

ON RISSO'S GRAMPUS, *G. rissoanus* (Desm.¹). BY JAMES MURIE, M.D., F.L.S., F.G.S., &c.; formerly Pathologist to the Glasg. Roy. Infirmary; Assist. Conservator Roy. Coll. of Surg., Eng.; and late Prosector to the Zoological Soc. Lond. (Plate V.)

1.—Remarks on the Species, its Character, &c.

IN a report² laid before the Parisian Academy of Sciences in 1812, by Cuvier, Lacépède and Geoffroy Saint-Hilaire, on some Cetaceans captured on the coasts of France in the beginning of that year, mention and a figure is given of a remarkable form from the Mediterranean. This Baron Cuvier denoted "le Dauphin de M. Risso," *Delphinus aries?* though believing it, from the drawing sent him, to be none other than his *D. griseus*.

The original observer, Prof. A. Risso of Nice, subsequently in 1826³ gave the characters more in detail and refigured the animal. Other systematists admitted the species, though still some doubts clung to it. The worthy Laurillard, however, was fortunate in being present at the capture of a male and female in the bay of Saint Jean, near Nice, in 1829; and by a sketch made on the spot, and a fresh description, established the identity of the creature. As *Phocæna rissonnus*, M. Fred. Cuvier, in his *Cétacés*⁴, supplemented the last-mentioned author's notes by some remarks of his own and a new figure. Dr Gray⁵ in various publications has recognised the species, and Gervais⁶, I believe, first figured the skull. Lately Van Beneden⁷ and Gervais, in their great work on the whale group, have given excellent illustrations of the skeletal peculiarities of the closely-allied and almost identical forms *G. griseus* and *G. rissoanus*: but the

¹ Laurillard has been credited with the specific name *rissoanus*, but in searching authorities I find Desmarest in 1820 (*Encycl.* p. 519) seems first to have Latinized G. Cuvier's D. d. M. Risso thus. Other writers have used *rissoi*, *rissonnus*, *rissii*, &c. I prefer to retain the earlier name, especially as it is that in most frequent use.

² *Annales du Museum*, xix. 1, Pl. 1.

³ *Hist. Nat. de l'Europe Méridionale*, iii. 23, Pl. 1, fig. 2.

⁴ *De l'Histoire Naturelle des Cétacés*, Paris, 1836, p. 196, Pl. 13, fig. 1.

⁵ *Zool. Erebus and Terror*, p. 32, and *Cat. B. M.* 1850, &c.

⁶ *Zool. et Paléont. Franc.* p. 300, Pl. 37, figs. 1 and 2.

⁷ *Ostéographie des Cétacés Vivant et Fossiles*, Pl. 54.

letter-press concerning them has not yet been issued. Such is all the original matter published concerning the species in question, although several writers refer to and even figure it; for which, and an epitome of the salient points, consult Gray's most useful *Cat. of Seals and Whales in the Brit. Mus.*, 1866.

It is rather curious that G. Cuvier's, Risso's, and Laurillard's (pub. by F. Cuvier) representations are widely different from one another, though they agree less or more in an essential particular, viz. irregular light linear devices slashed throughout the body. In fact these scratch-like lines are the exterior specific distinctive mark. Notwithstanding evident shortcomings in the figure, Risso's own simple description is very graphic: "Son corps est allongé, arrondi, renflé vers sa partie antérieure, diminuant insensiblement de grosseur vers la queue qui est déprimée; sa peau est mince, unie, de couleur grise à nuances bleuâtres, traversée par des traits irréguliers et des raies inégales, droites ou flexueuses, blanchâtres; le ventre est d'un blanc mat; la tête fort grande; le museau arrondi, relève en arc, obtus, percé vers la nuque par l'ouverture des événements; la bouche est ample, arquée; la mâchoire supérieure pourvue d'alvéole seulement, est plus avancée, et couvre l'inférieure, qui est garnie de chaque côte de cinq grosses dents coniques," &c. Laurillard states from his observations that the male and female differ in appearance, the former resembling Risso's description, but the latter of a uniform brown.

In the beginning of this year an adult female whale, readily identified with Risso's species by colour and scratch-markings, was brought to London, which, after being publicly exhibited for a short interval, was purchased by Mr Gerrard for the British Museum. Prof. Flower obtained Dr Gray's permission to investigate this rare form, and brought forward a notice of his intention to describe the skeleton in a future communication to the Zoological Society. Since then a second much younger female has been captured on our coast, which I had an opportunity of dissecting. As this disagreed in some ways from the other, I have thrown together my notes on its soft anatomy in the form of a communication; purposely avoiding all mention of its skeleton, which doubtless Prof. Flower, with his knowledge of the group, will skilfully interweave in his memoir.

Tables of admeasurements in inches and decimals, of the young female examined by me.

Extreme length, following the curve of the body	. 79.0
From the snout to the fork of the tail	. 75.0
Vertical depth of the body in front of the dorsal fin	. 15.5
Distance between the anterior root of the dorsal fin and the snout, following the superficial curve	. 35.0
Taken in an approximate straight line the same points more apart, about	. 31.0
Distance from postero-margin of dorsal fin to fork of tail	33.0
Dorsal fin, length of its base	. 9.0
„ in height	. 6.0
„ its anterior marginal curve	. 12.25
„ its posterior concave border	. 7.0
„ breadth about its middle	. 4.5
Distance from snout to root of flipper	. 17.0
Pectoral limb, in extreme free length	. 12.0
„ its greatest breadth	. 3.5
„ diameter about middle of free portion	. 2.0
„ girth at axillary end	. 10.0
„ thickness about middle of flipper.	. 0.6
Caudal fin, in extreme breadth	. 14.25
„ width base of each fluke	. 5.5
„ ditto, about the middle of same	. 3.5

The shape of the body and fins and position of the latter, are shown at a glance in Pl. V., a faithful recopy of a careful drawing to scale made at the time. The colour of the entire back, fins and tail is of a neutral tint. The throat and abdomen to beyond the anus is white or with a tinge of yellow in it, a kind of streaked dirty white. This rises almost to the medio-lateral line and intermingled with faint but increasing streaks and mottles, and a shade of light brown, or rather purple tinge, graduates insensibly into the leaden or bluish grey of the upper half of the sides. There is a grey patch on each shoulder. The protuberant muzzle is the yellowish white; the caudal region behind the anus, dark. In truth with variation of figure, white forehead and mandible, it is uncommonly like a light-coloured porpoise. The grand feature of interest, however, is the

scratched-like lines which in this animal differed completely from hitherto figured specimens, or that examined by Mr Flower. Instead of innumerable obliquely intercrossing marks over the entire superficies and fins, the narrow white but grey-edged lines were seven in number, somewhat vertically placed along the sides from the shoulder to about opposite the vent; the front and hinder pairs being cross-barred longitudinally. So remarkable a feature, undoubtedly irregular in individuals, is notwithstanding a most prominent specific landmark. As to sexual coloration, I am not inclined to lay stress on Laurillard's statement of the female being brown as contradistinguished from the scale; in this case the brownish hue was most meagre. There is quite as great variety in the porpoise, and, so far as my observations extend, the male is occasionally the darkest, but this really may be a matter of age.

As regards the eye, this has the same narrow elliptical form common to the cetacea. From the anterior to posterior canthus or long diameter is 0·9 inch, and across or vertical depth 0·5 inch. It is placed ten inches posterior to the snout, two behind the angle of the mouth and one-and-a-half above it. The iris appeared of a deep purple tint; but whether this was a post-mortem effect or the natural hue, I will not pretend to say, as Risso notes it is golden-coloured.

I may mention that a double row, four in each, of bristle roots¹ existed on the upper lip. The caudal region is ridged above, stopping short of the tail fork, and there is a less notable keel beneath.

2.—*Generative parts and muscles around.*

The opening of the vulva, four inches long, is situate two feet in front of the fork of the tail; the measurement being taken to the posterior angle of the former. The anus lies a couple of inches behind. In the simple commissural lips of the generative outlet, development of clitoris, and lateral fissures of the mammary gland, there is no departure from the cetacean type. Neither did I observe any special deviation of the urogenital organs interiorly.

¹ Vide Rousseau, *Ann. d. Scien. Nat.* Nov. 1830.

In my memoir on the "Deductor" I have made some original investigations on the muscles of the pelvo-generative parts, hitherto little heeded in cetacean dissections. Having figured these, I refrain doing so in the Grampus, but make a memorandum of what I observed.

The fleshy rectus abdominus terminates in a wedge-shaped manner opposite the anterior pudendal angle and clitoris, and is continued by a tendon which spreads out in an aponeurosis between the vulva and rectum. Here it passes beneath the backward extension of the great panniculus carnosus, which extends triangularly along the medio-lateral line to about opposite the hinder angle of the uro-genital slit.

There is a well-developed internal and external sphincter ani. A broadish sheet representing a transversus perinæi reaches from the post-border of the rectum forwards to the vulva. I observed also, what I have incidentally noticed in globiceps, beneath the last and midway betwixt the rectum and vulva, a layer of transverse or somewhat oblique muscular fibres, half an inch in antero-posterior diameter, which passed from the median line across the ilio coccygeus. On the left side part of its fibres ran on to the inter-pelvic fascia.

A small but distinctly separate muscle is met with on the outer side at the anterior end of the generative outlet, and divergently across from the clitoris. Its fibres in a thin layer are spread out and encircle the root of the clitoris, and thence narrowing, proceed out towards the surface of the posterior extremity of the rectus abdominus.

The next in order of position is a longish muscle with a thick round fleshy belly. It arises upon the posterior half of the pelvic bone, and reaching forwards is inserted in front of the vulva. Functionally it is a compressor of the mammary gland, which lies between it and the muscle next to be described. Homologically, from situation and attachments, it is an erector clitoridis or ischio-cavernosus.

Placed more deeply than the last is a much smaller and arciform muscle, also roundish bellied. It is attached to the side of the vulva, behind the mammary gland, and rather lower than the latter. In passing forwards partially under the here imperfectly developed gland, it proceeds to and is fixed upon the deep

pelvic fascia, viz. that which forms a bridge of union between the bones of the opposite sides. This muscle is a true constrictor or sphincter vagina; corresponding to the bulbo-cavernosus of the male.

Lastly, I may take notice of a very large, elongate, thick, fleshy pelvo-caudal muscle; representative of the pubo- and ilio-coccygeus of tailed quadrupeds. This arises partly by tendon and partly by fleshy fibres outside that last described, and from the deep or interior surface of the pelvic fascia. It is continued straight backwards below the erector clitoridis and alongside the rectum. Immediately behind this, having reached the middle line it joins its fellow of the opposite side, and the two form a tapering fleshy mass above a foot long, inserted into the chevron bones, and lying upon the infra-caudal muscles.

I may add that as in globiceps a series of vessels and nerves pass inwards between the pelvic bone and the origin of the ilio-coccygeus. The arteries are derivative of the apparent internal iliac, pudic branches being very distinguishable passing towards the clitoris. The common iliac artery besides, splits into the usual Cetaceæ rete mirabile. Several large glands are situate between and at the anterior ends of the pelvic bones.

In previous whales which I have dissected, I have found some muscular variation from what is here stated, but that and other surrounding structures it is not my intention now to speak of.

3.—*Spiracular Cavity, its Sacs and the Larynx.*

The blow-hole in Risso's Grampus, as in the common Porpoise, is crescentic; concavity forwards. In shape, therefore, the external breathing aperture is unlike that of its supposed ally globiceps, where it is more angular in outline. As in other Delphinæ, where the skull is unsymmetrical, the spout-hole in our specimen was a trifle to the right of the middle line, and opened near, but not quite, at the summit of the head. By measurement in a straight line it was found to be 7 inches behind the tip of the snout, and as much as $12\frac{1}{2}$ inches, following superficially the protuberant curve of the upper lip or maxillary arch.

Communicating with the spiracular cavity, as Von Baer terms the upper common narial passage, are several diverticula

or membranous pouches; the nasal sacs of allied forms. There are three pairs of these, with the addition of a subsidiary sacculate canal on the right. Their wall structures are identical with the same organs in other cetaceans. I have so fully discussed the nature and homology of the nasal sacs in my memoir alluded to, that I will not here enlarge upon the subject. Briefly I may state that I do not regard them as altered and displaced turbinal bones. This view, Von Baer¹ gave forth fully above forty years ago, in a paper full of masterly reasoning, and his notion has not since been contradicted. Indeed Professor Huxley in his Hunterian Lectures² favorably inclines to Von Baer's idea. But, as I have shown, they do not tally with osseous elements, but are modifications of membranous sacs met with in the nares of ruminants, and some pachyderms; the two very families used in proof to

Fig. 1.

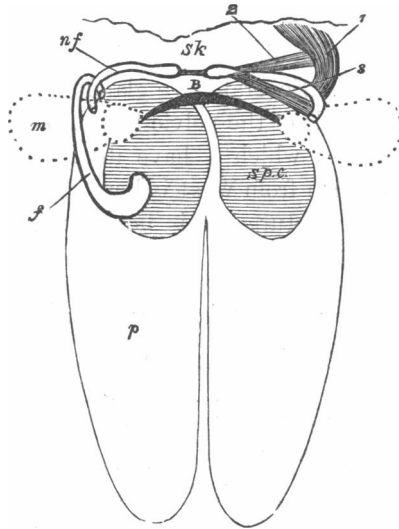


Fig. 1. Diagrammatic representation of the nasal sacs, &c. *b.* Blowhole: the dark crescent immediately above which the letter is placed. *sp. c.* Spiracular cavity. *p.* Premaxillary sac. *m.* Maxillary sac. *nf.* Naso-frontal sac. *f.* Second or facial division of same. *sk.* Indicates the skull, the wavy lined being the coronal suture. 1. 2. 3. The three deep muscular slips acting chiefly upon the naso-frontal sac.

¹ *Der Nase der Cetaceen*, Isis, 1826, p. 811.

² Reported in the *Lancet*, 31 March, 1866, p. 350.

demonstrate that the cetacean nasal sacs are homologues of the turbinate bones.

The diagram, fig. 1, illustrates the points of interest connected with the nasal sacs in Risso's Grampus; and I may note that in the terms and lettering I adopt the same used by me concerning analagous parts in globiceps. I have above said of the former, that its sacs are seven in number, and in communication with the spiracular cavity (*sp.*) or common upper nares. Of the membranous chambers the premaxillary (*p.*) (anterior central pouch of Sibson¹ in the Porpoise) is double, long and slipper-shaped. The pair of flask-shaped maxillary bags (*m.*) (anterior lateral pouches, Sib.), as the dotted lines show, are but of moderate size, indeed relatively small compared with what I have met with in fully adult Cete. Each naso-frontal canal (*nf.*) (posterior deep sacs, Sib.) lined with dark pigmentum, has its orifice towards, and opening into, the lateral or maxillary pouch. These so-called naso-frontal cavities are narrow backwardly, and inwardly curved tubes, which mesially terminate in a somewhat bulbous manner, short of each other; but they nevertheless are connected by what appears as a small impervious cord, a central dark puncta being, however, discernible in it. Lastly, I observed, only on the right side though, a secondary tubular prolongation derived from, or close to, the naso-frontal sac. This, for distinction's sake, I denominate the facial division (*f.*) of the naso-frontal sac. In this case it was both longer and larger than the latter; opened by a separate orifice into the maxillary pouch close to, or nearly in conjunction with, that of the post naso-frontal. But unlike the latter it branched forwards, or presented a lateral and crescentiform facial position, ending blindly in a recurved dilatation.

I do not wish to retread the argument used by me, but ere passing from the subject, reiterate conviction of the exceeding likeness of the cetacean naso-frontal sacs to those at the root of the Tapir's proboscis; and the likelihood of the maxillary sacs corresponding to those within the Saiga's² nose.

I have expatiated on the homology of the muscles of the blow-hole in globiceps, collating them with those of the epi-

¹ *Philosoph. Trans.* 1848, p. 117.

² See *P. Z. S.* 1870, p. 478, fig. 8.

cranial, and naso-facial regions in other mammals. As regards the number of layers, their action, &c., I do not coincide with previous writers. My intention with respect to those of Risso's Grampus, which are in the main similar to its above ally, is merely to add some few remarks on what I have already written and figured, though still unpublished.

In *G. rissoanus* the superficial fleshy sheet, equivalent to an occipito-frontalis, closes the blow-hole by compressing it from before backwards. For, while attached to the occipito-frontal crest behind, it is inserted in front of the sacs converging into a gristly fibrous centre-point.

The second layer, which may be the homologue of the levator labi superioris alaque nasi, has a similar use; and its attachments are the same as in the form compared.

The third layer, functionally acts like the preceding, but compresses more the maxillary sac than influences closure of the blow-hole. This may either be a levator superioris proprius, a levator anguli oris, or the zygomatici—possibly all combined.

The fourth layer, or thin radiating muscular sheet, acts much like a depressor ali nasi, inasmuch as it drags downwards and outwards the parts in front of the blow-hole. It is there fastened by a very broad and thickish aponeurosis, and which, moreover, as it passes outwards overlies the anterior surface of the sac.

Some very short and still deeper fibres in globiceps pass from the naso-frontal sac backwards to the bone behind. In the Grampus, there are three well defined slips in this situation marked 1, 2, 3, in the diagram, fig. 1. The first of these is the broadest, and is directed backwards. The second, a much narrower slip, is attached to the inner end of the naso-frontal sac and passes obliquely outwards and backwards. The third goes more forwards, partly overlying and in front of the cylindrical sac. These three muscles act as compressors and tractors of the sac in virtue of the position they hold to it. They, from situation, if not absolutely function, are homologous with the diminutive bundles which influence the alar cartilages of higher mammals.

The naso labialis or longitudinal semi-fatty muscle, resting upon the upper surface of the premaxilla is very large, and posteriorly it unites with the upper radiate layers in front of the

blow-hole. Use, a protractor and dilator of the blow-hole, as likewise compressor of the premaxillary sac.

Proceeding from the nares to the hyo-laryngeal apparatus—I shall merely note of the basihyal bone, that it has not such regular crescentic proportions as is the case in *Globiocephalus*; but instead is more angular and sharper tipped.

In the Ray Society's translation of that valuable monograph on the Greenland whale, *Balæna mysticetus*, by Professors Eschricht and Reinhardt, the following statement is made (p. 101): "We know that the most essential peculiarity of the whalebone whales, as compared with that of the toothed whales, consists in its allowing the mucous membrane of respiratory canals, by means of an opening on its ventral surface, to appear in the form of a sac with an exterior covering of a strong layer of muscles;" then follow remarks on similar laryngeal sacs in terrestrial mammals.

Now the above seeming distinction between the whalebone and toothed whales, I am prepared to show in the case of Risso's Grampus is one rather of degree than of kind. In short the species under consideration has a laryngeal sinus or small glandular sac opening into the interior of the larynx. In describing this structure I invite attention to the woodcut fig. 2, an exact copy of a sketch made on the fresh object. It represents the interior of the larynx opened, by the wall being cut away a little to the one side of the middle line or towards the observer.

At the lower end of the perpendicular epiglottis-arytenoid passage, the longitudinal folds are here and there interrupted by shallow glandular pits and depressions. Among these, one on the middle of the anterior wall is distinguished from the rest by its forming not a mere crypt, but an orifice leading into a moderate-sized pouch. In the drawing an asterisk marks where a stylet passes through the orifice in question.

The said sac, sinus or deep laryngeal pouch (*Gl. s.*), fills in great part the angle of junction between the enlarged epiglottis and the thyroid cartilage: but it does not reach to the posterior border of the latter. The vacuity or interior hollow of the pouch is of very moderate capacity. In fact, as Eschricht and Rheinhardt say of the enormous laryngeal sac of the Right

Whale, *Balæna*, that while from without it seems very large yet the cavity is comparatively very small; so is it with *Grampus*, where the walls are of considerable thickness. These are composed of a basis of glandular substance partially bound together by fibrous trabecular partitions of smooth mucous membrane, leaving many irregular-sized deepish loculi between.

A sparse padding of fatty substance exteriorly surrounds the pouch, and a thick layer of muscle intervenes betwixt the latter and the inner wall of the cartilaginous thyroid plate. These evidently correspond to those transversely-striped whorled muscular fascicles which surround or form the exterior coat of the so-called air-bag or laryngeal sac, both in the Right¹, the

Fig. 2.

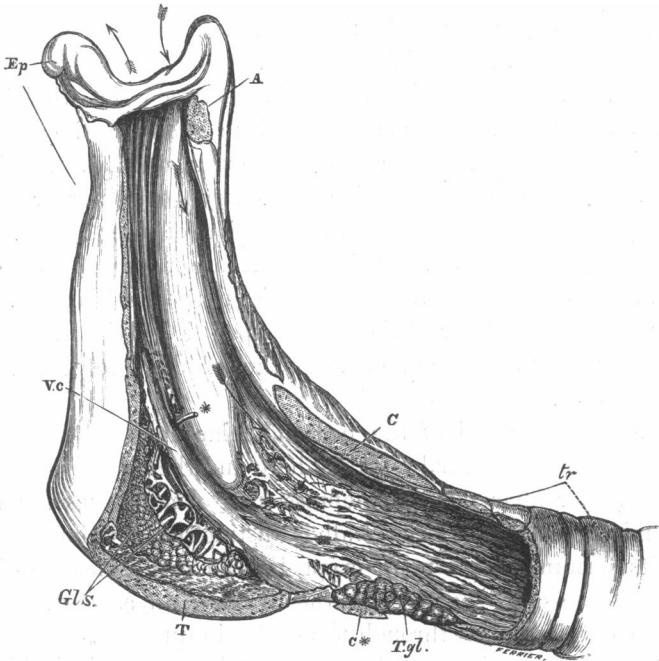


Fig. 2. The larynx in section. The downward arrows denote the posterior more open laryngeal passage; the upward directed arrows guide to the narrower anterior funnel. *Ep.* Epiglottis. *A.* Cut part of the left arytenoid cartilage. *T.* Section of thyroid cartilage. *C. C*.* Segments of cricoid. *tr.* Trachea. *T. gl.* Thyroid gland. *Gl. s.* Glandular sac: the stylet (*) shows the orifice of communication with the glottis. *V. c.* Fold or vocal cord.

¹ Vid. Eschricht and Rheinhardt's Engl. Trans. p. 102.

Pike Whale¹ and the Razorback². Their situation and general disposition in Risso's Grampus leads me to suspect they are Thyro-arytenoidei. In the Whalebone Whale they are vastly developed, and follow the disposition of the capacious sac, viz. run backwards betwixt the thyroid and the ventral ring of the cricoid cartilage.

The constituent cartilaginous elements of the larynx resemble much those of globiceps. The tabular prolongation of the epiglottis (*Ep.*) and the arytenoids (*A*) rise to nearly a level with each other; and their adjoining margins are attached quite to the upper flange or lips of their combined orifice. In this they differ from *Balænoptera rostrata*³, where they are comparatively loose, but agree with *Globocephalus*.

The body of the thyroid cartilage is a broad flattish plate (seen in section, fig. 2 *T*), and from which alar expansions spread out. These terminate in elongate narrowing inferior cornu attached by ligamentous union laterally and near the posterior border of the cricoid cartilage. The latter cricoid (*C*) presents a ridge and thick arch superiorly, and a narrow backwardly set ring (*C**) inferiorly, which encircles the commencement of the trachea. Here they impinge against, and partly override a small thyroid glandular body (*T. gl.*), which reaches backwards for a short distance beyond.

With the naturalists and anatomists of the first quarter of this century it was a moot question whether the cetacea possessed voice, and in sequence vocal cords. I am not sure indeed if the latter point has been unequivocally settled. That some species utter sound is now unquestioned, and notably the species under consideration and the Ca'ing Whale. As to vocal cords, Meckel⁴ strongly opposes Cuvier, and in denial of the latter's statement as well as others, of their being wanting, replies: "Loin de là, l'absence des parties en question se trouve compensé jusqu'à certain point, à ce qu'il paraît par un autre organisation." With his further description and nature of the parts my own observations coincide; so instead of quotation, I shall refer to fig. 2 of the Grampus's opened larynx.

¹ Carte and Macalister, *Philosoph. Trans.* 1868, p. 238.

² Knox, *Cat. Prep. Whale*, p. 11.

³ Carte, p. 234, and Knox on *Larynx of same species*.

⁴ *Anat. Comp.* Vol. x. p. 596.

The tracheal and lower laryngeal mucous membrane folds are numerous and longitudinal. Glandular pits are here and there distributed, and in abundance, opposite the anterior half of the cricoid shield. In the floor of the chamber from about opposite the cricoid, a double raised smooth membranous fold commences, which runs on and upwards to the root of the epiglottis.

As the folds diverge forwards and merge into the narrow rugæ of the upright epiglottic funnel, they are mesially pierced by the orifice of the laryngeal sac already spoken of: around which are glandular crypts. The said parallel folds I take to be the representatives of vocal cords (*Vc*), for reasons I shall presently mention. Above them and on either side of the chamber is a broad, smooth, and long eminence which extends from about the middle of the vocal cords up to near the extremity of the arytenoid cartilage. These eminences and folds thus more or less divide the interior of the erect part of the larynx into an anterior narrow canal and wider posterior channel; the upwardly directed arrows defining the course of the former and the downwardly-placed ones the latter. The abnormally changed relations of the parts, the vocal cords being longitudinal rather than transversely-placed in the Cetæ, are best studied by comparison with the same region in some ruminants. In *Hyomoschus aquaticus*¹, as Flower has shown, "the vocal cords are placed nearly vertically in the sides of the larynx, and thrown unusually far from its posterior wall, so that when they are brought in contact, a cylindrical tubular air-passage remains open behind them, but the communication between that passage and the thyroid pouch is shut off." I have myself described a similar condition of parts in the larynx of *Saiga tartarica*², figuring moreover a longitudinal membrano-fatty eminence, as exists in Risso's Grampus and other whales.

Taking these facts into consideration, and remembering that in the cetacean larynx we have it twisted partially in its long axis, that is a horizontal and vertical portion, and it will be the more readily admitted that vocal cords are not absent. Furthermore, from analogy I am inclined to think that during moderate inspiration the current is chiefly by the posterior channel, but

¹ P. Z. S. 1867, p. 957.

² L. c. fig. 11. B.

by both in a full inspiration. On the other hand, when the cetacean blows with force or utters sound, the posterior division of the chamber is lessened, and exit of air is chiefly through the anterior constricted canal. In watching the movements of the porpoises formerly possessed by the Zoological Society, and as I have witnessed at sea, they occasionally skim the surface; at such times, therefore, gentle inspiration in the manner I have indicated might take place. Immediately after they rise from submergence, however, the blowing is very decided. It would be interesting to note if the voice of cetaceans agrees with such ruminants as approach in form of interior larynx.

The trachea is moderately wide, as are its numerous rings. There is a third bronchus to the right lung, as in other toothed whales. It was with some degree of interest that I examined the lungs to see whether I should discover in them those curious glands at their post-ventral apices figured and described by me at length in *globiceps*. They exist fully developed, but more than one to each apex, the additional and somewhat smaller bodies lying deeper or behind the others. In shape the lungs themselves comport to those of the Pilot Whale, that is free from incisions and lobes, excepting the tendency to an antero-inferior lobulus. The superficial sinuous vessels are well marked; and the membranous bridge connecting the diaphragm and post-ventral lung-tips of moderate breadth.

4.—*The Alimentary Tract, &c.*

The mouth from the front to its angle is seven inches long. The eaved margin of the maxillary arch overlaps slightly the mandibular one when the mouth is closed. There is a rudimentary roughened callous premaxillary palatal pad. The tongue is smooth-surfaced; its tip distinctly notched, and it is free for $2\frac{1}{2}$ inches from its frænal attachment.

No teeth were visible in this specimen; but in both upper and lower jaw a well-marked dental groove obtained. Laurillard has remarked¹ of the species: "Ces animaux sont sujets à perdre leur dents, et surtout celles de la mâchoire supérieure; aussi n'en connaît-on pas le nombre normal, leur forme est semblable

¹ Fred. Cuvier's *Cétacés*, p. 199.

à celle des dents de dauphin." Risso says¹ the mandible is furnished with five great conical teeth on each side. As this subject is best treated with the osteology, I return to a consideration of the viscera.

The compound stomach of Risso's Grampus corresponds very closely with that of the Pilot Whale, such as I have figured in my memoir of the latter animal. Professor Turner's² woodcut, depicting as an anatomical preparation the stomachs of a much younger specimen of the same animal, shows that the relations of the compartments to each other varies from youth to age. That this is the case not only in these aquatic forms, but also obtains in the ruminantia, his researches³ and the observations of Dr Gedge⁴ on the sheep seem to prove.

Comparing the *G. rissoanus* with the specimen of globiceps dissected by myself, I noted in it that the first gastric cavity, as contrasted with the others, was smaller than in the latter cetacean form. This might be as much owing to the animals not having quite arrived at the adult stage as to generic distinction. The second and particularly the third cavity (Turner's 2nd and 4th) were much more elongate or ovoid in *Grampus* than in *Globiocephalus*; the peculiar globular inflation of these cavities in the latter genus being very characteristic. The narrow tunnelled passage betwixt the walls of the second and third gastric cavities (which Turner reckons the third stomach), and connecting these two, has its upper orifice in the *Grampus* close to that leading from the first to the second cavity.

The long cylindrical fourth cavity and dilated commencement of the duodenum are alike in both forms. This remark applies to the lining of mucous membrane in the whole of the cavities. I may further state, as is a very common occurrence in Cete captured on our coast, there was no food throughout the alimentary canal; mucus, with a yellowish bilious tinge, pervading the upper portion of the gut.

A small compound spleen resembling in shape that of globiceps, lies, as in it, on the right or concave surface of the large first stomach.

The intestines measured 47 feet 2 inches; thus being seven

¹ *Op. cit.* p. 24.

² *Camb. Journ. of Anat.* 1868, p. 73, fig. 2.

³ *Ibid.* 1869, p. 117.

⁴ *Ibid.* 1868, p. 323, Pl. VII. figs. 1—4.

times longer than the entire body: in the globiceps examined by me the proportion was as 9 to 1. Both genera present considerable similitude in the distribution of the intestinal glands, the folds of the mucous membrane, and absence of a cæcum.

A century ago Hunter recognized the considerable uniformity and simplicity of the cetacean liver, and Risso's Grampus offers no exception. In shape, absence of lobulations, smoothness of surface, and no gall-bladder, it agrees quite with the Porpoise and globiceps. Moreover, as in the latter, the bile-duct expands and forms a reservoir within the wall of the duodenum, previous to penetrating the mucous coat of the gut.

The heart offers nothing worthy of remark: there was no accessory orifice and valve in the septal segment of the tricuspid valve, as noticed by me in the Ca'ing Whale. The great vessels spring from the aortic arch as follows: at the summit a short distance apart are a right and left innominate. From the right and behind the deep intercostal is derived. Above this the innominate trifurcates, viz. into a subclavian and double carotid: the same obtains on the left side. The left deep intercostal, however, springs from the left side of the aortic arch at a considerable distance away, and not from the innominate, as on the right side. This arrangement is not unlike what Professor Turner¹ has figured in the Pilot Whale.

In being elongate, loosely acinate, and the vessels entering at the upper end but ventral surface, the kidneys follow *Globiocephalus*.

5.—*Fleshy and other coverings of the body generally.*

The animal being in fair condition, there was as usual a wide-spread adipose layer overlying the panniculus carnosus. This latter muscle was extensive and of moderate thickness. The facial prominence consisted of material similar to the larger boss of globiceps, but correspondingly less oleaginous in the centre.

Those post-inferior lumbo-caudal masses which by some have been erroneously taken as magnified representations of the iliacus and psoas are large and powerful in *Grampus*. As elsewhere shown, their true homology is with the comparatively

¹ *Loc. cit.* p. 67, fig. 1.

diminutive sacro-coccygeus and infra-caudal muscles of quadrupeds. The dorsal spinal layers offer no departure from other Cete. I may mention, however, trace of a trapezius or rhomboideus capitis, viz. a very thin layer continued on to the occipital crest. The more fleshy rhomboideus proprius passes spinally over the splenius; in some whales a strong aponeurotic fascia alone overlies the latter muscle.

There is a very decided teres major present. A sterno-scapular muscle obtains. This covers the first rib and part of the intercostal space behind; its fleshy belly is more than an inch broad, and the insertion is on the deep surface of the coracoid process. The coraco-brachialis is strong though short.

A few fibres or slender slip representative of a triceps were discernible between the post-humeral border and the infra-glenoidal foot. Nothing which could be construed into remnants of flexors or extensors of the lower fore-limb were observed by me.

The serratus magnus has digitations upon the first four costæ. The external oblique continues forwards to the first rib; but the muscular belly of the rectus abdominis stops at the second rib, and by aponeurosis only proceeds to the anterior rib and sternum. The minutiae of the fleshy parts of the tongue and hyoidean region I did not enter into, but as they passed through my hands I was convinced of their great resemblance to those of globiceps.

The general results of myological examination of Cetacea lead to the inference that as a whole there is little variation, excepting it may be in minor details. It is asserted, however, that the pike-whale¹ has long flexors and extensors of the forearm and manus, an observation requiring confirmation as to its constancy in *Balænoptera* or limitation to the genus.

6.—*Generic affinities as elucidated by the exterior and soft structures.*

In the present phase of Cetology the skeleton has become so much the all-important basis of classification that hints derivable from exterior peculiarities and internal organization are

¹ *Phil. Trans.* 1868, p. 228, figs. 2 and 3, Pl. V.

in a manner overshadowed. Doubtless there is some justification for this in the case of the Cetacea, where a certain sameness of form, a slight gradation of colour, and considerable similarity of interior construction run through the family: besides, essentially accurate delineations of specimens are not overabundant. But is it wisdom to lose sight of the exterior and anatomy, though to skeletal distinctions much of the impetus of modern zoology is due? Let us see in how far externals and internals other than bones tell in the present instance.

G. Cuvier, Risso, and Desmarest¹, have ranged our species under the genus *Delphinus*. Fred. Cuvier², with a leaning as above, placed it notwithstanding under his wide group of porpoises and dolphins, *Phocæna*. Lesson and Hamilton³ refer it to *Globiocephalus*, to which generic division I apprehend Rheinhardt⁴, in a passing remark of his, opines, as apparently does Flower⁵ in his preliminary note.

Gray⁶, though at one time regarding it as mayhap his *G. svineval*, has since generically put it under *Grampus*, and most reasonably says of Lesson's choice, "but the position of the dorsal and the form of the pectoral as well as the description of the teeth make me believe it rather belongs to this genus (*Grampus*)." Van Beneden and Gervais⁷ follow Gray, but Gervais himself in his earlier memoirs⁸ classed it as a *Delphinus*.

My own first impression on seeing the body was the idea of a magnified porpoise, with a dash of the deductor and dolphin. I then compared it with photographs and most carefully executed coloured drawings of the porpoise and globiceps in my possession.

In analysis of the features, the colour aside from specific scratch-markings, decidedly is akin to *Phocæna*. By lightening the shade of the latter, giving it a paler forehead and darkening the subcaudal region, the general effect would agree. Again, this grampus shows leanings to the dolphins, where abdominal whiteness, irregular slashing of same, and iridescent hues are

¹ *Encycl. Mam.* p. 519.

² *Hist. Nat. des Cétacés*, p. 208.

³ In Jardine's *Nat. Lib.* 'Whales', p. 219, Pl. XVIII.

⁴ 'On *Pseudorca crassidens*,' Ray Soc. Transl. 1866, foot-note, p. 216.

⁵ *P. Z. S.*, 1870, p. 128.

⁶ *Erebus and Terror*, also *Cat. B. M.* 1850 and 1866.

⁷ *Ostéographie des Cétacés*.

⁸ *Zool. et Paléont.* &c.

far from uncommon. The orcas come between them and globiceps, inclining to deepening of tint; in the latter a sooty black.

The shape and position of the fins are relevant to generic conception, inasmuch as in *Delphinus* the dorsal is falcate and placed about the centre of the body. *Pseudorca*¹ and *Orca* nearly agree, and are intermediate between it and *Grampus*; where, also high, it is slightly behind the middle. In *Globiocephalus* it is lower, broader, and a trifle in front of the middle point. *Phocæna*, while having it if anything behind the middle, has it relatively much broader and wanting the deep scooping of the posterior border.

As is well known, *Globiocephalus* has a long, narrow, acute pectoral fin, the extreme of the short, relatively broad one of *Phocæna*. *Delphinus*, as far as I can judge from the accounts of others, would take an intermediate place, but nearer to the latter. Regarding the general "cut," as Rheinhardt deftly expresses it, *Pseudorca's* resembles the Ca'ing whale, but its breadth is greater in proportion to its length. In these respects *Grampus rissoanus* rather agrees than differs from *Pseudorca*. *Orca* has a broader fore-limb than either. The *D. griseus*, Cuv. (*Grampus cuvieri* of Gray), though doubtless the nearest ally to Risso's species, has oddly enough by D'Orbigny's computation an extraordinary long pectoral, which G. Cuvier's words in part contradict, as certainly does his figure. In fact the words "moins qu'au globiceps"² point to similarity with *G. rissoanus*³.

Cuvier recognised globiceps by its enlarged, protuberant blunt muzzle. In the grampus this is much less truncate and nodose, in our specimen comparable to the outline of a parrot's beak. In the killers and the porpoise it becomes very sensibly diminished and backwardly inclined, and in the dolphins runs into an elongate flattened beak, particularly in such forms as *Tursio* and *Lagenorhynchus*.

There is but a single premaxillary nasal sac in *Phocæna*; in *Grampus rissoanus* as in *Globiocephalus* it is double.

¹ Consult Prof. Rheinhardt's very appropriate Remarks on *P. Crassidens*, Ray Soc. p. 217. His stricture on Gray's generic character of fin, however, I do not agree with.

² See Rheinhardt's criticism on this very subject, *l.c.* p. 216 and 217, foot-note.

³ Which Pl. 54 as referred to in the *Ostéographie* well brings out.

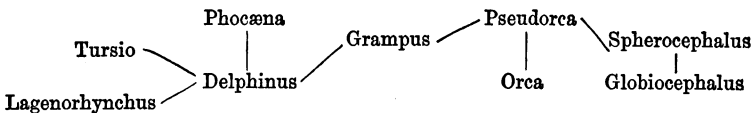
The patterns of the larynx and hyoidean apparatus come nearest in the two latter. Each of them has those peculiar enlarged glands at the ventral diaphragmatic ends of the lungs; and these are certainly wanting in *Phocæna* and *Delphinus* (*Delphis?*), specimens of which were compared along with *Globiocephalus* by Jackson¹, who distinctly mentions their presence in the latter.

The number of compartments of the stomach and their relation to one another is typical of both the two last-mentioned genera; and is liker them than the one preceding. The same family connection is shown in the kidneys, where the blood-vessels enter at the fore and inner or atlanto-mesial end.

The teeth, few and early deciduous, are an important feature; but as our specimen was edentulous or at least non-erupted, I leave out their consideration as a point to base judgment on.

To sum up, as far as my examination extends, the specimen in question has its nearest alliance with and indeed would appear to be a species of the genus *Grampus* as defined by Gray; which group, however, while clear to me, it may be remarked is far from being isolated or rigidly circumscribed. On the one hand it has many solid points of connection with *Pseudorca* and *Orca*; other characters draw it towards *Globiocephalus*. It has again more than mere resemblances to the genera of true dolphins and to the porpoise, though possibly further removed from them than the killers.

When Professors Van Beneden, Gervais and Flower have worked out its entire osteology, the data will enable a sound comprehension of its affinities to be formed; provisionally therefore I offer the subjoined scheme of relationships.

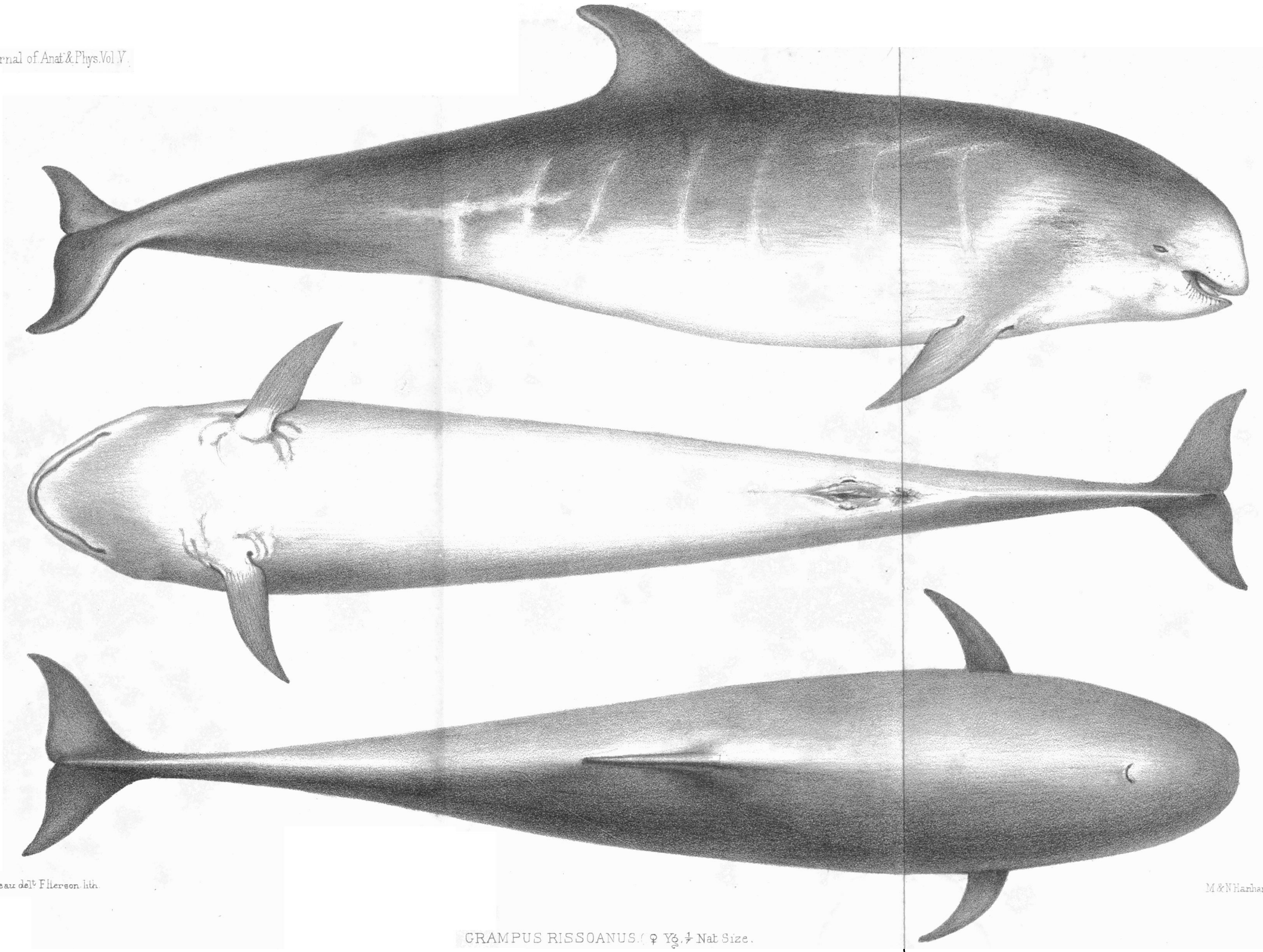


P. S. In quoting Professor Turner's paper for 1869, I did so in my MS. from a knowledge of its contents, not having the Journal by me at the time; but in correcting the proof neces-

¹ *Bost. Journ. Nat. Hist.* Vol. v. p. 137.

sarily made it a point to certify the statement and number of page. In doing this my eye caught a reference of his to "*Note sur un Cétacé Grampus griseus*" par. M. P. Fisher, in *Ann. des Scien. Nat.* 5th Ser. 1867, p. 363. I therefore read this, and I confess with much interest. Fisher's description of the animal examined by him leads me to believe it was identical with that dissected by myself, inasmuch as colouring, streaks or scratch-marks, and form of head and body are concerned. His remarks on the stomach as well as Turner's confirm what I have above said of certain genera individually examined by me. Fisher tersely compares the skeleton and dentition of his supposed Cuvier's with Risso's species, and speaks of their geographical range and migrations. He sums up with four conclusions and a corollary. Without giving his own words I may curtly express his ideas as follows: 1. *G. rissoanus* appears in the Mediterranean about the same period of the year that *G. griseus* is found on the French Atlantic coast. 2. Their dentition is nearly alike the latter with 2 to 4 mandibular teeth on each side, the former 5 to 6. 3. Their bones are identical. 4. Difference of colour accounted for by its being variable, and shape by post-mortem effect. Hence he is of opinion the two species ought to be re-united, as Baron Cuvier was inclined to regard them.

It appears to me that M. Fisher from his stand-point has not overdrawn legitimate inferences, provided that it was *G. griseus* and not *G. rissoanus* he examined. As to variation of colour in what has been designated under the latter title, what I have mentioned proves, and Van Beneden and Gervais' plate shews great likeness in osteological features; so that I am prepared to find, when the latter has been carefully compared in the young and old, that they may after all be but one specific form, though Dr Gray lays stress on the black colour of his *G. cuvieri* = *D. griseus* Cuv.



C. Berjeau del. F. Herson. lit.

M. & N. Harhart imp.

GRAMPUS RISSOANUS. (♀ Y⁶, $\frac{1}{2}$ Nat. Size.)