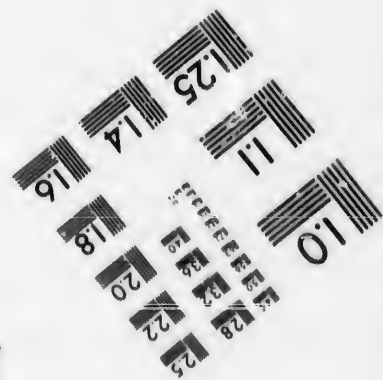
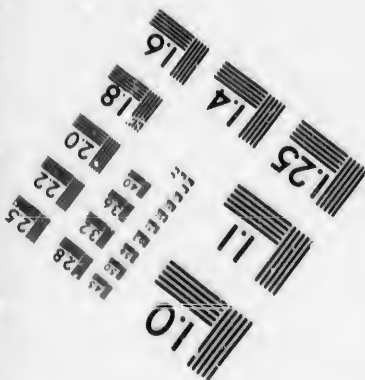
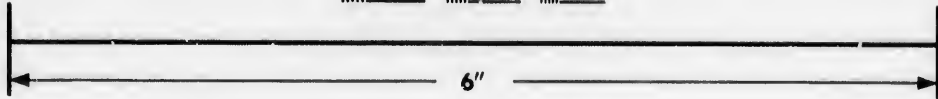
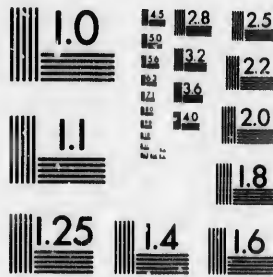


**IMAGE EVALUATION
TEST TARGET (MT-3)**



**Photographic
Sciences
Corporation**

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

28
25
22
20
18

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**



Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

10
01

© 1987

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

Coloured covers/
Couverture de couleur

Coloured pages/
Pages de couleur

Covers damaged/
Couverture endommagée

Pages damaged/
Pages endommagées

Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée

Pages restored and/or laminated/
Pages restaurées et/ou pelliculées

Cover title missing/
Le titre de couverture manque

Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées

Coloured maps/
Cartes géographiques en couleur

Pages detached/
Pages détachées

Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)

Showthrough/
Transparence

Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur

Quality of print varies/
Qualité inégale de l'impression

Bound with other material/
Relié avec d'autres documents

Includes supplementary material/
Comprend du matériel supplémentaire

Tight binding may cause shadows or distortion along interior margin/
La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure

Only edition available/
Seule édition disponible

Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

Pages wholly or partially obscured by errata slips, tissues, etc. have been refilmed to ensure the best possible image/
Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.

Additional comments:
Commentaires supplémentaires:

Pagination as follows : [21] - 36, 79 - 86 p. Part 1 is followed by part 2.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The copy filmed here has been reproduced thanks to the generosity of:

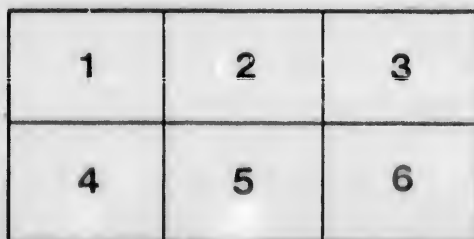
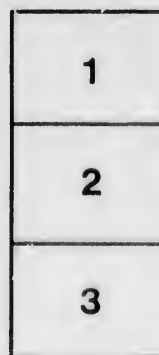
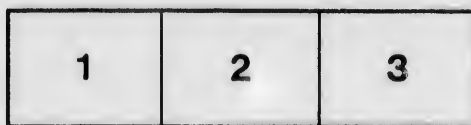
Seminary of Quebec
Library

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shell contains the symbol \rightarrow (meaning "CONTINUED"), or the symbol ∇ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Séminaire de Québec
Bibliothèque

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole \rightarrow signifie "A SUIVRE", le symbole ∇ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

200

Zoologie Invertebrés no 2

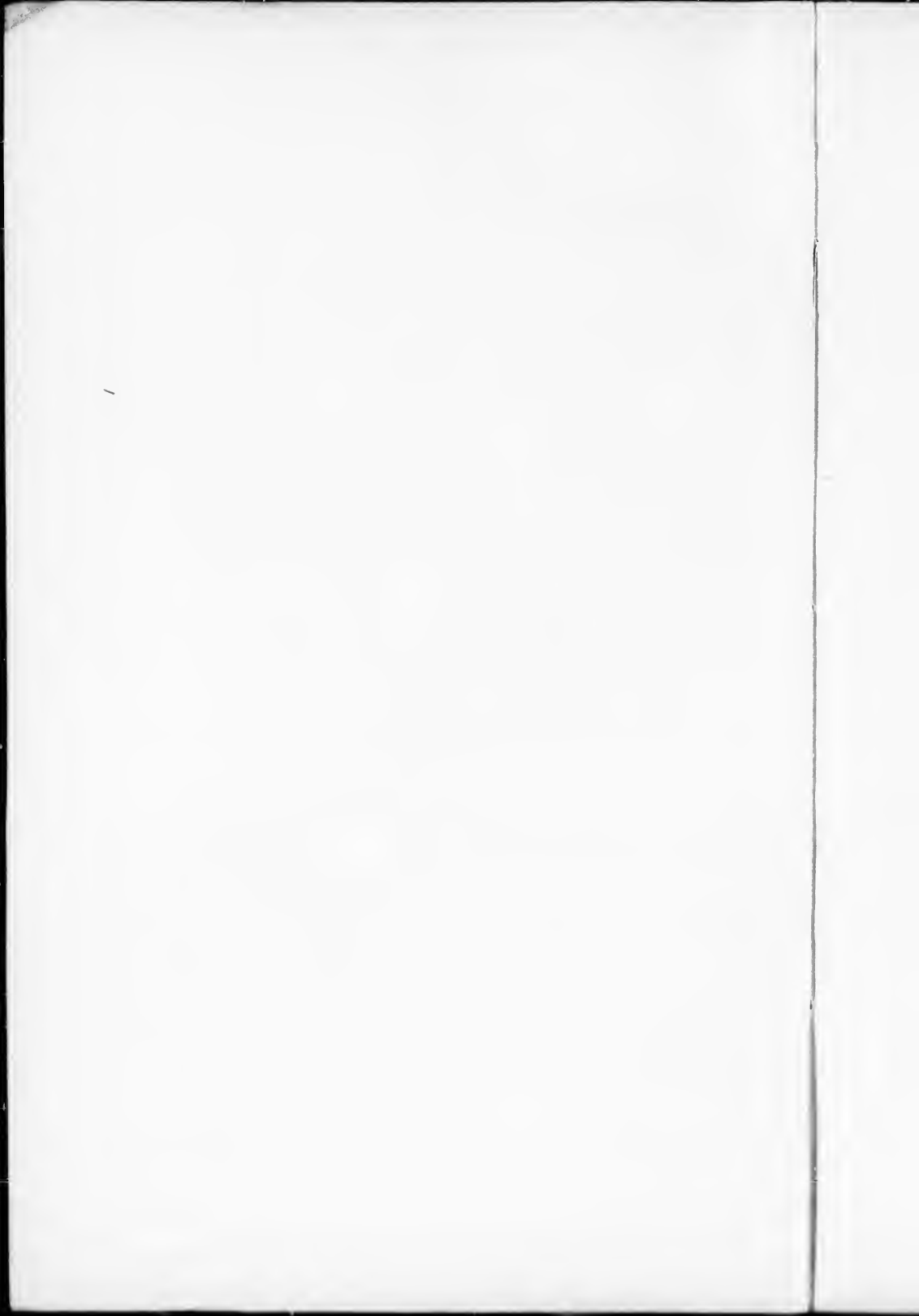
THE COLOSSAL CEPHALOPODS OF THE NORTH ATLANTIC.

By A. E. VERRILL,

PROFESSOR OF ZOOLOGY, YALE COLLEGE, NEW HAVEN, CONNECTICUT, U. S. A.

[FROM THE AMERICAN NATURALIST, VOL. IX, 1875.]







[From the AMERICAN NATURALIST, Vol. ix, January and February, 1875.]

THE COLOSSAL CEPHALOPODS OF THE NORTH ATLANTIC.

BY PROF. A. E. VERRILL.

In a former article published in the NATURALIST (vol. viii, p. 167, March, 1874) the writer gave a brief account of several gigantic cuttle-fishes, or "squids," which have been observed or captured at or near Newfoundland,¹ and in an earlier volume (vii, p. 91) Dr. Packard gave an account of previous captures of similar huge Cephalopods on the coasts of North America and Europe. The existence of several distinct species of these colossal ten-armed Cephalopods has been satisfactorily demonstrated in the various papers that have been written upon the subject both in Europe and America. Most of the specimens hitherto obtained have been taken in the Atlantic Ocean, but at least one gigantic species (*Enoploteuthis unguiculata*) inhabits the Indian Ocean, while the origin of some of the described specimens is not known.

In this article I propose to describe portions of five different specimens of these monsters, now in my possession, and also to give some account of five other specimens that have been observed on our side of the Atlantic.

The five specimens that I have been able to study evidently belong to two quite distinct species, both of which belong to the genus *Architeuthis* of Steenstrup (or *Megaloteuthis* of Kent). The largest of these is represented only by the jaws of two

¹ See also an article on this subject by the writer, in the "American Journal of Science," vol. vii, p. 158, Feb., 1874; and letters from Mr. Alexander Murray in the NATURALIST, vol. 2, p. 120, Feb., 1874.

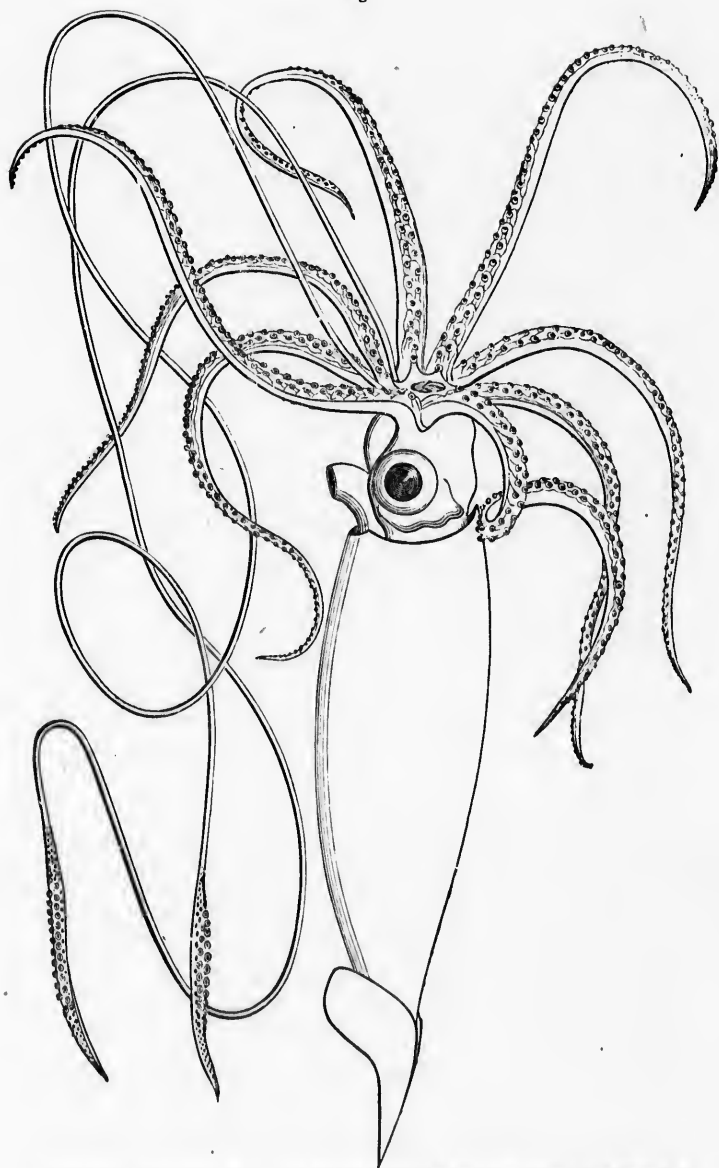
specimens, one of which (No. 1 in my former articles) was found floating at the Banks of Newfoundland, and the other (which we will designate as No. 10) was taken from the stomach of a sperm whale. The upper jaw of the latter was imperfectly figured by Dr. Packard in his article referred to above, and it is the largest jaw yet known. These belong to an apparently undescribed species, which I propose to name *Architeuthis princeps*,² and shall describe more fully farther on. It is readily distinguished from the following by the blacker, thicker, stronger and more incurved beaks, and especially by the large and very prominent tooth or projection, arising from the margin of the cutting edges of the alae, on the lower jaw. The body appears to have been relatively much longer than in the following species.

The second species, which I consider identical with the *Architeuthis monachus* of Steenstrup, is more fully represented by parts of three individuals, and seems to be the species most commonly met with on the coasts of Newfoundland and Labrador.

The most complete specimen (fig. 1) that has ever come under scientific observation was captured in November, 1873, at Logie Bay, near St. John's, Newfoundland. It became entangled in herring-nets and was secured by the fishermen with some difficulty and only after quite a struggle, during which its head was badly mutilated and severed from the body, and the eyes, most of the siphon-tube, and the front edge of the mantle were destroyed. Fortunately this specimen was secured by the Rev. M. Harvey of St. John's. After it had been photographed and measured, he attempted to preserve it entire in brine, but this was found to be ineffectual, and after decomposition had begun to destroy some of the most perishable parts, he took it from the brine and, dividing it into several portions, preserved such parts as were still undecomposed in strong alcohol. These various portions are now in my possession, and with the photographs have enabled me to present a restoration, believed to be quite accurate, of the entire creature (fig. 1). In this figure the eyes, ears, siphon-tube, and front edge of the mantle have been restored from a small squid (*Loligo pallida*) to which this gigantic species seems to be nearly

² This species was named and characterized in a communication made to the Connecticut Academy of Sciences, Nov. 18, 1874, and will be described in greater detail in its Transactions.

Fig. 1.



Architeuthis monachus (No. 5), one twenty-second natural size, from Logie Bay, N. F.
(28)

allied in many respects. The other parts have been drawn directly from the photographs and specimens.³

Mr. Harvey has published popular accounts of this specimen and the previously captured arm of a still larger one, in an interesting article in the *Maritime Monthly Magazine* of St. John, N. B., for March, 1874, and in several newspapers.⁴ These articles, and extracts from them, have been widely copied in the newspapers and magazines. To him we are, therefore, mainly indebted for these latest and most important additions to our knowledge of these remarkable animals. The preserved parts of this specimen (No. 5) which I have been able to examine are as follows: the anterior part of the head, with the bases of the arms, the beak, lingual ribbon, etc.; the eight shorter arms, but without the suckers, which dropped off in the brine, and are now represented only by the strong marginal rings; the two long tentacular arms, which are well preserved, with all the suckers in place; the tail; portions of the "pen" or internal shell; the ink-bag and pieces of the body.

Since this is the most complete specimen hitherto obtained, it will be first described as a standard for comparison with the other less complete ones.

The general appearance and form of this species,⁵ which appears

³The figure was originally made, from the photographs only, by Mr. P. Roetter, of the Museum of Comparative Zoology, but after the arrival of the specimens it had to be altered in many parts. These necessary changes were made by the writer, after a careful study of the parts preserved, in comparison with the photographs and original measurements.

⁴Acknowledgments are also due to Mr. Alexander Murray, Provincial Geologist, who cooperated with Mr. Harvey in the examination and preservation of these specimens, and who has also written some of the accounts of them that have been published. See the *AMERICAN NATURALIST*, vol. viii, p. 122, February, 1874; "*American Journal of Science*," vol. vii, p. 160; and "*Nature*," vol. ix, p. 322, February 26, 1874.

⁵Mr. W. Saville Kent, from the descriptions and photographs of this species, has seen fit to give it new generic and specific names, viz.: *Megaloteuthis Harveyi*, according to notices of his communication made to the Zoological Society of London, March 3, 1874, in "*Nature*" (vol. ix, p. 375, March 12, and p. 403, March 19). But as no sufficient reason was given for doing so, in the notices referred to, and as his original communication appears not to have been published yet (at least it has not been received here) I am unable to judge what his actual reasons for this proceeding may be.

My identification is based on a comparison of the jaws with the jaws of *A. monachus*, well figured and described by Steenstrup. Their agreement is very close in nearly all respects, but the beak of the lower jaw is a little more divergent in Steenstrup's figure. His specimen was a little larger than the one here described and was taken from a specimen cast ashore in 1853. So that Mr. Kent was probably unaware of that specimen when he said ("*Nature*," ix, p. 403) that *A. monachus* "was instituted for the reception of two gigantic Cephalopods, cast on the shores of Jutland in the years 1639 and 1760, and of which popular record alone remains."

His statement that *Architeuthis dux* Steenstrup is known from the beak alone is

to be the *Architeuthis monachus* of Steenstrup, is well shown by fig. 1. From the great size of the large suckers on the long arms, I judge it to be a male. The body was relatively stout, and according to the statement of Mr. Harvey, it was, when fresh, about seven feet long and five and one-half feet in circumference. The portion of the body shown in the photograph appears to have been only about five and one-half feet long, and is badly mutilated anteriorly, so that it is possible that Mr. Harvey has allowed too much for the missing parts. In restoring the figure here presented, the length of the body was reckoned at seven feet, and reduced twenty-two times. The "tail" or caudal fin (fig. 2) is said by Mr. Harvey to have been twenty-two inches across, but the preserved specimen is considerably smaller, owing, undoubtedly, to shrinkage in the brine and alcohol. It is remarkable for its peculiar spear-shaped or broad sagittate form. The posterior termination is unusually acute and the lateral lobes extend forward considerably beyond their insertion. In the preserved specimen the total length,

Fig. 2.



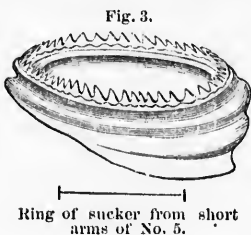
Tail of No. 5

from the anterior end of the lateral lobes to the tip, is twenty-three inches; from the lateral insertions to the tip, thirteen inches; from the dorsal insertion thirteen and five-tenths inches; total breadth about fifteen inches; width of lateral lobes six inches. The body, as seen in the photograph, is badly collapsed and it must be a matter of great difficulty to obtain the true diameter of the body in any of these large squids, owing to the

erroneous, for Steenstrup, Harting, and Dr. Packard, in their articles on this subject, all state that the suckers, parts of the arms, and the lateral shell or pen were preserved, and they have been figured by Prof. Steenstrup; Harting has also given a figure of the lower jaw. Steenstrup mentions having the arm-hooks (Tandvæbningen), which would indicate a genus distinct from our species.

Should the *Architeuthis dux* prove to belong to a genus distinct from this and all known genera, it might perhaps be taken as the type of *Architeuthis*, and in that case the generic name given by Kent could be retained, and the two species here described would then be called *Megâloteuthis monachus* and *M. princeps*, if my identification of the former species be correct.

fact that they collapse greatly when taken from the water. The circumference of the body given above may, therefore, be considerably too small. In that case the figure represents the body more slender than it should be. The head was probably at least equal to one-fifth the length of the body. The eight shorter arms, when fresh, were, according to Mr. Harvey's measurements, six feet long and all of equal length, but those of the different pairs were respectively ten, nine, eight and seven inches in circumference. In alcohol they have shrunk considerably, both in length and diameter. They are three-cornered or triquetral in form and taper very gradually to slender acute tips. Their inner faces are occupied by two alternating rows of large obliquely campanulate suckers, with contracted apertures surrounded by broad, oblique, marginal rings, armed with strong, acute teeth



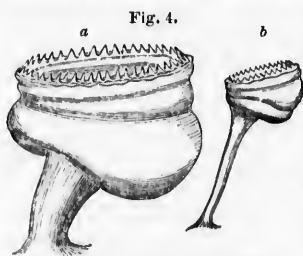
around their entire circumference, but largest and most oblique on the outside (fig. 3). These suckers gradually diminish in size to the tips of the arms, where they become very small, but are all similar in form and structure. The largest of these suckers are said by Mr. Harvey to have been about an inch in diameter, when fresh. The largest of

their marginal rings in my possession are $\cdot 65$ of an inch in diameter, at the serrated edge, and $\cdot 75$ beneath. The rings of the smaller suckers are more oblique and more contracted at the aperture, with the teeth more inclined inward, those on the outside margin being largest. The two long tentacular arms are remarkable for their slenderness and great length when compared with the length of the body. Mr. Harvey states that they were each 24 feet long and 2.75 inches in circumference when fresh. In the brine and alcohol they have shrunk greatly, and now measure only 13.5 feet in length, while the circumference of the slender portion varies from 2.25 to 3.25 inches. These arms were evidently highly contractile, like those of many small species, and consequently the length and diameter would vary greatly according to the state of contraction or relaxation. The length given (24 feet) probably represents the extreme length in an extended or flaccid condition, such as usually occurs in these animals soon after death. The slender portion is three-cornered or trique-

tral in form, with the outer angle round, the sides slightly concave, the marginal angles prominent, and the inner face a little convex and generally smooth, except toward the end, where it begins to enlarge. Although so slender, these arms are very strong and elastic. The terminal portion, bearing the suckers, is 30 inches in length and expands gradually to the middle, where it is 4.5 to 5 inches in circumference (6 inches when fresh), and 1.5 to 1.6 across the inner face. The sucker-bearing portion may be divided into three parts. The first region occupies about 7 inches, in which the arm is triquetral, with margined lateral angles, and gradually increases up to the maximum size, the inner face being convex and bearing about forty irregularly scattered, small, flattened, saucer-shaped suckers, attached by very short pedicels, and so placed in depressions as to rise but little above the general surface. These suckers have narrow marginal rings, with the thin edges nearly smooth, or minutely denticulate, and .10 to .12 of an inch in diameter, surrounded by a thick and prominent marginal membrane. These suckers are at first distantly scattered, but become more crowded as the arm increases in breadth, until they form five or six very irregular rows, covering the whole width of the inner face, which becomes here 1.6 inches broad. Scattered among these suckers are about as many low, broad, conical, smooth, callous verrucae, or wart-like prominences, rising above the general surface, their central elevation corresponding in form and size to the apertures of the adjacent suckers. These, without doubt, are intended to furnish secure points of adhesion for the corresponding suckers of the opposite arm, so that, as in some other genera, these two arms can be fastened together at this wrist-like portion, and thus they can be used unitedly. By this means they must become far more efficient organs for capturing their prey than if used separately. Between these smooth suckers and the rows of large ones there is a cluster of about a dozen small suckers, with serrate margins, mostly less than a quarter of an inch in diameter, attached by slender pedicels, and with an oblique marginal ring, strongly and sharply serrate on the outer margin.

The second division of the sucker-bearing part of the arm succeeds the small suckers. Here the arm is well rounded on the back and flattened on the face, where it bears two alternating rows of very large serrate suckers, and an outer row of small ones on each side, alternating with the large ones. The inner edge is bor-

dered by a rather broad, regularly scalloped, marginal membrane, the scallops corresponding to the large suckers. On the other edge there is a narrower and thinner membrane, which runs all the way to the tip of the arm, just outside the suckers. In one of the rows of large suckers there are eleven, and in the other ten, above half an inch in diameter, but each row has at either end one or two smaller ones, from a half an inch to a quarter of an inch in



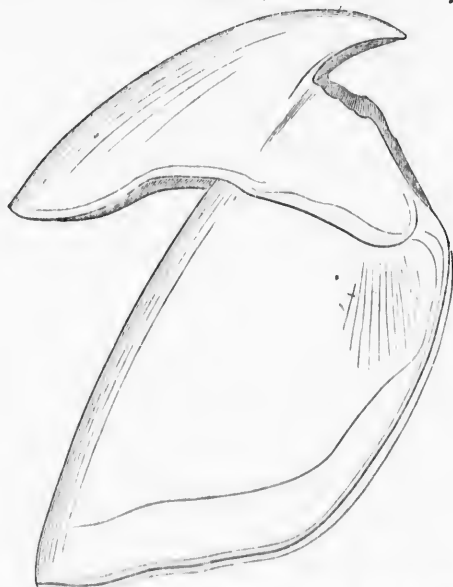
Suckers from long arms of No. 5.
Natural size.

diameter, so that either twelve or thirteen might be counted as belonging to the rows of large suckers. The largest of these (fig. 4, *a*) are from 1 to 1.15 inches in diameter at the margin. These are attached by strong, though slender, pedicels, so that their margins are elevated about an inch above the surface of the arm. Each one is situated in the centre of a pentagonal depressed area, about an inch across, bounded by ridges, which alternate regularly, and interlock on the two sides, so as to form a zigzag line along the middle of the arm. These large suckers are campanulate, and somewhat oblique; the marginal ring is strong, and sharply serrate all around. The small marginal suckers (fig. 4, *b*) are similar in structure, but more oblique, and mostly only $\frac{3}{4}$ of an inch in diameter; they are attached by much longer and more slender pedicels, and their marginal teeth are relatively larger and more incurved, especially on the outer margin. By reason of their longer pedicels they rise to the same height as the large ones. The third, or terminal division of the arm, gradually becomes much compressed laterally, and tapers regularly to the tip, which is flat, blunt, and slightly incurved. Just beyond the large suckers, where this region begins, the circumference is 3.5 inches. The face is narrow and bears a large number of small serrate and pedicellate suckers, arranged in four regular alternating rows, and gradually diminishing in size to the tip of the arm, where the rows expand into a small cluster. These suckers are much like the marginal ones of the previous division, and at first are about $\frac{1}{4}$ of an inch in diameter, but decrease to about $\frac{1}{10}$ of an inch near the tip of the arm. The lateral membrane or fold of skin, of the preceding divisions, recedes farther

from the margin near the commencement of this division, and gradually passes around to the back side, where it forms a broad, thick wing or keel, extending to the tip. The color, where preserved, is pale reddish, with thickly scattered small spots of brownish red.

The form of the jaws of this specimen is well shown by figs. 5 and 6. When in place, these jaws constitute a powerful beak, looking something like that of a parrot or hawk, except that the

Fig. 5.

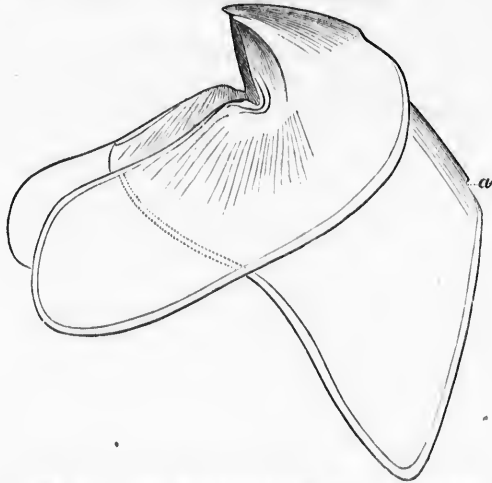


Upper jaw of *Architeuthis monachus*, No. 5. Natural size.

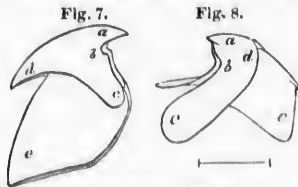
upper jaw shuts into the lower, instead of the reverse, as in birds. In life the great spaces behind and between the large, thin, lateral and posterior processes and expansions are filled with firm muscles and cartilage, which support and give great strength to the beak. The color is dark brown, becoming almost black toward the tip, where its substance is thicker and firmer, and smoothly polished externally. The upper jaw (fig. 5) measures 3.85 inches in total length; 1 inch in greatest breadth; and 2.50 from front to back.

The lower jaw (fig. 6) is 3 inches long; 2.75 broad; and 2.65 from front to back.

Fig. 6.

Lower jaw of *Architeuthis monachus*, No. 5. Natural size.

The small squids of our coast have a very similar pair of jaws. Those of *Loligo pallida* (figs. 7, 8) are here figured, twice the natural size, for comparison and to explain the terms used in describing the large jaws. The lower jaws

Jaws of *Loligo pallida*.⁶

of the large squids are more characteristic than the upper ones. In the one under consideration the points to be particularly noticed are, first, the narrow, but decided notch at the base of the nearly straight cutting edge; second, the broad, low, rounded projection or tooth on the anterior edge of the ale; third, the angle between the edges of the ale and the rostrum is nearly a right angle, and the tip of the jaw is slightly incurved.

⁶ Figure 7, upper jaw, and 8, lower jaw of *Loligo pallida* V., enlarged two diameters; a, the rostrum or beak; a b, the cutting edge, with a notch at b; b c, the anterior edge of the ale or wings; d, the frontal lamina in the upper jaw, or chin-portion (*mentum*) in the lower jaw; e, the palatine lamina in the upper jaw, or gular lamina in the lower jaw.

The most remarkable anatomical character observed in this specimen is found in the form and arrangement of the teeth on the "lingual ribbon," or *odontophore*, for in this respect it differs widely from all other known Cephalopods.

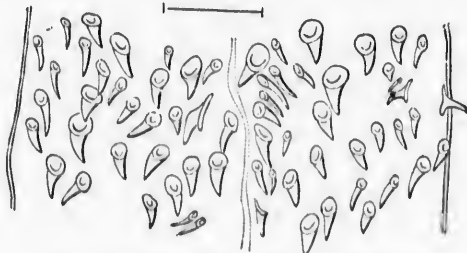
The ordinary squids and cuttle-fishes all have these teeth arranged in seven regular longitudinal rows; those of the three middle rows being generally two or three-pronged, as in *Loligo*

Fig. 9.

Teeth of *Loligo pallida*, much enlarged.

pallida (fig. 9), while the lateral rows have long, simple, fang-like teeth. But in this species (fig. 10), the teeth are very irregularly scattered over the surface of the broad thin membrane, and it is difficult to trace the rows, if such they can be called, for the arrangement seems to be somewhat in irregular quinennx. The number of rows, however, cannot be less than twenty. These

Fig. 10.

Lingual teeth of *Architeuthis monachus*, No. 5.

teeth are all simple, but vary considerably in size and form. They are all attached by a more or less rounded, flattened base, and all are considerably curved; some are broad and tapering; others are slender and acute; but the different forms and sizes are irregularly intermingled across the whole breadth of the membrane.⁷

⁷ Irregular granules of silica are scattered in great numbers over the membrane among the teeth, and similar grains are embedded in the membrane lining the mouth

This peculiar type of dentition must be regarded as an extremely generalized one. Whether it be also an embryonic type, or one that prevailed in ancient geological periods must be left for future determination. The character of these teeth indicates that this genus should hold low rank among the related genera. This conclusion is confirmed both by the structure of the caudal-fin, or tail, which somewhat resembles the early condition of the fins in the young *Loligo*, soon after it hatches, and by the form and structure of the internal shell or "pen," which is also very simple in structure, and but little differentiated or specialized.

The portions of the pen in my possession belong mostly to the two ends, with fragments from the middle region, so that although neither the actual length nor the greatest breadth can be given, we can yet judge very well what its general form and character must have been. It was a broad and extremely thin structure, of a yellowish brown color, and translucent. Its anterior portion resembles that of *Loligo*, but its posterior termination is entirely different, for instead of having a regular lanceolate form, tapering to a point at the posterior end, as in *Loligo*, it expands and thins out toward the posterior end, which is very broadly rounded or irregularly truncate, fading out insensibly both at the edges and end into soft membrane. The anterior end, for about an inch and a half, was rapidly narrowed to a pen-like point, as in *Loligo*; from this portion backward the width gradually increases from 1.2 inches to 5 inches, at a point 25 inches from the end, where our specimen is broken off; at this place the marginal strips are wanting, but the width is 5 inches between the lateral midribs, which were, perhaps, half an inch from the margin. Along the centre of the shell, there is a strong, raised, rounded midrib, which fades out a short distance from the posterior end, but is very conspicuous in the middle and anterior sections. On each side of the midrib is a lateral rib of smaller size. These at first diverge rapidly from the central one, and then run along nearly parallel with the outer margin and about .4 of an inch from it, but beyond 11 inches from the point the margins are torn off. Like the midrib the lateral ribs gradually fade out before reaching the posterior end; near the place where they finally disappear, they are about 6 inches apart.

From the above description it will be seen that the most important and most characteristic features of this species, or rather of

the *genus* to which it belongs, are to be found in the *lingual dentition*, in the *internal shell*, in the *form of the caudal-fins*, and in the cluster of small suckers and tubercles on the long arms. As already stated, the first three of these peculiarities indicate a low, or generalized structure, and therefore a low rank in our system of classification, unless it should be found to have some other characters not yet known and of greater importance, which might outweigh those here given. It will appear, therefore, that this genus of huge squids should be classed below *Loligo*, which, in its turn, would go below *Ommastrephes*, to which genus the common small squids of our northern coasts belong, for the latter genus has distinct eyelids, which are not found in *Loligo*, and the internal shell is also more specialized.

The pen of our *Architeuthis* seems to resemble that of the ancient genus *Teudopsis*, found fossil in the Jurassic formations, and contemporaneous with the huge marine saurians, *Ichthyosaurus*, *Plesiosaurus*, etc., the "sea-serpents" of those ancient seas. May there not also be huge marine saurians still living in the North Atlantic, in company with the giant squids, but not yet known to naturalists?

Such a belief seems quite reasonable when we consider how many species of great marine animals, both among Cephalopods and Cetaceans, are still known only from single specimens, or even mere fragments, generally obtained only by chance. The specimen above described, is, however, not the only specimen of its kind that has been observed on the American coast.

I have received through Professor Baird, of the Smithsonian Institution, a pair of jaws and two large suckers of the long arms, which were taken from a specimen (No. 4), cast ashore in Bonavista Bay, Newfoundland. These jaws agree precisely in form and size with those described above, so that the size of these two individuals must have been about the same. The suckers (fig. 11), had been dried, and have lost their true form, but the marginal rings are perfect, and only .92 of an inch in diameter, and though somewhat smaller than in the specimen just described, they have the same kind of denticulation around the margin. Their smaller size may indicate that the specimen was a female, but they may not have been the largest of those on the arm.



Fig. 11.
Sucker of long arm of
Architeuthis monachus, No. 4. Natural
size.

Accounts of an attack made upon two men by another specimen, in Conception Bay, Oct. 27, 1873, have been published in the *NATURALIST*,⁸ and in many other magazines, as well as in the newspapers. In the encounter the monster lost two of his arms by amputation with a hatchet. A portion of one of these arms, measuring nineteen feet in length, was preserved by Rev. M. Harvey and Mr. Alexander Murray for the museum at St. John's, Newfoundland. It has been photographed, and cuts copied from the photograph have been published in some of the English magazines.⁹

It is stated that six feet of this arm had been destroyed before it was preserved, and the captors estimated that they left from 6 to 10 feet attached to the creature, which would make the total length between 31 and 35 feet. According to Mr. Murray the portion preserved measured but 17 feet in length, when he examined it, Oct. 31, 1873, after it had been a few days in strong brine; the circumference of the slender portion was 3.5 to 4 inches; of the enlarged sucker-bearing part, 6 inches; length of the part bearing suckers, 30 inches; diameter of largest suckers, 1.25 inches. Calculating from the photograph, the portion bearing the larger suckers was about 18 inches in length, and about 2.4 inches broad, across the face; distance between attachments of large suckers, 1.68; outside diameter of larger suckers, 1.16 to 1.28; inside diameter, .74 to 1 inch; diameter of small suckers of the outside rows, .40 to .48 of an inch. Comparing all these dimensions with those of the Logie Bay specimen, and calculating the proportions as nearly as possible, it follows that this specimen was very nearly one-third larger than the latter, but the large suckers appear to have been relatively smaller, for they were hardly one-twelfth larger than in the Logie Bay specimen. As the relative size of the large suckers is a good sexual character among squids, it is probable that this individual was a *female*. In form, proportions and structure, it agrees very closely with the specimen first described, and therefore I do not hesitate to refer it to the same species. The lack of denticles on the margins of the large suckers is probably due to accidental injury, either before or

⁸ Vol. viii, No. 2, p. 120, February, 1874, in a letter from Mr. Alexander Murray.

⁹ See "Annals and Magazine of Natural History," vol. xli, p. 68; and "The Field," Dec. 13, 1873. The central line of this photograph is reduced four and a quarter times, while the front part is reduced about four times.

after death,¹⁰ but this may possibly be a sexual character. The fishermen estimated the body of this individual to have been about 60 feet in length and 5 feet in diameter, but if the above proportions be correct, as I believe, then the body could not have been more than about 10 feet long, and 2.5 feet in diameter, and the long arms should have been about 32 feet in length. Allowing 2 feet for the head, the total length would, therefore, be 44 feet.

Another specimen (No. 3), probably of the same species, and similar in size to the last, was captured at Coombs' Cove, Newfoundland. The following account has been extracted from a newspaper article of which I do not know the precise date, forwarded to me by Professor Baird, together with a letter, dated June 15, 1873, from T. R. Bennett, Esq., of English Harbor, N. F., who states that he wrote the article, and that the measurements were made by him, and are perfectly reliable.

"Three days ago, there was quite a large squid ran almost ashore at Coombs' Cove, and some of the inhabitants secured it. The body measured 10 feet in length and was nearly as large round as a hog'shead. One arm was about the size of a man's wrist, and measured 42 feet in length; the other arms were only 6 feet in length, but about 9 inches in diameter, very stout and strong. The skin and flesh were 2.25 inches thick, and reddish inside as well as out. The suction cups were all clustered together, near the extremity of the long arm, and each cup was surrounded by a serrated edge, almost like the teeth of a hand-saw. I presume it made use of this arm for a cable, and the cups for anchors, when it wanted to come to, as well as to secure its prey, for this individual, finding a heavy sea was driving it ashore, tail first, seized hold of a rock and moored itself quite safely until the men pulled it on shore."

It would appear from this description, that one of the long arms had been lost before the capture. The large diameter of the short arms, compared with their length, and with the size of the long arms, is the only point in which this specimen apparently differed essentially from those described above. Possibly the *circumference* was intended,¹¹ which would make the proportions agree well with those of the other specimens.

In a letter from Mr. Harvey, dated Dec. 10, 1873, he says that

¹⁰The photograph shows that the suckers had been much injured, and only six of the larger ones remained.

¹¹A similar mistake actually occurred in the description of the long arms, in the letter from Mr. Murray, published in the *AMERICAN NATURALIST* for February, 1873, p. 122, referred to above, but in that instance the error was very obvious.

the speaker of the House of Assembly stated to him that he had measured a specimen cast ashore in Fortune Bay, which was between 42 and 43 feet in length, the body and head together being between 12 and 13 feet, and the two long arms each 30 feet. This we may designate as No. 6.

Dr. Honeyman, Geologist of Nova Scotia, has published in a Halifax paper, a statement made to him by a gentleman who claims to have been present at the capture of another specimen (No. 7) in the Straits of Belle Isle, at West St. Modent, on the Labrador side. "It was lying peacefully in the water when it was provoked by the push of an oar. It looked fierce and ejected much water from its funnel; it did not seem to consider it necessary to discharge its sepia, as mollusca of this kind generally do, in order to cover their escape." * * * * "The length of its longest arm was 37 feet; the length of the body 15 feet; whole length 52 feet. The bill was very large. The suckers of its arms or feet, by which it lays hold, about 2 inches in diameter. The monster was cut up, salted, and barrelled for dog's meat." In this account the length given for the "body" evidently includes the head also. This creature was probably disabled, and perhaps nearly dead, when discovered at the surface, and this seems to have been the case with most, if not all, of the specimens hitherto seen living. Animals of this sort probably never float or lie quietly at the surface when in good health. The specimen last described (No. 7) may, possibly, have belonged to *A. princeps*, if the length of the body be correctly stated.

Mr. Harvey also refers to a statement made to him by a clergyman, Rev. M. Gabriel, that two specimens (Nos. 8 and 9), measuring respectively 40 and 45 feet in total length, were cast ashore at Lamaline, on the southern coast of Newfoundland, in the winter of 1870-71. These may also have been of the same species as those described above, all of which I now refer to *Architeuthis monachus* of Steenstrup.

NOTE.—Since the above has been in type, Mr. Kent's paper, referred to on page 24 has been received by the editors of the "American Journal of Science," and will be again noticed in our next article.

[To be continued.]

he had
was be-
being
This

l in a
n who
ecimen
on the
when it
ejected
neces-
merally
length
5 feet ;
kers of
meter.
meat."
cludes
perhaps
ems to
itherto
or lie
en last
ceps, if

clergy-
, meas-
ashore
the win-
species
iteuthis

n page 24
d will be

THE COLOSSAL CEPHALOPODS OF THE NORTH
ATLANTIC. II.

BY PROF. A. E. VERRILL.

AFTER the first part of this article was printed, I received an interesting letter from the Rev. Mr. Harvey, who, in accordance with my request, has made a new examination of the large arm of

"No 2," preserved in the Museum at St. John's, N. F. He states, in this letter, that all the suckers were originally denticulated around the margin, as suggested by me in the last number of the NATURALIST, and that this fact was previously overlooked on account of the mutilation it had undergone. He has also furnished to me a full series of measurements of its various parts. It has contracted excessively in the alcohol, and is now only thirteen feet and one inch in length (instead of nineteen feet, its original length), the enlarged sucker-bearing portion being two feet and three inches; the large suckers occupy twelve inches; the terminal part bearing small suckers, nine inches; circumference of slender portion 3.5 to 4.25 inches; of largest part 6 inches; breadth of face, among large suckers, 2.5 inches; from face to back, 1.62 inches; diameter of largest suckers outside, .75 of an inch: inside, .63 of an inch. It will be evident from these measurements, when compared with those made while fresh and from the photograph, that the shrinkage has been chiefly in length, the thickness remaining about the same, but the suckers are considerably smaller than the dimensions previously given.

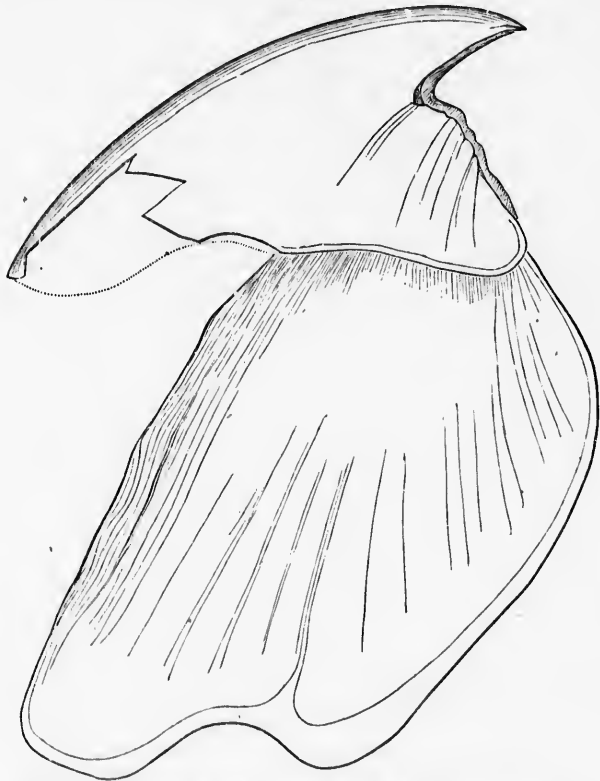
Mr. Harvey also mentions that a specimen was cast ashore at Bonavista Bay, December, 1872, and his informant says that the long arms measured thirty-two feet in length, and the short arms about ten feet in length, and were "thicker than a man's thigh." The body was not measured, but he thinks it was about fourteen feet long, and very stout, and that the largest suckers were 2.5 inches in diameter. The size of the suckers is probably exaggerated, and most likely the length of the body also. It is even possible that this was the same specimen from which the beak and suckers described in my last article, as No. 4, from Bonavista Bay, were derived, for the date of capture of that specimen is unknown to me. The latter, however, was much smaller than the above measurements of the former would admit, and it will, therefore, be desirable to give this one a special number (11).

Another specimen, which we may designate as No. 12, was cast ashore this winter, near Harbor Grace, but was destroyed before its value became known, and no measurements are given.

Architeuthis princeps Verrill, sp. nov., figures 25, 26, 27. This species is based on the lower jaw mentioned as No 1 in my former papers, and on the upper and lower jaws designated as No. 10, in the first part of this article; besides these jaws we only have the

rough measurements of the body of No. 4, and an estimate of the diameter of the sessile arms. The jaws of No. 10 were obtained from the stomach of a sperm whale taken in the N. Atlantic, and were presented to the Essex Institute by Capt. N. E. Atwood, of Provincetown, Mass., but the date and precise locality of the cap-

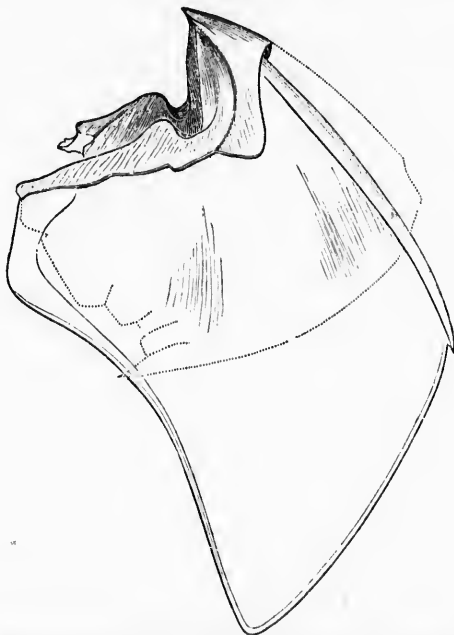
Fig. 25.

Upper jaw of *Architeuthis princeps* Verrill. No. 10. Natural size.

ture are unknown. The form of these jaws is well shown in figures 25 and 26. The total length of the upper jaw (fig. 25) is 5 inches; greatest breadth, 1.45; front to back 3.5 inches; width of palatine lamina, 2.32. The frontal portion is considerably broken, but the dorsal portion appears to extend nearly to the

posterior end, the length from the point of the beak to the posterior edge being 3·4 inches. The texture is firmer and the laminae are relatively thicker than in *A. monachus*. The rostrum and most of the frontal regions are black and polished, gradually becoming orange-brown and translucent toward the posterior border, and marked with faint striæ radiating from the tip of the beak, and

Fig. 26.



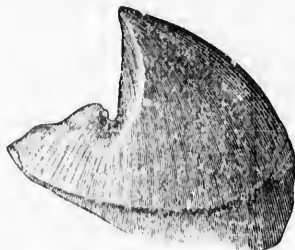
Lower Jaw of *Architeuthis princeps*. No. 10. Natural size. The dotted line shows the position of the beak.

by faint ridges or lines of growth parallel with the posterior margin; a slight but sharp ridge extends backward from the notch at the base of the cutting edge, and other less marked ones from the anterior border of the alæ. The tip of the beak is quite strongly curved forward, and acute, with a slight shallow groove, commencing just below the tip, on each side, and extending backward only a short distance and gradually fading out. The cutting edge is nearly smooth and well curved, the curvature being greatest toward the tip; at its base there is a broad angular notch, deepest

externally. The inner face of the rostrum is convex in the middle and concave or excavated toward the margins, which are, therefore, rather sharp. The anterior borders of the alæ are convex, or rise into a broad, but low, lobe or tooth beyond the notch, but beyond this they are nearly straight, but with slight, irregular lobes, which do not correspond on the two sides. The anterior edges of the alæ make nearly a right angle with the cutting edges of the rostrum. The palatine lamina is broad, thin, and dark brown, becoming reddish brown and translucent posteriorly, with a thin, whitish border. The surface is marked with unequal divergent striæ and ridges, some of which, especially near the dorsal part, are quite prominent and irregular; the posterior border has a broad emargination in the middle, but the two sides do not exactly correspond. The lower jaw (fig. 26) was badly broken, and many of the pieces, especially of the alæ, are lost, but all that remain have been fitted together. The extreme length is 3.63 inches; the total breadth, and the distance from front to back, cannot be ascertained, owing to the absence of the more prominent parts of the alæ; from tip of beak to posterior dorsal border of mentum, 1.68; from tip of beak to posterior lateral border of alæ, 2.20; from tip of beak to posterior dorsal border of gular lamina, 2.37; from tip of beak to bottom of notch at its base, .80; tip of beak to inner angle of gular lamina, 1.85; height of tooth from bottom of notch, .25; breadth between teeth of opposite sides, .60; from front to back of gular lamina, in middle, 1.75. The rostrum is black, with faint radiating striæ, and with slight undulations parallel with the posterior border; the beak is acute, slightly incurved, with a notch near the tip, from which a very evident groove runs back for a short distance, while a well marked, angular ridge starts from just below the notch, and descends in a curve to the alæ, opposite the large tooth, defining a roughened or slightly corrugated and decidedly excavated area, between it and the cutting edges; the cutting edge below this ridge is nearly straight, or slightly convex; the notch at its base is rounded and deep and strongly excavated at bottom; the tooth is broad, stout, obtusely rounded at summit, sloping abruptly on the side of the notch, and gradually to the alar edge. The anterior edge of the alæ, beyond the tooth, is rounded and strongly obliquely striated: it makes, with the cutting edge, an angle of about 110°. The inner surfaces of the two sides of the internal plate of the rostrum form an angle of about 45°.

The lower jaw of No. 1 (fig. 27) is represented only by its anterior part, the alæ and gular laminae having been cut away by the person who removed it. It agrees very well in form and color with the corresponding parts of the one just described, but is somewhat smaller. The lateral ridges of the rostrum are rather more prominent, and the area within it is narrower and more deeply excavated, especially at the base of the notch, where the

Fig. 27.



Part of lower jaw of *Architeuthis princeps*, No. 1. Nat. size.

excavation goes considerably lower than the inner margin. The notch is narrower and not so much rounded at its bottom. The tooth is about the same in size as that of No. 10, and appears to be even more prominent, because the edge of the alæ is more concave at its outer base; it is also more compressed and less regularly rounded at summit; the anterior edge of the alæ seems to rise into another low lobe beyond the concave portion. This jaw measures 1.30 inches from the tip to the posterior dorsal border of mentum; .65 from tip to the bottom of the notch; .16 from bottom of notch to tip of the tooth.

Both these lower jaws agree in having a very prominent tooth on the alar edge, with a large and deeply excavated notch between it and the cutting edge, and in this respect differ from the two lower jaws of *A. monachus* in my possession, for in the latter the tooth or lobe is low and broad, and scarcely prominent, while the notch is narrow and shallow. This seems to be the best character for distinguishing the jaws of the two species. But they also differ in the angle between the alar edge and the cutting edge of the rostrum, especially of the lower jaw, for while in *A. monachus* this is hardly more than a right angle, in *A. princeps* it is about 110° . Moreover, the darker color and firmer texture of the jaws of the latter seem to be characteristic.

The proportions of the body seem to be quite different, if we can judge by the measurements given of the specimen (No. 1) which was found dead and floating at the surface of the water, at the Banks of Newfoundland, by Capt. Campbell, of the schooner

B. D. Haskins, from Gloucester, Mass., in October, 1871.¹ It is stated that this specimen was measured, and that the body was fifteen feet long, and four feet and eight inches in circumference. The arms were badly mutilated, but the portions remaining were estimated to be nine or ten feet long and about twenty-two inches in circumference, two being shorter than the others. This would indicate a much more elongated form of body than that of *A. monachus*. If these proportions be correct, the body of No. 10 must have been about nineteen feet in length, and five feet and nine inches in circumference.

This specimen is probably the largest invertebrate hitherto actually examined by any naturalist. Larger cephalopods may possibly have been seen by mariners, but most of their statements of size are only rude estimates, and are nearly always much exaggerated.

Notes on specimens described by other writers. We are mainly indebted to Professor Steenstrup and to Dr. Harting for our knowledge of the specimens preserved in European museums, or cast ashore on the European coasts. Professor Steenstrup has given interesting accounts, compiled from contemporary documents, of a specimen taken in 1546, and of two specimens of large cephalopods cast ashore at Iceland in 1639 and 1790, and has also described and figured² the jaws of another specimen of *A. monachus*, obtained at Jutland in 1853. In the same memoir, of which I have seen only the first part, there are references to a description and figures of *A. Titan*, obtained in 1855, by Capt. Hygom, in N. Lat. 31°; W. Long. 76.° The latter specimen appears to be the same that Harting³ mentioned under the name of "*Architeuthis dux* Steenstrup," as collected at the same time and place, and of which he published an outline figure of the lower jaw, copied from a drawing furnished to him by Steenstrup. Harting states that the pen or "gladius" of this specimen is six feet long. Many important parts of this specimen were secured, and I

¹ See the American Naturalist, Vol. vii, p. 51, Feb., 1871.

² In a paper, of which I have only seen some proof-sheets, given by him to Dr. Packard, entitled "*Spolia Atlantica*." Whether this memoir has been published I do not know. The plate (1) that I have seen, is marked "*Vid. Selsk. Skrifter V. Række, naturv. og mathem. Afd. iv, Blad*;" and there are references to three other plates illustrating *A. Titan*, etc.

³ Description de quelques fragments de deux Céphalopodes gigantesques. Publié par l'Académie Royale des Sciences à Amsterdam, 1860, 4to, with three plates.

regret that I have been unable to see the figures and description of it, referred to by Harting as forming part of Prof. Steenstrup's memoir, then unpublished. But to judge by the outline figure given by Harting, it is a species quite distinct from those described above. The lower jaw resembles that of *A. monachus* more than *A. princeps*, and is a little larger than that of our No. 5 (see fig. 6). The beak is more rounded dorsally, less acute, and scarcely incurved, the notch is narrow, and the alar tooth is not prominent.

Harting, in the important memoir referred to, describes specimens of two species, both of which are evidently quite distinct from all those enumerated above.

The first of these (Plate I) is represented by the jaws and buccal mass, with the lingual dentition, and some detached suckers, preserved in the museum of the University of Utrecht, but from an unknown locality. These parts are well figured and described, and were referred to *Architeuthis dux* by Harting. But the character of the dentition (fig. 28) is so totally different from

Fig. 28.

Teeth of *Loligo Hartingii* Verrill. Enlarged.

what I have found in *A. monachus* that it will be necessary to refer this species to a different genus, if not to a distinct family. The form of the lower jaw is quite unlike that of *A. dux*, for the beak is very acute, the cutting edge is concave, the notch shallow and broad, and the alar tooth is somewhat prominent. The size is about the same as our No. 5. The suckers figured are from the sessile arms, and agree pretty nearly with those of *A. monachus* (see fig. 3). The edge is strengthened by an oblique, strongly denticulated ring. The internal diameter of the largest of these suckers is .75 of an inch; the external, 1.05 inches. They were furnished with slender pedicels, attached obliquely on one side. The lingual teeth (see fig. 28 copied from Harting,) are in seven regular rows, and resemble closely those of *Loligo* (fig. 9). In fact, I cannot find, in the figures and description, any character by which this species can be separated from *Loligo*, and at the same time it is evident that it is a species distinct from all others

known. I would, therefore, propose to designate it by the name of *Loligo Hartingii*.

The other species described by Harting was represented by the jaws and pharynx, an eye, a part of one of the sessile arms, and of one of the long tentacular arms, preserved in the museum of the Zoological Garden of Amsterdam. They were taken from the stomach of a shark, captured in the Indian Ocean. Harting referred this specimen to the genus *Euoploteuthis*, and doubtfully to the species described by Owen under the name of *E. unguiculata*, from a specimen in the Hunterian museum, collected between Cape Horn and Australia by Banks and Solander, on Capt. Cook's first voyage. The jaws of this species are very sharp and strongly incurved, and a little smaller than those of the *Loligo Hartingii*.

Instead of circular suckers with denticulated margins, the arms bear two rows of large sharp incurved hooks or claws, arising from large, swollen, muscular bulb-like bases, attached to the arms by short pedicels. The lingual dentition is also quite peculiar, but the teeth are arranged in seven rows, as usual.

Mr. Kent, in the article already referred to,⁴ mentions a sessile arm of a giant cephalopod, which has been long preserved in the British Museum, but of which the origin is unknown. He states that it is 9 feet long; 11 inches in circumference at the base, tapering off to a fine point. There are from 145 to 150 suckers, in two alternating rows, those at the base being half an inch in diameter. The relatively small size of the suckers and great length of the arms show that this arm cannot belong to the same species as our *Architeuthis monachus*, which Mr. Kent thought probable. But as the arms of *A. princeps* and *Loligo Hartingii* are still unknown, it may belong to one of those species, or it may belong to the species observed, but not captured, by the officers of the "Alecton," in 1861, near Teneriffe, and named *Loligo Bouyeri* by Crosse and Fischer, but known only from the imperfect descriptions of it given by the officers, and a sketch of it prepared while the crew were making unsuccessful attempts to get it on board.

The body of this one was estimated at 15 to 18 feet in length, with the arms somewhat shorter.

⁴ Proceedings Zoological Society of London, for 1871, page 178.

