

through a period when life was rare and doubtful, we entered on a period which is termed Primordial, Lower Silurian, an age of crustaceans and mollusks, principally the former, having forms peculiar to extreme antiquity, living and enjoying life, where now we have the busy harbour of Saint John and Kennebeckasis, the choice waters for modern aquatic contests. We have also roamed among the coral reefs of Upper Silurian seas, with their abounding *trilobites*, *cephalopods*, *brachiopods* and *favosites*. These and their tombs give geological interest to the Bay des Chaleurs. We have wandered among Devonian fields examining their peculiar vegetation, among which sported the earliest winged insects—the remains of these are found at Courtenay Bay. From these we passed easily and naturally into the carboniferous region—the period of luxuriant ancient vegetation. In this period we saw submarine volcanoes in vigorous operation, shaking and rending the Upper Silurian foundations of the carboniferous period in the north—the ancient coral reefs being elevated, parted and broken—the coral polypedomas and their tombs are seen dropping into the molten lava, and narrowly escaping destruction.

A great leap brought us into the Post Pliocene period, with ice sheets—glaciers and icebergs—the debris of rocks accumulated in the railway path attesting their existence.

A later stage of the same period brought us into seas with their walruses, seals and cetaceans and molluscs, with specific names that chill, *Grænländica*, of Greenland, the land of ice. These at the same time introduce us to the *molluscs* of the time in which we live.

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ART. II.—ON THE SMALLER CETACEANS INHABITING THE BAY OF FUNDY AND SHORES OF NOVA SCOTIA. BY J. BERNARD GILPIN, A. B., M. D., M. R. C. S.

(Read Jan. 11, 1875.)

IN making out five distinct species of this order, I have had much difficulty from the want of material. Some species abound in our waters, but being useless, are rarely taken, and are thus

only seen. Of others I have only the skull or parts of the skeletons of dead ones, thrown upon our shores. Of others, the Beluga for instance, I have the report alone of the Indians, and there remain but two species of which I have material sufficient for a paper. These are the common Porpoise, or puffing pig, and the ocean Porpoise, which is confounded by fishermen with the true Dolphin, and which has no doubt been described by Jackson (Boston Nat. History Report), as *D. Delphis*. This paper must be considered then, as very imperfect, and hereafter to be added to. Though there must be much valuable information locked up in the various American Journals, I can put my hand on no American systematic work, but have found much benefit from "Catalogue Seals and Whales." B. Museum. J. E. Gray, F. R. S., 1866, and have used his nomenclature, giving the American synonyms when able.

## ORDER :

## CETACEÆ.

## FAMILY :

## DELPHINNIDÆ.

*Delphinus delphis*. Linn. Cuvier. Gray.

## DOLPHIN OF ALL SEAS :

*Lagenorhyncus leucoplurus*. Gray.

*Delphinus delphis?* Jackson (Boston Nat. History S.)

## WHITE SIDED DOLPHIN. SEA PORPOISE.

*Phocæna communis*. F. Cuvier. Gray.

*Phocæna tuberculifera*. Gray.

*Delphinus phocæna*. Linn.

## THE PORPOISE.

*Beluga catadon*. Cuvier. Gray.

*Physeter catadon*. Linn.

*Delphinopterus lincus*. Pallas. Bell.

## WHITE WHALE.

## FAMILY :

## GLOBIOCEP HALIDE.

*Globiocephalus intermedius*. Harlem. Gray.

*Globiocephalus melas*. Dekay.

*Delphinus globioceps*. Jackson (Boston Journal).

## AMERICAN BLACK-FISH.

*Delphinus delphis*. Dolphin of all Seas.

Of this species, there is a part of a skeleton in the Provincial Museum, Halifax, a skull from the ocean, and jaw of one caught near Liverpool, N. S. They all agree in the teeth being more numerous, (from one hundred and fifty to one hundred and sixty,) the rostrum being longer and narrower, the palate having a central ridge with a deep sulcus running inside the teeth, and differ from other skulls in all these particulars. As they coincide with the description of writers on this species, I have no doubt in placing it among the cetæ of Nova Scotia.

*Lagenorhynchus Leucoplurus*.

At Digby Gut, August, 1875, I examined two Sea Porpoises shot by the Indians. The measure of one of them taken upon the spot was—

Length .....	5	ft.	10	inches.
From nose to base of flipper .....	1	"	3	"
From nose to base of back fin.....	2	"	8½	"
Height of back fin.. ..			7	"
Length of back fin .....			9½	"
Spread of caudal fin.....	1	"	4½	"
Length of flipper .....			9	"
Length of mouth .....			7¾	"
Eye from mouth.....			2	"

The other fish was rather larger, but agreed in form and colour. In form they were very round. The forehead sloped upwards from a beak or snout, in a convex line to the back fin which was falcate.

in form. From its posterior edge the line of back sloped rapidly to the tail. The lower line of belly sloped gently to posterior edge of flipper ran straight to beneath dorsal, then rapidly upwards to tail. The dorsal and pectoral fin (flipper) were both falcate. The back behind the dorsal became carinated, ending in a ridge between the caudal fins. The mouth was formed into a beak or snout, with gentle curves. The eye black, about two inches from mouth, the lines of which ran upward. The blowhole on the forehead, between the eye crescentic concave forwards; ear, a small puncture. In colour the beak was white with tips of both jaws black (in one specimen the lower jaw was all black). The back, fins and tail blue-black. There were three irregular ill-defined white spots shaded by black dots on the sides, the black of the upper parts shading gradually into bluish ash around them. The eye was in a whitish spot, and there were two faint parallel white lines running along the sides and losing themselves in the white patches. The belly was pure white, with a tolerably well defined edge. The eye was dark reddish black. On inside the mouth the palate was white, with a black triangular spot on the point. The palate membrane was very thick, apparently holding the teeth firmly, as there were no alveola processes, and the teeth dropped freely out after removing the membrane. The teeth were pointed and slightly incurved; twenty-two in upper jaw, lower jaw twenty-five on each side. There were no teeth at the points of either jaw. It seems probable that the teeth vary in different individuals. The genital organs are concealed in a deep fold in both sexes. In the female may be seen two smaller folds on each side of the larger one concealing milk paps. On opening the body and removing the blubber the muscle was very full of blood, deep red, and coarse fibre. The heart and blood vessels, and lungs very well developed and full of blood. The liver moderate, the kidneys with well-developed ureters and bladder of urine. The stomach very capacious, constricted in several parts, resembling the colon of a horse. Inside the mucus membrane deeply corrugated, in some parts a deep rose colour, suddenly succeeded by pale pearl, answering to the constrictions.

This very imperfect account must be taken as the result of a very rough dissection done upon the sea beach. The jaws of this fish corresponded exactly with those of several skulls in my possession, from Bay of Fundy, Sable Island, and Halifax Harbour. To the latter one, lent me by my friend, Dr. Somers, Dalhousie College, was attached a portion of the skeleton. In all of them we found the palate flat, composed of maxillars, intermaxillars, and portion of vomer showing between them, but no central ridge, or deep sulci running parallel with teeth, as in *D. delphis*. The spinous process of atlas is large and rakes backward, covering the four next vertebræ. The spinous process of second and third are ankylosed to it. To the body of the fifth is a small process pointing forward on either side. The spinous process of the sixth is larger. To the seventh, both to its body and to its transverse process is articulated a short broad rib. This mark of articulation on the bodies is lost after the tenth vertebra. From the atlas to the tail there is an elastic cartilagenous disk between each vertebra. The vertebræ are articulated to the sides of each other, until the seventeenth vertebra, where the point of articulation has risen above the neural arch, and forms the sub-spinal process, common to the whole order. The vertebræ increase on their spinous and transverse process, rather than bodies, to the middle of the body, the spinous becoming more erect and longer, the transverse longer and flatter. After the middle they decrease in the same order, retaining the sub-spinal process almost into the tail. Sixty-two vertebræ remained upon the skeleton which had lost a portion of the tail. Twenty V. bones, each attached to the cartilagenous disk remained. These V. bones form an attachment for the muscles moving the flukes of the tail downward and backward. Though not attached to this skeleton, I found in others a well developed scapula, with coracoid and acromion process, the humerus, radius and ulna massed into one, and metacarpals and phalanges, typed out by spots of bony deposits upon cartilage. The true ribs or those attached to sternum were all jointed, one third rib from sternum, and all the ribs were articulated to the transverse process. These divergences, no doubt common to the smaller genera of the order become important when we consider

this class as the first type of air breathing warm blooded mammals created. That this species is now confounded with *D. delphis* by the fishermen of our coasts, and has been described as such by Godman and Jackson, cannot be doubted. Of its habits little is known, though common upon our coasts. The Indians readily distinguish it from *Phocœna communis*, and care little for its capture, as it yields less oil and is more difficult to kill. Of their relative number with *Phocœna* in the Bay of Fundy, perhaps half-a-dozen are captured during the season, at Digby Gut, while of the other, perhaps one thousand. The specimens I have described were small, and no doubt young fish, some individuals going above eight feet in length. The adults may have the marking more decided and teeth more numerous. In its skull and skeleton it so resembles the Genus *Lagenorhyncus* that I have placed it there and adopted Gray's conjecture of its being the *D. delphis* of Jackson.

*Phocœna communis*,

*Phocœna tuberculifera*,

#### COMMON PORPOISE.—PUFFIN FIG.

This is by far the most common species inhabiting our shores. They are met with on all our coasts, but mostly along the sides of the Bay of Fundy, especially where it pours its rapid tides through the Digby Gut into the Basin of Annapolis. Here in spring and summer they may be seen in eager pursuit of the gaspereaux and herring, which are running for their spawning and feeding grounds. In this turbid tide they may perpetually be seen rising and disporting themselves, unmolested indeed by the fisherman, but keenly hunted by the few remaining *Micmacs*, who come from the interior and form temporary camps on its rocky shores.

On the 23rd July, 1874, at the fishing beach, Digby Gut, I examined a large female porpoise, which, with her young one, was freshly brought ashore, both covered and killed by one shot.

Extreme length .....	5 feet 1 inch.
From nose to D. fin.....	2 " 7 "
D. fin in height .....	9 "

D. fin in breadth.....	7 inches.
Girth in widest part.....	3 feet 3 “
Width of tail.....	1 “
From nose to fore fin.....	1 “
Eye from nose.....	10 “
Length of mouth.....	4 “
Blowhole from nose.....	7 “

In external form the body was very round but tapered very fast behind the dorsal to the tail. The two last feet being scarcely one quarter the circumference of the body; the mouth was not prolonged into lips or snout like the ocean porpoise. The outline arising from a somewhat prominent forehead rose gently to the back fin, then fell suddenly to the tail which was set up like a duck's. The lower line of belly, commencing from lower lip, slightly concave, swelled rapidly into a convex line till beneath dorsal, then sloped rapidly to tail. The whole appearance, though evidently elastic towards its tail, was that of a firm inflexible body, which did not give way to its own weight, or become flattened when out of water, as the sharks often do. The line of mouth ran upwards crossing the line of the axis of body at about an angle of  $40^{\circ}$ . If produced it would run through the back fin. The under lip closed into the upper; the eye was small and near the angle of the mouth, the external orifice of the ear a little behind the eye, was of the size of a bristle; the fore fin was very small, inflexible, of a long oval, and though nearly immovable yet having a slight flexion at the humeral joint, and this joint was outside the integuments; the back fin was a little higher than long, anterior edge slightly concave at base, but well convexed at tip—the posterior edge well concaved. In this instance I did not notice the small spines on the anterior edge of fin, but as my attention was not called to it, and as afterwards I examined eight or ten of both sexes and found them upon all I must have overlooked them, and must conclude they are typical. The spread of the tail which was horizontal and turned up, was one foot; the mammæ were hid in two small folds on either side of a deeper and larger fold, holding the vulva; the male organs were hid in a like fold; the mammary glands, when opened, appeared to be a plexus of vessels, turgid with red blood, and a thick white milk

flowed from them. In colour, the entire upper parts, including edge of lower lip, fore fin, dorsal and caudal fins were beautiful shining black. This black emarginating the lower lip, and passing through the fore fin ran irregularly to the tail. Below this, pure white shaded at the junction of the colour by ashy grey, which grey also appeared in irregular patches upon the belly. In others that I observed afterwards the black line was less distinct, and large greyish patches above the shoulder. These last answer to the colouring in Jardine's Nat. Library. The young beside the mother was about three feet long, or two-fifths the size of herself. The whole figure just out of water—the skin soft, yet glittering—its symmetrical rotundity—its beautiful black and pearly white—its arched forehead and emarginated lower lip, with its appearance of strength, mingled with flexibility, strike you at once. A recent skull measured :

From occiput to tip of nose .....	9½ inches.
Greatest width of maxilla bones .....	5 “

As usual in this order, the os frontis was nearly covered by the maxilla bones, its superior surface thrown up into high ridges, the nasal bones, two knobs posterior to the spouting holes, and the intermaxilla bones forming two irregular cubes directly in front of these holes, instead of the plane concave surface found in other genera of this order. The palate was broad and flat, and formed by the maxilla bones, the intermaxillas, and a small portion of the vomer. The teeth were on upper jaw, about twenty-two or three on either side, and in lower jaw about the same. They were contracted at the root, but broad and trenchant at the edge. The number is given as an approximation. There was no alveola process—no teeth at either commissure, and teeth were held in a thick mucous membrane, rather than in an alveola process.

In a recent skeleton of one three feet and one-half long, examined in July, 1875, the sternum was of one piece, but hollowed on one side of the interior surface. The ribs were fourteen, one pair so small as almost to escape notice. Eight were articulated to the sternum by a cartilage longer or shorter, and all these eight had a



joint one-third of rib distant from sternum; the spinous processes were short and broad; the transverse long and pointed, especially at the middle of the body; the ribs were attached to the transverse processes. The scapula was shaped like a pole axe, with acromion and coricoid processes; the humerus ulna and radius massed into one bone, and the carpal, metacarpal and phylange bones pretypified by osseous deposits, rather than separate bones. In the *Phocœna* then we find the short, broad, spinous process, differing from the other genera, but in common with them the rib articulating with the transverse process and jointed in the middle.

The porpoise probably frequents our coast the entire year. It is seen in early spring and again in December, but is only hunted during the summer months, when they approach the shores in pursuit of the migratory fish, and when only they are fat enough as our Indians say, to repay their capture. At other seasons they doubtless prey upon bottom feeders, on cod, flounder, haddock and hake. They pup in April or early May, and produce one at a birth, which about the end of June is three feet long, or two-thirds the size of the mother, which still suckles it. During pairing time they are exceedingly bold and careless of your approach, seemingly not noticing you as they pursue each other in frolicksome play. In ordinary times they rise to the surface about every ten minutes, sometimes throw themselves entirely out of the water, but usually make about three rotatory dives on the surface, and then retire below. If you are near you will hear a slight puff or snore. They usually swim in small herds, both male and female—the young beside the mother. Though, doubtless, the fishery of them might be made systematically profitable, and much more oil extracted from them than by the rude Indian way, yet our fishermen have never abandoned their more valuable herring or hake and cod, in their pursuit. It is left for the few lingering descendants of the ancient Souriquois to follow a sport they must have caught from their conquerors rather than received from their ancestors. The ancient Indian had no market for their oils, or iron pots to boil them in, or guns to shoot them. They could obtain food easier than by chasing them with stone-headed lance, hurled from a birch canoe. But however got, it sits

them well. It shows well, in that waiting, patient, but fiery glance—taking in everything in a moment—in that double instinct, or two men acting as one like a machine, and in that absorbing love of sport, devouring hunger and cold, and making age for a time spring to labour, forgetting what it has lost, and youth to anticipate that strength it has never yet attained, A sweet rural lane from the town of Digby, insensibly losing its cart ruts, then changing into a bridle path, then obstructed by brush fence, ending in a sheep walk, winds under the brow of the north mountain, and brings you out upon Fishing beach, looking broadly out upon the Bay of Fundy. Here the ruins of countless ages and continual landslides from the steep mountain side, have formed at its foot a terrace level, now well clothed by alder and spruce pine, the rough shingly beach lying seaward far beyond with its ceaseless roar. Here the red man has pitched his tent. It is only a summer one, and you miss the neat birch bark wig-wam with its conical form of poles tied at a centre. A curious patch of old rags, dead bushes and broken boards, picked up in the landwash serve as a substitute. You have come down to see a porpoise hunt; the whole place reeks with oil; the stones themselves are slipping with it, and the smoke fires poison the very air. All is quiet. The lords of the soil lie sleeping in the hot July sun—the dogs are too lazy to bark, and the children are playing on the shingles to seaward. You ask a squaw, invariably using their terse tongue, “Sister no porpoise to-day?” and she answers you shorter, “Too much wind.” As you turn to depart, you notice the sleeping men almost simultaneously starting up, glancing around, and with light hand and lighter foot, noiselessly but rapidly preparing their guns, lances, paddles and canoes. The wind is rapidly falling, and looking seaward large patches of simmering calm are forming in the rapid tideway, and yet those sleeping fellows found it out before you. Carefully as if it were a baby, their frail canoes are launched, and the little flotilla is at sea. A school of porpoises have been breaking water far to seaward, and each Indian seeks the place where he thinks they will break next.

Each canoe has a standing figure forward. He is a poor fellow,

drunk last night, ill fed, and ill clothed, and his greasy red skin shows through many a tattered rag; yet as he stands there, with his gun across his breast, no Grecian demigod, no Roman conqueror ever stood so firm upon pedestal of bronze or marble as he does upon his bit of frail bark, tossed upon the savage rolling tide. His pose is both strong and easy to indifference. His high cheek bones, and flattened features are downright ugly, yet the light of sport has so lit that broad nostril and tossing hair, that his bronze figure would pale not, if put beside an ancient hero lit by battle light, or martyr illuminated by holier fire.

Behind him, at the stern, sits his "alter ego"—two men with one mind. This rearward fellow's duty is to keep his canoe even balanced, and to watch every motion of his superior. Not a word is spoken, and your dull Saxon eye sees nothing, yet there is a dirty flattened palm thrust out from the foremost fellow's rags, now elevated, now depressed, directing every motion. The stern fellow too sits his rolling perch, his paddle across his lap with the easiest indifference, and yet an untrained foot would never stand an instant, or untrained man sit for a moment upon the thwart of that canoe without being shot into the sea, and rolling her over and over for many a yard. A flotilla of some half dozen of these pretty crafts roll, and wait and watch their prey. A porpoise now breaks water within thirty yards of the nearest canoe, quietly—a slight snore—and a broad glittering back, followed by a fin goes gliding in a circle through the water. The nearest Indian fires, and his canoe is whirled to the bloody water, and now armed with a long lance, he drives it into the dying fish, lying with its white side and belly, broad upon the red and oily water. With it he controls its feeble struggles, keeps it from sinking, and guides it to the side of his canoe. Here an inclined plane is formed by resting the handles of the paddles upon the sides of the canoe, the blades floating upon the water. Up this watery plane the round fish is urged, and pulled and guided by their dexterous hands, and finally the handles inside being tilted, it is rolled safely on board. Its weight between two and three hundred, that of the canoe scarce fifty pounds. This feat so daintily, so silently performed, could not have been done without

the most dexterous balancing, the nicest handling, and the most perfect accord betwixt man and man. Nature teaches her forest child some lessons she withholds from his civilized conqueror. As flies the fish hawk with his prey straight to his nest, so usually the red man brings to camp his victim, but they are not unknown sometimes to pile a half dozen in their canoes in one hunt. "Malti Pictou," said his paddle man to me, "once took thirteen in one canoe, he say, he then had enough—suppose where me sit just so much above water," measuring off upon his greasy finger about half an inch, to show me the canoe was loaded to gunwale; "Basin all over glass," he added to explain the perfect calm. The fish when brought to shore is flenched like a seal, and the blubber about two-thirds of an inch thick attached to the skin, is cut into small pieces by the women and children and thrown into an iron pot filled with boiling water. Sitting around this, they collect the oil as it rises to the surface. In this rude way some two or three gallons may be obtained from one fish. Some Indians have had fifty or sixty fall to their own gun, and perhaps from three or four thousand gallons may be the yearly produce of the South shore of the Bay of Fundy. The oil is valuable, gradually increasing in price, and if the Indians could place it properly in the American market, it would net them a good return.

In naming this species I have, following Bell, Camper and Jackson, considered "communis" and "tuberculifera" as identical. Gray on the other hand makes two species, differing by the one having short spines on the anterior of dorsal fin, and in its osteology. In the American species these spines are so small that they may be overlooked, but having taken about ten specimens of both sexes at the water's edge, and finding each to have spines, I may say it is the exception for them to have none. In counting the ribs of a young one taken in the Bay of Fundy, I found fourteen pairs and eight attached to the sternum. As Gray makes thirteen pairs only and seven attached to the sternum, I recounted them and caused others to count them for me, but with the same result. The fourteenth pair were so small that they might easily have been overlooked.

*Beluga catadon.*

WHITE WHALE.

Of this beautiful species I have only the report of our Indians, of its casual appearance in the Bay of Fundy and on our coasts. They call it a white porpoise, and all agree in its size and appearance. They have a superstitious dread of it and never attack it. There is a tradition of one having been stranded in the Digby Basin many years ago.

Our visitors are doubtless strays from the Gulf of St. Lawrence, where they abound and are fished for their oils.

*Globiocephalus intermedius.*

AMERICAN BLACK FISH.—BOTTLE NOSE.

This species is common enough upon our coasts, but seldom taken. They are too large for the Indians to attack, and their habit of rushing to each other's support when wounded or stranded makes them too formidable to be attacked from frail canoes. When a large number of them appear off a harbour's mouth, in which are many strong and well-manned boats, the boats go to seaward of them and returning in close order upon them, by firing guns, loud shouts, and splashing the water with their oars, the whole herd is easily frightened and stranded. The whole settlement rejoices in this rich harvest of oil—sometimes twenty are thus taken.

One was stranded by the tide-way at Lunenburg, Nova Scotia, during the summer of 1873. The long falcate pectoral—the caudal fin, and the skull and jaws are in the Provincial Museum, Halifax. This fish has been confounded with the black fish of Europe, (*G. melas*), (*G. Svineval Gray*), by DeKay, but is considered a separate species by Gray from osteological differences. The skull preserved at the Provincial Museum, Halifax, measures:—

Length.....	2 feet.
Width widest part.....	1 “ 7 inches.
Length of Lower jaw.....	1 “ 9 “
Width of lower jaw at condyle.....	6½ “
Teeth in lower jaw extended.....	7 “ from tip.
The largest tooth.....	1 “

In form, this skull was lower and broader or flatter than *Phocœna* or *Delphis*. The intermaxilla bones very broad, covering the maxilla's almost to the end. Posterior to spouting holes the nasal bones appeared higher than crest of maxilla's, which here covered the os frontis. Anterior to spouting holes, the intermaxilla's were very flat and concave. The teeth were all gone from the upper jaw but in the lower jaws there were only fourteen left. They were strong, conical, incurved and pointed, and of various sizes, the largest being one inch long. From the state of upper jaw it was impossible to say if the teeth had dropped out after death, but in the lower jaws there were seven alveola cups, showing where a tooth had been lost during life. Unlike the other genera, *Phocœna*, *Delphis*, and *Lagenorhyncus*, whose teeth have no alveola socket, their teeth seemed set in a strong but spongy alveola bone, extending seven inches on either side of jaw, and wherever a tooth had gone, there a shallow cup remained, as if during life, the tooth had been gradually pushed out by a bony deposit filling up the alveola process into a shallow cup. Thus counting the remaining teeth with the cups we could say the lower jaw had ten teeth on one side and eleven upon the other, which would give over forty for all. The palate was very flat and no vomer showing. The commissure of the lower jaw round, strong with no teeth inserted at its arch. The pectoral fin was four feet long and eleven inches in its widest part. In shape it was a very long oval with its long axis produced to a narrow point and depressed downwards.

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ART. III. — SPONTANEOUS GENERATION, OR PREDESTINATED GENERATION. BY ANDREW DEWAR.

(*Read April 12, 1875.*)

IN giving a paper on the above subject, we are well aware that we are treading on dangerous ground. The bare mention of the title is enough to arouse bitterness and contention in many whose minds have been trained in the strict theological schools of a past day; but, knowing well that we are addressing a Scientific Society