CANADIAN PACIFIC FAUNA

10. ARTHROPODA

10e. CIRRIPEDIA

BY
IRA E. CORNWALL

WITH FIGURES

FISHERIES RESEARCH BOARD OF CANADA
OTTAWA, 1955

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INTRODUCTION

The barnacles or Cirripedia are among the most familiar animals of the seashore. They are an aberrant group of crustaceans which have adopted a non-motile way of life and have been extremely successful in colonizing shallow water, particularly the zone between low and high tide.

Barnacles are of two general types, the sessile or "acorn" barnacles, and the stalked or "goose" barnacles. The ones most often seen are the ordinary beach barnacles, of the sessile type. There is one intertidal stalked barnacle in British Columbia, usually found at about half-tide mark. Most stalked barnacles live attached to floating logs or other objects, so that they are found along shore only when washed in by storms. The sessile barnacles have produced specialized types which live only on whales, attached to and sometimes nearly covered by the whale's skin, while a few stalked species occur chiefly attached to the sessile whale barnacles.

Barnacles are hermaphroditic, though the genus *Scalpellum* has small "complemental" males attached to the large bisexual individuals. The eggs develop and hatch inside the parent, then usually are released to become three-horned free-swimming larvae called *nauplii*, which in a general way are comparable to larvae of other marine crustaceans. Nauplii moult several times before transforming to the very different *Cypris* stage. The latter is covered by two valves which resemble the shell of a clam but are thin and flexible. The *Cypris* larva does not feed or moult and soon settles down to the fixed existence of the adult barnacle. *Scalpellum* is also peculiar in that it develops to the *Cypris* stage inside the parent.

Only nine kinds of bottom-dwelling sessile barnacles are known from British Columbia, yet it is difficult to distinguish between some of them by the outward appearance. This is well illustrated in Figure 19, which shows some of the forms taken by *Balanus cariosus*. "E" is the "normal" form assumed by an isolated individual, with conspicuous downward-pointing spines on most of the shell. However such individuals are not very common, as this is an intertidal barnacle and, like all intertidal species, it is subject to crowding. "A" is a specimen that has started to grow on a point of rock. It could not expand sideways, so it gained room by lengthening its walls. "B" shows two taken from a large group growing close together on a pile of a wharf. It is thin-walled, and shows very little of the normal sculpture of the shell. "C" is another from a group; it is thin-walled, has an opening as wide as the shell, and shows not a trace of the spine structure. "D" is the most interesting of the lot. It grew on a rock where there was, at certain times, much pounding by driftwood. The action of the driftwood

wore the shell down nearly as fast as it grew, but the cover-plates are very little worn as they would yield, to a certain extent, to the pounding. These five look like different kinds of barnacles, but the inside sculpture of the cover-plates, the mouth parts, and the cirri, or legs, are the same in all of them.

The shore-living barnacles are all subject to crowding and take many forms. Some gain room by lengthening the walls, while others deepen the base. The pedunculate barnacles are not crowded in the same way. They have flexible peduncles, or stalks, that allow them a certain amount of motion; therefore they can be identified by the size and shape of the plates. But some of them are much alike in outward appearance, so the mouth-parts and cirri must be examined to determine the species.

"Whale barnacles" are a diverse and highly specialized assemblage, represented by 6 species in British Columbia, which can be observed only where whaling is in progress. Observations at Cachalot, Kyuquot Sound, in 1926 and at Coal Harbour, Quatsino Sound, in recent years show that barnacles occur here regularly on only two kinds of large whales—the humpback whale (3 common species) and the gray whale (1 common species). Occasionally the species found on the humpback are seen on sperm or finback whales.

Barnacles from foreign waters are continually being brought to British Columbia on ships, but none of those introduced in this manner are known to have become permanent residents of our waters. For example, in 1925 a ship came up from the California coast and stood for some time off William Head, Vancouver Island. To its hull were attached numbers of *Balanus tintinnabulum californicus*. After a few weeks young specimens of *B. tintinnabulum* were found growing on the rocks at Weir's Beach, but they did not persist. Whales also bring exotic barnacles to British Columbia waters. On August 8, 1950, Mr. G. C. Pike found two small specimens of *Balanus trigonus* and one of *B. tintinnabulum* growing on a shell of *Coronula diadema* attached to a humpback whale at Coal Harbour. Other specimens of *B. tintinnabulum* have also been seen there.

These adventitious arrivals are not treated in this paper. The species native to waters immediately north and south of us are described by Henry (1942) and Cornwall (1951). In addition, a stalked barnacle of nearly cosmopolitan occurrence, *Lepas anserifera*, may turn up on the British Columbia coast at any time. It will run to *pectinata* in the key on page 7, and is distinguished by having stronger radial furrows on the valves and 5 or 6 pairs of filamentary appendages.

DESCRIPTIONS AND GLOSSARY

The principal structures used in identifying barnacles are shown in Figure 1, and are described briefly in the glossary below. Bold-face numbers refer to parts shown in Figure 1, and the letters in brackets indicate which of the drawings of Figure 1 contain the feature in question.

adductor muscle—the main muscle for drawing together the opercular valves to close the orifice.

adductor pit—a pit in the scutum for the attachment of the adductor muscle. **1** (E).

adductor ridge—a ridge on the interior of the scutum. **2** (E).

ala (pl. *alae*)—the thin portion of the wall plate of a sessile barnacle which projects from the side and is overlapped by the radius. **3** (A).

antennules—segmented organs which protrude between the shells during the later free-swimming (*Cypris*) stage of a barnacle. The third segment of each forms a sucker-like disc connected with the cement glands, and serves for the attachment of the animal.

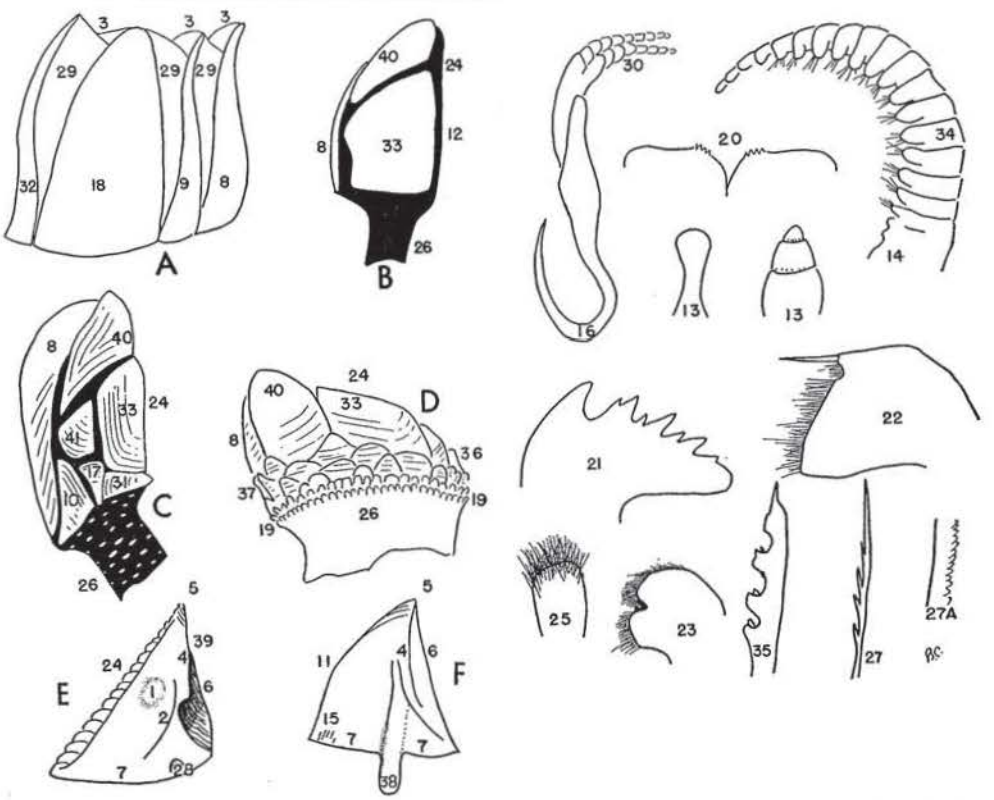

FIGURE 1. Sketches illustrating the structure of barnacles. Numbers correspond with the descriptive term used in the glossary. A, lateral view of a typical *Balanus*. B, *Lepas hilli*. C, *Scalpellum columbianum*. D, *Mitella polymerus*. E, a scutum, diagrammatic. F, a tergum, diagrammatic.

apex—the upper angle of the scutum and of the tergum. **5** (E, F).

articular furrow—a groove on the tergal margin of the scutum and on the scutal margin of the tergum, for the articulation of these two valves. **6** (E, F).

articular ridge—the ridge on the scutum and on the tergum that locks these valves together. **4** (E, F).

basal margin—the margin of the scutum and of the tergum between the occludent margin and the tergal or scutal margin. **7** (E, F).

basis or *base*—the base of the barnacle. It may be calcareous or membranous. (See Fig. 16.)

biramous—dividing into two branches, as do the cirri of barnacles. **30.**

bullate—thick and swollen; a term used in describing a labrum such as that of *Mitella polymerus.*

capitulum—the enlarged and usually flattened part of a pedunculate barnacle which is set on the peduncle, and in which the body is placed. **12** (B).

carina—the plate in the shell of *Balanus* which has two alae. In the genus *Chthamalus* the carina and the rostrum both have two alae, but the carina can be identified by the fact that the posterior cirri are next to it. In pedunculate barnacles the carina is the keel-like plate extending up between the two terga. **8** (A–D).

carinal latus—the valve under the upper latus. **10** (C).

carinal margin—the margin of the terga next to the carina. **11** (F).

carinolaterals—the narrow plates next to the carina in *Balanus.* They have alae on one side and radii on the other. **9** (A).

caudal appendages or *caudal furca*—the simple or segmented tail-like appendages which in some genera are set on each side of the anus. **13.**

cement glands—these supply the cement which passes through the prehensile antennae and serve to attach the larva to some object. In sessile barnacles the cement flows under the shell base and fastens it to its support. In pedunculate barnacles the base of the peduncle is cemented to its support. In *Lepas fascicularis* the cement forms a float that usually supports several barnacles, each of which contributes to the building of it.

chitin—a tough layer overlying the true skin or corium.

cirrus, pl. *cirri*—the biramous legs of a barnacle, six on each side. They are swept through the water in unison, to capture food. **14, 30.**

compartments—the plates forming the wall, or shell, of a sessile barnacle. **8, 9, 18, 32** (A).

complemental male—a small male barnacle which, in some genera, is attached to the female or hermaphrodite, and fertilizes or assists in the fertilization of the eggs.

corium—the true skin under the chitin.

cypris—the last free-swimming stage of the barnacle larva.

depressor muscle—the muscle for closing the coverplates; it is attached to the scutum near the basal margin.

filamentary appendages—tapering appendages, attached to the bases of the cirri in some species, and to the prosoma in others. **16.**

ganglion (pl. *ganglia*)—a mass or knot of nerve matter.

gnathites (also called *trophi*)—the mouth parts: labrum, mandibles, maxilla and palpus. **20, 21, 22, 23, 25.**

inframedian latus—the plates on the capitulum of pedunculated barnacles set between the scutum and the upper latus. **17** (C).

infra-oesophageal ganglion—the ganglion that lies back of the oesophagus.

labrum—the mouth part that acts as an upper lip. **20.**

lamina (pl. *laminae*)—the outer and inner layers of the shell of sessile barnacles. If there are parietal tubes they are between these layers.

laterals—the plates in the wall of *Balanus* between the carino-laterals and the rostrum. In the genus *Chthamalus* they are between the carina and the rostrolaterals. **18** (A).

latus (pl. *latera*)—the plates forming the lower row at the base of the capitulum. **19.**

mandibles—mouth parts which are parallel to the maxillae and point toward the labrum. **21.**

mantle—the exterior membrane. It encloses the body and limbs, and is strengthened, as a rule, by shelly plates on its outer surface.

maxilla (pl. *maxillae*) also called the maxillulae or the *first maxillae*—mouth parts which are parallel to the mandibles and point toward the labrum. **22.**

nauplius (pl. *nauplii*)—the first free-swimming stage of the barnacle.

occludent margin—the margin of the scutum and the margin of the tergum adjacent to, or forming, the margin of the opening for the protrusion of the cirri. **24** (B–E); **11** (F).

opercular valves—calcareous plates partly or wholly covering the orifice; i.e., the scuta and terga. **33, 40** (B–D).

operculum—the movable opercular valves, scuta and terga, and the membrane connecting them. **33, 40** (B–D).

orifice—the opening through which the cirri are protruded.

outer maxillae—the mouth parts set on a prominence facing the labrum, between the two maxillae. **23.**

ovigerous frena—a pair of semicircular folds of membrane depending inside the sack. The ovigerous lamellae are attached to them.

ovigerous lamellae—sheets of ova or eggs held together by delicate transparent membrane. The ova lie in a layer from two to four deep on each side of the sack.

paries (pl. *parietes*)—the median portion of the plates forming the wall of sessile barnacles, and differentiated from the overlapping portions (radii) and the underlapping portions (alae) of the plates by a change of direction of the growth lines. **8, 9, 18, 32** (A).

palpus (pl. *palpi*)—mouth parts attached to the upper part of the labrum. **25.**

pectinated—having a comb-like edge. **27, 27**A.

peduncle—A. The stalk or support of the capitulum of a pedunculate barnacle. **26** (B–D). B. (also called protopodite) The support of the two rami of the cirri. **14.**

pedunculate barnacle—one having a peduncle or stalk; a goose barnacle.

parietal tubes—tubes lying between the outer and inner lamina of the compartments or wall plates.

pit for the lateral depressor muscle—a depression on the basal margin of the scutum. **28** (E).

plate—see *valve*.

prosoma—the soft rounded bag-like portion of the barnacle body. It is really the much-modified head.

protopodite—the support of the two rami of the cirri. **14.**

radius (pl. *radii*)—the part of the wall plate which overlaps the ala of the next plate. **29** (A).

ramus (pl. *rami*)—a branch of a cirrus. Each cirrus has two rami, posterior and anterior. **30.**

rostral latus—the lateral plate under the margin of the scutum. Not present in all pedunculate barnacles. **31.**

rostrolaterals—plates in the wall of *Chthamalus* which have radii on both sides. They lie between the rostrum and the laterals.

rostrum—the plate opposite the carina in the shell of a sessile barnacle. **32** (A). In pedunculate barnacles this plate, if present, is in line with the orifice.

scutum (pl. *scuta*)—the two triangular opercular valves, or cover plates. **33** (B–D); E.

segment—one of the articulated divisions of a cirrus. **34.**

septum (pl. *septa*)—the walls or partitions dividing the parietal tubes into a series of cells. Also the walls between the parietal tubes.

serrate—saw-like. A barnacle's spines may all be serrate, or only a few serrate, or none at all. **27, 27**A, **35.**

sessile—permanently attached. Among barnacles, the term is applied only to those which have a rigid shell attached to some object. The opposed term is *pedunculate* or *stalked.*

sheath—the thickened portion of the shell around the orifice of a sessile barnacle, to which the opercular membrane is attached.

spine—a rigid pointed projection. **27, 27**A, **35.**

splanchnic—of or pertaining to the viscera.

spur—the downward projection on the basal margin of the tergum. **38** (F).

stalked barnacle—see *pedunculate barnacle.*

subcarina—the plate under the carina of some pedunculate barnacles. **37** (D).

subrostrum—the plate under the rostrum of a pedunculate barnacle. **37** (D).

supra-oesophageal ganglion—the nerve ganglion which is between the oesophagus and the prosoma.

tergal margin—the margin of the scutum adjacent to the tergum. **39** (E).

tergum (pl. *terga*)—the opercular valve adjacent to the carina. **40** (B–D), F.

transverse septa—walls dividing the parietal tubes into a series of cells. (See *septum.*)

trophi—mouth parts. (See *gnathites.*)

umbo (pl. *umbones*)—the first-formed part of a valve or plate.

upper latus—a valve on the capitulum of pedunculated barnacles which projects between the lower margins of the tergum and the scutum. **41** (C).

valve—any one of the calcareous plates covering a part of a barnacle's body.

KEY TO MAJOR GROUPINGS

1 Stalked barnacles **Suborder Lepadomorpha** 2

Sessile barnacles (in the rare whale barnacle *Xenobalanus* (Fig. 39), the body much exceeds the wall and simulates a stalk) **Suborder Balanomorpha** 3

2 Peduncle naked and smooth; valves of the capitulum 5 or less (Fig. 1B), sometimes inconspicuous **Lepadidae** (p. 7)

Peduncle "scaly", i.e., partially covered by small plates; valves of the capitulum 12 or more (Figs. 1C, 1D) **Scalpellidae** (p. 7)

3 Alae present on each side of the rostrum (as well as of the carina); edge of the labrum concave but not notched (Fig. 17G). (Only 1 British Columbia species; not over 8 mm. in diameter) **Chthamalidae** (p. 22)

Alae present on the carina, absent from the rostrum; edge of the labrum with a narrow median notch (Fig. 20E) **Balanidae** 4

4 Opercular valves completely close the orifice; "ordinary" barnacles, never found on the skin of whales **Balaninae** (p. 22)

Opercular valves smaller than the orifice, or absent; whale barnacles, attached to or embedded in a whale's skin **Coronulinae** (p. 40)

LEPADIDAE AND SCALPELLIDAE (STALKED BARNACLES)

KEY

1 Body plates (valves) 13 or more (Fig. 1C) **Scalpellidae** 2

Valves 5 or less (Fig. 1B, 11) **Lepadidae** 3

2 Valves more than 30, plus 80–90 in a small basal bract-like series (Fig. 13); intertidal *Mitella polymerus* (p. 18)

Valves 13, no bract-like series at their base (Fig. 15A); found below the tidal zone *Scalpellum columbianum* (p. 20)

3 Valves large, nearly covering the body (Fig. 2); found on inanimate floating objects, or free floating *Lepas* 4

Valves small, covering not more than 1/5 of the body (Fig. 12D); normally found attached to *Coronula* on whales *Conchoderma* 7

N.B.: *If valves are entirely absent, look for a star-shaped shell at the base, in the whale's skin, and refer to the key to Coronulinae.*

4 Carina not forked though sometimes narrowly notched at the base; valves thin; a large hollow float developed at the base of the stalk, to which there are usually several individuals attached (Fig. 4) *Lepas fascicularis* (p. 9)

Carina forked at the base (Fig. 8E); no basal float developed (Fig. 2) 5

5 A projection on top of the occludent angle of the scutum fits into a shallow recess of the tergum (Fig. 8F); one small "filamentary" appendage attached to the base of the 1st cirrus (Fig. 8B) *Lepas pectinata* (p. 13)

No projection at the top of the scutum, the adjacent margin of the tergum straight or very broadly excavated (Fig. 6); filamentary appendages usually 2 or 3 pairs (Fig. 3E) 6

6 One or two pairs of filamentary appendages present (usually 2); small square depressions often present on the valves *Lepas anatifera* (p. 8)

Three pairs of filamentary appendages; square depressions lacking *Lepas hilli* (p. 11)

7 A pair of large ear-like appendages at the top of the body chamber (Fig. 9): carina vestigial or absent; common *Conchoderma auritum* (p. 14)

No ear-like appendages; carina more than half as long as the body (Fig. 12D); rare *Conchoderma virgatum* (p. 16)

Lepas anatifera Linnaeus 1758

Figures 2, 3

Lepas anatifera Linnaeus 1758, Syst. Naturae 10th ed., p. 668. Darwin 1851, p. 73. Pilsbry 1907a, p. 79. Henry 1940a, p. 226; 1940b, p. 37. Cornwall 1951, p. 342.

DISTRIBUTION: World-wide, usually on floating objects. Commonly drifts onto the British Columbia coast.

GENERAL APPEARANCE (Fig. 2): The plates on the capitulum usually are white or bluish gray, and are smooth except for very fine growth lines.

PEDUNCLE: The peduncle is about 1/3 as wide as the capitulum; its length varies greatly.

SCUTUM: The umbones are at the angle formed at the juncture of the occludent and the basal margins. Many specimens, but not all, have a row of square depressions extending across the valve.

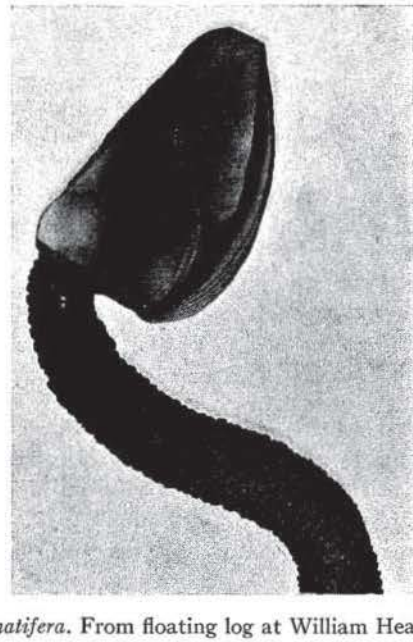

FIGURE 2. *Lepas anatifera*. From floating log at William Head, Vancouver Island.

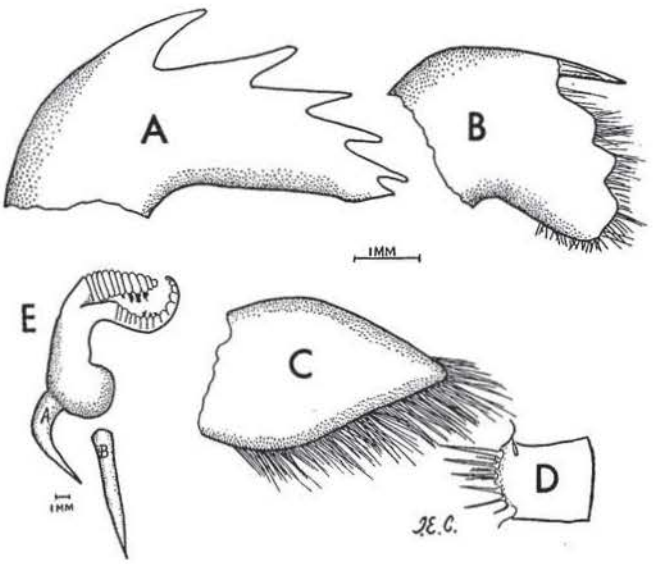

FIGURE 3. *Lepas anatifera*. A, mandible. B, maxilla. C, palp. D, middle segment of cirrus VI. E, cirrus I. A and B are the two filamentary appendages.

TERGUM: The umbones are at the top angle.

MANDIBLE (Fig. 3A): There are 5 sharp teeth, and the lower angle is pointed.

MAXILLA (Fig. 3B): There is a large and a small spine at the upper angle. The margin is step-like and bears many small spines. The lower margin is blunt.

LABRUM: Bullate.

CIRRI (Fig. 3D, E): The first cirrus has rami of unequal length, and a filamentous appendage attached to its base. The segments of the sixth cirrus are protuberant, with 6 spines on the median one. There is a small spine near the front upper margin.

REMARKS: Henry (1940a, p. 226) comments as follows: "This is one of the most variable species of the genus *Lepas*. The number of filamentary appendages, i.e., one at the base of the first cirri and one on the prosoma on each side, is the most reliable criterion in differentiating this species from the closely related species, *L. hilli*".

Lepas fascicularis Ellis and Solander 1786

Figures 4, 5

Lepas fascicularis Ellis and Solander 1786, Zoophytes, Tab. XV, fig. 5. Darwin 1851, p. 92. Pilsbry 1907a, p. 81. Hiro 1937, p. 400. Cornwall 1951, p. 340.
Lepas fascicularis aurivillii Nilsson-Cantell. Henry 1940a, p. 231.

DISTRIBUTION: Pacific and Atlantic Oceans. A pelagic species which drifts ashore on the British Columbia coast, sometimes in great numbers.

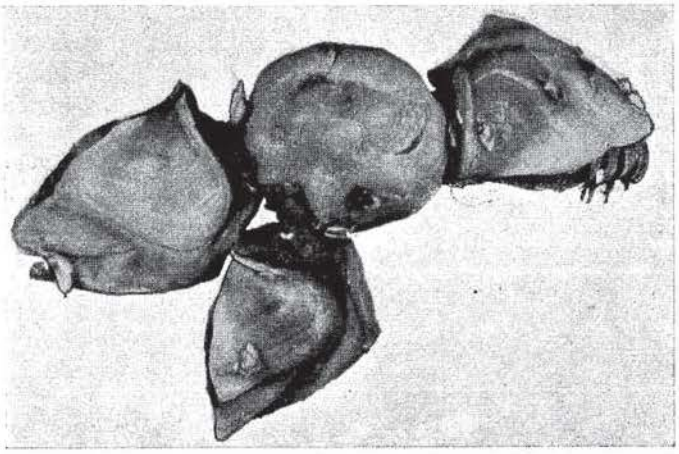

FIGURE 4. *Lepas fascicularis*. Three specimens on one float.

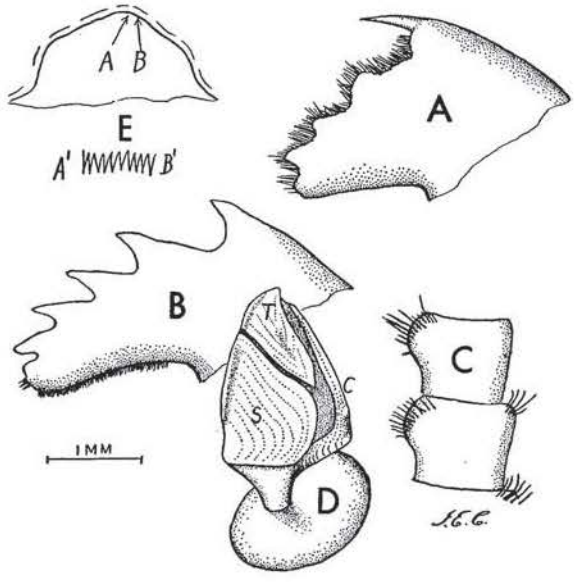

FIGURE 5. *Lepas fascicularis*. A, maxilla. B, mandible. C, middle segments of cirrus VI. D, single specimen on its float. E, labrum, with portion A–B enlarged below.

GENERAL APPEARANCE (Figs. 4, 5D): The 5 plates forming the capitulum are very thin and paper-like; the peduncle is very short; several barnacles are usually attached to the same float. The float is composed of a vesicular structureless membrane. This float is formed by a singular development of the cement tissue which ordinarily serves to attach the cirripede to some object. The free-swimming young first attaches itself to some small floating object and around this it builds

the float. The color of those taken in the North Pacific is usually dirty white, or some shade of purple, but there is considerable variation in color.

MANDIBLE (Fig. 5B): The mandible has 5 teeth; the lower angle is rounded and pectinated.

MAXILLA (Fig. 5A): Below the two large spines at the upper angle the margin forms 3 steps. The margin bears many small spines that are set close together.

LABRUM (Fig. 5E): Bullate, with many very small teeth in the centre of the margin, as indicated in the Figure.

CIRRI (Fig. 5C): The first cirri have slightly protuberant segments. Cirrus VI has a row of small non-pectinate spines on each side.

Lepas hilli (Leach) 1818

Figures 6, 7

Pentalasmis hilli Leach 1818, Tuckey's Congo Expedit., p. 413.
Lepas hilli Darwin 1851, p. 77. Pilsbry 1907a, p. 80. Cornwall 1925, p. 490.

DISTRIBUTION: World-wide; usually on floating objects. Commonly drifts onto the British Columbia coast.

GENERAL APPEARANCE: The capitulum is flat. The valves are bluish grey, and the margin of the orifice is usually bright orange-yellow. The lining of the capitulum is leaden-purple, the body more reddish. The ova are a beautiful blue. This species has often been mistaken for *L. anatifera* as they are so much alike. On the valves of *L. hilli* there are never any of the small square depressions that are so often to be seen on the valves of *L. anatifera*.

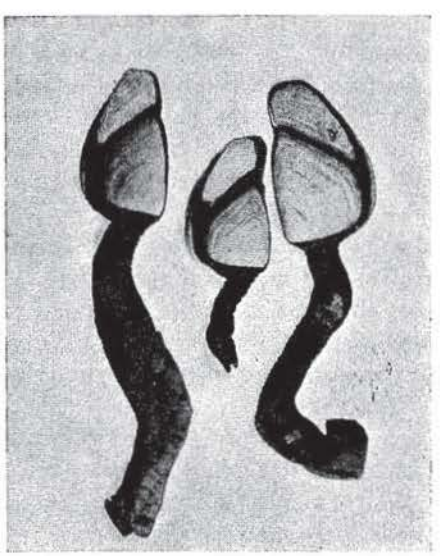

FIGURE 6. *Lepas hilli*. From a floating log at William Head, Vancouver Island.

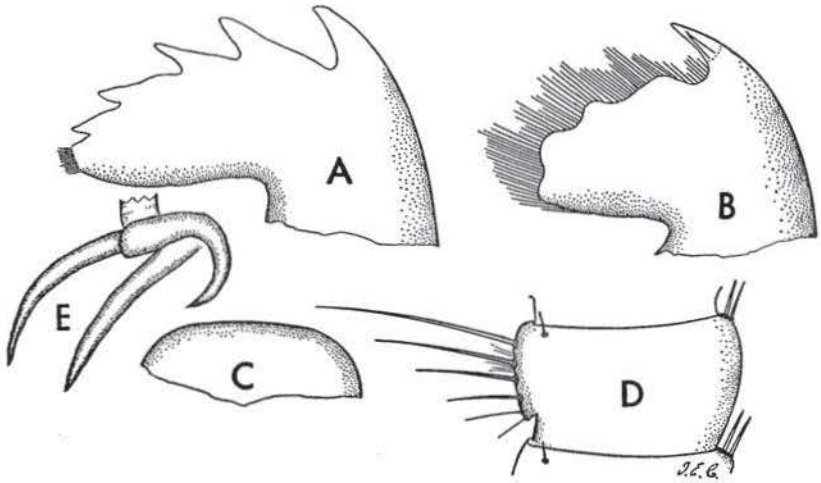

FIGURE 7. *Lepas hilli*. A, mandible. B, maxilla. C, outline of labrum. D, median segment of cirrus VI. E, filamentary appendages at base of cirrus I.

SIZE: The capitulum of the specimen described was about 25 mm. long. This is a little smaller than the usual size of the capitulum of *L. anatifera*. The peduncle varies greatly in length.

SHELL (Fig. 6): The valves of a fresh specimen are nearly transparent, but appear bluish-grey as the skin under them is that color.

SCUTUM (Fig. 6): No tooth at the basal margin, and with scarcely any trace of the internal basal rim. The surface is smooth, but there may be faint growth lines radiating from the umbo.

TERGUM (Fig. 6): Surface smooth; umbo at the upper angle.

MANDIBLE (Fig. 7A): Exactly the shape of the mandible of *L. anatifera* except that the lower angle is not pointed but bears a row of small spines. Upper and lower margins hairy. The sides are covered with fine hairs which extend to and cover the base of the teeth on both sides.

MAXILLA (Fig. 7B): A deep notch below the two spines at the upper angle, and 3 rounded prominences, or steps, below the notch; the lower angle is rounded. The two upper spines are unequal in length, the shorter being on the side away from the mandible.

LABRUM (Fig. 7C): Rounded; the edge bears many minute conical teeth that point downward.

CIRRI (Fig. 7D): Segments of the first cirrus protuberant, except for 6 at the distal end which are small and delicate. The median segment of cirrus VI bears 6 pairs of spines and a few small spines set between the main rows. There is one small stout spine near the upper margin of each segment. At what may be called the back of each segment there is a row of small stout spines, usually about 6.

FILAMENTARY APPENDAGES (Fig. 7E): There are always 3, or more, filamentary appendages on each side. One is attached to the base of the first cirrus, and

the others are attached to the prosoma close to the base of the first cirrus. The appendages are shown on a much smaller scale than the other parts shown in Figure 7.

Lepas pectinata Spengler 1793, var. **pacifica** Henry 1940

Figure 8

Lepas pectinata Spengler 1793, Skrifter Naturhist. Selskabet, 2. Darwin 1851, p. 85. Pilsbry 1907a, p. 81.

Lepas pectinata pacifica Henry 1940a, Proc. U.S. Nat. Mus. 88: 228; 1940b, p. 37.

DISTRIBUTION: The species as a whole has almost a world-wide distribution. The only examples examined by us have been small specimens, of the smooth *pacifica* type, but the relation of this form to typical *pectinata* has yet to be clarified. Henry (1940a) records *pacifica* from northern British Columbia to Oregon.

GENERAL APPEARANCE (Fig. 8F): The 5 plates on the capitulum are white; they are thin and brittle, with growth ridges and radial striations irregular and not very prominent. The most distinctive character is the small projection at the upper angle of the scutum that corresponds with a slight indentation in the tergum. There is a ridge on the scutum close to, and parallel with, the occludent margin, Figure 8E.

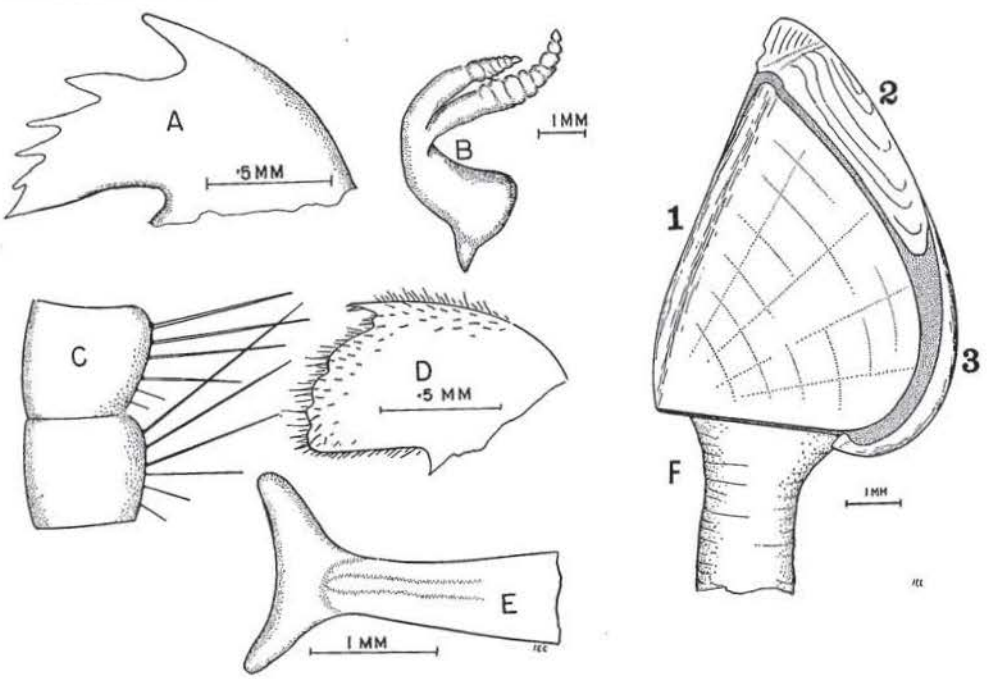

FIGURE 8. *Lepas pectinata*. A, mandible. B, cirrus I with filamentary appendage at the base. C, middle segments of cirrus VI. D, maxilla. E, lower end of carina. F, whole specimen showing (1), scutum, (2) tergum, (3) carina.

SIZE: Capitulum up to 20 mm. long (Henry). The specimen figured here was 8 mm. in length.

CARINA (Fig. 8E, 8F3): The carina is about the same width throughout its length except where it narrows just above the fork. The prongs of the fork diverge at an angle of nearly 140°.

TERGUM (Fig. 8F2): In the tergum there is a slight indentation that corresponds with the projection on the upper angle of the scutum. These two plates are separated by a narrow even space.

SCUTUM (Fig. 8F1): There is a prominent ridge on the occludent margin of the scutum, and the upper termination of this ridge forms the projection that corresponds with the indentation in the margin of the tergum. The lower margin of the scutum forms an unusually straight even line. The growth ridges and radial markings are faint and irregular.

MANDIBLE (Fig. 8A): The mandible has 5 teeth. The lower angle, in the specimen figured, is sharply pointed, but this is variable. The surface bears many fine spines, and there are a few spines between the teeth.

MAXILLA (Fig. 8D): There are two large teeth at the upper angle, below them there is a hollow, and below the hollow the margin forms several irregular steps and bears many stout spines.

LABRUM: Bullate.

CIRRI (Fig. 8C): The middle segment of cirrus VI has 6 spines.

FILAMENTARY APPENDAGE (Fig. 8B): There is one small triangular appendage attached to the base of cirrus I.

Conchoderma auritum (Linnaeus) 1767

Figures 9, 10

Lepas aurita Linnaeus 1767, Syst. Nat., 12th ed., p. 1110.
Conchoderma auritum Darwin 1851, p. 141. Pilsbry 1907a, p. 99. Cornwall 1924, p. 425; 1927, p. 513.

DISTRIBUTION: World-wide. In British Columbia found abundantly on *Coronula* on whales, but not yet taken elsewhere.

SIZE: A full grown specimen may be up to 125 mm. long, but the length of the peduncle varies.

APPEARANCE (Fig. 9, 10F, G): The color is extremely variable. In some the capitulum is spotted with purple on a pinkish ground. In others the purple may be in stripes which run down to and along the peduncle.

BASE: Membranous.

PEDUNCLE (Fig. 10): Cylindrical, distinctly separated from the capitulum, generally 2 or 3 times as long as the latter.

CARINA: A minute spot in young specimens; often absent in old ones.

SCUTA (Fig. 9): Of a fair size, below the orifice.

TERGA: Much smaller than the scuta, sometimes lacking; situated above the orifice.

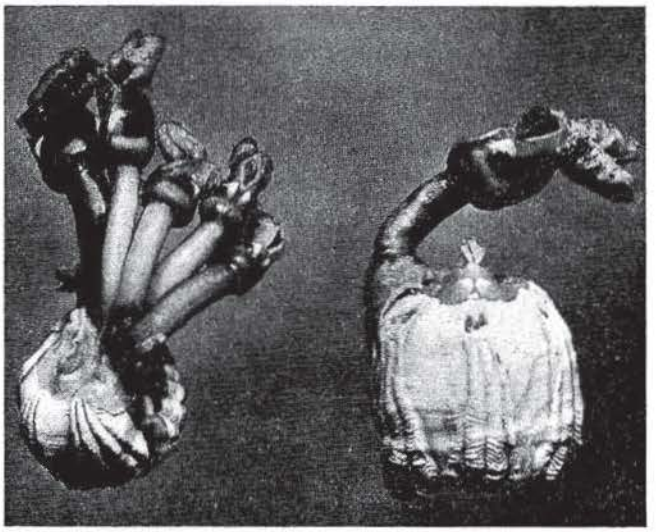

FIGURE 9. *Conchoderma auritum* or *Coronula diadema*. From a 41-foot male humpback whale landed in 1948 at Coal Harbour, Quatsino Sound, B.C. Collected by G. C. Pike.

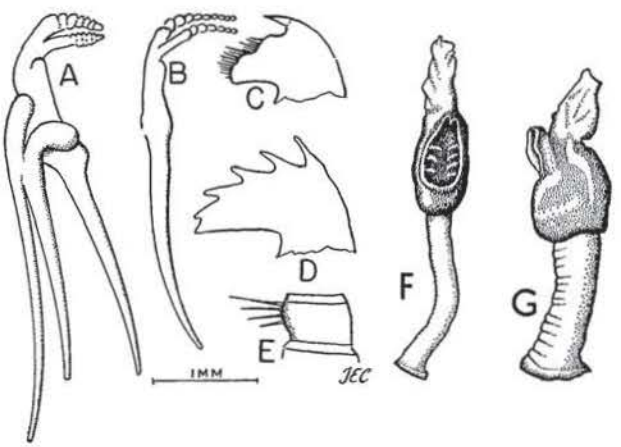

FIGURE 10. *Conchoderma auritum*. A, cirrus I with three branchiae attached to it. B, cirrus II with one branchia. C, maxilla. D, mandible. E, middle segment of cirrus VI. F and G, specimens from a shell of *Coronula diadema* on the throat of a humpback whale.

MANDIBLE (Fig. 10D): The mandible has 5 teeth, and the lower angle is pointed.

MAXILLA (Fig. 10C): Under the great spine at the upper angle there is a hollow, and below it the margin is irregular and bears many spines.

LABRUM: The outline of the labrum is irregular.

CIRRI (Fig. 10A, B): Short and broad, with the anterior faces of the segments

slightly protuberant. The middle segment of cirrus VI has 4 short strong spines (Fig. 10E).

BRANCHIAE (Fig. 10A, B): Darwin (1854) states that there are 8 on each side, but in the many specimens I have examined there were only 4: 3 on cirrus I and 1 on cirrus II. The branchiae are long and tapered, and are about twice the length of the cirri to the bases of which they are attached.

REMARKS: This species occurred on almost all humpback whales (*Megaptera nodosa*) seen at Kyuquot Sound in 1926 and at Quatsino in recent years, usually attached to *Coronula diadema* or less frequently to *C. reginae*. At Quatsino Mr. G. C. Pike has found it rather uncommonly on sperm whales (*Physeter macrocephalus*), usually on broken or diseased teeth. One specimen was found on the deformed jaw of a fin whale (*Balaenoptera physalus*).

In other parts of the world *Conchoderma auritum* has occasionally been found on ships, buoys and other floating objects, sometimes also on rocks.

Conchoderma virgatum (Spengler) 1790

Figures 11, 12

Lepas virgata Spengler 1790, Skrifter Naturhist. Selskabet, I, pl. VI., fig. 9.
Conchoderma virgatum Darwin 1851, p. 146. Pilsbry 1907a, p. 99.

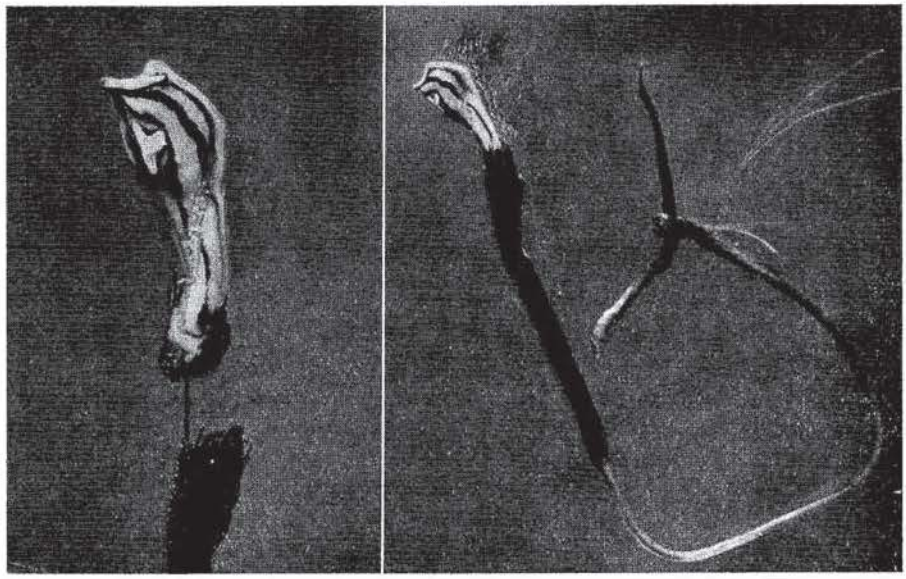

FIGURE 11. *Conchoderma virgatum*. The right hand panel shows the specimen in its natural position attached to the tip of the parasitic copepod *Penella*; the three-pronged attachment of the *Penella*, at right centre, was removed from the whale. The left-hand panel shows the barnacle in side view, with a bit of the copepod still attached. From the skin of a finback whale landed at Coal Harbour, Quatsino Sound, May 13, 1953. Collected by G. C. Pike.

DISTRIBUTION: World wide. The only authenticated specimen from British Columbia waters is the one illustrated in Figures 11 and 12. It was found on May 13, 1953, by G. C. Pike, fastened to the tip of a *Penella* (parasitic copepod) attached to a fin whale (*Balaenoptera physalus*). There are in the Pacific Biological Station a dozen specimens labelled "collection of Rev. G. Taylor", which probably came from local waters.

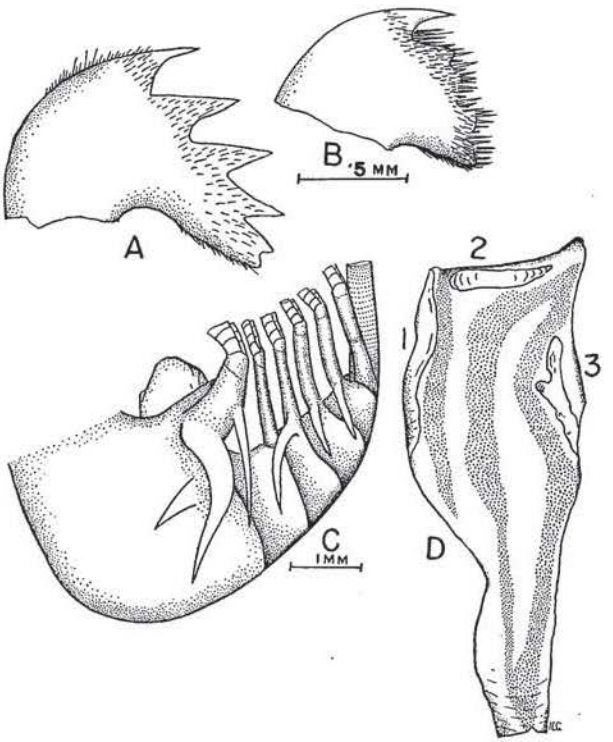

FIGURE 12. *Conchoderma virgatum*. A, mandible. B, maxilla. C, side view of body showing 6 filamentary appendages. D, side view of specimen showing (1) carina, (2) tergum, (3) scutum.

GENERAL APPEARANCE (Fig. 12D): Small, almost nude, with dark stripes extending from the top of the capitulum down the stalk to the base. In life the capitulum and peduncle are gray with a slight tinge of blue, and dark areas are purplish brown. The body and pedicles of the cirri are dark lead-colored, and the cirri are almost black. The upper margin of the capitulum is nearly square, and there are no ear-like projections as in *C. auritum*.

CARINA (Fig. 12D, 1): The carina of the specimen figured is sinuous. It tapers to each end.

TERGA (Fig. 12D, 2): Pointed at one end and rounded at the other; the umbo is at about the center, and varies greatly in different specimens.

SCUTA (Fig. 12D, 3): Trilobed, very variable in shape. Sometimes they differ considerably in the same specimen.

MANDIBLE (Fig. 12A): There are 4 large sharp teeth, and a small one near the lower angle. Basal edges of the teeth are minutely pectinate on one side.

MAXILLAE (Fig. 12B): Under two large teeth at the upper angle there is a hollow; from there to the lower angle the outline forms irregular steps that bear many large spines. Usually there are 5 steps, but in the specimen figured there were only 4.

FILAMENTARY APPENDAGES (Fig. 12C): Six on each side. The largest is attached to the base of the first cirrus, another to the pedicle of the third cirrus, and a third is on the flank of the prosoma just under the base of the first cirrus. The other 3 are attached to the bases of the third and fourth cirri.

REMARKS: A very variable species. Darwin recognized several varieties and one related species, but was not sure of their distinctness. Pilsbry (1907a) mentions only one.

Mitella polymerus (Sowerby) 1833

Figures 13, 14

Pollicipes polymerus Sowerby 1833, Proc. Zool. Soc. London, p. 74. Darwin 1851, p. 307.
Mitella polymerus Pilsbry 1907a, p. 5; 1921, p. 112. Cornwall 1925, p. 486; 1951, p. 339. Henry 1940a, p. 234; 1940b, p. 35.

DISTRIBUTION: World-wide, in the intertidal zone. Not uncommon in British Columbia, on exposed headlands. Once taken on a whale in Alaska (Pilsbry).

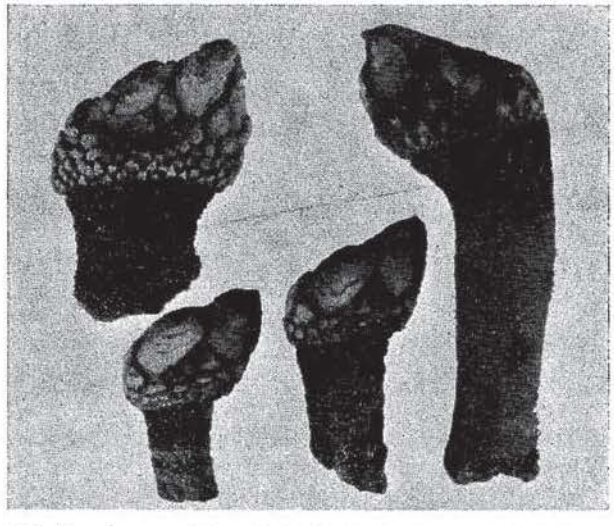

FIGURE 13. *Mitella polymerus*. From half-tide level, William Head, Vancouver Island.

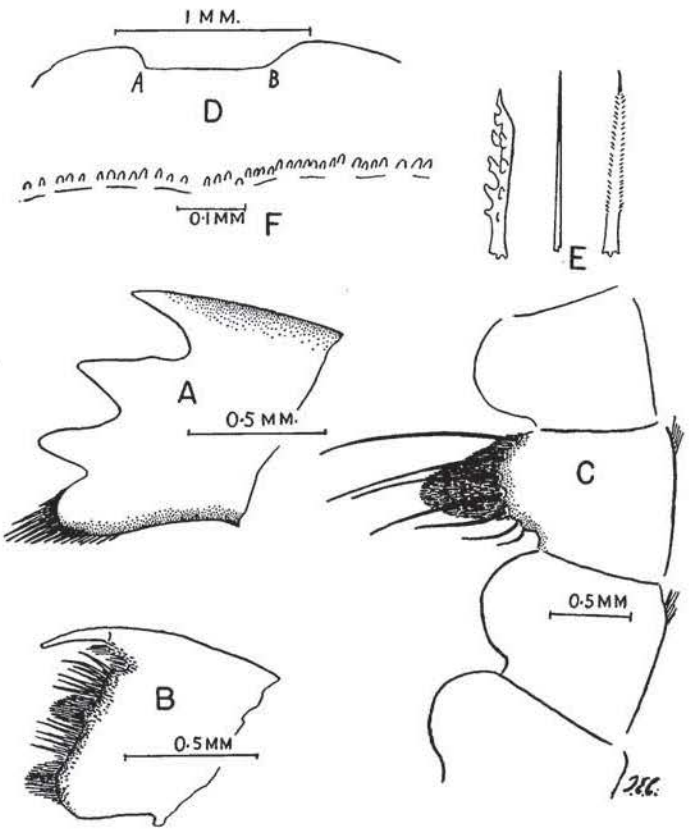

FIGURE 14. *Mitella polymerus*. A, mandible. B, maxilla. C, middle segments of cirrus VI. D, labrum. E, spines of cirrus I. F, portion of labrum from A to B, highly magnified to show teeth. From William Head, Vancouver Island.

GENERAL APPEARANCE (Fig. 13): The capitulum has several whorls of valves which decrease in size from above downward. In the lowest of these whorls there are some 80 or 90 valves. The valves are of unequal size with a dark connecting membrane, and their surface is usually much disintegrated.

SIZE: These barnacles occur in groups, usually with a great variety of sizes in each. Those in the centre may be up to 150 mm. long, those on the outside of the group only a few millimeters.

PEDUNCLE (Fig. 13): Upper part less in diameter than the capitulum, and tapered a little downward. Covered with small calcareous scales.

FILAMENTARY APPENDAGES: In two rows on the under side of the prosoma, 12 on each side. On the end of each appendage there are about 6 minute spines. There is another short appendage attached to the prosoma beneath the peduncle of cirrus I; its free end lies between the peduncles of I and II. In the base of this

appendage there is a hard transparent disc. The number of the appendages varies with the size of the barnacle.

CAUDAL APPENDAGES: Two-segmented, short.

SCUTUM: Nearly oval.

TERGUM: About the same length as the scutum; the interior is concave.

MANDIBLE (Fig. 14A): There are 3 large teeth; the lower angle is very protuberant and is covered with spines.

MAXILLA (Fig. 14B): There is a deep narrow notch under the two large spines at the upper angle. At the middle of the margin there is a tuft of fine spines and another tuft at the lower angle.

LABRUM (Fig. 14B, D): Bullate and not notched. There are many irregular small teeth set in the level part between a and b in the figure.

CIRRI (Fig. 14C, E): The first cirrus has protuberant segments and has 3 kinds of spines (E). The median segment of cirrus VI bears 7 pairs of long spines and a tuft of fine spines (C).

REMARKS: In almost every group of this species there will be a few that have one or two white scales on the capitulum. This is where a sessile barnacle has grown on the scale: when this happens, the outer lamina of the scale becomes loose and drops off leaving the light inner lamina exposed.

If the peduncle is steamed for 20 minutes, and then skinned, it makes very good eating. The flesh is red and tastes like lobster.

Scalpellum columbianum Pilsbry 1909

Figure 15

Scalpellum columbianum Pilsbry 1909, p. 367. Cornwall 1930, p. 215. Henry 1940a, p. 232; 1940b, p. 36.

DISTRIBUTION: A deep-water species, described from specimens taken in Lowe Inlet, B.C. Also taken at 30 fathoms in Departure Bay, B.C., and from Burrard Inlet.

SIZE: The specimen described is 9 mm. long and 4.5 mm. wide.

GENERAL APPEARANCE (Fig. 15A): There are 13 plates in the much compressed capitulum. The occludent border is straight. Carina very long, its border evenly arched. Peduncle has many widely spaced scales. The capitulum shown is wider than in Pilsbry's (1909) figure, which was drawn from a dried specimen. The growth lines on the plates are faint, but plain enough to show the position of the umbones. The peduncle is about half the length of the capitulum.

CARINA (Fig. 15A, No. 1): Very long, evenly curved and deeply grooved. There is a line of spines or hairs on each side of the groove.

TERGUM (Fig. 15A, No. 2): Triangular, with the umbo at the apex.

SCUTUM (Fig. 15A, No. 3): Projects over the tergum, with the umbo at the apex.

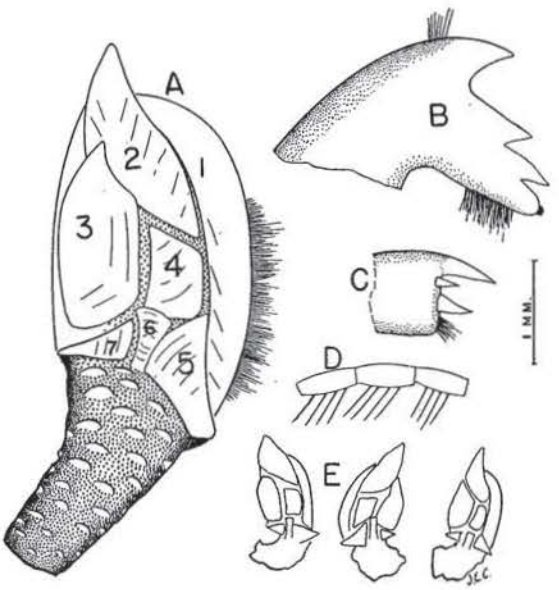

FIGURE 15. *Scalpellum columbianum*. A, side view of adult animal. B, mandible. C, maxilla. D, middle segments of cirrus VI. E, young specimens attached to the same stones as A.

UPPER LATUS (Fig. 15A, No. 4): The edges are nearly parallel and the umbo is at the apex.

CARINAL LATUS (Fig. 15A, No. 5): Nearly triangular; umbo at the lower point which projects beyond the carina.

INFRAMEDIAN LATUS (Fig. 15A, No. 6): Curved on both sides; umbo at the centre.

ROSTRAL LATUS (Fig. 15A, No. 7): Triangular; scutal margin longer than that of *Scalpellum gruvelianum* Pilsbry 1907, to which this species is related.

MANDIBLE (Fig. 15B): There are 4 teeth, with a wide space between the first and second. The lower tooth is more blunt than the others and has a tuft of short spines at its end. There is a small tuft of spines on the top of the mandible, and spines on the lower margin.

MAXILLA (Fig. 15C): Two stout spines on the margin below the tooth at the upper angle, and a tuft of small spines below the two large spines. The mandible and maxilla are different from *Scalpellum gruvelianum*.

CIRRI (Fig. 15D): Have 11 segments and the median segments bear 4 pair of spines.

REMARKS: Young *S. columbianum* are shown in Figure 15E. These were growing on the same support as the mature specimens. The two specimens described by Pilsbry (1909) were dried and therefore the mouth parts could not be figured. In 1928 Mrs. E. Berkeley collected two more specimens from about 30 fathoms in Departure Bay. One contained 56 eggs, which is a larger number

than usually found in this genus. These eggs were all in an advanced stage of development, but not all in the same stage; some had only one eye spot, others had two, and a few were in the early *Cypris* stage as 6 cirri could be seen on each side. Development to the *Cypris* stage within the mantle cavity of the female has been observed by several students of the Cirripedia (see Barnard, 1924).

Henry (1940a, p. 233) shows a very young specimen (1.5 mm.) which has a greater number of plates than larger specimens. The 3 immature specimens figured by the writer (1930) were larger and have the same number and arrangement of plates as mature individuals.

CHTHAMALIDAE AND BALANINAE (ORDINARY SESSILE BARNACLES)

KEY

1 Base membranous; cover plates, in closed position, with a cross-line as in Figure 17F; a tiny barnacle, not over 8 mm. in diameter, usually low conical or almost flat; intertidal, mainly above half-tide *Chthamalus dalli* (p. 23)

Base calcareous (except in *cariosus*); cross line not as above, though somewhat similar in *glandulus* (Fig. 21K); adults commonly much larger than 8 mm. diameter *Balanus* 2

2 Base membranous; when not too crowded, the walls have many downward-pointing spines (Fig. 19E); up to 75 mm. diameter; mainly intertidal, common *Balanus cariosus* (p. 26)

Base calcareous; no downward-pointing spines on the walls 3

3 Longitudinal tubes present in the walls (Fig. 21, 30)—tubes often irregular in young specimens, and sometimes destroyed by wear in *glandulus*, which is intertidal 4

Walls without such tubes; rather small species (up to 21 mm. diameter), found only below lowest tide level 8

4 Tubes in the walls containing numerous cross-septa, at least above the middle (Fig. 21, 26F) 5

Tubes lacking cross-septa; found in the lowest intertidal zone and deeper 7

5 Tubes filled with white powder; membranous lining of cover-plates black; up to 20 mm. diameter; found throughout the intertidal zone—our most abundant barnacle *Balanus glandulus* (p. 33)

Tubes without powder; lining of cover plates light colored; found in the lower part of the intertidal zone and deeper 6

6 Wall smooth and white, deeply notched at the top and with the radii sunk well below the parietes (Fig. 21); orifice large, acute-angled in the carina; up to 28 mm. diameter *Balanus crenatus* (p. 28)

Wall rougher, usually only slightly notched at the top: the radii only slightly below the level of the parietes (Fig. 30); orifice small, oval or irregular; wall covered by a brown epidermis; up to 55 mm. diameter *Balanus rostratus* (p. 38)

7 Base solid and radially grooved (Fig. 18); tip of scutum purple; up to 35 mm. diameter *Balanus balanus* (p. 25)

Base irregularly porous; interior of cover plates buff with purple tips; our largest barnacle, up to 150 mm. (6 inches) diameter *Balanus nubilus* (p. 36)

8 Wall rough and strongly ribbed; orifice small and oval (Fig. 23) *Balanus engbergi* (p. 31)

Wall smooth, or ribbed on the lower half only (Fig. 27): orifice angular, nearly square. *Balanus hesperius* (p. 35)

Chthamalus dalli Pilsbry 1916

Figures 16, 17

Chthamalus dalli Pilsbry 1916, p. 316. Cornwall 1925, p. 472. Henry 1940b, p. 17; 1942, p. 121.

DISTRIBUTION: Unalaska to Lower California. Found only in the intertidal zone, and usually above half-tide mark. Formerly abundant in British Columbia; now less common near cities.

SIZE: The average specimen is about 6 mm. in diameter and 3 mm. high.

GENERAL APPEARANCE (Fig. 17F): The shell is brown and has a dark band near the base. It may be steeply conic or much flattened. Walls ribbed.

BASE: The base appears to be entirely membranous, but there may be a thin layer of calcareous matter near the edge.

SCUTUM (Fig. 17B): Roughly triangular, longer than wide. Articular ridge short, extending downward for about half the width of the plate. Articular furrow

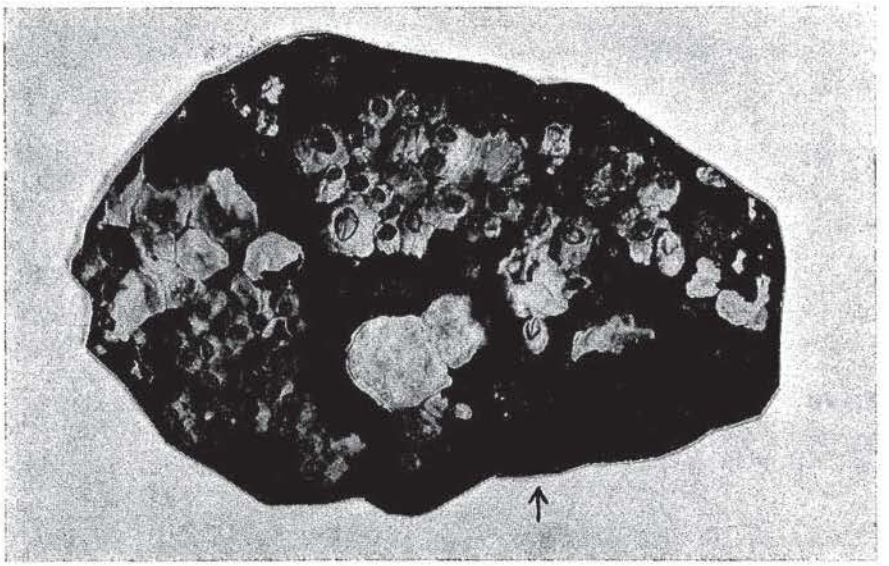

FIGURE 16. *Chthamalus dalli* and *Balanus glandulus*. Most of the individuals are *C. dalli*; there are two specimens of *B. glandulus* immediately above the arrow. The large white patches indicate former occupancy of a site by a *B. glandulus* which has died and disintegrated, leaving only its calcareous base. Entrance of Kyuquot Sound, B.C., 1925.

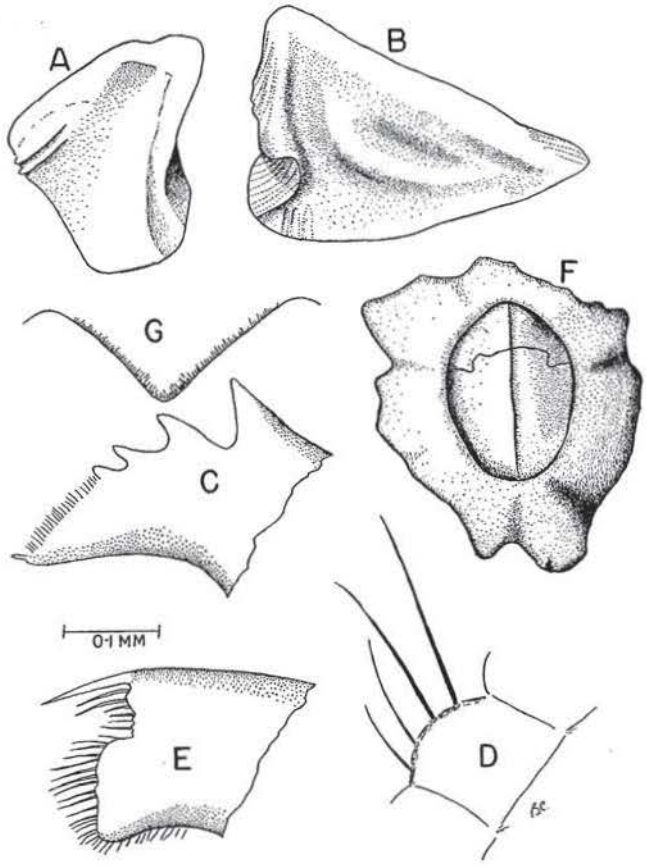

FIGURE 17. *Chthamalus dalli.* A, interior of tergum. B, interior of scutum. C, mandible. D, middle segment of cirrus VI. E, maxilla. F, single animal from above, showing cover plates in position and characteristic cross-line. G, margin of labrum.

deep; adductor ridge is prominent; adductor pit large but shallow. There are several irregular grooves for the lateral depressor muscles.

TERGUM (Fig. 17A): Broad, about 3/4 as high as wide. Upper margin arched. Crests for the attachment of the depressor muscles well developed and projecting slightly beyond the margin.

MANDIBLE (Fig. 17C): On the cutting edge of the mandible there are 4 teeth and the lower half has a brush-like row of small spines. (This arrangement is characteristic of all *Chthamalus*.)

MAXILLA (Fig. 17E): Two large spines at the upper angle, below which there is a wide depression. The margin bears numerous spines of equal length.

LABRUM (Fig. 17G): Not notched, but with a wide V-shaped depression. In the depression there are several teeth, and the margin is hairy.

CIRRI (Fig. 17D): Cirrus I has rami of 7 and 6 segments. Cirrus II has 6 and 5 segments. Cirrus III has 12 segments each bearing 4 pair of spines. Cirrus VI has 20 segments and the median segments have 4 pairs of spines.

REMARKS: This species appears to be the only barnacle on this coast that commonly has a macroscopic parasite. It was tentatively identified at the United States National Museum as the isopod *Hemioniscus balani* (Spence Bate). When this parasite is present in the barnacle there are no eggs.

Balanus balanus (Linnaeus) 1758

Figure 18

Lepas balanus Linnaeus 1758, Syst. Nat., 10th ed., p. 667.
Balanus balanus Pilsbry 1916, p. 149. Henry 1942, p. 101.
Balanus porcatus da Costa 1778. Darwin 1954, p. 256.
Balanus balanus pugetensis Pilsbry 1916, p. 163. Henry 1942, p. 101.

DISTRIBUTION: Northern Atlantic, Pacific and Arctic Oceans; on the Pacific coast, south to Puget Sound. Recorded by Henry from Langara Island and Seymour Inlet, B.C. (typical *balanus*); and from Queen Charlotte Sound, Seymour Inlet and Wentworth Island, B.C. (*pugetensis*).

SIZE: Up to 35 mm. diameter and 22 mm. high.

GENERAL APPEARANCE (Fig. 18): Shell conical, somewhat convex; white or yellowish; usually sharply and narrowly ribbed longitudinally, but southern specimens tend to be merely rugose, or quite smooth. Orifice small, ovate, entire; broad at the rostral end and sharp at the carinal end.

BASE: Calcareous; rather thin, obscurely furrowed.

RADII: Smooth, fairly broad; summits almost parallel to the bases.

PARIETES: Usually with 2 to 4 strong sharp longitudinal ribs, these sometimes irregular or absent. The walls contain large, square tubes, lacking transverse septa in the upper part.

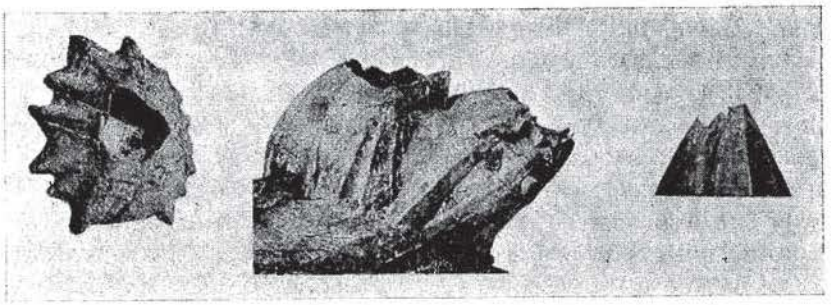

FIGURE 18. *Balanus balanus*. The heavily ribbed specimen at left is from Seymour Inlet, B.C.; the others are of the form *pugetensis*, from Puget Sound, Washington. (Photographs from Henry, 1942.)

SCUTUM: Surface with narrow prominent growth ridges, crossed by fine longitudinal striae. Articular ridge low, rather abruptly terminated below.

TERGUM: Much narrower than the scutum, twice as long as wide. Beak purplish or pink (rarely white), projecting well above the scutum.

MANDIBLE: With 3 large teeth and 2 small or rudimentary ones.

MAXILLA: With a small notch under the upper pair of spines; in the lower part there is a single large spine.

LABRUM: With 2–6 teeth.

CIRRI: Dark brownish purple. Rami of I with 26 and 12–13 segments, respectively; in II the segments are but little protuberant; cirrus III is 1/3 longer than II, it has numerous simple spines on the anterior border and numerous multifid spines on the distal border; cirrus IV has similar but weaker spines; cirrus VI has about 46 segments having shield-shaped fronts bearing 4-5 pairs of spines and some minute intermediate bristles. The *pugetensis* form is said to have less spiny cirri.

REMARKS: The above description is compiled from those of Darwin, Pilsbry and Henry. Pilsbry's *pugetensis* was based mainly on the smoothness of the parietes of Puget Sound specimens. However Henry (1942) found that a strong rib occurred frequently on the carina and 2–4 ribs were sometimes found on other compartments of Puget Sound material; she "considered *pugetensis* a *forma* rather than a subspecies", and identified both *pugetensis* and typical *balanus* from the same station in Seymour Inlet, B.C. It would seem that the name *pugetensis* is of little taxonomic value.

Balanus cariosus (Pallas) 1788

Figures 19, 20

Lepas cariosa Pallas 1788, Nova Acta Acad. Sci. Imp. Petropolitanae 2, p. 234.
Balanus cariosus Darwin 1854, p. 273. Pilsbry 1916, p. 189; 1921, p. 112. Cornwall 1925, p. 472; 1951, p. 322. Henry 1940a, p. 13; 1942, p. 102.

DISTRIBUTION: Northern Pacific Ocean, south to Japan and to southern California. Common in the littoral zone along the whole British Columbia coast.

GENERAL APPEARANCE (Fig. 19): The only *Balanus* on the North American west coast with a membranous base. A normal specimen has external sculpture of many downward pointing spines giving it what Darwin (1854) called "a thatched appearance". Radii very narrow. Internally the shell is smooth. Toward the base the plates are roughened, first with shallow pits and then with slightly irregular ridges which correspond with the septa between the pores. The walls are thick, and permeated with pores which have cross-septa. The normal color of the shell is white, when eroded it is dirty gray. When crowded, members of this species gain room by lengthening the walls of the shell (Fig. 19A). The walls are then very thin, and there is no trace of the thatched appearance. This is one of the most variable of barnacles, and it is not usual to find one with a "normal" shell.

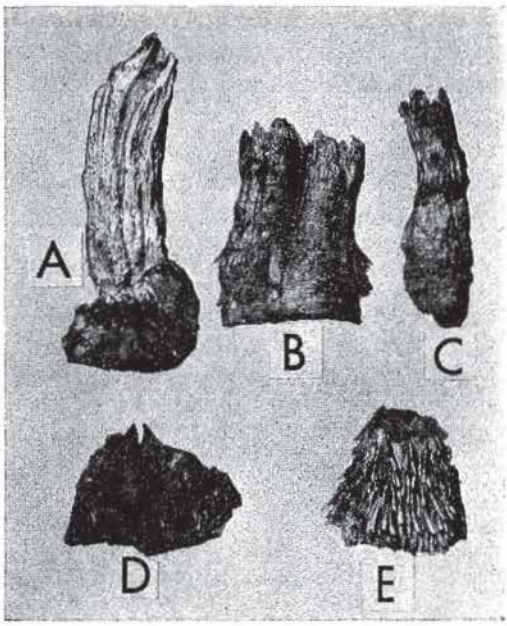

FIGURE 19. *Balanus cariosus*. Examples of variation in form. A, thick-walled tubular. B and C, thin-walled, taken from a group on a pile. D, thick-walled, worn down by driftwood. E, the "normal" shell of an isolated individual.

SIZE: The specimen described is 48 mm. in diameter and 30 mm. high, but individuals up to 75 mm. across the base occur. Tubular specimens have been collected that were 100 mm. long.

BASE: Membranous.

RADII: Narrow.

SCUTUM (Fig. 20A, B): Externally the scutum has irregular growth ridges and fine longitudinal striae; the lower half is covered with membrane; the top is usually eroded. There are from 4 to 6 rounded teeth on the occludent margin. Internally, there is a high articular ridge and the articular furrow extends nearly to the basal margin; the pit for the lateral depressor muscle is deep, it extends under the curved adductor ridge; there is a slight ridge in the centre of this pit; the basal margin is convexly curved.

TERGUM (Fig. 20C, D): The exterior of the tergum is marked with prominent growth-ridges and longitudinal striae; there are 3 shallow furrows running parallel to the scutal margin; the shape is rather narrow; the spur is near the scutal margin; the basal margin on the scutal side of the spur is lower than on the carinal side and is nearly at right angles to the spur. On the carinal side of the spur the basal margin forms a continuous curve with the carinal margin. The furrow to the spur is closed. Internally, there is a long articular ridge that curves over the ridge running up from the spur and terminates in the articular furrow;

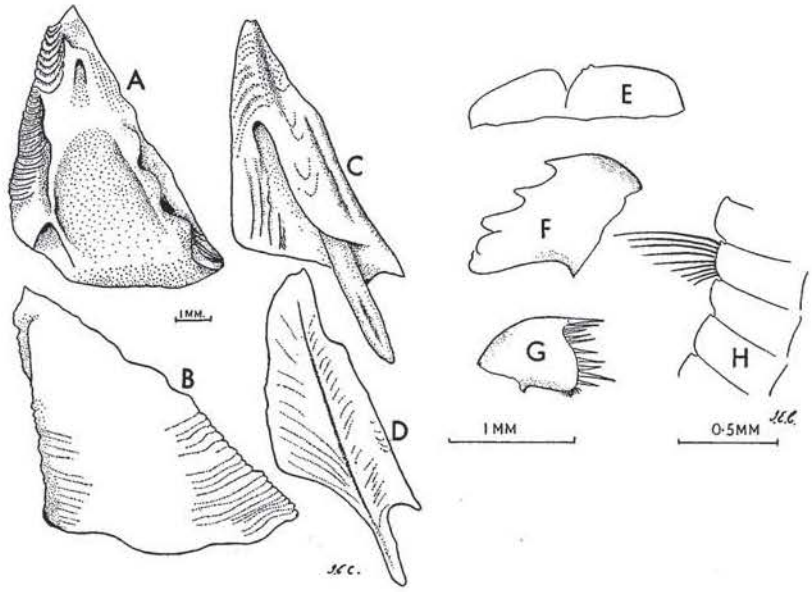

FIGURE 20. *Balanus cariosus*. A, interior of scutum. B, exterior of scutum. C, interior of tergum. D, exterior of tergum. E, labrum. F, mandible. G, maxilla. H, middle segments of cirrus VI.

the spur is very long and narrow and the crests for the attachment of the depressor muscles are well developed.

MANDIBLE (Fig. 20F): The mandible has 4 teeth, and the lower angle is rather irregular. Upper and lower margins are set with very minute spines.

MAXILLA (Fig. 20G): There are two large spines set on a prominence at the upper angle. Below this the margin is concave, then convex, the lower angle being well rounded.

LABRUM (Fig. 20E): Deeply notched. Pilsbry (1916) states that there are teeth on each side of the notch, but in the many British Columbia specimens examined there were none.

CIRRI (Fig. 20H): Nearly black. The posterior ramus of I has 17 segments, the anterior has 21. Rami of II have 15 strongly protuberant segments. Cirrus III has 15 segments, and IV has about 15 segments. Cirrus VI has 40 segments, and the median segments bear about 9 pairs of spines, but this number varies with the age of the barnacle.

Balanus crenatus Bruguière 1789

Figures 21, 22

Balanus crenatus Bruguière 1789, Encyclopède Méthodique (des Vers), p. 168. Darwin 1854, p. 261. Pilsbry 1916, p. 165; 1921, p. 111. Cornwall 1925, p. 476; 1951, p. 329. Henry 1940b, p. 19; 1942, p. 105.

DISTRIBUTION: Arctic Ocean; north Atlantic, south to Long Island Sound; north Pacific, south to Santa Barbara, California; northern Japan. Quite common, found chiefly below low tide mark, but some are exposed by the lowest tides.

GENERAL APPEARANCE (Fig. 21): This is a difficult barnacle to identify. Darwin's (1854) accurate description is as follows: "White, usually of a dirty tint from the yellowish or brownish persistent epidermis. Generally with parietes rugged and irregularly folded longitudinally, but sometimes much depressed and extremely smooth; often cylindrical and very rugged; occasionally club shaped, the upper part being much wider than the lower. Specimens in this latter condition have extremely narrow parietes, like mere ribs, and wide radii. The orifice in cylindrical varieties is often deeply toothed. The radii are generally

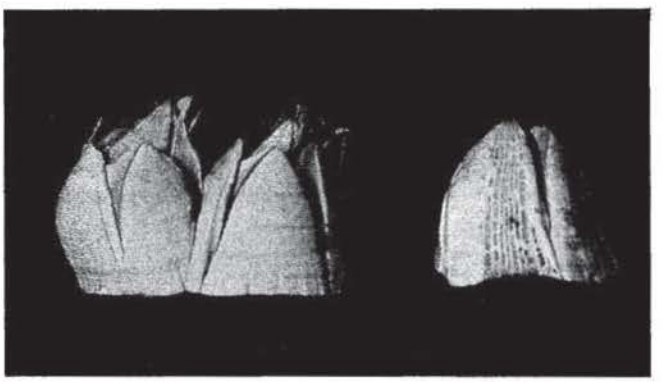

FIGURE 21. *Balanus crenatus*. The right-hand specimen has part of the wall removed to show tubes and septa. William Head, B.C.

narrow and have jagged oblique summits. But not infrequently they are so narrow as to form mere linear borders to the compartments. The orifice is rhomboidal, passing into oval, either very deeply or very slightly toothed".

SIZE: The average size of a normal specimen is about 14 mm. high and 12 mm. in diameter.

BASE: Thin, calcareous, and with furrows that correspond to the pores in the walls.

SHELL: The internal carinal margin of each compartment from the sheath to the basis, generally, but not invariably, projects a little inward beyond the general internal surface of the shell in a manner not common with other species of this genus; the basal edge of this projecting margin rests on the calcareous basis and is crenulated like the basal edge of the longitudinal parietal septa. The internal surface of the shell is ribbed, but the ribs are not very prominent. The parietal tubes are large and are crossed in the upper part and often low down by thin transverse septa; the longitudinal parietal septa are only slightly denticul-

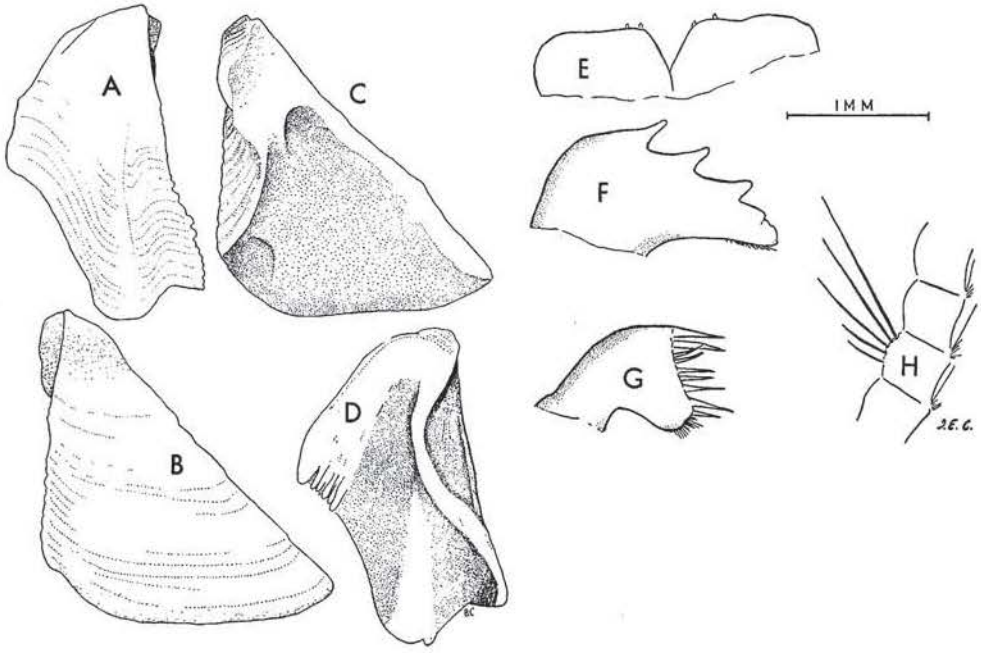

FIGURE 22. *Balanus crenatus*. A, exterior of tergum. B, exterior of scutum. C, interior of scutum. D, interior of tergum. E, labrum. F, mandible. G, maxilla. H, middle segments of cirrus VI.

ated at their bases; occasionally they divide at the basis close to the outer lamina of the parietes making some short outer subordinate pores. In the circular furrow beneath the lower edge of the sheath there are sometimes little ridges dividing it into small cells; sometimes, however, this furrow is filled up by irregular knobs of calcareous matter. The radii are always rather narrow, and often they form mere linear ribbons of nearly uniform width along the edge of the compartments. Their summits or edges are always more or less irregular and jagged, they form an angle with the horizon of generally above 40°. Their septa are fine, and barely or not at all denticulated. The alae have oblique summits; their sutural edges are rather thick and distinctly crenated.

SCUTUM (Fig. 22B, C): The lines of growth are not very prominent and sometimes there is a thin membrane which may be partly disintegrated. When the cover-plates are in position the beaks of the two scuta project as two small flattened points. Internally, the articular ridge is well developed but there is no adductor ridge. There is a distinct, but shallow, impression for the attachment of the adductor muscle, and the depression for the lateral depressor muscle is small and variable.

TERGUM (Fig. 22A, D): The growth ridges are not prominent; there is a faint longitudinal depression the same width as the spur, which is wide and short.

The spur is about its own width from the basiscutal angle. Internally, the upper part of the articular ridge is well developed; the crests for the depressor muscles are numerous, but variable.

MANDIBLE (Fig. 22F): On the cutting margin of the mandible there are 3 large teeth and 1 small one. There are a few small spines on the lower margin.

MAXILLA (Fig. 22G): There is generally a small notch under the two lagre spines at the upper angle, but this is variable.

LABRUM (Fig. 22E): There is a deep wide notch, and the margin is level on each side of it. In the specimen figured there were 2 teeth on each side of the notch, but the number of teeth varies.

CIRRI (Fig. 22H): The first pair have rami of unequal length, one ramus being twice the length of the other, one specimen had 11 and 24, a smaller specimen 7 and 12. The second cirrus has only 2 or 3 more segments than the shorter ramus of the first. The third very little longer than the second. The median segment of the sixth cirrus has about 5 pairs of spines (Fig. 22H); the number varies with the age of the barnacle.

REMARKS: Most of the American records of this species are from low tide to 50 fathoms, but they have been taken from 80 to 90 fathoms.

Pleistocene specimens of *Balanus crenatus* have been collected from Lawlors Lake, St. John County, New Brunswick. They have also been found in interglacial deposits near Jordan River, Vancouver Island. These fossil specimens do not differ from the living specimens.

The subspecies *B. crenatus curviscutum* Pilsbry 1916, from Bristol Bay, Alaska, is said to differ in having a narrower tergal spur than the typical form. It is recorded also from Port Townsend, Washington, by Henry (1942).

Balanus engbergi Pilsbry 1921

Figures 23, 24

Balanus engbergi Pilsbry 1921, p. 113. Henry 1940b, p. 33; 1942, p. 107.

DISTRIBUTION: Alaska to Oregon; rare. The only known British Columbia specimens were dredged off Victoria.

GENERAL APPEARANCE (Fig. 23): Strongly ribbed, the ribs unequal. Orifice is small and oval. The compartments may be covered with a thin pale cuticle, but this may be all or partly worn off.

SIZE: The dimensions of the type are: greatest basal diameter 14 mm., height 7.3 mm., length of orifice 2.5 mm.

BASE: Calcareous, radially grooved, lacking pores.

SHELL (Fig. 23): Compartments forming the wall very firmly united; they have no tubes and are thick and deeply furrowed between the ribs. The ribs are unequal, and the larger ones have flat-bottomed grooves with raised borders that give the barnacle its characteristic appearance. Internally, the sheath is

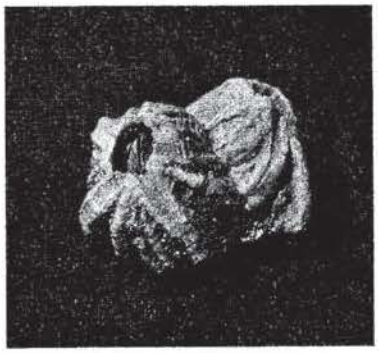

FIGURE 23. *Balanus engbergi.* Dredged off Victoria, B.C.

short and there are deep cavities below it. Below the sheath the walls are folded like a heavy curtain, and near the base they are closely ribbed.

RADII: Very narrow.

SCUTUM (Fig. 24A, D): The scutum resembles that of *Balanus hesperius.* The tergal border is longer than the basal and is convex. The occludent margin has a regular series of rounded oblique ridges. The exterior is convex between the apex and the basal margin, and is closely and regularly sculptured with lines of growth which are finely striate from apex to basal margin. Internally there is a strong articular ridge, but no adductor ridge. The pits for the attachment of the adductor and that for the depressor muscles are both deep.

TERGUM (Fig. 24B, C): Thin and flat, with fine transverse growth ridges and

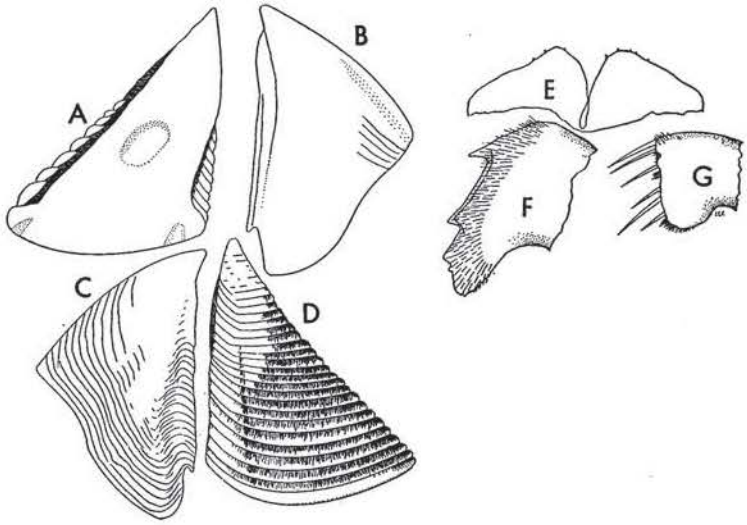

FIGURE 24. *Balanus engbergi.* A, interior of scutum. B, interior of tergum. C, exterior of tergum. D, exterior of scutum. E, labrum. F, mandible. G, maxilla.

some radial striae. The spur is about half the width of the basal margin of the valve. Internally there are 5 shallow crests for the attachment of the depressor muscle.

MANDIBLE (Fig. 24F): Cutting edge with 2 strong teeth and 1 small one. Lower angle irregular. Surface spinose; spines absent from the upper margin.

MAXILLA (Fig. 24G): Two spines at the upper angle. Margin rather irregular, with several large spines and a few small spines; lower margin spinose.

LABRUM (Fig. 24E): Deeply notched, with 3 very small teeth on one side and 4 on the other. No spines on the margin.

CIRRI: The first cirrus has rami of unequal length, one has 8 and the other 21 segments. Cirrus II has nearly equal segments. Median segment of cirrus VI has 4 pairs of spines.

Balanus glandulus Darwin 1854

Figures 25, 26

Balanus glandulus Darwin 1854, p. 265. Pilsbry 1916, p. 178. Cornwall 1925, p. 483; 1951, p. 326. Henry 1940b, p. 15; 1942, p. 108.
Balanus crenatus of Pilsbry 1907b, p. 75 (not Bruguière).

DISTRIBUTION: From California to the Aleutian Islands; chiefly in the intertidal zone. Very abundant on rocks of the intertidal zone in British Columbia.

GENERAL APPEARANCE (Fig. 25): The shell of a normal specimen is conical, but they become tubular when crowded.

SIZE: Large specimens are commonly about 18 mm. in diameter and 10 mm. high.

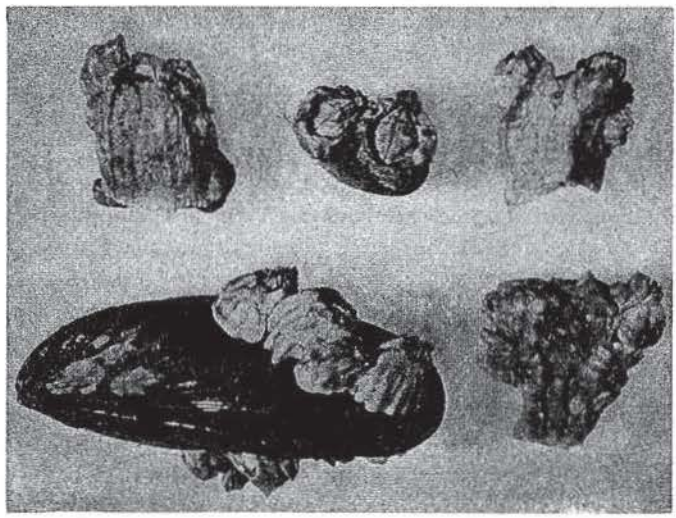

FIGURE 25. *Balanus glandulus*. Specimens from Departure Bay, B.C. The parietal tubes are exposed on a portion of the worn shell of the large specimen at upper left. The middle pair show the characteristic cross-line, different from that of *Chthamalus* (Fig. 17F).

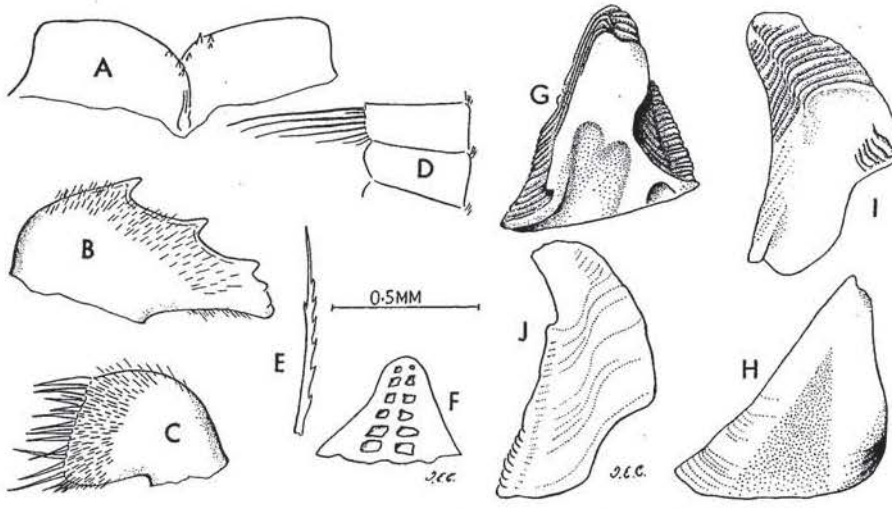

FIGURE 26. *Balanus glandulus*. A, labrum. B, mandible. C, maxilla. D, middle segments of cirrus VI. E, spine from cirrus, highly magnified. F, upper portion of carina, with outer lamina filed off to show tubes and cross septa. G, interior of scutum. H, exterior of scutum. I, interior of tergum. J, exterior of tergum.

BASE (Fig. 16): Calcareous, very thin and firmly attached to its support. The base usually remains when the barnacle is removed.

SHELL (Fig. 25): Smooth or ribbed. The parietal tubes are very small and are usually filled with white powder; if the powder is cleaned out the transverse septa can be seen (Fig. 26F). However some specimens lack tubes entirely. Internally, the sheath has a broad excavation under it, and this is periodically closed by a horizontal wall thus forming a series of cells. There is one row of these cells in each carinolateral and two in each of the other plates.

RADII: Very narrow in some specimens; in others, they are distinctly differentiated from the parietes, but they are never really wide.

SCUTA (Fig. 26G, H): On the exterior of the tergum the growth ridges are irregular and prominent. In young specimens there is a triangular dark area with its base on the basal margin of the plate. This is a translucent area through which the black lining of the plate can be seen. In old specimens the plate becomes thick and this dark area cannot be seen. Internally the articular furrow is deep, articular ridge is short and prominent. Adductor pit variable. There is a deep arched-over pit below the juncture of the articular and adductor ridges. The pit for the attachment of the lateral depressor muscle is deep and marginal.

TERGA (Fig. 26I, J): Apex of the tergum rounded and projecting toward the scutum. Spur rounded and very near the scutal margin. Articular furrow deep, and crests for the attachment of the depressor muscle are well developed.

MANDIBLE (Fig. 26B): There are 3 well-developed teeth, and the lower angle is irregular. The upper and lower margins are hairy.

MAXILLA (Fig. 26C): Two large spines at the upper angle, then several small spines; the largest spine on the margin is near the lower angle. Many single spinules on the sides; upper and lower margins hairy.

LABRUM (Fig. 26A): Deeply notched, the margin on each side of it curved. The number of teeth varies; in one specimen there were as many as 7 teeth on one side and 6 on the other.

CIRRI (Fig. 26D): First pair with the rami unequal by 3 or 4 segments, the longer ramus being only 1/4 of its own length longer than the other ramus. Second pair short with the segments somewhat protuberant. Third pair with the rami 1/3 longer than those of the second pair. Sixth pair with the upper segments elongated and bearing 6 or 7 pairs of spines. The cirri are densely pigmented in many specimens.

Balanus hesperius Pilsbry 1916

Figure 27

Balanus hesperius Pilsbry 1916, p. 193.
Balanus hesperius, forma *laevidomus* Pilsbry 1916, p. 196.
Balanus hesperius laevidomus Henry 1940b, p. 31.

DISTRIBUTION: Northeastern Pacific Ocean, from the Bering Sea to Monterey, California. Recorded by Pilsbry from Parry Passage, Graham Island, B.C. The form *laevidomus* is the common one in Puget Sound.

GENERAL APPEARANCE (Fig. 27): A low conical or cylindrical barnacle, usually with a large orifice. Wall white, partly covered with thin yellowish epidermis. Smooth or ribbed: up to 7 ribs on rostrum, carina and laterals, 2 or 3 on carinolaterals.

SIZE: Up to 21 mm. in diameter and 14 mm. high.

BASE: Calcareous, thin, grooved internally.

RADII: Wide, summits oblique.

ALAE: Exposed, summits only slightly oblique.

PARIETES: Strongly ribbed internally; tubes absent.

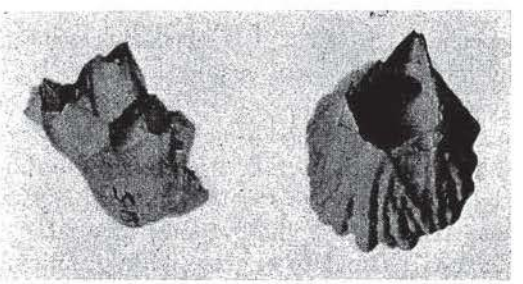

FIGURE 27. *Balanus hesperius.* Left, group of smooth specimens. Right, specimen with compartments ribbed at base. (Photographs from Henry, 1940b.)

SCUTUM: Covered with close, sharp growth-ridges, every other one more prolonged and higher on the occludent margin. Articular ridge very high, reflexed; adductor ridge very short, passing upward into a heavy callus between the articular ridge and the deep pit of the adductor muscle, which callus is cut into several sharp ridges.

TERGUM: Spur short, very close to the basiscutal angle.

MANDIBLE: With 3 strong teeth and 2 weak or obsolete ones.

MAXILLA: Two large spines at upper edge and one near lower edge, with smaller ones interspersed.

LABRUM: With 2 or 3 teeth on each side of the notch; sparsely hairy.

CIRRI: Cirrus VI with 34 segments on both rami, and 3 or 4 pairs of spines per segment.

REMARKS: Pilsbry distinguished the "form" (not subspecies) *laevidomus* mainly by the fewer and more widely spaced growth ridges on the scutum and its usually longer basal margin. More extensive material will probably be needed to assess the usefulness of this name.

Balanus nubilus Darwin 1854

Figures 28, 29

Balanus nubilus Darwin 1854, p. 253. Pilsbry 1916, p. 131. Cornwall 1925, p. 479; 1951, p. 335. Henry 1940b, p. 29; 1942, p. 112.
Balanus flos Pilsbry 1907b, p. 201; 1916, p. 135.
Balanus altissimus Cornwall 1936, p. 472.

DISTRIBUTION: West coast of North America, from low tide mark to about 30 fathoms. Common where there is strong tidal action.

SIZE: Some specimens are 100 mm. or more in diameter, and nearly the same in height.

GENERAL APPEARANCE (Fig. 28): A very large barnacle, steep-walled, and with a wide opening. Usually much eroded. Interior of scuta and terga buff. Usually a patch of purple near the beak of the tergum.

BASE: Thick at the edges, thin at the centre. Imperfectly porous. Room is gained by deepening the base.

SHELL: Small specimens are strongly ribbed, but it is rare to find a large one that shows the true form as they are usually attacked by boring sponges that destroy the sculpture of the shell. The sutures between the wall plates are marked by wide areas of denticulation which increases in extent as the barnacle grows. Figure 29H shows a small portion of this denticulation on the edge of the carinolateral compartment of a large specimen. Figure 29E shows the denticulation between the base and the bottom of a compartment.

SCUTUM (Fig. 29B, C): The lines of growth are prominent, deep and regular. Internally, the articular ridge is not well developed: the adductor ridge is prominent and is produced downward and makes a cavity for the depressor muscle.

FIGURE 28. *Balanus nubilus*. A group of individuals, 3 to 5 inches tall, under an overhanging rock near lowest low tide. The picture shows also pendulous sea anemones, and starfish at upper right and left. Dodds Narrows, Nanaimo, B.C., June, 1954.

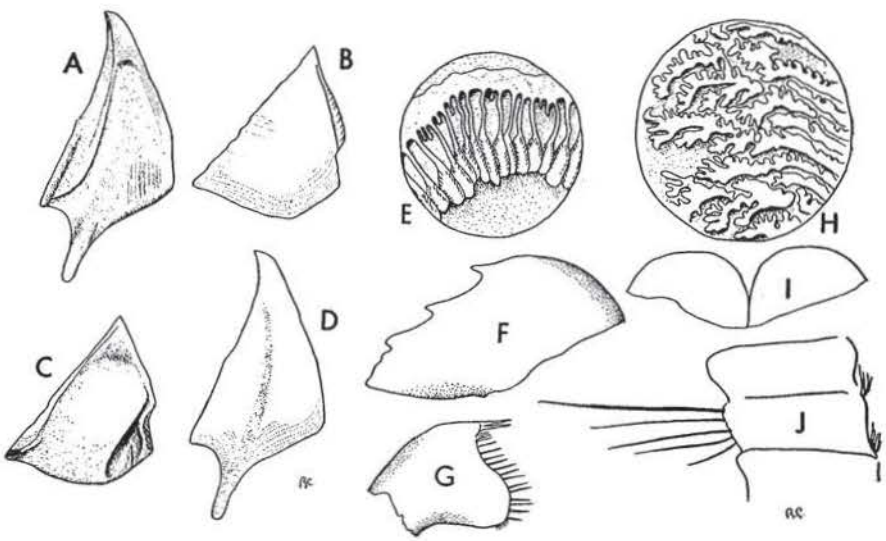

FIGURE 29. *Balanus nubilus*. A, interior of tergum. B, exterior of scutum. C, interior of scutum. D, exterior of tergum. E, denticulation between compartment and base, highly magnified. F, mandible. G, maxilla. H, denticulation between compartments. I, labrum. J, middle segments of sixth cirrus.

TERGUM (Fig. 29A, D): Externally, the growth ridges are narrow and regular; the longitudinal furrow from the beak to the spur is very shallow. Internally, the lower quarter of the scutal margin projects in a characteristic manner. The crests for the depressor muscle are numerous. In old specimens the beak is very prominent.

MANDIBLE (Fig. 29F): There are 3 small teeth and the upper and lower margins are hairy.

MAXILLA (Fig. 29G): The two spines at the top are set on a prominence and are small. Below them the margin is curved and bears many spines that are nearly as long as the top ones. The upper and lower margins are hairy.

LABRUM (Fig. 29I): Convexly curved; the outline of the labrum of this species is one of its most distinctive characteristics. The notch is deep and there is usually a single tooth on one side.

CIRRI (Fig. 29J): Cirrus I has rami of unequal length. In the specimen described the two rami have 32 and 17 segments. The margin of the shorter ramus is strongly protuberant. Cirrus II has 17 and 16 strongly protuberant segments. Cirrus III has 20 segments in each ramus. Cirrus IV has a small group of erect spinules on the anterior part of the lower segments, also a distal row of spinules. Cirri V and VI have both segments of the pedicle densely spinulose near their distal anterior borders, and the median segments have six pairs of spines. Part of the spines of the cirri—especially those on their inner faces—are beautifully pectinated on both sides.

REMARKS: This species is often found attached in large groups to the holdfasts of kelp.

Balanus rostratus Hoek 1883

Figures 30, 31

Balanus rostratus Hoek 1883, Challenger Report, Zool., 8, p. 152. Pilsbry 1916, p. 138.
Balanus rostratus alaskensis Pilsbry 1916, p. 141. Cornwall 1925, p. 484. Henry 1940b, p. 21; 1942, p. 117.
Balanus rostratus heteropus Pilsbry 1916, p. 142.

DISTRIBUTION: Alaska to Puget Sound, at depths up to 60 fathoms. Taken at William Head, Vancouver Island, where they were exposed by very low tides. Recorded at Seymour Inlet and Wentworth Island (Henry, 1942).

SIZE: A specimen from William Head, Vancouver Island, is 56 mm. in diameter; one from Kodiak is 61 mm. in diameter and 53 mm. high.

GENERAL APPEARANCE: The shell is conical, usually extensively eroded. Radii narrow, and walls smooth.

BASE: Thin at the centre; radially grooved; pores absent.

SHELL (Fig. 30): Cross-septa present in the parietal tubes. Radii very narrow and with a glossy surface.

SCUTUM: Externally, the growth ridges are prominent and regular, and they

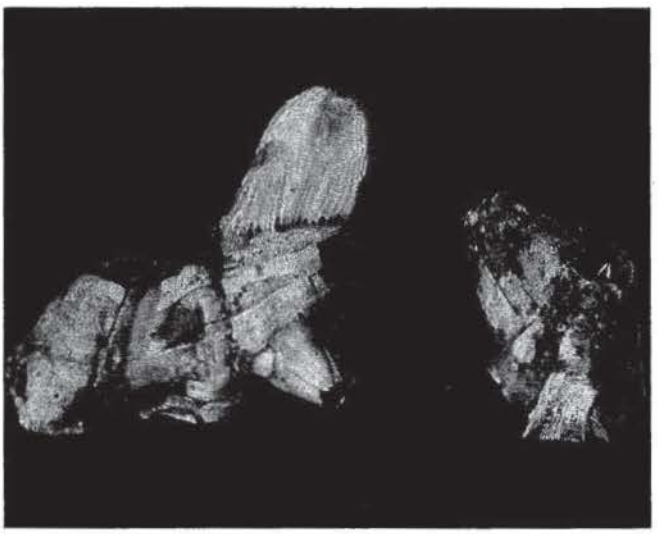

FIGURE 30. *Balanus rostratus*. The upper specimen on the left has part of the wall removed to show tubes and septa. William Head, B.C.

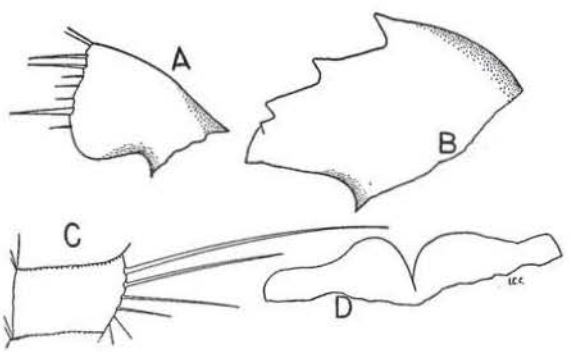

FIGURE 31. *Balanus rostratus*. A, maxilla. B, mandible. C, median segment of cirrus VI. D, abrum.

are crossed by very fine longitudinal striae. Adductor ridge prominent. Articular furrow shallow. Pit for the lateral depressor muscle deep and narrow, with several longitudinal ribs in it. Apices of the scuta faintly pink.

TERGUM: External surface flat, except for the broad, shallow depression running to the spur. Internally, the articular furrow is shallow, and the articular ridge not prominent. Crests for the attachment of the depressor muscle long, but weakly developed. Apex beaked and faintly pink. Spur broad and set close to the scutal margin.

MANDIBLE (Fig. 31B): Three large conical teeth, the fourth tooth very small. Lower angle sharp; the upper and lower margins with short, small spines.

MAXILLA (Fig. 31A): There are two small spines above the two large spines; below the latter there is a depression not deep enough to be called a notch. A little more than half way down the margin there is another large spine, and there are several small spines below it. The lower angle is sharp.

LABRUM (Fig. 31D): There were no teeth on the labrum of the specimen figured, but some specimens have a single small tooth on each side. The notch is not very deep.

CIRRI (Fig. 31C): The first cirrus has rami of 32 and 17 segments. The second and third cirri are about equal in length; the pedicle of the third is very wide. The median segments of the sixth cirrus bear 5 pairs of spines. There is a row of multifid spinules at the upper margin of each segment.

REMARKS: The status of the several varieties of *rostratus* described by Pilsbry is still much in doubt, so only the specific name is used here. Henry (1940b) synonymized *heteropus* with *alaskensis*.

CORONULINAE (SESSILE WHALE BARNACLES)

KEY

1 Body contained within the wall (Fig. 9) 2

Body elongate, resembling a pedunculate barnacle, projecting much beyond the small star-shaped wall which is embedded in the whale's skin (Fig. 39); rare in British Columbia *Xenobalanus globicipitis* (p. 46)

2 Wall double, the parietes with regular ribs which are finely "beaded" (Fig. 33A); found on humpback whales *Coronula* 3

Wall single, covered with irregular radial ridges separated by deep fissures (Fig. 37A); found on gray whales *Cryptolepas rachianecti* (p. 44)

3 Hole at the base of the body chamber less than half the diameter of the orifice (Fig. 33B); usually not more than half of the vertical height of the wall embedded in the skin, large specimens being little or not at all embedded (Fig. 33A); found mostly on the whale's throat folds, other parts of the ventral surface, and on the rostral tubercles *Coronula diadema* (p. 40)

Hole at the base of the body chamber about 3/4 as large as the orifice (Fig. 35B); almost the whole of the vertical height of the wall buried in the skin, with only a part of the flat upper surface exposed; a smaller and more depressed species (Fig. 35A), usually found on the flippers or the flat surfaces of the lower jaw *Coronula reginae* (p. 43)

Coronula diadema (Linnaeus) 1767

Figures 9, 32, 33, 34

Lepas diadema Linnaeus 1767, Syst. Naturae, 12th ed., p. 1109.
Coronula diadema Darwin 1854, p. 417. Pilsbry 1916, p. 273. Cornwall 1924, p. 421; 1927, p. 504.

DISTRIBUTION: Cool to subtropical seas of both hemispheres, wherever the humpback whale (*Megaptera nodosa*) occurs. It occurs mainly on the lips, throat and fins of the whale. In British Columbia it was abundant on all humpbacks

FIGURE 32. Throat of humpback whale showing many *Coronula diadema*, some of them bearing *Conchoderma auritum*. From Kyuquot Sound, 1926.

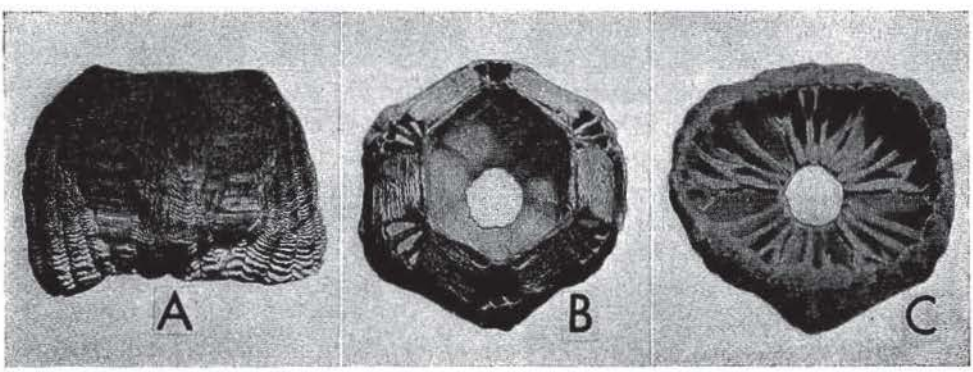

FIGURE 33. *Coronula diadema*. A, side view. B, top view. C, bottom view. From a humpback whale, Kyuquot Sound, 1926.

inspected in 1926 at Kyuquot Sound, and in recent years at Quatsino Sound. This species has not been seen on any other kind of whale in British Columbia.

SIZE: The specimen of Figure 34 was 46 mm. in diameter and 39 mm. in height. Large ones are up to 86 mm. in diameter and 67 mm. high.

GENERAL APPEARANCE (Fig. 9, 33): Barrel-shaped, heavy, with 6 sets of three apertures each between the radii at the top of the shell. The wide orifice is

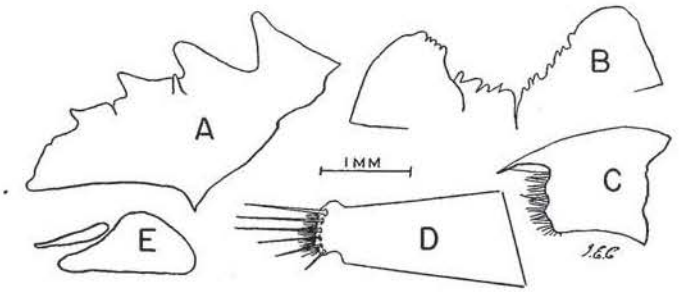

FIGURE 34. *Coronula diadema*. A, outline of cutting edge of mandible. B, outline of labrum. C, maxilla. D, middle segment of cirrus VI. E, rudimentary cover plates. Taken from a humpback whale caught off Kyuquot Sound.

covered with a tough membrane, and there is a hood in the centre through which the cirri are projected (Fig. 9).

BASE: Membranous; very much smaller than the orifice.

SHELL (Fig. 33): none of the many specimens collected were embedded in the skin of the whale, but even the smallest had the skin projecting into the spaces formed by the shell. These spaces are formed by the greatly developed ribs, each of which has a T-shaped external fold whose transverse portions touch, forming enclosed spaces between the ribs. The radii are well developed, and are very little below the level of the ribs; they are marked by fine growth lines, and the exposed surface of the T-shaped folds have fine growth lines crossed by longitudinal striae, giving them a beaded appearance. Externally, the shell appears to be formed by triangles fitted together; the radii form one set with their apices down, and the exposed surfaces of the ribs form the other, with their apices up. The orifice is hexagonal, and is formed mainly by the straight edges of the radii. The ribs form but a small portion of the margin of the orifice; each rib usually has its top sufficiently eroded to expose the three compartments with black skin of the whale inside. When the barnacle is attached to the whale these eroded areas appear like groups of three black lines radiating from each corner of the hexagonal orifice.

SCUTA AND TERGA (Fig. 34E): Both cover plates are rudimentary, and the terga may be wanting.

MANDIBLE (Fig. 34A): The number of teeth varies with the size of the barnacle, small ones have 2 or 3, and large ones 5. The lower angle is irregular.

MAXILLA (Fig. 34C): The large spine at the upper angle is not articulated but is an extension of the body of the maxilla. The margin below the large spine is irregular, and bears many small spines.

LABRUM (Fig. 34B): The margin of the labrum bears many irregular teeth, and is deeply notched.

CIRRI: The cirri are rather short and the spines are small and strong. There are six spines on the margin of the median segment of the sixth cirrus.

BRANCHIAE: The great development of the branchiae of whale barnacles is very remarkable; those of the Coronulinae being the largest found on any barnacle. They are attached to the under side of the opercular membrane near its edge, in a line extending from the carinal margin nearly to the point of attachment of the animal's body. Beyond their line of attachment they hang loose and extend to the rostral margin of the membrane, where they meet. Each branchia consists of two folds, each of which is deeply plicated; they hang down beyond the body and meet under it. The amphipod *Paracyamus boopis* Lutkin, which is found in great numbers clinging to the whale barnacles, also has very large branchiae.

Coronula reginae Darwin 1854

Figures 35, 36

Coronula reginae Darwin 1854, p. 419. Pilsbry 1916, p. 275. Cornwall 1927, p. 507.

DISTRIBUTION: Mainly found on the humpback whale (*Megaptera nodosa*), it occurs on the lips and flippers of that species throughout its range in the north and south Atlantic and Pacific Oceans. In British Columbia, it was common at Kyuquot Sound in 1926 and it has been found on all humpbacks landed in Quatsino Sound in recent years. At Coal Harbour (Quatsino) single specimens were also taken from the tail of a sperm whale (*Physeter macrocephalus*), and from the lower jaw of a blue whale (*Balaenoptera musculus*) (G. C. Pike).

DIMENSIONS: The specimen of Figure 36 was 49 mm. in diameter and 20 mm. in height.

GENERAL APPEARANCE (Fig. 35): Similar to *C. diadema* but much more depressed.

BASE (Fig. 35): Membranous; somewhat smaller than the orifice.

SHELL (Fig. 35): Much more depressed and rounded than that of *C. diadema*.

SCUTA AND TERGA: The cover plates are often wanting, but when present they resemble those of *C. diadema*.

MANDIBLE (Fig. 36A, C): Like that of *C. diadema*, but the lower angle bears many small spines.

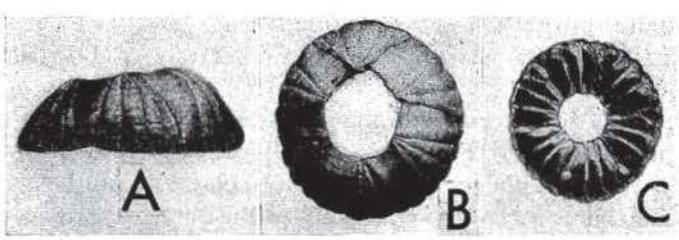

FIGURE 35. *Coronula reginae*. A, side view. B, top view. C, bottom view. The shell is usually embedded for two-thirds of its height in the skin of the whale.

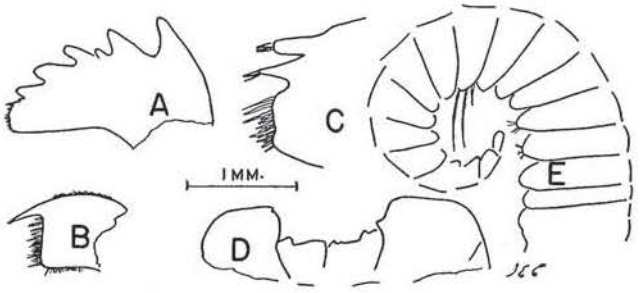

FIGURE 36. *Coronula reginae*. A, mandible. B, maxilla. C, lower angle of mandible highly magnified. D, outline of labrum. E, cirrus VI. Taken from a humpback whale caught off Kyuquot Sound.

MAXILLA (Fig. 36B): The margin below the upper great spine is even, and the upper and lower margins bear many fine spines.

LABRUM (Fig. 36D): The outline is very irregular; teeth smaller than in *C. diadema*.

CIRRI (Fig. 36E): Light brown in color, short and strongly made. There are 3 short spines on the middle segment of cirrus VI.

BRANCHIAE: Very large, consisting of two folds that nearly surround the body.

REMARKS: Darwin (1854) states that all parts of the body-chamber can be seen from one point of view. I have examined specimens from the north and south Pacific, from the Atlantic and some taken in the India Ocean, and the diameter of the opercular opening of all is less than the greatest diameter of the body-chamber. It has been stated that this species is found mainly on the light parts of the skin of the whale, but I have found them on both the light and dark skin.

Cryptolepas rachianecti Dall 1872
Figures 37, 38

Cryptolepas rachianecti Dall 1872, p. 300. Pilsbry 1916, p. 279.

DISTRIBUTION: Bering Sea to Lower California and Korea; Hawaiian Islands. Occurs only on the gray whale, *Eschrichtius glaucus*. It was present in large numbers on all of the 10 gray whales landed at Coal Harbour, Quatsino Sound, in April, 1953 (G. C. Pike).

SIZE: Greatest diameter 52 mm., height 14 mm.

GENERAL APPEARANCE (Fig. 37E): Usually the shell is covered by the whale's skin so that only the sulphur-yellow opercular membrane can be seen. The hood in the centre of the membrane is extremely protusible.

BASE: Membranous, of about the same diameter as the opercular opening.

SHELL (Fig. 37, E–G): Wholly embedded in the whale's skin. The 4 to 6 ribs

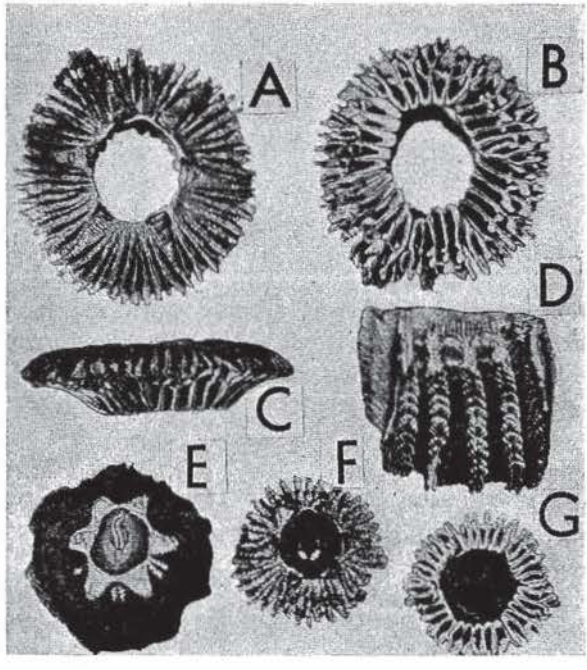

FIGURE 37. *Cryptolepas rachianecti.* A, top view with skin removed. B, bottom view. C, side view. D, portion of edge, magnified. E, top view with body in position in the whale's skin. F, top view. G, bottom view. From Neah Bay, Washington. (After Pilsbry, 1916).

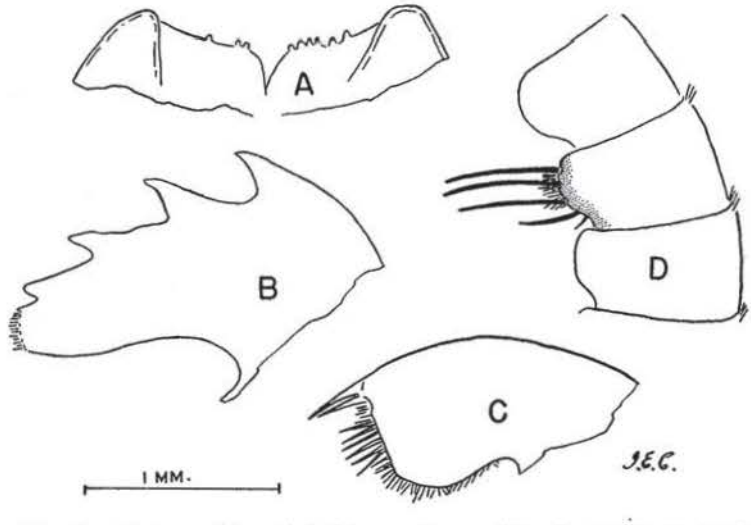

FIGURE 38. *Cryptolepas rachianecti.* A, labrum. B, mandible. C, maxilla. D, median segment of cirrus VI.

on each compartment are actually loops of the wall (see Fig. 37B); they are denticulate on both sides. Usually there are about 30 ribs, but the number varies. The wall round the body-chamber is thick and solid, but has a friable porous outer layer that forms the greater part of the substance of the ribs. The sheath is transversely grooved, and it is slightly shorter than the body-chamber.

SCUTA AND TERGA: The cover-plates are very small, and their exposed surface is worn off.

MANDIBLE (Fig. 38B): The mandibles have 4 large teeth, and the lower angle bears a row of small spines.

MAXILLA (Fig. 38C): At the upper angle there are 2 teeth, and below them is a slight depression; below the depression the margin is straight. The lower angle is rounded, and bears many fine spines.

LABRUM (Fig. 38A): Deeply notched, and with an irregular number of teeth, frequently more on one side than on the other.

CIRRI: Short and stout. Segments very protuberant, and the spines of the few that were examined do not taper to a point as is usual. The middle segment of cirrus VI has 4 large spines and one not so large (Fig. 38D). There are groups of small spines between the large ones.

Xenobalanus globicipitis Steenstrup 1851

Figures 39, 40

Xenobalanus globicipitis Steenstrup 1851, Videnskab. Medd. Naturhist. Forening Kjöbenhavn, Plate 3, Figs. 11–15. Darwin 1854, p. 438. Pilsbry 1916, p. 283.

DISTRIBUTION: Atlantic and Pacific Oceans. The writer took several specimens from the tip of the fin of a sei whale (*Balaenoptera borealis*) at Kyuquot Sound in 1925. Only one specimen was found by Mr. Pike during the Quatsino operations of recent years: a small specimen attached to the side of the head of a blue whale (*Balaenoptera musculus*). In the Atlantic Ocean this species occurs on the blackfish (*Globiocephalus intermedius*).

SIZE: Body up to 43 mm. in length and 5 mm. in diameter; shell about 10 mm. in greatest diameter.

GENERAL APPEARANCE (Fig. 39): There is no other barnacle that can be mistaken for this one. It hangs like a tassel at the tip of the flipper, and the rudimentary shell is nearly buried in the skin of the whale.

BASE (Fig. 40D): Membranous, star-shaped.

PSEUDO-PEDUNCLE (Fig. 39): There is no true peduncle, but the hood that forms the body-chamber is elongated to resemble one.

SCUTA AND TERGA: No traces of cover-plates could be found in any of the specimens examined.

MANDIBLE (Fig. 40E): The mandibles have 3 small teeth, and the lower angle is rounded.

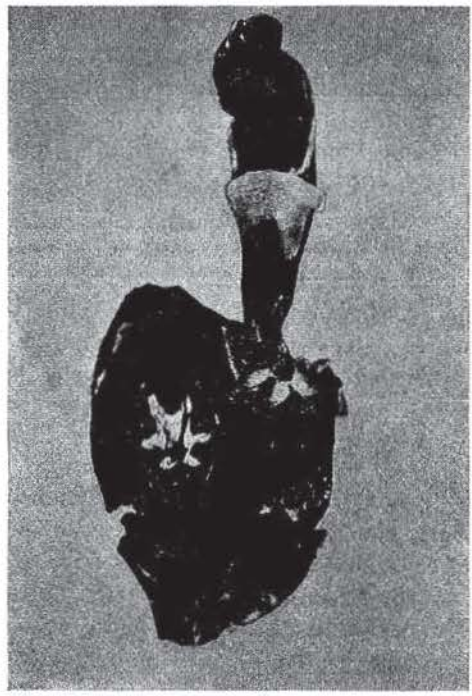

FIGURE 39. *Xenobalanus globicipitis*. The black oval is a piece of whale's skin showing two fresh star-shaped marks of the barnacle's wall, and a well-healed mark of a former attachment (below the left white star). The specimen has been slightly shifted to the left from its base; the white ring about its middle is caused by an air space between the membranous collar and the animal proper.

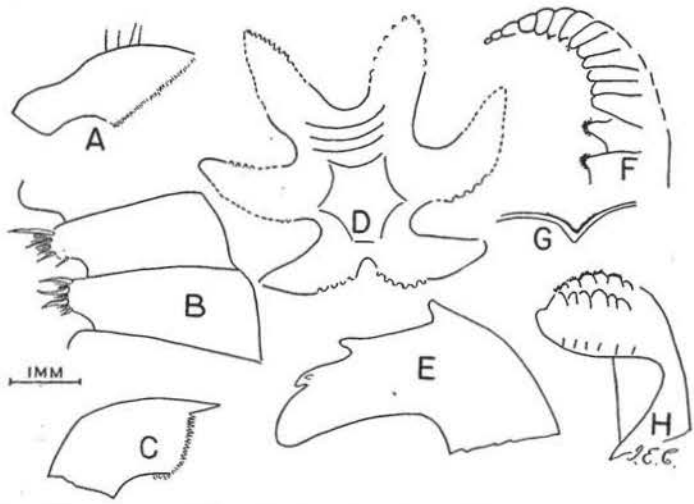

FIGURE 40. *Xenobalanus globicipitis*. A, palpus. B, middle segment of cirrus VI. C, maxilla, D, outline of shell, very highly magnified; this is embedded in skin of whale. E, mandible. F. cirrus VI. G, outline of labrum. H, cirrus I.

MAXILLA (Fig. 40C): There is a large spine at the upper angle, and below it there are many fine spines. The lower angle is rounded.

LABRUM (Fig. 40G): The labrum is notched, and the margin bears many small spines. There are no teeth.

CIRRI: Short and stout. There are 4 very short stout spines in the middle segment of cirrus VI (Fig. 40F). The first cirrus is short and the rami are bent over in a peculiar manner (Fig. 40H).

SHELL (Fig. 40D): Small and star-shaped; it is buried in the skin of the whale and acts as an anchor for the pseudo-peduncle.

BRANCHIAE: As in all whale barnacles, the branchiae are greatly developed. They are attached nearly half way down the sack on the carinal margin, and consist of two folds of which the outer is slightly longer than the inner.

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