**Pinnidae**

**Pen shells**

Diagnostic characters: Shell large and brittle, equiva]ve, laterally compressed, subtrigonal in outline; ventrally and posteriorly gaping; very inequilateral, pointed in front, wide and flexible behind. Um-

bones at anterior end which is eroded and internally closed by a series of small transverse partitions. Outer sculpture mainly composed of radial ribbing, smoothish or provided with imbricated scales or spines, and often crossed by concentric undulations ventrally. Perio-

tracum usually absent. **Ligament linear**, recessed in a narrow groove along dorsal margin. **Hinge without teeth. Interior of shell with a thin nacreous layer** which is restricted to the anterior half of valves. Two unequal adductor muscle scars, the anterior relatively small and placed in the anterior angle of shell, the posterior large and situated about midlength. No pallial sinus. Internal margins thin, smoothish, reflecting the external sculpture. Gills of eumelibranchiate type, with folded branchial sheets. Foot conical, elongate and grooved, with a profuse silky byssus. Siphons absent. Mantle widely open, papillate on margins.

Habitat, biology, and fisheries: Sessile animals, living generally partly embedded in heterogenous soft bottoms, with the narrow anterior tip of shell downwards, and attached to various hard elements of the substrate by means of long byssal threads. The posterior gape of the flexible shell can be closed by contraction of the adductor muscles. In relation to their vertically embedded mode of life, the Pinnidae have developed several unique anatomical features: a pair of special gutter-shaped canals inside the mantle lobes, to remove rapidly sediment material from the anterior portion of the mantle cavity, and a protrusible pallial organ above the posterior adductor muscle, to clear away debris from the posterior part of the shell. Sexes separate. Free-swim-

ming larval stage present. Pinnidae have a noticeable economic importance in the western Pacific. They are actively collected for food in Japan and surrounding areas, as well as in Polynesia and several other Indo-Pacific island groups. In Polynesia, shells are carved to form decorative ornaments, and entire valves of large specimens are sometimes used as plates by native populations.

Similar families occurring in the area

**Mytilidae**: stiff shell, without posterior gape; internal nacreous layer not restricted to the anterior half of shell; hinge sometimes with small teeth or crenulations; anterior end always without internal transverse parti-

tions; posterior adductor scar situated in the posterior quarter of valves.

**Key to species of interest to fisheries occurring in the area**

1a. Outer surface of valves with a median radial keel, at least for the young stages of growth; internal nacreous layer divided in 2 lobes by a median radial groove (Fig. 1a) ........................................... → 2

1b. Outer surface of valves without a median radial keel, even for the young stages of growth; internal nacreous layer undivided (Fig. 1b) ........................................... → 3

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**Fig. 1 inner surface**

a) *Pinna*  

b) *Atrina*
2a. Posterior margin of shell squarely truncate; posterior adductor scar often extending onto ventral lobe of nacreous area (Fig. 2)  
\[\text{Pinna muricata}\]

2b. Posterior margin of shell arcuate or broadly rounded (Fig. 3); posterior adductor scar never extending onto ventral lobe of nacreous area  
\[\text{Pinna bicolor}\]

3a. Posterior adductor scar completely enclosed within the nacreous area (Fig. 4)  
\[\text{Atrina pectinata}\]

3b. Hind margin of posterior adductor scar slightly protruding beyond the nacreous area  
\[\text{Atrina vexillum}\]

List of species of interest to fisheries occurring in the area

The symbol \[\text{©}\] is given when species accounts are included.

\[\text{© Atrina pectinata} \ (\text{Linnaeus, 1767})\]
\[\text{© Atrina vexillum} \ (\text{Born, 1778})\]
\[\text{© Pinna bicolor} \ (\text{Gmelin, 1791})\]
\[\text{© Pinna muricata} \ (\text{Linnaeus, 1758})\]

Reference

Atrina pectinata (Linnaeus, 1767)

Frequent synonyms / misidentifications: Pinna chemnitzii Hanley, 1858; P. japonica Reeve, 1858; P. lischkeana Clessin, 1891; P. lurida Reeve, 1858; P. pectinata Linnaeus, 1767 / Pinna pectinata “Linnaeus” Hanley, 1855 = Atrina fragilis (Pennant, 1777).

FAO names: En - Comb pen shell; Fr - Jambonneau pectiné.

Diagnostic characters:

Shell reaching a large size, usually rather thin, fragile, moderately inflated and triangularly wedge-shaped in outline, with a highly variable sculpture. Dorsal margin nearly straight or slightly concave, posterior margin generally truncate. Ventral margin widely convex posteriorly, straightish to shallowly depressed anteriorly. Outer surface of valves with 15 to 30 radial ribs which may be smooth to densely set with short, open spines. Dorsalmost radial rib frequently with a series of short and sharp spines protruding along the dorsal margin of shell. Inner surface of shell with shallow grooves corresponding to the external radial ribs. Internal nacreous layer rather thin, undivided, occupying the anterior 2/3 to 3/4 of valves. Posterior adductor scar completely enclosed within the nacreous area.

Colour: outside of shell slightly shiny, translucent olivaceous tan, often tinged with darker purplish brown or grey toward the umbones. Interior similarly coloured, iridescent on nacreous area.

Size: Maximum shell length 37 cm, commonly to 26 cm.

Habitat, biology, and fisheries: In sand or muddy sand with shells, with the ventral (open) portion of the shell facing towards the current. From low intertidal areas to depths of about 20 m. Tolerant to wide ranges of temperature (from 1° to 39°C) and to low-salinity water. Collected in many areas for food and fertilizer, this species is frequently used commercially in the northern part of its range (Japan, Taiwan Province of China) where it reaches a larger size. There it is planted intertidally and actively cultivated for subsequent harvest. In the Philippines, the shucked soft parts are often sold in the markets, and the posterior adductor muscle is sometimes sold separately.

Distribution: Widely distributed in the Indo-West Pacific, from southeastern Africa to Melanesia and New Zealand; north to Japan and south to New South Wales. New Zealand populations are generally considered a distinct subspecies under the name Atrina pectinata zelandica (Gray, 1835).
Atrina vexillum (Born, 1778)

Frequent synonyms / misidentifications: Pinna nigra Chemnitz, 1785 (Invalid name); P. vexillum Born, 1778 / None.

FAO names: En - Flag pen shell; Fr - Jambonneau noir.

Diagnostic characters: Shell reaching a very large size, thick and solid, inflated, variable in shape from triangular to hatchet-shaped or subglobular. Dorsal margin usually nearly straight, posterior margin broadly oval to somewhat truncate in outline. Ventral margin broadly convex posteriorly and concave near the umbones, often strongly lobate in medium-sized and large specimens. Outside of valves with 10 to 17 main radial ribs, often bearing scale-like spines, and with weaker interstitial riblets. Internal nacreous layer moderately strong, undivided, occupying the anterior half or 2/3 of valves. Hind margin of posterior adductor scar slightly protruding beyond the nacreous area (protrusion of adductor scar more developed in mature specimens). Colour: outside of shell dark reddish brown to nearly black, usually dull. Shell material semitranslucent, appearing a rich reddish purple when viewed with transmitted light. Interior dark brown to black, iridescent on nacreous area.

Size: Maximum shell length 48 cm, commonly to 30 cm.

Habitat, biology, and fisheries: In sandy-mud bottoms, or in sandy eel-grass patches on reefs sublittorally, from depths of 1 to about 35 m. Because it attains a large size, this common species is probably one of the most economically important members of the family in the Indo-West Pacific. The large posterior adductor muscle is highly prized as food, and the black shell carved by natives in Polynesia to make decorative ornaments or plates. Beautiful but very fragile black pearls are sometimes produced by the animal.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and Hawaii, and south to Queensland and New Caledonia.
**Pinna bicolor** Gmelin, 1791

Frequent synonyms / misidentifications: *Pinna atropurpurea* Sowerby, 1825 / *Pinna deltoides* Menke, 1843.

**En** - Bicolor pen shell; **Fr** - Jambonneau bicolore.

Maximum shell length 50 cm, commonly to 40 cm. Embedded in muddy sand and reef flats, in littoral and adjacent subtidal shallow waters to depths of about 10 m. Planktonic larval stage probably short, hence a range restricted to the shores of continental areas and adjacent islands. Species of minor economic importance, locally collected for subsistence purposes. Indo-West Pacific, from East and southeast Africa, including Madagascar, Mauritius Island, the Red Sea and the Persian Gulf, to New Caledonia; north to Japan and south to South Australia. Generally absent from oceanic islands of the central Indian Ocean and the tropical West Pacific, but sporadically found in Hawaii.

**Pinna muricata** Linnaeus, 1758

Frequent synonyms / misidentifications: *Pinna exquisita* Dall, Bartsch, and Rehder, 1938; *P. hawaiensis* Dall, Bartsch, and Rehder, 1938; *P. philippinensis* Reeve, 1858; *Quantulopinna delsa* Iredale, 1939; *Q. muricata* (Linnaeus, 1758) / None.

**En** - Prickly pen shell; **Fr** - Jambonneau épineux.

Maximum shell length 31 cm, commonly to 15 cm. In various soft bottoms (silty mud, sand, sandy gravel), among rocks, in eel-grass flats or in sandy patches of coral reefs, from low tide levels to a depth of about 40 m. Occasionally collected for food by coastal populations. Widespread in the Indo-West Pacific, from eastern Africa, including South Africa, Madagascar, the Red Sea and the Gulf of Oman, to eastern Polynesia; north to southern Japan and south to New South Wales.
**PTERIIDAE**

Pearl oysters

*Diagnostic characters:* Shell somewhat compressed, obliquely ovate to suborbicular in outline, with a straight dorsal margin often produced at each end into a wing-like ear, trigonal in front and sometimes very long behind. Shell slightly inequivalve, with left valve a little more inflated than right valve which is provided with a strong byssal notch anteriorly. Outer surface of shell often scaly or lamellate. Umbones small, prosogyrate, in front of midlength of valves. A narrow cardinal area in each valve, with the external ligament more or less stretching along under and behind the umbo. **Hinge** narrow and elongate, **toothless or with** 1 or 2 denticles near the umbo and a lamellate process posteriorly. **Interior** of shell **partly nacreous**, often with a wide non-nacreous margin ventrally. **Only 1 large and subcentral, posterior adductor muscle scar** usually present in the adult. **Pallial line without a sinus.** Gills of filibranchiate type, with folded or smooth branchial sheets. Foot small, grooved, with a well-developed byssus. Siphons absent. Mantle lobes free, with marginal tentacles.

**Habitat, biology, and fisheries:** Pteriidae live attached by their strong byssus to various substrates (rocks, pebbles, shells, aquatic plants, alcyonarians, etc.), mainly in warm, tropical to subtropical and relatively shallow waters. They may occur in dense colonies. The Pteriidae are important economic bivalves in the Indo-West Pacific. They are actively exploited since ancient times for their ability to produce pearls. Some species are intensely cultivated for pearl production and their shell used as a source of mother-of-pearl for the industry. The soft parts are also consumed by native coastal populations in many parts of the area.

**Similar families occurring in the area**

Isognomonidae: cardinal area with a series of transverse ligamental grooves.

Malleidae: cardinal area relatively wide, with a single transverse central groove for the ligament; shell often with a long, non-nacreous ventral to posteroventral expansion; dorsal margin of shell sometimes produced into very long wing-like expansions at both ends.
Key to species of interest to fisheries occurring in the area

1a. Shell obliquely ovate in outline; posterior ear drawn out into a wing-like expansion (Fig. 1a) → 2

1b. Shell subcircular to subquadrate in outline; posterior ear ill-defined, not forming a wing-like expansion (Fig. 1b) → 3

2a. Shell colour plain black; outline initially narrowly oblique, later greatly expanding ventrally; non-nacreous internal margin relatively wide (Fig. 2) Pteria pengium

2b. Shell colour dark brown, with a few yellowish radial rays; outline obliquely oval and rather narrow; non-nacreous internal margin reduced (Fig. 3) Pteria avicular

3a. Shell rather thick and large (reaching 20 cm in height or more), subcircular in outline; anterior margin markedly protruding beyond the tip of anterior ear; hinge toothless (Fig. 4a) → 4

3b. Shell rather thin and small (not exceeding 9 cm in height), subquadrate in outline; anterior margin protruding only slightly or not at all beyond the tip of anterior ear; hinge with 2 small teeth in each valve (Fig. 4b) → 5

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Fig. 1

a) Pteria

b) Pinctada

Fig. 2 Pteria pengium

radial rays

Fig. 3 Pteria avicular (exterior)

Fig. 4 interior of left valve

a) subcircular outline

b) subquadrate outline
4a. Outer surface uniformly fawn, sometimes with radial stripes of darker spots in the unbonal region; nacreous area with a golden border (Fig. 5); non-nacreous margin horny. ........................................... *Pinctada maxima*

4b. Outer surface dark greyish brown or green, with radial stripes of white to yellowish spots (Fig. 6); nacreous area with a darker border; non-nacreous margin very dark. ........................................... *Pinctada margaritifera*

5a. Nacreous area with golden tint; non-nacreous margin with white porcelaneous patches (Fig. 7) ........................................... *Pinctada maculata*

5b. Nacreous area silvery, without golden tint; non-nacreous margin without white porcelaneous patches (Fig. 8) ........................................... *Pinctada radiata*

**List of species of interest to fisheries occurring in the area**

The symbol ◆ is given when species accounts are included.

◆ *Pinctada maculata* (Gould, 1850)
◆ *Pinctada margaritifera* (Linnaeus, 1758)
◆ *Pinctada maxima* (Jameson, 1901)
◆ *Pinctada radiata* (Leach, 1814)
◆ *Pteria avicular* (Holten, 1802)
◆ *Pteria penguin* (Röding, 1798)

**References**


**Pinctada maculata** (Gould, 1850)

**Frequent synonyms / misidentifications:** *Pinctada panasesae* (Jameson, 1901); *P. pitcairnensis* (Jameson, 1901); *Pteria maculata* (Gould, 1850) / None.

**FAO names:** En - Spotted pearl oyster; Fr - Pintadine tachetée.

**Diagnostic characters:** Shell rather thin and small, subquadrate in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Anterior margin protruding only slightly or not at all beyond the tip of anterior ear. Outer surface of shell, when not worn, covered with numerous, flattened and brittle, imbricating concentric scales bearing slender, radially projecting spines, especially toward the margins. **Hinge line with 2 small teeth on each valve:** 1 rounded anterior tubercle just in front of the umbo, and 1 slightly slanting posterior ridge behind the ligamental area. Parallel accessory ridges sometimes developed on both valves, so that the posterior teeth appear double. **Colour:** outside of shell with a variable coloration, usually white to tan with a number of purple, or brown to black radiating bands and sometimes a superimposed pattern of finely wavy concentric lines of reddish brown. Internal nacreous area with pale yellow to deep orange-gold tint. Non-nacreous margin with white porcelaneous patches, generally alternating with irregular, dark purplish brown or black blotches.

**Size:** Maximum shell height 6 cm, commonly to 5 cm.

**Habitat, biology, and fisheries:** Byssally attached to rocks, the underside of stones or coral pieces. Littoral and sublittoral to a depth of about 20 m. Extremely common in some shallow water Polynesian lagoons. This species can give regular but rather small yellow pearls. Locally exploited for its edible meat, golden nacreous shell and, sometimes, for pearls (Philippines, western Polynesia).

**Distribution:** Western Pacific and adjacent areas of the eastern Indian Ocean, from Cocos (Keeling) Islands to eastern Polynesia; north to Japan and south to northern New South Wales, Kermadec, Norfolk and Lord Howe islands.
Pinctada margaritifera (Linnaeus, 1758)

Frequent synonyms / misidentifications: Meleagrina margaritifera (Linnaeus, 1758); Pinctada nigromarginata (Saville-Kent, 1890) / None.

FAO names: En - Blacklip pearl oyster; Fr - Pintadine à lèvre noire.

Diagnostic characters: Shell rather thick and large (attaining 25 cm in length), subcircular in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Anterior margin markedly protruding beyond the tip of anterior ear. Outer surface of valves, when not worn, with densely set, flattened, imbricating concentric scales and moderately long, parallel-sided and flattened spines with tapering or rounded ends; spines lying relatively flat on surface of valves, arranged in radial rows and often strongly projecting on shell margins. Hinge completely devoid of teeth. Colour: outside of shell dark greyish brown or green to nearly black in ground colour, with radial stripes of white or yellowish markings corresponding to the basal portion of old flattened spines. Internal nacreous area silvery, with a darker smoky hue and a hint of red and green iridescence on border. Non-nacreous area very dark.

Size: Maximum shell height 25 cm, commonly to 13 cm.

Habitat, biology, and fisheries: On various bottoms, byssally attached to hard substrates at least in the young stages. Mainly in clear water under the influence of currents. Often in dense colonies. Littoral and sublittoral to a depth of 20 m. This large-sized, edible species is commonly used for the mother-of-pearl industry and pearl trade in many areas of the Indo-West Pacific. It produces highly prized dark pearls, which are collected both from natural banks and by aquaculture.

Distribution: Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to eastern Polynesia; north to Japan and the Hawaii, and south to southern Queensland.
**Pinctada maxima** (Jameson, 1901)

**Frequent synonyms / misidentifications:** None / *Meleagrina margaritifera* (Linnaeus, 1758)

**FAO names:** En - Goldlip pearl oyster; Fr - Pintadine à lèvre dorée.

**Diagnostic characters:** Shell rather thick and large to very large (attaining 30 cm in length), subcircular in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Anterior margin markedly protruding beyond the tip of anterior ear. Outer surface of valves, when not worn, covered with flattened, imbricating concentric scales bearing large and irregular, flat spines with blunt ends, roughly arranged in radial rows and projecting at shell margins. **Hinge** completely devoid of teeth.

**Colour:** outside of shell uniformly fawn, sometimes with radial stripes of darker spots in umbonal region; then, ground colour in that region green, dark brown, or purple. Internal nacreous area highly lustrous, silvery with a variably extended golden border. Non-nacreous margin clear, of a plain horny colour.

**Size:** Maximum shell height 30 cm, commonly to 20 cm.

**Habitat, biology, and fisheries:** On various bottoms, byssally attached to hard substrates or objects, at least in the young stages. Mainly in clear water under the influence of currents. Often in dense colonies. Littoral and sublittoral to a depth of 60 m; most common sublittorally, from depths of 5 to 30 m. This large-sized, edible species is abundantly used for the mother-of-pearl industry and pearl trade and has a great economic importance in many areas. Cultivated in China, Thailand, New Guinea, and the Philippines.

**Distribution:** Eastern Indian Ocean to the tropical western Pacific, from Nicobar and Andaman Islands to Melanesia; north to Japan and south to Queensland.
**Pinctada radiata** (Leach, 1814)

**Frequent synonyms / misidentifications:** *Pinctada aerata* (Reeve, 1857); *P. fucata* (Gould, 1850); *P. lacunata* (Reeve, 1857); *P. martensi* (Dunker, 1872); *P. perviridis* (Reeve, 1857); *P. vulgaris* of authors (not of Schumacher, 1817) (A deleted, dubious name) / *Pinctada imbricata* (Röding, 1798).

**FAO names:** En - Rayed pearl oyster; Fr - Pintadine radiée; Sp - Pintadina radiada.

Diagnostic characters: Shell rather thin and small to medium sized, relatively inflated, subquadrate in outline, with a short and ill-defined posterior ear which is not drawn out into a wing-like process. Dorsal margin relatively long, anterior margin protruding only slightly or not at all beyond the tip of anterior ear. Outer surface of shell, when not worn, with densely set, appressed and flattened, imbricating concentric scales and moderately small, radially projecting spines mostly preserved towards the margins. **Hinge line with 2 small teeth in each valve:** 1 rounded anterior tubercule just in front of the umbo, and 1 posterior ridge, situated behind the ligamental area and almost parallel to dorsal margin. A small accessory ridge sometimes present above the posterior tooth of right valve. **Colour:** outside of shell variable, uniform or with darker markings or radial rays, mostly of reds and browns, but sometimes of green and bronze coloration. Internal nacreous area highly iridescent. Non-nacreous margin glossy, light brown with dark brown or reddish blotches corresponding to the main external rays.

**Size:** Maximum shell height 9.5 cm, commonly to 6 cm.

**Habitat, biology, and fisheries:** Byssally attached to rocks, dead corals and various submerged objects, often forming large natural banks. On soft bottoms, they aggregate to one another. Littoral, sublittoral and shell zone, from low tide levels to a depth of about 150 m. Most common on sublittoral bottoms, from depths of 5 to 25 m. Collected in many areas of the Indo-West Pacific for its edible muscle, nacreous shell and ability to develop pearls, this species is a major economic species for pearl production in India, Sri Lanka, Myanmar, China, and Japan where it is also actively cultivated.

**Distribution:** Widespread in the Indo-West Pacific, from East Africa, including Madagascar, the Red Sea and the Persian Gulf, to Melanesia and Hawaii; north to Japan and south to northern Victoria.

**Remarks:** There has been much confusion about the taxonomy of this important economic species, and there is still no general agreement among authors about the correct scientific name. In areas where it is intensively fished or cultivated, it has been generally known as *Pinctada fucata* (India), *P. vulgaris* (Sri Lanka) and *P. martensi* or *P. fucata martensi* (Japan). It appears, however, that *P. radiata* must be used as the oldest available name.
Pteria penguin (Röding, 1798)

Frequent synonyms / misidentifications: Magnavicula penguin (Röding, 1798); Pteria lotorium (Lamarck, 1819) / Pteria macroptera (Lamarck, 1819).

FAO names: En - Penguin wing oyster; Fr - Avicule épaisse.

Diagnostic characters: Shell solid, reaching a very large size, obliquely ovate in outline, with posterior ear drawn out into a narrow, more or less elongated, wing-like expansion; slightly inequivalve, left valve a little more inflated and with a weak rounded fold radiating from umbo to posteroventral end of shell. Outline of shell variable, initially narrowly oblique, later greatly expanding ventrally and almost as high as long, or even higher than long in larger specimens and with the posterior ear relatively short. Interior of shell with a wide non-nacreous margin ventrally. Colour: outside of shell plain dark brown to black. Interior silvery and brilliantly nacreous, with a broad, posteroventrally expanded, glossy black margin.

Size: Maximum shell length 30 cm, commonly to 20 cm.

Habitat, biology, and fisheries: Byssally attached to rocks, corals, gorgonians and other hard objects. Littoral and sublittoral, from low tide levels to a depth of 35 m. Collected for food and pearl trade. Aquaculture in Thailand and in the central Philippines.

Distribution: Widespread in the Indo-West Pacific, from East Africa and the Red Sea to Fiji Islands; north to southern Japan and south to northern Queensland.
**Pteria avicular** (Holten, 1802)

**Frequent synonyms / misidentifications:** *Pteria cypsellus* (Dunker, 1872); *P. peasei* (Dunker, 1872) / None.

**En** - Swift wing oyster; **Fr** - Avicule martinet.

Maximum shell length 13 cm, commonly to 10 cm. Byssally attached to colonial coelenterates and other hard substrates. Littoral and sublittoral to a depth of 30 m. Collected for food and pearl trade. This is a major cultivated species in southern China. Eastern Indian Ocean to the tropical western Pacific, from Myanmar to the Philippines; north to Japan and south to northern Australia.

![Exterior of left valve](after Kira, 1962)