

FICHES D'IDENTIFICATION DU ZOOPLANCTON

Editées par
J. H. FRASER

Marine Laboratory, P.O. Box 101, Victoria Road
Aberdeen AB9 8DB, Scotland

FICHE NO. 163

CRUSTACEA

CIRRIPEDIA: BALANOMORPH NAUPLII OF THE NW ATLANTIC SHORES

(Literature on six species common in the NE Atlantic is listed)

by

W. H. Lang

EPA Environmental Research Laboratory
Narragansett, Rhode Island 02882, USA

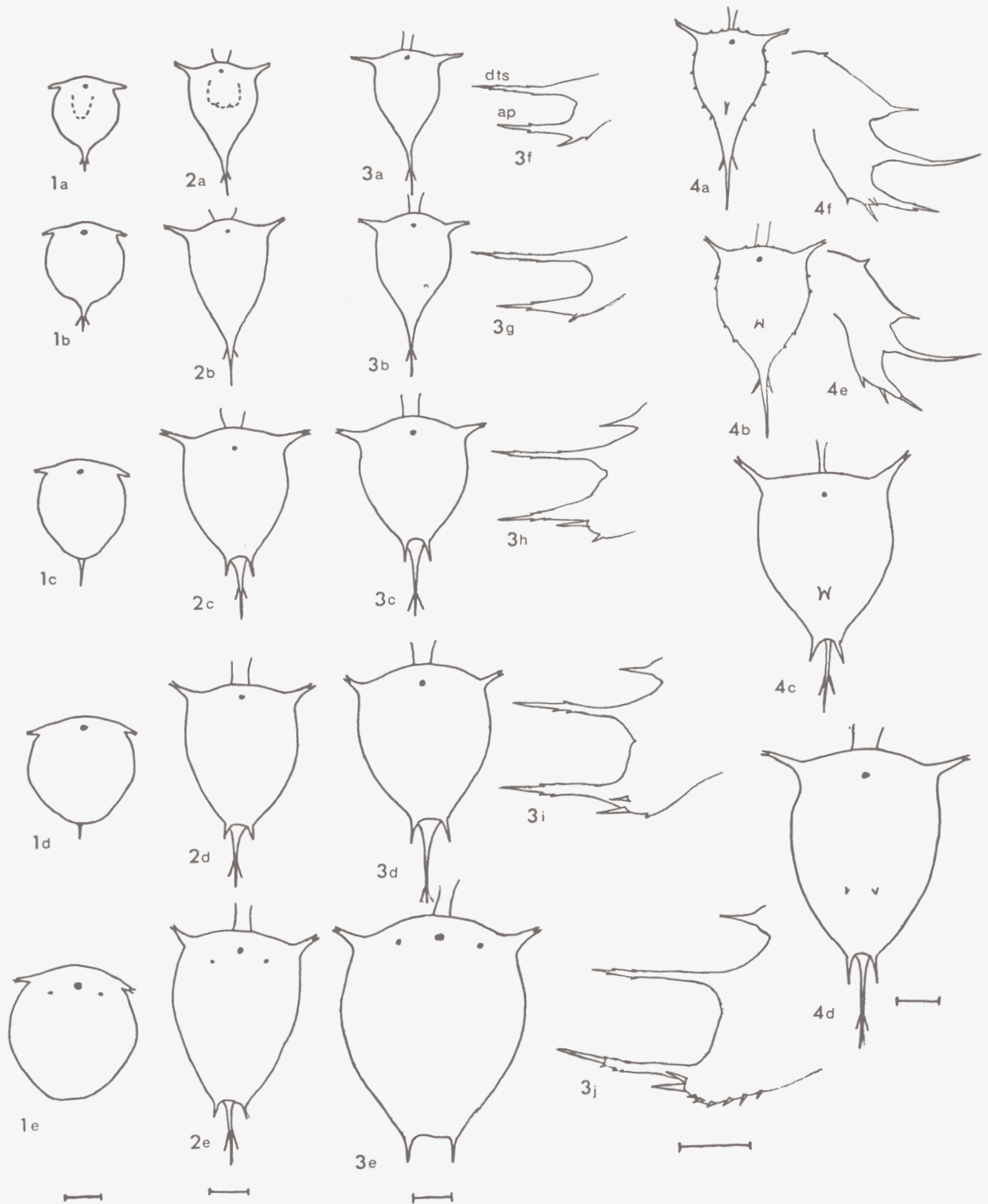
(This publication may be referred to in the following form:
Lang, W. H. 1980. Balanomorph nauplii of the NW Atlantic shores.
Fich. Ident. Zooplancton 163: 6 pp.)

<https://doi.org/10.17895/ices.pub.5148>

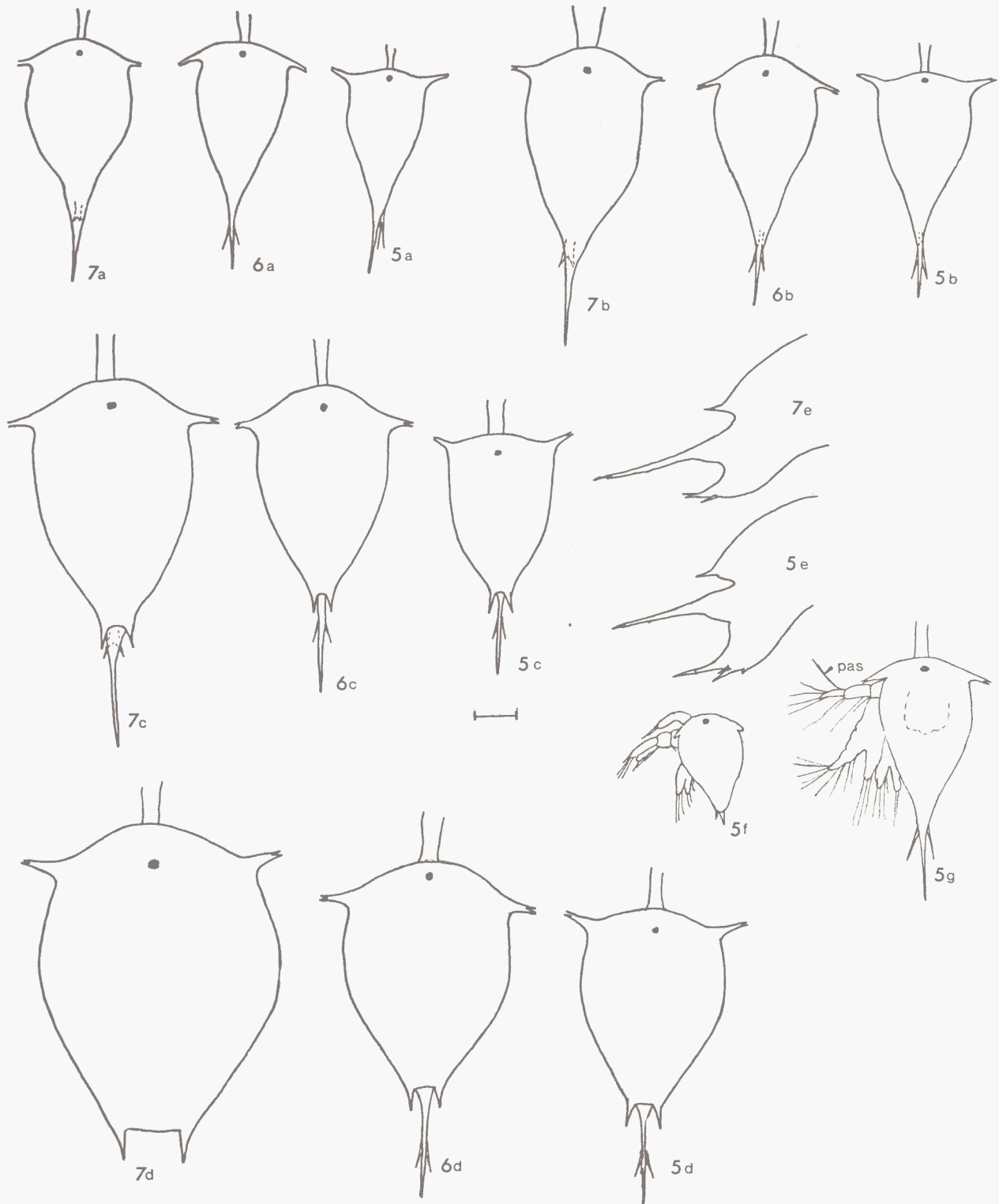
Conseil International pour l'Exploration de la Mer
Palægade 2-4, DK-1261 Copenhagen K
Danemark

SEPTEMBRE 1980

ISSN 0443-9155



Figures 1-4: 1. *Chthamalus fragilis*: 1a-1e, naupliar stages II-VI. 2. *Balanus eburneus*: 2a-2e, naupliar stages II-VI. 3. *Balanus improvisus*: 3a-3e, naupliar stages II-VI; 3f-3j, abdominal process (ap) and dorsal thoracic spine (dts) of naupliar stages II-VI. 4. *Balanus venustus*: 4a-4d, naupliar stages II-V; 4e, ap and dts of stage IV; 4f, ap and dts of stage V. Scale lines represent 0.1 mm.



Figures 5-7: 5. *Balanus crenatus*: 5a-5d, naupliar stages II-V; 5c, ap and dts of stage V; 5f, stage I with appendages; 5g, stage III with appendages. Pas = preaxial seta. 6. *Balanus balanus*: 6a-6d, naupliar stages II-V. 7. *Semibalanus balanoides*: 7a-7d, naupliar stages II-V; 7e, ap and dts of stage IV. Scale line represents 0.1 mm.

KEY TO NAUPLIAR STAGE

The larval development of the most abundant balanomorph (acorn) barnacle species in the North Atlantic consists of six naupliar stages and one cyprid. Stage I nauplii generally have a duration of less than 24 h and lack well-defined morphological features seen in later stages. Their identification is based on relative size and, when possible, association with stage II nauplii in the same sample. Species identification of naupliar stages II–IV is made easier if the larval stage is determined first.

1. Frontolateral horns extended, abdominal process well developed (Fig. 5g) 2
 Frontolateral horns folded against body, abdominal process rudimentary spine (Fig. 5f) Nauplius I
2. Posterior shield marginal spine absent (Figs. 3b,g) 3
 Posterior shield marginal spine present (Figs. 3c,h) 4
3. Frontolateral horns with plain tips, antennule without preaxial setae (Fig. 3a) Nauplius II
 Frontolateral horns with split tips, antennule with one preaxial seta (pas) (Fig. 5g) Nauplius III
4. Abdominal process with only one or two pairs of large spines and up to three small spines (Figs. 3h,i) 5
 Abdominal process with two pairs of large spines, six pairs of small spines (Fig. 3j) Nauplius VI
5. Abdominal process with one pair of large spines (Fig. 3h) Nauplius IV
 Abdominal process with two pairs of large spines (Fig. 3i) Nauplius V

KEY TO SPECIES

A key to the naupliar stages of the seven predominant barnacle species of the Northwest Atlantic shores (Gulf of St. Lawrence to Cape Hatteras, N. C.) is presented (see ZULLO (1979) for a guide to adults). Literature on the larval identification of six additional species common in the Northeast Atlantic is listed.

STAGES II–III

1. Nauplius small, length less than 0.45 mm, stage II; 0.55 mm, stage III: predominant spring through fall 2
 Nauplius large, length greater than 0.45 mm, stage II; 0.55 mm, stage III: predominant in winter 5
2. Labrum trilobed (Fig. 2a) 3
 Labrum unilobed (Fig. 1a) (1) *C. fragilis*
3. Shield without dorsal and lateral spines 4
 Shield with 1–2 dorsal, numerous lateral spines (Figs. 4a,b) (4) *B. venustus*
- 4.¹ Nauplius length 0.32–0.36 mm, II; 0.36–0.41 mm, III; frontolateral horns always arched anteriorly
 (Figs. 2a,b) (2) *B. eburneus*
 Nauplius length 0.35–0.40 mm, II; 0.37–0.46 mm, III; frontolateral horns directed laterally
 (Figs. 3a,b) (3) *B. improvisus*
5. Nauplius with short frontolateral horns, laterally to posteriorly directed 6
 Nauplius with moderate frontolateral horns, anteriorly directed (Figs. 5a,b) (5) *B. crenatus*
6. Nauplius with distinct abdominal process and furcal spines, frontolateral horns swept back (Figs. 6a,b) (6) *B. balanus*
 Nauplius with rudimentary abdominal process and small furcal spines, frontolateral horns perpendicular (Figs. 7a,b) (7) *S. balanoides*

STAGES IV–V

1. Labrum trilobed 2
 Labrum unilobed (1) *C. fragilis*
2. Shield length less than 0.4 mm, IV; less than 0.5 mm, V 3
 Shield length greater than 0.4 mm, IV; greater than 0.5 mm, V 5
3. Shield without dorsal spine, frontolateral horns moderate in length 4
 Shield with small dorsal spines, frontolateral horns appear proportionally long (Figs. 4c,d,e,f) (4) *B. venustus*

¹ Distinguishing between early stage *B. improvisus* and *B. eburneus* is very difficult. *B. eburneus* nauplii are most often restricted to spring and summer months, *B. improvisus* occur year round. In a given location and season *B. eburneus* nauplii are usually smaller, with a proportionally shorter abdominal process, and frontolateral horns arched more distinctly forward.

4. Abdominal process distinctly shorter than dorsal thoracic spine (Figs. 2c,d) (2) *B. eburneus*
 Abdominal process subequal to or longer than dorsal thoracic spine (Figs. 3c,d,h,i) (3) *B. improvisus*
- 5.² Frontolateral horns perpendicular to shield, anterior shield margin distinctly convex 6
 Frontolateral horns directed anteriorly, anterior shield margin slightly convex (Figs. 5c,d) (5) *B. crenatus*
6. Stage IV with well-formed abdominal process, stage V shield length about 0.55 mm (Figs. 6c,d) (6) *B. balanus*
 Stage IV with stubby abdominal process, stage V shield length about 0.65 mm (Figs. 7c,d,e) (7) *S. balanoides*

STAGE VI

1. Labrum trilobed 2
 Labrum unilobed (1) *C. fragilis*
2. Shield length less than 0.65 mm 3
 Shield length greater than 0.65 mm 5
3. Abdominal process shorter than dorsal thoracic spine, shield distinctly longer than wide 4
 Abdominal process longer than dorsal thoracic spine, shield nearly round (Figs. 3e,j) (3) *B. improvisus*
4. Shield length 0.42–0.50 mm (2) *B. eburneus*
 Shield length 0.50–0.65 mm, frontolateral horns prominent (4) *B. venustus*
5. Frontolateral horns perpendicular, nauplius restricted to late winter/spring 6
 Frontolateral horns directed forward (5) *B. crenatus*
6. Shield length over 0.80 mm, antenna exopodite with 11 setae (7) *S. balanoides*
 Shield length 0.65–0.75 mm, antenna exopodite with 9 setae (6) *B. balanus*

REFERENCES ON LARVAL DESCRIPTIONS

1. *C. fragilis*: LANG, 1979.
 2. *B. eburneus*: COSTLOW and BOOKHOUT, 1957; LANG, 1979.
 3. *B. improvisus*: JONES and CRISP, 1954; LANG, 1979.
 4. *B. venustus*: LANG, 1979.
 5. *B. crenatus*: PYEFINCH, 1949.
 6. *B. balanus*: BARNES and COSTLOW, 1961; CRISP, 1962a.
 7. *S. balanoides*: BASSINDALE, 1936; CRISP, 1962a.
 8. *C. hameri*: CRISP, 1962b.
 9. *C. stellatus*: BASSINDALE, 1936.
 10. *B. perforatus*: NORRIS and CRISP, 1953.
 11. *E. modestus*: KNIGHT-JONES and WAUGH, 1949.
 12. *V. stroemia*: BASSINDALE, 1936; LERESTE, 1965.
 13. *B. amphitrite*: COSTLOW and BOOKHOUT, 1958; LANG, 1979.

²) Note that stage V *B. crenatus* and stage IV *S. balanoides* nauplii are very similar in size and proportion. The abdominal process configurations (Figs. 5e, 7e) readily distinguish these nauplii.

CIRRIPEDIA: THORACICA

Species	Distribution		Probable seasonal occurrence			
	New England	United Kingdom	Dec-Mar	Apr-Jun	Jul-Sep	Oct-Nov
1. <i>Chthamalus fragilis</i>	X	X	-	X	X	-
2. <i>Balanus eburneus</i>	X	-	-	X	X	-
3. <i>Balanus improvisus</i>	X	X	X	X	X	X
4. <i>Balanus venustus</i>	X	-	-	X	X	X
5. <i>Balanus crenatus</i>	X	X	X	X	?	X
6. <i>Balanus balanus</i>	X	X	X	X	-	-
7. <i>Semibalanus balanoides</i>	X	X	X	X	-	-
8. <i>Chirona hameri</i>	X	X	-	X	-	-
9. <i>Chthamalus stellatus</i>	-	X	-	-	X	-
10. <i>Balanus perforatus</i>	-	X	-	-	X	-
11. <i>Eliminius modestus</i>	-	X	?	X	X	X
12. <i>Verruca stroemia</i>	-	X	X	X	X	X
13. <i>Balanus amphitrite</i>	rare	X	-	-	X	-

REFERENCES

- BARNES, H., and COSTLOW, J. D., 1961. The larval stages of *Balanus balanus* (L.) DaCosta. J. mar. biol. Ass. U.K., 41:59-68.
- BASSINDALE, R., 1936. The developmental stages of three English barnacles, *Balanus balanoides*, *Chthamalus stellatus*, and *Verruca stroemia*. Proc. Zool. Soc. Lond., 106:57-74.
- COSTLOW, J. D., and BOOKHOUT, C. G., 1957. Larval development of *Balanus eburneus* in the laboratory. Biol. Bull. Woods Hole, 112:313-324.
- COSTLOW, J. D., and BOOKHOUT, C. G., 1958. Larval development of *Balanus amphitrite* var. *denticulata* Broch reared in the laboratory. Biol. Bull. Woods Hole, 114:284-295.
- CRISP, D. J., 1962a. The planktonic stages of the cirripedia *Balanus balanoides* (L.) and *Balanus balanus* (L.) from north temperate waters. Crustaceana, 3:207-221.
- CRISP, D. J., 1962b. The larval stages of *Balanus hameri* (Ascanius, 1967). Crustaceana, 4:123-130.
- JONES, L. W. G., and CRISP, D. J., 1954. The larval stages of the barnacle *Balanus improvisus* Darwin. Proc. Zool. Soc. Lond., 123:765-780.
- KNIGHT-JONES, E. W., and WAUGH, G. D., 1949. On the larval development of *Eliminius modestus* Darwin. J. mar. biol. Ass. U.K., 28:413-428.
- LANG, W. H., 1979. Larval development of shallow water barnacles of the Carolinas (Cirripedia: Thoracica) with keys to naupliar stages. NOAA Tech. Rep. (U.S.) Natl Mar. Fish. Serv. Circ., 421:1-39.
- LERESTE, L., 1965. Contribution a l'étude des larves de cirripèdes dans le golfe de Marseille. Red. Trav. Stn Mar. Endoume, 38:33-121.
- NORRIS, E., and CRISP, D. J., 1953. The distribution and planktonic stages of the cirripede *Balanus perforatus* Bruguière. Proc. Zool. Soc. Lond., 123:393-409.
- PYEFINCH, K. A., 1949. The larval stages of *Balanus crenatus* Bruguière. Proc. Zool. Soc. Lond., 118:916-923.
- ZULLO, V. A., 1979. Marine flora and fauna of the northeastern United States. Arthropoda: Cirripedia. NOAA Tech. Rep. (U.S.) Natl Mar. Fish. Serv. Circ., 524:1-29.