

Article X.—NOTES UPON THE EXTERNAL AND INTERNAL ANATOMY OF *BALÆNA GLACIALIS* BONN.

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On February 22, 1907, two specimens of the North Atlantic Right Whale, *Balæna glacialis* Bonn., were captured off the southern coast of Long Island, New York, near the villages of Amagansett and Wainscott. Both animals were females, one being adult and the other young. As they were beached just at the edge of low tide where surf was continually breaking over them, investigations were carried on with the greatest difficulty, and we were able to obtain but comparatively few external measurements. However, an opportunity was given for considerable study upon the fresh skeleton. For convenience in reference I have arranged the following notes in the order adopted by True in his monograph on 'The Whalebone Whales of the Western North Atlantic.'

EXTERNAL CHARACTERS.

Size.—The length of the Amagansett whale at the time of capture was given me by the whalers as 56 feet and 7 inches taken with a tape laterally, from the tip of the snout to end of the "flukes." When I arrived the flukes had been removed and the peduncle severed in two places, but the lengths of the several sections gave a total of 54 feet from the tip of the snout to the notch of the flukes, along the mid-dorsal line.

The Wainscott whale was lying belly up and was measured in a *straight* line from the tip of the snout to the notch of the flukes. Hence the lengths of the two specimens are unfortunately not directly comparable.

External Measurements.

	Amagan- sett.	Wain- scott.	Amagan- sett.	Wain- scott.
	Feet	Feet Inches	% ¹	% ¹
Total length of whale.....	54	40 3	100	100
	Inches	Inches		
Tip of snout to eye (straight).....	150	103	23.1	21.3
" " " " occipital condyle.....	192	120	29.6	24.8
" " " " posterior end of baleen.....	173	—	26.6	—
" " " " anterior end of bonnet.....	24	—	3.7	—
"Small" to caudal bifurcation.....	—	58	—	12.0

¹ Reduced to per centum to agree with True.

	Amagan- sett. Inches	Wain- scott. Inches	Amagan- sett. %	Wain- scott. %
Breadth of "small".....	—	20	—	4.1
Depth of "small".....	—	33	—	6.8
Tip of mandible to end of condyle (straight).....	159	—	24.5	—
Maximum depth of lower lip.....	68	—	10.	—
" thickness of lower lip.....	27	—	4.1	—
Flukes, tip to tip.....	—	160	—	33.1
Breadth of right lobe (notch to posterior margin)...	49	44	7.6	9.1
Length right lobes of flukes axially.....	92	89	14.2	18.4
Pectoral from tip to insertion.....	86	—	13.4	—
" " " head of humerus.....	98	90	15.1	18.7
" greatest breadth.....	46	47	7.09	9.7
" " " at insertion.....	37	37	5.7	7.6
" thickness at insertion.....	16	—	2.4	—
" greatest thickness of posterior margin.....	4	—	.6	—
Length of blow-hole axially.....	10	8.50	1.5	1.7
Divergence posteriorly.....	14.50	12.25	2.2	2.5
" anteriorly.....	3.75	2.75	.5	.5
Breadth of bonnet.....	12	9	1.8	1.8
Length of ".....	18	12	2.7	2.5
Longest whalebone (excluding bristles).....	77	36?	11.8	—
Greatest breadth base of whalebone.....	9	—	1.3	—

Color.—Both individuals were partly flensed when I examined them, but in each case the skin of one side and of the back was practically intact. The Wainscott whale externally was everywhere dense ivory-black, showing not the slightest indication of lighter color, either on the fins or flukes, or even on those portions of the body infested by parasites.

The Amagansett whale was of the same color with the exception of the flukes and flippers and the region immediately surrounding the genitalia, where there were numerous milk-white patches varying in diameter from two to fourteen inches.

On the flukes of this specimen, from the tips for a considerable distance along the posterior border, there were narrow streaks and patches of white, showing on both the inferior and superior surfaces. The pectorals also were strongly marked with white in large patches, particularly on the inferior surface along the posterior margin. Anteriorly and on the superior surface the white areas were greatly reduced in size and number, generally taking the form of narrow streaks. These white areas were perfectly healthy and there was no indication of former injury or the presence of parasites.

Inasmuch as all hitherto recorded American specimens of this species, according to True, with one exception, have been black, this variation in color is noteworthy. A photograph of a whale, undoubtedly an example of *B. glacialis*, captured at Amagansett, Long Island, N. Y., in March, 1897,



Fig. 1. Model of Amagausett whale: Scale 1 inch to 1 foot. Modeled by Mr. James L. Clark.

shows the left pectoral to be strongly marked with white along the posterior edge. Capt. J. B. Edwards of Amagansett, who has had a life-long experience as a whaler, says in a letter: "I have seen several Right Whales with white markings or spots on the sides, and some with the breast and throat nearly all white." In this connection Dr. True remarks: "The Cape Lookout specimen, captured March 20, 1894, a female, was said to be a 'white bellied' one. The figure published in the *Bulletin of the North Carolina Dept. of Agriculture* (14, No. 7, April, 1894, p. 4) shows the whole under surface light colored, from a point in advance of the eye to the anus, the white area extending up to the base of the pectorals and having irregular margins. If the drawing was correctly made from the specimen itself, it indicates a remarkable color variation. In a letter Mr. H. H. Brimley

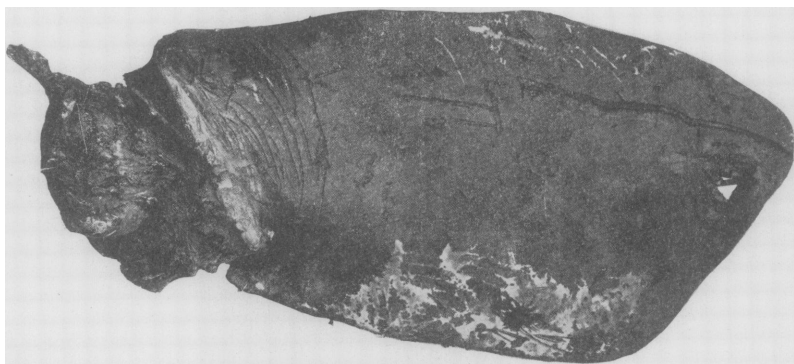


Fig. 2. Inferior surface of left pectoral fin of Amagansett whale.

remarks that this specimen had 'a great deal of pure white on its under side.'"¹

It would seem, then, that this species is subject to considerable color variation.

Head.—The anterior portion of both the Amagansett and Wainscott whales presented the same general appearance. The mandible of the former specimen from tip to end of condyle, in a straight line, measured 13 feet and 3 inches. On the inner side of the *right* ramus there was a large shallow depression extending well into the bone and pure white in color—probably the scar from some old wound. The lower lip of this whale had a maximum depth of 5 feet and 8 inches, its greatest thickness being 27 inches, and was strongly crenulated along the superior and posterior margins. Its interior surface was a light bluish-gray, uneven in tone, the light and dark colors giving a slightly mottled effect. The mucous membrane of the roof of the mouth was a delicate pink or flesh color.

¹ Whalebone Whales of Western North Atlantic, p. 250.

The "bonnet" of the Amagansett specimen measured 18 inches in length by 12 inches in breadth, its posterior margin being extended along the superior median line of the rostrum to within a short distance of the anterior ends of the blow-holes, forming an irregular ridge, the average width being 5 inches. On both rami of the mandible, and at a point directly above the eye, numerous rough protuberances of the same character as the bonnet were to be found. All of these protuberances were thickly infested by Amphipod crustaceans (*Cyamus* sp.?).

The region of the spiracles was only slightly elevated above the general level of the head, the blow-holes themselves having an axial measurement of 10 inches, diverging anteriorly $3\frac{3}{4}$ inches, and posteriorly $14\frac{1}{2}$ inches.

Between the tip of the snout and the anterior end of the bonnet, 150 white hairs, each about one half inch long, were counted. In the region of the mandibular symphysis there were about the same number, but the rest of the head was absolutely naked.

Baleen.—The baleen of the Amagansett specimen, including both plates and bristles, was deep blue-black in color, with the exception of the anterior portion, where for a distance backward of 18 inches, the bristles and extreme bases of the plates were pure white. The gum externally and between the plates was zinc white. The longest plate of whalebone from gum to tip, exclusive of the bristles, measured 6 feet 5 inches, its greatest basal breadth being 9 inches. The bristles were exceptionally abundant for this species, and reached in some instances a length of 10 inches. I was unable to measure the baleen of the Wainscott whale as it had been removed before I arrived, but the whalers stated that it was not more than 3 feet in length.

Flukes and Pectoral Fins.—The flukes of both specimens were convex anteriorly, having acuminate, slightly recurved tips and an open, rather shallow notch. The posterior border was noticeably convex near the notch, and then nearly straight to within a short distance from the tips where it became slightly concave. The left fluke of the Amagansett whale evidently had been injured at the tip, which was blunt and rounded and eight inches shorter than that of the opposite side.

The pectoral fins presented the characteristic angular form. The anterior border was irregularly convex, but posteriorly the margin formed a wide and blunt obtuse angle, the distal arm of which was short and nearly straight, the proximal being longer and very slightly convex.

Eye.—The eyeball of the Amagansett whale measures $3\frac{1}{4}$ inches antero-posteriorly, and 3 inches in vertical diameter. These measurements, however, were taken from the preserved specimen after the eyeball had been trimmed of adhering matter. The iris of clear brown is surrounded by a

narrow irregular ring of lighter color and measures $2\frac{1}{4}$ inches on the long axis. The pupil is elliptical, slightly flattened laterally, its longitudinal diameter being $1\frac{1}{4}$ inches. Parallel to the optical orifice, above and below, were two deep depressions or furrows 7 inches in length.

OSTEOLOGY.

Vertebræ.—The following vertebral formulæ of the Amagansett and

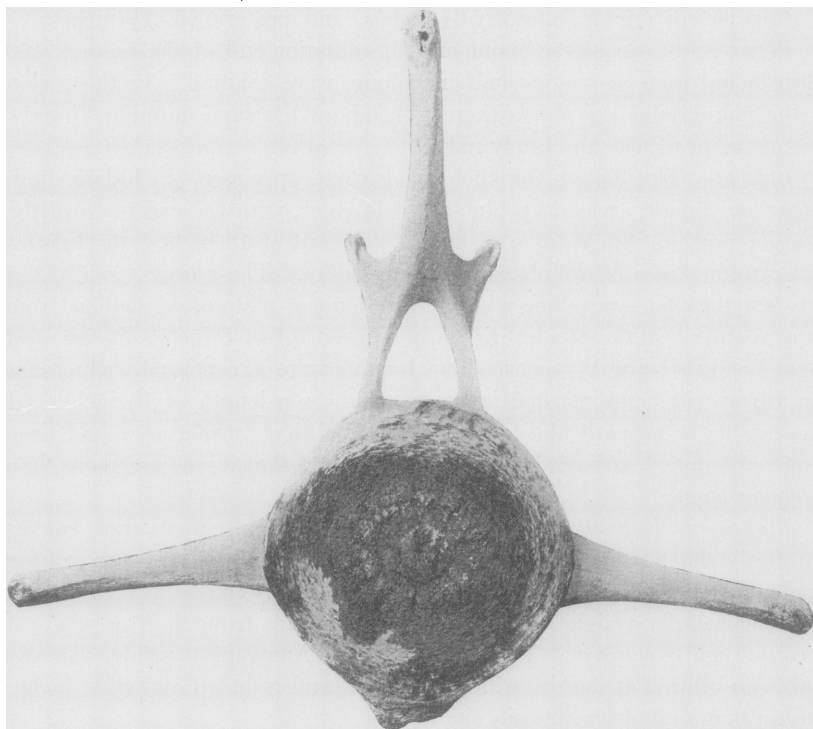


Fig. 3. Posterior view of first caudal vertebra of Amagansett whale.

Wainscott whales show only a slight variation in the number of caudals.

Amagansett,	C 7	D 14	L 11	Ca 24
Wainscott,	C 7	D 14	L 11	Ca 23

The cervical vertebræ of the two individuals correspond closely. The neural arches of the sixth and seventh cervicals of the Wainscott whale are

united, these vertebræ being entirely free from the preceding ankylosed cervicals, except at the distal end of the left diapophysis and the inferior portion of their centra.

In the Amagansett specimen only the neural arch of the seventh cervical is free, the remainder, viz.: the entire centrum and the transverse processes at the distal ends, being ankylosed.

Recognizing the fact that there is considerable question as to the correct number of lumbar vertebræ which may be assigned to this species, all the caudal vertebræ with their attached chevrons were sent to the Museum in the flesh. Subsequently these were carefully numbered under my personal supervision, thereby precluding any possibility of error in the location of the first chevron and the precise determination of the lumbar units. Although in both specimens the posterior end of the inferior median carina was distinctly widened upon the 32d vertebra, yet the 33d vertebra was the first to bear a chevron and is thus denoted as the first caudal. (It is true that the chevrons had been removed roughly from the caudals of the Wainscott whale before they were transferred to the Museum and I was unable to examine them *in situ*, nevertheless every indication led me to believe that they corresponded with those of the Amagansett specimen).

Measurements of the skeletons and other relative data are appended in the following tables.

Measurements of Skeletons of Amagansett and Wainscott Whales.

	Amagan- sett. Feet 54 Inches.	Wain- scott. Feet 40 Inches.	Amagan- sett. % ¹	Wain- scott. % ¹
Total Length of whale.....	163	110	100	100
" " " skull (straight).....	30	23.50	18.4	21.3
Greatest breadth of atlas.....	17	17	10.4	15.4
" depth " "	8	5.75	4.9	5.2
Length of diapophysis of atlas.....	4	4.50	2.4	4.09
Height of neural spine of atlas.....	27.50	21.25	16.8	19.3
Greatest breadth of 1st dorsal (posterior).....	22.50	17.50	13.8	15.9
" depth " " "	9	7.75	5.5	7.04
Depth of centrum " " " "	11	10	6.7	9.09
Breadth of " " " " "	11	6.50	6.7	5.9
Length of diapophysis of 1st dorsal (posterior)....	5.50	3.25	3.3	2.9
Height of neural spine of 1st dorsal.....	44.50	33	27.3	30.0
Greatest breadth 1st lumbar.....	27	19.25	16.5	17.5
" depth " " (posterior).....	10	8.25	6.1	7.5
Depth of centrum " " " "	12.50	11	7.6	10.0
Breadth of centrum 1st lumbar "	16	11	9.8	10.0
Length of diapophysis 1st lumbar.....	12.50	6.50	7.6	5.9
Height of neural spine " "				

¹ Reduced to per centum to agree with True.

	Amagan- sett. Inches	Wain- scott. Inches	Amagan- sett. %	Wain- scott. %
Greatest breadth of 1st caudal.....	36	24.50	22.0	22.2
“ depth “ “ “ (posterior).....	30	22.50	18.4	20.4
Depth of centrum “ “ “ “	13	12	7.9	10.9
Breadth of centrum of 1st caudal (posterior).....	13.25	12.25	8.1	11.1
Length of diapophysis 1st caudal.....	13	6.50	7.9	5.9
Height of neural spine “ “	12	8	7.3	7.2
Length of humerus (including epiphyses).....	22	19	13.4	17.2
Length of radius (excluding “ “).....	21	19	12.8	17.2
Length of ulna (“ “).....	18	16.25	11.0	14.7
Neural spine ends on vertebra.....	No. 45	No. 44		
First vertebra with transverse process perfor- ated by vertical foramen	No. 39	“ 38		
Transverse processes end on vertebra.....	“ 42	“ 41		
Anterior zygapophysis first definitely separated on vertebra.....	No. 15	“ 17		

Skull. The proportionate variations in the two skulls shown by the measurements given in the appended table are relative in all probability to the extreme youth of the Wainscott specimen:

	Amagan- sett. Inches	Wain- scott. Inches	Amagan- sett. % ¹	Wain- scott. % ¹
Total length of whale.....	54	Feet 40 Inches 3		
Length of skull (straight).....	163	110	100	100
Greatest breadth (orbital).....	102	76	62.5	69.0
Length of rostrum (straight).....	134	91	82.2	82.7
Breadth of rostrum at middle (curved).....	20	14	12.2	12.7
Anterior end of nasals to end of rostrum (on curve).....	127	82	77.9	74.5
Breadth of orbital processes of frontals at distal ends.....	11	9.50	6.7	8.6
Length of nasals (median).....	10	9	6.1	8.1
Breadth of 2 nasals distally.....	10	9.50	6.1	8.6
Length from tip of rostrum to anterior orbital margin (straight).....	137	94	84.0	85.5
Length of mandible (straight).....	154	106	94.4	96.3
“ “ “ (curved).....	170	122	104.0	110.9
Depth of mandible at middle.....	12	9	7.3	8.1
“ “ “ at coronoid.....	18	13.50	11.0	12.2

Scapula.—The differences in the scapulæ of the respective specimens are minor and confined chiefly to the acromion. In the Amagansett scapula this is long, strongly curved, and much contracted distally. In the Wainscott whale it is but slightly depressed and shows little curvature. The

¹ Reduced to per centum to agree with True.

distal end is somewhat thickened and the proximal width is continuous throughout its entire extent. The right scapula of both animals is somewhat broader than the left. Measurements are given in the following table:

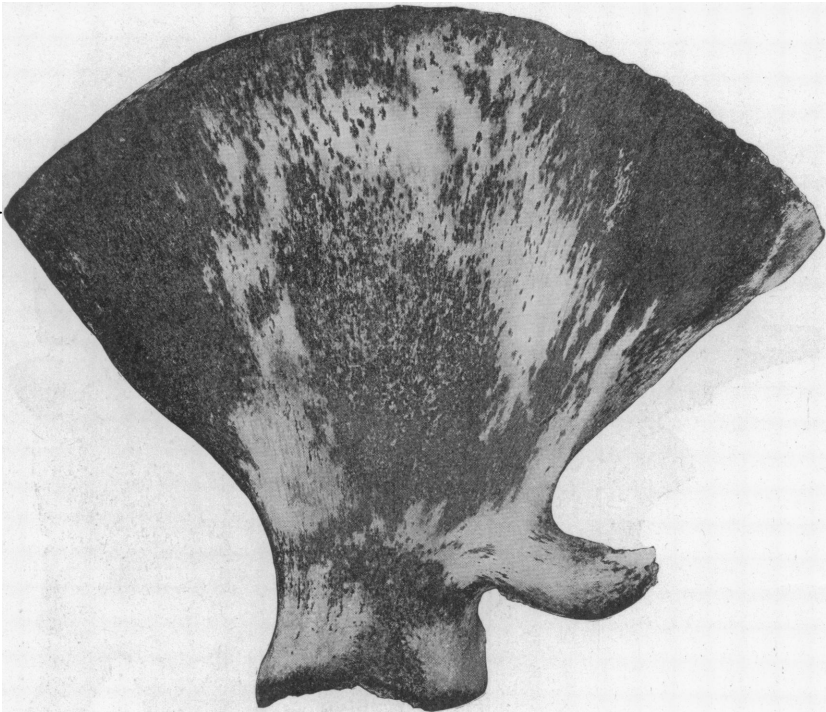


Fig. 4. Scapula of Amagansett whale.

<i>Amagansett.</i>		
	Right. Inches.	Left. Inches.
Greatest breadth.....	47.25	45
“ height.....	38	37.50
Length of acromion.....	9.50	9.50
Breadth of glenoid fossa.....	13	12.75
 <i>Wainscott.</i>		
	Right. Inches.	Left. Inches.
Greatest breadth.....	36.25	34.50
“ height.....	26.75	26.75
Length of acromion.....	5.75	5.75
Breadth of glenoid fossa.....	11.75	11.50

Carpals.—The number and size of the carpal bones in the respective flippers of the two specimens differ materially. In the right carpus of the Amagansett whale, five distinct ossifications were found; the left carpus had four. In the Wainscott specimen there were four ossifications in the

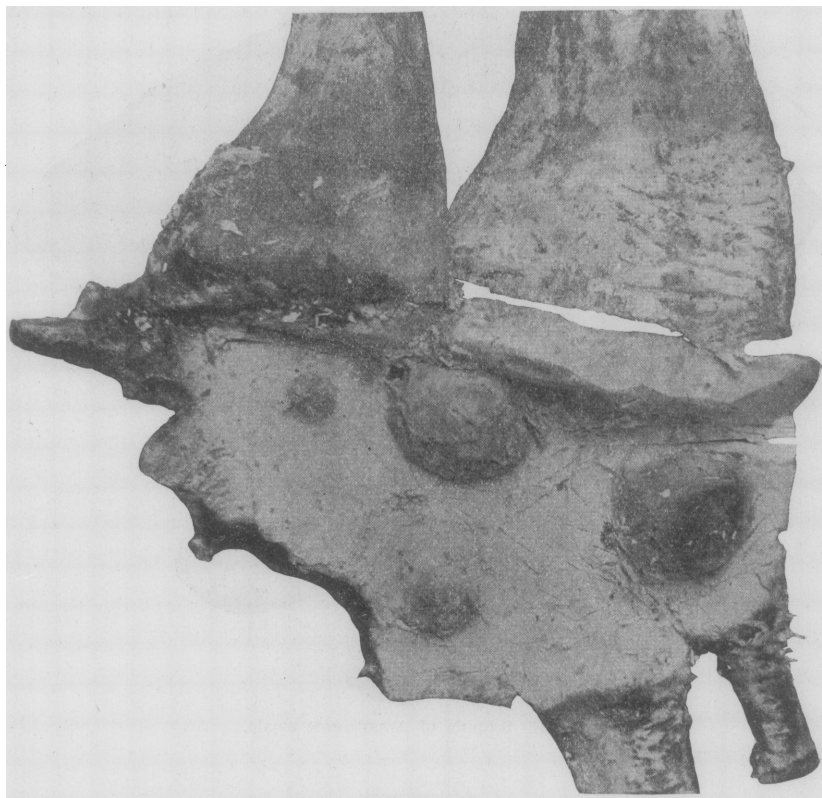


Fig. 5. Right carpus of Wainscott whale, showing ossifications.

right and three in the left carpus. These bones in both individuals were irregularly rounded in shape and composed of soft cancellous tissue, their relative sizes varying decidedly. The positions of these structures, so far as they were represented by ossifications, remained constant.

Phalanges.—The formula for the phalanges of the Wainscott specimen, the dissections having been made in the laboratory, is as follows: Wainscott I₁ II₄ III₅ IV₄ V₅.

Unfortunately the flippers of the Amagansett whale were disturbed in transit, but from an examination of a cast taken soon after the specimen

reached the Museum, I am convinced that the formula would correspond with the Wainscott series above given. Although this formula agrees with that of none of the skeletons in American museums as shown by True, it is certainly correct. Moreover, True has stated that as the series of phalanges in all the mounted American skeletons is incomplete, he was not able to give a reliable formula.

Chevrons.—The number of chevrons present in the two individuals shows a marked variation. Twelve were found in the Amagansett whale, and nine in the smaller Wainscott specimen. This discrepancy is due in all probability to the decided difference in the ages of the two animals. The

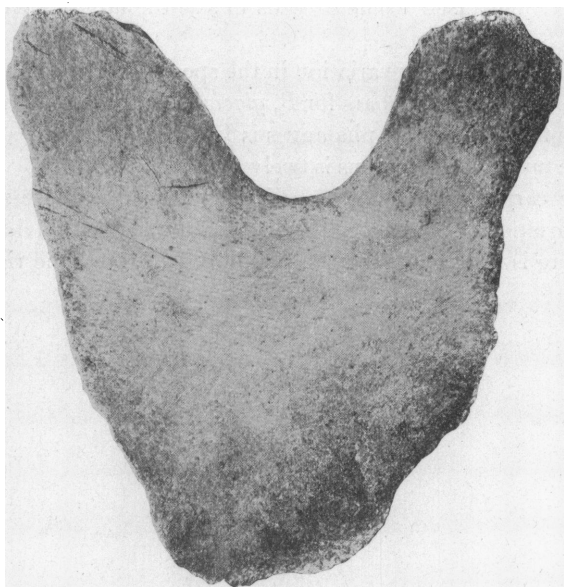


Fig. 6. Dorsal view of sternum of Amagansett whale.

first chevron of the Amagansett series is considerably smaller than those immediately succeeding, and has no spinous process, the lateral laminae being free and somewhat contracted at the distal ends. The fifth chevron is the largest, measuring $11\frac{1}{2}$ inches in length, the spinous process being 8 inches wide. As the series of chevrons in all exhibited American skeletons is apparently incomplete, and as these were examined *in situ*, this observation may prove of value in further study of the species.

Ribs.—The ribs of each specimen number fourteen. The first is single headed, its length in a straight line and breadth distally being given in the table below. A considerable difference between the two sides of the skeleton

of each individual was apparent, the ribs throughout, as well as practically all the bones of the right side, being larger in varying degrees.

	Breadth.		Length.	
	Right. Inches.	Left. Inches.	Right. Inches.	Left. Inches.
Amagansett.....	10.25	8.50	55	52.50
Wainscott.....	5.50	5.25	39	36

CONCLUSIONS.

The results of the preceding notes may be summarized as follows:

1. The Amagansett whale exceeds in size the largest specimen hitherto recorded.
2. Considerable color variation in the species is a fact.
3. The number of lumbar for *B. glacialis* is normally eleven.
4. The formula for the phalanges is I₁ II₄ III₅ IV₄ V₃.
5. The number of chevrons is twelve.
6. The carpal bones, which ossify very late in life, are subject to considerable variation in the respective flippers of a single individual.
7. There is bilateral asymmetry in both examples, the right side being larger.