Intertidal Molluscs in UAE Lagoons

by Gary R. Feulner & Richard J. Hornby

Abstract

This paper reviews the gastropod and bivalve mollusc species found in the intertidal lagoon environments of the UAE, including several Haminoeid and Assimineid gastropods not yet identified, and briefly describes their customary habitats. The species discussed are listed immediately below, totaling 25 gastropods and some 24+ bivalves. Species nomenclature is that of Bosch et al. (1995), except as otherwise indicated; family nomenclature follows the checklist of marine invertebrates in Hellyer & Aspinall (2005), compiled in conjunction with George (2005). Numbers in parentheses indicate those assigned to each species in Bosch et al. (1995), the most comprehensive mollusc reference for the UAE.

Class Gastropoda
Subclass Prosobranchia
Family Trochidae
- *Osilinus kotschyi* (#47)

Family Littorinidae
- *Littoraria (Littorinopsis) intermedia* (#114)
- *Echinolittorina arabica* (#115)
- *Peasiella mauritiana* (#119)

Family Planaxidae
- *Planaxis sulcatus* (#148)

Family Cerithiidae
- *Clypeomorus bifasciatus persicus* (#166)

Family Potamididae
- *Cerithidea cingulata* (#184
- *Potamides conicus* (#185)
- *Terebralia palustris* (#187)

Family Muricidae
- *Thais savignyi* (#493)

Family Columbellidae
- *Mitrella blanda* (#536)

Family Nassariidae
- *Nassarius (Plicarcularia) persicus* (#560)

Family Olividae
- *Ancilla (Sparella) farsiana* (#604)

Family Bullidae
- *Bulla ampulla* (#823)

Family Haminoeidae
- *Haminoea* sp. 1
- *Haminoea*(?) sp. 2

Family Assimineidae
- *Assiminea* sp.
- *Paludinella*(?) sp.

Subclass Pulmonata
Family Ellobiidae
- *Allochroa bronnii* (#849)
- *Cassidula* cf. *labrella* (#850)
- *Cassidula nucleus* (#851)
- *Melampus* cf. *castaneus* (#853)
- *Laemodonta monilifera* (#854)

Family Amphibolidae
- *Salinator fragilis* (#864)

Family Onchidiidae
- *Onchidium peronii*

Class Bivalvia
Family Mytilidae
- *Brachiodontes variabilis* (#943)
- *Musculista senhousia* (#954)

Family Pteriidae
- *Pinctada radiata* (#971)

Family Malleidae
- *Parviperna nucleus* (#979)

Family Ostreidae
- *Saccostrea cuccullata* (#996)

Family Spondylidae
- *Spondylus marisrubri* (#1014)

Family Lucinidae
- *Pillucina fischeriana* (#1026)
- *Anodontia edentula* (#1028)

Family Ungulinidae
- *Diplodonta* spp. (#1036-1039)

Family Chamidae
- *Chama reflexa* (#1066)

Family Mesodesmatidae
- *Caecella qeratensis* (#1106)

Family Tellinidae
- *Tellina* spp. (#1116-1123)
- *Pinguitellina pinguis* (#1143)

Family Psammobiidae
- *Asaphis violascens* (#1160)
- *Hiatula mirbahensis* (#1166)
- *Hiatula ruppelliana* (#1167)
- *Psammosphaerica psammosphaerita* (#1168)

Family Veneridae
- *Circenita callipyga* (#1198)
- *Amiantis umbonella* (#1205)
- *Callista florida* (#1207)
- Dosinia spp. (#1218-1223)
- *Marcia flammea* (#1225)

Family Laternulidae
- *Laternula erythraensis* (#1267)
- *Laternula navicula*

Introduction

The intertidal zone is a demanding environment under any circumstances, and it is especially demanding in the Arabian Gulf, where for much of the year high air temperatures and high water temperatures can make life very stressful whether the tide is in or out. Continuing investigation of intertidal molluscs in the coastal lagoons of the UAE, both along the Arabian Gulf and the Gulf of Oman, has given a better understanding of what species are present, where, and, to some extent, how they cope with the heat and threat of desiccation. These lagoons are generally characterised by low wave energy, high temperatures and hypersalinity. The intertidal parts of the lagoons support fewer mollusc species than most subtidal environments but, nevertheless, a wide range of species is present, including some that are abundant and others that are among the UAE's least conspicuous.

The main focus of this paper is the gastropods, because they are relatively easy for the casual observer to find, and new information is becoming available on this group. The most numerous molluscs in lagoons are probably bivalves but they are mostly rather small and live within rather than on the sediment. Some information is provided here on bivalves, but no attempt is made to cover the other classes of intertidal molluscs, i.e. the Scaphopoda (tusk shells), Polyplacophora (chitons) and Cephalopoda (cuttlefish which lay their eggs in intertidal parts of lagoons).

Mudflats

The most conspicuous molluscs of the intertidal lagoon environment are the Potamidids (mud creepers or horn shells). The two small, conical mud creepers of the Arabian Gulf, *Cerithidea cingulata* (#184 in *Seashells of Eastern Arabia* by Bosch *et al*.) and *Potamides conicus* (#185), exemplify the "grin and bear it" strategy. They lay out on mudflats in large numbers, typically fully exposed to the sun at low tide *(Fig. 1*). *C. cingulata* is most often found on areas of relatively firm and sandy substrate, but at some sites it may be almost totally overgrown by algae (*Fig. 2*). *P. conicus* is typically found a little higher than *C. cingulata*. It favours soft mud that seems to hold moisture, but may sometimes climb mangrove pneumatophores or take shelter under loose flaps of the black mats of cyanobacteria (formerly called blue-green algae) found in the uppermost intertidal zone. The two are similar in appearance and, especially when muddy, it may be difficult to distinguish smaller *C. cingulata* from adult *P. conicus*. Also found alive at a few sites in the Northern Emirates, on damp, soft mud in the uppermost intertidal zone, in association with *P. conicus*, is the air-breathing snail *Salinator fragilis* (#864). This species is far more commonly observed, however, as empty shells in flotsam at the high tide line and under saltbushes in Arabian Gulf khors.

Exposed Rock

On hard surfaces such as rock or beachrock (*fasht*), in areas without significant wave action, the small, nobbled winkle *Echinolittorina arabica* (#115) (formerly *Nodilittorina arabica*; Williams *et al*. 2003) is found in large numbers in the uppermost intertidal zone. This species is able to feed on micro-algae that live within the outermost layers of the rock, and over time it can excavate small hollows that serve to protect and conceal it somewhat, as well as to create a more favorable micro-environment (H. Brückner, *pers. comm*.) (*Fig.* 3). Despite the high temperatures at the rock surface, these 6-12mm shells can be present in such abundance that it is impossible to walk without stepping on them (*Fig. 4*). *E. arabica* is also common on silt and cyanobacterial mats in the upper part of the intertidal zone in the extensive lagoons to the west of Abu Dhabi island, and likewise in the East Coast salt marshes near Qurayyah, north of Fujairah (Morris & Morris 1993), but otherwise in the Northern Emirates it has been found in such environments only very exceptionally.

Sometimes found in association with *E. arabica* is *Planaxis sulcatus* (#148). *P. sulcatus* is more common as an intertidal mollusc in rocky environments with higher wave energy, but in both sheltered and exposed environments it demonstrates an alternative summer survival strategy: "stay cool in the pool". Whereas during the winter it is often abundant on emergent rocks at low tide, in summer it routinely beats the heat by staying submerged, i.e. by effectively *not* being intertidal. Even in summer, however, *P. sulcatus* can be found emergent in shaded hollows in beachrock. The suspicion has been expressed that "*Planaxis sulcatus*", which is widespread in the Indo-Pacific region, may prove to comprise two or more species yet to be differentiated (D.G. Reid, *pers. comm*.)

Saltbushes

Another summer survival strategy is to seek shade. There are a number of ways to do this; one is to find a "shade tree." Within the Arabian Gulf, the air-breathing Ellobiid species *Melampus* cf. *castaneus* (#853) has been found on damp ground under saltbushes (*Halocnemum strobilaceum* and *Arthrocnemum macrostachyum*) and rushes (*Juncus rigidus*) at the uppermost edge of the intertidal zone at sites from Ajman to Ra's al-Khaimah, and on mud under mangrove trees (*Avicennia marina*) at sites in Abu Dhabi from Ra's Ghanadah in the east to Dabb'iyah in the west. Also found under saltbushes at Khor al-Beidha, Umm al-Qaiwain, was the related air-breather *Laemodonta monilifera* (#854).

Under some of the same Arabian Gulf saltbushes, populations have recently been recognised of two tiny species not included in *Seashells of Eastern Arabia*. These are *Assiminea* sp. (c.3mm) and *Paludinella*(?) sp. (c.1mm), both Assimineids. The former is also found on the East Coast at Khor Kalba, in a somewhat different environment (see below). The two species occupy firm but damp ground under the saltbushes (*Fig 5*); the smaller *Paludinella*(?) is especially common in shallow depressions where mangrove leaves and other litter have collected. Both actively flee towards shade when they are exposed to sunlight by a prying observer. News of these Assimineids attracted the interest of a Japanese expert, to whom specimens have been sent for taxonomic study. *Assiminea nitida* has been said to live in estuarine habitats along Indo-Pacific shores and the subspecies *A.n. nitida* has been collected from brackish or possibly even freshwater plantation localities in the Eastern Province of Saudi Arabia (Neubert 1998). The UAE lagoon populations could represent the same species as in the Eastern Province, but even if so, it is now anticipated that they will prove to be distinct from better known Indo-Pacific relatives (D.G. Reid, *pers. comm*.).

Rarely, the winkle *E. arabica* (discussed above) and its cousin the mangrove tree snail *Littoraria* (*Littorinopsis*) *intermedia* (#114, discussed below) are found alive under saltbushes, and some that have been found in this environment manage to reach relatively large size. Moreover, in this environment the delicate nodularity of the shell of *E. arabica* is usually better preserved than on specimens from more typical habitats.

Fig 1. The mud creeper *Cerithidea cingulata* is often present in very large numbers on intertidal flats.

Fig 2. The mud creeper *Cerithidea cingulata* may be almost totally overgrown by algae.

Fig 3. Beachrock pockmarked by *Echinolittorina arabica* feeding on endolitihic algae.

Fig 4. Abundant *Echinolittorina arabica* on a beachrock platform near Rafa'ah, Umm al-Qaiwain.

Fig 5. Two gastropod species new to the UAE (*Assiminea* sp. and *Paludinella* sp.) have been recognised under these saltbushes fringing the intertidal mudflats at Khor al-Zawra.

Rock Crevices

L. monilifera and another air-breather, *Allochroa bronnii* (#849), are also found in hollows and overhangs of low beachrock cliffs. These and other local representatives of the Family Ellobiidae are not well studied taxonomically and the species names currently assigned to them may be subject to change (E. Neubert, *pers. comm.*). The authors have noticed that *Melampus* cf. *castaneus*, in particular, seems quite variable in form, and always somewhat different from the depiction in *Seashells of Eastern Arabia*.

Cliff Dwellers

Other species found in hollows and crevices on beachrock cliffs include the tiny winkle *Peasiella mauritiana* (#119) (*P. isseli* of the Red Sea has been distinguished by Reid & Mak (1998) and East Arabian specimens have been classified with the Indian Ocean *P. mauritiana*) as well as two diminutive bivalves - the mussel *Brachiodontes variabilis* (#943) and the winged oyster *Parviperna nucleus* (#979). These two species can be abundant, packing together very tightly, even to the extent of covering the rock beneath. The large rugose oyster *Saccostrea cucullata* (#996) can be conspicuous on more well-lithified cliffs along shorelines or channels, although because of its size the cliff environment does not provide the same degree of shelter to this species as it does to smaller ones *(Fig 6)*. *S. cucullata* is also sometimes found on the base of larger mangrove trunks within Khor Kalba (*Fig. 7*).

Still another intertidal cliff dweller found on UAE shores generally is the sea slug *Onchidium peronii* (*Fig. 8*), but this species can also be found on sandy and muddy substrates and has been found on mud within mangroves at various sites within Abu Dhabi Emirate and at Khor Kalba on the East Coast. Finally, the predatory *Thais savignyi* (#493) is found occasionally on cliffs within lagoons, e.g. at Khor Hulaylah. All of the cliff-dwelling species discussed here are able to tolerate sites exposed to at least moderate wave action (e.g. the lee sides of some breakwaters) as well as sheltered ones, and all are widespread regionally.

Algae and Sea Grass

The cerith *Clypeomorus bifasciatus persicus* (#166) occupies a niche all its own. It is typically found concentrated on mats of filamentous algae such as *Chaetomorpha linum* on intertidal mud flats and in channels, on seagrass flotsam at the high water line and in floating filamentous algal mats in lagoons. Perhaps this could be called the "damp cloth" strategy. However, *C.b. persicus* can also be common on seagrass in the subtidal zone down to about four metres. In addition, it frequently climbs pneumatophores within peri-mangrove areas - a "catch the breeze" strategy.

The buoyant shell of *Bulla ampulla* (#823) will be familiar to anyone who has walked the shoreline of any Arabian Gulf lagoon, but the live animal is less often seen. It inhabits lower intertidal areas of seagrass and algae, where it emerges from the surrounding sand at dusk. Breeding is synchronised and the adults die afterwards (D.G. Reid, *pers. comm.*), resulting in locally plentiful dead specimens. In the UAE, live animals have been observed at Khor Julfar, where apparent breeding occurred in March, but it is not known whether this is a regular annual phenomenon. DNA studies are expected to distinguish the populations of the northern Indian Ocean, including the Arabian Gulf, from the more southerly populations of East Africa (D.G. Reid, *pers. comm.*).

A similar appearing but smaller species (c.15mm), tentatively identified as *Haminoea* sp. (D.G. Reid, *pers. comm.*), darkly speckled through its transparent shell, has been found emergent on sea grass, at least in springtime, in Ra's al-Khaimah Khor and Khor Julfar. (*Fig. 9*)

Algal mats could also be home to other minute mollusc species that remain to be noticed and collected, much less identified, including possibly species that are not strictly intertidal, but rather brackish water and marine species that live preferentially on the algal substrate.

Fig 6. The rugose oyster *Saccostrea cucullata* on a cliff within Khor Kalba.

Fig 7. The rugose oyster *Saccostrea cucullata* on the base of an old mangrove tree within Khor Kalba.

Fig 8. The intertidal sea slug *Onchidium peronii.*

Channel Bottoms

The top shell *Osilinus kotschyi* (#47) is an upper sub-tidal to mid-intertidal species. In the lagoon environment it is typically found in shallow tidal channels, on relatively firm, well-washed sandy or shelly substrate, and occasionally with the cerith *Clypeomorus bifasciatus persicus* on algae or sea grass. It can also be found in rocky or stony foreshore environments exposed to moderate wave action. *O. kotschyi* is distinctive in that it typically covers its aperture not by closing its operculum, but by attaching itself to a broken piece of bivalve shell or a bundle of sand, shell and algae.

Three species that are readily found on clean sand within intertidal lagoons are *Nassarius* (*Plicarcularia*) *persicus* (#560), *Ancilla* (*Sparella*) *farsiana* (#604) and the small but attractive mitre shell *Mitrella blanda* (#536). These all have a large muscular foot with which they can readily drag themselves beneath the surface when it gets too hot (an "undercover" strategy), or when danger threatens. They probably spend time on the surface because that is where they find the highest concentration of their food (microscopic algae, other organisms and organic detritus).

Mangrove Forests

By comparison with many intertidal habitats, investigation of the UAE's mangrove forests, or mangals, requires some perseverance. The mangrove trees (*Avicennia marina*) may grow in dense thickets near channels, with variably saturated, anoxic and sulphurous mud and pneumatophores underfoot, sometimes with biting midges, and inundated twice a day, flooding major access channels to two metres or more.

Generally speaking, the UAE's Arabian Gulf mangals support all of the mollusc species discussed above, in the respective habitats. The East Coast mangroves at Khor Kalba, on the other hand, are somewhat distinctive and deserve special mention. The two small mud creepers, *P. conicus* and *C. cingulata* are found in large numbers in their accustomed environments at Khor Kalba, being intertidal mudflats and channels adjacent to the forest areas. But at Khor Kalba the large mud creeper *Terebralia palustris* (#187) is also present and locally abundant, mostly within the forest areas, on damp, organic rich mud under the mangroves and in the channels among them. This is the only natural site in the UAE where *T. palustris* is known to occur today.

Also found at Khor Kalba on mud within the mangrove forest are three smaller species: two air-breathing Ellobiids, *Cassidula cf. labrella* (#850) and *Laemodonta monilifera*, as well as *Assiminea sp.* (apparently the same as the Arabian Gulf species), although the mangrove mud environment seems quite different from the habitats in which the latter two species have so far been found within Arabian Gulf lagoons. Fowler (2005) has also recorded shells of the Ellobiid *Allochroa bronnii* (#849) from Khor Kalba.

The observed distribution of air-breathing intertidal gastropods within the UAE deserves brief comment. Only *Cassidula cf. labrella* has not been found within the Arabian Gulf, whereas *Melampus cf. castaneus* and the non-Ellobiid *Salinator fragilis*, both common along the Arabian Gulf coast, are unrecorded at Khor Kalba. Also absent at Khor Kalba is *Cassidula nucleus* (#851), so far known only from shells reported by Bosch *et al*. (1995) from lagoons along the Arabian Gulf coast of the UAE and collected by one of the authors (GRF) at Khor Hulaylah. As to these latter species, if they are in fact absent at Khor Kalba, this must be due to the lack of suitable local habitat rather than to any broader biogeographical parameters, since Bosch *et al.* (1995) record of *M. cf. castaneus* from the Gulf of Oman and *S. fragilis* and *C. nucleus* from Masirah Island, off southern Oman. Lists made by several UAE-based seashell collectors active during the 1980s and 1990s have been consulted and found to include no Ellobiids other than *M. cf. castaneus*.

Adding a dash of colour to the muddy substrate within the mangroves both at Khor Kalba and in Ra's al-Khaimah Khor (on the Arabian Gulf) is the small (c.7mm), vivid orange *Haminoea sp. (Fig. 10)*, not yet satisfactorily identified but currently under study at The Natural History Museum in London.

In the mangrove trees themselves, and preferentially in smaller trees on the edge of the forest, the mangrove tree snail *Littoraria (Littorinopsis) intermedia* (#114), a 1.0-2.5mm winkle, is found above the barnacle horizon, typically within the first 30-50cm above high water level *(Fig. 10)*. (Occasionally, tree snails may be noticed on the mud below mangrove shrubs, but this is normally because they have been inadvertently dislodged by the observer.) Rarely, the similar-looking winkles *Planaxis sulcatus* (#148, discussed above) and *Echinolittorina arabica* (#115, discussed above), normally found on rocky substrates, are found at the base of mangrove trunks or on pneumatophores. In this environment they are usually very small, dirty and worn looking.

Burrowing Bivalves

Many, if not most, bivalve molluscs are burrowers as a way of life and they appear to remain permanently within the sediment. This "undercover" strategy provides them with protection from predators, heat and desiccation, but also a micro-environment full of organic matter, on which they can peacefully filter feed. The most abundant bivalves in UAE khors are small, typically 5-8mm in diameter, and there can be thousands per square metre. The most abundant species are the Lucinid *Pillucina fischeriana* (#1026) and Venus clams of the genus *Dosinia* (#1218 to 1223). They live within the upper few centimetres of the intertidal mud and among the roots of seagrass in the low intertidal and shallow subtidal. Their discarded shells are essentially ubiquitous among shell debris within UAE lagoons. Other common small bivalves in low intertidal parts of Arabian Gulf lagoons are the striped mussel *Musculista senhousia* (#954), apparently restricted to the Arabian Gulf; the tellins *Pinguitellina pinguis* (#1143) and *Tellina spp.* (#1116 to 1123); the Venus clam *Callista florida* (#1207); and the distinctive lantern shell *Laternula erythraensis* (#1267), first described in *Tribulus* (Morris & Morris 1993). Individuals of the genus Tellina are very common around Abu Dhabi but seldom match up to the descriptions of the various species in Bosch *et al.* (1995), probably reflecting the influence of local conditions.

Larger bivalves are also present within intertidal flats. One of the most conspicuous is the edible Venus clam *Marcia flammea* (#1225), which can be seen exposed to the sun on wet mud in mid-summer - a peculiar strategy which results in it being much collected for food. Other large bivalves present in mudflats are the Venus clam *Amiantis umbonella* (#1205) and the bulbous Lucinid *Anodontia edentula* (#1028), whose shells can be abundant among shell debris in shallow tidal channels within lagoons.

On the East Coast, in mangrove channels at Khor Kalba, Morris & Morris (1993) reported a sequence of burrowing bivalves ranging from *Diplodonta* spp. (#1036 to 1039), *Laternula* spp. (#1267 *et al*.), *Marcia* spp. (#1224-1226) and *Hiatula* spp. (#1166 to 1167) exposed in subsidiary channels in the upper intertidal, to *Psammosphaerica psammosphaerita* (#1168) beside the main mangrove channel, to *Circenita callipyga* (#1198) and then *Asaphis*

Fig 9. A unidentified, speckled *Haminoea* (?) sp. at low tide in Ra's al-Khaimah Khor.

Fig 10. The tiny orange *Haminoea* sp. adds colour to the mangrove mud.

violascens (#1160) in the lower intertidal.

In sand flats at Qurayyah, north of Fujairah, they found *Caecella qeratensis* (#1106) and *Laternula erythraensis* (#1267) as recently dead, paired shells, along with *Hiatula* spp. and *Dosinia* spp. *Caecella qeratensis* and *Hiatula mirbahensis* were first scientifically described from this Fujairah locality and are named, respectively, for the nearby Fujairah villages of Qerat (Girath) and Mirbah (Morris & Morris 1993).

Encrusting Bivalves

Where hard substrate is present, another range of bivalve species is likely to occur, as many non-burrowing bivalves need to attach themselves firmly to a solid surface. The most suitable situations within lagoons are the sides and bottoms of natural drainage channels. Here, among others, one can expect to find the jewel box *Chama reflexa* (#1066), the thorny oyster *Spondylus marisrubri* (#1014) and the pearl oyster *Pinctada radiata* (#971).

Conservation

Sadly, as well adapted as they are, the outlook for many of the mollusc species discussed in this report is not very promising. Virtually all of the lagoonal environments in the Northern Emirates are under severe threat from development. Because there are generally no pre-existing claims on intertidal land, it has become a prime target for 'reclamation' and exploitation. Several well-known scenic khors and lagoons that have so far been untouched are even now being readied for at least partial destruction, too often to make way for projects that will be marketed under the ironic and ignominious pretext that, because they are close to water, they are close to nature and 'eco-friendly'.

Acknowledgements

Dr. David G. Reid of the Mollusca Research Unit at The Natural History Museum in London has provided or arranged for specialist identification of various gastropod specimens, and his sustained interest has encouraged continuing investigations by one of the authors (GRF) over a number of years. Narayan Karki of Dubai provided valuable field assistance in recent intensive investigations at Khor Kalba, and Arshad Mahmood of Ajman facilitated the collection of *Paludinella*(?) sp. at Khor Zawrah.

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Gary R. Feulner
P.O. Box 31045
Dubai, U. A. E.
Email: grfeulner@shuaacapital.com

Dr. Richard J. Hornby
Nautica Environmental Associates
P.O. Box 44780
Abu Dhabi, U. A. E.
Email: dnahornby@yahoo.co.uk