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New Records of the Gulf-Stream Beaked Whale, *Mesoplodon gervaisi*, and Some Taxonomic Considerations

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INTRODUCTION

The American Museum of Natural History has recently received from Dr. Eugenie Clark of the Cape Haze Marine Laboratory, Placida, Florida, the nearly complete skeleton of a Gulf-Stream beaked whale, *Mesoplodon gervaisi*, which stranded on the beach at Boca Grande, Florida, early in April, 1959. When Dr. Clark discovered it on April 30, its bones had been picked nearly clean by vultures except for a bit of the fluke, the skin color of which was black, with a pale posterior margin. She measured it, however, and found its length from the tip of the snout to the middle of the posterior margin of the flukes to be 12 feet, 9 inches.

Dr. Clark later learned that the whale had been examined the first day it was on the beach, while it was fresh enough to be still bleeding, by a Captain Claude McCall who works as a fisherman out of Boca Grande. McCall could not remember the exact date, but he told Dr. Clark that the color of the animal was "dark slate black above and lighter on the lower parts with no special markings." Shown the photographs of a stranded *Mesoplodon mirus* in Moore and Wood (1957), McCall thought that the Boca Grande specimen seemed to have been slimmer (not yet bloated); its flippers seemed smaller than those of the *mirus*, and he commented that in the Boca Grande specimen the tip of the lower jaw did not project beyond the tip of the beak as shown in the photographs of *M. mirus*. The little whale's mouth was closed,

McCall said, and the two teeth in the lower jaw protruded and fit into grooves in the skin of the outer upper jaw. The above information is summarized from Dr. Clark's thoughtful, helpful letters of May 7, June 3, and June 12, 1959, to the author.

This specimen from the Gulf of Mexico conforms with 16 out of 18 taxonomic characters proposed as distinguishing *gervaisi* from *mirus* (see Moore and Wood, 1957), and, as the alveoli of the single pair of mandibular teeth are beside the posterior half of the symphysis (see fig. 1), the specimen is unquestionably identified as *gervaisi*.

Sex of the Boca Grande Whale

When examining the freshly stranded whale, McCall saw no penis protruding, and when he returned a week later to knock out the teeth for his son, the whale's state of decay was quite advanced, and vultures had eaten too much of the whale's flesh for him to have observed the genitalia of the animal. Dr. Clark inquired with much care about the sex of the animal, and this fact is documented here, even though negative, because of the importance of this specimen. All 11 previously known specimens of this species are from the western North Atlantic except the type specimen, which has also been, until now, the only old male known. The Boca Grande skeleton represents the first on this side of the Atlantic, therefore, of a fully adult, possibly old, male of this species recognized by science. The sex of both this specimen and the type must be inferred primarily from the large size of the single pair of teeth and their protrusion above the gum. The teeth are vestigial in females of this family (Fraser, *in* Norman and Fraser, 1949, p. 269) and usually remain hidden in the tissues of the gum so that the animals appear to be toothless. The observation by McCall that the teeth of the adult male fit into grooves in the skin of the upper jaw is an item completely new in the knowledge of this rare species.

Prior to receiving this male specimen from Boca Grande, the author had entertained some thought that the type specimen of *gervaisi* might eventually prove to be a different species from that of the other specimens that have up to now been identified with it (Moore and Wood, 1957, pp. 17, 22). The possibility of such a difference may now be reconsidered. The further suggestion offered in Moore and Wood (1957), that the peculiarities of the type specimen of *gervaisi* may be characteristic of old males, is also now reopened to question.

Specimen from Padre Island, Texas

The alveoli in the mandible of the Gulf-Stream beaked whale from

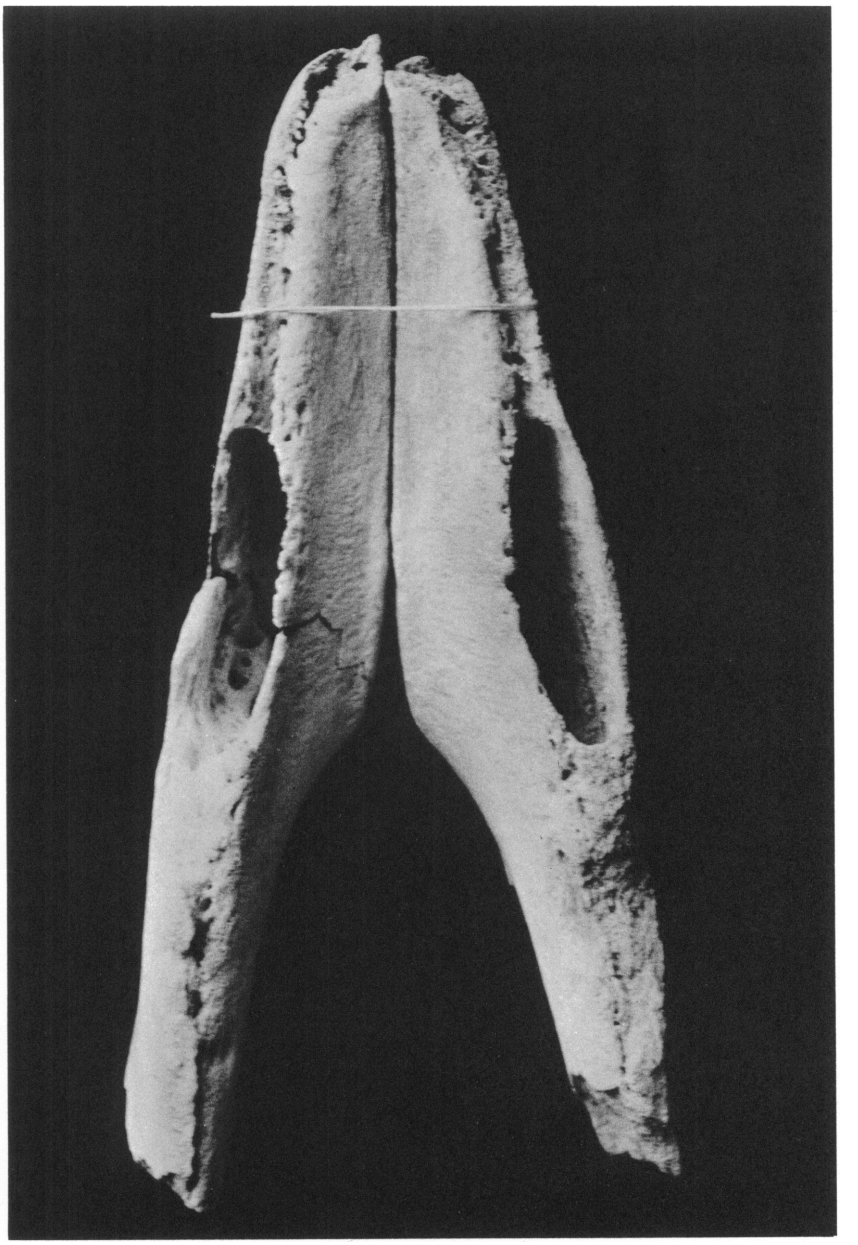

FIG. 1. Anterior extremity of the broken mandible of male *Mesoplodon gervaisi* from Boca Grande, Florida, showing, in this occlusal aspect, the relative positions of alveoli and symphysis.

Boca Grande, Florida, measure 55 mm. in length and 15 mm. in width (fig. 1), and the undamaged alveolus (of the right side) is 50 mm. in depth, measured against the right wall of the alveolus which is naturally 10 mm. higher than its left wall. The left tooth (A.M.N.H. No. 150037) of the unidentified male specimen of *Mesoplodon* from the Texas coast (Moore, 1958, p. 6) fits rather snugly into this alveolus. Although the greatest dimensions of this tooth (96.2 by 51.0 by 14.9 mm.) of the Texas coast specimen are quite close to those of the type of *gervaisi* (about 80.0 by 52.0 by 12.0 mm. from drawings in Van Beneden and Gervais, 1880,. pl. 24, fig. 3), the tooth of the type is straight in the vertical axis and has slight differences from that of the Texas specimen in the contours of the dorsal profile. These differences seemed so great that the possibility of identity was not suspected before the tooth of the Texas specimen was tried in the alveolus of the Boca Grande specimen, which was then noted to have a curvature that accommodates the curved tooth. The curvature in the long axis of the tooth of the Texas specimen is in the vertical plane, the concavity facing mesiad (see fig. 3). It is therefore concluded in the light of present knowledge that A.M.N.H. No. 150037 from Padre Island 40 miles south of Port Aransas, Texas, originally reported as *Mesoplodon densirostris* by Gunter (1955), represents in fact a third adult male of the species *Mesoplodon gervaisi*.

Teeth of Boca Grande Whale

The teeth of the specimen from Boca Grande, Florida, were received after the above conclusion had been reached. The left one measures 87.0 by 53.5 by 11.5 mm.; the right one, 88.3 by 53.8 by 11.7 mm. They share with the Texas specimen the inward curve of the root, although their curvature is less (see fig. 3). The tooth of the Texas whale is longer and its roots appear to be quite closed, whereas the roots of the teeth of the Florida whale are shorter and not entirely closed. From this one might suppose that the teeth of the latter might have grown longer had it lived longer. This suggestion is possibly supported by the fact that, while the tooth tips of both whales are worn, the tip of the tooth of the Texas specimen is worn to a thinner, smaller point (see figs. 3 and 4). If, then, the Florida specimen had lived longer and had its tooth grown slightly shorter at the tip and longer and more curved at the root, it might have become quite like the Texas specimen.

The wear on the tooth in both of these Gulf of Mexico specimens seems to be greater on the posterior margin of the apex and thus to have a tendency to move the apex forward at the same time as lowering

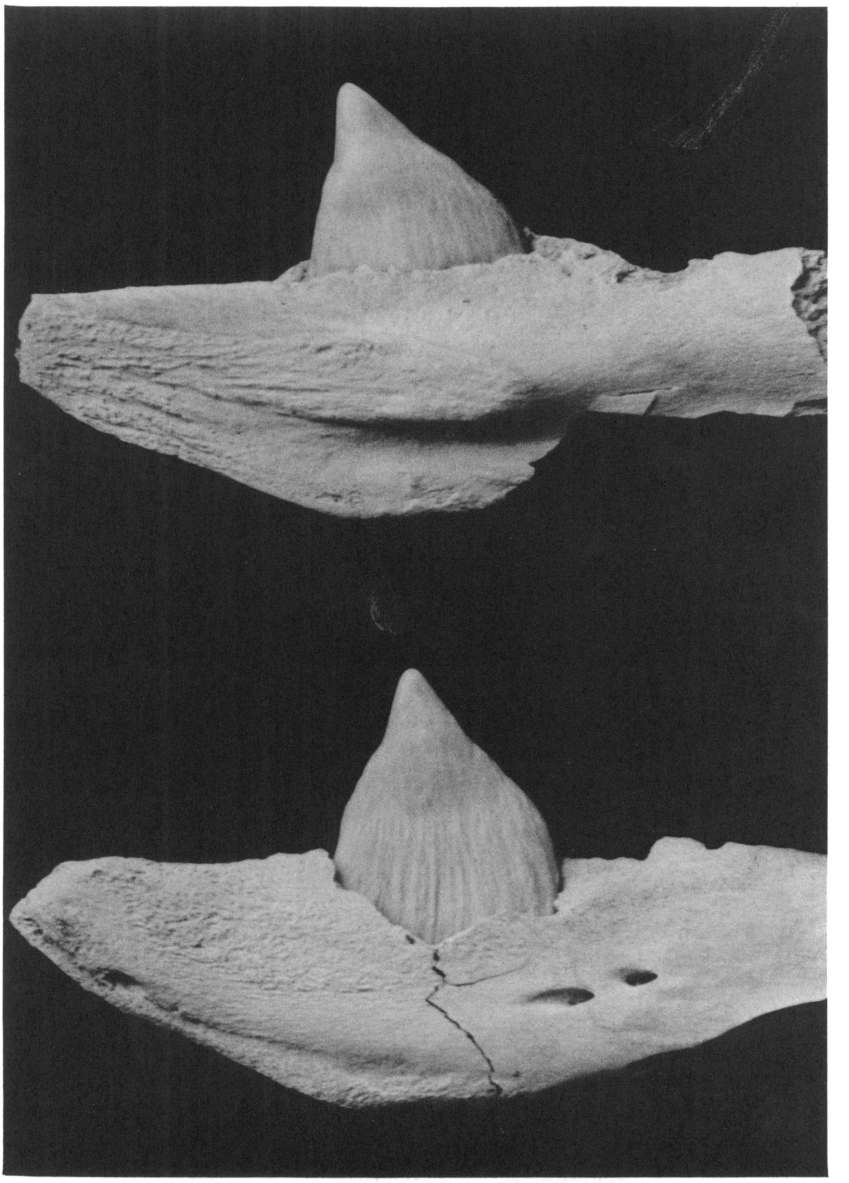

FIG. 2. Left views of teeth in broken mandibular rami of male *Mesoplodon gervaisi* from Boca Grande, Florida, showing (*upper*) character of the symphysis and (*lower*) locations of foramina. The upper figure is the right ramus and tooth, and the anterior extremities of the rami are to the left.

it (see figs. 3 and 4). The resulting succession of shape in the three presumed adult males of *Mesoplodon gervaisi* will then be the specimen from Boca Grande, Florida, the one from Padre Island, Texas, and the type specimen from the English Channel. Acceptance of this explanation of the observed differences would leave the lack of a mesial concavity in the root of the tooth of the English Channel specimen as the only markedly individual or potentially geographic variation in the teeth of these three.

On the labial surface of each tooth in the Boca Grande specimen (figs. 3 and 4) there are two small vertical grooves in the dentine which

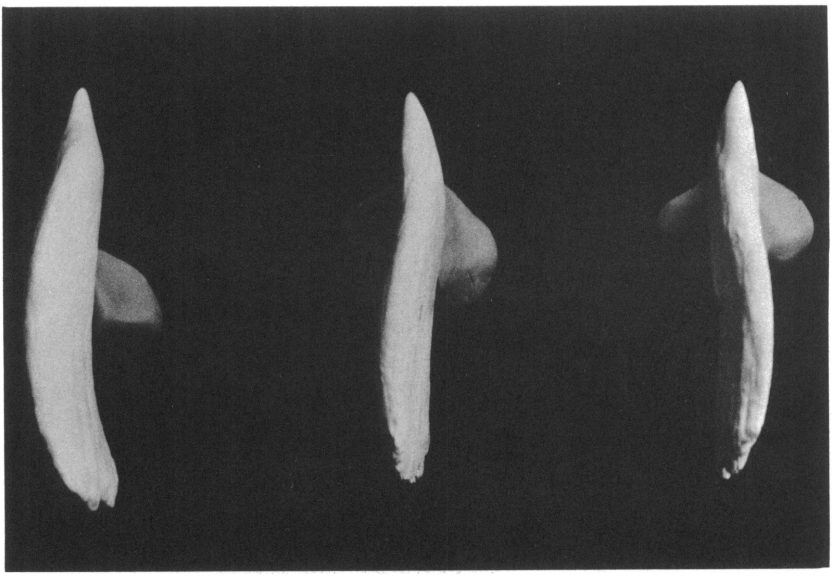

FIG. 3. Posterior views of teeth of male *Mesoplodon gervaisi*. (*Left*) left tooth from Padre Island, Texas; (*center*) left tooth from Boca Grande, Florida; (*right*) right tooth from Boca Grande, Florida. (Supporting material shows.)

disappear towards the tip because of wear, and towards the base because of being filled and covered by the cementum. These two grooves and the resulting castellated pattern of the margin of the cementum would be expected to disappear with further wear, and none are seen in the Texas or English Channel specimens.

McCall told Dr. Clark that when he removed the teeth from the Boca Grande whale, each tooth had a cluster of about a half dozen goose-necked barnacles hanging from its outer surface, which resembled "a bunch of flowers."

Specimen from Vero Beach, Florida

On March 9, 1958, a collector, John Paradiso, sent by the United States National Museum reached the specimen of *Mesoplodon gervaisi* that had stranded 8 miles north of Vero Beach, on the Atlantic coast of Florida. It was in a rather advanced state of decay, but excellent unpublished photographs (taken by Bob Palmer of Vero Beach) lent to the author by the United States National Museum reveal several features of interest. The extremity of the lower jaw definitely appears to protrude beyond the tip of the beak, and, as that of the young male

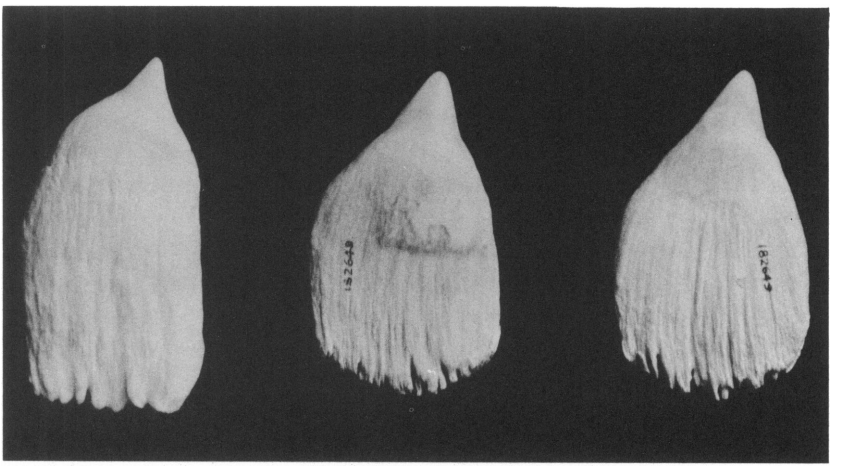

Fig. 4. Teeth of male *Mesoplodon gervaisi* from Gulf of Mexico. (*Left*) left tooth from Padre Island, Texas; (*center*) left tooth from Boca Grande, Florida; (*right*) right tooth from Boca Grande, Florida. The anterior edges of the teeth are all to the right, hence this figure shows the lingual aspect of the two left teeth and labial aspect of the right one.

gervaisi stranded at Atlantic City (True, 1910, pl. 41, fig. 1) does also, and Rankin (1955, p. 28) describes her adult female specimen from Jamaica ". . . with the lower jaw jutting out in front of the upper," it seems most likely that McCall may have been mistaken about this aspect in the Boca Grande whale. One of the photographs of the Vero Beach specimen shows the absence of a median notch in the posterior margin of the flukes.

The Vero Beach specimen, in addition to having the teeth located beside the posterior half of the symphysis, is identified as *gervaisi* by 15 of the 18 taxonomic propositions for distinguishing between *Mesoplodon mirus* and *M. gervaisi* considered by Moore and Wood (1957).

For the record it disagrees in propositions 8, 9, and 11 of that study.[1] Of these, 9 and 11 were concluded in that study to be of no value for distinguishing the species. Number 8 was in 1957 thought to have diagnostic value, but the available sample for it was only two specimens of *mirus* and three of *gervaisi*. The consideration of but three more specimens of *gervaisi* has thus introduced a variant. It seems probable that, as more specimens are accumulated and studied, exceptions will eventually be found to every one of those 18 taxonomic propositions, and none will remain completely diagnostic. Nevertheless, it will become obvious enough by then which characters are the *most* useful in the identification of newly discovered specimens lacking the mandible. In the absence of any single diagnostic skull character it will at any rate be possible to identify new material by use of the best several characters with full confidence, much as the Vero Beach specimen is identified by the consensus of 18 characters here.

Because of the state of decay of the genital parts, John Paradiso (letter of July 16, 1959, to the author) could not determine the sex of the Vero Beach specimen, but he obtained the following external body measurements: total length, 14 feet, 3 inches; circumference immediately in front of flipper, 6 feet; width across the flukes, 3 feet; height of dorsal fin, 7½ inches; distance between eye aperture and corner of gape, 8 inches. He says that Paul Kruse, fisheries biologist from the United States Fish and Wildlife Service Laboratory, Vero Beach, had first observed this specimen while flying along the beach early in February, but at the time he did not stop to examine it, assuming it to be a pilot whale.

In one of the unpublished United States National Museum photographs the ventral aspect of the Vero Beach whale is well revealed, but no genital or anal aperture can be seen. A gash in the body wall appears about where the anal aperture would have been, as though vultures had torn away flesh from an area 6 or 8 inches square. It seems certain that the genital aperture of a male would be sufficiently anterior to the anal aperture to appear in the photograph anterior to the gash described. If there were a penis, it would have been extruded by bloating, and would show in this photograph, but there is no indication of it. One of the photographs shows the gum cut away from the left side of the lower jaw to expose the tip of the tooth, which is small and acute-angled. This is certainly the tooth of an immature individual or an adult female. Because the skull has a greatest length of 802 mm.

[1] Skull character propositions 8, 9, and 11 of Moore and Wood (1957) are identical with numbers 11, 12, and 14 of the present paper. (See tables 1–3.)

(measured by the author), and this is the greatest known for the species (see table 3), there can be little doubt that the specimen is adult and therefore female.

Inasmuch as the Vero Beach specimen is so evidently a large, and possibly fairly old, female, the extent of the filling of the mesirostral canal is a matter of some interest, for the photograph provided the present writer of the lactating adult female *gervaisi* from Jamaica (Rankin, 1956) shows only the posterior quarter of the length of the canal to be filled. The Vero Beach specimen has the posterior half of the length of the canal filled. Because there is some suggestion in the characters reported here for the Boca Grande male that it had barely attained adulthood, whereas the mesirostral groove is filled for its entire length, the evidence from these two new specimens invites an inferential modification of Raven's thesis that in this species the filling of the mesirostral canal progresses with increasing age. This modification is that the filling of the canal progresses at a slower rate in females than in males.

THE PREMAXILLARY AND MAXILLARY FORAMINA

Nishiwaki and Kamiya (1958, pp. 68, 76) quote Raven's (1937, p. 6) unsupported assertion that, "The relative position of the maxillary to the premaxillary foramen is apparently a constant character in a given species," and use it as their own principal basis for "classifying the species of *Mesoplodon*." In using this character thus as the most fundamental one, they have separated *mirus* and *gervaisi* as distantly as any two species are separated within the genus. Evidently Raven was following Flower's (1878, p. 417) findings of a much earlier time, apparently without checking to learn whether Flower's proposition still held good on the specimens and new species that had been found and reported upon in the 60 intervening years. Raven (1937) and Nishiwaki and Kamiya (1958) regrettably overlook a number of statements of fact on this taxonomic character in the literature, three of which are made or quoted in scientific papers which the latter authors cite. In reading the following quotations from this overlooked literature, one should bear in mind that Nishiwaki and Kamiya (1958, pp. 75 and 76) have restated Flower's proposition so that, in some species of *Mesoplodon*, now including *mirus*, the premaxillary foramina ". . . seem to be situated on a level equal [with], or more caudal to, the maxillary foramina, . . ." but that in other species, including *gervaisi*, the ". . . premaxillary foramina are rostral to the maxillary foramina."

True (1913, p. 653), in the original diagnosis of the species *mirus*,

states succinctly, "Maxillary foramina behind the premaxillary foramina." Raven (1937, p. 17) quoted True's entire diagnosis of *mirus*, including the above-cited part, making no comment on the fact that it appears to disagree with his own restatement of Flower's generalization 11 pages earlier.

Harmer (1924, p. 561), in his detailed description of a fully adult male of the species *mirus*, remarks, ". . . the premaxillary foramina . . . are slightly in advance of the maxillary foramina . . ." Harmer (1924, pl. 1, fig. 2) illustrated this relationship with a dorsal photograph of the specimen, as did Fraser (1955, pl. 13). Raven (1937) as well as Nishiwaki and Kamiya (1958) ignores Harmer's observation.

Fraser (1955) minutely reconsidered many of the proposed skull-character differences between *mirus* and *gervaisi*, and remarks: "The maxillary and premaxillary foramina are in approximately the same relative position to each other in [one specimen each of *gervaisi* and *mirus*]. This, contrary to Raven's opinion, does not appear to be a very good character for distinguishing *M. gervaisi* from *M. mirus*."

Rankin (1956, p. 348) states in her description of the adult female *gervaisi* from Jamaica, ". . . only the left premaxillary foramen is distal to the anterior maxillary foramina, as the right one is on a level with them."

Because the above scientific observations have been so ignored, the present author has examined anew the available evidence as it pertains to *gervaisi* and *mirus*. The proposition on the relative positions of the premaxillary and maxillary foramina as stated by Nishiwaki and Kamiya does not discriminate properly the following specimens of *mirus:* the type from Beaufort, North Carolina (True, 1913, pl. 54); the adult male from Liscannor, Ireland (Fraser, 1955, pl. 13); the one from Mason Island, Connecticut (Thorpe, 1938, fig. 1); A.M.N.H. No. 174293 from Florida (Moore and Wood, 1957), the skull of which is before the present author. Thus, in more than half of the specimens of *mirus* of which the skulls have been studied, the left premaxillary foramen is anterior to a line connecting the anterior margins of the maxillary foramina.

Dr. David H. Johnson of the United States National Museum provided the present writer some time ago with unpublished photographs of the skull of the adult female *M. mirus* from Oregon Inlet, North Carolina (Brimley, 1943), which is of special significance here. The dorsal view of this specimen clearly shows both premaxillary foramina to be about a centimeter anterior to a line connecting the anterior edges of the maxillary foramina.

Although in *gervaisi* no anterior limit of the maxillary foramen is seen, and any decision as to whether or not the proposition applies must therefore be arbitrary, the proposition under discussion can hardly be said to discriminate the following specimens of *Mesoplodon gervaisi:* the individual from North Long Branch, New Jersey (True, 1910, pl. 2); the adult female from Jamaica (Rankin, 1956), which the present author has studied in an excellent unpublished photograph of the dorsal aspect of the skull; and the adult male from Boca Grande, Florida (fig. 5 of the present report). Thus, three of the nine specimens of *gervaisi* of which the skulls have been studied are not well discriminated by this allegedly diagnostic character.

One must conclude that the relative position of the premaxillary foramina and maxillary foramina is variable within the sample now known of *Mesoplodon mirus* and, for this species, has no taxonomic worth. In *M. gervaisi* its worth is very doubtful. The proposition may be more constant in some of the other species of *Mesoplodon,* but its advocates have not demonstrated that this is so any more firmly than they have for *gervaisi* and *mirus.*

DISTINCTIONS BETWEEN *MESOPLODON GERVAISI* AND *MESOPLODON MIRUS*

It should first be emphasized that little doubt can be entertained that *gervaisi* and *mirus* are distinct species. The single pair of mandibular teeth in *mirus* are invariably at the anterior end of the symphysis, and in *gervaisi* they are invariably beside the posterior half of the length of the symphysis. This is known for a female of *mirus* bearing a full-term young (Brimley, 1943) and a female of *gervaisi* with milk in her mammaries and accompanied by a young calf (Rankin, 1956). Between the known adult male of *mirus* (Harmer, 1924) and the presumed adult males of *gervaisi* (Van Beneden and Gervais, 1880; the present paper) not only does the location of the teeth distinguish the species, but trenchant differences are seen in the character of the tooth itself. All the *gervaisi* specimens used in this comparison (table 1) except those from North Long Branch, Melbourne, and Trinidad, for which no mandibles were found, have been identified by the location of the tooth beside the posterior half of the symphysis. All the *mirus* specimens used in table 2 were identified by the location of the tooth beside the anteriormost part of the symphysis.

Moore and Wood (1957) point out also that there are indications of a tendency towards separate geographic ranges for *gervaisi* and *mirus* in maps presented of the localities at which the known specimens have

been found. The addition in the present paper of three new locality records for *gervaisi* strengthens the concept of a generally more southern range for *gervaisi* than for *mirus*. The *Mesoplodon mirus* reported by Mousset and Duperier (1956) for the southernmost portion of the Atlantic coast of France is unfortunately a *Ziphius cavirostris*.

The present exploration of the variability of skull characters in these two species of *Mesoplodon* is offered in part for the practical value of making easier the identification of any further specimens of these two species in instances in which no jaw is available and only a skull or part of a skull represent the animal to be identified. Also, the data presented express something of the degree of relationship between these two species, which may be of assistance to the paleontologist seeking to evaluate fossil finds of this genus, to the zoogeographer, and to persons reporting new strandings of *Mesoplodon*, skulls of which differ to some extent from those of other known specimens.

The following taxonomic propositions are taken verbatim from Moore and Wood (1957), except for my making the modifications that were indicated in that publication for 4 and 6, the deletion of one, and the insertion of eight additional propositions, which necessitated renumbering. The origins of these 25 numbered propositions, which follow, are cited from the literature, in parentheses at the end of each, to give credit but not to indicate responsibility. Often the original mention of the characteristic is stated in a passage of descriptive anatomy which is neither comparative nor taxonomic. Nevertheless, the descriptive remarks have in these instances enabled the present author to see an apparent difference between the species that could be defined and tested. In some instances the author cited for the origin of a proposition stated it comparatively and adequately for his one, two, or three fairly good skulls, but not adequate enough for it to apply as well as possible to the additional material reported on by Moore and Wood (1957) or subsequently available to the present author. It has consequently been necessary to modify some comparative propositions to make them apply as well as possible to the increased amount of material. The case of proposition 7 was somewhat of this sort. Originally adapted to separate all the species of *Mesoplodon*, 7 is here restated to obtain the fairest precise testing that could be given to the concept of its originators but particularly as it applies to the species *gervaisi* and *mirus*. The left premaxillary foramen is generally anterior to its mate in these two species, so, by confining the proposition to the right premaxillary foramen, one enables the proposition to apply to more specimens than it does as stated by its originators. In

other cases no particular effort is made to stay within the concepts of the originators if alteration seems more promising, because the originators attribute no supraspecific importance to them. Completeness is not claimed, or presumed, for coverage of the literature or empirical examination of the skulls to discover testable taxonomic differences. Taxonomic characters may, of course, prove to exist elsewhere in the skeleton, in the complexities of the cervical vertebrae, for instance (see fig. 9). However, there are fewer skeletons available, and for better testing the present study concentrates on the most abundantly available part, the skull.

This current treatment improves upon that of Moore and Wood (1957) by an increase of from 18 to 25 taxonomic propositions, an increase in the number of specimens studied at first hand from five to eight, and an increase in the number of specimens studied from photographs from six to nine.

Conformity to, or disagreement with, each of the 25 taxonomic propositions is generally determined best from a particular view of the skull. It may be helpful to note here which view of the skull is best for determining conformity to or disagreement with which taxonomic propositions: the dorsal view, as in figure 5, is best for propositions 1 to 5 and 7; the lateral view, as in figure 6, is best for propositions 6, 9, 10, and 12 to 19; the ventral view, as in figure 7, is best for propositions 20 to 25; the posterior view, as in figure 8, is best for proposition 8; and proposition 11 is measured.

1. MAXILLARY PROMINENCES: The maxillary prominences that flank the base of the rostrum are longer, lower, and more nearly parallel to the long axis of the skull in *gervaisi*. (True, 1913, p. 653.)

2. MAXILLARY PROMINENCE: The anterior margin of each maxillary prominence protrudes so that it intersects the lateral margin of the rostrum and forms a notch there in *mirus*, at least on the left side, if not on both.[1] In *gervaisi* the lateral margin of the rostrum curves gently out around the maxillary prominence, with no angular break. (Fraser, 1955, p. 625.)

[1] Raven (1937, p. 23) suggested that the variation of these notches from an acute angle through obtuse angles to no notches in *mirus* may be progressive with age. This in part seems to be supported by a comparison of the young male *mirus* from Vero Beach which has notches with about 90-degree angles, with the photographs of the adult male *mirus* from Liscannor (Harmer, 1924, pls. 1, 2), which has notches of about 100 degrees. However, there is no example yet of the condition, hypothetical in *mirus*, of no notches. (It seems a bit odd, therefore, to invoke, as Raven has, the absence of these notches in *pacificus* as evidence that *pacificus* is subspecifically related to *mirus*.)

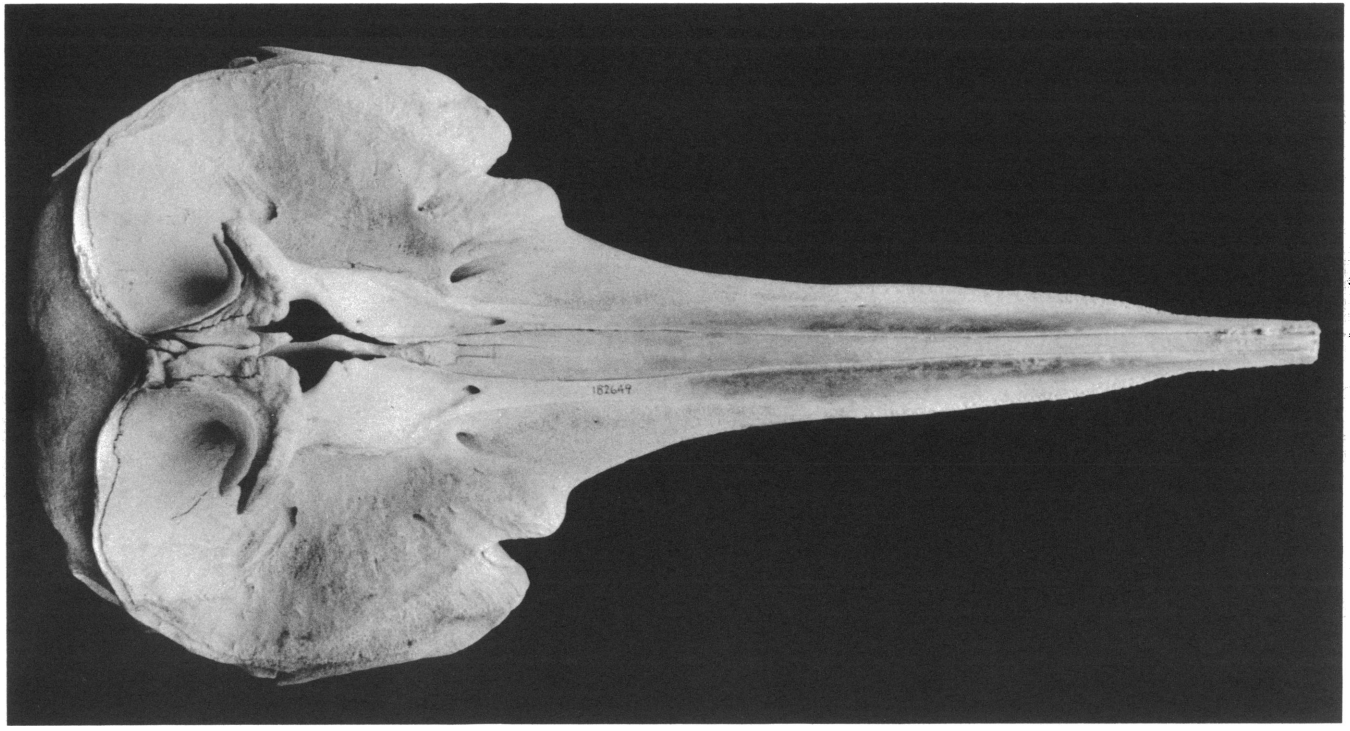

FIG. 5. Dorsal aspect of the skull of *Mesoplodon gervaisi* from Boca Grande, Florida, showing slight notch on left side which makes it mildly exceptional to proposition 2, and the position of the right premaxillary foramen which makes it exceptional to proposition 7.

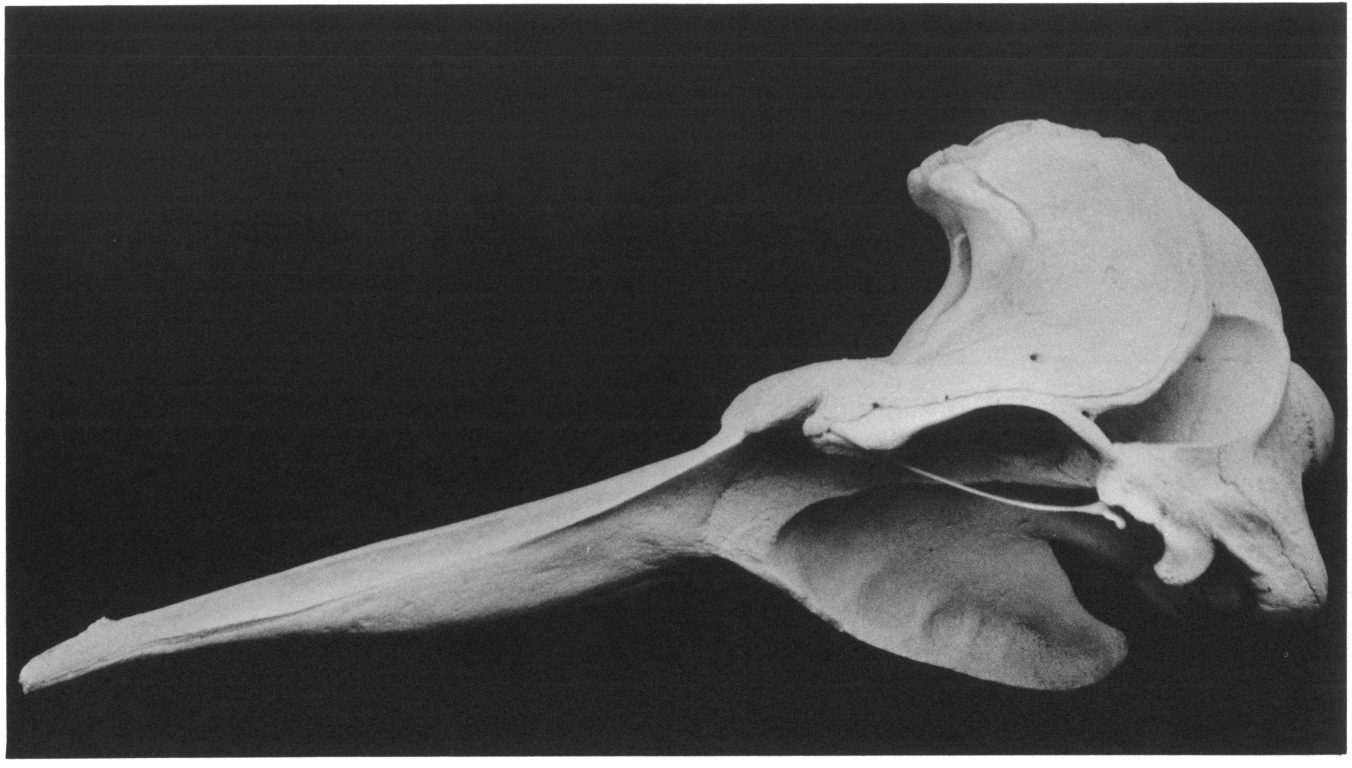

FIG. 6. Lateral aspect of the skull of *Mesoplodon gervaisi* from Boca Grande, Florida, showing the rather narrow pterygoid notch which makes this specimen exceptional to proposition 14.

3. ROSTRUM, LATERAL MARGIN: Anterior to the concave basal curve the external free margin of the rostrum proceeds towards the tip in a straight line in *mirus*, but describes a further long, gentle, convex curve in *gervaisi*. (True, 1913, p. 653.)

4. ANTORBITAL TUBERCLE: The lacrimal extends beyond the maxilla 10 mm. or more in *mirus* to form the apex of the antorbital tubercle. In *gervaisi* it extends less than 10 mm. (in some specimens not at all). (Fraser, 1955, p. 626.)

5. APEX OF BEAK: Towards the apex of the beak the premaxillae diverge from the median line (i.e., separate) in *mirus*, but in *gervaisi* they remain in contact. (True, 1913, p. 655.)

6. MAXILLARY PLATE: The greatest anteroposterior width of the postnarial, dorsal extension of the left maxillary plate measured parallel to the long axis of the beak is only about one-half of the greatest proximal span of the premaxillaries in *gervaisi*, whereas in *mirus* its width is about two-thirds of the greatest span of the premaxillaries. (True, 1913, p. 654.)

7. PREMAXILLARY FORAMINA: In *gervaisi* the right premaxillary foramen is entirely anterior to a line connecting the anterior margins of the maxillary foramina,[1] but in *mirus* the right premaxillary foramen is in contact with this line or posterior to it. (Nishiwaki and Kamiya, 1958, pp. 68, 76.)

8. SUPRAOCCIPITAL: The dorsolateral slope of the margin of the supraoccipital is rather flat in outline in *mirus* but arched in *gervaisi*. (Fraser, 1955, p. 627.)

9. ROSTRAL PROFILE: The ventral outline of the rostrum is straight in *mirus*, but in *gervaisi* it is convex proximally and concave distally. (True, 1913, p. 654.)

10. ROSTROPTERYGOID PROFILE: In *gervaisi* the ventral profile of the rostrum is intersected sharply by that of the pterygoids, whereas in *mirus* the ventral outlines of these two come together in a gentle curve. (True, 1913, p. 654.)

11. TEMPORAL FOSSA: The shape of the temporal fossa as described by its margin is more elongate in *gervaisi* than in *mirus*. The data considered are ratios of greatest width by greatest length. (Fraser, 1955, p. 627.)

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[1] No distinct anterior margin exists in the maxillary foramina of these two species, but for the purpose of treating this proposition (which Moore and Wood, 1957, intentionally disregarded in its original form) as well as possible, I think one must arbitrarily in each case assume an anterior margin like the posterior one, and with no greater elongation. Such an arbitrary feature, of course, lessens the value of this taxonomic proposition.

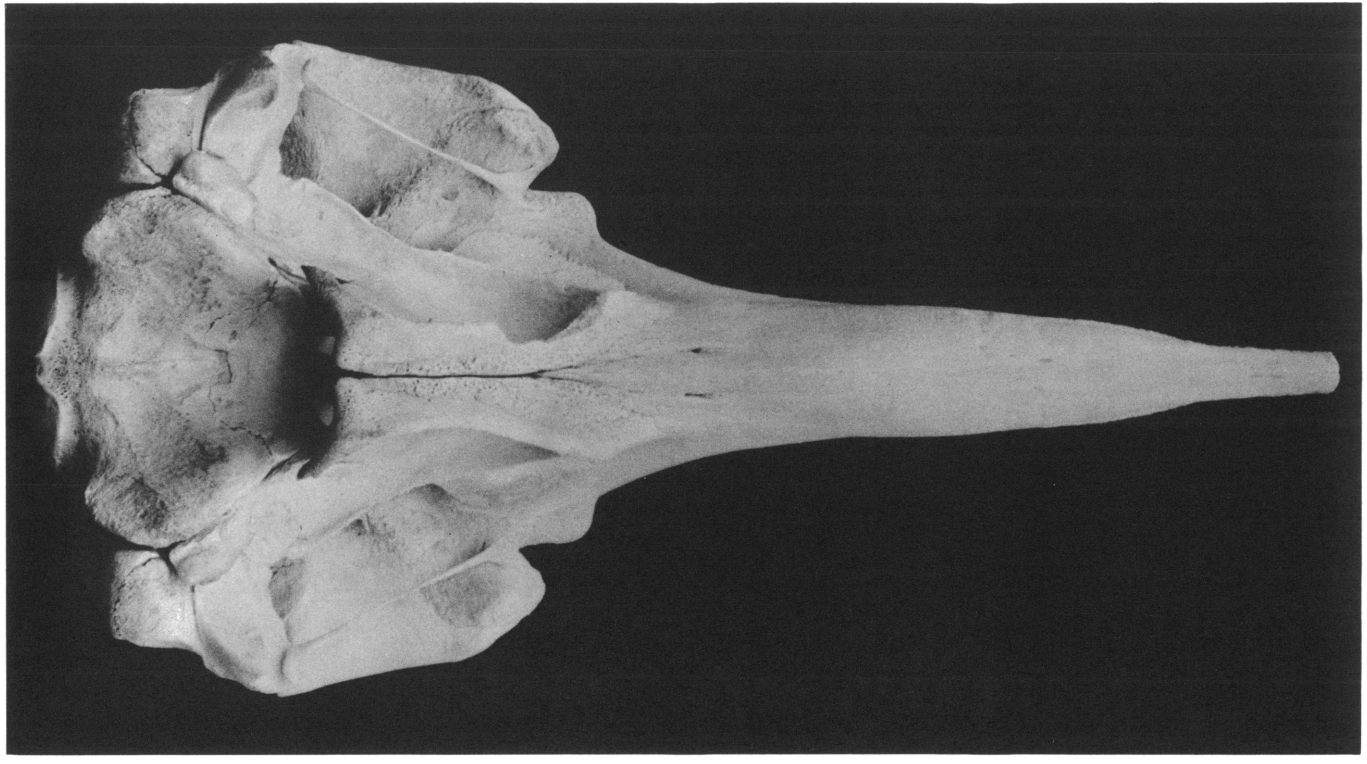

FIG. 7. Ventral aspect of skull of *Mesoplodon gervaisi* from Boca Grande, Florida, showing the broadly truncated median notch in the posterior margin of the vomer (proposition 24).

12. ZYGOMATIC PROCESS: The zygomatic process of *mirus* is more robust than that of *gervaisi*. (True, 1913, p. 654.)

13. POSTORBITAL PROCESS: The postorbital process of the frontal tapers to a point in *gervaisi*, but in *mirus* it thickens and becomes truncated at the end. (Fraser, 1955, p. 627.)

14. PTERYGOID NOTCH: The notch in the posterior margin of each wing of the pterygoid is longer and narrower in *mirus* than in *gervaisi*. The data considered are greatest width divided by greatest length. (True, 1913, p. 654.)

15. ANTORBITAL TUBERCLE: The extension of the frontal forward from the orbit into the antorbital tubercle is greater in *mirus*, and the lacrimal (in this side view) appears reduced to a thin layer wrapped around the protrusion of the frontal. In *gervaisi* the frontal contributes no more than half of the tubercle. (Moore and Wood, 1957, p. 15.)

16. MAXILLARY BEVEL: On the dorsal surface about at the midlength of the rostrum in *mirus* a sharp change in slope of the maxilla begins at the outside edge and angles forward to the inside edge. Posterior to this the surface of the maxilla is level or slopes gently towards the sagittal plane; anterior to it the outward slope is steep. In *gervaisi* there is no such sharp change in the slope of the dorsal maxillary surface; its surface may be completely level or gradually slope outward. (True, 1913, p. 654.)

17. LACRIMAL: The external free border of the lacrimal bone is about one-half of the length of the orbit in *mirus*, less in *gervaisi*. (True, 1913, pp. 653, 654.)

18. MAXILLARY PROMINENCE: The height of the maxillary prominence, whether it be a rounded point, as is more general, or more rarely a plateau, has anterior and posterior slopes of mild (and often equal) grade in *gervaisi*, but in *mirus* the anterior slope is abrupt. (True, 1913, p. 654.)

19. FILLING OF CANAL: In an old male specimen of *mirus* the surface of the vomer filling the mesorostral canal rises almost to the level of the dorsal margins of the premaxillae, but at no point surpasses that level, along its whole length. In an old *gervaisi* the vomer may rise above the rims of the canal for a good portion of its length. (Harmer, 1924, p. 561.)

20. PTERYGOID RIDGE: On the inferior surface of the pterygoid in *gervaisi* there is an oblique ridge beginning at or near the posterior edge of the pterygoid at or near the sagittal plane, which extends obliquely laterad nearly the length of the ventral surface of the pterygoid. This ridge is absent in *mirus*, although a change in the texture

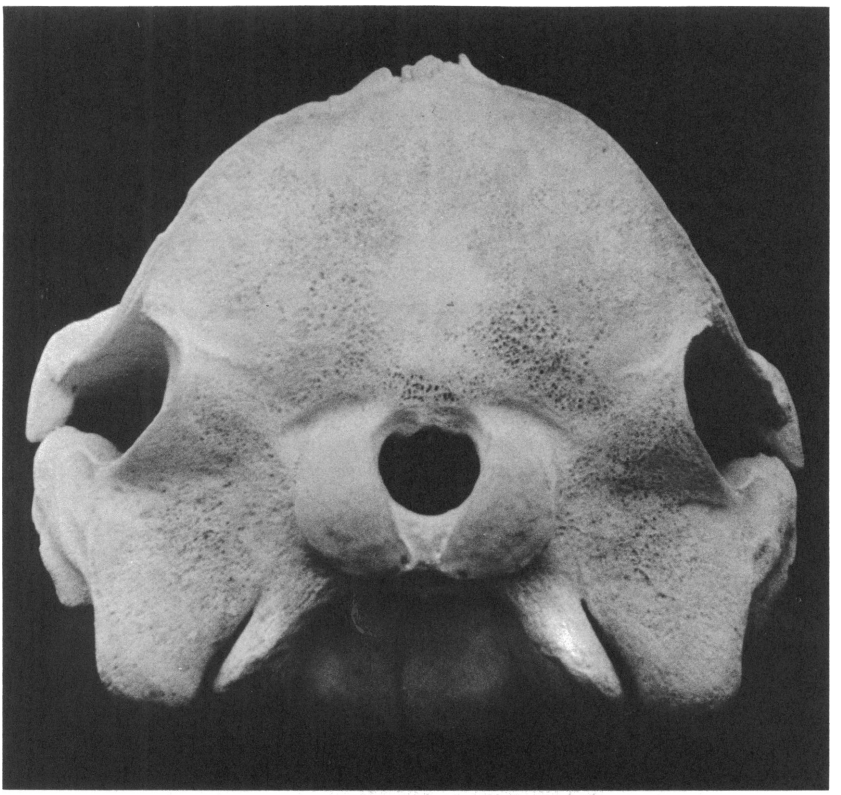

FIG. 8. Posterior aspect of skull of *Mesoplodon gervaisi* from Boca Grande, Florida.

of the bone may make a corresponding line visible. (True, 1913, p. 655.)

21. PALATINES: The maxillae of *mirus* extend posteriorly between the pterygoids, separating the palatines and preventing their meeting in the sagittal plane, but the palatines meet in *gervaisi*. (True, 1913, p. 655.)

22. ROSTRAL KEEL: The ventral surface of the rostrum just forward of the pterygoids in *gervaisi* has a sagittal keel, but in *mirus* it is smoothly rounded. (Fraser, 1955, p. 628.)

23. VOMER: The vomer appears in the sagittal plane on the ventral surface of the beak in *mirus* as an elongated fusiform ridge with a visible length about one-third of that of the beak. In *gervaisi* it is shorter and has its greatest width at the anterior end, or it may be absent from the surface. (True, 1913, p. 655.)

24. MARGIN OF VOMER: The midline of the posterior margin of the vomer is marked by an acute-angled notch in *mirus*, but in *gervaisi* a broad, truncated notch, or a wide emargination marks the midline, or a truncated notch occurs on each side of the midline, separated by a posteriorly directed process. (True, 1913, p. 655.)

25. FORKED PALATINE: The anterior end of the palatine bone is bifurcated in *gervaisi*. (Often the posterior angle between the two anterior points of the palatine is intruded upon by the pterygoid bone, somewhat obscuring the nevertheless still evident pattern.) In *mirus* the palatine has a single anterior point. (True, 1910, p. 14.)

Abbreviations, in the present paper, of the names of institutions are:

A.M.N.H., the American Museum of Natural History
A.N.S.P., Academy of Natural Sciences of Philadelphia
B.M., British Museum (Natural History), London
M.C.Z., Museum of Comparative Zoölogy at Harvard College, Cambridge, Massachusetts
U.S.N.M., United States National Museum, Washington, D. C.
Y.P.M., Peabody Museum of Natural History, Yale University, New Haven, Connecticut

Individual specimens designated in tables 1 to 4 by geographic abbreviations are identified here by their localities of origin and the institutions in which they were deposited. The catalogue numbers, when known, are given.

Mesoplodon gervaisi

Atl.C., Atlantic City, New Jersey, U.S.N.M. No. 23346
Boca, Boca Grande, Florida, A.M.N.H. No. 182649
Cuba, Cayo Alacranes, Cuba, Museo Poey, Habana
Jam., Bulls Bay, Jamaica, University College, Mona, Jamaica
Largo, Key Largo, Florida, A.M.N.H. No. 121894
Melb., Melbourne, Florida, A.M.N.H. No. 135639
N.L.B., North Long Branch, New Jersey, M.C.Z. No. 7308
Rock., Rockaway Beach, Long Island, New York, A.M.N.H. No. 90051
Trin., Trinidad, West Indies, B.M. No. 1953.10.6.1
Vero, Vero Beach, Florida, U.S.N.M. No. 306302

Mesoplodon mirus

Beau., Beaufort, North Carolina, U.S.N.M. No. 175019
Conn., Mason Island, Connecticut, Y.P.M. No. 0-2340
Edge., Edgemere, Long Island, New York, A.M.N.H. No. 90053
Eire, Liscannor, Ireland, B.M. No. 1920.5.20.1
Fla., Flagler Beach, Florida, A.M.N.H. No. 174293
N. J., Island Beach, New Jersey, A.N.S.P. No. 20484
Oreg., Oregon Inlet, North Carolina, North Carolina State Museum, Raleigh

TABLE 1

VARIATION OF *Mesoplodon gervaisi* IN THE 25 TAXONOMIC PROPOSITIONS DESCRIBED IN THE TEXT

(C, conforms with the proposition as it characterizes *gervaisi;* D, differs from the proposition as it characterizes *gervaisi* and in the manner attributed to *mirus;* C(?), conforms somewhat incompletely or dubiously. Parentheses around sex symbol indicate that sex is inferred from tooth and skull characters.)

Taxonomic Proposition	Eur. (♂)	Rock. ♀	N.L.B. —	Atl.C. ♂	Melb. —	Vero (♀)	Boca (♂)	Largo (♀)	Jam. ♀	Trin. —
1 Maxillary prominences	D	C	—	C	C	C	C	C	C	C
2 Maxillary prominence	C	C	D	C	C	C(?)	D	C	D	C
3 Rostrum, lateral margin	C(?)	C	—	C	C	C	C	C	C	C
4 Antorbital tubercle	C	C	C	C	C	C	C	C	C	C
5 Apex of beak	C	C	—	C	C	C	C	C	C	C
6 Maxillary plate	—	C	—	—	C	—	C	C	—	—
7 Premaxillary foramina	C	C	D	C	C	—	D	C	D	C
8 Supraoccipital	C	C(?)	C	C	C	C(?)	C	C(?)	—	C
9 Rostral profile	C	C	—	C	C	C	C	C	C	C
10 Rostropterygoid profile	D	C	—	C	C	C	C	C	C	C
11 Temporal fossa	—	C	—	—	C	D	C	C	—	C
12 Zygomatic process	—	D	—	—	D	D	C	C	—	C
13 Postorbital process	C	D	C	D	C	C	C	C	C	C
14 Pterygoid notch	—	D	—	C	C	D	D	C	—	D
15 Antorbital tubercle	D	C	D	D	C	C	C	C	D	C
16 Maxillary bevel	—	C	—	—	C	C	C	C	—	C
17 Lacrimal	C	D	D	C	D	C	C	D	C	D
18 Maxillary prominence	C	C	C	C	C	—	C	C	D	C
19 Filling of canal	C	—	?	—	C	—	C	—	—	?
20 Pterygoid ridge	D	C	C	C	C	C	C	C	C	C
21 Palatines	D	C	C	C	D	C	C	C	C	D
22 Rostral keel	C	C	—	—	C	C	C	D	—	C
23 Vomer	C	C	—	C	C	C	C	C	C	C
24 Margin of vomer	C	C	C	C	C	—	C	C	C	C
25 Forked palatine	C	C	C	C	C	—	C	C	C	C(?)

It seems likely, now that further material has been available for study, that taxonomic propositions 1 and 20 may fully distinguish the species *gervaisi* and *mirus,* and that the apparent disagreement of the type specimen of *gervaisi* with these two propositions is a result of errors by the artist. However, the published photograph (Brasil, 1909,

TABLE 2

VARIATION OF *Mesoplodon mirus* IN THE 25 TAXONOMIC PROPOSITIONS DESCRIBED IN THE TEXT

(C, conforms with the proposition as it characterizes *mirus;* D, differs from the proposition as it characterizes *mirus,* and in the manner attributed to *gervaisi;* C(?), conforms somewhat incompletely or dubiously. Parentheses around sex symbol indicate that sex is inferred from skull and tooth characters.)

Taxonomic Proposition	Eire ♂	Conn. ?	Edge. (♀)	N.J. ♀	Oreg. ♀	Beau. ♀	Fla. ♂
1 Maxillary prominences	C	C	C	C	C	C	C
2 Maxillary prominence	C	C	C	C	C	C	C
3 Rostrum, lateral margin	C(?)	C	C	C	C	C	C
4 Antorbital tubercle	C	C	C	C	C	C	C
5 Apex of beak	D	D	C	C	C	C	C
6 Maxillary plate	C	C	C	C	D	C	C
7 Premaxillary foramina	C	C	C	C	D	C	C
8 Supraoccipital	C	—	C	C	C	C	D
9 Rostral profile	C	C	C	C	C	C	C
10 Rostropterygoid profile	C	C	C	C	C	C	C
11 Temporal fossa	C	—	C	C	—	—	C
12 Zygomatic process	—	—	C	C	—	—	C
13 Postorbital process	C	C	C	C	C	C	C
14 Pterygoid notch	C	C	C	—	C	D	C
15 Antorbital tubercle	C	C	C	C	C	C	C
16 Maxillary bevel	—	—	C	C	—	—	C
17 Lacrimal	C	C	C	C	—	C	C
18 Maxillary prominence	C	C	C	C	C	C	C
19 Filling of canal	C	—	—	—	C	—	—
20 Pterygoid ridge	C	C	C	C	C	C	C
21 Palatines	C	C	C	D	C	C	D
22 Rostral keel	C	C(?)	C	C(?)	—	—	C
23 Vomer	C	C	C	C	C	C	C
24 Margin of vomer	C	D	C(?)	C	C	C	C
25 Forked palatine	C	—	C	D	C	C	C

pl. 1) supports the drawing in Van Beneden and Gervais in showing the condition that makes the type of *gervaisi* the only known exception to proposition 10.

It is not common in mammalian taxonomy to find characters of the skull that distinguish all specimens of one living species from all specimens of another species of the same genus, if large series of specimens are studied. However, in a genus that is taxonomically only beginning to be known by material additional to the types, data such as are presented in tables 1 and 2 state the degree of distinction evidently

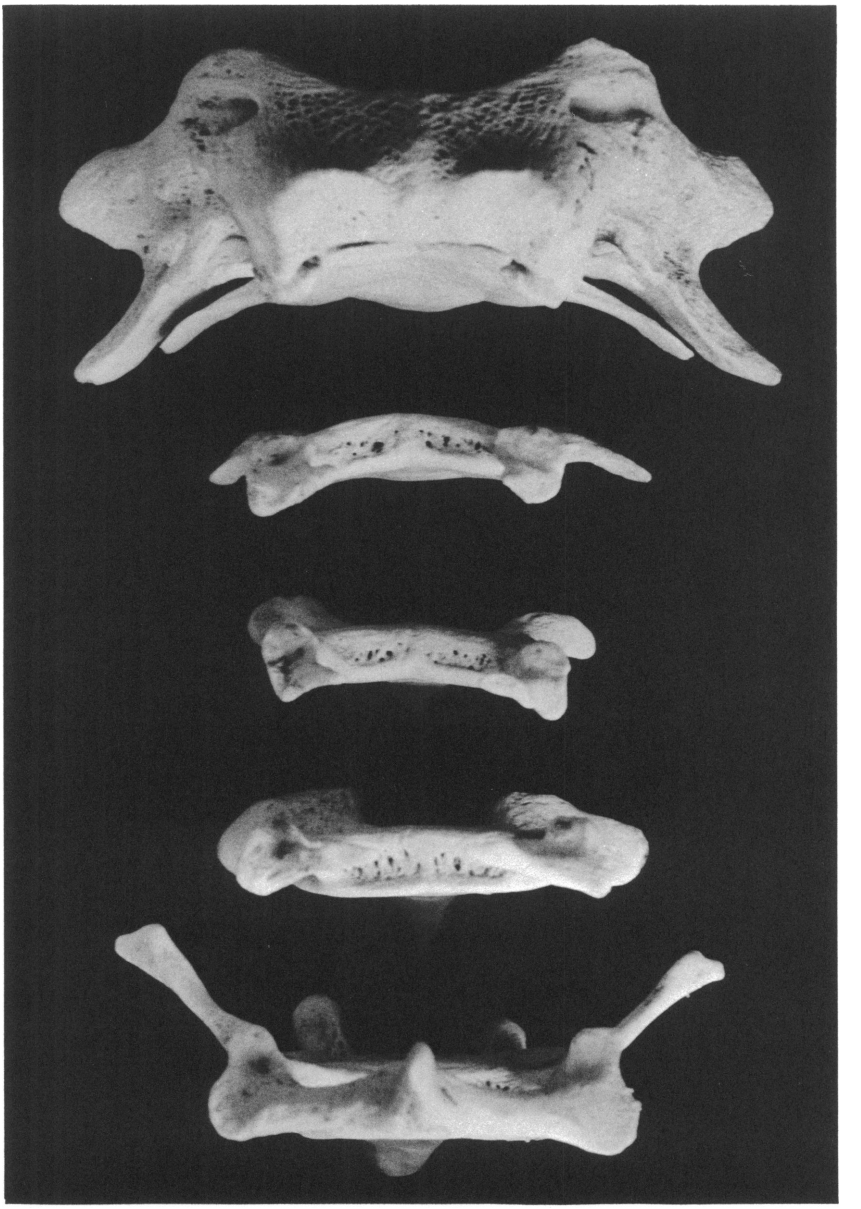

FIG. 9. Dorsal aspect of cervical vertebrae of *Mesoplodon gervaisi* from Boca Grande, Florida: atlas at top, with vertebrae 2 and 3 fused with it, and vertebrae 4 to 7 separate. (Supporting material shows with increasing clarity projecting posteriorly in the midline from vertebrae 5, 6, and 7.)

possessed by two species about as clearly and usefully as one can have it for the identification of further material. A new specimen may apparently be expected to be exceptional to one or two of the better propositions, but the probability is very great that any new specimen which is in fact one of these two species will be collectively distinguished as such by a preponderance of propositions 1, 3, 4, 8, 9, 10, 16, 18, 20, 22, 23, 24, and 25.

The North Long Branch Specimen

Although Glover Allen (1909, p. 360) published a photograph of the specimen of *Mesoplodon* from North Long Branch, New Jersey, in the flesh, designating the location of the tooth to be in the lower jaw at some distance from the apex of the jaw, such a location is poorly seen in the photograph, and one is uncertain whether Allen himself examined the specimen before the beak and mandible were destroyed. He identified the specimen as *Mesoplodon bidens.* True (1910) clearly distinguished the North Long Branch specimen from *bidens* and treated it as *europaeus* (=*gervaisi*), but before he had recognized and described the species *mirus,* hence he did not distinguish it from *mirus,* and subsequently no one else has done so.

Although this partial skull lacks the rostrum and mandible, it exhibits (in photographs published by True, 1910) the characters attributed to *mirus* by propositions 2, 15, and 17. These particular propositions are here shown to be taxonomically very weak, in that at least two specimens indisputably identifiable as *gervaisi* by the location of their teeth also disagree with each of these three propositions. The North Long Branch specimen does, however, display the character attributed to *gervaisi* in proposition 4 which distinguishes all 10 of the *gervaisi* from all seven of the *mirus.* It also possesses the pterygoid ridge of proposition 20 which distinguishes nine of the 10 *gervaisi* from all seven of the *mirus.* (The exception to this, the type specimen, has been examined in this character only from the drawings in Van Beneden and Gervais, 1880, pl. 24, and one must suspect strongly at this point that the artist was at fault.) The North Long Branch specimen also conforms with *gervaisi* in proposition 8 which distinguishes all nine *gervaisi* fairly well from five of six *mirus,* in proposition 13 which distinguishes eight of 10 *gervaisi* from all seven *mirus,* in proposition 18 which distinguishes eight of nine *gervaisi* from all seven *mirus,* and proposition 25 which distinguishes all of nine *gervaisi* from five of six *mirus.* While none of the individual propositions 8, 13, 18, and 25 can be considered diagnostic, of course, it does seem fair to say

that each of them can be considered taxonomically suggestive. As all four suggest that the North Long Branch specimen is *gervaisi*, and as they support the strong propositions 4 and 20 in this respect, it is concluded that identification of the North Long Branch specimen is here attained.

Now that the specimen from North Long Branch, New Jersey, is more firmly identified as *gervaisi*, one needs to reconsider the reported length of 22 feet ". . . by the fishermen who measured it." The greatest other length known for *gervaisi* is that of the specimen from Rockaway Beach, New York, which is just over 15 feet, and the lactating female with a calf known from Jamaica is not that long. Further, one may observe in table 3 that the skull measurements of the specimen from North Long Branch, New Jersey, are smaller, in every instance but one, than those of the specimen from Vero Beach, Florida (which is the largest *gervaisi* skull on record). Because the Vero Beach specimen measured only 14 feet, 3 inches, it seems that the 22-foot length alleged for the North Long Branch specimen may be an instance of a fisherman's having pulled a scientist's leg.

Allen (1909, p. 359) suggested that because of the small size of the tooth, which he may have known only from the photograph published, the North Long Branch animal must be a female. The portion of the mesirostral groove remaining after destruction of the beak is well filled by the vomer and mesethmoid, which indicates maturity, and, inasmuch as a mature male would probably have had a pair of teeth more conspicuous than seems indicated in the photograph, Allen may be right about the sex. However, the external appearance of *Mesoplodon gervaisi* is very poorly known, and, as the photograph shows the tooth only obscurely, the North Long Branch specimen is here treated as of unknown sex.

STATUS OF *MESOPLODON PACIFICUS* LONGMAN

Raven (1937, pp. 22–25) proposed that *Mesoplodon pacificus* Longman, 1928, be regarded as a subspecies of *Mesoplodon mirus*, suggesting that some of their more obvious differences are possibly due to age and emphasizing the strikingly similar apical location of the single pair of mandibular teeth. In a careful re-assessment of the evidence as cited by Raven, but with the photographs and discussion of the characters of *pacificus* by Longman, it might be hard for a taxonomist to agree with Raven that the differences between *mirus* and *pacificus* are subspecific. However, Nishiwaki and Kamiya (1958, p. 69) have accepted that arrangement, and without going into the matter at all exhaus-

tively, I believe it worth while here to observe how the evidence in table 2 bears on this relationship.

Table 2 shows that all seven specimens of *Mesoplodon mirus* conform to propositions 1, 2, 3, 4, 9, 10, 13, 15, 18, 20, and 23, and all six studied for proposition 17 conform to it. These dozen characters, whether they happen to distinguish *mirus* from *gervaisi* or not (many of them apparently do), must at this point in our knowledge of *mirus* be accepted as characteristic of *mirus*. In attempting to test these 12 characteristics of the skull of *mirus* with the photographs of the skull of *M. pacificus* (Longman, 1928, pl. 43), one finds no evidence available in propositions 1, 20, and 23, and agreement between the two forms only in proposition 13. The one known specimen of *pacificus* differs from all seven specimens of *mirus* in those skull characters of propositions 2, 3, 4, 9, 10, 15, and 18, and from all six specimens of *mirus* studied for proposition 17. These are not trivial characters, and their stability in *mirus* is impressive. The fact that *pacificus* is like *mirus* in only one of these nine characteristics of the skull of *mirus* and disagrees with it in eight of them provides an ample basis for rejecting *pacificus* as a subspecies of *mirus*. Until further knowledge of *pacificus* can be acquired, it therefore should stand as a full species.

THE VARIATION WITHIN *MESOPLODON GERVAISI*

In comparison with *gervaisi*, the sample of *mirus* shows remarkable constancy in the characters of the skull treated here. The relative variability of *gervaisi* in some of these has been discussed by the present author (Moore and Wood, 1957, p. 24) on the basis of a smaller sample. The speculation advanced there that some of the observed variation may prove to be regularly expressed sexual dimorphism, must, of course, be tested here on the new material of *gervaisi*. Three kinds of evidence examined for indications of sexual dimorphism in *gervaisi* may be reported as follows:

First, inspection of table 1 in the present paper reveals that no one of these 25 characters chances to distinguish males from females in *gervaisi*.

Next, the amount of agreement of each individual of *gervaisi* with each one of the other nine specimens of *gervaisi* in the 25 propositions may be shown as ratios of the number of times two specimens agree to the number of propositions in which it is possible to compare the two. The lower left portion of table 3 gives these ratios. For reference the figures from which the ratios were obtained are given as fractions in the upper right portion of table 3. It may be seen that the agreement

between any two of the males is in all three cases less than 0.75, whereas agreement between any two of the four females is above 0.80 in half of the six comparisons possible. Only the type specimen ("Eur.") shows better agreement with the other two males than with females in the 25 propositions, the other two males generally showing better agreement with females than with males. Three of the four females have higher ratios of agreement with other females than with the males. Inasmuch as the type specimen may still be the only old adult male of

TABLE 3

VARIATION IN *Mesoplodon gervaisi* IN THE 25 PROPOSITIONS DESCRIBED IN TEXT

(Upper right half, the number of propositions in which any specimen agrees with any other, divided by the number of times in which it has been possible to compare them. Lower left half, ratios of the two numbers. Parentheses around sex symbol indicate that sex is inferred from skull and tooth characters.)

	Eur. (♂)	Boca (♂)	Atl.C. ♂	Melb. ?	Trin. ?	N.L.B. ?	Vero (♀)	Largo (♀)	Rock. ♀	Jam. ♀
Eur.	—	12/19	12/17	14/19	12/17	7/12	7/12	10/17	12/17	9/16
Boca	0.63	—	14/19	19/25	18/22	10/12	15/17	18/23	18/23	15/17
Atl.C.	0.71	0.74	—	15/19	13/18	8/12	10/13	15/18	15/18	13/17
Melb.	0.74	0.76	0.79	—	20/22	8/12	13/17	20/23	20/23	11/17
Trin.	0.74	0.82	0.72	0.91	—	7/11	13/17	18/21	18/21	10/16
N.L.B.	0.58	0.82	0.67	0.67	0.64	—	4/6	8/11	7/11	9/11
Vero	0.58	0.88	0.72	0.77	0.77	0.67	—	13/18	15/18	11/12
Largo	0.59	0.78	0.83	0.88	0.86	0.73	0.72	—	20/24	12/17
Rock.	0.71	0.78	0.83	0.88	0.86	0.64	0.83	0.83	—	11/17
Jam.	0.56	0.88	0.77	0.65	0.63	0.82	0.92	0.71	0.65	—

gervaisi studied, and the Boca Grande male, although adult, may, as does the New Jersey male, agree with the females so well because of comparative youth, the evidence available barely suggests a tendency towards sexual dimorphism in the general agreement of males with males and females with females recorded for these 25 characters of the skull. Moore and Wood (*loc. cit.*), with fewer specimens, reported individual variation to be greater in males than in females of *gervaisi*, but the conspicuously high ratios of agreement of the new male from Boca Grande with the four females, and the surprisingly low ratios of agreement of the Jamaica female with two of the other three females, seem now somewhat to weaken the earlier finding.

Finally, measurements of the skulls may also be inspected for evidences of sexual dimorphism. It has been a customary procedure of

TABLE 4

SKULL MEASUREMENTS OF *Mesoplodon gervaisi*

(Each skull measurement in roman type is in millimeters; each ratio of a skull measurement is in italics and is in hundredths of the measurement in roman type nearest above it; exception: see description of ratio 25 below. Parentheses around sex symbol indicate that sex is inferred from skull and tooth characters.)

	Eur.[a] (♂)	Boca (♂)	Atl.C. ♂	Trin. ?	Melb. ?	N.L.B. ?	Cuba ?	Rock. ♀	Vero (♀)	Largo (♀)	Jam. ♀
1	[765]	673	675	733+	699[b]	—	720[b]	780[b]	802	755[b]	788
2	*0.60*	*0.62*	*0.63*	*0.64*	*0.60*[b]	—	—	*0.64*[b]	*0.69*	*0.61*[b]	—
3	*0.74*	*0.81*	*0.78*	*0.78*	*0.78*[b]	—	—	*0.79*[b]	*0.88*	*0.77*[b]	*0.81*
4	—	*0.83*	—	*0.81*	*0.83*[b]	—	—	*0.82*[b]	*0.92*	*0.80*[b]	—
5	—	*0.07*	—	—	*0.00*	—	—	*0.10*	*0.06*	*0.09*	—
6	—	*0.16*	—	—	*0.13*	—	—	*0.13*	*0.14*	*0.13*	—
7	*0.13*	*0.18*	*0.15*	*0.15*	*0.20*	—	—	*0.16*	*0.14*	*0.17*	—
8	—	*0.07*	—	—	*0.07*	—	—	*0.06*	*0.06*	*0.06*	—
9	327	309	287	300	326	325	—	332	341	327	338
10	[*1.13*]	*1.06*	—	*1.11*	*1.08*	—	—	*1.08*	*1.06*	*1.08*	*1.04*
11	*1.11*	*1.02*	*1.05*	*1.06*	*1.06*	—	—	*1.05*	*1.03*	*1.05*	—
12	—	*0.87*	—	—	*0.85*	—	—	*0.86*	*0.86*	*0.89*	—
13	*0.70*	*0.65*	*0.72*	*0.72*	*0.68*	*0.65*	—	*0.71*	*0.67*	*0.66*	*0.65*
14	—	*0.34*	—	*0.36*	*0.31*	—	—	*0.32*	*0.32*	*0.32*	—
15	*0.12*	*0.13*	*0.12*	*0.14*	*0.13*	*0.11*	—	*0.12*	*0.13*	*0.14*	*0.12*
16	*0.51*	*0.47*	*0.50*	*0.49*	*0.46*	*0.45*	—	*0.48*	*0.47*	*0.46*	*0.42*
17	—	*0.28*	—	—	*0.30*	—	—	*0.31*	*0.30±*	*0.29*	—
18	*0.34*	*0.30*	*0.36*	*0.31±*	*0.31*	*0.30*	—	*0.32*	*0.30±*	*0.30*	*0.30*
19	—	*0.17*	—	*0.19*	*0.17*	—	—	*0.21*	*0.18*	*0.16*	—
20	*0.64*	*0.60*	*0.63*	*0.62*	*0.64*	*0.63*	—	*0.62*	*0.63*	*0.63*	*0.60*
21	—	—	—	—	—	—	—	—	—	—	—

TABLE 4—(*Continued*)

	Eur. (♂)	Boca (♂)	Atl.C. ♂	Trin. ?	Melb. ?	N.L.B. ?	Cuba ?	Rock. ♀	Vero (♀)	Largo (♀)	Jam. ♀
22	*0.20*	*0.21*	*0.21*	*0.20*	*0.22*	—	—	*0.21*	*0.18*	*0.16*	—
23	*0.17*	*0.16*	*0.14*	*0.16*	*0.15*	—	—	*0.16*	*0.14*	*0.14*	—
24	[*0.17*]	*0.15*	*0.15*	*0.16*	*0.15*	*0.14*	—	*0.15*	*0.16*	*0.15*	*0.16*
25	—	*0.42*	—	—	*0.40*	—	—	*0.49*	*0.52*	*0.46*	—
26	—	*0.24*	—	*0.25*	*0.25*	—	—	*0.25*	*0.21*	*0.24*	—
27	—	*0.22*	—	*0.21*	*0.21*	—	—	*0.20*	*0.25*	*0.24*	—
28	—	*0.93*	*0.89*	*0.91*	*0.92*	*0.87*	—	*0.93*	*0.95*	*0.86*	*0.89*
29	[655]	589	565	—	—	—	610	654	748	642±	686
30	[*0.19*]	*0.19*	*0.20*	—	—	—	*0.23*	*0.24*	*0.22*	*0.24*±	*0.26*
31	*0.18*	*0.18*	*0.18*	—	—	—	—	*0.17*	*0.18*	*0.19*±	*0.18*
32	[*0.81*]	*0.81*	*0.79*	—	—	—	—	*0.77*	*0.78*	*0.76*±	*0.74*
33	—	*0.00*	—	—	—	—	—	*0.03*	—	*0.04*±	—
34	[*0.08*]	*0.10*	—	—	—	—	—	*0.06*	—	*0.05*±	—
35	—	*0.02*	—	—	—	—	—	*0.02*	—	*0.02*±	—
36	[*0.11*]	*0.12*	—	—	—	—	—	*0.13*	—	*0.15*±	—

[a] Dimensions of "Eur." estimated by True (1910) from drawings in Van Beneden and Gervais (1880) except bracketed ones which are measurements of skull by Brasil (1909, p. 220) or from the life-sized photographs of the right tooth published by Brasil.

[b] Amounts added to measurements for missing tips of beaks: 13 mm. for Melb., 20 mm. for Cuba, 9 mm. for Rock., 70 mm. for Largo.

1. Greatest length of skull.
2. Ratio of greatest length of rostrum (measured from line across bases of antorbital notches) to greatest length of skull.
3. Ratio of tip of rostrum to posterior margin of pterygoids, near mid-sagittal plane, to greatest length of skull.
4. Ratio of tip of rostrum to posteriormost extension of wing of pterygoid, to greatest length of skull.
5. Ratio of greatest length of portion of vomer visible on palate to greatest length of skull.
6. Ratio of greatest length of orbit to greatest length of skull.
7. Ratio of greatest length of temporal fossa to greatest length of skull.

8. Ratio of greatest length of right nasal on the vertex to greatest length of skull.
9. Greatest width across centers of orbits.
10. Ratio of greatest width across postorbital processes of frontals to greatest width across centers of orbits.
11. Ratio of greatest width across zygomatic processes to greatest width across centers of orbits.
12. Ratio of greatest breadth of skull across exoccipitals to greatest width across centers of orbits.
13. Ratio of least width across posterior margins of temporal fossae to greatest width across centers or orbits.
14. Ratio of greatest width across occipital condyles to greatest width across centers of orbits.
15. Ratio of greatest inside width of foramen magnum to greatest width across centers of orbits.
16. Ratio of greatest width of premaxillae at their proximal expansion to greatest width across centers of orbits.
17. Ratio of least width of premaxillae opposite anterior nares to greatest width across centers of orbits.
18. Ratio of greatest width of premaxillae anterior to anterior nares to greatest width across centers of orbits.
19. Ratio of width of premaxillae opposite premaxillary foramina to greatest width across centers of orbits.
20. Ratio of greatest width of rostrum in antorbital notches to greatest width across centers of orbits.
21. Ratio of greatest width of rostrum in notches (if any) formed by maxillary prominences to greatest width across centers of orbits.
22. Ratio of greatest width of rostrum at midlength of rostrum to greatest length across centers of orbits.
23. Ratio of greatest depth of rostrum at midlength to greatest length across centers of orbits.
24. Ratio of greatest inside width of anterior nares (at right angles to sagittal plane) to greatest width across centers of orbits.
25. Ratio of greatest width of temporal fossa (without regard to orientation of skull) to greatest length of temporal fossa.
26. Ratio of least distance between maxillary foramina to greatest width across centers of orbits.
27. Ratio of distance between posterior border of maxillary foramen and anterior end of maxillary prominence to greatest width across centers of orbits.
28. Ratio of height of skull (vertex to inferior border of pterygoids) to greatest width across centers of orbits.
29. Greatest length of mandible.
30. Ratio of greatest length of mandibular symphysis to greatest length of mandible.
31. Ratio of greatest height of mandible at coronoid process to greatest length of mandible.
32. Ratio of distance from posteriormost point on mandibular condyle to posterior margin of symphysis to greatest length of mandible.
33. Ratio of distance (on longitudinal axis of mandible) that symphysis extends posteriorly beyond the alveolus to greatest length of mandible.
34. Ratio of length of alveolus to greatest length of mandible.
35. Ratio of width of alveolus to greatest length of mandible.
36. Ratio of distance between anterior end of mandible and anterior end of alveolus to greatest length of mandible.

cetologists, for the purpose of interspecific comparisons, to present skull measurements as ratios of the greatest length of the skull. Adequate tables for that purpose are available for *gervaisi* in Rankin (1956, p. 332) and for *gervaisi* and *mirus* in Moore and Wood (1957, pp. 18–20). For purposes of intraspecific comparisons, at least, something may be gained here by presenting some of the smaller width measurements as ratios of a stable, generally used, large width measurement. One might prefer greatest width of the skull, but the greater availability of data from the literature for skull width at the centers of the orbits requires one to use that measurement (9 in table 4). Ratios 10 to 24 and 26 to 28 are therefore of measurement 9. Ratio 25 is the width of the temporal fossa given as a ratio of the length of the temporal fossa (to provide the basic data for taxonomic proposition 11, p. 16). Measurements of the mandible are rendered in table 4 as hundredths of the greatest length of the mandible—29 in the table.

From table 4 one can observe that the Boca Grande male has a remarkably small skull, and that from the data now available in this species the females tend to be larger than the males. Although True (1910, p. 14) thought the symphysis of the type specimen of *gervaisi* so short as to imply that part of the tip of the mandible may have been missing, evidence in the present paper (table 4, ratio 30) seems to indicate that the type is normal, even when Brasil's measurement, which is 10 mm. shorter than True's estimate, is used. Rankin (1956, p. 354) found that the proportion of symphysis length to mandible length does not adequately separate *gervaisi* from *mirus*. Now the length of the symphysis is observed (ratio 30, table 4) to show some promise as a means of distinguishing adult males from adult females.

Rankin (1956) also put a good deal of emphasis on the evidence from four specimens indicating that proportional length of symphysis may increase with age, but the additional material now available shows this increase to be rather limited. The greatest length of the mandible, table 4, measurement 29, varies a great deal in the three males and nicely in the order of their relative ages as suggested by the growth and wear of the teeth. The length of the mandible may, therefore, in future material prove to be an important indicator of relative age.

Thus, one ends with lesser relative length of symphysis in males as the only fairly firm new suggestion of sexual dimorphism, but with an indication also that the size of the skull (and presumably the size of the body) may be greater in females.

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SUMMARY

An apparently adult male of *Mesoplodon gervaisi* stranded on the Gulf coast of Florida at Boca Grande, about latitude 26° 42′ N., in April, 1959, and most of its skeleton was recovered and presented to the American Museum of Natural History. Its protruding mandibular teeth were said to fit into grooves in the skin of the upper jaw. It is the second adult male recognized and the twelfth known specimen of the species.

The left tooth of a male beaked whale stranded at Padre Island, Texas, about latitude 27° 15′ N., in September, 1946, is now identifiable as *Mesoplodon gervaisi* and is the thirteenth specimen made known as such.

An apparently adult female of this species stranded on the Atlantic coast of Florida near Vero Beach at about latitude 27° 45′ N., about February of 1958, and its skeleton was secured by the United States National Museum. Its skull is the largest on record for the species, and it is the fourteenth known specimen.

From study of these materials, the skulls of three other specimens of *gervaisi*, and photographs of five others, it has been possible to reject

finally a number of propositions that have been made in the literature from studies of smaller amounts of material of this and related species, and to offer the following findings:

1. The discovery by Flower (1878) that the relative position of the maxillary and premaxillary foramina separates certain species of *Mesoplodon* from others was made when only one specimen of *gervaisi* was known and before *mirus* had been found. Even as altered by Nishiwaki and Kamiya (1958), it does not satisfactorily distinguish either *gervaisi* or *mirus*.

2. The partial skull from North Long Branch, New Jersey (Allen, 1909), is shown here to belong to *gervaisi*.

3. *Mesoplodon pacificus* Longman is shown to differ from *M. mirus* in too many skull characters to be considered a subspecies of it.

4. To the sexual dimorphism in *gervaisi* previously restricted to the single pair of mandibular teeth, one may now add that relatively greater length of the symphysis seems to characterize adult females, and that greater size of the skull (and presumably the size of the whole animal) may also characterize the female.

5. The known maximum length of *gervaisi* is concluded to be 467 cm. (15.3 feet).

6. The length of the mandible seems to provide an indication of relative age.

7. It appears that the mesirostral canal of *gervaisi* may fill more slowly in females than in males.

8. The three new locality records for *gervaisi* support the concept that *gervaisi* may have a somewhat more southern range than that of *mirus*.

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