

KEYS FOR THE IDENTIFICATION OF THE ECHINODERMATA OF THE BRITISH ISLES

by

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Very largely derived from Th. Mortensen "Handbook of the Echinoderms of the British Isles", Oxford University Press, 1927.

CRINOIDEA

Crinoids have five, ten or more feather-like arms attached to a small, cup-shaped body. The mouth and anus are both on the upper side of the body. The lower side is, in the sea-lilies attached to a jointed stalk. The feather-stars, on the other hand, spend a brief juvenile period attached to a stalk and then become free-living. The lower side of the body then consists of a large calcareous plate, the centrodorsal, and this bears a number of slender, jointed appendages, called cirri, with which the feather-star holds onto convenient objects. In British seas there are three species of feather-star but no sea-lilies. *Antedon petasus* was not originally included in this key.

KEY

1. Cirri short, the longest having 14-17 joints; centrodorsal flattened (fig. 1.3) 2
 Cirri long, having 40-50 joints; centrodorsal conical or broadly truncated (fig. 2) *Leptometra celtica*
 10 arms; colour in bold patches. Depths of 30m to more than 200m; west coasts of Scotland and Ireland.
2. Distal edge of brachials with prominent raised ridges (fig. 1.1) *Antedon bifida*
 10 arms; colour red, purple, orange or yellow, mottled. Subtidal down to 200m; southwest, west and northeast coasts.
 Distal edge of brachials smooth (fig. 1.2) *Antedon petasus*
 10 arms; colour in bold brown, purple, orange or yellow stripes. Depths 25m down to 325m; west coasts, shallower in western Scotland and North Channel. (BEP)

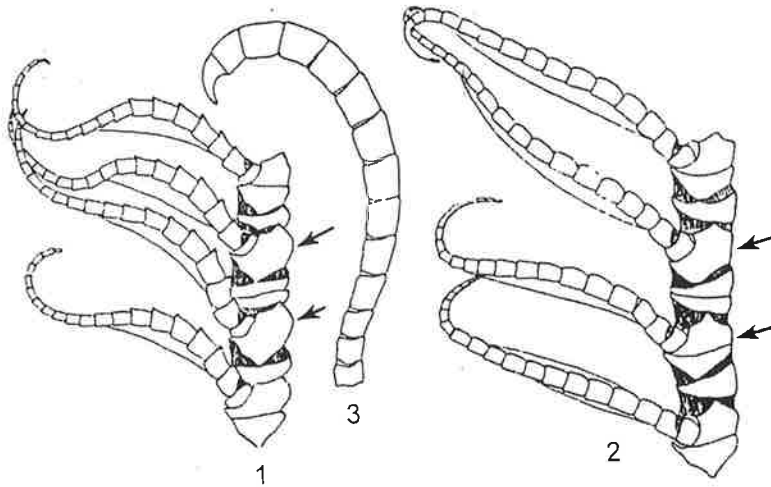


FIG. 1 Part of arm (side view), with genital pinnules, of *Antedon bifida* (1) and *petasus* (2); a cirrus of *A. bifida* (3). $\times 7$.

ASTEROIDEA

Asteroids or starfish have a starshaped body, with either a spiny or smooth surface. There are five or more arms of variable length, extending from a central disc, usually without a distinct limit between disc and arm. The mouth is on the underside of the disc and the anus, if present, is on the upper side. On the underside of each arm is a furrow, the ambulacral furrow, containing the soft, fingerlike tube feet. Along the edges of the ambulacral furrow are rows of ambulacral spines, which are generally larger than the other spines of the under surface. Along the edge of the disc and arms of some species there is a series of large distinct plates, the marginal plates. The skin of the upper side is supported by a network of calcareous plates, to which spines are usually attached. The spines may be single or in groups. In some cases they are arranged in regular bundles attached to a central column; these bundles are called paxillae. Other small spines may be arranged in pairs to form pincers of various types, named pedicellariae (fig. 3). The skin between the spines of the upper side may bear delicate, extensible tubes, termed papulae, which act as gills.

KEY

1. Marginal plates large, usually distinct sometimes covered by skin; tube feet in 2 series 3
 Marginal plates inconspicuous; tube feet in 2 or 4 series 2
2. Crossed pedicellariae present (fig. 3); spines of upper side usually single; tube feet in 4 series 13
 Pedicellariae rare, never of crossed type; spines of upper side usually in groups; tube feet in 2 series 7
3. Tube feet pointed, no sucking disc 4
 Tube feet with sucking disc 6
4. Both rows of large marginal plates obvious; those of the lower row each have 4 or 5 large spines which form fringe around whole body (fig. 4). *Astropecten irregularis*
 5 fairly short arms; colour pinkish or yellowish. Max. diam. 20 cm. Shallow water to more than 200 m depth, in sand. All round British Isles.
 Only lower row of marginal plates obvious, all with spines; upper row of plates paxilliform (see above) 5
5. 5 arms; lower marginal plates bear 3 (rarely 4) spines each *Luidia sarsi*
 Colour reddish brown. Max. diam. 34cm. Shallow water to more than 200 m; all round British Isles.
 7 arms; lower marginal plates have 4 or 5 spines each (fig. 5) *Luidia ciliaris*
 Colour red. Max. diam. 60 cm. Shallow water to more than 200 m; south, west and northeast coasts.
6. Marginal plates large and distinct; edge of disc vertical; upper side and marginal plates bear thick spines *Hippasteria phrygiana*
 Disc large, arms short; colour red. Max. diam. 40 cm. Depths of 20 to more than 200 m; west north and northeast coasts, rare.
 Marginal plates less distinct, partly overlapping; disc sharp-edged, with fringe of fine spines; upper surface with thick smooth skin and no spines *Porania pulvillus*
 Disc large, arms short; colour red or yellowish, spotted or mottled. Max. diam. 12 cm. Shallow water to more than 200 m on sand; south west, and northeast coasts.
7. Body flattened to give sharp edge between upper and lower sides 8
 No sharp limit between upper and lower sides 9

8. Body very thin with a crest-like thickening along each ray (fig. 6)Anseropoda placenta
 Shape pentagonal, colour red on upper side, yellow on lower. Max. diam. 20 cm. Shallow water to 200 m; south, west and northeast coasts.
 Body not very thin; no crest along rays 8a
- 8a Asterina gibbosa
 Body starshaped, with very short arms; upper side slightly swollen; colour greenish, yellowish or brownish. Max. diam. 6 cm. On or under stones, shore and shallow water; all round British Isles.
- Asterina phylactica
9. Small disc, 5 long arms (rarely 6 or 7) 10
 Large disc, at least 7 arms, usually 9 or more 12
10. Spines rather coarse, single Echinaster sepositus
 Usually 5 arms, occasionally 6 or 7; colour scarlet; soft skin covers body and most spines. Max. diam. 14 cm. Shallow water to more than 200 m; Brittany, Channel Isles.
 Spines very fine, in small groups 11
11. Spines end in crown of long thorns, not covered by skin (fig. 9) Henricia sanguinolenta
 5 arms, colour red, tips of arms usually white. Max. diam. 20 cm. Shallow water to more than 200 m; northwest, north and northeast coasts. N.B. Other species of *Henricia* may be present in the area.
 Spines have rather blunt ends with irregular points (fig. 8) and are covered with thick skinHenricia oculata
 5 arms, colour red, orange or yellow. Low water to about 100 m, on coarse sand and gravel; south and west coasts, Irish Sea. N.B. Other species of *Henricia* may be present in the area.
12. Marginal paxillae are long, obvious and in a single row round the edge of the bodyCrossaster papposus
 8 to 13 arms, typically 10-12, colour disc usually purplish red, arms whitish with broad red transverse band, underside whitish. Max. diam. 38 cm. Shallow water to 100 m, on coarse sand and gravel; all round British Isles.
 Marginal paxillae are small, inconspicuous and in two rows, the upper much smaller than the lower..... Solaster endeca
 7 to 13 arms, typically 9-10, colour yellowish red or violet. Max. diam. 40 cm. Shallow water to more than 200 m; west, north and northeast coasts. Not in Channel.
13. Upper side has groups of granules or small spines Stichastrella rosea
 5 long tapering arms, colour orange, reddish or yellowish. Max. diam. 30 cm. Shallow water to more than 200 m; west, north and east coasts.
 Upper side has single spines 14
14. Spines along edge of ambulacral grooves in very regular single series Marthasterias glacialis
 Small disc long tapering arms; three conspicuous series of large spines on upper side of arms, colour greenish, yellowish, orange or reddish. Max. diam. 70 cm. Shore to 200 m; southwest and west coasts.
 Spines in two series along edge of ambulacral grooves, at least on outer parts of arms 15

15. Upper side rather soft, with fairly large naked spaces between the spines; these spaces are occupied by several small, delicate papulae; the spines are irregularly arranged except for a fairly regular row along the midline of each arm *Asterias rubens*

Usually 5 arms sometimes more; arms broad at base, tapering to tip. Colour reddish brown, orange or violet, with paler spines. Max. diam. 54 cm.. Shore to more than 200 m; very common all round British Isles.

- Upper side firm, with only small naked spaces and one or two papulae between the spines; spines irregularly arranged *Leptasterias muelleri*

5 arms, broad at base and tapering to tip; colour reddish or violet, arm tips whitish. Max. diam. 20 cm. Shore to more than 200 m; western Ireland, Irish Sea, west and north Scotland.

OPHIUROIDEA

Ophiuroids or brittle stars, have a body clearly divided into a central disc and five (rarely more) thin, jointed arms. The mouth is on the underside of the disc and there is no anus. On the underside of each arm there are two rows of tentacle pores, through which the soft tube feet emerge. The surface of the disc and arms are usually covered with calcareous plates, the shape and arrangement of which are important for identification. On the upper side of the disc there is often a pair of large plates close to the base of each arm, termed radial shields (fig. 12, 14). In the middle part of the disc there may be large, well marked, primary plates surrounded by smaller plates (fig. 18). Some species have the upper part of the disc covered with granules or spines or by thick naked skin. The arm joints usually have four plates, one upper (dorsal), one lower (ventral), and two lateral. Arm spines are attached to the lateral plates. At the sides of the tentacle pores there are very often some tiny plates, called tentacle scales (fig. 11, 13). The mouth area has a variety of special plates. Five jaws project into the mouth opening and along their edges are some small plates, called mouth papillae (fig. 11). On the apex of each jaw is either a single vertical series of teeth (fig. 11, 18) or several series of tooth papillae.

KEY

1. The arms are moved vertically; disc and arms are covered with thick skin; arm spines point downwards 2
 The arms are usually moved horizontally; disc and arms are covered with scales; arm spines are not directed downwards 3
2. Arms branched several times *Gorgonocephalus caputmedusa*
 Arms curl together to form dense network, colour yellowish or white. Max. diam. disc 9 cm. Depths of more than 150 m; edge of continental shelf and northern North Sea.
- Arms unbranched *Asteronyx loveni*
 Disc covered by smooth skin; long narrow arms; colour faint reddish. Max. diam. disc 35 mm, arm length 350 mm. Depths of more than 45 m; edge of continental shelf and some Scottish sea lochs.

Fig 12. - *Ophiura affinis*

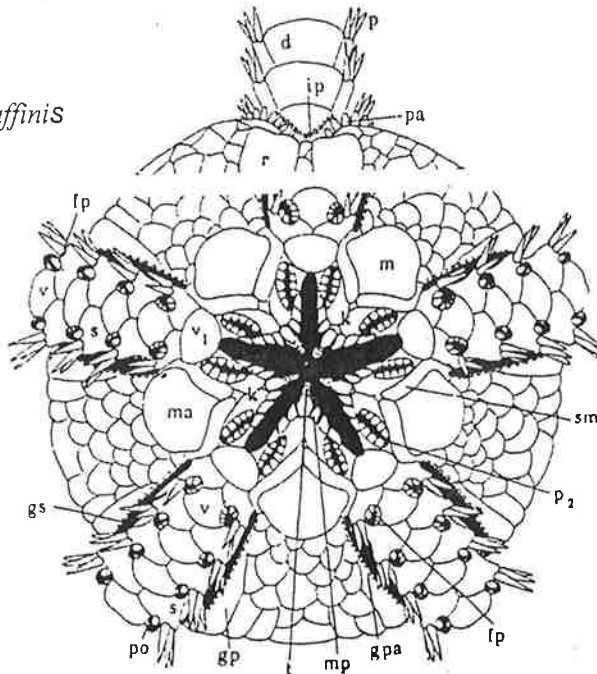


FIG. 11.—A Brittle-star (*Ophiura robusta*) from the oral side; at the upper edge of the figure part of dorsal side of disk and arm of another species (*Ophiura affinis*); enlarged. (From *Danmark's Fauna*.)

d, Dorsal plate; fp, Foot papillae or tentacle scales; gp, Genital plate; gpa, Genital papillae; gs, Genital or bursal slit; lp, Inner comb of papillae; k, Jaw; m, Mouth shield; ma, Madreporite; mp, Mouth papillae; p, Arm spines; pa, Outer comb of papillae; po, Pore of tube-foot; p₂, Second foot pore; r, Radial shield; s, Slide or lateral plate; sm, Adoral shield; t, Teeth; v, Ventral plate; v₁, First ventral plate.

| | | |
|----|--|----|
| 3. | Arm spines pressed close to arm | 16 |
| | Arm spines stick out | 4 |
| 4. | Tooth papillae present (fig. 13, 14, 16) | 5 |
| | Only a single vertical series of teeth (fig. 11) | 9 |
| 5. | Mouth papillae present (fig. 13) | 6 |
| | No mouth papillae (fig. 14) | 8 |

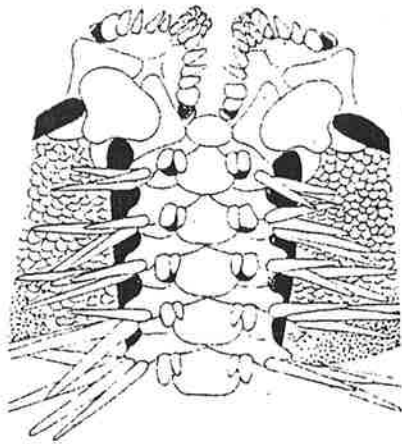


FIG. 13.—*Ophiocomina nigra*; part of oral side. × 8.

6. Upper side of disc covered with small granules, two tentacle scales beside each tentacle pore (fig. 13) *Ophiocomina nigra*

Arm spines smooth and slender. Max. diam. disc 25 mm, arm length 120 mm. Colour black, brown, grey or pink. Shallow water to 100 m, on stones, gravel or coarse sand; south, west and northeast coasts.

- Upper side of disc smooth, with very small scales; two tentacle scales, the inner one very long (fig. 16); arm spines short and flattened 7

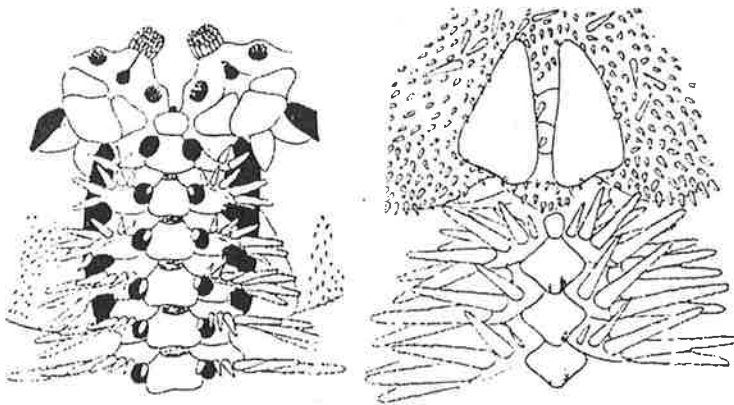


FIG. 14.—*Ophiothrix fragilis*; part of oral and dorsal side. × 8.

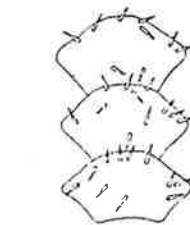


FIG. 15.—Dorsal plates of *Ophiothrix Lütkeni*. × 6. (From Denmark's Fauna.)

7. 7 arm spines each side of each joint; radial shields distinct (fig. 16) *Ophiopsila aranea*

Colour reddish brown with white spots, arms sometimes banded. Max. diam. disc 12 mm, arm length 89 mm. Depths 25 to 200 m, rock crevices; southwest England, western Ireland.

- 12 arm spines each side of each joint; radial shields completely hidden by scales *Ophiopsila annulosa*

Colour reddish brown with white spots, arms distinctly banded. Max. diam. disc 12 mm, arm length 80 mm. Depths 30 to 100 m; buried in coarse gravel; western Ireland, southwest England, southwest Scotland.

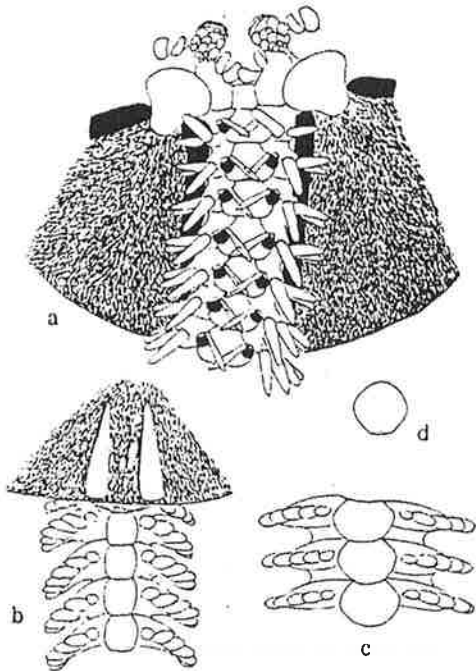


FIG. 16.—*Ophiopsila aranea*; part of oral side (a), of dorsal side, with basal part of arm (b), and of dorsal side of arm, from the middle (c); mouth shield of younger specimen (d). × 8.

8. Upper arm plates each raised at outer end, giving arm a keeled appearance; no spines on these plates (fig 14) *Ophiotrix fragilis*

Upper surface of disc spiny, radial shields obvious, 7 arm spines each side of each joint; colour reddish, violet, white or spotted. Max. diam. disc 20 mm, arm length 100 mm. Shore to more than 200 m; all round British Isles.

- Upper arm plates have flat outer edge and bear small spines (fig. 15) *Ophiotrix luetkeni*

Upper surface of disc spiny, radial shields obvious; max. of 8 arm spines each side of each joint., colour pinkish, arms banded pink and white. Depths of 50 to more than 200 m; west of Ireland and north Minch

9. Two papillae on apex of jaw (fig. 19) 11
 One papilla on apex of jaw (fig. 18) 10
 10. Upper arm plates each surrounded by a circle of small plates (fig. 18) ... *Ophiopholis aculeata*

Disc covered with granules but naked areas over primary plates; radial shields not visible. Max. diam. disc 20 mm, arm length 80 mm. Shore to more than 200 m in crevices; west and northeast coasts.

- Upper arm plates not surrounded by small plates (fig. 17) *Ophiactis balli*

Disc covered with small scales, a few spines near edge; radial shields visible. Colour reddish with white bands on arms Max. diam disc 5 mm, arms 30 mm. Depths of 30 to more than 200 m, in crevices; south, west and northeast coasts.

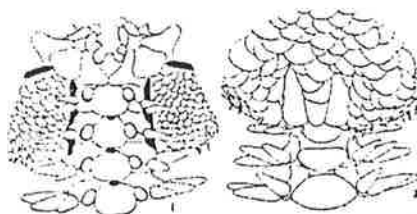


FIG. 17.—*Ophiactis Balli*. 1. Oral side. 2. Dorsal side. × 8. (From *Danmark's Fauna*.)

11. Two outer mouth papillae on either side of jaw (fig. 19), the outermost very broad *Amphipholis squamata*
- Disc covered with scales, small radial shields visible (fig. 19); colour greyish. Max. diam. disc 5 mm, arm length 20 mm. Very common on shore, in crevices and algae, extends down to more than 200 m. All round British Isles.

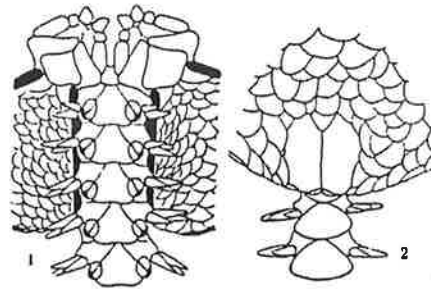


FIG. 19.—*Amphipholis squamata*; part of oral side (1) and of dorsal side (2). × 12. (From *Danmark's Fauna*.)

- One outer mouth papilla either side (fig. 20) 12
12. Scales of lower side and margin of disc end in small tubercles; radial shields transversely furrowed (fig. 20) *Acrocnida brachiata*
- Disc covered with small scales, radial shields small; colour greyish. Max. diam. disc 13 mm; arm length 200 mm. Shore to 40 m, in sand. south, west and northeast coasts.

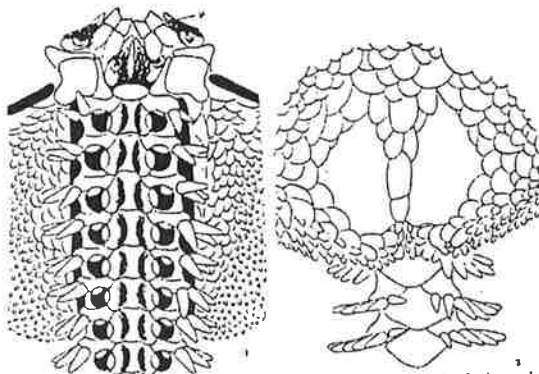


FIG. 20.—*Acrocnida brachiata*; part of oral side (1) and of dorsal side (2) × 9. (From *Danmark's Fauna*.)

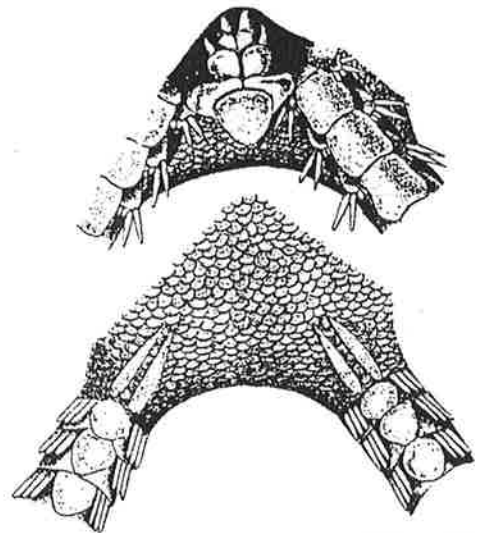


FIG. 21.—*Paramphiura punctata*; part of oral and dorsal side. × 20. (After Koehler, *Notes échinologiques*.)

- Scales smooth, radial shields without transverse furrow 13
13. Outer mouth papilla is a large rounded scale which obscures the jaw (fig. 21) *Paramphiura punctata*
- Disc covered with small scales; radial shields narrow (fig. 21); 5 slender arm spines on each side of each joint. Max. diam. disc 3 mm. North Sea and Channel, very rare.
- Jaws not obscured (fig. 22, 23) 14
14. Tentacle scales present (fig. 23) 14a
- No tentacle scales (fig. 22, 24) 15
- 14a Two elongate tentacle scales, arm spines round in cross-section *Amphiura chiajei*

Disc covered with scales, small radial shields visible; colour brownish. Max. diam. disc 11 mm, arm length 90 mm. Shallow water to more than 200 m, in muddy sand; south and west coasts, southern North Sea.

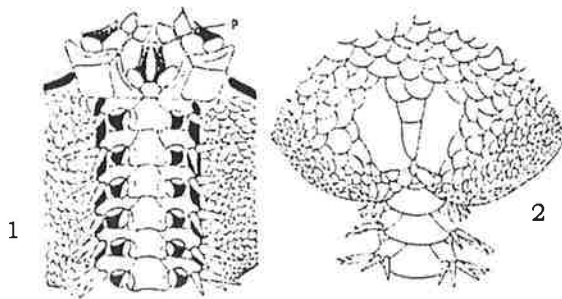


FIG. 22 —1-2. *Amphiura Chiajei*; part of oral side (1) and dorsal side (2).

- Two small tentacle scales, arm spines flattened *Amphiura incana*
 15. Upper side of disc covered with coarse scales *Amphiura filiformis*

Very delicate. Colour brownish. Max. diam. disc 10 mm, arm length 100 mm. Shallow water to more than 200 m, muddy sand and mud; all round British Isles, except perhaps the southeast.

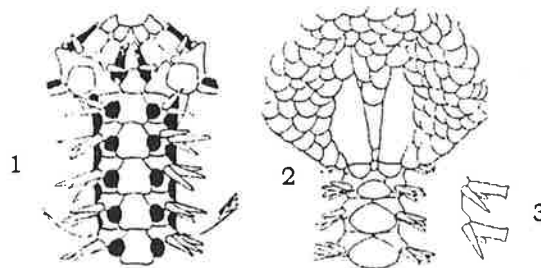


Fig. 23 - *Amphiura filiformis*; part of oral side (1) and dorsal side (2); arm spines (3). All figures $\times 8$. (From *Danmark's Fauna*.)

- Upper side of disc naked except for narrow radial shields (fig. 24) *Amphiura securigera*

Colour greenish pale radial shields. Max. diam. disc 5 mm, arm length 60 mm. Depths of 25 to more than 200 m, on gravel; west coasts and Irish Sea.

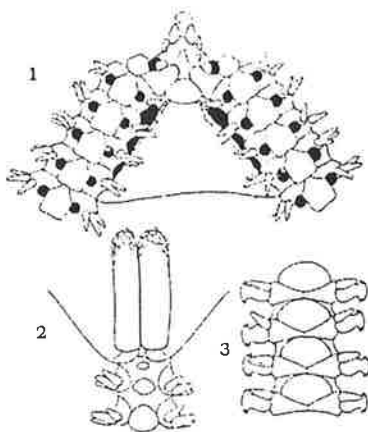


Fig. 24. - *Amphiura securigera* - part of oral side (1), part of dorsal side (2), four arm joints seen from the dorsal side (3)

16. A straight row of fine papillae across upper base of arm at edge of disc .. *Ophiocten scutatatum*

Disc covered by very small scales and several large primary plates; tentacle scales very large (fig. 25). Max. diam. disc 8 mm, arm length 24 mm. Depths of more than 150 m; near edge of continental shelf.

A pair of crescent-shaped rows of fine papillae (arm combs) at upper base of arm (fig. 11, 26) 17

17. Lower arm plates separated by pairs of pores (fig. 26.3); arm combs contain about 30 visible papillae each *Ophiura ophiura*

Disc covered by rather coarse scales, radial shields small; colour reddish brown. Max. diam. disc 36 mm, arm length 120 mm. Shallow water to 200 M, sand and muddy sand; all round British Isles. Synonym - *O. texturata*

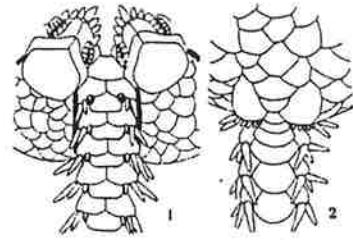
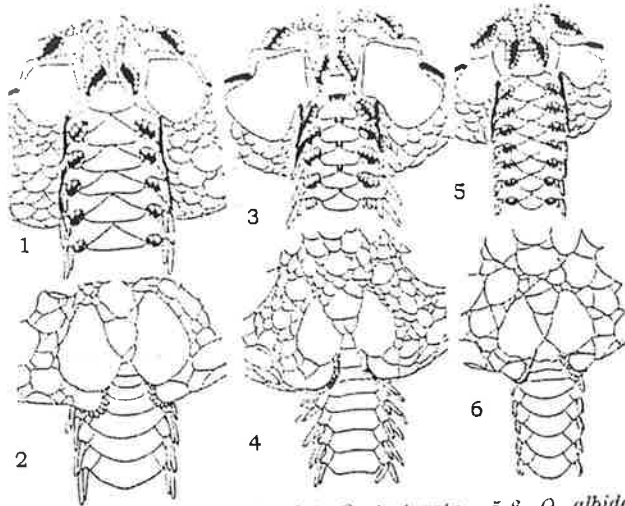


FIG. 27. —1-2. *Ophiura robusta*.

FIG. 26 —1-2. *Ophiura sarsi*. 3-4. *O. texturata*. 5-6. *O. albida*. The upper figures represent part of the oral side, the lower figures of the dorsal side. × 4. (From *Danmark's Fauna*.)

No pores between lower arm plates (fig. 26) 18

18. Arm combs feebly developed (fig. 27) *Ophiura robusta*

Radial shields small; colour gray or brown with white spots Max. diam. disc 10 mm, arm length 30 mm. Depths from 40 to more than 200 m; northern North Sea.

Arm combs well developed (fig. 26) 19

19. Second tentacle pore opens outside mouth (fig. 30); single tentacle scales *Ophiura affinis*

Disc covered with fine scales and conspicuous circular primary plates; radial shields small; 3 small arm spines either side of each joint; colour reddish brown or gray. Max. diam. disc 8 mm, arm length 25 mm. Shallow water to more than 200 m, muddy sand; all round British Isles.

Second tentacle pore opens inside mouth slit (fig. 26.5); other tentacle pores near mouth have several tentacle scales 20

20. Innermost upper arm plate is heart-shaped (fig. 26.6); arm spines short, the longest being about half the length of the arm joint *Ophiura albida*

Disc has rather coarse scales, radial shields touch; colour reddish brown with pale radial shields. Max. diam. disc 15 mm, arm length 60 mm. Shallow water to more than 200 m, coarse sand and gravel; all round British Isles.

Innermost upper arm plate not heart shaped (fig. 26.2); longest arm spines are longer than arm joints *Ophiura sarsi*

Disc has rather coarse scales: radial shields may touch; colour reddish, often mottled, radial shields may be paler. Shallow water to more than 200 m; northern North Sea, rare.

ECHINOIDEA

Echinoids or sea urchins, have a body without arms. It may be globular, egg shaped, or flattened. The skeleton, or test, forms a complete covering and is composed of flat calcareous plates with knobs, or tubercles, to which spines are attached. The mouth is on the underside while the anus is either on the upper side (in regular urchins) or near one end of the egg shaped, irregular urchins. The plates of the test are arranged in ten double series (fig. 31). Those of five double series are perforated by small pores, through which the soft tube feet emerge. The perforated plates are termed the ambulacral plates and the intermediate plates are termed interambulacral. On both sets of plates there are large tubercles which carry primary spines and smaller secondary tubercles bearing secondary spines (fig. 37). In regular urchins there is a circular soft-skinned area around the mouth, called the peristome, which bears a variable number of small calcareous plates. The test at the edge of the peristome is notched by gill clefts. In heart urchins the peristome is not obvious because it is covered with closely fitting plates. The spines are typically conical but in heart urchins they are variously flattened and ornamented. In addition, heart urchins often have small club-shaped dark spines arranged in narrow bands called fascioles (fig. 47). Among the spines are delicate pincer-like organs or pedicellariae. These have heads composed of three valves, mounted on flexible stalks, and are of various shapes and sizes. Those with large globular heads, the globiferous pedicellariae, are the most valuable in the identification of regular urchins.

KEY

1. Body round (fig. 31), anal opening near centre of upper side 2
 Body oval, anal opening not central 9
2. Edge of test around mouth area is incised by deep gill clefts *Sphaerechinus granularis*
 Test somewhat flattened closely covered with short spines. The valves of the globiferous pedicellariae have no side teeth (fig. 32). Ambulacral plates have 4 pairs of pores (fig. 41). Colour violet with white-tipped spines. Max. diam. 13 cm. Shallow water; Channel Islands and France.
 Edge of test around mouth area is not deeply incised, gill clefts scarcely noticeable 3
3. Valves of globiferous pedicellariae have no side teeth (fig. 35); spicules in tube feet have branched ends (fig. 42) *Strongylocentrotus droebachiensis*
 Test somewhat flattened, closely set with spines; ambulacral plates have 5 or 6 pairs of pores (fig. 37); colour greenish brown, spines green, red or violet with paler tips. Max. diam. 8 cm. Shore and shallow water; north and northeast coasts.
 Valves of globiferous pedicellariae have side teeth (fig. 34, 36); spicules in tube feet are simply c-shaped. 4
4. Ambulacral plates each have 5 or 6 pairs of pores *Paracentrotus lividus*
 Test somewhat flattened, closely covered with strong spines; colour dark violet or olive green. Max. diam. 7 cm. Shore to 30 m, rock pools and crevices; common in western Ireland; very rare in southwest Scotland.
 Ambulacral plates each have 3 pairs of pores (fig. 38, 40)..... 5
5. Skin of peristome is packed with thick plates; valves of globiferous pedicellariae have several lateral teeth (fig. 34) *Psammechinus miliaris*
 Test somewhat flattened closely set with short, strong spines. Colour greenish with purple-tipped spines. Max diam. 5 cm. Shore to 100 m depth, under stones and in crevices; all round British Isles.
 Peristome is membranous, with only a few thin plates; valves of the globiferous pedicellariae have one or two teeth each side (fig. 36) 6

6. Every ambulacral plate bears a primary tubercle (fig. 38) *Echinus elegans*
 Test somewhat flattened, rather large primary spines; colour white, pink or violet, spines pink with white tip. Max. diam. 8 cm. Depths of more than 100 m; off west and north coasts.
- Approximately every second ambulacral plate has a large primary tubercle (fig. 39) 7
7. Test white, globular *Echinus tenuispinus*
 Spines short and slender, rather scarce; peristome plates bear small spines. Max. diam. 6 cm. Depths of more than 100 m, near edge of continental shelf.
- Test red, purple or greenish 8
8. Test globular, uniformly red to purple with white tubercles; plates on peristome bear small spines *Echinus esculentus*
 Spines short, reddish; primaries and secondaries about the same size. Common species in shallow water.
- Test slightly conical red colour broken by vertical white bands, or restricted to small patch on top; no spines on peristome plates *Echinus acutus*
 Primary spines longer and thicker than secondaries, red or green at base and white at tip. Max. diam. 15 cm. In depths of more than 50 m; outer continental shelf and northern North Sea.
9. Mouth in centre of underside, anus on underside between mouth and posterior margin; test flattened, very small (fig. 43) *Echinocyamus pusillus*
 Fine short spines; colour green or gray. Max. length 15 mm. Shallow water, common in gravel; all round British Isles.
- Test more or less egg-shaped, mouth near anterior end of underside anus usually on posterior margin (fig. 49) 10
10. Narrow band of dark spines, termed a fasciole, forms a ring or oblong below the anal region 11
- In addition to a subanal fasciole there is a second fasciole on the upper surface of the test (fig. 48) 12
11. Subanal fasciole about three times as broad as long (fig. 46); test somewhat flattened *Spatangus purpureus*
 Test heart-shaped (fig. 44); colour violet, spines of upper side paler. Max. length 12 cm. Shallow water to more than 200 m; all round British Isles.
- Subanal fasciole less than twice as broad as long (fig. 45); test high *Spatangus raschi*
 Colour deep violet. Max. length 12 cm. Depths more than 150 m; off western coasts.
12. Upper fasciole runs around tips of petal-like ambulacra (fig. 47) *Brissopsis lyrifera*
 Colour brown. Max. length 7 cm. Shallow water to more than 200 m, in soft mud; west, north and east coasts.
- Upper fasciole surrounds only the anterior ambulacral petal (fig. 48, 49) 13
13. Anterior ambulacrum is a deep furrow (fig. 48) *Echinocardium cordatum*
 Colour yellowish. Max. length 9 cm. Common on sandy shores and shallow water, also occurs down to 200 m; all round British Isles.
- Anterior ambulacrum is flush with test (fig. 49) 14

14. Some large tubercles, carrying long spines, between the ambulacra of the upper side; large labrum (plate behind the mouth, fig. 51) *Echinocardium flavescens*

Colour yellow or pink. Max length 9 cm. Shallow water to more than 200m, in muddy sand; all round British Isles.

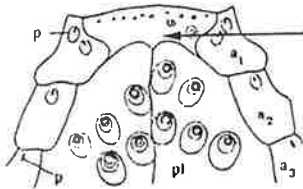


Fig. 50. - *Echinocardium pennatifidum* - labrum

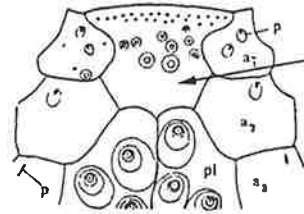


Fig. 51. - *Echinocardium flavescens*, labrum

- No large tubercles on upper side; small labrum (fig. 50) *Echinocardium pennatifidum*

Colour yellowish. Max. length 7 cm. Shore to more than 200 m, in sand or gravel; south, west and northeast coasts.

HOLOTHURIANS

Holothurians or sea cucumbers are rather soft, sausage-shaped animals without arms. The mouth is at one end of the body, surrounded by retractable tentacles and the anus is at the other end. In some species the body is flattened and the lower side on which the animal walks, is called ventral and the upper side is called dorsal. There are basically five longitudinal rows of tube feet, but various modifications of this pattern exist and a few have no tube feet. After collection, the tentacles are usually retracted but if living specimens are left for a while in cool water they may extend them. Preserved specimens usually have to be partly dissected to discover the number of tentacles and their shape. In one group of holothurians the part of the body behind the tentacles is more flexible than the rest (the introvert) and can be pulled back into the body by retractor muscles, carrying the tentacles well out of sight. In other holothurians the tentacles are drawn back into a fold around the mouth but there are no specialised retractor muscles. The body is covered with skin which contains, in most species, small calcareous deposits. The shape of these deposits is very important in classification. To investigate them, mount a small piece of skin on a slide in a drop of glycerine, and examine with a low power objective (e.g. x 10). Gentle pressure on the cover slip may help to make the deposits more visible. If it does not, a second preparation may be made, using a drop of a commercial 'bleach' instead of glycerine and leaving 30 min to clear. Very thick or opaque skin may have to be heated with a drop of 20 % potassium hydroxide solution, but this requires care. Potassium hydroxide is caustic. After treatment the residue must be washed well before mounting on a slide.

KEY

1. Tube feet well developed; tentacles shield or bush shaped 2
 No tube feet; tentacles feather or finger shaped 20
2. Tentacles shield-shaped; no introvert (Aspidochirota) 3
 Tentacles bush-shaped; introvert and associated retractor muscles present (Dendrochirota) ..
3. Calcareous deposits abundant, including well developed tables (fig. 54, 55) 4
 Calcareous deposits scarce, usually very reduced tables, consisting of disc without spire
 *Holothuria forskali*
4. Deposits tables only (fig. 54) *Mesothuria intestinalis*
 Body slightly flattened, numerous tube feet in 3 or 4 longitudinal series;
 colour black or brownish on upper side, paler below, Max. length 30 cm.
 Low water to about 50 m depth; west and southwest coasts.
- 4a. Deposits tables only (fig. 54) *Mesothuria intestinalis*
 Body cylindrical, tube feet mainly ventro-lateral; colour grey, pink or violet.
 Max. length 30 cm. Depths of more than 50 m; off western Scotland.

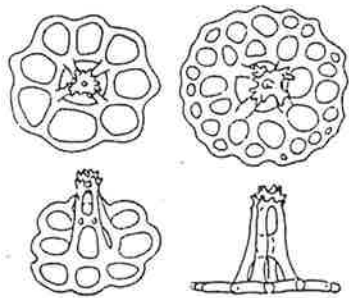


FIG. 54.—Calcareous deposits (tables) of *Mesothuria intestinalis*, seen from above and in side view. x 145. (From *Danmark's Fauna*.)

- 4a Three types of deposit: tables (fig. 53), flat rods and star-shaped bodies 4a
- 4a Body nearly cylindrical; colour in life red or grey. Numerous star-shaped deposits present (fig. 53) *Parastichopus tremulus*

Found in shallow water near Canna, Outer Hebrides. Might have been accidentally transported into shallow water by fishing boats. (BEP)

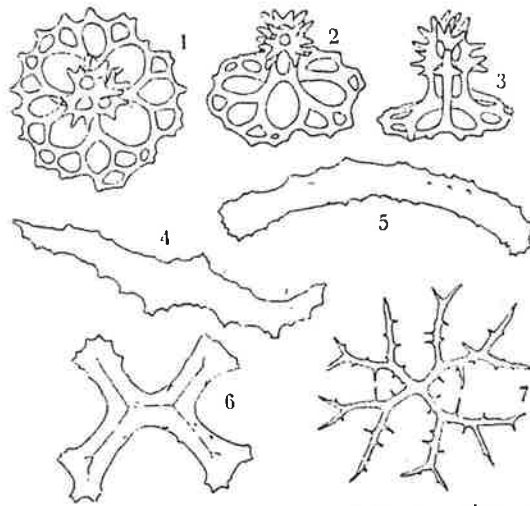


FIG. 53.—Calcareous deposits of *Stichopus tremulus*. × 200.
(From *Danmark's Fauna*.)

1-3. Tables, from above and in side view. 4-6. Spinous rods. 7. Star-shaped body

Body flattened; colour in life brownish with white spots. Star-shaped deposits less numerous and mostly in the radii (fig. 55) *Stichopus regalis*

Body flattened, with tube feet in three rows on underside, many papillae around edge and on upper side; colour brown, often with white spots. Max. length 30 cm. Edge of continental shelf, upper depth limit not known.

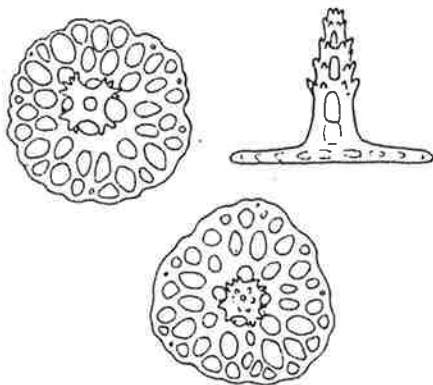


FIG. 55.—Tables of *Stichopus regalis*, from above and inside view. × 245.

- | | | |
|----|---|---------------------------|
| 5. | Body cylindrical..... | 6 |
| | Body with flat lower sole, upper side with scales | 19 |
| 6. | 10 tentacles | 7 |
| | 15 to 30 tentacles, usually in two rings | 17 |
| 7. | Tube feet in five fairly distinct rows | 8 |
| | Tube feet scattered all over body | 14 |
| 8. | Body thick, cylindrical; skin leathery and almost without deposits. Young specimens have plates with holes (fig. 56)..... | <i>Cucumaria frondosa</i> |
| | Colour usually brown, tentacles almost black, may be paler. Max. length 50 cm. Shallow water to 200 m; Scotland. | |
| | Body not large and thick | 9 |

9. Body elongated, with thin posterior end; deposits cup-shaped spicules (baskets) and smooth plates with holes (fig. 57) *Leptopentacta elongata*

Smooth skin, colour brown. Max. length 15 cm. In muddy sand, shallow water to 70 m; west, north and north-east coasts.

Body small, not elongated; deposits smooth or tuberculate plates, with or without baskets or stellate spicules 10

10. Deposits smooth plates, with or without star-shaped spicules (fig. 58) 11

Deposits tuberculate, with baskets or star-shaped spicules (fig. 60) 12

11. Deposits large plates with holes (fig. 56) *Paracucumaria hyndmani*

Body stout, slightly tapering posteriorly; skin smooth and thick; colour whitish or faint red. Max. length 5 cm. In gravel or muddy sand; shallow water to more than 200 m; south, west and north-east coasts.

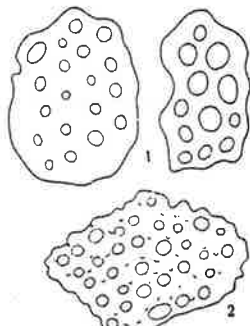


FIG. 56. — Calcareous deposits of *Cucumaria Hyndmani* (1) and *Cuc. frondosa*, young (2). 1, $\times 50$; 2, $\times 80$. (From *Danmark's Fauna*.)

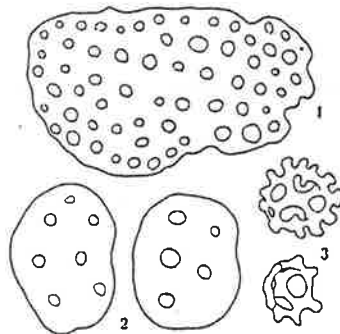


FIG. 57. — Calcareous deposits of *Cucumaria elongata*. 1, $\times 50$; 2-3, $\times 145$. (From *Danmark's Fauna*.)

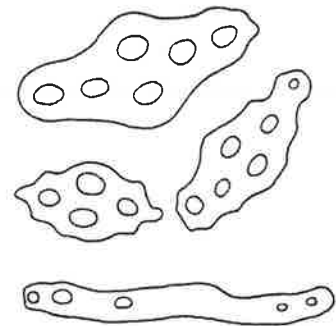


FIG. 58. — Deposits of *Cucumaria saxicola* from the skin and the tube-feet (the lowermost figure). $\times 180$.

Deposits small plates with four main holes (fig. 58), also small star-shaped bodies in outer layer of skin *Pawsonia saxicola*

Body cylindrical; skin delicate, colour white, tentacles dark. Max. length 15 cm. Under stones on shore and in crevices down to 50 m. Southwest England and southwest Ireland.

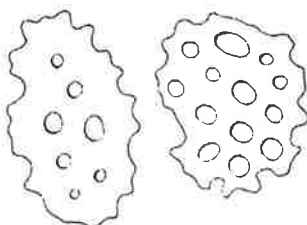


Fig. 59. - Deposits from *Pseudothyone raphanus*

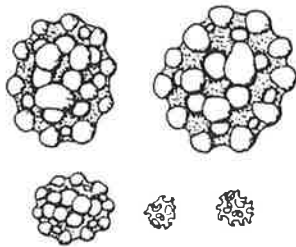


Fig 60. - Deposits of *Ocnus planci*

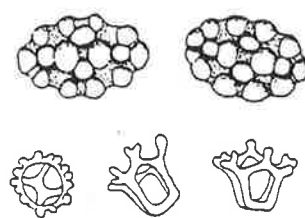


Fig. 61. - Deposits of *Aslia lefevrei*

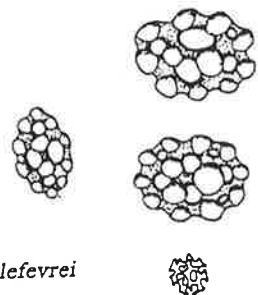


Fig. 62. - Deposits of *Ocnus lactea*

12. Deposits in surface layer of skin are baskets, inner layer of plates with 4 holes and prominent nodules (fig. 61) *Aslia lefevrei*

Body cylindrical, skin tough; colour brownish or black. Max. length 15 cm. Under stones, shore to 20 m depth; southwest England and western Ireland.

Deposits in surface layer are irregular starshaped 13

13. Tube feet scarce, in zig-zag rows *Ocnus lactea*

Body cylindrical, skin thick and smooth; inner layer of deposits with large nodules and usually 4 holes (fig. 62); colour white or brown. Max. length 4

cm. In crevices and on algae, shore to 100 m; south west and northeast coasts.

Tube feet in five distinct double rows *Ocnus planci*

Body cylindrical, skin thick, smooth; inner layer of deposits with large nodules and more than four holes (fig. 60). Colour brownish. Max. length 15 cm. Shallow water to more than 100 m; distribution not well known, but found on west coasts, Irish Sea and Dogger Bank.

- 14. Deposits present all over body 15
- At least part of body lacks deposits 16

15. Deposits are tables with spires (fig. 63) *Thyone fusus*

Body attenuated at both ends; colour white or pink. Max. length 20 cm. In shell gravel, shallow water to more than 200 m; all round British Isles.

Deposits flat plates with smooth holes (fig. 59) *Pseudothyone raphanus*

Body with long thin "tail"; colour yellowish or brownish. Max. length 6 cm. Muddy sand or muddy gravel, shallow water to more than 200 m; southwest, west and northeast coasts.

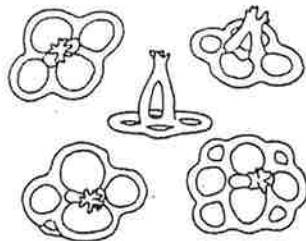


FIG. 63. — Calcareous deposits of *Thyone fusus*. × 200. (From *Danmark's Fauna*.)

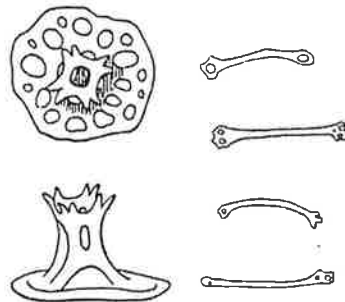


Fig. 64. - Deposits of *Neopentadactyla mixta*

16. No deposits except in tube feet *Thyone roscovita*

Skin thick, rosy grey, not transparent. Shore to 40 m; Brittany and Atlantic coast of France. May have extended range recently, now found on western coasts to southwest Scotland and Irish Sea. (BEP)

Deposits at posterior end of body only *Thyone inermis*

Body attenuated at both ends, skin thin transparent; deposits discs with spires; colour pink. Max. length 15 cm. Depths of 30 to 180 m; south and west coasts.

17. Tube feet in five fairly distinct rows *Neopentadactyla mixta*

Body elongated, attenuated at both ends; deposits are tables (fig. 64); colour yellowish violet. Max. length 20 cm. Found in gravely 20 to 200 m depth; west of England, west of Ireland and Irish Sea.

Tube feet scattered all over body 18

18. Tentacles of inner ring in close pairs, almost fused together *Thyonidium hyalinum*

Body short, skin thin and transparent, tube feet large and few. Deposits tables (fig. 65), but scarce in larger specimens; colour reddish. Max. length 12 cm. 10 to more than 200 m depth; west and northeast coasts.

Tentacles of inner ring in more widely spaced pairs *Thyonidium drummondii*

Body elongated tapering at ends, skin thick and not transparent; deposits absent except around bases of tentacles, they are small tables (fig. 66); tube

feet very fine and numerous; colour whitish, tentacles darker. Max. length 20 cm. Shallow water to more than 200 m.; west coasts.

19. Body flattened, broad oval shape; centre of sole without tube feet, scales of upper side large; mouth opening surrounded by many small plates *Psolus squamatus*

Colour white, yellowish or pinkish. Max. length 7 cm. 50 to more than 200 m depth; western Scotland. (NB. Young *P. phantapus* are the same shape as *P. squamatus*. They can be distinguished by the shape of the deposits in the skin of the sole) (fig. 67, 68.)

Body not flattened, sole rather small, anterior and posterior ends stick upward; posterior end tapers to a tail; tube feet all along centre line of sole; scales rather small *Psolus phantapus*

Colour varies from yellowish brown to almost black; Max. length 15 cm. 56 to more than 200 m depth; northwest and northeast coasts.

20. No deposits in skin *Rhabdomolgus ruber*

Body cylindrical, colour red. Max. length 1cm. Shallow water; Heligoland and Brittany.

Deposits are anchor shaped, with attached flat 'anchor plates' (fig. 71) 21

21. Anchor plate has a distinct 'handle' at end attached to anchor (fig. 71)..... 22

Anchor plate does not have such a handle 24

22. Tentacles 11, each with a long terminal digit and one pair of smaller lateral digits *Labidoplax buski*

Body cylindrical, colourless; anchor plates have 6 main holes (fig. 69). Max length 3 cm. In muddy gravel from 10 to more than 200 m depth; west coasts.

Tentacles 12, each with two pairs of lateral digits 22a

- 22a Anchor plates with six regularly-spaced holes *Labidoplax media*

Body cylindrical, transparent with brown glands. Max. length 3cm. In glutinous mud; Strangford Lough and southwest Scotland.

Anchor plates with many irregular holes 23

23. Anchor plates are thin, elongate, with smooth edge and many holes (fig. 71) *Labidoplax digitata*

Body cylindrical, colour red or brown. Max. length 30 cm. In muddy sand, shore to about 70 m depth; south and west coasts.

Anchor plates are thick, fan-shaped, with serrate edge and many holes (fig. 70) *Labidoplax thomsoni*

Body cylindrical. Shore of Belfast Lough.

24. Tentacles 10, simple, no digits *Leptosynapta minuta*

Body cylindrical, transparent, colourless; deposits anchors, large and small plates (fig. 72). Max. length 1 cm. Shallow water; Heligoland, Brittany and Irish Sea.

Tentacles usually 12, with lateral digits 25

25. Tentacles have 8 to 11 pairs of short digits *Leptosynapta bergensis*

Body cylindrical, colour dark pink; anchor plates of anterior end of body usually smooth (fig. 74). Max. length 30 cm. In muddy sand; shallow water; North Sea and Channel.

Tentacles have 5 to 7 pairs of digits, increasing in length towards the tip 26

26. Anchor plates of anterior end of body have serrated edge (fig. 73) *Leptosynapta gallienei*

Body cylindrical, skin rough, deep pink. Max. length 30 cm. Shore and shallow water; Brittany.

Anchor plates of anterior end of body have smooth edge 27

27. Pink colour soluble in alcohol; deposits in tentacles are rods with holes in the enlarged ends (fig. 76) *Leptosynapta cruenta*

Colour, pale pink. Max. length 25 cm. Sandy shores in Brittany.

Pink colour not soluble in alcohol; deposits in tentacles are rods with enlarged ends but without holes *Leptosynapta inhaerens*

Colour pale pink. Max length 30 cm. Coarse sand; shore to 50 m; west and northeast coasts.