdeen | Grampian | by-catch |
| SW1990/72 | P. phocoena | F | - | 106 | 06/09/90 | Abersoch | Gwynedd | suffocation |
| SW1990/72A | P. phocoena | M | - | 139 | 05/09/90 | Pembrey | West Glamorgan | parasitic pneumonia |
| SW1990/73 | P. phocoena | M | 0 | 79 | 05/09/90 | Unknown | Dyfed | *Clostridium* myositis |
| SW1990/77A | P. phocoena | M | - | 142 | 24/09/90 | Porthcawl | Mid Glamorgan | not established |
| SW1990/77B | P. phocoena | M | - | 138 | 25/09/90 | Llanelli | Dyfed | by-catch |
| SW1990/79 | P. phocoena | M | 1 | 125 | 27/09/90 | Sunderland | Tyne & Wear | by-catch |
| SW1990/84 | P. phocoena | F | 6 | 150 | 07/10/90 | Bridlington | Humberside | parasitic pneumonia |
| SW1990/92 | P. phocoena | F | - | 180 | 30/10/90 | Ainsdale | Merseyside | adenocarcinoma |
| SW1990/94 | P. phocoena | F | 11 | 151 | 07/11/90 | Sea Palling Beach | Norfolk | pneumonia |
| SW1990/96 | P. phocoena | M | 4 | 135 | 10/11/90 | Penzance | Cornwall | parasitic bronchitis |
| SW1990/98 | P. phocoena | F | - | 125 | 18/11/90 | Dale | Dyfed | parasitic & bacterial pneumonia |
| SW1990/100 | P. phocoena | F | - | 125 | 21/11/90 | Shell Island | Gwynedd | mycotic pneumonia |
| SW1990/100A | P. phocoena | M | 0 | 102 | ??/??/?? | Portslade | East Sussex | starvation |
| SW1990/106 | P. phocoena | M | 1 | 112 | 29/11/90 | Isle of Sheppey | Kent | morbillivirus infection |
| SW1990/107 | P. phocoena | F | - | 176 | 05/12/90 | Druidston | Dyfed | parasitic & bacterial pneumonia |
| SW1990/109 | P. phocoena | F | 0 | - | ??/12/90 | Sennen Cove | Cornwall | suspected by-catch |
| SW1990/111 | P. phocoena | M | - | 137 | 19/12/90 | Borth | Dyfed | suspected by-catch |
| SMRU91-06 | P. phocoena | F | 8 | 145 | 26/07/91 | Isle of Noss | Shetland | not established |
| SMRU91-08 | P. phocoena | F | 4 | 158 | 08/10/91 | Weisdale Voe | Shetland | neoplasia |
| 91L-2937 | P. phocoena | F | 0 | 117 | 12/09/91 | Dinas, Caernarfon | Gwynedd | generalised *Streptococcus lactis* infection |

***Table 3. (continued)***

| Reference No. | Species | Sex | Age (yrs) | Length (cm) | Found | Location | County / Region | Probable Cause of Death |
|---|---|---|---|---|---|---|---|---|
| 91L-2936 | P. phocoena | M | - | 109 | 04/10/91 | Morfa, Harlech | Gwynedd | enteritis |
| SMRU91-15 | P. phocoena | M | 0 | 107 | ??/??/?? | Unknown | Isle of Man | by-catch |
| SMRU91-07 | P. phocoena | F | 1 | 143 | 30/09/91 | Bard Head, Bressay | Shetland | by-catch |
| SMRU91-16 | P. phocoena | M | - | - | 17/10/91 | Port Erin | Isle of Man | not established |
| SW1991/14 | P. phocoena | F | 14 | 189 | ??/01/91 | Wherrytown | Cornwall | starvation |
| SW1991/17 | P. phocoena | M | 8 | 141 | 29/01/91 | Joss Bay | Kent | pneumonia |
| SW1991/17A | P. phocoena | F | 4 | 137 | 05/02/91 | Shanklin | Isle of Wight | parasitic pneumonia |
| SW1991/19A | P. phocoena | M | 5 | 150 | 12/02/91 | Skinningrove | Cleveland | parasitic lung haemorrhage |
| SW1991/19B | P. phocoena | F | 2 | 131 | ??/02/91 | Porthmeor, St Ives | Cornwall | suffocation |
| SW1991/20 | P. phocoena | F | 1 | 132 | 07/02/91 | Southwold Beach | Suffolk | parasitic pneumonia |
| SW1991/22 | P. phocoena | M | 11 | 152 | 14/02/91 | South Shields | Tyne & Wear | parasitic stomach haemorrhage |
| SW1991/23 | P. phocoena | M | 0 | 103 | 18/02/91 | Bridlington Bay | Humberside | physical trauma |
| SW1991/24 | P. phocoena | M | 7 | 143 | 16/02/91 | Bexhill | East Sussex | unknown |
| SW1991/28 | P. phocoena | F | 3 | 132 | 07/03/91 | Hornsea | Humberside | by-catch |
| SW1991/29 | P. phocoena | F | 0 | 110 | 11/03/91 | Bridlington | Humberside | physical trauma |
| SW1991/30 | P. phocoena | M | 1 | 94 | 09/03/91 | Warkworth | Northumberland | unknown |
| SW1991/31 | P. phocoena | M | 2 | 111 | 13/03/91 | Seahouses | Northumberland | inhalation pneumonia |
| SW1991/32A | P. phocoena | M | 2 | 151 | 17/03/91 | Carne Beach, Veryan | Cornwall | physical trauma |
| SW1991/35 | P. phocoena | M | 0 | 100 | 27/03/91 | South Shields | Tyne & Wear | starvation |
| SW1991/36 | P. phocoena | F | 14 | 152 | 02/04/91 | Fort Victoria | Isle of Wight | by-catch |
| SW1991/43 | P. phocoena | F | 9 | 148 | 20/04/91 | Filey Brigg | North Yorkshire | parasitic pneumonia |
| SW1991/48 | P. phocoena | F | - | 120 | 25/04/91 | Mablethorpe | Lincolnshire | *Erwinia* meningo-encephalitis |
| SW1991/54 | P. phocoena | F | 3 | 128 | 13/05/91 | Foulness Point | Essex | parasitic stomach haemorrhage |
| SW1991/59 | P. phocoena | F | 0 | 82 | 07/06/91 | Gorleston Beach | Norfolk | starvation |
| SW1991/61 | P. phocoena | F | 0 | 72 | 10/06/91 | Ferryside | Dyfed | starvation |
| SW1991/63 | P. phocoena | F | 0 | 76 | 12/06/91 | Skegness | Lincolnshire | not established |
| SW1991/70 | P. phocoena | M | 1 | 102 | 22/06/91 | Blyth | Northumberland | not established |
| SW1991/71 | P. phocoena | M | - | 127 | 24/06/91 | Anglesey | Gwynedd | enteritis |
| SW1991/73 | P. phocoena | M | 0 | 88 | 26/06/91 | Hunstanton | Norfolk | starvation |
| SW1991/74 | P. phocoena | M | 0 | 78 | 29/06/91 | Amroth Beach, Tenby | Dyfed | not established |
| SW1991/84 | P. phocoena | F | 0 | 72 | 17/07/91 | Harlech | Gwynedd | starvation |
| SW1991/95 | P. phocoena | F | - | 140 | 30/07/91 | Great Yarmouth | Norfolk | not established |
| SW1991/96 | P. phocoena | M | 0 | 87 | 01/08/91 | Lowestoft | Suffolk | starvation |
| SW1991/100 | P. phocoena | M | 0 | 60 | 12/08/91 | Southerness Point | Dumfries & Galloway | physical trauma |
| SW1991/104 | P. phocoena | M | 12 | 142 | 29/08/91 | Hornsea | Humberside | physical trauma |
| SW1991/109 | P. phocoena | F | 1 | 114 | 06/09/91 | Reighton Sands | North Yorkshire | not established |
| SW1991/111 | P. phocoena | F | 1 | 134 | 05/09/91 | Robin Hood's Bay | North Yorkshire | not established |
| SW1991/112 | P. phocoena | M | 10 | 136 | 06/09/91 | Hornsea | Humberside | by-catch |
| SW1991/116 | P. phocoena | F | 5 | 152 | 16/09/91 | Clacton on Sea | Essex | not established |
| SW1991/117A | P. phocoena | M | 0 | 97 | 01/08/91 | Holland on Sea | Essex | starvation |
| SW1991/120 | P. phocoena | F | 0 | 117 | 23/09/91 | Burry Port | Dyfed | bacterial pneumonia |
| SW1991/124 | P. phocoena | F | - | 134 | 01/10/91 | Skomer Island | Dyfed | physical trauma |
| SW1991/128 | P. phocoena | M | 3 | 130 | 02/10/91 | Saltburn by the Sea | Cleveland | pneumonia |
| SW1991/135 | P. phocoena | F | 0 | 87 | 21/10/91 | Blackpool | Lancashire | starvation |
| SW1991/136 | P. phocoena | M | - | 144 | 22/10/91 | Cardigan Island | Dyfed | parasitic pneumonia |
| SW1991/142 | P. phocoena | F | - | 118 | 13/11/91 | Towyn | Clwyd | physical trauma |
| SW1992/7 | P. phocoena | F | - | 131 | 17/01/92 | Borth | Dyfed | suffocation |
| SW1992/112 | P. phocoena | M | - | 133 | 15/05/92 | Tywyn | Gwynedd | by-catch |
| SW1992/170 | P. phocoena | M | 6 | 157 | 29/07/92 | Tywyn | Gwynedd | neck fracture |
| SW1992/175 | P. phocoena | M | 4 | 140 | 03/08/92 | Pembrey | Dyfed | not established |
| LAW-01 | P. phocoena | F | - | 140 | ??/??/88 | Unknown | County Down | morbillivirus infection |
| LAW-02 | P. phocoena | F | - | 135 | ??/??/88 | Unknown | County Down | morbillivirus infection |
| LAW-03 | P. phocoena | M | 0 | 70 | ??/06/88 | Islay | Western Isles | not established |
| LAW-04 | P. phocoena | F | - | 86 | 01/06/88 | Derbyhaven Bay | Isle of Man | not established |
| LAW-05 | P. phocoena | - | - | - | ??/09/88 | Cardigan Bay | Dyfed | not established |
| LAW-06 | P. phocoena | - | - | - | 24/09/88 | Aberaeron | Dyfed | not established |
| LAW-07 | P. phocoena | M | - | - | 27/10/88 | Fleshwick Bay | Isle of Man | not established |
| LAW-08 | P. phocoena | M | - | 147 | 09/11/88 | Kilkeel | County Down | morbillivirus infection |
| LAW-09 | P. phocoena | - | - | 109 | 19/12/88 | Crawfordsburn | County Down | morbillivirus infection |
| LAW-10 | P. phocoena | F | - | 163 | 04/01/89 | Castlerock | County Antrim | liver abscess ? |
| LAW-11 | P. phocoena | F | - | 125 | 17/02/89 | Folkestone | Kent | by-catch* |
| LAW-12 | P. phocoena | M | - | 135 | 17/02/89 | Folkestone | Kent | by-catch* |
| LAW-13 | P. phocoena | F | - | 135 | 02/03/89 | off Hanna Voe | Shetland | not established |
| LAW-14 | P. phocoena | F | - | - | 07/03/89 | Unknown | Shetland | by-catch * |
| LAW-15 | P. phocoena | - | - | 72 | 26/06/89 | Borth | Dyfed | not established |
| LAW-16 | P. phocoena | - | - | 71 | 27/06/89 | Cei Bach | Dyfed | not established |
| LAW-17 | P. phocoena | M | - | 102 | 08/08/89 | Whitby | North Yorkshire | by-catch* |
| LAW-18 | P. phocoena | F | - | 79 | ??/08/90 | Unknown | South Wales | not established |

*§ approximate: most of head absent*

*When the term 'by-catch*' is given in the probable cause of death column this means that the animal was found entangled in fishing nets, but no post-mortem was carried out. This distinguishes it from 'by-catch' where post-mortem investigations were used to establish the cause of death*

***Table 4. Concentrations of trace metals in liver samples (mg kg⁻¹ wet weight)***

| Reference No. | %Dry Matter | Cr | Ni | Cu | Zn | As | Se | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|---|---|
| **H. grypus** | | | | | | | | | | |
| LAW-19 | 30.5 | <0.5 | <0.5 | 22 | 25 | - | - | 0.06 | 110 | < 0.6 |
| LAW-20 | 30.1 | <0.5 | <0.5 | 26 | 80 | - | - | < 0.06 | 1.7 | < 0.6 |
| LAW-21 | 26.5 | <0.6 | <0.6 | 9.1 | 88 | - | - | < 0.07 | 2.5 | < 0.7 |
| LAW-22 | 26.2 | <0.5 | <0.5 | 7.2 | 68 | - | - | 0.12 | 45 | < 0.6 |
| LAW-23 | 33.7 | <0.5 | <0.5 | 3.8 | 60 | - | - | < 0.06 | 0.26 | < 0.6 |
| LAW-24 | 36.1 | 0.6 | <0.5 | 13 | 36 | - | - | 0.28 | 3.9 | < 0.6 |
| LAW-25 | 30.9 | <0.5 | <0.5 | 14 | 63 | - | - | 0.16 | 3.5 | < 0.6 |
| LAW-26 | 28.7 | <0.5 | <0.5 | 18 | 53 | - | - | 0.16 | 430 | 1 |
| LAW-27 | 30.9 | <0.5 | <0.5 | 7.8 | 61 | - | - | 0.06 | 7.9 | < 0.6 |
| LAW-28 | 31.1 | <0.5 | <0.5 | 22 | 40 | - | - | 0.19 | 210 | 1.8 |
| LAW-29 | 26.4 | <0.5 | <0.5 | 14 | 89 | - | - | 0.2 | 370 | 1.4 |
| LAW-30 | 25 | <0.5 | <0.5 | 7.7 | 89 | - | - | 1.2 | 12 | 0.6 |
| LAW-31 | 25 | 0.8 | <0.5 | 14 | 43 | - | - | < 0.07 | 110 | 1 |
| LAW-32 | 23.9 | 2 | 2.1 | 29 | 110 | - | - | 0.22 | 210 | 0.15 |
| LAW-33 | 25.6 | <0.5 | <0.5 | 39 | 61 | - | - | < 0.06 | 11 | 0.53 |
| LAW-34 | 28.9 | 0.5 | 1.2 | 6.1 | 24 | - | - | < 0.06 | 1.5 | 0.56 |
| LAW-35 | 25.4 | <0.5 | <0.5 | 15 | 28 | - | - | < 0.06 | 31 | 1.7 |
| LAW-36 | 26.8 | <0.5 | <0.5 | 12 | 67 | - | - | 0.97 | 20 | 0.73 |
| LAW-37 | 26.8 | <0.5 | <0.5 | 14 | 37 | - | - | 0.2 | 120 | 1.3 |
| LAW-38 | 29.3 | <0.5 | <0.5 | 7.9 | 28 | - | - | 0.33 | 220 | 7 |
| LAW-39 | 32.9 | <0.5 | <0.5 | 28 | 85 | - | - | 0.79 | 280 | 0.95 |
| SS1990/3 | 30.9 | <0.6 | <0.6 | 48 | 51 | - | 45 | 1.9 | 131 | 0.17 |
| SS1990/7 | 20.9 | < 0.56 | < 0.56 | 4.1 | 19 | - | 5.7 | 2 | 6.1 | < 0.03 |
| SS1990/11 | 22.8 | < 0.54 | < 0.54 | 8.7 | 55 | - | 0.9 | < 0.06 | 1.2 | < 0.03 |
| SS1990/12A | 20.1 | < 0.54 | < 0.54 | 7.6 | 47 | - | 0.8 | < 0.07 | 0.27 | < 0.03 |
| SS1990/12B | 25.5 | < 0.55 | < 0.55 | 11 | 53 | - | 1.3 | < 0.07 | 0.47 | < 0.03 |
| SS1990/16 | 26.1 | 0.66 | < 0.51 | 18 | 57 | - | 2.1 | 0.1 | 2 | < 0.03 |
| SS1991/1A | 26.4 | < 0.55 | <0.5 | 16 | 53 | - | 0.7 | < 0.06 | 2.2 | 0.22 |
| SS1991/1B | 24.3 | < 0.55 | < 0.55 | 12 | 46 | - | 1.2 | < 0.07 | 0.78 | 0.07 |
| SS1991/9 | 27 | < 0.65 | < 0.65 | 15 | 71 | - | 1.2 | 0.27 | 0.07 | 0.06 |
| SS1991/23 | 24.6 | 0.6 | <0.5 | 5.2 | 77 | - | - | 0.64 | 170 | 1.9 |
| SS1991/27 | 26.5 | <0.5 | <0.5 | 2.2 | 22 | - | - | 0.41 | 14 | 0.38 |
| SS1991/28 | 25.6 | < 0.44 | < 0.44 | 9.9 | 60 | - | 68 | < 0.05 | 52 | 0.49 |
| SS1991/30A | 25.5 | 0.63 | < 0.46 | 3.2 | 17 | - | 30 | 0.33 | 80 | 0.43 |
| SS1991/41 | 26.3 | < 0.51 | < 0.51 | 18 | 36 | - | 123 | 0.14 | 301 | 1.7 |
| SS1991/50 | 23.5 | < 0.51 | < 0.51 | 40 | 55 | - | 2.4 | < 0.06 | 1.3 | 0.11 |
| SS1991/55 | 19.5 | <0.5 | <0.5 | 1.9 | 29 | - | 0.25 | < 0.06 | 0.22 | < 0.03 |
| SS1991/58 | 29.2 | < 0.53 | < 0.53 | 18 | 91 | - | 29 | 0.18 | 65 | 0.07 |
| SS1991/73 | 20.5 | 1 | < 0.51 | 17 | 113 | - | 0.82 | < 0.06 | 2.6 | 0.06 |
| SS1992/9 | 26.1 | 0.67 | < 0.53 | 3.6 | 33 | - | 37 | 0.15 | 65 | 0.05 |
| **P. vitulina** | | | | | | | | | | |
| LAW-40 | 26.4 | <0.6 | <0.6 | 6.2 | 42 | - | - | 0.12 | 57 | < 0.7 |
| LAW-41 | 30.3 | <0.6 | <0.6 | 12 | 41 | - | - | < 0.07 | 16 | < 0.7 |
| LAW-42 | 31.6 | <0.6 | <0.6 | 5.8 | 48 | - | - | < 0.07 | 6.4 | < 0.7 |
| LAW-43 | 28.9 | <0.5 | <0.5 | 6.9 | 41 | - | - | < 0.06 | 6.2 | < 0.6 |
| LAW-44 | 26.6 | <0.7 | <0.7 | 7.4 | 39 | - | - | 0.1 | 110 | < 0.8 |
| LAW-45 | 27.5 | <0.5 | <0.5 | 7.4 | 50 | - | - | 0.18 | 100 | < 0.6 |
| LAW-46 | 28.6 | <0.5 | <0.5 | 6.2 | 43 | - | - | 0.14 | 36 | < 0.7 |
| LAW-47 | 30 | <0.6 | <0.6 | 9.3 | 44 | - | - | 0.11 | 9.6 | < 0.7 |
| LAW-48 | 29 | <0.7 | <0.7 | 9 | 57 | - | - | 0.3 | 98 | < 0.8 |
| LAW-49 | 29.2 | <0.5 | <0.5 | 6 | 66 | - | - | 0.11 | 21 | < 0.6 |
| LAW-50 | 28.1 | <0.6 | <0.6 | 6.6 | 47 | - | - | 0.2 | 59 | < 0.7 |
| LAW-51 | 29.2 | 1 | <0.5 | 10 | 49 | - | - | 0.29 | 49 | < 0.6 |
| LAW-52 | 29.1 | <0.6 | <0.6 | 6.7 | 49 | - | - | 0.15 | 9.6 | < 0.7 |
| LAW-53 | 29.3 | <0.6 | <0.6 | 5.2 | 32 | - | - | 0.17 | 81 | < 0.7 |
| LAW-54 | 27.6 | 0.9 | <0.5 | 17 | 49 | - | - | 0.94 | 170 | < 0.6 |
| LAW-55 | 27.7 | <0.5 | <0.5 | 21 | 58 | - | - | 0.2 | 45 | < 0.6 |
| LAW-56 | 26.8 | <0.6 | <0.5 | 15 | 72 | - | - | 0.12 | 66 | < 0.6 |
| LAW-57 | 26 | <0.5 | <0.5 | 7.8 | 47 | - | - | < 0.06 | 6.3 | < 0.6 |
| LAW-58 | 27.4 | <0.5 | <0.5 | 20 | 48 | - | - | 0.79 | 160 | < 0.6 |
| LAW-59 | 25.4 | <0.6 | <0.5 | 17 | 48 | - | - | < 0.06 | 7.5 | < 0.6 |
| LAW-60 | 28.3 | <0.5 | <0.5 | 13 | 55 | – | - | 0.14 | 35 | < 0.6 |
| LAW-61 | 30.9 | 0.8 | <0.5 | 11 | 52 | - | - | < 0.06 | 0.98 | < 0.6 |
| LAW-62 | 30.4 | <0.6 | <0.6 | 7.9 | 39 | - | - | < 0.07 | 1.4 | < 0.7 |
| LAW-63 | 26.9 | <0.6 | <0.6 | 16 | 48 | - | - | 0.5 | 44 | < 0.7 |

***Table 4. (continued)***

| Reference No. | %Dry Matter | Cr | Ni | Cu | Zn | As | Se | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|---|---|
| **P. vitulina** | | | | | | | | | | |
| LAW-64 | 25.8 | <0.5 | <0.5 | 8.9 | 51 | - | - | 0.14 | 12 | < 0.6 |
| LAW-65 | 28.7 | 0.6 | <0.5 | 17 | 79 | - | - | 2.9 | 95 | < 0.6 |
| LAW-66 | 28.3 | <0.5 | <0.5 | 11 | 39 | - | - | < 0.06 | 0.99 | < 0.6 |
| LAW 67 | 30.8 | <0.5 | <0.5 | 11 | 29 | - | - | 0.13 | 5.7 | < 0.6 |
| LAW 68 | 24.6 | <0.5 | <0.5 | 26 | 60 | - | - | < 0.06 | 1 | < 0.6 |
| LAW 69 | 23.1 | <0.5 | <0.5 | 7.2 | 25 | - | - | 0.16 | 5 | 0.18 |
| **B. acutorostrata** | | | | | | | | | | |
| SW1991/2 | 23.7 | 2.1 | 1.2 | 5 | 35 | - | - | 1.1 | 1.8 | 0.15 |
| **D. delphis** | | | | | | | | | | |
| IC1990/4 | 29.6 | < 0.56 | < 0.56 | 5.8 | 35 | - | 8.2 | 0.24 | 0.57 | 0.12 |
| IC1991/1 | 24.1 | 1.7 | 1.2 | 4 | 45 | - | - | 0.33 | 66 | 0.14 |
| IC1991/1 | 17.6 | <0.5 | <0.5 | 40 | 15 | - | - | < 0.06 | 0.5 | 0.05 |
| SW1990/5A | 27.6 | <0.5 | <0.5 | 7.1 | 42 | - | - | 0.71 | 6.1 | 0.43 |
| SW1990/26 | 25.9 | <0.5 | <0.7 | 4.2 | 26 | - | - | 0.34 | 11 | 1 |
| SW1990/45 | 27.5 | <0.5 | <0.5 | 12 | 89 | - | - | 2.2 | 6.9 | 0.37 |
| SW1990/46 | 30.3 | < 0.55 | < 0.55 | 3.9 | 58 | - | 2.7 | 1.1 | 0.14 | 0.19 |
| SW1990/47 | 25.7 | < 0.65 | < 0.65 | 9.6 | 67 | - | 13 | 9 | 1.9 | 0.29 |
| SW1990/68 | 29.3 | 0.92 | < 0.57 | 3.1 | 41 | - | 2.3 | 0.18 | 11 | 0.09 |
| SW1990/78 | 28.2 | < 0.51 | < 0.51 | 5.1 | 42 | - | 13 | 0.68 | 67 | 0.11 |
| SW1990/81 | 27 | <0.5 | <0.5 | 5.3 | 45 | - | na | 0.1 | 3.7 | 0.21 |
| SW1990/87 | 27.5 | < 0.57 | < 0.56 | 8.4 | 36 | - | 2.9 | 0.21 | 5 | 0.13 |
| SW1990/88 | 25 | < 0.57 | < 0.53 | 81 | 19 | - | 1.7 | < 0.06 | 3.4 | 0.1 |
| SW1990/90A | 27.3 | < 0.51 | < 0.51 | 6.9 | 36 | - | 6.2 | 0.54 | 13 | 0.04 |
| SW1990/97 | 31.6 | < 0.52 | < 0.52 | 3.6 | 46 | - | 1.3 | < 0.07 | 0.21 | 0.05 |
| SW1990/101 | 27.2 | < 0.52 | < 0.52 | 7 | 30 | - | 4.7 | 0.32 | 8.3 | 0.09 |
| SW1990/102 | 25.3 | < 0.52 | < 0.52 | 4.3 | 32 | - | 1.2 | 0.29 | 2.1 | 0.08 |
| SW1990/103 | 27.9 | < 0.57 | < 0.57 | 4.9 | 30 | - | 2.1 | 0.33 | 1.7 | 0.07 |
| SW1990/104 | 26.7 | < 0.51 | < 0.51 | 4.3 | 30 | - | 3.1 | 0.31 | 3.6 | 0.07 |
| SW1990/108 | 25.9 | < 0.58 | < 0.58 | 4.4 | 38 | - | 13 | 1 | 30 | 0.08 |
| SW1991/7 | 28.1 | < 0.68 | < 0.62 | 6.8 | 32 | – | 38 | 0.6 | 93 | 0.13 |
| SW1991/10 | 28.3 | <0.5 | <0.5 | 3.2 | 32 | - | - | 0.09 | 2.5 | 0.28 |
| SW1991/37 | 28.2 | <0.5 | <0.5 | 4.4 | 35 | - | - | 0.34 | 11 | 0.19 |
| SW1991/40 | 27.7 | < 0.51 | < 0.51 | 4.9 | 28 | - | 11 | 0.34 | 25 | 0.07 |
| SW1991/46 | 24.7 | 0.76 | < 0.54 | 4.5 | 37 | - | 22 | 0.12 | 2.2 | 0.08 |
| SW1991/83 | 29.1 | < 0.55 | < 0.55 | 4.2 | 25 | - | 45 | 0.3 | 130 | 0.1 |
| SW1991/129 | 31.2 | < 0.57 | < 0.57 | 6.4 | 99 | - | 0.8 | < 0.07 | 0.67 | 0.06 |
| SW1991/137 | 28.2 | 1.1 | <0.5 | 5.1 | 43 | - | 12 | 6.5 | 33 | 0.03 |
| SW1992/1 | 22.1 | < 0.56 | < 0.56 | 2.7 | 21 | 0.86 | - | 2.7 | 3.1 | 0.12 |
| SW1992/2 | 26.2 | 0.74 | < 0.67 | 4.9 | 32 | 0.7 | - | 0.16 | 11 | 0.05 |
| SW1992/3 | 25.1 | < 0.68 | < 0.68 | 5.3 | 37 | 0.91 | - | 0.12 | 7.4 | 0.05 |
| SW1992/4 | 30.5 | < 0.57 | < 0.57 | 4.2 | 24 | 0.73 | - | 0.14 | 6.1 | 0.04 |
| SW1992/10 | 27.9 | < 0.65 | < 0.65 | 5.6 | 32 | 0.89 | 3.8 | 0.72 | 6.4 | 0.12 |
| SW1992/11 | 27.6 | < 0.57 | <0.5 | 4.1 | 64 | 2.6 | 2.2 | 0.48 | 2.8 | 0.02 |
| SW1992/12 | 26.7 | < 0.52 | < 0.52 | 5.1 | 30 | 0.51 | 8.5 | 0.94 | 24 | 0.05 |
| SW1992/14(1) | 29.2 | < 0.63 | < 0.63 | 4.6 | 34 | 1.6 | 2.5 | 0.6 | 2.7 | 0.14 |
| SW1992/14(2) | 24.9 | < 0.61 | < 0.61 | 6 | 36 | 1.5 | 4.1 | 0.65 | 8.1 | 0.03 |
| SW1992/19(1) | 26.6 | 0.64 | < 0.62 | 5.1 | 34 | 1.4 | - | 0.47 | 0.3 | 0.06 |
| SW1992/19(2) | 25.3 | < 0.62 | < 0.62 | 5.7 | 27 | 0.85 | - | 0.47 | 5.6 | 0.09 |
| SW1992/20 | 26.7 | < 0.54 | < 0.54 | 4.7 | 31 | 0.77 | - | 0.72 | 11 | 0.15 |
| SW1992/172(1) | 30.7 | 0.81 | < 0.62 | 6.5 | 24 | - | 18 | 0.66 | 50 | 0.11 |
| SW1992/172(2) | 34.5 | 1 | < 0.57 | 5.3 | 37 | - | 1.7 | < 0.07 | 1.5 | 0.1 |
| **G. griseus** | | | | | | | | | | |
| SW1990/70 | 23.5 | 0.7 | 0.6 | 31 | 40 | - | - | < 0.06 | 1.3 | 0.15 |
| **G. melas** | | | | | | | | | | |
| SW1990/88A | 30.4 | < 0.65 | < 0.65 | 9.8 | 41 | - | 6.9 | 0.34 | 25 | 0.1 |
| SW1991/55 | 28.2 | 5.6 | 1.1 | 3.8 | 65 | - | 39 | 65 | 23 | 0.22 |
| **L. acutus** | | | | | | | | | | |
| LAW 70 | 36.1 | <0.5 | <0.5 | 6.7 | 36 | - | - | 1.8 | 44 | <0.6 |
| SW1990/114 | 26.2 | < 0.54 | < 0.54 | 6.2 | 71 | - | 1.3 | < 0.07 | 0.39 | < 0.03 |
| SW1991/9 | 26.3 | 2.8 | < 0.57 | 8.1 | 61 | - | 33 | 0.76 | 72 | 0.08 |

***Table 4. (continued)***

| Reference No. | %Dry Matter | Cr | Ni | Cu | Zn | As | Se | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|---|---|
| **L. albirostris** | | | | | | | | | | |
| SW1989/49 | 30 | <0.6 | <0.6 | 6.8 | 27 | - | - | 0.11 | 27 | 3.8 |
| SW1991/108 | 30.4 | 0.56 | < 0.54 | 6.7 | 34 | - | 2.1 | 0.08 | 0.8 | 0.11 |
| SW1991/126 | 27.9 | < 0.55 | < 0.55 | 5.1 | 26 | - | 4.9 | 0.07 | 4.1 | 0.13 |
| **S.coeruleoalba** | | | | | | | | | | |
| SW1990/4 | 26.6 | <0.5 | <0.6 | 10 | 65 | - | - | 8.4 | 10 | < 0.7 |
| SW1990/20 | 26.8 | <0.5 | <0.5 | 12 | 46 | - | - | 11 | 11 | < 0.6 |
| SW1990/57 | 27.9 | 0.69 | 0.73 | 3.7 | 8.5 | - | 0.86 | < 0.07 | 0.95 | < 0.03 |
| SW1991/11 | 32.5 | 3.7 | < 0.53 | 7.4 | 42 | - | 9.1 | 4.6 | 22 | 0.06 |
| SW1991/18 | 30.1 | 0.66 | < 0.51 | 6.4 | 51 | - | 4.2 | 4.8 | 4.4 | 0.11 |
| SW1991/26 | 27.7 | <0.5 | <0.5 | 8.4 | 45 | - | - | 1.7 | 5.7 | 1.6 |
| SW1991/122 | 29.2 | < 0.59 | < 0.59 | 5.1 | 39 | - | 0.94 | 0.21 | 0.59 | 0.1 |
| **T. truncatus** | | | | | | | | | | |
| LAW-71 | 23.3 | <0.6 | <0.6 | 5.7 | 32 | - | - | 0.07 | 20 | < 0.7 |
| SW1989/47 | 26.3 | <0.5 | <0.5 | 8.3 | 42 | - | - | 0.12 | 21 | < 0.6 |
| SW1991/42 | 27.1 | 0.68 | < 0.63 | 5.2 | 29 | - | 83 | < 0.08 | 201 | 0.58 |
| SW1991/115 | 28.2 | < 0.55 | < 0.55 | 13 | 268 | - | 0.97 | < 0.07 | 1.6 | 0.07 |
| SW1991/130 | 36.3 | < 0.59 | < 0.59 | 3.8 | 47 | - | 40 | < 0.07 | 93 | 0.14 |
| SW1992/25 | 33.4 | < 0.52 | < 0.52 | 8.1 | 37 | - | 81 | 0.09 | 191 | 0.61 |
| **P. phocoena** | | | | | | | | | | |
| IC1990/1 | 32 | 0.26 | 0.05 | 5.7 | 54 | - | 2.6 | 0.04 | 1.8 | 0.2 |
| IC1990/2 | 30.7 | <0.5 | 1 | 11 | 40 | - | - | 0.08 | 22 | 0.37 |
| IC1990/3 | 29.8 | <0.5 | 0.5 | 5 | 40 | - | - | < 0.06 | 0.6 | 0.26 |
| IC1990/4 | 28.8 | <0.5 | <0.5 | 27 | 46 | - | - | < 0.06 | 0.7 | 0.21 |
| 91L-2947 | 36.1 | < 0.52 | < 0.52 | 53 | 28 | - | 1.3 | < 0.06 | < 0.01 | 0.06 |
| SW1989/43A | 30 | <0.6 | <0.6 | 13 | 140 | - | - | 0.23 | 150 | 4.3 |
| SW1989/51 | 22.9 | 0.84 | < 0.54 | 46 | 57 | - | 2.9 | < 0.06 | 0.07 | < 0.03 |
| SW1989/89 | 27.9 | <0.4 | <0.6 | 12 | 50 | - | - | 0.41 | 10 | < 0.7 |
| SMRU90-04 | 29.2 | 0.26 | < 0.02 | 21 | 37 | - | 1.2 | 0.03 | 0.3 | 0.04 |
| SMRU90-51 | 27 | 0.82 | < 0.49 | 8.8 | 29 | - | 3.3 | 0.11 | 3.8 | 0.39 |
| SMRU90-55 | 34 | 1.2 | 0.76 | 4.2 | 115 | - | 6 | < 0.06 | 12 | 0.07 |
| SMRU90-60 | 31.6 | 0.79 | < 0.53 | 5.4 | 22 | - | 2 | 0.07 | 0.26 | < 0.03 |
| SMRU90-61 | 30.4 | 0.69 | <0.6 | 6.1 | 37 | - | 3.9 | 0.16 | 10 | < 0.03 |
| SMRU90-72A | 26.7 | 0.45 | 0.12 | 12 | 84 | - | 54 | 0.66 | 102 | 0.26 |
| SW1990/31 | 28.9 | <0.6 | <0.5 | 11 | 90 | - | - | 0.18 | 16 | < 0.6 |
| SW1990/39 | 22.9 | 1.6 | 0.7 | 4.1 | 26 | - | - | < 0.06 | 0.5 | 0.52 |
| SW1990/50 | 27.5 | <0.5 | <0.5 | 12 | 32 | - | - | 0.22 | 14 | 0.25 |
| SW1990/50A | 27.8 | <0.5 | <0.5 | 6.5 | 23 | - | - | < 0.06 | 0.8 | 0.17 |
| SW1990/51(1) | 35.8 | <0.5 | <0.5 | 8.7 | 39 | - | - | 0.34 | 57 | 0.46 |
| SW1990/51(2) | 27.5 | <0.5 | <0.5 | 54 | 80 | - | - | < 0.06 | 2 | 0.18 |
| SW1990/54 | 33.9 | <0.5 | <0.5 | 26 | 39 | - | - | < 0.06 | 1.8 | 0.19 |
| SW1990/65 | 26.1 | <0.5 | <0.5 | 11 | 150 | - | - | 0.21 | 30 | 0.29 |
| SW1990/70 | 23.5 | 0.7 | 0.6 | 31 | 40 | - | - | < 0.06 | 1.3 | 0.15 |
| SW1990/71 | 26.8 | 0.77 | < 0.53 | 8.2 | 34 | - | 6.6 | 0.13 | 10 | 0.16 |
| SW1990/72 | 26.3 | 0.9 | 0.9 | 7.8 | 42 | - | - | 0.22 | 12 | 0.16 |
| SW1990/72A | 23.5 | 0.7 | 0.6 | 31 | 40 | - | - | < 0.06 | 1.3 | 0.15 |
| SW1990/77A | 27.7 | 0.9 | <0.5 | 8.4 | 30 | - | - | 0.44 | 15 | 0.12 |
| SW1990/77B | 26.4 | <0.5 | <0.5 | 7.5 | 31 | - | - | 0.37 | 20 | 0.11 |
| SW1990/79 | 24.6 | < 0.52 | < 0.52 | 7.6 | 35 | - | 1.3 | 0.13 | 0.94 | < 0.03 |
| SW1990/84 | 30.1 | <0.5 | <0.5 | 6 | 32 | - | 1.1 | 0.93 | 0.57 | < 0.03 |
| SW1990/92 | 25.5 | <0.5 | 1 | 7.6 | 120 | - | - | 0.14 | 73 | 0.49 |
| SW1990/94 | 25.7 | < 0.62 | < 0.55 | 7.6 | 73 | - | 12 | 0.16 | 45 | 0.03 |
| SW1990/96 | 27.7 | < 0.54 | < 0.54 | 6.9 | 60 | - | 5 | 0.27 | 11 | 0.13 |
| SW1990/98 | 27.1 | <0.5 | <0.5 | 5.7 | 110 | - | - | 0.18 | 4.3 | 0.2 |
| SW1990/100 | 25.1 | <0.5 | 1.1 | 12 | 110 | - | - | 0.07 | 23 | 0.2 |
| SW1990/100A | 27.7 | 0.76 | < 0.53 | 8.2 | 43 | - | 0.8 | < 0.06 | 0.65 | < 0.03 |
| SW1990/106 | 24.5 | < 0.53 | < 0.53 | 8.4 | 104 | - | - | 0.1 | 12 | 0.07 |
| SW1990/107 | 23.8 | 1.8 | 0.9 | 17 | 110 | - | - | 0.44 | 190 | 0.16 |
| SW1990/109 | 35.1 | < 0.52 | < 0.52 | 4 | 26 | - | 0.9 | 0.2 | 1.1 | < 0.03 |
| SW1990/111 | 30.2 | <0.5 | 0.7 | 5.9 | 30 | - | - | 0.11 | 6.8 | 0.18 |
| SMRU91-06 | 28.1 | 0.53 | <0.5 | 6.3 | 55 | - | 12 | 0.23 | 28 | 0.07 |

***Table 4. (continued)***

| Reference No. | %Dry Matter | Cr | Ni | Cu | Zn | As | Se | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|---|---|
| **P. phocoena** | | | | | | | | | | |
| SMRU91-15 | 29.6 | 0.64 | 0.17 | 13 | 66 | - | 1.1 | < 0.02 | 0.71 | 0.07 |
| SMRU91-16 | 25.2 | 0.67 | 0.25 | 36 | 162 | - | 1.6 | 0.02 | 1.6 | 0.06 |
| 91L-2937 | 40 | < 0.53 | < 0.53 | 11 | 42 | - | 2 | < 0.06 | 1.4 | 0.05 |
| 91L-2936 | 31.3 | < 0.51 | < 0.51 | 7.7 | 37 | - | 5.6 | 0.12 | 2.3 | 0.56 |
| SMRU91-07 | 29.6 | < 0.54 | < 0.54 | 4.8 | 25 | - | 2.6 | 0.23 | 3 | < 0.03 |
| SW1991/14 | 24.7 | <0.5 | <0.5 | 4.5 | 174 | - | - | 0.25 | 52 | 0.06 |
| SW1991/17 | 25.8 | 4.4 | < 0.54 | 8.5 | 104 | - | 4.8 | 0.43 | 8.6 | 0.03 |
| SW1991/17A | 23.5 | 0.69 | < 0.55 | 4.3 | 41 | - | 3.9 | 0.15 | 7 | 0.05 |
| SW1991/19A | 25.6 | < 0.51 | < 0.51 | 13 | 53 | - | 8.1 | 1.4 | 24 | < 0.03 |
| SW1991/19B | 26.2 | 0.8 | < 0.57 | 6.9 | 30 | - | 1.1 | < 0.07 | 0.12 | 0.08 |
| SW1991/20 | 25.1 | < 0.52 | < 0.52 | 9.8 | 181 | - | 2.6 | 0.71 | 4.1 | < 0.03 |
| SW1991/22 | 25.7 | 0.72 | < 0.51 | 7.8 | 76 | - | 7.6 | 0.51 | 31 | < 0.03 |
| SW1991/23 | 27.2 | 0.48 | 0.14 | 6.2 | 70 | - | 1.7 | 0.03 | 0.89 | 0.03 |
| SW1991/24 | 26.2 | <0.5 | <0.5 | 5.3 | 31 | - | 5.1 | 0.6 | 12 | < 0.03 |
| SW1991/28 | 27.2 | < 0.52 | < 0.52 | 6.6 | 29 | - | 2 | 0.31 | 2.1 | 0.05 |
| SW1991/29 | 27.5 | 0.77 | 0.68 | 14 | 40 | - | 1 | 0.27 | 0.54 | 0.1 |
| SW1991/30 | 29.8 | 0.24 | < 0.02 | 3.8 | 46 | - | 1.1 | 0.21 | 0.58 | 0.05 |
| SW1991/31 | 27.2 | 0.27 | 0.04 | 5.4 | 41 | - | 2.7 | 0.54 | 3 | 0.07 |
| SW1991/32A | 26.9 | 0.98 | <0.6 | 7.2 | 33 | - | 2.4 | < 0.07 | 4.3 | 0.04 |
| SW1991/35 | 26.2 | < 0.57 | < 0.57 | 15 | 110 | - | 1.7 | < 0.07 | 1.5 | 0.07 |
| SW1991/36 | 25.9 | < 0.52 | < 0.52 | 15 | 27 | - | 47 | 0.55 | 82 | 0.16 |
| SW1991/43 | 26.9 | 0.68 | < 0.53 | 9.5 | 33 | - | 5.3 | 0.26 | 8.5 | 0.06 |
| SW1991/48 | 24.5 | 0.69 | < 0.49 | 9 | 50 | - | 4.3 | 0.18 | 0.74 | 0.1 |
| SW1991/54 | 28 | < 0.58 | < 0.58 | 10 | 63 | - | 8.4 | < 0.07 | 14 | 0.14 |
| SW1991/59 | 24.5 | < 0.56 | < 0.56 | 76 | 50 | - | 2.3 | < 0.07 | 1.8 | 0.05 |
| SW1991/61 | 21.1 | 0.8 | <0.5 | 2.8 | 20 | - | - | < 0.06 | 1 | 0.08 |
| SW1991/63 | 41.6 | 0.91 | 0.26 | 68 | 36 | - | 4.4 | < 0.02 | 1.1 | 0.04 |
| SW1991/70 | 28.7 | 0.65 | 0.15 | 7.6 | 65 | - | 3 | 0.03 | 2.3 | 0.09 |
| SW1991/71 | 26.8 | 1.2 | <0.5 | 8.8 | 86 | - | - | 0.09 | 5.9 | 0.35 |
| SW1991/73 | 26.3 | < 0.56 | < 0.56 | 24 | 41 | - | 0.94 | < 0.07 | 1.5 | < 0.03 |
| SW1991/74 | 27.2 | < 0.53 | < 0.53 | 66 | 77 | - | 0.86 | < 0.06 | 1.2 | 0.04 |
| SW1991/84 | 48.1 | < 0.55 | < 0.55 | 70 | 38 | - | 1.9 | < 0.07 | 1.2 | 0.06 |
| SW1991/95 | 30.6 | 1.1 | < 0.54 | 12 | 34 | - | 17 | 0.29 | 28 | 0.22 |
| SW1991/96 | 29.8 | 0.47 | 0.07 | 13 | 36 | - | 1.7 | < 0.02 | 0.64 | 0.02 |
| SW1991/104 | 23.9 | <0.5 | <0.5 | 11 | 77 | - | 7 | 0.26 | 24 | < 0.03 |
| SW1991/109 | 26.6 | < 0.59 | < 0.59 | 8.4 | 44 | - | 1.8 | 0.19 | 1.6 | 0.07 |
| SW1991/111 | 28.2 | < 0.57 | < 0.57 | 6.9 | 33 | - | 38 | 2.8 | 99 | 0.09 |
| SW1991/116 | 23.7 | <0.5 | <0.5 | 3.3 | 20 | - | 1.7 | 0.68 | 1.3 | < 0.03 |
| SW1991/117A | 30.6 | 0.38 | 0.09 | 9.2 | 5.5 | - | 2.1 | 0.28 | 1 | 0.06 |
| SW1991/120 | 25 | 0.74 | < 0.54 | 7.4 | 137 | - | 1.8 | < 0.08 | 3.5 | 0.06 |
| SW1991/124 | 25.3 | < 0.52 | < 0.52 | 6.9 | 51 | - | 2.9 | < 0.06 | 3.4 | 0.04 |
| SW1991/128 | 25.4 | 0.3 | 0.04 | 7.5 | 57 | - | 2.2 | 0.17 | 2.5 | 0.03 |
| SW1991/135 | 27.1 | < 0.53 | < 0.53 | 57 | 40 | - | 1.2 | < 0.06 | 0.74 | 0.18 |
| SW1991/136 | 28.9 | < 0.54 | < 0.54 | 13 | 43 | - | 106 | 0.25 | 65 | 0.63 |
| SW1991/142 | 22.9 | 0.52 | < 0.49 | 3.5 | 20 | - | 1.1 | 0.08 | < 0.01 | < 0.03 |
| SW1992/7 | 28.4 | < 0.51 | < 0.51 | 9.6 | 35 | - | 3.7 | < 0.06 | 2.5 | 0.08 |
| SW1992/112 | 20.6 | <0.5 | <0.5 | 2.9 | 17 | - | 2.8 | 0.15 | 0.83 | 0.04 |
| SW1992/170 | 22.2 | < 0.53 | < 0.53 | 5 | 23 | - | 17 | 0.84 | 1.2 | 0.09 |
| SW1992/175 | 30.7 | 1.9 | < 0.58 | 10 | 28 | - | 17 | < 0.07 | 31 | 0.12 |
| LAW-01 | 27.5 | <0.6 | <0.6 | 12 | 50 | - | - | 0.07 | 1.4 | < 0.7 |
| LAW-02 | 26.4 | <0.6 | <0.6 | 8.9 | 48 | - | - | 0.16 | 8.4 | < 0.7 |
| LAW-03 | 28.7 | <0.6 | <0.6 | 160 | 49 | - | - | < 0.07 | 0.66 | < 0.7 |
| LAW-04 | 31.8 | <0.6 | <0.6 | 120 | 62 | - | - | < 0.07 | 2.9 | < 0.7 |
| LAW-05 | 40.5 | <0.6 | <0.6 | 8.7 | 49 | - | - | < 0.07 | 0.63 | < 0.7 |
| LAW-06 | 55.5 | <0.5 | <0.5 | 6.6 | 25 | - | - | < 0.06 | 0.61 | < 0.6 |
| LAW-07 | 27.2 | <0.6 | <0.6 | 17 | 66 | - | - | 0.11 | 0.59 | < 0.7 |
| LAW-08 | 27.4 | <0.6 | <0.6 | 6.5 | 44 | - | - | 0.24 | 26 | < 0.7 |
| LAW-09 | 27.1 | <0.6 | <0.6 | 16 | 120 | - | - | 0.12 | 5.2 | < 0.7 |
| LAW-10 | 28.6 | <0.6 | <0.6 | 8.1 | 140 | - | - | 0.14 | 30 | < 0.7 |
| LAW-11 | 30.2 | <0.6 | <0.6 | 10 | 36 | - | - | 0.11 | 7.5 | < 0.7 |
| LAW-12 | 31.1 | <0.6 | <0.6 | 8.2 | 31 | - | - | 0.14 | 5.4 | < 0.7 |
| LAW-13 | 28.3 | <0.6 | <0.6 | 10 | 34 | - | - | 0.17 | 4.9 | < 0.7 |
| LAW-14 | 30.3 | <0.6 | <0.6 | 7.4 | 34 | - | - | 1.2 | 1.1 | < 0.7 |
| LAW-15 | 25 | <0.5 | <0.5 | 7.3 | 87 | - | - | < 0.06 | 2.8 | < 0.6 |
| LAW-16 | 30.2 | 0.5 | <0.5 | 30 | 71 | - | - | < 0.06 | 1 | < 0.6 |
| LAW-17 | 28.4 | <0.6 | <0.6 | 17 | 36 | - | - | < 0.07 | 0.89 | < 0.7 |
| LAW-18 | 21.6 | <0.5 | <0.5 | 79 | 40 | - | - | < 0.06 | 1.6 | 0.11 |

***Table 5. Concentrations of trace metals in kidney samples (mg kg$^{-1}$ wet weight)***

| Reference No. | % Dry Matter | Cr | Ni | Cu | Zn | As | Se | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|---|---|
| **H. grypus** | | | | | | | | | | |
| SS1991/28 | 21.3 | < 0.55 | < 0.55 | 5.2 | 40 | - | 8.8 | 0.43 | 22 | 0.31 |
| SS1991/30A | 27.9 | < 0.5 | < 0.5 | 12 | 28 | - | 31 | < 0.06 | 13 | 0.86 |
| SS1991/55 | 22.6 | < 0.57 | < 0.57 | 5.7 | 47 | - | 0.29 | < 0.07 | < 0.01 | < 0.03 |
| SS1991/58 | 24.3 | < 0.55 | < 0.55 | 2.7 | 48 | - | 2.6 | 0.71 | 5.2 | < 0.03 |
| SS1991/73 | 20.4 | < 0.49 | < 0.49 | 8.7 | 51 | - | 0.52 | < 0.06 | 2.9 | 0.05 |
| SS1992/9 | 22.8 | < 0.57 | < 0.57 | 2.0 | 27 | - | 1.4 | 0.7 | 0.88 | 0.04 |
| **D. delphis** | | | | | | | | | | |
| SW1991/40 | 31.9 | < 0.56 | < 0.56 | 2.1 | 15 | - | 2.6 | 1.6 | 2.3 | 0.03 |
| SW1991/46 | 20.9 | 0.63 | < 0.58 | 3.1 | 20 | - | 3.7 | 1.9 | 0.48 | 0.05 |
| SW1991/83 | 20.9 | < 0.58 | < 0.58 | 2.6 | 17 | - | 3.3 | 4.1 | 4.4 | 0.08 |
| SW1991/129 | 18.8 | < 0.54 | < 0.54 | 7.6 | 21 | - | 2.3 | < 0.06 | 0.35 | < 0.03 |
| SW1992/1 | 21.5 | < 0.58 | < 0.58 | 3.0 | 19 | 0.87 | - | 2.9 | 3.5 | 0.11 |
| SW1992/2 | 23.7 | 1.1 | 0.58 | 2.5 | 16 | 0.83 | - | 1.1 | 1.5 | 0.02 |
| SW1992/3 | 25.3 | < 0.66 | < 0.66 | 5.4 | 35 | 0.84 | - | 0.12 | 6.0 | 0.04 |
| SW1992/4 | 27.4 | 0.83 | < 0.67 | 2.7 | 17 | 1.4 | - | 1.4 | 1.2 | 0.03 |
| SW1992/10 | 27.1 | 2.2 | < 0.55 | 2.5 | 15 | - | 3.9 | 2.3 | 0.86 | 0.03 |
| SW1992/11 | 21.3 | < 0.52 | < 0.52 | 3.4 | 22 | - | 2.1 | 3.0 | 1.1 | < 0.03 |
| SW1992/12 | 26.7 | < 0.56 | < 0.56 | 2.5 | 19 | - | 3.6 | 9.3 | 2.7 | < 0.03 |
| SW1992/14(1) | 26.1 | < 0.57 | < 0.57 | 3.1 | 19 | - | 3.0 | 2.0 | 0.72 | < 0.03 |
| SW1992/14(2) | 23.9 | < 0.54 | < 0.54 | 2.5 | 15 | - | 1.9 | 1.4 | 0.8 | < 0.03 |
| SW1992/19(1) | 22.8 | 2.6 | 1.3 | 2.7 | 16 | 0.95 | - | 2.6 | 0.3 | 0.05 |
| SW1992/19(2) | 24.1 | < 0.57 | < 0.57 | 3.1 | 17 | 1.0 | - | 2.7 | 1.5 | 0.06 |
| SW1992/20 | 28.5 | 3.1 | 1.6 | 1.9 | 12 | 1.4 | - | 2.4 | 0.9 | 0.06 |
| SW1992/172(1) | 21.4 | 1.0 | < 0.5 | 3.0 | 17 | - | 3.6 | 3.3 | 4.7 | 0.07 |
| SW1992/172(2) | 22.0 | 2.2 | < 0.67 | 2.9 | 17 | - | 2.2 | 0.26 | 0.54 | 0.06 |
| **G. melas** | | | | | | | | | | |
| SW1991/55 | 20.8 | 1.2 | < 0.56 | 8.5 | 51 | - | 11 | 176 | 12 | 0.06 |
| **L. albirostris** | | | | | | | | | | |
| SW1991/108 | 23.0 | < 0.59 | < 0.59 | 3.1 | 19 | - | 2.9 | 0.67 | 0.11 | 0.04 |
| SW1991/126 | 23.4 | < 0.57 | < 0.57 | 3.4 | 15 | - | 2.6 | 0.36 | 1.3 | < 0.03 |
| **S. coeruleoalba** | | | | | | | | | | |
| SW1991/122 | 23.9 | < 0.62 | < 0.62 | 4.2 | 24 | - | 2.3 | 1.0 | 0.42 | 0.09 |
| **T. truncatus** | | | | | | | | | | |
| SW1991/42 | 26.7 | 0.77 | < 0.59 | 2.0 | 17 | - | 9.9 | 0.2 | 18 | 0.17 |
| SW1991/115 | 22.1 | < 0.52 | < 0.52 | 9.3 | 66 | - | 0.91 | < 0.06 | 0.85 | 0.05 |
| SW1991/130 | 32.7 | < 0.51 | < 0.51 | 1.7 | 20 | - | 4.7 | 0.15 | 6.0 | 0.05 |
| SW1992/25 | 25.0 | < 0.55 | < 0.55 | 2.6 | 22 | - | 6.8 | 1.2 | 11 | 0.19 |
| **P. phocoena** | | | | | | | | | | |
| SW1991/19B | 23.3 | < 0.53 | < 0.53 | 3.0 | 16 | - | 2.3 | < 0.06 | 1.1 | 0.03 |
| SW1991/32A | 23.9 | 1.1 | < 0.59 | 2.3 | 16 | - | 1.9 | 0.26 | 1.2 | 0.06 |
| SW1991/35 | 22.7 | < 0.53 | < 0.53 | 3.3 | 22 | - | 2.3 | 0.24 | < 0.01 | < 0.03 |
| SW1991/36 | 20.0 | < 0.57 | < 0.57 | 2.9 | 17 | - | 2.4 | 2.5 | 4.9 | 0.03 |
| SW1991/43 | 18.8 | 1.8 | < 0.68 | 3.6 | 18 | - | 2.5 | 1.7 | 0.81 | 0.06 |
| SW1991/48 | 20.7 | 0.74 | < 0.56 | 4.6 | 21 | - | 1.5 | 1.2 | 0.19 | 0.06 |
| SW1991/54 | 20.6 | < 0.55 | < 0.55 | 3.9 | 20 | - | 2.6 | 0.7 | 1.5 | 0.08 |
| SW1991/59 | 18.8 | < 0.52 | < 0.52 | 3.1 | 19 | - | 0.58 | < 0.06 | 0.59 | < 0.03 |
| SW1991/73 | 21.3 | < 0.54 | < 0.54 | 5.9 | 18 | - | 0.64 | < 0.06 | 0.46 | < 0.03 |
| SW1991/74 | 20.3 | < 0.56 | < 0.56 | 4.7 | 21 | - | 0.58 | < 0.07 | 0.5 | 0.07 |
| SW1991/95 | 25.6 | 0.85 | < 0.6 | 3.5 | 21 | - | 2.7 | 0.9 | 3.7 | 0.07 |
| SW1991/104 | 27.0 | < 0.53 | < 0.53 | 9.0 | 33 | - | 12 | 0.18 | 32 | 0.03 |
| SW1991/109 | 24.3 | < 0.53 | < 0.53 | 4.6 | 22 | - | 3.2 | 0.76 | 0.49 | 0.03 |
| SW1991/111 | 24.2 | < 0.51 | < 0.51 | 3.5 | 21 | - | 4.9 | 8.7 | 9.5 | 0.04 |
| SW1991/116 | 20.8 | < 0.58 | < 0.58 | 3.7 | 23 | - | 2.4 | 0.64 | 4.3 | 0.05 |
| SW1991/120 | 19.2 | < 0.51 | < 0.55 | 3.2 | 22 | - | 0.86 | 0.38 | 0.37 | 0.03 |
| SW1991/135 | 20.6 | < 0.55 | < 0.55 | 3.5 | 19 | - | 0.86 | 0.07 | < 0.01 | < 0.03 |
| SW1991/136 | 20.1 | < 0.53 | < 0.53 | 3.1 | 22 | - | 2.2 | 1.5 | 5.3 | 0.11 |
| SW1991/142 | 23.8 | < 0.55 | < 0.55 | 12 | 29 | - | 0.8 | < 0.07 | < 0.01 | < 0.03 |
| SW1992/7 | 19.8 | 1.2 | < 0.51 | 2.9 | 19 | - | 1.6 | 0.12 | 0.81 | < 0.03 |
| SW1992/112 | 27.9 | 0.63 | < 0.54 | 15 | 29 | - | 3.0 | 0.3 | 37 | 0.09 |
| SW1992/170 | 28.3 | < 0.49 | < 0.49 | 13 | 45 | - | 1.3 | 0.18 | 5.6 | 0.23 |
| SW1992/175 | 22.0 | 2.0 | < 0.59 | 3.3 | 18 | - | 2.6 | 0.87 | 2.1 | 0.09 |

***Table 6. Concentrations of trace metals in stomach contents of common dolphins (mg kg$^{-1}$ wet weight)***

| Reference No. | Cr | Ni | Cu | Zn | As | Se | Cd | Hg | Pb |
|---|---|---|---|---|---|---|---|---|---|
| **D. delphis** | | | | | | | | | |
| SW1992/2 | <0.87 | <0.87 | 1.7 | 5.9 | 1.3 | - | 0.77 | 0.2 | <1.1 |
| SW1992/4 | 6.1 | 2.9 | 1.5 | 14 | 2 | - | 0.75 | 0.24 | <1.0 |
| SW1992/19(1) | <0.62 | 0.78 | 1.7 | 61 | 3.5 | - | 0.6 | 0.1 | <0.75 |
| SW1992/19(2) | <0.71 | <0.71 | 4.1 | 103 | 0.62 | - | 0.65 | 0.09 | <0.85 |
| SW1992/20 | 13 | 6.4 | 2.9 | 46 | 1.1 | - | 0.84 | 0.09 | <1.2 |

***Table 7. Concentrations of total chlorobiphenyls and organochlorines other than chlorobiphenyl congeners in blubber samples (mg kg$^{-1}$ wet weight)***

| Reference No. | %HEL | ICES 7 CBs | Total 25 CBs | HCB | α-HCH | γ-HCH | p,p'-DDE | p,p'-DDT | p,p'-TDE | Dieldrin |
|---|---|---|---|---|---|---|---|---|---|---|
| **H. grypus** | | | | | | | | | | |
| SS1991/23 | 41 | 38.6 | 55.7 | - | - | - | 4.8 | - | - | - |
| **D. delphis** | | | | | | | | | | |
| SMRU90-73 | 91 | 5.31 | 9.34 | 0.56 | 0.002 | nd | 8.3 | 0.05 | 0.036 | 0.027 |
| IC1990/4 | 85 | 26.9 | 47.3 | 0.18 | 0.058 | 0.24 | 7.1 | 0.26 | 1.1 | 1.9 |
| IC1991/1 | 75 | 1.35 | 2.34 | 0.012 | - | - | 0.8 | - | - | - |
| SW1990/5A | 71 | 15 | 24.9 | 0.23 | - | - | 5.7 | - | - | - |
| SW1990/20A | 55 | 18.8 | 33.2 | 0.18 | 0.053 | 0.15 | 4.3 | 0.19 | 0.63 | 1.2 |
| SW1990/45 | 75 | 6.09 | 9.53 | 0.34 | - | - | 7.3 | - | - | - |
| SW1990/46 | 90 | 8.42 | 15.5 | 0.58 | - | - | 5.9 | - | - | - |
| SW1990/47 | 82 | 3.46 | 10.9 | 0.11 | - | - | 1.2 | - | - | - |
| SW1990/68 | 85 | 49 | 83.8 | 0.37 | - | - | 34.4 | - | - | - |
| SW1990/78 | 86 | 46.6 | 82.1 | 0.26 | 0.045 | 0.13 | 24.9 | 0.14 | 2 | 1.9 |
| SW1990/81 | 82 | 1.41 | 2.26 | 0.014 | - | - | 0.51 | - | - | - |
| SW1990/87 | 88 | 14.5 | 26.1 | 0.13 | - | - | 3.3 | - | - | - |
| SW1990/88 | 78 | 10.2 | 16.1 | 0.3 | 0.039 | 0.068 | 5.5 | 0.11 | 0.55 | 1.4 |
| SW1990/97 | 79 | 43.4 | 75.8 | 0.64 | 0.12 | 0.59 | 17.2 | 0.54 | 1.7 | 5.3 |
| SW1990/101 | 82 | 19.8 | 34.1 | 0.16 | 0.056 | 0.16 | 6.2 | 0.25 | 1.2 | 1.7 |
| SW1990/102 | 82 | 18.5 | 31.8 | 0.13 | 0.039 | 0.11 | 5.4 | 0.2 | 0.71 | 1.2 |
| SW1990/103 | 80 | 29.2 | 50 | 0.16 | 0.038 | 0.11 | 13.9 | 0.23 | 1 | 1.7 |
| SW1990/104 | 80 | 20.3 | 35.6 | 0.19 | - | - | 5.2 | - | - | - |
| SW1990/108 | 91 | 20.7 | 35.7 | 0.19 | 0.047 | 0.14 | 11 | 0.22 | 0.14 | 1.7 |
| SW1991/7 | 87 | 3.06 | 5.47 | 0.025 | 0.044 | 0.13 | 0.27 | 0.14 | 0.81 | 1.5 |
| SW1991/10 | 86 | 36 | 57.2 | 0.42 | - | - | 29 | - | - | - |
| SW1991/37 | 78 | 19.2 | 35.2 | 0.28 | 0.089 | 0.28 | 3.8 | 1.2 | 1.9 | 2.9 |
| SW1991/83 | 90 | 4.7 | 8.26 | 0.036 | - | - | 0.49 | - | - | - |
| SW1991/137 | 76 | 12.7 | 23.6 | 0.12 | 0.032 | 0.26 | 3.9 | 0.44 | 0.8 | 0.85 |
| SW1992/1 | 82 | 41.6 | 71.4 | 0.068 | 0.26 | 0.19 | 2.4 | 11 | 2.2 | 1.8 |
| SW1992/2 | 80 | 19.8 | 34 | 0.087 | 0.24 | 0.19 | 2.5 | 5.3 | 1.4 | 0.78 |
| SW1992/3 | 84 | 27.8 | 47.8 | 0.073 | 0.18 | 0.19 | 2.6 | 7.5 | 1.7 | 1 |
| SW1992/4 | 84 | 21.1 | 35.7 | 0.08 | 0.21 | 0.2 | 1.9 | 5 | 1.1 | 0.77 |
| SW1992/10 | 92 | 22.4 | 38.1 | 0.058 | 0.16 | 0.16 | 1.4 | 5.4 | 1.1 | 1 |
| SW1992/11 | 88 | 11.1 | 18.9 | 0.06 | 0.22 | 0.21 | 1.2 | 2.1 | 0.6 | 0.54 |
| SW1992/12 | 64 | 18.7 | 31 | nd | 0.064 | 0.11 | 0.71 | 8.3 | 0.57 | 0.44 |
| SW1992/14(1) | 90 | 11.3 | 19.3 | 0.048 | 0.092 | 0.13 | 0.72 | 2.8 | 0.49 | 0.45 |
| SW1992/14(2) | 92 | 8.35 | 14.2 | 0.06 | 0.11 | 0.15 | 0.87 | 2.7 | 0.57 | 0.6 |
| SW1992/19(1) | 84 | 8.88 | 15.2 | 0.079 | 0.25 | 0.27 | 1.3 | 1.7 | 0.6 | 0.5 |
| SW1992/19(2) | 86 | 11.9 | 20 | 0.06 | 0.1 | 0.12 | 1.1 | 5.9 | 1 | 1 |
| **G. griseus** | | | | | | | | | | |
| SW1990/70 | 88 | 6.49 | 10.1 | 0.12 | 0.015 | 0.047 | 1.2 | 0.34 | 0.99 | 0.94 |
| **G. melas** | | | | | | | | | | |
| SW1990/88A | 84 | 29.1 | 44.8 | 0.13 | - | - | 11.3 | - | - | - |
| SW1991/55 | 75 | 17.8 | 28.9 | 1.02 | - | - | 16.6 | - | - | - |
| **L. acutus** | | | | | | | | | | |
| SW1989/88B | 77 | 13.5 | 27 | - | 0.22 | 0.11 | - | 4.2 | 4.3 | 4 |
| **S. coeruleoalba** | | | | | | | | | | |
| SW1991/26 | 56 | 10.1 | 18.4 | 0.55 | - | - | 8.2 | - | - | - |
| **T. truncatus** | | | | | | | | | | |
| SW1991/42 | 68 | 72.1 | 119.3 | 0.22 | - | - | 36.8 | - | - | - |
| SW1991/115 | 57 | 6.87 | 10.9 | 0.36 | - | - | 3.3 | - | - | - |
| **P. phocoena** | | | | | | | | | | |
| IC1990/1 | 84 | 4.88 | 9.36 | 0.37 | - | - | 1.5 | - | - | - |
| IC1990/2 | 73 | 0.92 | 1.44 | 0.037 | - | - | 0.29 | - | - | - |
| IC1990/3 | 70 | 10.4 | 16.1 | 0.43 | - | - | 2.5 | - | - | - |
| IC1990/4 | 93 | 5.17 | 7.93 | 0.27 | - | - | 1.1 | - | - | - |
| IC1991/2 | 62 | 4.46 | 7.33 | 0.26 | nd | 0.026 | 1.5 | 0.26 | 0.42 | nd |
| SMRU90- 01 | 86 | 6.68 | 12.2 | 0.26 | - | - | 3.3 | - | - | - |
| SMRU90- 04 | 93 | 2.16 | 3.64 | 0.19 | - | - | 1 | - | - | - |
| SMRU90-02 | 89 | 0.17 | 0.26 | 0.011 | - | - | 0.11 | - | - | - |
| SMRU90-03 | 82 | 5.57 | 9.62 | 0.29 | - | - | 2.8 | - | - | - |
| SMRU90- 05 | 87 | 4.13 | 5.92 | 0.31 | - | - | 3.2 | - | - | - |
| SMRU90-06 | 89 | 3.61 | 5.24 | 0.36 | - | - | 2.4 | - | - | - |
| SMRU90-07 | 83 | 0.11 | 0.17 | 0.002 | - | - | 0.064 | - | - | - |
| SMRU90- 08 | 91 | 4.15 | 6.02 | 0.39 | - | - | 2.8 | - | - | - |
| SMRU90-09 | 87 | 4.58 | 6.82 | 0.46 | - | - | 2.9 | - | - | - |
| SMRU90-10 | 72 | 2.34 | 3.86 | 0.25 | - | - | 1.4 | - | - | - |
| SMRU90-11 | 90 | 0.086 | 0.12 | 0.009 | - | - | 0.057 | - | - | - |
| SMRU90-12 | 87 | 0.65 | 0.65 | nd | - | - | 0.39 | - | - | - |
| SMRU90-13 | 76 | 3.38 | 4.9 | 0.31 | - | - | 1.9 | - | - | - |
| SMRU90-14 | 89 | 5.62 | 8.29 | 0.63 | - | - | 4.7 | - | - | - |
| SMRU90-15 | 92 | 5.51 | 8.23 | 0.27 | - | - | 4.3 | - | - | - |

***Table 7. (continued)***

| Reference No. | %HEL | ICES 7 CBs | Total 25 CBs | HCB | α-HCH | γ-HCH | p,p'-DDE | p,p'-DDT | p,p'-TDE | Dieldrin |
|---|---|---|---|---|---|---|---|---|---|---|
| **P.phocoena** | | | | | | | | | | |
| SMRU90-16 | 91 | 0.18 | 0.26 | 0.012 | - | - | 0.16 | - | - | - |
| SMRU90-17 | 87 | 8.45 | 13 | 0.39 | - | - | 5.1 | - | - | - |
| SMRU90-18 | 93 | 9.93 | 15.2 | 0.44 | - | - | 5.6 | - | - | - |
| SMRU90-19 | 89 | 6.12 | 9.08 | 0.43 | - | - | 4.4 | - | - | - |
| SMRU90-51 | 93 | 12.9 | 23.1 | 0.092 | 0.018 | 0.21 | 2.3 | 1.8 | 0.88 | 1 |
| SMRU90-55 | 85 | 43.3 | 76.9 | 0.94 | 0.07 | 0.31 | 17 | 5.7 | 5.4 | 11.4 |
| SMRU90-60 | 92 | 0.085 | 0.12 | 0.005 | - | - | 0.04 | - | - | - |
| SMRU90-61 | 89 | 10.6 | 17.1 | 1.8 | - | - | 5.5 | - | - | - |
| SMRU90-75 | 93 | 6.96 | 12.9 | 0.61 | 0.13 | 0.21 | 3.7 | 2 | 1.8 | 3.3 |
| SMRU90-76 | 89 | 9.68 | 15.4 | 0.54 | - | - | 6.5 | - | - | - |
| SW1990/39 | 92 | 11 | 18.6 | 0.35 | - | - | 2.1 | - | - | - |
| SW1990/50 | 95 | 9.99 | 15.9 | 0.23 | - | - | 1.3 | - | - | - |
| SW1990/50A | 79 | 6.87 | 9.96 | 0.44 | - | - | 1.6 | - | - | - |
| SW1990/51(1) | 78 | 3.07 | 5.88 | 0.026 | 0.006 | 0.022 | 0.28 | 0.092 | 0.13 | 0.22 |
| SW1990/51(2) | 70 | 0.2 | 0.34 | 0.031 | 0.004 | 0.02 | 0.22 | 0.011 | 0.11 | 0.2 |
| SW1990/54 | 64 | 12.5 | 22.3 | 0.38 | 0.079 | 0.17 | 2.9 | 1 | 1.6 | 1.4 |
| SW1990/65 | 76 | 23.2 | 36.4 | 0.98 | - | - | 6.3 | - | - | - |
| SW1990/66 | 85 | 16 | 25.5 | 0.45 | - | - | 2.6 | - | - | - |
| SW1990/71 | 88 | 2.06 | 3.39 | 0.025 | 0.006 | 0.02 | 0.92 | 0.83 | 0.29 | 0.29 |
| SW1990/72 | 81 | 19 | 32.9 | 0.3 | 0.016 | 0.11 | 2.9 | 1.4 | 2.5 | 3.6 |
| SW1990/72A | 88 | 6.49 | 10.1 | 0.12 | 0.015 | 0.047 | 1.2 | 0.34 | 0.99 | 0.94 |
| SW1990/73 | 71 | 18.1 | 31.3 | 0.5 | - | - | 2.6 | - | - | - |
| SW1990/77B | 85 | 27.9 | 52.9 | 0.37 | - | - | 2.6 | - | - | - |
| SW1990/79 | 87 | 2.84 | 4.69 | 0.32 | 0.027 | 0.012 | 1.6 | 0.65 | 0.57 | 1.6 |
| SW1990/84 | 91 | 17.9 | 29.9 | 0.3 | 0.02 | 0.077 | 7.9 | 7.1 | 5.8 | 8.6 |
| SW1990/92 | 83 | 0.19 | 0.33 | 0.005 | - | - | 0.076 | - | - | - |
| SW1990/94 | 75 | 13.3 | 24.4 | 0.32 | 0.039 | 0.11 | 6.6 | 4 | 2.8 | 6.6 |
| SW1990/96 | 85 | 43.7 | 76.9 | 0.73 | 0.077 | 0.31 | 8.9 | 4.5 | 3.8 | 7.7 |
| SW1990/98 | 85 | 1.11 | 1.71 | 0.049 | - | - | 0.39 | - | - | - |
| SW1990/100 | 76 | 0.8 | 1.24 | 0.037 | - | - | 0.25 | - | - | - |
| SW1990/100A | 89 | 8 | 13.3 | 1.1 | 0.15 | 0.23 | 7 | 3.6 | 2.7 | 8 |
| SW1990/106 | 76 | 21.2 | 34.8 | 0.53 | 0.066 | 0.28 | 7.1 | 0.1 | 2.1 | 4 |
| SW1990/107 | 87 | 4.79 | 8.05 | 0.068 | - | - | 0.93 | - | - | - |
| SW1990/109 | 89 | 14.2 | 24.7 | 0.2 | 0.078 | 0.17 | 2.1 | 0.14 | 0.79 | 0.93 |
| SW1990/111 | 93 | 0.24 | 0.41 | 0.003 | - | - | 0.049 | - | - | - |
| SMRU91-06 | 92 | 2.38 | 4.09 | 0.13 | 0.067 | 0.1 | 1.1 | 0.11 | 1 | 3 |
| SMRU91- 08 | 90 | 1.14 | 1.95 | 0.063 | nd | nd | 0.44 | 0.59 | 0.21 | 0.15 |
| SMRU91-15 | 92 | 13.5 | 21.8 | 0.64 | 0.11 | 0.35 | 3.8 | 1.2 | 3.5 | 5 |
| SMRU91-07 | 93 | 2.64 | 4.63 | 0.21 | nd | nd | 1.2 | nd | 0.75 | nd |
| SW1991/14 | 64 | 52.7 | 88.8 | 0.54 | 0.066 | 0.16 | 16.8 | 0.25 | 4.7 | 5.6 |
| SW1991/17 | 89 | 24.2 | 41.1 | 0.44 | 0.061 | 0.16 | 10.5 | 0.12 | 3 | 6.3 |
| SW1991/17A | 87 | 18.1 | 32.8 | 0.38 | 0.058 | 0.23 | 4.1 | 0.085 | 2.4 | 5 |
| SW1991/19A | 90 | 18.2 | 31.7 | 0.4 | 0.06 | 0.17 | 6.3 | 0.12 | 2.6 | 5.6 |
| SW1991/19B | 89 | 8.13 | 14.3 | 0.2 | 0.074 | 0.18 | 1.7 | 0.77 | 1.1 | 0.97 |
| SW1991/20 | 87 | 7.11 | 12.9 | 0.45 | 0.074 | 0.22 | 2.9 | 0.12 | 0.98 | 2.5 |
| SW1991/22 | 85 | 11.3 | 19 | 0.29 | nd | 0.055 | 5.2 | 0.032 | 0.87 | 0.16 |
| SW1991/23 | 86 | 30 | 50.8 | 0.83 | 0.14 | 0.44 | 8.1 | 1.9 | 3.2 | 6.6 |
| SW1991/24 | 91 | 21.4 | 37.8 | 0.5 | 0.078 | 0.3 | 7.3 | 0.14 | 1.3 | 6 |
| SW1991/28 | 89 | 3.96 | 7.06 | 0.46 | 0.045 | 0.058 | 2.6 | 0.038 | 0.62 | 2 |
| SW1991/29 | 88 | 6.22 | 10.5 | 0.49 | 0.037 | 0.057 | 3.7 | 0.11 | 0.09 | 3.3 |
| SW1991/30 | 92 | 4.19 | 7.19 | 0.28 | 0.11 | 0.23 | 1.6 | 0.58 | 0.63 | 1.5 |
| SW1991/31 | 87 | 22.8 | 38.4 | 0.49 | 0.088 | 0.24 | 8.4 | 2 | 2.7 | 4.3 |
| SW1991/32A | 91 | 6.37 | 11 | 0.14 | 0.035 | 0.081 | 1 | 0.48 | 0.45 | 0.62 |
| SW1991/35 | 74 | 4.91 | 7.46 | 0.39 | - | - | 1.5 | - | - | - |
| SW1991/36 | 93 | 6.7 | 12 | 0.22 | 0.048 | 0.2 | 1.9 | 0.11 | 0.93 | 1.8 |
| SW1991/43 | 88 | 2.05 | 4.19 | 0.2 | 0.045 | 0.052 | 1.1 | 0.58 | 0.46 | 0.68 |
| SW1991/48 | 86 | 5.48 | 8.5 | 0.14 | - | - | 1.2 | - | - | - |
| SW1991/54 | 90 | 11 | 17.7 | 0.33 | - | - | 3.1 | - | - | - |
| SW1991/59 | 77 | 3.25 | 5.9 | 0.13 | - | - | 0.77 | - | - | - |
| SW1991/61 | 52 | 1.78 | 3.05 | 0.086 | - | - | 0.25 | - | - | - |
| SW1991/63 | 75 | 4.81 | 8.56 | 0.29 | 0.034 | 0.15 | 2.2 | 0.86 | 1.6 | 4.3 |
| SW1991/70 | 92 | 16.6 | 25.3 | 0.43 | 0.094 | 0.45 | 2.2 | 0.67 | 1.7 | 2.4 |
| SW1991/71 | 81 | 11.3 | 19.4 | 0.58 | - | - | 2.7 | - | - | - |
| SW1991/73 | 53 | 5.15 | 9.06 | 0.2 | - | - | 1.8 | - | - | - |
| SW1991/74 | 77 | 2.87 | 5.05 | 0.076 | - | - | 0.28 | - | - | - |
| SW1991/95 | 84 | 10.1 | 17.1 | 0.29 | - | - | 3.2 | - | - | - |
| SW1991/100 | 62 | 4.39 | 7.75 | 0.22 | 0.031 | 0.14 | 1.7 | 0.41 | 2.9 | 3.5 |
| SW1991/104 | 86 | 32.5 | 58.1 | 0.8 | - | - | 13.4 | - | - | - |
| SW1991/111 | 86 | 19 | 31.8 | 0.2 | - | - | 23 | - | - | - |
| SW1991/112 | 90 | 32.9 | 54.8 | 0.71 | 0.088 | 0.36 | 11.2 | 3.4 | 6 | 11.7 |
| SW1991/116 | 82 | 15.4 | 26.7 | 0.24 | - | - | 5 | - | - | - |
| SW1991/117A | 85 | 3.13 | 5.78 | 0.58 | 0.13 | 0.063 | 3.4 | 1.2 | 1.4 | 1.1 |
| SW1991/120 | 73 | 38.2 | 63.5 | 1.2 | - | - | 9.2 | - | - | - |
| SW1991/128 | 92 | 4.46 | 7.41 | 0.39 | 0.062 | 0.08 | 3 | 0.91 | 0.86 | 1.4 |
| SW1991/135 | 73 | 10.4 | 18.1 | 0.46 | - | - | 4.5 | - | - | - |
| SW1991/136 | 82 | 52.9 | 89.8 | 0.46 | - | - | 7.7 | - | - | - |
| SW1991/142 | 83 | 4.45 | 7.56 | 0.1 | - | - | 0.58 | - | - | - |
| SW1992/7 | 88 | 10.4 | 16.4 | 0.34 | - | - | 1.5 | - | - | - |

***Table 8. Concentrations of chlorobiphenyl congeners in blubber (mg kg$^{-1}$ wet weight)***

| Reference No. | %HEL | CB18 | CB31 | CB28 | CB52 | CB49 | CB47 | CB44 | CB66 | CB101 | CB110 | CB151 | CB149 | CB118 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **H. grypus** | | | | | | | | | | | | | | |
| SS1991/23 | 41 | nd | nd | nd | 0.23 | 0.08 | 0.21 | nd | 0.15 | 0.62 | 0.31 | 0.089 | 1.3 | 0.2 |
| **D. delphis** | | | | | | | | | | | | | | |
| SMRU90-73 | 91 | nd | nd | 0.12 | 0.35 | 0.064 | nd | 0.1 | 0.74 | 0.56 | 0.13 | 0.3 | 0.8 | 0.66 |
| IC1990/4 | 85 | 0.043 | 0.026 | nd | 0.77 | 0.049 | 0.23 | 0.039 | 1.8 | 0.71 | 0.35 | 1.9 | 4.4 | 1.4 |
| IC1991/1 | 75 | nd | nd | nd | 0.062 | 0.003 | 0.019 | nd | nd | 0.08 | 0.17 | 0.091 | 0.21 | 0.086 |
| SW1990/5A | 71 | nd | nd | nd | 0.55 | nd | 0.15 | nd | nd | 0.98 | nd | 1.2 | 2.8 | 1.1 |
| SW1990/20A | 55 | 0.023 | 0.027 | nd | 0.51 | 0.06 | 0.15 | 0.027 | 1.1 | 0.59 | 0.24 | 1.2 | 2.8 | 1 |
| SW1990/45 | 75 | nd | nd | nd | 0.47 | nd | 0.1 | nd | nd | 1.1 | 0.12 | 0.4 | 1 | 0.65 |
| SW1990/46 | 90 | 0.13 | 0.068 | 0.26 | 0.86 | 0.3 | 0.32 | 0.23 | 1.2 | 1.1 | 0.8 | 0.41 | 1.2 | 1.1 |
| SW1990/47 | 82 | nd | nd | 0.15 | 0.44 | 0.16 | 0.19 | 0.14 | 0.28 | 0.5 | 5.1 | 0.14 | 0.45 | 0.44 |
| SW1990/68 | 85 | nd | nd | nd | 2.2 | nd | 0.62 | nd | nd | 3.1 | 2 | 3.6 | 7.7 | 3.3 |
| SW1990/78 | 86 | 0.065 | 0.029 | nd | 1.3 | 0.045 | 0.42 | 0.057 | 2.9 | 0.89 | 0.62 | 3.4 | 7.1 | 1.6 |
| SW1990/81 | 82 | nd | nd | nd | 0.069 | 0.003 | 0.023 | nd | nd | 0.11 | 0.009 | 0.097 | 0.24 | 0.13 |
| SW1990/87 | 88 | nd | nd | nd | 0.57 | 0.084 | 0.15 | nd | nd | 1.3 | 3.3 | 0.88 | 2.5 | 1.1 |
| SW1990/88 | 78 | 0.021 | nd | 0.091 | 0.43 | 0.17 | 0.11 | 0.05 | 0.85 | 1.1 | 0.18 | 0.4 | 1.3 | 1.6 |
| SW1990/97 | 79 | 0.087 | 0.096 | nd | 1.9 | 0.13 | 0.63 | 0.07 | 3.7 | 1.9 | 0.57 | 3.2 | 7.5 | 2.9 |
| SW1990/101 | 82 | 0.031 | 0.036 | nd | 0.63 | 0.06 | 0.19 | 0.041 | 1.4 | 0.94 | 0.025 | 1.3 | 3.3 | 1.3 |
| SW1990/102 | 82 | 0.026 | 0.028 | nd | 0.5 | 0.049 | 0.15 | 0.03 | 1.2 | 0.85 | 0.23 | 1.2 | 3 | 1.3 |
| SW1990/103 | 80 | 0.029 | 0.047 | nd | 0.82 | 0.06 | 0.26 | 0.034 | 1.8 | 0.81 | 0.36 | 2 | 4.6 | 1.7 |
| SW1990/104 | 80 | 0.03 | 0.028 | nd | 0.66 | 0.058 | 0.19 | 0.053 | 1.5 | 1.3 | 0.27 | 1.3 | 3.5 | 1.5 |
| SW1990/108 | 91 | 0.03 | 0.06 | nd | 0.59 | 0.076 | 0.17 | 0.043 | 1.3 | 0.5 | 0.26 | 1.3 | 3.2 | 1.1 |
| SW1991/7 | 87 | nd | nd | nd | 0.024 | 0.041 | 0.066 | 0.02 | nd | 0.15 | 0.12 | 0.14 | 0.4 | 0.25 |
| SW1991/10 | 86 | nd | nd | nd | 2 | nd | 0.6 | nd | nd | 2.6 | nd | 2.8 | 5.9 | 2.6 |
| SW1991/37 | 78 | nd | nd | nd | 1 | 0.16 | 0.29 | nd | 2.3 | 1.1 | 0.28 | 1.3 | 3.7 | 1.4 |
| SW1991/83 | 90 | nd | nd | nd | 0.077 | 0.071 | nd | nd | 0.14 | 0.26 | 0.22 | 0.21 | 0.61 | 0.36 |
| SW1991/137 | 76 | 0.024 | 0.015 | nd | 0.29 | 0.039 | 0.1 | 0.038 | 0.96 | 0.45 | 0.17 | 0.98 | 2.3 | 0.77 |
| SW1992/1 | 82 | 0.056 | nd | nd | 1.8 | 0.32 | 0.56 | 0.049 | 2 | 1.4 | 0.49 | 3.3 | 7.5 | 1.9 |
| SW1992/2 | 80 | nd | nd | nd | 0.91 | 0.21 | 0.27 | nd | 1.1 | 0.87 | 0.24 | 1.4 | 3.7 | 0.97 |
| SW1992/3 | 84 | nd | nd | nd | 1.3 | 0.22 | 0.38 | 0.031 | 1.5 | 1.3 | 0.32 | 2 | 4.9 | 1.5 |
| SW1992/4 | 84 | nd | nd | nd | 0.91 | 0.17 | 0.26 | nd | 1 | 0.75 | 0.26 | 1.4 | 3.6 | 1.1 |
| SW1992/10 | 92 | nd | nd | nd | 0.75 | 0.25 | 0.22 | nd | 1 | 0.89 | 0.25 | 1.5 | 4 | 1.1 |
| SW1992/11 | 88 | nd | nd | nd | 0.39 | 0.43 | 0.11 | 0.03 | 0.58 | 0.83 | 0.14 | 0.68 | 2 | 1.2 |
| SW1992/12 | 64 | nd | nd | nd | 0.48 | 0.15 | 0.14 | nd | 0.62 | 0.39 | 0.2 | 1.2 | 2.4 | 0.59 |
| SW1992/14(1) | 90 | nd | nd | nd | 0.32 | 0.27 | 0.09 | nd | 0.5 | 0.38 | 0.13 | 0.79 | 1.9 | 0.71 |
| SW1992/14(2) | 92 | nd | nd | nd | 0.28 | 0.22 | 0.07 | nd | 0.41 | 0.49 | 0.09 | 0.51 | 1.4 | 0.58 |
| SW1992/19(1) | 84 | nd | nd | nd | 0.33 | 0.34 | 0.1 | nd | 0.49 | 0.61 | 0.11 | 0.58 | 1.6 | 0.94 |
| SW1992/19(2) | 86 | nd | nd | nd | 0.47 | 0.14 | 0.12 | nd | 0.6 | 0.51 | 0.14 | 0.83 | 2 | 0.76 |
| **G. griseus** | | | | | | | | | | | | | | |
| SW1990/70 | 88 | nd | nd | nd | 0.19 | 0.094 | 0.057 | nd | 0.28 | 0.3 | 0.12 | 0.22 | 0.76 | 0.48 |
| **G. melas** | | | | | | | | | | | | | | |
| SW1990/88A | 84 | nd | nd | nd | 0.83 | nd | 0.23 | nd | nd | 1.4 | nd | 1.9 | 4.5 | 1.3 |
| SW1991/55 | 75 | nd | nd | 0.066 | 1.3 | 0.34 | 0.21 | 0.08 | 1.4 | 2.1 | 0.14 | 0.93 | 3 | 2.4 |
| **L. acutus** | | | | | | | | | | | | | | |
| SW1989/88B | 77 | 0.074 | nd | 0.14 | 1.2 | 0.085 | 0.33 | 0.083 | 3 | 0.098 | 0.24 | 1.2 | 3.1 | 0.78 |
| **S. coeruleoalba** | | | | | | | | | | | | | | |
| SW1991/26 | 56 | nd | nd | 0.061 | 0.47 | 0.027 | 0.14 | 0.028 | 1.2 | 0.62 | 0.16 | 0.67 | 1.7 | 0.67 |
| **T. truncatus** | | | | | | | | | | | | | | |
| SW1991/42 | 68 | nd | nd | nd | 2.5 | 0.089 | 0.9 | nd | 2.6 | 0.99 | 0.62 | 3.9 | 9.4 | 1.5 |
| SW1991/115 | 57 | nd | nd | nd | 0.35 | 0.16 | 0.07 | 0.06 | 0.41 | 0.79 | 0.2 | 0.31 | 0.88 | 0.91 |
| **P. phocoena** | | | | | | | | | | | | | | |
| IC1990/1 | 84 | nd | nd | nd | 0.42 | nd | 0.099 | nd | nd | 0.61 | nd | 0.39 | 1.2 | 0.61 |
| IC1990/2 | 73 | nd | nd | nd | 0.059 | nd | 0.011 | nd | nd | 0.027 | nd | 0.044 | 0.15 | 0.036 |
| IC1990/3 | 70 | nd | nd | nd | 0.48 | 0.15 | 0.12 | nd | nd | 0.96 | nd | 0.56 | 1.6 | 0.97 |
| IC1990/4 | 93 | nd | nd | nd | 0.26 | nd | nd | nd | nd | 0.23 | nd | 0.21 | 0.68 | 0.36 |
| IC1991/2 | 62 | 0.017 | nd | 0.026 | 0.19 | 0.085 | 0.064 | 0.029 | 0.39 | 0.37 | 0.15 | 0.17 | 0.57 | 0.56 |
| SMRU90-01 | 86 | nd | nd | nd | 0.53 | 0.064 | 0.054 | nd | 0.76 | 0.12 | 0.11 | 0.23 | 0.92 | 0.26 |
| SMRU90-04 | 93 | nd | nd | nd | 0.16 | 0.11 | nd | nd | 0.22 | 0.28 | 0.14 | 0.11 | 0.34 | 0.28 |
| SMRU90-02 | 89 | nd | nd | nd | 0.014 | nd | nd | nd | nd | 0.015 | nd | 0.01 | 0.028 | 0.014 |
| SMRU90-03 | 82 | nd | nd | nd | 0.47 | 0.071 | 0.068 | nd | 0.64 | 0.089 | 0.087 | 0.23 | 0.88 | 0.18 |
| SMRU90-05 | 87 | nd | nd | nd | 0.42 | nd | nd | nd | nd | 0.42 | nd | 0.22 | 0.65 | 0.25 |
| SMRU90-06 | 89 | nd | nd | nd | 0.38 | nd | nd | nd | nd | 0.38 | nd | 0.21 | 0.69 | 0.27 |
| SMRU90-07 | 83 | nd | nd | nd | 0.007 | nd | nd | nd | nd | 0.008 | nd | 0.006 | 0.017 | 0.006 |
| SMRU90-08 | 91 | nd | nd | nd | 0.37 | nd | nd | nd | nd | 0.44 | nd | 0.22 | 0.64 | 0.35 |
| SMRU90-09 | 87 | nd | nd | nd | 0.4 | nd | nd | nd | nd | 0.55 | nd | 0.28 | 0.85 | 0.44 |
| SMRU90-10 | 72 | nd | nd | nd | 0.18 | 0.09 | 0.042 | nd | 0.3 | 0.076 | nd | 0.11 | 0.33 | 0.15 |
| SMRU90-11 | 90 | nd | nd | nd | 0.008 | nd | nd | nd | nd | 0.009 | nd | 0.004 | 0.014 | 0.007 |
| SMRU90-12 | 87 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd |
| SMRU90-13 | 76 | nd | nd | nd | 0.35 | nd | nd | nd | nd | nd | nd | 0.21 | 0.74 | 0.28 |
| SMRU90-14 | 89 | nd | nd | nd | 0.51 | 0.076 | 0.09 | nd | nd | 0.67 | nd | 0.3 | 0.9 | 0.56 |
| SMRU90-15 | 92 | nd | nd | nd | 0.65 | nd | nd | nd | nd | nd | nd | 0.32 | 1 | 0.2 |

***Table 8. (continued)***

| Reference No. | %HEL | CB18 | CB31 | CB28 | CB52 | CB49 | CB47 | CB44 | CB66 | CB101 | CB110 | CB151 | CB149 | CB118 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P. phocoena** | | | | | | | | | | | | | | |
| SMRU90-16 | 91 | nd | nd | nd | 0.02 | nd | nd | nd | nd | 0.017 | nd | 0.01 | 0.03 | 0.01 |
| SMRU90-17 | 87 | nd | nd | nd | 0.93 | nd | nd | nd | nd | nd | nd | 0.5 | 1.8 | 0.29 |
| SMRU90-18 | 93 | nd | nd | nd | 1 | nd | nd | nd | nd | nd | nd | 0.58 | 2.1 | 0.33 |
| SMRU90-19 | 89 | nd | nd | nd | 0.74 | nd | nd | nd | nd | nd | nd | 0.35 | 1.1 | 0.3 |
| SMRU90-51 | 93 | nd | nd | nd | 0.27 | 0.12 | 0.081 | 0.049 | 0.42 | 0.5 | 0.2 | 0.49 | 1.4 | 0.65 |
| SMRU90-55 | 85 | 0.067 | nd | nd | 3.6 | 0.26 | 0.52 | 0.074 | 5.7 | 1.7 | 0.85 | 2.4 | 7.8 | 2.7 |
| SMRU90-60 | 92 | nd | nd | nd | 0.008 | nd | nd | nd | nd | 0.011 | nd | 0.004 | 0.015 | 0.007 |
| SMRU90-61 | 89 | nd | nd | nd | 0.88 | nd | 0.11 | nd | nd | nd | nd | 0.58 | 2.3 | 0.34 |
| SMRU90-75 | 93 | nd | nd | nd | 0.75 | 0.14 | 0.12 | nd | 1.3 | 0.35 | 0.11 | 0.44 | 1.4 | 0.43 |
| SMRU90-76 | 89 | nd | nd | nd | 0.93 | 0.092 | 0.15 | nd | nd | 0.86 | nd | 0.66 | 2.2 | 0.49 |
| SW1990/39 | 92 | nd | nd | nd | 0.52 | 0.09 | 0.14 | nd | nd | 0.5 | nd | 0.7 | 2.3 | 0.75 |
| SW1990/50 | 95 | nd | nd | nd | 0.36 | nd | 0.11 | nd | nd | 0.27 | nd | 0.41 | 1.3 | 0.46 |
| SW1990/50A | 79 | nd | nd | nd | 0.74 | nd | 0.08 | nd | nd | 0.27 | nd | 0.29 | 1.2 | 0.34 |
| SW1990/51(1) | 78 | nd | nd | nd | nd | 0.092 | nd | nd | 0.088 | 0.089 | nd | 0.09 | 0.23 | 0.16 |
| SW1990/51(2) | 70 | nd | nd | nd | nd | 0.088 | nd | nd | 0.085 | 0.078 | nd | 0.063 | 0.18 | 0.14 |
| SW1990/54 | 64 | 0.03 | nd | nd | 0.53 | 0.16 | 0.14 | 0.054 | 1.3 | 1 | 0.24 | 0.72 | 2.2 | 1.3 |
| SW1990/65 | 76 | nd | nd | nd | 1.7 | 0.09 | 0.25 | nd | nd | 0.84 | nd | 1 | 3.6 | 0.85 |
| SW1990/66 | 85 | nd | nd | nd | 0.75 | 0.089 | 0.18 | nd | nd | 0.83 | 1.2 | 0.77 | 2.6 | 1.5 |
| SW1990/71 | 88 | nd | nd | nd | 0.06 | 0.066 | nd | nd | 0.1 | 0.073 | nd | 0.075 | 0.25 | 0.12 |
| SW1990/72 | 81 | 0.06 | nd | nd | 0.6 | 0.096 | 0.15 | nd | 0.94 | 0.43 | 0.23 | 0.76 | 2.7 | 0.67 |
| SW1990/72A | 88 | nd | nd | nd | 0.19 | 0.094 | 0.057 | nd | 0.28 | 0.3 | 0.12 | 0.22 | 0.76 | 0.48 |
| SW1990/73 | 71 | 0.046 | nd | nd | 1.2 | 0.084 | 0.2 | 0.035 | 2.1 | 0.51 | 0.3 | 0.84 | 3 | 0.91 |
| SW1990/77B | 85 | 0.046 | nd | nd | 1.5 | 0.065 | 0.21 | 0.042 | 3.1 | 0.39 | 0.48 | 1.8 | 4.7 | nd |
| SW1990/79 | 87 | nd | nd | nd | 0.18 | 0.092 | 0.047 | nd | 0.25 | 0.26 | 0.085 | 0.13 | 0.44 | 0.33 |
| SW1990/84 | 91 | nd | nd | nd | 1.3 | 0.12 | 0.12 | nd | 1.3 | 0.26 | 0.26 | 0.71 | 3.1 | 0.44 |
| SW1990/92 | 83 | nd | nd | nd | 0.012 | nd | nd | nd | nd | 0.015 | 0.005 | 0.013 | 0.037 | 0.019 |
| SW1990/94 | 75 | 0.03 | nd | nd | 1 | 0.07 | 0.12 | 0.04 | 1.7 | 0.37 | 0.24 | 0.77 | 2.6 | 0.5 |
| SW1990/96 | 85 | 0.07 | 0.028 | nd | 2.1 | 0.888 | 0.26 | 0.059 | 3.2 | 0.51 | 0.64 | 2.1 | 8 | 1.5 |
| SW1990/98 | 85 | nd | nd | nd | 0.089 | 0.007 | 0.014 | nd | nd | 0.056 | 0.006 | 0.066 | 0.19 | 0.064 |
| SW1990/100 | 76 | nd | nd | nd | 0.057 | 0.003 | 0.009 | nd | nd | 0.03 | nd | 0.043 | 0.14 | 0.039 |
| SW1990/100A | 89 | nd | nd | nd | 0.9 | 0.1 | 0.14 | nd | 0.94 | 0.58 | 0.12 | 0.5 | 1.7 | 0.8 |
| SW1990/106 | 76 | 0.061 | nd | nd | 0.89 | 0.19 | 0.23 | 0.042 | 1.6 | 1.3 | 0.39 | 1 | 3 | 2 |
| SW1990/107 | 87 | nd | nd | nd | 0.15 | nd | nd | nd | nd | 0.25 | nd | 0.26 | 0.67 | 0.3 |
| SW1990/109 | 89 | 0.27 | 0.021 | nd | 0.48 | 0.067 | 0.12 | 0.032 | 1.1 | 0.35 | 0.22 | 0.75 | 2.5 | 0.91 |
| SW1990/111 | 93 | nd | nd | nd | 0.007 | nd | nd | nd | nd | 0.012 | nd | 0.013 | 0.033 | 0.015 |
| SMRU91-06 | 92 | nd | nd | nd | 0.15 | 0.072 | 0.034 | nd | 0.28 | 0.18 | 0.036 | 0.11 | 0.39 | 0.18 |
| SMRU91-08 | 90 | nd | nd | nd | 0.03 | 0.032 | nd | nd | 0.083 | 0.059 | 0.026 | 0.039 | 0.12 | 0.09 |
| SMRU91-15 | 92 | 0.027 | nd | 0.015 | 0.73 | 0.08 | 0.13 | 0.019 | 1.2 | 0.43 | 0.16 | 0.53 | 1.9 | 0.77 |
| SMRU91-07 | 93 | nd | nd | nd | 0.13 | 0.042 | 0.028 | nd | 0.23 | 0.13 | 0.034 | 0.13 | 0.45 | 0.18 |
| SW1991/14 | 64 | 0.097 | 0.036 | nd | 2.8 | 0.14 | 0.29 | 0.08 | 3.8 | 0.81 | 0.82 | 2.8 | 9.6 | 1.5 |
| SW1991/17 | 89 | 0.058 | nd | nd | 2 | 0.091 | 0.18 | 0.038 | 2.8 | 0.43 | 0.4 | 1.3 | 5.1 | 0.62 |
| SW1991/17A | 87 | 0.056 | nd | nd | 1.8 | 0.086 | 0.21 | 0.034 | 2.4 | 0.47 | 0.4 | 1.1 | 4.2 | 0.75 |
| SW1991/19A | 90 | 0.053 | nd | 0.027 | 1.6 | 0.092 | 0.16 | 0.32 | 2.3 | 0.37 | 0.34 | 1.1 | 4 | 0.059 |
| SW1991/19B | 89 | 0.021 | nd | nd | 0.28 | 0.052 | 0.065 | 0.021 | 0.67 | 0.29 | 0.13 | 0.45 | 1.4 | 0.56 |
| SW1991/20 | 87 | 0.033 | nd | nd | 0.53 | 0.076 | 0.1 | 0.018 | 0.93 | 0.47 | 0.13 | 0.44 | 1.5 | 0.6 |
| SW1991/22 | 85 | 0.016 | nd | nd | 0.77 | 0.049 | 0.081 | nd | 1.2 | 0.18 | 0.19 | 0.57 | 2.1 | 0.28 |
| SW1991/23 | 86 | 0.058 | nd | nd | 2.6 | 0.13 | 0.34 | 0.027 | 3.7 | 1 | 0.51 | 1.8 | 6 | 1.2 |
| SW1991/24 | 91 | 0.065 | nd | 0.027 | 1.7 | 0.17 | 0.22 | 0.037 | 2.4 | 0.52 | 0.4 | 1.2 | 4.3 | 0.77 |
| SW1991/28 | 89 | nd | nd | nd | 0.39 | 0.071 | 0.058 | nd | 0.61 | 0.21 | 0.063 | 0.22 | 0.73 | 0.32 |
| SW1991/29 | 88 | 0.016 | nd | 0.022 | 0.63 | 0.059 | 0.077 | nd | 0.86 | 0.24 | 0.083 | 0.3 | 1.1 | 0.37 |
| SW1991/30 | 92 | 0.018 | nd | 0.038 | 0.22 | 0.074 | 0.051 | nd | 0.52 | 0.36 | 0.063 | 0.21 | 0.72 | 0.42 |
| SW1991/31 | 87 | 0.027 | nd | nd | 1.1 | 0.11 | 0.19 | 0.022 | 2.2 | 0.7 | 0.35 | 1.3 | 4.2 | 1.3 |
| SW1991/32A | 91 | nd | nd | nd | 0.23 | 0.037 | 0.054 | 0.019 | 0.52 | 0.22 | 0.099 | 0.34 | 1 | 0.47 |
| SW1991/35 | 74 | nd | nd | nd | 0.22 | 0.13 | 0.059 | nd | 0.36 | 0.31 | 0.064 | 0.19 | 0.49 | 0.58 |
| SW1991/36 | 93 | 0.03 | nd | nd | 0.46 | 0.072 | 0.11 | 0.021 | 0.86 | 0.34 | 0.15 | 0.4 | 1.2 | 0.57 |
| SW1991/43 | 88 | nd | nd | nd | 0.11 | 0.039 | 0.028 | 0.016 | 0.19 | 0.16 | 0.055 | 0.09 | 0.24 | 0.24 |
| SW1991/48 | 86 | nd | nd | nd | 0.21 | nd | nd | nd | nd | 0.34 | nd | 0.27 | 0.77 | 0.46 |
| SW1991/54 | 90 | nd | nd | nd | 0.58 | 0.15 | 0.12 | nd | 0.68 | 0.97 | 0.14 | 0.6 | 1.8 | 1.1 |
| SW1991/59 | 77 | nd | nd | nd | 0.18 | 0.2 | 0.059 | nd | 0.48 | 0.43 | 0.22 | 0.17 | 0.59 | 0.47 |
| SW1991/61 | 52 | nd | nd | nd | nd | 0.13 | nd | nd | 0.29 | 0.2 | nd | nd | 0.39 | nd |
| SW1991/63 | 75 | nd | nd | nd | 0.46 | 0.046 | 0.085 | 0.02 | 0.76 | 0.25 | 0.094 | 0.26 | 0.86 | 0.32 |
| SW1991/70 | 92 | nd | nd | nd | 0.46 | 0.05 | 0.076 | nd | 0.79 | 0.27 | 0.24 | 0.68 | 1.9 | 0.79 |
| SW1991/71 | 81 | 0.031 | nd | 0.032 | 0.55 | 0.1 | 0.14 | 0.026 | 1 | 0.63 | 0.17 | 0.54 | 1.7 | 1.1 |
| SW1991/73 | 53 | nd | nd | nd | 0.27 | 0.19 | 0.078 | 0.04 | 0.62 | 0.54 | 0.2 | 0.24 | 0.83 | 0.51 |
| SW1991/74 | 77 | nd | nd | nd | 0.084 | 0.096 | 0.04 | nd | nd | 0.21 | 0.14 | 0.14 | 0.46 | 0.3 |
| SW1991/95 | 84 | nd | nd | nd | 0.54 | 0.075 | 0.12 | 0.022 | 0.93 | 0.49 | 0.16 | 0.54 | 1.7 | 0.81 |
| SW1991/100 | 62 | 0.018 | nd | nd | 0.45 | 0.033 | 0.062 | nd | 0.67 | 0.16 | 0.078 | 0.22 | 0.86 | 0.2 |
| SW1991/104 | 86 | 0.045 | nd | nd | 2.4 | 0.17 | 0.37 | 0.027 | 3.7 | 0.79 | 0.53 | 1.8 | 5.9 | 1.3 |
| SW1991/111 | 86 | nd | nd | nd | 0.48 | 0.1 | 0.09 | 0.04 | 0.72 | 1.1 | 0.17 | 1 | 3.2 | 1.3 |
| SW1991/112 | 90 | 0.027 | nd | nd | 2.1 | 0.064 | 0.26 | 0.018 | 2.5 | 0.37 | 0.44 | 1.2 | 5.1 | 0.69 |
| SW1991/116 | 82 | nd | nd | nd | 0.81 | 0.15 | 0.15 | nd | 1.4 | 0.29 | 0.25 | 0.71 | 2.5 | 0.58 |
| SW1991/117A | 85 | 0.045 | nd | 0.028 | 0.34 | 0.088 | 0.064 | 0.036 | 0.65 | 0.37 | 0.061 | 0.2 | 0.52 | 0.42 |
| SW1991/120 | 73 | nd | nd | nd | 2.3 | 0.28 | 0.32 | nd | 3.1 | 0.74 | 0.61 | 1.7 | 6.8 | 1.4 |
| SW1991/128 | 92 | nd | nd | nd | 0.27 | 0.059 | 0.049 | nd | 0.52 | 0.22 | 0.063 | 0.2 | 0.66 | 0.34 |
| SW1991/135 | 73 | 0.036 | nd | nd | 0.87 | 0.13 | 0.19 | 0.03 | 1.1 | 0.44 | 0.13 | 0.5 | 1.7 | 0.71 |
| SW1991/136 | 82 | nd | nd | nd | 2.4 | 0.071 | 0.19 | nd | 3 | 0.37 | 0.79 | 1.6 | 8.1 | nd |
| SW1991/142 | 83 | nd | nd | nd | 0.13 | 0.05 | 0.04 | nd | 0.26 | 0.16 | 0.066 | 0.19 | 0.62 | 0.27 |
| SW1992/7 | 88 | nd | nd | nd | 0.51 | 0.064 | 0.086 | nd | nd | 0.18 | 0.14 | 0.43 | 1.4 | 0.43 |

***Table 9. Concentrations of chlorobiphenyl congeners in blubber (mg kg$^{-1}$ wet weight)***

| Reference No. | %HEL | CB153 | CB105 | CB141 | CB138 | CB158 | CB187 | CB183 | CB128 | CB156 | CB180 | CB170 | CB194 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **H. grypus** | | | | | | | | | | | | | |
| SS1991/23 | 41 | 17.8 | 0.37 | 0.047 | 11.5 | 0.27 | 5 | 2.4 | 1.2 | 1 | 8.2 | 3.7 | 1 |
| **D. delphis** | | | | | | | | | | | | | |
| SMRU90-73 | 91 | 1.5 | 0.22 | nd | 1.4 | 0.075 | 0.66 | 0.23 | 0.23 | 0.13 | 0.72 | 0.3 | 0.046 |
| IC1990/4 | 85 | 10.8 | 1.4 | 0.067 | 8.8 | 0.47 | 3.6 | 1.3 | 1.3 | 0.88 | 4.4 | 2.2 | 0.32 |
| IC1991/1 | 75 | 0.49 | nd | 0.01 | 0.43 | 0.031 | 0.21 | 0.068 | 0.055 | nd | 0.2 | 0.1 | 0.02 |
| SW1990/5A | 71 | 5.4 | nd | 0.16 | 4.6 | 0.27 | 2.3 | 0.78 | 0.65 | 0.21 | 2.4 | 1.2 | 0.14 |
| SW1990/20A | 55 | 7.7 | 0.86 | 0.05 | 5.6 | 0.27 | 2.8 | 0.97 | 0.62 | 0.59 | 3.4 | 1.3 | 1.27 |
| SW1990/45 | 75 | 1.7 | nd | 0.06 | 1.6 | 0.1 | 0.84 | 0.23 | 0.25 | 0.06 | 0.57 | 0.24 | 0.043 |
| SW1990/46 | 90 | 2.4 | 0.31 | 0.19 | 2 | 0.16 | 0.65 | 0.25 | 0.32 | 0.18 | 0.7 | 0.3 | 0.038 |
| SW1990/47 | 82 | 0.91 | 0.14 | 0.09 | 0.73 | 0.076 | 0.29 | 0.11 | 0.11 | 0.055 | 0.29 | 0.12 | 0.031 |
| SW1990/68 | 85 | 19.4 | nd | nd | 17.2 | 0.97 | 6.9 | 2.5 | 2.6 | nd | 3.8 | 7.3 | 0.6 |
| SW1990/78 | 86 | 18.9 | 2.3 | 0.093 | 15.5 | 0.83 | 6.4 | 2.6 | 2.4 | 1.6 | 8.4 | 4 | 0.67 |
| SW1990/81 | 82 | 0.48 | nd | 0.015 | 0.46 | 0.032 | 0.19 | 0.059 | 0.06 | 0.023 | 0.16 | 0.086 | 0.012 |
| SW1990/87 | 88 | 5.3 | nd | 0.22 | 4.2 | 0.22 | 1.9 | 0.6 | 0.54 | 0.22 | 2 | 0.9 | 0.14 |
| SW1990/88 | 78 | 3.2 | 0.41 | 0.083 | 2.8 | 0.17 | 0.73 | 0.29 | 0.41 | 0.23 | 1 | 0.46 | 0.055 |
| SW1990/97 | 79 | 16.9 | 2.6 | 0.16 | 14.6 | 0.85 | 4.7 | 1.7 | 2.3 | 1.2 | 5.2 | 2.6 | 0.27 |
| SW1990/101 | 82 | 7.7 | 1 | 0.11 | 6.1 | 0.32 | 2.6 | 0.89 | 0.8 | 0.61 | 3.1 | 1.4 | 0.22 |
| SW1990/102 | 82 | 7.3 | 0.97 | 0.11 | 5.6 | 0.29 | 2.4 | 0.86 | 0.74 | 0.58 | 2.9 | 1.3 | 0.21 |
| SW1990/103 | 80 | 11.8 | 1.4 | 0.08 | 9.6 | 0.5 | 3.8 | 1.4 | 1.1 | 0.89 | 4.5 | 2.1 | 0.26 |
| SW1990/104 | 80 | 7.9 | 1 | 0.15 | 6.1 | 0.3 | 2.5 | 0.85 | 0.63 | 0.59 | 2.8 | 1.2 | 1.17 |
| SW1990/108 | 91 | 8.1 | 1.1 | 0.043 | 6.7 | 0.33 | 2.7 | 1 | 0.91 | 0.66 | 3.7 | 1.6 | 0.26 |
| SW1991/7 | 87 | 1.1 | 0.12 | 0.051 | 0.77 | 0.038 | 0.58 | 0.2 | 0.082 | 0.13 | 0.77 | 0.29 | 0.13 |
| SW1991/10 | 86 | 12.7 | nd | nd | 12.2 | 0.85 | 4.7 | 1.5 | 2.4 | nd | 3.9 | 2.2 | 0.23 |
| SW1991/37 | 78 | 7.4 | 1.4 | nd | 6 | 0.31 | 2.7 | 0.77 | 0.95 | 0.57 | 2.3 | 1.1 | 0.17 |
| SW1991/83 | 90 | 1.8 | 0.089 | 0.077 | 1.2 | 0.063 | 0.88 | 0.29 | 0.18 | 0.12 | 1 | 0.41 | 0.2 |
| SW1991/137 | 76 | 4.8 | 0.79 | 0.1 | 3.7 | 0.22 | 2 | 0.77 | 0.48 | 0.53 | 2.7 | 1.2 | 0.21 |
| SW1992/1 | 82 | 17 | 1.2 | 0.11 | 14 | 0.72 | 5.7 | 1.9 | 2.2 | 0.72 | 5.5 | 2.6 | 0.38 |
| SW1992/2 | 80 | 7.9 | 0.68 | 0.077 | 6.6 | 0.33 | 2.7 | 0.87 | 1 | 0.34 | 2.5 | 1.2 | 0.18 |
| SW1992/3 | 84 | 11 | 0.88 | 0.11 | 9.1 | 0.49 | 3.9 | 1.3 | 1.5 | 0.49 | 3.6 | 1.7 | 0.27 |
| SW1992/4 | 84 | 8.5 | 0.68 | 0.05 | 6.9 | 0.34 | 3 | 0.98 | 1 | 0.38 | 2.9 | 1.3 | 0.26 |
| SW1992/10 | 92 | 9.2 | 0.69 | 0.093 | 7.2 | 0.34 | 3.3 | 1 | 1 | 0.4 | 3.3 | 1.4 | 0.23 |
| SW1992/11 | 88 | 4.2 | 0.28 | 0.12 | 3.1 | 0.15 | 1.4 | 0.41 | 0.49 | 0.18 | 1.4 | 0.64 | 0.09 |
| SW1992/12 | 64 | 8.1 | 0.44 | 0.025 | 5.8 | 0.27 | 3.1 | 1 | 0.77 | 0.35 | 3.3 | 1.4 | 0.31 |
| SW1992/14(1) | 90 | 4.7 | 0.35 | 0.029 | 3.5 | 0.17 | 1.6 | 0.52 | 0.51 | 0.21 | 1.7 | 0.78 | 0.12 |
| SW1992/14(2) | 92 | 3.3 | 0.27 | 0.06 | 2.4 | 0.12 | 1.2 | 0.39 | 0.36 | 0.15 | 1.3 | 0.52 | 0.09 |
| SW1992/19(1) | 84 | 3.3 | 0.21 | 0.07 | 2.6 | 0.13 | 1.1 | 0.38 | 0.4 | 0.16 | 1.1 | 0.54 | 0.076 |
| SW1992/19(2) | 86 | 4.8 | 0.4 | 0.035 | 3.8 | 0.19 | 1.5 | 0.53 | 0.57 | 0.2 | 1.6 | 0.72 | 0.097 |
| **G. griseus** | | | | | | | | | | | | | |
| SW1990/70 | 88 | 2.5 | 0.19 | 0.06 | 2.1 | 0.11 | 0.7 | 0.25 | 0.25 | 0.13 | 0.92 | 0.36 | 0.06 |
| **G. melas** | | | | | | | | | | | | | |
| SW1990/88A | 84 | 11.4 | nd | nd | 9.4 | 0.48 | 4.4 | 1.5 | 0.13 | nd | 4.8 | 2.2 | 0.35 |
| SW1991/55 | 75 | 5.4 | 0.51 | 0.11 | 4.3 | 0.27 | 1.6 | 0.64 | 0.63 | 0.26 | 2.2 | 0.86 | 0.16 |
| **L. acutus** | | | | | | | | | | | | | |
| SW1989/88B | 77 | 5.2 | 1.2 | 0.076 | 4.5 | 0.22 | 1.6 | 0.55 | 0.7 | 0.33 | 1.6 | 0.68 | 0.075 |
| **S. coeruleoalba** | | | | | | | | | | | | | |
| SW1991/26 | 56 | 3.6 | 0.65 | 0.058 | 3.1 | 0.17 | 1.3 | 0.5 | 0.47 | 0.33 | 1.6 | 0.71 | 0.13 |
| **T. truncatus** | | | | | | | | | | | | | |
| SW1991/42 | 68 | 31.5 | 1.5 | 0.067 | 21.5 | 1.4 | 10.8 | 4.4 | 3.2 | 1.5 | 14.1 | 5.2 | 1.6 |
| SW1991/115 | 57 | 2.4 | 0.22 | 0.08 | 1.7 | 0.1 | 0.63 | 0.23 | 0.26 | 0.11 | 0.72 | 0.3 | 0.049 |
| **P. phocoena** | | | | | | | | | | | | | |
| IC1990/1 | 84 | 1.5 | 1.3 | 0.087 | 1.3 | 0.087 | 0.53 | 0.16 | 0.17 | 0.21 | 0.44 | 0.21 | 0.032 |
| IC1990/2 | 73 | 0.36 | nd | nd | 0.31 | 0.022 | 0.14 | 0.047 | 0.031 | nd | 0.13 | 0.063 | 0.012 |
| IC1990/3 | 70 | 3.6 | nd | 0.17 | 3.1 | 0.17 | 1.4 | 0.4 | 0.41 | nd | 1.3 | 0.59 | 0.1 |
| IC1990/4 | 93 | 1.9 | nd | nd | 1.6 | 0.1 | 0.82 | 0.26 | 0.22 | nd | 0.82 | 0.37 | 0.096 |
| IC1991/2 | 62 | 1.6 | 0.22 | 0.06 | 1.3 | 0.078 | 0.39 | 0.14 | 0.18 | 0.12 | 0.41 | 0.18 | 0.035 |
| SMRU90-01 | 86 | 2.8 | 0.38 | nd | 2.1 | 1.2 | 0.75 | 0.3 | 0.16 | 0.17 | 0.87 | 0.39 | 0.067 |
| SMRU90-04 | 93 | 0.68 | 0.092 | 0.038 | 0.58 | nd | 0.17 | 0.05 | 0.08 | 0.07 | 0.18 | 0.064 | nd |
| SMRU90-02 | 89 | 0.059 | 0.006 | nd | 0.048 | 0.003 | 0.022 | 0.006 | 0.005 | nd | 0.019 | 0.008 | 0.001 |
| SMRU90-03 | 82 | 2.3 | 0.33 | nd | 1.8 | 0.11 | 0.69 | 0.26 | 0.12 | 0.16 | 0.73 | 0.35 | 0.055 |
| SMRU90-05 | 87 | 1.4 | nd | nd | 1.3 | 0.07 | 0.41 | 0.14 | 0.13 | nd | 0.34 | 0.17 | nd |
| SMRU90-06 | 89 | 1.3 | nd | nd | 1 | nd | 0.37 | 0.11 | 0.11 | nd | 0.28 | 0.14 | nd |
| SMRU90-07 | 83 | 0.041 | nd | nd | 0.032 | 0.002 | 0.017 | 0.005 | 0.003 | nd | 0.015 | 0.006 | 0.001 |
| SMRU90-08 | 91 | 1.4 | nd | nd | 1.2 | 0.069 | 0.46 | 0.14 | 0.13 | nd | 0.39 | 0.18 | 0.027 |
| SMRU90-09 | 87 | 1.5 | nd | nd | 1.3 | 0.07 | 0.54 | 0.14 | 0.16 | nd | 0.39 | 0.18 | 0.024 |
| SMRU90-10 | 72 | 0.9 | 0.14 | nd | 0.77 | nd | 0.21 | 0.085 | 0.087 | nd | 0.26 | 0.13 | nd |
| SMRU90-11 | 90 | 0.031 | nd | nd | 0.024 | nd | 0.009 | 0.003 | 0.003 | nd | 0.007 | 0.003 | nd |
| SMRU90-12 | 87 | 0.27 | nd | nd | 0.22 | nd | nd | nd | nd | nd | 0.16 | nd | nd |
| SMRU90-13 | 76 | 1.4 | nd | nd | 1 | nd | 0.42 | nd | nd | nd | 0.35 | 0.15 | nd |
| SMRU90-14 | 89 | 1.8 | nd | nd | 1.6 | 0.09 | 0.57 | 0.18 | 0.2 | nd | 0.48 | 0.23 | 0.033 |
| SMRU90-15 | 92 | 2.3 | nd | nd | 1.7 | 0.095 | 0.64 | 0.23 | 0.1 | nd | 0.66 | 0.29 | 0.047 |
| SMRU90-16 | 91 | 0.063 | nd | nd | 0.053 | 0.003 | 0.021 | 0.006 | 0.005 | nd | 0.017 | 0.008 | 0.001 |

***Table 9. (continued)***

| Reference No. | %HEL | CB153 | CB105 | CB141 | CB138 | CB158 | CB187 | CB183 | CB128 | CB156 | CB180 | CB170 | CB194 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **P.phocoena** | | | | | | | | | | | | | |
| SMRU90-17 | 87 | 3.5 | nd | nd | 2.8 | 0.14 | 1.1 | 0.34 | 0.18 | nd | 0.93 | 0.43 | 0.065 |
| SMRU90-18 | 93 | 4.1 | nd | nd | 3.4 | 0.17 | 1.2 | 0.4 | 0.2 | nd | 1.1 | 0.5 | 0.072 |
| SMRU90-19 | 89 | 2.5 | nd | nd | 1.9 | 0.11 | 0.67 | 0.24 | 0.13 | nd | 0.68 | 0.31 | 0.048 |
| SMRU90-51 | 93 | 4.5 | 0.34 | 0.08 | 3.7 | 0.17 | 3 | 0.98 | 0.43 | 0.42 | 3.3 | 1.6 | 0.38 |
| SMRU90-55 | 85 | 16.6 | 3.2 | 0.27 | 13.9 | 0.96 | 4.3 | 1.7 | 1.5 | 1.4 | 4.8 | 2.3 | 0.29 |
| SMRU90-60 | 92 | 0.03 | nd | nd | 0.023 | nd | 0.009 | nd | 0.003 | nd | 0.006 | 0.003 | nd |
| SMRU90-61 | 89 | 4.4 | nd | nd | 3.5 | 0.21 | 1.6 | 0.64 | 0.23 | nd | 1.5 | 0.68 | 0.11 |
| SMRU90-75 | 93 | 2.7 | 0.58 | nd | 2 | 0.13 | 0.75 | 0.25 | 0.21 | 0.17 | 0.73 | 0.3 | 0.041 |
| SMRU90-76 | 89 | 3.6 | nd | nd | 2.8 | 0.2 | 1.2 | 0.41 | 0.27 | nd | 1 | 0.46 | 0.072 |
| SW1990/39 | 92 | 4 | nd | nd | 3.4 | 0.21 | 2 | 0.71 | 0.38 | nd | 1.8 | 0.89 | 0.18 |
| SW1990/50 | 95 | 3.8 | nd | nd | 3.3 | 0.22 | 1.7 | 0.68 | 0.41 | nd | 1.8 | 0.88 | 0.21 |
| SW1990/50A | 79 | 2.7 | nd | nd | 2.2 | 0.14 | 0.68 | 0.23 | 0.18 | nd | 0.62 | 0.29 | nd |
| SW1990/51(1) | 78 | 0.87 | 0.052 | 0.093 | 0.75 | 0.038 | 0.87 | 0.3 | 0.1 | 0.18 | 1.2 | 0.39 | 0.29 |
| SW1990/51(2) | 70 | 0.54 | 0.043 | 0.036 | 0.45 | nd | 0.19 | 0.061 | 0.064 | 0.042 | 0.23 | 0.091 | 0.021 |
| SW1990/54 | 64 | 4.5 | 0.86 | 0.16 | 3.7 | 0.22 | 1.5 | 0.51 | 0.53 | 0.36 | 1.5 | 0.66 | 0.11 |
| SW1990/65 | 76 | 8.8 | nd | nd | 7.6 | 0.52 | 3.6 | 1.2 | 0.77 | nd | 3.4 | 1.8 | 0.36 |
| SW1990/66 | 85 | 6 | nd | nd | 4.9 | 0.28 | 2 | 0.67 | 0.61 | nd | 2 | 0.94 | 0.16 |
| SW1990/71 | 88 | 0.79 | 0.063 | 0.047 | 0.65 | 0.037 | 0.3 | 0.11 | 0.062 | 0.055 | 0.37 | 0.13 | 0.034 |
| SW1990/72 | 81 | 7.7 | 0.82 | 0.063 | 6.4 | 0.34 | 3.6 | 1.2 | 0.68 | 0.51 | 3.2 | 1.5 | 0.22 |
| SW1990/72A | 88 | 2.5 | 0.19 | 0.06 | 2.1 | 0.11 | 0.7 | 0.25 | 0.25 | 0.13 | 0.92 | 0.36 | 0.06 |
| SW1990/73 | 71 | 7.3 | 1.2 | 0.093 | 6 | 0.41 | 1.7 | 0.81 | 0.65 | 0.6 | 2.2 | 0.99 | 0.12 |
| SW1990/77B | 85 | 11.7 | 1.9 | 0.071 | 9.8 | 0.49 | 5.2 | 1.8 | 1.1 | 1.4 | 4.5 | 2.2 | 0.4 |
| SW1990/79 | 87 | 0.96 | 0.12 | 0.032 | 0.84 | 0.043 | 0.25 | 0.087 | 0.11 | 0.048 | 0.27 | 0.1 | 0.016 |
| SW1990/84 | 91 | 7.5 | 0.8 | 0.38 | 6.4 | 0.25 | 2.4 | 0.69 | 0.4 | 0.34 | 2 | 0.97 | 0.12 |
| SW1990/92 | 83 | 0.058 | nd | nd | 0.051 | 0.003 | 0.04 | 0.012 | 0.006 | nd | 0.035 | 0.016 | 0.009 |
| SW1990/94 | 75 | 5.4 | 0.96 | 0.03 | 4.3 | 0.24 | 2 | 0.63 | 0.33 | 0.43 | 1.7 | 0.8 | 0.17 |
| SW1990/96 | 85 | 18.6 | 2.6 | 0.08 | 14.2 | 0.79 | 5.7 | 2.3 | 1.2 | 1.5 | 6.8 | 3.3 | 0.48 |
| SW1990/98 | 85 | 0.42 | nd | nd | 0.36 | 0.023 | 0.14 | 0.044 | 0.033 | nd | 0.12 | 0.066 | 0.007 |
| SW1990/100 | 76 | 0.31 | nd | nd | 0.27 | 0.017 | 0.11 | 0.034 | 0.026 | nd | 0.096 | 0.05 | 0.007 |
| SW1990/100A | 89 | 3.7 | 0.45 | 0.042 | 3.3 | 0.16 | 0.91 | 0.27 | 0.33 | 0.13 | 0.84 | 0.36 | 0.036 |
| SW1990/106 | 76 | 8.2 | 1 | 0.18 | 6.5 | 0.38 | 2 | 0.79 | 0.92 | 0.58 | 2.3 | 1.1 | 0.17 |
| SW1990/107 | 87 | 1.6 | nd | nd | 1.5 | 0.08 | 1.1 | 0.34 | 0.16 | nd | 0.99 | 0.47 | 0.18 |
| SW1990/109 | 89 | 6.1 | 0.85 | 0.056 | 4.5 | 0.22 | 1.8 | 0.59 | 0.48 | 0.43 | 1.9 | 0.87 | 0.11 |
| SW1990/111 | 93 | 0.084 | nd | nd | 0.076 | 0.004 | 0.056 | 0.017 | 0.007 | nd | 0.05 | 0.024 | 0.009 |
| SMRU91-06 | 92 | 0.89 | 0.14 | nd | 0.76 | 0.025 | 0.27 | 0.082 | 0.079 | 0.067 | 0.22 | 0.096 | 0.025 |
| SMRU91-08 | 90 | 0.42 | 0.053 | nd | 0.31 | nd | 0.18 | 0.069 | 0.035 | 0.05 | 0.23 | 0.091 | 0.028 |
| SMRU91-15 | 92 | 5.2 | 0.68 | 0.046 | 5 | 0.22 | 1.4 | 0.47 | 0.38 | 0.34 | 1.4 | 0.59 | 0.097 |
| SMRU91-07 | 93 | 1.1 | 0.12 | nd | 0.77 | 0.039 | 0.34 | 0.11 | 0.049 | 0.074 | 0.33 | 0.13 | 0.21 |
| SW1991/14 | 64 | 22.1 | nd | 0.1 | 17.4 | 0.88 | 7.2 | 2.8 | 1.1 | 1.8 | 8.1 | 3.9 | 0.65 |
| SW1991/17 | 89 | 10.4 | nd | 0.036 | 8.2 | 0.36 | 3 | 1 | 0.53 | 0.69 | 2.5 | 1.2 | 0.17 |
| SW1991/17A | 87 | 7.6 | 1.5 | 0.034 | 6 | 0.29 | 1.9 | 0.56 | 0.51 | 0.47 | 1.5 | 0.84 | 0.081 |
| SW1991/19A | 90 | 8 | nd | 0.027 | 6.2 | 0.3 | 2.2 | 0.71 | 0.44 | 0.52 | 1.9 | 0.87 | 0.12 |
| SW1991/19B | 89 | 3.3 | 0.52 | 0.05 | 2.6 | 0.15 | 1.1 | 0.37 | 0.29 | 0.26 | 1.1 | 0.5 | 0.075 |
| SW1991/20 | 87 | 2.6 | 0.57 | 0.046 | 2.3 | 0.11 | 0.78 | 0.22 | 0.3 | 0.18 | 0.61 | 0.29 | 0.033 |
| SW1991/22 | 85 | 4.9 | nd | nd | 3.8 | 0.16 | 1.5 | 0.51 | 0.2 | 0.34 | 1.4 | 0.6 | 0.11 |
| SW1991/23 | 86 | 13.1 | 1.9 | 0.055 | 10 | 0.41 | 2.7 | 0.72 | 0.79 | 0.59 | 2.1 | 0.95 | 0.087 |
| SW1991/24 | 91 | 8.8 | 1.6 | 0.038 | 7.4 | 0.33 | 2.5 | 0.79 | 0.55 | 0.59 | 2.2 | 1.1 | 0.14 |
| SW1991/28 | 89 | 1.7 | 0.29 | 0.017 | 1.3 | 0.069 | 0.42 | 0.14 | 0.14 | 0.092 | 0.038 | 0.16 | 0.019 |
| SW1991/29 | 88 | 2.4 | 0.43 | 0.019 | 2.1 | 0.099 | 0.51 | 0.16 | 0.18 | 0.14 | 0.46 | 0.22 | 0.023 |
| SW1991/30 | 92 | 1.6 | 0.29 | 0.036 | 1.2 | 0.057 | 0.41 | 0.12 | 0.15 | 0.1 | 0.35 | 0.16 | 0.024 |
| SW1991/31 | 87 | 9.8 | 1.4 | 0.049 | 7.8 | 0.35 | 2.4 | 0.67 | 0.69 | 0.52 | 2.1 | 1 | 0.11 |
| SW1991/32A | 91 | 2.6 | 0.39 | 0.04 | 1.9 | 0.1 | 0.86 | 0.28 | 0.22 | 0.2 | 0.95 | 0.42 | 0.065 |
| SW1991/35 | 74 | 1.9 | 0.21 | 0.025 | 1.6 | 0.065 | 0.35 | 0.099 | 0.24 | 0.098 | 0.3 | 0.15 | 0.015 |
| SW1991/36 | 93 | 2.5 | 0.51 | 0.031 | 2.2 | 0.11 | 0.73 | 0.21 | 0.29 | 0.19 | 0.63 | 0.35 | 0.072 |
| SW1991/43 | 88 | 0.7 | 0.1 | 0.02 | 0.6 | 0.034 | 0.21 | 0.82 | 0.098 | 0.053 | 0.24 | 0.12 | 0.024 |
| SW1991/48 | 86 | 2 | nd | nd | 1.7 | 0.076 | 0.9 | 0.27 | 0.21 | nd | 0.77 | 0.39 | 0.13 |
| SW1991/54 | 90 | 4.1 | 0.39 | 0.097 | 3.2 | 0.15 | 1.2 | 0.34 | 0.41 | 0.16 | 1 | 0.47 | 0.08 |
| SW1991/59 | 77 | 1.1 | 0.26 | 0.04 | 0.86 | 0.045 | 0.23 | 0.063 | 0.14 | 0.056 | 0.21 | 0.1 | nd |
| SW1991/61 | 52 | 0.75 | 0.16 | nd | 0.56 | nd | 0.3 | nd | nd | nd | 0.27 | nd | nd |
| SW1991/63 | 75 | 1.9 | 0.35 | 0.029 | 1.4 | 0.11 | 0.44 | 0.18 | 0.15 | 0.12 | 0.48 | 0.22 | 0.028 |
| SW1991/70 | 92 | 7.5 | 0.72 | 0.018 | 6.4 | 0.2 | 2 | 0.41 | 0.42 | 0.45 | 1.2 | 0.69 | 0.075 |
| SW1991/71 | 81 | 4 | 0.69 | 0.1 | 3.5 | 0.22 | 1.3 | 0.46 | 0.49 | 0.34 | 1.5 | 0.66 | 0.11 |
| SW1991/73 | 53 | 1.9 | 0.33 | 0.067 | 1.4 | 0.094 | 0.48 | 0.17 | 0.19 | 0.13 | 0.53 | 0.22 | 0.029 |
| SW1991/74 | 77 | 1 | 0.19 | 0.052 | 0.82 | 0.059 | 0.38 | 0.15 | 0.14 | 0.11 | 0.46 | 0.18 | 0.034 |
| SW1991/95 | 84 | 4 | 0.53 | 0.04 | 3.1 | 0.17 | 1.1 | 0.36 | 0.37 | 0.24 | 1.2 | 0.49 | 0.08 |
| SW1991/100 | 62 | 1.8 | 0.36 | 0.016 | 1.4 | 0.097 | 0.36 | 0.15 | 0.14 | 0.11 | 0.38 | 0.17 | 0.02 |
| SW1991/104 | 86 | 12.8 | 2.2 | 0.065 | 10.8 | 0.7 | 4.3 | 1.6 | 0.93 | 1 | 4.4 | 1.9 | 0.36 |
| SW1991/111 | 86 | 7 | 0.53 | 0.01 | 5.2 | 0.25 | 2.9 | 1 | 0.71 | 0.35 | 3.9 | 1.5 | 0.28 |
| SW1991/112 | 90 | 14.5 | 1.4 | 0.036 | 10.5 | 0.62 | 4.6 | 1.7 | 0.43 | 1.1 | 4.7 | 2.1 | 0.35 |
| SW1991/116 | 82 | 6.4 | 0.93 | 0.033 | 5.1 | 0.3 | 2.1 | 0.72 | 0.45 | 0.51 | 2.2 | 0.94 | 0.16 |
| SW1991/117A | 85 | 0.9 | 0.23 | 0.044 | 0.8 | 0.046 | 0.26 | 0.092 | 0.12 | 0.057 | 0.27 | 0.12 | 0.014 |
| SW1991/120 | 73 | 16.7 | 2 | 0.09 | 12.8 | 0.64 | 4.2 | 1.4 | 1.1 | 0.86 | 4.3 | 1.9 | 0.25 |
| SW1991/128 | 92 | 1.8 | 0.28 | 0.015 | 1.4 | 0.067 | 0.42 | 0.14 | 0.15 | 0.11 | 0.43 | 0.18 | 0.032 |
| SW1991/135 | 73 | 4 | 0.64 | 0.37 | 3.4 | 0.19 | 1.2 | 0.4 | 0.36 | 0.23 | 1 | 0.44 | 0.079 |
| SW1991/136 | 82 | 23.5 | 2.7 | 0.051 | 17.2 | 0.89 | 8.2 | 3.7 | 0.93 | 1.8 | 9.4 | 4 | 0.89 |
| SW1991/142 | 83 | 1.8 | 0.21 | 0.025 | 1.4 | 0.063 | 0.68 | 0.24 | 0.15 | 0.15 | 0.69 | 0.31 | 0.055 |
| SW1992/7 | 88 | 4.4 | 0.49 | nd | 3.4 | 0.17 | 1.3 | 0.51 | 0.3 | 0.32 | 1.5 | 0.65 | 0.13 |

***Table 10. Concentrations of organochlorine compounds in stomach contents of common dolphins (mg kg$^{-1}$ wet weight)***

| Reference No. | %HEL | ICES 7 CBs | Total 25 CBs | HCB | $\alpha$-HCH | $\gamma$-HCH | p,p'-DDE | p,p'-DDT | p,p'-TDE | Dieldrin |
|---|---|---|---|---|---|---|---|---|---|---|
| **D. delphis** | | | | | | | | | | |
| SW1992/2 | 8 | 0.024 | 0.059 | nd | 0.005 | 0.001 | 0.009 | 0.007 | 0.017 | 0.007 |
| SW1992/4 | 5 | 0.025 | 0.046 | 0.002 | 0.004 | 0.001 | 0.006 | 0.006 | 0.01 | 0.006 |
| SW1992/19(1) | 18 | 0.111 | 0.24 | 0.01 | 0.027 | 0.004 | 0.021 | nd | 0.037 | 0.042 |
| SW1992/19(2) | 3 | 0.017 | 0.038 | nd | nd | nd | 0.004 | 0.005 | 0.003 | 0.005 |
| SW1992/20 | 2 | 0.013 | 0.029 | nd | nd | nd | 0.005 | 0.003 | 0.01 | 0.01 |

| Reference No. | %HEL | CB18 | CB31 | CB28 | CB52 | CB49 | CB47 | CB44 | CB66 | CB101 | CB110 | CB151 | CB149 | CB118 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D. delphis** | | | | | | | | | | | | | | |
| SW1992/2 | 8 | nd | nd | nd | nd | 0.023 | nd | nd | nd | 0.002 | nd | nd | 0.004 | 0.002 |
| SW1992/4 | 5 | nd | nd | nd | nd | 0.007 | nd | nd | nd | 0.002 | 0.003 | 0.001 | 0.004 | 0.003 |
| SW1992/19(1) | 18 | nd | nd | nd | nd | 0.053 | nd | nd | nd | nd | 0.012 | 0.007 | 0.018 | 0.013 |
| SW1992/19(2) | 3 | nd | nd | nd | nd | 0.012 | nd | nd | nd | nd | nd | nd | 0.003 | 0.002 |
| SW1992/20 | 2 | nd | nd | nd | nd | 0.011 | nd | nd | nd | nd | nd | nd | 0.002 | 0.002 |

| Reference No. | %HEL | CB153 | CB105 | CB141 | CB138 | CB158 | CB187 | CB183 | CB128 | CB156 | CB180 | CB170 | CB194 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **D. delphis** | | | | | | | | | | | | | |
| SW1992/2 | 8 | 0.01 | 0.001 | 0.001 | 0.007 | nd | 0.004 | nd | nd | nd | 0.003 | 0.002 | nd |
| SW1992/4 | 5 | 0.01 | nd | nd | 0.007 | nd | 0.003 | nd | 0.001 | nd | 0.003 | 0.002 | nd |
| SW1992/19(1) | 18 | 0.05 | 0.005 | nd | 0.031 | nd | 0.016 | 0.005 | 0.005 | nd | 0.017 | 0.008 | nd |
| SW1992/19(2) | 3 | 0.007 | 0.001 | nd | 0.005 | nd | 0.003 | nd | 0.001 | nd | 0.003 | 0.001 | nd |
| SW1992/20 | 2 | 0.005 | nd | nd | 0.004 | nd | 0.002 | nd | nd | nd | 0.002 | 0.001 | nd |

This programme has also created the largest dataset to date on contaminants in marine mammal tissues collected using a single set of analytical methodology. Comparisons between individuals can therefore be made without the usual caveats concerning comparability of concentrations determined in different laboratories and by different methods (Wagemann and Muir, 1984; Law *et al.*, 1989(a) and (b)). Because both detailed pathological data and tissue contaminant concentrations were available from the same individuals, it was possible to investigate possible relationships between tissue levels of environmental contaminants and a number of pathological conditions. No evidence was found that chlorinated hydrocarbons result in an increased susceptibility to infectious and parasitic diseases in harbour porpoises. Porpoises that died from an infectious or parasitic disease were in significantly poorer body condition than porpoises that died from acute physical trauma (Kuiken *et al*., 1994(b)). This may indicate that thinner porpoises are more susceptible to infections and parasitic diseases, or alternatively may reflect the fact that, once ill, animals lose appetite and so their body condition deteriorates. There was no correlation between blubber levels of chlorinated hydrocarbons and adrenocortical hyperplasia in harbour porpoises, but this lesion did occur in porpoises that died after prolonged illness (Kuiken *et al*., 1993).

These findings increase our knowledge of causes of disease and death in marine mammals, and contribute to a better understanding of the lesions found on postmortem examination and how they relate to environmental contamination. Among other things, this improves the diagnosis of causes of mortality in marine mammals. Marine mammals are subjected to a variety of potentially harmful factors in their environment, all of which can potentially interact with each other. To understand the effects they have on marine mammal populations, a multidisciplinary approach is essential. With this project we hope to have made a step in the right direction.

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## APPENDIX 1. Cetacean postmortem report form

# CETACEAN POSTMORTEM REPORT

SW NO.:................................. PM NO.: ................................. OTHER ID NO.: ............................

SPECIES: ..................................................................................... SEX: .............................................

LOCATION FOUND: ............................................................................. DATE FOUND: ................

FOUND BY (name, address): ..........................................................................................................

..................................................................................................................................................

PATHOLOGIST: ........................................................................... DATE OF PM: ..........................

FROZEN?: Y/N

**1. BASIC MEASUREMENTS**

BODY CONDITION USING CONDITION CODE:. . . . .

Condition code:

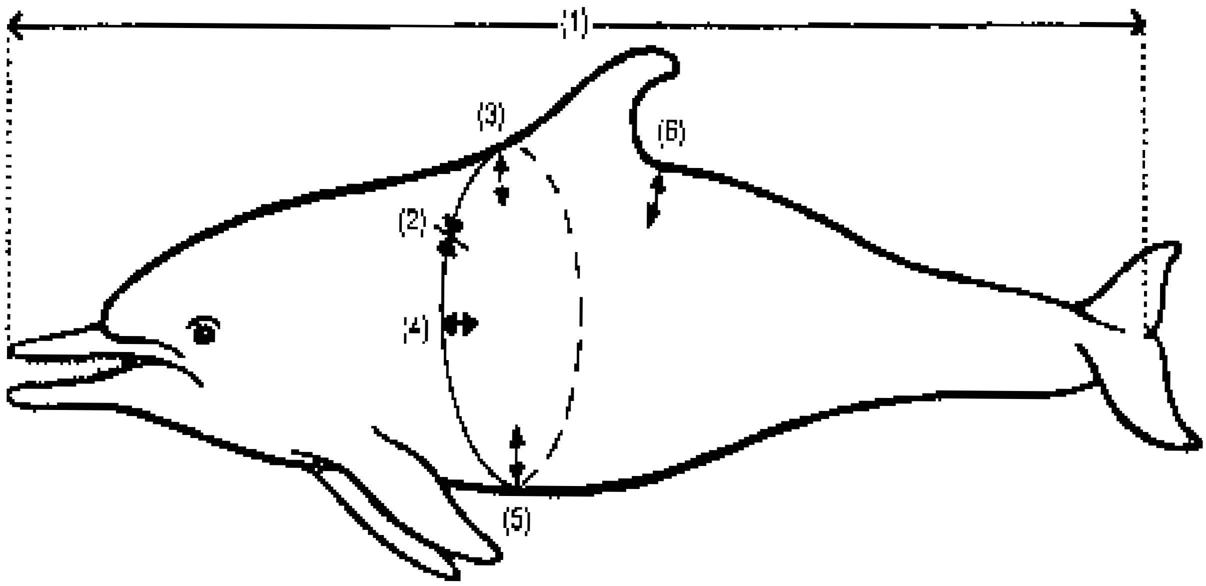
1) **live** (becomes code 2 at death)
2a) **extremely fresh** (as if just died, no bloating, meat is considered by most to be edible)
2b) **slight decomposition** (slight bloating, blood imbibition visible)
3) **moderate decomposition** (moderate bloating, skin peeling, penis may be extended in males, 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 carcase or skeletal remains, no organs present)

PHOTOGRAPHS TAKEN

| | |
|---|---|
| -lateral views whole body, both sides: | Y/N |
| -lateral views dorsal fin, both sides: | Y/N |
| -baleen whales: ventral view tail flukes: | Y/N |
| -other photographs (list): | |
| - | - |
| - | - |

BODY WEIGHT (kg):. . . . . .

LENGTH, GIRTH AND BLUBBER THICKNESS (see diagram below):
-tip upper jaw to tail notch (cm) (1):. . . . . .
-girth in front of dorsal fin (cm) (2):. . . . . .
-blubber thickness in front of dorsal fin:. . . . . .
-dorsal mid-line (mm) (3):. . . . . .
-lateral (mm) (4):. . . . . .
-ventral mid-line (mm) (5):. . . . . .
-blubber thickness behind dorsal fin:. . . . . .
-dorsal mid-line (mm) (6):. . . . . .



## 2. GROSS PATHOLOGICAL EXAMINATION

*Encircle the appropriate category:* *NE = not examined*
*NAD = nothing abnormal detected*
*A = abnormal (describe fully in section 5)*

**EXTERNAL EXAMINATION**

NE NAD A -body orifices
NE NAD A -fins and flukes
nutritional state: good / moderate / poor

**INTEGUMENT**

NE NAD A -epidermis
NE NAD A -blubber
NE NAD A -subcutaneous tissue
NE NAD A -mammary glands

**MUSCULOSKELETAL SYSTEM**

NE NAD A -skull
NE NAD A -other bones
NE NAD A -back muscle mass
NE NAD A -other muscles

**NERVOUS SYSTEM**

NE NAD A -brain
NE NAD A -spinal cord
NE NAD A -peripheral nerves

**CARDIOVASCULAR SYSTEM**

NE NAD A -pericardial sac
NE NAD A -myocardium
NE NAD A -valves
NE NAD A -arteries, veins

**RESPIRATORY SYSTEM**

NE NAD A -nasal cavity
NE NAD A -sinuses
NE NAD A -trachea, bronchi
NE NAD A -lungs
NE NAD A -pleura/pleural cavity

**ALIMENTARY SYSTEM**

NE NAD A -mouth
NE NAD A -oesophagus
NE NAD A -cardiac section stomach
NE NAD A -fundic section stomach
NE NAD A -pyloric section stomach
NE NAD A -intestine
NE NAD A -anus
NE NAD A -liver
NE NAD A -pancreas
NE NAD A -peritoneum/
peritoneal cavity

**UROGENITAL SYSTEM**

NE NAD A -kidneys
NE NAD A -ureters
NE NAD A -urinary bladder
NE NAD A -urethra
NE NAD A -ovaries/testes
NE NAD A -uterus
NE NAD A -vagina/penis
NE NAD A -vulva/preputium

**LYMPHATIC AND ENDOCRINE SYSTEMS**

NE NAD A -adrenal glands
NE NAD A -thyroid gland
NE NAD A -spleen
NE NAD A -thymus
NE NAD A -lymph nodes

## 3. CHECKLIST OF STANDARD SAMPLES

*In each square, enter:* ✓ *( = sample taken)*
*X ( = sample not taken or not present)*
*Record any* *extra* *samples taken in section 4.*

** = samples to collect and weights to measure, when possible, if condition code is 4 or 5*

Weights
left testis* (g):. . . . . .
right testis* (g):. . . . . .
heart* (g): . . . . . .
food remains cardiac section stomach* (g): . . . . . .

Ethanol

| | | |
|---|---|---|
| ☐ | food remains* from: . . . . . . / . . . . . . / . . . . . . | all |
| ☐ | parasites from: . . . . . . / . . . . . . / . . . . . . / . . . . . . / . . . . . . / . . . . . . / . . . . . . / . . . . . . / . . . . . . | pref. all |

Freeze at -20$^{0}$C

| | | |
|---|---|---|
| ☐ | blubber | 2 x 20g |
| ☐ | blubber (Phocoena) | 20g |
| ☐ | epidermis* | 4 cm$^2$ |
| ☐ | foetus/placenta | whole |
| ☐ | kidney | 2 x 20 g |
| ☐ | milk | up to 20 ml |
| ☐ | rib (fifth) | 15 cm |
| ☐ | scapula | whole |
| ☐ | serum (also hemolytic) | up to 20 ml |
| ☐ | skull* | whole |
| ☐ | teeth*(baleen plates)* | >4 (2) |
| ☐ | thymus | 1 cm$^3$ |

10% Formalin

| | | |
|---|---|---|
| ☐ | adrenal glands | both |
| ☐ | brain | whole |
| ☐ | heart | 1 $cm^3$ |
| ☐ | kidney | 1 $cm^3$ |
| ☐ | liver | 1 $cm^3$ |
| ☐ | lung | 4 x 1 $cm^3$ |
| ☐ | lung (for Kennedy) | 4 x 1 $cm^3$ |
| ☐ | mammary gland | 1 cm slice |
| ☐ | mesenteric ln. | 1 cm slice |
| ☐ | ovaries* | both |
| ☐ | pancreas | 1 $cm^3$ |
| ☐ | pulm. ass. ln. | 1 cm slice |
| ☐ | spleen | 1 $cm^3$ |
| ☐ | testes* | both/slices |
| ☐ | thymus | 1 $cm^3$ |

Bacteriology

| | | |
|---|---|---|
| ☐ | heart blood | - |
| ☐ | kidney | swab/block |
| ☐ | liver | swab/block |
| ☐ | lung | swab/block |

Virology (freeze at -70$^0$C

| | | |
|---|---|---|
| ☐ | brain | 1 $cm^3$ |
| ☐ | kidney | 1 $cm^3$ |
| ☐ | lung | 1 $cm^3$ |

## 4. LIST OF EXTRA SAMPLES

Extra samples of lesions taken for histological examination (list):

-
-
-
-
-
-

Extra samples of lesions taken for bacteriological examination (list):

-
-
-
-
-
-

Other extra samples taken (list):

-
-
-
-
-
-
-
-

**5. DESCRIPTION OF ABNORMALITIES GROSS PATHOLOGICAL EXAMINATION**
(add extra pages if necessary)

PRELIMINARY DIAGNOSIS OF GROSS PATHOLOGICAL EXAMINATION (in order of importance):

a.

b.

c.

d.

e.

**6. RESULTS OF HISTOLOGICAL EXAMINATION** (add extra pages if necessary)

## 7. RESULTS OF BACTERIOLOGICAL EXAMINATION

Heart blood: . . . . . .

Lung: . . . . . .

Liver: . . . . . .

Kidney: . . . . . .

Other: . . . . . .

. . . . . .

. . . . . .

## 8. MISCELLANEOUS RESULTS

## 9. FINAL DIAGNOSIS (in order of importance):

a.

b.

c.

d.

e.

# APPENDIX 2. Summary of results derived from the analysis of reference materials certified for trace metals (MAFF)

(a) Analyses conducted in 1991.
Units are mg $kg^{-1}$. Mean value ± one standard deviation given.

NRC* DOLT-1 Dogfish liver

| | MAFF value | (n) | Certified value |
|---|---|---|---|
| Cd | 3.90 ± 0.27 | 13 | 4.18 ± 0.28 |
| Cu | 18.5 ± 1.2 | 13 | 20.8 ± 1.2 |
| Hg | 0.25 ± 0.06 | 14 | 0.22 ± 0.03 |
| Zn | 86.4 ± 5.3 | 13 | 92.5 ± 2.3 |

*n = number of analyses*

NIST[§] 1566a Oyster tissue

| | MAFF value | (n) | Certified value |
|---|---|---|---|
| Hg | 0.06 ± 0.01 | 17 | 0.06 ± 0.01 |
| Cd | 3.8 ± 0.6 | 14 | 4.15 ± 0.38 |
| Cu | 60.0 ± 4.7 | 19 | 66.3 ± 4.3 |
| Zn | 810 ± 72 | 18 | 830 ± 57 |
| Ni | 1.85 ± 0.55 | 7 | 2.25 ± 0.44 |
| Cr | 1.95 ± 0.36 | 4 | 1.43 ± 0.46 |

NRC TORT-1 Lobster hepatopancreas

| | MAFF value | (n) | Certified Value |
|---|---|---|---|
| Pb | 10.3 ± 1.0 | 19 | 10.4 ± 2.0 |
| Zn | 168 ± 9.8 | 20 | 177 ± 10.0 |
| Hg | 0.34 ± 0.06 | 28 | 0.33 ± 0.06 |
| Cd | 24.1 ± 1.1 | 19 | 26.3 ± 2.1 |
| Cu | 408 ± 14 | 19 | 439 ± 22 |

NRC DORM-1 Dogfish muscle

| | MAFF value | (n) | Certified value |
|---|---|---|---|
| Cu | 4.97 ± 0.41 | 14 | 5.22 ± 0.30 |
| Hg | 0.63 ± 0.05 | 19 | 0.79 ± 0.07 |
| Zn | 19.2 ± 1.7 | 13 | 21.3 ± 1.0 |

IAEA[¶] MAA2/TM Fish muscle

| | MAFF value | (n) | Certified value |
|---|---|---|---|
| Cu | 3.85 ± 0.35 | 27 | 4.0 ± 0.10 |
| Hg | 0.41 ± 0.06 | 42 | 0.47 ± 0.02 |
| Zn | 30.8 ± 1.6 | 27 | 33.0 ± 1.0 |

Sources of CRMs :

* NRC - National Research Council, Canada
§ NIST - National Institute of Standards and Technology, USA
¶ IAEA - International Atomic Energy Agency, Monaco.

(b) Analyses conducted in 1992.
Units are mg $kg^{-1}$. Mean value ± one standard deviation given.

NBS 1566 a Oyster tissue

| | MAFF value | (n) | Certified value |
|---|---|---|---|
| Cd | 4.12 ± 0.28 | 37 | 4.15 ± 0.38 |
| Cu | 61.8 ± 3.3 | 36 | 66.3 ± 4.3 |
| Hg | 0.06 ± 0.01 | 39 | 0.06 ± 0.007 |
| Zn | 829 ± 53 | 37 | 830 ± 57 |
| Se | 2.29 ± 0.3 | 9 | 2.21 ± 0.24 |

NRC DOLT-1 Dogfish liver

| | MAFF value | (n) | Certified value |
|---|---|---|---|
| Hg | 0.24 ± 0.04 | 70 | 0.225 ± 0.037 |
| Cd | 4.31 ± 0.41 | 57 | 4.18 ± 0.28 |
| Cu | 19.3 ± 1.1 | 62 | 20.8 ± 1.2 |
| Zn | 85.2 ± 6.2 | 61 | 92.5 ± 2.3 |
| Pb | 1.18 ± 0.23 | 23 | 1.36 ± 0.29 |
| Se | 6.5 ± 0.4 | 12 | 7.34 ± 0.42 |

NRC TORT-1 Lobster hepatopancreas

| | MAFF value | (n) | Certified Value |
|---|---|---|---|
| Pb | 9.6 ± 13 | 21 | 10.4 ± 2.0 |
| Zn | 156 ± 10 | 16 | 177 ± 10.0 |
| Hg | 0.32 ± 0.06 | 17 | 0.33 ± 0.06 |
| Cd | 23.4 ± 1.6 | 19 | 26.3 ± 2.1 |
| Se | 6.36 ± 0.46 | 5 | 6.88 ± 0.47 |
| Cu | 390 ± 34 | 16 | 439 ± 22 |

NRC DORM-1 Dogfish muscle

| | MAFF value | (n) | Certified value |
|---|---|---|---|
| Cr | 3.12 ± 0.44 | 44 | 3.6 ± 0.40 |
| Cu | 5.12 ± 0.47 | 85 | 5.22 ± 0.30 |
| Hg | 0.69 ± 0.09 | 92 | 0.79 ± 0.07 |
| Zn | 19.2 ± 2.0 | 83 | 21.3 ± 1.00 |
| Pb | 0.35 ± 0.10 | 27 | 0.40 ± 0.12 |
| Se | 1.69 ± 0.28 | 17 | 1.62 ± 0.12 |