

Survey of Reproductive Data for the Beaked Whales (Ziphiidae)

JAMES G. MEAD

Division of Mammals, National Museum of Natural History, Smithsonian Institution, Washington D.C., 20560

ABSTRACT

Outside of *Berardius bairdii* and *Hyperoodon ampullatus*, the two species of ziphiids for which there have been commercial fisheries, little reproductive data are known. Mean length at birth ranges from 210 cm in *Mesoplodon europaeus* to 450 cm in *B. bairdii*. Maximum reported lengths range from a low of 430 cm for male *Mesoplodon hectori* to a high of 1,280 cm for female *B. bairdii*. Age at attainment of sexual maturity is known only for *H. ampullatus* and *B. bairdii* and ranges between 7 and 11 years. The maximum reported age of a ziphiid is 71 years for a male *B. bairdii*.

INTRODUCTION

This is a survey of the literature for reproductive data on beaked whales (Ziphiidae). I have consulted one unpublished thesis (Ross, 1979) because of the bulk of data that it contained for the Southern Hemisphere species. I have consulted all of the papers dealing with beaked whale fisheries management and have tried to consult all of the papers dealing with stranded beaked whales. In addition I have used unpublished data on specimens contained in the United States National Museum (USNM) in Washington, D.C. and have used specimen data gathered by the Scientific Event Alert Network (SEAN) (Smithsonian Institution, Washington, D.C., 20560) and published in its monthly bulletin.

In dealing with the published data I have encountered a few minor problems. Most researchers do not specify whether the gonad weights are for one gonad or both gonads combined. I have interpreted them as being for one gonad. The maximum weight for ovaries appeared to be the weight with a corpus luteum. However, those weights that were obviously from an ovary with a corpus luteum were not included in the sample to obtain the mean ovary weight. There was no indication whether the testis weights were taken with the epididymus attached or trimmed off.

I could find no discussion or illustrations of the histology of the ovaries, testes or mammary glands in any beaked whale.

DEFINITION OF TERMS

Minimum length/age at sexual maturity: This is the length/age of the smallest/youngest individual in the sample that was known to be sexually mature. In the case of limited samples that consisted of very short/young animals and very long/old animals, I left that category blank. If an animal seemed approximately the right length/age, a recently matured animal, or in the rare case where data were available on the number of corpora in the ovaries and there were only one or two, I included that animal in this category.

Mean length/age at sexual maturity: This category was restricted to fishery species, the only exception being *Mesoplodon europaeus*, where I had a large enough

sample of unpublished material to derive a meaningful average.

Maximum length/age: The maximum reported lengths and ages for a species. This category was left out if there were no data or if the data were for specimens young enough that they were not a good approximation of the maximum length/age that the species could be expected to attain.

Length of the longest fetus and the shortest calf: These are self-explanatory.

Mean length at birth: This is either the mean length at birth reported by other workers or a weighted average (taking into account other species of a genus) between the maximum reported fetal length and the length of the shortest calf.

Gonad weights in general: These are weights of a single gonad unless otherwise specified. For minimum gonad weights it is the weight of the smallest of the pair and for maximum gonad weights it is the weight of the largest of the pair. The testis weights on USNM specimens are with the epididymis removed.

Gonad weights for immature animals: These are weights of the gonads of juvenile animals. For fishery animals there was enough of a sample to yield a mean weight, but for stranded animals the weight is for the smallest gonad of a non-mature animal. In some cases this turned out to be a calf and in those cases it is lower than it should be to give an impression of the gonad weight of a juvenile.

Minimum gonad weights at sexual maturity: These were the minimum gonad weights of an animal that had just become sexually mature. In some cases where there were no data on the corpora in the ovaries, the lesser of the two gonad weights was chosen on a mature animal.

Mean gonad weight at sexual maturity: For fishery samples, this represents an actual mean. For stranded animals, it may represent the gonad weight of an animal that was presumed to be a 'typical' mature specimen.

Maximum gonad weight: This represents the maximum reported gonad weight of an individual. In females this is usually presumed to be an ovary with a corpus luteum attached. In males it may represent the combined weight of both testes in some cases, but it is intended to be the weight of the single largest testis.

Age: The ages of ziphiids are expressed in growth layer groups (GLGs; Perrin and Myrick, 1980: 48). As an

initial hypothesis, 1 GLG layer group can be assumed to represent 1 year's growth.

RESULTS

Berardius arnuxii

There are practically no reproductive data available for this species. Gaskin (1968: 44) gave a maximum length of 30 feet (900 cm) for males and Hale (1962: 231) gave the maximum length as 885 cm for females. The 885-cm female was pregnant but Hale gave no details of the fetus or the ovaries.

This species is restricted to the temperate and polar waters of the Southern Hemisphere, but is close enough morphologically to its northern relative to allow the assumption that reproductive parameters obtained for its *Berardius bairdii* can reasonably be applied to it as well. The lengths should be reduced by about 20% to make up for the lesser size of *B. arnuxii*.

Berardius bairdii

Omura, Fujino and Kimura (1955) gave the bulk of the data on this species, based upon a sample of 924 animals caught off Japan. The minimum length at sexual maturity was 1,000 cm for females and 950 cm for males; the mean length at sexual maturity was 1,050 cm for females and 1,000 cm for males. Nishiwaki and Oguro (1971, p. 118), based on a sample of 701 animals caught off Japan, gave maximum lengths of 42 feet (1,280 cm) for females and 39 feet (1,190 cm) for males. The only record of a male longer than this is a specimen in the United States National Museum (USNM 49725) whose length is given as about 41 feet (1,250 cm) by True (1910, pp. 61, 63). I agree with Omura *et al.* (1955, p. 96) in questioning the sex and disallowing this record. Kasuya (1977, p. 15) gave the mean age at sexual maturity as 8–10 GLGs based on his age/length curve and the data on length at sexual maturity presented by Omura *et al.* (1955, pp. 113, 114), the maximum reported age for males at 71 GLGs (1955, pp. 3, 13) and that for females at 39 GLGs (1955, p. 3).

Omura *et al.* (1955, p. 113) gave testis weights as 1 kg in an immature specimen, 3 kg as the minimum weight at sexual maturity, and 5 kg as the mean weight at sexual maturity. Rice (1963, p. 186) gave 17.6 kg as the maximum testis weight. The only ovary weight was given by Pike (1953, p. 103) as less than two ounces (60 g) for a 29-foot 3-inch (890-cm) specimen. Ohsumi (1964, p. 134) concluded that there was no difference between the right and left ovaries as to age at maturity or accumulation of corpora.

The length of gestation was originally given as 10 months (Omura *et al.*, 1955, p. 114), based on an estimated growth curve of fetal lengths. Kasuya (1977, p. 17) gave 17 months based upon 'short cycles' (lunar months) observed in the prenatal dentine and the estimated fetal growth rate. I have chosen to adopt Kasuya's estimate. The length of the longest fetus was 14 feet (420 cm; Omura *et al.*, 1955, p. 115) and the length of the shortest calf was 481 cm (True, 1910, p. 64). Stejneger's notes on this animal (True, 1910, p. 64) said that he thought that there were remains of the umbilical cord present, but as the animal was in a state of advanced putrefaction, he was unsure of this. Omura *et al.* (1955,

p. 114) estimated the length at birth to be 15 feet (450 cm). The peak period of calving occurs in March and April, and the peak period of mating therefore occurs in October and November (Kasuya, 1977, p. 17).

Hyperoodon ampullatus

This is another species that has been the object of a fishery and for which reproductive data are readily available. The samples that these studies were based on were 5,095 (Christensen, 1973), 129 (Benjaminsen, 1972) and an additional 74 from Labrador (Benjaminsen and Christensen, 1979). The minimum length at sexual maturity for females was 20 feet (600 cm) and 24 feet (730 cm) for males (Benjaminsen, 1972, p. 239); the mean length at sexual maturity was 22–23 feet (690 cm) for females and 24–25 feet (750 cm) for males (Benjaminsen, 1972, p. 238); maximum length for males was 32 feet (980 cm) (Benjaminsen, 1972, p. 238). Thompson (1846) recorded a female that was 28.5 feet (870 cm) long. Benjaminsen and Christensen (1979, p. 156) gave a minimum age of attainment of sexual maturity of 7 GLGs for both sexes, and a mean age at sexual maturity of 11 GLGs for females and 7–11 GLGs for males. Christensen gave maximum ages of 27 GLGs for females (1973, p. 335) and 37 GLGs for males (1973, p. 333).

The testis weight of an immature animal was 100 g per pair, minimal weight at attainment of sexual maturity was about 200 g per pair, mean weight at sexual maturity was about 1,200 g per pair, and maximum weight was 2,600 g per pair (Benjaminsen and Christensen, 1979, p. 156).

The gestation period was given as 12 months (Benjaminsen, 1972, p. 240) based upon a fetal length/month plot. The lactation period is estimated to be about 1 year based upon the presence of milk in the stomach of a 1-year old calf (Benjaminsen and Christensen, 1979, p. 158). The mean calving interval is estimated to be 2 years (Benjaminsen and Christensen, 1979, p. 158). The largest reported fetus was 12 feet (11.5 Norwegian feet; 361 cm; Ohlin, 1893, p. 8), the smallest calf was 11 feet 6 inches (350 cm; Fraser, 1934, p. 32) and the mean length at birth was reported to be around 10 feet (300 cm; Benjaminsen, 1972, p. 240). However, I feel that 360 cm is in better agreement with the data. The peak of calving is in April.

Hyperoodon planifrons

There is a paucity of reproductive data for this animal. Zemskiy and Budylenko (1970, p. 201) gave a report of a 570-cm lactating female. Fraser (1964, p. 198) reported the largest specimen of this species, a 745-cm lactating female. Hale (1931, p. 294) reported the largest male, a 694-cm specimen. Ross (1979, p. 61) reported a 291-cm calf which he assumed, from the pigmentation (the presence of 'fetal folds'), had been recently born. The testis weights of the calf were 3.7 g and 3.2 g.

One has to use caution in extending the reproductive data from *Hyperoodon ampullatus* to *H. planifrons*. Although they are clearly related, there is a greater degree of osteological differentiation between them than there is between *Berardius arnuxii* and *B. bairdii*. In fact Moore (1968, p. 274) erected a new subgenus, *Fraserocetus*, to include *H. planifrons*.

Table 1

Total body lengths in cm and ages in GLGs for ziphiids. Estimated lengths are marked with an *

		<i>Berardius arnuxii</i>	<i>Berardius bairdii</i>	<i>Hyperoodon ampullatus</i>	<i>Hyperoodon planifrons</i>	<i>Mesoplodon bidens</i>	<i>Mesoplodon bowdoini</i>	<i>Mesoplodon carlhubbsi</i>	<i>Mesoplodon densirostris</i>	<i>Mesoplodon europaeus</i>	<i>Mesoplodon ginkgodens</i>	<i>Mesoplodon grayi</i>	<i>Mesoplodon hectori</i>	<i>Mesoplodon layardii</i>	<i>Mesoplodon mirus</i>	<i>Mesoplodon pacificus</i>	<i>Mesoplodon stejnegeri</i>	<i>Tasmacetus shepherdi</i>	<i>Ziphius cavirostris</i>
Length	Minimum at sexual maturity	Females	1,000	600	570	—	—	—	—	—	—	—	—	—	—	—	—	—	527
		Males	950	730	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Mean at sexual maturity	Females	1,050	690	—	—	—	—	—	450	—	—	—	—	—	—	—	—	580
	Males	1,000	750	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	550
Maximum	Females	885	1,280	870	745	505	457	532	471	520	490*	533	443	615	510	—	525	660	754
	Males	900*	1,190	980	694	550*	—	532	473	456	477	564	430	584	533	—	525	700	700
Age	Minimum at sexual maturity	Females	—	7	—	—	—	—	9	—	—	—	—	—	—	—	—	—	—
		Males	—	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Mean at sexual maturity	Females	—	8-10	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Males	—	8-10	7-11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Maximum	Females	—	39	27	—	—	—	—	—	27	—	—	—	—	—	—	—	—	30
	Males	—	71	37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	36
Length longest fetus		—	420	361	—	157	155	90	190	218	—	—	—	76	105	—	—	—	267
Length shortest calf		—	481	350	291	245	—	247	261	196	—	242	210	280	233	—	—	—	269
Mean length at birth		—	450	360	—	240	—	250	—	210	—	—	—	—	—	—	—	—	270

Mesoplodon

The 12 species of *Mesoplodon* make up a reasonably diverse yet clearly related assemblage. *M. carlhubbsi* seems to be so closely related to *M. bowdoini* that it may turn out to be a subspecies of it. Where there seem to be separate Northern and Southern Hemisphere populations (as in *M. mirus* and *M. hectori*) there appear to be consistent differences that indicate that interbreeding is relatively rare.

Mesoplodon bidens

Despite being one of the most commonly stranded *Mesoplodon* species, there is surprisingly little reproductive data available. The maximum length of females was 505 cm (Jonsgård and Hoidal, 1957, p. 509) and of males 550 cm (18 feet; Isseling and Scheygrond, 1950). There are reports of males of 17 feet (520 cm; Andrews, 1870; title not seen, data from Flower, 1871, p. 210) and 16 feet (490 cm; Sowerby, 1804). (Data that are expressed in whole numbers of feet are likely to have been estimates.) The largest measured male was 15 feet 8 inches (478 cm; Turner, 1885, p. 145).

There are no gonad weights reported for *Mesoplodon bidens*.

The length of the longest fetus was 5 feet 2 inches (157 cm; Jonsgård and Hoidal, 1957, p. 509) and the smallest calf was 245 cm (Grieg, 1908). There were traces of the umbilical cord on the 245 cm calf, so I have estimated the length at birth at 240 cm.

Mesoplodon bowdoini

There is one 457-cm physically mature female known (Tidemann, 1980, p. 64) and a 14-foot (420 cm) female that was carrying a 5-foot 2-inch (15 cm) fetus (McCann, 1976, p. 107; identified as *M. stejnegeri*).

Mesoplodon carlhubbsi

The largest physically mature male and female specimens measured 532 cm (Mead, Walker and Houck, 1982, pp. 13, 20) The right ovary of that female weighed 13.2 g. The mean testis weight of a sexually mature male was 250 g (1982, p. 13). The largest fetus was 90 cm (1982, p. 8) and the smallest calf was 247 cm (1982, p. 6). The mean length at birth was estimated to be 250 cm (1982, p. 6) on rather tenuous grounds. Based upon the mean length at birth estimate, the calving season was estimated to be mid-summer (1982, p. 13).

Mesoplodon densirostris

The maximum reported lengths were 473 cm for a male and 471 cm for a female (Ross, 1979, p. 316, table 27), and the minimum reported age at sexual maturity was 9 GLGs.

The testis of an immature male weighed 27 g (1979, p. 42). The minimum weight of the ovaries at sexual maturity was 12 g, the mean weight at sexual maturity was 14 g and the maximum weight was 25 g (1979, p. 317, table 24).

The length of the longest fetus was 190 cm and of the shortest calf 261 cm (1979, p. 313, table 24).

Mesoplodon europaeus

Data on 7 mature females were available: 420 cm, ovary weights 18.5, 15.3 g (USNM 504349); 430 cm with a 196-cm calf (SEAN Bull., 3(5): 25); 14 feet (430 cm) with a 7-foot (210 cm) calf (Rankin, 1955, p. 26); 430 cm with a 162 cm fetus (USNM 550069); 458 cm, ovary weights 13.4, 12.0 g (USNM 504610); 473 cm, ovary weights 8, 12 g (USNM 504256); 17 feet (520 cm) with a 7-foot 2-inch (218 cm) fetus (Brimley, 1943, p. 199). The

Table 2
Gonad weights in grams for Ziphiids

	<i>Berardius arnuxii</i>	<i>Berardius bairdii</i>	<i>Hyperoodon ampullatus</i>	<i>Hyperoodon planifrons</i>	<i>Mesoplodon bidens</i>	<i>Mesoplodon bowdoini</i>	<i>Mesoplodon carlhubbsi</i>	<i>Mesoplodon densirostris</i>	<i>Mesoplodon europaeus</i>	<i>Mesoplodon ginkgodens</i>	<i>Mesoplodon grayi</i>	<i>Mesoplodon hectori</i>	<i>Mesoplodon layardii</i>	<i>Mesoplodon mirus</i>	<i>Mesoplodon pacificus</i>	<i>Mesoplodon stejnegeri</i>	<i>Tasmacetus shepherdi</i>	<i>Ziphius cavirostris</i>
Immature																		
Females	—	60	—	—	—	—	—	—	—	—	—	—	—	—	—	2.6	—	5.2
Males	—	1,000	50	3.2	—	—	—	27	—	—	—	1.6	—	6.5	—	—	—	—
Minimum at sexual maturity																		
Females	—	—	—	—	—	—	—	12	12	—	—	—	—	11	—	12	—	16
Males	—	3,000	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	150
Mean at sexual maturity																		
Females	—	—	—	—	—	—	13	14	14	—	—	—	—	15	—	—	40	—
Males	—	5,000	600	—	—	—	250	—	—	140	—	—	—	—	—	—	—	4,000
Maximum																		
Females	—	—	—	—	—	—	—	25	18.5	—	—	—	—	49	—	—	—	57
Males	—	17,600	1,320	—	—	—	—	—	160	—	—	116	—	170	—	—	—	—

maximum reported length of a mature male is 456 cm (USNM 504738). The maximum reported age is 27 GLGs (USNM 504610; Perrin and Myrick, 1980, p. 8).

The minimum weight of an ovary that was considered to be mature was 12 g (the 8-g ovary of USNM 504256 is problematical and is ruled out for this consideration), the mean weight of sexually mature ovaries was 14 g, and the maximum weight was 19 g (18.5 g). The maximum reported weight of a mature testis was 160 g (USNM 504738).

The length of the longest reported fetus was 218 cm (Brimley, 1943, p. 199) and the length of the shortest reported calf was 196 cm (SEAN Bull., 3(5): 25). I have estimated the mean length at birth at 210 cm (the length of the calf that was reported by Rankin, 1955, p. 26).

Mesoplodon ginkgodens

The maximum reported length of a female was 16 feet (490 cm; Moore and Gilmore, 1965, p. 1239) and of a male 477 cm (Nishiwaki, Kasuya, Kureha and Oguro, 1972, p. 46).

The maximum reported weight of a mature testis was 140 g (Nishiwaki *et al.*, 1972, p. 48).

These data have to be used with caution because the sample size is extremely small (i.e. two).

Mesoplodon grayi

The maximum reported length of a female was 17 feet 6 inches (533 cm; von Haast, 1876, p. 457) and of a male 18 feet 6 inches (564 cm; Courtenay-Latimer, 1963, p. 122).

There are no reported gonad weights for this animal.

The shortest reported calf was 242 cm (SEAN Bull., 3(4): 14).

Mesoplodon hectori

The largest reported female was 443 cm and the largest male 430 cm (estimated), (Mead, 1981, pp. 430–1).

The weight of an immature testis was 1.6 g (1981, p. 431) and the maximum reported weight of a mature testis was 116 g (1981, p. 431).

The length of the shortest reported calf was 210 cm (1981, p. 431).

Mesoplodon layardii

These data have to be used with caution because the sample is extremely small (4).

This is the largest species of *Mesoplodon*, barring *M. pacificus* whose total length is unknown. The largest reported female was 615 cm and the largest male 584 cm (Ross, 1979, p. 298, table 10).

Gonad weights are unknown for this species.

The shortest reported calf was 280 cm (1979, p. 16) and the longest reported fetus 76 cm (Gaskin, 1968, p. 54).

Mesoplodon mirus

The largest reported female was 510 cm (Ross, 1979, p. 302, table 15) and the largest male 17 feet 6 inches (533 cm; Talbot, 1960, p. 406).

The testis weight for an immature male was 7 g (6.5 g) (Ross, 1979, p. 311, table 22) and the maximum weight of a testis was 170 g (USNM 504724). The minimum weight of a mature ovary was 11 g (Ross, 1979, p. 311, table 22), the 'mean' weight (derived by taking the lesser of the two ovary weights for USNM 504612) was 15 g and the maximum reported weight was 49 g (48.5 g; Ross, 1979, p. 311, table 22).

The length of the shortest reported calf was 233 cm (1979, p. 302; table 15) and the longest reported fetus was 105 cm (Ross, 1969, p. 585).

Mesoplodon pacificus

No known reproductive data. The only specimens of this species are two skulls found on beaches.

Mesoplodon stejnegeri

The largest reported female of this species was 17 feet 2.5 inches (525 cm; SEAN Bull., 2(10): 12) and the largest male 525 cm (Francis H. Fay, pers. comm.; the reported length of 16.5 feet (Anon. 1978, *Alaska*, 44(1): 20) was an error).

The ovaries of an immature female weighed 2.6 g (USNM 504330) and the minimum ovary weight of a presumably mature female was 12 g (11.6 g; SEAN 6497, SEAN Bull., 6(8): 9).

There are no reported fetuses or calves.

Tasmacetus shepherdii

The largest reported female was 660 cm (Mead and Payne, 1975, p. 213) and the largest male 23 feet (700 cm; Sorensen, 1940, p. 201). The gonads of the female weighed about 40 g each (Mead and Payne, 1975, p. 213) and were judged to be sexually mature.

These data must be used with caution because the sample size is extremely small (2).

Ziphius cavirostris

This is a more common ziphiid, perhaps the most common in terms of absolute numbers, and it has been the subject of a fishery in Japan. The shortest mature female was a 527-cm specimen with a 142-cm fetus (Filella, 1975, p. 49). The mean lengths of sexually mature individuals were 19 feet (580 cm) for females and 18 feet (550 cm) for males (Omura *et al.*, 1955, p. 117). The maximum reported length of a female was 24 feet 9 inches (754 cm; Fraser, 1946, p. 46) and of a male was 23 feet (700 cm; Nishiwaki and Oguro, 1972, p. 17). The maximum reported age was about 30 GLGs for a female and 36+ GLGs for a male (Ross, 1979, p. 46). This corresponds well to the maximum age of an unsexed tooth of 36+ GLGs and the maximum age of a male of 35 GLGs reported by Perrin and Myrick (1980, p. 6).

The ovary weight for a 269-cm calf was 5.2 g (USNM 504756). The minimum ovary weight at sexual maturity, taken as the lesser of the two weights in a mature female (USNM 504094), is 16 g. The maximum reported ovary weight was 57 g (56.7 g; Kenyon, 1961, p. 72). The minimum weight of a sexually mature testis was reported as 150 g (Ross, 1979, p. 48). This was for an animal that was physically mature and had at least 36 growth layers in the dental cementum. The weight seems rather low when compared to the maximum reported weight of 4 kg (Omura *et al.*, 1955, p. 117) and it may be that this represents a senescent animal whose testes have atrophied.

The length of the largest reported fetus was 267 cm (Tomilin, 1957, p. 438) and the shortest calf was 269 cm (USNM 504756). Accordingly I have taken 270 cm as an estimate for the mean length at birth.

REFERENCES

- Andrews, W. 1870. Notice of the capture of *Ziphius sowerbyi* on the Irish coast. *Proc. Roy. Irish Acad., Dublin*, ser. 2, 1(11): 49.
- Benjaminsen, T. 1972. On the biology of the bottlenose whale, *Hyperoodon ampullatus* (Forster). *Norw. J. Zool.* 20(3): 233-41.
- Benjaminsen, T. and Christensen, I. 1979. The natural history of the bottlenose whale, *Hyperoodon ampullatus* (Forster). pp. 143-164, 12 figs., In: H. E. Winn and B. L. Olla (eds), *Behavior of Marine Animals*, volume 3, Cetaceans. Plenum Press, N.Y. xix + 438 pp.
- Brimley, H. H. 1943. A second specimen of True's beaked whale, *Mesoplodon mirus* True, from North Carolina. *J. Mammal.* 24(2): 199-203.
- Christensen, I. 1973. Age determination, age distribution and growth of bottlenose whale, *Hyperoodon ampullatus* (Forster), in the Labrador Sea. *Norw. J. Zool.* 21(4): 331-40.
- Courtenay-Latimer, M. 1963. Gray's beaked whale *Mesoplodon grayi*. *Ann. Cape Prov. Mus. (nat. Hist.)* 3: 122.
- Filella, S. 1975. Nota sobre la hembra de Ballena de Cuvier, *Ziphius cavirostris* Cuv., que en avanzado estado de gravidez fue hallada en la playa de Barcelona, el día 24 de marzo de 1973. *Inmersion y Ciencia*, 8-9: 47-50.
- Flower, W. H. 1872. On the recent ziphioid whales, with a description of the skeleton of *Berardius arnouxii*. *Trans. zool. Soc. Lond.* 8(3): 203-34, pls. 27-9.
- Fraser, F. C. 1934. Report on Cetacea stranded on the British coasts from 1927 to 1932. *Brit. Mus. (nat. Hist.)* 11: 1-41, 6 maps.
- Fraser, F. C. 1946. Report on Cetacea stranded on the British coasts from 1933 to 1937. *Brit. Mus. (nat. Hist.)* 12: 1-56, 7 maps.
- Fraser, F. C. 1964. Whales and whaling. pp. 191-205, 7 figs., In: R. E. Priestly, R. J. Adie and G. de Q. Robin (eds), *Antarctic Research*, Butterworths, London. xi + 360 pp.
- Gaskin, D. E. 1968. The New Zealand Cetacea. New Zealand Marine Department, *Fish. Res. Bull. (New Series)* 1: 92 pp., 80 figs.
- Grieg, J. A. 1908. Spidshvalen. *Norsk Fisk. Tid.*, 6te hefte, 264-68.
- von Haast, J. 1876. Further notes on *Oulodon*, a new genus of ziphioid whales from the New Zealand seas. *Proc. zool. Soc. Lond.*, 1876: 457-58.
- Hale, H. M. 1931. Beaked whales - *Hyperoodon planifrons* and *Mesoplodon layardii* - from South Australia. *Rec. S. Aust., Mus.* 4(3): 291-311.
- Hale, H. M. 1962. Occurrence of the whale *Berardius arnuxi* in southern Australia. *Rec. S. Aust. Mus.*, 14(2): 231-43, pls. 5, 6.
- Ijsseling, M. A. and Scheygrond, A. 1950. *Die zoogdieren van Nederland*. 2. herziene druk. 544 pp., Zutphen, Thieme.
- Jonsgård, Å. and Hoidal, P. 1957. Strandings of Sowerby's whale (*Mesoplodon bidens*) on the west coast of Norway. *Norsk Hvalfangsttid.* 1957(9): 507-12.
- Kasuya, T. 1977. Age determination and growth of the Baird's beaked whale with a comment on the fetal growth rate. *Sci. Rep. Whales Res. Inst., Tokyo* 29: 1-20.
- Kenyon, K. W. 1961. Cuvier beaked whales stranded in the Aleutian Islands. *J. Mammal.* 42(1): 71-6.
- McCann, C. 1976. Notes on the foetal skull of *Mesoplodon stejnegeri*. *Sci. Rep. Whal. Res. Inst., Tokyo* 28: 107-17, 5 pls.
- Mead, J. G. 1981. First records of *Mesoplodon hectori* (Ziphiidae) from the Northern Hemisphere and a description of the adult male. *J. Mammal.* 62(2): 430-32.
- Mead, J. G. and Payne, R. S. 1975. A specimen of the Tasman beaked whale, *Tasmacetus shepherdii*, from Argentina. *J. Mammal.* 56(1): 213-18.
- Mead, J. G., Walker, W. A. and Houck, W. J. 1982. Biological observations on *Mesoplodon carlhubbsi* (Cetacea: Ziphiidae). *Smithson. Contr. Zool.* 344: 1-25.
- Moore, J. C. 1968. Relationships among the living genera of beaked whales, with classifications, diagnoses and keys. *Fieldiana: Zool.* 53(4): iv + 206-98.
- Moore, J. C. and Gilmore, R. M. 1965. A beaked whale new to the Western Hemisphere. *Nature*, 205(4977): 1239-40.
- Nishiwaki, M., Kasuya, T., Kureha, K. and Oguro, N. 1972. Further comments on *Mesoplodon ginkgodens*. *Sci. Rep. Whal. Res. Inst., Tokyo* 24: 43-56, 10 pls.
- Nishiwaki, M. and Oguro, N. 1971. Baird's beaked whales caught on the coast of Japan in recent 10 years. *Sci. Rep. Whal. Res. Inst., Tokyo* 23: 111-22.
- Nishiwaki, M. and Oguro, N. 1972. Catch of the Cuvier's beaked whale off Japan in recent years. *Sci. Rep. Whales Res. Inst., Tokyo* 24: 35-41.
- Ohlin, A. 1893. Some remarks on the bottle-nose whale (*Hyperoodon*). *Acta Univ. lund.* 29: 1-13, 1 pl.
- Ohsumi, S. 1964. Comparison of maturity and accumulation rate of corpora albicantia between the left and right ovaries in Cetacea. *Sci. Rep. Whales Res. Inst., Tokyo* 18: 123-48, 1 pl.
- Omura, H., Fujino, K. and Kimura, S. 1955. Beaked whale *Berardius bairdi* of Japan, with notes on *Ziphius cavirostris*. *Sci. Rep. Whales Res. Inst., Tokyo*, 10: 89-132, 10 pls.

- Perrin, W. F. and Myrick, A. C., Jr (eds). 1980. [1981] Age determination of toothed whales and sirenians. *Rep. Int. Whal. Commn* (special issue 3): viii + 1-229.
- Pike, G. C. 1953. Two records of *Berardius bairdi* from the coast of British Columbia. *J. Mammal.* 34(1): 98-104.
- Rankin, J. J. 1955. A rare whale in tropical seas. *Everglades Nat. Hist.*, 3(1): 24-31.
- Rice, D. W. 1963. Progress report on biological studies of the larger Cetacea in the waters off California. *Norsk Hvalfangsttid.* 1963(7): 181-87.
- Ross, G. 1969. Evidence for a southern breeding population of True's beaked whale. *Nature* 222(56176): 585.
- Ross, G. 1979. The smaller cetaceans of the south east coast of southern Africa. Unpublished thesis submitted to the University of Port Elizabeth, South Africa. v + 415 pp., 53 figs., 126 tables.
- Sorensen, J. H. 1940. *Tasmacetus shepherdi*. History and description of specimens cast ashore on Mason's Bay, Stewart Island, in February 1933. *Trans. roy. Soc. N. Z.* 70: 200-04.
- Sowerby, J. 1804. Extracts from the minute book of the Linnean Society. *Trans. Linn. Soc., London* 7: 310.
- Talbot, F. H. 1960. True's beaked whale from the south-east coast of South Africa, *Nature* 186(4722): 406.
- Thompson, W. 1846. Notice of a bottle-nosed whale, *Hyperoodon butzkopf*, Lacep., obtained in Belfast Bay in October 1845. *Ann. Mag. nat. Hist* 17: 150-53, pl. 4.
- Tidemann, C. R. 1980. *Mesoplodon bowdoini* Andrews (Ziphiidae): a new whale record from New South Wales. *Vict. Nat.* 97: 64-5.
- Tomilin, A. G. 1957. *Zveri SSSR i prilozhaschikh stran. Zveri vostochnoi Evropy i severnoi Azii., IX. Kitoobraznye.* Akad. Nauk, Moscow, 756 pp. [Translated in 1967 as *Mammals in the USSR and Adjacent Countries. Vol. IX. Cetacea*, by the Israel Program for Scientific Translations, Jerusalem, 717 pp.]
- True, F. W. 1910. An account of the beaked whales of the family Ziphiidae in the collection of the United States National Museum, with remarks on some specimens in other American museums. *Bull. U. S. nat. Mus.*, 73: v + 1-89, 42 pls.
- Turner, W. 1885. The anatomy of a second specimen of Sowerby's whale (*Mesoplodon bidens*) from Shetland. *J. Anat. Lond.* 20: 144-88.
- Zemskiy, V. A. and Budylenko, G. A. 1970. Ploskolobye butylkonosy iz Antarktiki. pp. 193-202. In: V. A. Zemskiy (ed.) *Kity iuzhnogo polusharii (Biologiya i morfologiya)*, *Trud. AtlantNIRO*, 20; 1-234.