

AN ILLUSTRATED CHECKLIST OF THE INTERTIDAL BIVALVIA OF THE STATE OF KUWAIT

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Abstract From recent surveys and a review of previous studies a list of 214 species of marine bivalves collected on the shores of Kuwait is presented. For each there are illustrations and citations from past studies. Species are included only if they could be verified from specimens or high-quality images.

The absence of species previously recorded, and the unique elements of the bivalve fauna are briefly discussed.

Key words Northwest Arabian Gulf, Persian Gulf, Mollusca, Taxonomy, Identification

INTRODUCTION

This checklist is the first illustrated compilation of the intertidal Bivalvia of Kuwait and is intended to function as a basic taxonomic tool for biologists and shellers alike. For the latter and those with a general interest we have included all species found on the shore either living or as dead shells only. It is also an open access precursor to an intended atlas by Dr Manal Al-Kandari that would include descriptions, differential diagnoses, detailed illustrations and distribution maps. However, much taxonomic research remains to be done before such a definitive atlas can be produced. The most relevant guide for the Arabian Gulf is Dance *et al.* (1995) but it is not specific to Kuwait and the nomenclature is now rather out of date. Jones's field guide (Jones, 1986) contains only a fraction of the molluscan fauna, and it is now taxonomically outdated.

The impetus for this checklist arises out of the taxonomic work required to support a survey of the intertidal fauna of Kuwait carried out by the Kuwait Institute for Scientific Research, from 2013 through to 2018. The results on the Mollusca were submitted by Oliver (2014, 2015a, b, 2016, 2017a, b, 2019) and a summary was published in 2020 (Al-Kandari, *et al.*, 2020). Further collecting took place in November/December of 2019 and this added considerably to the number of species, although most were recovered dead from the strandline. Taxonomic research resulting from

the most recent KISR survey is ongoing, already published are papers on oysters (Al-Kandari, Oliver *et al.* 2021; Salvi, Al-Kandari *et al.* 2022, 2023); nudibranchs (Nithyanandan, Al-Kandari & Mantha, 2021) and on a tellinid in the genus *Pseudopsammobia* (Oliver, Al-Kandari & Dekker 2023).

METHODS

This checklist is based primarily on the specimens collected during the KISR intertidal survey and the survey methods can be found in Al-Kandari *et al.* (2020). It became apparent that the number and names of species found did not always agree with past lists making comparisons very difficult. To arrive at a verified checklist only records based on voucher specimens or high-quality published photographs have been accepted.

Only verifiable records in the following publications have been accepted. The lists made by Deeks and Johnston (in Clayton 1983) are supported by excellent photographs and to some extent by specimens in the William Stuart collection (now in the National Museum of Wales). The illustrations in Jones (1986) are generally sufficient to confirm the identity of the species but no voucher material exists. The checklist of Glayzer *et al.* (1984) is supported by their collection now in the Natural History Museum, London. The illustrated shells in Oliver in Dance *et al.* (1995) are present in the National Museum of Wales as are many of the species described by J. C. Melvill from the collections of F. W. Townsend.

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Specimens relevant to the study by Behbehani & Ghareeb (2002) are present in the collection of the senior author held in the University of Kuwait. The work of Al-Yamani, *et al.* (2012) concerns mainly offshore benthos but the photographs in the book and specimens present in KISR allow verification. All the material collected by Al-Kandari cited in Al-Kandari & Oliver *et al.* (2020) is maintained in the Al-Salmiyah laboratory of KISR although a voucher set will be deposited in the National Museum of Wales.

The checklist refers to previous records in the major publications through a numerical system as follows 1 Deeks and Johnston, 1983; 2 Glayzer *et al.*, 1984; 3 Al-Bakri 1985; 4 Jones 1986; 5 Oliver in Dance 1995; 6 Behbehani & Ghareeb 2002; 7 Al-Yamani *et al.* 2012; 8 Al-Kandari *et al.*, 2020.

If species are mentioned in the above reports but cannot be confirmed, they are cited but not illustrated.

In general, the systematics and nomenclature follow that in MollucaBase (2023) but the sequence has been adapted to bring similar looking species onto the same plate and to maximise the use of space. Reference back to MollucaBase (2023) will give full systematics along with original references. Where we deviate from MollucaBase (2023) a brief explanation is given.

Distributions and place names are based primarily on the data to be found in Glayzer *et al.* (1984), Behbehani & Ghareeb (2002) and Al-Kandari *et al.* (2020). These studies include intertidal sites from the very north at Warbah Island to the extreme south at the border with Saudi Arabia. Many changes in place names have occurred through the period 1984 to the present and this is made further confusing due to the variation of translating Arabic names into English. Here we present a map (Fig. 1) synthesising the collecting localities and the names applied to them through the period 1984 to present.

A cautionary note must be made if attempts are made to make diversity or numerical comparisons from the lists of molluscs in the checklists and survey reports cited above. All adopted slightly different methodologies with differing levels of expertise and collecting effort. Furthermore, the systematics and nomenclature changes through time make direct comparisons difficult unless voucher specimens have been retained. The

maintenance of reference collections is essential when comparisons of different studies are to be made. Museums play an important role here yet it is unfortunate that Kuwait does not have a central repository for marine specimens.

A Short History of Molluscan Research in Kuwait

The history of the study of the Mollusca of Kuwait is rather short. Throughout the seventeenth century and onwards to the 1930s the pearl industry was the primary source of income for the state and many of its people. At its peak up to 800 boats were employed in pearl diving but the financial slump of the 1930's and the development of pearl culture in Japan drove the industry into terminal decline. A thorough and entertaining history of the pearling industry in Kuwait is to be found in 'Pearling in the Arabian Gulf: A Kuwait Memoir' by Saif Marzooq al-Shamlan (2000). In some parts of the world the pearling industry brought with it a scientific interest and a wider view on the marine biology as a whole. This is exemplified by the reports on the pearl-oyster fisheries of the Gulf of Manaar, Ceylon by Prof. Herdman of Liverpool University (Herdman, 1902–1906). Although Kuwait had links with European countries, notably the United Kingdom, such investigations into the Kuwait pearling industry did not take place.

At the turn of the 20th century through the work of the cable laying ship 'Patrick Stewart' captained by F. W. Townsend large quantities of shells were collected from the coasts of Oman, Iran and Pakistan and the southern part of the Arabian Gulf. The shells were sent to James Cosmo Melvill who, over thirty years, described many hundreds of new species to science (Melvill & Standen, 1907; Melvill, 1928). There are scattered mentions of Kuwait (as Kowait) but it does not figure largely in these works.

Academic institutions came rather late to Kuwait, the university being inaugurated in 1966 and the Kuwait Institute for Scientific Research in 1967. Molluscan research did not figure largely with most studies relating to molluscs as hosts of trematode helminths. Early compilations of lists were made by ex-patriot Europeans firstly through the efforts of the Ahmadi Natural History and Field Studies Group with the molluscs reported by Michael Deeks and David Johnston in Clayton (1983). This was followed by the first comprehensive checklist by Barbara

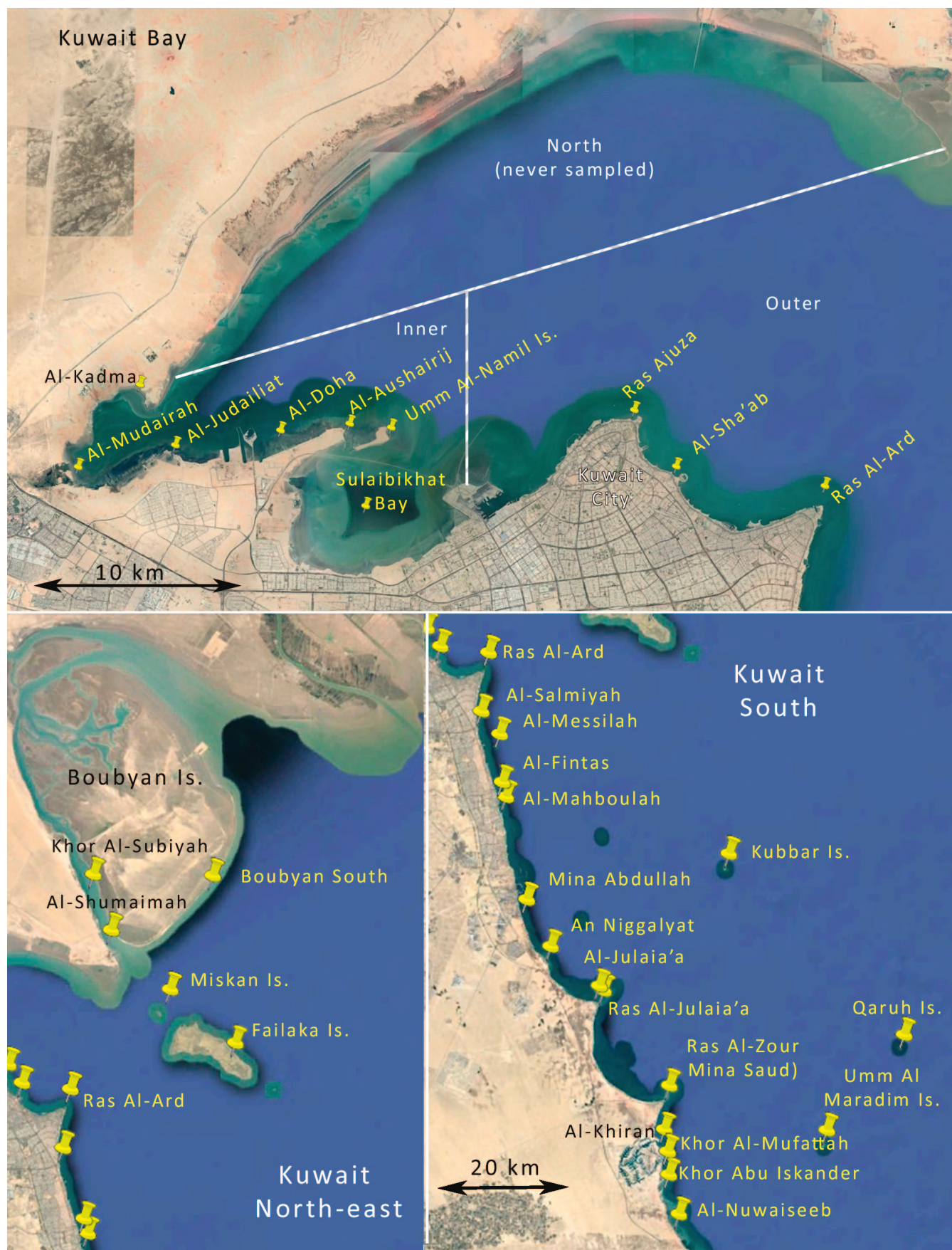


Figure 1 Map showing the collecting localities from 1984 through to present.

and David Glayzer with the help of Kathleen Smythe (Glayzer *et al.*, 1984). Kathleen Smythe (Chatfield, 1991) became an expert in the molluscs of the Arabian region and worked alongside Herbert E. J. Biggs and Don and Eloise Bosch publishing on the molluscs of the Arabian Gulf and Oman (Smythe, 1972, 1979, 1984). The Glayzers published their checklist in 1984 in which they listed 230 gastropods, 5 chitons, 5 scaphopods, 144 bivalves and 1 cephalopod for a total of 385 species; 66 others were not identified, thus suggesting a total of 451. This list is based on extensive collecting by dedicated amateurs over a lengthy period from as early as 1972 through to 1982. Both live and dead shells of collected specimens were listed inferring that both intertidal and subtidal species may be included. It was also noted that many of the smaller species were extracted from shell sand such that their original habitat was unknown.

In 1985 the first environmental assessment of the intertidal of Kuwait was published by the Kuwait Institute for Scientific Research (Al-Bakri *et al.*, 1985). This report listed 45 gastropods, 69 bivalves, 1 scaphopod, 1 chiton and 1 cephalopod (117 total). In 1986 a field guide to the intertidal fauna of Kuwait was published (Jones, 1986). This guide did not attempt to be comprehensive, listing only the more common species. It included 41 gastropods, 1 chiton, 1 scaphopod, 48 bivalves and 1 cephalopod, for a total of 92 species. In 1995 an identification manual to the eastern Arabian fauna was published (Dance *et al.*, 1995) but this volume did not specify records from Kuwait in particular but included Kuwait in the northern Arabian Gulf region. Following that publication the only significant study was that of Behbehani and Ghareeb (2002). This study was initially published only as an internal Kuwait University Project Report and was not openly available. Given the timing of this survey (1997–2001), just a few years before the Gulf War of 2001 it is a valuable account on the state of the intertidal fauna immediately before such a critical environmental event. This, like most previous studies, included both live and dead shell records and does present relative abundance data. Twenty-three stations covering the entire coastline and including offshore islands were sampled resulting in a total of 366 species of which 164 were Bivalvia. (Behbehani & Ghareeb, 2002).

From 2004 to 2012 the Kuwait Institute for Scientific Research sampled 19 offshore and 19 intertidal stations (Al-Yamani *et al.*, 2012). A total of 99 nominal taxa were identified but not all to species level. This was followed by the 2013/2018 KISR intertidal survey (Al-Kandari *et al.*, 2020).

The focus on this survey was a quantitative assessment of the living malacofauna and little effort was put into collecting dead shells. A total of 36 sites along Kuwait's mainland and islands were sampled quantitatively and qualitatively from which 271 species were recorded. Of the 211 species that were collected alive; 104 were Gastropoda; 100 were Bivalvia; 3 species were recorded for the Polyplacophora, and 2 each for the Scaphopoda, and Cephalopoda. As many as 61 species, notably the micro-molluscs, were probably new records for Kuwait and many may also be new to science. Molluscan diversity was higher in rocky-sandy areas than intertidal mudflats. The highest species richness was found in the area of the south coast of Kuwait and around Failaka Island.

Further qualitative collecting took place in November/December of 2019, and this added considerably to the number of species, but most were recovered dead from the strandline.

CHECKLIST

PLATE 1

PROTOBRANCHIA, NUCULOIDEA, NUCULIDAE

1/1. *Ennucula layardii* (A. Adams, 1856)

Nucula layardii A. Adams, 1856: 51

Nucula layardi 2; *Nuculoma layardii* 5, 7, 8

A shallow burrower in muds and sandy mud, mostly offshore but occasionally intertidal.

Rare in the intertidal reported from Ras Al-Ard 7 Disarticulated valves are common on the strandline on the coast of south Boubyan. Type locality: Sri Lanka.

1/2. *Nucula rugulosa* G.B. Sowerby I, 1833

Nucula rugulosa G.B. Sowerby I, 1833: 16, fig. 19

Nucula consentanea 6; *Nucula* sp. 7

In muddy sand offshore. Beached valves only in the intertidal; subtidal at Sulaibikhat Bay and between Boubyan and Failaka Islands. Type locality: Unknown

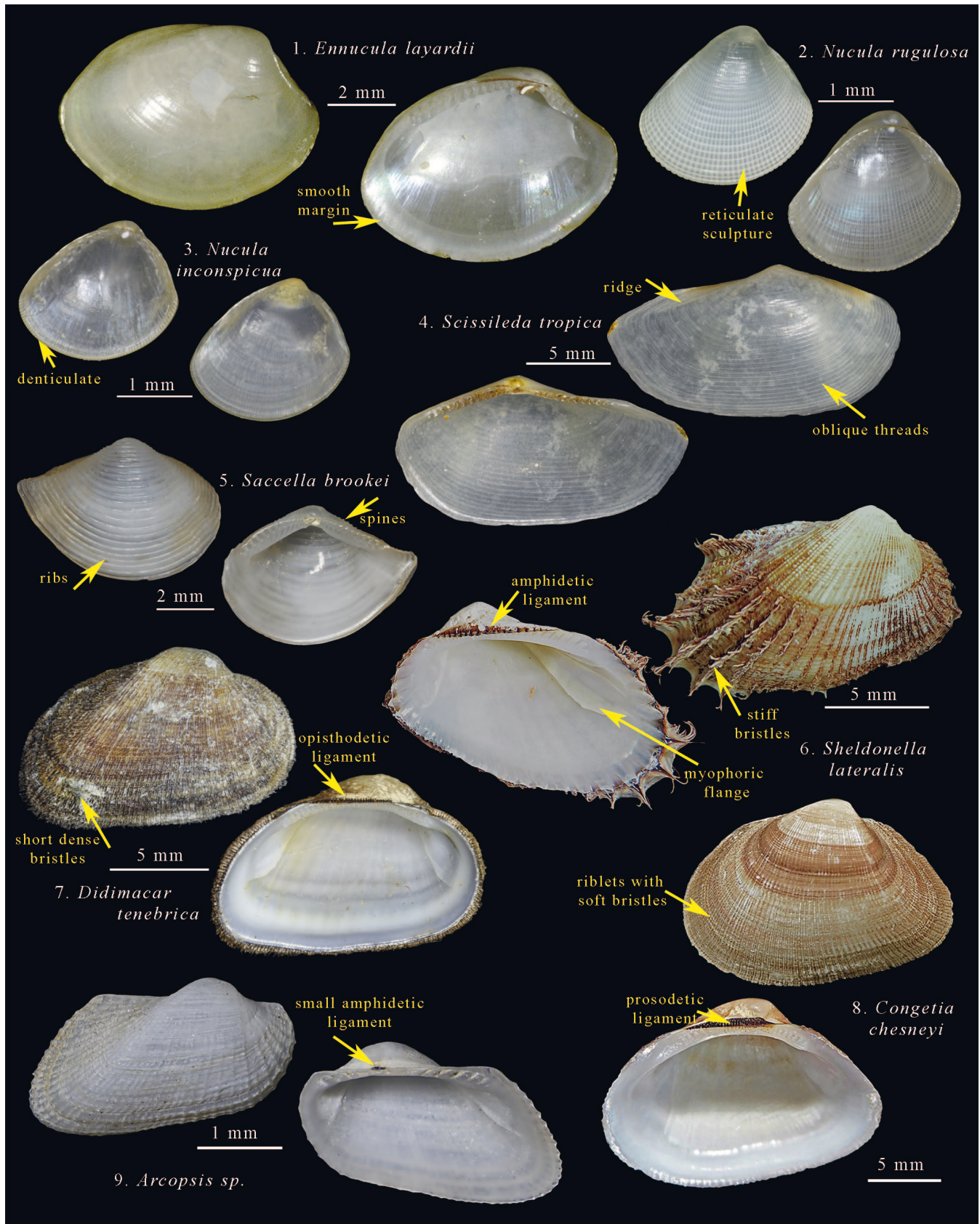


Plate 1

- 1/3. *Nucula inconspicua* H. Adams, 1871
Nucula inconspicua H. Adams, 1871: 793
Nucula inconspicua 7

Soft sediments, offshore. Shells only on the strandlines at Al-Salmiyah, Miskan and Ras Al-Zour. Recorded from muddy and silty substrates in Kuwait Bay 7. Type locality: Gulf of Suez.

PROTOBRANCHIA, NUCULANOIDEA, YOLDIIDAE

- 1/4. *Scissilella tropica* (Melvill, 1897)
Yoldia tropica Melvill, 1897: 25, pl. 7 fig. 29
Yoldia nicobarica 2; *Yoldia tropica* 5, 7; *Scissilella tropica* 8

Offshore in muddy sediments. Disarticulated valves are common on the strandline of the south coast of Boubyan and on Miskan and Failaka Island. Reported offshore from muddy substrates between Ras Al-Ard and Failaka Island 7. Type locality: Karachi, Pakistan.

PROTOBRANCHIA, NUCULANOIDEA, NUCULANIDAE

- 1/5. *Saccella brookei* (Hanley, 1860)
Leda brookei Hanley, 1860: 132, pl. 229 fig. 106
Nuculana brookei 2, 5

Offshore in mud or sand. Dead valves on the strandline, no locality was given 2. Type locality: Borneo.

PTERIOMORPHA, ARCOIDEA, NOETIIDAE

- 1/6. *Sheldonella lateralis* (Reeve, 1844)
Arca lateralis Reeve, 1844: pl. 17 fig. 115
Sheldonella cafrina 2; *Sheldonella lateralis* 5, 6, 8;
Anadara sp. juv 7

Attached by a weak byssus under rocks, in crevices on middle and lower shores. Sporadic on rocky shores on the south coast of Kuwait Bay and Failaka. Type locality: Philippines.

- 1/7. *Didimacar tenebrica* (Reeve, 1844)
Arca tenebrica Reeve, 1844: pl. 16 fig. 105
Striarca tenebrica 2; *Striarca sculptilis* 4;
Didimacar tenebrica 5, 6, 7, 8

Attached by a weak byssus under rocks from the middle to lower shore. Common on all rocky shores. Type locality: Samar, Philippines.

- 1/8. *Congetia chesneyi* (P. G. Oliver & Chesney, 1994)
Noetiella chesneyi P. G. Oliver & Chesney, 1994: 30

Noetiella chesneyi 5, 6; *Congetia chesneyi* 8
 In soft muds from low in the intertidal and off-shore. Muddy areas in Kuwait Bay, off Boubyan and Failaka. Type locality: Basra, Iraq

1/9. *Arcopsis* sp.

Identity uncertain but the hinge and ligament fit with the genus *Arcopsis* rather than *Striarca*. Only *Arcopsis sculptilis* (Reeve, 1844) is recorded from Arabian waters; *Barbatia margarethae* is considered a synonym (MolluscaBase, 2023). The illustration of *A. sculptilis* in Huber (2010) does not match the Kuwait shell and neither does the original illustration of *margarethae*.

Known from a few disarticulated valves from the strandlines of Miskan and Ras Al-Zour.

PLATE 2

PTERIOMORPHA, ARCOIDEA, ARCIDAE

- 2/10. *Barbatia trapezina* (Lamarck, 1819)
Arca trapezina Lamarck, 1819: 41
Barbatia helblingi 2, 3, 4; *B. decussata* (in part) 5;
B. foliata 6, 7; *B. trapezina* 8

Epibyssate, attached to rocks from the mid tide level and below. Common on all rocky shores. Type locality: Timor.

- 2/11. *Barbatia decussata* (G. B. Sowerby I, 1833)
Byssosarca decussata G. B. Sowerby I, 1833: 18
 Epibyssate, attached by a thin byssus under rocks in the upper and middle shore. This species is easily confused with *B. trapezina*. *B. decussata* is found higher in the intertidal, while *B. trapezina* is found lower in the intertidal and sublittoral

To date the only confirmed specimens come from Al-Sha'ab. Type locality: Lord Hood's & Chain islands.

- 2/12. *Barbatia setigera* (Reeve, 1844)
Arca setigera Reeve, 1844: pl. 14 fig. 94
Barbatia lacerata 2; *Barbatia setigera* 5, 6, 7, 8
 Epibyssate attached to rocks from the mid tide level and below. Sporadic on rocky shores, Al-Nuwaiseeb, Ras Al-Zour, Al-Julaia'a. Type locality: Zanzibar.

- 2/13. *Barbatia parva* (G. B. Sowerby I, 1833)
Byssosarca parva G. B. Sowerby I, 1833: 19
Barbatia parva 5, 8
 Epibyssate attached to rocks from the mid tide level and below. Apparently uncommon, Umm

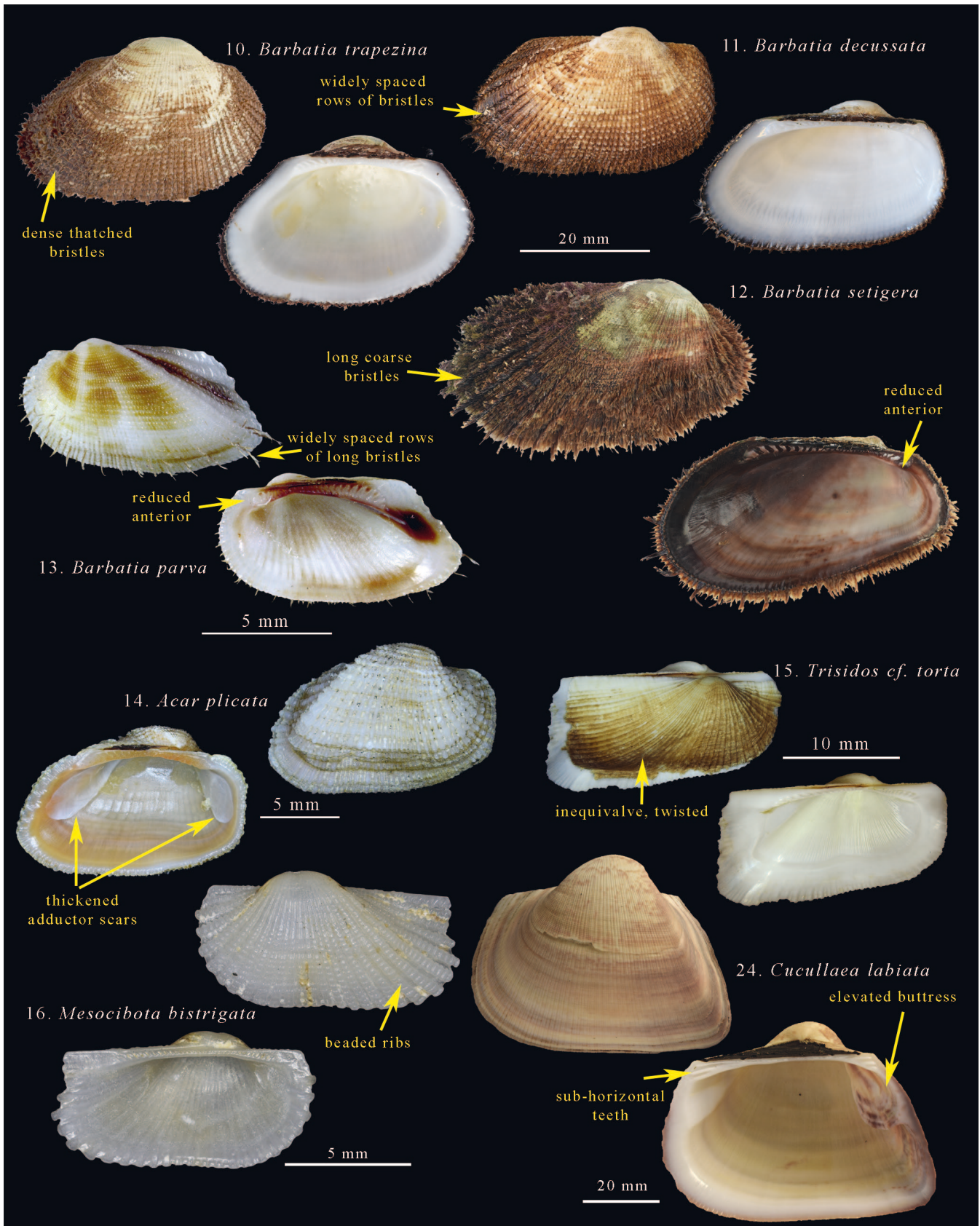


Plate 2

Al-Maradim, Ras al-Zour and Al-Nuwaiseeb, perhaps confused with small *B. setigera*. Type locality: Ducie is., Pitcairn Group.

2/14. *Acar plicata* (Dillwyn, 1817)

Arca plicata Dillwyn, 1817: 227

Acar plicata 2, 5, 6, 7, 8; *Barbatia plicata* 3, 4

Epibyssate, attached to underside of rocks from the mid tide level and below. Common on all rocky shores. Type locality: Red Sea.

2/15. *Trisidos cf. torta* (Mörch, 1850)

Arca torta Mörch, 1850: 33

Trisidos tortuosa 2, 5, 8

Huber (2010) considers that *Trisidos torta* (Mörch, 1850) can be distinguished from *Trisidos tortuosa* (Linnaeus, 1758) and that the former is present in the Arabian Gulf. The small size and worn nature of the Kuwait shells prevents a precise identification.

Attached by a byssus in sediments among rocks. Found only as small disarticulated valves on the strandlines of Boubyan, East Coast of Failaka and Ras Al-Zour. Live collected shells in Glayzer collection without locality. Type locality: Philippines.

2/16. *Mesocibota bistrigata* (Dunker, 1866)

Arca bistrigata Dunker, 1866: 87, pl. 30 figs 4–6. The Kuwait shells are small (less than 10 mm) but this species may reach 55 mm elsewhere. *Arca requiescens* Melvill and Standen 1907 from the Gulf of Oman is very similar to the Kuwait shells but was taken at a depth of 285 m. Known only from disarticulated valves from the strandline of East Failaka. Type locality: Mumbai, India.

PLATE 3

3/17. *Anadara ehrenbergi* (Dunker, 1868)

Anomalocardia ehrenbergi Dunker 1866: 116, pl. 38, figs 17–18

Anadara ehrenbergi 1, 2, 4, 5, 6, NOT 7

Shallow burrowing in sand, low tide.

Recorded living in sand at Ras Al-Julaia'a and Khor Al-Mufattah 2, but not seen living since. Type locality: Red Sea.

3/18. *Anadara (Mosambicarca) erythraeonensis* (Jonas in Philippi, 1851)

Arca erythraeonensis Jonas in Philippi, 1851: 51

Anadara secticostata 2; *A. erythraeonensis* 5; NOT 6, 7

Shallow burrowing in muddy sediments, low tide.

Recorded living in thick muddy sludge at Umm Al-Namil 2, but not seen living since. Type locality: Red Sea.

3/19. *Anadara uropigimelana* (Bory de Saint-Vincent, 1827)

Arca uropigimelana Bory de Saint-Vincent, 1827: 156

Anadara uropigimelana 2, 5, NOT 6

Shallow burrowing in mud and muddy sand, low tide. Recorded living at Umm Al-Namil 2, but not seen living since. Type locality: Unknown.

3/20. *Anadara sp.*

Anadara antiquata 2; *Anadara sp.* 6, 8

Shallow burrowing in mixed muddy sediments. Distributed across the turbid waters of Kuwait Bay, Khor al-Al-Subiyah and Boubiyan.

***Anadara natalensis* (Krauss, 1848)**

Scapharca natalensis 6

Not confirmed. Type locality: Natal.

PTERIOMORPHA, ARCOIDEA, GLYCYMERIDIDAE

3/21. *Glycymeris taylori* (Angas, 1879)

Pectunculus taylori Angas, 1879: 419, pl. 35 fig. 3 upper left

Glycymeris striatularis 2; *G. cf. arabica* 5

Free living in sand, lower shore and below. Recorded living at Khor Al Muffatah 2, but not living since. Type locality: Unknown.

3/22. *Glycymeris livida* (Reeve, 1843)

Pectunculus lividus Reeve, 1843: pl. 9 fig. 51

Glycymeris lividus 1, 2, 5, 6, 7

A shallow burrower in mobile sand, offshore. Washed ashore after storm at Ras Al-Julaia'a 2 and from offshore sandy substrates near Mahboulah 7. Type locality: Red Sea.

3/23. *Tucetona guesi* (Jousseaume, 1895)

Pectunculus guesi Jousseaume, 1895: 187

Glycymeris maskatensis 2; *Glycymeris pectunculus* 5, 6, 7; *Tucetona audouini* 8

Free living in sand, lower shore and below. Found mostly as disarticulated valves on the strandline but also in the intertidal zone from Mahboula to Ras Al-Zour 7. Type locality: Gulf of Aden.

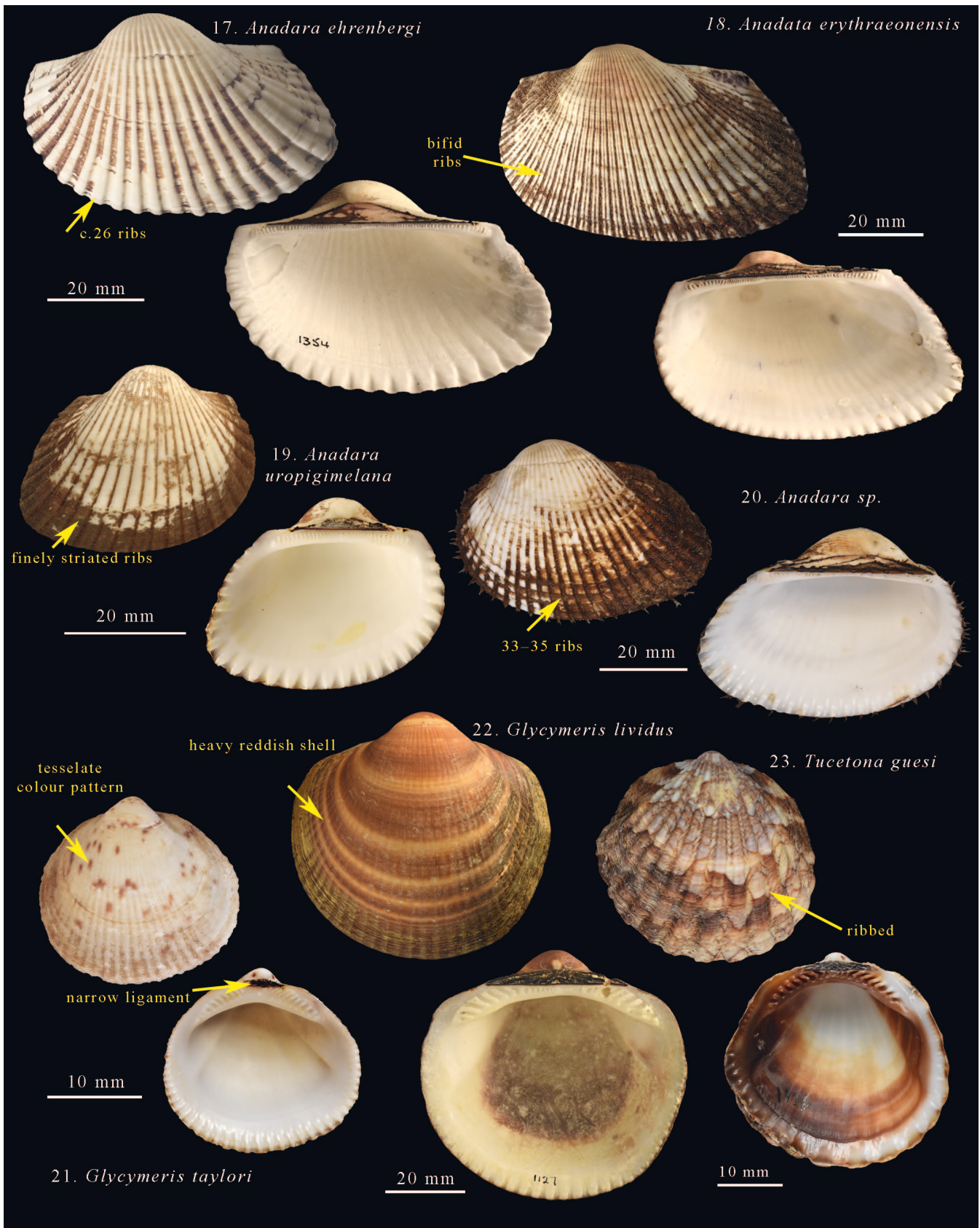


Plate 3

PTERIOMORPHA, ARCOIDEA, CUCULLAEIDAE

2/24. (on plate 2) *Cucullaea labiata* ([Lightfoot], 1786)

Arca labiata [Lightfoot], 1786: nr. 3947

Cucullaea concamerata 2; *C. labiata* 5

A shallow burrower in offshore sands. Washed ashore after storms at Ras Al-Julaia'a 2, not seen living since. Type locality: Unknown.

PLATE 4

PTERIOMORPHA, MYTILOIDEA, MYTILIDAE

4/25. *Arcuatula perfragilis* (Dunker, 1857)

VolSELLA perfragilis Dunker, 1857: 362

Amygdalum cf. *japonicum* 2; *Musculista perfragilis* 5

Byssally attached in muddy sediments. Found once at Al-Shumaimah, also offshore. Type locality: Moluccas.

4/26. *Arcuatula* cf. *senhousia* (W. H. Benson, 1842)

Modiola senhousia W. H. Benson, 1842: 489

Musculista senhousia 5, 6, 7, 8

The relation with *Arcuatula variegata* (W. H. Benson, 1855) described from the Sundarbans in Bengal needs more study. Byssally attached to stones and hard surfaces, but also in muddy areas. Immature individuals at Al-Shumaimah and Umm Al Shejar 8 but never in the dense aggregations typical of this species. Muddy substrates in Khor Al-Subiyah 7. Type locality: Chusan, China.

4/27. *Musculus coenobitus* (Vaillant, 1865)

Mytilus coenobitus Vaillant, 1865: 115, 122

Musculus mirandus 2; *M. coenobitus* 5, 8; *M. cumingianus* 6

Attached by a weak byssus on rocky shores in crevices or under rocks. May be embedded in ascidian tests. From Al-Doha sporadically south to Ras Al-Zour and Failaka. Type locality: Gulf of Suez.

4/28. *Musculus* cf. *costulatus* (Risso, 1826).

Modiolus costulatus Risso, 1826: 324, pl. 11 fig. 165

Musculus cf. *costulatus* 5, 8

Huber (2010) suggests that this may be the *Musculus concinnus* (Dunker, 1857) but there is

insufficient material to confirm this and Dunker's description is at variance as he states there are 20–24 posterior ribs whereas here there are only 12–16 in the Kuwait shells.

Attached by a weak byssus to the sides and undersides of rocks. Sporadic from Al-Shuwaikh south to Ras Al-Zour. Type locality: Mediterranean Sea (Nice).

4/29. *Brachidontes pharaonis* (P. Fischer, 1870)

Mytilus pharaonis P. Fischer, 1870: 169

Brachidontes variabilis 2, 3, 4, 5, 6, 7; *B. pharaonis* 8

Attached by a weak byssus on or under rocks from the middle and lower shores. A very common species found on most rocky shores. Type locality: Suez, Red Sea.

4/30. *Brachidontes* aff. *pharaonis* (P. Fischer, 1870)

Similar to *B. pharaonis* but rhomboidal and pale coloured. Sequence data required to resolve status.

Lives attached by a weak byssus under rocks and in crevices on the middle and lower shores. Best represented by specimens from the KISR Marina at Al-Salmiyah.

4/31. *Gregariella* sp.

Crenella ehrenbergi Issel, 1869: 92, pl.1 fig. 12

Gregariella simplicifilis 5, 6; *G. ehrenbergi* 8

The exact identity of this species remains uncertain; the type locality of *C. ehrenbergi* is Suez and South Africa for *simplicifilis*, in neither case do they match well with the Kuwait shells. Attached by a weak byssus under rocks and in crevices on the middle and lower shores. Occurs with *Brachidontes pharaonis* but not in such numbers. Frequently found on the rocky shores of the southern coast of Kuwait Bay south to Ras Al-Zour and Failaka.

4/32. *Gregariella coralliophaga* (Gmelin, 1791)

Mytilus coralliophagus Gmelin, 1791: 3359

Gregariella argentea 2; *G. coralliophaga* 8

Attached by a weak byssus in holes made by lithophagine mussels. Rarely found due to cryptic habitat, recorded from Abu Halifah, Al-Nuwaiseeb and Masfat Al-Ahmadi. Type locality: Indian Ocean.



Plate 4

4/33. *Rhomboidella vaillanti* (Issel, 1869)*Crenella vaillanti* Issel, 1869: 91, pl.1 fig. 13*Solamen vaillanti* 5, 6; *Rhomboidella vaillanti* 8

Attached by a weak byssus. Mostly as disarticulated shells on the strandline but recorded just twice living at Al-Doha and Masfat Al-Ahmadi. Type locality: Gulf of Suez.

4/34. *Solamen persicum* (E.A. Smith, 1906)*Crenella persica* E. A. Smith, 1906: 255*Solamen adamsianum* 5, 6

In sandy mud at low water mark. Miskan, disarticulated valves from the south-east coast of Failaka and Ras Al-Zour. Type locality: Arabian Gulf.

4/35. *Septifer cumingii* Récluz, 1849*Septifer cumingii* Récluz, 1849: 132*Septifer bilocularis* 2

Attached to the undersides of rocks. Found living at Umm Al-Namil 2. Type locality: Panama (Pacific Ocean).

4/36. *Modiolus auriculatus* Krauss, 1848*Modiola auriculata* Krauss, 1848: 20, pl. 2 fig. 4*Modiolus auriculatus* 2, 5

Attached by a byssus among rocks. Found only as worn disarticulated valves on the strandlines of Failaka and Al-Salmiyah. Type locality: Natal.

PLATE 5

5/37. *Lioberus ligneus* (Reeve, 1858)*Modiola lignea* Reeve, 1858: pl. 10 fig. 71*Modiolus ligneus* 5

Attached by a byssus in a byssus nest in soft sediments. Found only as disarticulated valves on the strandline at Ras Al-Zour. Type locality: Unknown.

5/38. *Botula cinnamomea* (Gmelin, 1791)*Mytilus cinnamomeus* Gmelin, 1791: 3352*Botula cinnamomea* 2, 3, 5, 6, 8

A burrower into calcareous rocks. On most rocky shores. Type locality: Indian Ocean

5/39. *Lithophaga robusta* Jousseaume in Lamy, 1919

Lithophaga robusta Jousseaume in Lamy, 1919: 253

Lithophaga teres [in part] 2, 3; ?*L. malaccana* 3; *L. robusta* 5, 6

A burrower into calcareous rocks and dead coral. Uncommon; Kubbar Island in coral 6. Type locality: Red Sea.

5/40. *Leiosolenus tripartitus* (Jousseaume, 1894)*Dactylus tripartitus* Jousseaume, 1894: 201

Lithophaga cumingiana 2; ?*L. cf. nasuta* 2; *L. malaccana* 4; *Leiosolenus tripartitus* 5, 6, 8; ?*L. hanleyanus* 6; ?*L. lima* 6

A burrower into calcareous rocks and clumps of tube worms. Very common on all rocky shores. Type locality: Red Sea.

5/41. *Leiosolenus* sp.*Leiosolenus* sp. 8

We have been unable to find any species of *Leiosolenus* that has a similar rhomboidal shape and especially the subtruncate posterior ventral margin. Due to its small size it may have been overlooked.

A burrower into calcareous rocks but also into clumps of tube worms, found along with *L. tripartitus*. Rare compared with the similar *L. tripartitus*. Found living at Ras Ajuza, Al-Judailiat, Al-Doha, Al-Julaia'a, Failaka.

Leiosolenus obesus (R. A. Philippi, 1847)*Leiosolenus obesus* 6

Not confirmed. Type locality: China?.

PTERIOMORPHA, PTERIOIDEA, PTERIIDAE

5/42. *Pteria tortirostris* (Dunker, 1849)*Avicula tortirostris* Dunker, 1849: 179*Pteria marmorata* 1, 2 : *P. tortirostris* 5, 8

The identification of species of *Pteria* is fraught with difficulty and should be regarded as provisional. Attached by a byssus to gorgonians in the sublittoral. Living specimens were found attached to gorgonian washed ashore at An Niggalyat 2. Type locality: Java.

PTERIOMORPHA, PTERIOIDEA, MARGARITIDAE

5/43. *Pinctada radiata* (Leach, 1814)*Avicula radiata* Leach, 1814: 98, pl. 43

Pinctada margaritifera 1, 3, 6, 7; *P. radiata* 3, 5, 6, 7, 8

Attached by a byssus among rocks or in mixed ground. Once a prolific dominant species but over exploitation has reduced its number greatly. Commonly throughout Kuwait. Type locality: Western Indian Ocean.



Plate 5

PTERIOMORPHA, PTERIOIDEA, **MALLEIDAE**

- 5/44. *Malleus regula* (Forsskål in Niebuhr, 1775)
Ostrea regula Forsskål in Niebuhr, 1775: 124
Malleus regula 2, 3, 4, 8; *Malvufundus regula* 5, 6
 Attached by a byssus among rocks or in mixed ground. On most rocky shores. Type locality: Red Sea

PTERIOMORPHA, PTERIOIDEA, **VULSELLIDAE**

- 5/45. *Electroma vexillum* (Reeve, 1857)
Avicula vexillum Reeve, 1857: pl. 17 fig. 70
 Attached by a byssus probably among sessile epifauna or algae. Found on the strandline at Ras Al-Zour in large numbers. Type locality: Sri Lanka.

PTERIOMORPHA, PTERIOIDEA, **ISOGNOMONIDAE**

- 5/46. *Isognomon nucleus* (Lamarck, 1819)
Perna nucleus, Lamarck, 1819: 142
Parviperna dentifera 2; *P. nucleus* 5, 6; *Isognomon dentifera* 4; *I. nucleus* 8
 Attached by a byssus among rocks or among oysters on the upper and middle shores. Locally common on rocky and cobble shores. Type locality: South Australia.

- 5/47. *Isognomon legumen* (Gmelin, 1791)
Ostrea legumen Gmelin, 1791: 3339
Isognomon legumen 2, 3, 5, 6, 8
 Shells with radial riblets and colour bands may be *Isognomon perna* (Linnaeus, 1767) but as both forms, in Kuwait, are found together we surmise that they are variants of a single species.
 Attached by a byssus among rocks or in mixed ground. Not uncommon on rocky and cobble shores. Type locality: Nicobar Islands.

PLATE 6

PTERIOMORPHA, PINNOIDEA, **PINNIDAE**

- 6/48. *Pinna bicolor* Gmelin, 1791
Pinna bicolor Gmelin, 1791: 3366
Pinna muricata 1, 2; *P. sp.* 3; *P. bicolor* 4, 5, 6, 8
 We recognise only a single *Pinna* species. Attached by a byssus embedded in sandy sediments and eel-grass beds. Now restricted to a few protected shores, common at Al-Nuwiseeb. Type locality: Red Sea.

PTERIOMORPHA, LIMOIDEA, **LIMIDAE**

- 6/49. *Limaria viali* (Jousseume in Lamy, 1920)
Lima viali Jousseume in Lamy, 1920: 637
 ? *Lima tenuis* 2; *Limatula viali* 5
 Probably on mixed ground offshore. Only 4 disarticulated valves from the strandline at Ras Al-Zour. Type locality: Red Sea.

- 6/50. *Limatula leptocarya* (Melvill, 1898)
Lima leptocarya Melvill, 1898: 28, pl. 2 fig. 2
Lima leptocarya 2; *Limatula leptocarya* 5, 8
 Probably in soft sediments offshore. Disarticulated valves on the strandline on Boubyan. Type locality: Gulf of Oman.

PTERIOMORPHA, PECTINOIDEA, **PECTINIDAE**

- 6/51. *Azumapecten ruschenbergerii* (Tryon, 1870)
Pecten ruschenbergerii Tryon, 1870: 171, pl. 14 fig. 1
Chlamys ruschenbergerii 2, 4; *C. livida* 3, 5, 6, 7; *C. senatoria* 6
 Attached by a byssus among rocks, lower shore. Widespread on rocky shores but never common. Type locality: Muscat, Oman.

PTERIOMORPHA, PECTINOIDEA, **SPONDYLIDAE**

- 6/52. *Spondylus exilis* G. B. Sowerby III, 1895
Spondylus exilis G. B. Sowerby III, 1895: 280, pl. 18 fig. 14
Spondylus gaederopus 1, 2; *S. marisrubri* 3, 4, 5, 6, 7; *S. variegatus* 7; *S. spinosus* 8
Spondylus species are very variable in sculpture and colour pattern and their taxonomy is confused. Here we amalgamate all Kuwait forms under one species while accepting that detailed studies using molecular techniques may reveal a number of cryptic species.

Cemented to the sides and undersides of rocks, lower shore. Widespread on rocky shores but never common. Type locality: Karachi, Pakistan.

PTERIOMORPHA, ANOMIOIDEA, **PLACUNIDAE**

- 6/53. *Placuna placenta* (Linnaeus, 1758)
Anomia placenta Linnaeus, 1758: 703
Placuna placenta 1, 2, 5, 6, 8
 Free living on muddy sediments in sheltered situations but now only as beached valves. Abundant shells on the strandline of the south



Plate 6

coast of Boubyan. Type locality: "in Pelago" uncertain.

PTERIOMORPHA, ANOMIOIDEA, ANOMIIDAE

6/54. *Anomia achaeus* Gray, 1850

Anomia achaeus Gray, 1850: 116

Anomia achaeus 5

Anomia achaeus is not uncommon on the shores of Bahrain but apart from the minute shell here seems to be absent from Kuwait with no previous records.

Attached to rocks and dead shells by the byssus. A single small upper valve at Ras Al-Zour. Type locality: Karachi, Pakistan.

PTERIOMORPHA, PLICATULOIDEA, PLICATULIDAE

6/55. *Plicatula complanata* Deshayes, 1863

Plicatula complanata Deshayes, 1863: 33, pl. 5 fig. 4

? *Plicatula plicata* 2; *P. australis* 5, 6; *P. complanata* 8

A variable taxon requiring investigation. Cemented to rocks, lower shore. Widespread on all rocky shores. Type locality: Reunion.

PLATE 7

PTERIOMORPHA, OSTREOIDEA, GRYPHEIDAE

7/56. *Hyotissa inermis* (G. B. Sowerby II, 1871)

Ostrea inermis G.B. Sowerby II, 1871: pl. 28 fig. 70

Attached to beach rock in the lower shore. Living only once at East Failaka. Type locality: Unknown.

PTERIOMORPHA, OSTREOIDEA, OSTREIDAE

7/57. *Saccostrea* sp.

Saccostrea cucullata 5, 6, 8; ?*Crassostrea* cf. *margaritacea* 4

Molecular data suggests that the northern Gulf population is not *S. cucullata* (Born, 1778; Ghaffari et al. 2022).

Attached to exposed rock surfaces and man-made concrete structures from the middle shore. Widespread on the outer southern shores of Kuwait Bay, all along the south coast and on the outer islands of Failaka, Miskan and Auha.

7/58. *Talonostrea salpinx* Oliver, Al-Kandari & Salvi, 2021

Talonostrea salpinx Oliver, Al-Kandari & Salvi, 2021: 1–20

Saccostrea cucullata 2; *Crassostrea* sp. 8

Forming extensive reefs and encrusting rocks on the upper and middle shore. Reefs along Khor Al-Subiyah, common on rocky shores of Kuwait Bay and Failaka, less so on southern shores. Type locality: Kuwait.

7/59. *Talonostrea* sp. nov.

A small species with dense overarching spines, under description.

Forming dense encrustations on the undersides of rocks from mid to lower shore. East Failaka, Miskan, Al-Shumaimah, Al-Messila, Belajat Beach. Type locality: Kuwait.

7/60. *Dendostrea sandvichensis* (G. B. Sowerby II, 1871)

Ostrea sandvichensis G. B. Sowerby II, 1871: pl. 27 fig. 66

Alectryonella plicatula 2, 6; *A. cf. crenulifera* 8

Attached to rocks but probably mostly living offshore, perhaps with corals. Living at Masfat Al-Ahmadi, Khor Abu Iskander, washed ashore at Al-Salmiyah and An Niggalyat. Type locality: Hawaii.

7/61. *Ostrea subucula* Jousseaume in Lamy, 1925

Ostrea subucula Jousseaume in Lamy, 1925: 322

"*Ostrea*" *subucula* 5, 6; *Booneostrea subucula* 8

On the undersides of rocks and cobbles from the mid and lower shores, often where rocks are resting loosely on sandy or gravel substrates. Widespread, Umm Al-Namil, east and south to Al-Nuwaiseeb, Khor Al-Subiyah and Failaka. Unpublished research (Oliver & Salvi) suggests that *Ostrea subucula* does not belong to *Booneostrea*. Type locality: Djibouti and Aden.

7/62. *Ostrea oleomargarita* Oliver, Salvi & Al-Kandari, 2023

Ostrea oleomargarita Oliver, Salvi & Al-Kandari, 2023: 90, figs 1–2

cf. *Nanostrea deformis* 6, 8

On the undersides of rocks and cobbles encrusted with worm tubes, barnacles and bryozoans, mid and lower shores. Southern shores of Kuwait Bay, Failaka. Type locality: Kuwait.

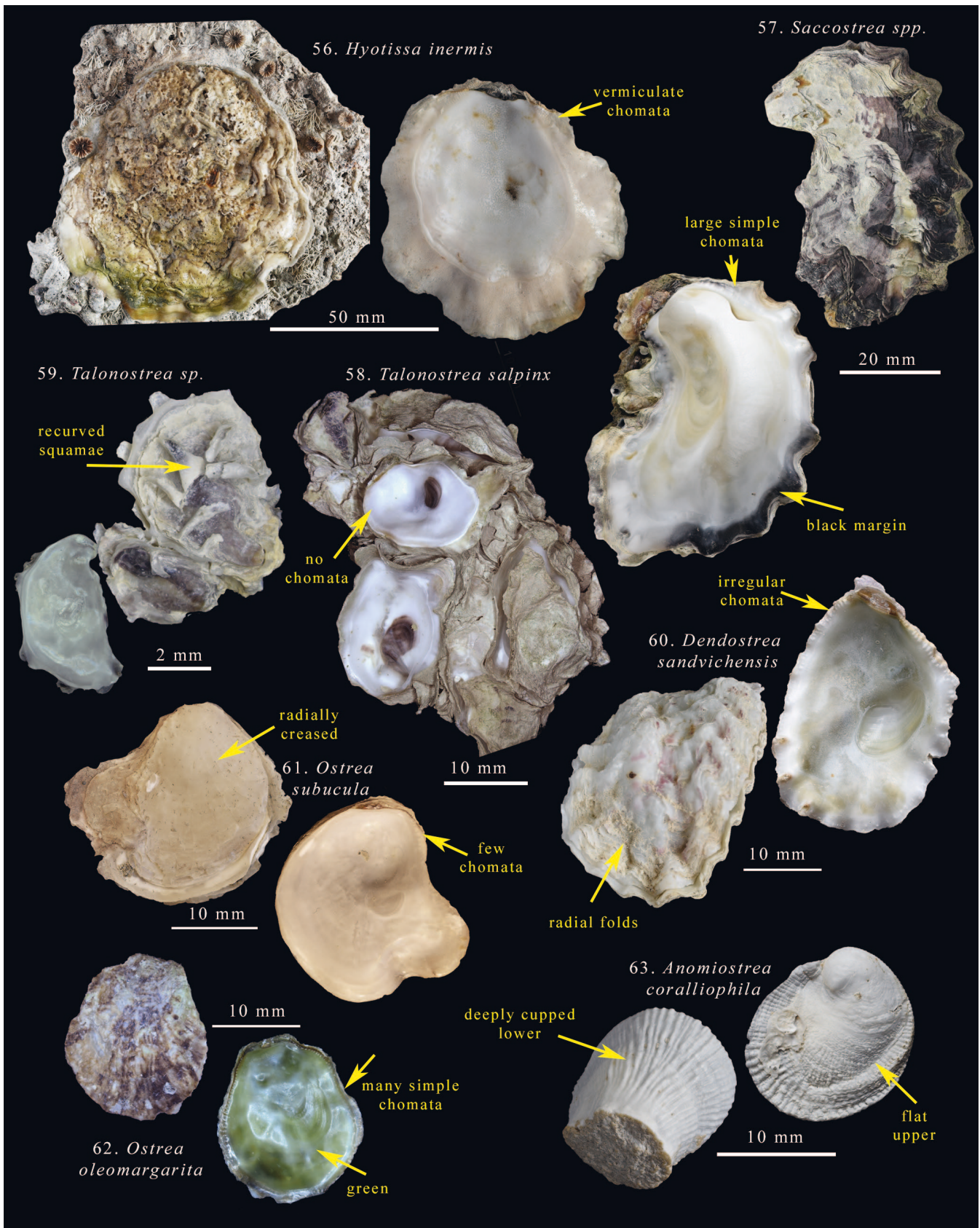


Plate 7

7/63. *Anomiostrea coralliophila* Habe, 1975*Anomiostrea coralliophila* Habe, 1975: 184*Ostrea pyxidata* 2

Symbiotic, attached in the burrows of ghost shrimps under boulders. Found only as disarticulated valves on the strandline, Al-Sha'ab; Anjafa Beach, Salwa; Al-Nuwiseeb; An Niggalayay. Type locality: Philippines.

PLATE 8

ARCHIHETERODONTA, CARDITOIDEA, CARDITIDAE

8/64. *Cardita ffinchi* (Melvill, 1898)*Mytilicardia ffinchi* Melvil, 1898: 30, pl. 2 fig. 17*Cardita ffinchi* 1, 2, 5

Attached by a byssus among rocks. Recorded living at Khor Al-Mufattah 2 but not seen since. Type locality: Oman & Arabian Gulf

8/65. *Begaina gubernaculum* (Reeve, 1843)*Cardita gubernaculum* Reeve, 1843: pl. 3 fig. 9a–b*Begaina gubernaculum* 2, 5, 6, 8

Attached by a byssus under rocks, in crevices. Widespread on rocky shores. Type locality: Zanzibar.

8/66. *Cardites bicolor* (Lamarck, 1819)*Cardita bicolor* Lamarck, 1819: 23*Cardita bicolor* 1, 2, 5, 6, 7, 8

Shallow burrower in sand. Mostly found as disarticulated shells, but alive from Al-Mahbouda to Al-Julaia'a 7. Type locality: Australia.

ARCHIHETERODONTA, CARDITOIDEA,
CONDYLOCARDIIDAE8/67a. *Carditopsis majeeda* (Biggs, 1973)*Cuna majeeda* Biggs, 1973: 387, pl. 6 figs 5–8*Cuna majeeda* 2; *Carditopsis majeeda* 5, 6, 8;*Carditella* sp. 7

In sandy sediment and sand among rocks.

Living at Al-Shumaimah, also East Failaka and Ras Al-Zour. Type locality: Arabian Gulf.

8/67b. *Carditopsis coxi* (Eames & Wilkins, 1957)

Cuna coxi Eames & Wilkins, 1957: 199, pl. 27 figs 1–3.

Abundant disarticulated valves at Miskan. Type locality: Iraq, Arabian Gulf.

C. majeeda and *C. coxi* are very similar and may be conspecific but the former is widely distributed

in the Arabian Gulf, Oman and Yemen while *C. coxi* is known only from N. Kuwait and Iraq.

ARCHIHETERODONTA, CRASSATELLOIDEA,
CRASSATELLIDAE8/68. *Bathytormus radiatus* (G. B. Sowerby I, 1825)

Crassatella radiata G. B. Sowerby I, 1825: 7, app. ii, pl. 1 fig. 2

Bathytormus radiatus 5

Shallow burrower in sand, offshore. Disarticulated valves on Miskan, South Boubyan, East Failaka. Type locality: Unknown.

EUHETERODONTA, ANOMALODESMATA, LATERNULIDAE

8/69. *Exolaternula erythraea* (S. & N. Morris, 1993)

Laternula (Exolaternula) erythraea S. & N. Morris 1993: 8, 19

Laternula erythraeensis 5, 6; *L. erythraea* 8

In soft sediments. Sporadic from Al-Khuwaisat, Al-Shumaimah and north Failaka. Type locality: Fujairah, Arabian Gulf.

8/70. *Laternula anatina* (Linnaeus, 1758)*Solen anatinus* Linnaeus, 1758: 673*Laternula anatina* 6

Burrowing into soft mud low in the intertidal. Found in inner Kuwait Bay and Khor Al-Al-Subiyah. "O. asiatica" Asian seas.

EUHETERODONTA, ANOMALODESMATA, THRACIIDAE

8/71. *Thracia cf. salsettensis* Melvill, 1893

Thracia salsettensis Melvill, 1893: 65, pl. 1 fig. 24

Thracia salsettensis 5

Thracia adenensis Melvill, 1898: 206, pl. 12 fig. 16

Thracia adenensis 5, 8

So few specimens have been collected making a definitive identification difficult. Only two species have been reported from the Arabian region, *T. adenensis* and *T. salsettensis*. The undulating surface is typical of the latter but is only shown in one shell. Here we use the earliest name.

In soft sediments, mostly offshore. Found living at Al Shumaimah, disarticulated valves on the strandline at Al-Nuwiseeb and Ras Al-Zour. Type locality: Mumbai, India.



Plate 8

8/72. *Ixartia* sp.

This species is very similar to the European *Ixartia distorta* (Montagu, 1803). This genus is not known from the Indo-Pacific and given the distinctive characters can be assumed to be undescribed.

Probably nesting in crevices on rocky shores. Found only a disarticulated valve from the strandline of Ras Al-Zour. *Ixartia* is considered a synonym of *Thracia* in MolluscaBase (2023) but the hinge and cryptic habits suggests adoption at the generic level.

EUHETERODONTA, ANOMALODESMATA,
PERIPLOMATIDAE

8/73. *Periploma indicum* Melvill, 1898

Periploma indicum Melvill, 1898: 36, pl. 2 fig. 4

Periploma indicum 5, 7

In soft sediments offshore in Kuwait Bay. Single disarticulated valve from the strandline of Miskan. Type locality: Gulf of Oman.

EUHETERODONTA, ANOMALODESMATA, LYONSIIDAE

8/74. *Lyonsia* sp. nov.

Irregular form suggests a nestling habit. Found only as disarticulated valves from the strandline of Ras Al-Zour.

EUHETERODONTA, ANOMALODESMATA, PANDORIDAE

8/75. *Pandora flexuosa* G. B. Sowerby I, 1822

Pandora flexuosa G. B. Sowerby I, 1822: 2, pl. [50] figs 4–5

Pandora flexuosa 5, 6

In soft sediments offshore. Disarticulated valves from the strandlines of Miskan and Ras Al-Zour. Type locality: East Indies.

8/76. *Frenamya* cf. *ceylanica* (G. B. Sowerby I, 1835)

Pandora ceylanica G. B. Sowerby I, 1835: 94

? *Pandora ceylanica* 5, 6

In soft sediments. No precise data. Type locality: Sri Lanka.

PLATE 9

EUHETERODONTA, ADEPODONTA, HIATELLIDAE

9/77. *Hiatella* sp.

Saxicava flaccida Gould, 1861: 24

Hiatella flaccida 5, 8; *Corbula mirabilis* 6

Regarded as conspecific with the European *Hiatella arctica* (Linnaeus, 1767) in MolluscaBase (2023), but genetic studies show a complex pattern within *Hiatella* (Laakkonen *et al.*, 2016). Nestling in crevices or vacated borings in rock. Widespread on rocky shores but seldom collected, most records are from the southern coasts.

EUHETERODONTA, ADEPODONTA, SOLENIDAE

9/78. *Solen dactylus* Cosel, 1989

Solen dactylus Cosel, 1989: 200

Solen sp. 1; ?*S. truncatus* 2; *S. dactylus* 5, 6, 7, 8

A rapid burrower in sand and muddy sand. Common at Ras Al-Subiyah, south coast of Boubiyan and northern coast of Kuwait Bay. Type locality: Karachi, Pakistan.

9/79. *Solen cylindraceus* Hanley, 1843

Solen cylindraceus Hanley, 1843: 101

Solen cylindraceus 2, 5

A rapid burrower in sand and muddy sand. Known in Kuwait only from two valves washed ashore at Ras Al-Julaia'a 2. Type locality: Unknown.

EUHETERODONTA, LUCINOIDEA, LUCINIDAE

9/80. *Pegophysema kora* (Taylor & Glover, 2005)

Anodontia (*Pegophysema*) *kora* Taylor & Glover, 2005: 302

Anodontia edentula 2, 5, 7; *Euanodontia* cf. *ovum* juv. 8

In sea-grass beds. Ras Al-Zour and muddy and sandy substrates in Kuwait Bay 7. Type locality: Bahrain, Arabian Gulf.

9/81. *Cardiolucina semperiana* (Issel, 1869)

Lucina semperiana Issel, 1869: 82

Bellucina seminula 2; *B. semperiana* 5; ? *Lucina dentifera* 6; *Cardiolucina semperiana* 8

Burrower into sandy sediments, offshore. Disarticulated valves from the strandlines of South Boubiyan and Al-Salmiyah. Type locality: Red Sea.

9/82. *Ctena divergens* (R. A. Philippi, 1850)

Lucina divergens R. A. Philippi, 1850: 103, pl. 2 fig. 4

Ctena divergens 2, 5, 6, 8

Burrower into sandy sediments. Mostly on the southern shores of Kuwait Bay and on the south coast. Type locality: Pacific Ocean?.



Plate 9

9/83. *Rugalucina angela* (Melvill, 1899)
Lucina (Codakia) *angela* Melvill, 1899: 98, pl. 2 fig. 8

Codakia fischeriana 2; *Pillucina fischeriana* 5, 6; *P. angela* 5; *P. vietnamica* 8

Burrower into muddy sand, lower shore and below. On southern coast. Type locality: Pakistan.

9/84. *Rugalucina cracentis* Taylor & Glover, 2019
Rugalucina cracentis Taylor & Glover, 2019: 122, figs 3 & 7

Chavania erythraea 8

Burrower into soft sediments. Rarely found in the intertidal, only at Masfat Al-Ahmadi. Type locality: Gulf of Suez.

9/85. *Scabrilucina victorialis* (Melvill, 1899)
Cryptodon victorialis Melvill, 1899: 98–99, pl. 2 fig. 9, 9a

Lucina victorialis 5; *Scabrilucina victorialis* 8

Burrower into soft sediments mostly offshore. Rare in Kuwait, found living only once at Al-Doha. Type locality: Pakistan and Arabian Gulf.

9/86. *Pusillolucina arabica* Taylor & Glover, 2019
Pusillolucina arabica Taylor & Glover, 2019: 126, figs 3, 9 & 10

? *Loripes* sp. (juv.) 7

Offshore. Disarticulated valves on the strandlines of Al-Salmiyah, Miskan and Ras Al-Zour. Type locality: Saudi Arabia, Arabian Gulf.

9/87. *Gonimyrtea pamela* (Melvill & Standen, 1907)

Lucina pamela Melvill & Standen, 1907: 815, pl. 55 fig. 6

Offshore, shells on the strandline. Recorded by Melvill & Standen (1907) from Kuwait, not recorded since from Kuwait. Type locality: Kuwait.

10/88. *Lepiroides ambiguus* (Deshayes, 1856)

Galeomma ambigua Deshayes, 1856: 168

Galeomma peilei 2; *Amphilepida peilei* 5, 6, 7, 8

Free living, crawling under rocks. Al-Judailiat, Al-Shumaimah, Ras Al-Al-Subiyah and Umm Al Shejar, but always rare. Type locality: Philippines.

10/89. *Lepiroides cf. elongatus* (G. B. Sowerby III, 1897)

Scintilla elongata G. B. Sowerby III, 1897: 26

Amphilepida faba 8

We are unable to confirm the identity of this species. Free living, crawling under rocks. Found once at Al-Doha. Type locality: Durban, South Africa.

10/90. *Lepiroides cf. callipareia* Melvill, 1899

Scintilla callipareia Melvill, 1899: 99, pl. 2 fig. 10

Scintilla rosea 2; *Amphilepida callipareia* 5, 8

Free living, crawling under rocks. Al-Doha and Al-Nuwaiseeb. Type locality: Arabian Gulf.

10/91. *Scintillula aff. ovulina* (Deshayes, 1856)

Scintilla ovulina Deshayes, 1856: 174

Under rocks in sand, upper intertidal. Found only once at Abu Halifah. Type locality: Samar, Philippines.

10/92. *Scintillula* ? sp.

Galeommatidae sp. 8

Similar to *Scintillula pustula* but with a different hinge. Life habits unknown.

Disarticulated valves on the strandline on the south coast of Boubyan.

10/93. *Scintillula pustula* (Deshayes, 1863)

Erycina pustula Deshayes, 1863: 16, pl. 2 figs 10–12

Marikellia pustula 5, 8. NOT *Marikellia* sp. 7

Life habits unknown. Disarticulated valves only on the strandlines of Boubyan and Miskan. Type locality: Reunion.

PLATE 10

EUHETERODONTA, GALEOMMATOIDEA,
 GALEOMMATIDAE

Many species have been found as valves only or as rare living examples. The taxonomy is fraught with difficulty and much more work using live collected specimens is needed to resolve both generic and species concepts.

EUHETERODONTA, GALEOMMATOIDEA, LASAEIDAE

10/94. *Kellia leucedra* Melvill & Standen, 1907

Kellia leucedra Melvill & Standen, 1907: 817, pl. 53 fig. 3

Under rocks on lower shore. On many rocky shores on the south coast of Kuwait Bay, the south coast and Failaka. Type locality: Arabian Gulf.



Plate 10

10/95. Lasaeidae gen. et sp. 1

The hinge characters of this shell do not allow us to allocate it to any known genus. The inverted v-shaped tooth is distinctive and most closely resembles that illustrated for *Issina* now *Thecodonta*. However, the lack of a right valve prevents us from making a comparison.

Habitat unknown. A single valve from the strandline on the SE coast of Failaka.

10/96. Lasaeidae gen. et sp. 2

The hinge characters of this shell and the lack of any right valves do not allow us to allocate it to any genus. The radial rays are very distinctive but we can find no reports of such a colour white or semi-transparent with 2–3 reddish brown radial rays.

Habitat unknown. Strandline on Miskan.

10/97. Kurtiella sp. 1

Mysella sp. #2 8

Free living, in crevices probably commensal. Rare, living only at Masfat Al-Ahmadi, disarticulated valves on the strandline on Miskan.

10/98. Kurtiella aff. rudis (Lyngé, 1909)

Montacuta (*Tellimya*) *rudis* Lyngé, 1909: 184, pl. 3 figs 33–34

Mysella sp#1 8

In rock crevices and vacated burrows, probably commensal. Rarely found on rocky shores, live Al-Messilah Beach, Abu Halifah, Masfat Al-Ahmadi; disarticulated shells on the strandline on Miskan. Type locality: Koh Chang, Thailand.

PLATE 11

11/99. Kurtiella sp. 2

Mysella sp. 5

Unknown, but members of this genus are usually commensal. Known from disarticulated valves only, Al-Salmiyah, Umm Al-Nimal, Al-Sha'ab, East Failaka, Salwa, Miskan.

11/100. Larissamya comta P. G. Oliver, Skryabin & Al-Ghunaim, 2017

Larissamya comta P. G. Oliver, Skryabin & Al-Ghunaim, 2017: 141–146

Amphilepida faba 7

Offshore or at extreme low tide, probably lives in association with the brittle-star *Amphiura*. Sulaibikhat and Kuwait Bay. Type locality: Kuwait.

11/101. Curvemysella paula (A. Adams, 1856)

Pythina paula A. Adams, 1856: 47

Curvemysella peculiaris 5; *Curvemysella* sp. 7

Known to be a commensal with pagurid (hermit) crabs. Known from disarticulated valves only from the strandlines of Ras Al-Zour and Khor Subiya. Type locality: Raine Island, Queensland.

11/102. Tellimya aff. ferruginosa (Montagu, 1808)

The specimen closely resembles the European *Tellimya ferruginosa* but is very unlikely to be conspecific. We could find no related taxon from the Arabian region or Indian Ocean.

Probably commensal with a burrowing echinoderm. A single specimen from Mina Al-Ahmadi. Type locality: England.

11/103. Sagamikellia khorica P. G. Oliver & Chesney, 1997

Sagamikellia khorica P. G. Oliver & Chesney, 1997: 53, figs 4–6

Axinopsida sp. 5

Habitat unknown. Disarticulated valves only from the strandlines of Ras Al-Zour and Miskan. Type locality: Oman

EUHETERODONTA, GALEOMMATOIDEA, BASTEROTIIDAE

11/104. Basterotia borbonica (Deshayes, 1863)

Anisodonta borbonica Deshayes, 1863: 16, pl. 2 figs 15–17

Basterotia borbonica 5

Life history not known, other species are associated with echiurid worms. Disarticulated valves only from the strandlines of Boubyan and Failaka. Type locality: Reunion.

EUHETERODONTA, GASTROCHAENOIDEA,
GASTROCHAENIDAE**11/105. Gastrochaena cuneiformis** Spengler, 1783

Gastrochaena cuneiformis Spengler, 1783: 178

Gastrochaena cuneiformis 2, 8; *G. gigantea* 5

Burrowing into calcareous substrates. Widespread on rocky shores on the south coast of Kuwait Bay, south to Al-Nuwaiseeb and Failaka. Type locality: Unknown.

11/106. Dufoichaena dentifera (Dufo, 1840)

Gastrochaena dentifera Dufo, 1840: 221

Gastrochaena dentifera 5, 8

Boring into calcareous rocks. Widespread on rocky shores on the south coast of Kuwait Bay,

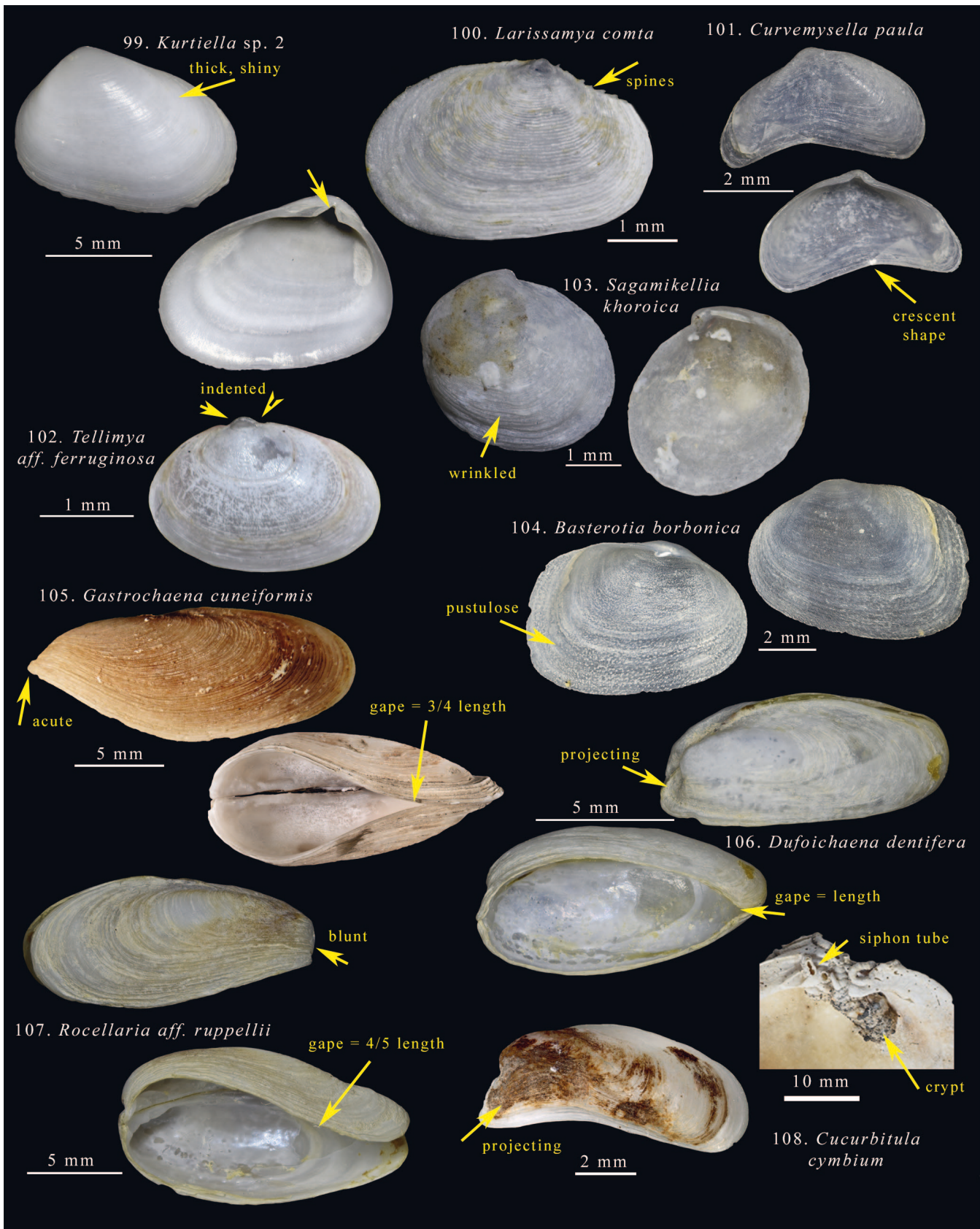


Plate 11

south to Ras Al-Zour and Failaka. Type locality: Seychelles.

11/107. *Rocellaria aff. ruppellii* (Deshayes, 1855)

Gastrochaena ruppellii Deshayes, 1855: 328

Gastrochaena dentifera 6; *G. sp.*? 8

Boring into calcareous rocks. Rare, only at Al-Sha'ab. Type locality: Red Sea

11/108. *Cucurbitula cymbium* (Spengler, 1783)

Gastrochaena cymbium Spengler, 1783: 182

Cucurbitula cymbium 5, 8

Cucurbitula cymbium typically builds crypts attached to larger dead bivalve shells, but in Kuwait it is more frequently found boring into calcareous rocks without building a crypt.

Widespread on rocky shores especially Al-Doha, the only location where crypts have been found. Type locality: Unknown.

PLATE 12

EUHETERODONTA, CARDIOIDEA, **CARDIIDAE**

12/109. *Fulvia fragilis* (Forsskål in Niebuhr, 1775)

Cardium fragile Forsskål in Niebuhr, 1775: 31

Laevicardium papyraceum 2; *Fulvia fragilis* 5, 6, 7; *F. australe* 6

Shallow burrower in sand mostly offshore. Widespread as valves on strandline. Type locality: Red Sea.

12/110. *Vepricardium coronatum* (Schröter, 1786)

Cardium coronatum Schröter, 1786: 53

NOT *Bucardium coronatum* 5

Shallow burrower in sand. Only as disarticulated valves from the strandline of the south coast of Boubyan. Type locality: Nicobars, India.

12/111. *Vasticardium assimile lacunosum* (Reeve, 1845)

Cardium lacunosum Reeve, 1845: sp. 81

Trachycardium lacunosum 1, 2, 3; *T. rubicundum* 7; *Acrosterigma lacunosa* 5, 6, 7; *Acrosterigma assimile* 6, 7; *Vasticardium lacunosum* 8

Shallow burrower in sand. Mostly on the sandy areas along the south coast. Type locality: Kuwait.

12/112. *Fragum sueziense* (Issel, 1869)

Cardium sueziense Issel, 1869: 76, pl. 3 fig. 4

Parvicardium suezensis 2, 5; *Fragum sueziense* 8

Shallow burrower in sand, mostly offshore. Living in the intertidal only at Al-Nuwaiseeb,

many disarticulated valves from the strandline of Ras Al-Zour. Type locality: Red Sea.

EUHETERODONTA, CHAMOIDEA, **CHAMIDAE**

12/113. *Chama asperella* Lamarck, 1819

Chama asperella Lamarck, 1819: 95

Chama asperella 5, 6, 8

Cemented under rocks middle and lower shore.

Widespread on most rocky shores. Type locality: Shark Bay, W. Australia.

12/114. *Chama pacifica* Broderip, 1835

Chama pacifica Broderip, 1835: 227

Chama pacifica 1, 2; *Chama sp.* 3; *C. aspera* 4; *C. reflexa* 5, 7; *C. pacifica* 8

Cemented to rocks, can be dense in gullies, mostly lower shore. Widespread on most rocky shores, most commonly on the southern coast. Type locality: Lord Hood's Island.

EUHETERODONTA, MACTROIDEA, **MACTRIDAE**

12/115. *Mactra lilacea* Lamarck, 1818

Mactra lilacea Lamarck, 1818: 479

Mactra lilacea 1, 2, 4, 5, 6, 7, 8

Shallow burrower in sand. Disarticulated valves are not uncommon on sandy shores, recorded living at Abu Halifah and Ras Al-Zour. Type locality: "Lisbon", not accepted.

12/116. *Mactrotoma ovalina* (Lamarck, 1818)

Mactra depressa Spengler, 1802: 118

Mactra ovalina 5, 6; *Mactrotoma depressa* 8

Shallow burrower in muddy sand. Recorded live in the intertidal only at Al-Doha. Type locality: Indian Ocean.

12/117. *Meropesta nicobarica* (Gmelin, 1791)

Mactra nicobarica Gmelin, 1791: 3261

Meropesta nicobarica 2, 5, 6

Deep burrower in muddy sand. Living Ras Al-Julaia'a 2. Type locality: Type locality: Nicobar Ids, India.

12/118. *Lutraria turneri* Jousseaume, 1891

Lutraria turneri Jousseaume, 1891: 207

Lutraria philippinarum 2; *L. australis* 5

Deep burrower in muddy sand. Live at Ras Al-Julaia'a 2, disarticulated valves on the strandline at Al-Judailiat and Al-Doha. Type locality: Gulf of Aden.



Plate 12

EUHETERODONTA, MACTROIDEA, MESODESMATIDAE

12/119. *Atactodea subobtusa* (Jousseaume, 1895)*Mesodesma subobtusa* Jousseaume, 1895: 187

Atactodea glabrata 5; *A. glabrata* 6; *A. subobtusa* 8
 Now regarded as distinct from the widespread and more trigonal shaped *Atactodea striata* (Gmelin, 1791). Free living in mobile sands at mid tide levels. Recorded live at Al-Fnaitees Beach and Al-Sha'ab. Type locality: Aden.

PLATE 13

EUHETERODONTA, TELLINOIDEA, TELLINIDAE

13/120. *Tellinella philippii* (Anton, 1844)*Tellina philippii* Anton, 1844: 126,*Tellina rastellum* 2, 5

A burrower in muddy sand. Living in sand between rocks at Al-Fnaitees 2 but not found since, juvenile valves on strandline at Ras Al-Zour. Type locality: Unknown.

13/121. *Pseudotellidora pellyana* (H. Adams, 1873)

Tellidora pellyana H. Adams, 1873: 208, pl. 23 fig. 14

Tellidora pellyana 2, 4, 5, 6, *Pseudotellidora pellyana* 8

A burrower in muddy sand. Disarticulated valves from the strandline at Al-Salmiyah, Mina Abdullah, Ras Al-Zour, Khor Iskander. Type locality: Arabian Gulf.

13/122. *Pharaonella wallaceae* (A. E. Salisbury, 1934)

Tellina wallaceae A. E. Salisbury, 1934: 90, pl. 14 figs 3–5

Tellina wallaceae 2; *Pharaonella wallaceae* 5, 6

A rapid burrower in sand or muddy sand perhaps in eelgrass beds. Found alive at An Niggalyat and Ras Al-Julaia'a 2, but not since. Type locality: Muscat, Oman.

13/123. *Confusella muscatensis* (P. G. Oliver & Chesney, 1997)

Moerella muscatensis P. G. Oliver & Chesney, 1997: 71, figs 45–48

Moerella n. sp. 5; *M. muscatensis* 6;*Confusella muscatensis* 8

A burrower in sand. Living only once in the intertidal at Al-Khiran, probably mostly offshore. Type locality: Muscat, Oman.

13/124. *Iridona methoria* (Melvill, 1897)*Tellina methoria* Melvill, 1897: 23, pl. 7 fig. 31

Tellina methoria 5, 7; ? *Tellina bertini* 6; *Iridona methoria* 8

A burrower in muddy sand. Abundant at Al-Doha, also recorded from the intertidal at Ras Al-Zour. Probably mostly offshore. Type locality: Mekran, Gulf of Oman.

13/125. *Jitlada arsinoensis* (Issel, 1869)*Tellina arsinoensis* Issel, 1869: 59–60, pl. 1 fig. 3*Tellina arsinoensis* 5, 6, 7; *Jitlada arsinoensis* 8

A burrower in muddy sand. Generally scarce from low in the intertidal but abundant at Al-Doha. Type locality: Red Sea.

13/126. *Angulinides adenensis* (E. A. Smith, 1891)

Tellina adenensis E. A. Smith, 1891: 426, pl. 33 fig. 8

Angulus adenensis 4; *Tellinides adenensis* 5

A rapid burrower in sand. Illustrated by 4 but not found by 2, 6, 8. Type locality: Aden.

13/127. *Hanleyanus immaculatus* (R. A. Philippi, 1849)*Tellina immaculata* Philippi, 1849: 55, pl. 5 fig. 2*Tellina emarginata* 2, 5; *Hanleyanus immaculatus* 8

A burrower in muddy sand. Disarticulated valves on shore, common in the subtidal at Sulaibikhat Bay. Type locality: Mergui Archipelago.

13/128. *Nitidotellina unifasciata* (G. B. Sowerby II, 1867)

Tellina unifasciata G. B. Sowerby II, 1867: pl. 29, species 156

Tellina nitens 2, 5; *T. valtonis* 6, 7; *Nitidotellina unifasciata* 8

A burrower in muddy sand. Rare in the intertidal, only at Al-Nuwaiseeb. Type locality: Unknown.

13/129. *Exotica triradiata* (H. Adams, 1871)

Tellina triradiata H. Adams, 1871: 790, pl. 48 fig. 9

Offshore. Only on strandlines at Miskan. Type locality: Red Sea.

13/130. *Jactellina clathrata* (Deshayes, 1835)*Tellina clathrata* Deshayes, 1835: 23, pl. 7 fig. 31*Exotica clathrata* 2; *Loxoglypta rhomboides* 5, 7;*Jactellina clathrata* 8

A burrower in sand. Rare alive in the intertidal, Qaruh Island. Type locality: Unknown.

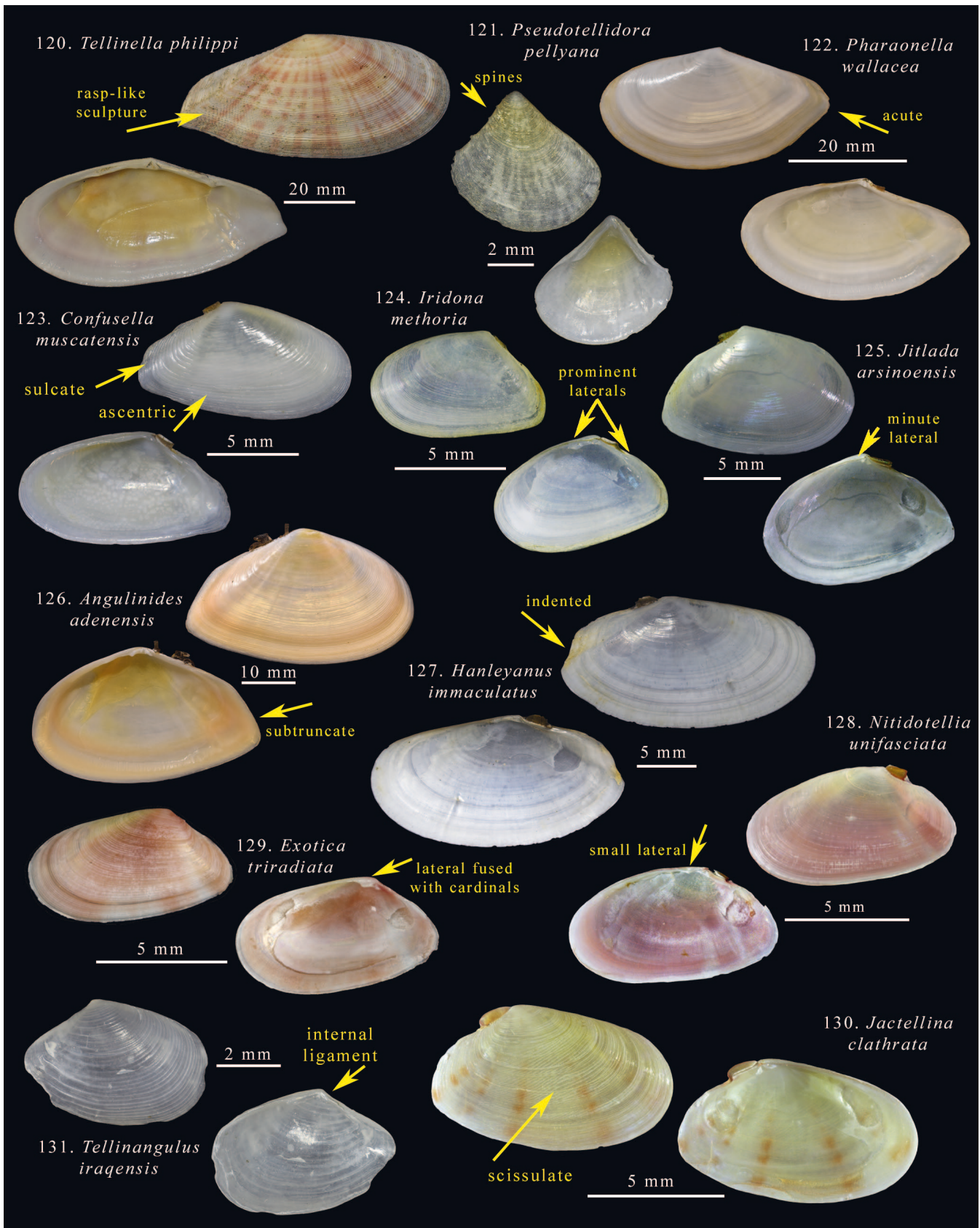


Plate 13

13/131. *Tellinangulus iraqensis* (Dance & Eames, 1966)

Iraqitellina iraqensis Dance & Eames, 1966: 37, pl. 3 figs 2–3

?*Tellina* sp. 2 7

Huber, 2015 considers *I. iraqensis* to be a synonym of *Tellina aethiopica* Thiele, 1931 but as the environments in which they occur are so different further investigation is warranted.

Probably a burrower in muddy sediments. Dead valves only on strandline at Miskan, East Failaka. If *Tellina* sp. 2 is conspecific, then living at Ras Al-Ard and Ras Al-Zour. Type locality: Basra, Iraq.

PLATE 14

14/132. *Cadella semen* (Hanley, 1845)

Tellina semen Hanley, 1845: 164

Tellina miracyllium Melvill & Standen 1907: 820: pl. 56 fig. 4

Cadella semen 5, 6

A burrower in sand. Alive at Al-Zour 6. Type locality: Philippines. Offshore in 18m by Melvill & Standen (1907) and described by them as *Tellina miracyllium*. Type locality: Arabian Gulf.

14/133. *Pseudopsammobia derelicta* Oliver, Dekker & Al-Kandari, 2023

Pseudopsammobia derelicta Oliver, H. Dekker & Al-Kandari, 2023: 424

A burrower in muddy sand. A single record of a living juvenile from Miskan, many disarticulated valves on the strandlines of Miskan, South Boubyan and East Failaka. Type locality: Kuwait.

14/134. *Arcopaginula inflata* (Gmelin, 1791)

Tellina inflata Gmelin, 1791: 3230

Tellina inflata 2; *Arcopaginula inflata* 5

A burrower in muddy sand. An Niggalyat and Ras Al Jil'at 2, but not found alive since. Type locality: Unknown.

14/135. *Pinguitellina pinguis* (Hanley, 1844)

Tellina pinguis Hanley, 1844: 63

Tellina robusta 2; *Pinguitellina pinguis* 5, 6, 8

A burrower in muddy sand. Scattered localities along the south coast, probably mostly offshore. Type locality: Philippines.

14/136. *Arcopella isseli* (H. Adams, 1871)

Tellina isseli H. Adams, 1871: 790, pl. 48 fig. 10

Arcopella isseli 5, 6

A burrower in muddy sand. Alive at Khor Iskander. Type locality: Red Sea.

14/137. *Leporimetis coarctata* (R. A. Philippi, 1845)

Tellina coarctata R. A. Philippi, 1845: 151.

Apolymetis coarctata 2; *Florimetis coarctata* 5

Offshore in muddy sand. A single valve was collected from the strandline on Failaka 2. Type locality: China.

14/138. *Tellinimactra edentula* (Spengler, 1798)

Tellina edentula Spengler, 1798: 96

Macoma edentula 2; *Tellinimactra angulata* 5, 6, 8

A burrower in muddy sand. Alive at Ras Al-Julaia'a 2, disarticulated valves common on the strandline on the south coast of Boubyan. Type locality: Tranquebar, India.

14/139. *Macomopsis dubia* (Deshayes, 1855)

Tellina dubia Deshayes, 1855: 371

Psammotreta praerupta 5, 6; *Macomopsis dubia* 8

A burrower in muddy sand. Scarce from low in the intertidal, probably mostly offshore, common in Sulaibikhat Bay. Type locality: Unknown.

14/140. *Macomopsis syndesmyoides* (Melvill & Standen, 1907)

Macoma syndesmyoides Melvill & Standen, 1907: 824, pl. 56 fig. 5

Tellinimactra syndesmyoides 5

Probably a burrower in mud or muddy sand. Disarticulated valves from the strandlines of Failaka and Miskan. Type locality: Gulf of Oman.

14/141. *Salmacoma nobilis* (Hanley, 1845)

Tellina nobilis Hanley, 1845: 165

Moerella iridescens 2 unpublished

A burrower in muddy sand. Probably mostly offshore, only at Khor Al-Al-Subiyah. Type locality: Philippines.

14/142. *Serratina* sp. 1 *sensu* Huber et al., 2015

Tellina sulcata 6

Not confirmed.

14/143. *Bosemprella* cf. *incarnata* (Linnaeus, 1758)

Tellina incarnata 6

Not confirmed. Type locality: Mediterranean Sea.



Plate 14

PLATE 15

EUHETERODONTA, TELLINOIDEA, DONACIDAE

15/144. *Donax erythraeensis* Bertin, 1881*Donax erythraeensis* Bertin, 1881: 99, pl.3 fig. 7*Donax erythraeensis* 5, 6, 8

A shallow burrower in sands. Sporadic on the sandy shores of the south coast, Ras Al-Zour, Al-Khiran. Type locality: Red Sea.

15/145. *Donax scalpellum* J. E. Gray, 1825*Donax scalpellum* J. E. Gray, 1825: 136*Donax scalpellum* 4, 5, ?6

Small shells may be juveniles of *D. scalpellum* or *D. impar* Hanley, 1882.

A rapid burrower in sands. Large shells not seen since 1984, small valves on strandline at Failaka and Ras Al-Zour. Type locality: Unknown.

EUHETERODONTA, TELLINOIDEA, PSAMMOBIIDAE

15/146. *Hiatula rosea* (Gmelin, 1791)*Solen roseus* Gmelin, 1791: 3238*Psammotella ruppelliana* 2; *Sanguinolaria* sp. 3;

Gari roseus 4; *Hiatula ruppelliana* 5, 6, 7; *Hiatula rosea* 8

In sandy mud. Disarticulated valves are widespread, alive at Al Doha and Al-Nuwiseeb. Type locality: Unknown.

15/147. *Gari occident* (Gmelin, 1791)*Solen occident* Gmelin, 1791: 3228*Gari occident* 2, 3, 5; *G. maculosa* 7

In sandy mud offshore. Shells figured or cited without locality 1, 2. Type locality: Unknown.

15/148. *Gari pallida* (Deshayes, 1855)*Psammobia pallida* Deshayes, 1855: 323*Gari weinkauffi* 2, 5

In sandy mud. Recorded live from Al-Fintas in 1984 2, but not since. Type locality: Red Sea.

15/149. *Gari maculosa* (Lamarck, 1818)*Psammobia maculosa* Lamarck, 1818: 513*Gari maculosa* 2, 4, 5

Offshore, probably in sand or muddy sand. Disarticulated valves from the strandline at An Niggalyat 2. Type locality: Unknown

15/150. *Asaphis violascens* (Forsskål in Niebuhr, 1775)*Venus violascens* Forsskål in Niebuhr, 1775: 31*Asaphis deflorata* 2; *Asaphis violascens* 5, 6, 8

In coarse sand among rocks, deeply buried. Living only at Al-Nuwiseeb, disarticulated valves on the strandlines of the south coast. Type locality: Red Sea.

EUHETERODONTA, TELLINOIDEA, SEMELIDAE

15/151. *Semele cordiformis* (Holten, 1802)*Tellina cordiformis* Holten, 1802: 10*Semele sinensis* 2, 5; *S. cordiformis* 8

In sandy mud mostly offshore. Living only at Al-Salmiyah (Al Bide) and Ras Al-Julaia'a. Type locality: "West Indies" Not accepted.

15/152. *Semele carnicolor* (Hanley, 1845)*Amphidesma carnicolor* Hanley, 1845: 162*Semele scabra* 2; *S. carnicolor* 5

In sandy mud. A single valve is present in the Bill Stuart collection and was listed without locality 2 and a single valve on Miskan. Type locality: Philippines.

15/153. *Theora lata* (Hinds, 1843)*Neaera lata* Hinds, 1843: 79*Theora cadabra* (in part) 8

Mostly off-shore in soft sediments. Rare compared with *T. mesopotamica*, alive from Al Nuwiseeb, disarticulated valves on Miskan. Type locality: Philippines.

15/154. *Theora mesopotamica* (Annandale, 1918)

Corbula (*Erodona*) *mesopotamica* Annandale, 1918: 170, pl. 20 figs 12–13

Abra cadabra Eames & Wilkins, 1957: 199, pl. 27 figs 4–5

Abra cadabra 2; *Theora cadabra* 5, 6, 8 in part

In mud, at low tide and offshore. Found in the muddy shores of the inner part of Kuwait Bay and around Boubyan. Type locality: Iraq, Arabian Gulf.

PLATE 16

16/155. *Abra cistula* (Melvill & Standen, 1907)

Syndesmya cistula Melvill & Standen, 1907: 825, pl. 56 figs 6, 6a

Syndesmya cistula 5

Probably in mud offshore. A single valve on the strandline on Miskan. Type locality: Gulf of Oman.



Plate 15

16/156. *Abra fragillima* (Issel, 1869)

Tellina fragillima Issel, 1869: 60, pl. 1 fig. 5
Probably in mud offshore. A single valve on the strandline at Al-Salmiyah. Type locality: Red Sea.

16/157. *Cumingia deshayesiana* Vaillant 1865

Cumingia deshayesiana Vaillant, 1865: 126, pl. 6 fig. 2

Cumingia striata 5, 6; *C. mutica* 8

In crevices and vacated burrows in rocks. Common on rocky shores throughout Kuwait. Type locality: Red Sea.

16/158. *Semelangulus rosamunda* (Melvill & Standen, 1907)

Tellina (Moera) *rosamunda* Melvill & Standen, 1907: 820, pl. 56 fig. 1

Tellina rosamunda 2; *Semelangulus rosamunda* 5, 6, 8

In muddy sand at low tide and offshore. Living once at Ras Al-Julaia'a. Type locality: Gulf of Oman.

16/159. *Ervilia scaliola* agg. Issel, 1869

Ervilia scaliola Issel, 1869: 53, pl. 1 fig. 2

Ervilia scaliola 2, 5, 6, 8; *Paphia* sp. juv. 7

Specimens attributable to *Ervilia scaliola* are markedly variable and may represent a complex of forms that are aggregated under this name

In sand at low tide and offshore. Infrequent in the intertidal, mostly from sites on the south coast, shells of all forms beached at Mina Abdullah. Type locality: Red Sea.

16/160. *Ervilia purpurea* E. A. Smith, 1906

Ervilia purpurea E. A. Smith, 1906: 66, pl. 8 figs 10–11

Ervilia purpurea 5, 6, 8

In sand at low tide and offshore. Living only at Mina Al-Ahmadi. Type locality: Dahlak, Red Sea.

16/161. *Leptomya cf. cochlearis* (Hinds, 1844)

Neaera cochlearis Hinds, 1844: 98

Leptomya cochlearis 5

A burrower in soft sediments offshore. Found only as broken valves on the strandline of Miskan. Type locality: Philippines.

EUHETERODONTA, TELLINOIDEA, SOLECURTIDAE

16/162. *Solecortus australis* (Dunker, 1862)

Macha australis Dunker, 1862: 424

Solecortus australis 2; *Solecortus australis* 5

In sandy mud. No locality and not seen since. Type locality: Unknown.

16/163. *Solecortus exaratus* (R. A. Philippi, 1849)

Solen exaratus R. A. Philippi, 1849: 174

Solecortus quoyi 2; *S. subcandidus* 5

In sandy mud. Two paired valves from Miskan and disarticulated valves from the strandlines of Miskan and Boubyan. Type locality: Unknown.

EUHETERODONTA, ARCTICOIDEA, TRAPEZIDAE

16/164. *Neotrapezium sublaevigatum* (Lamarck, 1819)

Cardita sublaevigata Lamarck, 1819: 26

Trapezium sublaevigatum 2, 4, 5, 6, 7; *Neotrapezium sublaevigatum* 8

In crevices and vacated burrows in rock. Common on all rocky shores. Type locality: Unknown.

EUHETERODONTA, GLOSSOIDEA, KELLIELLIDAE

16/165. *Alveinus miliaceus* (Issel, 1869)

Kellia miliacea Issel, 1869: 87, pl. 1 fig. 11

Kellia miliacea – Oliver & Zuschin, 2001: 213–230

In muddy sand. Known from a single dead valve from the strandline on Miskan. Type locality: Red Sea.

PLATE 17

EUHETERODONTA, UNGULINOIDEA, UNGULINIDAE

17/166. *Diplodonta subrotunda* (Issel, 1869)

Diplodonta subrotunda Issel, 1869: 253, pl. 3 fig. 2

Diplodonta subrotundata 5, 8

In muddy/sand sediment. Sporadic on the south side of Kuwait Bay and along the south coast. Type locality: Red Sea.

17/167. *Transkeia moolenbeeki* (Van Aartsen & Goud, 2006)

Diplodonta moolenbeeki Van Aartsen & Goud, 2006: 41–52

?*Diplodonta cf. globosa* 5; *D. (Transkeia) moolenbeeki* 8

Transkeia moolenbeeki is treated as a junior synonym of *T. satparensis* (Preston, 1915) in MolluscaBase (2023) but we disagree.

In muddy/sand sediment. Living in the intertidal Ras Ajuza and Al-Nuwiseeb. Disarticulated valves at Al-Sha'ab, south to Al Nuwiseeb and on Failaka. Type locality: Red Sea.

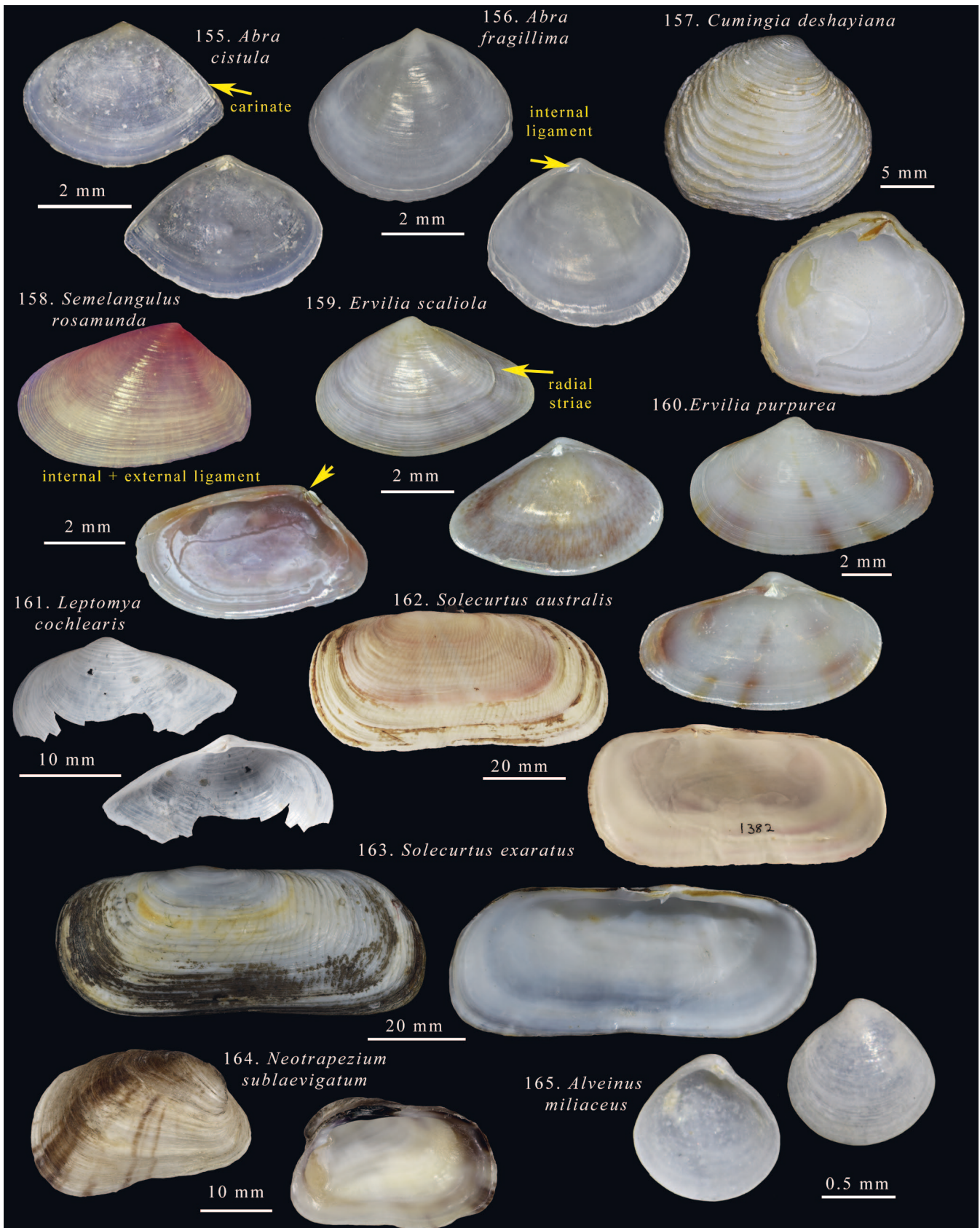


Plate 16

17/168. *Transkeia* sp.?

Resembles small *Diplodonta subrotunda* but the internalised ligament gives affinity with *Transkeia*.

In sandy mud at extreme low water mark. Al-Doha only.

17/169. *Transkeia globosa* (Forsskål in Niebuhr, 1775)

Venus globosa Forsskål in Niebuhr, 1775: 122

Diplodonta (Transkeia) globosa 8

Probably in muddy sand offshore. Disarticulated valves common on the strandlines of the south coast of Boubyan. Type locality: Red Sea.

17/170. *Neodiplodonta genethlia* (Melvill, 1898)

Diplodonta genethlia Melvill, 1898: 32, pl. 2 fig. 11

Diplodonta genethlia 5, 8

Probably in muddy/sand sediment. Disarticulated valves on the strandlines of the south coast of Boubyan and on Miskan. Type locality: Gulf of Oman.

17/171. *Timothyus holosphaerus* (Melvill, 1899)

Diplodonta holosphaera Melvill, 1899: 99, pl. 2 fig. 11

Diplodonta holosphaera 5, 6, 8

Mostly in sediment filled crevices and vacated burrows in rocks. Sporadic on the south side of Kuwait Bay and the south coast. Type locality: Karachi, Pakistan.

17/172. *Felaniella crebristrata* (G. B. Sowerby III, 1905)

Diplodonta crebristriata G. B. Sowerby III, 1905: 191

Diplodonta crebristriata 5, 8

Although *F. crebristriata* has been synonymised with *F. cuneata* (Spengler 1798) we regard the Arabian shells as distinct.

In muddy/sand sediment. Alive at Mina Abdullah, disarticulated valves on the south coast and Failaka. Type locality: Sri Lanka.

EUHETERODONTA, VENEROIDEA, VENERIDAE

17/173. *Periglypta crispata* (Deshayes, 1853)

Venus crispata Deshayes, 1853: 107

Periglypta puerpera 2

A shallow burrower in fine sand, most offshore. A single fragment is recorded from the strandline on the east coast of Failaka but was collected living at Abu Halifah 2 but not seen since. Type locality: Unknown.

17/174. *Placamen* cf. *lamellatum* (Röding, 1798)

Venus lamellata Röding, 1798: 183

Bassina calophylla 2, 5, 7; *Placamen* cf. *lamellatum* 8

Huber (2010) suggests that the Arabian shells are *P. lamellosum* (G. B. Sowerby I, 1825) but we find greater similarity to those illustrated by Huber as *P. lamellatum*. Type locality: Unknown.

A burrower in mud or muddy sand. Large, disarticulated valves on the strandline on the south coast of Boubyan. Alive at Ras Al-Zour 7.

17/175. *Timoclea arakana* (G. & H. Nevill, 1871)

Cryptogramma arakana G. & H. Nevill, 1871: 10, pl. 1 figs 16-16a

Timoclea arakana 2, 6, 8; *T. farsiana* 2, 4; *T. macfadyeni* 2; *Timoclea* sp. 7

A variable shell requiring resolution by molecular methods. A shallow burrower in fine sand mostly offshore. Alive in the intertidal at Ras Ajuza 7. Type locality: Arakan, Myanmar.

PLATE 18

18/176. *Gafrarium pectinatum* (Linnaeus, 1758)

Venus pectinata Linnaeus, 1758: 689

Gafrarium pectinatum 2, 3, 5, 6, 8

A shallow burrower in mixed sediments and also in rock crevices. Widely distributed on all coasts. Type locality: India.

18/177. *Microcirce consternans* P. G. Oliver & Zuschin, 2001

Microcirce consternans P. G. Oliver & Zuschin, 2001: 224, figs 17-20

Gouldiopa consternans 8

In muddy sand. Disarticulated valves from the strandline at Al-Julaia'a. Type locality: Muscat, Oman.

18/178. *Circe scripta* (Linnaeus, 1758)

Venus scripta Linnaeus, 1758: 689

Circe scripta 2, 4, 5, 6, 8

A shallow burrower in fine sand at low water mark and below. Intertidal at Al-Julaia'a and Al-Nuwaiseeb. Type locality: India.

18/179. *Circe rugifera* (Lamarck, 1818)

Cytherea rugifera Lamarck, 1818: 579

Circe corrugata 2; *C. rugifera* 5, 6

A shallow burrower in fine sand at low water mark. Intertidal at An Niggalyat and Al-Mufattah



Plate 17

Creeks 2, not seen since. Type locality: Egypt, Red Sea.

18/180. *Circe intermedia* Reeve, 1863

Circe intermedia Reeve, 1863: pl. 7 fig. 26

Circe intermedia 5

A shallow burrower in fine sand at low water mark and below. Disarticulated valves on strandline at Al-Nuwiseeb. Type locality: Unknown.

18/181. *Circenita callipyga* (Born, 1778)

Venus callipyga Born, 1778: 55

Circenita callipyga 1, 2, 3, 4, 5, 8; *Circe intermedia* 7; *Lioconcha ornata* 7; *Marcia marmorata* 7

The highly variable colour patterns have given rise to numerous misidentifications.

A shallow burrower in sand under rocks on upper shore, sand flats mid tide.

Widely distributed all along the southern coasts. Type locality: Unknown.

18/182. *Sunetta effossa* (Hanley, 1843)

Cytherea effossa Hanley, 1843: 123

Sunetta effossa 2, 5

Probably in sand offshore. Disarticulated valves on strandline at Al-Nuwiseeb. Type locality: Unknown.

18/183. *Callista florida* (Lamarck, 1818)

Cytherea florida Lamarck, 1818: 565

Callista lilacina 2; *C. florida* 4, 5, 6, 7, 8

A shallow burrower in sand from mid tide level and below. Alive at Abu Halifah elsewhere valves not uncommon on strandline. Type locality: Unknown.

18/184. *Callista umbonella* (Lamarck, 1818)

Cytherea umbonella Lamarck, 1818: 575

Meretrix meretrix 2, 4; *Amiantis umbonella* 5, 6, 7, 8

A shallow burrower in sand from mid tide level and below. Widely distributed on south side of Kuwait Bay, south coast and offshore islands of Failaka and Quaruh. Type locality: Red Sea.

18/185. *Dosinia prostrata* (Linnaeus, 1758)

Venus prostrata Linnaeus, 1758: 688

This large species of *Dosinia* was not included in Bosch (1995) but is illustrated by Subba Rao (2017) from western India. The closely related but smaller species *D. caelata* (Reeve, 1850), was listed by Jones (1986) but we suspect that this was *Dosinia alta*.

A burrower in muddy sand. Recorded from disarticulated valves from the strandline of the south coast of Boubyan. Type locality: Indian Ocean.

18/186. *Dosinia labiosa* Römer, 1862

Dosinia labiosa Römer, 1862: 218

Dosinia alta 2; *D. tumida* 5

A burrower in muddy sand. Washed ashore after storms, Al-Shuaiba. Type locality: Australia.

PLATE 19

19/187. *Dosinia erythraea* Römer, 1860

Dosinia erythraea Römer, 1860: 117

Dosinia exoleta 2; *D. erythraea* 5, 6, 7

A burrower in muddy sand. Living at Al-Shuaiba and Al-Mahboulah, many dead valves at Al-Doha. Type locality: Red Sea.

19/188. *Dosinia alta* (Dunker, 1849)

Artemis alta Dunker, 1849: 184

Dosinia alta 2, 5, 6, 7, 8

A burrower in sands from mid tide level and below. Living in the intertidal at locations along the south side of Kuwait Bay and the south coast. Type locality: Red Sea.

19/189. *Dosinia contracta* (Philippi, 1844)

Cytherea (Artemis) contracta Philippi, 1844: 172

Dosinia contracta 5, 8

The identity of this shell is uncertain. A burrower in sands and sandy gravels from low tide level and below. Intertidal at Al-Sha'ab. Type locality: East Indies.

19/190. *Dosinia* sp.

Known only from shells from off Boubyan in the Smythe collection in the NHM London. The prominent raised scales along the posterior dorsal margin are unlike any other Arabian *Dosinia*.

19/191. *Pelecypora* sp.

Pelecypora ceylonica 8

This shell is not *P. ceylonica* as illustrated by P. G. Oliver in Dance (1995: fig. 1219) but we have been unable to find a definite identification.

A burrower in muddy sand flats from mid tide level and below. Very common living Al-Judailiat, Umm Al-Namil, Sulaibikhat, dead shells at Miskan.



Plate 18



Plate 19

19/192. *Clementia papyracea* (Gmelin, 1791)*Macra papyracea* Gmelin, 1791: 3257*Clementia papyracea* 2, 5, 8

A burrower in mud. Disarticulated valves on the strandline on the south coast of Boubyan. Type locality: Nicobar Islands, India.

19/193. *Kyrina kyrina* Jousseaume, 1894*Kyrina kyrina* Jousseaume, 1894: 99*Kyrina kyrina* 6

A burrower in mud. Living at Umm Al-Namil and Al-Nuwaiseeb, disarticulated valves on strandline at Ras Al-Zour. Type locality: Red Sea.

19/194. *Tapes deshayesii* (Hanley, 1846)

Venus deshayesii Hanley, 1846: 363, pl. 16 fig. 35

Tapes deshayesii 5, 8

Huber (2010) regards this species as a junior synonym of *Tapes sulcarius* but we do not accept this synonymy. A burrower in sand mostly offshore. Recorded as disarticulated valves only from strandlines along the south coast. Type locality: Philippines.

19/195. *Tapes sulcarius* (Lamarck, 1818)*Venus sulcarius* Lamarck, 1818: 596*Paphia sulcaria* 2; *Tapes sulcarius* 4, 5, 7, 8

A deep burrower in sand mostly offshore. Mostly found as disarticulated valves, living at Ras Al-Zour and Al-Mahboulah. Type locality: Indian Ocean.

19/196. *Paratapes textilis* (Gmelin, 1791)*Venus textile* Gmelin, 1791: 3280*Tapes textile* 2; *Paphia textile* 4, 7; *P. undulata*

A shallow burrower in sand mostly offshore. Mostly recorded as disarticulated valves, living at Ras Al-Ard. Type locality: Malabar, India.

PLATE 20

20/197. *Protapes ziczac* (Linnaeus, 1758)*Venus ziczac* Linnaeus 1758: 689

Paphia gallus 2, 4; *Protapes sinuosa* 5, 6; NOT *Protapes sinuosa* 7

A burrower in sand at low tide level and below. Living subtidally in Sulaibikhat Bay, disarticulated valves on the strandline on Miskan. Type locality: India Ocean.

20/198. *Protapes rhamphodes* (P. G. Oliver & Glover, 1996)

Protapes rhamphodes P. G. Oliver & Glover, 1996: 393, fig. 3

Protapes n. sp. 5; *P. rhamphodes* 6, 8

A shallow burrower in muddy-sand, from low tide level and below. Sporadic, common at Al-Doha and Al-Judailiat. Type locality: Masirah, Oman.

20/199. *Protapes cor* (G. B. Sowerby II, 1853)

Venus cor G. B. Sowerby II, 1853: 727, pl. 160 fig. 184

Marcia cor 2; *Katelsia sp.* 4; *Protapes cor* 5, 6, 7, 8

A shallow burrower in mud from mid tide level and below. Widespread but mostly in Kuwait Bay and around Boubyan. Type locality: Karachi, Pakistan.

20/200. *Marcia cordata* (Forsskål in Niebuhr, 1775)*Venus cordata* Forsskål in Niebuhr, 1775: 123*Marcia hiantina* 2, 4; *M. opima* 2, 7

M. flammea 5, 6; *M. marmorata* 6; *Paphia undulata* 6; *Marcia cordata* 8

A shallow burrower in sand from mid tide level and below. Widely distributed, abundant at Al-Judailiat. Type locality: Red Sea.

20/201. *Marcia opima* (Gmelin, 1791)*Venus opima* Gmelin, 1791: 3279*Marcia optima* 4, 5

Doubtful in Kuwait. Type locality: India.

20/202. *Venerupis rugosa* G. B. Sowerby II, 1854

Venerupis rugosa G. B. Sowerby II, 1854: 768–769, pl. 165 fig. 25

?*Claudiconcha corrugata* 2, 3; *Venerupis rugosa* 5, 6, 7, 8

Nestles in crevices or vacated burrows in rock. Living in the intertidal on rocky shores on the south side of Kuwait Bay and the south coast. Type locality: Swan River, Australia.

20/203. *Irus vertumnalium* (Melvill, 1918)

Cypricardia vertumnalium Melvill, 1918: 157, pl. 5 fig. 34

Irus irus 2, 3; *I. macrophylla* 5, 6, 8

Nestles in crevices or vacated burrows in rock. Widespread on most rocky shores. Type locality: Karachi, Pakistan.



Plate 20

20/204. *Petricola fabagella* Lamarck, 1818
Petricola fabagella Lamarck, 1818: 505
Petricola hemprichi 2, 3, 5, 6; *P. fabagella* 8
 Boring into calcareous rock. Very common on all rocky shores. Type locality: Australia.

20/205. *Petricola lapicida* (Gmelin, 1791)
Venus lapicida Gmelin, 1791: 3269
Petricola lapicida 5
 Boring into calcareous rock and coral. Only as a disarticulated valve on the strandline at Al-Salmiyah. Type locality: Caribbean Seas.

20/206. *Asaphinoides madreporica* (Jousseaume, 1895)
Claudiconcha madreporica Jousseaume, 1895: 187
Asaphinoides madreporica 5, 8
 Nestling in crevices, in rocks and corals.
 Rarely found due to habit. Alive at Mina Abdullah only. Type locality: Red Sea.

PLATE 21

EUHETERODONTA, MYOIDEA, CORBULIDAE

21/207. *Corbula taitensis* Lamarck, 1818
Corbula taitensis Lamarck, 1818: 496
Corbula modesta 2; *C. taitensis* 5
 Probably living in sand. Disarticulated valves from the strandlines of Failaka and Al-Julaia'a, living at Abu Halifah 2. Type locality: Tahiti.

21/208. *Corbula subquadrata* Melvill & Standen, 1907
Corbula subquadrata Melvill & Standen, 1907: 843, pl. 56 fig. 7
Corbula subquadrata 5 NOT ILLUSTRATED, 8; *C. taitensis* 7
 Probably living in soft mud. Abundant as disarticulated valves on the strandlines of the south coast of Boubyan and on Miskan. Single living juveniles from Musfat Al-Ahmadi and Umm Al-Shajar may be this species. Type locality: Mumbai, Arabian Sea.

21/209. *Corbula sulculosa* H. Adams, 1870
Corbula sulculosa H. Adams, 1870: 6, pl.1 fig. 2
Corbula sulculosa 2, 5, 6, 7
 Probably living in sand. Disarticulated valves from the strandlines of Al-Salmiyah and Al-Julaia'a; offshore 7. Type locality: Red Sea.

21/210. *Varicorbula erythraeensis* (H. Adams, 1871)
Corbula erythraeensis H. Adams, 1871: 789 pl.48 fig. 2
Corbula erythraeensis 5
 Probably living in mud. Recorded from a few disarticulated valves from the strandline on Miskan. Type locality: Red Sea.

EUHETERODONTA, MYOIDEA, MYIDAE

21/211. *Cryptomya elliptica* (A. Adams, 1851)
Sphenia elliptica A. Adams, 1851: 88
Cryptomya elliptica 5, 6
 Probably offshore, burrowing in mud. Frequently as disarticulated valves on the strandline of the south coast of Boubyan. Type locality: Sydney, Australia.

21/212. *Tugonia decurtata* (A. Adams, 1851)
Sphenia decurtata A. Adams, 1851: 88
Tugonia divaricata 2; *Tugonella decurtata* 5
 Probably offshore, burrowing in mud. Disarticulated valves on the strandlines of Al-Nuwiseeb and Ras Al-Zour. Type locality: Philippines.

EUHETERODONTA, PHOLADOIDEA, PHOLADIDAE

21/213. *Aspidopholas tubigera* (Valenciennes, 1846)
Penitella tubigera Valenciennes, 1846: pl. 24 fig. 3,3a-c (no text)
Aspidopholas obtecta 2, 5, 6; *A. cf. ovum* 4; *Martesia striata* 6; *A. tubigera* 8
 Boring into soft rock. Widespread on many rocky shores in Kuwait Bay and along the south coast. Type locality: Solomons Is.

21/214. *Martesia striata* (Linnaeus, 1758)
Pholas striatus Linnaeus, 1758: 669
Martesia striata 2
 Wood boring. In timbers of Al-Shuaibah Pier 2. Type locality: European Seas.

DISCUSSION

This checklist records that 214 species of Bivalvia living or as dead shells can be found on the shores of Kuwait. Glayzer *et al.* (1984) listed 144, Behbehani and Ghareeb (2002) 164, Al-Kandari *et al.* (2020) 126. The differences can only be interpreted as variations in effort and expertise and

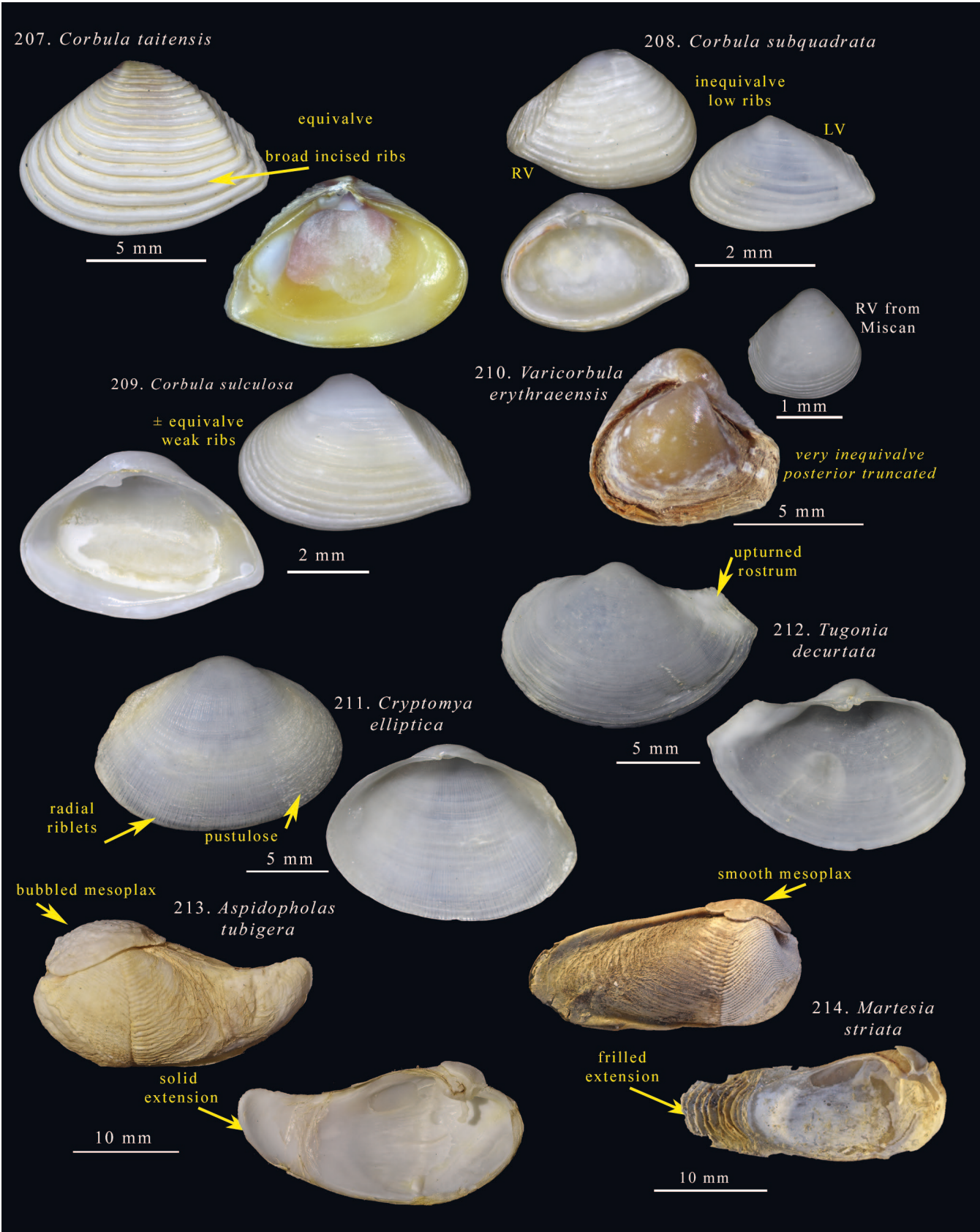


Plate 21

have no environmental implications. From the surveys of Behbehani & Ghareeb (2002) and Al-Kandari *et al.* (2020) the total number of living species is 110, the remainder being found only as valves on the strandline. This indicates that the offshore malacofauna is rich if not more so than the intertidal but it is relatively understudied.

Faunistic changes

A number of larger species, recorded by Glayzer *et al.* (1984), were not found, either living or as beached valves, by Behbehani & Ghareeb (2002) and Al-Kandari *et al.* (2020). These include *Anadara ehrenbergii*, *A. erythraonensis*, *A. uropigimelana*, *Tellinella philippii*, *Pharaonella wallaceae* and *Dosinia labiosa*. As the different surveys have differing methodologies and intensities one cannot be certain that these recent omissions represent true changes to the fauna. The Glayzer list (Glayzer *et al.*, 1984) was made from observations over many years by enthusiastic amateur shell collectors who would have focussed on unusual species. The Behbehani & Ghareeb and Al-Kandari surveys were focussed on distribution and numerical data making searching for rarities a low priority. However none of these species were found as dead shells in the collecting phase of 2019 despite the numerous additions of other species. Changes in the environment, including water quality, sedimentation, turbidity and pollution that could account for loss of biodiversity are fully summarised in the extensive volume "Fathoming the Northwestern Arabian Gulf" by Al-Yamani (2021)

New records and undescribed species

The majority of new records and undescribed taxa are represented by small species mostly in the Galeommatoidea. Most have not been collected living and numbers of specimens are small. Targeted collecting of living material is required here, because many inhabit cryptic habitats or are commensal with other invertebrates. Also in many cases the anatomy is more informative than the shell.

There remain many unresolved taxonomic issues where there is uncertainty about the current systematics although names have been applied. Examples are in the genera *Anadara*, *Brachidontes*, *Musculus*, *Hiatella*, *Thracia*, *Transkeia*, *Ervilia*, *Dosinia*, *Irus*, and require more material and the application of molecular systematics.

New additions result from increased collecting effort, level of identification expertise or targeting under sampled habitats. The recent studies on the Ostreidae show how the application of molecular systematics can dramatically change the identity of even common species. (Al-Kandari, Salvi *et al.*, 2021; Salvi *et al.*, 2022/23).

Uniqueness of the Kuwait fauna

There is evidence that the malacofauna of Kuwait has unique elements not shared with the southern part of the Arabian Gulf. Species found in Kuwait but as yet, not further south are *Congetia chesneyi*, *Protapes cor*, *Pelecypora sp.*, *Anadara sp.*, *Talonostrea salpinx*, *Talonostrea sp.*, *Theora mesopotamica*, *Tellinangulus iraqensis*, *Pseudopsammobia derelicta* and *Salmacoma nobilis*.

The majority of these prefer muddy sediments or can tolerate high levels of turbidity and large changes in salinity. There are indications that these elements are in common with the malacofauna of Pakistan and Gujerat (NW India) but substantiating this is difficult as the faunas of these regions remain poorly known. However, *C. chesneyi*, (Tripathy *et al.* 2003) *P. derelicta* (Oliver *et al.* 2023) and *Anadara sp.* (pers. comm. Ms Saedul Bukhari) have been recognised from that region of the NE Arabian Sea. Al-Yamani (2021) reviews the progress of inundation of the Gulf during the Holocene and it seems plausible that these species followed the regression of the Tigris/Euphrates deltaic conditions northward. As the progression occurred the southern Gulf became less suitable and today one sees elements of the fauna restricted to the northwest Gulf.

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