

sphere. Prof. G. O. Sars has obtained in Christiania a still undescribed *Diaptomus* by cultivating muds brought dry from Australia.

This fact possesses much interest as regards the geographical distribution of the genus. It indicates a ready means of dissemination and enables us to explain the presence of a *Diaptomus* in considerable quantities in the neighbourhood of Oran (*vide suprà*), in chotts which remain dry during the greater part of the year.

In connexion with this we may also call attention to the fact that certain *Diaptomi* appear to adapt themselves easily to waters of very different degrees of saltness. Dr. Raphael Blanchard has collected the species already mentioned in water which held in solution as much as 29.15 grains of chlorides per litre on April 1, 1888. At the same time this Copepod occurred in water containing not more than 14.04 grains of chlorides per litre. Analogous facts have been previously noted with regard to *D. salinus* and *D. laticeps*. This latter species lives as well in the fresh waters of Scandinavia as in the Salzigersee, near Halle, the water of which contains 0.15 per cent. of salts.

Thus, the genus *Diaptomus* may be regarded as cosmopolite. In all probability future researches will lead to the discovery of new species in different parts of the globe, and will enable us to ascertain a much more extended geographical distribution for the described forms.

XXIII.—*Critical Studies upon some Odontoceti of the Genera Tursiops, Orca, and Lagenorhynchus.* By M. CHR. LÜTKEN*.

I.

ABOUT twenty years ago Prof. Steenstrup acquired at Trieste the skin and skeleton of a small Dolphin captured in the Adriatic. On the amalgamation of our natural-history museums these two specimens passed into the Cetological collection of the University, and were mounted there, in 1865 and 1866, under the name of *Delphinus parvimanus*. In

* Translated from the 'Kongelige Danske Videnskabernes Selskabs Skrifter, naturvidenskabelig og matematisk Afhandlingar,' ser. 6, vol. iv. pp. 391–397. The Danish memoir of which this is an Abstract occupies 54 pages (pp. 337–390), and is illustrated with two plates and a considerable number of woodcuts.

fact, the late Prof. Reinhardt, from considerations indicated by him in the Journal of the Museum, had arrived at the conclusion that this must be a new and undescribed species of the group of Dolphins to which belongs *Tursiops tursio*, also known in the North; but he did not publish any description of the species in subsequent years, during which he displayed great activity in other directions, also as an author. For my own part I was anxious to take up this question, partly because this name of *D. parvimanus*, unknown in literature, and not objectively justified, must attract the attention of competent visitors, and partly because some Italian zoologists who had remarked it, and for whom it had a special interest, had applied to me for explanations of this matter. The investigation was facilitated for me by the memoir which Prof. Flower, Director of the Natural History Museum in London, and one of the first cetologists of our time, has just published upon the genera of the family Delphinidæ, which rendered it possible to limit and define the question more clearly than before. It soon became evident to me that the young animal in question was a species of the genus *Tursiops*, and that, in many respects, it might be regarded as a dwarf form of the above-mentioned *T. tursio*. To clear up the question completely it would certainly have been desirable not to be confined to an isolated young individual, even though represented, as in this case, by both the skin and the skeleton; but it is nevertheless reassuring to be able to employ as terms of comparison four complete skeletons and ten crania belonging to the type-species of the genus. It is seldom that researches of this nature can be founded upon such abundance of material, and it is precisely for this reason that they have often given unsatisfactory results.

I at once perceived that it is vain to seek in the characters of the cranium for a certain criterion of the independence of the supposed new species. The most reliable character is perhaps the smallness and fineness of the teeth, although experience proves that we cannot absolutely trust to this. This was the case also with nearly the whole skeleton; throughout in the specimens of *T. tursio* there appeared a variation, partly dependent upon and partly independent of age, which exceeded anything that we could reasonably expect. The number of vertebræ, for example, varied from 62 to 64, and one could not count upon the number of the ribs. That there is a variation dependent upon age as regards, for example, the degree of development of the apophyses of the vertebræ, is easily understood when we know that these parts are not completely ossified until late,

and, in consequence, that in young individuals they must present themselves in an abbreviated and comparatively undeveloped form; and there are many other variations which may be explained in an analogous manner. But the difficulty commences when an aged individual behaves in one or more particulars as if it was younger; in other words, when one of the features of organization which ordinarily accompany a certain age or a certain size is deficient, or at any rate is in a backward state—which of the two we do not at all know. Such experiences are very valuable, not only to explain an isolated case, but in general for the appreciation of the osteological differences that we observe between individual and individual, or between species and species; and they are only arrived at when we have sufficiently numerous materials to work upon. Hence the necessity of not giving to Natural-History collections too limited an extent, and the duty of seeking, by comparisons judiciously made, to obtain general results which may be made use of in analogous cases upon which the insufficiency of the materials does not enable us to judge directly. I will cite a few examples. The second of the first two cervical vertebræ, which are soldered together in these animals, always presents on each side a comparatively strong process or a transverse apophysis, which, when completely developed, is pierced by a large aperture; in the young animal it is short and imperforate, the portion which surrounds the aperture being still cartilaginous and no longer remaining in the skeleton when this is macerated. But what are we to think when we find that this part is nevertheless deficient in a skeleton which, by its size and other peculiarities, shows that it is older than another which possesses it; or, what comes to the same thing, that this formation appears in its full development in a skeleton which, in other respects, appears to be younger than another which does not possess it? The first piece of the sternum, the *manubrium sterni*, in the young *T. tursio*, as in many other Dolphins, is furnished with an apophysis on each side; in old individuals this apophysis is soldered below to the body of the *manubrium* by the ossification of a cartilaginous or tendinous ligament, which then appears to be perforated on each side by a round aperture. But how surprised one is at finding in still older individuals this hole opened out and converted into a notch, and the apophysis free, although we might have expected to find the contrary the case.

In the young *T. tursio* the first five ribs are the only ones which have a double articulation with the thoracic vertebræ, namely, by a tubercle with the transverse apophysis, and by

the head with the body of the vertebra; all the rest have only the first of these articulations, for the simple reason that they have neither neck nor head. I now find in a good-sized *T. tursio* that the sixth rib has also this double articulation; and if in a *T. tursio* of medium size I have already observed an intermediate phase, that is to say, a neck in course of formation but without the head and too short to reach the body of the corresponding vertebra, I see with satisfaction that all is regular, for the enigma resolves itself quite simply into a gradual and rather slow ossification of the tendinous ligament which, in the sixth rib, takes the place of the neck. But, for this very reason, my surprise is the greater when, in a still larger skeleton, I find only five pairs of completely developed ribs, without any traces of head or neck on the sixth pair.

Being thus rendered doubtful with regard to all those characters which, at the first glance, seemed to be of importance, and having lost nearly all hope of discovering one which could serve me for the small form, whose right to constitute a species I am seeking to establish, I proceed in the last place to the comparison of the *limbs*, although prepared beforehand to obtain only a negative result, as I know very well that the number of phalanges in the digits is very variable in these animals, and that for a perfectly analogous reason, namely, that the ossification of the extreme phalanges only takes place at a late period, and is consequently irregular. But while the number of joints in *T. tursio* is pretty nearly as follows:—1-2, 7-9, 6-7, 2-3, 1-2, so that the second digit is always the longest, and the one that has the most joints, I find here that this number in *T. parvimanus* is:—2, 6, 8, 3, 1, or, in other words, *it is the third digit that is the longest and composed of the most joints*, and at once it is placed beyond doubt that this form is a species distinct from *T. tursio**.

As to whether it may be identified with the other little-known and doubtful species of the genus *Tursiops* (such as *T. catalania*) is a secondary question, which, moreover, can-

* Its diagnosis is as follows:—*Tursiops parvimanus* (Reinhardt): Minor, dentibus $\frac{25}{24}$ minoribus, gracilioribus (diametro antero-posteriore 6 mill.), vertebrae 62, costis 13 paribus, quorum anteriora sex articulatione duplici cum vertebrae conjuncta sunt; vertebrae caudales inde ab 43tia canali verticali utrinque ad basin processus transversii perforatae; pinnae pectorales minutae, octavam partem longitudinis totius parumper superantes, digito tertio longiore, octo-articulato, secundo breviori sex-articulato. Caput, dorsum et pinnae nigrescentes, venter griseo-albus. Longitudo pedes sex paullo superat. (In mari Adriatico semel inventus, forsitan saepius cum *T. tursionibus* junioribus confusus, vel crania sub nomine *T. catalaniae* vel *T. cymodocae* descripta?)

not be solved until we possess authentic skeletons of these nominal species, only the crania of which are known, this, as we have seen, not being sufficient. The case under consideration has, in fact, taught us that a species of Dolphin may be perfectly justified as such, although we cannot indicate any distinctive character in the cranium.

II.

Eschricht, as is well known, in his uncompleted memoir upon the 'Carnivorous Cetacea,' arrived at the conclusion that in the northern seas there are no fewer than three species of the genus *Orca*. Death prevented him from proposing the names that they should bear. One of them, that which evidently has the best right to be recognized as a species distinct from the type-species (*O. gladiator*, Lac.), namely, the "Bo-vhidehval" of the inhabitants of the Faeroës, has since received the name of *Eschrichtii* from M. Steenstrup. Since then the question has remained in the same position. Reinhardt, who also accepted it, arranged it in the Museum under the name of *O. minor*, a name which was introduced into zoological literature by the late M. Malm. If we closely examine the ascertained differences between *Orca minor* and *O. gladiator*, both of which have the same very characteristic coloration, these differences (leaving out of consideration the supposition that the dorsal fin must always be higher in the old male *O. gladiator*) become reduced to this, that *O. gladiator* has 54 vertebræ and 12 pairs of ribs, while *O. minor* has respectively only 52 and 11. This is certainly not much, and therefore we need not be greatly surprised that this distinction has not been generally adopted by cetologists. Moreover, it must be admitted that scarcely any two authors agree as to their mode of regarding the supposed species of this genus, so that in taking for our guidance the opinions of cetologists, and the manner in which they arrange the different forms, we get lost in an inextricable confusion. Here, however, I have been able to introduce into the discussion some new materials which have led me to a definite opinion as to the species called *O. minor*. In September 1872 a family of three Grampuses was captured in the Limfjord, and of these the skeletons were acquired by the Museum, while the opportunity was taken to make a very good drawing of the adult female. The skeleton of the male, which was a little smaller than that of the female, was handed over by my predecessor to the Berlin Museum, but the other two, those of the female and of a young individual, have remained here, and some time since received a place in our Cetaceum. Reinhardt had referred them to *O. minor*, but

without giving any reason for this determination. As both of them have 53 vertebræ and 12 pairs of ribs, it would seem from this alone that there is no real limit between this form and *O. gladiator*. Of course I did not stop at this, but I have carefully examined and compared our five skeletons of *Orca gladiator* (*minor*) of different sexes and ages, as well as a certain number of crania, separate limbs, &c., without being able anywhere to find anything to support the *specific* differences indicated by my predecessors. In this respect I must range myself by the side of the northern zoologists who, by the study of their own materials, have arrived at the same results. As in *Tursiops*, I find in all the characters individual variations and variations arising from age, but nothing more. I have particularly directed my attention to the crania, to which one is in the habit of appealing in the first place, and I have convinced myself that they present no differences of any importance. But by this we have succeeded only to a very small extent in advancing the question as to how many species the genus *Orca* includes, and what these species are. As regards the north I can only recognize two, and one of these, that which bears the name *O. Eschrichtii*, needs to be further studied upon new materials.

III.

Although the two northern species of the genus *Lagenorhynchus* are well known as regards their osteological characters, I have thought that it might be useful to submit to a new comparison the very considerable materials at my disposal, because these materials apparently form a more numerous collection than exists elsewhere, and because, in general, one has not often the opportunity of making such comparisons between two very distinct species of the same genus of *Odontoceti*. It is therefore permissible to believe that the results thus obtained may have a more general interest by aiding in the solution of analogous questions in cases where the materials available are not so complete. The principal results furnished by the comparison of four skeletons and of several crania of each of the species in question are given in the following statement:—

L. albirostris, Gr.

The length of the skull in the adult animal is to that of the whole skeleton as 2:11, and is equal to the length of 16 vertebræ. The

L. acutus, Gr.

The length of the skull is a little more than two elevenths or one sixth of the whole skeleton, and corresponds to 14 vertebræ. The muzzle

muzzle is shorter than the cranium properly so called, and its width at the base is about two thirds of its length. The upper part of the intermaxillaries in front of the nostrils (the "triangle") is inflated, and the part of the maxillaries which accompanies it is hollowed out into a groove. The teeth are about 26 in number in the half of each jaw, and there are never more than 30; they measure as much as 19 millim. in length and 7 millim. in diameter at the base; there are about 4 of them to one inch.

Vertebrae : $88-92=7+15-16+23-24+43-45$. The last neuropophysis and the last parapophysis occur respectively upon one of the 76-79th and 69-72nd vertebrae, and the first perforant vascular canal upon one of the 67-69th vertebrae. The first two cervical vertebrae alone are soldered together by their bodies; in old individuals their comparatively short and broad spinous apophysis is also soldered to the two following; their transverse apophysis is rounded and massive, and the superior transverse apophysis of the seventh cervical vertebra is not shorter than that of the first thoracic vertebra. The *prosternum* is flat, with a deep notch starting from the anterior margin (it may also be perforated). The first 6 or 7 pairs of ribs are furnished with a head and a neck. The scapula is comparatively broad; its height is to its breadth as 2:3. The whole skeleton is exceedingly robust in old individuals, the intervals between the neuropophyses are insignificant, and strictly speaking there is no part of the vertebral column in which the metapophyses are completely wanting. The longest neuropophyses correspond with $6\frac{1}{2}$ vertebrae, the longest parapophyses with 5, and the neuropophyses of the caudal vertebrae are more vertical.

The broad anterior limbs in adult individuals are not quite one sixth as long as the whole length of the skeleton. The number of joints in the digits is 1, 9 (10), 7, 4, 3; the

is in general longer than the cranium properly so called, and its width at the base is equal to about half its length. The upper part of the intermaxillaries (the "triangle") is flat and slightly hollowed, and the contiguous parts of the maxillaries are not hollowed out. The teeth are about 35 in number, and not more than 40; they are about 10 millim. long and about 3 millim. in diameter at the base; there are about 5 of them to one inch.

Vertebrae : $78-82=7+14-15+18-22+38-41$. The last neuropophysis and the last parapophysis are respectively upon one of the 67-70th and 63-65th vertebrae, and the first vascular canal upon one of the 55-61st vertebrae. The first four cervical vertebrae, in adult individuals, are soldered together both by the bodies and the arches, their spinous apophysis is high and delicate; the transverse apophysis of the first two is flat, and the transverse apophysis of the seventh is not much developed. The *prosternum* is perforated, but without a notch, very convex or as if broken, and its anterior part is hollowed out crosswise. The first 5-6 (7) pairs of ribs are furnished with a head and a neck. The scapula is not so wide, its height being to its width as 2-2.5. The skeleton is of a less robust character, the intervals between the apophyses of the vertebrae are greater, there are 11-16 vertebrae without distinct metapophyses, the longest neuropophyses correspond to $4\frac{1}{2}$ vertebrae and the longest parapophyses to $3\frac{1}{2}$. The neuropophyses of the caudal vertebrae are directed more obliquely forward.

The length of the narrow and pointed anterior limbs is scarcely one seventh of that of the whole skeleton. The number of joints in the digits is 2 (3), 10 (9), 6 (7),

L. albirostris, Gr.

thumb therefore consists only of the metacarpus.

As to the animal itself, it is well characterized by the white colour of the upper lip, by the large size and breadth of the anterior limbs, and the faint indication or total absence of the whitish band or spots.

L. acutus, Gr.

3 (1), 1, and the thumb has consequently 1 (2) true phalanges.

The smaller and more pointed anterior limbs, the dark-coloured upper lip, and the distinct and clearly defined light lateral band well characterize this species.

I do not attempt to contribute anything towards the knowledge of the exotic species of the same genus, which, in general, seem capable of being referred to the two preceding types, but the relations of which to the northern species have not yet been submitted to a critical examination; but I will nevertheless remark that the late Prof. Malm, in a memoir which has unfortunately escaped the notice of Prof. Flower, has recorded a *Lagenorhynchus clanculus*, captured at Cape Horn, the skeleton of which contains only seventy-one vertebræ. It is therefore without doubt a distinct species from *L. albirostris*, and the diagnosis of the genus, so far as the number of vertebræ is concerned, must in consequence be modified. Nor will it be superfluous to remark that the genus *Lagenorhynchus* must be ranged in that division of the Odontoceti (the true Dolphins) to which belong the genera *Delphinus*, *Prodelphinus*, *Steno*, *Tursiops*, and *Sotalia*, and which is distinguished by the character of having the beak plainly separated from the frontal convexity.

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The Flora of West Yorkshire, with a Sketch of the Climatology and Lithology in connection therewith. By FREDERIC ARNOLD LEES. 8vo. Pp. 843, with Map. London: Lovell Reeve and Co., 1888.

A VOLUME of 843 pages with the numberless facts that a Flora of a large district implies is a difficult subject to compress into a short notice, especially when there are matters touched on in this work that a student of our Flora from its distribution-point would be tempted to be too discursive on.

The author dedicates his book to the late Rev. W. W. Newbould, and a better dedication could not be, for to few men are given the power of unselfish help that he possessed.

One peculiarity of this Flora may well be mentioned; the author



Lütken, Chr. Fr. 1888. "XXIII.—Critical studies upon some Odontoceti of the genera Tursiops, Orca, and Lagenorhynchus." *The Annals and magazine of natural history; zoology, botany, and geology* 2, 179–186.

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