HANDBOOK ON OIL IMPACT ASSESSMENT

4.0 SPILL RESPONSE

4.1 Assessing the damage

Technical document

Condition manual: the physical condition of stranded seabirds

Like other homoeothermic ("warm-blooded") aquatic animals, such as seals and cetaceans, many seabirds have a thick layer of subcutaneous fat to help insulate them from the cold sea water. The primary barrier to cold, however, is the almost impervious layer of outer contour feathers that overlays a thick layer of extremely dense down feathers in species like divers, grebes, seaduck and auks. Oil ruins the structure of these feathers and water will leak through. Typically, slightly oiled seabirds will start preening and, by doing so, damage their plumage even more. The time spent on feather care comes at the expense of foraging time, and diving seabirds will refrain from going under water (i.e. cannot forage), since the water will penetrate the plumage, reach the skin and ultimately cause hypothermia. Severely oiled seabirds are promptly immobilised, may suffocate in the oil, and die virtually immediately. During the standard autopsy, an impression can be obtained of the physical condition of the seabirds affected, as an aid in describing the type of mortality (immediate, or delayed). This technical document provides guidelines for assessing the physical condition and the condition of some vital organs of seabirds.

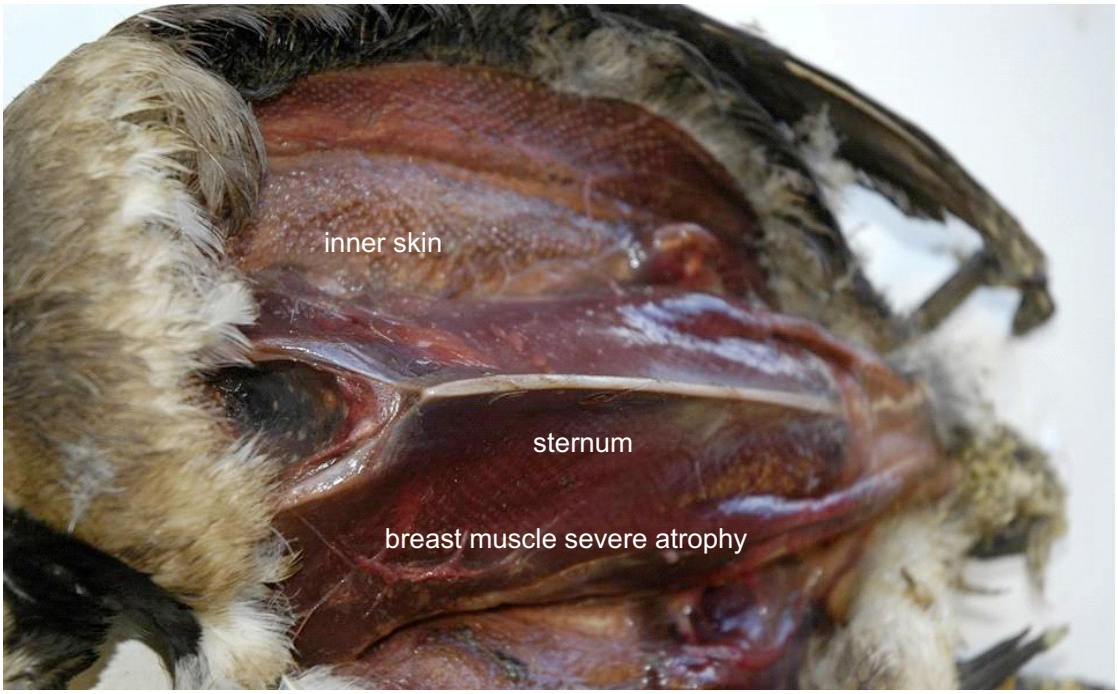

Figure 1. Sternum and breast muscle of a severely emaciated, partly oiled Common Guillemot *Uria aalge*.

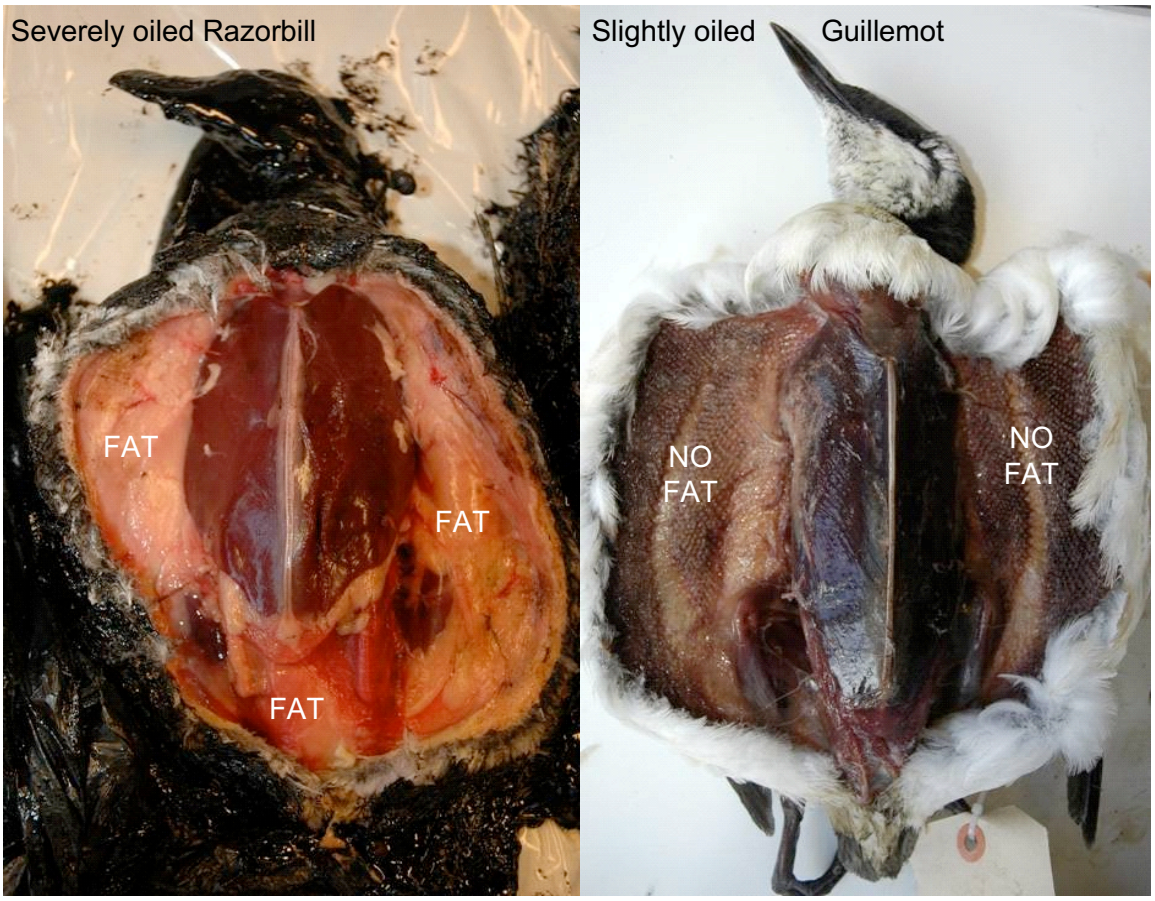

Figure 2. Subcutaneous fat stores, sternum and breast muscle of (a) a severely oiled and very fat (i.e. good condition) Razorbill *Alca* torda and (b) a partly oiled, severely emaciated (i.e. starved) Common Guillemot *Uria aalge*.

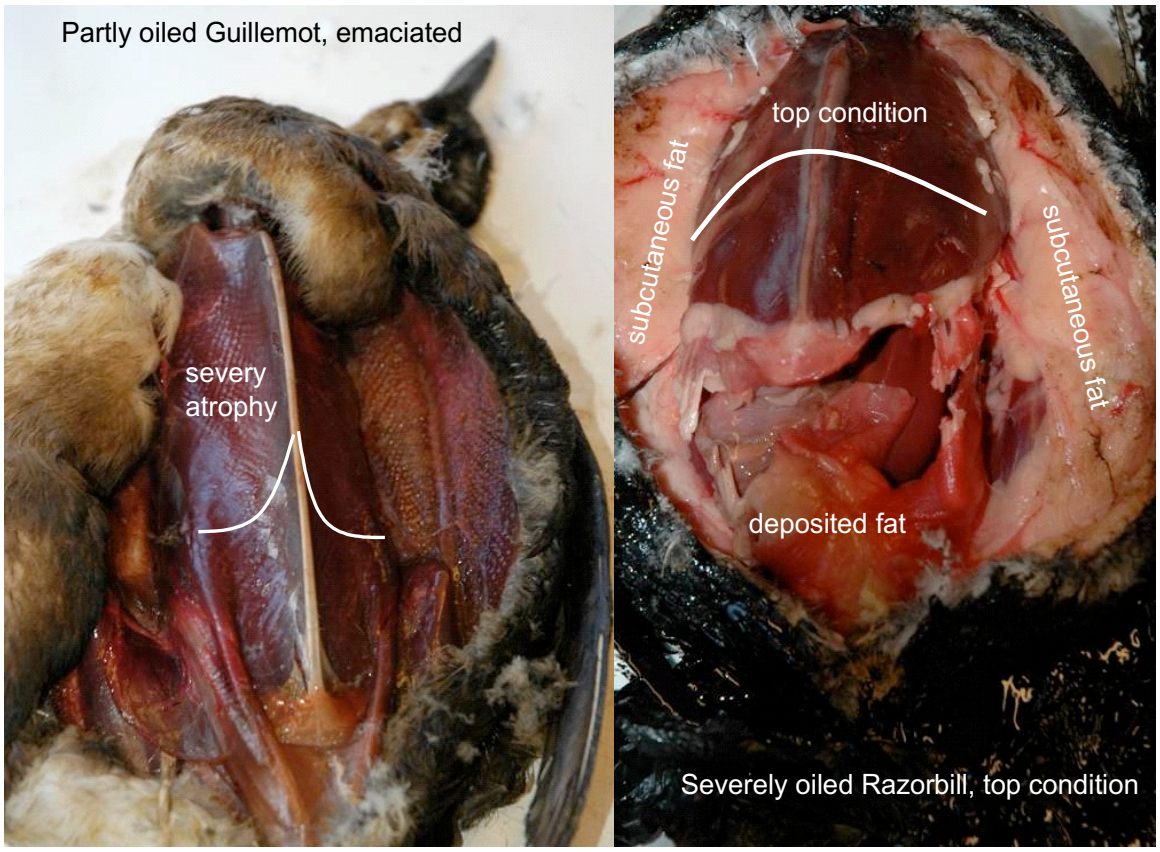

Figure 3. Breast muscle profiles of (a) a severely emaciated (i.e. starved) Common Guillemot *Uria aalge* and (b) a very fat (i.e. good condition) Razorbill *Alca* torda and (b).

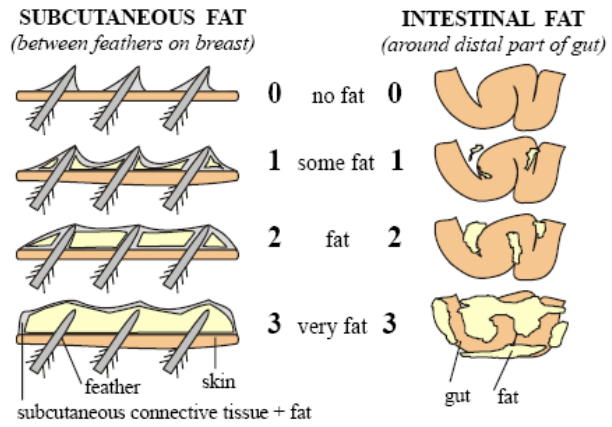

Figure 4. Fat deposit in stranded seabirds, scored according to a four-point scale (from Van Franeker 1983, 2004).

0 – no fat, feather quills clearly visible when the skin is opened during a standard autopsy (belly and breast skin are inspected), not a trace of fat between the intestines. See Fig. 2b for a clear example.

1 – some fat between the feather quills, scattered traces of fat in membranes between the intestines

2 – fat, feather quill tops just visible as little humps in the subcutaneous fat, intestines clearly visible but extensive fat stores between the loops

3 – very fat, feather quills invisible, intestines hidden in thick layers of fat. See Fig. 3b for a clear example.

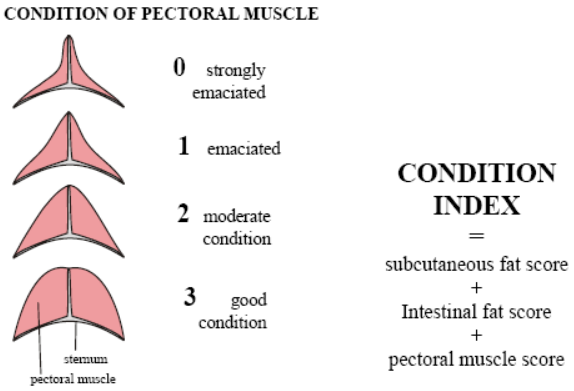

Figure 5. Breast muscle profiles and a suggested condition index based on fat score and pectoral muscle score (from Van Franeker 1983, 2004).

0 – breast muscle mostly gone. Sternum keel as a razor. See Fig. 3a for a clear example.

1 – breast muscle clearly concave

2 – breast muscle thick, but tip of sternum keel sticks out

3 – breast muscle very thick, sternum keel as a depression in the centre. See Fig. 3b for an example.

Fat score and condition index Birds in deteriorating body condition usually deplete their fat reserves first (subcutaneous and intestinal fat deposits disappear) and then start using proteins from muscles like the pectoral flight muscles (breast muscles). Figs. 4-5 illustrate how to score the various characters on a four-point scale (0-3) and how to calculate the overall condition index; examples of extreme cases are shown in Figs. 1-3. The condition index is based on the sum of scores of fat stores and breast muscles (0-9): score 0-1 = mortally emaciated; 2-3 critically emaciated; 4-6 moderate body condition; and 7-9 good body condition.

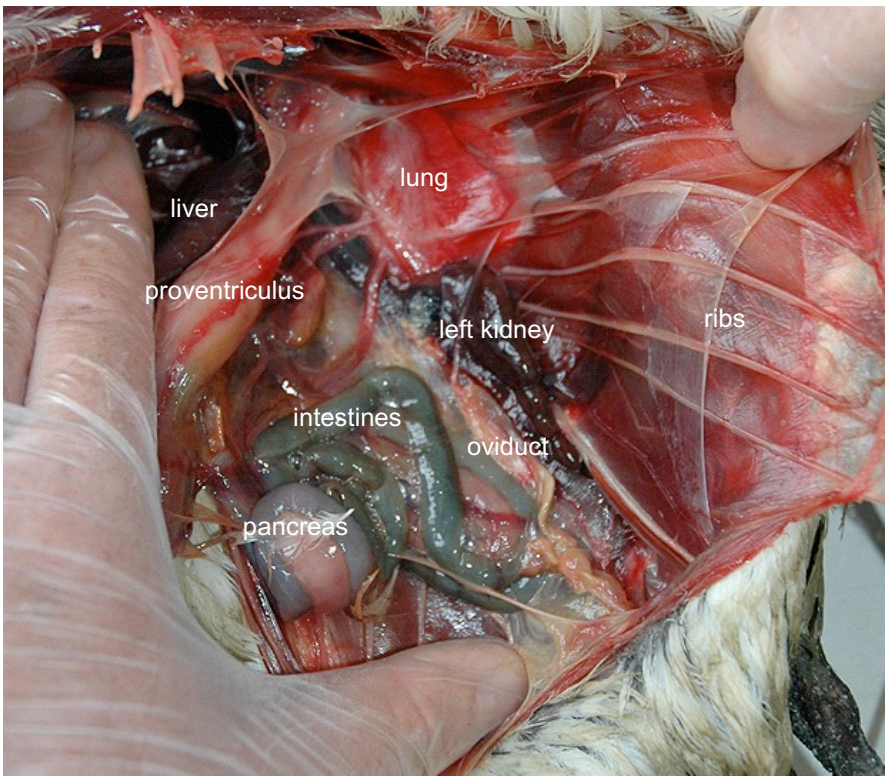

Fig. 6. Visual inspection of vital organs in the thoracic cavity by lifting the sternum (see methods of standard autopsy) and while pushing the stomach and liver to the left side.

- The pancreas should not be confused with deposited fat between the intestines.
- The illustrated intestines have a proper shape but are mal-arranged and greenish (inflammation).
- The illustrated lungs are reddish, suggesting some degree of pneumonia
- Kidney colour is fine, the organ is probably healthy
- Liver colour (barely visible) is fine, the organ is probably healthy

In this badly emaciated example, there is not a trace of fat deposited between the intestines.

Other organs Some animals found in oil spills are critically ill, and the oil may not have contributed much to their fate. On the other hand, pneumonia is often diagnosed in (slightly) oil contaminated seabirds that suffered from hypothermia. We suggest to record organ health from visual inspections using a simple four-point scoring system ranging from 0 for extremely poor health to 3 for good condition. Decay of corpses will complicate judgment of organ health: attempt to give a judgment as if the bird was 'fresh'. Health scores for different organs may assist in defining the cause of death or the duration of the dying process. They are not meant to describe the state of decay of the corpse. Descriptions here can not be exhaustive. Please use notes to describe situations not properly covered. Note that this simple methodology is indicative only, and useful when large numbers of casualties are to be dealt with within a short time-span; this method can never replace a proper assessment of the physical condition by a veterinarian or pathologist.

While lifting the sternum during a standard autopsy (Fig. 6), assessing the presence of deposited fat is the first observation (see Fig. 4 for coding system). The colour and condition of the **intestines** (or **gut**) can be evaluated at the same time. Healthy birds will show neatly arranged, pink intestines that are fairly firm when touched. Blood veins are visible as thin red lines, but there should not be any bleedings (red, purple or blackish areas). Do not confuse the *pancreas* (pinkish or greyish) with the presence of fat (yellowish; Fig. 6).

Normally, one will have to push aside the liver to get a proper look into the thoracic cavity. Examine the liver for whitish, reddish or blackish spots, the organ should be large, bi-lobed, supple and dark red all over. Decomposition of the corpse will quickly affect liver colour! Greenish livers are often associated with smelly carcasses.

Kidney lobes will be visible when the bird is sexed. As in the liver, dark red is the appropriate colour of the kidneys (uniform fleshy colour). Spotted, pale reddish, greyish or yellowish kidneys are indicative for disease.

Lateral and dorsal of the heart, the lungs can be seen. Healthy lungs are dry and bright pink. Bleedings will make the lungs reddish or even dark red. Oil may have filled the lungs and made them blackish. Foamy water should not be visible in the lungs, and parasite worms should either be absent or sparsely present.

Table 1. Four-point scales of organ health (0-3, ranging from poor condition to pristine), for visual inspections

Intestines (Guts)		
0	Heavily infected	nearly black, shriveled
1	Infected	dark green, loose, empty
2	Slightly or partly infected	(partly) greenish, loose
3	Pristine	nice pink with blood veins visible, neatly arranged, equally filled
Kidneys		
0	Degenerated, crumbly	hard structures in the organ, colour variable
1	Heavily spotted	white, red, or dark spots
2	Slightly spotted	white, red, or dark spots
3	Pristine	uniform fleshy colour
Liver		
0	Cancers or other hard parts	hard structures in the organ, colour variable
1	Heavily spotted	white, red, or dark spots
2	Slightly spotted	white, red, or dark spots
3	Pristine	uniform fleshy colour[1]
Lungs		
0	Heavily infected, filled with blood or oil	black or dark red
1	Infected	completely bright red, watery
2	Slightly or partly infected	partly red or reddish, watery
3	Pristine	completely pink and "dry"

!! [1]Corpses that are not fresh have their organs coloured greenish or blackish, despite the fact that they may have been OK when the bird died. In particular the liver gets a blackish wash all over at an early stage in the degeneration of the corpse. In case of great stink: do not try to record condition of liver from visual observations only.

Notes on (possible) cause of death Under notes, please specify what may have caused the death of the bird (proximate cause of death), integrating all aspects thus far recorded, plus aspects that may not have been covered in the descriptions on the record form. In many cases you will not be able to say more than 'killed in oil' or 'died from starvation' without a clear clue as to what triggered the deteriorating condition. However, in other cases you may suspect that for example a small amount of oil fouling, an injury, or internal problem is likely to have triggered

death directly or indirectly. In apparently healthy birds there may be indications of drowning, collision or other causes. In addition to descriptions, Van Franeker (2004) proposed a series of standard categories, listed below. Note that the category-listing is preliminary and not exhaustive.

Table 2. Suggested coding to log possible (proximate) causes of death in stranded seabirds (from Van Franeker 2004, modified)

Code	Proximate cause of death	Description
OIL	oil	(dark, mineral) in a quantity that you suspect to be directly or indirectly (via gradual loss of condition) related to the death of the bird
EXT	other external contaminant	likely to have contributed directly or indirectly to the death of the bird
SHO	wounded by shot	evidenced indirectly by damage to feathers or tissue or directly by shot in the bird
DRO	drowned	suspected in 'healthy birds' from: excellent plumage and condition, all organs healthy except for some fresh blood and or water in the lungs
ENT	entanglement	(not immediately drowned); entanglement as recorded by finder or still present on corpse. Broken limbs may be indicative for birds having been extracted from netting by force.
EUT	euthanised	bird euthanised in a rehabilitation center, or by the finder on the shoreline
HOO	hook	fishing hook with or without line fragment hooked into body, beak, or throat
COL	collision	as evidenced by for example fractures or internal bleedings
CEM	cement-cloaca	a hard stony ball may form in the cloacal area; these may grow to several cm diameter; please measure length and width in mm
GUT	other intestinal problems	e.g. extremely swollen gut (but no CEM); or holes in stomach wall;…
CAN	cancer	to a proportion likely to have contributed to death. Measure length and width of cancer tissue in mm
PLU	plumage problems	extreme wear to bare shafts of feathers following delayed or arrested moult; deformed feathers; absence of down; …….
STA	starvation without clear cause	many birds are emaciated but show no clear evidence of anything that triggered the start of the emaciation process

Logging data Autopsy forms supplied with this handbook were designed such that all data can be logged easily (Fig. 7). The fat scores and the condition of the breast muscle together should result in a condition index (avoid missing values in this set). Four organs can be described according to suggested coding, or by brief descriptions. A quick way of data logging is simply encircling the 0-3 codes for either entry, and the manual described what is meant with each of the codes used. For most necropsies, after some practice, there will be little doubt what to highlight and what to ignore. The main pitfall will be the assessment of organ health in decomposed carcasses. The liver will be among the first organs that cannot be reliably judged through a simple visible inspection. Be alert for internal bleedings, other than the ones described, for example caused by a collision or hard blows on the body (amateuristic euthanasia, windturbine collisions, etc.), parasitic infections, ulcers or cancers. All these extras may be recorded under 'Notes' (Fig. 7).

INTERNAL STUDY:	*Simply encircle the condition score according to the manual, and/or describe*				
subcutaneous fat:	*0*	*1*	*2*	*3*	remarks:
deposited fat:	*0*	*1*	*2*	*3*	remarks:
breast muscle:	*0*	*1*	*2*	*3*	remarks:
guts:	*0*	*1*	*2*	*3*	colour: remarks:
kidneys:	*0*	*1*	*2*	*3*	colour: remarks:
liver:	*0*	*1*	*2*	*3*	colour: remarks:
lungs:	*0*	*1*	*2*	*3*	colour: remarks:

Notes:

Proximate cause of death:

Figure 7. Detail of proposed autopsy form where data physical condition and state of some vital organs can be entered according protocols in this manual. All autopsy forms associated with this handbook will have these or very similar boxes included. Accurate descriptions can be added to the basic scores.

Instruments needed

Instruments needed are similar to those required for a standard autopsy. A shopping list is provided {autopsy shopping list}

Further reading

Borgsteede F.H.M. 1997. Parasitology of marine birds. In: Jauniaux T., Bouquegneau J.-M. & Coignoul F. (eds) Marine mammals, seabirds and pollution of marine systems: 91-108. Presses Fac. Médecine Vét. Univ. Liège, Liège.

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Dorrestein G.M. & M. van der Hage Marine bird necropsy findings In: Marine Mammals, Seabirds and Pollution of Marine Systems http://www.ulg.ac.be/fmv/patho/marine2.htm Accessed 7 Sep 2007

Abstract: The pattern of diseases found upon the necropsy of marine birds will be different depending on the origin of the bird (the wild or rehabilitation centre). The ratio of oiled/non-oiled birds and therefore the necropsy results will vary with the time of year and the species involved (coastal, estuarine or pelagic species). At necropsy one should be familiar with the anatomical peculiarities of the different marine species. The main reasons for a necropsy are to get valid information about the mortality cause and biological information about the species, to confirm a diagnosis, to check for an unsuccessful therapy, to enlarge knowledge, or simply to find out what is going on. The main problems/diseases/necropsies seen in marine birds at beach surveys are: acute and chronic oil pollution, chemical pollution, food shortage, entanglement, plastic ingestion, and infectious diseases (esp. parasites). In rehabilitation centres the main medical problems are related to management, dehydration, cloacal impaction, gizzard impaction, ulcers and bumblefood, corpora aliena, stress, viral infections (e.g. duck plague), bacterial infection (e.g. avian cholera, tuberculosis), fungal infections (e.g. aspergillosis), and parasitic infestation (worms and protozoans). The necropsies and the diagnoses are discussed.

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Friend M., McLean R.G. & Dein F.J. 2001. Disease emergence in birds: challenges for the twenty-first century. The Auk 118(2): 290-303.

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Skerratt L.F., Franson J.C., Meteyer C.U. & Holmén T.E. 2005. Causes of mortality in sea ducks (Mergini) necropsied at the USGS-National Wildlife Health Center. Waterbirds 28(2): 193-207.

Citation

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