

# Abnormal tailflukes in harbour porpoises *Phocoena phocoena* from The Netherlands (Mammalia: Cetacea, Odontoceti)

Kompanje, E.J.O. - Abnormal tailflukes in harbour porpoises *Phocoena phocoena* from The Netherlands (Mammalia: Cetacea, Odontoceti) - DEINSEA 4: 59-76 [ISSN 0923-9308]. Published 30 August 1998.

Twentyfour cases of harbour porpoises (*Phocoena phocoena*) with abnormally shaped tailflukes found dead along the coast of The Netherlands in the period 1934 - 1961 are described and discussed. The phenomenon is not known from elsewhere in the world and has not occurred earlier or later (as to 1998). Seven abnormal tails (shaped like a ribbon or a string) are kept in three natural history museums in The Netherlands. The other cases are well documented by photographs and/or detailed drawings. Both sources were studied. It is concluded that the abnormally shaped tailflukes are caused by extreme regeneration after manmade amputations of the flukes. Most probably, fishermen had cut off the tailflukes of bycatch porpoises and subsequently released the mutilated animals into the sea. All other causes, as given by Slijper (1936) and Van Deinse (1945), are considered highly unlikely.

*Abnormale staartflippers bij bruinvissen Phocoena phocoena van de Nederlandse kust* - Dit artikel beschrijft 24 bruinvissen met abnormale staartflippers die tussen 1934 en 1961 dood werden aangetroffen op de Nederlandse kust. Dit verschijnsel is tot op heden alleen van de Nederlandse kust bekend en alleen uit deze periode. Van de 24 gevallen worden zeven abnormale staarten bewaard in drie natuurhistorische musea in Nederland. Van de andere gevallen zijn foto's of gedetailleerde tekeningen bekend. Geconcludeerd wordt dat de abnormale staarten het gevolg zijn van extreme regeneratie na amputatie (door mensen) van de flippers. Zeven gevallen werden al eerder beschreven door Slijper (1936) en Van Deinse (1945). Als mogelijke oorzaken voor dit opmerkelijke fenomeen noemden zij (1) congenitaal teratologisch (aangeboren afwijking), (2) regeneratie na amputatie door een bootschroef, (3) regeneratie na beten van orka's, tuimelaars of andere bruinvissen, of (4) regeneratie nadat mensen de flippers hadden afgesneden. Deze verschillende opties worden in dit artikel kritisch gezien en op één na (4) als onwaarschijnlijk verworpen. Het zijn hoogstwaarschijnlijk vissers geweest die de staartflippers van bijvangst bruinvissen afsneden en de verminkte dieren levend terug in zee gooiden.

Correspondence: E.J.O. Kompanje, Natuurmuseum Rotterdam, P.O. Box 23452, NL-3001 KL Rotterdam, The Netherlands; e-mail [natuurmuseum@nrm.nl](mailto:natuurmuseum@nrm.nl)

Keywords: Cetacea, Odontoceti, harbour porpoise, *Phocoena phocoena*, tail flukes, amputation, regeneration, The Netherlands

## INTRODUCTION

In his thesis, Slijper (1936) described a harbour porpoise *Phocoena phocoena* (LINNAEUS, 1758) with bilateral abnormal tailflukes. He concluded that the cause of this phenomenon

was teratologic. Van Deinse (1945) described six other cases of a similar abnormality in this species. He concluded that these deformations were the result of extreme regeneration after traumatic amputation due to (1) a screwpro-

pellier, (2) the bites from killer whales *Orcinus orca*, (3) bites of bottlenose dolphins *Tursiops truncatus*, or bites of male harbour porpoises or (4) manmade cuts. Viergever (1947) follows Van Deinse suggesting the same possible causes. Between 1934 and 1961 24 harbour porpoises with such abnormal tailflukes were found on the Dutch coast. To the best of our knowledge, before or after this period no other cases have been described or have been collected. Besides, the phenomenon has only occurred in the Netherlands. This article describes all known cases of abnormal tail flukes in the harbour porpoise and critically reviews the possible causes as given by Slijper (1936) and Van Deinse (1945). It should be noted that without the interest of the Dutch cetologist dr A.B. van Deinse probably nothing was known of this interesting phenomenon (see Appendix 1).

## MATERIAL

A total of 24 cases of strandings of harbour porpoises with abnormal tailflukes can be traced in the Dutch stranding archives kept in the National Museum of Natural History (RMNH, Leiden, The Netherlands). Van Deinse (1962) lists a total of 25 cases, but of one of these cases no details could be traced in the RMNH-archives, the literature or in museum collections.

Seven of these deformed tails are preserved in fluid in three Natural History Museums in the Netherlands:

13-X-1935, RMNH 27300  
09-X-1936, RMNH 27302  
13-XI-1938, RMNH 27301  
26-VIII-1945, RMNH 7456  
24-IX-1947, RMNH 7426  
13-III-1949, NMR 999000169  
27-XI-1949, ZMA 1408

Photographs of seven cases (some of the complete animal on the beach) are kept in the archives of the National museum of Natural History, Leiden and the archives of the author:

10-X-1934  
13-X-1935  
03-X-1936  
09-X-1936  
21-VIII-1938  
13-XI-1938  
06-X-1946

Detailed drawings of six cases are also kept in the archives of the National museum of Natural history, Leiden:

13-X-1935  
03-X-1936  
09-X-1936  
04-VIII-1950  
21-II-1954  
07-X-1956

Museum acronyms are as follows: RMNH = Nationaal Natuurhistorisch Museum (National Museum of Natural History, formerly Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands; ZMA = Zoölogisch Museum, Universiteit van Amsterdam, The Netherlands; NMR = Natuurmuseum Rotterdam (Natural History Museum, Rotterdam), The Netherlands.

## DESCRIPTION OF THE CASES

### Case 1: 10 October 1934

South of Zandvoort (Province of Noord Holland) near beachmarker 69 a dead harbour porpoise with a total length of 135 cm was found. The animal showed abnormal outgrowths of the tailflukes. Almost nothing was left of the normal flukes: they are replaced by abnormal stringlike outgrowths (Fig. 1). Both strings had a length of 74 cm. The tail was collected but unfortunately was wasted. Slijper (1936) concluded that the cause of this deformation was of teratological origin ('Offenbar.. teratologisch..' page 496). He further noted that the abnormal strings consist of collagen fibers covered with skin ('...einen 74 cm langen, dünnen Anhang, in dem sich die Bindegewebe-lamellen der Schwanzflosse fortsetzen, der also aus Haut und kompaktem

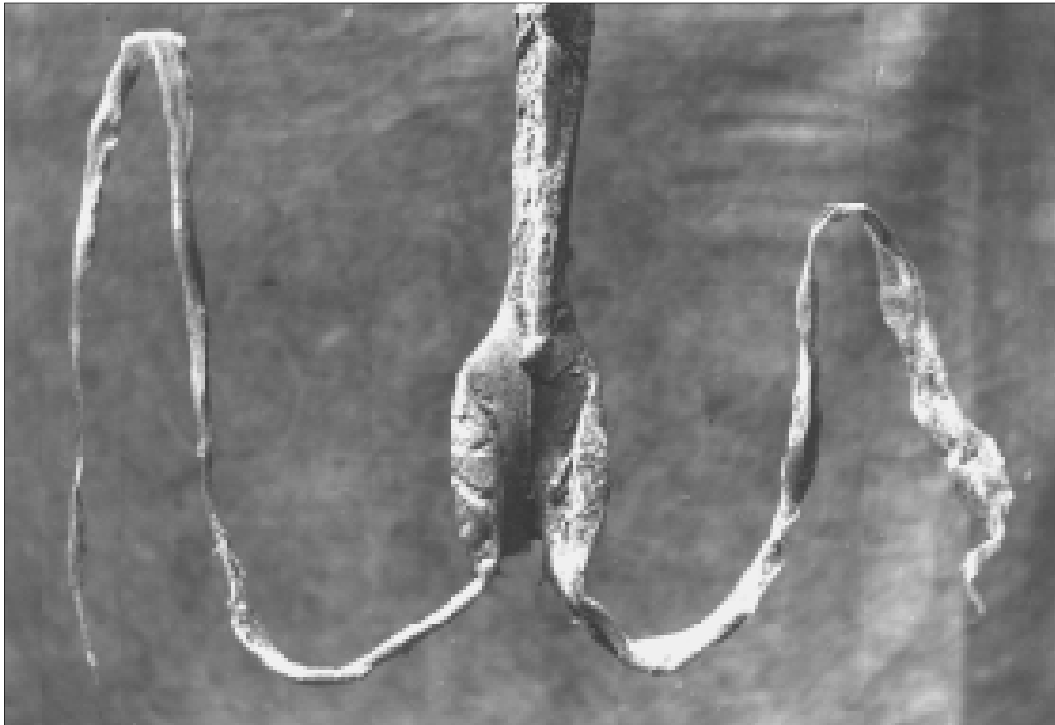


Figure 1 Abnormal tailflukes, Case 1: 19-X-1934. [photo: H. van Thiel]

Bindegewebe bestaat.’). Photographs of this case are kept in the archives of the RMNH.

Literature: Slijper 1936: 496 (fig.251); Van Deinse 1945: 23-35; Van Deinse 1946a: 158

#### Case 2: 13 October 1935

South of IJmuiden (Province of Noord Holland), near beachmarker 58, a dead male harbour porpoise with a length of 140 cm was found. Both tail-flukes were replaced by long string-like outgrowths with a length of 88 cm and 44 cm (Fig. 3b). The features of this case are very similar to case 1. Almost nothing is left of the normal flukes. The boundary between normal fluke and the abnormal outgrowth is clearly visible (Figs. 3b & 9). Three photographs of the dead porpoise on the beach and drawings of the tail are kept in the archives of the RMNH. A detailed 1/1 drawing by Van Deinse is kept in the archives of the NMR. The tail was collected by Van Deinse and is kept in the RMNH-collection (RMNH 27300). On two of the photographs which were taken on the beach, it seems that the dorsal fin is also

deformed (Fig. 2, Appendix 1). Van Deinse (1945; 1946a) did not mention any deformation of the dorsal fin, as he only received the tail and the photographs from the finder, so he could have missed this feature.

Literature: Van Deinse 1945: 23-35 (fig.1); Van Deinse 1946a: 158

Figure 2 Case 2: 13-X-1935; the dead harbour porpoise on the beach of IJmuiden, The Netherlands. [photo: C. de Raaf]





Figure 3 Abnormal tailflukes **a** Case 9: 26-VIII-1945 (RMNH 7456); **b** Case 2: 13-X-1935 (RMNH 27300); **c** Case 4: 09-X-1936 (RMNH 27302); scalebar = 4 cm, for arrow see Fig. 9. [photo: Rob 't Hart]

**Case 3: 3 October 1936**

Between Zandvoort and IJmuiden (Province of Noord Holland), near beachmarker 58, a 100 cm long male harbour porpoise was found. Outgrowths of the tailflukes are present on both sides and have a length of 15 cm (right) and 9 cm (left). The tail was collected by Van Deinse, but could not be traced. A drawing of the tail by Van Deinse is kept in the archives of the RMNH.

Literature: Van Deinse 1945: 23-35 (fig.2); Van  
Deinse 1946a: 158

**Case 4: 9 October 1936**

A dead male harbour porpoise with a total length of 135 cm was found on the beach near Kamperland, Noord-Beveland (Province of Zeeland). The tailflukes were replaced by rather bizarre shaped outgrowths (Fig. 3c). These have a length of 44 and 30 cm. The tail was collected and preserved by Van Deinse and is now kept in the collection of the RMNH (RMNH 27302). Drawings of the tail by Van Deinse are kept in the archives of the same museum.

Literature: Van Deinse 1945: 23-35 (fig.2); Van Deinse  
1946a: 158

**Case 5: November 1936**

A dead harbour porpoise of unknown sex with a total length of 125 cm was found on the beach between Katwijk and Wassenaarseslag (Province of Zuid Holland). Both tailflukes were replaced by abnormal outgrowths with a length of 60 cm. Of this case nothing is kept.

Literature: Van Deinse 1948a: 8

**Case 6: 20 August 1937**

At beachmarker 78, near Noordwijk aan Zee (Province of Zuid-Holland) a 155 cm long dead female harbour porpoise was found. Both tailflukes showed an abnormal outgrowth with a length of 20 cm. Of this case nothing is kept.

Literature: Van Deinse 1945: 23-35; Van Deinse 1946a:  
158



Figure 4 Abnormal tailfluke, Case 7: 21-VIII-1938 [photo: C. Leyenaar]

**Case 7: 21 August 1938**

This harbour porpoise was found on the beach of Westerschouwen (Province of Zeeland). The adult male had a total length of 145 cm. Nothing of the normal flukes was left. Only on the left side a 94 cm long stringlike outgrowth was found. The right string was probably rotten off. Some of the most distal caudal vertebrae were visible (Fig. 4). This case resembles the first two cases. Three photographs of the dead porpoise on the beach are kept in the archives of the RMNH. The tail was collected by Van Deinse, but could not be traced.

Literature: Van Deinse 1945: 23-35 (fig.3); Van Deinse  
1946a: 158

**Case 8: 13 November 1938**

On the beach of Scheveningen (Province of Zuid-Holland) an adult male harbour porpoise was found. The animal has a total length of 150 cm. The tailflukes showed abnormal outgrowths on the tips of the flukes (Fig 5b). The length of the stringlike outgrowths was 17 cm and 4 cm. The tail was collected by Van Deinse and is now kept in the RMNH-collection (RMNH 27301).

Literature: Van Deinse 1945: 23-45 (fig.3); Van Deinse  
1946a: 158

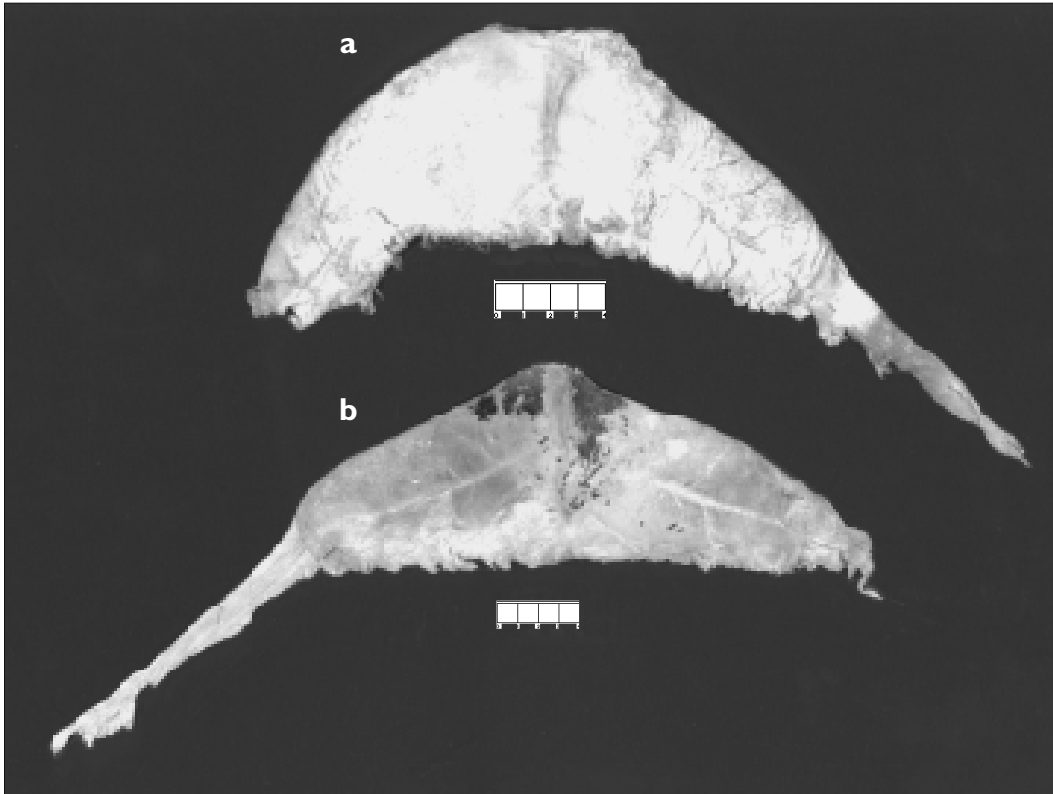


Figure 5 Abnormal tailflukes, **a** Case 16: 27-XI-1949 (ZMA 1408); **b** Case 8: 13-X-1938 (RMNH 27301) [photo: Rob 't Hart]

#### **Case 9: 26 August 1945**

A decomposed female harbour porpoise with a total length of 186 cm was found on the beach, one kilometer south of Noordwijk aan Zee (Province of Zuid-Holland). The bizarrely shaped tailflukes had a length of 36 cm (right) and 24 cm (left) (Fig 3a). The tail was collected and is kept in the RMNH-collection (RMNH 7456).

Literature: Van Deinse 1945: 35; Van Deinse 1946b: 19

#### **Case 10: 20 October 1945**

A decomposed male harbour porpoise with a total length of 122 cm was found between Renesse and Scharendijke, Schouwen, (Province of Zeeland). The abnormal outgrowths of the flukes had a length of 45 cm (right) and 34 cm (left). The tail was collected and preserved by the finder, mr. J. Viergever. During the disastrous February storm in 1953,

Mr. Viergever's house with all his belongings, including his collection, washed away after the bursting of the dikes (dr. P.J.H. van Bree, pers. comm., April 1996).

Literature: Van Deinse 1946b: 19

#### **Case 11: 06 October 1946**

On the beach of Westerschouwen (Province of Zeeland) a female harbour porpoise with a total length of 140 cm was found. Both tailflukes showed long string-like outgrowths. Both strings had a length of 40 cm and a width of 1.5 cm. In the archives of the RMNH a photograph of this tail is kept. The tail itself was not collected.

Literature: Van Deinse 1948a: 8; Viergever 1947: 13-14

#### **Case 12: 24 September 1947**

This harbour porpoise was found on the beach near Noordwijk aan Zee. Both tailflukes were

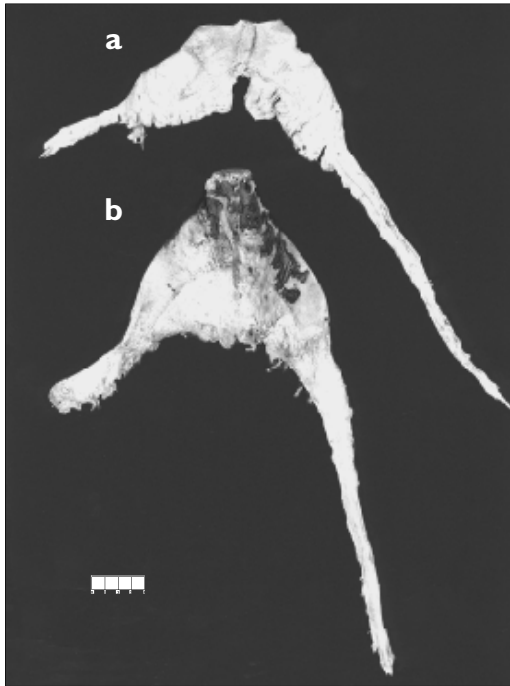


Figure 6 Abnormal tailflukes, **a** Case 15 13-III-1949 (NMR 999000169); **b** Case 12: 24-IX-1947 (RMNH 7426), scale-bar = 4cm. [photo: Rob 't Hart]

deformed (Fig. 6b). This case is similar to case 15. The tail is preserved in the RMNH-collection (RMNH 7426).

Literature: Van Deinse 1948b: 23

#### Case 13: 29 July 1948

South of beachmarker 4 on the island of Schouwen (Province of Zeeland) a dead harbour porpoise was found. According to Van Deinse (1949) the porpoise had a total length of only 60 cm. The strings of the abnormal flukes measured 22 and 20.5 cm. This case arises some questions. A total length of 60 cm in a harbour porpoise represents an unborn foetus. A newborn harbour porpoise has a total length between 67 and 90 cm (Kinze 1994). A very small newborn measured 63 cm (Schulze 1987). After three to four months the newborn porpoise reaches a total length of 100-110 cm (Fisher & Harrison 1970). In case the length of this animal was taken correctly, then

the abnormal fluke-outgrowths should have developed intra-uterine. For several reasons this is not plausible to consider. Most probably the length of this animal was not correctly taken, or not correctly reproduced by Van Deinse in his list of stranded cetaceans of 1948. The tail was collected and preserved by the finder, mr. J. Viergever, but got lost in the 1953 flood (see case 10).

Literature: Van Deinse 1949: 32

#### Case 14: 20 September 1948

A dead harbour porpoise with a total length of 145 cm was found on the beach of Noordwijk aan Zee (Province of Zuid-Holland). Both tailflukes were abnormal. The strings of the flukes had a length of circa 25 cm. Nothing is kept of this case.

Literature: Van Deinse 1951: 23

#### Case 15: 13 March 1949

A decomposed, decapitated porpoise of unknown sex with an estimated total length of ca 120 cm was found near Noordwijk aan Zee (Province of Zuid-Holland). Both tailflukes were abnormal. The strings on the flukes measured 23 and 6.5 cm. (Fig. 6a). The abnormal tail was collected and is kept in the collection of the Natuurmuseum Rotterdam (NMR 999000169).

Literature: Van Deinse 1950: 23

#### Case 16: 27 November 1949

On the beach near Bloemendaal (Province of Noord-Holland) a female harbour porpoise with a total length of 149 cm was found. On the tip of the left fluke an outgrowth with a length of 11 cm was visible (Fig. 5a). This tail was collected for the collection of the Zoological Museum Amsterdam (ZMA 1408).

Literature: Van Deinse 1950: 24

#### Case 17: 04 August 1950

A dead harbour porpoise with a total length of ca 140 cm was found on the beach of Noordwijk aan Zee (Province of Zuid-Holland). The sex of this animal is unknown.

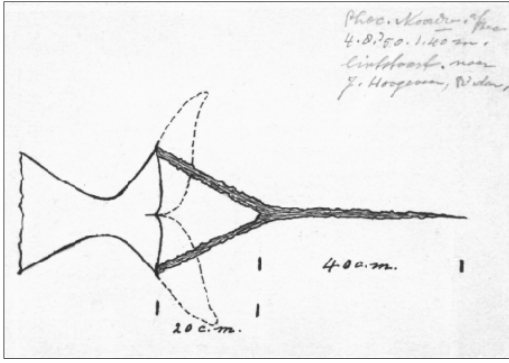


Figure 7 Abnormal tailfluke, Case 17: (04-VIII-1950) [illustration: A.B. van Deinse]

The description of the strings of the flukes is bizarre and unlikely to be true. According to a drawing of the tail (made by Van Deinse after a personal communication with the finder) kept in the archives of the RMNH, the outgrowths of the left and right flukes are fused 20 cm from the boundary between the rest of the normal fluke and the abnormal outgrowth (Fig. 7). The length of the fused string measured 20 cm. This case must be judged with some scepticism. It seems very unlikely that the collagen fibers of the two outgrowths will fuse together in a swimming animal.

Literature: Van Deinse 1951: 64

#### Case 18: 1950

Van Deinse (1951) mentioned in his list of stranded cetaceans in the year 1950 that two (case 17 & 18) harbour porpoises with abnormal tails were found, but he did not list any details of these cases. In addition to case 17, nothing is known of the presumed second case of 1950.

Literature: Van Deinse 1951: 64

#### Case 19: 21 February 1954

On the beach between Zandvoort and Bloemendaal (Province of Noord-Holland) an adult female harbour porpoise with a total length of 146 cm was found. On both flukes abnormal tissue was visible (right fluke: length 3.5 cm, width 3 cm; left fluke: length 4 cm,

width 3.5 cm). A sketch of the tail by Van Deinse is kept in the RMNH-archives.

Literature: Van Deinse 1955: 103

#### Case 20: 31 October 1954

Near beachmarker 73 north of Noordwijkerhout (Province of Zuid-Holland) a dead porpoise with a total length of 120 cm was found. Both tailflukes showed outgrowths each with a length of 15 cm. Measured from the spinal column, 10 cm of the normal fluke was left. Of this case nothing is preserved.

Literature: Van Deinse 1955: 103

#### Case 21: 01 November 1954

Just north of Noordwijkerhout (Province of Zuid-Holland) near beachmarker 77 a dead porpoise of unknown sex with a total length of 140 cm was found. Both tailflukes were abnormal. Measured from the spinal column, only 10 cm of the normal flukes was left. The strings measured 15 and 3 cm. Of this case nothing is preserved.

Literature: Van Deinse 1955: 103-104

#### Case 22: 19 August 1956

An adult male porpoise with a total length of 150 cm was found on the beach at IJmuiden-Zuid (Province of Noord-Holland). Both tailflukes were abnormal, one showed a string with a length of 26 cm, the other had a string with a length of 6 cm. Of this case nothing is preserved.

Literature: Van Deinse 1957: 153-154

#### Case 23: 7 October 1956

A female harbour porpoise with a total length of ca 125 cm was found between beachmarkers 49-52 (Province of Zuid-Holland). The left tailfluke was normal, but on the right fluke abnormal tissue (length 11 cm, width 3 cm) was present. The tail was collected and preserved by the finder. Unfortunately, it could not be traced, despite serious efforts, and must be considered lost. In the RMNH-archives a sketch of the deformed tail, made by the finder, is kept.

Literature: Van Deinse 1957: 154



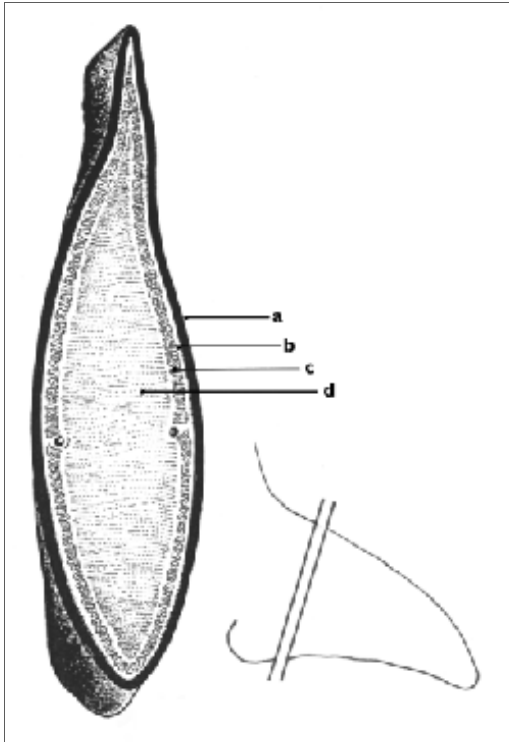


Figure 8 Cross-section through one of the healthy tailflukes of an adult ♀ harbour porpoise *Phocoena phocoena*:

**a** cutaneous layer; **b** subcutaneous fat layer; **c** ligamentous layers of radiating collagen fibers; **d** the core of dense fibrous tissue: [drawing L. A. Man in 't Veld]

#### Case 24: 23 August 1961

A female harbour porpoise with a total length of about 150 cm was found between Scheveningen and Kijkduin (The Hague, Province of Zuid-Holland). On the left tailfluke a string of 11 cm was present. The right fluke was normal. Of this case nothing is kept.

Literature: Van Deinse 1962: 33

#### ANATOMY OF THE NORMAL TAIL

The tailflukes of cetaceans are a pair of flattened horizontally disposed extremities of streamlined contour. In cross section they show a complex of nonskeletal connective tissues which are connected to the last ten or so caudal vertebrae (Felts 1966). The flukes contain four different tissue components (Fig. 8).

They are covered by a cutaneous layer (epidermis and dermis), not different from other regions of the body. Under the skin a subcutaneous fat layer is present. This is far thinner than on the body. Under this layer several ligamentous layers of radiating collagen fibers are found, extending from the caudal vertebrae. The bulk of the tailflukes is formed by a core of extremely tough, dense fibrous tissue within the sheath of the previous mentioned ligamentous layers. The laminae of this white-fibrous tissue are anteroposteriorly directed. In this core, a deep arterial system is found which is surrounded by a complex of venous channels. At the juncture of the subcutaneous fat layer and the ligamentous envelope a pattern of superficial veins is found (Roux 1883; Felts 1966; Purves 1967; Greenwood *et al.* 1974).

The fibrous mass of the core consists of horizontal, vertical and oblique bundles of collagen fibers. This fibrous mass is extremely tough. Entire dolphins of hundreds of kilo's can be pulled up by cables passed through holes cut in the tailflukes or dorsal fins. The material can be easily cut, but it can not be torn apart. The flukes and dorsal fin have, in this way, remarkable physical properties, unique for cetaceans. The core forms a solid attachment to the caudal vertebrae and to the lateral vertebral ligaments.

The tailflukes are of great importance in body hydrodynamics. A second function is the possibility to disperse body heat through the tailflukes. A vascular adaptation in cetaceans is the countercurrent heat exchanger (heatloss and heat-retention), as seen in the flukes, flippers and dorsal fin. This consists of a central artery surrounded by numerous veins. When the dolphin must disperse body heat, the artery dilates and the blood must return via the peripheral venous system where its heat is lost to the surrounding seawater (Scholander & Schevill 1955). In the male dolphin the abdominal testes are cooled by this system (Rommel

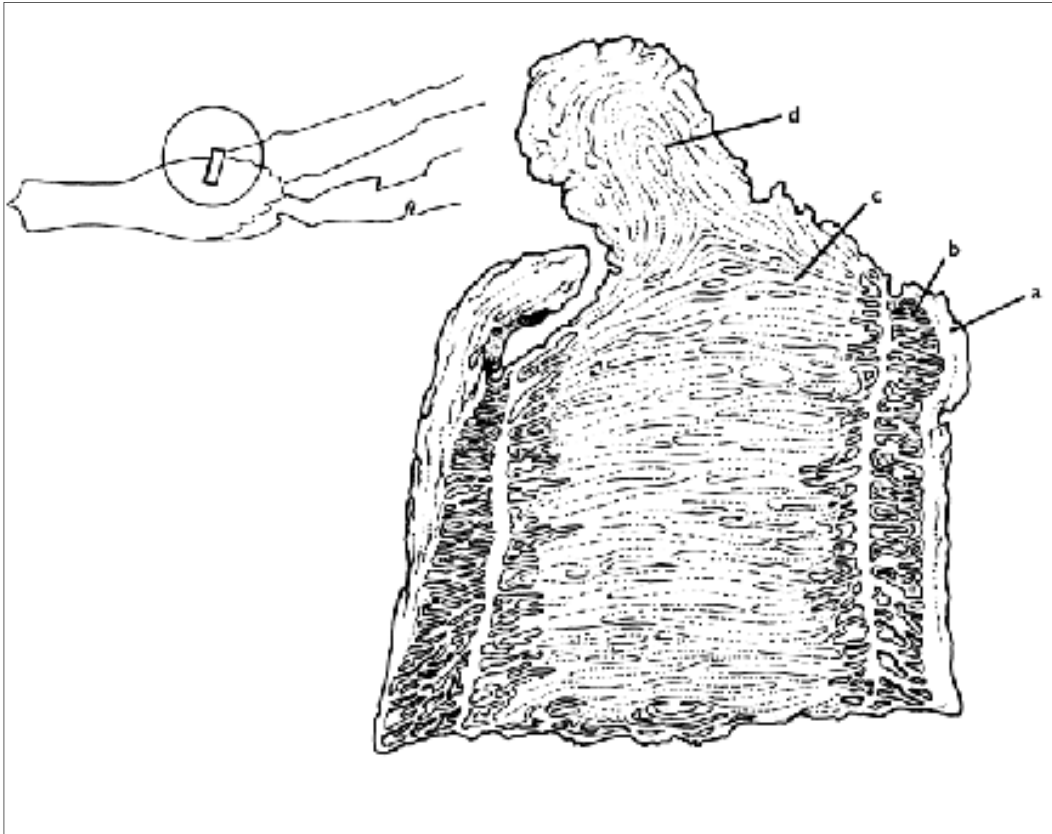


Figure 9 Cross-section through the tail of a case 2 (13-X-1935) at the boundary between normal and abnormal tissue (see arrow in figure 3b). **a** ligamentous layers of radiating collagen fibers; **b** idem; **c** the core of dense fibrous tissue; **d**, abnormal outgrowth of the core. [Illustration: L.A. Man in 't Veld]

*et al.* 1992, 1994; Pabst *et al.* 1995). In the female dolphin the uterus is cooled this way (Rommel *et al.* 1993).

#### FEATURES OF THE ABNORMAL FLUKES

In most of the cases, the largest part of the normal form of the tailflukes is lost. The normal symmetrical flukes are replaced by bizarre stringlike outgrowths of abnormal form. In 18 of the 24 tailflukes the deformation is bilateral. In most of the preserved tails the boundary between normal and abnormal tissue (the cut-line) is clearly visible. Cases 1, 2, 4, 7 and 11 are very similar: both normal tailflukes are for the greater part absent and are replaced by small stringlike outgrowths. In these cases the

sharp boundary between the rest of the normal fluke and the abnormal outgrowth is clearly visible. The cases 3 and 9 are similar in form but more is left of the normal fluke and the outgrowths are broader. In cases 3 and 9 the boundary between normal and abnormal tissue is also clearly visible. The cases 8, 16, 19 and 23 are also very similar: a great part of the normal flukeform is left and the outgrowths are located on the distal parts of the flukes. The dense connective tissue has a remarkably regenerative ability (Junqueira & Carneiro 1983). The abnormal strings all originated from the central core of the tailfluke (Fig. 9). Unlike Slijper (1936) and Van Deinse (1945) we found no skin covering the abnormal outgrowths.

## POSSIBLE CAUSES

### 1 Congenital abnormality?

Slijper (1936) mentioned the first case of bilateral abnormal tailflukes in a Dutch harbour porpoise. He briefly described the cause as teratological, so in his opinion the porpoise was born with abnormal flukes. As the 24 cases of abnormal tailflukes are very heterogeneous in appearance and only known from one locality (the Dutch North Sea coast) and one particular period (1934-1961) it seems unlikely that the abnormal flukes are a congenital deformation.

### 2 Propeller strikes?

Van Deinse (1945) mentioned the injury by a strike of a screw or propeller of a vessel as a possible cause of the amputation of the tailflukes. Reports of injuries in cetaceans by a propeller strike are rare in literature. Roest *et al.* (1953) described a Cuvier's beaked whale *Ziphius cavirostris* with a large gash which was thought to have been caused by a ship's propeller. Bloom & Jager (1994) described the injury and subsequent healing of a propeller strike in a bottlenose dolphin. The dolphin was hit dorsally and the injury consisted of a series of eleven curved slash wounds. Richardson *et al.* (1995) mentioned collisions between vessels and bottlenose dolphins in the Gulf of Mexico: there dolphins were injured or killed occasionally by strikes of screws.

These cases prove that the blades of the propeller can cut like knives, suggesting that it is not unlikely that parts of or an entire tailfluke can be cut off when it is struck. Since bilateral amputation without injuring the spine has occurred in 18 of the 24 cases described here, it seems unlikely that they have been caused by a propeller strike. Kremer (1991) reports that harbour porpoises react very shyly on motorboats. The species is timid and does not approach boats. Harbour porpoises are often sighted from boats, but tend to change behaviour and move away (Taylor & Dawson

1984). Avoidance may occur up to 1 – 1.5 km from a ship (Barlow 1988), but is stronger within 400 m from a vessel (Polacheck & Thorpe 1990; Richardson *et al.* 1995). From this point of view it is very unlikely that in the period 1934 - 1960 so many collisions between motorvessels and harbour porpoises occurred (resulting in the deformed tailflukes) and after 1960 not a single case has been reported.

### 3 Killer whale attacks?

Van Deinse (1945) mentioned attacks of killer whales *Orcinus orca* as a possible cause of the traumatic amputation of tailflukes. The killer whale is an opportunistic feeder. The list of prey species is extensive. The fact that killer whales attack, kill and eat cetaceans (including harbour porpoises) is well documented. Eschricht (1866) reported the stomach contents of a single killer whale: the decomposed and skeletal remains of no less than 13 harbour porpoises and 14 seals. Van Dieren (1931) found the remains of two pregnant harbour porpoises in the stomach of a male killer whale stranded on 31 July 1931 on the island of Terschelling in the Netherlands. Leatherwood *et al.* (1988) published dramatic photographs of killer whales pursuing, herding and enclosing a harbour porpoise. The whales played with the chanceless porpoise for over 30 minutes, lifting it out of the water and forcing it back and forth before killing and eating it. Evans (1988) observed killer whales pursuing harbour porpoises off Southwest Ireland, and Bloch & Lockyer (1988) reported killer whales that attacked and ate a harbour porpoise just outside Torshavn in the Faroes.

The fact that killer whales are able to bite off parts of flukes and flippers (in the case of fin whales) is reported by Mitchell & Reeves (1988). Lopez *et al.* (1996) mentioned a case of a bottlenose dolphin in which lesions on the tailflukes were the result of a killer whale attack. The harbour porpoise is a slow swimmer. The maximum observed swimming

speed is 22.2 km/hr (Gaskin *et al.* 1974). The killer whale may reach a speed of 38 km/hr (Sigurjonsson 1994). So it seems unlikely for a harbour porpoise whose tail has been bitten off to escape from a hunting killer whale. Besides, it is very strange that no other reports of degenerated tailflukes are known from coastal waters where killer whales and harbour porpoises are much more common. In the Dutch coastal waters the killer whale has always been rare (Kompanje 1995). In conclusion we can state that the theory of Van Deinse (1945) [bilaterally bitten off tailflukes without injuring the spines by killer whales] is not plausible.

#### 4 Interactions with other cetaceans?

Schulze (1987) described how a common dolphin *Delphinus delphis* attacked and injured a harbour porpoise. Ross & Wilson (1996) described the violent interactions between bottlenose dolphins and harbour porpoises in the Moray Firth in Scotland. They examined dead harbour porpoises. The majority (63 %) of these porpoises died a violent death, characterized by multiple skeletal fractures and internal organ damage, caused by aggressive attacks of bottlenose dolphins. This molest was well illustrated in their article. H.M. Ross (personal communication, 1995) performed autopsies on harbour porpoises which had been killed by bottlenose dolphins, but did not find any bitten-off tailflukes. Van Deinse (1945) suggested bitten-off tailflukes by bottlenose dolphins and male harbour porpoises as a possible cause for the amputation of the tailflukes. This seems, however impossible as these species do not seem to be able to bite through the central core of the tailfluke. Bites of cetaceans will result in the well-known rake marks rather than amputations.

#### 5 Interactions with sharks?

The fact that cetaceans and sharks interact in tropical waters is well-known and frequently observed (Wood *et al.* 1970; Corkeron *et al.*

1987a; Corkeron *et al.* 1987b; Norris 1994). Actual interaction between sharks and cetaceans in northern waters like the North Sea has never been observed. Anselmo & Van Bree (1995) described a harbour porpoise found dead on the Friesian island of Ameland, The Netherlands, which, according to the authors, had been injured and killed by a porbeagle *Lamna nasus*. It seems however not plausible that sharks which normally occur in the North Sea (like the porbeagle) do attack healthy porpoises. The case reported by Anselmo & Van Bree (1995) is at best due to scavenging on a moribund or dead porpoise. A harbour porpoise which stranded alive in March 1993 on the Friesian island of Ameland and was rehabilitated in the Harderwijk Marine Mammal Park showed injuries on its caudal keel. According to R.A. Kastelein (pers. comm. 1995) these were probably due to shark bites. From another area, Williamson (1963) described a 79 cm long harbour porpoise from the stomach of a Greenland shark *Somniosus micr ocephalus*. According to its length this was a stillborn fetus. Arnold (1972) and Templeman (1963) both described a find of a harbour porpoise in the stomach of a white shark *Carcharodon carcharias*. Wood *et al.* (1970) observed various degrees of injuries on flippers, dorsal fins and tailflukes of dolphins caused by sharkbites. Surprisingly, they never encountered a cetacean with a significant portion of their flippers, dorsal fins or tailflukes missing as the result of a shark attack, whereas in sea turtles sometimes entire flippers were missing. Lopez *et al.* (1996) described 15 cases of cetacean strandings in Spain with clear signs of shark attack and 13 cases of possible attacks, but no cases of bitten-off tailflukes. In conclusion it is unlikely that a shark attack results in a (bilateral) amputation of the tail-flukes. Besides, the shark species that normally occur in the Dutch part of the North sea are not capable to injure a porpoise in such a significant way.



Figure 10 A.B. van Deinse (with hat and pipe) and two of his students holding a dead bycatch harbour porpoise *Phocoena phocoena* of which the abdomen was cut open by fisherman, 01-VII-1923, beach between Katwijk and Scheveningen, The Netherlands. [photo: L. Pouderoyen]

#### 6 Man-made amputations?

The sharp boundaries between the normal fluke form and the abnormal outgrowth strongly indicates that the tailflukes were cut-off with a knife by man. Harbour porpoises often become entangled in fishing nets. According to Kastelein *et al.* (1995) harbour porpoises have not developed a way to cope with vague barriers like fishing nets. They react to the nets not by swimming around them, but quickly swim through the obstacle. During their experiments, harbour porpoises swam closer to the nets when fish were attached to the nets. It is documented that harbour porpoises are incidentally captured alive as bycatch of different types of fishery (IUCN, 1991). Dutch fishermen considered the harbour porpoise as a rival: the porpoise also preys upon herring *Clupea harengus*. In relation to this rivalry Strijbos (1927), Van Deinse (1945) and IJsseling & Scheygrond (1949) reported the

practice of Dutch fishermen of cutting open the abdomen of bycatch harbour porpoises and young bottlenosed dolphins and subsequently throwing them (still alive) back into the sea (Fig. 10). Van Deinse (1945) reported a dead harbour porpoise found in January 1939 on the beach near Scheveningen, having the tailflukes cut-off. On that occasion fisherman declared that it was common practice to cut off (and even eat) the tail-flukes of porpoises that were caught alive in their nets. In the light of rivalry between fisherman and porpoises, cutting-off tailflukes and throwing the live animals back into the sea, can be seen as a variation of the brutal practice to cut open the abdomen (as described above). The animals with open abdomen would die within minutes after being thrown back, but the ones with cut off tailflukes could be able to survive, resulting in the described extreme string like deformation of the tailflukes.

The harbour porpoises with abnormal tailflukes are only known from the middle and southern parts of The Netherlands, south of IJmuiden. From the Friesian Islands (Wadden Sea) along the northern coastline of The Netherlands not a single case is known, despite the fact that strandings of dead cetaceans from these islands were always reported in detail.

In the period 1939 - 1945 no cases have become known. This could have two reasons. (1) Most parts of the North Sea coast of The Netherlands were a forbidden area during the Second World War, so searching for stranded cetaceans was almost impossible; and (2) no herring and other trawler fishery took place in the Dutch coastal waters during the Second World War (M. Romers, pers. comm. February 1996). Barros & Odell (1990) mentioned possible fishery-related mortalities in bottlenose dolphins in the Southeastern United States: 'Evidence suggesting such interactions included gunshot wounds, tail flukes cut off, and lacerations of various kinds'.

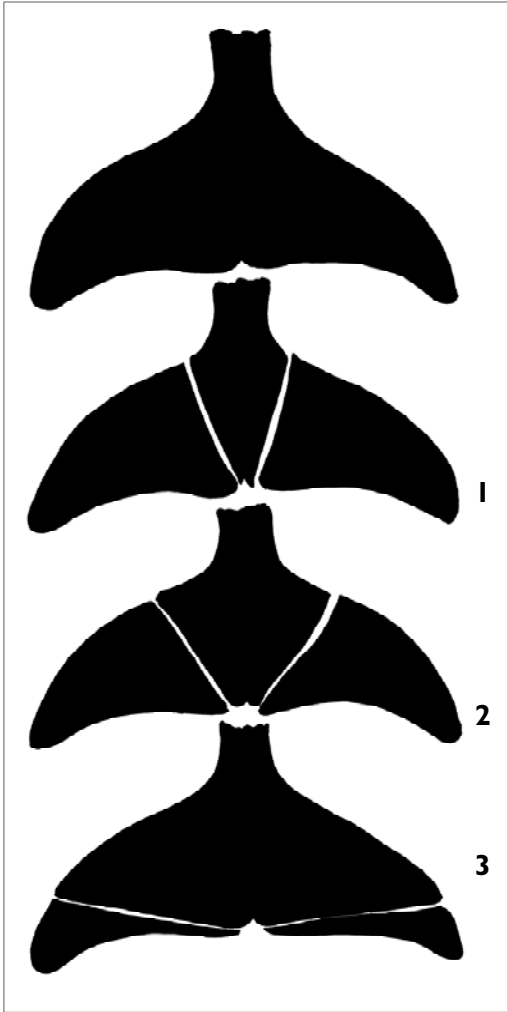


Figure 11 Three ways in which the tailflukes or harbour porpoises were cut-of, recognised during this study. [illustration E.J.O. Kompanje]

#### Classification of cuts

A study of the preserved tails, the detailed photographs and the drawings, revealed three different types of (man made) cuts (Fig. 11). Cases 1, 2, 4, 7 and 11 are of type 1; cases 3 and 9 are of type 2; and cases 8, 12, 15, 16, 17, 19 and 23 are of type 3. Due to absence of photographs or drawings, the cases 5, 6, 10, 13, 14, 18, 20, 21, 22 and 24, can not be classified with certainty. Cases 5 and 10 most likely belong to type 1 and cases 20, 21 and 24

are most likely caused by cuts of type 3.

The cases 1 up to and including 7 and 9 & 10 (types 1 and 2) were found between 1934 and 1945. The cases 11 up to and including 24 (type 3) were found between 1946 and 1961. The transition between type 1 and type 2 is gradual, but the types 2 and 3 are very different, suggesting two different habits of mutilation that caused the different features of the tails. Only case 8, which is classified as type 3, was found in the first period (1938).

#### DISCUSSION

The healing ability of skinwounds in cetaceans is remarkably good (Van Utrecht 1959; Geraci *et al.* 1986; Corkeron *et al.* 1987a, 1987b; Kastelein *et al.* 1990). Despite this, normal woundhealing is not possible when the tailflukes are cut off laterally of the spinal column. The distance between the wound-edges of the sharp wound is too large for the skin to overbridge and close the wound. Besides, the central core of the fluke is too dense. Wound constriction and wound closure can not take place. On the other hand, the wound does not dry out, because of the constant irrigation of the wound with seawater. This permits the central core to grow out of the fresh wound. The dense fibrous tissue of the core regenerates more rapidly than the skin, resulting in the abnormal flukes: they are an outgrowth of the central core (Fig. 9). Such severe wounding with bizarre and abnormal woundhealing would obviously affect (at least) the locomotion of the porpoise, especially in such important bodyparts as the tailflukes. Gilmore (1961) mentioned that whales without flukes or flippers or parts of those missing, are able to swim and live a normal life. This author described a humpback whale *Megaptera novaeangliae* with one fluke missing, a gray whale *Eschrichtius robustus* with both flukes missing and two blue whales *Balaenoptera musculus* with parts of both flukes missing, but without abnormal outgrowths. Kleinenberg *et al.* (1969) reported beluga's *Delphinapterus leucas* with defor-

med tailflukes, pectoral fins and lips. The most common deformation is a damaged edge of the tailfluke. Healed wounds on the edges of the tailflukes are common in several cetacean species. The sperm whale *Physeter macrocephalus* which got stranded on 3 January 1970 on the Spijkerplaat, off Breskens, The Netherlands showed many healed marginal wounds on his tailflukes, but with skin covering all over (illustrated in Buijs & Dudok van Heel 1980).

The fact that harbour porpoises can survive for some time without functional tailflukes is proven by the cases described above. Unfortunately nothing is known of the healthstate, stomach-contents and pathological features of the 24 harbour porpoises with abnormal tailflukes. Detailed autopsies were not performed.

Dolphins possess a vascular countercurrent heat exchanger that functions to cool the abdominal testes in the male and the uterus in the female. Arteries in the posterior abdomen are juxtaposed to veins returning cooled blood from the surfaces of the dorsal fin and the tailflukes (Scholander & Schevill 1955; Rommel *et al.* 1992, 1993, 1994; Pabst *et al.* 1995). The deformed, afunctional tailflukes should have had there influence on the cooling of testes and uterus, and might have disturbed the spermatogenesis and the maternal function. It also could have been a threat to the health of the developing fetus in the case of pregnancy. Unfortunately nothing is known about the state and function of the sexual organs of the porpoises described in this article.

## CONCLUSION

It must have been common practice on some fishing-vessels in the period between 1934 and 1961 to cut off the tailflukes of live bycatch harbour porpoises and to throw the mutilated animals back into the sea. This brutal habit must be seen in the light of rivalry

between fisherman and (fish eating) porpoises. Given the nature of mutilations and the healing abilities of the different structures in the tailflukes, wound healing does not result in normal scarring but in the stringlike flukes that were first described by Slijper (1936) and Van Deinse (1945). All other explanations given for the amputations, such as interactions with killer whales, bottlenose dolphins, other harbour porpoises or sharks, injuries from collision with screw propellers are wrong. A congenital origin of the abnormalities is also considered impossible.

## ACKNOWLEDGEMENTS

I would like to thank dr Chris Smeenk for giving access to the collections and archives of the National Museum of Natural History, Leiden, The Netherlands and for providing tails from harbour porpoises and white-beaked dolphins for comparative dissections. Dr. Peter J.H. van Bree, Zoological Museum Amsterdam, The Netherlands, for lending me the deformed tail of case 7 and for valuable historical information, Bram (A.S.) Couperus, Netherlands Institute for Fisheries Research (RIVO-DLO), for providing tailflukes of white-sided dolphins for comparative dissections, Ron A. Kastelein, Harderwijk Marine Mammal Park, Harderwijk, The Netherlands, for the information on the 'shark-bitten' porpoise 'Frank', Dick Mol and Mart Romers (Visserijmuseum [Museum of the Dutch Sea Fishery], Vlaardingen) for historical information and Leo Man in 't Veld, Natuurmuseum Rotterdam, for making the histological illustrations. Rob 't Hart, Rotterdam, photographed the preserved tails.

## REFERENCES

- Anselmo, S., & P.J.H. van Bree, 1995 - Shark predation on harbour porpoise *Phocoena phocoena* in the North Sea - Sula 9: 23-25
- Arnold, P.W., 1972 - Predation on harbor porpoise *Phocoena phocoena* by a white shark *Carcharodon carcharias* - Journal Fishery Research Canada 29(8): 1213-1214
- Barlow, J., 1988 - Harbor porpoise, *Phocoena phocoena*, abundance estimation for California, Oregon and Washington: 1. Ship surveys - Fishery Bulletin 86(3): 417-432
- Barros, N.B., & D.K. Odell, 1990 - Food habits of bottlenose dolphins in the Southeastern United States - in: Leatherwood, S., & R.R. Reeves (eds.) - The bottlenose dolphin - pp. 309-328, Academic Press, inc., San Diego
- Bloch, D., & C. Lockyer, 1988 - Killer whales (*Orcinus orca*) in Faroese waters - Rit Fiskideildar 11: 55-64
- Bloom, P., & M. Jager, 1994 - The injury and subsequent healing of a serious propeller strike to a wild bottlenose dolphin (*Tursiops truncatus*) resident in cold waters off the Northumberland coast of England - Aquatic Mammals 20:59-64
- Buijs, D., & W.H. Dudok van Heel, 1980 - Bodyplan of a male sperm whale (*Physeter macrocephalus*) stranded near Breskens, Netherlands - Aquatic Mammals 7: 27-32
- Corkeron, P.J., R.J. Morris, & M.M. Bryden, 1987a - A note on healing of large wounds in bottlenose dolphins, *Tursiops truncatus* - Aquatic Mammals 13: 96-98
- Corkeron, P.J., R.J. Morris, & M.M. Bryden, 1987b - Interactions between bottlenose dolphins and sharks in Moreton Bay, Queensland - Aquatic Mammals 13: 109-113
- Eschricht, D.F., 1866 - On the species of Orca inhabiting the northern seas - in: Flower, W.H., (ed.) - Recent memoirs on the Cetacea - pp.153-188, Robert Hardwicke, London
- Evans, P.G.H., 1988 - Killer whales (*Orcinus orca*) in Irish waters - Rit Fiskideildar 11: 42-54.
- Felts, W.J.L., 1966 - Some functional and structural characteristics of cetacean flippers and flukes - in: Norris, K.S., (ed.) - Whales, dolphins and porpoises - pp. 255-276, University of California Press, Berkeley and Los Angeles
- Fisher, H.D., & R.J. Harrison, 1970 - Reproduction in the common porpoise (*Phocoena phocoena*) of the North Atlantic - Journal Zoology 161: 471-486
- Gaskin, D.E., P.W. Arnold, & B.A. Blair, 1974 - *Phocoena phocoena* - Mammalian species, American Society Mammalogy 42
- Geraci, J.R., D.J. St. Aubin, & B.D. Hicks, 1986 - The epidermis of odontocetes: a view from within - in: Bryden, M.M., & R. Harrison, (ed.) - Research on Dolphins - pp. 3-21, Clarendon Press, Oxford
- Gilmore, R.M., 1961 - Whales without flukes or flippers - Journal of mammalogy 42:419-420
- Greenwood, A.G., R.J. Harrison, & H.W. Whitting, 1974 - Functional and pathological aspects of the skin of marine mammals - in: Harrison, R.J., (ed.) - Functional anatomy of marine mammals. Volume 2 - pp 73-110, Academic Press, London, New York, San Francisco
- IUCN., 1991 - Dolphins, porpoises and whales of the world. The IUCN red data book - IUCN, Gland & Cambridge
- Junqueira, L.C., & J. Carneiro, 1983 - Basic histology, Fourth edition - Lange Medical Publishers, Los Altos
- Kastelein, R.A., M.J. Bakker, & T. Dokter, 1990 - The medical treatment of 3 stranded Harbour porpoises (*Phocoena phocoena*) - Aquatic Mammals 15:181-202
- Kastelein, R.A., D. de Haan, C. Staal, S.H. Nieuwstraten, & W.C. Verboom, 1995 - Entanglement of Harbour porpoises (*Phocoena phocoena*) in fishing nets - in: Nachtigall, P.E., J. Lien, W.W.L. Au, & A.J. Read, (eds.) - Harbour porpoises - laboratory studies to reduce bycatch - pp. 91-156, De Spil Publishers, Woerden
- Kinze, C.C., 1994 - *Phocoena phocoena* (Linnaeus, 1758) - Schweinswal oder Kleintümmeler (auch Brautfisch) - in: Robineau, D., R. Duguy, & M. Klima, (Hrsg.) Handbuch der Säugetiere Europas, Band 6: Meeressäuger, Teil I: Wale und Delphine- Cetacea, Teil IA - pp.242-264, Aula Verlag, Wiesbaden
- Kleinenberg S.E., A.V. Yablokov, B.M. Bel'kovich, & M.N. Tarasevich, 1969 - Beluga (*Delphinapterus leucas*) investigation of the species - Israel Program for Scientific translations, Jerusalem
- Kompanje, E.J.O., 1995 - Strandings of killer whales *Orcinus orca* in the Netherlands between 1783 and 1995 with some remarks on skeletal and dental pathology (Mammalia, Cetacea, Odontoceti) - Deinsea 2:67-82
- Kremer, H., 1991 - Der Schweinswal in Nord- und Ostsee - Umweltstiftung WWF-Deutschland, Frankfurt am Main



- Leatherwood, S., R.R. Reeves, W.F. Perrin, & W.E. Evans, 1988 - Whales, dolphins and porpoises of the eastern North Pacific and adjacent arctic waters - Dover pub.inc., New York
- Lopez, A., J. Barrull, & I. Mate, 1996 - Feridas e cicatrices nos corpos dos cetáceos vrados en Galicia como indicio de depredacion e de alimentacion baseada en preas, principalmente por quenllas - *Eubalaena* 9: 10-21
- Mitchell, E. & R.R. Reeves, 1988 - Records of killer whales in the western North Atlantic, with emphasis on eastern Canadian waters - *Rit Fiskideildar* 11:161-193
- Norris, K.S., B. Würsig, R.S. Wells, & M. Würsig, 1994 - The Hawaiian spinner dolphin - University of California Press, Berkeley, Los Angeles, London
- Pabst, D.A., S.A. Rommel, W.A. McLellan, T.M. Williams, & T.K. Rowles, 1995 - Thermoregulation of the intra-abdominal testes of the bottlenose dolphin (*Tursiops truncatus*) during exercise - *Journal of experimental biology* 198: 221-226
- Polacheck, T., & L. Thorpe, 1990 - The swimming direction of harbor porpoise in relationship to a survey vessel - *Reports International Whaling Commission* 40: 463-470
- Purves, P.E., 1968 - The structure of the flukes in relation to laminar flow in cetaceans - *Zeitschrift für Säugetierkunde* 34:1-8
- Richardson, W.J., C.R. Greene, C.I. Malme, & D.H. Thomson, 1995 - Marine mammals and noise - Academic Press, San Diego
- Roest, A.I., R.M. Storm, & R.C. Dumas, 1953 - Cuvier's beaked whale (*Ziphius cavirostris*) from Oregon - *Journal Mammalogy* 34:251-252
- Rommel, S.A., D.A. Pabst, W.A. McLellan, J.G. Mead, & C.W. Potter, 1992 - Anatomical evidence for a counter current heat exchanger associated with dolphin testes - *Anatomical Record* 232: 150-156
- Rommel, S.A., D.A. Pabst, & W.A. McLellan, 1993 - Functional morphology of the vascular plexuses associated with the cetacean uterus - *Anatomical Record* 237: 538-546
- Rommel, S.A., D.A. Pabst, W.A. McLellan, T.M. Williams & W.A. Friedl, 1994 - Temperature regulation of the testes of the bottlenose dolphin (*Tursiops truncatus*): evidence from colonic temperatures - *Journal of Comparative Physiology* 164: 130-134
- Ross, H.M. & B. Wilson, 1996 - Violent interactions between bottlenose dolphins and harbour porpoises - *Proceedings Royal Society London B* 263: 283-286
- Roux, W., 1883 - Beiträge zur Morphologie der funktionellen Anpassung. I. Structure eines hoch differenzierten bindegewebigen Organs (der Schwanzflosse des Delphins) - *Arch. Anat. Entw.* 4:76-162
- Scholander, P.F. and W.E. Schevill, 1955 - Counter-current vascular heat exchange in the fins of whales - *Journal of applied Physiology* 8: 279-282
- Schulze, G., 1987 - Die Schweinswale - A.Ziemsen Verlag, Wittenberg Lutherstadt
- Sigurjonsson, J., 1994 - *Orcinus orca* (Linnaeus, 1758)-Schwertwal, Grosser Schwertwal - in: Niethammer, J. & F. Krapp (Hrg.-) - *Handbuch der Säugetiere Europas*, Band 6: Meeressäuger, teil 1: Wale und Delphine-Cetacea - pp.431-468, Aula Verlag, Wiesbaden
- Slijper, E.J., 1936 - Die Cetaceen vergleichend-anatomisch und systematisch - *Capita Zoologica* 6/7:1-590
- Stribos, J.P., 1927 - Strandvondsten - *De Levende Natuur* 373-376
- Taylor, B.L. & P.K. Dawson, 1984 - Seasonal changes in density and behavior of harbor porpoise (*Phocoena phocoena*) affecting census methodology in Glacier Bay National Park, Alaska - *Reports International Whaling Commission* 34: 479-483
- Templeman, W., 1963 - Distribution of sharks in the Canadian Atlantic - *Bulletin Fishery Research Canada* 140: 83
- Utrecht, W.L. van, 1959 - Wounds and scars in the skin of the common porpoise, *Phocoena phocoena* (L.) - *Mammalia* 23:100-122
- Van Deinse, A.B., 1945 - De staart der cetacea en eenige gevallen van lintvormige staarten bij *Phocoena phocoena* (L.) - *Zoologische mededelingen* 25: 23-35
- Van Deinse, A.B., 1946a - De recente Cetacea van Nederland van 1931 tot en met 1944 - *Zoologische Mededelingen* 26: 139-210
- Van Deinse, A.B., 1946b - De gestrande Nederlandse Cetacea van 1945 - *Het Zeepaard* 6: 18-20
- Van Deinse, A.B., 1948a - De Nederlandse Cetacea van 1946 - *Het Zeepaard* 8: 6-9
- Van Deinse, A.B., 1948b - De Nederlandse Cetacea van 1947 - *Het Zeepaard* 8: 23-24
- Van Deinse, A.B., 1949 - De Nederlandse Cetacea van 1948 - *Het Zeepaard* 9: 32-35
- Van Deinse, A.B., 1951 - Onze walvisachtige dieren van 1950 - *Het Zeepaard* 11: 64-73
- Van Deinse, A.B., 1955 - De Nederlandse Cetacea van

1954 - Mededelingenblad van de Vereniging voor  
Zoogdierkunde en Zoogdierbescherming : 103-105  
Van Deinse, A.B., 1957 - Walvisnieuws 1956 -  
Mededelingenblad van de Vereniging voor  
Zoogdierkunde en Zoogdierbescherming: 151-158  
Van Deinse, A.B., 1962 - Walvisnieuws over 1961 - Lutra  
4: 33-40  
Van Dieren, J.W., 1931 - De zwaardvisch van Terschelling  
- De Levende Natuur 36: 225-238  
Viergever, J., 1947 - Lintstaartbruinvis - Het Zeepaard 1:  
13-14

Williamson, G.R., 1963 - Common porpoise from the  
stomach of a Greenland shark - Journal of Fishery  
research Canada 20: 1085-1086  
Wood, F.G., D.K. Caldwell and M.C. Caldwell, 1970 -  
Behavioral interactions between porpoises and sharks -  
Investigations on cetacea 2: 264-277  
Ijsseling, M.A. & A. Scheygrond, 1949 - De zoogdieren  
van Nederland. 2e druk - N.V. W.J. Thieme & Cie,  
Zutphen

received 31 May 1996

accepted 24 June 1996

**APPENDIX I** Case 2: 13-X-1935 (RMNH 27300), meticulously documented by dr A.B. van Deinse. [archives National  
Museum of Natural History, Leiden]

	<p>Totaal.</p>	<p><i>Phocaena phocaena</i>, Bruinvisch, gevonden. 13 Oct. 1935, 2 palen de k. gmuiden, paal 58, door A. v. d. Kloot, v. Spijk en F. A. Thomse, beide uit Haarlem. 3 foto's v. d. M. v. Sp., die de negat. heeft. Gest. d. 1. 40 M. Lang v. punt snuit tot begin staartaanhang 210. Langste staartvinn- aanhang 88 c. m. en kortere dito 45 c. m.. op 10 Oct. de staart van de vinderen v. en 4 tanden v. d. l. onderkaak. 1/2 tandformule <math>\frac{29}{24} \frac{30}{25}</math> basis rugvin 21 24 25 c. m. en hoogte 19 c. m. van buiten 2 gaat. V. v. m. v. d. staartvinn: Kop 89 c. m. 55 c. m. Staart. 22. Lange lintvormige staartaanhang als in- plaats v. d. normale accolade staart: Kop → de nor- male staart moet afgelegen zijn d. d. schreef v. c. boot en moet lang lintvormig zijn gere- gebrekend. Bericht ontv. v. H. v. Thiel, Haarlem. Berichten ontv. v. v. d. M. v. Sp. en v. Thomse, die zich hier- voor veel moeite gaven. Die grote foto v. d. ab- normale staart en de negat. op nat. v. d. op papier. A. B. van Deinse R. d. d. d. 19 Oct. 1935.</p>
	<p>Kop.</p>	
	<p>→ Kop.</p>	

DEINSEA - ANNUAL OF THE NATURAL HISTORY MUSEUM ROTTERDAM  
P.O.Box 23452, NL-3001 KL Rotterdam The Netherlands