

IDENTIFICATION GUIDE

TO THE INTERTIDAL AND SHALLOW-WATER
CRUSTACEANS OF KUWAIT

CIRRIPEDIA (BALANOMORPHA)

DECAPODA

STOMATOPODA

Manal Al-Kandari
Arthur Anker
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2023



Ras Ajuza

دليل تصنيف القشريات

في المياه الضحلة ومناطق المد والجزر في دولة الكويت (هديات الأرجل، عشاريات الأرجل وفميات الأرجل)

تم إعداد هذا الكتاب لإصدار أول دليل حقلي مرني لتصنيف القشريات الشائعة في المياه الضحلة ومناطق المد والجزر في دولة الكويت متضمنة مجاميع البرنقيل (هديات الأرجل) وعشاريات الأرجل (من الربيان والكركد والسرطانات الصحيحة والسرطانات الناسكة والسقلاطيات وغيرها) وفميات الأرجل (روبيان السرعوف أو فرس النبي) والتي قد تم رصدها وجمعها من 45 موقع على طول سواحل وجزر الكويت البحرية من الشمال الى الجنوب.

يحتوي هذا الدليل على صور توضيحية ملونة تخص 130 نوع من القشريات (تنتمي الى 48 عائلة) سواء الحية منها أو المحفوظة والموائل التي تستوطنها بالإضافة الى الوصف الأساسي لأشكالها مع معلومات بيولوجية وبيئية عنها ومواقعها الجغرافية.

يعد هذا الدليل مرجع علمي هام حيث اجريت آخر التحديثات للمراجع البيولوجية والتصنيفية للكائنات البحرية المتواجدة على سواحل دولة الكويت والتي بدورها تساهم في دراسات التنوع الأحيائي (البيولوجي) والتي تعتبر من ضمن الاستراتيجيات والخطط الوطنية والاتفاقات الدولية المتعلقة بالمحافظة وصون وحماية التنوع الأحيائي لدولة الكويت وذلك من خلال رصد وتوثيق وتسجيل الأنواع التي من ضمنها أنواع جديدة لم يسبق تسجيلها في الكويت و دول الخليج العربي.

كما انه يعد مصدر ثري من المعرفة للخبراء الأكاديميين والبيولوجيين (علماء الأحياء والبيئة) وطلاب المدارس والجامعات الذين يعملون في دراسات التنوع البيولوجي والبيئي . سيكون الكتاب ايضا ذو فائدة تثقيفية كبيرة للمجتمع بجميع فئاته العمرية وللغواصين والهواة ومحبين الطبيعة.

وأخيرا سيتوفر من خلال هذا الكتاب مفتاح علمي للأنواع الموجودة لتسهيل تصنيفها مع أنواع القشريات الأخرى في الخليج العربي وفي جميع أنحاء العالم.



Al-Salam Beach

Foreword 1

This book “Identification Guide to the Intertidal and Shallow Water Crustaceans of Kuwait” is a comprehensive guide to the identification of the species of cirriped, decapod and stomatopod crustaceans from the shallow waters and intertidal zones of the northwestern Arabian Gulf.

The information in this book is derived from several years of collecting specimens and relevant information from Kuwait’s marine environment. The leader of the research is Dr. Manal Al-Kandari. The study entailed long working hours in the field, and laboratory by the distinguished and dedicated authors, Drs. Manal Al-Kandari, Arthur Anker, Sergei Khvorov, and Valeriy Skryabin, and their highly competent research team.

Crustaceans, familiar to the average person as shrimps, lobsters, crabs, and barnacles are one of the most important and diverse groups of marine life forms. In the arid zone of Kuwait, they persist in some of the harshest conditions, of high salinity and high summer temperature. They play a vital role in marine and coastal ecology and have great economic importance to humans. Crustaceans have a great value as food, pharmaceuticals, and are used as good bioindicators, and biomonitor organisms in environmental research.

This lavishly illustrated book offers a remarkable look at the crustaceans of the northwestern Arabian Gulf. It makes an important contribution to the Convention on Biological Diversity by documenting the diverse crustacean fauna of the shallow coastal waters and the intertidal areas of Kuwait. It will no doubt be a key and treasured reference for specialists and students and for all those interested in marine biodiversity and crustacean ecology.

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Al-Khiran

Foreword 2

The marine biota of the Persian Gulf, particularly Crustacea, has been neglected until recently when the atlas of Persian Gulf Brachyura by Naderloo (2017) was published. Further evidence is supplied by the fact that my 1986 Field Guide remained in print until recently. Hence, it is especially rewarding to see this identification guide to Cirripedia, Decapoda and Stomatopoda published by Al-Kandari et al.

The most immediate and remarkable feature of this new guide is the excellent use of digital photography illustrating each species. Past guides have relied upon line drawings and/or paintings to distinguish species characteristics. However, for larger sized crustaceans, the authors demonstrate that high quality photographs are perfectly adequate for identification of species.

Habitat photographs and maps together with zones of distribution are of a high standard, and methods of collection are also well detailed. I remember sitting on a hovercraft in Bubiyan mudflats surrounded by thousands of deposit feeding *Macrophthalmus (Venitus) pectinipes*.

The authors provide an extensive literature review which updates all the latest taxonomical changes which have occurred in recent years.

This guide is recommended to all present scientists and future students of marine biology in the Gulf region. Congratulations are due to the authors for producing such a visually stunning guide to these crustacean groups for the Gulf regions.

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Auha Island

Preface

This book, «Identification Guide to the Intertidal and Shallow-Water Crustaceans of Kuwait», is the first visual field guide to the crustacean orders Balanomorpha (acorn barnacles), Decapoda (shrimps, lobsters, hermit crabs, true crabs, porcelain crabs, and alike) and Stomatopoda (mantis shrimps) of the supralittoral, intertidal and shallow waters of Kuwait.

The book is based on material collected during an extensive marine biodiversity survey covering almost the entire coastline and offshore islands of Kuwait, conducted under the coordination of the lead author (Dr. Manal Al-Kandari) and aiming to document the marine intertidal macro-invertebrates of the country qualitatively and quantitatively. This survey, conducted between 2013 and 2016, covered a total of 36 localities in Kuwait, extending from the north to the south, including the mainland coast and five islands: Boubyan, Failaka, Kubbar, Umm Al-Maradim, and Qaruh.

The lead author conducted a further complementary sampling at additional sites between 2016 and 2018, thus increasing the total number of surveyed localities to 45. These two surveys were further supplemented with a more specific sampling targeting decapod and stomatopod crustaceans in September and October 2019 and February 2020, with the participation of the lead author and the decapod experts Dr. Sergei Khvorov, Dr. Valeriy Skryabin, Dr. Arthur Anker (co-authors) and Dr. Sammy De Grave. Our recent fieldwork enabled us verify the taxonomic identity of previously collected material and to report additional species for Kuwait, including two species new for science (Anker et al. 2020a; De Grave et al. 2020). Preliminary results of these surveys for decapods, stomatopods, isopods, as well as molluscs and polychaetes, were published by Al-Kandari et al. (2019a, b, 2020a, b, 2021).

The present guide contains illustrations and basic biological and ecological information to facilitate the identification of 130 species (from 48 families) out of the 189 species presently observed in Kuwait's waters. Most of the species treated in more detail are commonly encountered in near-shore habitats, especially in the intertidal zone. However, some subtidal species were also included as they may be discovered by divers or found in dredges. On the other hand, most of the taxa not covered by the book are rare, or their records from Kuwait are considered doubtful, for instance, based on possible misidentifications. Nevertheless, all Balanomorpha, Decapoda, and Stomatopoda reported from Kuwait until the present date are listed in a comprehensive reference table.

The book is lavishly illustrated by colour photographs, showing living or freshly preserved specimens, mainly from

Kuwait, as well as by numerous *in situ* photographs of animals and their habitats. Each species page is presented with a brief description of the species' diagnostic morphological features and contains a map with confirmed collection localities in Kuwait, as well as a visual graphic design showing its bathymetric distribution.

We hope that the present, fully updated crustacean taxonomic account of the Balanomorpha, Decapoda, and Stomatopoda of Kuwait will significantly contribute to the knowledge of the coastal and near-shore marine biodiversity of the north-western part of the Arabian-Persian Gulf. It will serve as a visual reference and a database of the composition of these three important crustacean groups in the Arabian -Persian Gulf and will be an essential reference for future studies. Furthermore, it will be a valuable source of information not only for professional biologists and ecologists interested in invertebrate taxonomy, but also for marine biology and ecology students, scuba divers, curious nature lovers, and photographers, contributing to the conservation of marine habitats in Kuwait.



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Dardanus tinctor at Qaruh Island, Kuwait.
Photograph by Mahdi Bin Haider.

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We are most grateful to the management of the Kuwait Institute for Scientific Research (KISR), for providing the financial support to all research surveys conducted for producing this identification guide, and to the Kuwait Petroleum Company (KPC), which funded the first quantitative and qualitative intertidal macrofauna biodiversity survey conducted from 2013 to 2017.

Our gratitude is extended to Dr. David A. Jones, the coastal and marine ecology consultant of the Arabian-Persian Gulf, for his help in guiding and training the KISR staff on the standard operating procedures (SOPs) for collecting the intertidal macrofauna samples, both qualitatively and quantitatively.

We also express our gratitude to all those who have helped us accomplish this milestone. We appreciate the invaluable assistance of our dear colleagues, in the Ecosystem-Based Management of Marine Resources program and the Environment and Life Sciences Research Center of KISR, during fieldwork and sample processing. We are indebted to our mastermind, Dr. Faiza Al-Yamani, for her vital support and encouragement during the preparation of this guide; to Mr. Abdulrahman Yousef and Mr. Ali Alhammad for their tremendous help in driving the boat to the islands and muddy areas, and providing additional photographs; to Ms. Sumaiah Hussain for collecting soft substrate samples; to Mr. Sasikumar Chellakkan, for helping us collect the crabs from their deep burrows; to Mrs. Meera Reghu for her assistance in the labelling and management of the collected data; to Ms. Hadeel Abdulkhaliq Hadei for her incredible creative vision in the designing of this book; and to Mrs. Amani Al-Yaqout, Eslam Basuny and Mr. Mohammed Al Kandari (from Aquaculture department) for providing underwater photographs. We are also grateful to Dr. Sammy De Grave (Oxford University Museum of Natural History) for providing additional samples and taxonomic expertise; to Benny Chan (Academia Sinica), Peter K.L. Ng (National University of Singapore) and Tin-Yam Chan (National Taiwan Ocean University), for checking and confirming or correcting our tentative identifications; and to Dr. Lujain Al-Sayegh (Kuwait Environment Public Authority), for helping us recollect the samples to be photographed.

Additional colour photographs were provided by the following colleagues: Dr. Gustav Paulay (Florida Museum of Natural History), Rashed Abdollahi and Hossein Ashrafi (University of Ostrava), Raveendhiran Ravinesh, Biju Kumar, and Anna Zhadan. Our appreciation is extended to the following marine divers and photographers: Mahdi Bin Haider, Faisal Alsarraf, Dr. Yaser Mohammed Abdulraheem, Mohammed Al-Sabah, Husain Alqallaf, Mohammed AlSaleh, Maryam Fahad AlMashaan AlMeshaweh and Najem Al-Misbah, who provided us with beautiful underwater pictures of the materials examined. We acknowledge the assistance of Dr. Arafat AlShuaibi, Dr. Igor Polikarpov, Mr. Abdulaziz Alyousef and the AM team in providing the photos of the intertidal species and photographing some of the collected specimens.



Dardanus tinctor from Umm Al-Maradim Island. *In situ* photograph by Maryam Fahad AlMashaan AlMeshaweh.



Leptochryseus kuwaitense in Sulaibikhat Bay, Kuwait.
Photograph by Igor Polikarpov.

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Introduction

Crustaceans represent a huge and ecologically, anatomically, and physiologically high heterogeneous ordering to the latest findings based on large-scale phylogenomic analyses. Crustaceans also include hexapods (insects and alike), together forming a vast lineage (clade) called Pancrustacea or Tetragonata. This lineage or clade is by far the most biodiverse group of animals on the planet.

The present guide deals with three anatomically different orders of marine macro-crustaceans, namely, Balanomorpha, Decapoda, and Stomatopoda. These orders differ greatly in their lifestyle, ecology, and significance for humans.

Balanomorpha from the crustacean class Thecostraca and its subclass Cirripedia is an important order of barnacles, comprising the commonly seen and widely distributed stalkless (sessile) barnacles, also known as acorn barnacles. There are about 185 species of acorn barnacles globally, many in cold and temperate waters. Acorn barnacles possess a heavy calcareous skeleton adhering to the surfaces of rocks; logs; mangrove roots; shells; man-made substrates, such as jetties, boats and metallic structures of oil platforms (biofouling); and living animals (whales, marine turtles, decapod crustaceans, other barnacles, molluscs etc.) (Fig.1).



Figure 1. Colony of acorn barnacle *Tetraclita rufotincta* at Qaruh Island, Kuwait. Photograph by Valeriy Skryabin.

Barnacle growth can have strong negative effects on the performance of various artificial systems or animals, reducing hydrodynamics and increasing load, thereby resulting in additional energy consumption or blocking the inside of piping and condensers. On the other hand, sessile barnacles are key organisms in some seashore communities; their vertical distribution has been used for establishing vertical zonation on rocky coasts. In addition, a giant eastern Pacific species (*Austromegabalanus psittacus*) is harvested as seafood in Peru and Chile, where it is known as “picoroco”, a local delicacy.

Decapoda from the class Malacostraca is a very large and well-known order of crustaceans, which includes many of

the familiar and/or commercially important crustaceans, such as shrimps (prawns), lobsters, crayfishes, spiny and slipper lobsters, squat lobsters, hermit crabs, true crabs (Fig. 2), and



Figure 2. Kuwait saltmarsh crab *Leptochryseus kuwaitense* in Sulaibikhat Bay, Kuwait. Photograph by Igor Polikarpov.

several other, lesser known groups; for instance, burrowing mole crabs, porcelain crabs, ghost and mud-shrimps, and mud-lobsters. Decapods have a cephalothorax covered by a shield (carapace), a pleon (sometimes incorrectly called “abdomen”), and five pairs of walking legs typically. Decapods probably have the most diverse range of body forms among crustacean orders and greatly range in size, from around 3 mm total length of adults for some tiny symbiotic shrimps (*Synalpheus* spp., *Typton* spp.) to almost 40 cm carapace width, 3.7 m claw span and 19 kg weight for the giant Japanese spider crab (*Macrocheira kaempferi*). Decapods inhabit all types of marine and freshwater habitats around the world. Most of them are found in various marine habitats, with the majority of the species confined to the shallow waters of tropical and subtropical seas. However, some species are found in polar waters and the deep sea, to the depth of at least 6,000 m, while others are pelagic. Approximately, 9% of decapod species live in freshwater, whereas 1% of species are found in terrestrial or semi-terrestrial habitats. Some of the latter are found at elevations of over 1,000 m or as far away as 15 km from the ocean to which they must return for reproduction.

Over 15,000 species of Decapoda have been described so far, with over half of them, i.e., over 8,000 species, included in the clade Brachyura or true crabs (Fig. 2). Most crabs are found in marine habitats, but many are terrestrial or semi-terrestrial or found in freshwater. The true shrimps (Caridea) represent the second-most species-rich group of Decapoda, with almost 3,600 species worldwide, observed in marine, brackish and freshwater habitats (Fig. 3). Other important groups of Decapoda are Anomura (over 2,500 species), represented in Kuwait by porcelain crabs (family Porcellanidae) (Fig. 4), squat lobsters (family Galatheididae), mole crabs (family Hippidae), and hermit crabs (families Paguridae and Diogenidae); Dendrobranchiata (540 species), which includes many commercial prawns, such as the famous «tiger prawn» (family Penaeidae); Axiidea and Gebiidea, two lineages of fossorial shrimp-lobster looking decapods known mainly as ghost-shrimps or mud-shrimps

(families Callinassidae and Upogebiidae); and Achelata, the spiny and slipper lobsters (families Palinuridae and Scyllaridae). These groups are primarily marine, with a few exceptions, mainly within the Anomura. The economic importance of decapod fisheries and farming, involving shrimps, prawns, crabs, lobsters, spiny and slipper lobsters, and freshwater crayfishes, is estimated at over US\$ 100 billion per year.



Figure 3. Marbled shrimp *Saron marmoratus* at Qaruh Island, Kuwait. Photograph by Faisal Al-Sarraf.



Figure 4. Porcelain crab *Petrolisthes rufescens* on exposed rocky intertidal near Al-Khiran, Kuwait. Photograph by Valeriy Skryabin.

The order Stomatopoda (Fig. 5) from the class Malacostraca includes about 450 species of predatory crustaceans, popularly known as mantis shrimps. They are encountered in most tropical and subtropical, shallow-water marine habitats. Mantis shrimps have powerful raptorial appendages or “claws”, which are used to attack and immobilize or kill prey by spearing (spearmen) or stunning /crashing (smashers). Most stomatopod species measure from 5 to 10 cm in total length, although some

giant species in the genera *Oratosquilla* and *Harpiosquilla* may reach 45 cm. The presence of stomatopods enables ecologists to estimate the general health of coral reef ecosystems since many reef-dwelling species are sensitive to pollution caused by petroleum, sewage discharge, and agricultural runoff. Most mantis shrimps have no commercial value, but some species are sold as seafood in the Philippines, Vietnam, China, Japan, and some Mediterranean countries.



Figure 5. Bott's reef mantis shrimp *Gonodactylus botti*. Photograph by Abdulrahman Yousef.

Intertidal and Shallow-Water Marine Habitats of Kuwait

Kuwait is situated in the inner-most part of the Arabian-Persian Gulf, a shallow semi-enclosed sea of the north-western Indian Ocean, between Iran and the Arabian Peninsula, about 1000 km long and with a maximal width of about 300 km. The average depth of the Arabian-Persian Gulf is 35 m, with the maximal depth of about 100 m near its entrance at the Strait of Hormuz. A subtropical hyper-arid climate characterizes the entire Gulf region. Deserts and semi-desertic mountains dominate most of the coastal areas, with only a few large rivers discharging into the Arabian-Persian Gulf. Therefore, the salinity of the Arabian-Persian Gulf is variable; but significantly higher than the average salinity of the open Indian Ocean.

The position of Kuwait near the Shatt Al-Arab delta, a confluence of three important rivers, namely, Euphrates, Tigris and Karun, results in a unique ecological setting for the country. The northern coast of Kuwait is influenced by freshwater discharge and deposition of sediments from Shatt Al-Arab. In contrast, most of the southern coast is similar to the other Gulf countries, in its chemical, physical and biological properties. For the general geological and ecological characteristics of Kuwait's waters and the Arabian-Persian Gulf in general, such as fluctuations of water temperature, salinity, pH, water turbidity, tide, current, etc., the reader is referred to Al-Rifaie et al. (2012), Naderloo (2017), El-Anbaawy (2018) and Al-Yamani (2021).

The heavy sediment discharge from Shatt Al-Arab resulted in extensive and nutrient-rich mudflats along the northern coast of Kuwait, especially in the Kuwait Bay, such as in Sulaibikhat and Kadmah Bays, in Khor Al-Subiyah, and around Boubyan Island. The intertidal area of these mudflats can extend for 6 km or more during extreme low tides and contains deep (0.5–1.5 m), very soft, soggy mud, which is very difficult to walk upon; therefore, special slide boards are required during the biological sampling in these mudflats at low tide requires the use of (Fig. 6).



Figure 6. Moving through soggy mud with a slide board. Photograph by Abdulrahman Yousef.



Figure 7. Mudskippers and sentinel crabs-key species of Kuwaiti mudflats in Sulaibikhat Bay, Kuwait. Photograph by Valeriy Skryabin.

In addition, Kuwait's mudflats are home to a rich community of benthic animals, including sponges, polychaetes, molluscs, crustaceans, echinoderms, lancelets, and teleost fishes. Perhaps the animals most commonly observed on these mudflats are mudskippers and several species of crabs. However, most of the mudflat animals are "infaunal", i.e., they live in temporary or permanent burrows in the mud (Fig. 7) and are not often if ever seen in the open, i.e. on the surface of the mud. Therefore, mudflats represent important breeding and rich feeding grounds for numerous resident and migratory birds, including the crab plover (*Dromas ardeola*) (Fig. 8).

Some mid- and upper intertidal and adjacent supra-littoral areas of Sulaibikhat Bay and Al-Khiran are characterized by salt marshes and salt flats (sabkhas) dominated by halophytic plants (Fig. 9). These salt flats are inhabited by a few well-adapted and hardy species of crabs, including a beautiful camptandriid crab *Leptochryseus kuwaitense*, a species originally described from Kuwait (Fig. 2).



Figure 8. Crab plovers *Dromas ardeola* in Sulaibikhat Bay, Kuwait. Photograph by Abdulrahman Al-Sirhan.



Figure 9. Kuwait's salt flats (sabkhas with mud crab burrows) in Sulaibikhat Bay, Kuwait. Photograph by Abdulrahman Yousef.

The area around two small islands situated to the northwest of Boubyan Island, such as Umm Al-Shajer Island and Khor Al-Subiyah on the southwestern coast of Boubyan Island, is characterized by the presence of oyster beds and reefs, an ecologically unique habitat (Omar and Roy 2014), which was proposed for a potential world heritage reserve. The formation of oyster beds and reefs requires conditions not found in other areas of Kuwait or along the western coast of the Arabian-Persian Gulf. Moreover, these oysters are key components of local intertidal communities and are known locally as “Bogar Boubyan” or “Boubyan cows”, due to their resemblance to a cattle herd (Fig. 10).

In the earlier accounts of Mollusca of Kuwait, the Boubyan oyster was tentatively identified as *Saccostrea cucullata* (Glazer et al. 1984; Omar and Roy 2014). However, the recent molecular and morphological analyses showed that the accurate name of the genus is *Talonostrea*, representing a new reef-forming oyster, namely *Talonostrea salpinx*, for science. (Al-Kandari et al. 2021). Oyster beds and reefs provide habitat for many organisms, including crabs, shrimps, and various groups of marine worms. The sentinel crab *Venitus dentipes* and Dussumier’s mudskipper *Boleophthalmus dussumieri* are the most conspicuous and common components of the oyster reef macrofauna (Al-Kandari et al. 2017).

Unfortunately, the increased damming of Euphrates, Tigris, and Karun in Turkey, Syria, Iraq, and Iran significantly decreased the total water discharge from these rivers through Shatt Al-Arab into the Arabian-Persian Gulf, thereby severely affecting the local estuarine ecosystem, hydrological cycle, and sedimentation in the entire northern Gulf (Naderloo 2017).

There are no natural mangroves in Kuwait; however, small “experimental” mangroves of *Avicennia marina* with trees reaching 2.5 m were recently planted in some areas of Kuwait (AboEl-Nil 2001), e.g., in the marine protected area of Sulaibikhat Bay (Fig. 11). The mangrove areas attract many mudflat inhabitants, especially mudskippers, mud-loving snapping shrimps (*Alpheus* spp.), and various mudflat crabs.

Most of the coastline from the south of Kuwait City to the Saudi Arabian border is composed mainly of sandy shores, with occasional rocky and mixed rocky-sandy outcrops (Fig. 12) or silty-muddy bays. The deep artificial canals near Al-Khiran in the south of Kuwait are characterized by sandflats with intertidal and subtidal seagrass beds (Fig. 13), with significant burrowing activity, mainly by crustaceans, molluscs, as well as echinurans and other polychaetes.

Generally, the coastal marine biodiversity of Kuwait seems to generally increase from north to south, i.e., with increasing distance from the Kuwait City metropolis, due to the less intense coastal development in the southern part of the country, and therefore, has more transparent and less polluted waters. Failaka Island, situated approximately 20 km east of Kuwait City, is under the influence of heavy sediment discharge due to its proximity to Shatt Al-Arab, with one of its main mouths situated only about 50 km north of the island. Failaka’s shores comprise different habitats mainly of sandy and/or muddy sandflats, with numerous rocky terraces and outcrops. The turbidity of Failaka’s coastal waters does not allow for coral growth; however, many green and brown algae and some



Figure 10. Big rocks covered by oyster reefs, named locally as Bogar Boubyan (“Boubyan cows”) at Khor Al-Subiyah, Kuwait. Photograph by Valeriy Skryabin.



Figure 11. Mangroves planted in Sulaibikhat Bay, Kuwait. Photograph by Abdulrahman Yousef.



Figure 12. Sandy shore with rocky outcrops at Ras Al-Zour, Kuwait. Photograph by Valeriy Skryabin.



Figure 13. Seagrass bed at Miscan Island, Kuwait. Photograph by Valeriy Skryabin.

sponges and ascidians are abundant in the intertidal and shallow subtidal areas (Fig. 14). This is also true of the small Auha Island east of Failaka, with sandflats and rocky intertidal mudflats dominating its coasts (Fig. 15).

The large yellow sponges, which occur in the intertidal and shallow subtidal flats around Failaka, Auha, and Miscan Islands (Fig. 16), are often inhabited by polychaetes, amphipods, sponge barnacles, brachyuran and anomuran crabs, snapping shrimps (*Synalpheus* spp.), sponge-boring mud-shrimps (*Upogebia octoceras*) and brittle stars. Some intertidal flats of Failaka, Kuwait Bay, Boubyan, and other localities are characterized by extensive sand reefs built by the sabellariid polychaete *Sabellaria alcocki* (Fig. 17). These reefs provide large three-dimensional structures on the otherwise barren sand flat and are used as shelter by many crustaceans and other invertebrates. Due to the size and diversity of habitats, Failaka presently accounts for the highest number of macrofaunal species collected from Kuwait (Al-Kandari et al. 2017). However, this number may be somewhat biased because of the island's proximity to Kuwait City and the more intensive exploration of its coastal habitats by KISR's scientists.

Kuwait's biologically rich marine habitats may be found around the offshore islands of Kubbar, Qaruh, and Umm Al-Maradim (Fig. 18, see next page). Umm Al-Maradim Island is larger than Kubbar and Qaruh Islands and appears to have the highest diversity of reef habitats. Historically, these three islands may have harboured the only healthy coral reef of the country and the extreme north-western part of the Arabian-Persian Gulf. However, due to the development of the adjacent coastline to the west, especially south of Salmiyah and in Al-Khiran, and increased and uncontrolled leisure activities in and around the islands themselves, the coral reefs of Kubbar, Qaruh and Umm Al-Maradim degraded rapidly over the last decades. The destruction of coral reefs in Umm Al-Maradim was exacerbated by the construction of a small harbour on the island's southern coast in 2007. Today, only a few areas around these three islands have living colonies of larger branching corals (*Acropora* and *Pocillopora*). Most of the remaining subtidal habitats can be described as vast fields of coral rubble and dead corals, dominated by flowerpot corals (*Goniopora*), algae, sponges, and long-spined sea urchins (*Diadema*), as well as sand-flats composed of coarse sand, silt, and small coral fragments, with numerous burrows of free-living or goby-associated snapping shrimps (*Alpheus djiboutensis*). Nevertheless, even in their degraded state, coral reefs of Kubbar, Qaruh, and Umm Al-Maradim still harbour a reasonable diversity of crustaceans, most of which still need to be explored and studied.

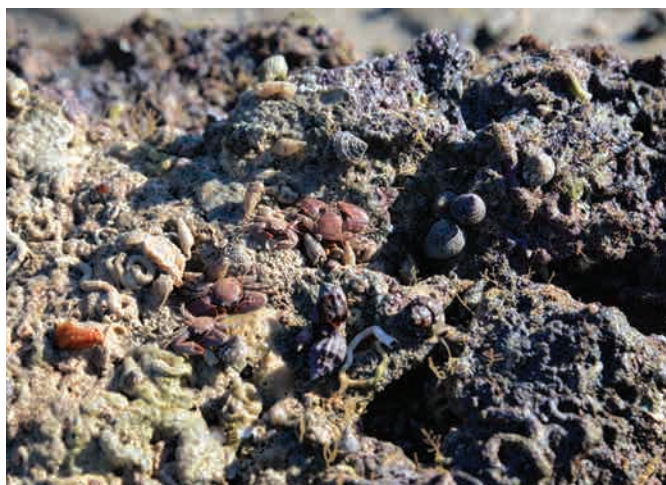


Figure 14. “Living rock” covered by various organisms in the intertidal area of Failaka Island, Kuwait. Photograph by Abdulrahman Yousef.



Figure 16. An unidentified yellow sponge commonly found on the shores of eastern Failaka Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 15. Sandflats and seagrass bed of Auha Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 17. *Sabellaria alcocki* reef at Aushairij, Kuwait. Photograph by Valeriy Skryabin.



Figure 18. Kuwait's offshore Islands (top down: Kubbar, Qaruh and Umm Al-Maradim). Photographs by Valeriy Skryabin.

Because of the accessibility of the intertidal areas and their high economic value, they are vulnerable to human activities. Much of Kuwait's coast, especially in the north, has been heavily altered by rapid and uncontrolled development, often with significant land reclamation. Development of the Kuwait's coasts include the construction of houses, apartment complexes and hotels, boat ramps, harbours, piers, jetties, retaining walls, wave breakers, oil refineries, and other industrial complexes, and a major causeway. The apparent consequences of this development are massive urban and industrial discharges into the sea and significant pressure on the intertidal and other marine habitats. The intertidal zone is also the most vulnerable to oil spills. For instance, the bulk of oil released during the First Gulf War, which washed off on the coast of Jubail, Saudi Arabia, had devastating effects on the fauna. Furthermore, overfishing/overharvesting poses an additional threat to edible crustaceans and marine animals in general. Nevertheless, we hope that this book will contribute to greater awareness among Kuwait's population and politicians on the ecological importance of the country's remaining natural coasts and a delicate balance between economy and conservation. Climate change and an irreversibly degraded environment are incompatible with the quality of life and will ultimately affect us profoundly.

History of Taxonomic Research on the Crustaceans of Kuwait and the Arabian-Persian Gulf

Balanomorpha (Fig. 19). Nilsson-Cantell (1938) was apparently the first to report 13 species of acorn barnacles from the Arabian-Persian Gulf, including *Pyrgoma projectum* (as *Arossella projectum*) and *Conopea calceola* (as *Balanus calceolus*) from east of Al-Zawr Island in Kuwait. Stubbings (1961) reported four species of Balanomorphs from Kuwait, more precisely *Microeuraphia permitini* (as *Chthamalus malayensis*), *Acasta sulcata*, *Striatobalanus amaryllis* (as *Chirona amaryllis*) and *Amphibalanus amphitrite* (as *A. amphitrite* var *communis* and *A. amphitrite* var *hawaiiensis*). Jones 1986a, in his famous “Field guide to the sea shores of Kuwait and the Arabian Gulf”, listed four species of acorn barnacles: *Chthamalus barnesi* (as *C. malayensis*), *M. permitini* (as *Euraphia* sp.), *A. amphitrite* (as *A. amphitrite* var *communis*) and *Megabalanus tintinnabulum*. Al-Yamani et al. (2012) listed three species of sessile barnacles from Kuwait: *A. amphitrite* (as *Balanus amphitrite*), *Microeuraphia withersi* (as *Euraphia withersi*), and *M. tintinnabulum*. Shahdadi et al. (2011a,b, 2014) published three crucial studies on the barnacles of the Arabian-Persian Gulf and the Gulf of Oman, summarizing Kuwait’s records. Based on these somewhat contradictory records, at least six species of acorn barnacles are expected to occur in Kuwait (Table 2). However, it is evident that the barnacle fauna of Kuwait and the Arabian-Persian Gulf is known very patchily and will need further taxonomic studies.

Decapoda (Fig. 20). The exploration of the decapod fauna of the Arabian-Persian Gulf started in the middle of the 19th century, with Heller’s (1861) record of a single species of brachyuran crab. In several publications Alcock (1896, 1900), recorded over 50 species of crabs, supposedly from the Arabian-Persian Gulf and adjacent areas (see discussion and references in Naderloo 2017). Further contributions, including new species and records of shrimps and crabs from the Arabian-Persian Gulf, were made by Nobili (1906) and Coutière (1908). The first comprehensive study of any decapod group of the Arabian-Persian Gulf was conducted by Stephensen’s (1946) “Brachyuran crabs of the Iranian Gulf”, where the author treated no less than 124 species, including three species described as new to science. Naderloo (2017) published an important synthesis of the Brachyura of the Arabian-Persian Gulf, based mainly on the material collected along the Iranian coast and previous literature records, listing 223 species of true crabs. Regional reports and checklists summarizing previous taxonomic work, as well as new species descriptions, were published for various groups of caridean shrimps, Caridea (Anker and De Grave 2009; De Grave and Ashelby 2011 and references therein; Dehghani et al. 2019a, 2019b; Ashrafi et al. 2020; Anker et al. 2020a, 2020b; Al-Kandari et al. 2020a; De Grave et al. 2020); ghost- and mud-shrimps, Axiidea and Gebiidea (Sakai and Türkay 1995; Dworschak 2009; Sepahvand and Sari 2010; Sepahvand et al. 2013; Sepahvand and Tudge 2019); hermit crabs, Paguridea (Naderloo et al. 2012); porcelain crabs (Ng et al. 2012; Al-Kandari et al. 2020a); and for all Decapoda (Naderloo and Türkay 2012). Despite these studies, the taxonomic knowledge of the decapod fauna of the Arabian-Persian Gulf remains rather unsatisfactory, perhaps with the notable exception of the Brachyura. This is certainly due to the inadequate and/or insufficient sampling of crustaceans in some areas of the Arabian-Persian Gulf, including most of the coastline of the United Arab Emirates, Bahrain and Qatar, and the southern offshore islands of Kuwait. The northern and eastern (Iranian) sides of the Arabian-Persian Gulf and the adjacent Gulf of Oman were better sampled, as evidenced by the diversified decapod fauna of the Iranian coast (Naderloo and Türkay 2012; Naderloo et al. 2012, 2013; Naderloo 2017; Dehghani et al. 2019a), including several recently described new taxa (e.g. Anker et al. 2010; Ng et al. 2012; Marin et al. 2014; Sepahvand et al. 2015, 2016, 2018; Dehghani et al. 2019b; Anker and Ashrafi 2019).



Figure 19. Acorn barnacles *Amphibalanus amphitrite* at Khor Al-Subiyah, Kuwait. Photograph by Valeriy Skryabin.



Figure 20. Pretty mudflat crab *Eurycarcinus integrifrons* hiding in a bivalve shell at Khor Al-Subiyah, Kuwait. Photograph by Valeriy Skryabin.

The very first records of decapods, specifically from Kuwait, were observed in the 1970s and published in two studies by Motoh (1975a, 1975b) on the “Macrura” (which included Dendrobranchiata, Caridea and Achelata) and Anomura, respectively, of Kuwait’s coast. Although these studies are clearly outdated, they listed 12 species of Dendrobranchiata (Penaeidae), four species of caridean shrimps, one species of spiny lobster, and five species of anomuran crabs for the country. In the 1980s, the decapod research in Kuwait accelerated due to the enthusiastic fieldwork conducted by Dr. David A. Jones and the resulting taxonomic studies (e.g. Jones and Clayton 1983; Collins et al. 1984; Jones 1986b; Al-Khayat and Jones 1996) and those mentioned earlier, which are still widely used as field guide (Jones 1986a). Taxonomic studies on decapods of Kuwait were re-initiated in 2009, with the description of a large and morphologically distinctive species of snapping shrimp (*Alpheus lutosus*) collected by Dr. D.A. Jones from the Shatt-Al-Arab delta (Anker and De Grave 2009). Al-Yamani et al. (2011) illustrated several non-identified (or partly identified) decapod larvae in a regional atlas of marine zooplankton (Fig. 21).

In addition, several faunal guides, such as Carpenter et al. (1997a), Deemer (2011) and Papathanasopoulou and Zogaris (2015), contain *in situ* colour photographs of shrimp and crab species; some of them may represent further new records for Kuwait. It is also important to highlight that several species descriptions of Decapoda were based on the material from Kuwait (Jones and Clayton 1983; Anker and De Grave 2009; Sakai et al. 2015; Anker et al. 2020a; De Grave et al. 2020), showing the country’s potential in the discovery of new taxa.

Stomatopoda (Fig. 22). The history of research on the stomatopod fauna of the Arabian-Persian Gulf was reviewed by Manning (1990), who documented a total of 23 species, including two species from Kuwait’s waters. Al-Kandari et al. (2020b) added five different species and briefly discussed two questionable records from Kuwait and the Arabian-Persian Gulf (including one recorded by Jones 1986a). Overall, it seems that the mantis shrimp fauna of the Arabian-Persian Gulf in general and Kuwait in particular, is still fragmentarily known and will need further research.

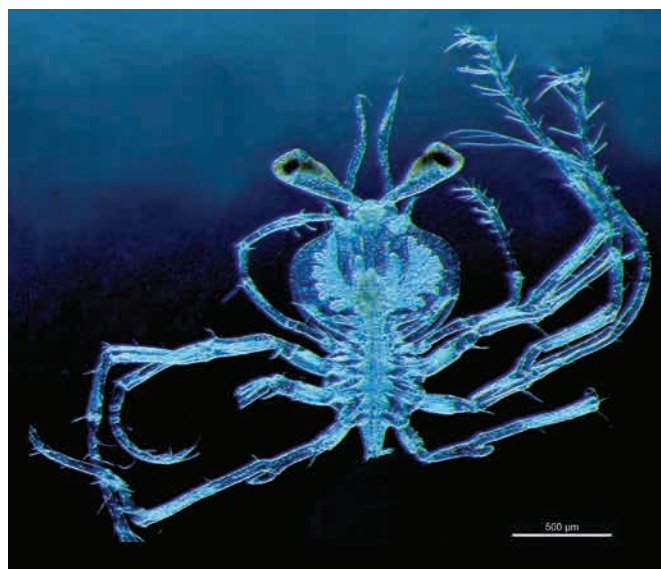


Figure 21. Phyllosoma of *Thenus orientalis*, Kuwait. Photograph by Sergei Khvorov.



Figure 22. Smith's reef mantis shrimp *Gonodactylus smithii* *in situ* at Kubbar Island, Kuwait. Photograph by Faisal Al-Sarraf.

Biological Sampling and Processing of Crustaceans, with Focus on Acorn Barnacles, Decapods and Stomatopods

Crustaceans represent a morphologically and ecologically highly diversified assemblage of animals. Therefore, their sampling requires various techniques ranging from the relatively easy, visually guided hand collecting at low tide or by snorkelling/scuba diving to the deployment of suction pumps, beach seines, plankton nets, dredges and ROVs. Generally, the sampling of crustaceans depends mainly largely on the group and/or the habitat targeted. In this chapter, we briefly describe several techniques that may be used to qualitatively sample intertidal and shallow-water macro-crustaceans in different Kuwaiti coastal habitats, emphasising on barnacles, decapods, and mantis shrimps. All crustaceans should be handled with great care to avoid accidental damage to the specimens, including autotomy (self-amputation) of appendages, especially the chelipeds (claw-bearing appendages). Small and fragile specimens should be handled either with soft tweezers or teaspoons. If a cheliped or a walking leg is dropped, it should be collected and preserved together with the rest of the body as any of these appendages may contain a wealth of taxonomic information.

Supratidal. Semi-terrestrial crabs can be most easily collected at night, when they are most active foraging along the shore or in the adjacent salt marshes (Fig. 23), or dug from their burrows during the day. Gravid females should not be taken unless justified by a specific project (e.g. scientific study of developing embryos, etc.).

Muddy intertidal. Many crabs living on intertidal mudflats can be easily collected by hand or dug from their relatively shallow, vertical shelters, i.e. simple, shaft-like burrows. Some crabs, however, live in deeper burrows and need to be extracted from them with a suction pump (Fig. 24). This is also true for most shrimps (especially Alpheidae) and mud-shrimps, which live in deep and often complex burrows. Many crustaceans use natural or artificial debris as shelter, including deeply immersed rocks, bricks, wood debris, etc., or build their burrows under these structures. Some caution is required while working in deep soggy mud (Figs. 6, 25).



Figure 23. Sampling in supratidal zone of Sulaibikhat Bay, Kuwait.



Figure 24. Collecting intertidal infauna by means of metallic suction pump.



Figure 25. The safest way to collect the inhabitants of deep soggy mud.

Sandy Intertidal. Most sandflat crabs and hermit crabs can be easily collected by hand at low tide. A suction pump is needed to extract infaunally living crabs, caridean shrimps, as well as ghost- and mud-shrimps from their burrows. Crabs and some shrimps may also use scarce rocks or debris as shelter. Mole crabs can be collected visually by spotting them at the receding wave flow or by sieving sand near the water edge (Fig. 26).

Rocky and Mixed Sand-rock Intertidal. Acorn barnacles adhere firmly to rocks and should be removed carefully with a chisel, together with a piece of the substrate, to avoid damage to the calcareous skeleton or their inner body parts (Fig. 27). Decapods and stomatopods can be collected visually, for example, from rock crevices or by flipping larger rocks (Fig. 28). Rocky pools can be best sampled with the aid of a small dip net (aquarium fish net), which allows the capturing of speedier palaemonid shrimps and mantis shrimps. Intertidal sponges (Fig. 29) may harbour symbiotic crustaceans, especially small caridean shrimps, mud-shrimps and porcelain crabs. Some are permanent residents of sponges, whereas others, such as small crabs, are only occasional sponge dwellers.

Shallow Subtidal Habitats. Depending on the habitat and bottom type, and water clarity, various techniques can be used to collect crustacean specimens below the tidal line. The most frequently used methods are washing and sieving algae, using suction pumps and push nets, seining beach, and collecting of potential crustacean hosts, such as sponges, bivalves, and ascidians, including by snorkelling or scuba diving. Washing and sieving large clumps of brown and green algae may yield small shrimps (especially hippolytid shrimps) and spider crabs clinging to them. Seagrass beds can be sampled using beach seines and large push nets, or by shallow-water dredging (Fig. 30, see next page). The use of suction pumps is necessary for extracting infaunal crustaceans, especially snapping shrimps, ghost-, and mud-shrimps, and mantis shrimps, and smaller symbiotic decapods (smaller alpheid shrimps, porcelain crabs, pea crabs, etc.) associated with them or with other burrowing animals, such as echinurans. Seagrass flats and tide pools can also be sampled at night with the aid of various types of hand nets. Muddy or muddy-sandy subtidal areas are best sampled by various types of dredges operated from a small boat or research vessel. Plankton nets are required for pelagic or benthopelagic shrimps and decapod larvae.

Coral Reef Habitats. Coral reefs and adjacent coral rubble flats are complex three-dimensional ecosystems, which present numerous challenges for the collector, who must be an experienced snorkeler or scuba diver (Figs. 31, 32). Crustaceans occupy numerous niches on coral reefs and their sampling, therefore, includes various strategies and techniques. One of the most common and efficient methods for collecting reef cryptofauna, in general, is gathering and breaking up large pieces of coral rubble or dead coral heads. Dead branching corals, such as *Acropora* and *Pocillopora*, often harbour a multitude of small crustaceans, including various groups of caridean shrimps, squat lobsters, porcelain crabs, true crabs, and mantis shrimps (especially from the family Gonodactylidae). Larger, heavily encrusted colonies of *Pocillopora*, rich in deep crevices lined by cryptic sponges,



Figure 26. Sieving sand near the water edge.



Figure 27. Extracting invertebrates from crevices of intertidal rocks.



Figure 28. Flipping a large rocks in search of crustaceans.



Figure 29. Sponges are home to many small crustaceans, such as this pilumnid crab.



Figure 30. A seaweed bed on the eastern shore of Failaka Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 31. Healthy colony of *Acropora* sp. at Qaruh Island, Kuwait. Photograph by Husein Alqallaf.



Figure 32. healthy coral reef at Umm Al-Maradim Island, Kuwait. Photograph by Faisal Al-Sarraf.

ascidians and algae, are particularly rich in this aspect. However, massive corals, such as some *Porites*, are also often inhabited by the so-called endolithic (= coral or rock-boring) animals, such as bivalves, sipunculans and decapods, especially the highly specialised snapping shrimps and mud-shrimps. Many coral reef decapods are free-living in the sand under coral rubble and can be collected by flipping coral rocks and (for shrimps) using a small hand net. Others live in symbiotic association with sponges, hermatypic corals, sea anemones, octocorals, bivalves, polychaetes, or echinoderms.

They can be collected only by carefully inspecting the hosts *in situ* (e.g., echinoderms, and octocorals) or carefully opening the hosts (e.g. sponges, and bivalves) as soon as possible after their collection. Living branching corals, which host many symbiotic decapods, should be collected at a very small scale and with coral-specific collecting permits (Fig. 33, 34).



Figure 33. Coral-associated shrimp, possibly *Philarius gerlachei*, at Qaruh Island, Kuwait. Photograph by Husein Alqallaf.



Figure 34. Coral crab *Cymo* cf. *melanodactylus*, Qaruh Island, Kuwait. Photograph by Husein Alqallaf.

Snapping shrimps of the genus *Alpheus*, living in partnership with gobies, are the symbiotic crustaceans most commonly seen on coral reef flats. Because of the deep and often complex tunnel systems built by the shrimps, the very particular type of sediment (typically coarse sand mixed with silt and coral fragments, often highly unsuitable for suction pumps), and the permanent and extremely “responsible” watchdog activity of the gobies, their sampling is exceptionally challenging (Anker 2000). The same is true for large burrowing stomatopods living in simple but very spacious U-shaped burrows. It is also essential to know that many decapods, especially large crabs, hermit crabs, and many shrimps, are most active at night. Therefore, collecting of these species can be collected by snorkelling or scuba diving at night, with all necessary precautions.

The actual collecting, i.e. searching and capturing of the animals, is only the first step in the long collecting process, which varies significantly between the groups and sampling methods.



Figure 35. Right (A) and wrong (B) ways to keep collected crustaceans in the field.



Figure 36. Getting the coordinates of the station using GPS.

However, the collector should always know (1) how sensitive the collected animals generally are, and how long they are expected to survive; (2) what type and size of vials should be used and how much water is needed; and (3) whether the animals can be put together in the same vial or kept separately (Fig. 35). For instance, it is not a good idea to mix shrimps and crabs in the same container, or several aggressive snapping shrimps, or several crabs together, and placing a stomatopod into these jars typically results in a massacre. This type of biological “collecting” often results in large amounts of mutilated or incomplete specimens (many missing claws and legs), which are difficult or even impossible to identify, even for an expert. Not surprisingly, these specimens would have very limited or no scientific value. Station data is also crucial and should include the exact location minimally (with GPS, if available Fig. 36), general type of habitat, depth, collector’s name and date. For symbiotic crustaceans, it is essential to note the host organism, which should be collected as well, if possible (or a fragment of it, such as a piece of alga, sponge, coral, etc.).

Generally, the captured animals are labelled with a field or station number (Fig. 37) and then quickly and safely transported to the laboratory, where they are re-labelled, i.e. given a unique number, and photographed alive, preferably on a black background. Colour photographs are essential as they have an aesthetic value and contain a wealth of important and often diagnostic taxonomic characters. For ethical reasons, all collected animals should be anesthetised (using clove oil) or gradually chilled on ice or in the refrigerator before preservation in 75%-80% ethanol. A small piece of tissue (typically a swimmeret = pleopod, or one of the posterior walking legs) should be taken and preserved in pure (molecular) ethanol for possible DNA analyses; this may be particularly important for the rare or less common species.



Figure 37. Labelling of captured animals in the field.

How to Use This Book?

This book is intended mainly as a field guide to the common sessile barnacles, decapods (shrimps, anomuran, and brachyuran crabs), and stomatopods (mantis shrimps), which may be found on Kuwait's coasts, either in the intertidal zone or in extremely shallow waters (1–10 m). These species were collected from 45 transects along coastal and shallow areas from the north to the south of Kuwait, including eight islands (Table 1, Fig. 39). This book also includes several rare and recently described species. However, it excludes crustaceans found in the deeper water, such as most penaeid prawns (Dendrobranchiata), typically trawled or dredged below 10 m. It also excludes rarely encountered species, for which no colour photographs or good habitus drawings are presently available, or species with doubtful records for Kuwait. Nevertheless, a complete list of all species of Balanomorpha, Decapoda, and Stomatopoda reported from Kuwait is provided in Table 2 (at the end of this chapter). This table also indicates whether a particular species was included in the guide (highlighted in bold). We sincerely hope that many of the current non-included taxa will eventually be found and photographed, which will enable their inclusion in the next edition of this guide.

Most records are based on the material collected and identified by the authors and literature records (Motoh 1975a; Galil 2009). Most records from Kuwait in Naderloo (2017) were not taken into account as they are represented merely by dots in the distribution maps. Voucher specimens are deposited in the Kuwait Institute for Scientific Research (KISR), as well as several major natural history museums outside of the country (see Anker and De Grave 2009; Galil 2009; Al-Kandari et al. 2020a, 2020b; De Grave et al. 2020). The present guide covers a total of 130/189 species of crustaceans. More than half are represented by true crabs (Brachyura), followed by true shrimps (Caridea). Anomuran crabs (Anomura) are represented in Kuwait by six hermit crabs, seven porcelain crabs, a single species of mole crab, and a squat-lobster. In addition, a single species of slipper lobster (Scyllaridae) and three species of prawns (Dendrobranchiata), including two well-known commercial species, are included. Acorn barnacles (Balanomorpha) and mantis shrimps (Stomatopoda) are represented by six and seven species, respectively.

For each species treated, we present one or several colour photograph(s) of the specimen(s) on a black background, and in several cases, additional *in situ* photographs (Fig. 38) are provided. A line drawing was used for a few species considered by us as important (for being interesting for one or the other reason) and for which no colour photograph was available. Most colour photographs presented here show specimens collected from Kuwait. However, in some rare cases, a photograph of a specimen from an adjacent area outside Kuwait was used, for instance, from Iran, Oman, or Saudi Arabia. Other information provided for each represented species are as follows: (1) important synonyms (if any); (2) common English names (especially for some common and well-known species);

(3) main diagnostic features; (4) geographical distribution [the Arabian/Persian Gulf from Kuwait to the Strait of Hormuz is referred to herein as the Arabian-Persian Gulf]; (5) ecology; (6) bathymetric distribution, in the form of a simple graphic diagram; (7) local distribution in Kuwait, in the form of a map showing collection localities; (8) remarks on biology, ecology, taxonomy, etc., or other interesting facts; and (9) a selection of 1–4 most relevant reference(s), where the reader may find additional information, especially on the species' morphology (including illustrations) and biology.

A taxonomically arranged checklist of all previous and presently recorded species for the barnacle orders Lepadoidea and Balanomorpha, and the malacostracan orders Decapoda and Stomatopoda is presented in Table 2.

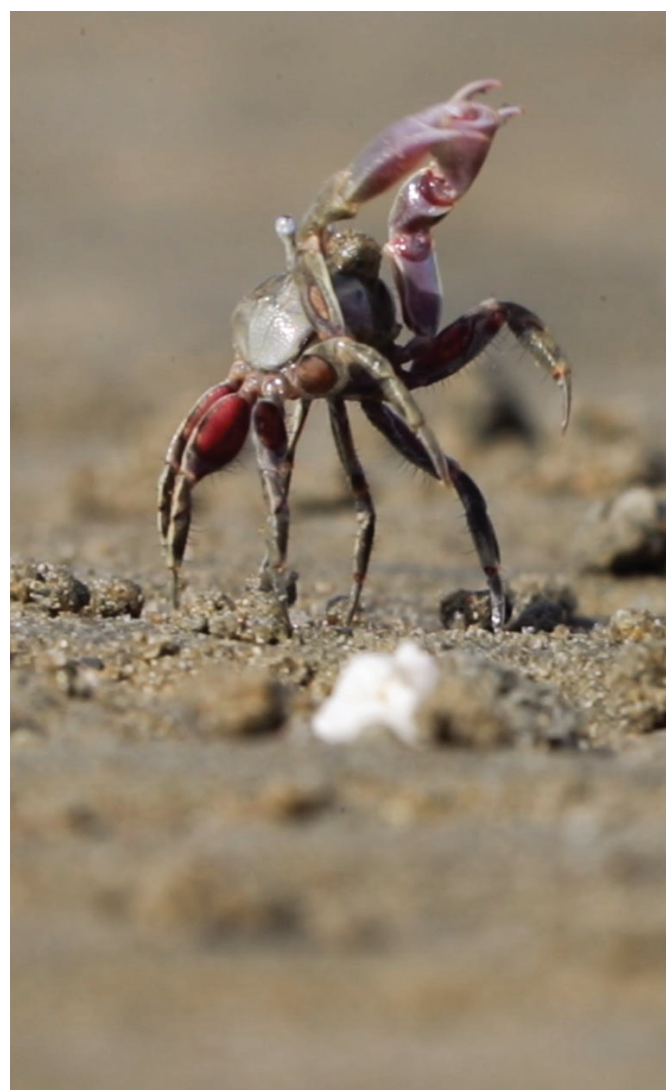


Figure 38. Sand bubbler crab *Ilyoplax* cf. *frater* *in situ*, Al-Khiran, Kuwait. Photograph by AM team.

Table 1. The intertidal and shallow subtidal stations of Kuwait (mainland and islands).

Region	Transect	Area	Latitude N	Longitude E	Habitat
Khor Al-Subiya (North and West of Boubyan Island)	KS1	Khor Al-Subiyah (Al-Magasel)	29°74.127'	48°09.567'	Mud - Rock
	KS2	Khor Al-Subiyah (Al-Shumaima)	29°65.672'	48°13.083'	Mud - Rock
	KS3	Khor Al-Subiyah (South)	29°57.867'	48°16.803'	Mud
Kuwait Bay	KB1	Kuwait Bay (Ras Al-Hala)	29°55.453'	48°15.455'	Mud
	KB2	Kuwait Bay (Mudairah)	29°54.453'	47°92.323'	Mud
	KB3	Kuwait Bay (Al-Kuwaisat)	29°37.795'	47°70.800'	Mud
	KB4	Kuwait Bay (Al-Judailiat)	29°37.495'	47°75.305'	Sand - rock
	KB5	Kuwait Bay (Aushairij)	29°38.412'	47°83.653'	Sand - rock
	KB6	Sulaibikhat Bay	29°32.837'	47°82.783'	Mud
	KB7	Sulaibikhat Bay	29°36.052'	47°95.340'	Sand - rock
	KB8	Shuwaikh Port (near Maternity Hospital)	29°39.135'	47°99.667'	Sand - rock
	KB9	Kuwait Bay (Al-Salam Beach)	29°36.632'	48°02.240'	Sand - rock
	KB10	Kuwait Bay (Ras Ajuza)	29°23.481'	47°59.800'	Sand - rock
	KB11	Kuwait Bay (Near Al-Sha'ab)	29°21.979'	48°01.344'	Sand - rock
East Kuwait Bay	SAL	Al-Salmiya (Belajat Street)	29°33.855'	48°09.625'	Sand - rock
South Kuwait Bay	MES	Al-Messilah	29°27.493'	48°09.012'	Sand - rock
	FNI	Al-Funaitees	29°19.198'	48°11.563'	Sand - rock
	AHA	Abu Halifa	29°13.590'	48°13.308'	Sand - rock
	MAN	Al-Mangaf	29°10.068'	48°13.872'	Sand - rock
	MAH	Masfat Al-Ahmadi	29°07.385'	48°14.460'	Sand - rock
	MAB	Mina Abdullah	29°00.118'	48°16.422'	Sand - rock
	JUL	Al-Julaia'a	28°82.467'	48°28.020'	Sand - rock
	DZO	Dohat Al-Zour	28°76.833'	48°30.350'	Sand - rock
	RZO	Ras Al-Zour	28°74.170'	48°38.250'	Sand - rock
	KHI	Al-Khiran	28°64.688'	48°39.048'	Sand - rock
	NUW	Al-Nuwiseeb	28°57.990'	48°40.130'	Sand - rock
Islands	BI1	Boubyan Island (Umm Al-Shajar)	29°90.438'	48°02.458'	Mud
	BI2	Boubyan Island (Ras Al-Gayed)	29°80.155'	48°36.625'	Mud
	BI3	Boubyan Island (South)	29°64.988'	48°31.383'	Mud
	MI	Miskan Island (Southeast)	29°48.395'	48°25.490'	Mud
	FI1	Failaka Island (Northwest)	29°46.748'	48°29.730'	Mud - rock
	FI2	Failaka Island (South)	29°42.708'	48°33.845'	Mud - rock
	FI3	Failaka Island (East 1)	29°39.382'	48°39.930'	Sand - rock
	FI4	Failaka Island (East 2)	29°39.517'	48°40.227'	Sand - rock
	AI1	Auha Island (North 1)	29°37.890'	48°43.833'	Sand - rock
	AI2	Auha Island (South)	29°37.758'	48°44.143'	Sand - rock
	UNI	Umm Al-Namil (Northeast)	29°38.687'	47°87.075'	Sand - rock
	KI1	Kubbar Island (East)	29°07.295'	48°49.120'	Sand - rock
	KI2	Kubbar Island (West)	29°07.130'	48°49.425'	Sand - rock
	QI1	Qaruh Island (North)	28°81.842'	48°77.588'	Sand - rock
	QI2	Qaruh Island (South)	28°81.703'	48°77.678'	Sand - rock
	UI1	Umm Al-Maradim Island (East)	28°68.232'	48°65.327'	Sand - rock
	UI2	Umm Al-Maradim Island (Northeast)	28°67.963'	48°65.345'	Sand - rock
	UI3	Umm Al-Maradim Island (Northwest)	28°68.267'	48°65.288'	Sand - rock
Shallow reef	QUR	Qit'at Uraifjan	29°0.024'	48°15.744'	Coral reef

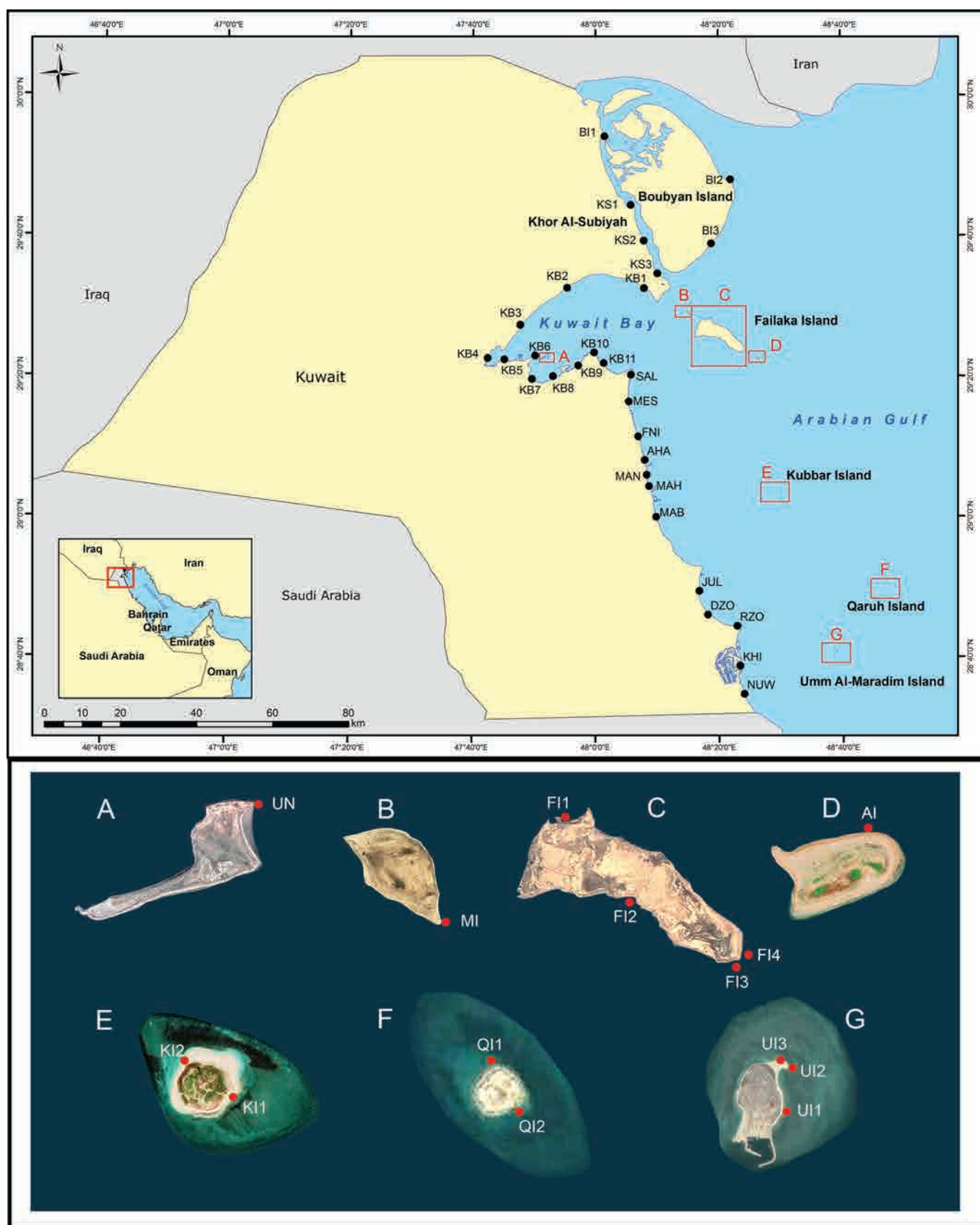


Figure 39. The intertidal and shallow subtidal sampling localities in Kuwait (mainland and islands). A - Umm Al-Namil Island; B - Miskan Island; C - Failaka Island; D - Auha Island; E - Kubbar Island; F - Qaruh Island; and G - Umm Al-Maradim Island.

Table 2. List of barnacles (Lepadoidae + Balanomorpha), decapods (Decapoda) and mantis shrimps (Stomatopoda) presently recorded from Kuwait, based on various sources.

All taxa highlighted in bold are treated in this guide. Partly identified (to the genus level) larval decapods reported by Grabe and Lees (1995) and Al-Yamani et al. (2011) were not included. The unverified records of *Brachyura* in Naderloo (2017) were also not considered.

The abbreviations of sampling localities essentially correspond to those in the map in Fig. 39, as following: **AHA** – Abu Halifa; **AI** – Auha (Ouha) Island (AI1–2); **DZO** – Dohat Al-Zour; **FI** – Failaka Island (FI1–4); **FNI** – Al-Funaitees; **JUL** – Al-Julaia’a; **KB** – Kuwait Bay west and north of Kuwait City (including Ras Al-Halah, Mudairah, Al-Kuwaisat, Al-Judailiat, Aushairij, Sulaibikhat Bay, Al-Salam Beach, Doha, and Shuwaikh port, Ras Ajuza, Al Shaab, KB1–11, and KBJ-Al-Jahra); **Shatt-Al-Arab delta including KS** – Khor Al-Subiya (KS1–3); and **BI** – Boubyan Island (BI1–3); **KHI** – Al-Khiran; **KI** – Kubbar Island (KI1–2); **MAA** – Mina Al-Ahmadi port; **MAB** – Mina-Abdullah; **MAH** – Masfat Al-Ahmadi; **MAN** – Al-Mangaf; **MES** – Al-Messilah; **MI** – Miscan Island (MI1); **NUW** – Al-Nuwaiseeb; **QI** – Qaruh Island (QI1–2); **QUR** – Quit’at Uraifjan offshore reef; **RZO** – Ras Al-Zour; **SAL** – Al-Salmiyah; **UI** – Umm Al-Maradim Island (UI1–3).

Taxon	Localities in Kuwait	References
Class Thecostraca Subclass Cirripedia Order Scalpellomorpha		
FAMILY Poecilasmidae		
01 <i>Octolasmis warwicki</i> Gray, 1825	Locality not provided	Jones 1986a
Order Balanomorpha (Barnacles)		
FAMILY Archaeobalaninae		
02 <i>Acasta sulcata</i> Lamarek, 1818	FI, MAA	Stubbings 1961; present study
FAMILY Balanidae		
03 <i>Conopea calceola</i> (Ellis, 1758)	FI	Nilsson-Cantell 1938 (as <i>Balanus calceolus</i>)
04 <i>Amphibalanus amphitrite</i> (Darwin, 1854)	BI, KS, KB, SAL, FNI, AHA, MAA, MAN, MAB, RZO, NUW, FI, QI, UI	Stubbings 1961 (as <i>Balanus amphitrite</i> var. <i>communis</i> and var. <i>hawaiiensis</i>); Jones 1986a (as <i>B. amphitrite</i>); Poltarukha 2017 (as <i>A. amphitrite amphitrite</i>); present study
05 <i>Striatobalanus amaryllis</i> (Darwin, 1854)	BI, MAA	Stubbings 1961 (as <i>Balanus amaryllis</i>); present study
06 <i>Megabalanus tintinnabulum</i> (Linnaeus, 1758)	KB	Jones 1986a; present study
FAMILY Chthamalidae		
07 <i>Chthamalus barnesi</i> Achituf and Safriel, 1980* [*presence in Kuwait requires confirmation]	Locality not provided	Jones 1986a (as <i>C. malayensis</i>)
08 <i>Microeuraphia permitini</i> (Zevina and Litvinova, 1970)	KB, SAL, MAA	Stubbings 1961 (as <i>C. malayensis</i>); Jones 1986a (as <i>Euraphia</i> sp.); Al-Yamani et al. 2012 (as <i>Euraphia withersi</i>); Poltarukha (2017); present study
FAMILY Pyrgomatidae		
09 <i>Arossella projectum</i> (Nilsson-Cantell, 1938)	FI	Nilsson-Cantell 1938 (as <i>Pyrgoma projectum</i>)
FAMILY Tetracelitidae		
10 <i>Tetracelita rufotincta</i> Pilsbry, 1916	QI, UI	Poltarukha 2017; present study

Class Malacostraca
Subclass Eumalacostraca
Order Decapoda

Suborder Dendrobranchiata (Prawns)

FAMILY Penaeidae

11	<i>Ganjampenaeopsis uncta</i> (Alcock, 1905)	Locality not provided	Motoh 1975a (as <i>Parapenaeopsis probata</i>)
12	<i>Megokris pescadorensis</i> (Schmitt, 1931)	Locality not provided	Motoh 1975a (as <i>Trachypenaeus pescadorensis</i>)
13	<i>Metapenaeopsis stridulans</i> (Alcock, 1905)* [*presence in Kuwait requires confirmation]	Locality not provided in Kuwait + records from Qatif, Saudi Arabia	Motoh 1975a
14	<i>Metapenaeus affinis</i> (H. Milne Edwards, 1837)	KS, KB, MAN, KHI	Motoh 1975a (as <i>M. mutatus</i>); Jones 1986a; present study
15	<i>Metapenaeus stebbingi</i> Nobili, 1904	Locality not provided	Motoh 1975a
16	<i>Parapenaeopsis stylifera</i> (H. Milne Edwards, 1837)	FI, E of FI	Motoh 1975a; Jones 1986a
17	<i>Marsupenaeus pulchricaudatus</i> Stebbing, 1914 [*presence in Kuwait requires confirmation]	Locality not provided	Motoh 1975a (as <i>Penaeus japonicus</i>)
18	<i>Penaeus hathor</i> Burkenroad, 1959 [*presence in Kuwait requires confirmation]	Locality not provided	Motoh 1975a (as <i>Penaeus latisulcatus</i>)
19	<i>Penaeus semisulcatus</i> De Haan, 1844	KS, KB, FI, KHI	Motoh 1975a; Jones 1986a; present study
20	<i>Trachysalambria palaestinensis</i> (Steinitz, 1932)	KB, N of KI	Motoh 1975a (as <i>T. curvirostris</i>); Chan et al. 2016

FAMILY Sergestidae

21	<i>Acetes japonicus</i> Kishinouye, 1905	BI, KS	Miquel, 1984; Al-Yamani et al. 2012; present study
22	<i>Sergestes</i> sp.	Locality not provided	Motoh 1975a

Suborder Pleocyemata

Infraorder Caridea (True shrimps)

FAMILY Alpheidae

23	<i>Alpheus digitalis</i> (De Haan, 1844)* [*possibly misidentification or undescribed species]	Locality not provided	Motoh 1975a
24	<i>Alpheus djiboutensis</i> De Man, 1909 [s. lat.]	KI, QI, UI	Jones 1986a (as <i>A. djeddensis</i>); present study
25	<i>Alpheus edamensis</i> De Man, 1888	KB, JUL, FI, KI, QI, UI	Al-Kandari et al. 2020a; present study
26	<i>Alpheus edwardsii</i> (Audouin, 1826) [s. lat.]	KB, AHA, MAH, MI, FI, KI, UI	Al-Kandari et al. 2020a; present study
27	<i>Alpheus inopinatus</i> Holthuis and Gottlieb, 1958	KB, SAL, MES, FNI, AHA, MAN, MAH, MAB, JUL, RZO, KHI, FI, KI, UI	Anker et al. 2020b; present study

28	<i>Alpheus lobidens</i> De Haan, 1849 [s. lat.]	BI, KS, KB, SAL, MES, FNI, AHA, MAN, MAH, MAB, JUL, RZO, KHI, NUW, FI, UI	Motoh 1975a (as <i>Alpheus</i> sp.); Jones 1986a; Anker and De Grave 2009; Anker et al. 2020b; present study
29	<i>Alpheus lutosus</i> Anker and De Grave, 2009	BI, KS, KB	(?) Jones 1986a (as <i>A. euphrosyne euphrosyne</i>); Anker and De Grave 2009; present study
30	<i>Alpheus macrodactylus</i> Ortmann, 1890	FI	Al-Kandari et al. 2020a; present study
31	<i>Alpheus maindroni</i> Coutière, 1898	FI	Al-Kandari et al. 2020a; present study
32	<i>Alpheus</i> cf. <i>rapax</i> Fabricius, 1798* [identity requires confirmation]	BI, KS	Anker and De Grave 2009
33	<i>Arete indicus</i> Coutière, 1903	KHI	Al-Kandari et al. 2020a; present study
34	<i>Athanas dimorphus</i> Ortmann, 1894	KB, SAL, RZO, FI, QI	Motoh 1975a (as <i>A. rathionastes</i>); Jones 1986a; Hayashi 1995; present study
35	<i>Athanas parvus</i> De Man, 1910	QI	Al-Kandari et al. 2020a; present study
36	<i>Salmones gracilipes</i> Miya, 1972	FI, KI	Anker et al. 2020a; present study
37	<i>Salmones ikaros</i> Anker, Al-Kandari and De Grave, 2020	FI	Anker et al. 2020a; present study
38	<i>Synalpheus gracilirostris</i> De Man, 1910	FI, AI, QUR, UI	Al-Kandari et al. 2020a; present study
39	<i>Synalpheus quinquedens</i> Tattersall, 1921	FI	Jones 1986a; Al-Kandari et al. 2020a; present study
40	<i>Synalpheus tumidomanus</i> (Paulson, 1875) [s. lat.]	KB, FI, QI, UI	Present study

FAMILY Chlorotocellidae

41	<i>Chlorocurtis jactans</i> (Nobili, 1904)	KHI	Al-Kandari et al. 2020a; present study
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FAMILY Hippolytidae

42	<i>Hippolyte ventricosa</i> H. Milne Edwards, 1837	KB, FI	Jones 1986a; present study
43	<i>Latreutes anoplonyx</i> Kemp, 1914	KB (Kuwait City), FI	Motoh 1975a; Grabe and Lees 1995; present study
44	<i>Latreutes mucronatus</i> (Stimpson, 1860)	KB, FI	Al-Kandari et al. 2020a; present study
45	<i>Saron marmoratus</i> (Olivier, 1811)	KHI (Bnaya reef), KI, QI, UI	Jones 1986a; George 2012; present study

FAMILY Lysmatidae

46	<i>Lysmata vittata</i> (Stimpson, 1860)	KS, FI, KI	Grabe and Lees 1995; present study
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FAMILY Ogyrididae

47	<i>Ogyrides sindibadi</i> De Grave, Al-Kandari and Anker, 2020	AHA	Grabe and Lees 1995; De Grave and Ashelby 2011 (both as <i>O. orientalis</i>); De Grave et al. 2020; present study
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FAMILY Palaemonidae

48	<i>Anchistus custos</i> (Forskål, 1775)	QUR, QI	Al-Kandari et al. 2020a; present study
49	<i>Cuapetes elegans</i> (Paulson, 1875)* [identification requires confirmation]	Locality not provided	Kazmi and Kazmi 2010
50	<i>Cuapetes ensifrons</i> (Dana, 1852)	KS, FI	Present study
51	<i>Exopalaemon styliferus</i> (H. Milne Edwards, 1840)	BI, KS	Salman and Bishop, 1990
52	<i>Periclimenes obscurus</i> Kemp, 1922 [identification requires confirmation]	Locality not provided	Jones 1986a; George 2012
53	<i>Periclimenella petitthouarsii</i> (Audouin 1826)	KI, UI	Al-Kandari et al. 2020a; present study

54	<i>Philarius gerlachei</i> (Nobili, 1905)	QI	Present study
55	<i>Urocaridella pulchella</i> Yokes and Galil, 2006	KI	Al-Kandari et al. 2020a; present study
FAMILY Thoridae			
56	<i>Thor paschalis</i> (Heller, 1862)	FI	Al-Kandari et al. 2020a; present study

Infraorder Axiidea (Mud Shrimps, Ghost Shrimps, and Burrowing Shrimps)

FAMILY Callichiridae

57	<i>Balsscallichirus masoomi</i> (Tirmizi, 1970)	KB, FI	Al-Kandari et al. 2020a; present study
58	<i>Michaelcallianassa indica</i> K. Sakai, 2002	FI	Al-Kandari et al. 2020a; present study

Infraorder Gebiidea (Mud Lobsters, and Mud shrimps)

FAMILY Upogebiidae

59	<i>Paragebica johorensis</i> Dworschak and Anker, 2022	FI	Anker and Al-Kandari et al., in prep.; present study
60	<i>Upogebia carinicauda</i> (Stimpson, 1860)	FI	Al-Kandari et al. 2020a; present study
61	<i>Upogebia nithyanandan</i> (Sakai, Türkay and Al Aidaroos, 2015)	KHI	Sakai et al. 2015; Dworschak and Poore 2018; Komai et al. 2020; present study
62	<i>Upogebia octoceras</i> (Nobili, 1904)	MI, FI, AI	Al-Kandari et al. 2020a; present study

Infraorder Achelata (Spiny lobsters, and Slipper lobsters)

FAMILY Palinuridae

63	<i>Panulirus versicolor</i> (Latreille, 1804)* [*probably based on historical records or imports, actual presence in Kuwait needs confirmation]	Locality not provided (most likely KI, QI, UI)	George 2012
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FAMILY Scyllaridae

64	<i>Biarctus sordidus</i> (Stimpson, 1860)	BI, QUR	present study
65	<i>Thenus orientalis</i> (Lund, 1793)	FI	Motoh 1975a; Al-Yamani et al. 2011, 2012; present study

Infraorder Anomura (Hermit Crabs, Squat Lobsters, Porcelain Crabs, Mole Crabs etc.)

SUPERFAMILY Paguroidea (Hermit Crab)

FAMILY Calcinidae

66	<i>Dardanus tinctor</i> (Forskål, 1775)	KB, MAN, KHI, NUW, KI, QI	Jones 1986a; Apel 2001; present study
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FAMILY Diogenidae

67	<i>Areopaguristes perspicax</i> (Nobili, 1906)	KS, KB, MES, AHA, MAN, MAH, JUL, DZO, RZO, KHI, NUW, FI, QI	Jones 1986a (as <i>P. persipax</i>); present study
68	<i>Clibanarius signatus</i> Heller, 1861	MAN, MAB, KI, QI, UI	Present study
69	<i>Diogenes alias</i> McLaughlin and Holthuis, 2001	KB, MI	Apel 2001; present study
70	<i>Diogenes avarus</i> Heller, 1865	KS, KB, SAL, MES, MAN, MAH, MAB, RZO, NUW, FI	Jones 1986a; present study
71	<i>Diogenes custos</i> Fabricius, 1798 [possible misidentification of <i>D. dubius</i> (Herbst, 1804)]	SAL, Locality not provided	Motoh 1975b; Apel 2001

FAMILY Paguridae

- | | | | |
|----|---|--|---------------|
| 72 | <i>Pagurus kulkarnii</i> Sankolli, 1961 | KB, SAL, MES,
AHA, MAN,
MAH, JUL, FI | Present study |
|----|---|--|---------------|

**SUPERFAMILY Galatheaidea
(Squat lobsters, and Porcelain crabs)****FAMILY Galatheididae**

- | | | | |
|----|---|----|---|
| 73 | <i>Galathea eulimene</i> Macpherson and Robainas-Barcia, 2015 | QI | Al-Yamani et al. 2012 (as <i>Galathea</i> sp.); present study |
|----|---|----|---|

FAMILY Porcellanidae

- | | | | |
|----|--|---|--|
| 74 | <i>Pachycheles natalensis</i> (Krauss, 1843) | KB, MES, AHA,
MAH, DZO, KHI,
FI. | Jones 1986a; present study |
| 75 | <i>Petrolisthes bosicii</i> (Audouin, 1826) | KB, SAL, MAN,
MAH, DZO, NUW,
FI, UI | Motoh 1975b; present study |
| 76 | <i>Petrolisthes carinipes</i> (Heller, 1861)*
[problematic record, species not known from Iran] | Locality not provided | Jones 1986a; George 2012 |
| 77 | <i>Petrolisthes ornatus</i> Paulson, 1875 | SAL, MES, MAH,
JUL, RZO | Motoh 1975b; Jones 1986a (as <i>P. indicus</i>); present study |
| 78 | <i>Petrolisthes rufescens</i> (Heller, 1861) | BI, KB, MES,
AHA, MAB, JUL,
DZO, RZO, KHI,
NUW, FI, KI | Jones 1986a; Al-Yamani et al. 2012; present study |
| 79 | <i>Petrolisthes lamarckii</i> (Leach, 1820) | SAL | Motoh 1975b |
| 80 | <i>Pisidia gordonii</i> (D.S. Johnson, 1970) | BI, KS, KB, SAL,
MES, MAN,
MAH, KHI, NUW,
FI, QI | Al-Yamani et al. 2012 (as <i>Petrolisthes carinipes</i>); present study |
| 81 | <i>Polyonyx obesulus</i> Miers, 1884 | FI | Al-Kandari et al. 2020a; present study |
| 82 | <i>Raphidopus persicus</i> Ng, Safaie and Naser, 2012 | FI, between KS/BI and KB | Al-Yamani et al. 2012 (as <i>Raphidopus</i> sp.); Al-Kandari et al. 2020a; present study |

SUPERFAMILY Hippoidea (Mole crabs)**FAMILY Hippidae**

- | | | | |
|----|---|-----|---|
| 83 | <i>Emerita holthuisi</i> Sankolli, 1965 | MAB | Jones 1986a; Al-Yamani et al. 2012; present study |
|----|---|-----|---|

FAMILY Albuneidae

- | | | | |
|----|--|-----|-------------|
| 84 | <i>Albunea symmysta</i> (Linnaeus, 1758) | SAL | Motoh 1975b |
|----|--|-----|-------------|

Infraorder Brachyura (True crabs)**FAMILY Matutidae**

- | | | | |
|----|---|----|---------------------------------------|
| 85 | <i>Matuta planipes</i> JC Fabricius, 1798 | FI | Jones 1986a; Apel 2001; present study |
| 86 | <i>Matuta victor</i> (Fabricius, 1781) | FI | Apel 2001 |

FAMILY Carpiliidae

- | | | | |
|----|---|--------|---------------------------------------|
| 87 | <i>Carpilius convexus</i> (Forskål, 1775) | KI, QI | Al-Kandari et al. 2017; present study |
|----|---|--------|---------------------------------------|

FAMILY Dorippidae			
88	<i>Dorippe quadridens</i> (Fabricius, 1793)	Locality not provided	Apel 2001
89	<i>Dorippoides nudipes</i> Manning and Holthuis, 1986	Locality not provided	Apel 2001
FAMILY Oziidae			
90	<i>Epixanthus frontalis</i> (H. Milne Edwards, 1834)	KB, JUL, RZO, NUW, FI, KI	Jones 1986a; Apel 2001; Al-Kandari et al. 2017; present study
FAMILY Euryplacidae			
91	<i>Eucrate crenata</i> (De Haan, 1835)	KB, FI, QI	Al-Kandari et al. 2017; Naderloo 2017; present study
92	<i>Trissoplax dentata</i> (Stimpson, 1858)	BI	Al-Kandari et al. 2017; present study
FAMILY Hymenosomatidae			
93	<i>Elamena sindensis</i> Alcock, 1900	KS, KB, FI	Apel 2001; Al-Kandari et al. 2017; present study
FAMILY Leucosiidae			
94	<i>Arcania erinacea</i> (Fabricius, 1787)	Locality not provided	Apel 2001
95	<i>Hiplyra sagitta</i> Galil, 2009	off MAH	Galil 2009
96	<i>Hiplyra variegata</i> (Rüppel, 1830)	KB, KHI	Naderloo 2017; present study
97	<i>Ixa holthuisi</i> Tirmizi, 1970	Locality not provided	Naderloo 2017
98	<i>Leucisca rubifera</i> (F. Müller, 1887)	KS, MES, MAN, MAH, MAB	Al-Kandari et al. 2017; present study
99	<i>Lyphira perplexa</i> Galil, 2009	off MAH	Galil 2009
100	<i>Myra fugax</i> (Fabricius, 1798) [*identity needs confirmation, possibly <i>M. subgranulata</i>]	Locality not provided	Apel 2001
101	<i>Nursia persica</i> Alcock, 1896	KB	present study
102	<i>Nursia plicata</i> (Herbst, 1803)	BI	Apel 2001; Al-Kandari et al. 2017; present study
103	<i>Philyra concinnus</i> Ghani and Tirmizi, 1995	KS	Al-Kandari et al. 2017; present study
104	<i>Philyra globulosa</i> H. Milne Edwards, 1837	Locality not provided	Apel 2001
105	<i>Philyra sagittifera</i> (Alcock, 1896)	KS, FI	Al-Kandari et al. 2017; present study
106	<i>Philyra</i> sp. n.*	Locality not provided	Apel 2001
107	<i>Seulocia anahita</i> Galil, 2005	Locality not provided	Galil, 2005
FAMILY Epialtidae			
108	<i>Acanthonyx limbatus</i> A. Milne-Edwards, 1862	RZO, FI	present study
109	<i>Cyphocarcinus capreolus</i> (Paulson, 1875)	KB	Apel 2001; Al-Kandari et al. 2017
110	<i>Hyastenus hilgendorfi</i> De Man, 1887	FI, MI	Apel 2001; Al-Kandari et al. 2017; present study
111	<i>Menaethius monoceros</i> (Latreille, 1825)	Locality not provided	Jones 1986a; Apel 2001
112	<i>Phalangipus persicus</i> Griffin, 1973	Locality not provided	Apel 2001

FAMILY Inachidae

- 113 *Achaeus lacertosus* Stimpson, 1857 FI Al-Kandari et al. 2017; present study

FAMILY Majidae

- 114 *Micippa philyra* (Herbst, 1803) KS, AHA, FI Al-Kandari et al. 2017; present study

FAMILY Parthenopidae

- 115 *Enoplolambrus carenatus* (H. Milne Edwards, 1834) Locality not provided Apel 2001 (as *Parthenope* cf. *quemvis*)
- 116 *Enoplolambrus pransor* (Herbst, 1796) Locality not provided Jones 1986a (as *Lambrus pransor*); Apel 2001 (as *Parthenope pransor*)

FAMILY Galenidae

- 117 *Halimede tyche* (Herbst, 1801) Locality not provided Apel 2001

FAMILY Pilumnidae

- 118 *Benthopanope* sp. KS, FI, UI Al-Kandari et al. 2017
- 119 *Cryptopilumnus pereiodontus* (Davie and Ghani, 1993) QI, UI Al-Kandari et al. 2017; present study
- 120 *Eurycarcinus integrifrons* De Man, 1879 BI, KS, KB, FI Al-Kandari et al. 2017; present study
- 121 *Eurycarcinus orientalis* A. Milne-Edwards, 1867 BI, KS, KB, FI Al-Bakri et al. 1985; Jones 1986a; Apel 2001; Al-Kandari et al. 2017; present study
- 122 *Heteropilumnus trichophoroides* (De Man, 1895) KB, FI Al-Kandari et al. 2017; present study
- 123 *Pilumnopus convexus* (Maccagno, 1936) BI, KS, KB, SAL, MES, FNI, AHA, MAN, MAH, MAB, JUL, RZO, KHI, NUW, FI, UI Al-Kandari et al. 2017; present study
- 124 *Pilumnopus vauquelini* (Audouin, 1826)* [probably misidentification] Locality not provided Jones 1986a
- 125 *Pilumnus longicornis* Hilgendorf, 1879 KB, MES, FNI, FI Jones 1986a; Apel 2001; Al-Kandari et al. 2017; present study
- 126 *Pilumnus savignyi* Heller, 1860 BI, KS, KB, MES, FNI, MAH, MAB, RZO, FI, KI, QI, UI Jones 1986a; Apel 2001; Al-Kandari et al. 2017; present study
- 127 *Pilumnus vespertilio* (Fabricius, 1793) Locality not provided Jones 1986a; Apel 2001
- 128 *Typhlocarcinops stephensi* Serène, 1964 KB, FI Al-Kandari et al. 2017; present study
- FAMILY Portunidae**
- 129 *Portunus hastatoides* Fabricius, 1798 Locality not provided Apel and Spiridonov 1998; Apel 2001
- 130 *Portunus segnis* (Forskål, 1775) KB, MES, MAB, JUL, DZO, KHI, NUW, UI Al-Bakri et al. 1985; Jones 1986a (as *Portunus pelagicus*); present study
- 131 *Charybdis hellerii* (A. Milne-Edwards, 1867) FI Jones 1986a; Apel and Spiridonov 1998; Apel 2001; present study
- 132 *Charybdis longicollis* Leene, 1938 KB Apel and Spiridonov 1998; Apel 2001
- 133 *Charybdis natator* (Herbst, 1794) Locality not provided Jones 1986a; Apel 2001
- 134 *Gonioinfradens giardi* (Nobili, 1905) RZO, UI Present study

135	<i>Thalamita bandusia</i> Nobili, 1906	KI, QI, UI	Present study
136	<i>Thalamita iranica</i> Stephensen, 1946	FI, KI, QI	Al-Kandari et al. 2017; present study
137	<i>Thalamita savignyi</i> A. Milne-Edwards, 1861	UI	Al-Kandari et al. 2017; present study
138	<i>Thranita rubridens</i> (Apel and Spiridonov, 1998)	KI, QI	Present study
FAMILY Tetraliidae			
139	<i>Tetralia cavimana</i> Heller, 1860	QI	Al-Kandari et al. 2017; present study
FAMILY Xanthidae			
140	<i>Actaea jacquelineae</i> Guinot, 1976	KB, FI	Jones 1986a (as <i>Actaea savignyi</i>) Apel 2001; present study
141	<i>Actaea savignii</i> (H. Milne Edwards, 1834)	KB, FI	Jones 1986a; Al-Kandari et al. 2017; present study
142	<i>Atergatis laevigatus</i> A. Milne-Edwards, 1865	KI, QI	Al-Kandari et al. 2017; present study
143	<i>Chlorodiella nigra</i> (Forskål, 1775)	QI, UI	Al-Kandari et al. 2017; present study
144	<i>Cyclodius drachi</i> (Guinot, 1964)	MES, MAH, QI, UI	Al-Kandari et al. 2017; present study
145	<i>Cymo melanodactylus</i> Dana, 1852	FI	Present study (photographic record)
146	<i>Leptodius exaratus</i> (H. Milne Edwards, 1834)	KB, SAL, MES, FNI, AHA, MAN, MAH, MAB, JUL, DZO, RZO, KHI, NUW, UNI, MI, FI, AI, KI, QI, UI	Al-Bakri et al. 1985; Jones 1986a (as <i>Xantho exaratus</i>); Apel 2001; Al-Kandari et al. 2017; Al-Wazzan 2017; present study
147	<i>Medaeops granulosus</i> (Haswell, 1882)	Locality not provided	Jones 1986a; Apel 2001
148	<i>Medaeops neglectus</i> (Balss, 1922)	MAH, FI	Al-Kandari et al. 2017; present study
149	<i>Paraxanthodes cumatodes</i> (MacGilchrist, 1905)	NUW	Al-Kandari et al. 2017
150	<i>Psaumis cavipes</i> (Dana, 1852)	UI	Al-Kandari et al. 2017; present study
151	<i>Zozymodes xanthoides</i> (Kraus, 1843)	BI, KS	Naderloo, 2017
FAMILY Grapsidae			
152	<i>Grapsus albolineatus</i> Latreille in Milbert, 1812	KI, QI, UI	Al-Kandari et al. 2017; present study
153	<i>Grapsus granulosus</i> H. Milne Edwards, 1853		
154	<i>Metopograpsus messor</i> (Forskål, 1775)	KB, MES, FNI, MAB, JUL, DZO, RZO, KHI, NUW, FI, KI, UI	Al-Bakri et al. 1985; Jones 1986a; Al-Kandari et al. 2017; present study
155	<i>Metopograpsus cannicci</i> Innocenti, Schubart and Fratini, 2020	MES, NUW	present study
FAMILY Sesarmidae			
156	<i>Nanosesarma sarii</i> Naderloo and Türkay, 2009	BI, KS, KB, UNI, SAL, MES, FNI, AHA, MAN, MAH, MAB, JUL, DZO, RZO, KHI, NUW, FI, KI, UI	Jones 1986a; Apel 2001 (both as <i>N. minutum</i>); Al-Yamani et al. 2012; Al-Kandari et al. 2017; present study

157	<i>Parasesarma persicum</i> Naderloo and Schubart, 2010	KS, KB, NUW	Jones 1986a (as <i>Sesarma plicatum</i>); Apel and Türkay 1999; Apel 2001 (both as <i>P. plicatum</i>); Al-Kandari et al. 2017; present study
158	<i>Pseudosesarma boulengeri</i> (Calman, 1920)	Locality not provided	Apel and Türkay 1999; Apel 2001 (as <i>Chiromantes boulengeri</i>)
FAMILY Varunidae			
159	<i>Eriocheir hepuensis</i> Dai, 1991	BI, KB	Naser et al. 2012; present study
160	<i>Metaplax indica</i> H. Milne Edwards, 1852	BI, KS, KB	Al-Bakri et al. 1985; Jones 1986a; Clayton 1986; Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
FAMILY Camptandriidae			
161	<i>Leptochryseus kuwaitense</i> (Jones and Clayton, 1983)	KB, KHI	Al-Bakri et al. 1985; Jones 1986a; Jones and Clayton 1983; Clayton 1986 (as <i>Cleistostoma kuwaitense</i>) Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
162	<i>Manningis arabicum</i> (Jones and Clayton, 1983)	KS, KB, FI	Jones 1986a (as <i>Paracleistostoma arabicum</i>); Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
163	<i>Nasima dotilliformis</i> (Alcock, 1900)	BI, KB	Al-Bakri et al. 1985; Jones 1986a (as <i>Cleistostoma dotilliforme</i>); Jones and Clayton 1983; Clayton 1986; Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
164	<i>Opusia indica</i> (Alcock, 1900)	BI, KS, KB, FI	Clayton 1986; Jones 1986a (as <i>Tylodiplax indica</i>) Apel 2001; Al-Kandari et al. 2017; present study
FAMILY Dotillidae			
165	<i>Dotilla blanfordi</i> Alcock, 1900	KS, KB, SAL, MAH, FI	Al-Bakri et al. 1985; Jones 1986a, b; Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
166	<i>Ilyoplax frater</i> (Kemp, 1919)	KB	Jones 1986a,b; Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017
167	<i>Ilyoplax stevensi</i> (Kemp, 1919)	BI, KS, KB, MAB	Jones 1986a; Clayton 1986; Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
168	<i>Scopimera crabricauda</i> Alcock, 1900	KB	Al-Bakri et al. 1985; Jones 1986a,b; Clayton 1986; Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
FAMILY Macrophthalmidae			
169	<i>Chaenostoma sinuspersici</i> (Naderloo and Türkay, 2011)	BI	Al-Kandari et al. 2017; present study
170	<i>Ilyograpsus rhizophorae</i> Barnard, 1955	BI, KS, KB	Jones 1986a (as <i>Ilyograpsus paludicola</i>) Al-Kandari et al. 2017; present study
171	<i>Macrophthalmus (Mareotis) depressus</i> Rüppel, 1830	KS, KB, MAB, KHI, FI	Al-Bakri et al. 1985; Jones 1986a; Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study
172	<i>Macrophthalmus grandidieri</i> A. Milne-Edwards, 1867* [*probably misidentification]	Locality not provided	Al-Bakri et al. 1985; Jones 1986a
173	<i>Macrophthalmus (Mareotis) laevis</i> A. Milne-Edwards, 1867	KS, KB	Apel and Türkay 1999; Al-Kandari et al. 2017; present study

- | | | | |
|-----|---|------------|---|
| 174 | <i>Macrophthalmus sulcatus</i> H. Milne Edwards, 1852 | BI, KB | Clayton 1986 and Jones 1986a (as <i>M. grandidieri</i>) Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study |
| 175 | <i>Venitus dentipes</i> (Lucas in Guérin-Méneville, 1836) | BI, KS, KB | Al-Bakri et al. 1985; Jones 1986a (as <i>Macrophthalmus pectinipes</i>); Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017 (as <i>M. dentipes</i>); present study |

FAMILY Ocypodidae

- | | | | |
|-----|---|-------------------------------|--|
| 176 | <i>Austruca iranica</i> (Pretzmann, 1971) | KS, KB, JUL, KHI, UNI | Collins et al. 1984; Jones 1986a; Clayton 1986 (as <i>Austruca lactea annulipes</i>); Apel and Türkay 1999; Apel 2001; Naderloo et al., 2010 (as <i>Uca lactea annulipes</i>); Al-Kandari et al. 2017; present study |
| 177 | <i>Austruca lactea</i> (De Haan, 1835)*
[probably misidentification] | KB (“Kuwait City”) | Zeil and Mutairi 1996 (as <i>Uca (Paraleptuca) lactea annulipes</i>) |
| 178 | <i>Austruca sindensis</i> (Alcock, 1900) | KB | Collins et al. 1984; Al-Bakri et al. 1985; Jones 1986a (as <i>Uca sindensis</i>); Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study |
| 179 | <i>Ocypode rotundata</i> Miers, 1882 | KB, MAB, JUL, KHI, KI, QI, UI | Al-Bakri et al. 1985; Jones 1986a,b; Clayton, 1986 (as <i>O. saratan</i>); Apel and Türkay 1999; Apel 2001; Al-Kandari et al. 2017; present study |

FAMILY Xenophthalmidae

- | | | | |
|-----|---|--------|---------------------------------------|
| 180 | <i>Xenophthalmus wolffi</i> Takeda and Miyake, 1970 | BI, KB | Al-Kandari et al. 2017; present study |
|-----|---|--------|---------------------------------------|

FAMILY Pinnotheridae

- | | | | |
|-----|--|---------|---------------------------------------|
| 181 | <i>Arcotheres tivelae</i> (Gordon, 1936) | KB, NUW | Al-Kandari et al. 2017; present study |
|-----|--|---------|---------------------------------------|

Subclass Hoplocarida

ORDER Stomatopoda

FAMILY Eurysquillidae

- | | | | |
|-----|--|----|--|
| 182 | <i>Manningia amabilis</i> Holthuis, 1967 | UI | Al-Kandari et al. 2020b; present study |
|-----|--|----|--|

FAMILY Gonodactylidae

- | | | | |
|-----|---|---------------------------|--|
| 183 | <i>Gonodactylellus demanii</i> (Henderson, 1893) | JUL, DZO, KHI, NUW | Jones 1986a; present study |
| 184 | <i>Gonodactylellus demanii</i> var. <i>spinosus</i> (Bigelow, 1893)*
[possible misidentification of <i>G. lanchesteri</i> (Manning, 1967)] | Locality not provided | Jones 1986a; Al-Kandari et al. 2020b |
| 185 | <i>Gonodactylus botti</i> Manning, 1975 | JUL, RZO, NUW, FI, KI, UI | Al-Kandari et al. 2020b; present study |
| 186 | <i>Gonodactylus smithii</i> Pocock, 1893 | JUL, FI, KI, UI | Al-Kandari et al. 2020b; present study |

FAMILY Nannosquillidae

- | | | | |
|-----|--|---------|--|
| 187 | <i>Bigelowina phalangium</i> (Fabricius, 1798) | MAH, FI | Al-Kandari et al. 2020b; present study |
|-----|--|---------|--|

FAMILY Squillidae

- | | | | |
|-----|---|--------|--|
| 188 | <i>Cloridina ichneumon</i> (Fabricius, 1798) | MAH | Al-Kandari et al. 2020b; present study |
| 189 | <i>Oratosquillina interrupta</i> (Kemp, 1911) | BI, AI | Manning 1990; present study |

A

76

Family Alpheidae

B

Alpheus lobidens De Haan, 1849

C



Figure 103. Dorsal (A) and lateral (B) views of *Alpheus lobidens* De Haan, 1849, Kuwait. Photographs by Arthur Anker.

E

Synonyms. *Alpheus lobidens lobidens* De Haan, 1849; (?) *Alpheus crassimanus* Heller, 1862; (?) *Alpheus lobidens polynesicus* Banner and Banner, 1974 (both probably valid species, see below).

F

Common Name. Green snapping shrimp.

Main Diagnostic Features. Species complex

1. Rostrum typically not reaching distal margin of first article of the antennular peduncle, with well-developed, somewhat sharp carina.
2. Major chela of “*edwardsii* type”, not particularly setose, with well-developed dorsal and ventral notches; dorsal shoulder not overhanging transverse groove.
3. Minor chela more or less sculptured, with balaeniceps crests in males, never in females.
4. Merus of third and fourth pereopods without strong distoventral tooth; dactylus simple.
5. Colour in life variable: usually greenish-brown, without black spots on pleon, or green- or brown-banded (species complex).
6. Size: maximal total body length about 45 mm.

G

Distribution. Indo-West Pacific from the Red Sea and South-East Africa to Japan, Australia, and Hawaii. Since several species are involved, the exact distribution of each of them remains to be determined.

H

Ecology. Benthic on rocky and mixed sand-mud-rock bottoms, largely intertidal and shallow subtidal (less than 5 m); free-living in burrows dug in muddy sand under large rocks.

I

J

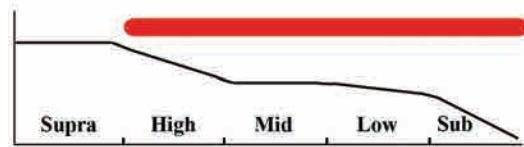


Figure 104. Bathymetric distribution of the species.

Remarks. *Alpheus lobidens* is a challenging species complex with at least three, and possibly more than six species (Anker and De Grave 2016; Anker et al. 2020b).

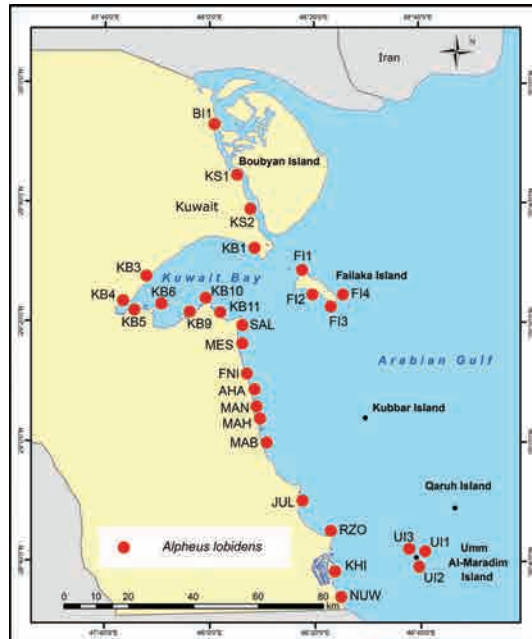


Figure 105. Presently known records of *Alpheus lobidens* in Kuwait.

The redescription of *A. lobidens* based on a specimen from Nagasaki by Cunha et al. (2020) is problematic as it did not correctly consider De Haan's extant dry-type specimen and did not seem to represent *A. lobidens sensu* De Haan (1849). Furthermore, the redescription and species comparisons in Cunha et al. (2020) do not contain any information on the colour pattern. The species from Kuwait, currently identified as *A. lobidens*, may correspond to *A. crassimanus* Heller, 1862, or another taxon. Thus, the revision of the *A. lobidens* complex can only move forward after a detailed redescription of the type specimen of *A. lobidens* and its comparison with freshly collected material, especially from Japan. Good illustrations of the general morphology of *A. lobidens s. lat.* can be found in Banner and Banner (1982); however, they may not correspond to *A. lobidens* of De Haan (1849).

Most Relevant References. De Haan (1833-1850); Banner and Banner 1974; Banner and Banner 1982; Anker et al. 2020b.

N



Figure 106. *Alpheus lobidens* on mixed sandy-rocky shore in Al-Sha'ab, Kuwait.

Figure 40. A species double-page in the present field guide.

- A - Colour index
- B - Taxonomic name
- C - Taxonomic authority
- D - One or different views of specimen
- E - Synonyms (invalid previous / different name)
- F - Vernacular name
- G - Morphological
- H - General distribution
- I - Ecology
- J - Bathymetric distribution
- K - Interesting facts
- L - Key references
- M - Presently known distribution in Kuwait
- N - Photograph of the animal in its natural habitat (if available)

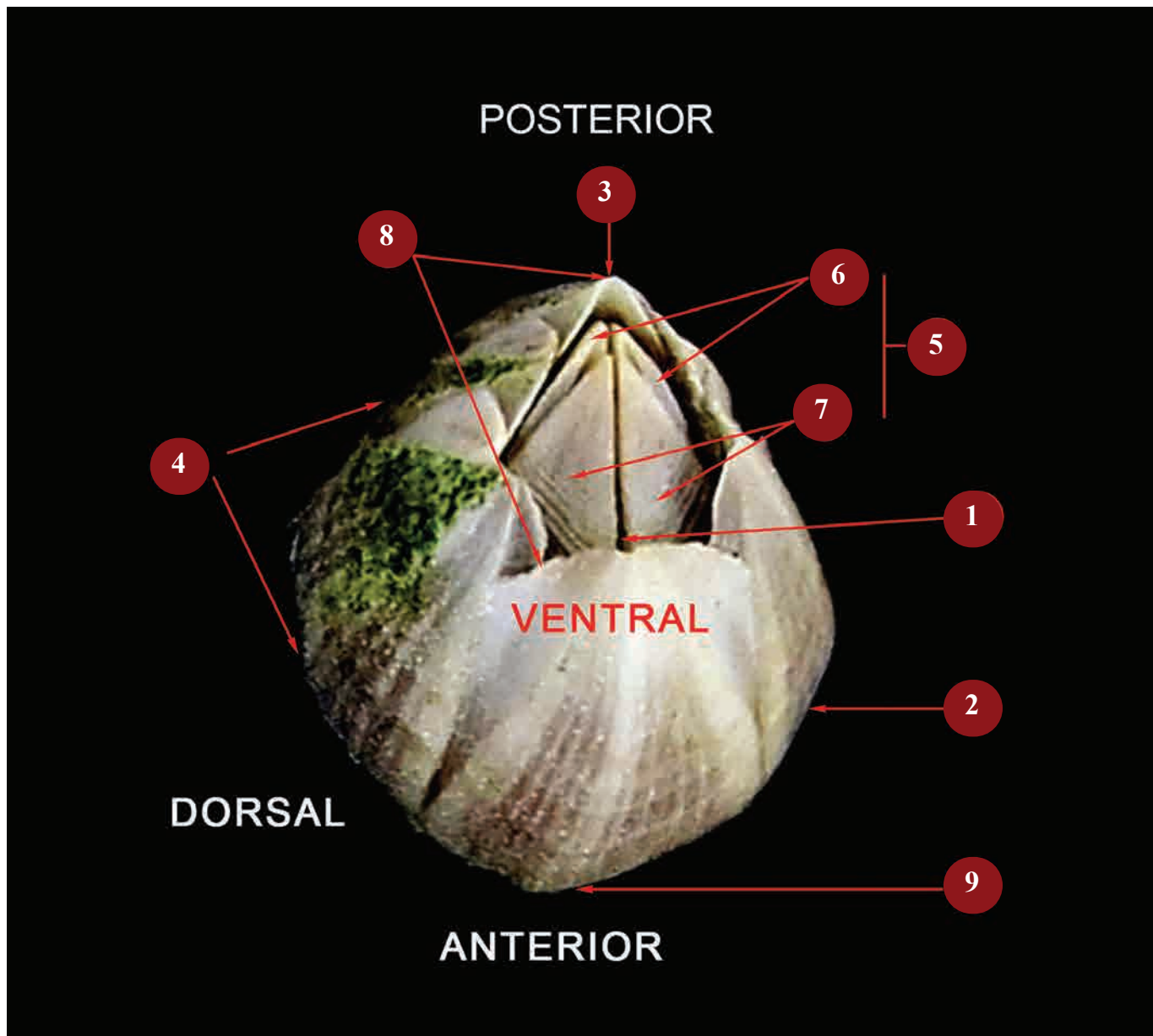


Figure 41. General morphology of Cirripedia exemplified by a balanomorph barnacle.

1. **Aperture** - opening at the apex of the cone surrounded by four opercular plates, thus forming a (door)
2. **Basis** - floor-like part of the barnacle attached to the rock or other support; calcareous in some species, membranous in others.
3. **Carina** - unpaired plate at the posterior end.
4. **Laterals** - conical shell wall is formed primitively of eight plates - lateral pairs of rostrolaterals, laterals, and carinolaterals.

5. **Operculum** - movable plates scuta and terga that form the cover of the opening through which the cirri are protruded. Opercular plates are attached at their basal edges to an opercular membrane that extends across the ventral orifice of the shell.
6. **Terga** - posterior paired opercular plates.
7. **Scuta** - anterior paired opercular plates.
8. **Orifice** - ventral opening of the shell.
9. **Rostrum** - anterior single plate.

Class Thecostraca
Subclass Cirripedia
Order Balanomorpha (Acorn barnacles)

Figure 42. Acorn barnacle *in situ* at a rocky shore of Al-Khiran, Kuwait. Photograph by Valeriy Skryabin.



Family Archaeobalaninae

Acasta sulcata Lamarck, 1818

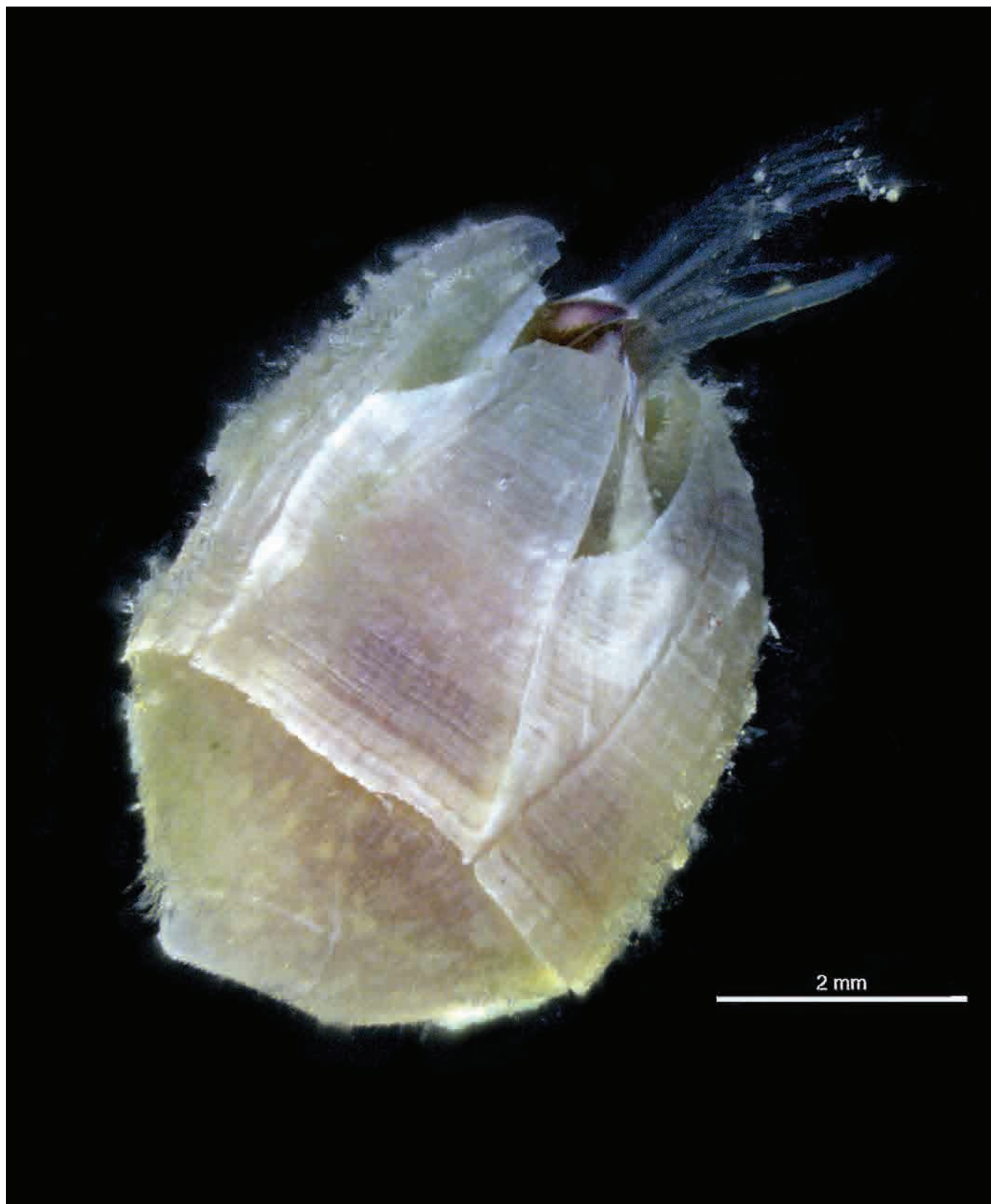


Figure 43. Lateral view of *Acasta sulcata* Lamarck, 1818, Kuwait. Photograph by Anna Zhadan.

Main Diagnostic Features.

1. Orifice rather small, with toothed edge. Basis saucer- or cup-shaped, pointed towards central umbo; rim crenate.
2. Externally, scutum with horizontal growth ridges; articular furrow shallow.
3. Spur of tergum broad, square-shaped, truncated at end, width slightly more than 1/2 of basal margin.
4. Sheath extending approximately half of parietes, with internal vesicular structure, inner shell surface below sheath with longitudinal ribs.
5. Shell white to pale yellow.
6. Size: 6 mm.

Distribution. Widely distributed in the Indo-West Pacific, including the Arabian-Persian Gulf and the Sea of Oman.

Ecology. Mostly in mid- and low intertidal; associated with sponges.



Figure 44. Bathymetric distribution of the species.

Remarks. *Acasta sulcata*, originally described by the famous French naturalist Jean-Baptiste Lamarck, is one of the most commonly reported and widely distributed species of sponge barnacles. In Kuwait, it is currently recorded only from Failaka; however, further prospection of intertidal sponges will likely result in more findings. Furthermore, this species was also recorded in Mina Al-Ahmadi of Kuwait by Stubbings (1961). For detailed descriptions and illustrations of the species, see Yu et al. (2017). Moreover, two other species of the barnacle family Archaeobalaninae have been reported from Kuwait: *Conopea calceola* (Ellis, 1758) and *Striatobalanus amaryllis* (Darwin, 1854) (see the following pages). The closely related genera *Conopea* and *Acasta* were taxonomically assessed recently by Kolbasov et al. (2016).

Most Relevant References. Stubbings 1961; Yu, et al. 2017; Kolbasov et al. 2016.

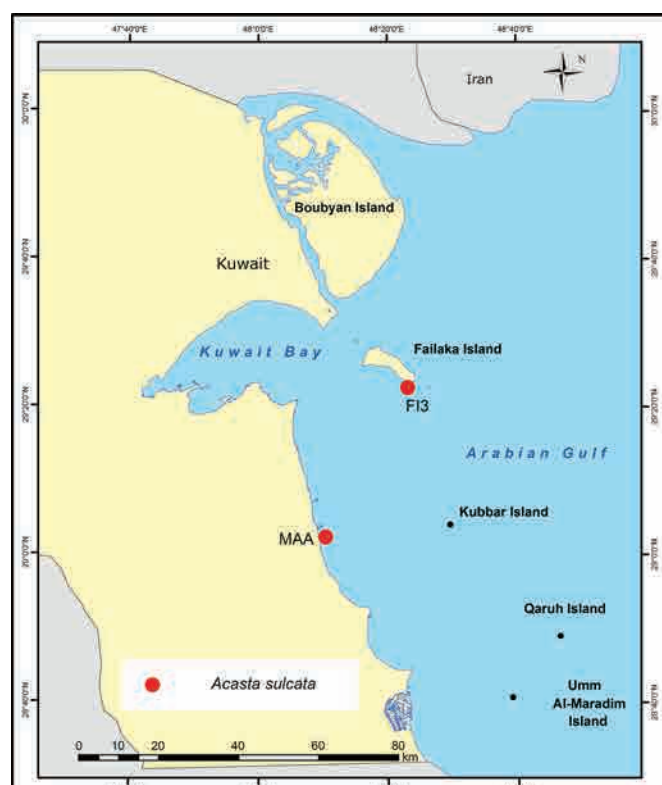


Figure 45. Presently known records of *Acasta sulcata* in Kuwait.



Figure 46. *Acasta sulcata*: three individuals (A); one of them in lateral view (B); barnacle embedded in its sponge host, with cirri extended (C), Kuwait. Photographs by Anna Zhadan.

Family Balanidae

Amphibalanus amphitrite (Darwin, 1854)

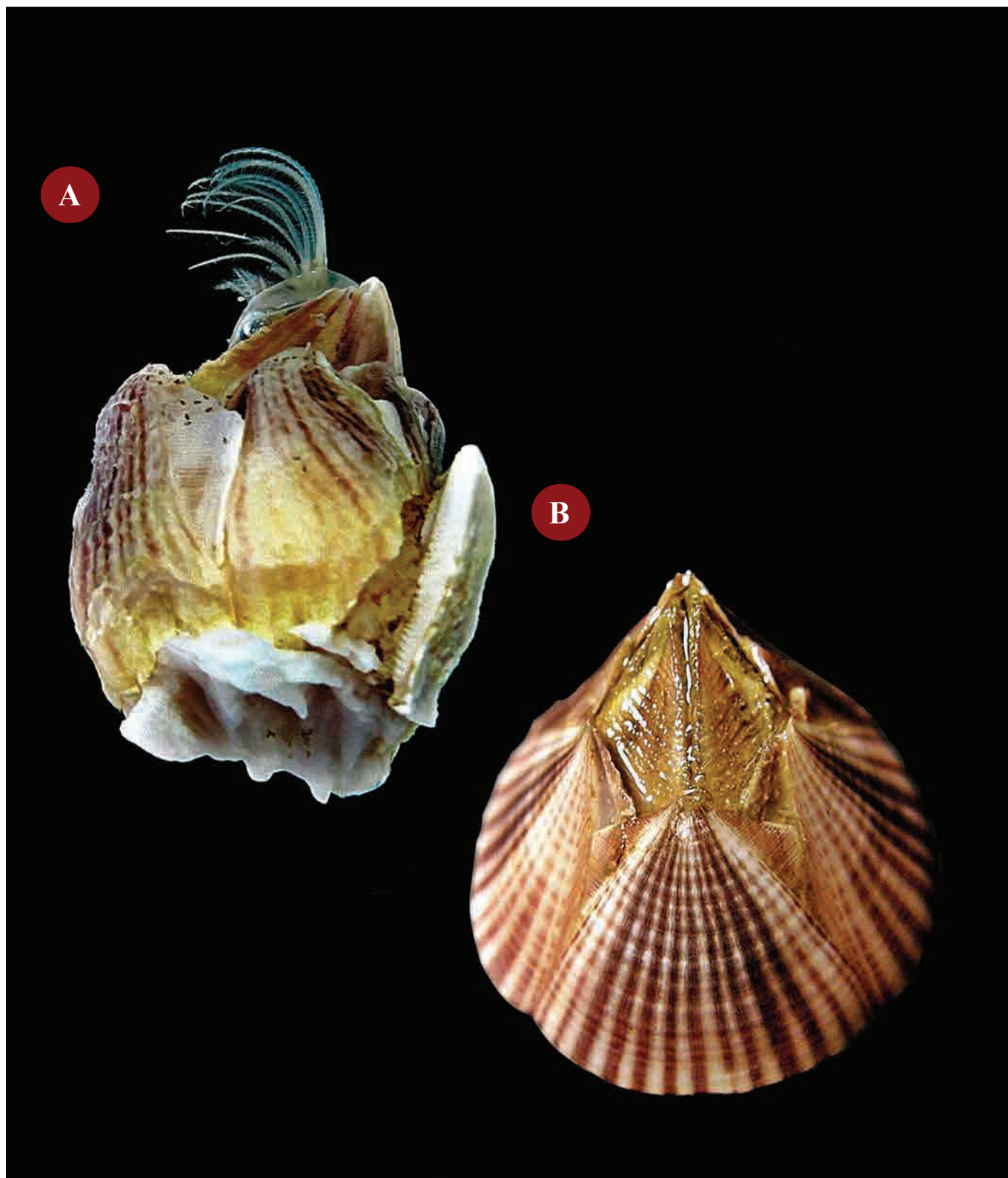


Figure 47. Lateral (A) and frontal (B) views of *Amphibalanus amphitrite* (Darwin, 1854), Kuwait. Photograph by Valeriy Skryabin.

Synonym. *Balanus amphitrite* Darwin, 1854.

Main Diagnostic Features.

1. Medium-sized, conical, fouling, sessile barnacle, the largest at the base.
2. Test surface with vertical ribbing.
3. Operculum is diamond-shaped, protected by a movable lid formed by two symmetrical triangular plates.
4. Shell plates are white to pale buff, with pinkish-red, purple-red, or red-brown vertical stripes.
5. Size: maximal height about 30 mm.

Distribution. Almost cosmopolitan, including most of the Indo-Pacific and the Arabian-Persian Gulf.

Ecology. High to low intertidal; naturally on rocks, also on jetties, oil platforms, and various larger floating objects, including boats and ships.

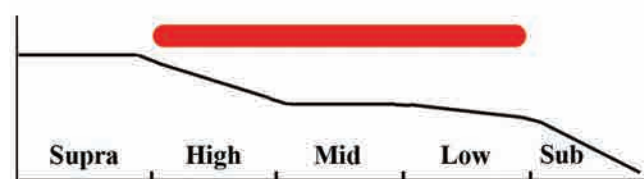


Figure 48. Bathymetric distribution of the species.

Remarks. *Amphibalanus amphitrite* was originally described by Charles R. Darwin in 1854 as *Balanus amphitrite* (see Clare and Hoeg 2008, for an unsuccessful tentative to retain the original name). Today, the species is one of the most widely distributed fouling barnacles carried by long-distance vessels. Illustrations and/or colour photographs of *A. amphitrite* can be found in Chan et al. (2009: Fig. 208) and especially in Shahdadi et al. (2014: Fig. 7), Pochai et al. (2017: Fig. 9) and Poltarukha (2017: Fig. 3); the latter author's material was recorded from Kuwait. Stubbings (1961) recorded this species from Mina Al-Ahmadi.

Most Relevant References. Darwin 1854; Clare and Hoeg 2008; Chan et al. 2009; Shahdadi et al. 2014; Pochai et al. 2017; Poltarukha 2017.

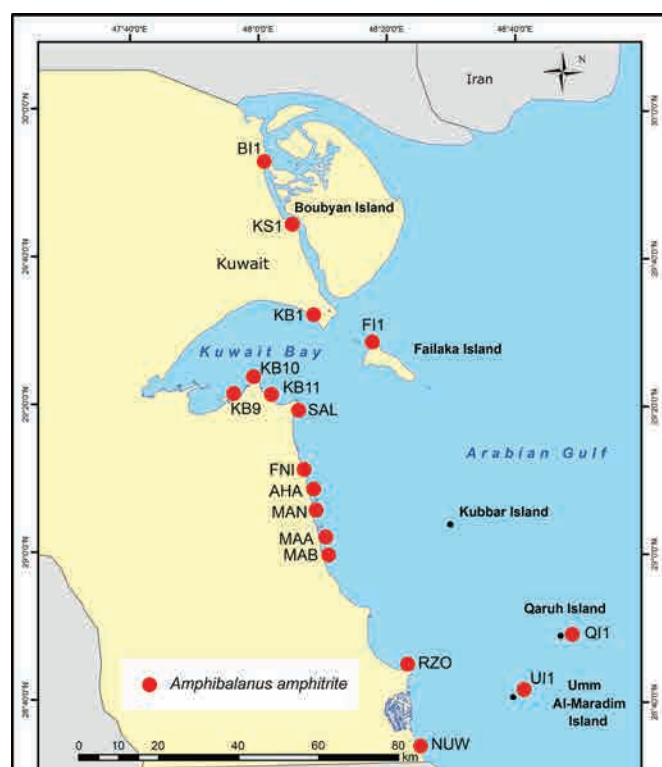


Figure 49. Presently known records of *Amphibalanus amphitrite* in Kuwait.



Figure 50. *Amphibalanus amphitrite* in the intertidal areas of Umm Al-Maradim Island (A) and Khor Al-Subiyah (B), Kuwait. Photographs by Valeriy Skryabin.

Family Balanidae

Striatobalanus amaryllis (Darwin, 1854)



Figure 51. lateral view of *Striatobalanus amaryllis* (Darwin, 1854), Kuwait. Photograph by Valeriy Skryabin.

Synonyms. *Balanus amaryllis* Darwin, 1854; *Chirona amaryllis* (Darwin, 1854).

Main Diagnostic Features.

1. Parietes conical, surface with pink radiating patterns; radii wide.
2. Scutum triangular; tergum narrow; external surface of scutum and tergum more or less strongly striated.
3. Beak produced apically; dorsal medial furrows very deep; spur long, narrow and blunt.
4. Orifice more or less rhomboid, diameter about half of basis diameter in conical individuals to subequal to basis diameter in cylindrical ones.
5. Shell whitish or white with purple areas or purple stripes, or purplish with red stripes.
6. Size: largest specimens reaching basal diameter of 50 mm and height 42 mm.

Distribution. Indo-West Pacific from the northern Indian Ocean to southern Japan and Australia.

Ecology. Typically in the mid- and low intertidal, but also in the shallow subtidal and deep-water habitats (maximal recorded depth: 500 m, according to Shahdadi et al. 2014); naturally fouling on rocks, but also on various artificial surfaces, including oil platform installations.



Figure 52. Bathymetric distribution of the species.

Remarks. *Striatobalanus amaryllis* was originally described by Charles R. Darwin in 1854 as *Balanus amaryllis*.

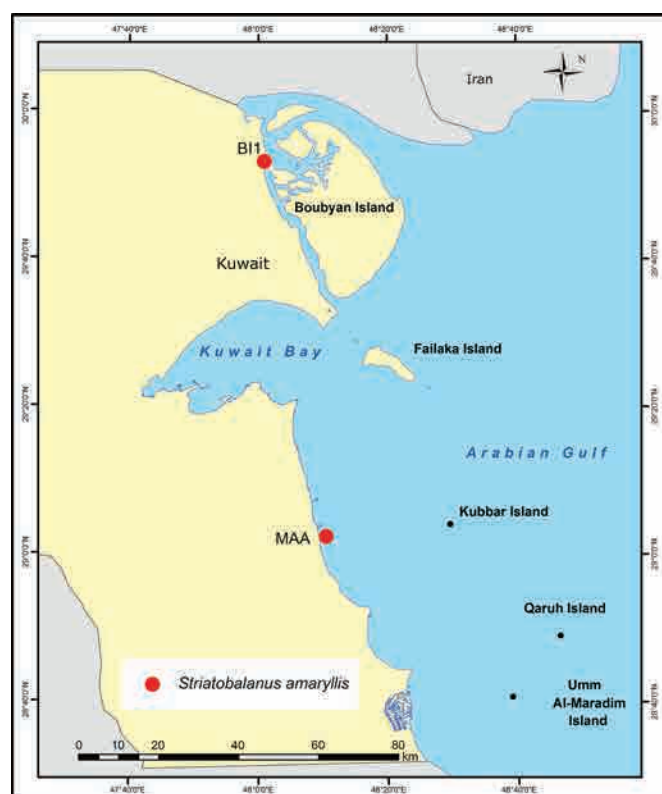


Figure 53. Presently known records of *Striatobalanus amaryllis* in Kuwait.

The species was re-diagnosed and illustrated by Chan et al. (2009: Figs. 190–192), with additional illustrations and morphological notes published by Shahdadi et al. (2014: Fig. 6). Stubbings (1961) recorded *S. amaryllis* for the first time from the Mina Al-Ahmadi port installations and provided some remarks on the morphology and size of Kuwait's specimens.

Most Relevant References. Darwin 1854; Stubbings 1961; Chan et al. 2009; Shahdadi et al. 2014.



Figure 54. Oyster reef of northwestern Boubyan Island, from where *Striatobalanus amaryllis* has been reported, Kuwait. Photograph by Valeriy Skryabin.

Family Balanidae

Megabalanus tintinnabulum (Linnaeus, 1758)

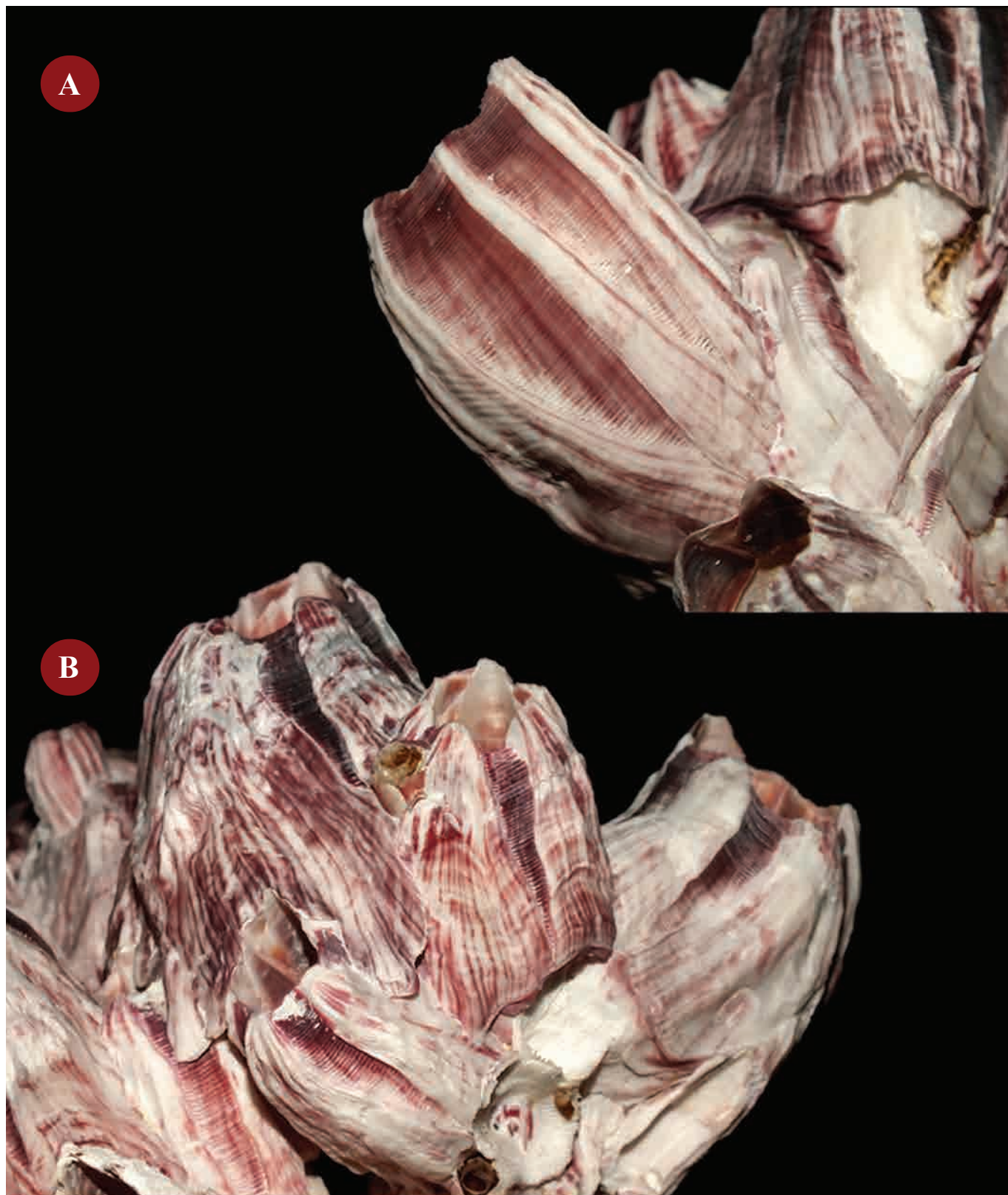


Figure 55. lateral view of single individual (A) and cluster (B) of *Megabalanus tintinnabulum* (Linnaeus, 1758), Kuwait. Photograph by Valeriy Skryabin.

Synonym. *Balanus tintinnabulum* Linnaeus, 1758.

Main Diagnostic Features.

1. Growth ridges of scutum not scalloped by longitudinal striae.
2. Parietes without spines or spinose projections (parietes smooth to roughened, occasionally weakly plicate).
3. Colour: reddish-purple, purplish-pink to blackish-purple, often with darker or lighter longitudinal striae.
4. Size: up to 50 mm in height and 65 mm in diameter.

Distribution. Cosmopolitan, including most of the tropical and subtropical Indo-Pacific and the Arabian-Persian Gulf.

Ecology. High to low intertidal; naturally on rocks, jetties, oil platforms and larger floating objects, including boats and ships.

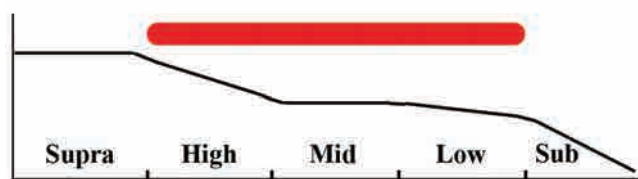


Figure 56. Bathymetric distribution of the species.

Remarks. *Megabalanus tintinnabulum* was one of the first tropical barnacles described scientifically. Similar to the previous species, *M. tintinnabulum* is a widely distributed fouling barnacle species. The *M. tintinnabulum* species complex was taxonomically revised by Henry and McLaughlin (1986). Good illustrations and/or colour photographs of *M. tintinnabulum* can also be found in Chan et al. (2009: Fig. 224–226) and Pochai et al. (2017: Fig. 11). It can be noted that *M. tintinnabulum* has comparatively larger shell plates than *A. amphitrite*. The two species can be distinguished by their colour, with *M. tintinnabulum* presenting a brownish-red surface with some irregular and diffuse longitudinal stripes and *A. amphitrite* presenting purplish longitudinal striations (see above).

Most Relevant References. Henry and McLaughlin 1986; Chan et al. 2009; Shahdadi et al. 2014; Pochai et al. 2017.

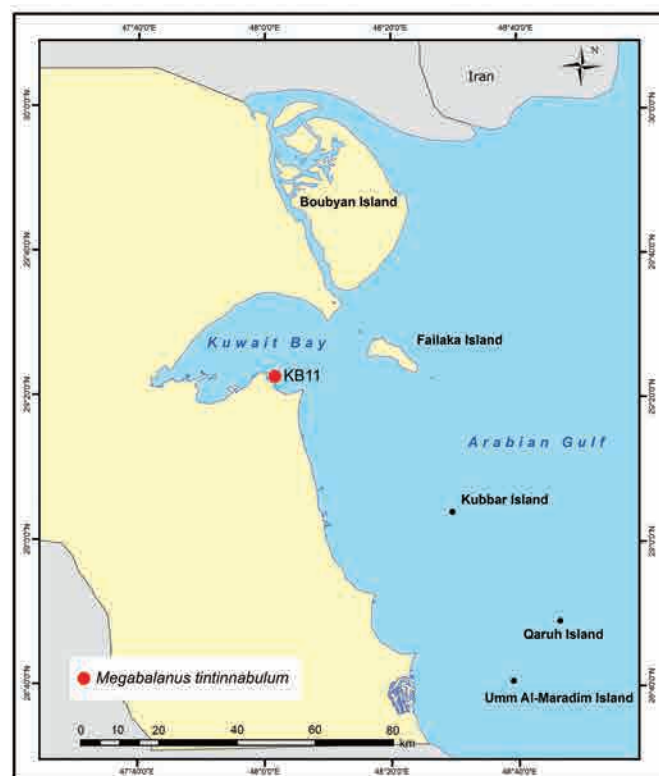


Figure 57. Presently known record of *Megabalanus tintinnabulum* in Kuwait.



Figure 58. Dense clusters of *Amphibalanus amphitrite* and *Megabalanus tintinnabulum* on a rocky intertidal at Al-Sha'ab, Kuwait. Photograph by Valeriy Skryabin.

Family Chthamalidae

Microeuraphia permitini (Zevina and Litinova, 1970)



Figure 59. Ventral view of *Microeuraphia permitini* (Zevina and Litinova, 1970), Kuwait. Photograph by Valeriy Skryabin.

Synonym. *Chthamalus permitini* Zevina and Litvinova, 1970.

Main Diagnostic Features.

1. Seams simple, straight, orifice diamond-shaped or hexagonal.
2. Tergum externally with marked groove along scutal margin; scutum with tergal margin with submarginal groove and distinct articular ridge.
3. Suture between opercular plates straight or (in eroded specimens) zigzag-shaped, not fused.
4. Basis membranous; conical shells with 6 thin, smooth or regularly ribbed fragile plates.
5. Colour varying from pale to dark brown, sometimes greenish brown or greyish.
6. Size: carino-rostral diameter of largest specimens about 13 mm.

Distribution. Western Indian Ocean, including the Red Sea, Oman, Madagascar and the Arabian-Persian Gulf (Poltarukha 2017).

Ecology. High to low intertidal, rarely also in the supra-intertidal; naturally on rocks, logs, or mangrove roots, but also on jetties, oil platforms, mollusk shells, and other barnacles (e.g. *Amphibalanus*, and *Tetraclita*) and various floating objects.



Figure 60. Bathymetric distribution of the species.

Remarks. *Microeuraphia permitini* is the most common chthamalid barnacle (also known as “star barnacles”) in the Arabian-Persian Gulf. The species was reported from Kuwait for the first time by Stubbings (1961) at Mina Al-Ahmadi port under the name “*Chthamalus malayensis* Pilsbry, 1916” and recently confirmed by Poltarukha (2017). Good illustrations and/or photographs of *M. permitini* can be found in the original description by Zevina and Litvinova (1970), as well as in Shahdadi and Sari (2011: Fig. 3A-H) and Poltarukha (2017: Fig. 1). Savari et al. (2017) studied the general aspects of the reproduction of *M. permitini* in three different ecological settings, i.e., a mangrove swamp, an exposed jetty and a sheltered jetty, in Iran.

Most Relevant References. Stubbings 1961; Shahdadi and Sari 2011; Shahdadi et al. 2014; Savari et al. 2017; Poltarukha 2017.

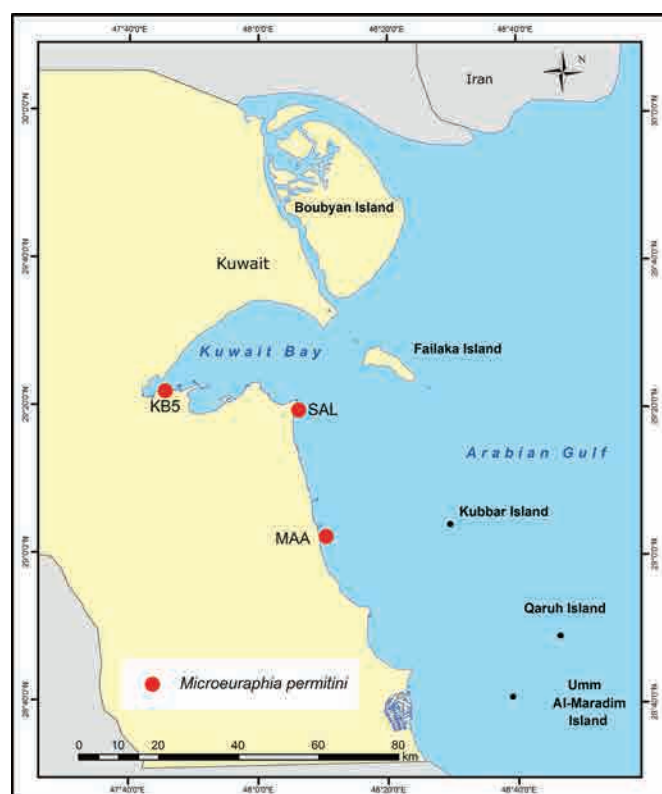


Figure 61. Presently known records of *Microeuraphia permitini* in Kuwait.



Figure 62. Colony of *Microeuraphia permitini* on a rocky substrate, Kuwait. Photograph by Valeriy Skryabin.

Family Tetracelitidae

Tetracelita rufotincta Pilsbry, 1916

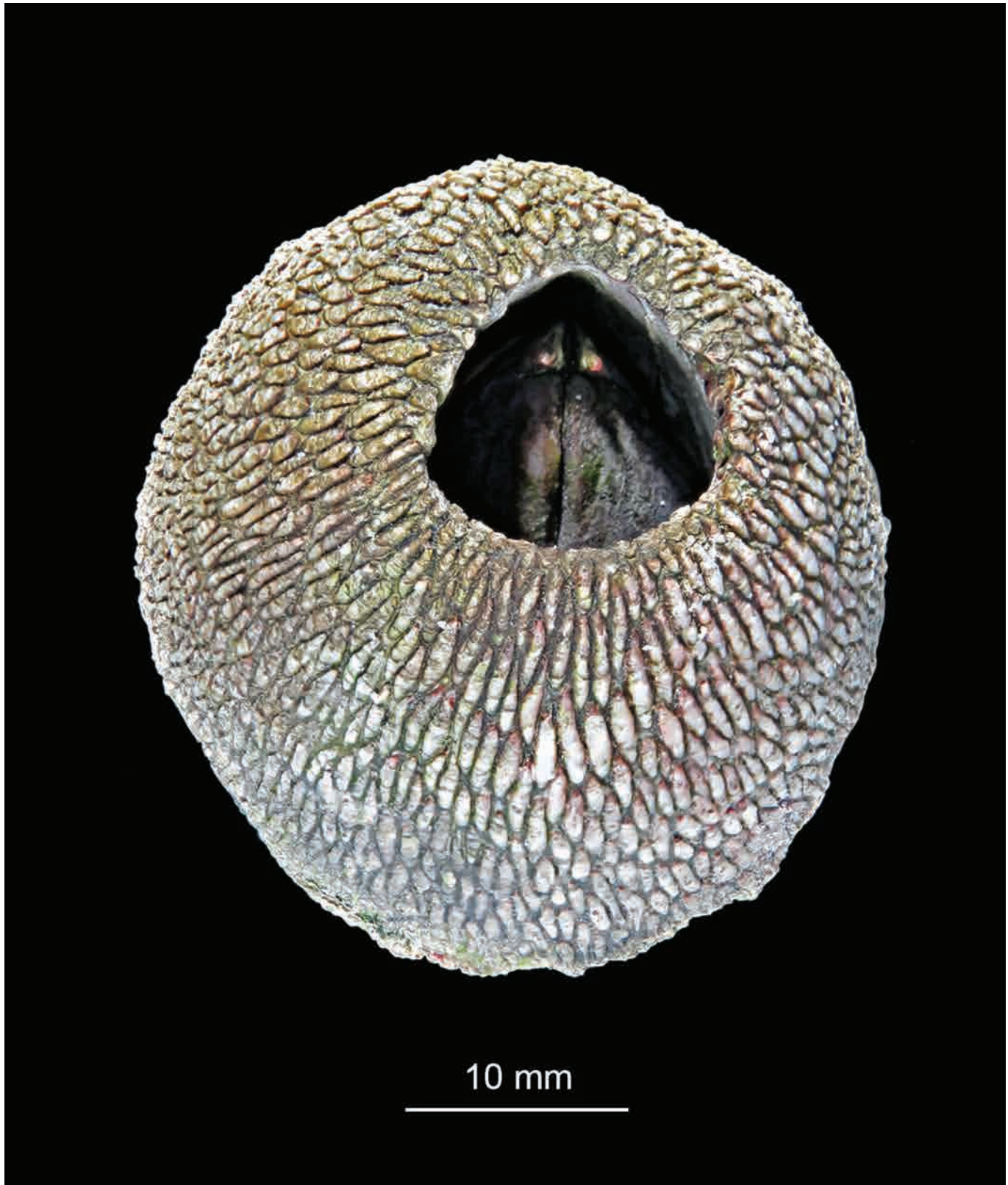


Figure 63. Ventral view of *Tetracelita rufotincta* Pilsbry, 1916, Kuwait. Photograph by Valeriy Skryabin.

Synonym. *Tetraclita squamosa rufotincta* Pilsbry, 1916.

Main Diagnostic Features.

1. Shell with 4 rough plates.
2. Parietes tuberos, with minute ribs externally.
3. Scutum with 10 oblique teeth on occludent margin.
4. Tergum with 6–8 depressor muscle crests.
5. Colour: grey with reddish-pink or purplish tinge.
6. Size: basal diameter to 40 mm; maximal height about 33 mm.

Distribution. Western Indian Ocean, including the Red Sea, the Arabian-Persian Gulf, Oman, India, East Africa and Madagascar (Poltarukha 2017).

Ecology. High to low intertidal; naturally on rocks, logs or mangrove roots, on jetties and ships.

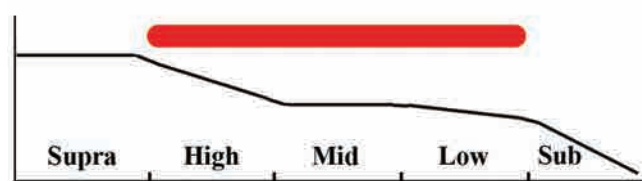


Figure 64. Bathymetric distribution of the species.

Remarks. *Tetracita rufotincta* is the only tetraclitid barnacle in Kuwait and therefore can be easily distinguished from all other barnacles by its very characteristic shell. The species was first reported from Kuwait by Poltarukha (2017), who provided a detailed redescription with illustrations (line drawings) of main shell plates and several appendages (see his Fig. 2). A concise diagnosis of *T. rufotincta*, accompanied by excellent colour photographs, may be found in Shahdadi et al. (2014).

Most Relevant References. Pilsbry 1916; Shahdadi et al. 2014; Poltarukha 2017.



Figure 66. Single individual of *Tetracita rufotincta* on an exposed rocky shore of Umm-Al-Maradim Island, Kuwait. Photograph by Valeriy Skryabin.

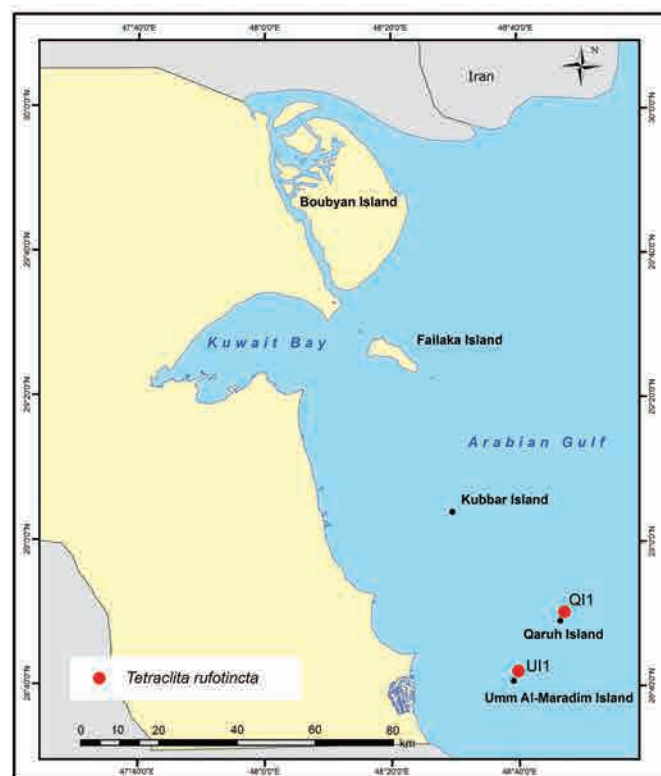


Figure 65. Presently known records of *Tetracita rufotincta* in Kuwait.



Figure 67. Colony of *Tetracita rufotincta* on a jetty of Umm Al-Maradim Island, Kuwait. Photograph by Valeriy Skryabin.

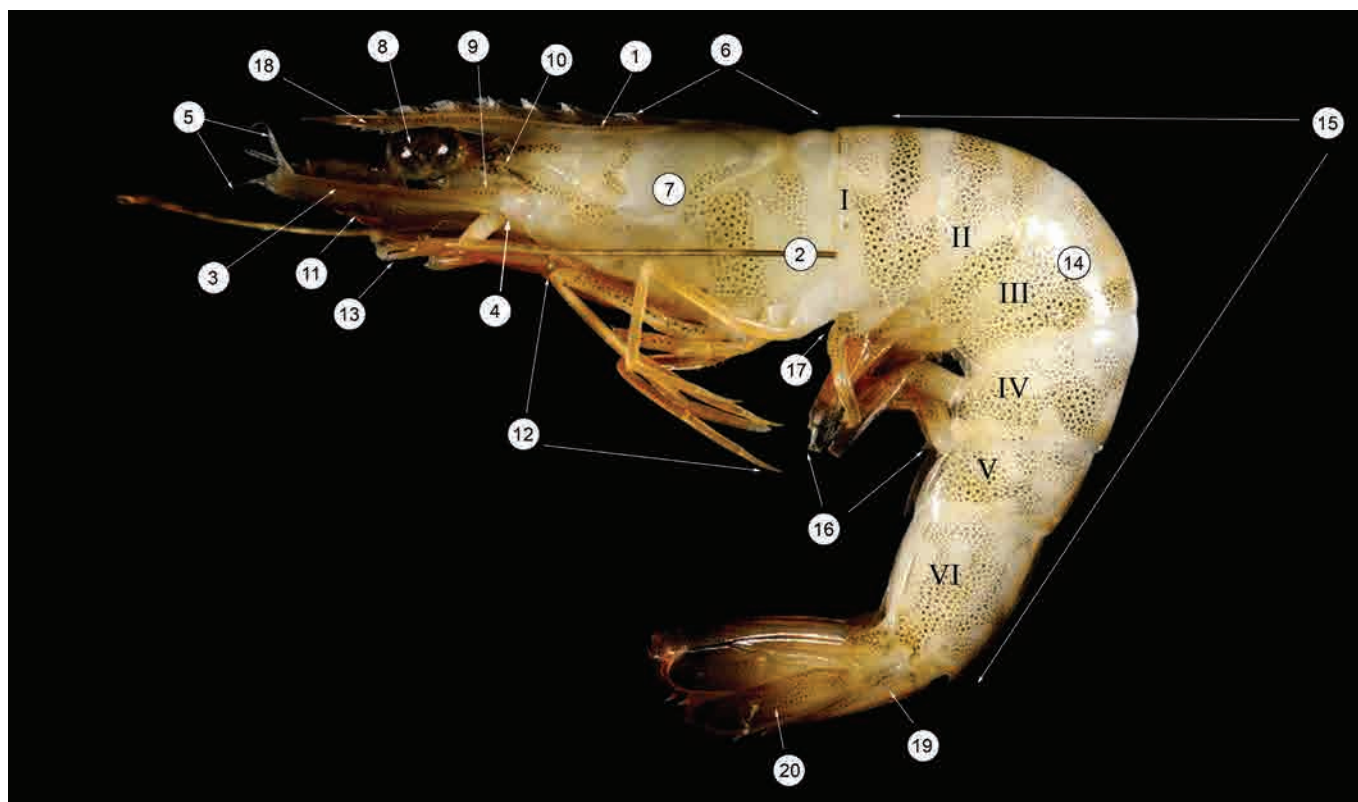


Figure 68. General morphology of a shrimp-like decapod crustacean exemplified by *Penaeus semisulcatus*, Dendrobranchiata.

1. **Adrostral carina** - ridge flanking the rostrum.
2. **Antenna** - second and typically larger pair of antennae (sensory appendages), biramous, consisting of peduncle (typically composed of protopod, endopod, and scaphocerite) and distal flagellum.
3. **Antennal scale** - also known as scaphocerite, modified blade-like exopod of antenna.
4. **Antennal spine** - in some shrimp-like decapods, a sharp spine-like projection on each anterolateral margin of the carapace, below the eye orbit and typically near the base of the antenna.
5. **Antennule** - first and typically smaller pair of antennae, consisting of basal peduncle and one or more distal flagella; each peduncle typically with statocyst protected by scale-like stylocerite; flagella with sensory setae or aesthetascs; in crab-like (brachyuran) decapods antennules may be folded into an orbito-antennular pit of the carapace.
6. **Cephalothorax** - anterior division (tagma) of body, consisting of head (cephalon) fused with thorax and entirely or almost entirely covered by carapace (shield).
7. **Carapace** - shield dorsally and laterally covering the cephalothorax.
8. **Compound eye** - complex eye consisting of array of contiguous ommatidia with common optic nerve trunks; found in crustaceans, insects and some myriapods.
9. **Hepatic carina** - longitudinally or obliquely disposed ridge of variable length lying ventral to the hepatic region of the carapace, sometimes extending almost to its anterior margin.
10. **Hepatic spine** - in shrimp-like decapods, an anteriorly directed, spine-like projection on the hepatic region on each side of the carapace.
11. **Maxilliped III** - the most external mouthpart appendage; maxillipeds I-III represent highly modified and anteriorly displaced first three pairs of thoracic appendages (thoracopods) and basically consist of protopod (bearing endite and epipodite), endopod, and exopod; may be pediform (leg-like, in most shrimps) or broadened and operculiform (in most crabs).
12. **Pereiopods** - also spelled «pereopods», five pair of appendages of thorax posterior to maxilliped III; biramous (rare in benthic decapods) or uniramous, consisting of protopod, endopod, and (rarely) exopod; in most cases, representing walking leg or claw and subdivided into coxa, basis (both part of protopod), ischium, merus, carpus, propodus, and dactylus (all part of endopod); may be reduced or modified for burrowing, grasping, carrying, etc.
13. **Cheliped** - pereiopod terminating in a chela or claw, consisting of a fixed finger (pollex, extension of propodus) and movable finger (dactylus).
14. **Pleon** - also known as «abdomen», posterior division (tagma) of body, consisting of 6 somites (pleomeres or pleonite), each bearing pair of appendages (pleopods); sixth pleomere (with uropods) continues posteriorly by telson (not a segment).
15. **Pleomere** - or pleonite, segment of pleon («abdomen»).
16. **Pleopods** - appendages of pleon, also known as swimmerets, originally one pair on each pleomere; typically consisting of a base (protopod) and two branches (endopod and exopod), originally used in swimming, but may be variously modified, for instance, as copulatory structures (e.g. gonopod, petasma) in male, or as egg-brooding appendages in females.
17. **Gonopods** - modified first and second pleopods in crabs, often referred to as a stylet-shaped G1 and cylindrical, tube-shaped G2.
18. **Rostrum** - unpaired anterior extension of the carapace projecting between eyestalks (ocular peduncles); often toothed and elongate in many shrimp-like decapods, lobsters, etc., may be reduced, absent or present as broad rounded lobe or two horn-like spines.
19. **Telson** - posterior-most, anus-bearing «part» of the body (not a true segment / somite); may form a tail-fan together with uropods or be reduced.
20. **Uropod** - modified pleopod of the last (sixth) pleomere, typically flattened and consisting of basal protopod and two rami (endopod and exopod); may form a tail-fan together with the telson.

Class Malacostraca
Order Decapoda
Suborder Dendrobranchiata(Prawns)

Figure 69. Green tiger prawn *Penaeus semisulcatus* from Al-Khiran, Kuwait. Photograph by Yaser Mohammed Abdulraheem.



Family Penaeidae

Metapenaeus affinis (H. Milne Edwards, 1837)

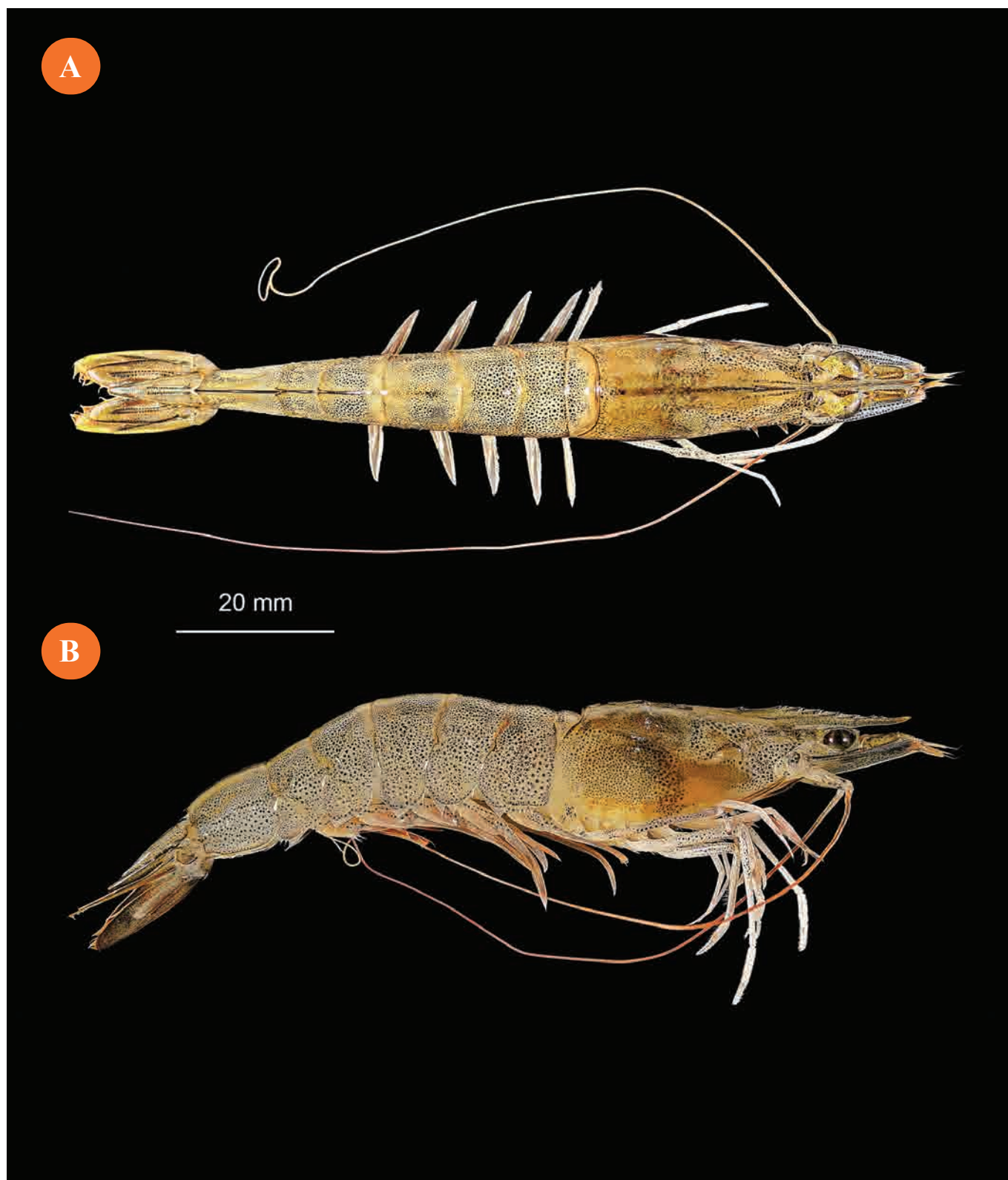


Figure 70. *Metapenaeus affinis* (H. Milne Edwards, 1837) in dorsal (A) and lateral (B) views of a specimen from a fish market in Kuwait City, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Penaeus mutatus* Lanchester, 1901; *Metapenaeus necopinans* Hall, 1956; *Metapenaeus ivanovi* Hassan, 1978.

Common Names. Jinga prawn, Indian prawn, Rubiyan.

Main Diagnostic Features.

1. Carapace and pleon partly pubescent.
2. Rostrum straight, with tip curved upward, armed with 7-10 dorsal teeth (not including epigastric tooth), without ventral teeth.
3. Oblique branchiocardiac carina extending from small hepatic spine.
4. Adrostral carina extending slightly beyond epigastric tooth.
5. Male fifth pereopod merus modified, with proximal notch followed by protuberance.
6. Overall colour pale beige or greyish speckled with darker chromatophores, denser on rostrum and tail fan; distal portion of uropods with neon-green colour; antennal flagella reddish.
7. Size: maximal total length: 105 mm for males and 118 mm for females.

Distribution. The Indo-West Pacific from the Arabian-Persian Gulf to the South China Sea, Papua New Guinea and Hawaii; Lessepsian migrant into the eastern Mediterranean Sea, with records from Turkey and Egypt (Aydin et al. 2009; Bakir and Aydin 2016; Ahmad et al. 2021).

Ecology. Benthic on sand-mud and mud bottoms, from the shallow subtidal to 60 m; juveniles are often found on intertidal mudflats or near estuaries or mangrove creeks.

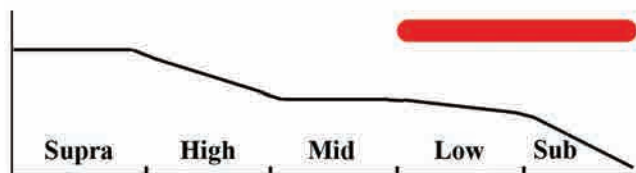


Figure 71. Bathymetric distribution of the species.



Figure 73. *Penaeus* sp., probably young *P. monodon*, in situ in Al-Khiran, Kuwait. Photograph by Yaser Mohammed Abdulraheem.

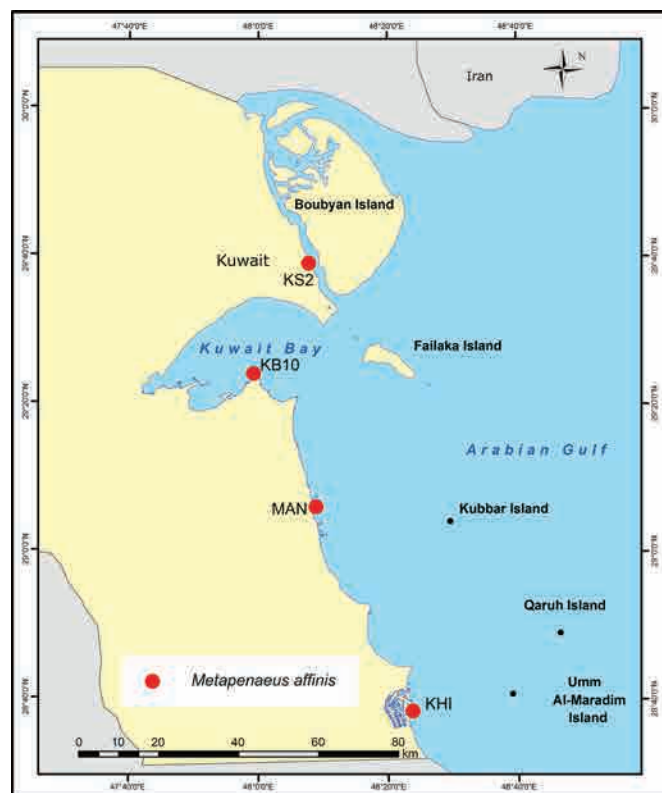


Figure 72. Presently known records of *Metapenaeus affinis* in Kuwait.

Remarks. *Metapenaeus affinis* is the second most important commercial prawn in Kuwait, after *Penaeus semisulcatus* (see below) and is also very popular in India and Indonesia. Illustrations of morphological characteristics of *M. affinis* were provided by Hall (1962), Bakir and Aydin (2016), and Ahmed et al. (2021). The abundance and seasonal migration of *M. affinis* in the Shatt Al-Arab delta were studied by Salman et al. (1990). A general synopsis of the morphology and biology of the species may be found in the FAO Fisheries Synopsis No. 98 (<https://www.fao.org/3/ac765t/AC765T10.htm>).

Most Relevant References. Holthuis 1980; Salman et al. 1990; Bakir and Aydin 2016; Ahmed et al. 2021.



Figure 74. Penaeid prawns on sale at a fish market in Kuwait City, among them possibly *Metapenaeus affinis* (smaller pinkish prawns) and *Penaeus semisulcatus* (larger greenish prawns). Photograph by Arthur Anker.

Family Penaeidae

Penaeus semisulcatus De Haan, 1844



Figure 75. *Penaeus semisulcatus* De Haan, 1844: lateral view of a specimen from Taiwan (A) and close-up of the frontal region of the shrimp off Al-Khiran, Kuwait (B). Photographs by Tin-Yam Chan (A) and Yaser Mohammed Abdulraheem (B).

Synonyms. *Penaeus ashiaka* Kishinouye, 1900; *Penaeus manilensis* de Procé, 1822; *Penaeus monodon manillensis* Villaluz and Arriola, 1938; *Penaeus semisulcatus paucidentatus* Parisi, 1919.

Common Names. Green tiger prawn (FAO); Grooved tiger prawn; Flower shrimp.

Main Diagnostic Features.

1. Carapace and pleon uniformly glabrous.
2. Rostrum more or less straight, armed with 7–8 dorsal and 2–3 ventral teeth.
3. Hepatic carina inclined downward and anteriorly.
4. Adrostral carina reaching well beyond epigastric tooth.
5. Overall colour pale beige-olive or pale greenish-brown with greyish spots, darker greenish-brown transverse bands and red-white banded (sometimes plain dark red-brown) antennal flagella (see Jahromi et al. 2019).
6. Size: maximal total length: 180 mm for males and 228 mm for females.

Distribution. Indo-West Pacific from the Red Sea and eastern Africa to Japan and Australia; Lessepsian migrant to the Mediterranean Sea.

Ecology. Benthic on sand and mud bottoms, at a depth range of 2–300 m (in the shallower Gulf at 2–30 m); juveniles sometimes found in tide pools or among algae or seagrass in 0.5–1 m.

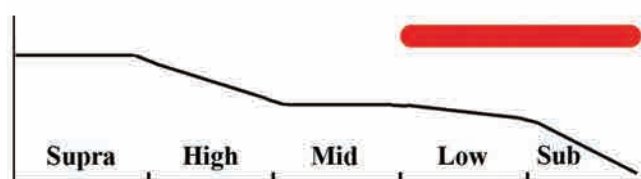


Figure 76. Bathymetric distribution of the species.

Remarks. *Penaeus semisulcatus* is one of the most important commercial prawns in Kuwait (Carpenter et al. 1997b) and one of the most common penaeids in the Arabian-Persian Gulf, based on the abundance of protozoa and mysis larvae in the planktonic samples taken along the Arabian-Persian Gulf's southern coast from Kuwait to UAE (Al-Aidaros 1993). The green tiger prawn is trawled offshore and cultured in ponds (Türkmen 2007). Due to its commercial interest, the biology of *P. semisulcatus* is well known: for instance, its natural movement and migration patterns in the Arabian-Persian Gulf were studied by Niamamandi et al. (2010), whereas its larval development and reproductive patterns (maturation and spawning) were described by Türkmen (2005) and Radhakrishnan et al. (2000), respectively; its complete mitochondrial genome is also known (Zhong et al. 2019). *Penaeus semisulcatus* may be relatively common in Kuwait's waters and was recorded from the country for the first time by Motoh (1975a), who published black and white colour photographs of the species. The best taxonomic account of *P. semisulcatus* is that of Dall (1957: Fig. 6), who contrasted it morphologically to the closely related *P. esculentus* and *P. monodon*.

Most Relevant References. De Haan 1844; Dall 1957; Holthuis 1980; Carpenter et al. 1997b; Jahromi et al. 2019; Zhong et al. 2019.

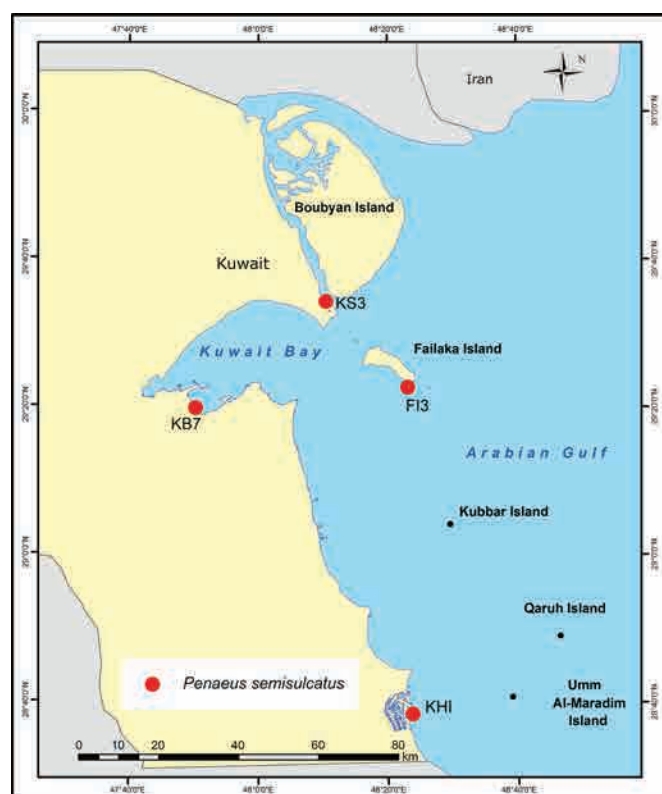


Figure 77. Presently known records of *Penaeus semisulcatus* in Kuwait.



Figure 78. Juvenile of *Penaeus* sp. with red-white banded antennae, probably *P. semisulcatus*, collected with a large hand net in the shallow water of Failaka Island, Kuwait. Photograph by Arthur Anker.



Figure 79. Lateral view of *Penaeus semisulcatus* from a seafood market in Kuwait City, Kuwait. Photograph by Sergei Khvorov.





Figure 80. Young individuals of *Penaeus* sp. from Al-Nuwiseeb, Kuwait. Photographs by Eslam Basuny.

Family Sergestidae

Acetes japonicus Kishinouye, 1905



Figure 81. Female of *Acetes japonicus* Kishinouye 1905, in lateral view, from Boubyan Island, Kuwait. Photograph by Sergei Khvorov (from Al-Yamani et al. 2011).

Synonyms. *Acetes dispar* Hansen, 1919; *Acetes cochinesis* Rao, 1968.

Common Name. Akiami paste shrimp.

Main Diagnostic Features.

1. Body translucent or semitranslucent.
2. Carapace with poorly developed crests and grooves.
3. Rostrum shorter than eyestalks, with first dorsal tooth.
4. Fourth and fifth pair pereopods lacking.
5. Size: maximal body length about 27.5 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf to Japan and Indonesia.

Ecology. Epipelagic; in shallow coastal waters (usually less than 50 m) over muddy bottoms.

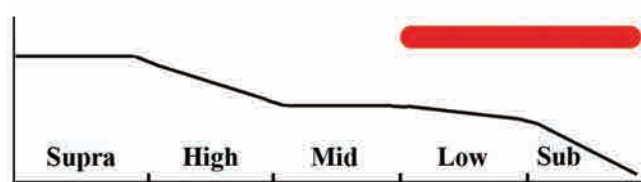


Figure 82. Bathymetric distribution of the species.

Remarks. *Acetes japonicus* was recorded from Kuwait by Al-Yamani et al. (2011), mainly from the coastal waters around Boubyan Island. However, this record was apparently not taken into the account by Vereshchaka et al. (2016), where the distribution range of *A. japonicus* or any other species of *Acetes* does not include the Arabian-Persian Gulf. The life history of the Japanese populations of this species was studied by Ikematsu (1953).

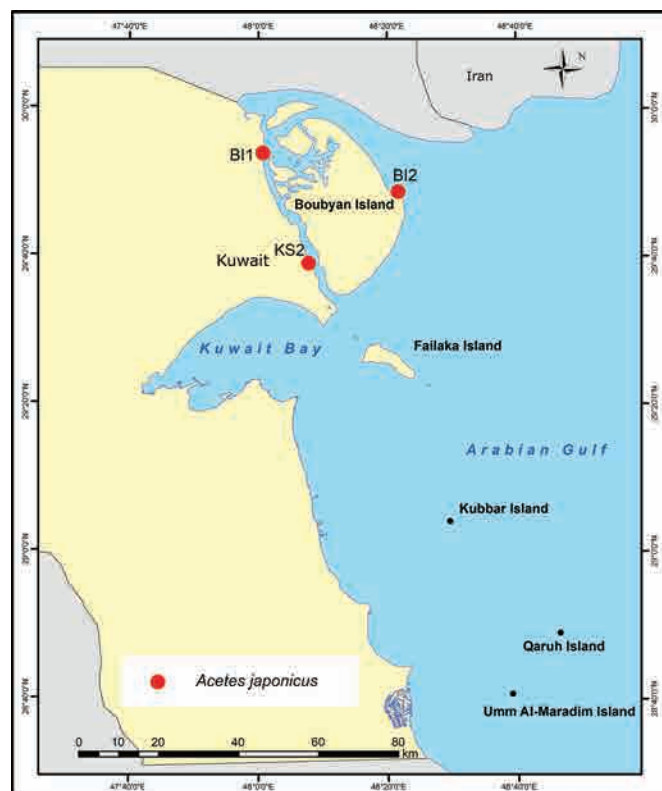


Figure 83. Presently known records of *Acetes japonicus* in Kuwait.

Most Relevant References. Kishinouye 1905; Miquel, 1984; Al-Yamani et al. 2011; Vereshchaka et al. 2016.



Figure 84. *Acetes japonicus* is often found in plankton net catches at Khor Al-Subiyah, Kuwait. Photograph by Valeriy Skryabin.

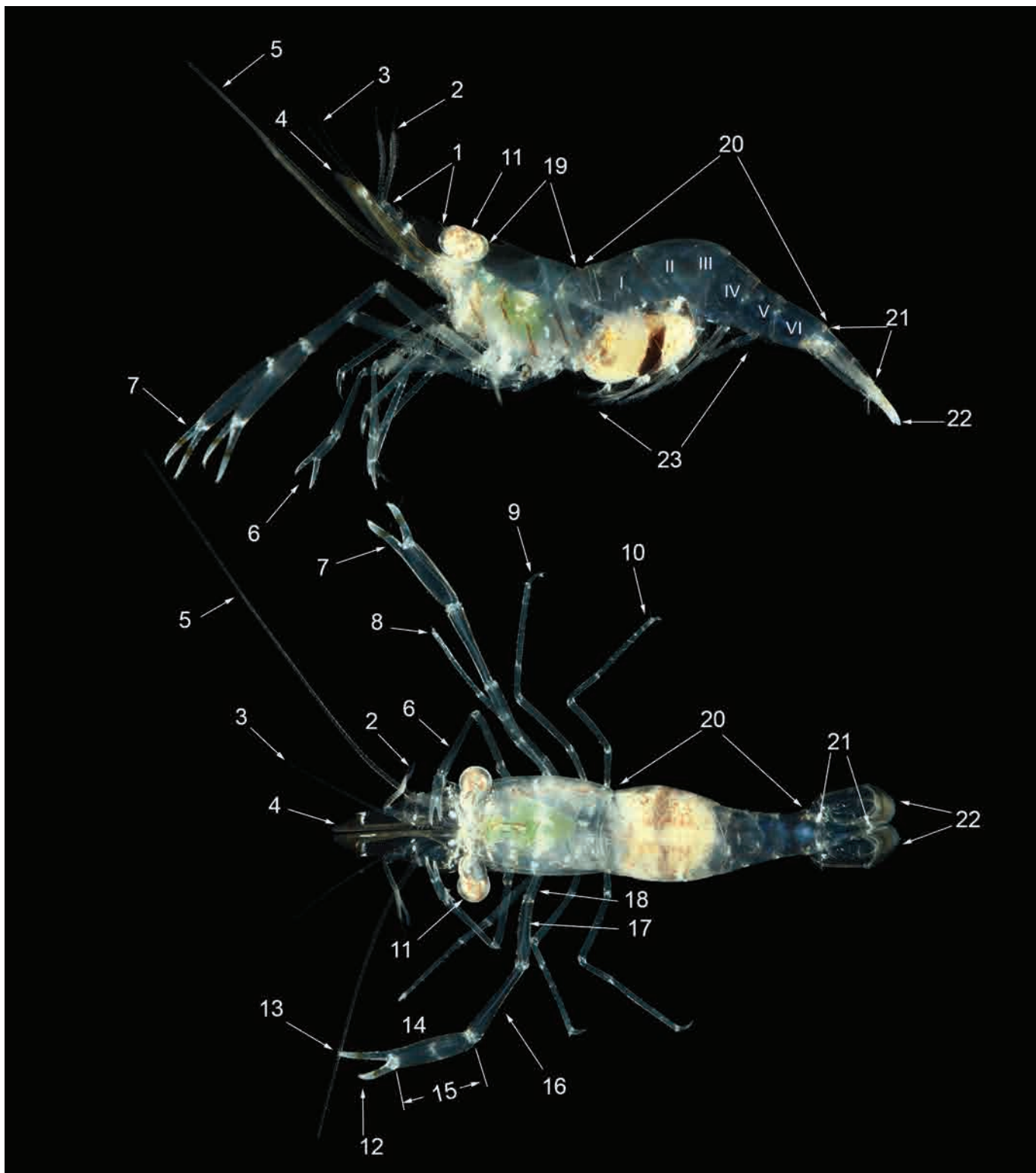


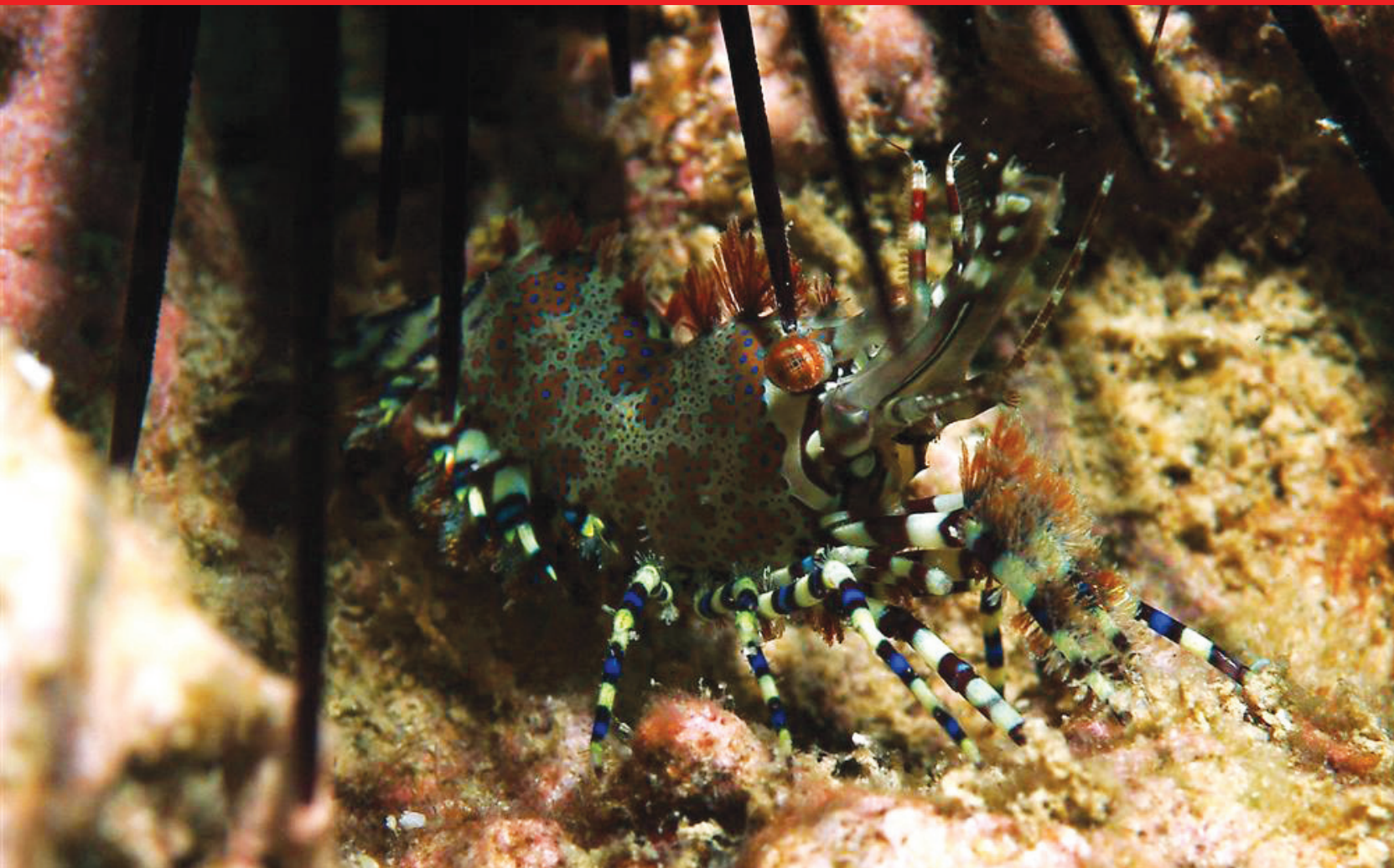
Figure 85. General morphology of Caridea illustrated here by a palaemonid shrimp (parasitised by a bopyrid isopod), Kuwait.

- | | | |
|------------------|--|-----------------------------------|
| 1. Rostrum. | 10. 5th pereopod. | 19. Carapace. |
| 2. Antennule. | 11. Eyestalk. | 20. Pleon. |
| 3. Flagella. | 12. Dactylus (movable finger of propodus). | 21. Telson. |
| 4. Scaphocerite. | 13. Pollex (fixed finger of propodus). | 22. Uropods. |
| 5. Antenna. | 14. Propodus. | 23. Pleopods. |
| 6. 1st pereopod. | 15. Manus (= palm). | I, II, III, IV, V, VI. Pleomeres. |
| 7. 2nd pereopod. | 16. Carpus. | |
| 8. 3rd pereopod. | 17. Merus. | |
| 9. 4th pereopod. | 18. Ischium. | |

Suborder Pleocyemata

Infraorder Caridea (Caridean shrimps)

Figure 86. Marbled shrimp *Saron marmoratus*, Qaruh Island, Kuwait. Photograph by Husain Alqallaf.



Family Alpheidae (snapping shrimps)

Alpheus djiboutensis De Man, 1909

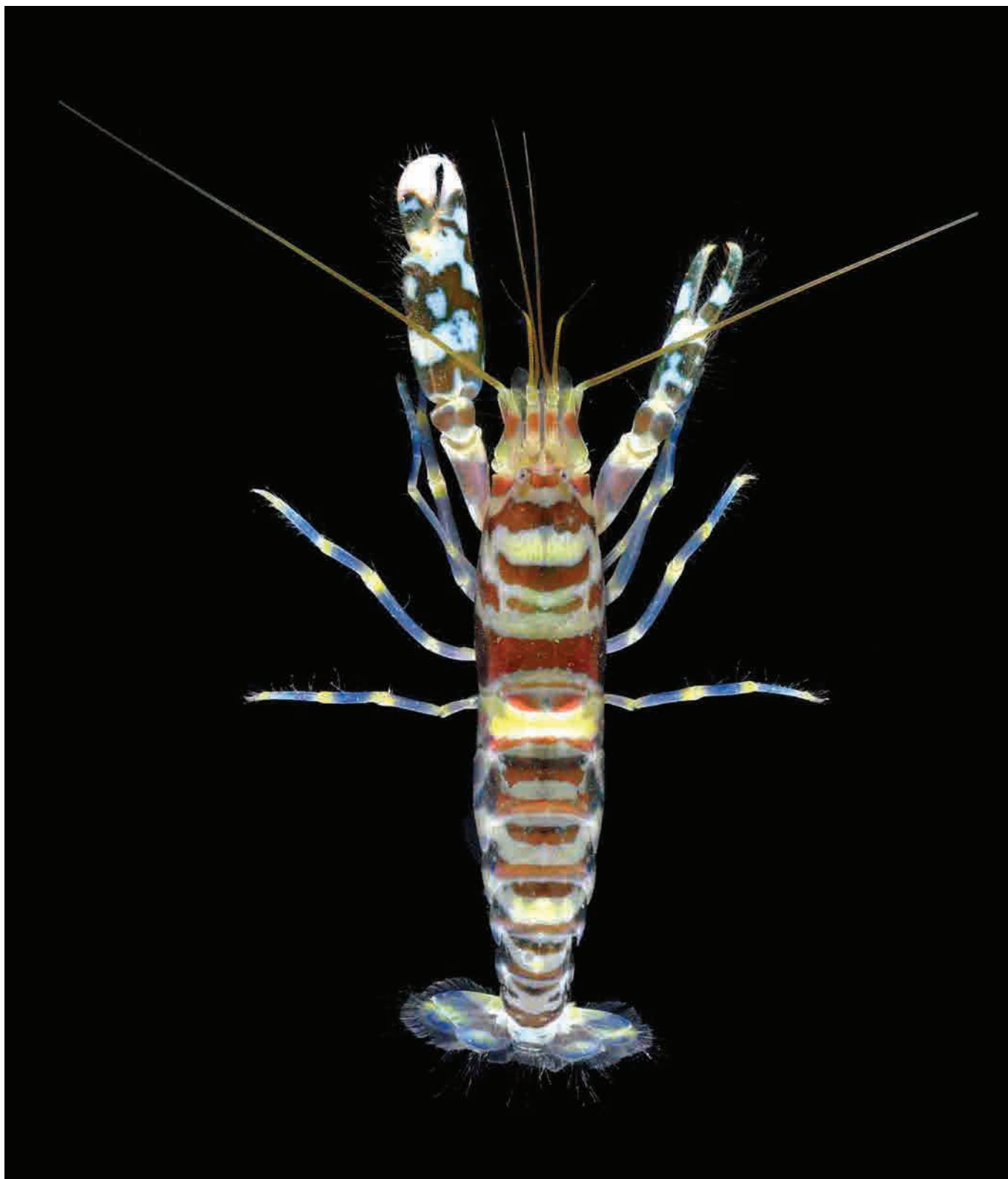


Figure 87. Dorsal view of *Alpheus djiboutensis* De Man, 1909 from Saudi Arabia. Photograph by Arthur Anker.

Synonym. None. Erroneously placed in the synonymy of *A. djeddensis* Coutière, 1897 by Banner and Banner (1982) [see below].

Common Name. Djibouti goby shrimp.

Main Diagnostic Features. Species complex

1. Carapace and abdomen with very slight pubescence.
2. Rostrum straight, simple, with rounded rostral carina.
3. Scaphocerite (antennal blade) concave laterally; distolateral tooth reaching well beyond lamellar portion of blade.
4. Major chela compressed, rectangular in cross-section, with deep dorsal notch.
5. Minor chela fingers with rows of plumose setae.
6. Second pereopod carpus with first sub-article about 1.5 times longer than second.
7. Third to fifth pereopods with subspatulate dactyli.
8. Colour pattern in life: dark-green to dark-brown bands, with dark carapace flanks, blue-and-yellow walking legs and dark green – pale blue blotched claws.
9. Size: maximal total body length about 55 mm.

Distribution. Indo-West Pacific: observed from the Red Sea, Gulf of Aden, the Arabian-Persian Gulf, southwestern Indian Ocean, possibly in Singapore, Taiwan, Australia, and other localities in the western Pacific.

Ecology. Benthic on the sand and fragmented coral rubble substrates, at a depth range of 0–30 m; always associated with several species of gobiid fishes. For the ecology and biology of goby-associated *Alpheus* spp., see the excellent reviews by Karplus et al. (1981) and Karplus and Thompson (2011), and the references therein.

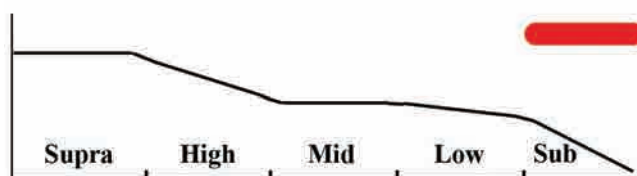


Figure 88. Bathymetric distribution of the species.

Remarks. *Alpheus djiboutensis* is the most common goby-associated snapping shrimp in the western Indian Ocean. However, its incorrect placement in the synonymy of the closely related *A. djeddensis* (not yet reported from the Arabian-Persian Gulf) by Banner and Banner (1982) resulted in a lot of confusion and numerous misidentifications (see also Anker and De Grave 2016). The colour patterns of the shrimps illustrated in Fig. 87 (Saudi Arabia) and Fig. 90 (Kuwait) correspond well with the specimen from Sudan identified as *A. djiboutensis* by Holthuis (1958). The blue-banded snapping shrimp figured by Jones (1986a) under the name “*A. djeddensis*” also appears to be *A. djiboutensis*. The ongoing revision of the goby shrimps (*Alpheus* spp.) of the Red Sea by one of the authors will soon clarify the taxonomic status of both *A. djiboutensis* and *A. djeddensis*. It must be noted that the Red Sea material identified as *A. djiboutensis* and/or *A. djeddensis* contains at least four taxa (Anker, pers. obs.); therefore, the identification of the present material as *A. djiboutensis* is at most tentative.

Most Relevant References. De Man 1909; Holthuis 1958; Karplus et al. 1981; Banner and Banner 1982 (part.); Karplus and Thompson 2011.

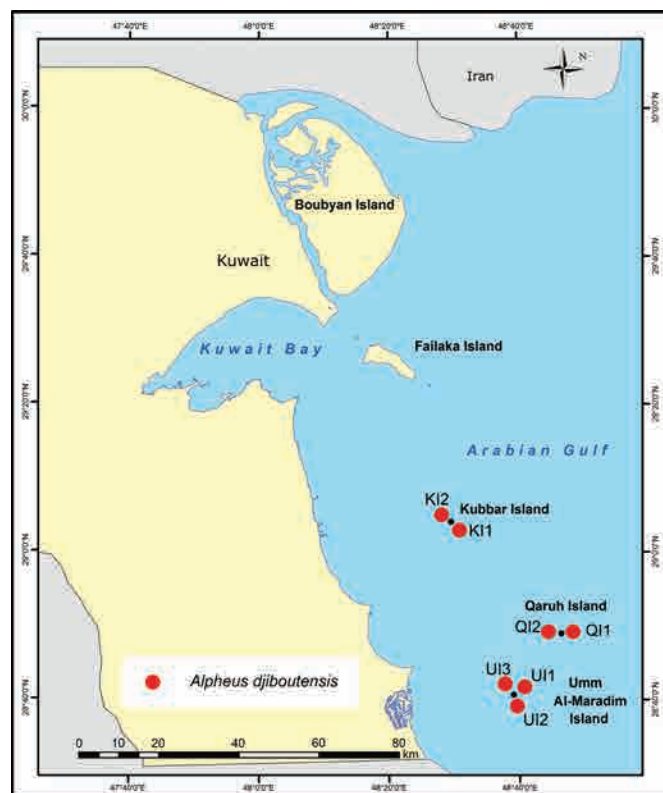


Figure 89. Presently known records of *Alpheus djiboutensis* in Kuwait.



Figure 90. *Alpheus djiboutensis*: in frontal view inside its burrow (A) and together with its partner goby, *Cryptocentrus* cf. *lutheri* (B), Kubbar Island, Kuwait. Photographs by Najem Jassim AL-Misbah.

Family Alpheidae

Alpheus edamensis De Man, 1888

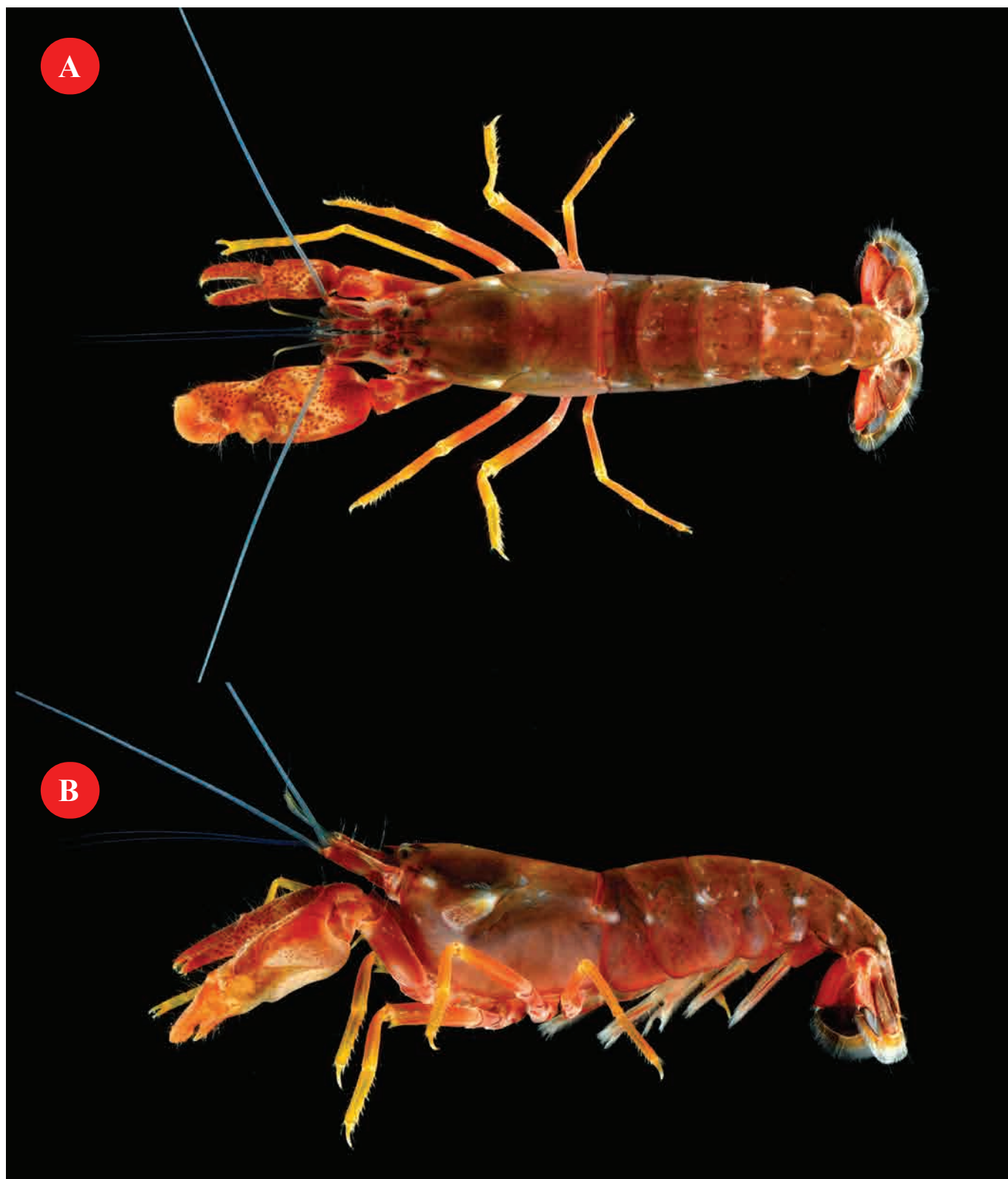


Figure 91. Dorsal (A) and lateral (B) views of *Alpheus edamensis* De Man, 1888, Kuwait. Photographs by Arthur Anker.

Synonyms. *Alpheus hippothoe* var. *edamensis* De Man, 1888; *Alpheus acanthomerus* Ortmann, 1890 (possibly valid species, see below).

Common Name. Edam snapping shrimp.

Main Diagnostic Features.

1. Rostrum extending to distal margin of first article of antennular peduncle or slightly beyond it, with blunt dorsal carina.
2. Major chela of “*edwardsii* type”, fairly setose, with well-developed dorsal and ventral notches; dorsal shoulder not overhanging transverse notch.
3. Minor chela with dactylus broadened, setose, but without balaniceps crests.
4. Second pereiopod carpus with first subarticle shorter than second.
5. Merus of third and fourth pereiopods with strong distoventral tooth; dactylus simple, neither biunguiculate nor spatulate.
6. Colour: orange or dark brown; major chela with dark brown spots; antennal flagella bluish.
7. Size: maximal total body length about 50 mm.

Distribution. Indo-West Pacific from the Red Sea, the Arabian-Persian Gulf, and Réunion to South-China Sea, Australia, and French Polynesia. However, all western Pacific records need confirmation.

Ecology. Benthic on sand-rock and rock-rubble bottoms, coral reefs, and adjacent rubble flats, from mid-intertidal to at least 50 m; free-living under rocks and large pieces of coral rubble.

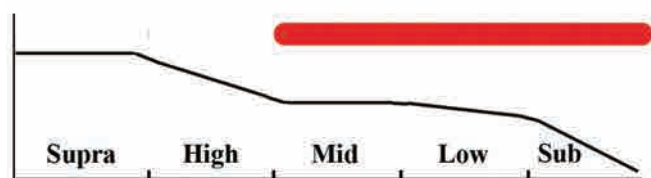


Figure 92. Bathymetric distribution of the species.

Remarks. *Alpheus edamensis* is a large and conspicuous snapping shrimp, easy to recognize, both by the combination of morphological features and by the unique colour pattern. The most diagnostic morphological features of *A. edamensis* are the setose major chela and the merus of the third and the fourth pereiopod armed with a strong distoventral tooth (see illustrations in Banner and Banner 1982). The most diagnostic characteristics of the colouration are the dark spots on the pale yellow areas of the major and minor chelae and bluish antennal flagella (Anker and De Grave 2016; Dehghani et al. 2019a; Al-Kandari et al. 2020a). The species was only recently reported from Kuwait (Al-Kandari et al. 2020a) and is widely distributed throughout the Arabian-Persian Gulf (Dehghani et al. 2019a) and the western Indian Ocean. All records of *A. edamensis* from the central-western Pacific need confirmation because of the somewhat questionable synonymy of *A. acanthomerus* and some differences in the colour pattern between the material from French Polynesia and other localities.

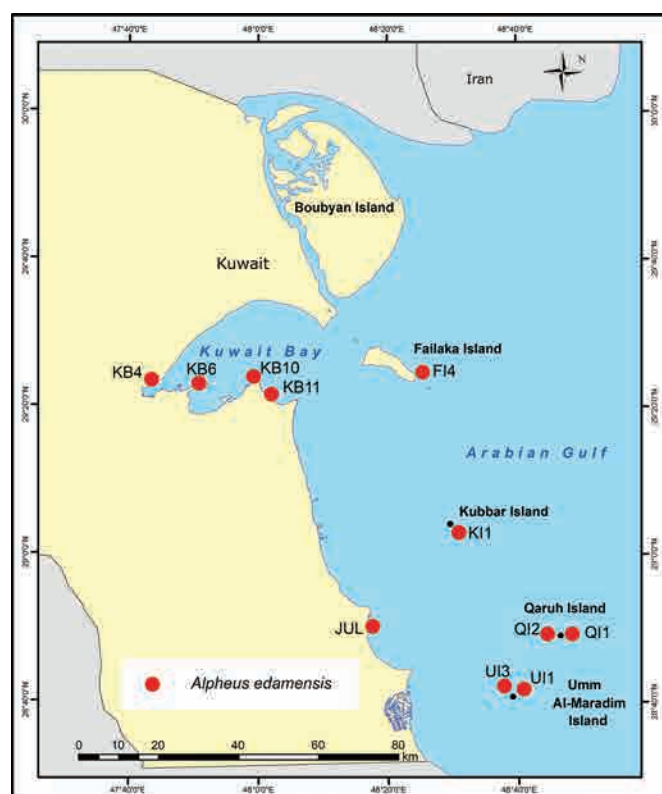


Figure 93. Presently known records of *Alpheus edamensis* in Kuwait.

Most Relevant References. De Man 1888; Banner and Banner 1982; Anker and De Grave 2016; Dehghani et al. 2019a, b; Al-Kandari et al. 2020a.



Figure 94. *Alpheus edamensis* inside empty shell, Qaruh Island, Kuwait. Photograph by Maryam Fahad AlMashaan AlMeshaweh.

Family Alpheidae

Alpheus edwardsii (Audouin, 1826)

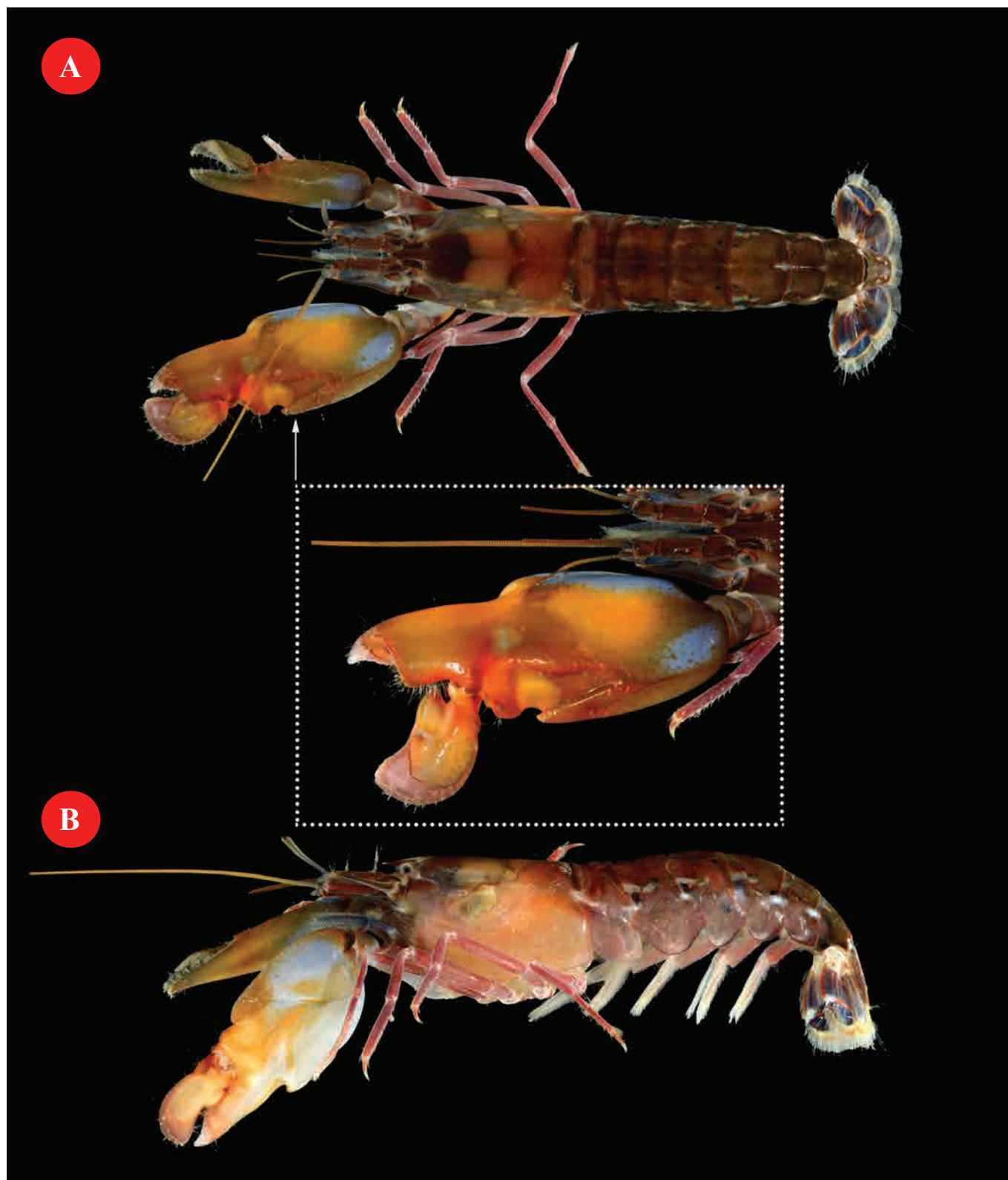


Figure 95. Dorsal (A) and lateral (B) views of *Alpheus edwardsii* (Audouin, 1826), Kuwait. Photographs by Arthur Anker.

Synonym. *Alpheus audouini* Coutière, 1905, currently considered a junior synonym, but most likely representing a valid species.

Common Name. Milne-Edwards' snapping shrimp.

Main Diagnostic Features. Species complex

1. Rostrum usually does not reach distal margin of the first article of the antennular peduncle, with blunt dorsal carina.
2. Major chela of “*edwardsii* type”, moderately setose, with well-developed dorsal and ventral notches; dorsal shoulder overhanging transverse groove.
3. Minor chela with balaeniceps crests in males, sometimes also in females.
4. Merus of third and fourth pereopods without strong distoventral tooth; dactylus simple, neither biunguiculate nor spatulate.
5. Colour in life variable, usually with greenish-brown or dark brown background and various types of white lines and blotches with or without a pair of black spots on pleon.
6. Size: maximal total body length about 50 mm.

Distribution. Indo-West Pacific from the Red Sea to Japan, Australia, and French Polynesia. Since several species are involved, the exact distribution of each of them remains unclear.

Ecology. Benthic on rocky and sand-rock-rubble bottoms and degraded flats, from mid-intertidal to at least 30 m; free-living under rocks and coral rubble.

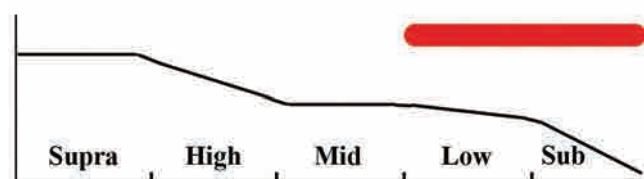


Figure 96. Bathymetric distribution of the species.

Remarks. *Alpheus edwardsii* represents a taxonomically challenging species complex of large to medium-sized snapping shrimps defined by the above combination of morphological features (Banner and Banner 1982). Therefore, all records of *A. edwardsii* must be regarded as tentative.

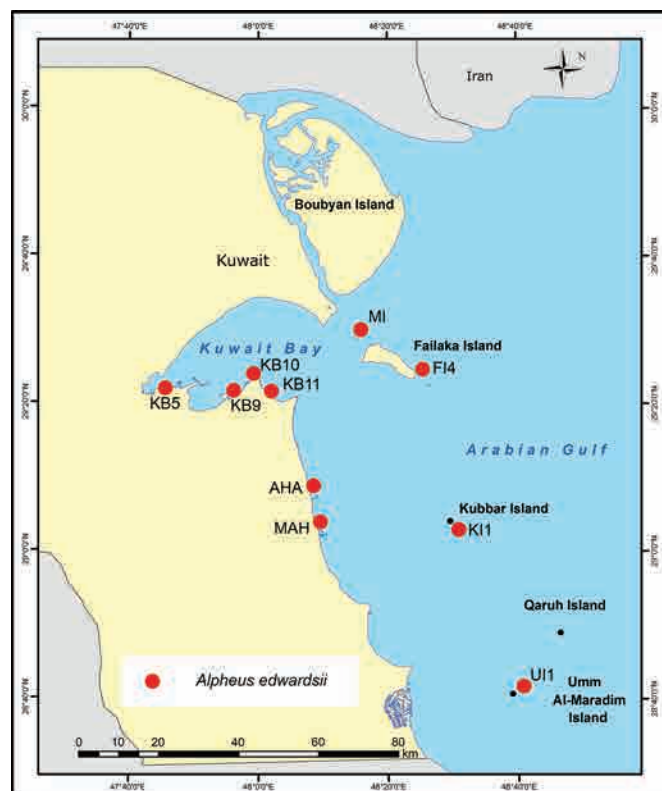


Figure 97. Presently known records of *Alpheus edwardsii* in Kuwait.

Two or three different colour morphs, each probably representing a distinct species, may be present in the same geographical area (see Anker and De Grave 2016 and Dehghani et al. 2019a, b, for examples). In the Arabian-Persian Gulf, at least two colour forms are present; however, only one of them seems to be present in Kuwait (Al-Kandari et al. 2020a). The taxonomic status of the Arabian-Persian Gulf populations, presently assigned to *A. edwardsii* will have to be reassessed during a comprehensive revision of the entire *A. edwardsii* complex. Such a revision would include a re-examination of the neotype of *A. edwardsii* from Suez (Banner and Banner 1972) and the type material of *A. audouini* Coutière, 1905, and several other taxa.

Most Relevant References. Banner and Banner 1972, 1982; Anker and De Grave 2016; Dehghani et al. 2019a, b; Al-Kandari et al. 2020a.



Figure 98. A muddy rocky beach at Al-Salam, Kuwait, a typical habitat of *Alpheus edwardsii*, *A. inopinatus* and *A. lobidens*.

Family Alpheidae

Alpheus inopinatus Holthuis and Gottlieb, 1958



Figure 99. Dorsal (A) and lateral (B) views of *Alpheus inopinatus* Holthuis and Gottlieb, 1958, Kuwait. Photographs by Arthur Anker.

Common Name. Stout-clawed snapping shrimp.

Main Diagnostic Features.

1. Rostrum usually reaches distal margin of first article of the antennular peduncle, with well-developed blunt carina.
2. Major chela of “*edwardsii* type”, fairly setose, with well-developed dorsal and ventral notches; dorsal shoulder not overhanging transverse groove.
3. Minor chela strongly sculptured with balaeniceps crests in males, never in females.
4. Merus of third and fourth pereopods without strong distoventral tooth; dactylus simple.
5. Colour in life greenish-brown, with two pairs of black spots on pleon.
6. Size: maximal total body length about 45 mm.

Distribution. Indo-West Pacific from the Red Sea and the Arabian-Persian Gulf to Australia.

Ecology. Benthic on rocky and mixed sand-mud-rock bottoms, largely intertidal and shallow subtidal (less than 5 m); free-living in burrows dug in muddy sand under large rocks.

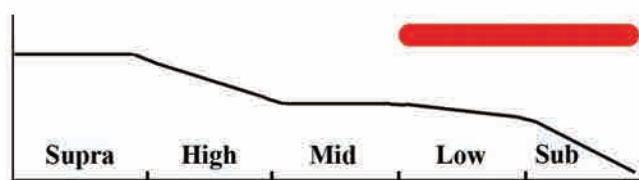


Figure 100. Bathymetric distribution of the species.

Remarks. *Alpheus inopinatus* has a long history of confusion with the closely related *A. lobidens*. This is hardly surprising as the taxonomic status of *A. lobidens* itself is still unresolved (see Anker and De Grave 2016; Anker et al. 2020b). The involvement of multiple species in what is now called the *A. lobidens* species complex (see below) further complicates this issue. Nevertheless, Anker et al. (2020) distinguished *A. inopinatus* from what appears to be the most common member of the *A. lobidens* complex in the Arabian-Persian Gulf, based on subtle morphological and colour pattern characters.

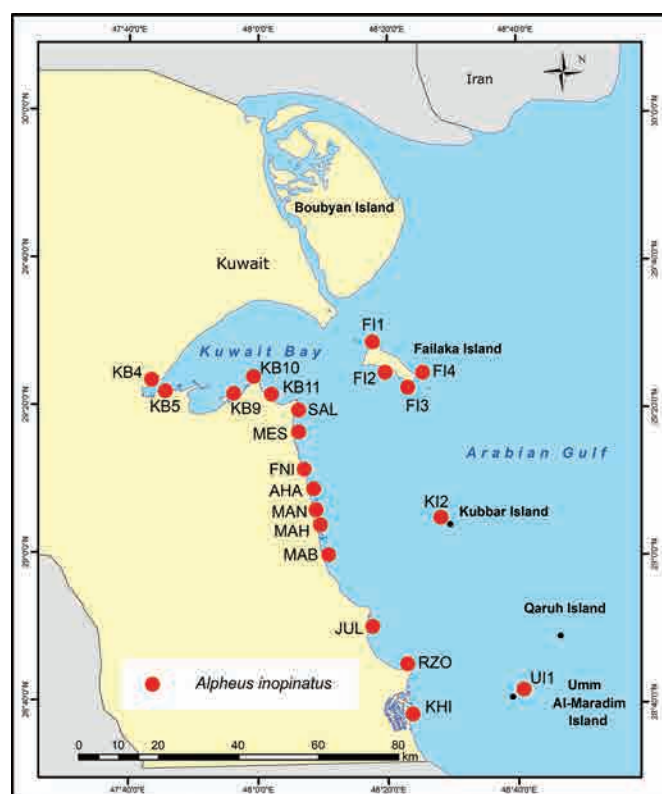


Figure 101. Presently known records of *Alpheus inopinatus* in Kuwait.

Furthermore, *A. inopinatus* was shown to be genetically distinct from several other species of the *A. lobidens* complex (Cunha et al. 2020). Good illustrations of the morphology of *A. inopinatus* were provided by Holthuis and Gottlieb (1958) and Banner and Banner (1982). Furthermore, *A. inopinatus* was shown to be genetically distinct from several other species of the *A. lobidens* complex (Cunha et al. 2020). Good illustrations of the morphology of *A. inopinatus* were provided by Holthuis and Gottlieb (1958) and Banner and Banner (1982).

Most Relevant References. Holthuis and Gottlieb, (1958); Banner and Banner 1982; Anker et al. 2020b.



Figure 102. *Alpheus inopinatus* found under a rock on an exposed rocky intertidal area near Al-Sha'ab, Kuwait. Photograph by Abdulaziz Alyousef.

Family Alpheidae

Alpheus lobidens De Haan, 1849



Figure 103. Dorsal (A) and lateral (B) views of *Alpheus lobidens* De Haan, 1849, Kuwait. Photographs by Arthur Anker.

Synonyms. *Alpheus lobidens lobidens* De Haan, 1849; (?) *Alpheus crassimanus* Heller, 1862; (?) *Alpheus lobidens polynesicus* Banner and Banner, 1974 (both probably valid species, see below).

Common Name. Green snapping shrimp.

Main Diagnostic Features. Species complex

1. Rostrum typically not reaching distal margin of first article of the antennular peduncle, with well-developed, somewhat sharp carina.
2. Major chela of “*edwardsii* type”, not particularly setose, with well-developed dorsal and ventral notches; dorsal shoulder not overhanging transverse groove.
3. Minor chela more or less sculptured, with balaeniceps crests in males, never in females.
4. Merus of third and fourth pereopods without strong distoventral tooth; dactylus simple.
5. Colour in life variable: usually greenish-brown, without black spots on pleon, or green- or brown-banded (species complex).
6. Size: maximal total body length about 45 mm.

Distribution. Indo-West Pacific from the Red Sea and South-East Africa to Japan, Australia, and Hawaii. Since several species are involved, the exact distribution of each of them remains to be determined.

Ecology. Benthic on rocky and mixed sand-mud-rock bottoms, largely intertidal and shallow subtidal (less than 5 m); free-living in burrows dug in muddy sand under large rocks.

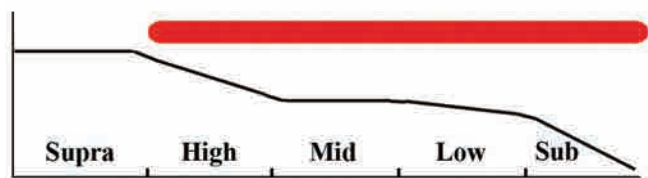


Figure 104. Bathymetric distribution of the species.

Remarks. *Alpheus lobidens* is a challenging species complex with at least three, and possibly more than six species (Anker and De Grave 2016; Anker et al. 2020b).

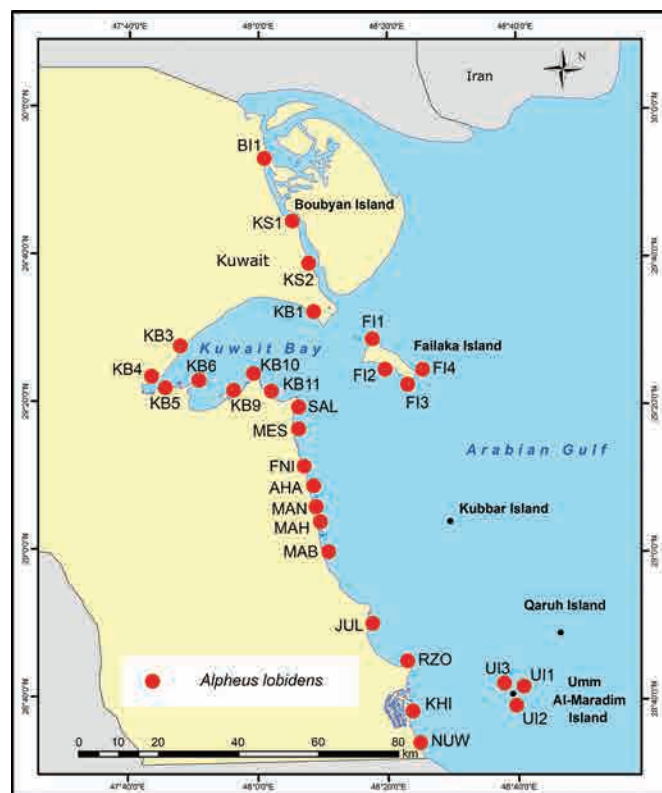


Figure 105. Presently known records of *Alpheus lobidens* in Kuwait.

The redescription of *A. lobidens* based on a specimen from Nagasaki by Cunha et al. (2020) is problematic as it did not correctly consider De Haan’s extant dry-type specimen and did not seem to represent *A. lobidens sensu* De Haan (1849). Furthermore, the redescription and species comparisons in Cunha et al. (2020) do not contain any information on the colour pattern. The species from Kuwait, currently identified as *A. lobidens*, may correspond to *A. crassimanus* Heller, 1862, or another taxon. Thus, the revision of the *A. lobidens* complex can only move forward after a detailed redescription of the type specimen of *A. lobidens* and its comparison with freshly collected material, especially from Japan. Good illustrations of the general morphology of *A. lobidens s. lat.* can be found in Banner and Banner (1982); however, they may not correspond to *A. lobidens* of De Haan (1849).

Most Relevant References. De Haan (1833-1850); Banner and Banner 1974; Banner and Banner 1982; Anker et al. 2020b.



Figure 106. *Alpheus lobidens* on mixed sandy-rocky shore in Al-Sha’ab, Kuwait. Photograph by Valeriy Skryabin.

Family Alpheidae

Alpheus lutosus Anker and De Grave, 2009



Figure 107. Dorsal view of female *Alpheus lutosus* Anker and De Grave, 2009 from Iran. Photograph by Hossein Ashrafi.

Common Name. Soggy-mud snapping shrimp.

Main Diagnostic Features.

1. Rostrum relatively short, reaching distal half of first article of antennular peduncle, with short rostral carina.
2. Major chela of «*edwardsii* type», not particularly setose, with well-developed dorsal and ventral notches; dorsal shoulder not overhanging transverse groove.
3. Minor chela with balaeniceps crests in males, without crests in females.
4. Major and minor chelae with strong sharp tooth on mesial face, near propodo-dactylar articulation; minor chela with similar tooth on lateral face.
5. Merus of third and fourth pereopods without strong distoventral tooth; dactylus broadened, spatulate.
6. Colour in life: pleon with greyish-greenish, transverse banding (two bands per pleonite); uropods distally with a conspicuous blue patch.
7. Size: maximal total body length about 45 mm.

Distribution. Indian Ocean: presently recorded only from the Arabian-Persian Gulf (Kuwait and Iran).

Ecology. Benthic on deep soggy mud bottoms, largely intertidal; free-living in self-dug burrows in mud.

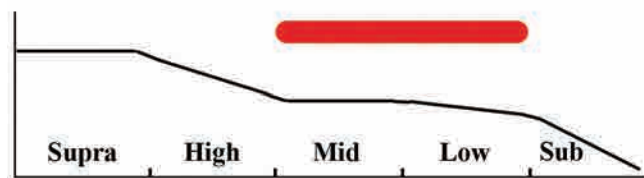


Figure 108. Bathymetric distribution of the species.

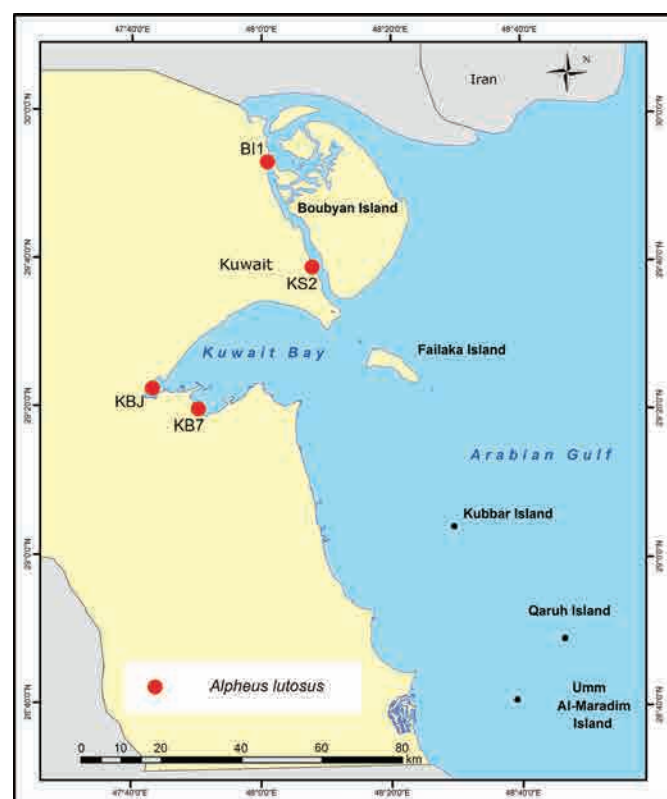


Figure 109. Presently known records of *Alpheus lutosus* in Kuwait.

Remarks. *Alpheus lutosus* was recorded from the Shatt Al-Arab delta in Kuwait (Anker and De Grave 2009) and since then, it has been recorded only once, more precisely from Iran (Dehghani et al. 2019a, b). This mud-loving snapping shrimp appears to be confined to muddy bays and estuarine areas with extensive mudflats, such as around Boubyan Island and Sulaibikhat Bay, and is not easy to collect.

Most Relevant References. Anker and De Grave 2009; Dehghani 2019a, b.



Figure 110. Mudflats at the northwestern side of Boubyan Island, typical habitat of *Alpheus lutosus*, Kuwait. Photograph by Valeriy Skryabin.

Family Alpheidae

Alpheus macrodactylus Ortmann, 1890



Figure 111. Dorsal view of *Alpheus macrodactylus* Ortmann, 1890, Kuwait; minor cheliped missing in the specimen. Photograph by Arthur Anker.

Main Diagnostic Features.

1. Rostrum rather short, reaching distal half of first article of antennular peduncle, with poorly developed rostral carina.
2. Orbital hoods projecting well beyond lateral margin of carapace.
3. Major chela of “*edwardsii* type”, not particularly setose, elongate, with well-developed dorsal and ventral notches; dorsal shoulder not overhanging transverse groove.
4. Minor chela with fingers non-balaeniceps, much longer than palm in males, with a row of small teeth on proximal third of finger cutting edges.
5. Merus of third and fourth pereiopods without strong distoventral tooth; dactylus broadened, spatulate.
6. Colour in life: pleon with greyish-greenish, transverse banding (one broad band per pleonite).
7. Size: maximal total body length 35 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf and South-East Africa to Guam and Australia.

Ecology. Benthic on mud bottoms, largely intertidal and shallow subtidal; free-living in self-dug burrows on mudflats or close to mangroves and estuaries.



Figure 112. Bathymetric distribution of the species.

Remarks. *Alpheus macrodactylus* belongs to the problematic *A. malabaricus* Fabricius, 1798, species complex and has affinities with the *A. euprosyne* De Man, 1897, species

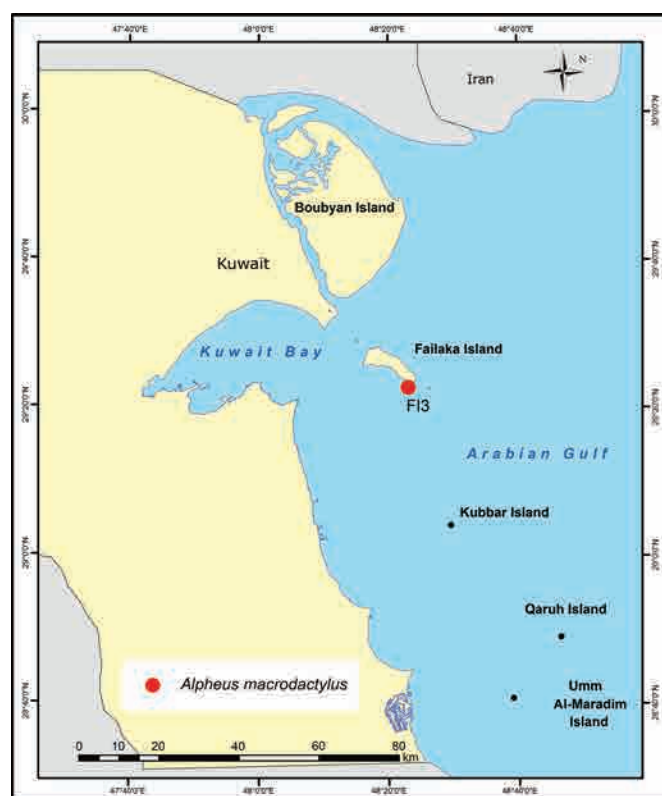


Figure 113. Presently known record of *Alpheus macrodactylus* in Kuwait.

complex. Chace (1988) suggested that *A. macrodactylus* may be a synonym of *A. malabaricus*; however, the two species seem to differ significantly by the shape of the minor chela (see illustrations in Banner and Banner 1982). Therefore, a revision of the *A. malabaricus* complex is needed to confirm the status of *A. macrodactylus*.

Most Relevant References. Ortmann 1890; Banner and Banner 1982; Chace 1988; Al-Kandari et al. 2020a.



Figure 114. Typical mudflat habitat of *Alpheus macrodactylus* on the eastern coast of Failaka Island, Kuwait. Photograph by Valeriy Skryabin.

Family Alpheidae

Alpheus maindroni Coutière, 1898

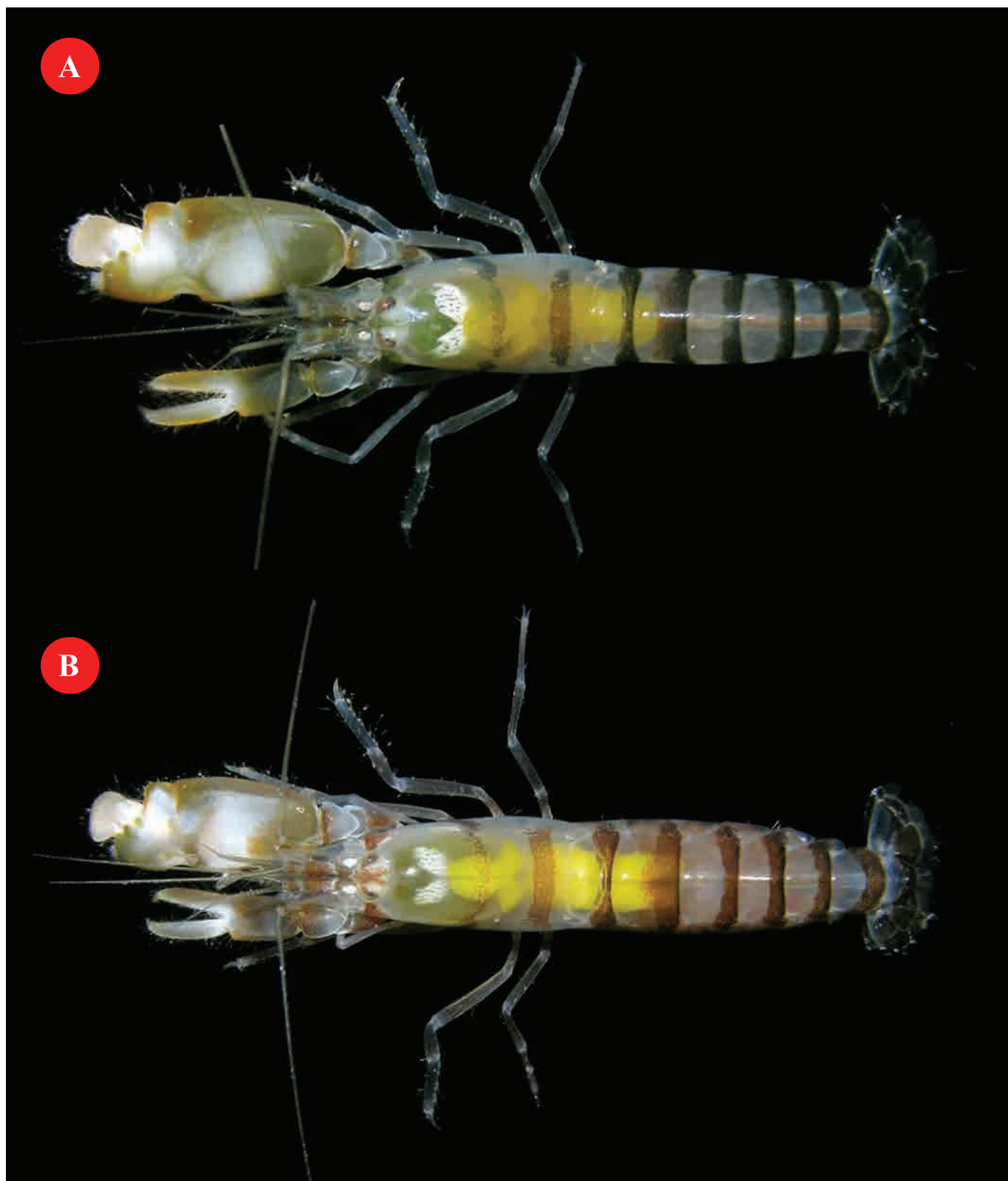


Figure 115. Dorsal views of male (A) and female (B) of *Alpheus maindroni* Coutière, 1898, from Egypt. Photograph by Arthur Anker.

Synonym. *Alpheus abumusa* Dehghani, Sari and Naderloo, 2019 [possibly].

Main Diagnostic Features. Species complex?

1. Rostrum short, not reaching distal half of first article of antennular peduncle, with very short rostral carina.
2. Major chela of “leviusculus type”, not setose, with shallow dorsal notch and deep ventral notch; distodorsal margin near transverse groove conspicuously protruding.
3. Minor chela with fingers non-balaeniceps in both sexes.
4. Merus of third and fourth pereopods unarmed; dactylus simple.
5. Colour in life: pleon with brown-transverse banding, sometimes with yellow chromatophores between bands; major chela greenish brown with conspicuous large white areas.
6. Size: maximal total body length 26 mm.

Distribution. Indo-West Pacific from the Red Sea and the Arabian-Persian Gulf to the Philippines and Australia.

Ecology. Benthic on hard or mixed bottoms, in the lower intertidal and shallow subtidal; free-living in crevices of rocks and coral rubble.



Figure 116. Bathymetric distribution of the species.

Remarks. *Alpheus maindroni* belongs to the *A. leviusculus* species group and is relatively easy to distinguish from its congeners due to the presence of a conspicuous distodorsal protuberance on the major claw palm (see illustrations in Banner and Banner 1982). The recently described *A. abumusa* Dehghani, Sari and Naderloo, 2019, was separated from *A. maindroni* by three characters, and two of them were apparently invalid; therefore, it may eventually fall in the synonymy of *A. maindroni* (see also Al-Kandari et al. 2020a). On the other hand, the eastern Australian specimens differ from the Indian Ocean specimens by some details of the colour pattern, and it cannot be excluded that two cryptic species are involved (A. Anker, pers. obs.).

Most Relevant References. Coutière 1898; Banner and Banner 1982; Dehghani et al. 2019a, b; Al-Kandari et al. 2020a.

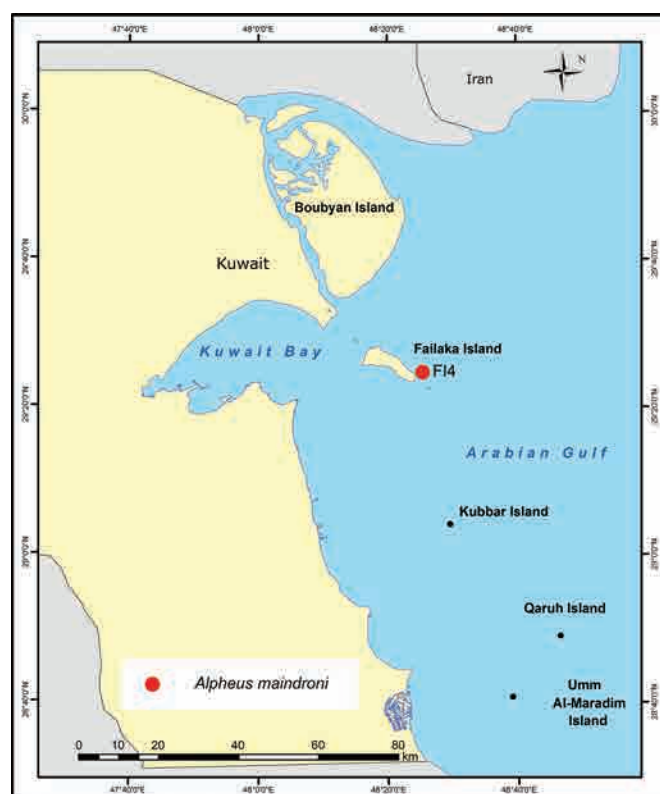


Figure 117. Presently known record of *Alpheus maindroni* in Kuwait.

Family Alpheidae

Arete indicus Coutière, 1903

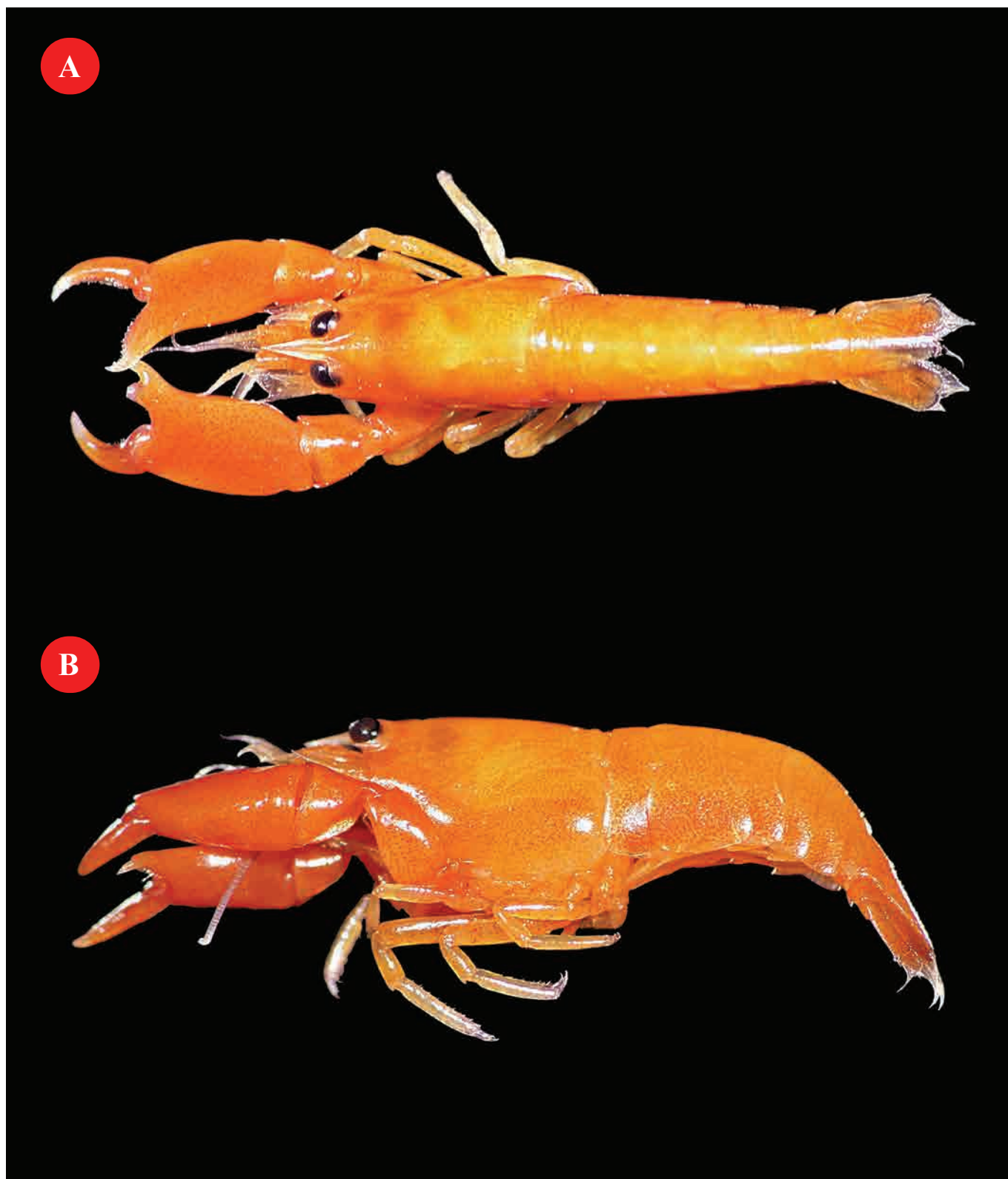


Figure 118. Dorsal (A) and lateral (B) views of a preserved specimen of *Arete indicus* Coutière, 1903, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Arete dorsalis* var. *indicus* Coutière, 1903; *Athanas indicus* (Coutière, 1903).

Main Diagnostic Features.

1. Body stout, bulky.
2. Rostrum long, reaching or almost reaching end of antennular peduncle.
3. Supraorbital teeth absent; extra-corneal teeth strong, sharp; infra-corneal teeth absent.
4. Chelipeds slightly asymmetrical and unequal, robust; chela armed with strong teeth.
5. Second pereopod carpus subdivided into four sub-articles.
6. Third and fourth pereopods stout; merus armed with small distoventral tooth; dactylus biunguiculate.
7. Uropodal exopod with distolateral angle strongly curved mesially.
8. Colour in life: body with dark purple, broad, longitudinal stripes; pleon with two conspicuous black eyespots.
9. Size: maximal total body length 12 mm.

Distribution. Indo-West Pacific from the Red Sea and East Africa to Japan, Australia, and French Polynesia. However, many records probably refer to closely related species.

Ecology. Benthic on hard bottoms, in the lower intertidal and shallow subtidal (to about 10 m); associated with boring sea urchins, *Echinometra* spp., typically *E. mathaei*.

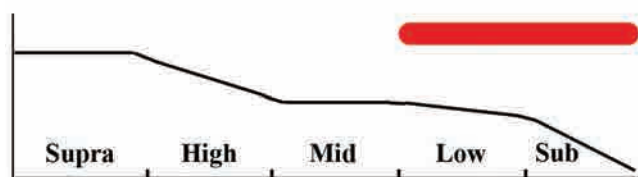


Figure 119. Bathymetric distribution of the species.

Remarks. *Arete indicus* is among the most distinctive species of the small but taxonomically problematic genus *Arete*, characterized by the unique colour pattern and shape of the uropodal exopod. In addition, *A. indicus* is an ecologically unique alpheid shrimp, an obligate symbiont of the boring sea urchins *Echinometra mathaei*. All species of *Arete* appear to be protandric hermaphrodites (Suzuki 1970; Gherardi 1991; Gherardi and Calloni 1993; Dabbagh et al. 2019). The species is rare or at least rarely collected from Kuwait, but it seems to be widely distributed throughout the Arabian-Persian Gulf (De Grave and Ashelby 2011; Dabbagh et al. 2019). However, its presence in the southern offshore islands of Kuwait is extremely likely.

Most Relevant References. Coutière 1903; Banner and Banner 1973; Gherardi 1991; Gherardi and Calloni 1993; Dabbagh et al. 2019.

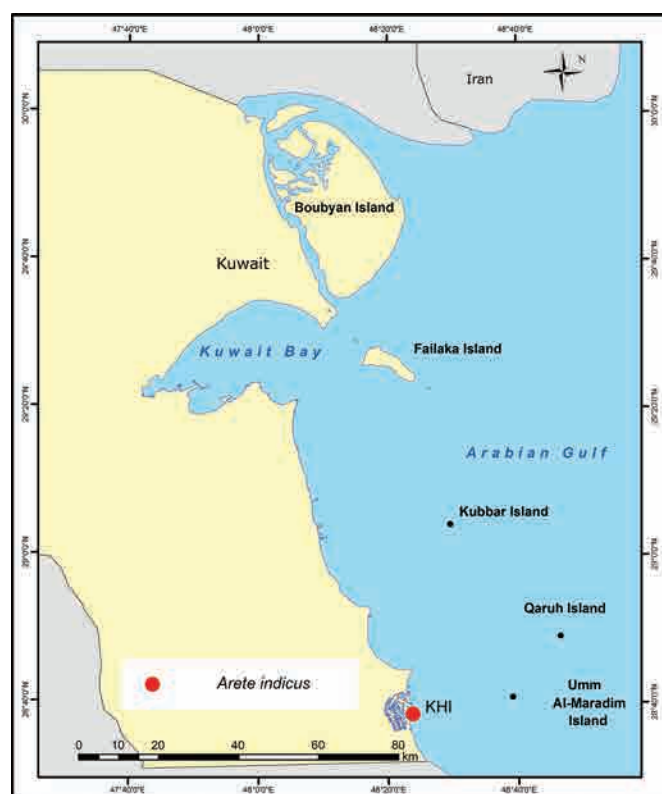


Figure 120. Presently known record of *Arete indicus* in Kuwait.



Figure 121. *Arete indicus* on its sea urchin host, *Echinometra mathaei*, Madagascar. Photograph by Arthur Anker.

Family Alpheidae

Athanas dimorphus Ortmann, 1894



Figure 122. Male of *Athanas dimorphus* Ortmann, 1894 in lateral (A) and dorsal (B) views and female in lateral view (C), Kuwait. Photographs by Arthur Anker.

Synonyms. *Athanas leptocheles* Coutière, 1896; *Athanas solenomerus* Coutière, 1896; (?) *Athanas dimorphus* seedang Banner and Banner, 1966 (probably valid species).

Main Diagnostic Features.

1. Body moderately stout.
2. Rostrum long, reaching to distal margin of second article of antennular peduncle.
3. Supraorbital teeth absent; extra-corneal and infra-corneal teeth present, former better developed.
4. Chelipeds subsymmetrical and subequal, carried folded, highly sexually dimorphic: enlarged and with chela fingers armed with strong teeth in males; slender and with chela fingers unarmed in females.
5. Second pereopod carpus is subdivided into five subarticles.
6. Third and fourth pereopods moderately stout; dactylus simple.
7. Colour in life: body with alternating white and dark blue-green to blue-purple transverse bands, especially on pleon.
8. Size: maximal total body length 15 mm.

Distribution. Indo-West Pacific from the Red Sea and South-East Africa to Japan, Australia, and New Caledonia; invasive in some parts of the western Atlantic (Brazil and Venezuela).

Ecology. Benthic on hard and mixed sand-mud-rock bottoms, in the lower intertidal and shallow subtidal to 100 m (but rare below 10 m); free-living, often in small groups, under rocks, coral rubble, or in crevices and tide pools, sometimes found in sponges and *Sargassum* in Failaka Island.

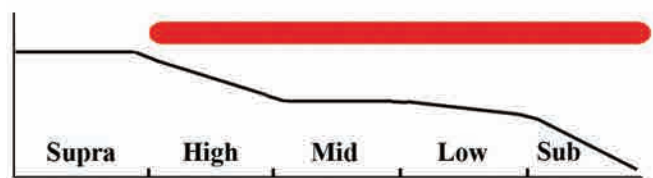


Figure 123. Bathymetric distribution of the species.

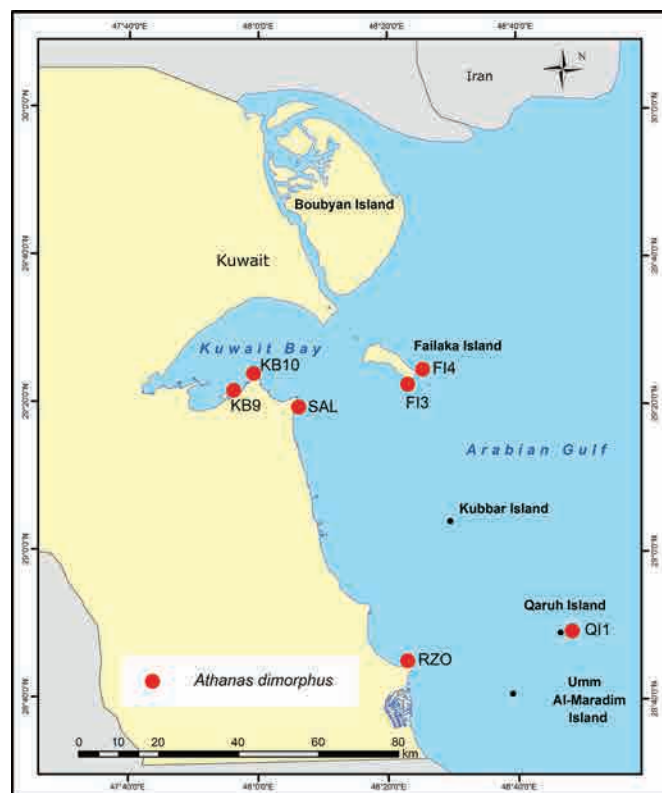


Figure 124. Presently known records of *Athanas dimorphus* in Kuwait.

Remarks. *Athanas dimorphus* is one of the most common small alpheid species in the Indo-West Pacific and is also invasively spread along the western Atlantic coast (e.g. Pachelle et al. 2011). It is widespread in the Arabian-Persian Gulf and was recorded from Kuwait by Jones (1986a). Nevertheless, the specimens have to be identified by an expert due to the presence of several poorly described species, which are morphologically very similar to *A. dimorphus*. The safest way to recognize *A. dimorphus* is by its diagnostic colour pattern (see also Pachelle et al. 2011; Anker and De Grave 2016).

Most Relevant References. Ortmann 1894; Banner and Banner 1973; Pachelle et al. 2011; Anker and De Grave 2016.

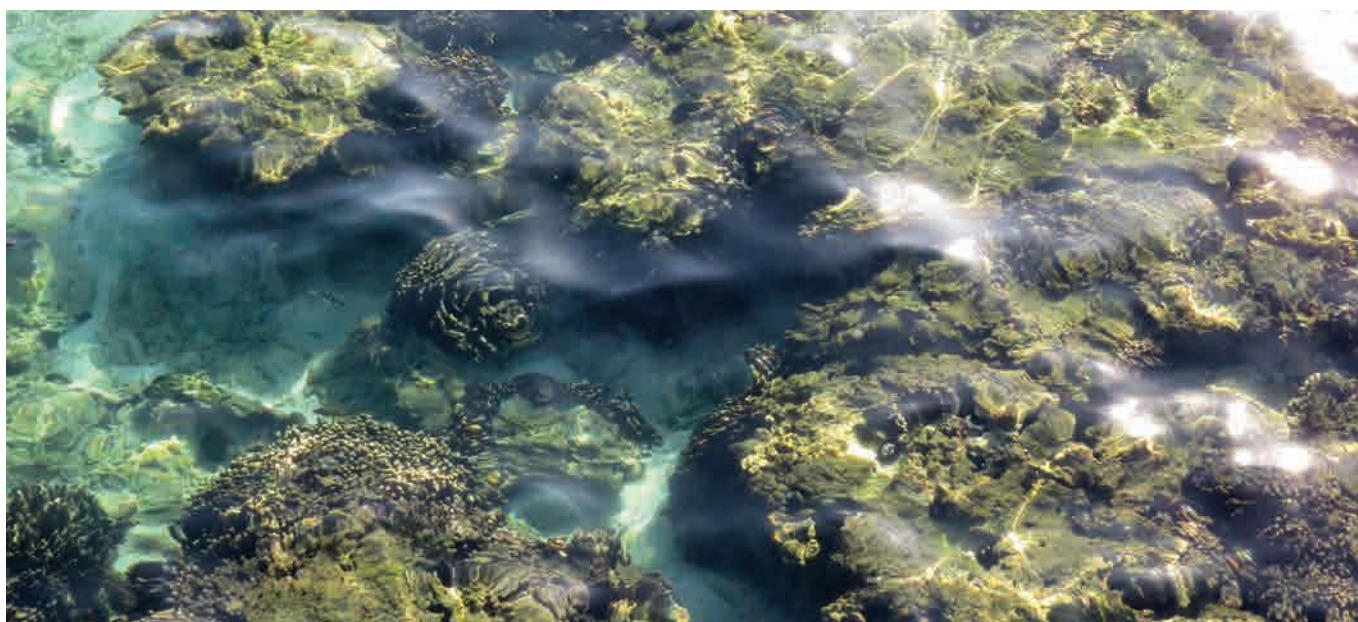


Figure 125. Degraded shallow coral reef at Qaruh Island, Kuwait, a typical habitat of *Athanas dimorphus*. Photograph by Valeriy Skryabin.

Family Alpheidae

Athanas parvus De Man, 1910

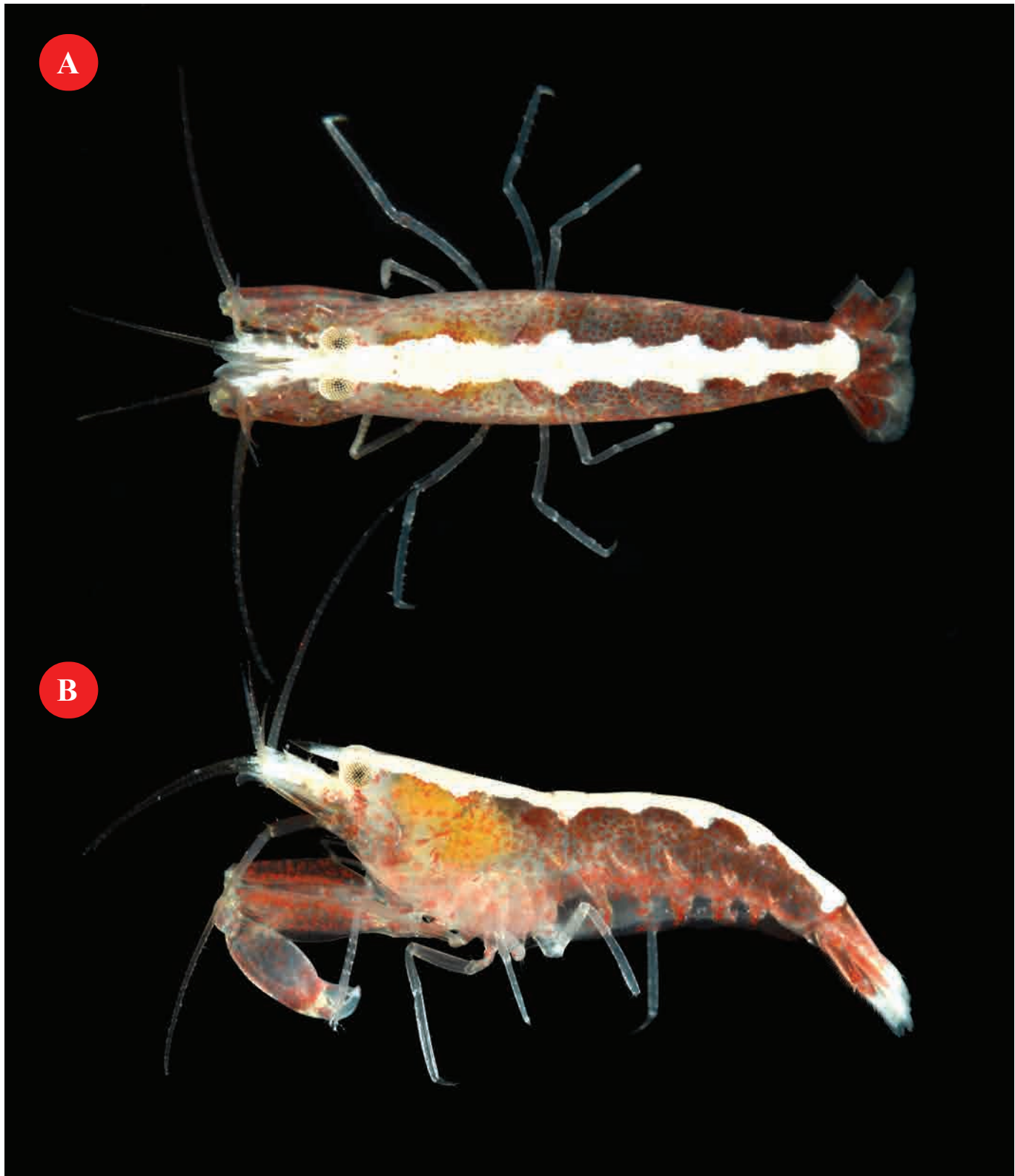


Figure 126. Male of *Athanas parvus* De Man, 1910 in dorsal (A) and lateral (B) views, Kuwait. Photographs by Arthur Anker.

Synonym. *Athanas sibogae* De Man, 1910.

Main Diagnostic Features.

1. Body rather slender.
2. Rostrum long, usually exceeding distal margin of second article of antennular peduncle.
3. Supraorbital teeth absent; extra-corneal and infra-corneal teeth present, former better developed.
4. Chelipeds somewhat asymmetrical, subequal, carried folded, highly sexually dimorphic: enlarged and with chela fingers armed with strong teeth in males; slender and with chela fingers unarmed in females.
5. Second pereopod carpus subdivided into five sub-articles.
6. Third and fourth pereopods slender; dactylus slender, biunguiculate.
7. Colour in life: body reddish with the broad white mid-dorsal band running from rostral tip across carapace and pleon to tail fan.
8. Size: maximal total body length 12 mm.

Distribution. Indo-West Pacific from the Red Sea and South-East Africa to Japan, Australia, and Samoa.

Ecology. Benthic on hard (coral and rocks) and mixed (sand-rock and coral rubble) bottoms, from the lower intertidal and shallow subtidal to 70 m (rather rare below 30 m); free-living under rocks, coral rubble, or in coral crevices.

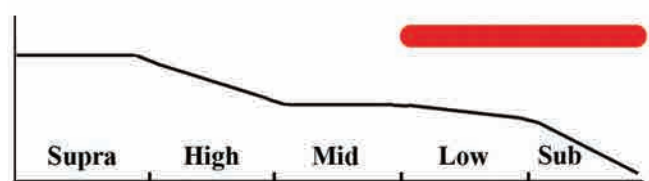


Figure 127. Bathymetric distribution of the species.

Remarks. *Athanas sibogae* is a common small alpheid observed across the Indo-West Pacific and is widespread in the Arabian-Persian Gulf (De Grave and Ashelby 2011), including the southern islands of Kuwait (Al-Kandari et al. 2020a). The easiest way to identify *A. parvus* is by observing the shape of

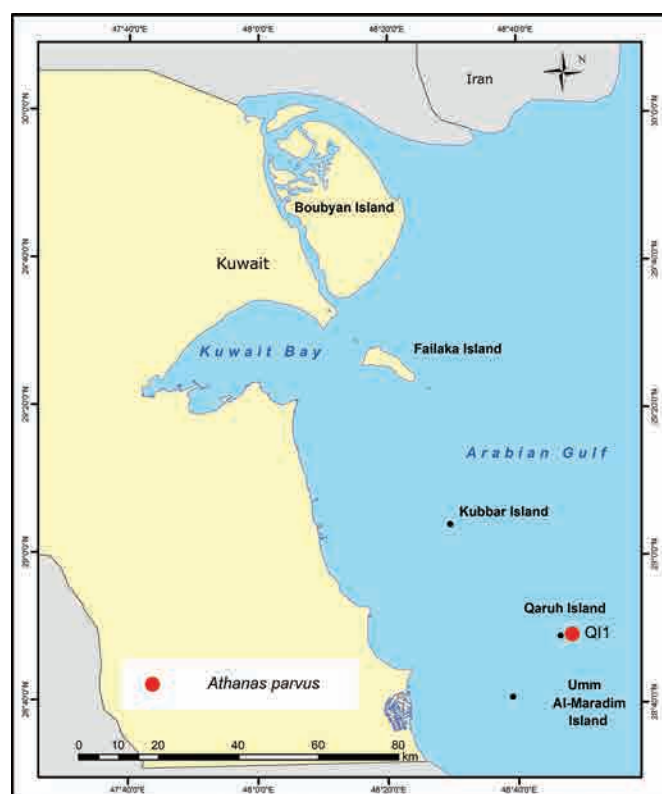


Figure 128. Presently known record of *Athanas parvus* in Kuwait.

the dactylus of the third to fifth pereopods. In most species of *Athanas*, the dactylus is simple, but in *A. parvus*, it has a well-demarcated secondary unguis and is, therefore, called biunguiculate (see illustrations in De Man 1911 and Banner and Banner 1973). although not unique to this species, The colour pattern of *A. parvus* (Fig. 120; see also Anker and De Grave 2016; Al-Kandari et al. 2020a), may provide additional identification help.

Most Relevant References. De Man 1910, 1911; Banner and Banner 1973; Anker and De Grave 2016; Al-Kandari et al. 2020a.



Figure 129. Coral reef at Qaruh Island, a typical habitat of *Athanas parvus*, Kuwait. Photograph by Faisal Al-Sarraf.

Family Alpheidae

Salmoneus gracilipes Miya, 1972



Figure 130. Ovigerous female of *Salmoneus gracilipes* Miya 1972, in dorsal (A) and lateral (B) views, Kubbar Island, Kuwait. Photographs by Arthur Anker.

Main Diagnostic Features.

1. Body rather slender.
2. Rostrum long, reaching or exceeding distal margin of second article of antennular peduncle.
3. Orbital teeth small, sharp; eyes partly visible in dorsal and lateral views.
4. Chelipeds very asymmetrical, unequal, carried folded; ischium of both chelipeds with spine; major cheliped merus slender, unarmed; major chela fingers with serrated cutting edges.
5. Third and fourth pereopods slender; dactylus slender, simple.
6. Posterior margin of telson with a deep notch.
7. Colour in life: pale buff; freshly laid eggs bright yellow.
8. Size: maximal total body length 15 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf to Japan, Indonesia, and Micronesia.

Ecology. Benthic on muddy or silty sand-rubble bottoms, in the lower intertidal and shallow subtidal areas (to 12 m); free-living under rocks, coral rubble, or in coral crevices, or associated with burrows, e.g., of echiurans.

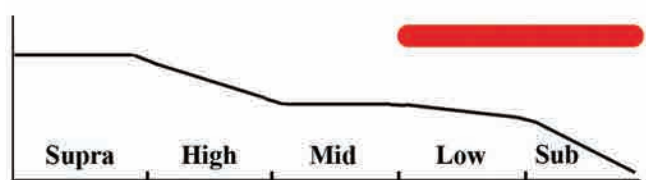


Figure 131. Bathymetric distribution of the species.

Remarks. Anker et al. (2020a) noted that the identification of the Kuwaiti material as *Salmoneus gracilipes* was tentative and will require confirmation, for instance, by a genetic comparison of the Failaka and Kubbar specimens with those from the type locality in Japan.

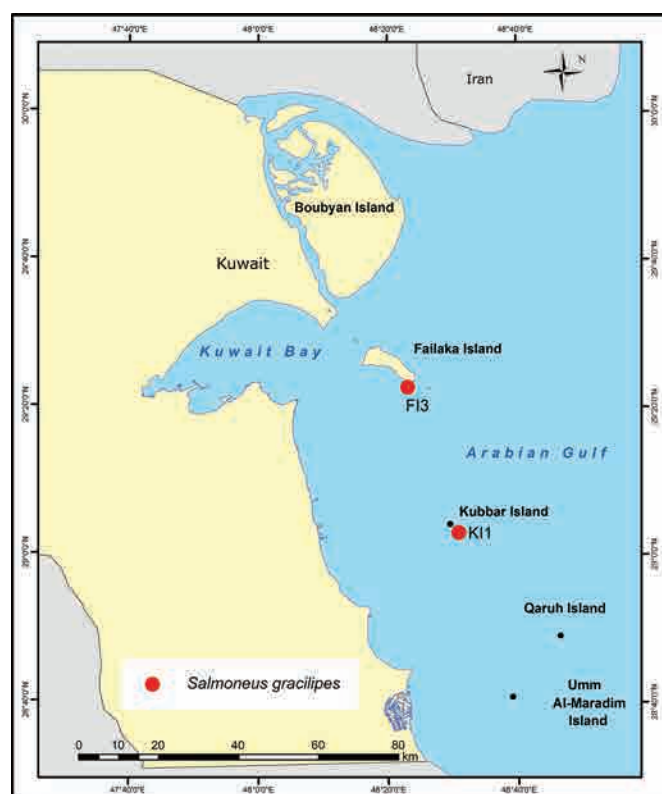


Figure 132. Presently known records of *Salmoneus gracilipes* in Kuwait.

The same is true for the Indonesian material reported by Anker et al. (2015). Generally, identifying most of the species of *Salmoneus* is very difficult and should involve a caridean specialist.

Most Relevant References. Miya 1972; Anker et al. 2015; Anker et al. 2020a.



Figure 133. Echiuran worm *Listriolobus* cf. *brevirostris*, possible host of one of the specimens of *Salmoneus gracilipes*, Failaka Island, Kuwait. (see Anker et al. 2020a).

Family Alpheidae

Salmoneus ikaros Anker, Al-Kandari and De Grave, 2020



Figure 134. Ovigerous female of *Salmoneus ikaros* Anker, Al-Kandari and De Grave, 2020 in dorsal (A) and lateral (B) views, Failaka Island, Kuwait. Photographs by Arthur Anker.

Main Diagnostic Features.

1. Body moderately stout.
2. Rostrum moderately long, not reaching distal margin of second article of antennular peduncle.
3. Orbital teeth small and sharp; eyes only slightly visible in dorsal and lateral views; cornea specialized, bipartite.
4. Chelipeds very asymmetrical, unequal, carried folded; ischium of both chelipeds with spine; major cheliped merus slender, unarmed; major chela fingers with serrated cutting edges.
5. Third and fourth pereopods slender; dactylus slender, simple.
6. Posterior margin of telson with minute notch.
7. Colour in life: pale buff.
8. Size: maximal total body length 14 mm.

Distribution. North-West Indian Ocean: presently observed only in the northern Arabian Gulf.

Ecology. Benthic on muddy bottoms, in the very shallow subtidal area (0.5–1 m at low tide); associated with burrows of the ghost-shrimp *Balsscallichirus masoomi* (see below).

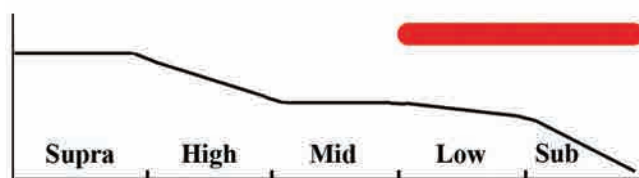


Figure 135. Bathymetric distribution of the species.

Remarks. This recently described symbiotic shrimp differs from all other species of *Salmoneus* by the oddly shaped, bipartite cornea of the eyestalks, although a similar condition

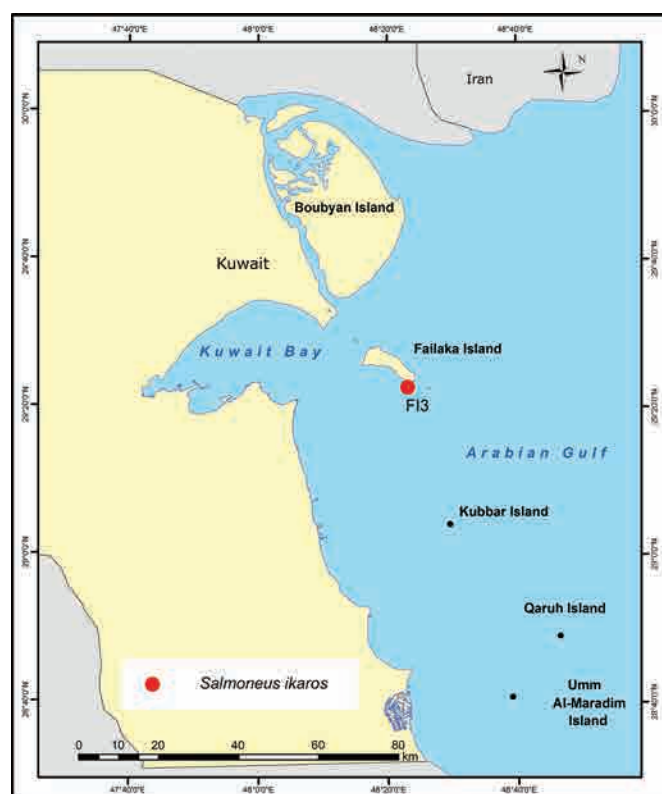


Figure 136. Presently known record of *Salmoneus ikaros* in Kuwait.

exists in *S. komaii*, a species not closely related to *S. ikaros* (Anker et al. 2020a). It is worth mentioning that the scientific name of the species refers to the historical Greek name of the Failaka Island, i.e., Ikaros.

Most Relevant Reference. Anker et al. 2020a.



Figure 137. Mudflats and muddy pools on the eastern shore of Failaka Island, Kuwait, near the type locality of *Salmoneus ikaros*. Photograph by Valeriy Skryabin.

Family Alpheidae

Synalpheus gracilirostris De Man, 1910



Figure 138. Ovigerous female of *Synalpheus gracilirostris* De Man, 1910, in dorsal view, Qit'at Uraifjan, Kuwait. Photograph by Arthur Anker.

Main Diagnostic Features.

1. Rostrum long, slender, 8–9 times as long as wide, much narrower than orbital teeth, latter sharply produced.
2. Antennal basicerite with sharp dorsal tooth and long sharp ventrolateral tooth, latter as long as stylocerite.
3. Antennal blade present, narrow, much shorter than distolateral tooth.
4. Major chela palm with small sharp distolateral tooth.
5. Third pereopod with merus unarmed; dactylus biunguiculate.
6. Posterolateral angles of telson slightly projecting, subacute.
7. Colour in life: pale greenish blue; eggs orange.
8. Size: maximal total body length 15 mm.

Distribution. Indo-West Pacific from the Red Sea and South-East Africa to the South-China Sea and Australia.

Ecology. Benthic on hard coral and coral rubble bottoms, from the low intertidal to about 50 m; free-living in crevices and among coralline algae and incrusting sponges.

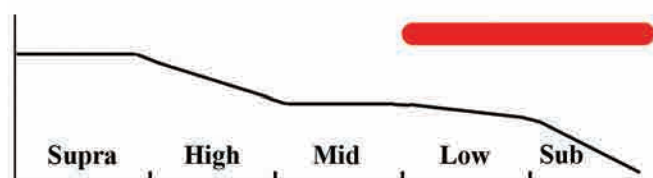


Figure 139. Bathymetric distribution of the species.

Remarks. As Al-Kandari et al. (2020a) pointed out, identifying the Kuwaiti material as *S. gracilirostris* of De Man (1910) requires confirmation. Banner and Banner's (1975) material from Australia does not match perfectly with the De Man's type material from Indonesia. The presence of long-rostrum forms in other species, e.g., the *S. hastilicrassus* complex, further complicates the identification issues.

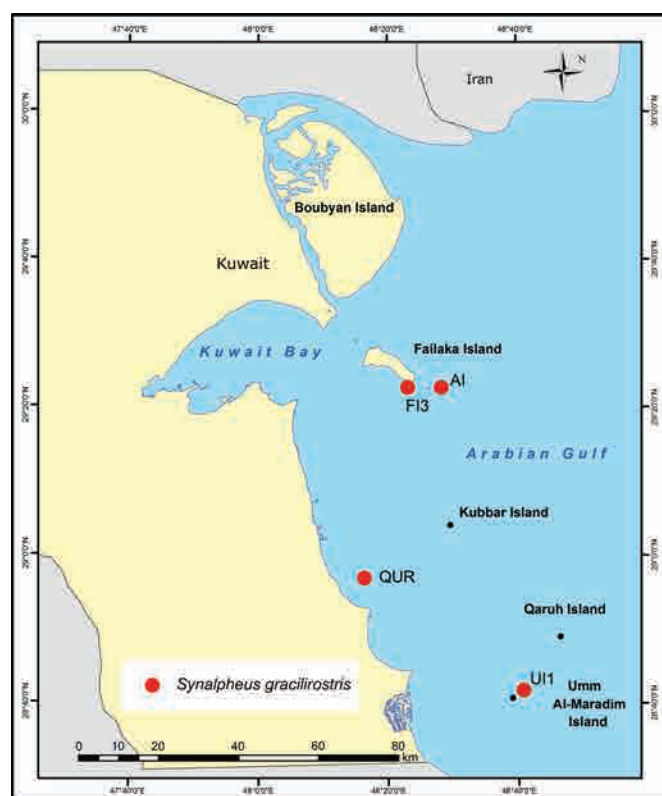


Figure 140. Presently known records of *Synalpheus gracilirostris* in Kuwait.

Most Relevant References. De Man 1910, 1911; Banner and Banner 1975; Al-Kandari et al. 2020a.



Figure 141. Frontal view of *Synalpheus gracilirostris* from Oman. Photograph by Gustav Paulay.

Family Alpheidae

Synalpheus quinquedens Tattersall, 1921



Figure 142. Ovigerous female of *Synalpheus quinquedens* Tattersall, 1921, from Iran, in dorsal view. Photograph by Rashed Abdollahi.

Main Diagnostic Features.

1. Rostrum rather short, not reaching distal half of first article of antennular peduncle, no more than four times as long as wide, subacute, as long as or slightly shorter than orbital teeth; orbital teeth slightly wider than rostrum, subacute.
2. Antennal basicerite with sharp dorsal tooth and long sharp ventrolateral tooth, latter as long as stylocerite.
3. Antennal blade present, narrow, much shorter than distolateral tooth.
4. Major chela palm with prominent, upwards-directed, blunt distolateral tooth.
5. Third pereiopod with merus unarmed; dactylus biunguiculate.
6. Posterior margin of sixth pleonite with five spiny processes (including two flanking telson).
7. Posterolateral angles of telson slightly projecting, subacute.
8. Colour in life: pale greenish to pale reddish; eggs green.
9. Size: maximal total body length 25 mm.

Distribution. Western Indian Ocean: Red Sea and Arabian Gulf south to Madagascar.

Ecology. Benthic on mixed bottoms with sponges, in the lower intertidal and shallow subtidal areas to about 64 m (although usually much shallower); associated with sponges.

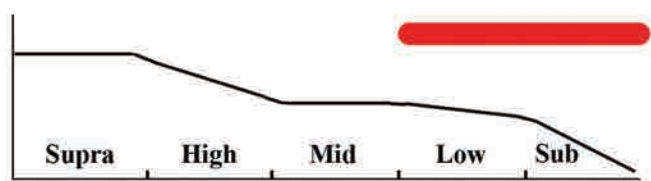


Figure 143. Bathymetric distribution of the species.

Remarks. *Synalpheus quinquedens* was first reported from Kuwait by Jones (1986a), and this record was recently confirmed by Al-Kandari et al. (2020a).

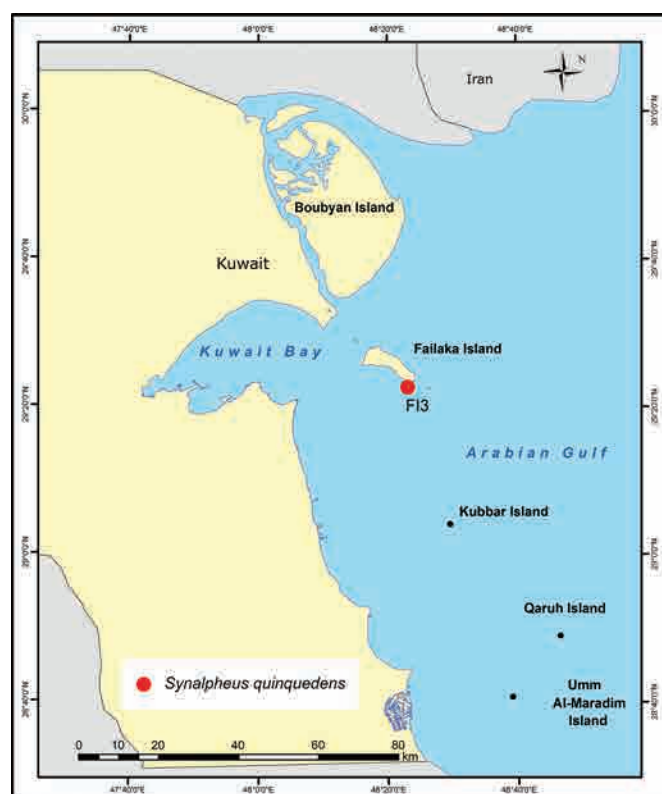


Figure 144. Presently known record of *Synalpheus quinquedens* in Kuwait.

Since the species also occurs in Iran (Ashrafi et al. 2020), it appears to be widespread in the Arabian-Persian Gulf. The most apparent morphological distinguishing character of *S. quinquedens* (and the related *S. pentaspinosus*) is the presence of five sharp teeth on the posterior margin of the last (sixth) pleonite.

Most Relevant References. Ashrafi et al. 2020; Al-Kandari et al. 2020a.



Figure 145. Male of *Synalpheus quinquedens* from Oman. Photograph by Gustav Paulay.

Family Alpheidae

Synalpheus tumidomanus (Paulson, 1875)

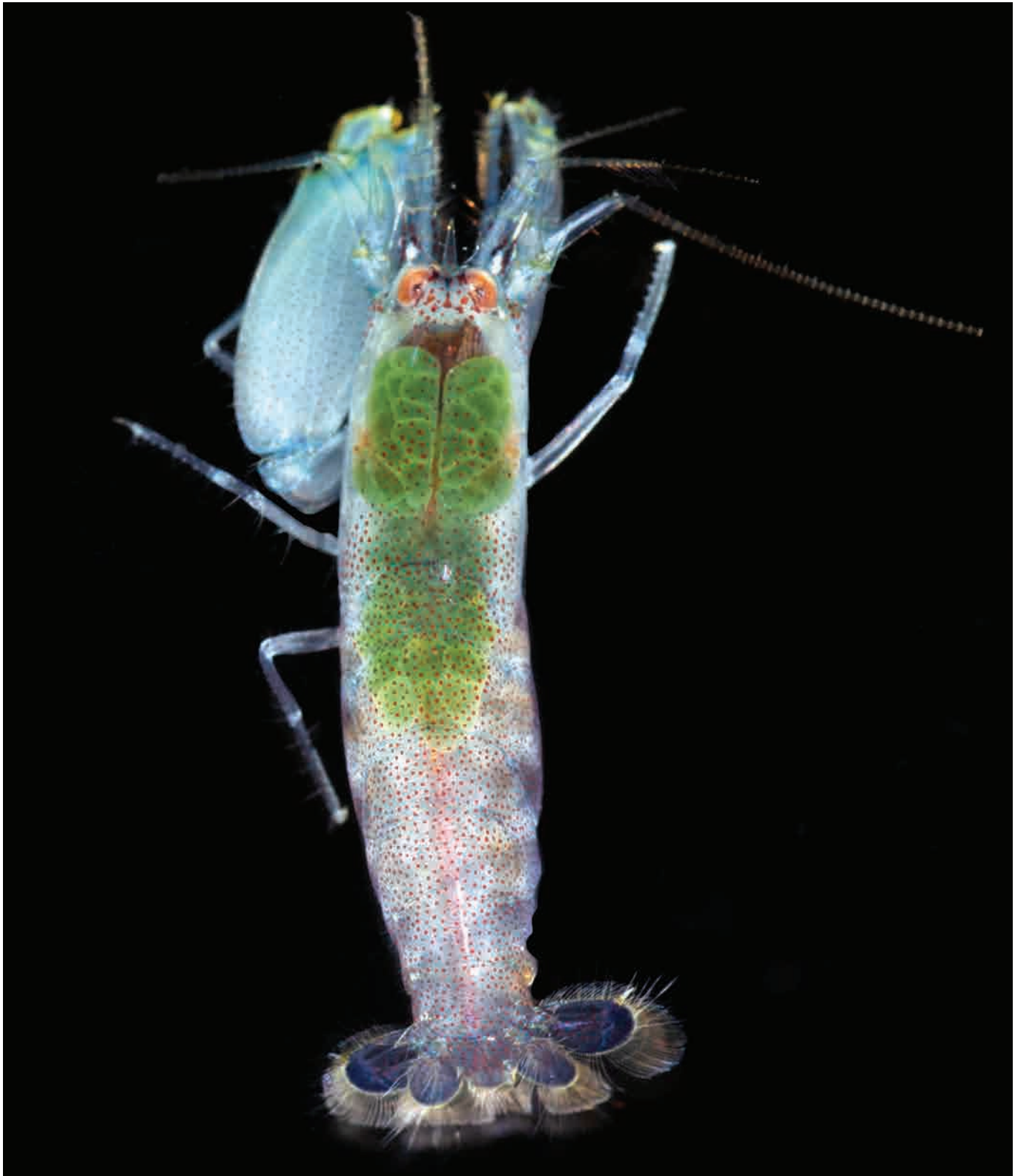


Figure 146. Ovigerous female of *Synalpheus* cf. *tumidomanus* (Paulson, 1875) from Oman, in dorsal view. Photograph by Gustav Paulay.

Synonyms. *Alpheus tumido-manus* Paulson, 1875; (?) *Synalpheus hululensis* Coutière, 1908; (?) *Synalpheus maccullochi* Coutière, 1908; (?) *Synalpheus theophane* De Man, 1910; (?) *Synalpheus anisocheir* Stebbing, 1915; (?) *Synalpheus japonicus* Yokoya, 1936 (some of them probably valid species, see below).

Main Diagnostic Features. Species complex

1. Rostrum variable, usually reaching distal half of first article of the antennular peduncle, acute or subacute, longer than acute orbital teeth.
2. Antennal basiscerite with or without a dorsal tooth, with long sharp ventrolateral tooth, latter almost as long as or much shorter than stylocerite.
3. Antennal blade present, moderately broad, much shorter than distolateral tooth.
4. Major chela palm with or without the distolateral tooth.
5. Third pereopod with merus unarmed; dactylus biunguiculate.
6. Posterolateral angles of telson not or very slightly projecting, subacute.
7. Colour in life: pale greenish with purple-red or blue chromatophores; eggs green.
8. Size: maximal total body length 28 mm.

Distribution. Indo-West Pacific from the Red Sea and South Africa to Japan, Australia, and Samoa. Since multiple species seem to be involved, the exact distribution of each of them remains undetermined.

Ecology. Benthic on various types of hard and mixed bottoms, usually with corals, coral rubble, algae, sponges, etc., from the mid-intertidal to about 60 m (usually much shallower); sometimes associated with sponges.

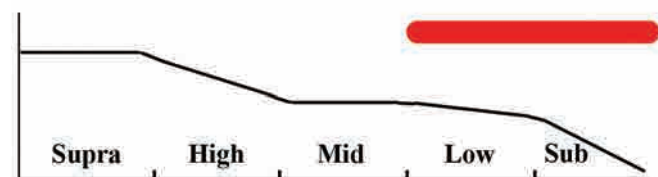


Figure 147. Bathymetric distribution of the species.

Remarks. *Synalpheus tumidomanus* remains a highly problematic taxon which needs a thorough taxonomic revision. The vast concept of the species adapted by Banner and Banner (1975) is not satisfactory. Kuwait's material is tentatively assigned to *S. tumidomanus*, awaiting a full redescription of the taxon and the eventual resurrection of several of its junior synonyms. According to Paulson (1875), *S. tumidomanus* has fairly large eggs, an important observation, which may help in the redefinition of the species.

Most Relevant References. Paulson 1875; Coutière 1908; De Man 1910, 1911; Banner and Banner 1975; Anker and De Grave 2016.

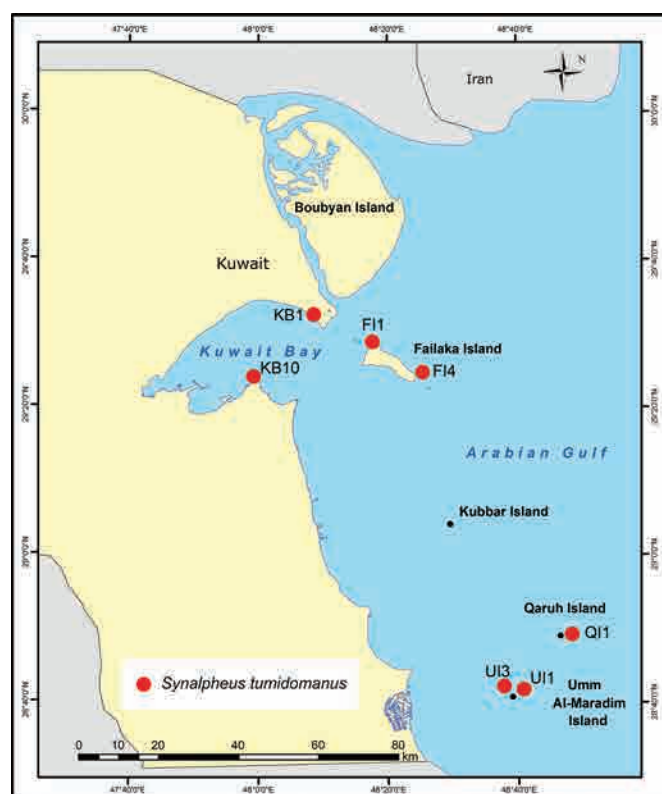


Figure 148. Presently known records of *Synalpheus tumidomanus* in Kuwait.

Family Chlorotocellidae

Chlorocurtis jactans (Nobili, 1904)



Figure 149. Ovigerous female of *Chlorocurtis jactans* (Nobili, 1904) from French Polynesia, in lateral view. Photograph by Arthur Anker.

Synonyms. *Virbius* (?) *jactans* Nobili, 1904; *Chlorocurtis miser* Kemp, 1925.

Main Diagnostic Features.

1. Carapace smooth, with sparse plumose setae; antennal and pterygostomial spines present.
2. Rostrum short, not reaching end of first article of antennular peduncle, very deep at base, with sharply pointing tip; dorsal margin strongly convex, armed with 5–8 teeth; ventral margin straight, unarmed.
3. Antennular peduncle not reaching end of scaphocerite.
4. Pleon smooth, with sparse plumose setae; third pleonite unarmed, but forming angle above fourth.
5. Colouration is cryptic, partly translucent and often has pink tinge and whitish spots.
6. Size: body length usually less than 10 mm.

Distribution. Indo-West Pacific from the Red Sea and Arabian Gulf to the South-China Sea and French Polynesia.

Ecology. Benthic on mixed bottoms dominated by algae and/or seagrasses, in the mid-intertidal and shallow subtidal (to at least 10 m); associated with algae and seagrass.

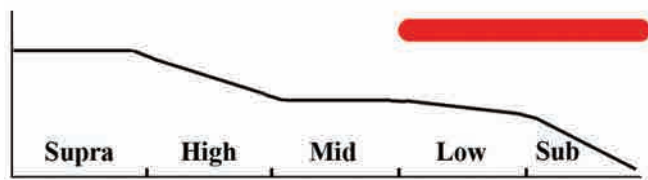


Figure 150. Bathymetric distribution of the species.

Remarks. The genus *Chlorocurtis* was recently transferred from the Pandalidae to the Chlorotocellidae, together with three other genera (Komai et al. 2019). The same authors also provided detailed line drawings of *C. jactans*. Additional drawings can be found in Kemp (1925, as *C. miser*), Ledoyer

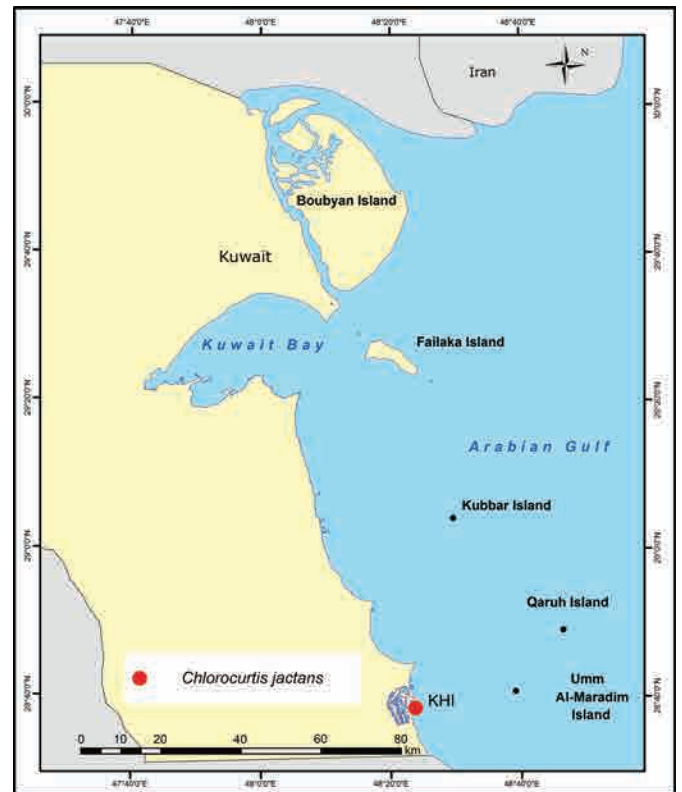


Figure 151. Presently known record of *Chlorocurtis jactans* in Kuwait.

(1969) and Gan and Li (2018); the latter authors also published colour photographs of the Chinese specimens. All chlorotocellid shrimps are associated with algae, seagrasses, gorgonians, and whip corals. In Kuwait, *C. jactans* is presently observed only in the Al-Khiran area (Al-Kandari et al. 2020a).

Most Relevant References. Nobili 1904; Kemp 1925; Ledoyer 1969; Gan and Li 2018; Komai et al. 2019; Al-Kandari et al. 2020a.



Figure 152. Intertidal seaweeds at Al-Khiran, Kuwait, from where *Chlorocurtis jactans* has been reported. Photograph by Valeriy Skryabin.

Family Hippolytidae

Hippolyte ventricosa H. Milne Edwards, 1837

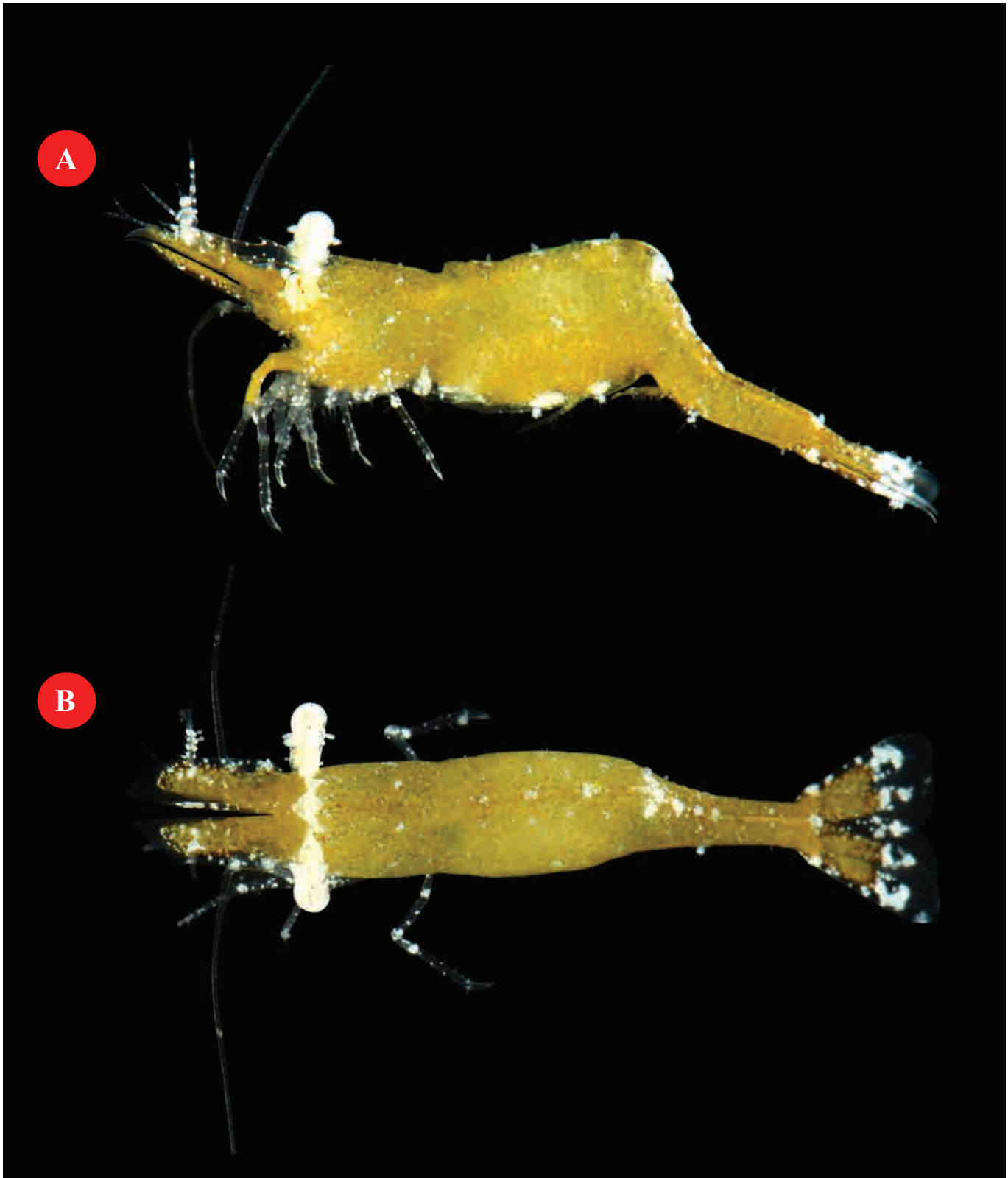


Figure 153. Ovigerous female of *Hippolyte ventricosa* (H. Milne Edwards, 1837) in lateral (A) and dorsal (B) views, Kuwait. Photographs by Arthur Anker.

Synonyms. *Hippolyte orientalis* Heller, 1862 (valid according to d'Udekem d'Acoz 1999); (?) *Virbius mossambicus* Hilgendorf, 1879.

Main Diagnostic Features. Species complex?

1. Rostrum long, variable in shape, with 1–2 dorsal teeth and 1–4 ventral teeth.
2. Hepatic spine reaching or slightly overreaching anterior margin of carapace.
3. Second pereopod carpus with 3 subarticles.
4. Third pereopod in full extension not reaching end of scaphocerite; dactylus of third pereopod with 2 terminal teeth and 8–9 spinules on ventral margin.
5. Colour pattern: usually bright green, sometimes olive or olive-brown.
6. Size: maximal body length 15 mm.

Distribution. Indo-West Pacific from the Red Sea and Arabian Gulf to southern China, Australia, and French Polynesia.

Ecology. Benthic on mixed bottoms dominated by algae and/or seagrasses, from the mid-intertidal zone to 30 m, but mostly in 0–10 m; associated with various types of algae and seagrasses and can adapt colour to the substrate of choice.

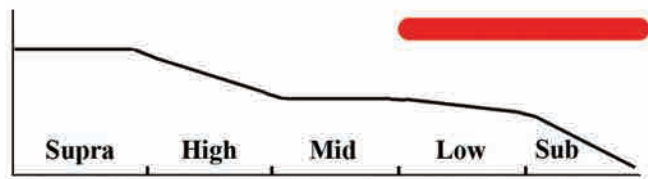


Figure 154. Bathymetric distribution of the species.

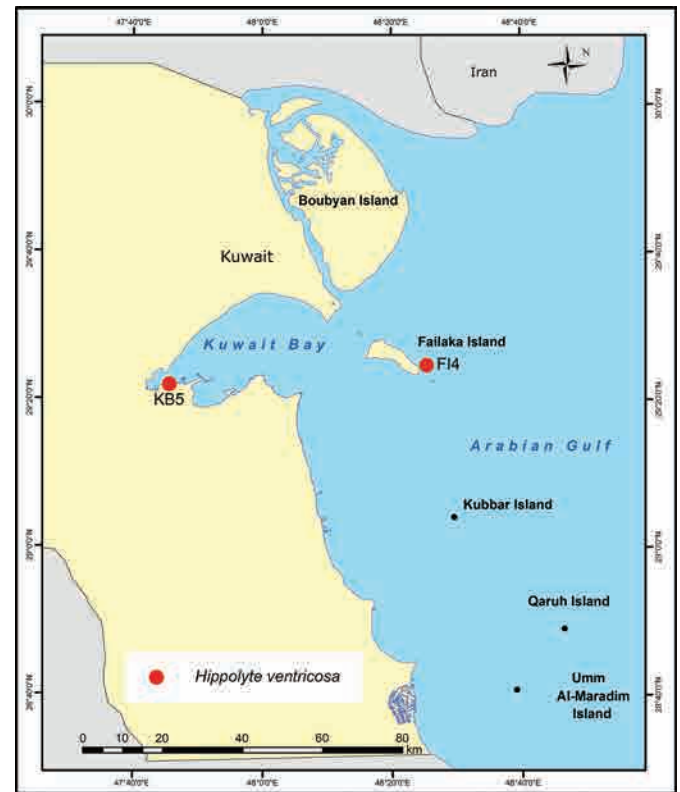


Figure 155. Presently known records of *Hippolyte ventricosa* in Kuwait.

Remarks. Despite an excellent redescription of the type material of *H. ventricosa* by d'Udekem d'Acoz (1999), this taxon remains problematic, mainly because of the uncertain status of several morphologically close forms, such as *H. orientalis*, as well as the recent descriptions of several additional taxa (e.g. Gan and Li 2017).

Most Relevant References. Milne Edwards 1837; d'Udekem d'Acoz 1999; Anker and De Grave 2016.



Figure 156. Ovigerous female of *Hippolyte* cf. *ventricosa* (H. Milne Edwards, 1837) from the Red Sea, brown colour morph in lateral view. Photograph by Arthur Anker.

Family Hippolytidae

Latreutes anoplonyx Kemp, 1914



Figure 157. Ovigerous female of *Latreutes anoplonyx* (Kemp, 1914) from Singapore, in lateral view. Photograph by Arthur Anker.

Common Name. Kemp's jellyfish shrimp.

Main Diagnostic Features.

1. Rostrum variable in shape and armature, with deep keel, 12–14 dorsal teeth, and 9–10 ventral teeth (or similar numbers).
2. Carapace 1 postorbital tooth on mid-dorsal keel.
3. Anterior margin of carapace above pterygostomial angle with a row of teeth.
4. Second pereopod carpus with 3 sub-articles, second longest.
5. Dactylus of fourth and fifth pereopods with 1 terminal tooth and 2 spinules on ventral margin.
6. Colour pattern: semitransparent with diffuse brown-reddish transverse bands or brown mottling on pleon.
7. Size: maximal body length 47 mm.

Distribution. Indo-West Pacific, from the Arabian-Persian Gulf and India to Japan and northern Australia.

Ecology. Symbiotic on several species of large jellyfish (Scyphozoa); typically found on jellies beached in the intertidal area or swimming in the shallow subtidal area (Bruce 1995; Anker and De Grave 2016).

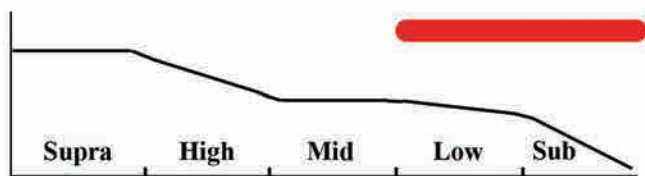


Figure 158. Bathymetric distribution of the species.

Remarks. The record of *L. anoplonyx* from Kuwait is based on Motoh (1975a)'s single record of three ovigerous females in the shore zone near Kuwait City. The largest female measured had a total body length of 37.6, thus falling within the size range of the species and excluding a possible misidentification with *L. mucronatus*. The published black-and-white photograph of a preserved specimen indicates that Motoh's record was correct.

Most Relevant References. Kemp 1914; Motoh 1975a; Bruce 1995; Anker and De Grave 2016.

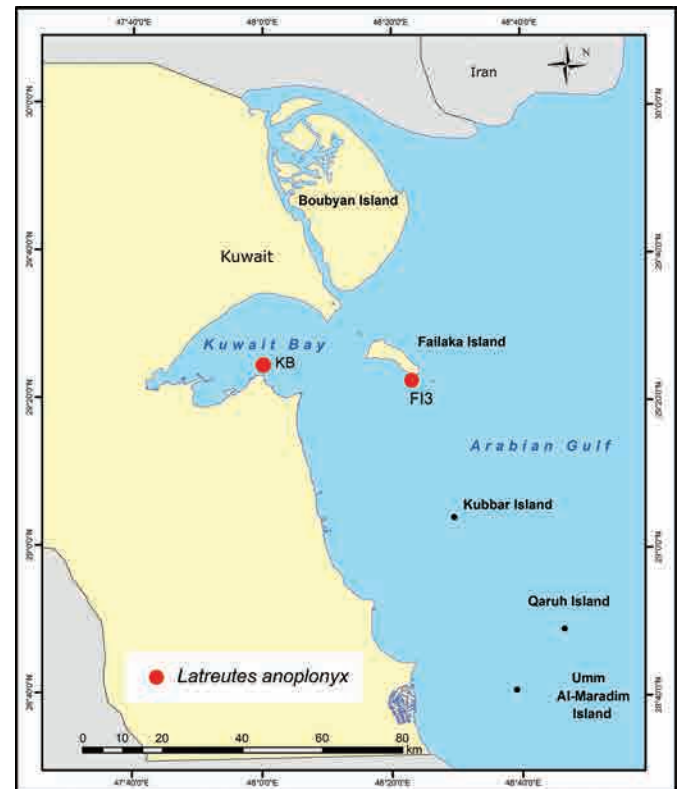


Figure 159. Presently known records of *Latreutes anoplonyx* in Kuwait.



Figure 160. Ovigerous female of *Latreutes anoplonyx* (Kemp, 1914), in lateral view, Kuwait. Reproduced from Motoh (1975a), Kuwait Institute of Scientific Research, Rep. MAB II, VII 75.

Family Hippolytidae

Latreutes mucronatus (Stimpson, 1860)



Figure 161. Ovigerous female of *Latreutes mucronatus* (Stimpson, 1860) in lateral (A) and dorsal (B) views, Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonyms. *Latreutes gravieri* Nobili, 1904; *Latreutes mucronatus* var. *multidens* Nobili, 1905; *Latreutes natalensis* Lenz and Strunck, 1914.

Main Diagnostic Features. Species complex?

1. Rostrum highly variable in shape and armature, usually with deep keel, with 7–15 dorsal teeth and 2–15 ventral teeth.
2. Carapace with 1–4 (typically 3) postorbital teeth on mid-dorsal keel.
3. Anterior margin of carapace above pterygostomial angle with a row of teeth.
4. Second pereopod carpus with 3 subarticles, second longest.
5. Dactylus of fourth and fifth pereopods with 2 terminal teeth and 3 spinules on ventral margin.
6. Colour patterns highly variable, e.g., mottled with chocolate-brown and white, uniform brown-orange, or brown speckled with darker spots and blotches.
7. Size: maximal body length about 18 mm.

Distribution. Indo-West Pacific, from the Arabian-Persian Gulf and Madagascar to Japan and Indonesia.

Ecology. Benthic on mixed bottoms dominated by algae, in the lower intertidal and shallow subtidal area; associated with various types of algae, occasionally found in association with scyphozoan jellyfish (Hayashi and Miyake 1968).

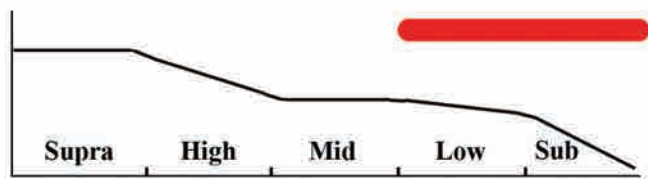


Figure 162. Bathymetric distribution of the species.

Remarks. According to Al-Kandari et al. (2020a), all Kuwaiti specimens have three post-orbital teeth, as does the material from Madagascar and Pakistan, reported by Ledoyer (1969) and Ghani and Tirmizi (1991), respectively, and in contrast to specimens from elsewhere in the species' geographical range, e.g., South Africa and Japan (Barnard 1950; Hayashi and Miyake 1968). However, whether more than two or more species is/are involved in what could constitute the *L. mucronatus* species complex remains to be unveiled. Good illustrations of the general morphology of this species can be found, for instance, in Ledoyer 1969 and Ghani and Tirmizi 1991.

Most Relevant References. Kemp 1916; Ledoyer 1969; Ghani and Tirmizi 1991; Al-Kandari et al. 2020a.

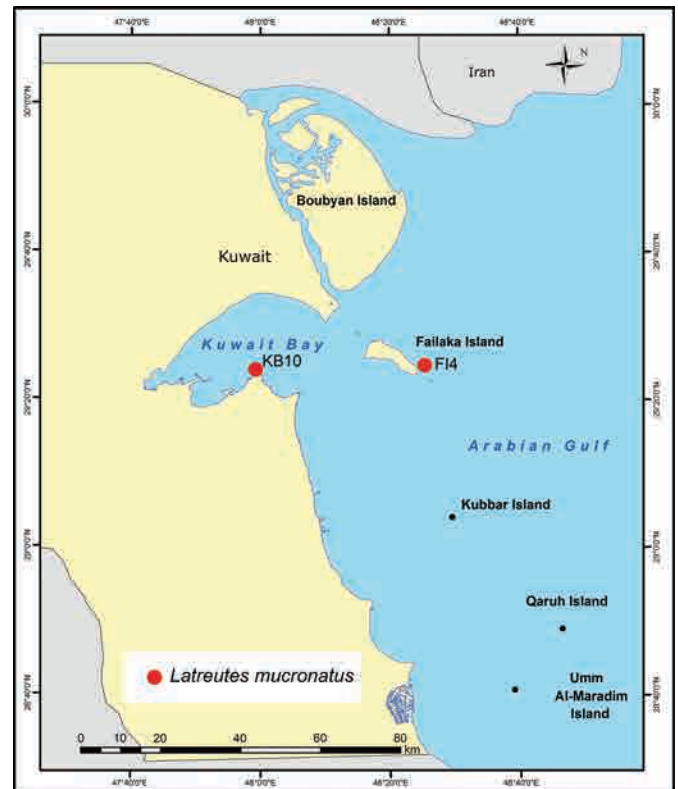


Figure 163. Presently known records of *Latreutes mucronatus* in Kuwait.



Figure 164. Ovigerous female of *Latreutes mucronatus* (Stimpson, 1860) in lateral view, Failaka Island, Kuwait. Photograph by Arthur Anker.



Figure 165. Seaweed bed in the intertidal area of eastern Failaka Island, one of the two collection localities of *Latreutes mucronatus* in Kuwait. Photograph by Valeriy Skryabin.

Family Hippolytidae

Saron marmoratus (Olivier, 1811)

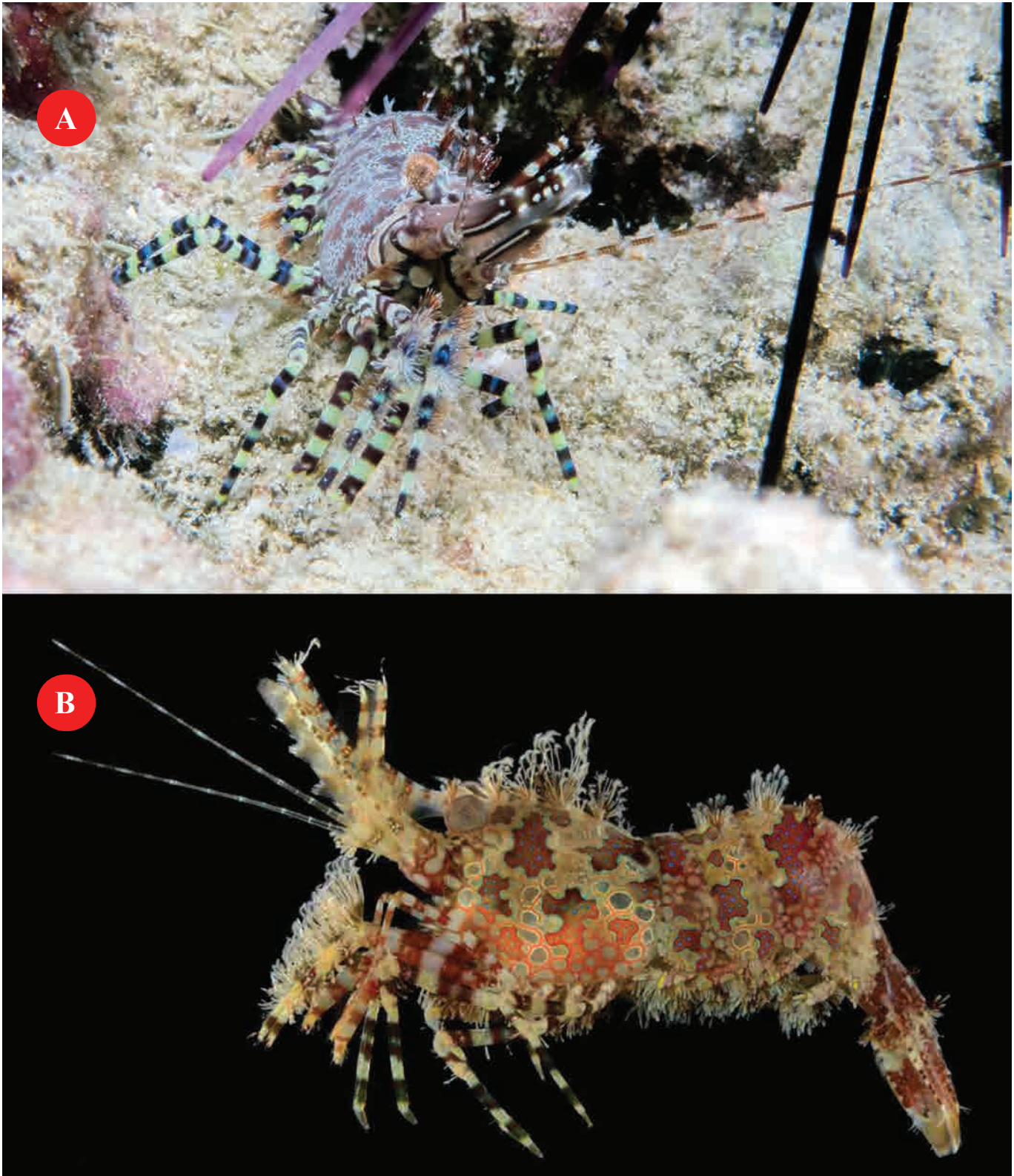


Figure 166. Male of *Saron marmoratus* (Olivier, 1811) on a coral reef at Kubbar Island, Kuwait (A), female from Singapore in lateral view (B). Photographs by Faisal Al-Sarraf (A) and Arthur Anker (B).

Synonyms. *Palaemon marmoratus* Olivier, 1811; *Hippolyte gibberosus* H. Milne Edwards, 1837; *Hippolyte hemprichii* Heller, 1861; *Hippolyte leachii* Guérin-Méneville, 1838; *Hyppolite* [lap. cal.] *kraussii* Bianconi, 1869; *Nauticarisc grandirostris* Pearson, 1905 (some may be valid, see below).

Common Name. Marbled shrimp.

Main Diagnostic Features. Species complex

1. Rostrum usually longer than carapace, curved upward, with variable armature.
2. Body often with setal tufts; carapace with single orbital margin.
3. Antennular peduncle without erect spinule on third article; basicerite of antenna lacking prominent distolateral tooth.
4. Third maxilliped sexually dimorphic, with dense setae in larger males.
5. Second pereopod carpus with 9–13 subarticles.
6. Fifth pereopod with 2 subdistal spines on merus.
7. Colour pattern highly variable, typical form mottled or marbled with chocolate-brown, orange, green, and blue, with spots, starts, and blotches.
8. Size: maximal body length about 50 mm.

Distribution. Indo-West Pacific, from the Red Sea and South Africa to Japan, Hawaii, and Australia; Lessepsian migrant into the eastern Mediterranean (Rothman et al. 2013). Since multiple species are involved, the distribution range of each of them remains unknown.

Ecology. Benthic on hard bottoms dominated by living and dead corals, fragmented coral rubble, coralline algae and rocks, from the lower intertidal zone to at least 30 m; free-living under large rocks, coral rubble, corals, etc.; active mostly at night.

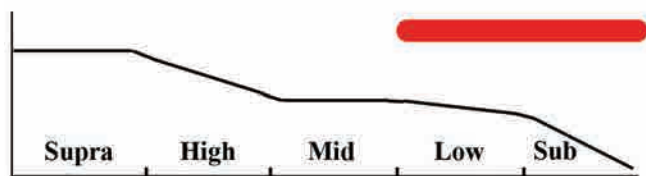


Figure 167. Bathymetric distribution of the species.

Remarks. *Saron marmoratus* is a well-known, very difficult species complex currently being studied by a team of taxonomists and geneticists. Various aspects of sexual dimorphism of *S. marmoratus* were studied by Coutière (1910), Kemp (1914), and Tirmizi and Kazmi (1971), affecting the third maxilliped or the sternum of the cephalothorax, but how much of this variation is interspecific remains to be shown. Colour patterns seem crucial in attempting to taxonomically resolve the *S. marmoratus* complex (Anker and De Grave 2016). In the Arabian-Persian Gulf area, *S. marmoratus* is recorded from Kuwait (Jones 1986a), Saudi Arabia, UAE (De Grave and Ashelby 2011), and the Iranian coast of the Gulf of Oman (Sheibani-Tezerji and Sari 2007).

Most Relevant References. Coutière 1910; Kemp 1916; Tirmizi and Kazmi 1971; Jones 1986a; Chace 1997; Anker and De Grave 2016.

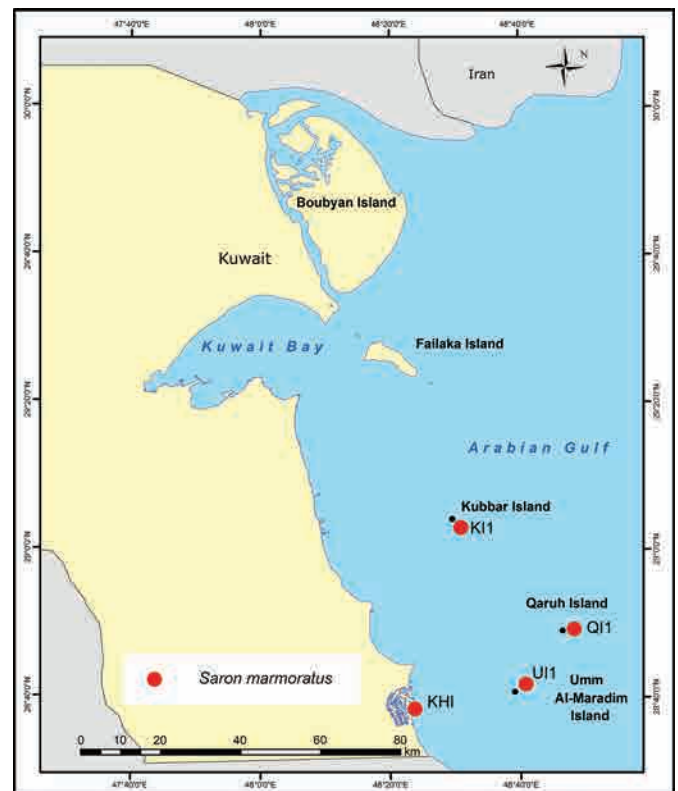


Figure 168. Presently known records of *Saron marmoratus* in Kuwait.



Figure 169. *Saron marmoratus* on a coral reef at Qaruh Island, Kuwait. Photographs by Husain Alqallaf (A) and Mohammed Al-Sabah (B).



Figure 170. *Saron marmoratus* on a coral reef at Qaruh Island, Kuwait.
Photograph by Maryam Fahad AlMashaan AlMeshaweh.

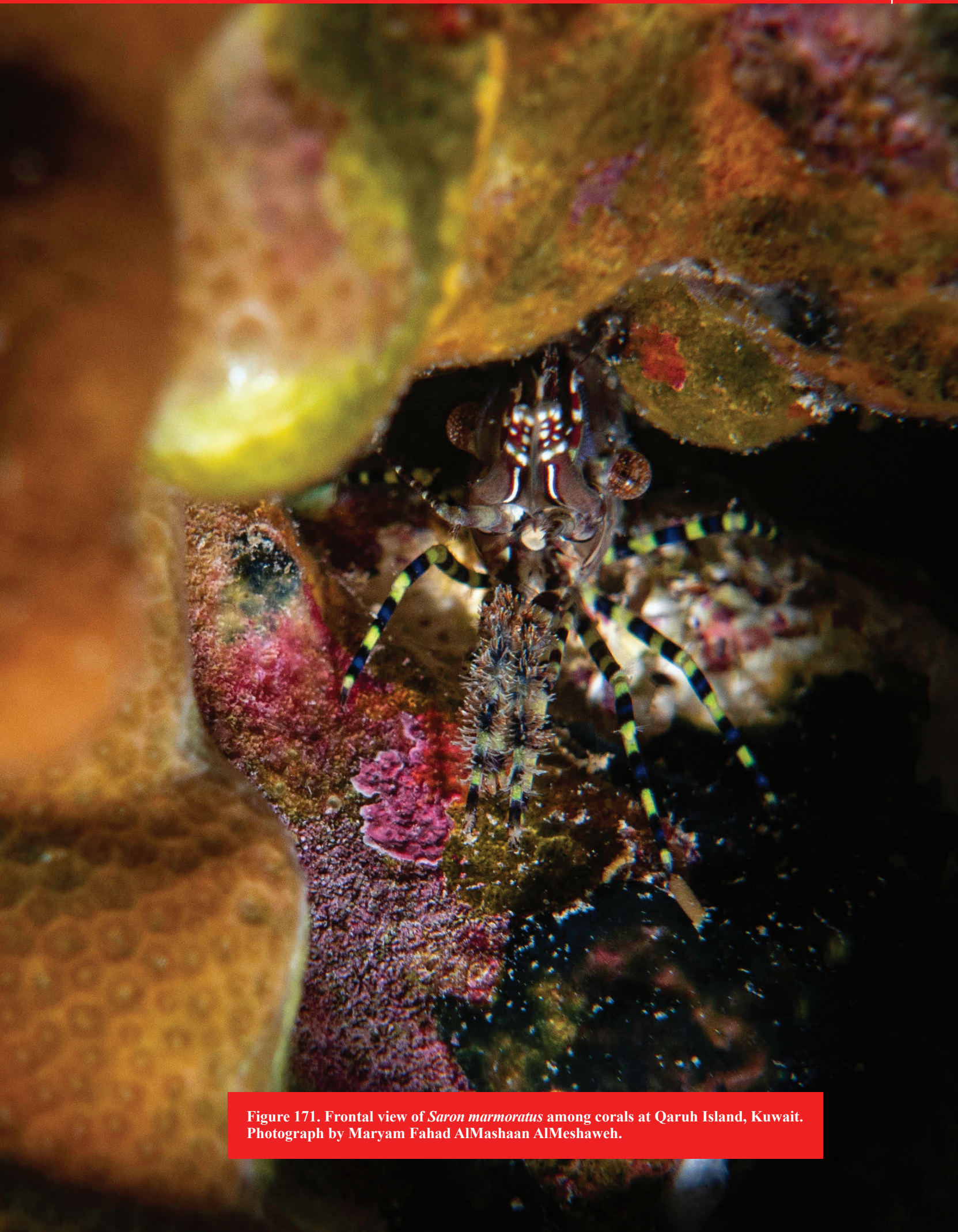


Figure 171. Frontal view of *Saron marmoratus* among corals at Qaruh Island, Kuwait.
Photograph by Maryam Fahad AlMashaan AlMeshaweh.

Family Lysmatidae

Lysmata vittata (Stimpson, 1860)

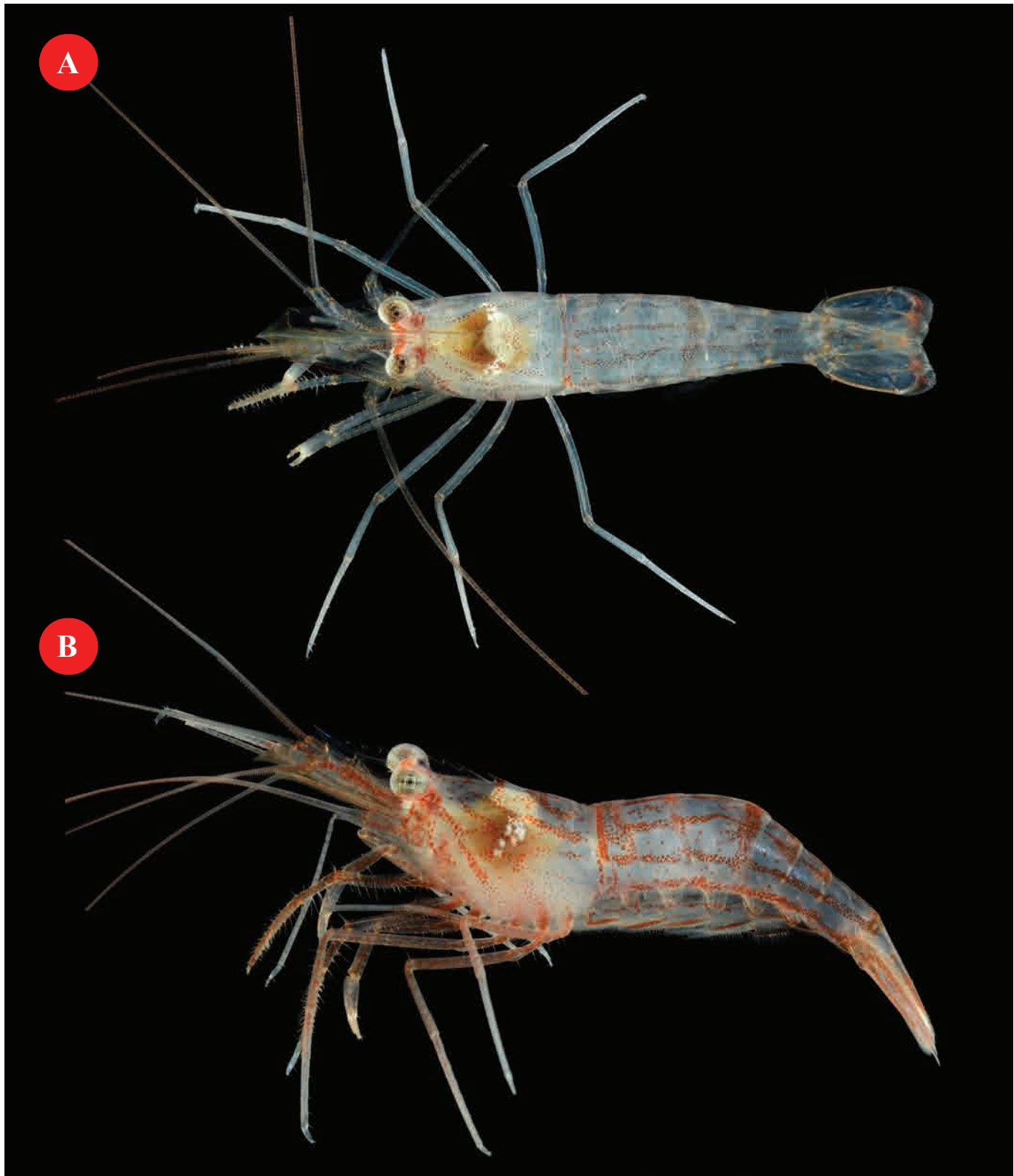


Figure 172. Non-ovigerous hermaphrodite of *Lysmata vittata* (Stimpson, 1860) in dorsal (A) and lateral (B) views, Kuwait. Photographs by Arthur Anker.

Synonyms. *Hippolysmata vittata* Stimpson, 1860; *Nauticaris unirecedens* Spence Bate, 1888, 1837; *Hippolysmata durbanensis* Stebbing, 1921.

Common Name. Stimpson's red-striped shrimp.

Main Diagnostic Features.

1. Rostral formula 2–3 [post-orbital teeth] + 2–5/1–5 [dorsal / ventral rostral teeth, respectively].
2. Carapace with antennal spine not fused with orbital angle; pterostomial angle with small tooth.
3. Antennule with stylocerite reaching about to mid-length of first article; dorsal flagellum without accessory branch.
4. First pereiopod with chela about 12 times as long as carpus.
5. Second pereiopod carpus is composed of 15–31 subarticles.
6. Third pereiopod with biunguiculate dactylus.
7. Colour pattern: unique disposition of red lines and bands, including several parallel-running longitudinal bands and broad dark red transverse “saddle” on third pleonite.
8. Size: maximal body length about 35 mm.

Distribution. Indo-West Pacific, from East Africa and the Arabian-Persian Gulf to Japan, Indonesia, and Australia; Lessepsian migrant into the eastern Mediterranean Sea (Abdelsalam 2018).

Ecology. Benthic on mixed and hard bottoms dominated by sand with rocks, coral rubble, and algae, from the lower intertidal zone to 54 m; free-living under large rocks, coral rubble, among algae, often found in tide pools.

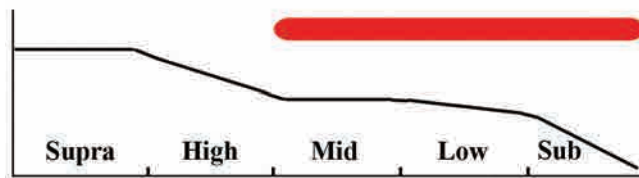


Figure 173. Bathymetric distribution of the species.

Remarks. *Lysmata vittata* is perhaps the most collected species of the genus from the Indo-West Pacific due to its frequent presence in the intertidal and wide distribution range. Nevertheless, the only prior record of *L. vittata* from Kuwait was that of Grabe and Lees (1995), based on larval material. Although Jones (1986a) did not list *L. vittata* in his famous guide, one of his rather diagrammatic and inaccurate figures on pl. 43 appears to represent a specimen of that species. Bruce (1990) redescribed *L. vittata* based on material from Hong Kong and provided numerous excellent illustrations of the species' morphology; whereas, high-quality colour photographs of *L. vittata* from Singapore were published by Anker and De Grave (2016).

Most Relevant References. Bruce 1990; Chace 1997; Anker and De Grave 2016.

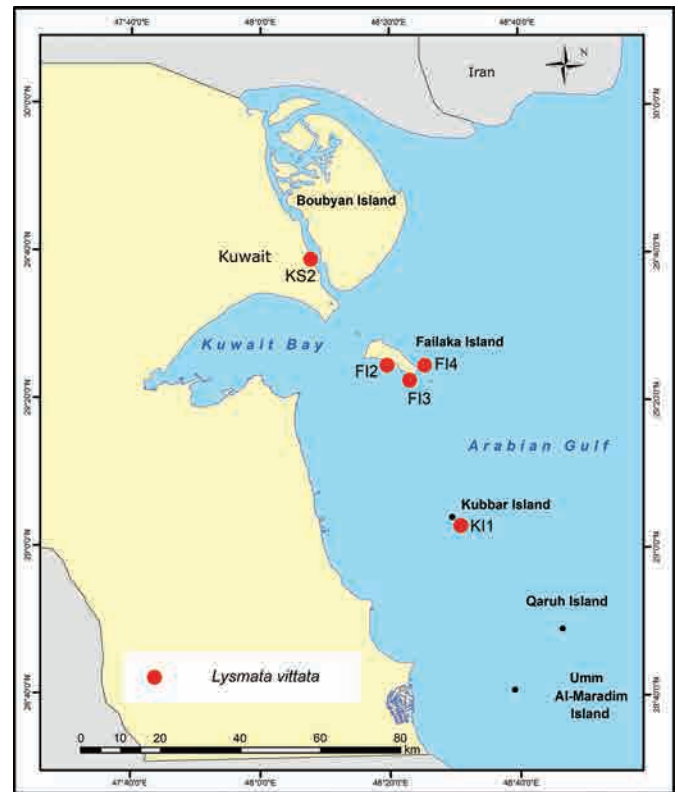


Figure 174. Presently known records of *Lysmata vittata* in Kuwait.



Figure 175. *Lysmata vittata* on a rocky intertidal area exposed at low tide, Failaka Island, Kuwait. Photograph by Valeriy Skryabin.

Family Ogyrididae

Ogyrides sindibadi De Grave, Al-Kandari and Anker, 2020

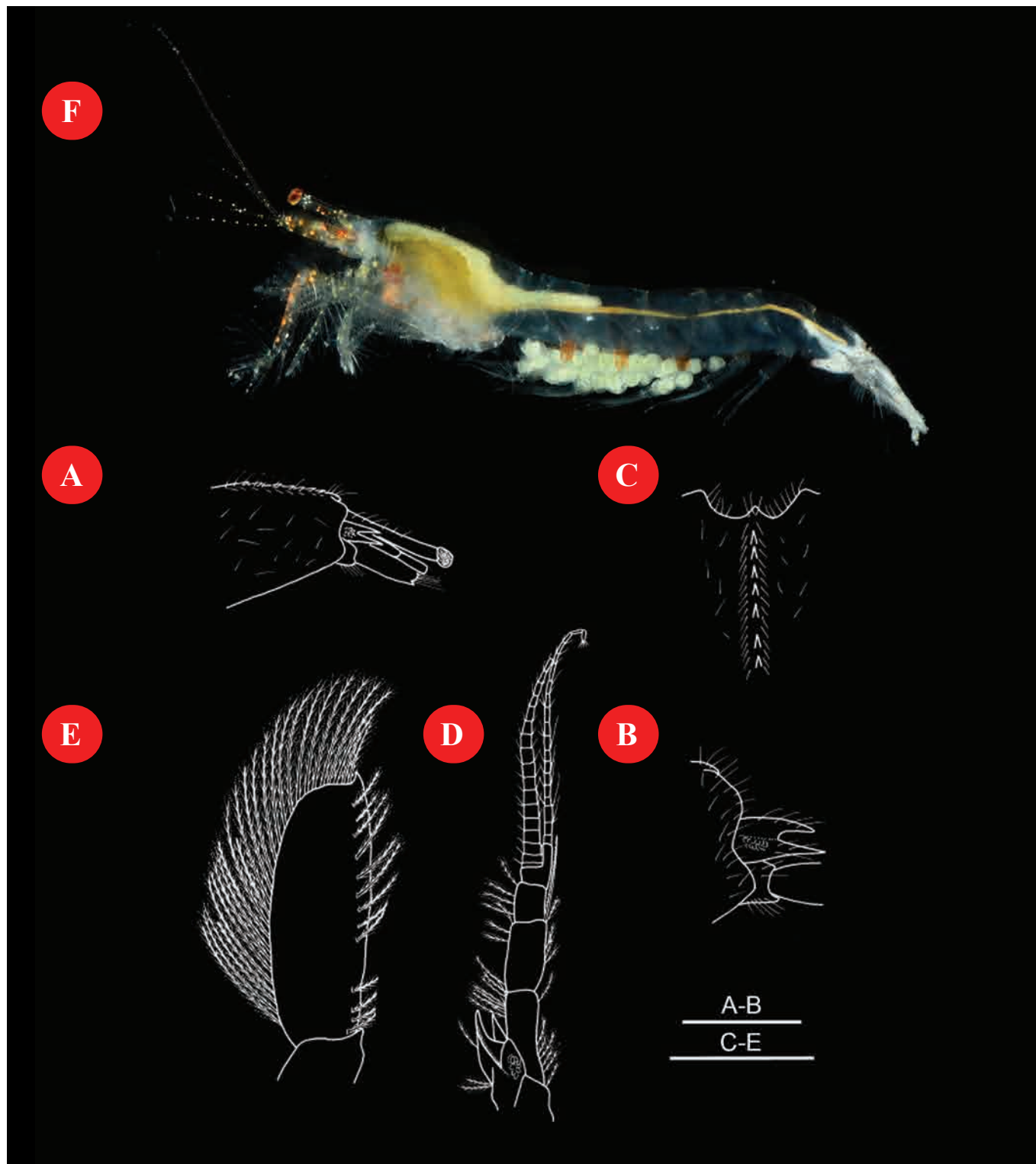


Figure 176. *Ogyrides sindibadi* De Grave, Al-Kandari and Anker, 2020, morphological details: anterior carapace and frontal appendages, lateral view (A); detail of anterolateral margin of carapace and basicerite, lateral view (B); detail of rostral keel, dorsal view (C); antennule, dorsal view (D); antennal scaphocerite, dorsal view (E); ovigerous female of *Ogyrides* cf. *orientalis* (lateral view) from Oman (F). Drawings B-E by De Grave et al. 2020. Photograph (A) by Arthur Anker.

Common Name. Sindbad telescope shrimp.

Main Diagnostic Features.

1. Carapace with 7 post-rostral teeth.
2. Eyestalks extremely elongate, parallel, “telescopic” (generic character).
3. Antennule with stylocerite nearing 2 sharp processes.
4. Antennal scaphocerite with a small distolateral tooth, shorter than antennular peduncle.
5. Second pereopod carpus is composed of 4 subarticles.
6. Third pereopod stout, with merus armed with 1 subdistal spinule.
7. Colour pattern unknown.
8. Size: body length less than 12 mm.

Distribution. Northwestern Indian Ocean: presently known only from the northern Arabian-Persian Gulf (Kuwait).

Ecology. Benthic on the sandy bottom in intertidal and possibly adjacent shallow subtidal areas; free-living and burrowing in sand.

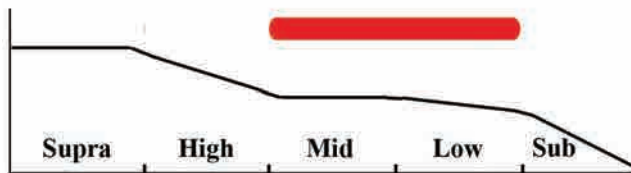


Figure 177. Bathymetric distribution of the species.

Remarks. *Ogyrides sindibadi* is the most recently described species in the small family of the so-called telescope shrimps. The species is presently observed only in Kuwait but is, likely, perhaps outside of it in the northwestern Indian Ocean. It is more widely prevalent in the Arabian-Persian Gulf and can

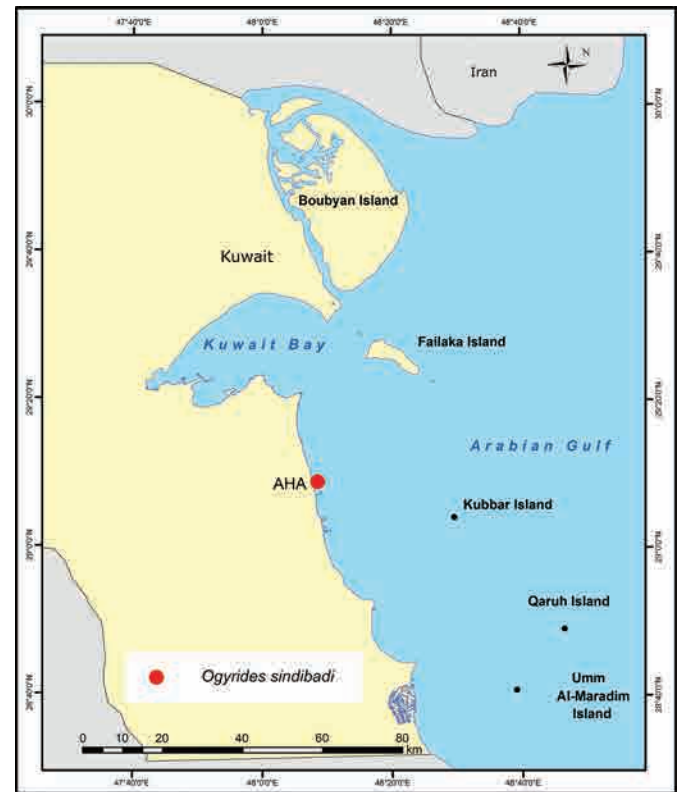


Figure 178. Presently known record of *Ogyrides sindibadi* in Kuwait.

be separated from its Indo-West Pacific congeners by the combining stouter walking legs (especially the third pereopod), the presence of seven post-rostral teeth, and the shape of the antennal scaphocerite (see De Grave et al. 2020 for details).

Most Relevant Reference. De Grave et al. 2020.



Figure 179. Type locality of *Ogyrides sindibadi* in Abu Halifa, Kuwait. Photograph by Valeriy Skryabin.

Family Palaemonidae

Anchistus custos (Forskål, 1775)

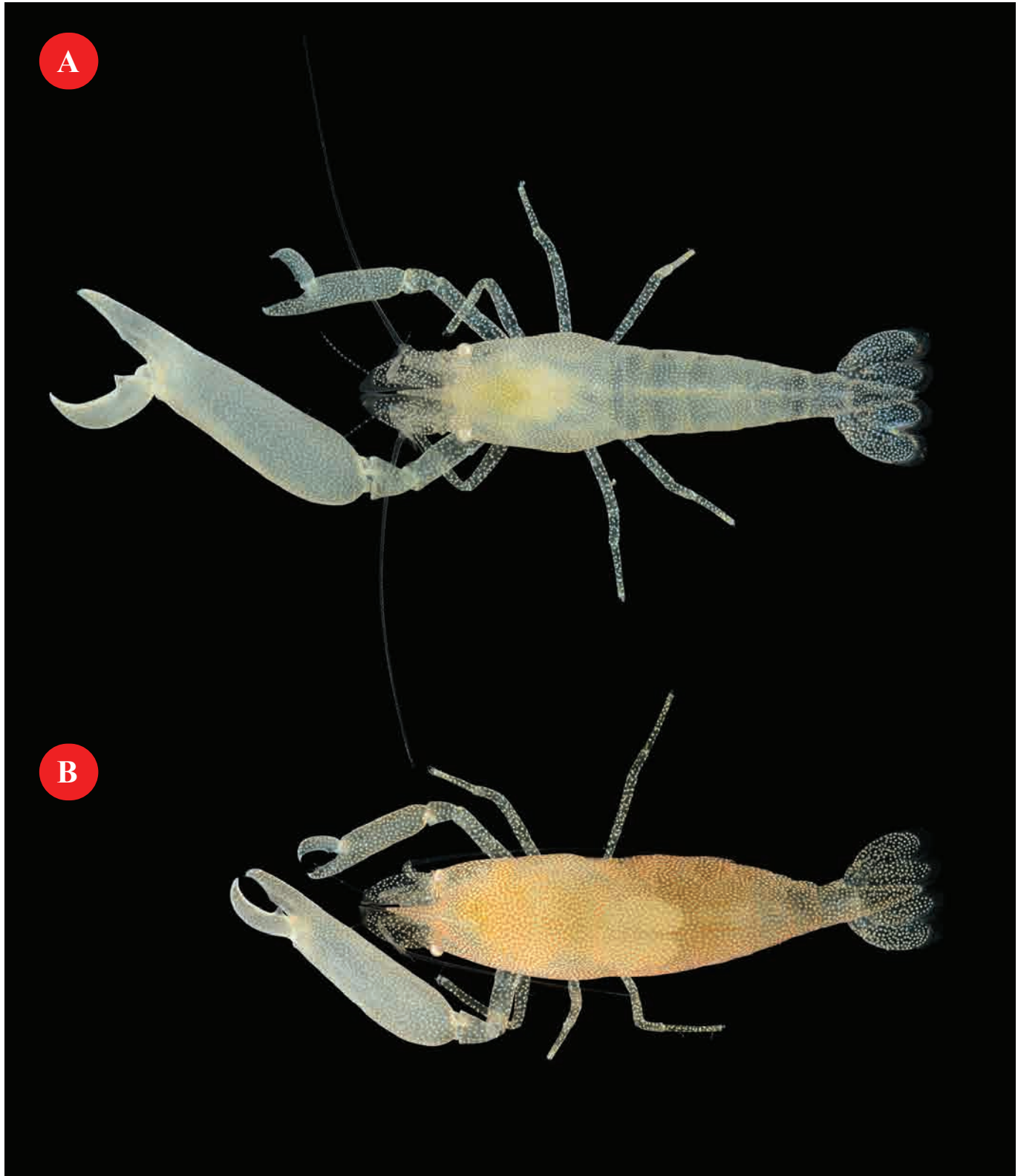


Figure 180. Male (A) and female (B) of *Anchistus custos* (Forskål, 1775) in dorsal view, Qit'at Uraifjan, Kuwait. Photographs by Arthur Anker.

Synonyms. *Cancer custos* Forskål, 1775; *Pontonia inflata* H. Milne Edwards, 1840; *Anchistia aurantiaca* Dana, 1852; *Harpilius inermis* Miers, 1884; *Pontonia pinnae* Ortmann, 1894: 16; *Marygrande mirabilis* Pesta, 1911.

Common Name. Fine-spotted fan clam shrimp.

Main Diagnostic Features.

1. Body dorsoventrally flattened, perfectly smooth.
2. Rostrum unarmed dorsally and ventrally, sexually dimorphic (longer and narrower in males), with minute apical teeth (or one tooth) above rostral point.
3. Second chelipeds subsymmetrical in shape but very unequal in size, sexually dimorphic (major cheliped larger and stouter in males); dactylus armed with large triangular tooth on cutting edge.
4. Third and fourth pereopods stout; dactylus simple, with apically strong curved unguis.
5. Colour pattern: background of body ranging from pale yellow to buff-orange, evenly speckled with numerous small white spots.
6. Size: body length reaching 35 mm.

Distribution. Indo-West Pacific from the Red Sea and Arabian Gulf to Fiji.

Ecology. Benthic on rocky-sandy or sandy-muddy bottoms, sometimes near seagrass beds, mid-intertidal down to 20 m; obligate associate of large bivalves of the genus *Pinna*, commonly known as pen shells or fan clams.

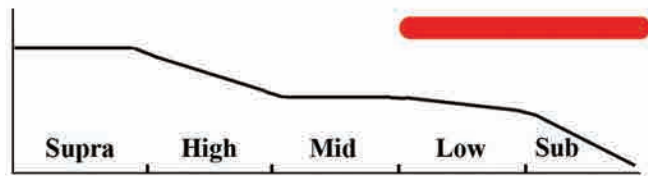


Figure 181. Bathymetric distribution of the species.

Remarks. *Anchistus custos* is the most common and widespread shrimp commensally associated with fan clams (mainly *Pinna* spp.) (Bruce 1982; De Grave 1999). The identification of the species of *Anchistus*, based on morphological characters is not easy (De Grave 1999). However, if the shrimp host is known, the identification is reduced to the verification of characters and comparison with the published descriptions (e.g. Holthuis 1952; Bruce 1982; De Grave 2020a). The colour pattern of *A. custos* is also species-diagnostic (Anker and De Grave 2016; Al-Kandari et al. 2020). The early larval development of *A. custos* (first zoea) was studied by Ghory and Kazmi (2018) in Pakistan.

Most Relevant References. Holthuis 1952; Bruce 1982; De Grave 2020a; Anker and De Grave 2016; Al-Kandari et al. 2020a.

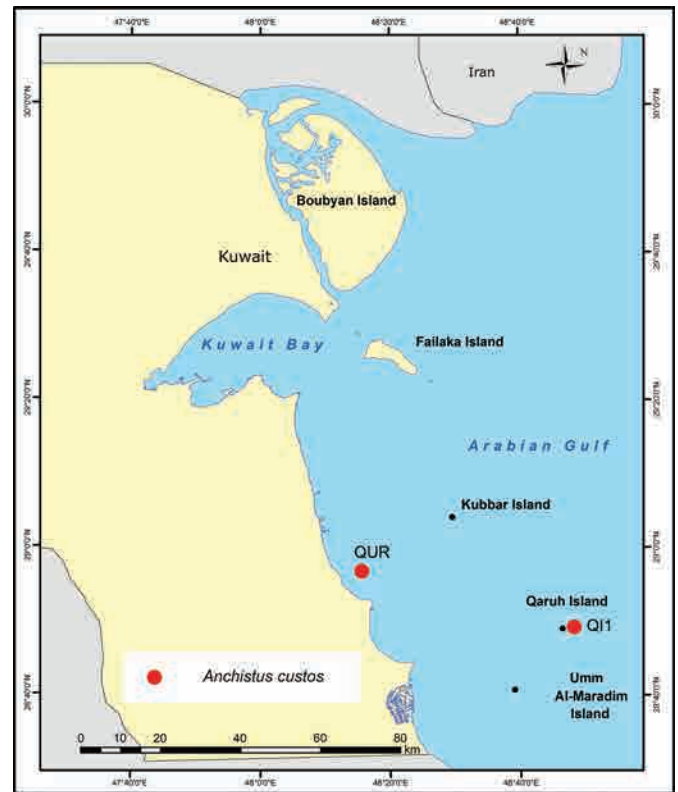


Figure 182. Presently known records of *Anchistus custos* in Kuwait.



Figure 183. Fan clam *Pinna bicolor*, one of the hosts of *Anchistus custos*, common on rocky-sandy bottoms at Qit'at Uraifjan, Kuwait. Photograph by Valeriy Skryabin.

Family Palaemonidae

Cuapetes ensifrons (Dana, 1852)



Figure 184. Male of *Cuapetes ensifrons* (Dana, 1852) from Kuwait in lateral (A) and dorsal (B) views, parasitised by a pair of isopods (Bopyridae, Hemiarthrinae). Photographs by Arthur Anker.

Synonyms. *Anchistia ensifrons* Dana, 1852; *Periclimenes ensifrons* (Dana, 1852); *Kemponia ensifrons* (Dana, 1852).

Main Diagnostic Features. Species complex?

1. Carapace and pleon smooth, not pitted; hepatic spine smaller than antennal spine.
2. Rostrum reaching to the end of antennal scale; rostral formula: 1–2 + 5–6/2–3 (postrostral teeth + dorsal/ventral teeth), posterior-most tooth not distant from an anterior tooth.
3. 4th thoracic sternite with slender processes.
4. Pleon without compressed prominence on 3rd somite.
5. Second chelipeds subsymmetrical in shape, subequal in size, sexually dimorphic (major cheliped longer and stouter in males); carpus nearly as long as palm, with or without distal teeth; fingers about $\frac{3}{4}$ length of palm.
6. Third and fourth pereiopods with dactylus simple, not distally truncate or biunguiculate.
7. Colour pattern: translucent with diffuse markings or whitish spots.
8. Size: body length reaching about 15 mm, perhaps more (large dominant males).

Distribution. Indo-West Pacific from the Red Sea, the Arabian-Persian Gulf and Comoro Islands to French Polynesia.

Ecology. Benthic on mixed sand-rock-algae-coral bottoms, from the mid-intertidal to at least 40 m; free-living under rocks, rubble, among algae, etc.

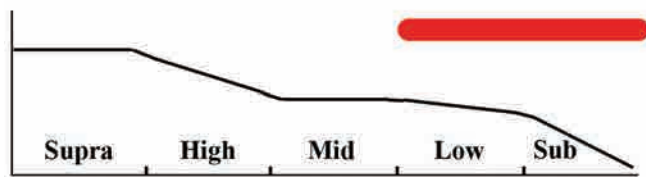


Figure 185. Bathymetric distribution of the species.

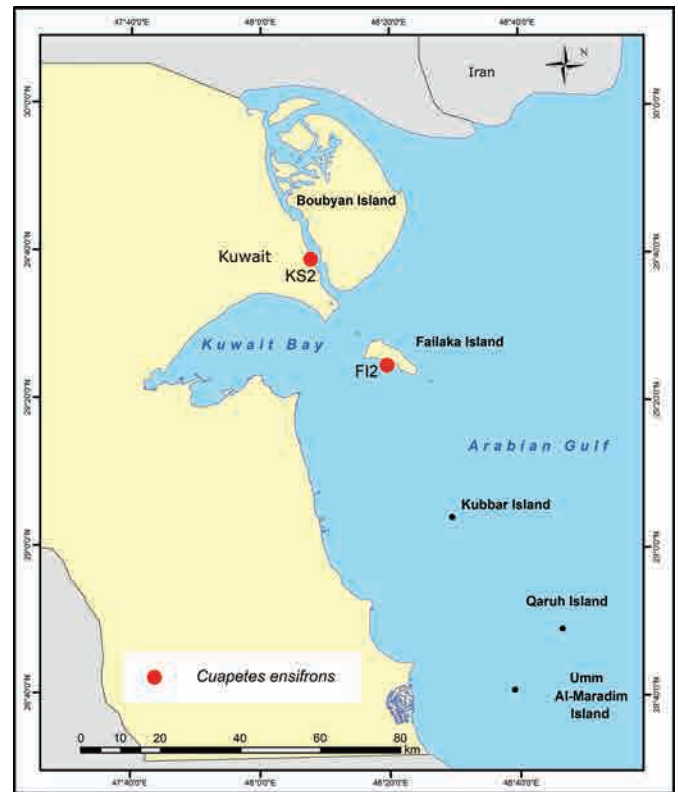


Figure 186. Presently known records of *Cuapetes ensifrons* in Kuwait.

Remarks. *Cuapetes ensifrons* appears to be either a variable species or (more likely) a species complex and needs to be studied further (Chace and Bruce 1993; Bruce 2004). For instance, some of the Kuwaiti specimens agree better with the diagnosis of *C. grandis* Stimpson, 1860, others agree with that of *C. ensifrons*; yet, they all came from the same locality and displayed the same colour pattern. For the illustrations of the species' morphological characters, see Li and Bruce (2006).

Most Relevant References. Chace and Bruce 1993; Bruce 2004; Li and Bruce 2006.



Figure 187. Typical habitat of *Cuapetes ensifrons*: small tide pool at the eastern shore of Failaka Island, Kuwait. Photograph by Valeriy Skryabin.

Family Palaemonidae

Periclimenella petitthouarsii (Audouin, 1826)

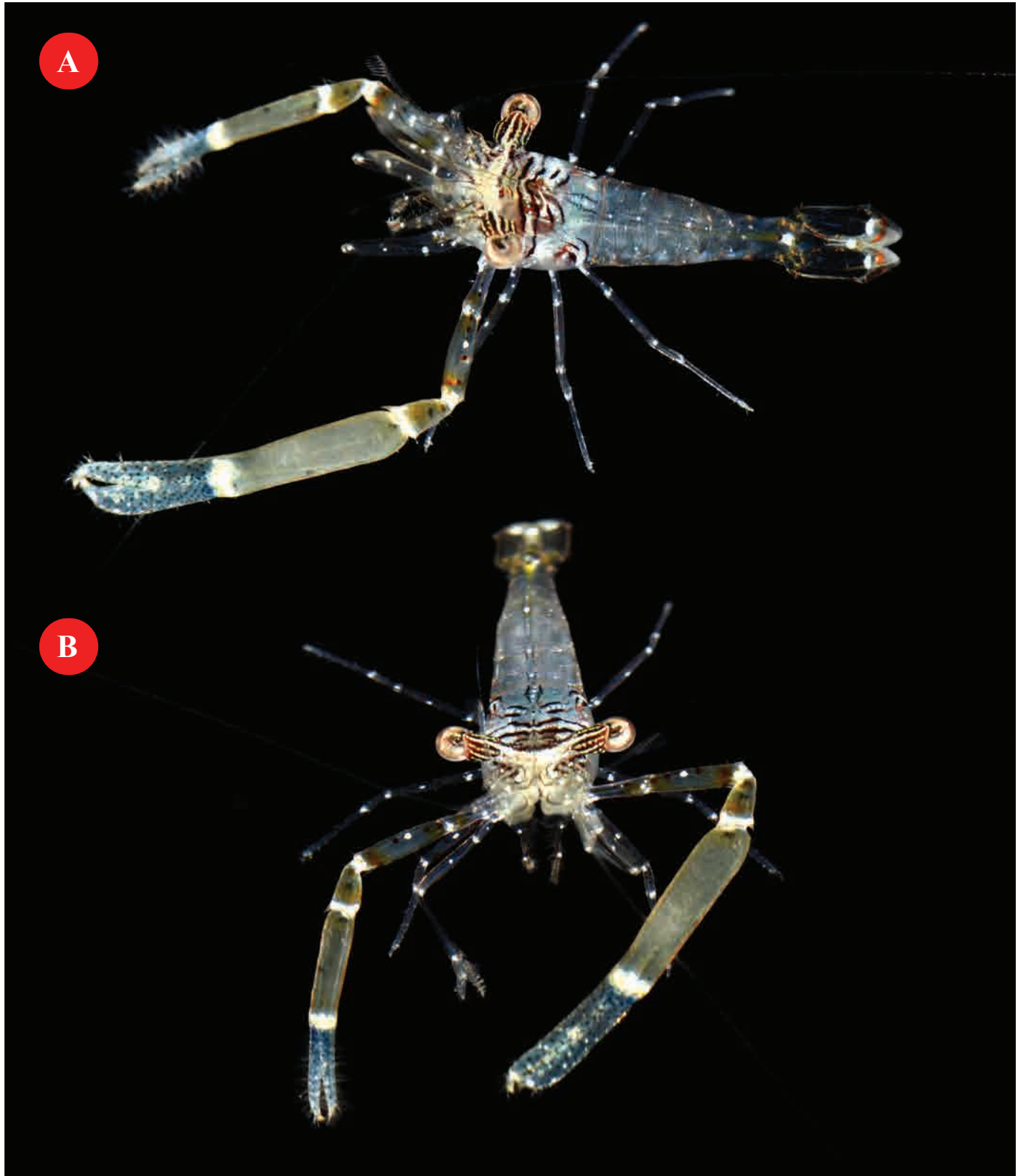


Figure 188. *Periclimenella petitthouarsii* (Audouin, 1826) from Saudi Arabia in dorso-lateral (A) and frontal (B) views. Photographs by Arthur Anker.

Synonyms. *Palaemon petitthouarsii* Audouin, 1826; *Anchistia petitthouarsii* (Audouin, 1826); *Periclimenes petitthouarsii* (Audouin, 1826).

Main Diagnostic Features.

1. Body cylindrical, neither compressed nor depressed.
2. Carapace with well-developed antennal tooth and with small non-mobile hepatic tooth; supra-orbital tooth absent.
3. Rostrum moderately long, compressed, slender, typically armed with 5–6 dorsal teeth (not including 1 post-rostral tooth situated posterior to orbital margin) and 3–5 ventral teeth.
4. First chelipeds with fingers excavated and armed with comb-like serrations on cutting edges.
5. Second chelipeds elongate, robust, unequal in size, asymmetrical in shape; major chela with tooth-fossa system on fingers.
6. Third to fifth pereopods with dactyli simple, notched on ventral margin.
7. Telson moderately slender, about 2.5 times as long as wide; posterior margin pointed, with 3 pairs of spines, intermediate by far longest and stoutest; dorsal surface with two pairs of spines.
8. Colour pattern: translucent greenish or yellowish; carapace with dark-red V-shaped transverse-oblique bands and bright yellow markings; pleon with less marked red transverse bands; eyestalks with dark-red longitudinal bands and yellow spots; chelipeds yellowish with dark red and white spots, except for pale violet, dark spotted fingers; walking legs yellowish with red and white spots.
9. Size: maximal body length about 18 mm.

Distribution. Western Indian Ocean from the Red Sea and Madagascar to the Arabian-Persian Gulf.

Ecology. Benthic on coral reefs; from the lowest intertidal zone (rare) to 20 m, most common in the shallow subtidal zone at depths of 1–10 m; on various corals, including *Stylophora*, *Montipora*, and *Seriatopora*.

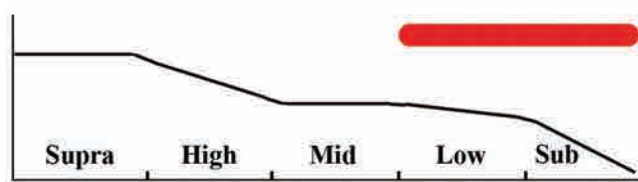


Figure 189. Bathymetric distribution of the species.

Remarks. *Periclimenella petitthouarsii* was only recently recorded from Kuwait (Al-Kandari et al. 2020) and replaced the closely related *P. spinifera* in the western part of the Indian Ocean; the latter species has a much wider distribution ranging from Thailand and Australia to French Polynesia (Đuriš and Bruce 1995; Đuriš 2017). Both species have a weak snapping mechanism on the major second pereopod (cheliped), consisting of a low, excavated tooth on the dactylus and a shallow fossa on the pollex, and a generally similar colour pattern (Bruce 1971).

Most Relevant References. Bruce 1971; Đuriš and Bruce 1995; Đuriš 2017; Al-Kandari et al. 2020a.

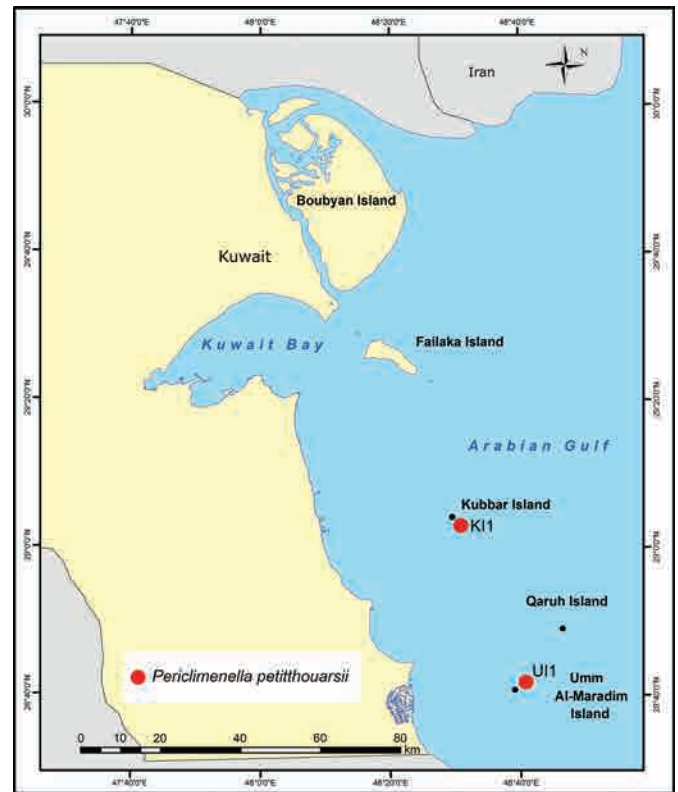


Figure 190. Presently known records of *Periclimenella petitthouarsii* in Kuwait.



Figure 191. *Periclimenella petitthouarsii* from Saudi Arabia. Photograph by Arthur Anker.



Figure 192. *Periclimenella petithouarsii* on a coral reef at Kubbar Island, Kuwait.
Photograph by Faisal Al-Sarraf.



Family Palaemonidae

Philarius gerlachei (Nobili, 1905)

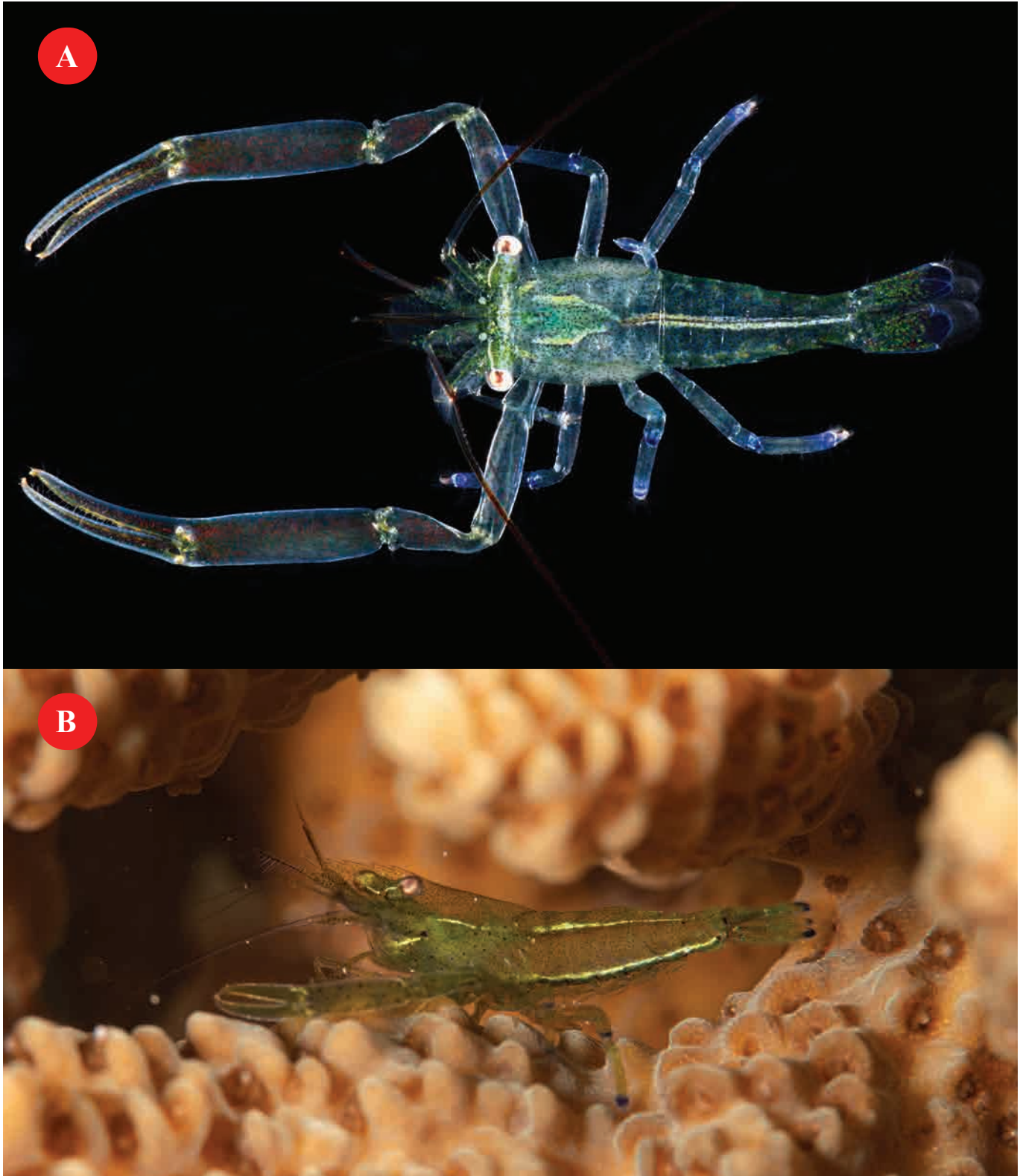


Figure 193. Male of *Philarius gerlachei* (Nobili, 1905) from Oman in dorsal view (A) and in lateral view *in situ* on its coral host, *Acropora* sp., off Qaruh Island, Kuwait (B). Photographs by Arthur Anker (A) and Faisal Al-Sarraf (B).

Synonym. *Harpilius gerlachei* Nobili, 1905.

Main Diagnostic Features.

1. Body slightly depressed dorso-ventrally, plump.
2. Carapace with strong antennal tooth, without hepatic tooth.
3. Rostrum long, compressed, typically armed with 4 dorsal teeth and 1 ventral tooth.
4. Eyestalks cylindrical, about as long as wide, with subovate cornea.
5. Second chelipeds elongate, robust in both sexes; palm about 1.5 times as long as fingers, latter armed with teeth.
6. Third to fifth pereopods smooth, robust, unarmed; dactylus stout, simple.
7. Telson slender, about 2.6 times as long as wide.
8. Colour pattern: greenish with dark-red or blackish dots and golden-yellow areas; eyestalks with dark-red or blackish longitudinal bands.
9. Size: maximal body length about 17 mm.

Distribution. Indo-West Pacific from the Red Sea and the Arabian-Persian Gulf to Australia; many previous records probably erroneous due to confusion with closely related species (see Marin and Anker 2011; Mitsuhashi 2012; Kou and Li 2016).

Ecology. Benthic on coral reefs, from the lowest intertidal zone to 30 m, most common in the shallow subtidal zones at depths of 2–15 m; obligate associate of branching corals, *Acropora* spp.

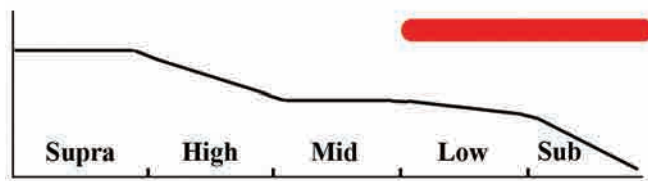


Figure 194. Bathymetric distribution of the species.

Remarks. *Philarius gerlachei* was recognized as a species complex by Marin and Anker (2011) and partly revised, with several species described therein and subsequently by Marin (2012), Mitsuhashi (2012) and Kou and Li (2016).

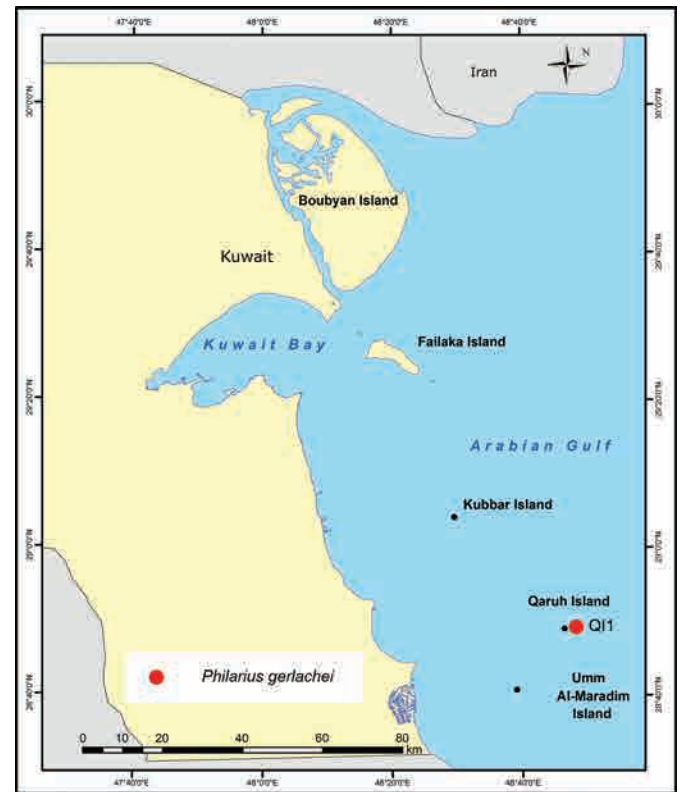


Figure 195. Presently known record of *Philarius gerlachei* in Kuwait.

Molecular analysis of this complex is highly desirable to confirm the validity of some species. This is the first record of *P. gerlachei* from Kuwait. The species can be easily confused with another symbiont of *Acropora* corals, *Harpilius lutescens* Dana, 1852, which is not recorded known from the Arabian-Persian Gulf.

Most Relevant References. Nobili 1905; Chace and Bruce 1993; Marin and Anker 2011; Anker and De Grave 2016; Āuriš 2017.

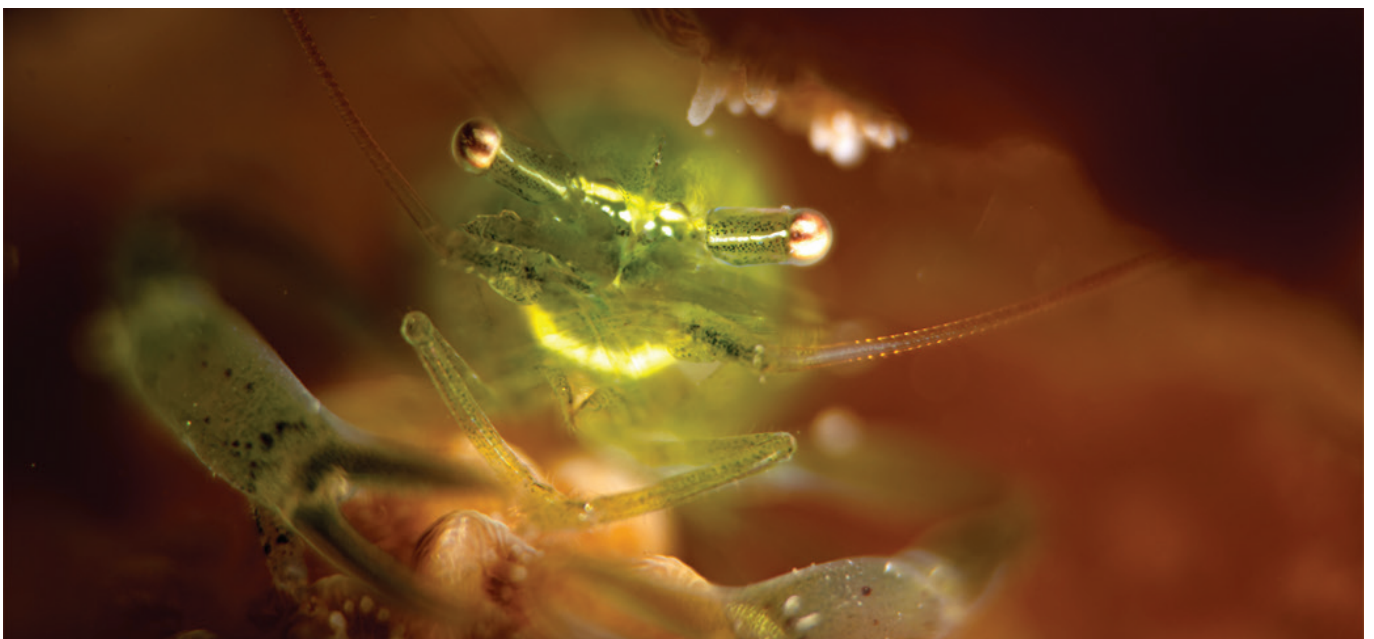


Figure 196. Close-up of *Philarius gerlachei* on *Acropora* sp., Qaruh Island, Kuwait. Photograph by Faisal Al-Sarraf.

Family Palaemonidae

Urocaridella pulchella Yokes and Galil, 2006

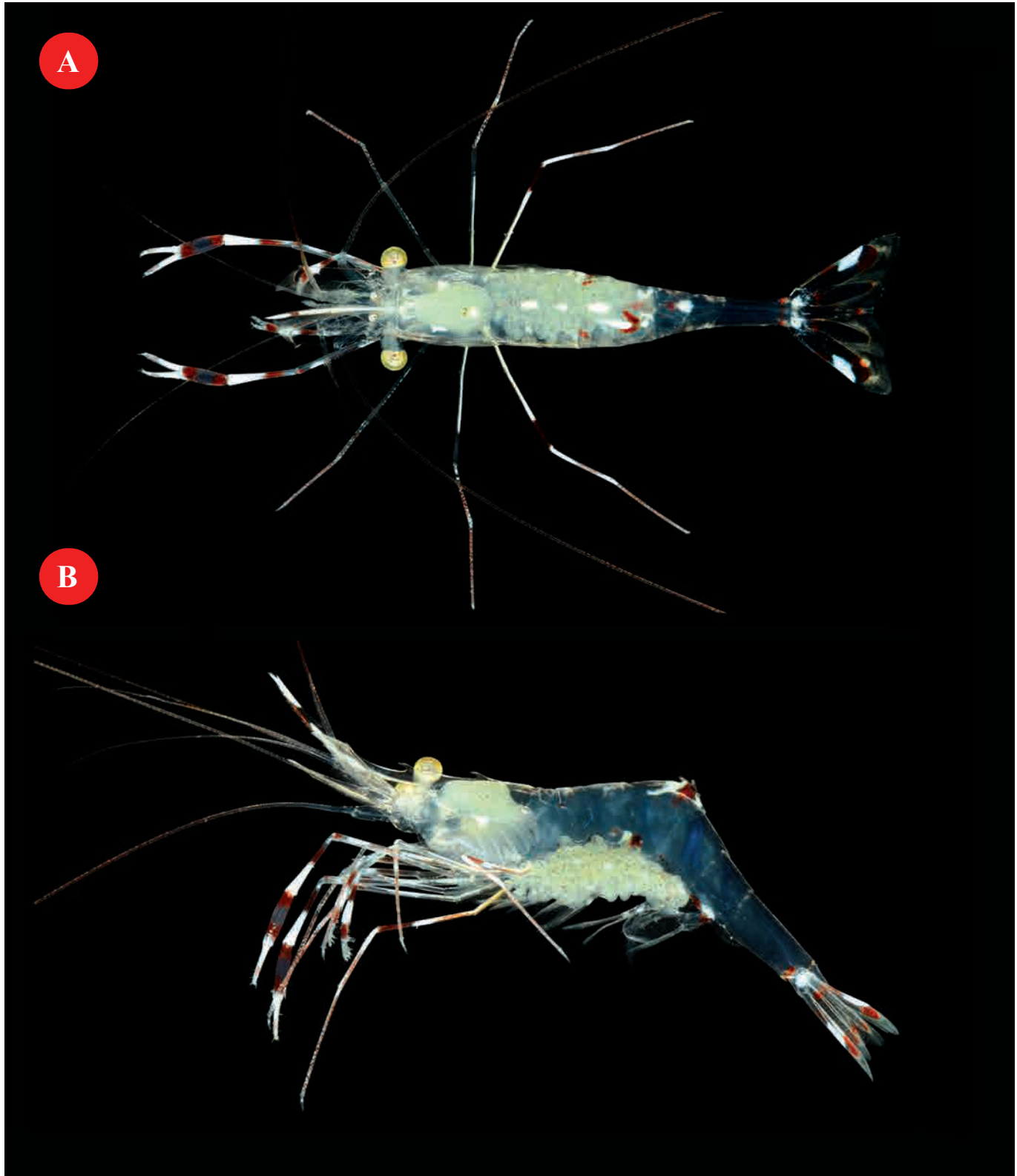


Figure 197. Ovigerous female of *Urocaridella pulchella* Yokes and Galil, 2006 from Kubbar Island, Kuwait, in dorsal (A) and lateral (B) views. Photographs by Arthur Anker.

Common Name. Fine-spotted fan clam shrimp.

Main Diagnostic Features.

1. Carapace with strong epigastric tooth on mid-line; branchiostegial tooth small.
2. Rostrum elongate, slender, curved upward, much longer than carapace, armed with 3 pairs of teeth: 2 strong proximal teeth above eyes, 2 smaller teeth in the middle and 2 even smaller.
3. Third pleonite with dorsal hump.
4. First and second pereopods (chelipeds) with carpus longer than palm.
5. Third to fifth pereopod very slender; dactylus simple, curved.
6. Colour pattern: translucent with species-diagnostic red and white markings and spots, especially on rostrum, third pleonite, tail fan, and pereopods.
7. Size: body length reaching at least 25 mm.

Distribution. North-West Indian Ocean: Red Sea, Oman, and the Arabian-Persian Gulf; Lessepsian migrant.

Ecology. Benthic on mixed sand-rock-coral bottoms in the subtidal areas (7–30 m); free-living, dwelling in crevices, small caves, or under large rocks and coral rubble, fish cleaner, primarily active at night.

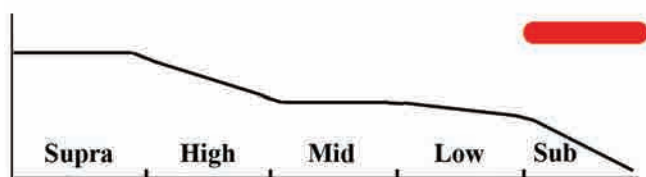


Figure 198. Bathymetric distribution of the species.

Remarks. *Urocaridella pulchella* was only recently recorded by Al-Kandari et al. (2020a) based on the material from Kubbar Island, which clearly show that more unreported (or even undescribed) shrimp and other decapod species may be present in the subtidal depths of Kuwait's southern islands. Al-Kandari et al. (2020a) noted that this species can be easily confused with the more widespread *U. cyrtorhyncha* (originally recorded from Japan), and more photo-vouchered material and molecular analysis of these two species is highly desirable.

Most Relevant References. Yokes and Galil 2006; Āuriš 2017; Al-Kandari et al. 2020a.

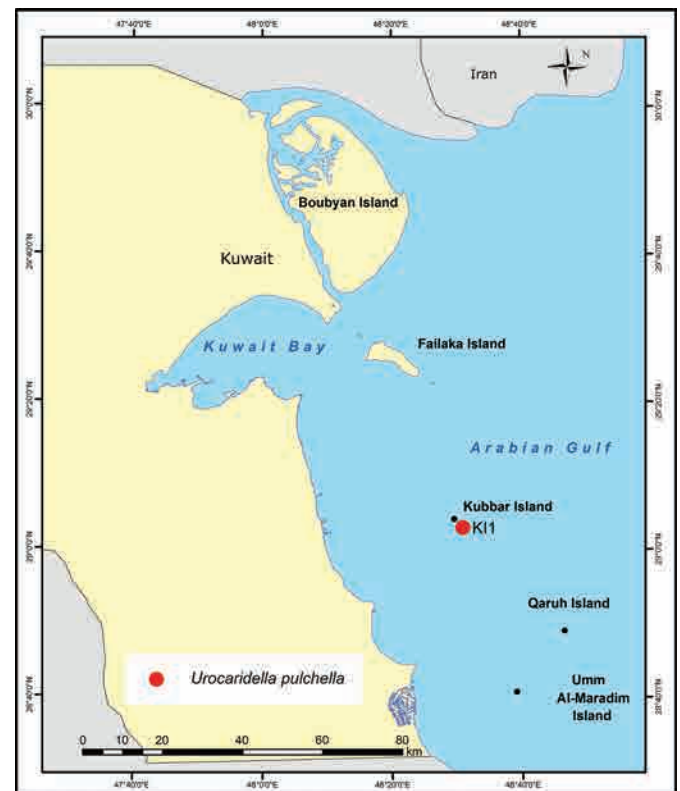


Figure 199. Presently known record of *Urocaridella pulchella* in Kuwait.



Figure 200. *Urocaridella pulchella* on a silty reef at Kubbar Island, Kuwait. Photograph by Yaser Mohammed Abdulraheem.



Family Thoridae

Thor paschalis (Heller, 1862)

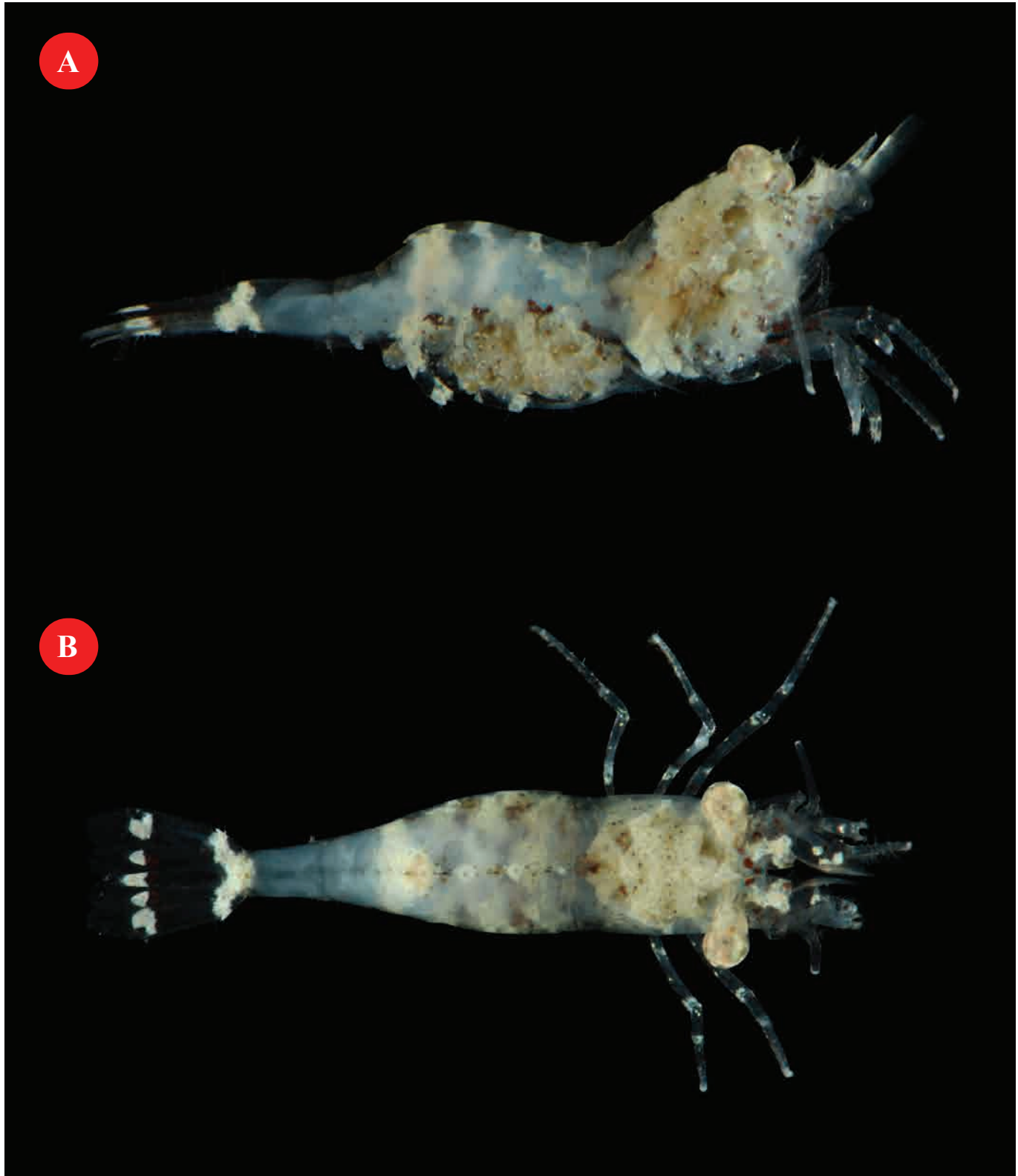


Figure 201. Ovigerous female of *Thor paschalis* (Heller, 1862) in lateral (A) and dorsal (B) views, Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonym. *Hippolyte paschalis* Heller, 1862.

Main Diagnostic Features.

1. Rostrum short, typically with 3 dorsal teeth (1 post-orbital) and bifid tip.
2. Supra-orbital teeth absent.
3. Pterygostomial angle often with small tooth.
4. Antennular peduncle with 1st article lacking medio-lateral tooth.
5. Second pereopods with 5 sub-articles, 2nd longest.
6. Third and fourth pereopods with dactylus terminating in 2 stout teeth; ventral margin armed with 4 or so spinules.
7. Colour pattern inconspicuous: translucent with whitish spots, bands, and brownish markings.
8. Size: body length reaching to about 12 mm.

Distribution. Indo-West Pacific from the Red Sea, the Arabian-Persian Gulf, and Madagascar to Australia; exact distribution still needs to be determined.

Ecology. Benthic on mixed sand-rock-algae bottoms, from the mid-intertidal zone to at least 30 m; typically associated with seaweed beds or algae-covered rocks and rubble, occasionally with corals.

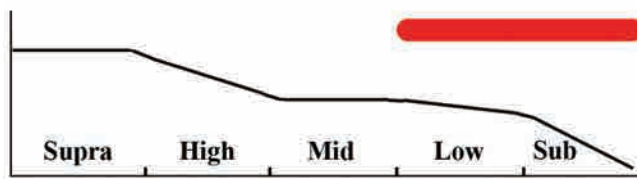


Figure 202. Bathymetric distribution of the species.

Remarks. *Thor paschalis* appears to be a very common shrimp in algae-dominated habitats throughout the Indo-West Pacific, but has been recorded from Kuwait only recently

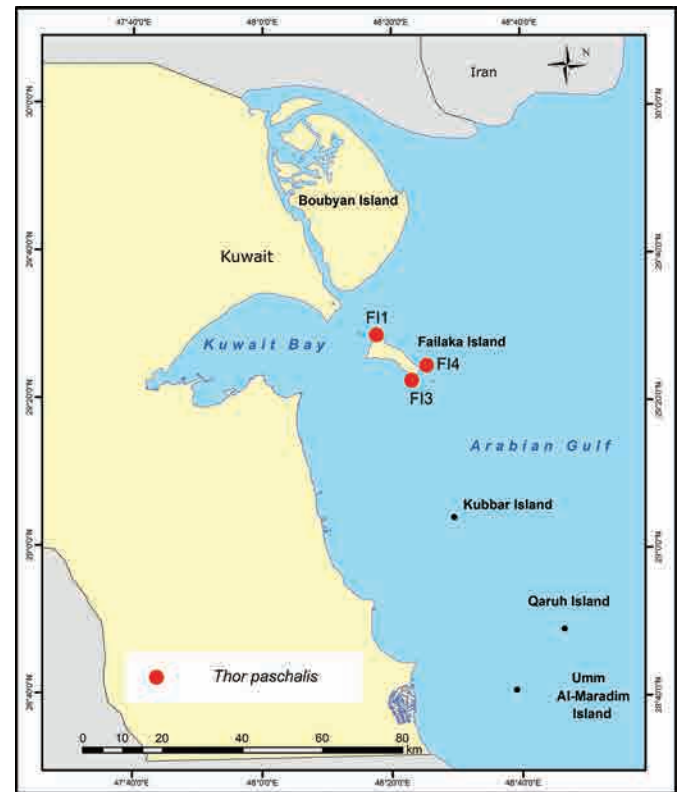


Figure 203. Presently known records of *Thor paschalis* in Kuwait.

(Al-Kandari et al. 2020a) and is presently observed only in Failaka Island. The species was originally recorded from the Red Sea (Heller 1862) and is also known in the western Indian Ocean from Iran and Madagascar (Ledoyer 1970; Ashrafi et al. 2020). However, a thorough morphological and molecular analysis of the *T. paschalis* population is needed to explain its morphological variability.

Most Relevant References. Heller 1862; Ledoyer 1970; Anker and De Grave 2016; Ashrafi et al. 2020; Al-Kandari et al. 2020a.



Figure 204. *Sargassum* sp. on the eastern shore of Failaka Island, Kuwait, from where *Thor paschalis* has been reported. Photograph by Valeriy Skryabin.

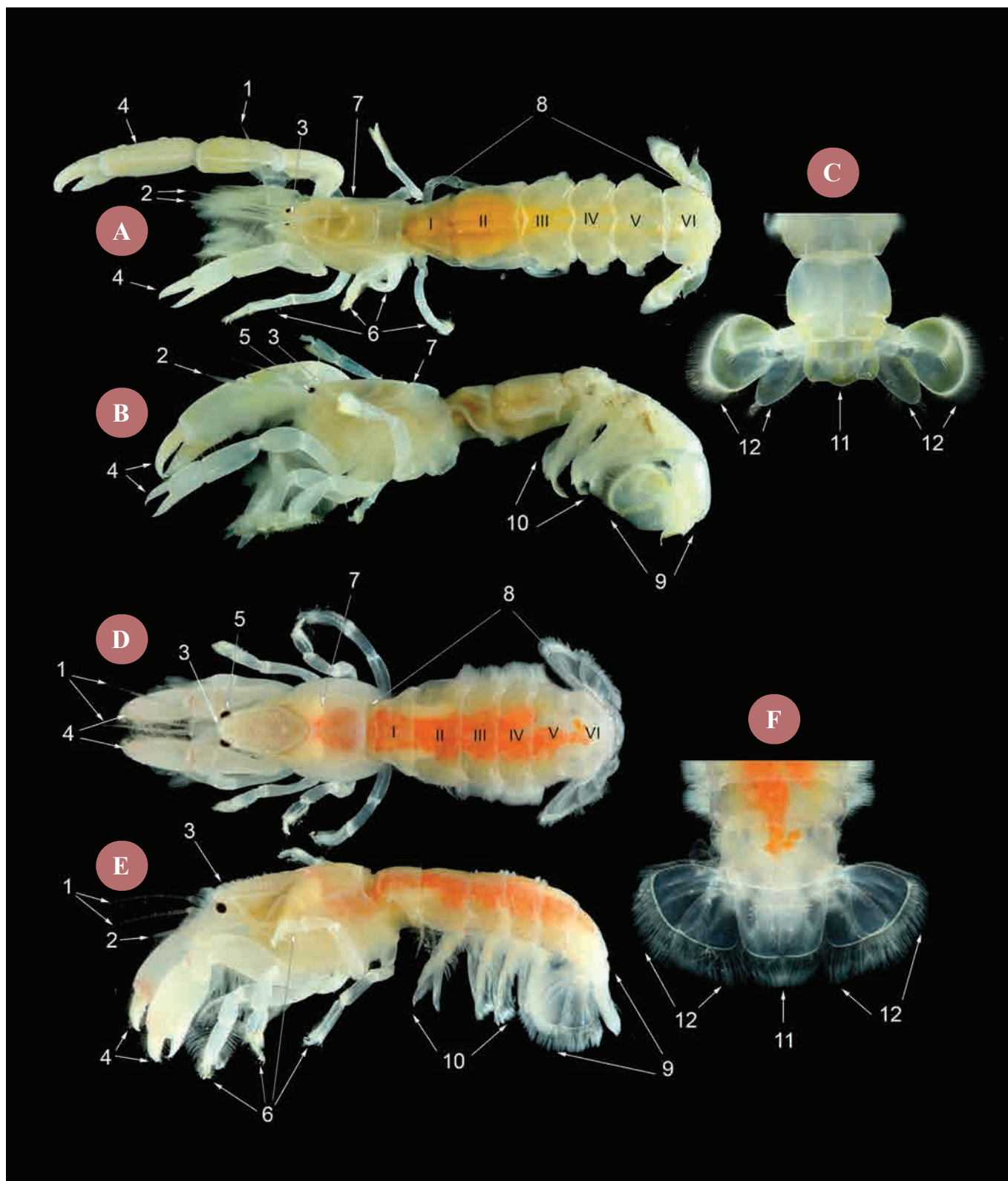


Figure 205. General morphology of Axiidae and Gebiidae exemplified by female of *Balsscallichirus masoomi*: dorsal view (A); lateral view (B); and posterior portion of pleon and tail fan (C); and female of *Upogebia octoceras*: dorsal view (D); lateral view (E); and posterior portion of pleon and tail fan (F).

1. Antenna.
2. Antennule.
3. Rostrum.
4. Chelipeds - 1st pereopods.
5. Eye.

6. 2nd - 5th pereopods.
7. Carapace.
8. Pleon.
9. Tail fan.
10. Pleopods.

11. Telson.
12. Uropods.
- I, II, III, IV, V, VI - 1st to 6th pleomeres.

Suborder Pleocyemata
Infraorder Axiidea
(Ghost Shrimps and Burrowing Lobsters)

Family Callichiridae

Balsscallichirus masoomi (Tirmizi, 1970)



Figure 206. Female of *Balsscallichirus masoomi* (Tirmizi, 1970) in dorsal (A) and lateral (B) views, with details of major cheliped (C) and posterior portion of pleon and tail fan (D), Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonyms. *Callianassa (Callichirus) masoomi* Tirmizi, 1970; *Podocallichirus masoomi* (Tirmizi, 1970); *Callianassa (Callichirus) kewalramanii* Sankolli, 1971.

Common Name. Masoom's ghost-shrimp.

Main Diagnostic Features.

1. Rostrum triangular, spiniform.
2. Anterolateral margin of carapace with sharp tooth (spine).
3. Eyestalks with anteromesial process; cornea small, dorsally situated.
4. Chelipeds strongly asymmetrical and unequal; major cheliped with merus and ischium armed with sharp teeth on their ventral margins, some teeth on merus noticeably larger.
5. Uropod with subtriangular lobe on exopod, fringed with long spiny setae.
6. Telson much broader than long, with transverse row of stiff setae and strong central convexity on posterior margin.
7. Colour in life: ivory white with yellow markings on chelipeds and yellow tinge on tail fan.
8. Size: body length reaching at least 31 mm.

Distribution. North-Western Indian Ocean: the Arabian-Persian Gulf (Kuwait and Iran), Pakistan, and India.

Ecology. Benthic/infaunal on soft bottoms, typically fine sand and silty areas, often with some rocks nearby; mid-low intertidal and adjacent shallow subtidal areas; lives in burrows.

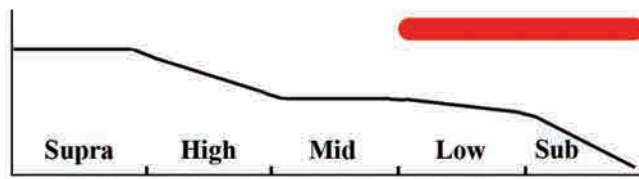


Figure 207. Bathymetric distribution of the species.

Remarks. *Balsscallichirus masoomi* is probably a common ghost-shrimp in the Arabian-Persian Gulf and the Gulf of Oman, despite only a few records so far (Sepahvand et al.

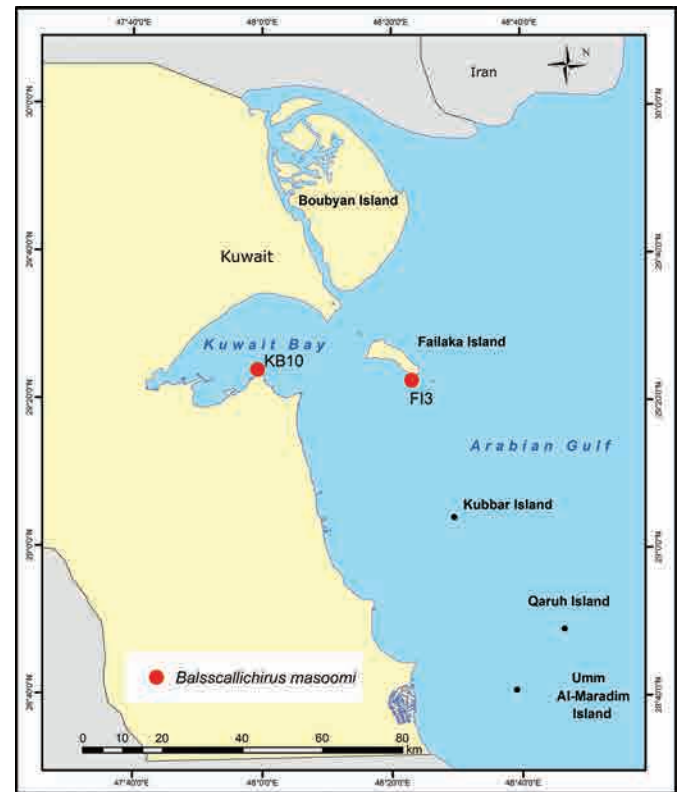


Figure 208. Presently known records of *Balsscallichirus masoomi* in Kuwait.

2013; Al-Kandari et al. 2020a). The species can be most easily recognized by the presence of serrations on the ventral margin of the major cheliped and the conspicuous convexity on the middle of the posterior margin of the telson. However, the specimens of Kuwait are morphologically slightly different from the type specimen from Pakistan and may need further study. The spacious burrows of *B. masoomi* occasionally harbour symbiotic shrimps, such as the alpheid shrimp *Salmones ikaeros* (see above).

Most Relevant References. Tirmizi 1970; Sepahvand et al. 2013; Al-Kandari et al. 2020a.



Figure 209. Near-shore sand flat at Ras Ajuzah, one of the two known localities of *Balsscallichirus masoomi* in Kuwait. Photograph by Valeriy Skryabin.

Family Callichiridae

Michaelcallianassa indica Sakai, 2002



Figure 210. Female of *Michaelcallianassa indica* Sakai, 2002 in dorsal (A) and lateral (B) views, and details of posterior portion of pleon and tail fan (C), Failaka Island, Kuwait. Photographs by Arthur Anker.

Main Diagnostic Features.

1. Rostrum triangular, spiniform.
2. Anterolateral margin of carapace with blunt lobe.
3. Eyestalks with subacute anteromesial process; cornea small, dorsally situated.
4. Chelipeds strongly asymmetrical and unequal; major cheliped with merus and ischium unarmed on their ventral margins; minor cheliped fingers strongly gaping in males.
5. Uropod with subrectangular lobe on exopod, fringed with long spiny setae.
6. Telson much broader than long, with transverse row of spinules and strong central concavity on posterior margin.
7. Colour in life: hyaline white with yellow tinge on tail fan.
8. Size: total body length reaching 43 mm.

Distribution. Northern Indian Ocean: the Arabian-Persian Gulf (Kuwait and Iran) and Andaman Sea (Thailand).

Ecology. Benthic/infaunal on mud-sand bottoms from the lower intertidal zone to 65 m; lives in deep burrows.

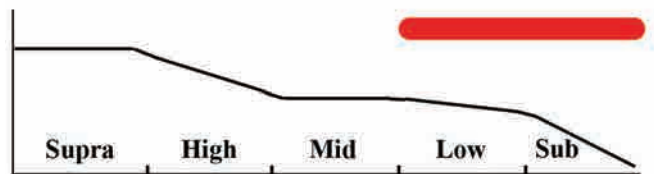


Figure 211. Bathymetric distribution of the species.

Remarks. *Michaelcallianassa indica* prefers deeper and muddier habitats than *B. massomi*, although both species were collected in similar conditions from Failaka Island. The biology of *M. indica* (and *B. masoomi*) is mainly unknown. This ghost-shrimp makes spacious burrows that may be inhabited by smaller animals and is sometimes a host itself for red-coloured symbiotic copepods (Fig. 213).

Most Relevant References. Sakai 2002; Sepahvand et al. 2013; Al-Kandari et al. 2020a.

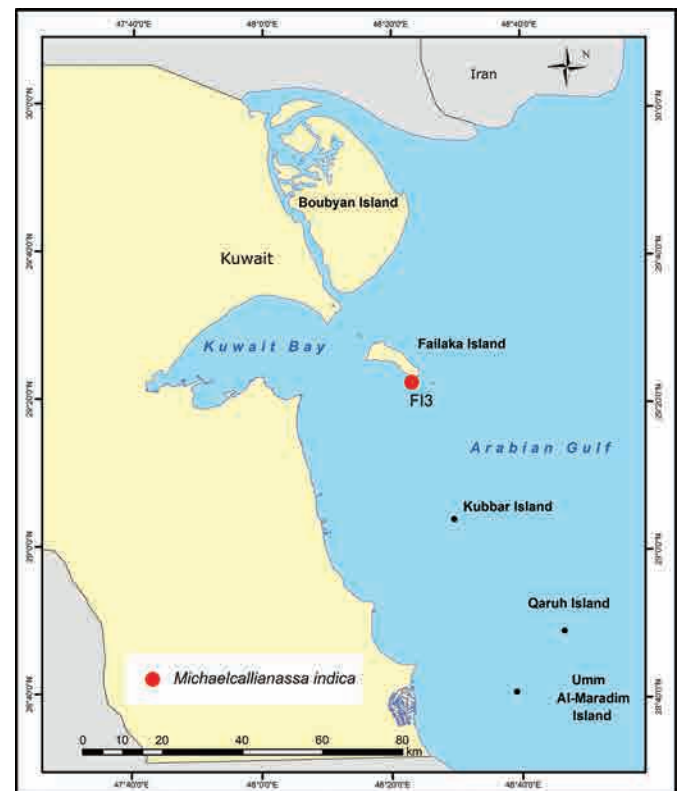


Figure 212. Presently known record of *Michaelcallianassa indica* in Kuwait.



Figure 213. Symbiotic copepods, possibly of the genus *Clausidium*, living on the tegument of *Michaelcallianassa indica* in Failaka Island, Kuwait. Photograph by Arthur Anker.



Figure 214. Intertidal mudflats of southern Failaka Island in Kuwait, typical habitat of some mud shrimps (*Upogebia* and *Paragebicula*). Photograph by Valeriy Skryabin.

Suborder Pleocyemata

Infraorder Gebiidea

(Mud Lobsters and Mud Shrimps)

Figure 215. Intertidal sponges, such as these on the shores of Miscan Island, Kuwait, are often inhabited by *Upogebia octoceras* (Upogebiidae). Photograph by Manal Al-Kandari.



Family Upogebiidae

Paragebicula johorensis Dworschak and Anker, 2022



Figure 216. Female of *Paragebicula johorensis* Dworschak and Anker, 2022, in lateral (A) and dorsal (B) views, Failaka Island, Kuwait. Photographs by Arthur Anker.

Main Diagnostic Features.

1. Rostrum obtuse, rounded in dorsal view, without apical denticle.
2. Hepatic spine present or absent; antennal spine small.
3. Lateral ridges of gastric region anteriorly diverging, forming sharp process.
4. Chelipeds symmetrical, relatively slender, subchelate; ischium with ventral spine; merus with 4 ventral spines and 1 distodorsal spine; carpus with 2 distal spines; propodus with 3 dorsal spines.
5. Third pereopod with merus armed with 3 strong spines on ventral margin; carpus with 2 distal spines.
6. Pleopods 2-5 biramous, lacking appendices internae.
7. Uropodal endopod and exopod narrow, leaf-like, distally truncate.
8. Colour pattern: translucent with reddish spots, especially on chelipeds and pleon.
9. Size: body length about 25 mm.

Distribution. Locally in the Indo-West Pacific; presently observed only from two distant localities: Johor Straits between Singapore and Malaysia (type locality) and Failaka Island in Kuwait; probably more widespread (but see below).

Ecology. Benthic/infaunal on muddy bottoms from the lower intertidal zone to about 30 m; lives in burrows.

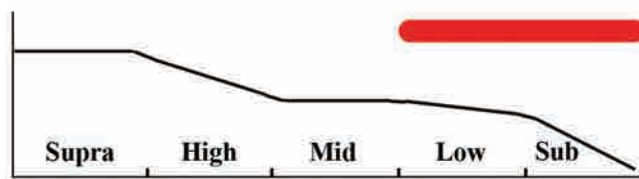


Figure 217. Bathymetric distribution of the species.

Remarks. Two specimens of *Paragebicula johorensis* were collected from the mudflats of Failaka Island in Kuwait in 2020, two years before this species was formally described. However, the recent description of this species was based on the material collected from the Johor Straits between Singapore and Malaysia in 2012 (Dworschak and Anker, 2022), i.e., well before the collection of Kuwait's specimens. A full account of Kuwait's material with illustrations will be published later (Anker and Al-Kandari, in prep.). The reader is referred to Sakai (2006) for the general characters of the genus *Paragebicula*, including the description of another species, *P. leptomorpha* Sakai, 2006, recorded from the Arabian-Persian Gulf.

Most Relevant References. Sakai 2006; Dworschak and Anker, 2022.

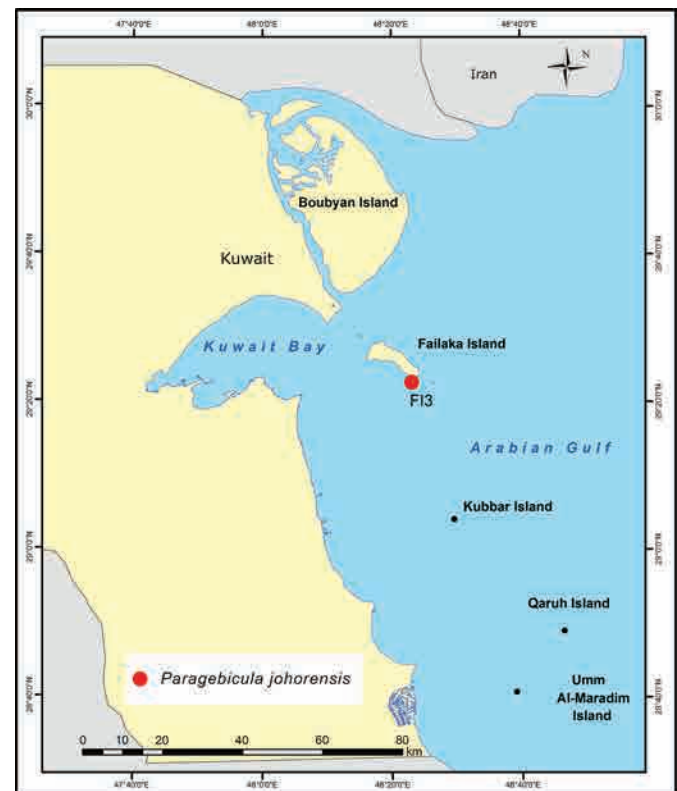


Figure 218. Presently known record of *Paragebicula johorensis* in Kuwait.

Family Upogebiidae

Upogebia carinicauda (Stimpson, 1860)

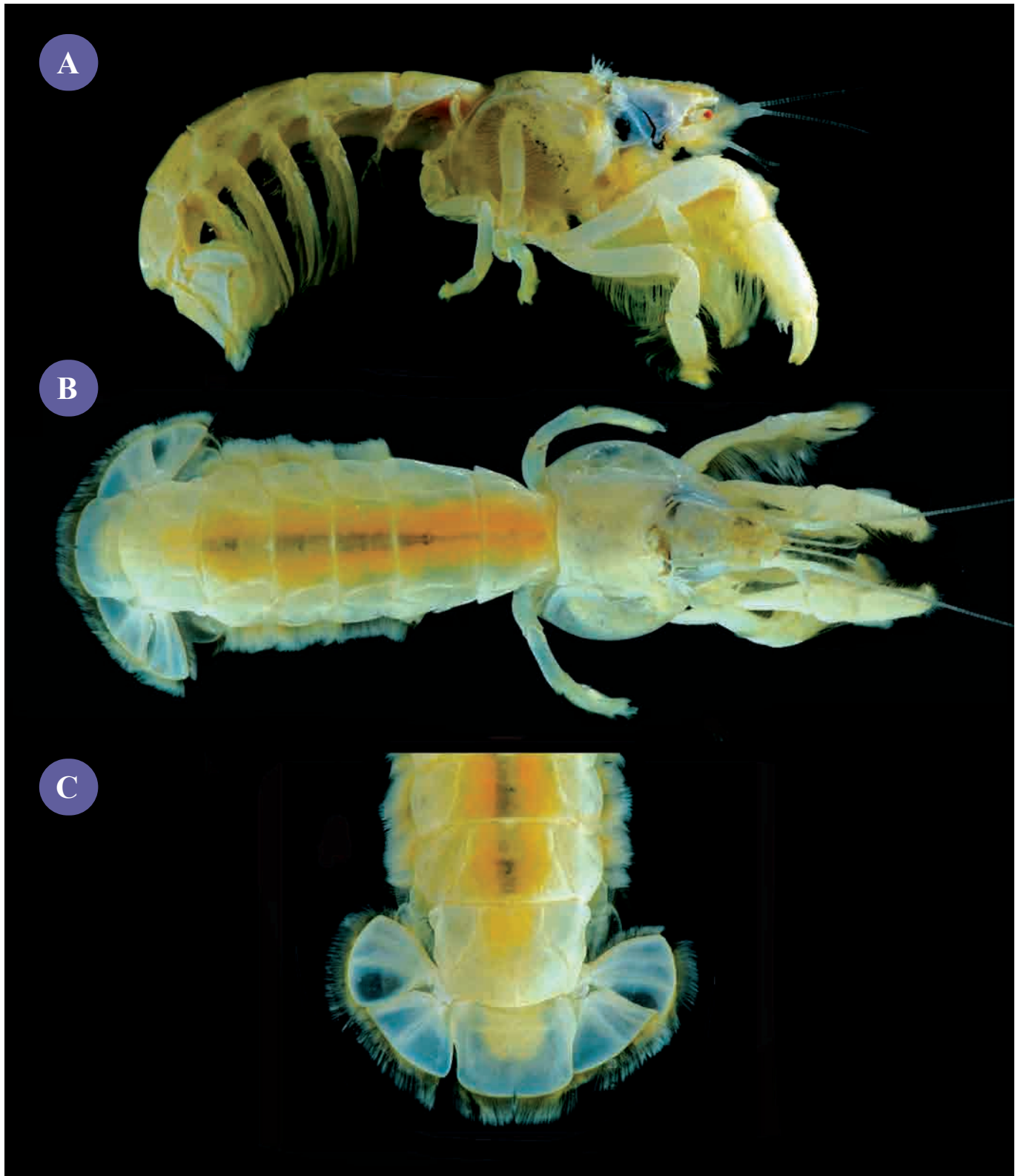


Figure 219. Female of *Upogebia carinicauda* (Stimpson, 1860) in lateral (A) and dorsal (B) views, with details of the posterior portion of pleon and tail fan (C), Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonym. *Gebia carinicauda* Stimpson, 1860. Note: we do not follow Sakai's (2006) synonymy awaiting a complete revision of this species complex (see also Al-Kandari et al. 2020).

Common Name. Ridge-tailed mud shrimp.

Main Diagnostic Features.

1. Rostrum with 4 teeth on distal margin and 1 infra-rostral tooth.
2. Chelipeds symmetrical, relatively robust, subchelate; ventromesial surface of propodus with large sharp tooth; dactylus almost twice as long as propodus.
3. Uropodal endopod with sharp distolateral angle.
4. Telson with elevated transverse ridge connecting two blunter longitudinal carinae.
5. Colour in life: opaque buff with yellow or brownish tinge; eyes dark brown-red.
6. Size: maximal body length 48 mm.

Distribution. Indo-West Pacific from the Red Sea and Arabian -Persian Gulf to Japan, Samoa, and Australia.

Ecology. Benthic/infaunal on mixed rock-sand-mud shores, largely in the intertidal and shallow subtidal zones; lives in complex ramified burrows in clay, mud/sand, or limestone rocks.

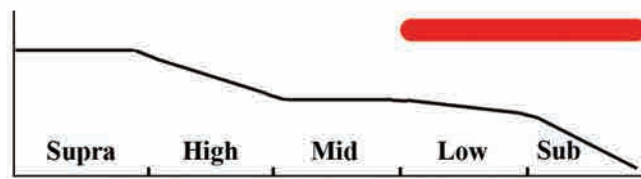


Figure 220. Bathymetric distribution of the species.

Remarks. *Upogebia carinicauda* is a common and widespread mud-shrimp, which is part of a larger species complex that needs to be studied utilizing integrative taxonomy. For the time being, all Arabian-Persian Gulf material of large mud and limestone-dwelling *Upogebia*, with a characteristic transverse ridge on the telson, is referred to as *U. carinicauda*. Good illustrations of the morphology of this species were provided by De Man (1928) and Sakai (1982).

Most Relevant References. De Man 1928; Sakai 1982; Sakai 2006; Sepahvand et al. 2013; Sepahvand et al. 2014; Al-Kandari et al. 2020a.

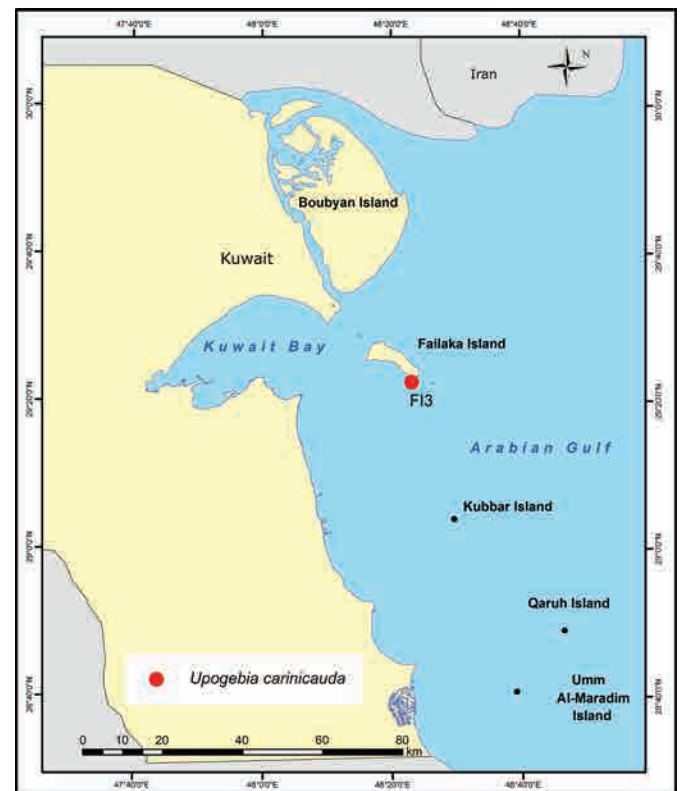


Figure 221. Presently known record of *Upogebia carinicauda* in Kuwait.

Family Upogebiidae

Upogebia nithyanandan (Sakai, Türkay and Al Aidaroos, 2015)



Figure 222. Male (A) and ovigerous female (B) of *Upogebia nithyanandan* (Sakai, Türkay and Al Aidaroos, 2015) from India in dorsal (A) and lateral (B) views. Photographs by Raveendhiran Ravinesh (A) and Tin-Yam Chan (B).

Synonym. *Kuwaitupogebia nithyanandan* Sakai, Türkay and Al Aidaroos, 2015.

Common Name. Nithyanandan's sponge mud-shrimp.

Main Diagnostic Features.

1. Rostrum subtriangular, distally rounded, more or less projecting, with dense field of apical setae; apex with minute denticles; post-rostral area largely without setae.
2. Anterolateral margin of carapace with 1 large subtriangular spine.
3. Eyes relatively large and with well-developed cornea.
4. Antennal scaphocerite absent.
5. Chelipeds symmetrical, equal, robust, fully chelate, with propodus slightly shorter than dactylus; merus armed with ventral spinules; remaining articles unarmed.
6. Telson broader than long, unarmed; posterior margin almost straight.
7. Colour in life: opaque whitish with beige or yellowish tinge.
8. Size: maximal total length around 25 mm.

Distribution. North-Western Indian Ocean: presently recorded only from the Arabian-Persian Gulf (Kuwait) and India (Tamil Nadu), but probably more widespread.

Ecology. Benthic on mixed and hard bottoms, from the lower intertidal zone to 4 m; associated with sponges.

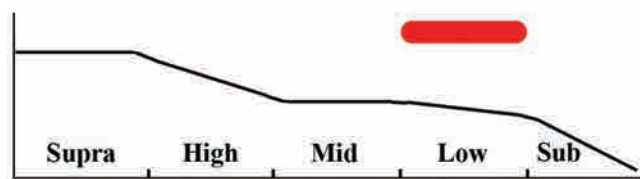


Figure 223. Bathymetric distribution of the species.

Remarks. This small and unusual species of *Upogebia* was originally described based on the material collected by Mr. Nithyanandan Manickam from Al-Khiran. The species was described under the name *Kuwaitupogebia nithyanandan*, and the genus was placed in its own family, Kuwaitupogebiidae. However, a few years later, *K. nithyanandan* was synonymized with *Upogebia balmaorum* Ngoc-Ho, 1990, by Dworschak and Poore (2018), but then it was again resurrected from the synonymy by Komai et al. (2020), although the genus *Kuwaitupogebia* and the family Kuwaitupogebiidae remain in the synonymy of *Upogebia* and Upogebiidae, respectively. The species was well illustrated by both Sakai et al. (2015) and especially Komai et al. (2020), based on the material from Kuwait and India, respectively.

Most Relevant References. Sakai et al. 2015; Komai et al. 2020.

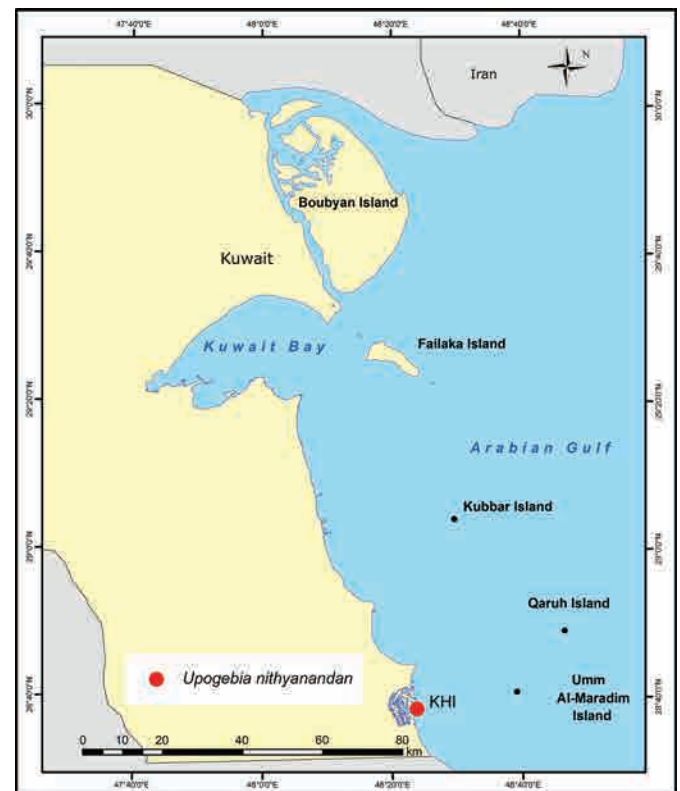


Figure 224. Presently known record of *Upogebia nithyanandan* in Kuwait.



Figure 225. Female of *Upogebia nithyanandan* from India, inside its unidentified host sponge. Photograph by Raveendhiran Ravinesh.

Family Upogebiidae

Upogebia octoceras (Nobili, 1904)



Figure 226. Female of *Upogebia octoceras* Nobili, 1904, in dorsal (A) and lateral (B) views, with details of posterior portion of pleon and tail fan (C), Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonym. *Upogebia darwinii* sensu Sakai 2006 (part.) [see below and Al-Kandari et al. 2020].

Common Name. Nobili's sponge mud-shrimp.

Main Diagnostic Features.

1. Rostral projection broadly rounded in dorsal view, with 6–10 conspicuous teeth on margin.
2. Hepatic spine absent; anterolateral margin of carapace unarmed.
3. Gastric lateral ridge with 13–15 teeth.
4. Chelipeds symmetrical, equal, relatively robust, fully chelate, largely unarmed.
5. Telson much wider than long, unarmed; posterior margin truncate, straight.
6. Colour pattern: semi-opaque buff yellowish; females with orange eggs.
7. Size: maximal total body length about 38 mm.

Distribution. Indo-West Pacific from the Red Sea, East Africa, and the Arabian-Persian Gulf to Thailand, Indonesia, and Australia.

Ecology. Benthic on hard and mixed bottoms, mainly in the lower intertidal zone; typically associated with sponges.

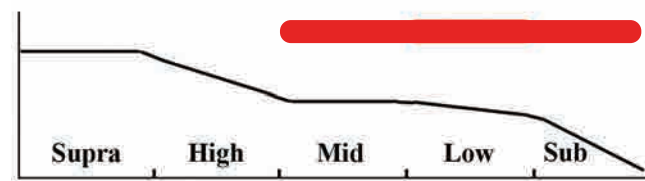


Figure 227. Bathymetric distribution of the species.

Remarks. *Upogebia octoceras* is a sponge-dwelling and sponge-boring mud shrimp, excavating or at least amplifying/engineering existing canals inside its hosts. The species is well-known in the Arabian-Persian Gulf under the name *Upogebia darwinii* (Miers, 1884), a species originally recorded from northern Australia (see Naderloo and Türkay 2012; Sepahvand et al. 2013). However, as explained in Al-Kandari et al. (2020a), it is more prudent to treat the two species as distinct (as did Ngoc-Ho 1990), awaiting a full integrative revision of this difficult group.

Most Relevant References. Nobili 1904; Ngoc-Ho 1990; Sakai 2006; Al-Kandari et al. 2020a.

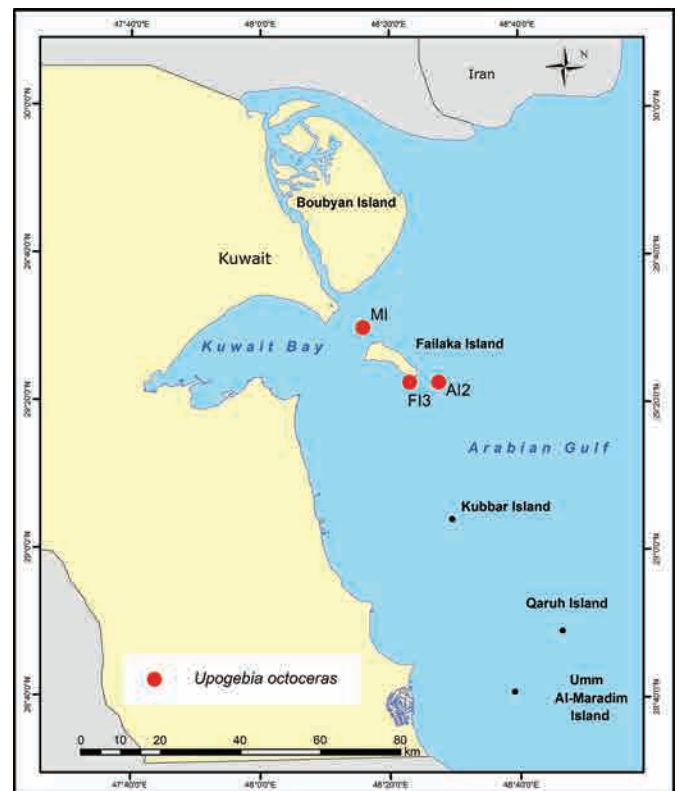


Figure 228. Presently known records of *Upogebia octoceras* in Kuwait.

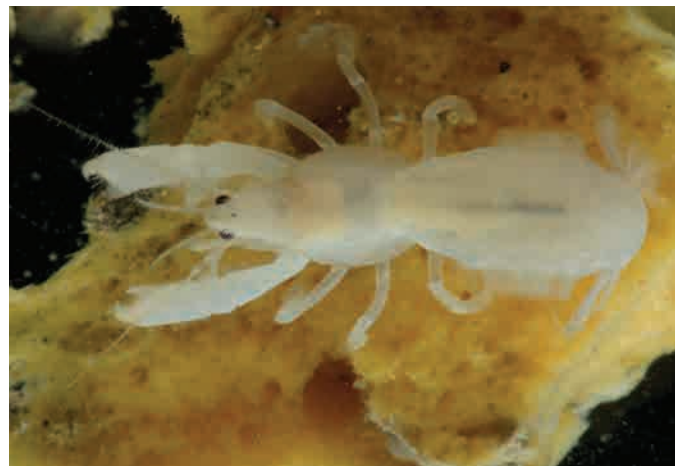


Figure 229. *Upogebia octoceras* inside unidentified host sponge, Failaka Island, Kuwait. Photograph by Arthur Anker.



Figure 230. Unidentified sponge-host of *Upogebia octoceras*, in the intertidal area of Failaka Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 231. Ovigerous and non-ovigerous females of flathead lobster *Thenus orientalis* on sale at a fish market in Kuwait City. Photograph by Sergei Khvorov.

Suborder Pleocyemata

Infraorder Achelata

(Spiny Lobsters and Slipper Lobsters)

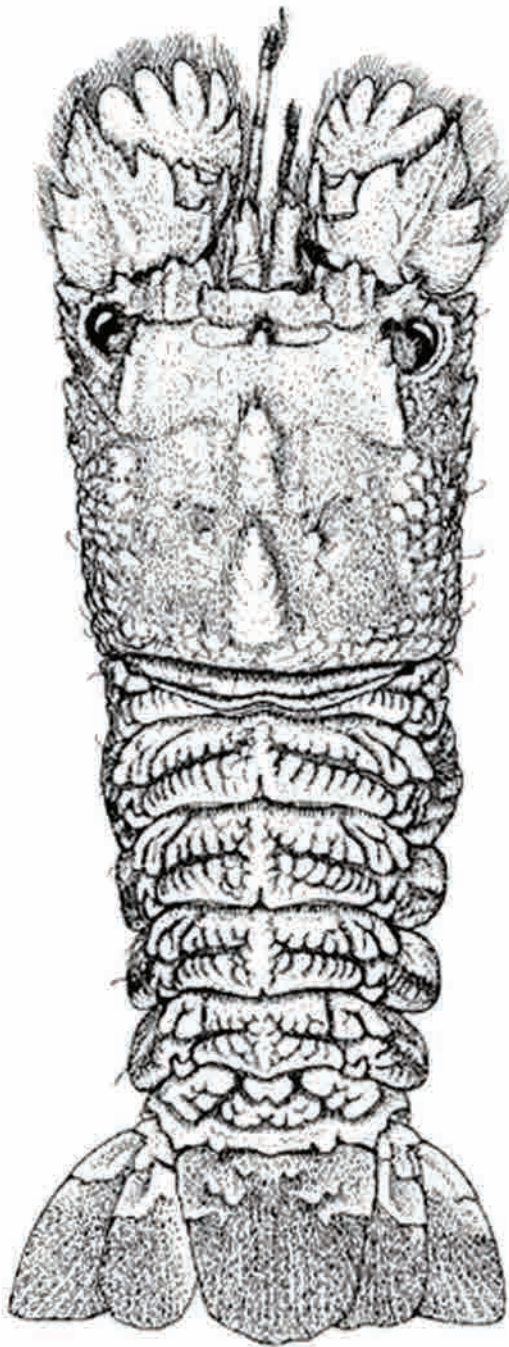
Figure 232. Ovigerous and non-ovigerous females of flathead lobster *Thenus orientalis* in dorsal view, Kuwait. Photograph by Sergei Khvorov.



Family Scyllaridae

Biarcus sordidus (Stimpson, 1860)

A



B



Figure 233. Female of *Biarcus sordidus* (Stimpson, 1860) from Bahrain in dorsal (A) and lateral (B) views. Adapted from Holthuis (2002).

Synonyms. *Arctus sordidus* Stimpson, 1860; *Scyllarus sordidus* (Stimpson, 1860); *Scyllarus tutiensis* Srikrishnadhas, Rahman and Anandasekaran, 1991.

Main Diagnostic Features.

1. Rostrum very broad, sometimes constricted behind anterior margin, with distinct rostral tooth.
2. Carapace mid-line with 1 high blunt or two-topped cardiac tooth and 1 similar gastric tooth.
3. Branchial carina interrupted by deep wide gap formed by cervical groove.
4. Pleonites with complex arborescent pattern of narrow grooves, without median humps.
5. Anterior margin of last (sixth) article of antenna convex, with 4 rounded teeth; anterior margin of fourth article with large tooth basally, its lateral margin with 2 large teeth.
6. Colour pattern: variable from pale greyish-brownish to brown-purplish, with conspicuous oval-shaped patch on dorsal surface of first pleonite and dark band near top of fourth antennal article; legs pale yellow with dark blue rings.
7. Size: total body length reaching to about 60 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf to China and Australia.

Ecology. Benthic on mixed sand-mud-shell bottoms, from 3 to 40 m, typically between 10 and 20 m.

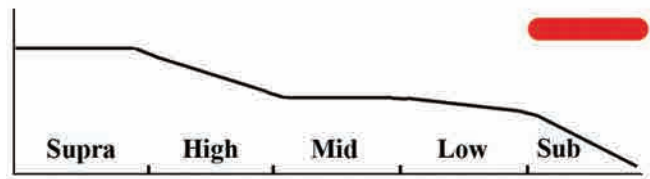


Figure 234. Bathymetric distribution of the species.

Remarks. As explained by Holthuis (2002), *Biarctus sordidus* of Stimpson (1860, as *Arctus sordidus*) should not be confused with *Scyllarus sordidus* of Nobili (1905), which is now a junior synonym of *Gibbularctus gibberosus* (De Man, 1905). The latter species is also recorded from the Arabian-Persian Gulf, however, only based on the original record of Nobili (1905) from UAE. A colour photograph of an adult specimen of *B. sordidus* from the Gulf of Mannar was published by Vaitheeswaran and Herman (2018), although their specimen appeared to be preserved and mostly discoloured.

Most Relevant References. Fischer and Bianchi 1984; Holthuis 1991; Burton and Davie 2007.

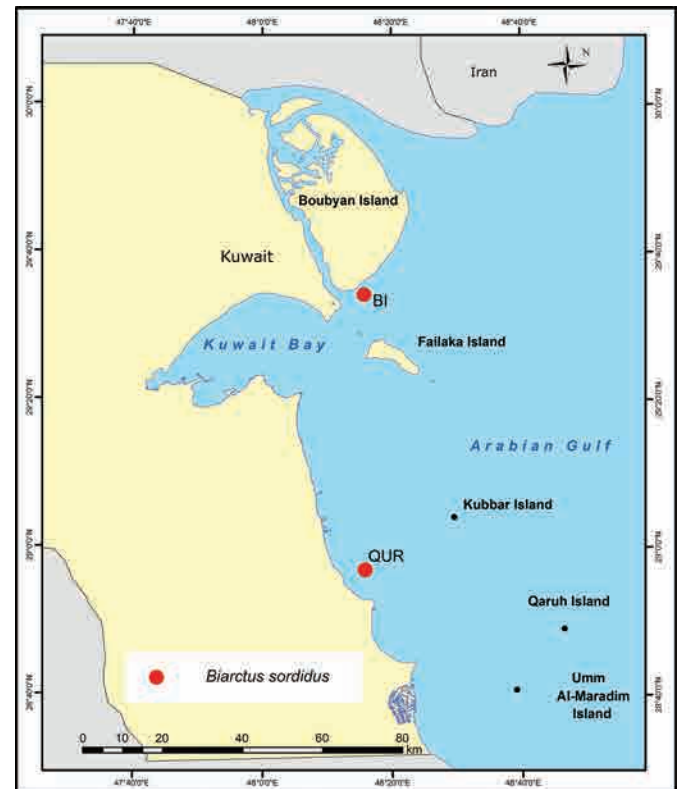


Figure 235. Presently known records of *Biarctus sordidus* in Kuwait.



Figure 236. Young slipper lobster, *Biartus sordidus*, Quit'at Uraifjan reef, Kuwait. Photograph by Yaser Mohammed Abdulraheem.



Family Scyllaridae

Thenus orientalis (Lund, 1793)



Figure 237. Female of *Thenus orientalis* (Lund, 1793) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Scyllarus orientalis* Lund, 1793.

Common Names. Flathead lobster, flathead locust lobster, Bay lobster (in Australia).

Main Diagnostic Features.

1. Body extremely flattened dorso-ventrally.
2. Carapace tapering posteriorly, much wider between eyes than at posterior margin; lateral margin straight, with cervical incision and 2 teeth: 1 distal near orbit (anterolateral) and 1 at anterior $\frac{1}{4}$ of carapace length (postcervical).
3. Carapace surface with granules and distinct median carina with 3 sharp teeth.
4. Anterior large article of antenna with 3 sharp triangular teeth on mesial half of distal margin, and some small teeth at either side of these; large posterior article ending in large, sharply pointed, inwardly curved tooth; lateral margin with 3 smaller teeth.
5. Pleon granular with transverse groove over middle of each pleonite; fifth pleonite with sharp tooth in central portion of posterior margin.
6. Colour pattern: pale brown with dark red-brown spots and markings; tail faint yellowish.
7. Size: total body length reaching about 250 mm.

Distribution. Indo-West Pacific from the Red Sea, East Africa, and the Arabian-Persian Gulf to Japan and Australia.

Ecology. Benthic on sand-mud bottoms mixed with shells and gravel in the subtidal areas between 8 and 70 m, most commonly encountered between 10 and 50 m; usually hiding in shelters by day and active at night.

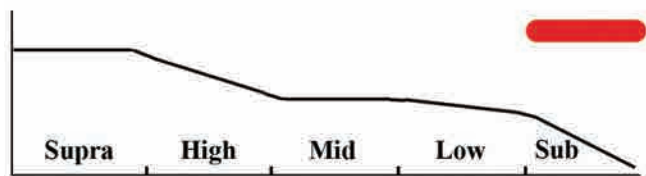


Figure 238. Bathymetric distribution of the species.

Remarks. *Thenus orientalis* is a widely distributed, commercially important slipper lobster (Holthuis 1991; Carpenter et al. 1997b; Burton and Davie 2007). The occurrence of *T. orientalis* in Kuwait is based on an older record by Motoh (1975a), although it is probably still present in the area and in adjacent waters of Saudi Arabia, Qatar, and Iran. However, all specimens collected from the Arabian-Persian Gulf need to be examined carefully based on the publication by Burton and Davie (2007), who showed that two pseudo-cryptic species of *Thenus* are present in the UAE (one of them *T. orientalis*) and an additional species is present in Pakistan.

Most Relevant References. Fischer and Bianchi 1984; Holthuis 1991; Carpenter et al. 1997b; Burton and Davie 2007.

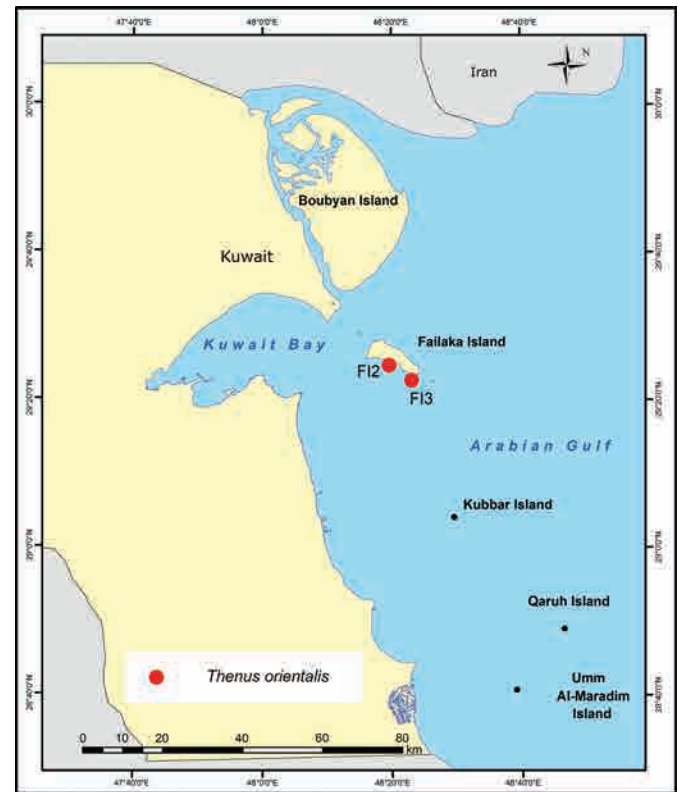


Figure 239. Presently known records of *Thenus orientalis* in Kuwait.



Figure 240. *Thenus orientalis* in situ off Qaruh Island, Kuwait. Photograph by Eslam Basuny.

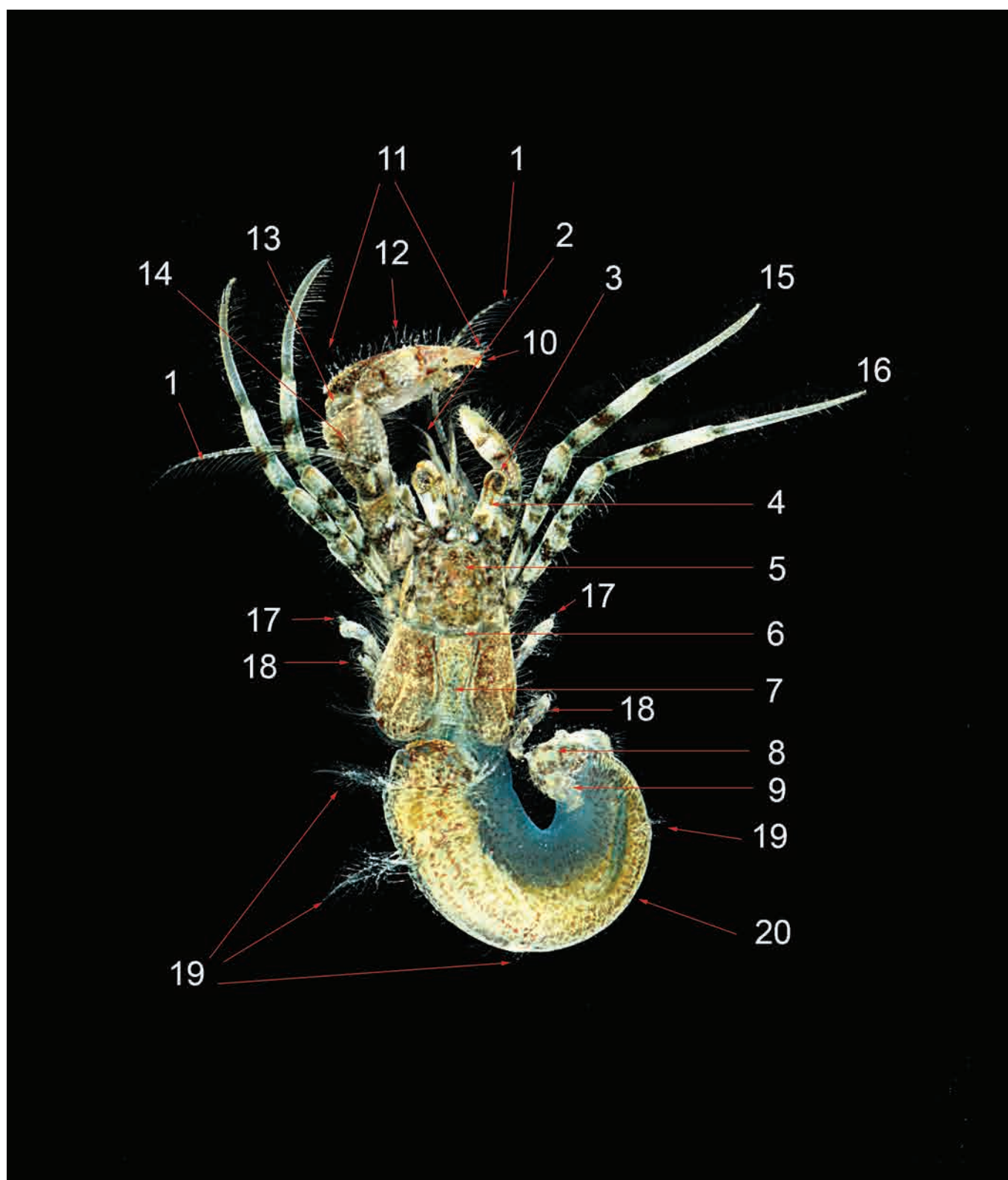


Figure 241. General morphology of Paguroidea exemplified by *Diogenes avarus*, a member of the family Diogenidae.

- | | | |
|-----------------------------------|------------------------------|-----------------------------|
| 1. Antenna. | 8. Telson. | 15-18. 2nd - 5th pereopods. |
| 2. Antennule. | 9. Uropod. | 19. Pleopods. |
| 3. Eye. | 10. Chela. | 20. Pleon. |
| 4. Eye stalk. | 11. Cheliped - 1st pereopod. | |
| 5. Carapace shield. | 12. Manus. | |
| 6. Cervical groove. | 13. Merus. | |
| 7. Posterior portion of carapace. | 14. Carpus. | |

Suborder Pleocyemata

Infraorder Anomura

(Hermit Crabs, Squat Lobsters, Porcelain Crabs, Mole Crabs)

Figure 242. *Dardanus tinctor* in situ off Al-Khiran, Kuwait. Photograph by Yaser Mohammed Abdulraheem.



Superfamily Paguroidea (Hermit Crabs)

Family Calcinidae

Dardanus tinctor (Forskål, 1775)

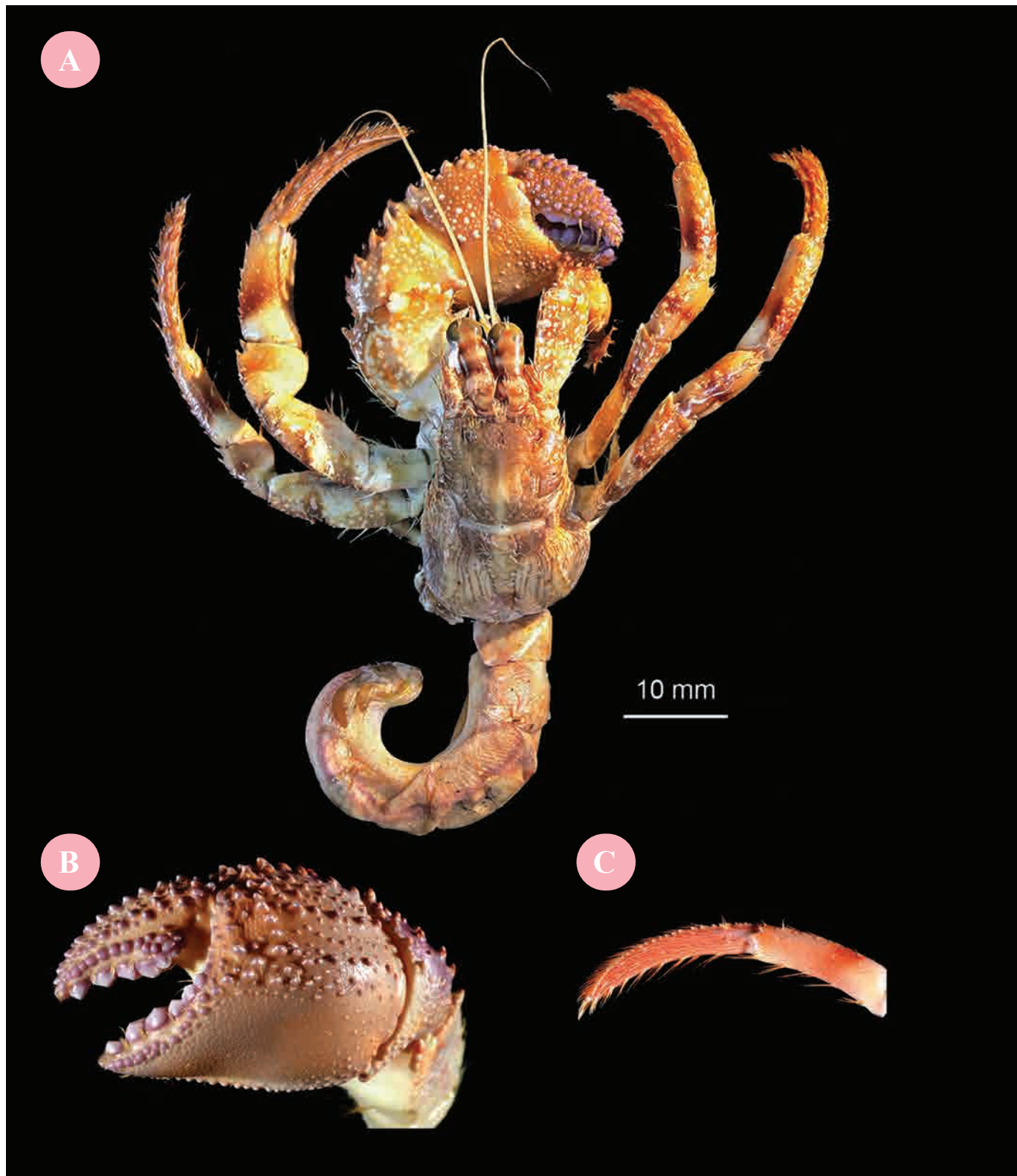


Figure 243. *Dardanus tinctor* (Forskål, 1775) in dorsal view without shell (A), left cheliped (B), and distal part of left pereopod 3 (C), Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Cancer tinctor* Forskål, 1775; *Pagurus varipes* Heller, 1861.

Common Name. Forskål's anemone hermit-crab.

Main Diagnostic Features.

1. Shield slightly longer than broad.
2. Anterior margin between rostrum and lateral projections gently concave.
3. Cornea dilated, but not broader than peduncle.
4. Chelipeds unequal, left much larger and stronger than right; chelae covered by rounded or conical tubercles, including 2 rows on the outer surface of pollex and several rows on the outer surface of dactylus.
5. Walking legs with dactyli longer than propodi, both with strongly serrated margins.
6. Colour pattern: generally reddish or red-yellowish, with red-purple chelae; carpi and propodi of walking legs with pallid to dark red or red-brown band; ocular peduncles dorsally with 2 broad transverse bands.
7. Size: shield length reaching 43 mm, resulting in maximal total body length of at least 90 mm.

Distribution. Indo-West Pacific from the Red Sea and the Arabian-Persian Gulf to Mauritius and Japan.

Ecology. Benthic on mixed and hard bottoms, from the lowest intertidal area (rarely) to at least 20 m; often associated with sea anemones, especially *Calliactis polypus*, and may harbour small mysids or opossum shrimps, *Heteromysis* spp. (Lewinsohn 1969).

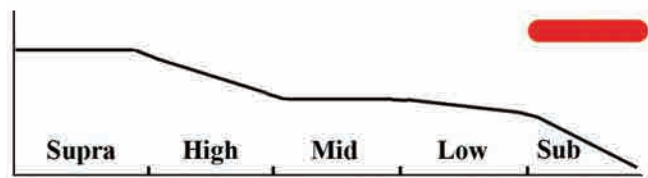


Figure 244. Bathymetric distribution of the species.

Remarks. *Dardanus tinctor* is presently the only species of the genus known from Kuwait and occurs throughout the Arabian-Persian Gulf (Naderloo et al. 2012; Seyfabadi et al. 2013). It is typically found at subtidal depths but occasionally ventures into the intertidal zone, presumably for feeding (Seyfabadi et al. 2013). The complete taxonomic account of *D. tinctor* is that of Lewinsohn (1969), with a very detailed description based on numerous specimens from throughout the Red Sea and black-and-white photographs. Another species of *Dardanus*, *D. lagopodes*, was reported from various localities in the Arabian-Persian Gulf (Seyfabadi et al. 2013) and may eventually be found in the southern offshore parts of Kuwait.

Most Relevant References. Lewinsohn 1969; Tirmizi and Siddiqui 1982; Jones 1986a; Naderloo et al. 2012; Seyfabadi et al. 2013.

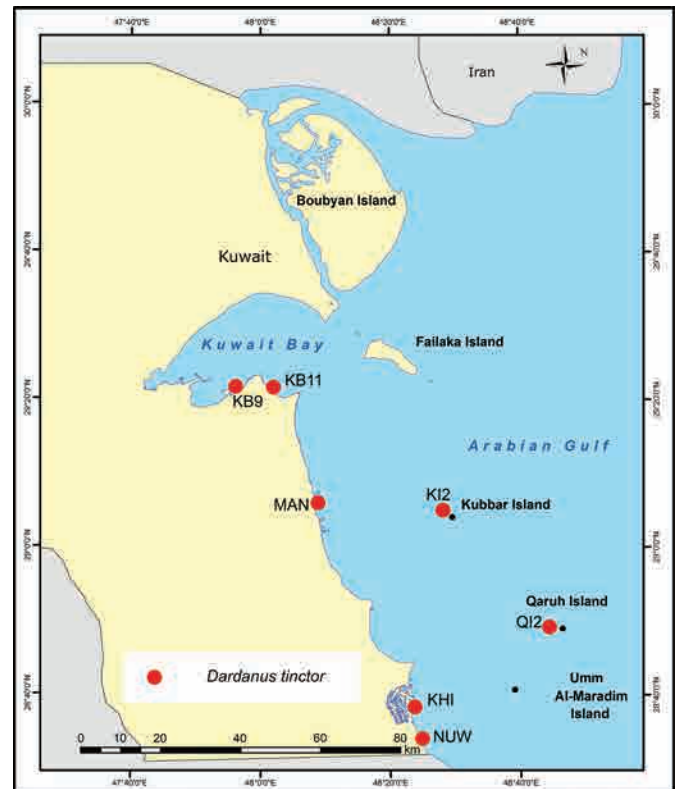


Figure 245. Presently known records of *Dardanus tinctor* in Kuwait.

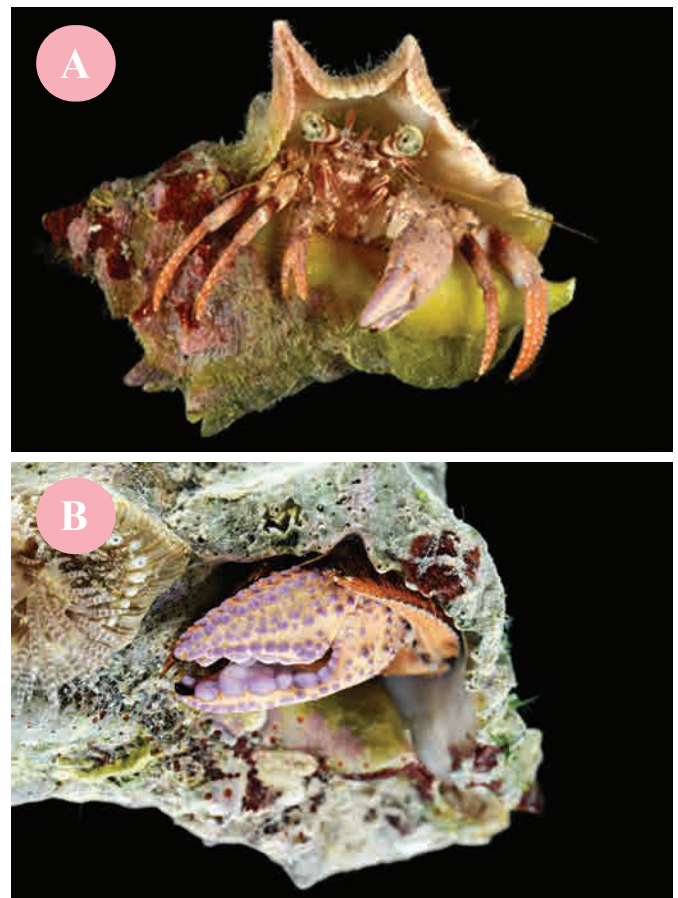


Figure 246. *Dardanus tinctor*: young individual inside the shell of *Indothis scalaris* (A); detail of left cheliped blocking the entrance of the shell (B); both specimens from Qaruh Island, Kuwait. Photographs by Arthur Anker (A) and Valeriy Skryabin (B).



Figure 247. *Dardanus tinctor* on a coral reef off Qaruh Island, Kuwait.
Photograph by Faisal Al-Sarraf.



Figure 248. *Dardanus tinctor* on a coral reef near Qaruh Island, Kuwait. Photograph by Maryam Fahad AlMashaan AlMeshaweh.



Figure 249. Possibly young *Dardanus tinctor* inside the shell of gastropod *Fusinus* cf. *arabicus*, Qaruh Island, Kuwait. Photograph by Maryam Fahad AlMashaan AlMeshaweh.



Family Diogenidae

Areopaguristes perspicax (Nobili, 1906)



Figure 250. Male of *Areopaguristes perspicax* (Nobili, 1906) in dorsal (A), ventral (B) and frontal (inside shell) (C) views, Kuwait. Photographs by Arthur Anker.

Synonym. *Paguristes jousseaumei* var. *perspicax* Nobili, 1906.

Common Name. Fluffy-legs hermit-crab.

Main Diagnostic Features.

1. Shield triangular.
2. Rostrum reduced.
3. Ocular peduncles shorter than antennular peduncles, elongate with some prominent spines.
4. Walking legs densely covered by hair-like setae; third pereopod coxa with single genital opening in females.
5. Pair of first pleopods present.
6. Colour pattern: shield purplish; pleon pale brown or pale cream; ocular peduncles and antennae bright blue.
7. Size: total body length reaching 20 mm.

Distribution. North-Western Indian Ocean from the Red Sea to the Arabian-Persian Gulf and India.

Ecology. Benthic on various types of sand-mud-rock bottoms, mainly in the intertidal zone.

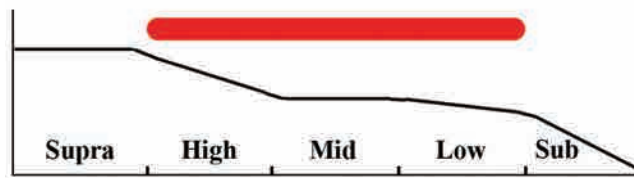


Figure 251. Bathymetric distribution of the species.

Remarks. *Areopaguristes perspicax* is probably the most common hermit crab in Kuwait and is also widely prevalent throughout the Arabian-Persian Gulf (Naderloo et al. 2012; Seyfabadi et al. 2013). This species can be easily recognized by the dense pilosity of the walking legs and bright blue antennae and ocular peduncles (Fig. 250, see also Trivedi and Vachhrajani 2017).

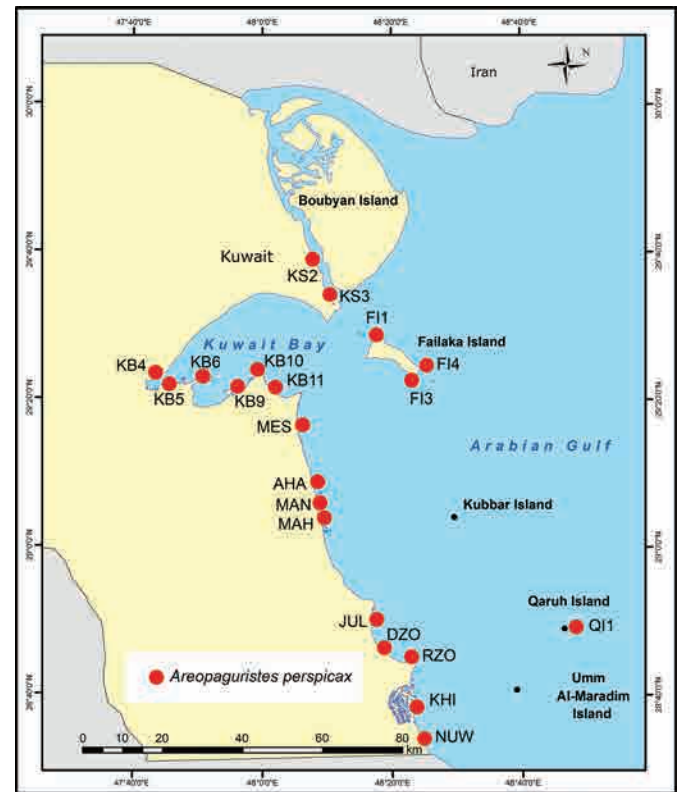


Figure 252. Presently known records of *Areopaguristes perspicax* in Kuwait.

However, it must be noted that several other species of *Areopaguristes* exist in the western Indian Ocean, and their identification may be more challenging (Dechancé 1963; Poupin et al. 2013). Like many other littoral hermit crabs, *A. perspicax* is not picky and has very broad preference for gastropod shells: for instance, it used 22 species of shells at one Iranian site studied by Seyfabadi et al. (2014).

Most Relevant References. Nobili 1906; Dechancé 1963; Seyfabadi et al. 2013; Trivedi and Vachhrajani 2017.



Figure 253. *Areopaguristes perspicax* inside the gastropod shell *Ergalatax junoniae*, Kuwait. Photograph by Mahdi Bin Hader.

Figure 254. *Areopaguristes perspicax* on a massive coral near Umm Al-Maradim Island, Kuwait. Photograph by Maryam Fahad AlMashaan AlMeshaweh.



Figure 255. Two different individuals of *Areopaguristes perspicax* from Failaka Island, Kuwait. Photographs by Arthur Anker.



Family Diogenidae

Clibanarius signatus Heller, 1861



Figure 256. Two individuals of *Clibanarius signatus* Heller, 1861 from Kuwait, outside of the shell in dorsal (A) and lateral (B) views; inside the shell of *Lunella coronata* (C). Photographs by Valeriy Skryabin.

Synonym. *Clibanarius semistriatus* Heller, 1862.

Common Name. Stripe-legged hermit-crab.

Main Diagnostic Features.

1. Shield longer than broad.
2. Antennules longer than ocular peduncles.
3. Chelipeds subequal, right slightly larger than left, both shorter and stouter than walking legs; chelae with noticeable notch in the articulation area between dactylus and propodus.
4. Walking legs with dactyli shorter than propodi; ventral margin of carpus with 5–6 small corneous spines.
5. Colour pattern: yellowish to grey with orange markings on carapace; walking legs and ocular peduncles with black or dark red-brown longitudinal stripes; chelipeds without stripes but with white spots laterally.
6. Size: total body length reaching about 28 mm.

Distribution. North-Western Indian Ocean from the Red Sea and the Arabian-Persian Gulf to India.

Ecology. Benthic on sand-mud bottoms, largely in the intertidal zone.

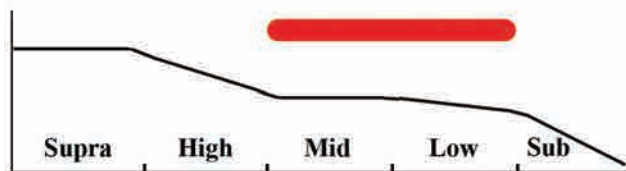


Figure 257. Bathymetric distribution of the species.

Remarks. *Clibanarius signatus* is quite common in Kuwait and throughout the Arabian-Persian Gulf (Naderloo et al. 2012) and can be a dominant hermit crab species in some intertidal areas (Jamshidi et al. 2016). McLaughlin and Dworschak (2001) provided a detailed diagnosis of *C. signatus* based on Heller's

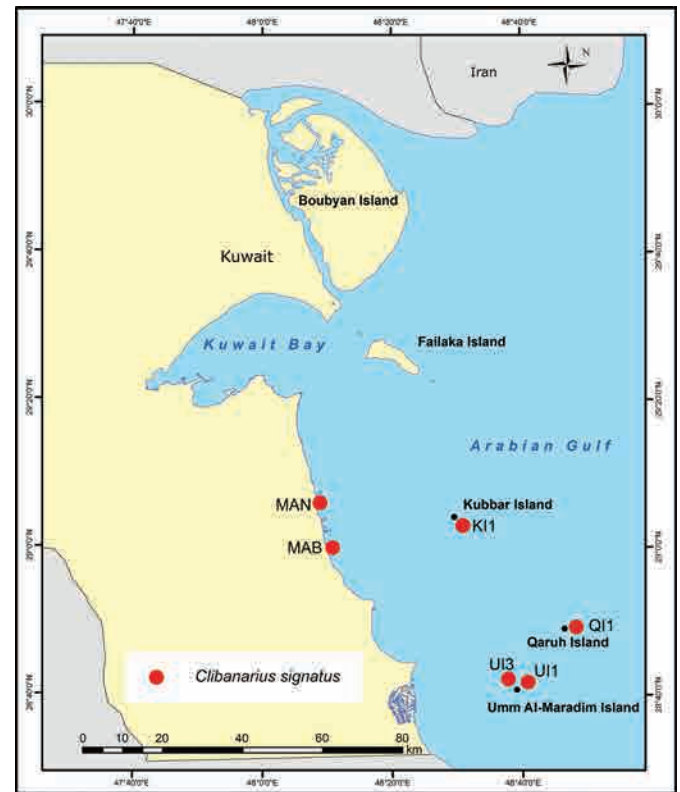


Figure 258. Presently known records of *Clibanarius signatus* in Kuwait.

type-material; whereas, excellent line drawings of the Red Sea specimens can be found in Lewinsohn (1969). Additional line drawings and a colour photograph of *C. signatus* from India were published by Trivedi et al. (2015) and Kachhfiya et al. (2017). Al-Yamani et al. (2012) published two colour photographs of the species under the name "Diogenidae gen. sp. 2" (specimen from Kubbar Island).

Most Relevant References. Lewinsohn 1969; McLaughlin and Dworschak 2001; Trivedi et al. 2015; Kachhfiya et al. 2017.



Figure 259. *Clibanarius signatus* on a rocky intertidal area, carrying a shell of *Lunella coronata*, Kuwait. Photograph by AM team.

Family Diogenidae

Diogenes alias McLaughlin and Holthuis, 2001

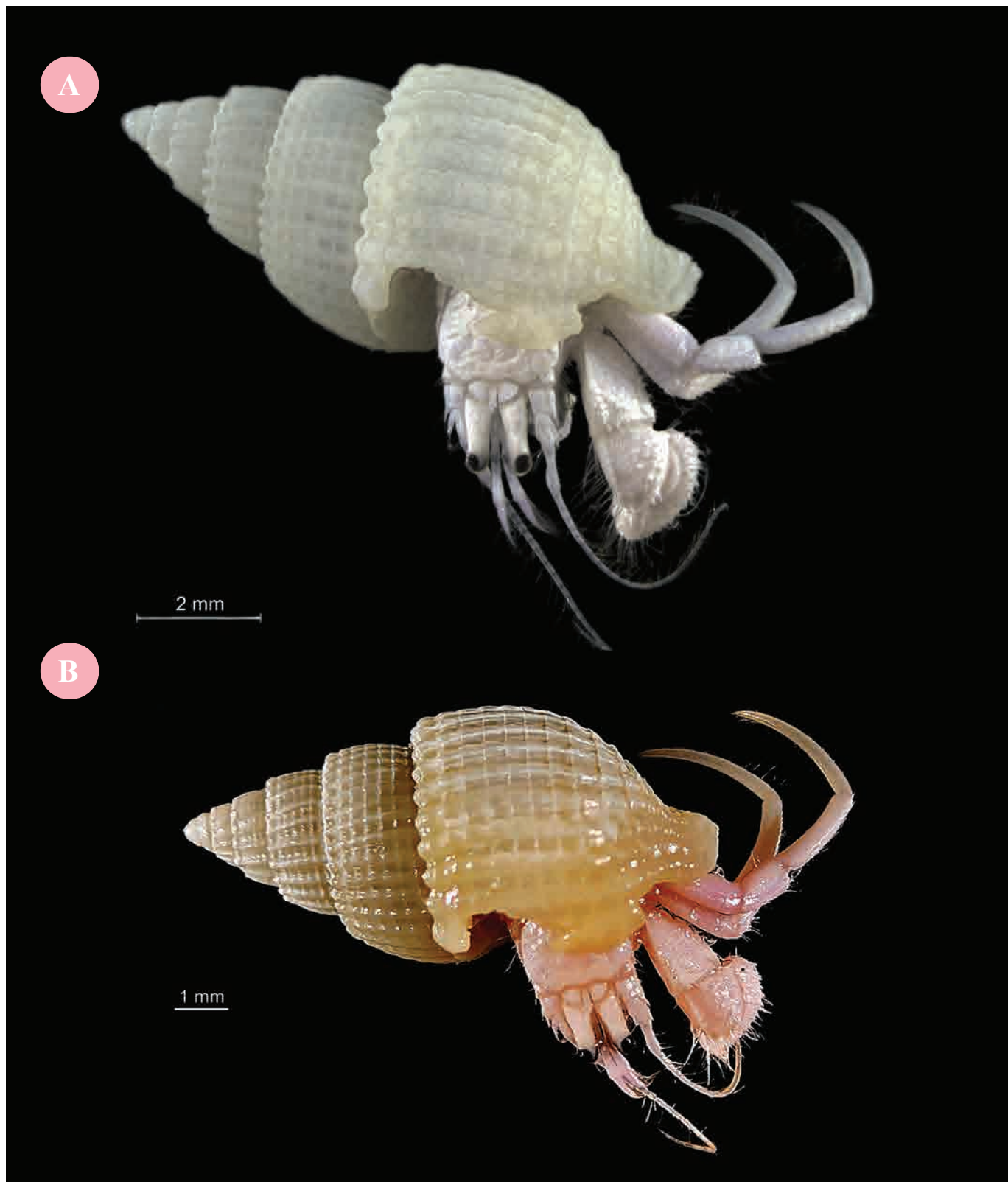


Figure 260. Preserved specimens of *Diogenes alias* McLaughlin and Holthuis, 2001 inside the shells of *Nassarius jactabundus*, from Masfat Al-Ahmadi (A) and Umm Al-Maradim Island (B), Kuwait. Photographs by Valeriy Skryabin.

Synonym. None [for incorrect identifications see McLaughlin and Holthuis 2001 and Trivedi et al. 2015].

Main Diagnostic Features.

1. Rostrum weakly developed.
2. Chelipeds unequal, left cheliped larger than right one.
3. Ocular peduncles slightly longer than shield; cornea not dilated.
4. Ocular acicles with entire anterior margin covered with spinules.
5. Antennal acicles prominently bifurcated; mesial margin with spinules.
6. Colour: carapace cream-buff; ocular peduncle with pink to brownish longitudinal lines; chelipeds cream-buff at base, with large brown spots.
7. Size: maximal total body length about 30 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf to South-China Sea and Indonesia.

Ecology. Benthic on mud-sand bottoms, from the lowest intertidal zone (rarely) to about 30 m; sometimes associated with sea anemones (Naderloo et al. 2012).



Figure 261. Bathymetric distribution of the species.

Remarks. *Diogenes alias* has a long history of taxonomic confusion, which started with Johan C. Fabricius and Johann F.W. Herbst in the 18th century (McLaughlin and Holthuis 2001). The species is rather rare in Kuwait and is presently recorded only from Kuwait Bay; however, it is widely prevalent in the rest of the Arabian-Persian Gulf (Naderloo et al. 2012). Good illustrations of the general morphology of *D. alias* can be found in Siddiqui et al. (2004) and Trivedi et al. (2015).

Most Relevant References. McLaughlin and Holthuis 2001; Siddiqui et al. 2004; Naderloo et al. 2012; Trivedi et al. 2015.



Figure 263. *Diogenes alias* inside the shell of *Hexaplex rileyi* covered by solitary corals and barnacles from Mischan Island, Kuwait. Photograph by Valeriy Skryabin.

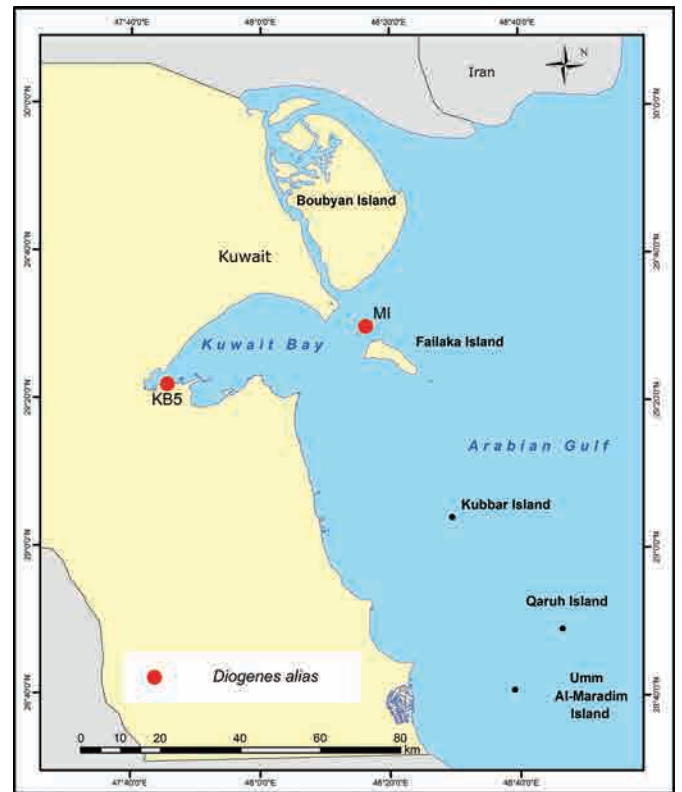


Figure 262. Presently known records of *Diogenes alias* in Kuwait.



Figure 264. Ovigerous female of *Diogenes alias* McLaughlin and Holthuis, 2001 from India in dorsal view. Photograph by Biju Kumar.

Family Diogenidae

Diogenes avarus Heller, 1865



Figure 265. Left-handed hermit crab *Diogenes avarus* Heller, 1865, in dorsal view extracted from the shell (A), and in frontal view inside the shell of *Nassarius persicus* (B, C), Kuwait. Photographs by Arthur Anker.

Main Diagnostic Features.

1. Shield longer than broad.
2. Rostrum well developed, rounded, shorter than lateral teeth.
3. Ocular acicles broad.
4. Antennal acicles elongate, triangular or subtriangular.
5. Eyestalks 4 times longer than wide.
6. Left cheliped larger than the right one; major chela with rows of granules on palm.
7. Colour pattern: whitish or cream with blackish or brownish spots and markings on chelipeds and walking legs.
8. Size: maximal total body length about 25 mm.

Distribution. Indo-West Pacific from the Red Sea, the Arabian-Persian Gulf, and East Africa to Vietnam and Australia.

Ecology. Benthic on sand, sand-rock, or sand-mud bottoms, mainly in the intertidal zone.

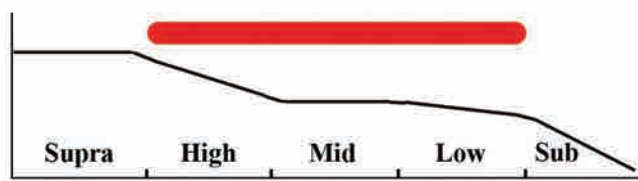


Figure 266. Bathymetric distribution of the species.

Remarks. *Diogenes avarus* is a very common intertidal hermit crab in Kuwait, especially on sandy and sandy-muddy beaches with some rocks, and is also common throughout the Arabian-Persian Gulf (Naderloo et al. 2012). Excellent illustrations of the general morphology of *D. avarus* can be found in Lewinsohn (1969) and Siddiqui et al. (2004).

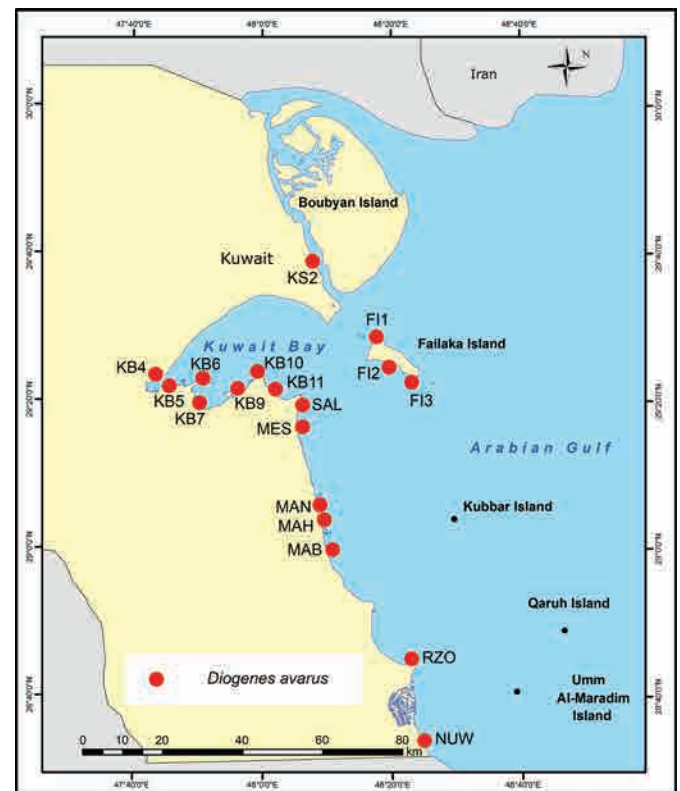


Figure 267. Presently known records of *Diogenes avarus* in Kuwait.

Most Relevant References. Lewinsohn 1969; Jones 1986a; Siddiqui et al. 2004; Naderloo et al. 2012.



Figure 268. *Diogenes avarus* carrying the shell of the dove snail *Mitrella blanda* (A) and the top shell *Eichelus persicus* (B, C), Kuwait. Photographs by Arthur Anker (A) and Valeriy Skryabin (B, C).

Family Paguridae

Pagurus kulkarnii Sankolli, 1961



Figure 269. Female of *Pagurus kulkarnii* Sankolli, 1962, in dorsal (A) and lateral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Kulkarni hermit-crab.

Main Diagnostic Features.

1. Shield slightly longer than broad.
2. Rostrum rounded.
3. Ocular peduncles moderately long, not reaching end of antennular and antennal peduncles.
4. Ocular acicles broadly triangular with terminal spinule.
5. Chelipeds unequal, right longer and stouter than left; dactylus with small conical tubercles on upper surface.
6. Walking legs with dorsomesial margin of carpus armed with a row of 5–8 spines.
7. Colour pattern: carapace buff or yellowish with orange and purple markings; ocular peduncles with orange band; antennal flagella with red-white annulation; chelipeds with brown-purple bands, chelae brown-orange; walking legs with broad orange transverse bands alternating with dark purple longitudinal streaks.
8. Size: maximal total body length about 25 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf and Pakistan to Taiwan and Philippines.

Ecology. Benthic on mixed and hard bottoms, mainly in the intertidal zone but was also recorded from shallow subtidal depths of 1–3 m (Komai and Rahayu 2014).

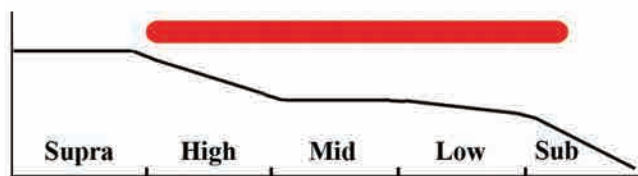


Figure 270. Bathymetric distribution of the species.

Remarks. *Pagurus kulkarnii* appears to be fairly common in Kuwait and was collected from numerous localities (see map).

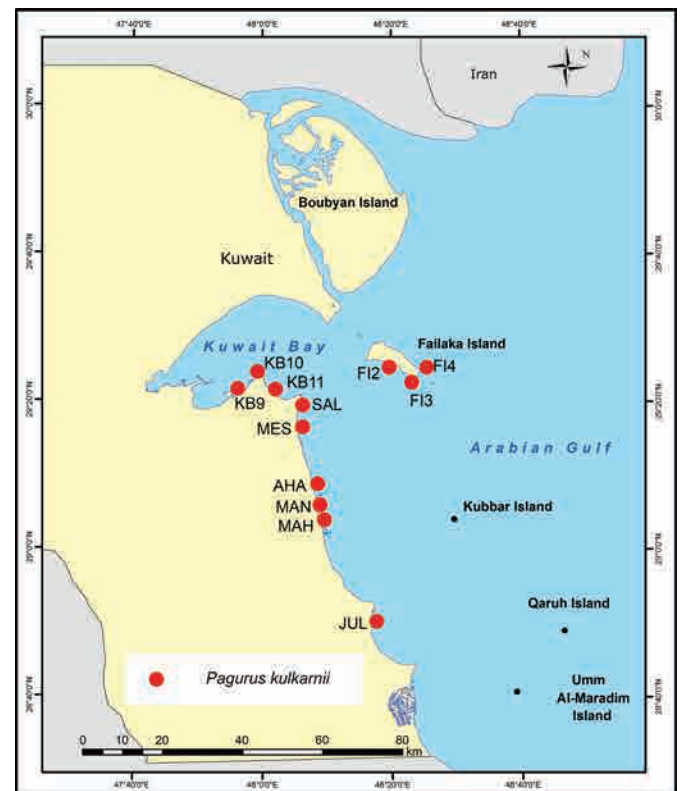


Figure 271. Presently known records of *Pagurus kulkarnii* in Kuwait.

Unfortunately, this species was not included in the popular guidebook of Jones (1986a), possibly due to the identification difficulties of pagurids at that time. However, it is very easy to identify *P. kulkarnii* is very easy to identify in the field due to its colour pattern, especially by the pattern of the walking legs and the red-white banded antennae (see colour photographs in McLaughlin et al. 2007 and Komai and Rahayu 2014).

Most Relevant References. Sankolli 1962; McLaughlin et al. 2007; Naderloo et al. 2012; Komai and Rahayu 2014.



Figure 272. *Pagurus kulkarnii* on a rocky intertidal area at Al-Nuwiseeb, Kuwait. Photograph by AM team.

Superfamily Galatheoidea

Family Galatheidae

Galathea eulimene Macpherson and Robainas-Barcia, 2015

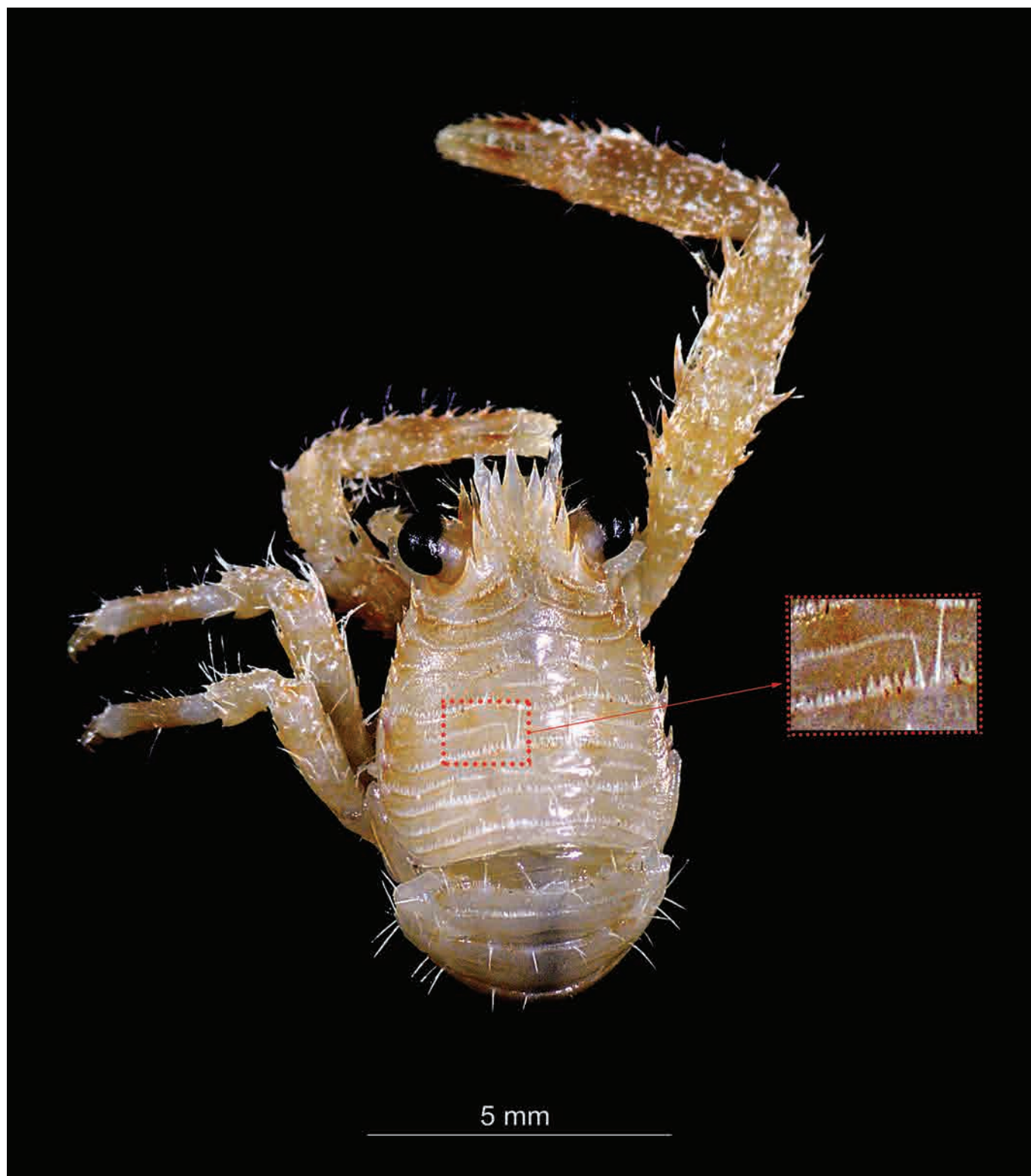


Figure 273. Preserved specimen (presumably female) of *Galathea eulimene* Macpherson and Robainas-Barcia, 2017 in dorsal view, with details of setae on transverse ridges, Qaruh Island, Kuwait. Photograph by Valeriy Skryabin.

Synonyms. *Galathea spinosorostris* sensu Macpherson and Cleve 2010 and references therein [not *Galathea spinosorostris* Dana, 1852].

Main Diagnostic Features.

1. Carapace with numerous transverse ridges with setae; 1 epigastric ridge medially interrupted, with 2 sharp teeth; lateral margins each with 7 teeth.
2. Front with large apical tooth and 3 similar teeth on each lateral margin.
3. Antennular and antennal peduncles with long, spine-like teeth.
4. Chelipeds equal or subequal in size, symmetrical or subsymmetrical in shape, more or less elongate, armed with variously sized, sharp teeth; finger cutting edges serrated, gaping in larger males.
5. Walking legs relatively stout, strongly toothed; dactylus about half-length of propodus, with row of spinules on ventral margin.
6. Colour pattern: translucent orange with reddish or brownish striae and symmetrical whitish patches and spots; chelae with whitish or yellowish patch on palm; eyes red.
7. Size: total body length reaching about 17 mm.

Distribution. Western Indian Ocean from the Red Sea and the Arabian-Persian Gulf south to Chagos, Mayotte, and Reunion.

Ecology. Benthic on hard bottoms, especially coral reefs and adjacent areas, typically in the shallow subtidal zones from 1.5 m to about 30 m, exceptionally at 772 m (Macpherson and Cleve 2010).

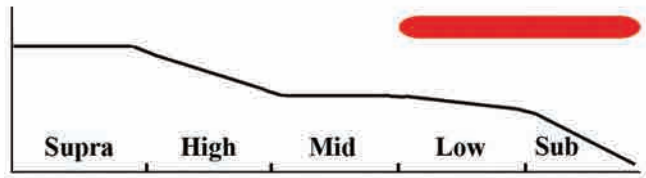


Figure 274. Bathymetric distribution of the species.

Remarks. *Galathea eulimene* is presently the only squat-lobster species recorded from Kuwait and is also one of the most common and widespread species of *Galathea* in the western Indian Ocean (Macpherson and Cleve 2010; Macpherson and Robainas-Barcia 2017). The species is recorded from the Arabian-Persian Gulf, from where no species of Galatheidæ have been previously recorded (see for example, Naderloo and Türkay 2012). However, it is likely that other squat-lobster species will eventually be found in the Arabian-Persian Gulf, especially on coral reefs and in deeper waters.

Most Relevant References. Macpherson and Cleve 2010 (as *G. spinosorostris*); Macpherson and Robainas-Barcia 2017.

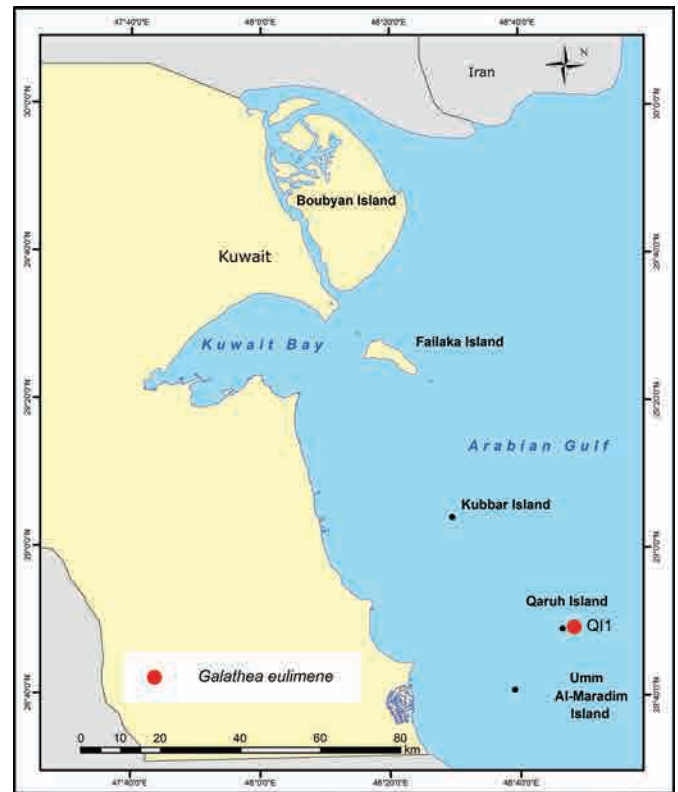


Figure 275. Presently known record of *Galathea eulimene* in Kuwait.

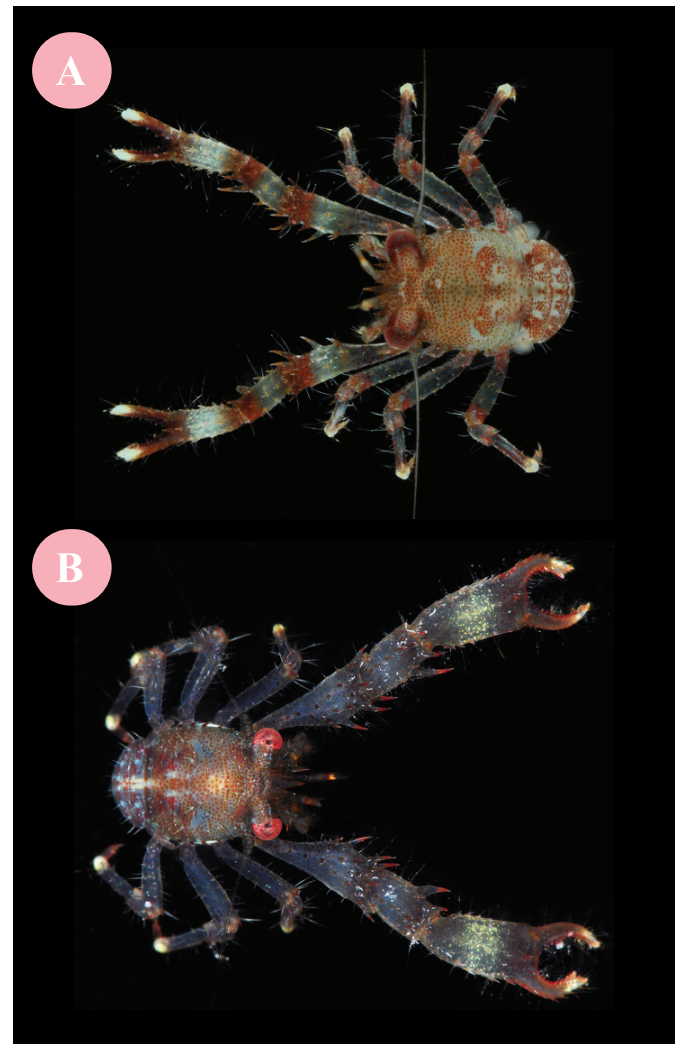


Figure 276. *Galathea eulimene*: female (A) and male (B) from the Red Sea coast of Saudi Arabia. Photographs by Arthur Anker.

Family Porcellanidae

Pachycheles natalensis (Krauss, 1843)



Figure 277. Male of *Pachycheles natalensis* (Krauss, 1843) in dorsal view with details of frontal margin (A) and ventral view (B), Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonyms. *Porcellana natalensis* Krauss, 1843; *Pisosoma natalensis* (Krauss, 1843).

Common Name. Natal porcelain crab.

Main Diagnostic Features.

1. Carapace almost perfectly rounded; side walls separated from rest of carapace by membranous groove.
2. Front gently rounded to almost straight, not projecting far beyond eyes.
3. Chelipeds heavy, sculptured; one of them considerably larger and with dense pilosity on lower (mesial) surface, at finger base; cheliped carpus as broad as long, with 1 large, bump-like lobe.
4. Walking legs stubby, granulated; dactylus with 3 spines on ventral margin.
5. Telson 5-plated; males with pair of pleopods.
6. Colour in life: reddish or brown-greenish dorsally, with small whitish dots, distinctly paler, more olive-greenish ventrally; other colour variants present (see below).
7. Size: maximal carapace length/width about 6.0/7.0 mm; maximal total length with pleon extended about 10 mm.

Distribution. Western Indian Ocean from the Red Sea and the Arabian-Persian Gulf to South Africa and India.

Ecology. Benthic on mixed and hard bottoms, especially on more exposed rocky and coral reefs, mainly in the intertidal and shallow subtidal zones; found on the underside of larger rocks or deep inside the crevices of rocks and corals.

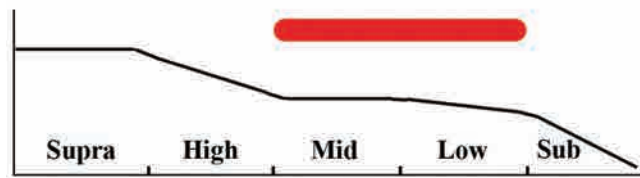


Figure 278. Bathymetric distribution of the species.

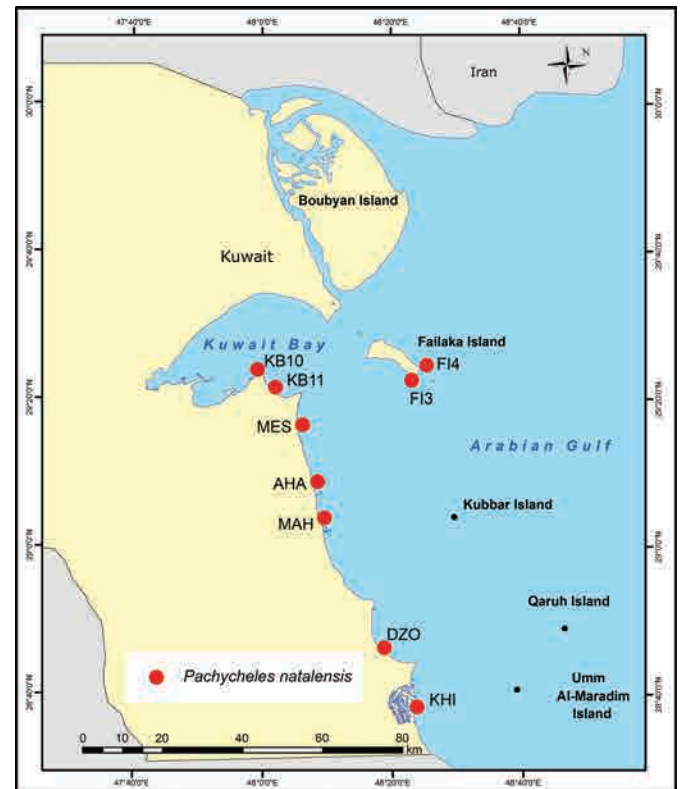


Figure 279. Presently known records of *Pachycheles natalensis* in Kuwait.

Remarks. *Pachycheles natalensis* appears to be relatively common in Kuwait (Jones 1986a), for it was collected from several surveyed sites along the central-northern coast, as well as from Failaka Island; its presence in the southern part of the country, especially at Al-Khiran and around the offshore islands, is also likely. Good illustrations of *P. natalensis* were published by Lewinsohn (1969), Tirmizi et al. (1982) and Hiller et al. (2010).

Most Relevant References. Haig 1966; Lewinsohn 1969; Jones 1986a; Hiller et al. 2010; Naderloo and Türkay 2012.



Figure 280. Ovigerous female of *Pachycheles natalensis* from Kuwait showing a less typical colour variant: whitish background with grey-greenish spots. Photograph by Arthur Anker.

Family Porcellanidae

Petrolisthes boscii (Audouin, 1826)

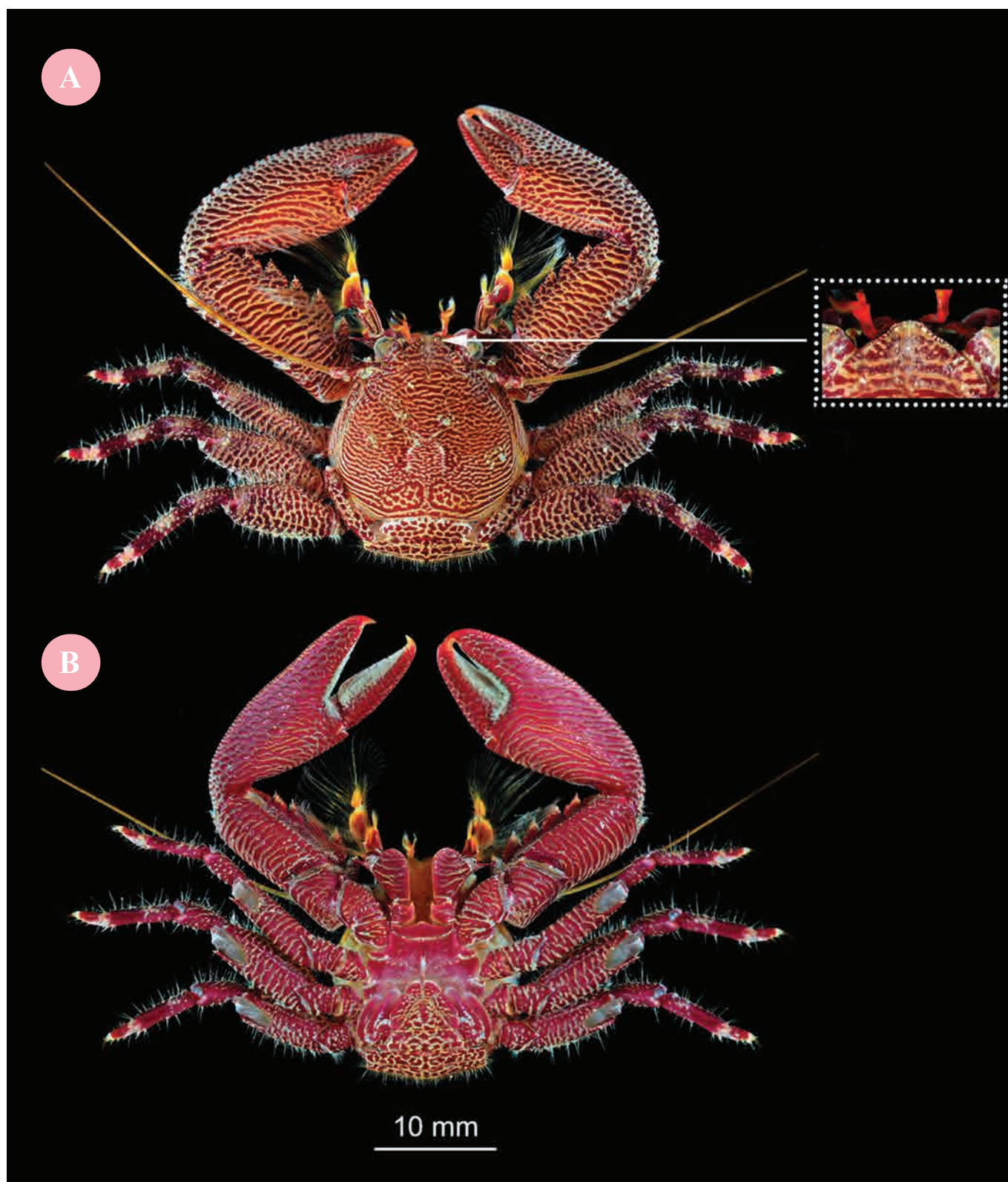


Figure 281. Male of *Petrolisthes boscii* (Audouin, 1826) in dorsal view, with details of frontal margin (A), and ventral view (B), Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Porcellana boscii* Audouin, 1826; *Petrolisthes rugosus* Miers, 1884; *Petrolisthes amakusensis* Miyake and Nakasone, 1966.

Common Name. Audouin's red porcelain crab.

Main Diagnostic Features.

1. Carapace slightly longer than broad, with 1 epibranchial tooth.
2. Front sinuously triangular with longitudinal depression.
3. Chelipeds large, subequal, with piliferous striations; carpus twice as long as broad, armed with 2–3 broad serrated teeth; outer margin of chelae evenly rounded.
4. Walking legs rugose, covered by plumose or simple setae; dactylus with 3 spines on ventral margin.
5. Colour in life: pink or reddish-yellow with bright or deep-red striations, spots, and bands; walking legs striated proximally, red-banded distally; underside deep purple-red.
6. Size: maximal carapace length/width about 17/16 mm; maximal total length with pleon extended about 25 mm.

Distribution. Indo-West Pacific from the Red Sea and the Arabian-Persian Gulf to Japan, Indonesia, and Australia.

Ecology. Benthic on mixed and hard bottoms, especially on rocky shores and shallow coral reefs, mainly in the intertidal and shallow subtidal zones, to about 18 m; typically between or underside large rocks.

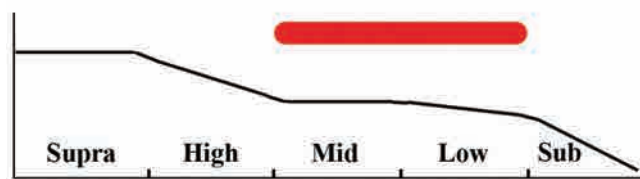


Figure 282. Bathymetric distribution of the species.

Remarks. *Petrolisthes boscii* is the largest and the most conspicuous porcelain crab on the coasts of Kuwait, with its beautiful colour pattern dominated by deep-red stripes and scales; the purplish red underside is also quite characteristic. The species is relatively common in Kuwait and throughout the Arabian-Persian Gulf (Naderloo and Türkay 2012). Therefore, it is surprising that it was not included in Jones' (1986a) field guide. However, it is possible that the species illustrated by D.A. Jones as "*P. carinipes*" with a "scarlet red" colouration, in fact, corresponds to *P. boscii* and that the drawing is inaccurate, the specimen being almost a "hybrid" between these two species (left cheliped corresponding to *P. carinipes* and the right one to *P. boscii*). Since *P. carinipes*, a species with a very distinctive colour pattern (see Osawa et al. 2010) has not yet been found on the Iranian side of the Arabian-Persian Gulf (Naderloo and Türkay 2012), and since no specimens recently collected in Kuwait are available, we consider D.A.Jones' record *P. carinipes* from Kuwait as doubtful (see also remarks under *Pisidia gordonii*). Good illustrations of the general morphology of *P. boscii* can be found in Lewinsohn (1969), Werding and Hiller (2007) and Hiller et al. (2010).

Most Relevant References. Lewinsohn 1969; Motoh 1975b; Werding and Hiller 2007; Hiller et al. 2010; Naderloo and Türkay 2012.

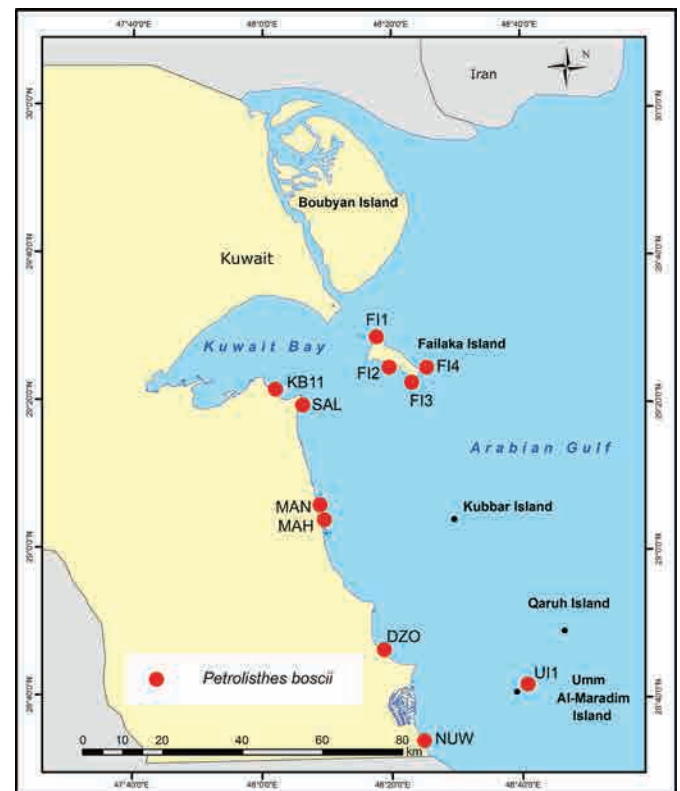


Figure 283. Presently known records of *Petrolisthes boscii* in Kuwait.



Figure 284. Male of *Petrolisthes boscii* from Failaka Island, Kuwait, in frontal view. Photograph by Arthur Anker.



Figure 285. *Petrolisthes boscii* on a rocky intertidal area of Failaka Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 286. *Petrolisthes boscii* on a rocky shore of Failaka Island, Kuwait.
Photograph by Arafat AlShuaibi.



Family Porcellanidae

Petrolisthes ornatus Paulson, 1875

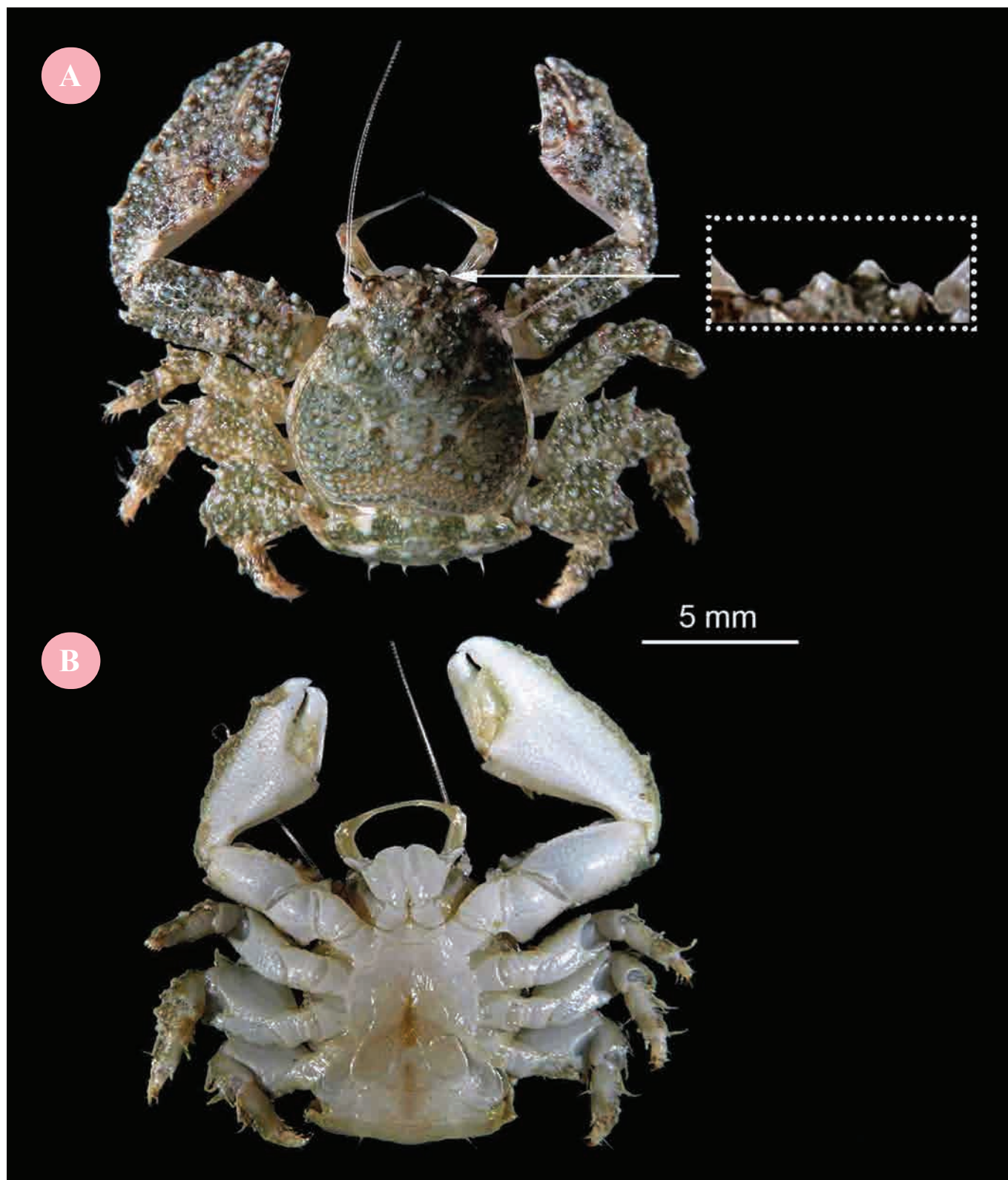


Figure 287. Male of *Petrolisthes ornatus* Paulson, 1875, in dorsal view, with details of frontal margin (A), and ventral view (B), Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Porcellana mossambica* Hilgendorf, 1879.

Common Name. Paulson's ornate porcelain crab.

Main Diagnostic Features.

1. Carapace distinctly longer than broad; dorsal surface uneven, covered with rounded tubercles and bumps of various sizes.
2. Front tridentate, with median lobe reaching distinctly beyond lateral lobes.
3. Basal article of antennae not extended towards orbit, i.e., antennae in close contact with eyes.
4. Chelipeds moderately robust, flattened, subequal; carpus twice as long as broad, rugose; anterior margin with 1 subacute proximal tooth followed by a row of blunt teeth or bumps.
5. Walking legs very stout, tuberculate; dactylus stout, with spinules on ventral margin.
6. Colour in life: greyish-green; underside deep purple-red.
7. Size: maximal carapace length/width about 9.0/8.0 mm; maximal total length with pleon extended about 12 mm.

Distribution. Western Indian Ocean from the Red Sea and the Arabian-Persian Gulf to Sri Lanka and South Africa.

Ecology. Benthic on mixed and hard bottoms, especially on rocky shores, mainly in the intertidal and very shallow subtidal zones (less than 3 m); typically under rocks and not often associated with corals or coral rubble (Lewinsohn, 1969).

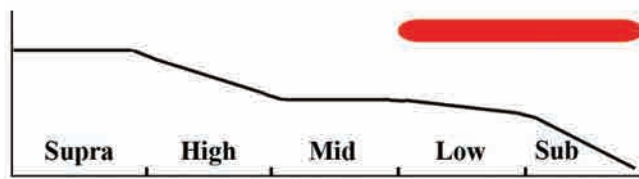


Figure 288. Bathymetric distribution of the species.

Remarks. *Petrolisthes ornatus* is a morphologically distinct porcelain crab, due to the presence of numerous large and small tubercles on almost the entire dorsal surface of the carapace, chelipeds, and ambulatory legs. Osawa (1998) suggested that this species may belong to his genus *Novorostrum* Osawa, 1998, because of the uneven, tuberculated dorsal surface and the anteriorly produced, tridentate front. As a matter of fact, Jones (1986a) confused *P. ornatus* with *N. indicum* (De Man, 1893), reporting it as "*Petrolisthes indicus*" from Kuwait. Werding and Hiller (2007) examined the material of *P. ornatus* from the Red Sea and decided to leave the species in the genus *Petrolisthes*. However, since they did not provide any comment on the genus *Novorostrum* and did not cite Osawa's publication, it is possible that they overlooked Osawa's remark on *P. ornatus* possibly belonging to *Novorostrum*. Whatever the case, a formal transfer of *P. ornatus* to *Novorostrum* is beyond the scope of the present book.

Most Relevant References. Lewinsohn 1969; Jones 1986a (as *Petrolisthes indicus*); Motoh 1975b; Osawa 1998; Werding and Hiller 2007; Naderloo and Türkay 2012; Prakash et al. 2013.

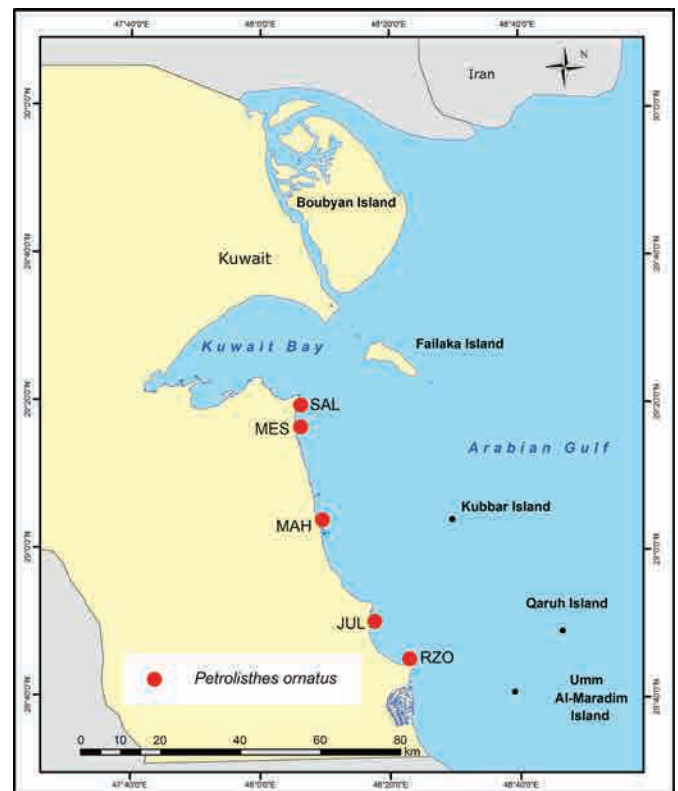


Figure 289. Presently known records of *Petrolisthes ornatus* in Kuwait.



Figure 290. *Petrolisthes ornatus* in situ in Failaka Island, Kuwait. Photograph by Valeriy Skryabin.

Family Porcellanidae

Petrolisthes rufescens (Heller, 1861)

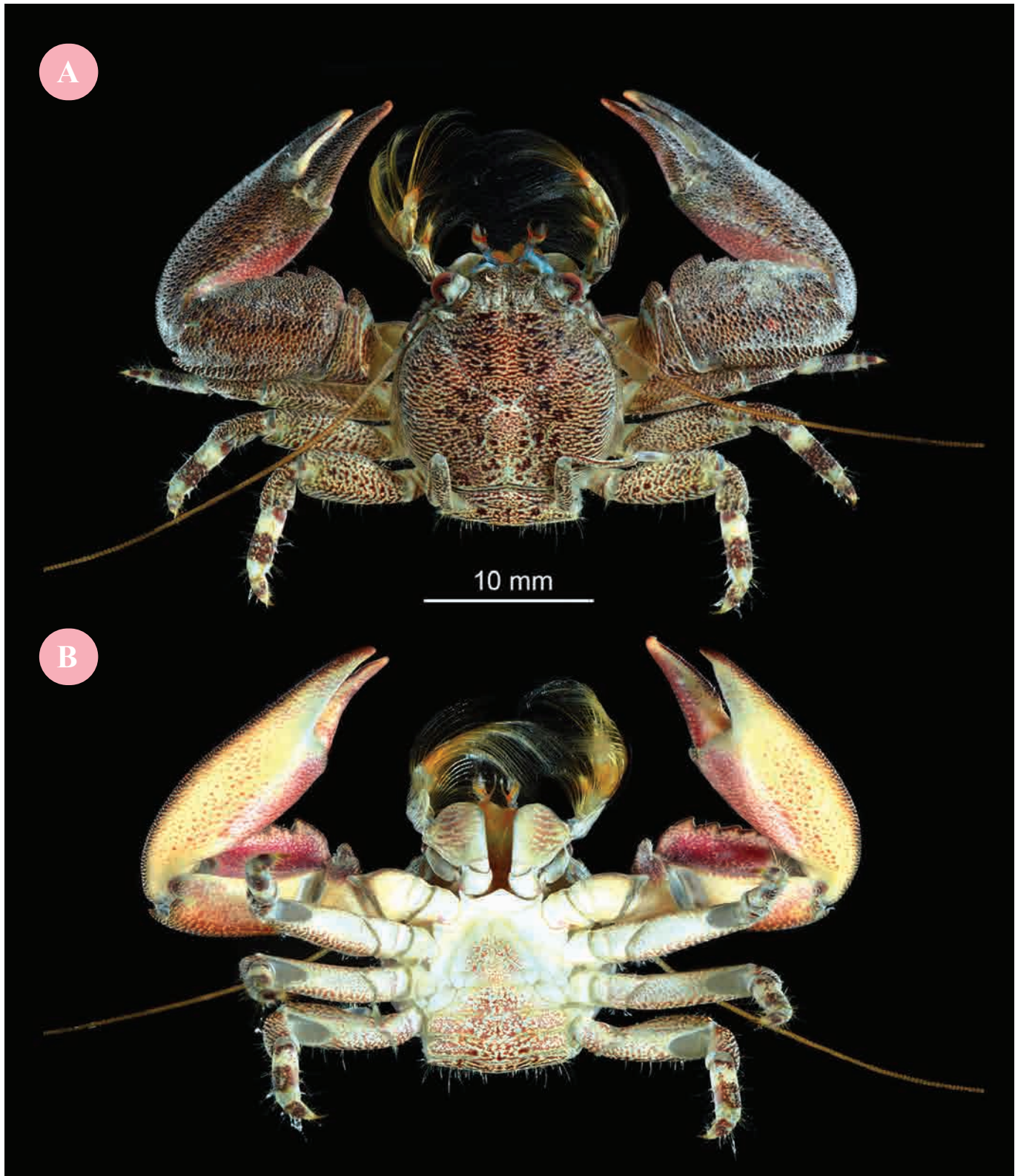


Figure 291. Male of *Petrolisthes rufescens* (Heller, 1861) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Arthur Anker.

Common Name. Dusky-spotted porcelain crab.

Main Diagnostic Features.

1. Carapace is almost rounded, slightly longer than broad.
2. Front broadly and sinuously triangular, with 3 feebly developed, rounded lobes; median lobe most pronounced.
3. Chelipeds robust, subequal; surface with numerous striae and low tubercles; carpus almost twice as long as broad, anteriorly armed with 3–4 broad blunt or subacute teeth, proximal-most tooth usually sharper and more pronounced than others, its posterior margin unarmed; outer margin of chelae evenly rounded.
4. Walking legs stout, only slightly rugose on distodorsal margin; dactylus with 3 spines on ventral margin.
5. Colour in life: pinkish or brownish with dusky brown or blackish spots and striations; walking legs with brown spots proximally, brown-banded distally; underside mostly pale except for purple-red areas on cheliped carpus and palm.
6. Size: maximal carapace length/width 10.3/9.6 mm; maximal total length with pleon extended about 13 mm.

Distribution. Western Indian Ocean from the Red Sea and the Arabian-Persian Gulf to the Nicobar Islands and Mauritius.

Ecology. Generalist species on a variety of benthic mixed and hard bottoms, prevalent in muddier parts of rocky shores, but also on oyster, sabellariid, and coral reefs, mainly in the intertidal zones, but also in the very shallow subtidal zones (less than 3 m); typically dwelling between or underside large rocks, among barnacles, etc.

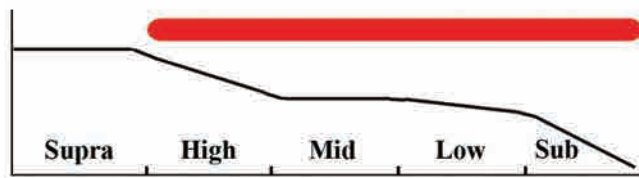


Figure 292. Bathymetric distribution of the species.

Remarks. *Petrolisthes rufescens* is the most common porcelain crab in Kuwait and throughout the Arabian-Persian Gulf (Jones 1986a; Al-Yamani et al. 2012; Naderloo and Türkay 2012). Lewinsohn (1969) provided a series of illustrations of the general morphology of *P. rufescens*; a good illustration of the habitus of the species can be found in Werding and Hiller (2007).

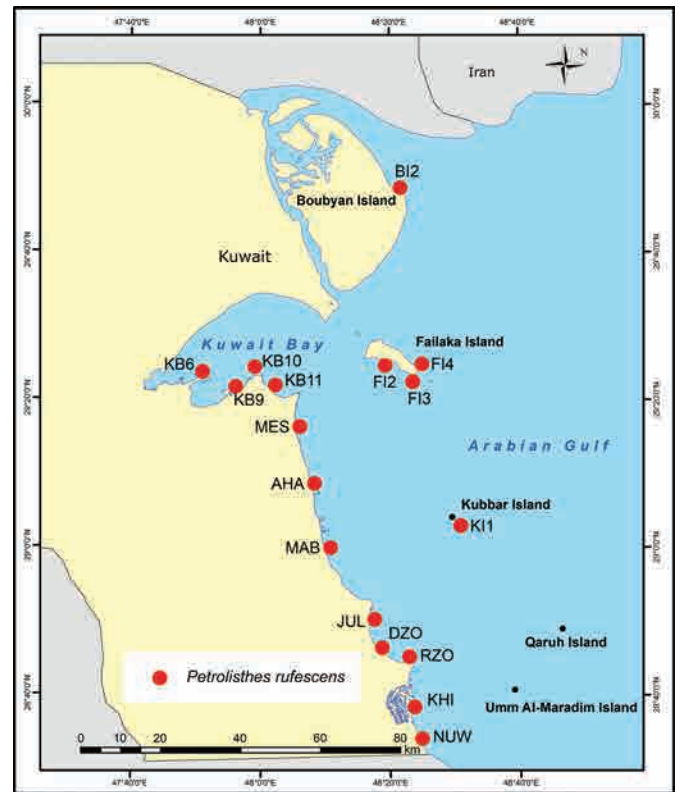


Figure 293. Presently known records of *Petrolisthes rufescens* in Kuwait.

Most Relevant References. Lewinsohn 1969; Werding and Hiller 2007; Al-Yamani et al. 2012; Naderloo and Türkay 2012.

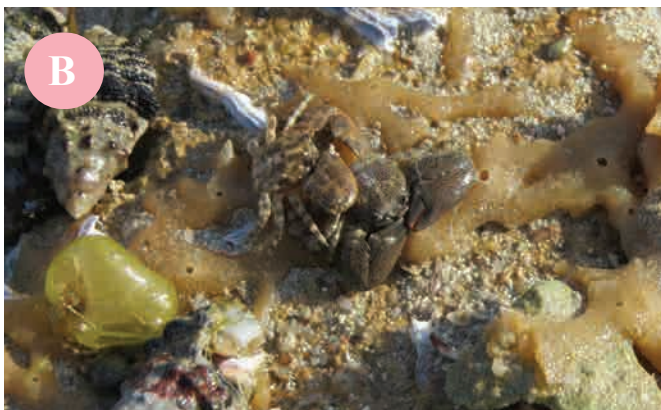


Figure 294. *Petrolisthes rufescens*: male from Failaka Island in frontal view (A), several individuals *in situ* on a rocky shore of Al-Khiran (B, C), Kuwait. Photographs by Arthur Anker (A) and Valeriy Skryabin (B, C).



Figure 295. *Petrolisthes rufescens* in situ on a rocky shore near Al-Sha'ab, Kuwait. Photograph by Abdulaziz Alyousef.



Family Porcellanidae

Pisidia gordonii (D.S. Johnson, 1970)



Figure 296. Male of *Pisidia gordonii* (D.S. Johnson, 1970) in dorsal view, with details of frontal view (A), and ventral view (B), Failaka Island, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Porcellana gordonii* Johnson 1970; *Porcellana* cf. *spinulifrons* Miers, 1879 in Gordon, 1931 [not *P. spinulifrons sensu* Miers, 1879].

Common Name. Gordon's porcelain crab.

Main Diagnostic Features.

1. Carapace slightly longer than broad, subovate, without prominent epibranchial tooth; dorsal surface posterior to rostrum, often with a median pair of setal tufts.
2. Front with 3 lobes, the median one considerably broader than the lateral ones.
3. Chelipeds relatively slender, unequal in size; merus with sharp distal projection; carpus with anterior margin rugose, with 1–2 larger acute teeth; chelae with 3 longitudinal crests with rows of acute tubercles, except in larger cheliped of larger specimens.
4. Walking legs slightly rugose, long, relatively slender.
5. Colour variable, more or less brownish or reddish, often symmetrically mottled or marbled with whitish areas; walking legs with dark bands.
6. Size: maximal carapace length 7.5 mm; maximal total length with pleon extended about 10 mm.

Distribution. Indo-West Pacific from the Red Sea and the Arabian-Persian Gulf to the South-China Sea and Indonesia.

Ecology. Benthic on mixed and hard bottoms, especially on rocky shores and silted sand flats with abundant rubble, sponges, etc., mainly in the intertidal and shallow subtidal zones, to a maximum depth of 50 m (rare); dwelling under rocks and in crevices, sometimes in sponges, on hydroids, etc. (Johnson 1970).

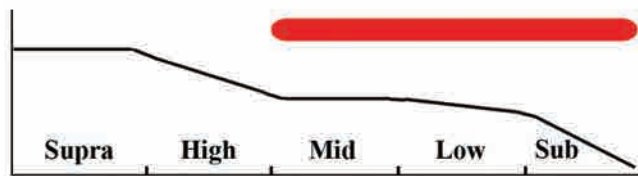


Figure 297. Bathymetric distribution of the species.

Remarks. According to Naderloo and Türkay (2012), three species of the genus *Pisidia* occur in the Arabian-Persian Gulf. They can be distinguished by the shape of the frontal margin and the armature of the chelipeds. The colour patterns of *Pisidia* spp. are quite variable (see Ferreira and Anker, 2021) and are not always beneficial for identification. Therefore, all collected specimens of *Pisidia* need to be carefully examined to identify the species correctly. *Pisidia gordonii* is probably the most common of the three species of *Pisidia* in the Arabian-Persian Gulf, and this is the first record of the species from Kuwait, although the material identified as *Petrolisthes carinipes* in Al-Yamani et al. (2012) appears to be *P. gordonii*. Decent illustrations of the general morphology of *P. gordonii* can be found, for instance, in Johnson (1970) and Hiller et al. (2010). The other two species of *Pisidia* present in the Arabian-Persian Gulf, namely, *P. inaequalis* (Heller, 1861) and *P. dehaanii* (Krauss, 1843), were illustrated by Werding and Hiller (2007) and Hiller et al. (2010), respectively. It is worth mentioning is that *P. gordonii* was named after the famous

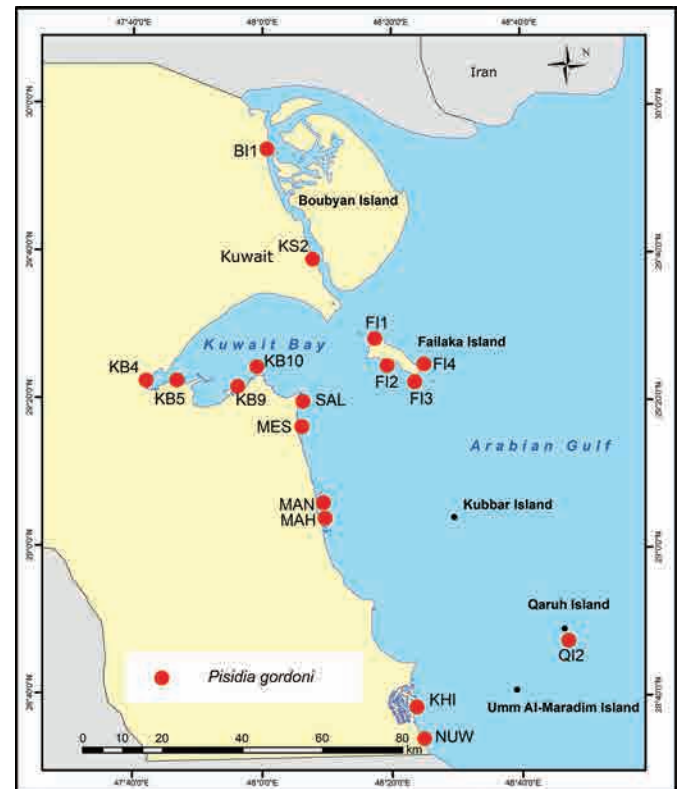


Figure 298. Presently known records of *Pisidia gordonii* in Kuwait.

Scottish carcinologist Dr. Isabella Gordon (1901–1988), and the correct Latin name of the species, therefore, should have been “*P. gordonae*”; however, an odd rule of the International Code of Zoological Nomenclature does not allow correcting the spelling mistakes made in the original descriptions of animal taxa.

Most Relevant References. Johnson 1970; Hiller et al. 2010; Naderloo and Türkay 2012; Belem et al. 2016.



Figure 299. Male of *Pisidia gordonii* on its host sponge, Failaka Island, Kuwait. Photograph by Arthur Anker.

Family Porcellanidae

Polyonyx obesulus Miers, 1884



Figure 300. Male of *Polyonyx obesulus* Miers, 1884, from in dorsal view (A) and dorso-frontal view on its host sponge (B), Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonyms. *Porcellana tuberculosa* De Man, 1888; *Polyonyx parvidens* Nobili, 1905.

Common Name. Red sponge porcelain crab.

Main Diagnostic Features.

1. Carapace ovoid, wider than long, nearly smooth, with small pits and short, delicate striae on the dorsal surface.
2. Front trilobate, without dense plumose setae on anterior margin; median lobe broad and blunt, longer than lateral lobes.
3. Chelipeds robust, somewhat unequal; carpus relatively long, unarmed on posterior margin; chela with short striae on outer surface; fingertips strongly curved; dactylus with an elevated ridge on posterior margin.
4. Walking legs stout; dactylus with dorsal (terminal) unguis slenderer than ventral unguis; ventral margin with 1 spinule.
5. Colour pattern: white with bright to pale red reticulation or marbling.
6. Size: maximal carapace length about 8.2 mm; maximal total length with pleon extended about 12 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf to Japan, Australia, and New Caledonia.

Ecology. Benthic on mixed and hard bottoms, from the intertidal zones (less common) and shallow subtidal zones (more common) to 55 m; often associated with sponges, also in coral crevices lined by encrusting sponges.

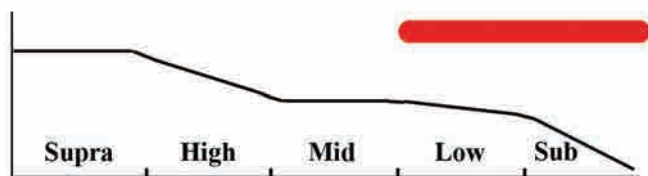


Figure 301. Bathymetric distribution of the species.

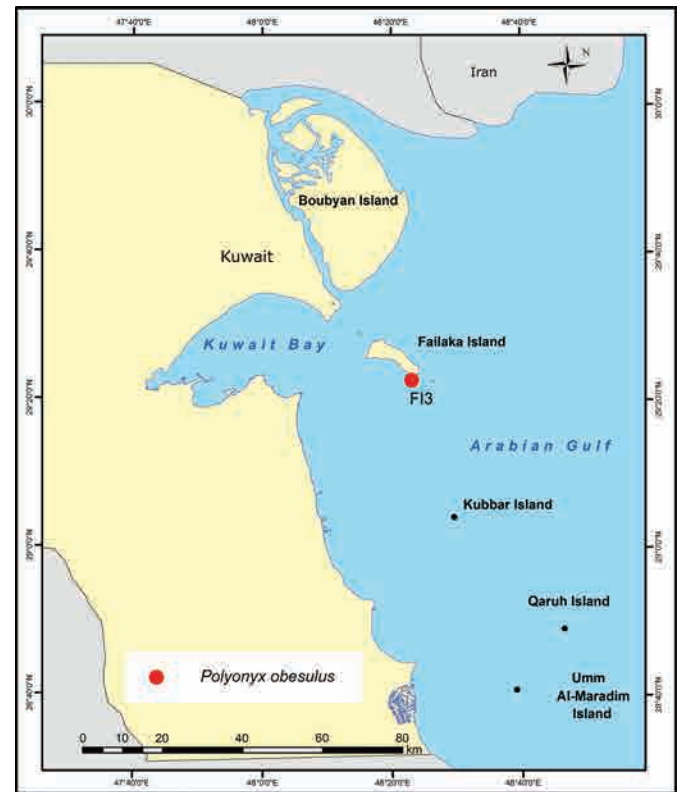


Figure 302. Presently known record of *Polyonyx obesulus* in Kuwait.

Remarks. *Polyonyx obesulus* is an easy-to-recognise porcelain crab, which seems relatively common throughout the Arabian-Persian Gulf (Naderloo and Türkay 2012) and throughout the Indo-West Pacific (Haig 1979; Osawa and Chan 2010). Nevertheless, the species is presently recorded from Kuwait based on a single specimen from Failaka, which was found in the same yellow sponge as *Upogebia octoceras* (see above) (Al-Kandari et al. 2020a), highlighting the need for more collection efforts.

Most Relevant References. Miers 1884; Haig 1979; Osawa and Chan 2010; Naderloo and Türkay 2012; Al-Kandari et al. 2020a.



Figure 303. Unidentified yellow sponge, common in the lower intertidal zones of southern parts of Failaka Island, Kuwait, host of *Polyonyx obesulus* and *Upogebia octoceras* (see above). Photograph by Valeriy Skryabin.

Family Porcellanidae

Raphidopus persicus Ng, Safaie and Naser, 2012



Figure 304. Female of *Raphidopus persicus* (Ng, Safaie and Naser, 2012) in dorsal (A) and ventral (B) views, Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonym. *Raphidopus indicus* Henderson, 1893 in Haig (1966) [not *R. indicus sensu* Henderson, 1893].

Common Name. Gulf tube-dwelling porcelain crab.

Main Diagnostic Features.

1. Body partly covered by long hair-like setae, especially on the sides of carapace, chelae, and walking legs, also on sternum.
2. Carapace ovoid, wider than long, with smooth, lateral margins, subdivided into 2 parts by small fissure just after the beginning of cervical groove; anterolateral margin behind cleft granulated, no trace of lateral spines; anterolateral and posterolateral margins strongly arcuate; dorsal surface without pubescence.
3. Frontal margin trilobate.
4. Chelipeds large, subequal, with hair-like setae; merus with a distinct spine on inner ventral margin; outer margin of carpus with 3–4 prominent spines on distal third.
5. Ambulatory legs relatively long and slender.
6. Colour in life: pale-brown or brown-reddish with whitish parts; setae pale brown (often with silt particles).
7. Size: maximal carapace length/width about 7.0/9.0 mm; maximal total length with pleon extended about 10 mm.

Distribution. North-West Indian Ocean: endemic to the Arabian -Persian Gulf.

Ecology. Benthic on soft bottoms from the lowest intertidal zone to 19 m; inquiline of burrows, one specimen found in the burrow of an echiuran, *Listriolobus cf. brevirostris*.

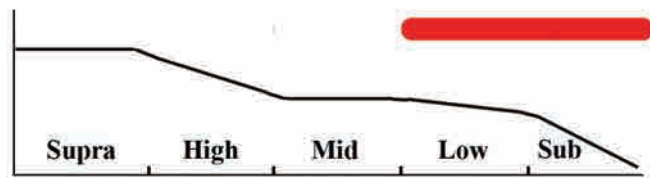


Figure 305. Bathymetric distribution of the species.

Remarks. *Raphidopus persicus* is the Arabian-Persian Gulf equivalent of the closely related *R. indicus* Henderson, 1893,

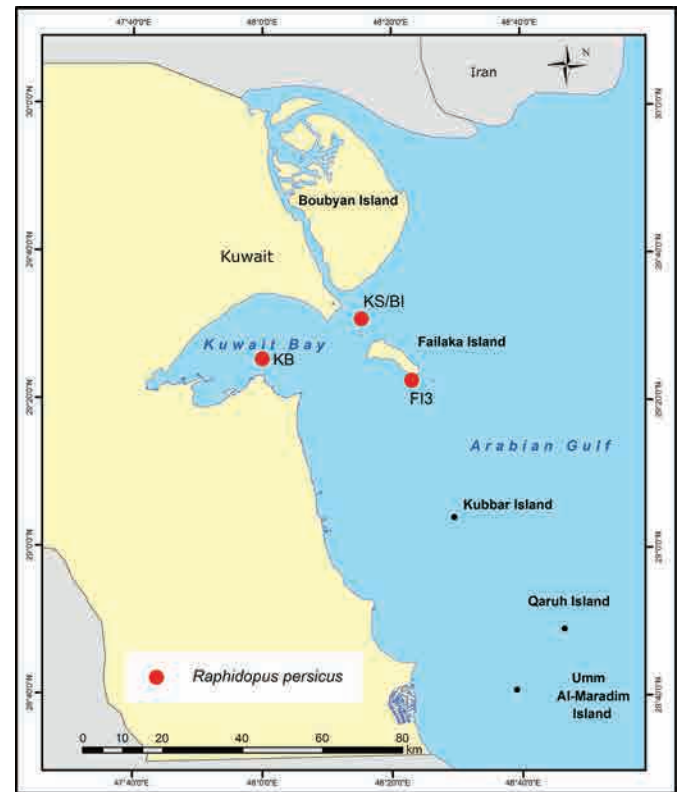


Figure 306. Presently known records of *Raphidopus persicus* in Kuwait.

from the Indian Ocean, with which it was confused until recently (Haig 1966; Naderloo and Türkay 2012; Ng et al. 2012). The species was only reported recently from Kuwait (Al-Kandari et al. 2020a). However it was already known based on the incompletely identified benthic samples (as *Raphidopus* sp.) from Kuwait Bay and between Boubyan and Failaka Islands (Al-Yamani et al. 2012). Remarkably, one Kuwaiti specimen was collected with a suction pump from a burrow of an echiuran worm (see Ecology); the type specimens were collected by a shrimp bottom trawl.

Most Relevant References. Haig 1966; Naderloo and Türkay 2012; Ng et al. 2012; Al-Yamani et al. 2012; Al-Kandari et al. 2020a.



Figure 307. Echiuran worm *Listriolobus cf. brevirostris* from Failaka Island, Kuwait, host of one of the specimens of *Raphidopus persicus*. Photograph by Arthur Anker.

Superfamily Hippoidea

Family Hippidae

Emerita holthuisi Sankolli, 1965

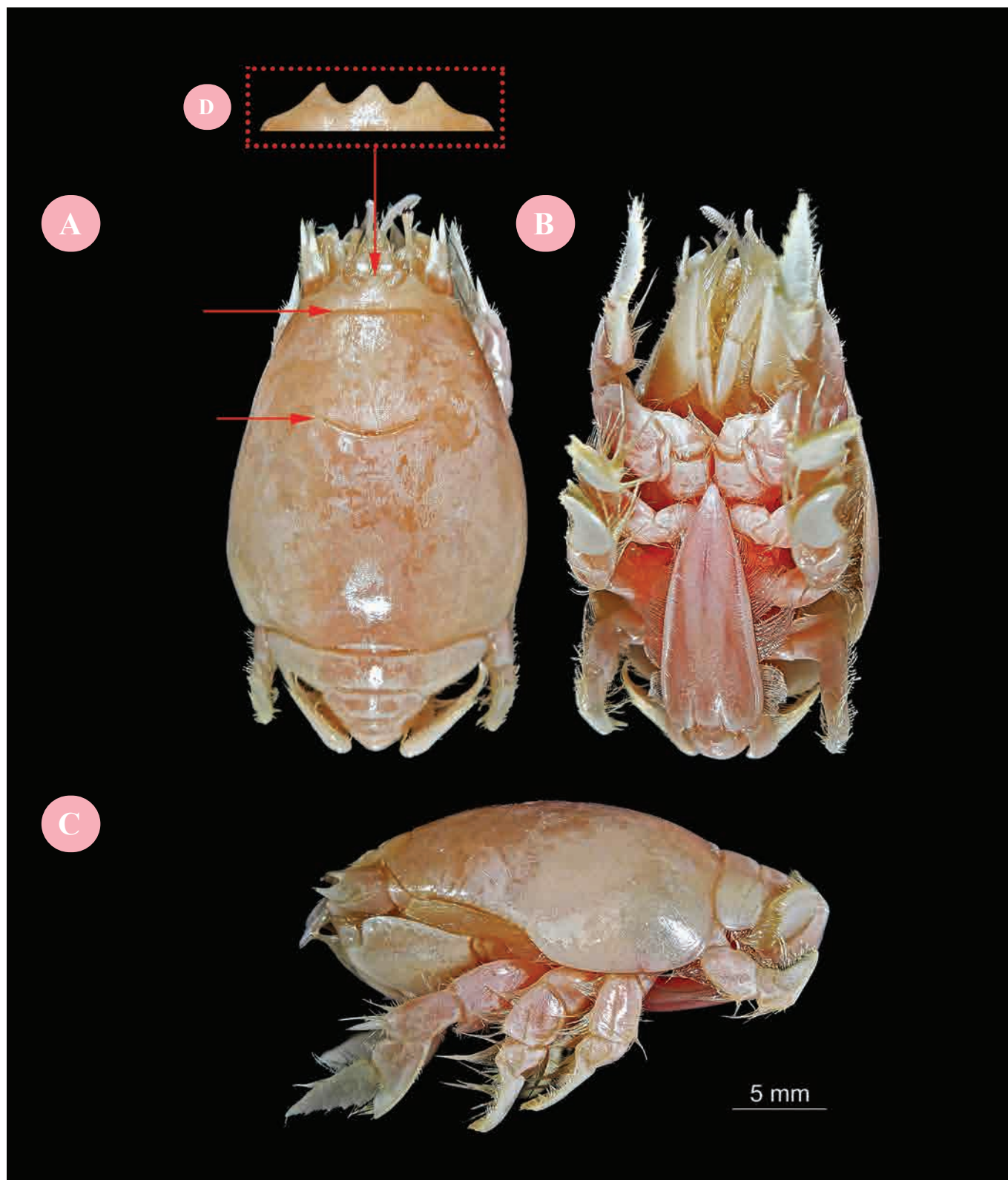


Figure 308. Ovigerous female of *Emerita holthuisi* Sankolli, 1965, in dorsal (A), ventral (B) and lateral (C) views, with details of the frontal margin (D), Kuwait. Photographs by Valeriy Skryabin.

Common Name. Holthuis' mole crab.

Main Diagnostic Features.

1. Body of fossorial type, subcylindrical, ovoid; dorsum of carapace distinctly convex.
2. Front with 3 lobes separated on either side by U-shaped sinus; median frontal lobe lower than lateral lobes; post-frontal furrow and post-gastric furrow distinct.
3. Eyestalks long and slender, reaching beyond the teeth of second article of antennular peduncle.
4. First pereopods not chelate; dactylus narrow, basally ovate, distally subacute (terminating in small spine), more than twice as long as the greatest width, with 4 teeth on ventral margin and no teeth on dorsal margin.
5. Width of the second pleonite not less than 2/3 of carapace width.
6. Colour in life: whitish or creamy with pale brown areas; females with fresh eggs bright orange.
7. Size: maximal total body length (with telson extended) about 30 mm.

Distribution. North-West Indian Ocean from the Red Sea and the Arabian-Persian Gulf to India.

Ecology. Benthic, burrowing in the sand on clean sandy beaches, moving up and down the water edge behind the surf.

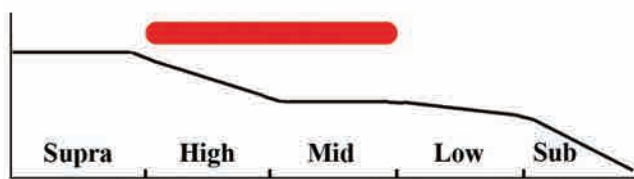


Figure 309. Bathymetric distribution of the species.

Remarks. *Emerita holthuisi* is a distinctive decapod and presently the only mole crab species from Kuwait (Jones 1986a; Al-Yamani et al. 2012). However, other species of *Emerita* are

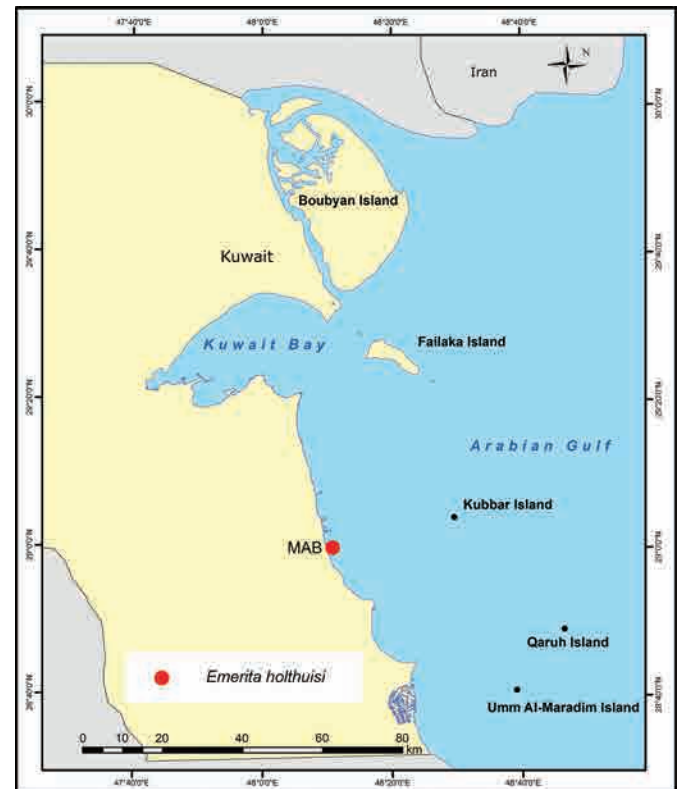


Figure 310. Presently known record of *Emerita holthuisi* in Kuwait.

known to occur elsewhere in the western Indian Ocean (Haye et al. 2002) and, therefore, all collected mole crabs need to be thoroughly identified using the key provided by Hsueh (2015). The original description by Sankolli (1965) contains good illustrations of *E. holthuisi*; whereas, the species' larval development was studied by Siddiqui and Ghory (2006).

Most Relevant References. Sankolli 1965; Jones 1986a; Hsueh 2015; Al-Yamani et al. 2012.



Figure 311. Several individuals of the mole crab *Emerita holthuisi* in Mina Abdullah, Kuwait. Photograph by Abdulrahman Yousef.

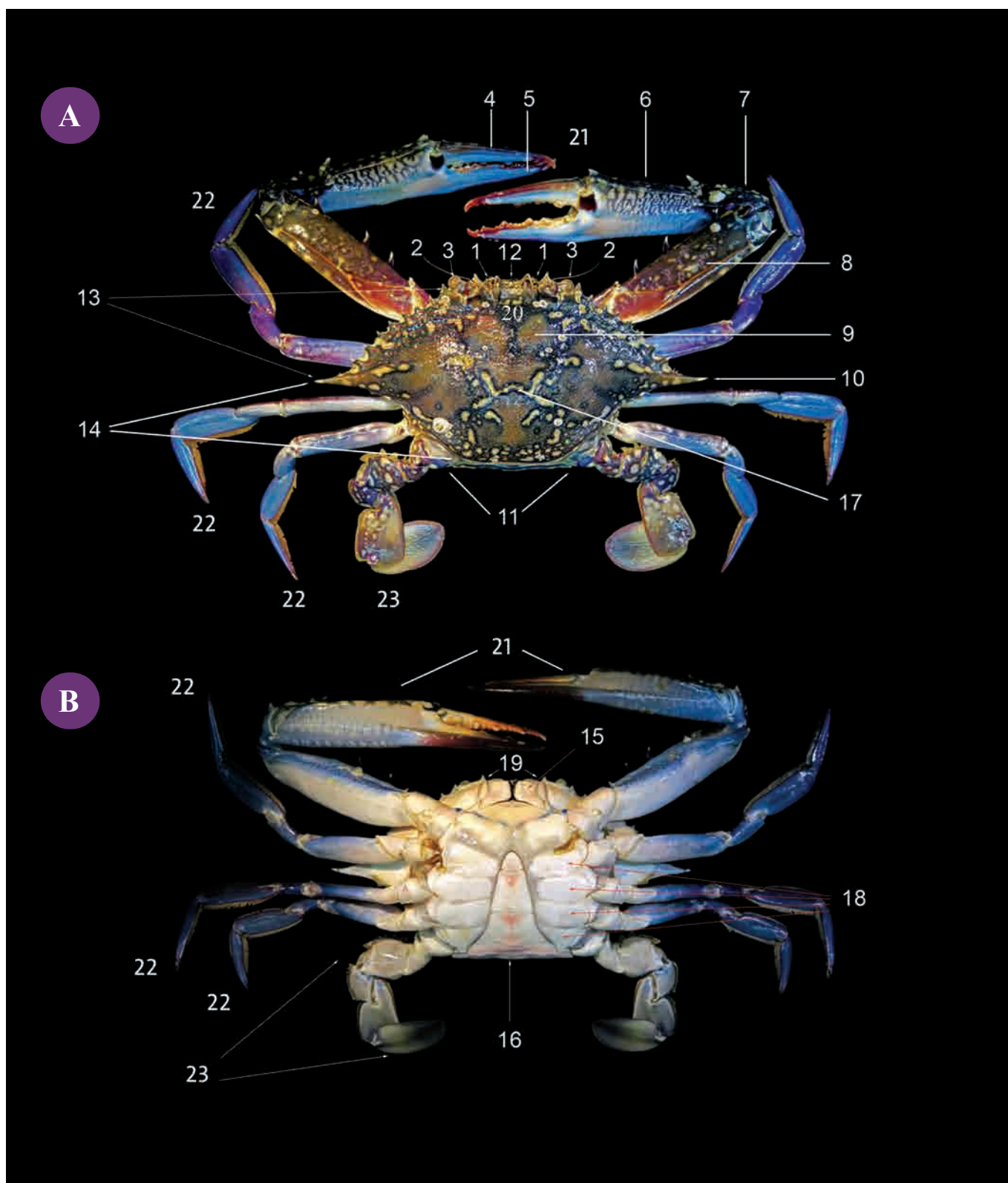


Figure 312. General morphology of Brachyura exemplified by the portunid crab, *Portunus segnis*.

- | | | |
|-------------------------------|---|---|
| 1. Antennule. | 10. 9th lateral spine. | 19. Buccal frame. |
| 2. Antenna. | 11. Posterior margin of carapace. | 20. Antero-lateral teeth. |
| 3. Eye. | 12. Anterior margin of carapace. | 21. Pereopod 1 = chelipeds. |
| 4. Dactylus (movable finger). | 13. Antero-lateral margin of carapace. | 22. Pereopods 2-4 = walking legs. |
| 5. Pollex (immovable finger). | 14. Postero-lateral margin of carapace. | 23. Pereopod 5 = swimming leg (in Portunidae) or walking leg (in other families). |
| 6. Propodus. | 15. 3rd maxilliped. | |
| 7. Carpus. | 16. Pleon. | |
| 8. Merus. | 17. Cervical groove of carapace. | |
| 9. Carapace. | 18. Thoracic sternites. | |

Suborder Pleocyemata

Infraorder Brachyura (True Crabs)

Figure 313. Male of *Carpilius convexus* *in situ* on a coral reef at Qaruh Island, Kuwait. Photograph by Faisal Al-Sarraf.



Family Matutidae

Matuta planipes Fabricius, 1798



Figure 314. *Matuta planipes* Fabricius, 1798 in dorsal view, Kuwait. Photograph by David A. Jones.

Synonyms. *Matuta lineifera* Miers, 1877; *Matuta rubro-lineata* Miers, 1877.

Common Name. Flower moon crab.

Main Diagnostic Features.

1. Carapace subcircular; surface minutely granular, with 6 mid-dorsal tubercles and 2 long lateral spines; anterolateral margin with 5 small tubercles followed by three large triangular bumps.
2. Frontal margin of carapace narrow, with emarginate rostrum and 2 lobes.
3. Chelae subequal, with coarse ridge on fingers in males.
4. Legs natatory-fossorial.
5. Male pleon with 3rd and 4th segments fused.
6. Colour pattern: yellow with violet to purple mottling and speckles.
7. Size: maximal carapace width 35 mm (excluding lateral spines).

Distribution. Indo-West Pacific from the Red Sea and South Africa to New Caledonia, Australia and Japan.

Ecology. Benthic on sandy-muddy bottoms, often on sandy beaches near reefs or seagrass beds. Quickly burying into sand if disturbed; from the intertidal zone to a depth of 50 m.

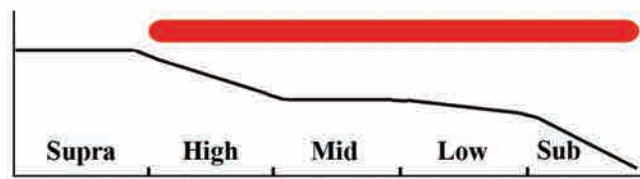


Figure 315. Bathymetric distribution of the species.

Remarks. Species of the genus *Matuta* may be distinguished by the characters of the male gonopod and ornamentation of the chelae.

Most Relevant References. Jones 1986a; Apel 2001; Naderloo 2017; Al-Khafaji et al. 2017.

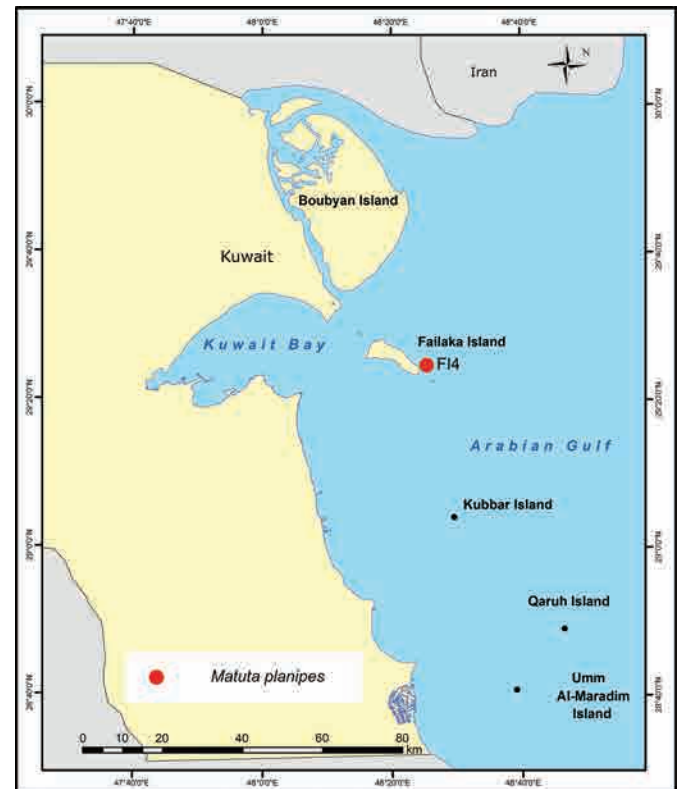


Figure 316. Presently known record of *Matuta planipes* in Kuwait.

Family Carpiliidae

Carpilius convexus (Forskål, 1775)

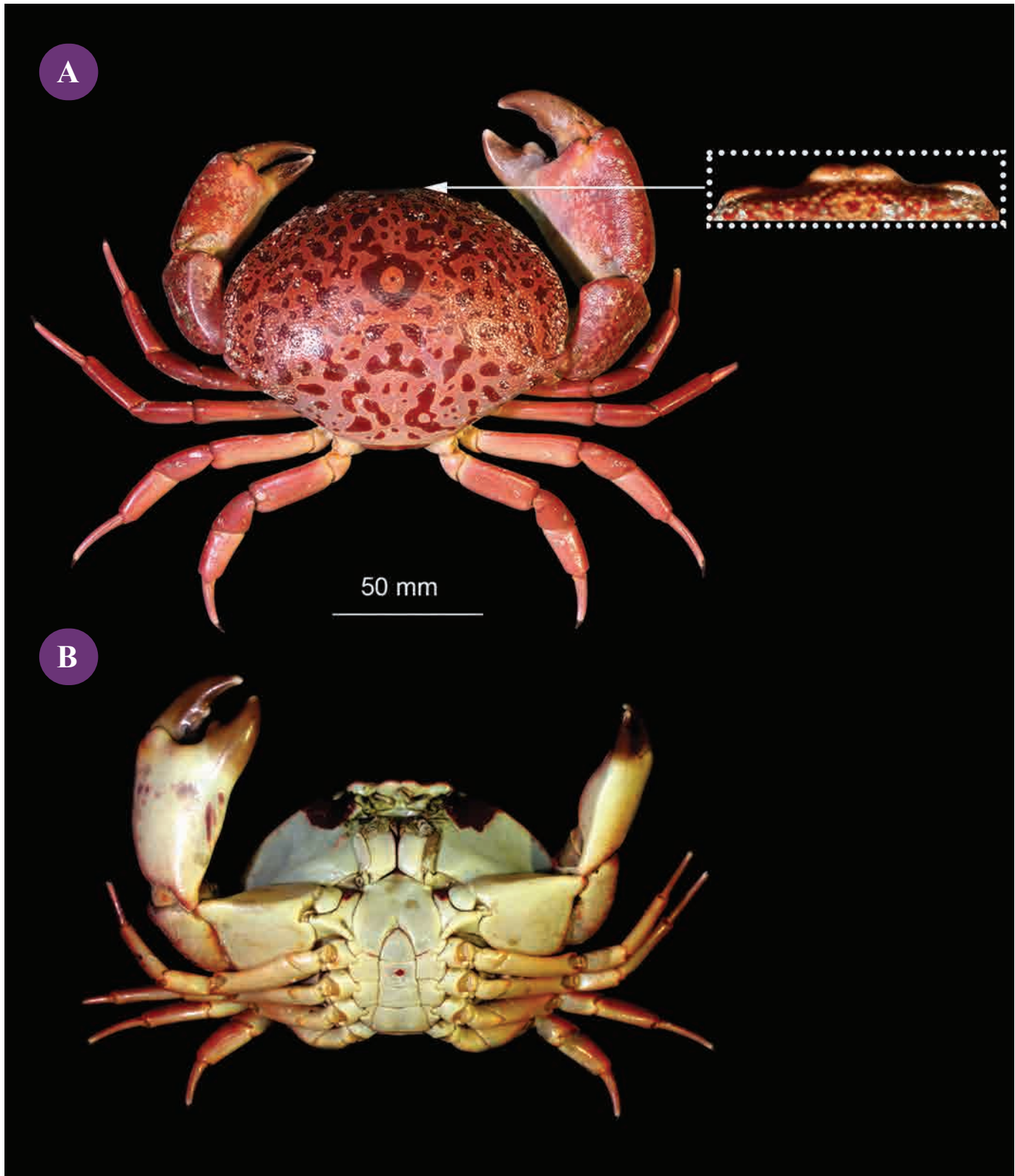


Figure 317. Male of *Carpilius convexus* (Forskål, 1775) in dorsal (A) and ventral (B) views, with details of frontal lobes in (A), Kubbar Island, Kuwait. Photographs by Sergei Khvorov.

Synonyms. *Cancer adpersus* Herbst, 1790; *Cancer convexus* Forskål, 1775; *Cancer petraeus* Herbst, 1801; *Carpilius lividus* Gibbes, 1850; *Cancer samuelis* Curtiss, 1938.

Common Names. Marbled stone crab; marbled reef crab.

Main Diagnostic Features.

1. Carapace wider than long, oval, convex, smooth; carapace regions poorly defined; orbital, hepatic and branchial regions marked with fine net-like corrugation.
2. Front bent down, consisting of 4 oval symmetrical protrusions.
3. Eyestalks short, stout.
4. Chelipeds stout, asymmetrical; carpus with obtuse distomesial (inner) angle.
5. Colour pattern: uniform red to reddish-brown, with irregular dark brown patches on the dorsal surface of carapace, sometimes red with large deep-purple central patch.
6. Size: relatively large crab; maximal carapace width about 150 mm.

Distribution. Indo-West Pacific from the Red Sea and South Africa, Japan, Hawaii, French Polynesia, and reaching Easter Island.

Ecology. Benthic on coral reefs, sheltering in crevices or under large rocks; at depths ranging from 0.5 (rare) to 95 m, mainly in the shallow subtidal zones (3–10 m).

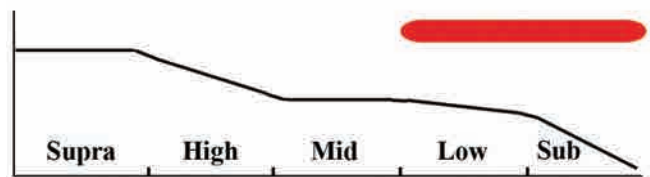


Figure 318. Bathymetric distribution of the species.

Remarks. *Carpilius convexus* was reported to be mildly toxic and unfit for consumption. In addition, it does not taste too good and, for that reason, is not eaten (Garth and Alcalá 1977). The coral crab genus *Carpilius* currently includes three widely distributed species, which inhabit tropical coral reefs and adjacent waters. Within the genus *Carpilius*, the Caribbean species *C. corallinus* is basal to the Pacific species *C. maculatus* and *C. convexus*. The Pacific species are sister taxa, despite the greater morphological resemblance of *C. corallinus* to the Pacific *C. convexus* (Wetzer et al. 2003).

Most Relevant References. Forskål 1775; Sakai 1976; Naderloo 2017; Wetzer et al. 2003.

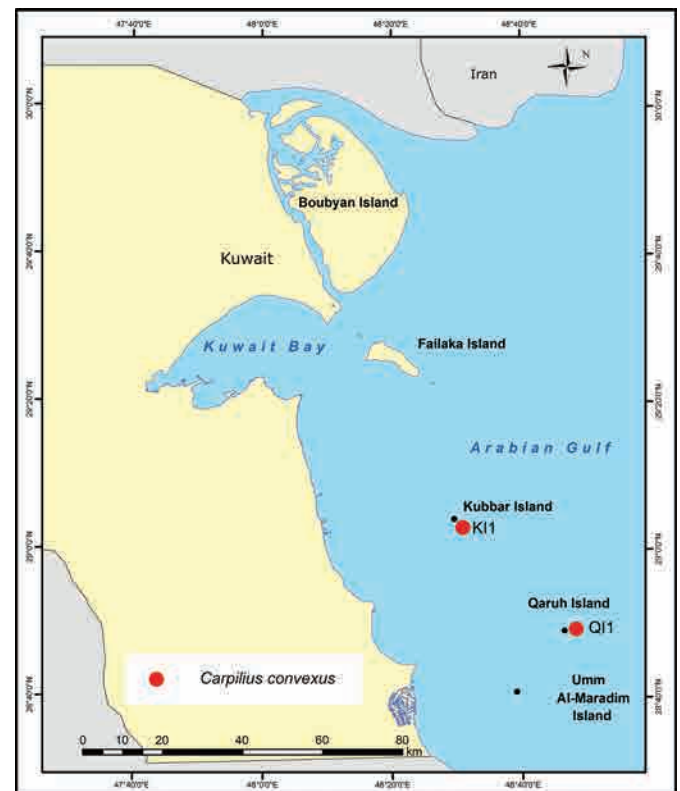


Figure 319. Presently known records of *Carpilius convexus* in Kuwait.



Figure 320. Male of *Carpilius convexus* in situ on a silty reef at Qaruh Island, Kuwait. Photograph by Najem Al-Misbah.



Figure 321. Female of *Carpilius convexus* in situ on a coral reef off Qaruh Island, Kuwait. Photograph by Ali Alhammad.



Figure 322. Precopulatory courtship ritual of *Carpilius convexus*, Qaruh Island, Kuwait. Photograph by Faisal Al-Sarraf.



Family Oziidae

Epixanthus frontalis (H. Milne Edwards, 1834)

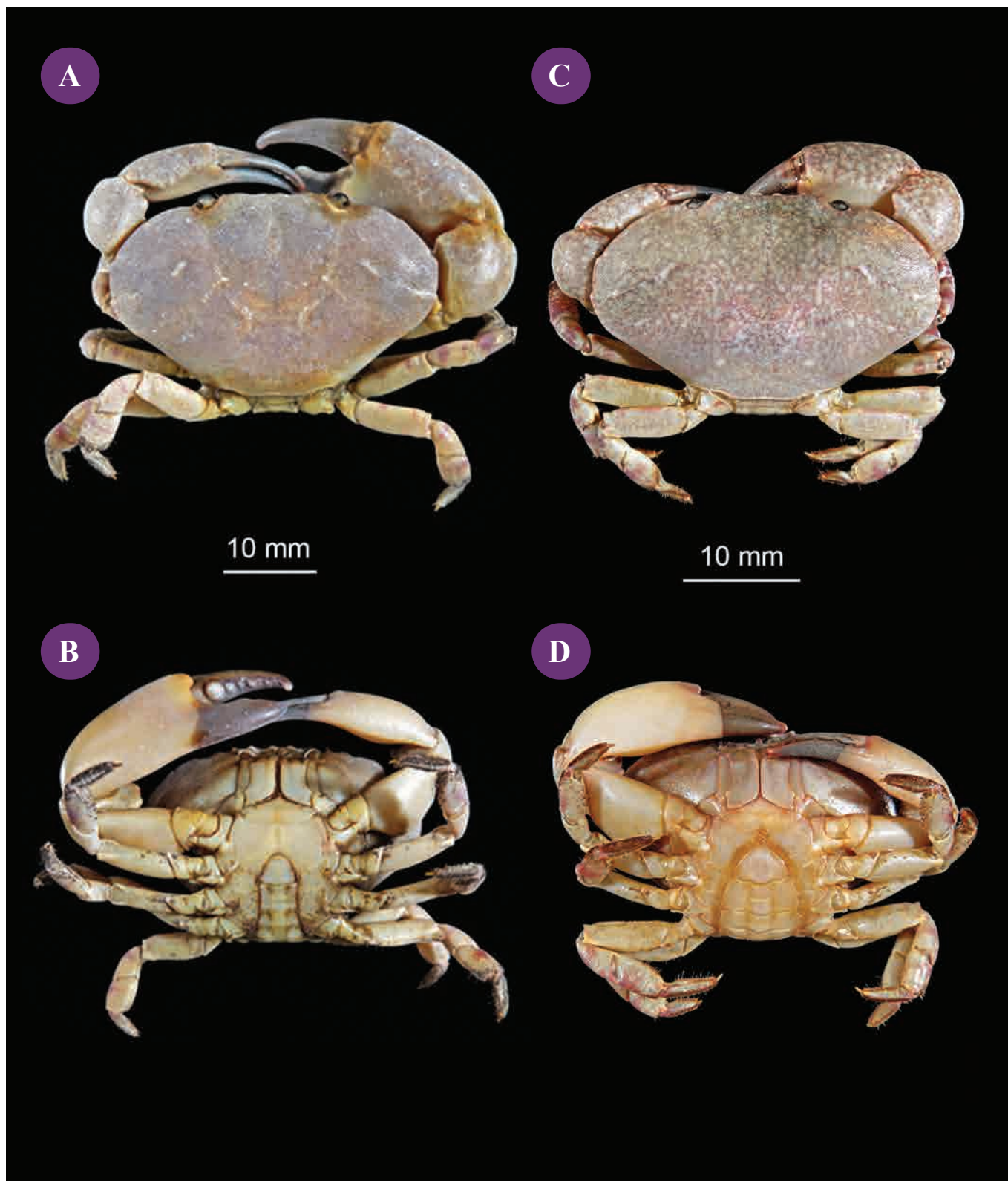


Figure 323. Male of *Epixanthus frontalis* (H. Milne Edwards, 1834) in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Ozius frontalis* H. Milne Edwards, 1834; *Epixanthus kotschii* Heller, 1860.

Common Name. Forceps crab.

Main Diagnostic Features.

1. Dorsal surface of carapace wider than long, flattened dorsally; anterolateral margin divided into 4 lobes.
2. Frontal margin furrowed, faintly rugulose; front narrow, divided into 4 small teeth.
3. Eyes large, globular.
4. Antennules long, cylindrical, folded transversely.
5. Chelipeds massive, unequal in size.
6. Female gonopore on sternal segment 6.
7. Male pleon relatively narrow, with 7 segments.
8. Colour in life: pale brown with yellow or pink tinge, with irregular white dots on dorsal surface of carapace.
9. Size: maximal carapace width about 30 mm.

Distribution. Indo-West Pacific from the Red Sea to the Arabian-Persian Gulf and Madagascar and across the Indian Ocean to Japan and Australia.

Ecology. Benthic on hard and mixed bottoms; for instance, sand mixed with broken shells and large rocks; typically under loose rocks and cobble in the high and mid-intertidal zone.

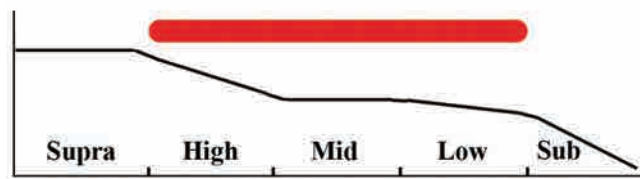


Figure 324. Bathymetric distribution of the species.

Remarks. The genus *Epixanthus* contains five valid species, which may be differentiated by a series of morphological characters (dorsal profile of the carapace, armature of the anterolateral margins of the carapace, surface texture of the carapace and chelipeds, etc.). *Epixanthus frontalis* is closest to *E. subcorosus* in having four lobes on the anterolateral margin of the carapace. However, these species differ in the anterolateral margins and sub-hepatic regions of the carapace as they are slightly rugose and uneven in *E. subcorosus* but minutely granular in *E. frontalis*. Male gonopods of *E. frontalis* were illustrated using SEM by Kaullysing et al. (2015).

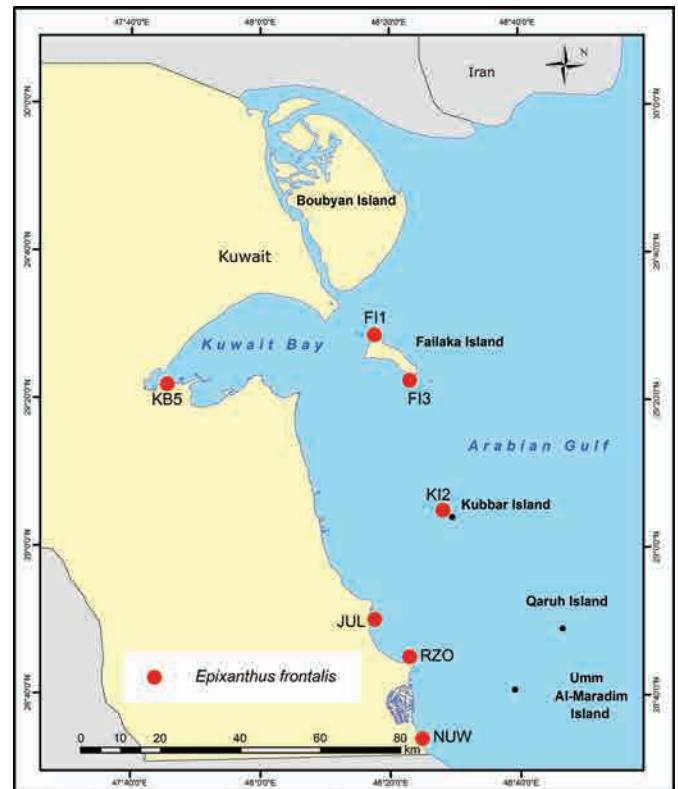


Figure 325. Presently known records of *Epixanthus frontalis* in Kuwait.

Most Relevant References. Kaullysing et al. 2015. Naderloo 2017.



Figure 326. *Epixanthus frontalis* in situ in the rocky intertidal areas of Failaka Island (A), Al-Nuwiseeb (B) and Al-Julaia'a (C), Kuwait. Photographs by Arafat AlShuaibi (A), AM team (B) and Abdulrahman Yousef (C).

Family Euryplacidae

Eucrate crenata (De Haan, 1835)



Figure 327. Male of *Eucrate crenata* (de Haan, 1835) in dorsal (A) and ventral (B) views, with detail of lateral margin in (A); female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Pilumnoplax sulcatifrons* Stimpson, 1858.

Common Name. Woolly-elbow reef crab.

Main Diagnostic Features.

1. Carapace with relatively short posterolateral borders and depression behind each orbit; antero lateral margin with 4 teeth.
2. Front distinctly divided into 2 flat-topped median lobes and 2 rounded lateral (outer) teeth.
3. Eyestalks slightly oblong.
4. Antennules short, cylindrical.
5. Chelipeds massive, unequal; male chelipeds larger than those of females; ventral surface of cheliped meri smooth or with short granules; carpus with dense pubescence distally.
6. Colour in life: pale brown to ochre, with numerous small red spots on anterior dorsal surface of carapace, chelipeds, and ambulatory legs; dorso-median part of each branchial region typically with 1 red-brown spot.
7. Size: maximal carapace width about 50 mm.

Distribution. Indo-West Pacific from the Red Sea and Madagascar through the Arabian-Persian Gulf and India to Japan, Indonesia, and Australia; penetrated to the Mediterranean Sea (e.g. Bakir and Salman 2018).

Ecology. Benthic on mixed sand-gravel-rock bottom; quickly burrowing into sand if disturbed; intertidal zone to 35 m.

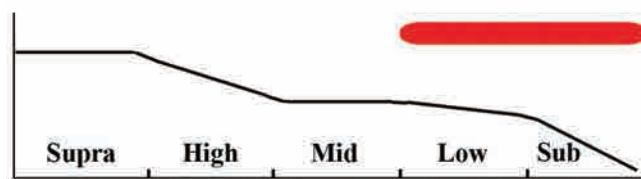


Figure 328. Bathymetric distribution of the species.

Remarks. The main diagnostic feature of the species is the presence of a depression on the carapace around each orbit and the relatively low and triangular outer orbital teeth and four anterolateral teeth; the third of which is obtuse and slightly elevated dorsally (Castro and Ng 2010). A shallow sulcus extends posteriorly for a short distance from the median notch of the front and bifurcates on the gastric region; it becomes less pronounced with size as the carapace becomes somewhat inflated, especially in females. A shallow sulcus with very short, scattered setae extends for a short distance from each third anterolateral tooth onto the gastric region; the sulcus becomes less pronounced and devoid of setae in larger individuals. Many of these characters, are also present in *E. solaris* from eastern Asia. However, the ventral surface of the cheliped meri of *E. crenata* is smooth or with very low granules; whereas, this part of the chelipeds has conspicuous high tubercles in *E. solaris*. The colour patterns of the two species are also quite different. The only other species of *Eucrate* known from the Arabian-Persian Gulf is *E. indica*, based on a single record from an unknown locality (Castro and Ng 2010); however, this species is different from *E. crenata* in the colour pattern (see also Naderloo 2017).

Most Relevant References. De Haan 1835; Castro and Ng 2010; Naderloo 2017; Bakir and Salman 2018.

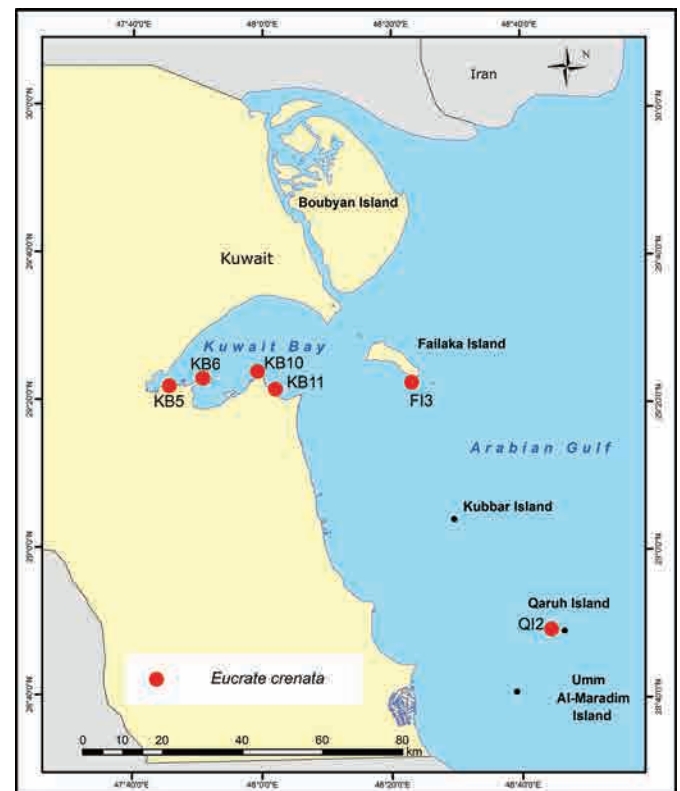


Figure 329. Presently known records of *Eucrate crenata* in Kuwait.



Figure 330. Male of *Eucrate crenata* from Oman. Photograph by Arthur Anker.

Family Euryplacidae

Trissoplax dentata (Stimpson, 1858)



Figure 331. Female of *Trissoplax dentata* (Stimpson, 1858) in dorsal (A) and ventral (B) views, with detail of anterolateral margin in (A), Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Eucrate costata* Yang and Sun, 1979.

Main Diagnostic Features.

1. Carapace slightly transverse, wider than long; anterolateral margin with 3 larger subtriangular teeth and 1 very low, sometimes barely noticeable tooth.
2. Front straight, faintly notched; suborbital margin with triangular inner suborbital tooth.
3. Eystalks slightly oblong.
4. Antennules short, cylindrical.
5. Chelipeds smooth, without tubercles; carpus with dense pubescence distally.
6. Colour in life: variable, usually greenish yellow or brownish yellow with red or purple dots; chelipeds white with purple dots; dorso-median part of each branchial region usually without red-brown spot.
7. Size: maximal carapace width about 21 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf of Aden and South Africa to China, Singapore, and eastern Australia.

Ecology. Benthic on mixed sand-rock bottoms; shallow subtidal to at least 40 m.

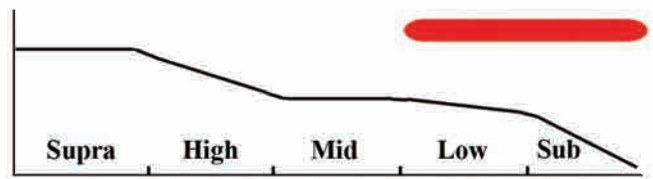


Figure 332. Bathymetric distribution of the species.

Remarks. *Trissoplax dentata* is closely related to *T. tuberosa*, presently its only congener, in the general shape of the carapace. The two species can be easily distinguished from each other by the presence of coarse tubercles on the outer cheliped surface in *T. tuberosa* (which is smooth in *T. dentata*) and the presence of a conspicuous tomentum of *T. dentata*. In the colour pattern, *T. dentata* is remarkably similar to *E. crenata* but usually does not have the two dark purple or brown-purple spots on the dorsal surface of the carapace (Castro and Ng 2010).

Most Relevant References. Castro and Ng 2010; Naderloo 2017.

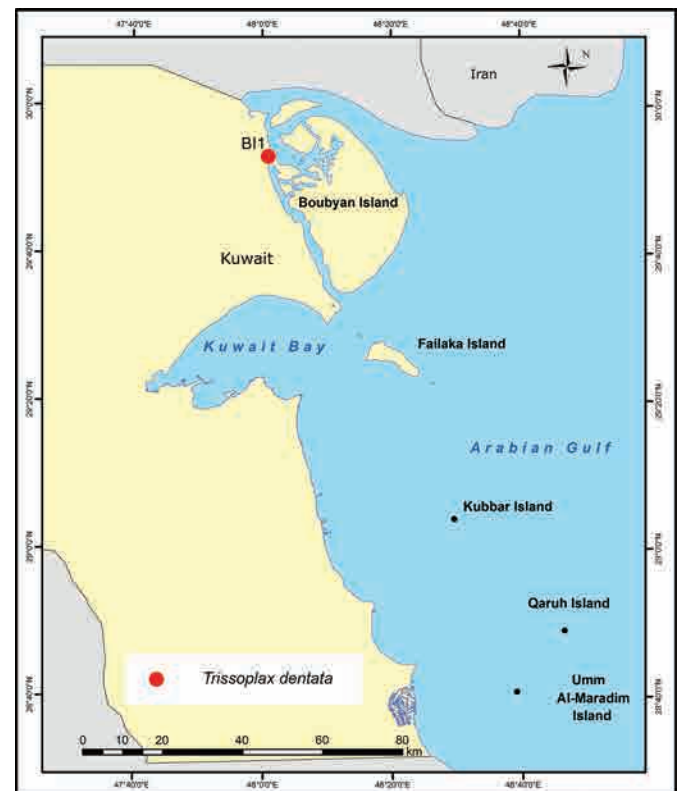


Figure 333. Presently known record of *Trissoplax dentata* in Kuwait.

Family Hymenosomatidae

Elamena sindensis Alcock, 1900

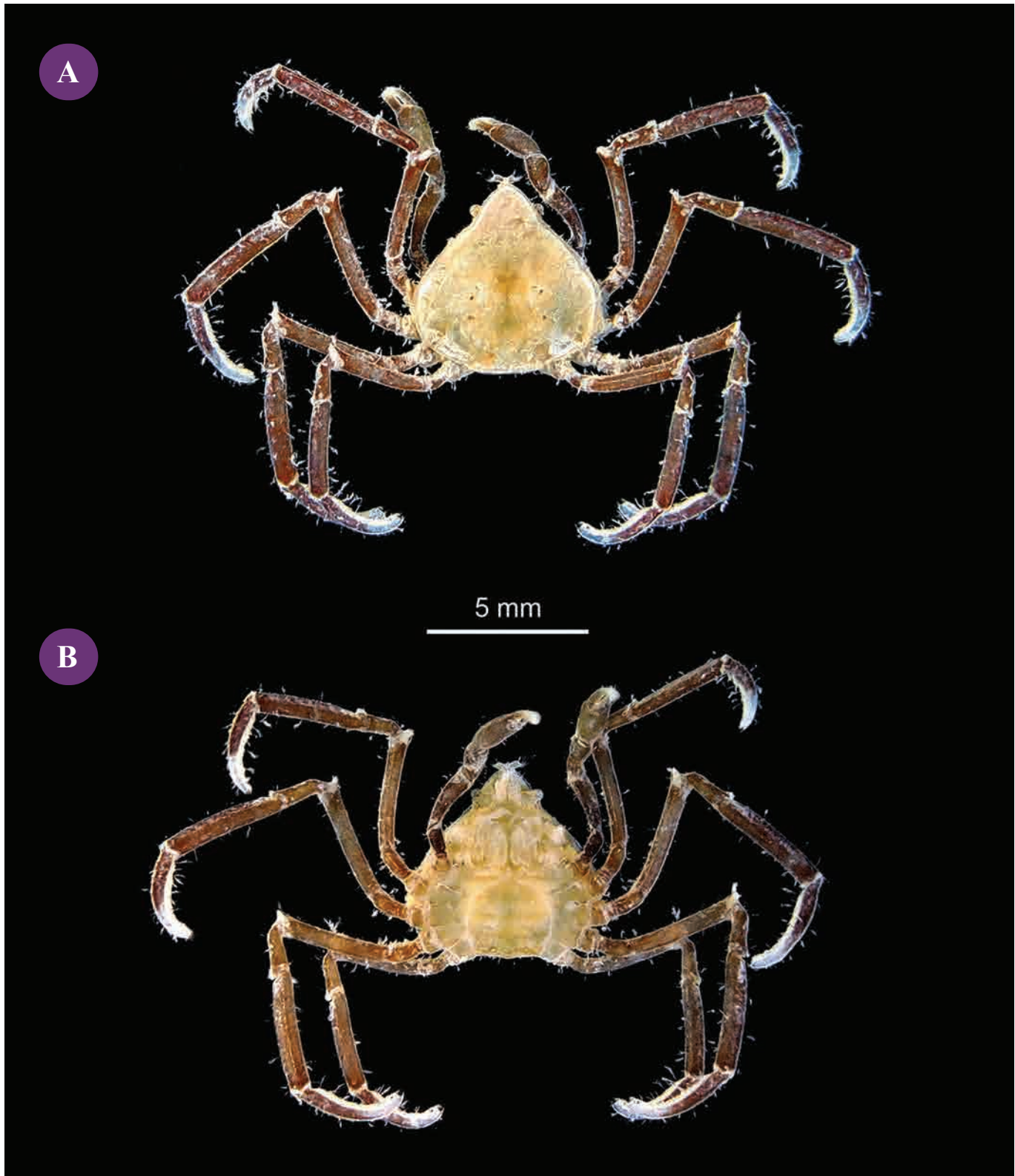


Figure 334. Female of *Elamena sindensis* Alcock, 1900 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Indian trigonal crab.

Main Diagnostic Features.

1. Carapace broadly piriform, smooth, flat, without distinct regions; carapace edge slightly turned up, entire, unarmed.
2. Front in the form of prominent broad triangular lamina, somewhat rounded at tip; post-ocular tooth absent; inter-antennular septum prominent.
3. Lobule of pterygostomian region midway between cheliped base and anterior angle of buccal cavity.
4. Eyes not completely concealed beneath front.
5. Male chelipeds about 1.6 times as long as carapace, palm somewhat swollen, with fingers stout and pointed, not gaping.
6. Female chelipeds slightly longer than carapace, slender, with slender palm and elongated fingers with spoon-tip.
7. Legs slender, 1st pair less than 3 times as long as carapace, merus and carpus each with distinct tooth at distal end of anterior margin; dactylus long, compressed, falcate, with 2–3 teeth at distal end of posterior margin.
8. Size: maximal carapace width about 6.6 mm.

Distribution. Restricted to the western Indian Ocean: the Red Sea and the Arabian-Persian Gulf.

Ecology. Benthic on hard and mixed bottoms, among rocks and sponges; lower intertidal zone and adjacent shallow subtidal zone (probably less than 5 m).

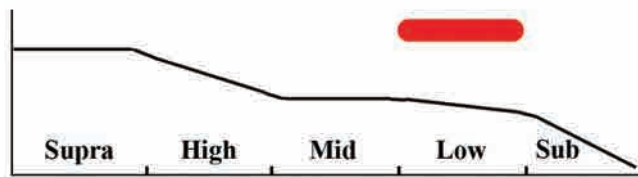


Figure 335. Bathymetric distribution of the species.

Remarks. Members of the genus *Elamena* can be separated into two groups. One group has a short, truncate rostrum; whereas, the carapace tends to have a polygonal form. The

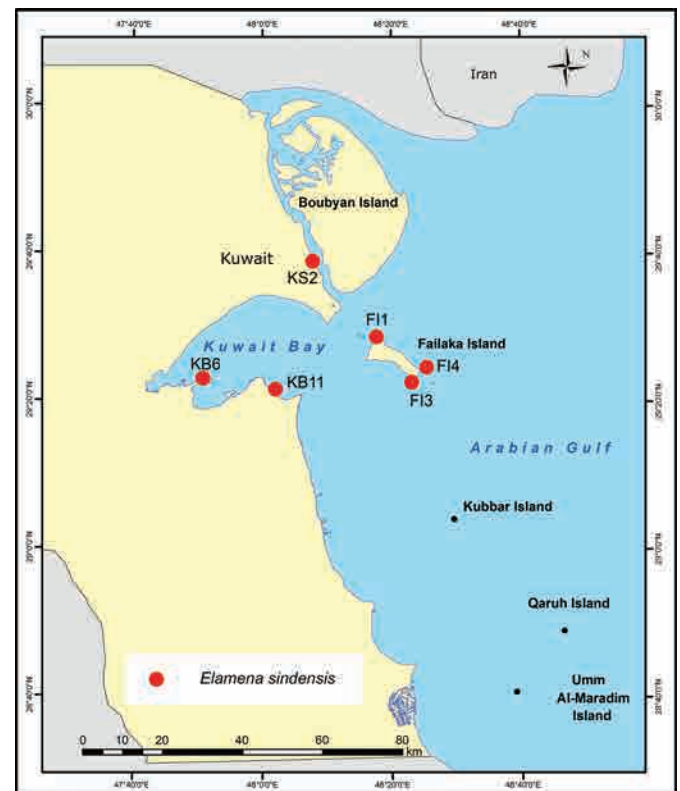


Figure 336. Presently known records of *Elamena sindensis* in Kuwait.

second group has a produced, triangular rostrum, while the carapace has a pear-shaped structure. *Elamena sindensis* belongs to the second group and cannot be confused with any other crab species in the region Gordon (1940).

Most Relevant References. Alcock, A. (1900); Tesch (1918); Gordon (1940).



Figure 337. Intertidal with some sponges on the eastern shore of Failaka Island: natural habitat of *Elamena sindensis* in Kuwait. Photograph by Valeriy Skryabin.

Family Leucosiidae

Hiplyra variegata (Rüppell, 1830)



Figure 338. Male of *Hiplyra variegata* (Rüppell, 1830) in dorsal (A) and ventral (B) views; preserved specimen from Sulaibikhat Bay, Kuwait. Photographs by Sergei Khvorov.

Synonym. *Philyra variegata* Serene 1968.

Main Diagnostic Features.

1. Carapace elliptical, relatively smooth, with granulated margins.
2. Front truncated, slightly raised.
3. Male chelipeds not particularly enlarged, slightly longer than body diameter; merus rounded, covered by small wart-like tubercles throughout; pollex with 2 distal triangular denticles, cutting edge densely fringed with setae; dactylus cutting edge blade-like.
4. Male pleon and telson completely smooth.
5. Colour in life: pale yellowish, marbled with labyrinth-shaped brown lines on dorsal surface.
6. Size: maximal carapace length 3.2, width 3.2 mm (for males).

Distribution. Western Indian Ocean from the Red Sea to the Arabian-Persian Gulf and East Africa.

Ecology. Benthic on mixed bottom in the subtidal zone to 56 m.

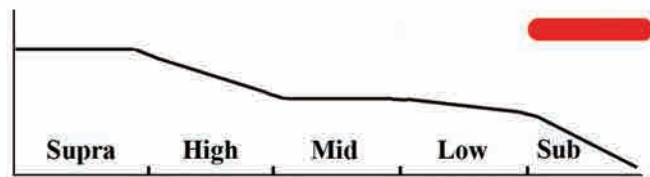


Figure 339. Bathymetric distribution of the species.

Remarks. The genus *Hiplayra* differs from the other leucosiid genera by relatively slender and long chelipeds, with a dense setation on the cheliped pollex and the fused male pleonites 2-6 (Galil 2009). The identification of species of *Hiplayra* is not easy and involves subtle morphological details and colour pattern (Galil 2009; Naderloo and Apel 2012; Naderloo 2017). The larval development of *H. variegata* was studied by Al-Aidaroos et al. (2015) in the Red Sea.

Most Relevant References. Galil 2009; Naderloo and Apel 2012; Naderloo 2017.

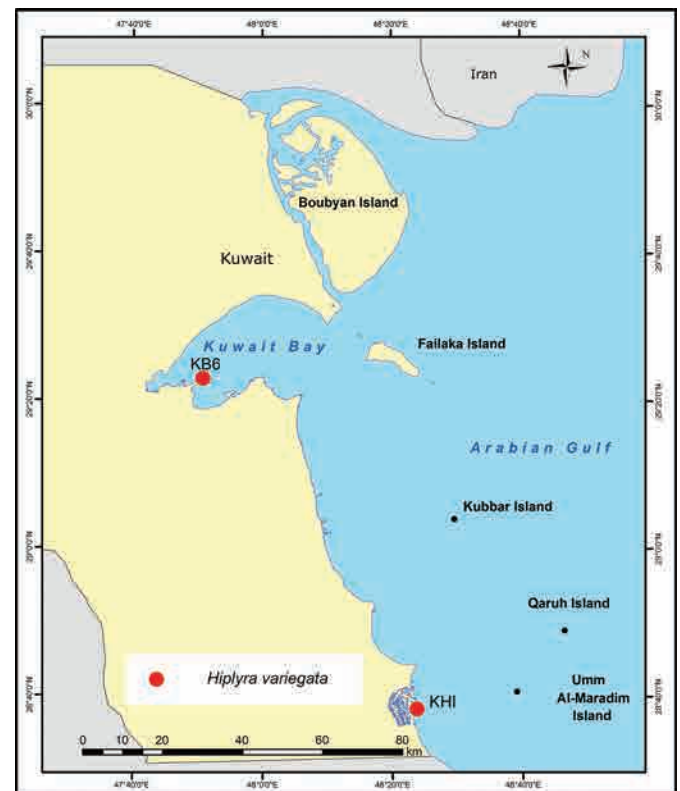


Figure 340. Presently known records of *Hiplayra variegata* in Kuwait.



Figure 341. Left chela of *Hiplayra variegata* from Failaka Island, Kuwait. Photograph by Sergei Khvorov.

Family Leucosiidae

Leucisca rubifera (Müller, 1887)

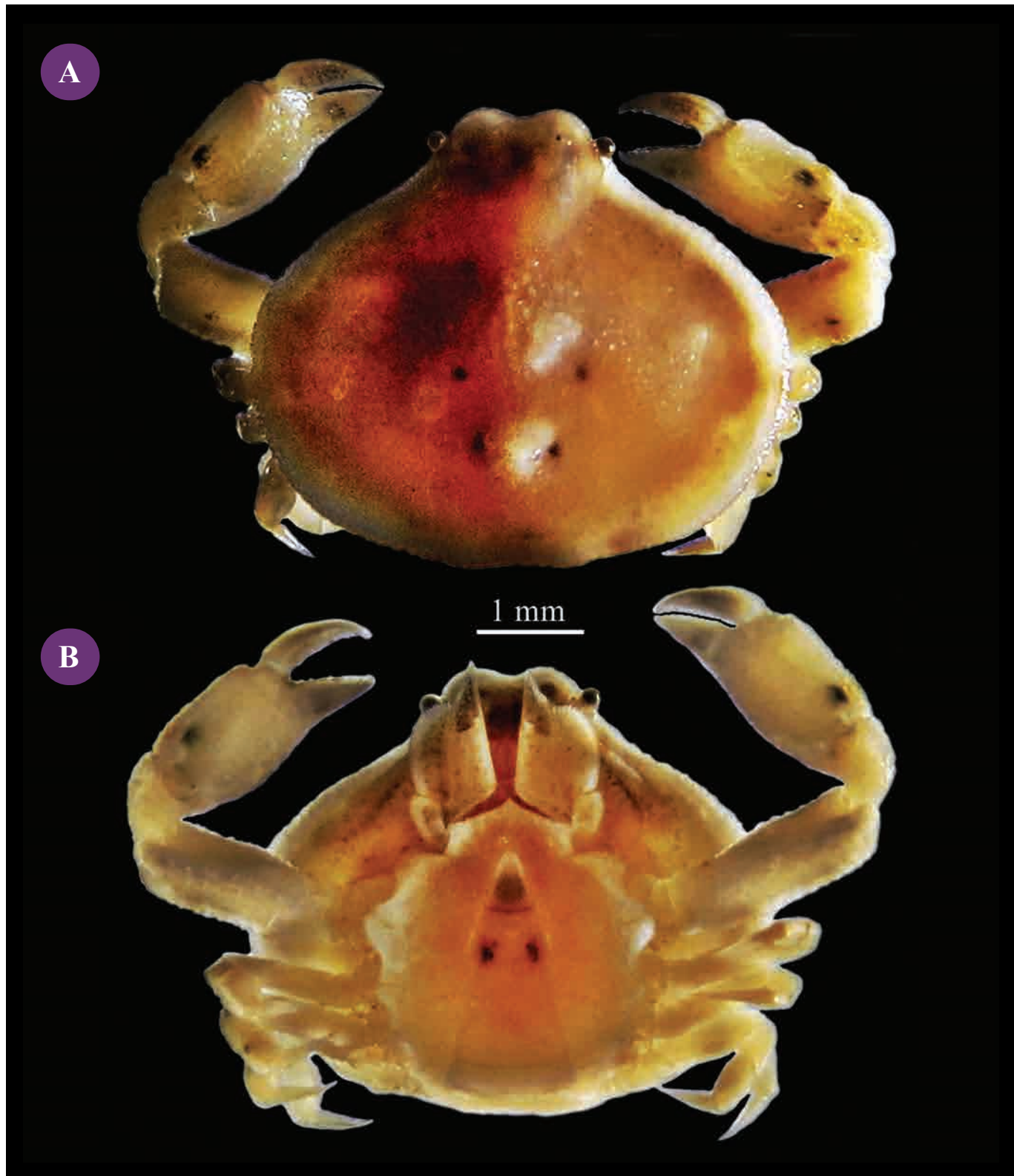


Figure 342. Male of *Leucisca rubifera* (Müller, 1887) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Nursia rubifera* Müller, 1887.

Main Diagnostic Features.

1. Carapace (without frontal margin) somewhat wider than long, with oval outline; central part with transverse field of fine granules and 2 large bumps on mid-line; carapace margins finely granulated.
2. Front moderately bilobed, narrow.
3. Eyes hidden beneath front.
4. Diagonal ridges of pleon very sharp, set transversely.
5. Exopods of third maxillipeds strongly curved.
6. Cheliped fingers moderately long, closing at full length; palm triangular, with sharp dorsal edge.
7. Colour in life: pale brown with irregular lilac striations on carapace and across legs.
8. Size: small species, maximal carapace width only 5 mm.

Distribution. Western Indian Ocean from the Red Sea and Madagascar to the Arabian-Persian Gulf and Sri Lanka.

Ecology. Benthic on rock-cobble and sand-rock bottoms; most common in the low intertidal zone and adjacent very shallow subtidal zone.

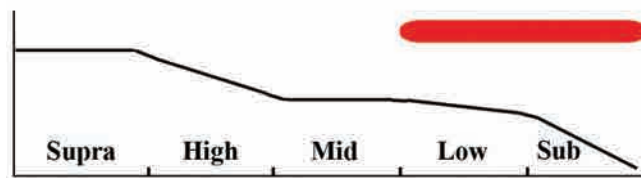


Figure 343. Bathymetric distribution of the species.

Remarks. *Leucisca rubifera* resembles *Paranursia abbreviata*, a widespread Indo-West Pacific species, in the general outline and ornamentation of the carapace. However, *P. abbreviata* has a more octagonal carapace and a non-bilobed frontal margin (Wong et al. 2021). For good illustrations (line-drawings and photographs) of *L. rubifera* see, for instance, Timizi and Kazmi (1979, as *Nursia rubifera*) and Naderloo (2017).

Most Relevant References. Müller 1887; Tirmizi and Kazmi 1979; Apel 2001; Naderloo 2017.

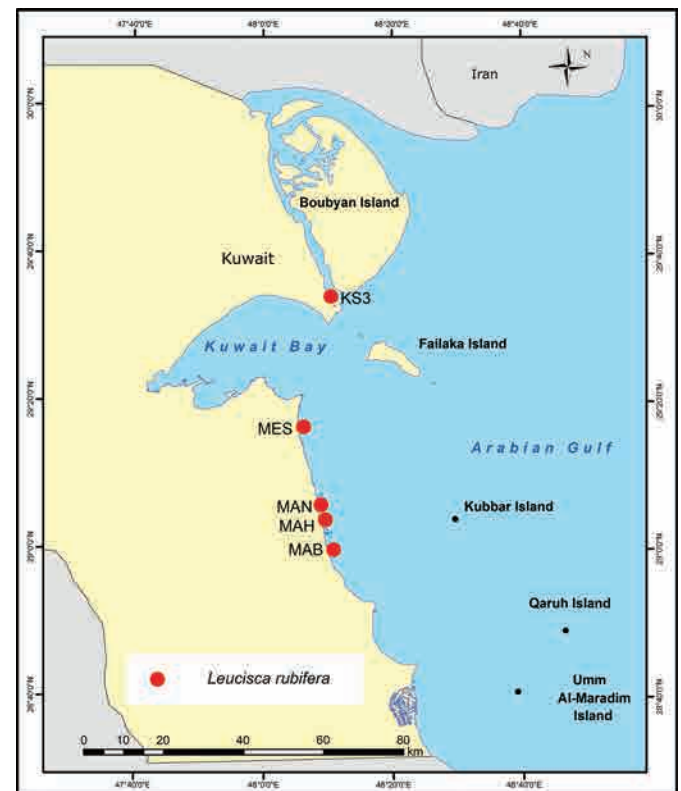


Figure 344. Presently known records of *Leucisca rubifera* in Kuwait.

Family Leucosiidae

Nursia persica Alcock, 1896



Figure 345. Female of *Nursia persica* Alcock, 1896 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Main Diagnostic Features.

1. Carapace strongly convex, about 0.9 as long as wide, with median longitudinal and epibranchial ridges; each lateral margin with 3 low lobules; posterior margin not clearly bilobed.
2. Front in the form of 2 broad, subtriangular, blunt or subacute teeth, extending as prominent ridges posterior to orbits.
3. Chelipeds with sharp ridge along the dorsal margin of palm, latter almost trigonal, with granular edges.
4. Walking legs slender, compressed; merus, carpus and propodus sharply carinate dorsally.
5. Colour in life: pale brown, with dark red spots on carapace and chelipeds and large black patches on branchial regions of carapace.
6. Size: maximal length of carapace 9.0 mm, with 10.5 mm.

Distribution. Western Indian Ocean, apparently restricted to the Arabian-Persian Gulf and adjacent parts of the Arabian Sea.

Ecology. Benthic on mixed (sand, gravel, and shells) bottoms; from the lowest intertidal zone to 11 m, sometimes associated with *Sargassum* sp.

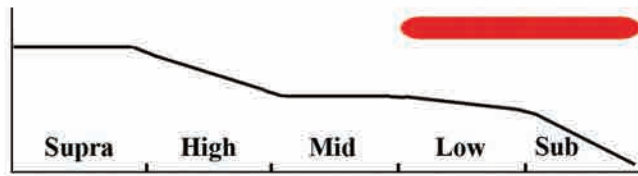


Figure 346. Bathymetric distribution of the species.

Remarks. *Nursia persica* is a rare pebble crab species in Kuwait, in general, and may be endemic to the Arabian-Persian Gulf and adjacent areas of the Gulf of Oman (Naderloo 2017).

Most Relevant References. Alcock 1896; Naderloo 2017.

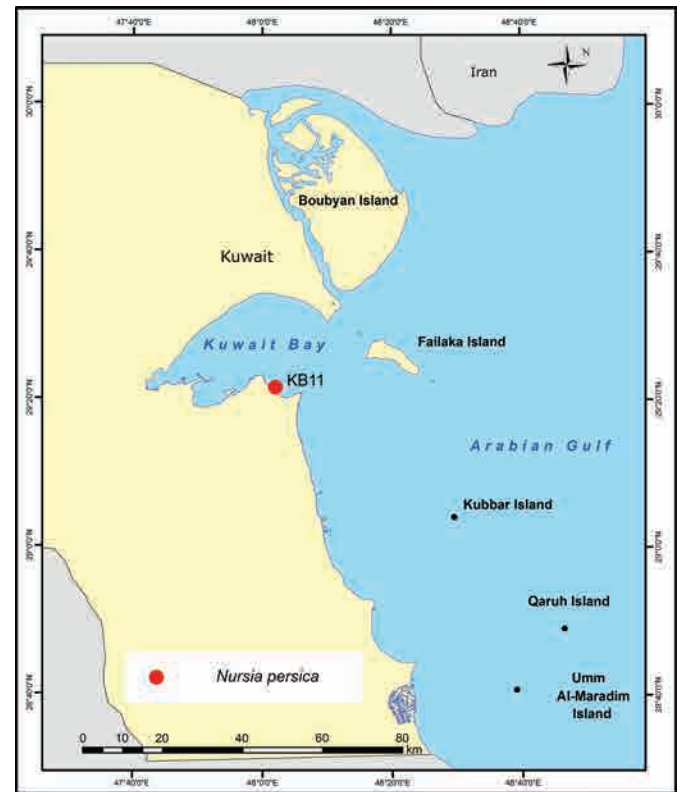


Figure 347. Presently known record of *Nursia persica* in Kuwait.

Family Leucosiidae

Nursia plicata (Herbst, 1803)



Figure 348. Female of *Nursia plicata* (Herbst, 1803) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Cancer plicata* Herbst, 1803.

Main Diagnostic Features.

1. Carapace about 0.75 times as long as wide, with posterior margin in the form of 2 semicircular, dorsally concave lobes; middle of carapace forming coarsely granular eminence surrounded by 3 large tubercles disposed in triangle; entire dorsal surface of carapace covered by tubercles.
2. Front hardly projecting beyond eyes.
3. Pleon of males consisting of 2 linear basal segments and 1 small triangular apical segment, and with long triangular plate with median sub-terminal tooth between them.
4. Chelipeds in adult males about 1.75 times, in adult females about 1.25 times the length of carapace.
5. Walking legs not much longer than cheliped merus, compressed.
6. Colour: yellowish with bright brick-red spots on lateral areas of carapace and chelipeds.
7. Size: maximal carapace length and width, 15 mm and 20 mm, respectively for males; 16 mm and 22 mm, respectively, for females.

Distribution. Indo-West Pacific: from the Arabian-Persian Gulf and India to China and Japan.

Ecology. Benthic on hard and mixed bottoms, especially cobble and sand mixed with coral rubble, clay with stones, etc.; most frequently found in the shallow subtidal zone from 3 to 20 m, rare in the low intertidal zone.

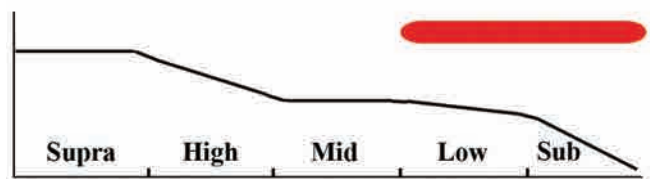


Figure 349. Bathymetric distribution of the species.

Remarks. *Nursia plicata* seems quite rare in Kuwait but is relatively common in other areas, such as Iran, India and Hong Kong (Naderloo and Sari 2005; Wong et al. 2021). This species may be most easily distinguished from *N. persica* by the noticeably broader carapace and less stout chelae.

Most Relevant References. Alcock 1896; Naderloo and Sari 2005; Naderloo 2017; Wong et al. 2021.

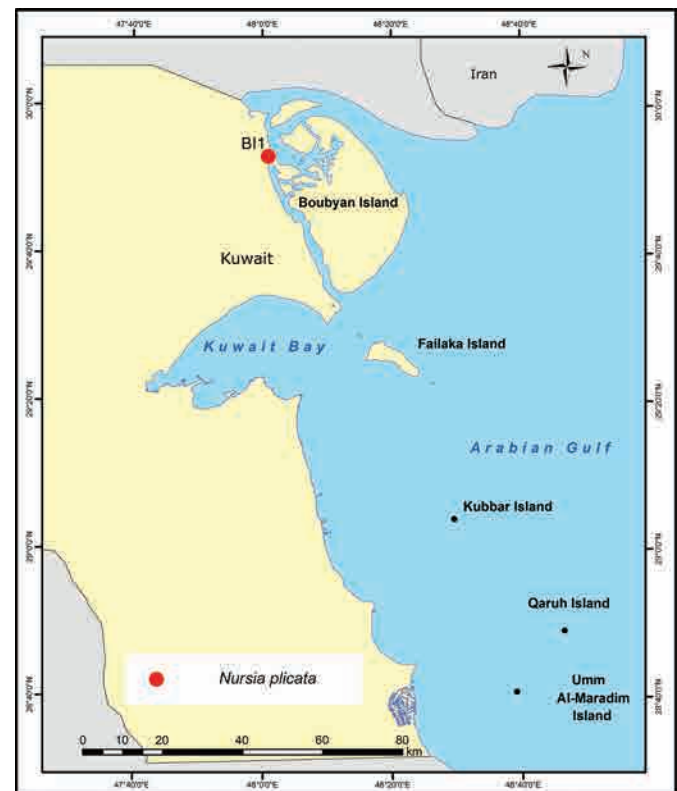


Figure 350. Presently known record of *Nursia plicata* in Kuwait.

Family Leucosiidae

Philyra concinnus Ghani and Tirmizi, 1995



Figure 351. Male of *Philyra concinnus* Ghani and Tirmizi, 1995 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Philyra rectangularis* Stephenson, 1945; *Philyra rectangularis* Miers, 1884.

Main Diagnostic Features.

1. Carapace rectangular, somewhat kite-shaped, with small distinct granules on epibranchial, cardiac and intestinal regions; anterolateral margins granulate, each with distinct tooth posteriorly; strong, outwardly directed spines on posterior margin of carapace usually present but variable.
2. Front smooth, almost straight; large part of buccal cavern edge seen in dorsal view.
3. Pleon two-segmented.
4. Chelipeds equal in both sexes.
5. Colour: carapace brown; chelipeds and legs yellowish.
6. Size: maximal carapace length 11 mm.

Distribution. Western Indian Ocean: apparently only in the Arabian Sea and the Arabian-Persian Gulf.

Ecology. Benthic on mud and mud-sand bottoms; mid-intertidal zone and possibly adjacent shallow subtidal areas (to 3 m or so).

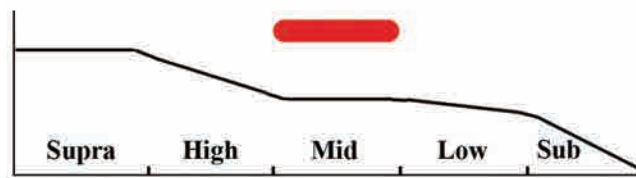


Figure 352. Bathymetric distribution of the species.

Remarks. As discussed by Naderloo and Türkay (2012) and Naderloo (2017), *P. concinnus* is morphologically very close to the largely sympatric (i.e. occurring in the same geographic region) *P. sagittifera*, which also occurs in Kuwait (see below). These two species are morphologically different from the other species of *Philyra* and have to be accommodated in a separate genus. The differences between *P. concinnus* and *P. sagittifera* are very slight, involving the dorsal sculpture of the carapace and, above all, differences in the male gonopods (Naderloo 2017).

Most Relevant References. Ghani and Tirmizi 1995a; Naderloo and Türkay 2012; Naderloo 2017.

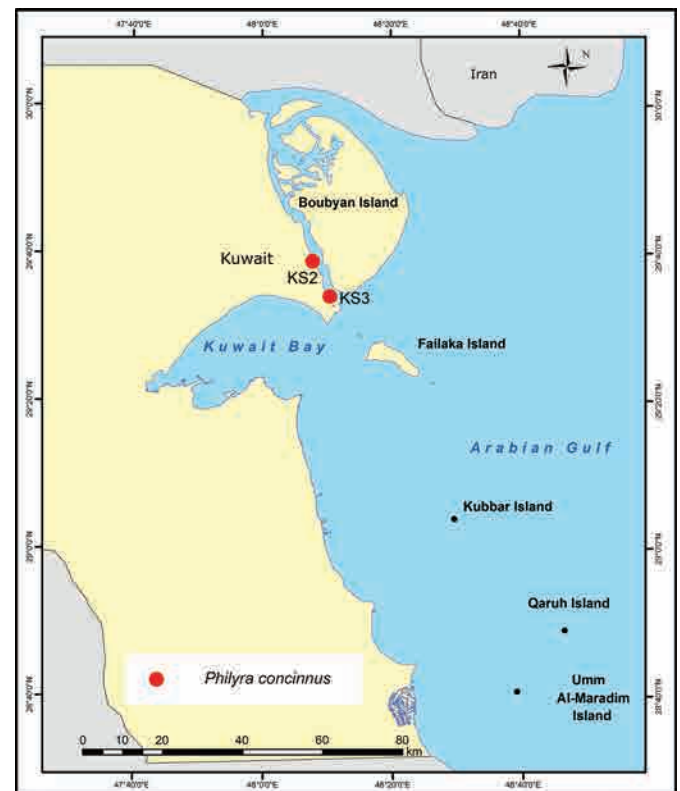


Figure 353. Presently known records of *Philyra concinnus* in Kuwait.

Family Leucosiidae

Philyra sagittifera (Alcock, 1896)



Figure 354. *Philyra sagittifera* (Alcock, 1896) in dorsal (A) view, possibly female, Kuwait. Photograph by Valeriy Skryabin.

Synonym. *Ebalia sagittifera* Alcock, 1896.

Main Diagnostic Features.

1. Carapace hexagonal, hardly longer than wide, with 3 broad granular ribs, which unite to form arrowhead-shaped structure, pointed forwards; anterolateral margin sharp, slightly curled, elegantly striated or milled; posterior margin of carapace with petaloid tubercle at either end and small denticle on mid-line in males; lateral tubercles indistinct and median tubercle absent in adult females.
2. Front emarginate; large part of buccal cavern edge seen in dorsal view.
3. Pleon of male two-segmented, without denticle.
4. Chelipeds about half as long as carapace: merus trigonal.
5. Colour in life: pale brownish tones.
6. Size: maximal carapace length and width 5.0 mm and 4.5 mm, respectively, in males; 6.0 mm and 5.5 mm, respectively, in females.

Distribution. Western Indian Ocean: Arabian Sea and the Arabian-Persian Gulf.

Ecology. Benthic on rock and mud-rock bottoms; low intertidal zone.

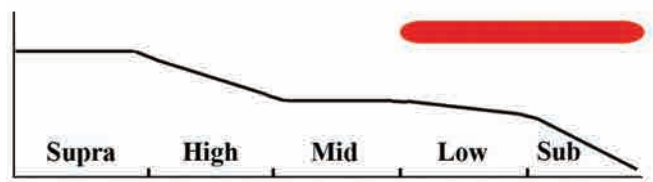


Figure 355. Bathymetric distribution of the species.

Remarks. See the details provided as the explanation of the previous species. The two species of *Philyra* were identified from Kuwait using photographs published by Naderloo (2017).

Most Relevant References. Alcock 1896; Stephensen 1946 (as *P. sexangula*); Naderloo and Türkay 2012; Naderloo 2017.

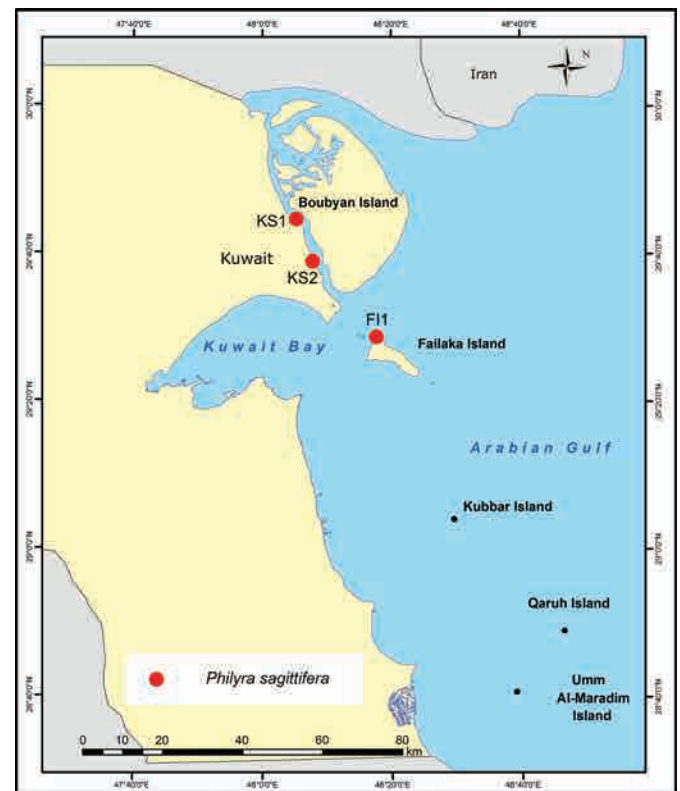


Figure 356. Presently known records of *Philyra sagittifera* in Kuwait.

Family Epialtidae

Acanthonyx limbatus A. Milne-Edwards, 1862



Figure 357. *Acanthonyx limbatus* A. Milne-Edwards, 1862, in dorsal view, with two vesicles of brown algae *Sargassum* sp. attached at the frontal margin for camouflage (a), Ras Al-Zour, Kuwait. Photograph by Valeriy Skryabin.

Synonym. *Dehaanius limbatus* (A. Milne-Edwards, 1862).

Main Diagnostic Features.

1. Carapace pear-shaped; surface vaulted; gastric region with 3 dorsal tubercles; posterior region with 4 dorsal club-like tubercles; each lateral margin with 3 pairs of subacute teeth decreasing in size from 1st to 3rd.
2. Rostral horns rather long, acute, widely separated.
3. Pleon six-segmented.
4. Eyestalk with minute projections, one above and one below cornea.
5. Chelipeds robust, large, about as long as carapace.
6. Colour in life: variable from brick red to brown.
7. Size: maximal carapace length about 40 mm.

Distribution. Western Indian Ocean: from the Mascarene Islands and the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on hard bottoms dominated by Sargassum beds; from mid- to low intertidal zone; decorating its carapace with seaweeds and hydroids, offering both camouflage and defense.

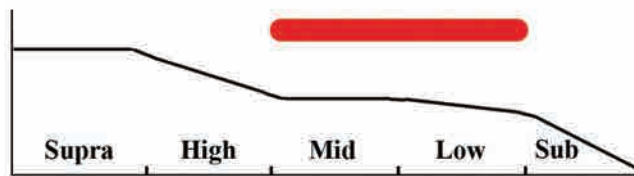


Figure 358. Bathymetric distribution of the species.

Remarks. *Acanthonyx limbatus* is one of the five species of the algae-associated decorator crab genus *Acanthonyx* in the Indian Ocean and possibly the common one in the Arabian-Persian Gulf, with records from UAE, Iran and Kuwait (Stephensen 1946; Griffin and Tranter 1986; Naderloo 2017). Good illustrations of the species may be found in Stephensen (1946), Chhapgar (1961, reproduced here) and Naderloo (2017).

Most Relevant References. Stephensen 1946; Chhapgar 1961; Griffin and Tranter 1986; Naderloo 2017.

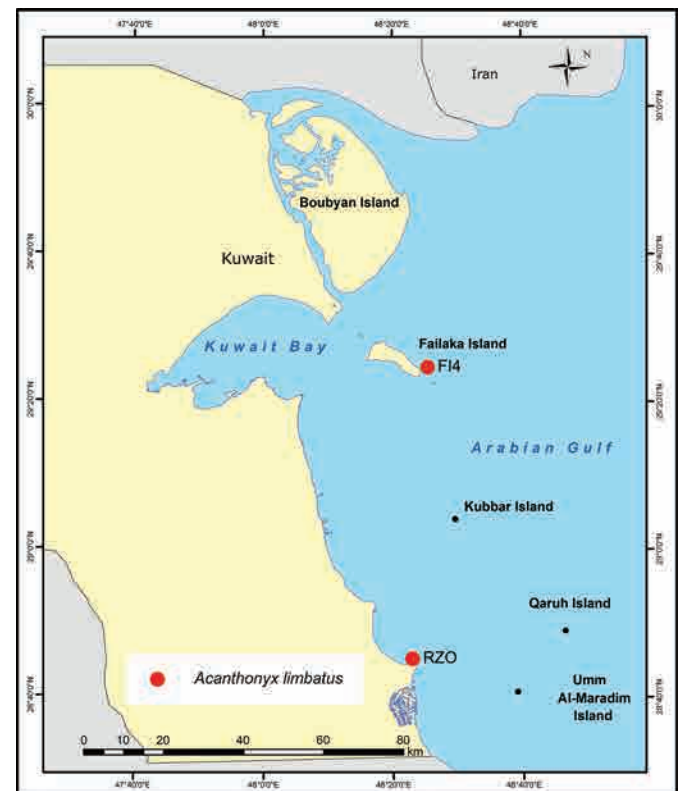


Figure 359. Presently known records of *Acanthonyx limbatus* in Kuwait.

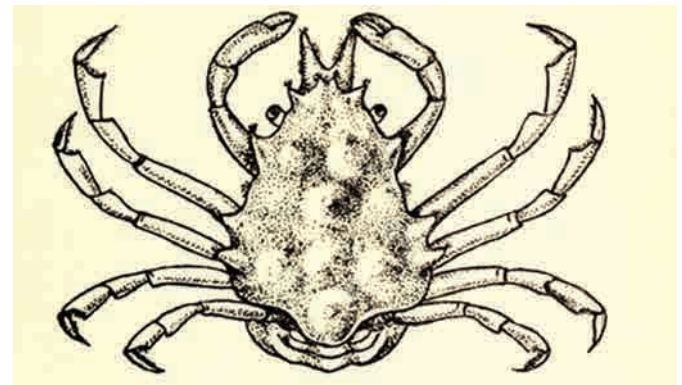


Figure 360. *Acanthonyx limbatus*, female specimen from India (from Chhapgar 1961).

Family Epialtidae

Hyastenus hilgendorfi De Man, 1887

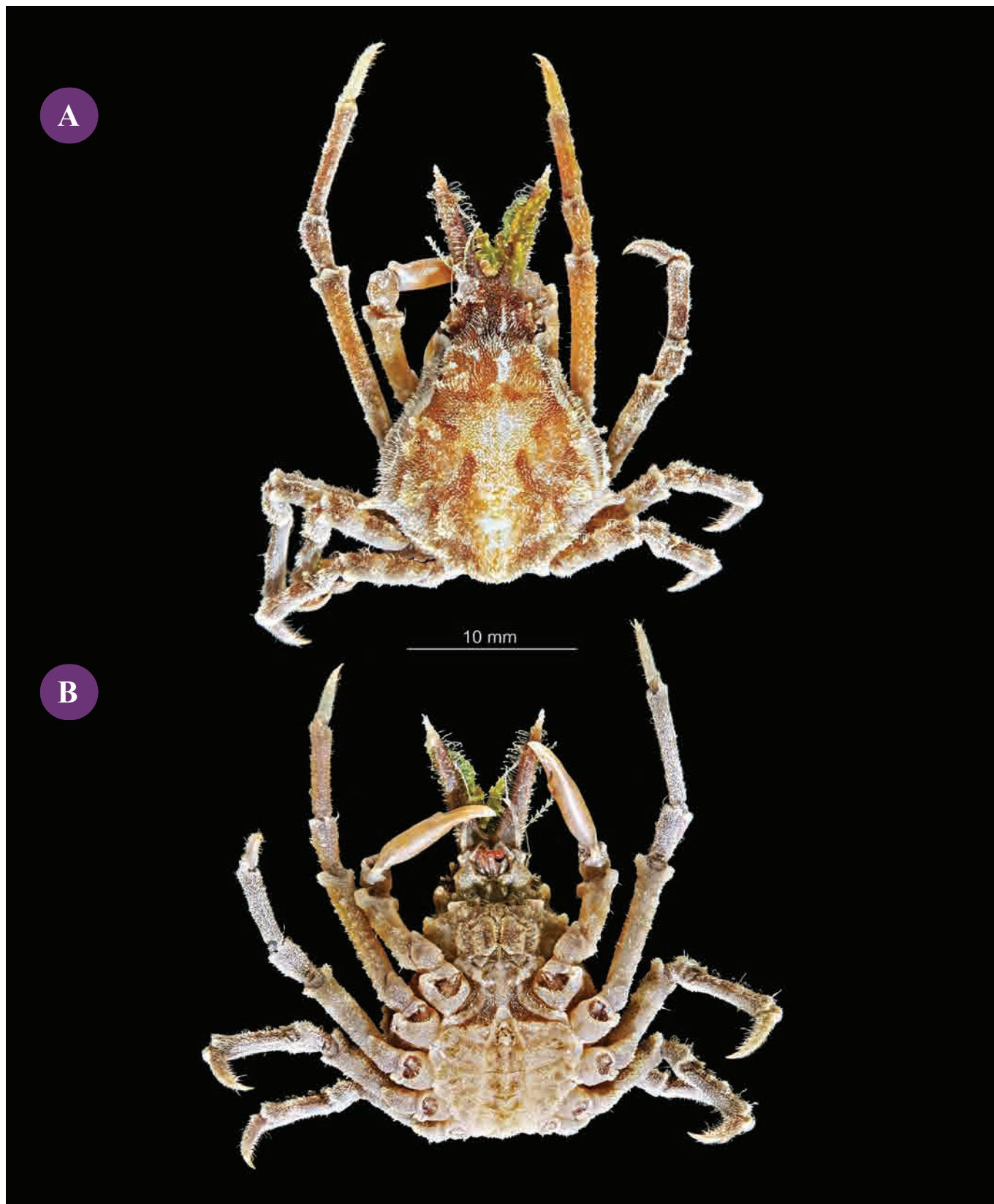


Figure 361. Male of *Hyastenus hilgendorfi* De Man, 1887 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.



Figure 362. Female of *Hyastenus hilgendorfi* De Man, 1887 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Hilgendorf's spider crab.

Main Diagnostic Features.

1. Carapace subpyriform, subtriangular, longer than wide; branchial margins with tubercles near cheliped bases, with 2-5 submarginal tubercles more posteriorly; epibranchial margins with small spine.
2. Rostral horns about half of postrostral carapace length.
3. Chelipeds slightly longer than body length.
4. Colour: yellowish or pale brown.
5. Size: maximal carapace length about 18 mm.

Distribution. Indo-West Pacific from the Red Sea and East Africa to the Philippines, Hawaii, and Australia; also in the Mediterranean Sea (Lessepsian migrant).

Ecology. Benthic on mixed (sand, mud, and rock) bottoms; mid and low intertidal zones and adjacent shallow subtidal zones, to about 40 m; carapace often covered by debris and epibionts, such as hydroids; occasionally associated with octocorals or clinging to jellyfishes.

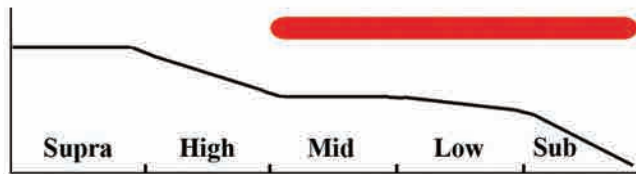


Figure 363. Bathymetric distribution of the species.

Remarks. *Hyastenus hilgendorfi* is one of the most common and widespread species of spider crabs in the Indo-West Pacific, with numerous records from the Arabian-Persian Gulf (e.g. Stephensen 1946; Naderloo and Türkay 2012; Naderloo 2017).

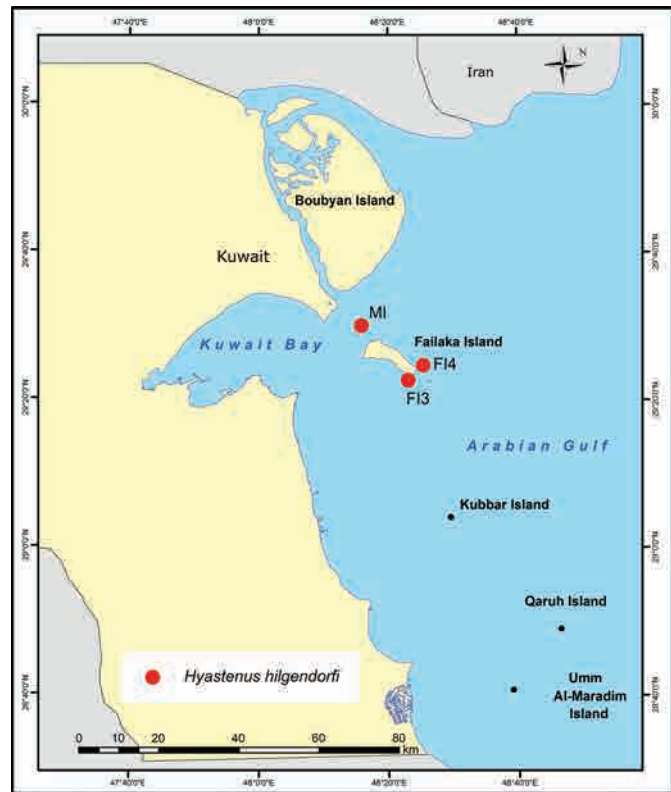


Figure 364. Presently known records of *Hyastenus hilgendorfi* in Kuwait.

The morphologically closest species is *H. pleione*, which can be separated from *H. hilgendorfi* by the ratio carapace length/distance between the external angles of the orbits, which is 5-2 in *H. pleione* and 9-4 in *H. hilgendorfi*.

Most Relevant References. Stephensen 1946; Griffin and Tranter 1986; Naderloo and Türkay 2012; Naderloo 2017.



Figure 365. *Hyastenus hilgendorfi* clinging to a jellyfish at Auha Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 366. *Hyastenus hilgendorfi* camouflaged by hydroids and silt in the rocky-muddy intertidal zone of eastern Failaka Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 367. *Hyastenus hilgendorfi* covered by hydroids *in situ* near Al-Khiran, Kuwait. Photograph by Yaser Mohammed Abdulraheem.



Family Inachidae

Achaeus lacertosus Stimpson, 1857



Figure 368. Female of *Achaeus lacertosus* Stimpson, 1857, in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Achaeus breviceps* Haswell, 1880; *Achaeus spinifrons* Sakai, 1938.

Common Name. Slender hairy spider crab.

Main Diagnostic Features.

1. Carapace smooth, hairy on sides; regions well-defined; cardiac region prominent; hepatic region with low angular elevation.
2. Frontal region and rostrum very short, with well-marked mesial furrow.
3. Eye peduncles rather long, as long as front.
4. Chelipeds swollen in males; merus trigonal; carpus smooth, rounded; palm compressed and longitudinally ridged; fingers as long as palm, slightly incurved, acute, toothed, cutting edges meeting throughout finger length.
5. Second pereiopods about 3 times as long as post-frontal region of carapace, with filiform (long, and slender) dactylus; following pereiopods decreasing in length posteriorly, with falciform (sickle-shaped) dactylus.
6. Colour in life: golden or reddish brown.
7. Size: maximal carapace length about 6 mm.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf and South Africa to Indonesia, Australia and Japan.

Ecology. Benthic on mixed (mud, rocks, and algae) bottoms; most common in the mid-intertidal zone carapace, often covered by algal debris or epibionts.

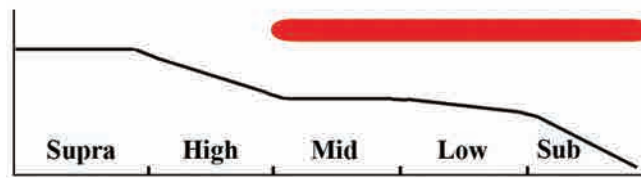


Figure 369. Bathymetric distribution of the species.

Remarks. *Achaeus lacertosus* is the only member of the spider crab family Inachidae in Kuwait and the only species of *Achaeus* present in the Arabian-Persian Gulf. Since the carapace of this crab is hairy and often covered by debris or epibionts, it needs to be cleaned to see most of its diagnostic features (Naderloo 2017).

Most Relevant References. Stimpson 1857; Haswell 1880; Naderloo 2017.

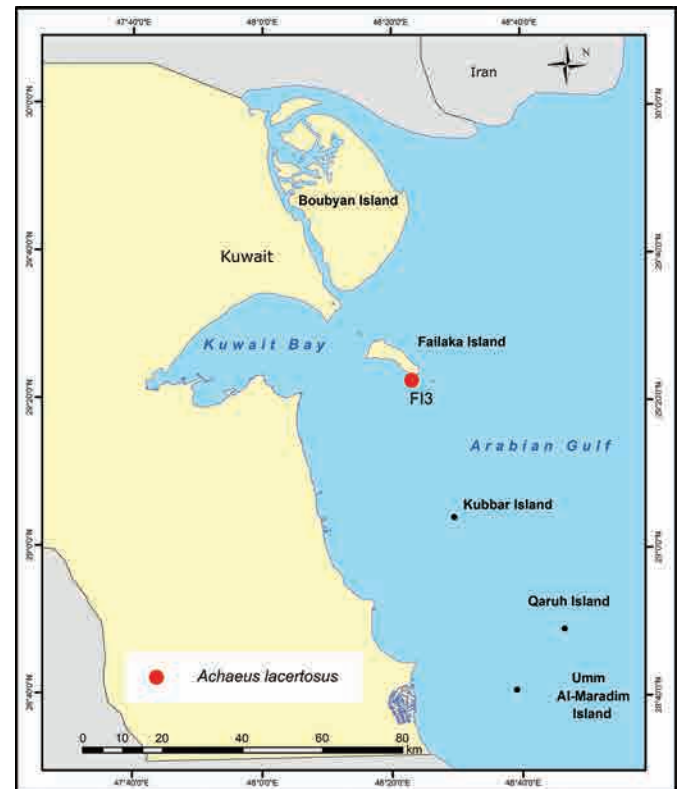


Figure 370. Presently known record of *Achaeus lacertosus* in Kuwait.

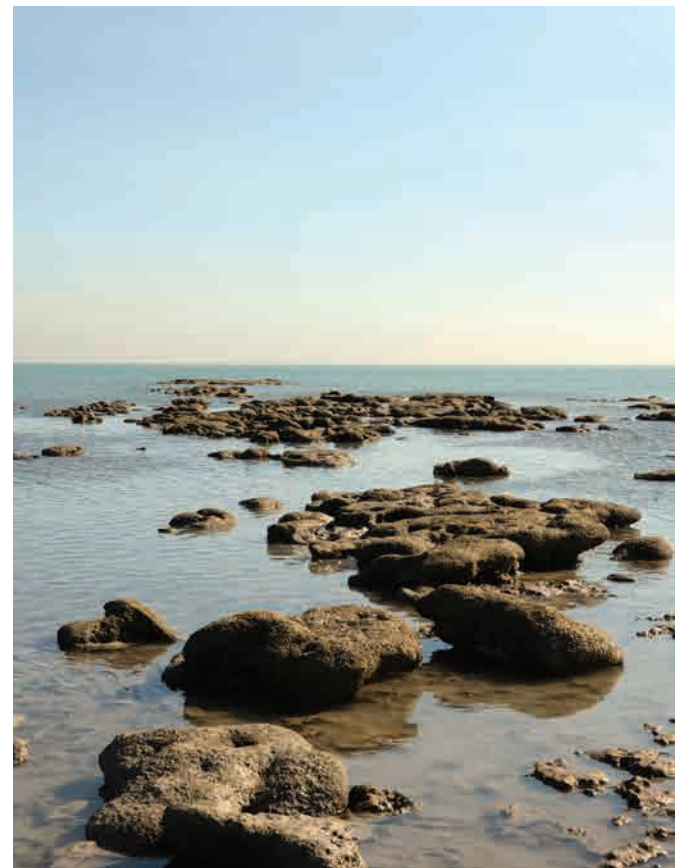


Figure 371. Rocky intertidal shore of eastern Failaka Island, Kuwait: typical habitat of *Achaeus lacertosus*.

Family Majidae

Micippa philyra (Herbst, 1803)

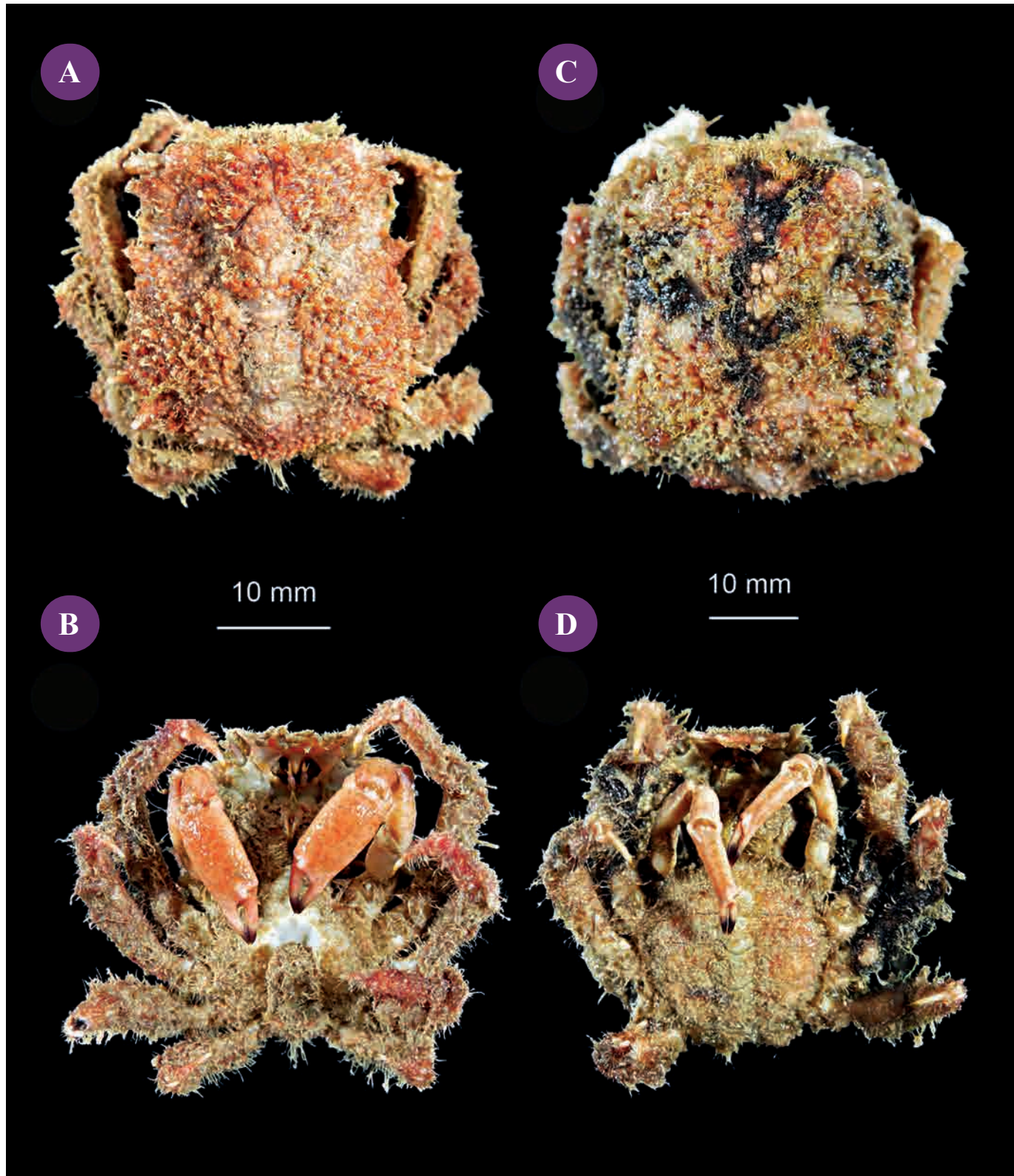


Figure 372. Male of *Micippa philyra* (Herbst, 1803) in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Cancer philyra* Herbst, 1803; *Micippa mascarenica* Kossmann, 1877; *Micippa mascarenica* var. *nodulifera* Baker, 1905; *Micippa superciliosa* Haswell, 1879; *Paramicippa asperimanus* Miers, 1884.

Main Diagnostic Features.

1. Carapace granular, with depressed hepatic regions; lateral margins armed with 6 slender spines increasing in length posteriorly; orbital region with pronounced preocular and postocular teeth.
2. Rostrum nearly vertically deflexed, terminating in 4 teeth.
3. Eyestalks relatively long, slender.
4. Chelipeds slender; carpus and palm covered with minute granules arranged mostly in irregular transverse rows; palm dilated; fingers smooth, gaping, i.e. meeting only near their apex.
5. First two walking legs (pereopods 2 and 3) about as long as the body in males.
6. Colour: variable, usually in brownish tones, with dark red, brown or black spots.
7. Size: maximal carapace length about 30 mm.

Distribution. Indo-West Pacific from Mozambique and the Arabian-Persian Gulf to Japan, the Philippines, and Australia.

Ecology. Benthic on rocky bottoms; from mid-intertidal area to shallow subtidal area, about 23 m; carapace covered, almost always concealed by debris and epibionts.

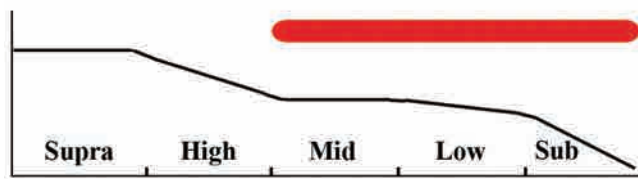


Figure 373. Bathymetric distribution of the species.

Remarks. Due to the morphological similarity of *M. philyra* (with six lateral spines on the carapace) and *M. platipes* (with ten such spines), these two species may be easily confused. According to Naderloo (2017), *M. platipes* is restricted to the Iranian coasts of the Arabian-Persian Gulf and the adjacent Gulf of Oman and Pakistani (Tirmizi and Kazmi 1986), whereas *M. philyra* is mainly distributed along the Arabian coast of the Arabian-Persian Gulf and throughout the Gulf of Oman, with one isolated observation from Iran.

Most Relevant References. Tirmizi and Kazmi 1986; Apel 2001; Naderloo and Turkay 2012; Naderloo 2017.

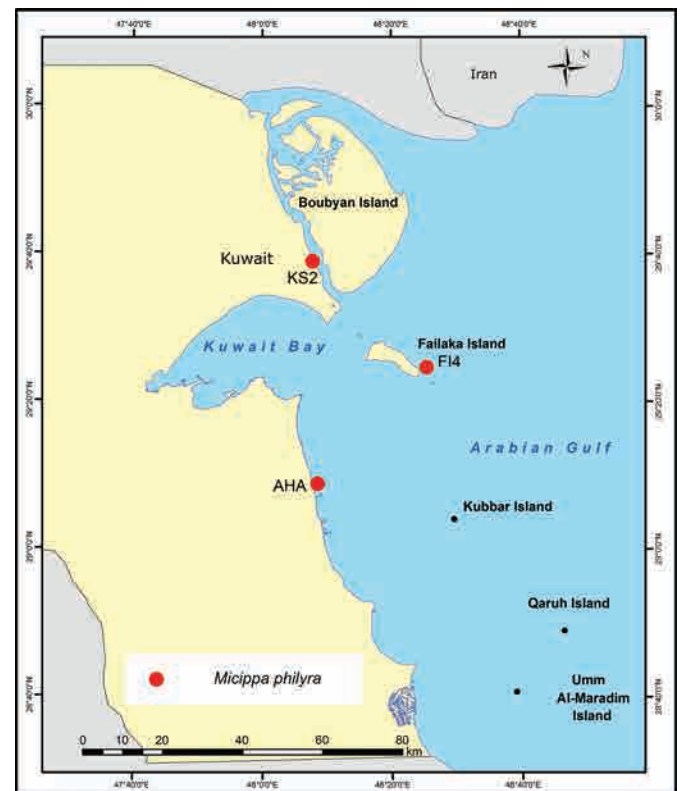


Figure 374. Presently known records of *Micippa philyra* in Kuwait.

Family Pilumnidae

Cryptopilumnus pereiodontus (Davie and Ghani, 1993)

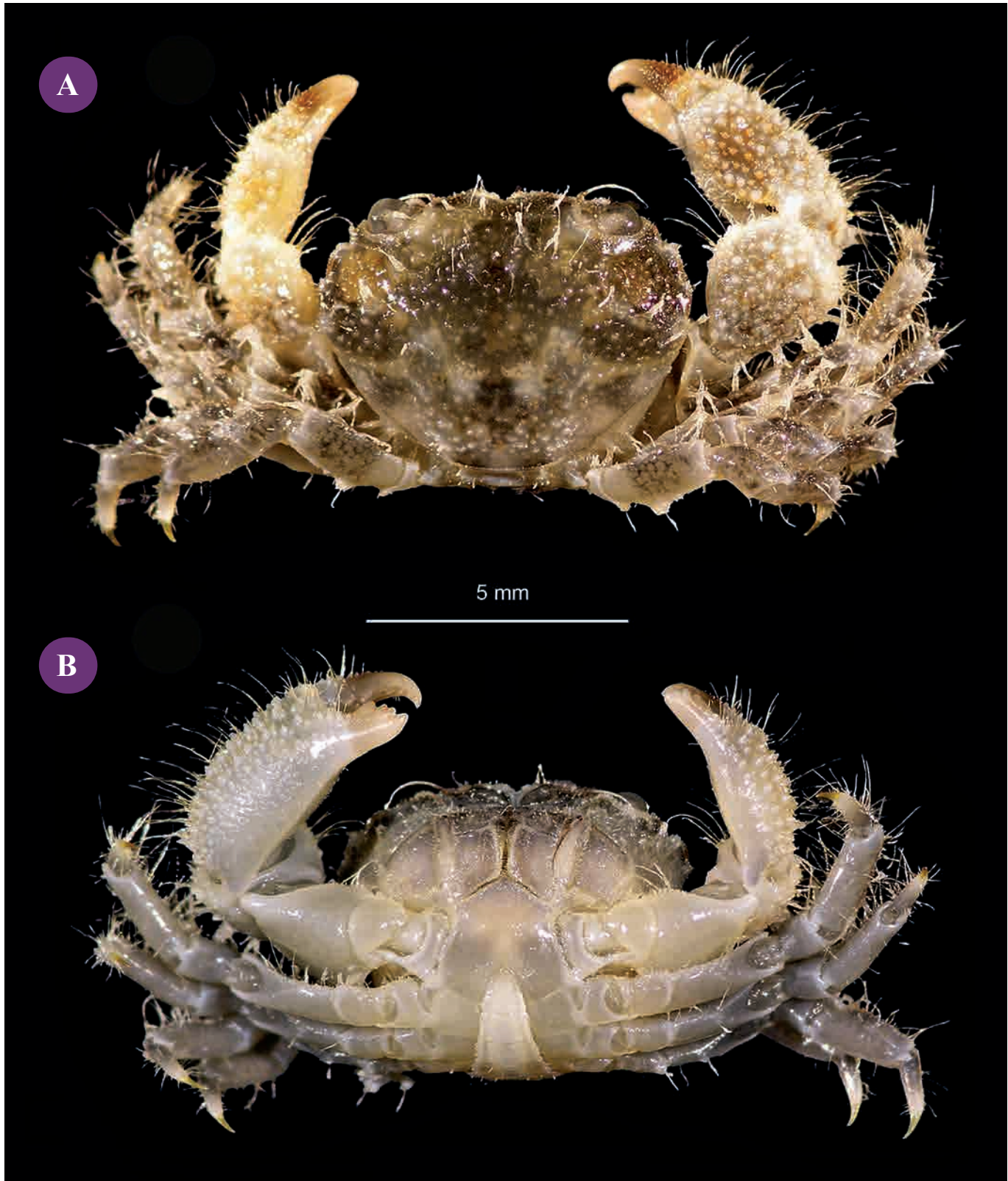


Figure 375. Male of *Cryptopilumnus pereiodontus* (Davie and Ghani, 1993) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Pilumnopus pereiodontus*, Davie and Ghani, 1993.

Main Diagnostic Features.

1. Carapace ovoid, 1.3–1.4 times broader than long, convex, sparsely covered with long setae; anterolateral margins with 3 teeth.
2. Front 0.4 times carapace width, bilobed.
3. Chelipeds unequal, markedly tuberculate on dorsal and lateral surfaces.
4. Walking legs (pereopods 2–5) slender, setose; third and fourth pereopods with teeth along the posterior margin of ischium and merus.
5. Male pleon relatively narrow, with 7 free segments.
6. Colour in life: pale brown or greenish-brown, marbled with white.
7. Size: maximal carapace width 7 mm.

Distribution. Western Indian Ocean: recorded only from the Arabian-Persian Gulf, the Gulf of Oman, and Pakistan.

Ecology. Benthic on hard and mixed bottoms, such as rocky shores and cobble; in holes and crevices of rocks; largely intertidal zone and adjacent shallow subtidal zone.

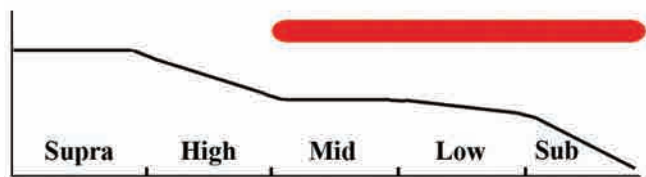


Figure 376. Bathymetric distribution of the species.

Remarks. This pilumnid species is difficult to place generically and appears closest to *Heteropanope changensis* (Rathbun, 1909) (Hsueh et al. 2009). The similarities are significant and include the general shape of the carapace, chelipeds, and walking legs. *Cryptopilumnus pereiodontus* differs from *H. changensis* by presenting less prominent anterolateral teeth, possessing rows of larger granules on the cheliped palms, and having somewhat denser setation.

Most Relevant References. Davie and Ghani 1993; Hsueh et al. 2009; Naderloo 2017.

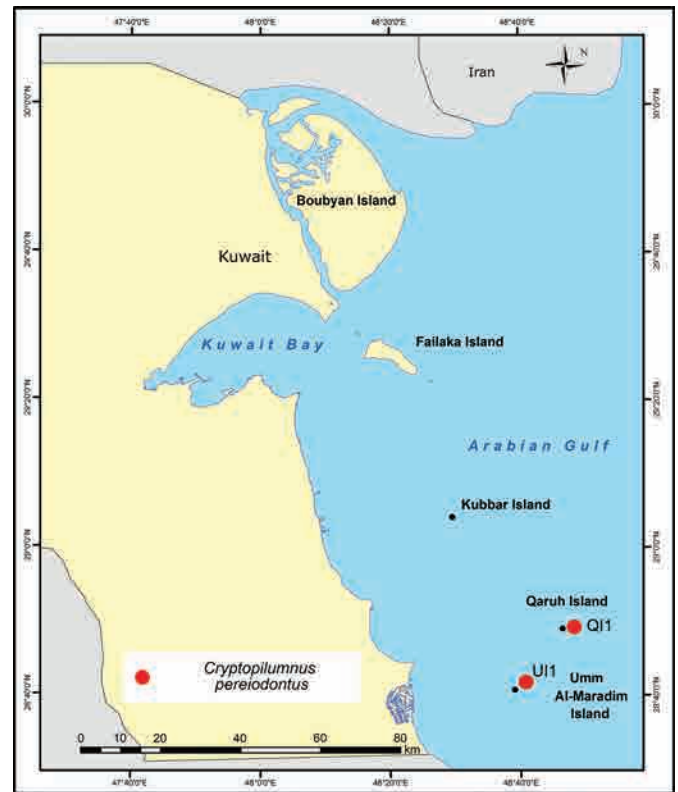


Figure 377. Presently known records of *Cryptopilumnus pereiodontus* in Kuwait.

Family Pilumnidae

Eurycarcinus integrifrons De Man, 1879

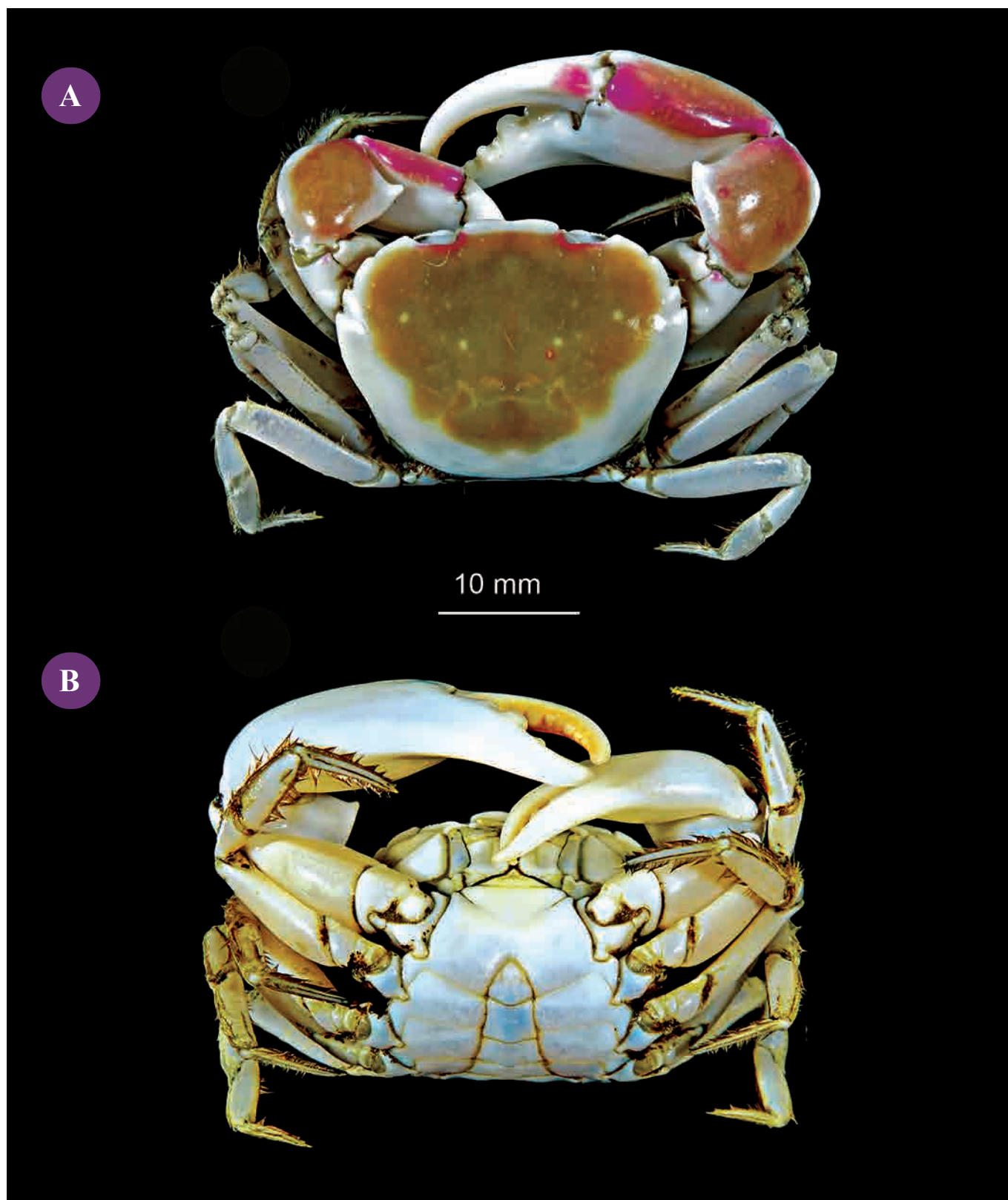


Figure 378. Male of *Eurycarcinus integrifrons* De Man, 1879 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Pretty mudflat crab.

Main Diagnostic Features.

1. Carapace nearly subquadrate, slightly broader than long (CB/CL=1.2–1.3), with smooth dorsal surface; anterolateral margin short, divided by 3 small incisions into 4 lobes; lateral margins and inflected portion of carapace fringed by short hairs.
2. Frontal margin straight, entire, not incised.
3. Pleon composed of 7 segments.
4. Third (external) maxillipeds composed of 7 articles.
5. Chelipeds unequal in size, both in males and females, massive in males, smooth.
6. Colour in life: carapace and chelipeds whitish with large orange-brown or pink-violet central patch occupying most of the dorsal surface of carapace, and with orange-brown, pink-violet, or pink-red areas on chelipeds.
7. Size: maximal carapace width 30 mm.

Distribution. Western Indian Ocean: from the Red Sea to the Arabian-Persian Gulf and western India; Lessepsian migrant to the eastern Mediterranean Sea (Özcan et al. 2010; Abdelsalam 2018).

Ecology. The species is recorded from intertidal areas in muddy and sandy shores and seagrass beds, occurring to depths of 32 m.

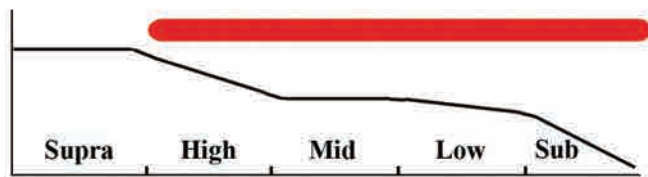


Figure 379. Bathymetric distribution of the species.

Remarks. The three presently recognized species of *Eurycarcinus* (*E. natalensis*, *E. integrifrons* and *E. orientalis*) can be separated using a large suite of morphological characters, mainly on the carapace and thoracic sternum (Ng et al. 2018). For instance, the carapace of *E. integrifrons* is subquadrate, whereas it is transversely ovate in *E. natalensis* and *E. orientalis*. Furthermore, *E. integrifrons*, differs markedly from *E. orientalis* (which is also present in Kuwait, see the following pages), by the form of the thoracic sternites 1–4, which are similar in general proportions in male and female in the former species (when compared to the male thoracic sternites 3 and 4 proportionately more elongated and with the suture between sternites 2 and 3 medially interrupted in *E. orientalis*).

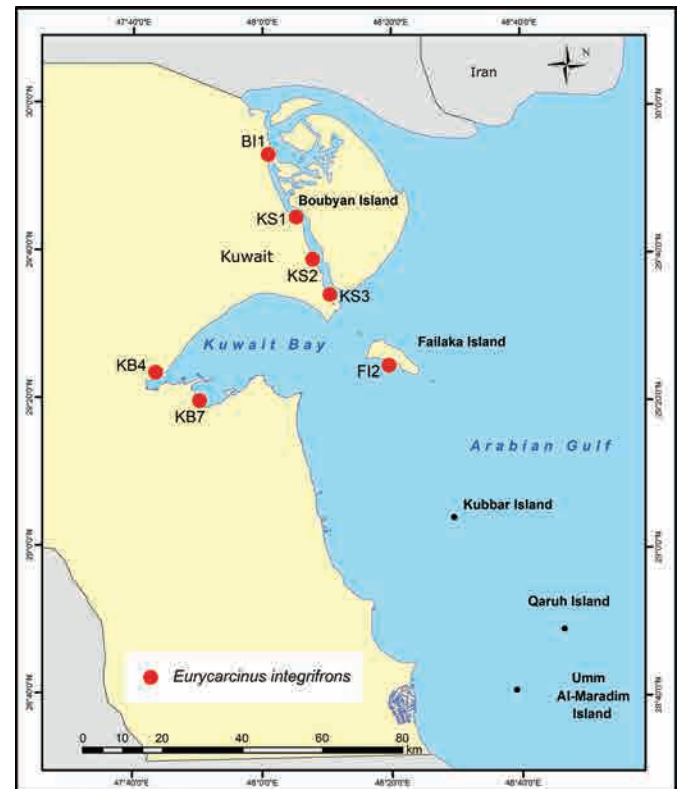


Figure 380. Presently known records of *Eurycarcinus integrifrons* in Kuwait.

Most Relevant References. De Man 1879; Özcan et al. 2010; Naderloo 2017; Abdelsalam et al. 2018; Ng et al. 2018.



Figure 381. *Eurycarcinus integrifrons* in the muddy intertidal zone of Sulaibikhat Bay (A) and Khor Al-Subiyah (B), Kuwait. Photographs by Valeriy Skryabin (A) and Igor Polikarpov (B).

Family Pilumnidae

Eurycarcinus orientalis A. Milne-Edwards, 1867



Figure 382. Male of *Eurycarcinus orientalis* A. Milne-Edwards, 1867 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari.

Common Names. Oriental mudflat crab; violet mudflat crab.

Main Diagnostic Features.

1. Carapace transversely ovate, 1.7 times wider than long, prominently high in frontal view, distinctly swollen; anterolateral margin with teeth, notches between first and third teeth without distinct setae.
2. Frontal margin distinctly bilobed.
3. Male pleonite 6 longitudinally subtrapezoidal, longer than broad.
4. Third maxilliped almost glabrous, except for the inner margin of ischium; ischium slightly longer than wide, subquadrate.
5. Chelipeds unequal in size; major cheliped relatively slender, fingers as long as palm.
6. Ambulatory legs (pereiopods 2–5) almost glabrous, except for small, scattered tufts of short setae.
7. Colour in life: two colour morphs, with either violet-purple or brown-purple carapace and chelipeds; legs dirty whitish.
8. Size: maximal carapace width and length 35 mm and 24 mm, respectively.

Distribution. Western Indian Ocean, with records from the Red Sea and the Arabian-Persian Gulf to India.

Ecology. Benthic, on muddy bottoms, often close mangroves; occasionally seen scavenging on other crabs. Typically in the mid-intertidal zone.

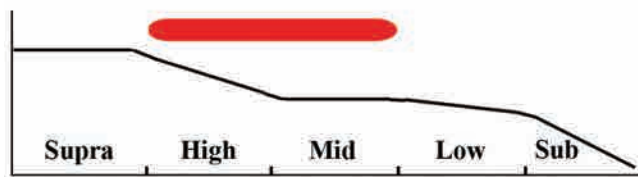


Figure 383. Bathymetric distribution of the species.

Remarks. *Eurycarcinus orientalis* can be easily distinguished from *E. integrifrons* by the shape of the carapace, which is subquadrate in *E. integrifrons* and transversely ovate in *E. orientalis* (see above). The two species can also be separated by colour (Naderloo 2017).

Most Relevant References. A. Milne-Edwards 1867; Naderloo 2017; Ng et al. 2018.

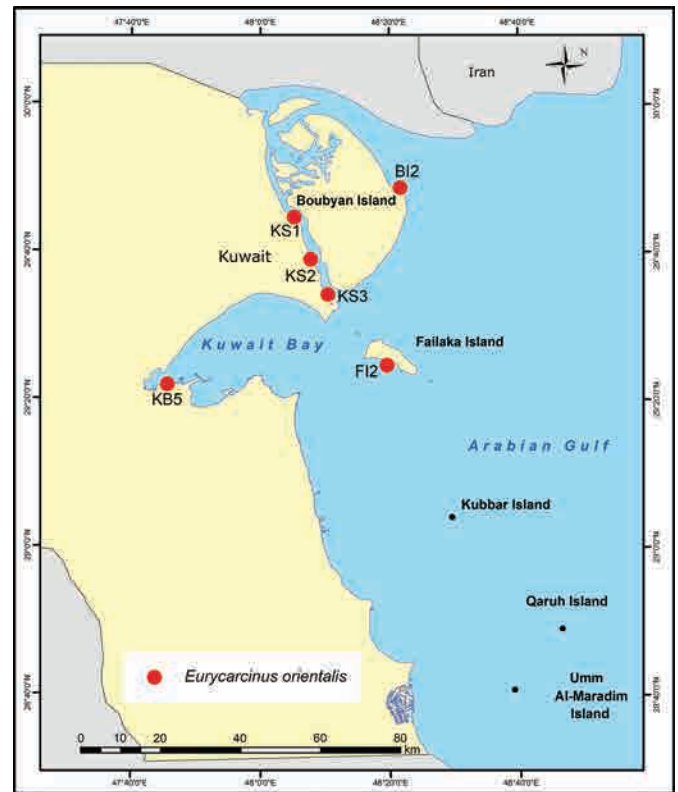


Figure 384. Presently known records of *Eurycarcinus orientalis* in Kuwait.



Figure 385. Burrow of *Eurycarcinus orientalis*, Kuwait. Photograph by David A. Jones.



Figure 386. Male of *Eurycarcinus orientalis* on mudflats of Kuwait. Photograph by Abdulaziz AlYousef.

A



Figure 387. *Eurycarcinus orientalis*, scavenging on unknown part of dead animal at Khor Al-Subiyah (A) and a dead *Venitus dentipes* at Al-Shumaima (B), Kuwait. Photographs by Abdulrahman Yousef (A) and Valeriy Skryabin (B).

B



Family Pilumnidae

Heteropilumnus trichophoroides (De Man, 1895)

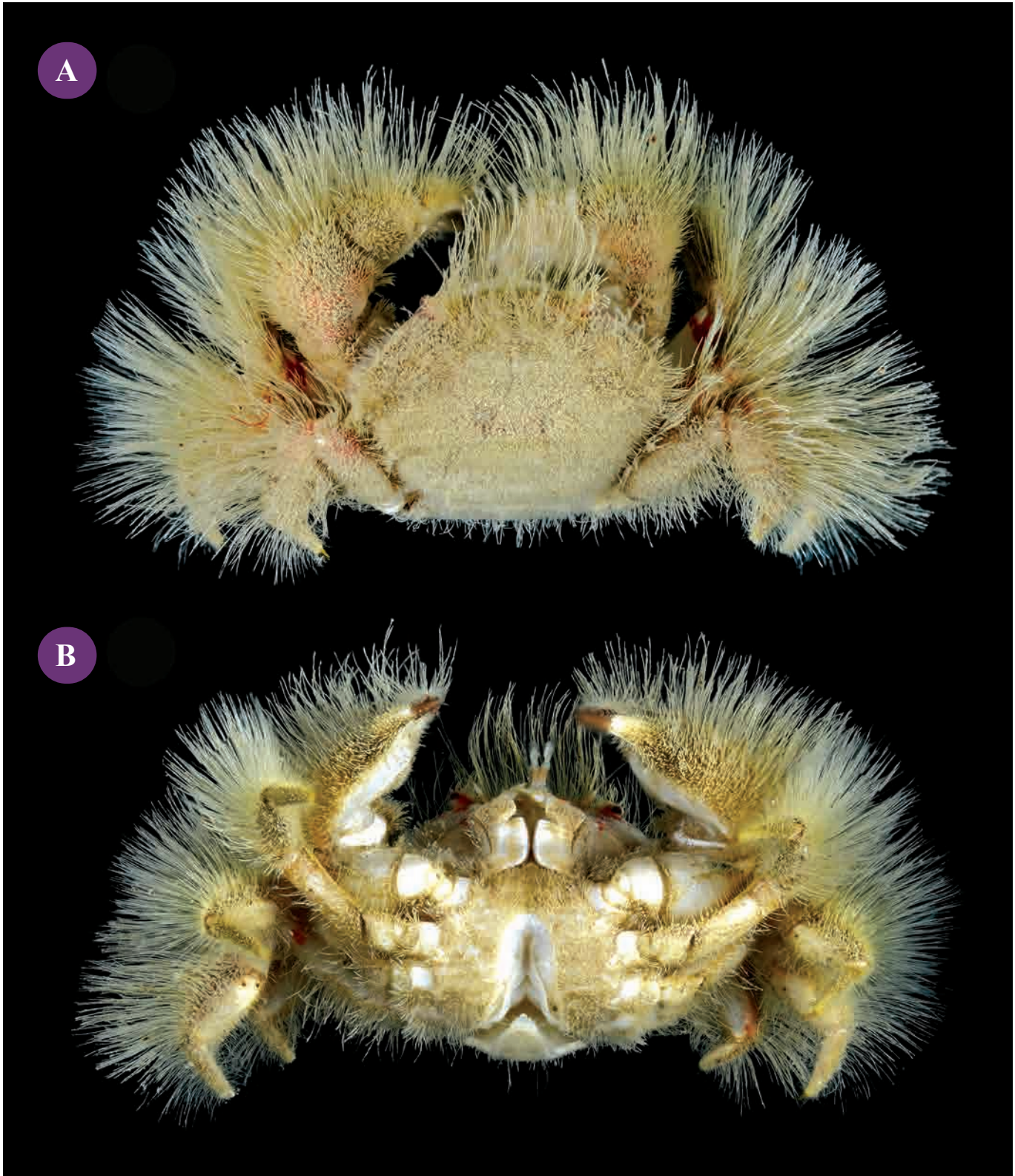


Figure 388. Male of *Heteropilumnus trichophoroides* (De Man, 1895) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari (A) and Arafat AlShuaibi (B).

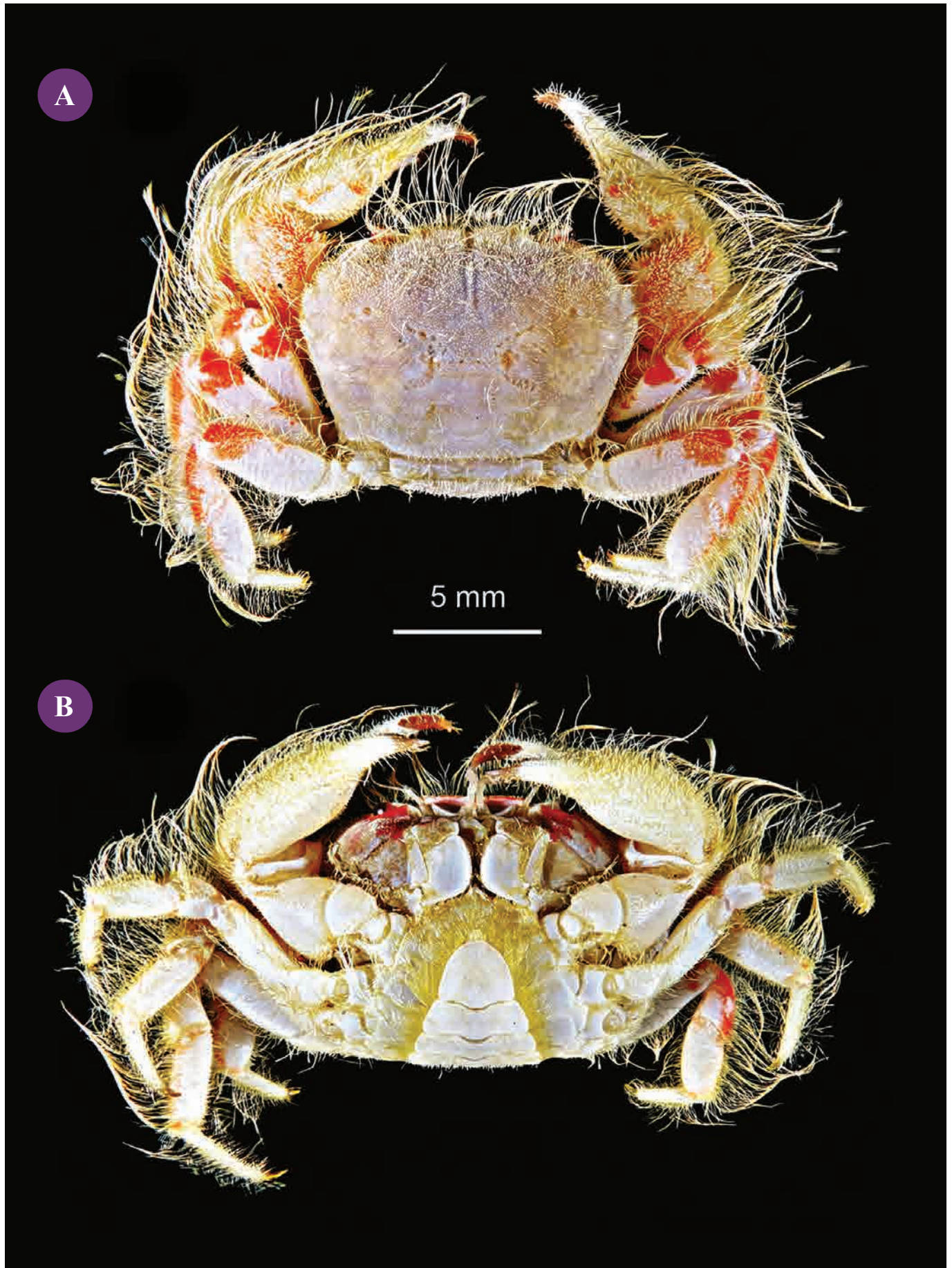


Figure 389. Female of *Heteropilumnus trichophoroides* (De Man, 1895) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Pilumnus borradailei* Rathbun, 1909; *Pilumnus trichophoroides* de Man, 1895 [in de Man, 1895-1898].

Main Diagnostic Features.

1. Carapace rather broadened and flattened from posterior margin to middle of gastric region; dorsal surface covered with long yellow setae; anterolateral margins not markedly arched; posterior margin straight, only 0.3 times wider than frontal margin.
2. Frontal lobes directed obliquely towards orbits.
3. Sternum and pleon smooth.
4. Walking legs (pereiopods 2–5) slender, covered with long yellow setae.
5. Colour in life: pale brown with reddish-brown tinge; setae yellow.
6. Size: maximal carapace width 12 mm.

Distribution. Indo-West Pacific: from the Red Sea and Seychelles to Japan, Indonesia and Australia.

Ecology. Benthic on mud-rocks and mud-cobble bottoms; lower intertidal and shallow subtidal zones.

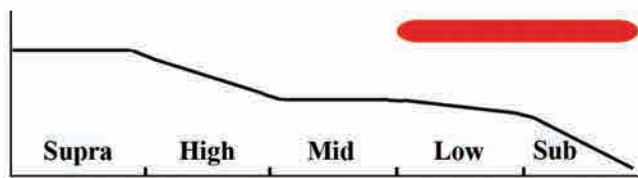


Figure 390. Bathymetric distribution of the species.

Remarks. *Heteropilumnus trichophoroides* is a distinctive pilumnid crab, with its very characteristic, long, erect, golden-yellow setae, most of which are organized in rows near the anterior margin of the carapace, as well as on the chelipeds and walking legs (see also Naderloo 2017).

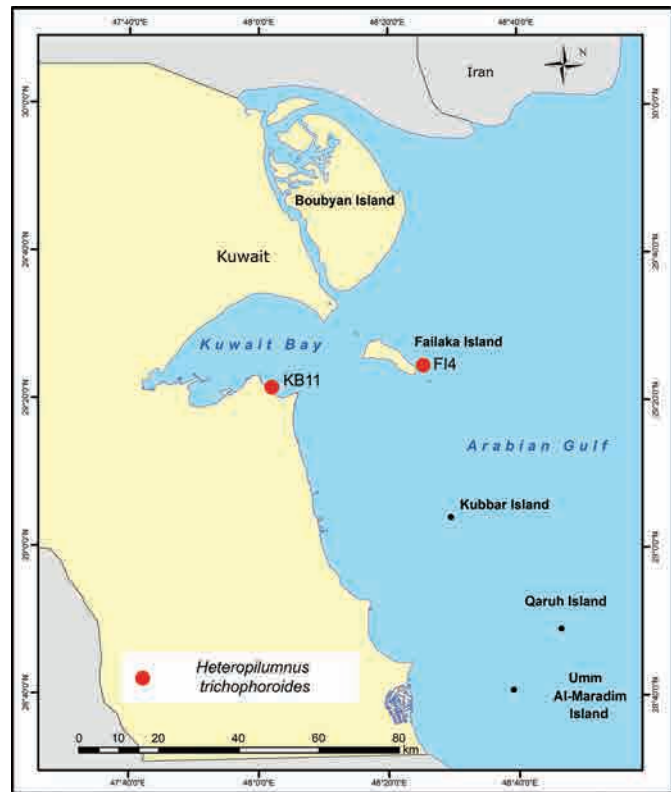


Figure 391. Presently known records of *Heteropilumnus trichophoroides* in Kuwait.

Most Relevant References. De Man 1895-1898; Naderloo 2017.



Figure 392. Natural habitat of *Heteropilumnus trichophoroides* at Al-Sha'ab intertidal area, Kuwait. Photograph by Valeriy Skryabin.



Figure 393. Male of *Heteropilumnus trichophoroides* with the removed setae on the right side of the carapace and right cheliped for a clearer view of the carapace sculpture, Kuwait. Photograph by Sergei Khvorov.



Figure 394. Frontal view of *Heteropilumnus trichophoroides*, Kuwait. Photograph by Arafat AlShuaibi.

Family Pilumnidae

Pilumnopeus convexus (Maccagno, 1936)



Figure 395. Male of *Pilumnopeus convexus* (Maccagno, 1936) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari.

Synonyms. *Heteropanope convexa* Maccagno, 1936;
Pilumnopus salomonensis Ward, 1942.

Main Diagnostic Features.

1. Carapace hexagonal, broader than long; dorsal surface with rows of small, rounded granules on frontal, gastric, branchial and cardiac regions; branchial region also with scattered plumose setae; anterolateral margin posterior to external orbital angle with 3 teeth, first tooth blunt, second and third teeth sharper, but not pointed.
2. Frontal margin bilobed, forming external angle; margin of lobes slightly convex.
3. First and second thoracic sternites completely fused.
4. Pleon with 6 segments + telson.
5. Chelipeds unequal, right much larger; major chela smooth; minor chela finely granulated.
6. Ambulatory legs (pereiopods 2–5) shorter than larger cheliped.
7. Colour in life: carapace olive with reddish brown spots on gastric, cardiac, and intestinal regions; chelipeds olive-brown, dorsal surface of palm and carpus reddish, inner surface white, fingers black; ambulatory legs brown with brown-red spots.
8. Size: maximal carapace width about 12 mm.

Distribution. Western Indian Ocean from the Red Sea and the Arabian-Persian Gulf to South Africa and India.

Ecology. Benthic on mainly rocky bottoms (rocky shores and reefs); from high to low intertidal zones.

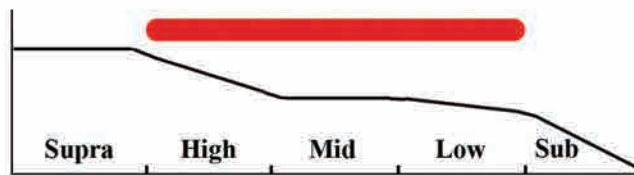


Figure 396. Bathymetric distribution of the species.

Remarks. *Pilumnopus convexus* can be distinguished from the closely related species in the genus *Pilumnopus* by its transversely hexagonal carapace, relatively sharp anterolateral teeth, and the tip of the male left gonopod being curved, forming a hook-like structure (Ghory et al. 2013; Naderloo 2017; Gosavi et al. 2017). The best and complete illustrations of the morphology of *P. convexus* are those of Ghory et al. (2013) and Naderloo (2017). The larval development of this crab was studied by Ghory et al. (2018).

Most Relevant References. Maccagno 1936; Naderloo and Türkay 2012; Naderloo 2017; Gosavi et al. 2017.

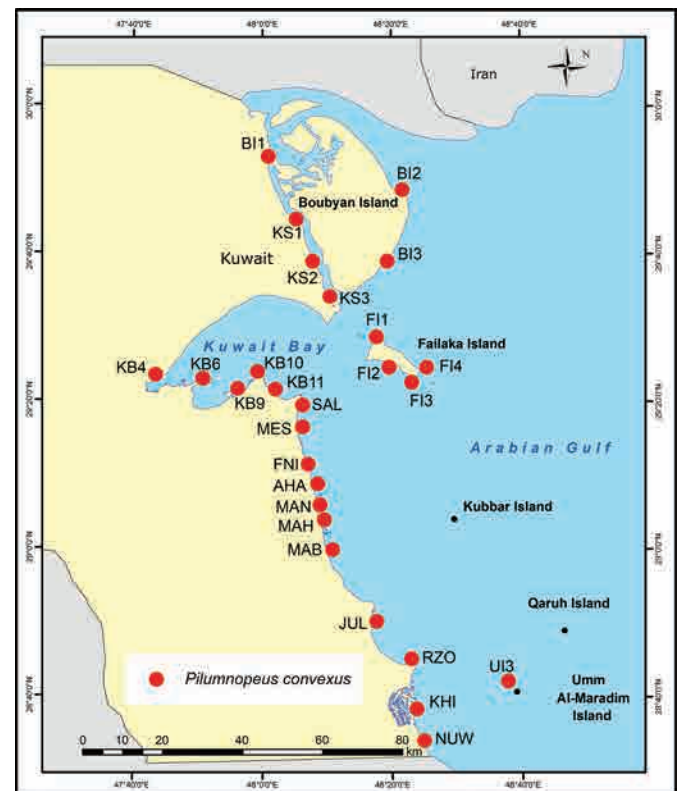


Figure 397. Presently known records of *Pilumnopus convexus* in Kuwait.



Figure 398. Different individuals of *Pilumnopus convexus* from Al-Doha, Kuwait. Photographs by Manal Al-Kandari.

Family Pilumnidae

Pilumnus longicornis Hilgendorf, 1879

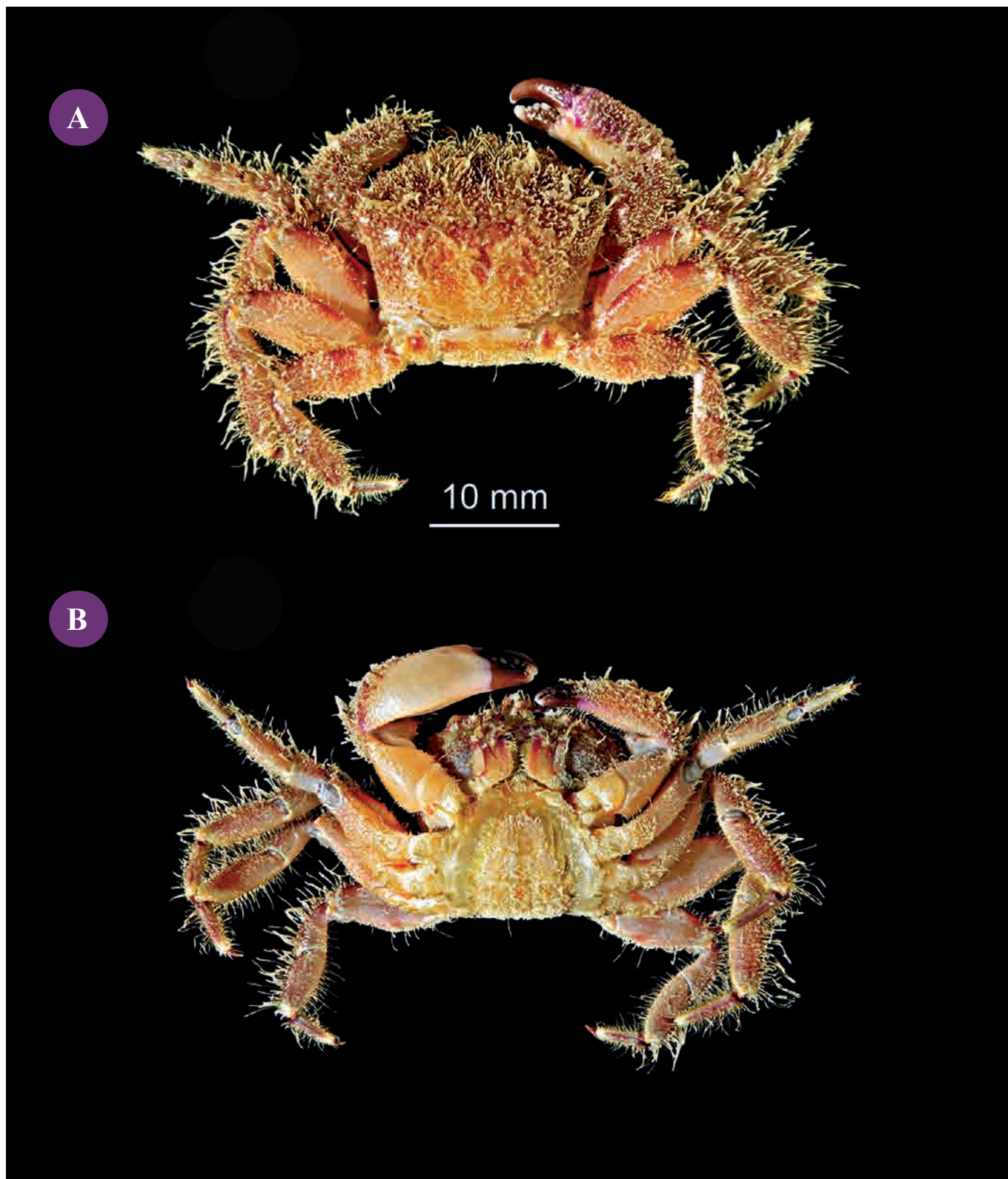


Figure 399. Female of *Pilumnus longicornis* Hilgendorf, 1879 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Pilumnus andersoni* De Man, 1887.

Main Diagnostic Features.

1. Carapace hexagonal, moderately swollen; dorsal surface covered with relatively thick short setae; posterolateral edge long, not concave.
2. Frontal margin with large rounded lobe on each side and very small pointed posterior tooth.
3. Antennal flagellum with about 6 pairs of longer bristles.
4. Major cheliped granulated dorsally and laterally; minor cheliped granulated on lateral (outer) surface, with 4 longitudinal rows of larger bumps.
5. Walking legs ((pereopods 2–5) moderately long, with spines on the anterior margin of merus.
6. Colour in life: males usually yellowish orange; females darker brick red or brown.
7. Size: maximal carapace width 13 mm for males and 20 mm for females.

Distribution. Indo-West Pacific: from the Red Sea and South Africa to the Philippines, Indonesia, and New Zealand.

Ecology. Benthic on rocky or mixed bottoms; low intertidal and subtidal areas, to the maximum depth of 33 m.

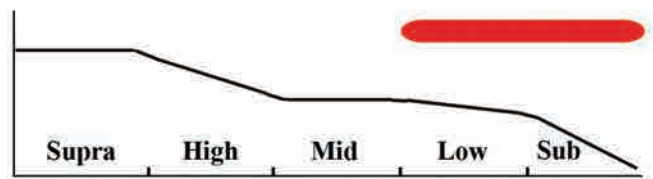


Figure 400. Bathymetric distribution of the species.

Remarks. The identification of the numerous species of *Pilumnus* is challenging and often needs an expert and extensive cleaning of the carapace. According to Naderloo (2017), six species of *Pilumnus* are present in the Arabian-Persian Gulf. However, only two of them were recorded from Kuwait, and they can be distinguished relatively easily, for instance, by the major cheliped being tuberculated/bumped in *P. longicornis* and smooth in *P. savignyi*.

Most Relevant References. Hilgendorf 1879; Naderloo 2017.

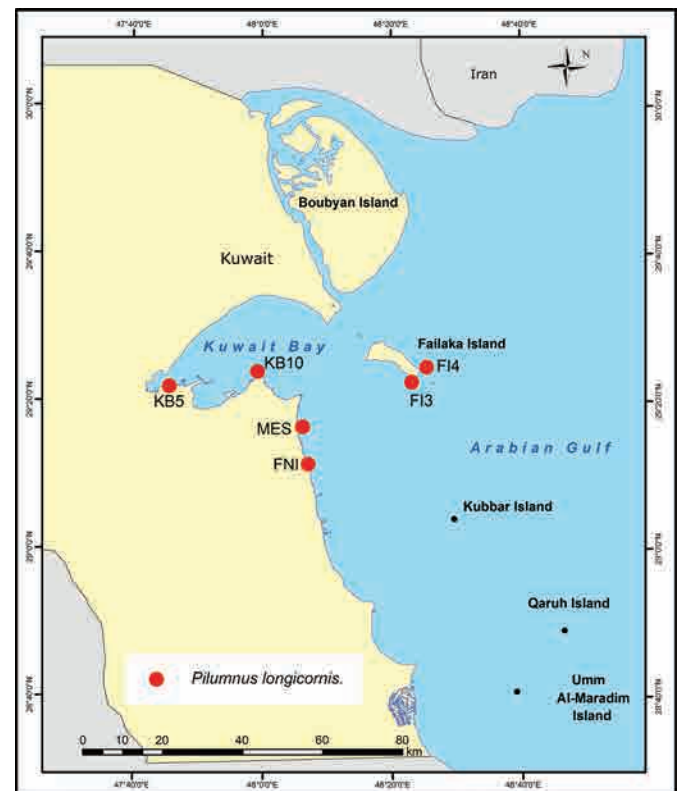


Figure 401. Presently known records of *Pilumnus longicornis* in Kuwait.

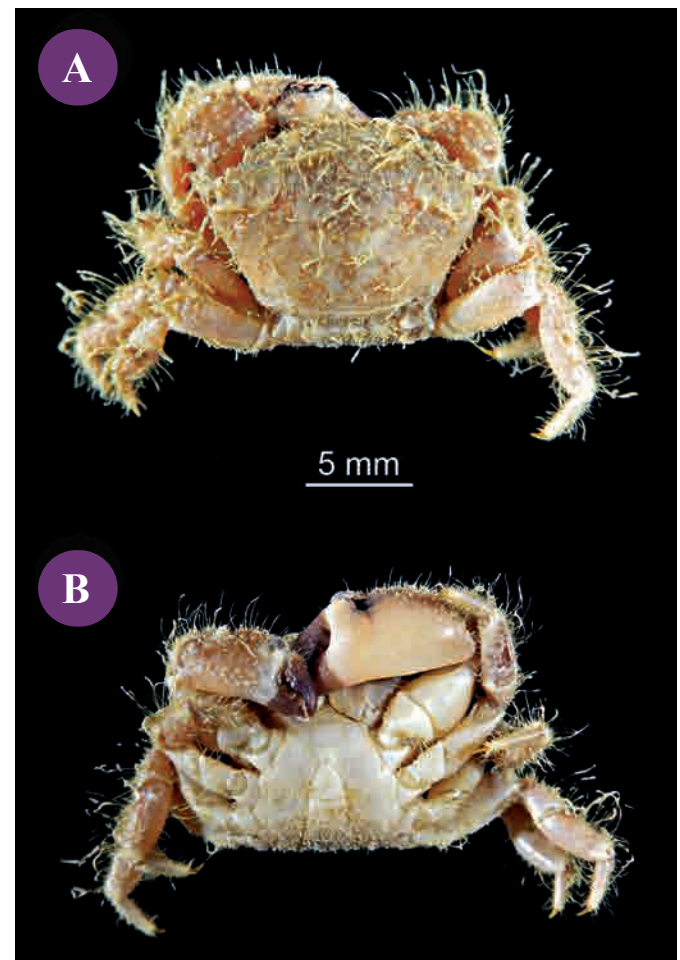


Figure 402. Male of *Pilumnus longicornis* Hilgendorf, 1879 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Family Pilumnidae

Pilumnus savignyi Heller, 1860

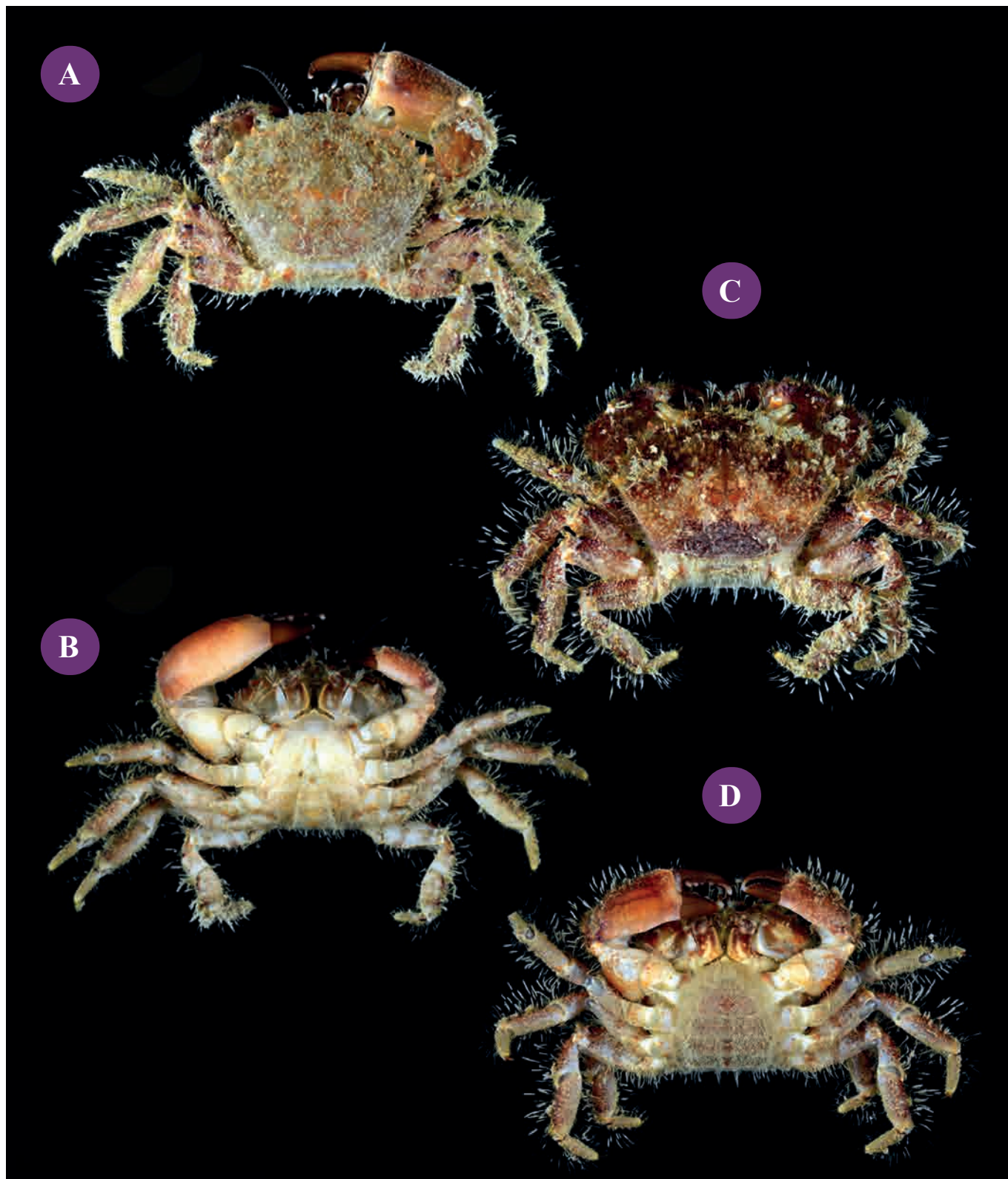


Figure 403. Male of *Pilumnus savignyi* Heller, 1860 in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Main Diagnostic Features.

1. Carapace slightly wider than long, moderately arched; surface with long stiff setae.
2. Frontal margin with deep median incision and two strong lateral indentations divided into 4 lobes: inner ones narrow and rounded, outer ones pointed and triangular; infraorbital margin with distinct spine; hepatic spine visible dorsally between exorbital angle and second anterolateral teeth.
3. Major cheliped with palm mostly smooth on lateral (outer) surface.
4. Walking legs (pereiopods 2–5) without distal spine on the posterior margin of carpus.
5. Male gonopod (G1) with markedly hook-shaped apical process.
6. Colour in life: males yellowish pale brown; females reddish brown with yellow patches.
7. Size: maximal carapace width and length about 20 mm and 14.6 mm, respectively.

Distribution. Western Indian Ocean: from the Red Sea and Seychelles to the Arabian-Persian Gulf and the Iranian coast of the Gulf of Oman.

Ecology. Benthic on hard and mixed bottoms, e.g. rocky shores, cobble, etc.; from mid-intertidal zone to at least 22 m.

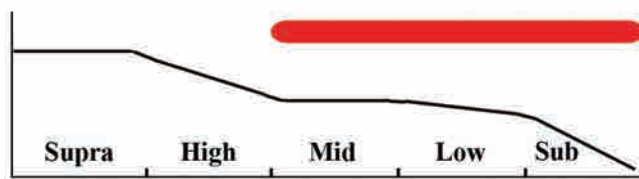


Figure 404. Bathymetric distribution of the species.

Remarks. *Pilumnus savignyi* was previously recorded from Kuwait, Iraq, and throughout the Arabian-Persian Gulf (Stephensen 1946; Jones 1986a; Naderloo 2017; Yasser et al. 2020). comments provided for the previous species.

Most Relevant References. Heller 1860; Stephensen 1946; Jones 1986a; Naderloo 2017; Yasser et al. 2020.

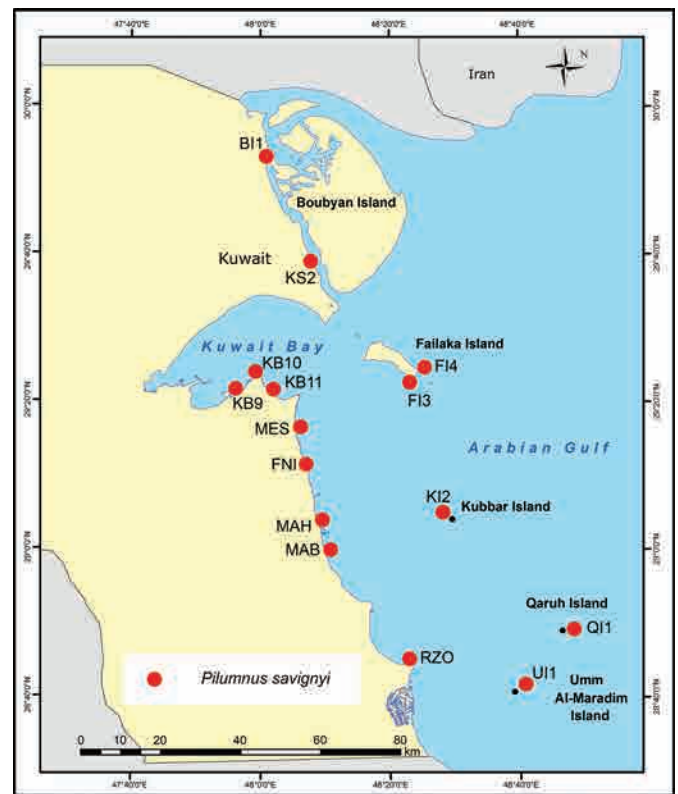


Figure 405. Presently known records of *Pilumnus savignyi* in Kuwait.



Figure 406. Male of *Pilumnus savignyi* in dorsal (A) and frontal (B) views, Failaka Island, Kuwait. Photographs by Arthur Anker.

Family Pilumnidae

Typhlocarcinops stephensi Serène, 1964



Figure 407. Female of *Typhlocarcinops stephensi* Serène, 1964 in frontal (A), dorsal (B) and ventral (C) views, Failaka Island, Kuwait. Photographs by Arthur Anker.

Main Diagnostic Features.

1. Carapace transverse, broader than long (length about 0.6 of width), noticeably sloping anteriorly; surface smooth, mostly glabrous, carapace regions hardly distinct; posterior portion of anterolateral margins with 2 or 3 obscure bumps.
2. Frontal margin 0.2 times of carapace width, with median furrow, nearly bilobed; orbits broadly oval, subcircular.
3. Merus of maxilliped 3 with anterolateral angle obsolete and rounded.
4. Chelipeds and walking legs (pereiopods 2–5) mostly smooth, with more or less dense setal rows on margins; chelipeds subequal; mesial carpal angle acute but not produced; palm smooth, “polished”, with distinct upper (dorsal) ridge.
5. Colour in life: carapace yellow; chelipeds and ambulatory legs whitish; setae orange.
6. Size: maximal carapace length and width about 12 mm and 18 mm, respectively.

Distribution. Indo-West Pacific from the Arabian-Persian Gulf to India and Vietnam.

Ecology. Benthic on muddy bottoms; from the lowest intertidal zone to at least 20 m.

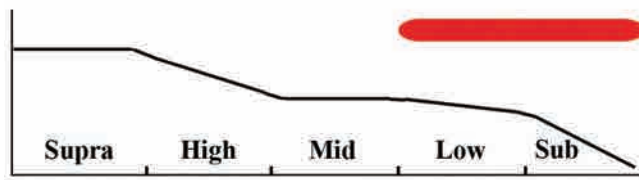


Figure 408. Bathymetric distribution of the species.

Remarks. The genus *Typhlocarcinops* was first observed by Rathbun (1909), to separate several species from the related genus *Typhlocarcinus*, more precisely, those in which the first pleonite occupies all the space between the last pairs of walking legs. This is a rarely observed crab species, living deep in burrows in muddy substrates, possibly as a “commensal” of some other burrowing animal.

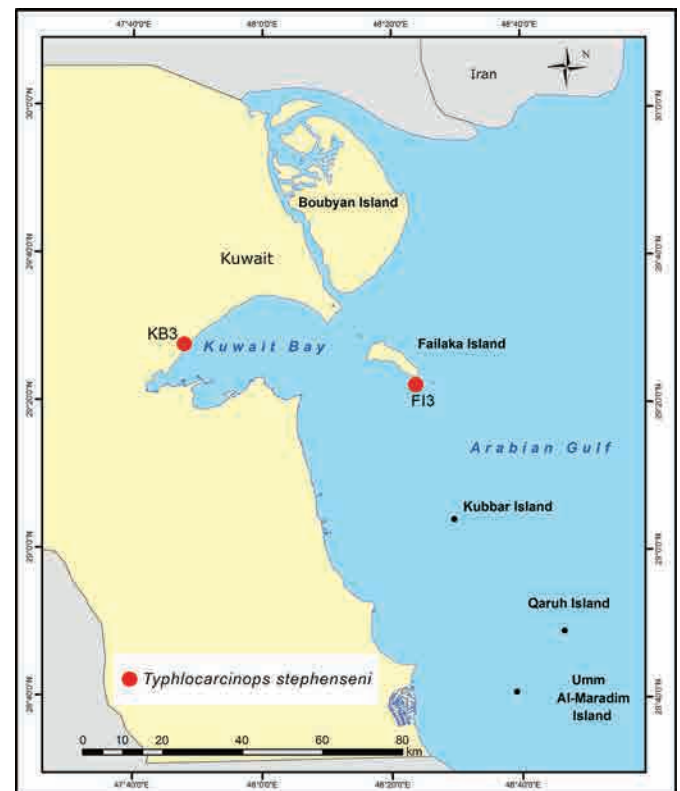


Figure 409. Presently known records of *Typhlocarcinops stephenseni* in Kuwait.

Most Relevant References. Rathbun 1909; Serène 1964; Naderloo 2017.

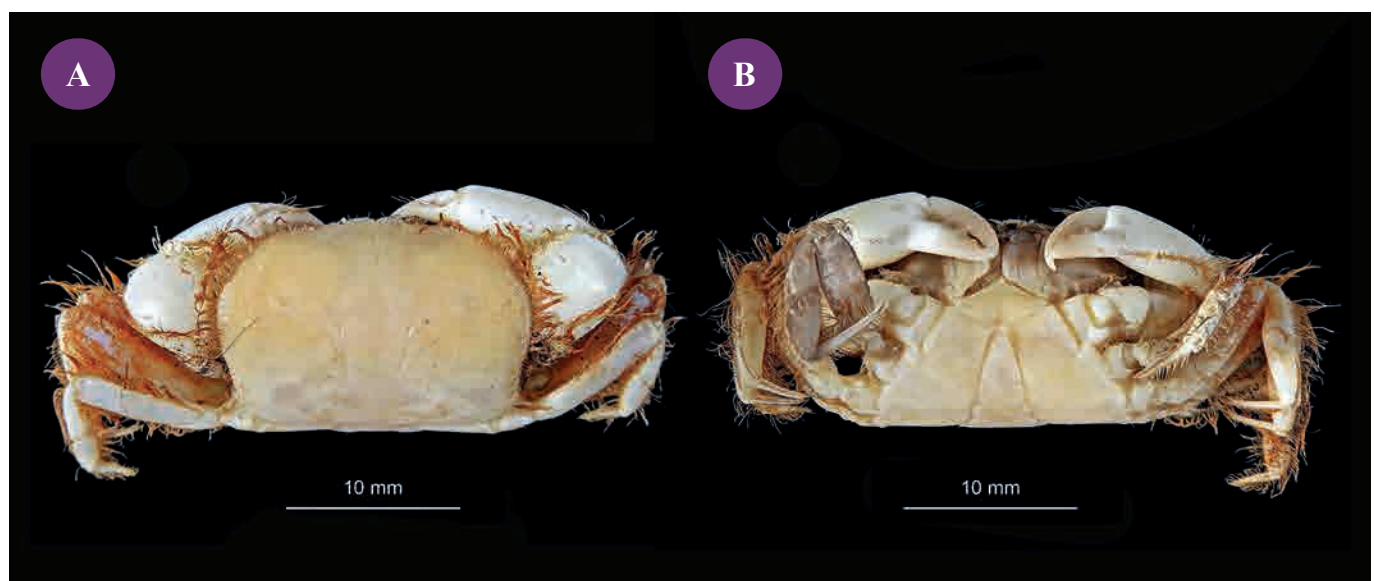


Figure 410. Male of *Typhlocarcinops stephenseni* Serène, 1964 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Family Portunidae

Portunus segnis (Forskål, 1775)

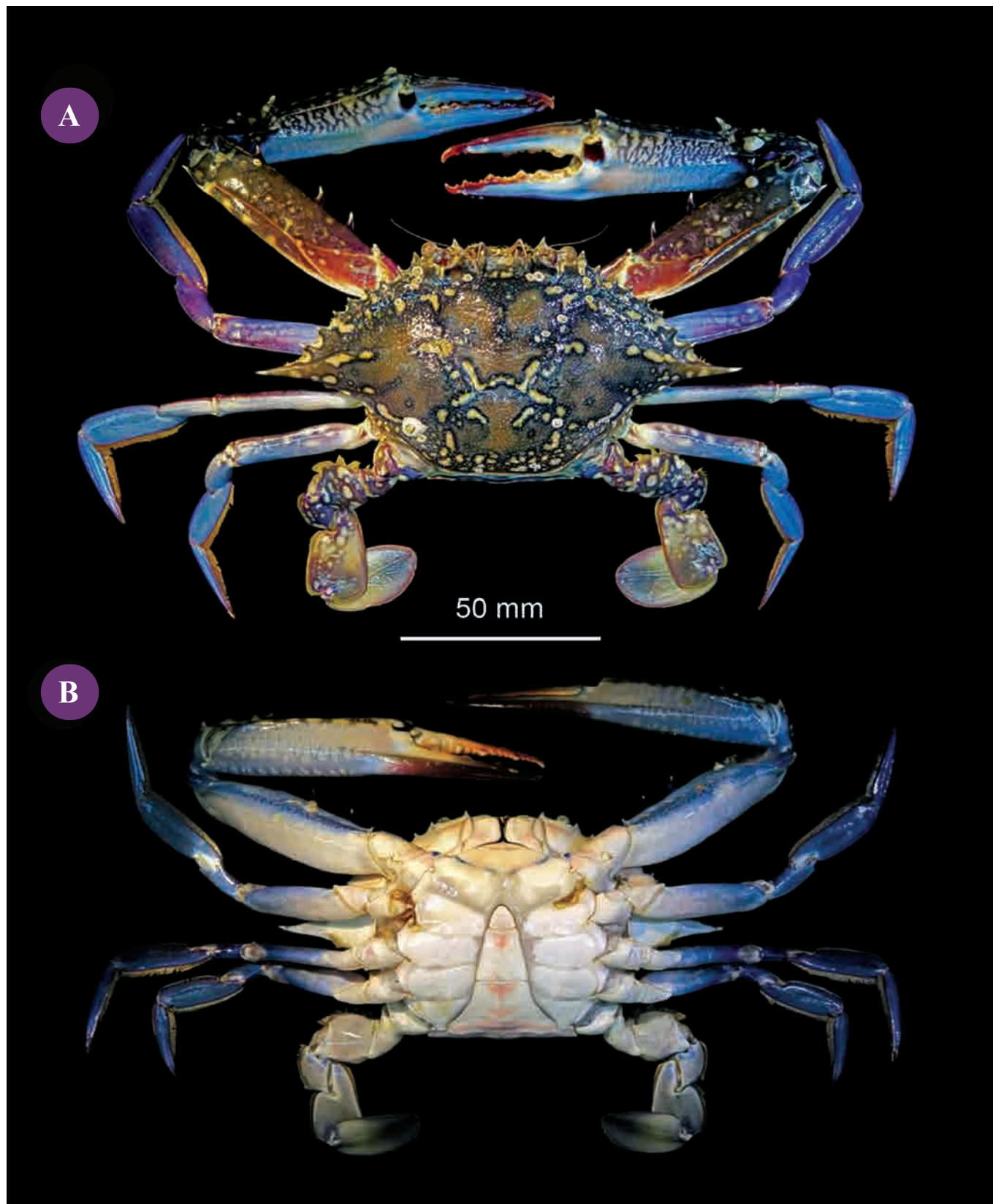


Figure 411. Male of *Portunus segnis* (Forskål, 1775) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.



Figure 412. Female of *Portunus segnis* (Forskål, 1775) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Cancer segnis* Forskål, 1775; *Portunus* (*Portunus*) *segnis* (Forskål, 1775); *Portunus mauritanus* Ward, 1942.

Common Name. Western flower crab.

Main Diagnostic Features.

1. Carapace width 2.2–2.3 times wider than long; regions relatively poorly defined.
2. Median frontal teeth minute or obsolete, inconspicuous.
3. Sixth pleonite of males relatively short, only slightly tapering.
4. Chelipeds narrow, elongated; merus of adult male at mostly 4.5 times as long as wide; anterior margin of merus usually with 3 spines.
5. Ambulatory legs (pereiopods 2–5) relatively elongated, slender; natatorial paddle of pereiopod 5 elongate, oval, obtusely angular distally.
6. Base of male gonopod (G1) with slight basal spur.
7. Colour: males with dark olive-green-blue carapace covered with pale or white spots, particularly posteriorly and anterolaterally; spots not tending to merge to form reticulation bands; cheliped fingertips blue tinged with rusty red; females similar to males except for red-brown cheliped fingertips.
8. Size: maximal carapace length and width about 56 mm and 122 mm, respectively, for males and 58 mm and 124 mm, respectively, for females.

Distribution. Western Indian Ocean: from the Red Sea and Mozambique to the Arabian-Persian Gulf and India; Lessepsian migrant into the Mediterranean Sea.

Ecology. Benthic on sand-mud or mud-rock substrates; sheltering under rocks and in tide pools, sometimes seen in the open; intertidal zone to 55 m.

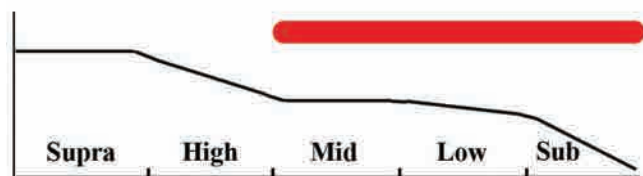


Figure 413. Bathymetric distribution of the species.

Remarks. All four species of the *Portunus pelagicus* species complex commonly known as “flower crabs”, can be separated based on the unique individual combinations of morphological characters, primarily involving the relative prominence of the frontal teeth, the length and armature of the cheliped merus, the shape of the sixth male pleonite, the shape of the paddle of the fifth pereiopod, and the colour pattern (Lai et al. 2010). The only other species in the northern Indian Ocean is *P. reticulatus*; however, this species has not been reported in the west of India or Sri Lanka. *Portunus segnis* is an important commercial species in the region (Carpenter et al. 1997b, see following pages and Figs. 415, 416, 417). The larval development of *P. segnis* was studied by Aidaroos et al. (2019) in Saudi Arabia.

Most Relevant References. Forskål 1775; Lai et al. 2010; Naderloo 2017.

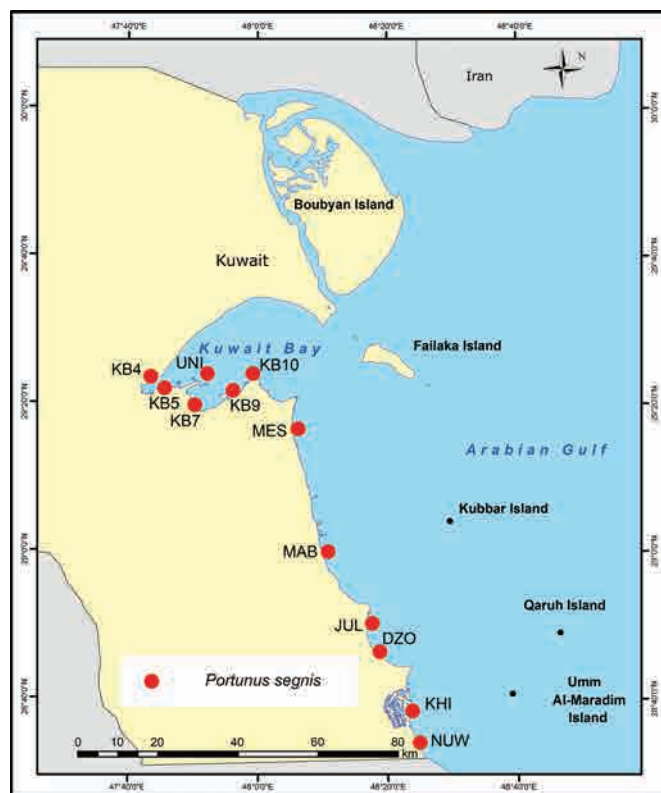


Figure 414. Presently known records of *Portunus segnis* in Kuwait.



Figure 415. *Portunus segnis* in situ at Al-Khiran (A) and Failaka Island (B), Kuwait. Photographs by Yaser Mohammed Abdulraheem (A) and Arafat AlShuaibi (B).



Figure 416. Several *Portunus segnis* trapped in gillnet, Failaka Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 417. *Portunus segnis* on sale on a seafood market in Kuwait City, Kuwait. Photograph by Arthur Anker.

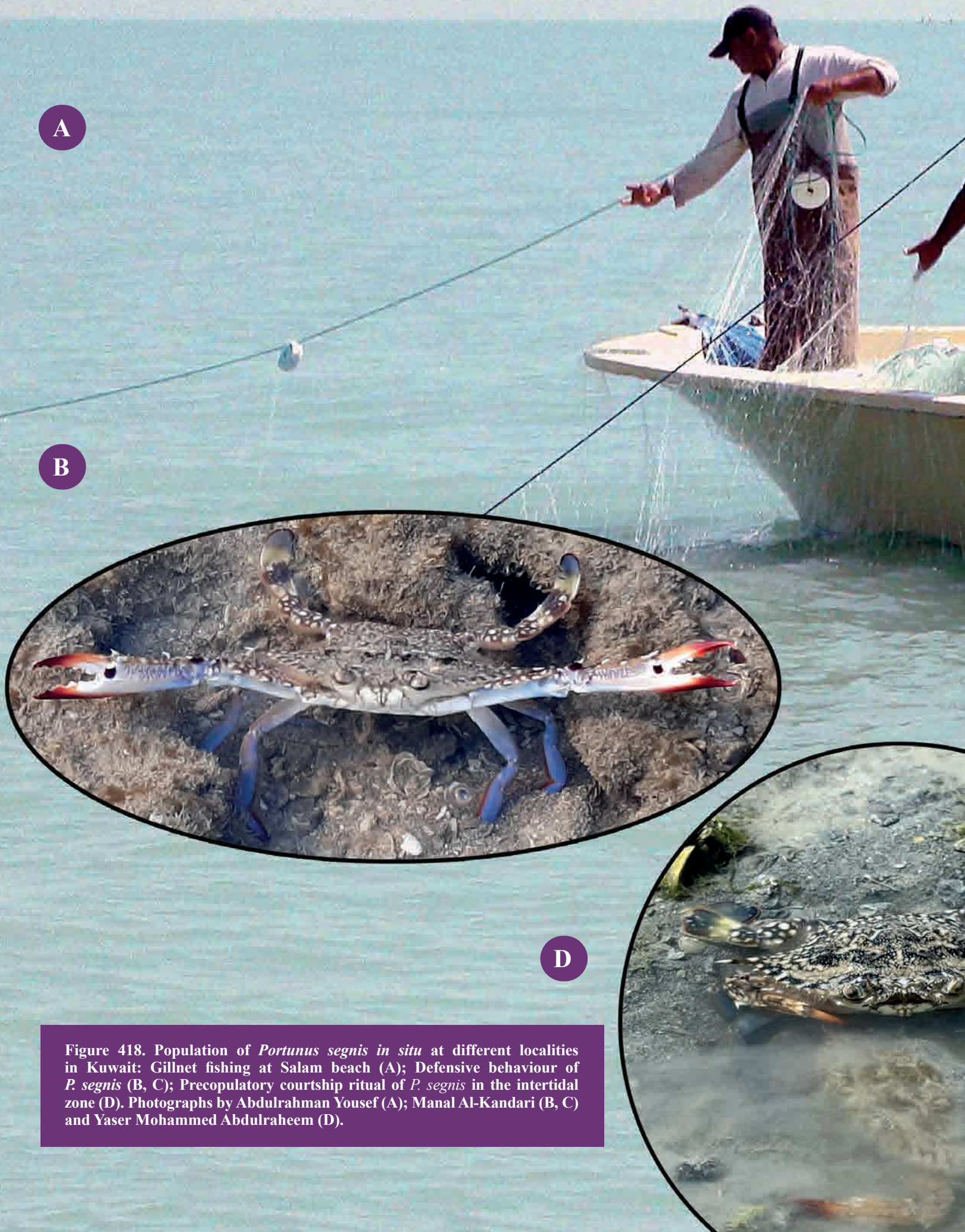


Figure 418. Population of *Portunus segnis* in situ at different localities in Kuwait: Gillnet fishing at Salam beach (A); Defensive behaviour of *P. segnis* (B, C); Precopulatory courtship ritual of *P. segnis* in the intertidal zone (D). Photographs by Abdulrahman Yousef (A); Manal Al-Kandari (B, C) and Yaser Mohammed Abdulraheem (D).



Family Portunidae

Charybdis hellerii (A. Milne-Edwards, 1867)



Figure 419. *Charybdis hellerii* (A. Milne-Edwards, 1867) specimen from Brazil (invasive species). Photograph by Arthur Anker.

Synonyms. *Charybdis merguiensis* de Man, 1887; *Charybdis vannamei* Ward, 1941; *Goniosoma Hellerii* A. Milne-Edwards, 1867.

Common Name. Indo-Pacific swimming crab.

Main Diagnostic Features.

1. Carapace strongly pubescent, sparsely pubescent, or glabrous; anterolateral margin with 6 sharp teeth.
2. Frontal region with 8 well-developed teeth separated by deep incisions: 3 pairs of frontal teeth + 1 pair of teeth on inner (mesial) angle of each orbit.
3. Pleon of adult males 6-segmented.
4. Chelipeds robust, spiny; merus with 3 strong spines on anterior surface.
5. Colour in life: variable, orange-brown or brown-green, marbled with yellowish and pale areas, sometimes with two dark patches and two white spots; carapace spines often with red tips.
6. Size: males up to 83 mm in carapace width; females up to 62 mm in carapace width.

Distribution. Indo-West Pacific from the Red Sea and Gulf to Japan, New Caledonia, and Australia; multiple introduction events to the Mediterranean Sea, West Africa, Brazil, Caribbean, and Atlantic coasts of the USA (e.g. Florida) (Lemaitre 1995; Watanabe et al. 2015; Negri et al. 2018; Dessouassi et al. 2019).

Ecology. Benthic on various types of bottoms, mainly sand-rock and mud-rock, also near mangroves and coral reefs; from the intertidal zone to 100 m; aggressive, carnivorous, highly adaptable swimming crab causing various problems in many areas where it is non-native.

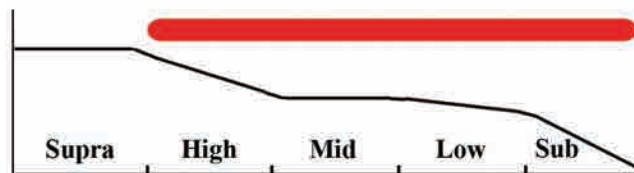


Figure 420. Bathymetric distribution of the species.

Remarks. *Charybdis hellerii* exhibits considerable variation in the degree of pubescence, sharpness of frontal teeth, and colour pattern. For instance, it is not rare to find both pubescent and glabrous individuals within the same population (Naderloo 2017), while the proportion of pubescent (Fig. 422) and glabrous (Fig. 419) specimens may be variable between populations (Dessouassi et al. 2019). The sharpness of frontal teeth increased with the size of the specimens. The colour pattern is also extremely variable and depends on the age and sex of individuals (Watanabe et al. 2015). Due to multiple introduction events, *C. hellerii* is today one of the most widespread and most studied crabs in the world, with a strong genetic structure (Negri et al. 2018), possibly indicating an ongoing lineage sorting and speciation.

Most Relevant References. Milne-Edwards 1867; Lemaitre 1995; Watanabe et al. 2015; Naderloo 2017; Negri et al. 2018; Dessouassi et al. 2019.

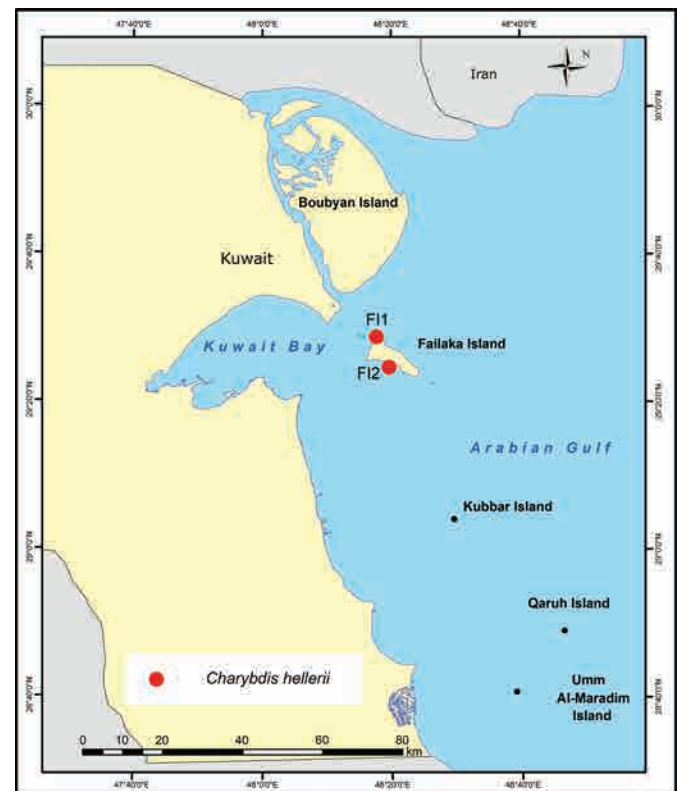


Figure 421. Presently known records of *Charybdis hellerii* in Kuwait.



Figure 422. Pubescent specimen of *Charybdis hellerii* in a sandy-rocky intertidal area in Kuwait. Photograph by David A. Jones.

Family Portunidae

Gonioinfradens giardi (Nobili, 1905)



Figure 423. *Gonioinfradens giardi* (Nobili, 1905) in dorsal (A) and frontal (B) views, Al-Julaia'a, Kuwait. Photographs by Manal Al-Kandari.

Synonyms. *Thalamita giardi* Nobili, 1905; *Charybdis (Goniosoma) giardi* (Nobili, 1905).

Main Diagnostic Features.

1. Carapace about 1.3 times as broad as long, usually smooth; regions poorly defined; anterolateral margin with 4 well-developed teeth + 1 small additional tooth at posterior base of the first tooth and a minute or rudimentary tooth between second and third large teeth.
2. Front divided into 6 lobes.
3. Penultimate segment of male pleon wider than long.
4. Chelipeds subequal or unequal; merus with 3 spines on the anterior margin; inner and outer (lateral) palmar surfaces without short, rounded carina distally.
5. Male gonopod (G1) abruptly bent at about mid-length; distal half slender.
6. Colour in life: carapace red mottled with brown and beige; carapace spines with red tips; eyes blue.
7. Size: maximal length/width of the Arabian-Persian Gulf specimens *ca.* 46/64 mm for males and 46/62 mm for females; Kuwaiti specimen (male? carapace only found): 32.5/44 mm.

Distribution. Western Indian Ocean from the Red Sea to the Arabian-Persian Gulf; Lessepsian migrant into the eastern Mediterranean Sea (Corsini-Foka et al. 2010, as *G. paucidentatus*).

Ecology. Benthic on hard bottoms (rocks, coral reefs etc.); intertidal zone to more than 100 m.

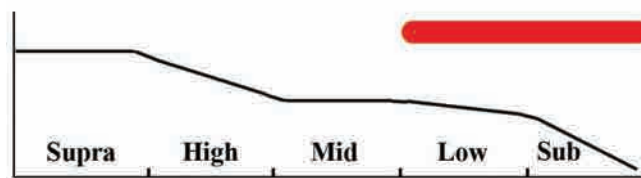


Figure 424. Bathymetric distribution of the species.

Remarks. *Gonioinfradens giardi* was only recently resurrected from the synonymy of *G. paucidentatus*, from which it differs in the shape of frontal lobes, the two median spines on the upper surface of the palm being situated closer, the absence of a short, rounded carina distally on both the inner and the outer (lateral) palmar surfaces, the shape of the male gonopod (G1) and other features, as well as by some details of the colour pattern (Galil et al. 2018). *Gonioinfradens paucidentatus* is distributed from East Africa to Japan and New Caledonia; however, it does not seem to occur in the Arabian-Persian Gulf; all specimens previously reported from the Arabian-Persian Gulf (e.g. Apel and Spiridonov 1998; Naderloo 2017) must be referred to as *G. giardi*. The young specimens of *Gonioinfradens* can easily be mistaken for *Thalamita spinifera* since they often lack one or both small anterolateral denticles, which are typical for *G. paucidentatus*.

Most Relevant References. Apel and Spiridonov 1998; Naderloo 2017 (both as *G. paucidentatus*); Galil et al. 2018.

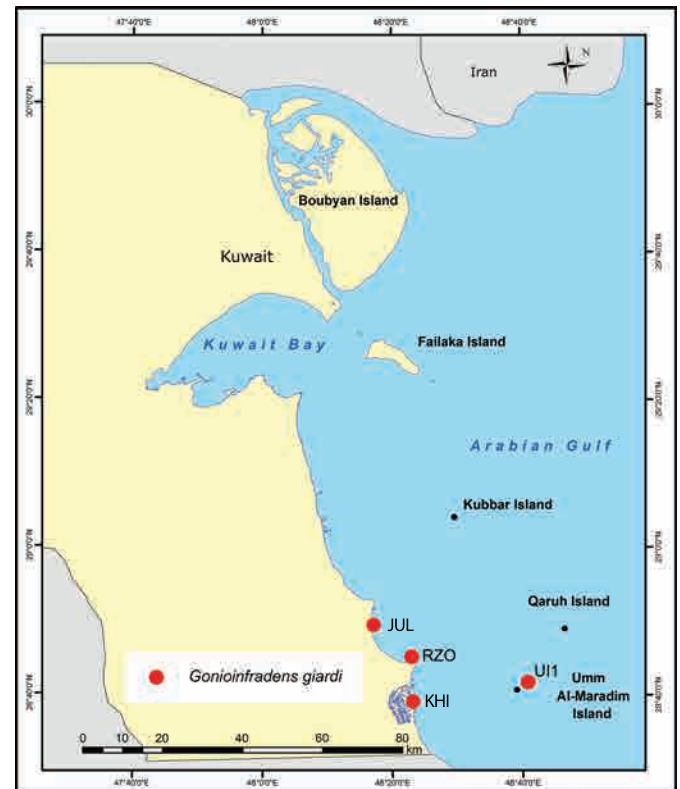


Figure 425. Presently known records of *Gonioinfradens giardi* in Kuwait.



Figure 426. *Gonioinfradens giardi* in situ near Al-Khiran, Kuwait. Photograph by Yaser Mohammed Abdulraheem.





Figure 427. *Gonioinfradens giardi* under rock near Umm Al-Maradim Island, Kuwait. Photograph by Faisal Al-Sarraf.

Family Portunidae

Thalamita bandusia Nobili, 1906

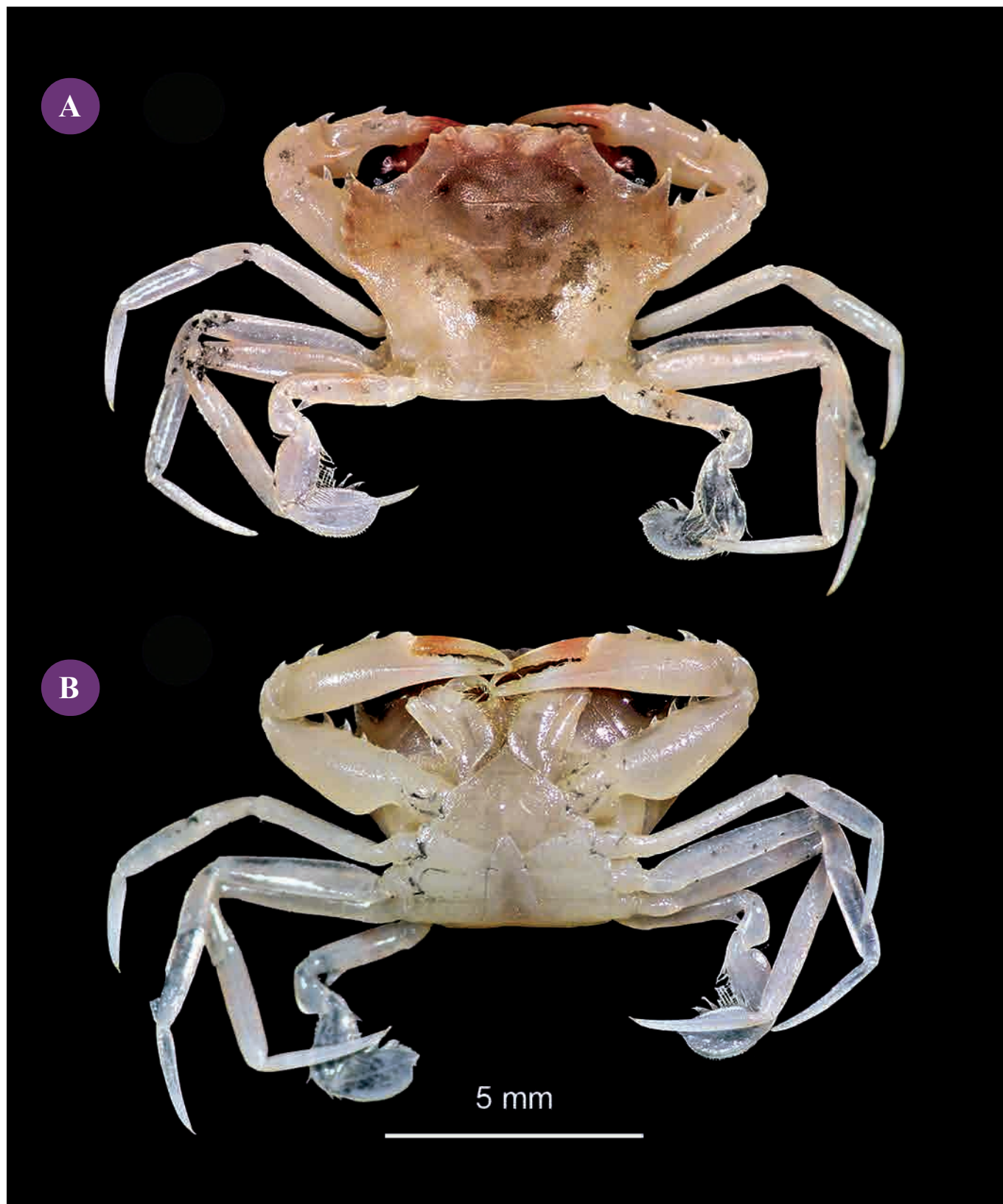


Figure 428. Male of *Thalamita bandusia* Nobili, 1906 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Main Diagnostic Features.

1. Carapace smooth, about 1.4–1.5 times as wide as long, maximal width between fourth anterolateral teeth; dorsal surface with epibranchial ridge and 1 pair of widely separated gastric ridges; anterolateral margin with 4 teeth, first broadest, third smallest.
2. Front (excluding inner supraorbital lobe) of about same width as posterior margin, with 6 frontal lobes: median lobes rounded, slightly more prominent than truncate submedian lobes, latter broadest, lateral lobes narrowest, subtriangular; inner supraorbital lobes narrow and arcuate.
3. Pleonites 4–5 not keeled in both sexes; penultimate pleonite of males broader than long, with markedly converging lateral edges.
4. Chelipeds unequal, nearly smooth.
5. Ambulatory legs (pereiopods 2–5) with disto-posterior angles of merus and propodus rounded; dactyli long, much narrower than propodi, slightly curved.
6. Propodus of natatory fifth leg with 4–6 spinules on posterior border.
7. Colour in life: pale brown.
8. Size: maximal carapace length/width about 6 mm/8.5 mm, respectively.

Distribution. Western Indian Ocean from the Red Sea and the Gulf of Aden to the Arabian-Persian Gulf.

Ecology. Benthic on sandy-rocky bottoms; from the lower intertidal zone down to 45 m.

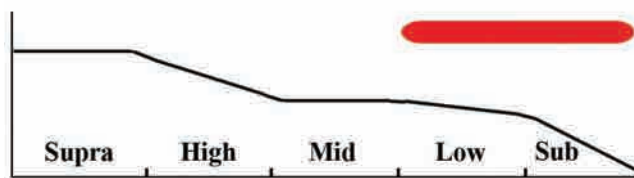


Figure 429. Bathymetric distribution of the species.

Remarks. *Thalamita bandusia* belongs to a small group of species with six frontal lobes, which also includes *T. primna*, differing from all of them by the presence of only one pair of gastric ridges and four teeth on the anterolateral margin. For the complete taxonomic account and/or illustrations of the species, see Apel and Spiridonov (1998) and Naderloo (2017).

Most Relevant References. Nobili 1906; Apel and Spiridonov 1998; Naderloo 2017.

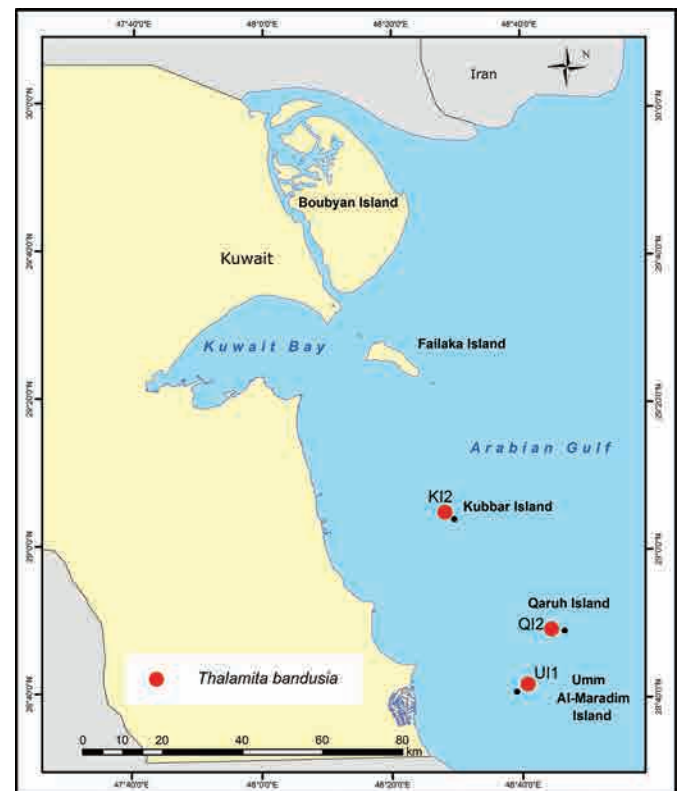


Figure 430. Presently known records of *Thalamita bandusia* in Kuwait.



Figure 431. Young individual of *Thalamita bandusia*, Kuwait. Photograph by Valeriy Skryabin.

Family Portunidae

Thalamita iranica Stephensen, 1946



Figure 432. Male of *Thalamita iranica* Stephensen, 1946 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Iranian swimming crab.

Main Diagnostic Features.

1. Carapace about 1.5 times wider than long; maximal width between fifth anterolateral teeth; surface with short pilosity; metabranchial region with 4 granulated ridges; anterolateral margin with 5 teeth, first and second broadest.
2. Front (excluding inner supraorbital lobe) of about same width as posterior margin, with 2 straight or slightly convex frontal lobes.
3. Penultimate pleonite of males with almost parallel lateral margins; pleonites 1–3 of females with transverse ridge over most of its width.
4. Chelipeds unequal, granulated.
5. Ambulatory legs (pereiopods 2–5) with disto-posterior angles of each merus slightly produced in males.
6. Colour in life: dorsal surface greenish grey with pale brown mottling; third maxilliped with bright blue stripes; cheliped dactylus with 3 stripes: grey-green, white, and brown; cheliped pollex with green, orange, and white stripes; ambulatory and natatory legs with blue spots.
7. Size: maximal size (carapace width/length) of males: 19.5 mm/13 mm; that of females: 14/10 mm.

Distribution. Western Indian Ocean: known only from the Red Sea, Gulf of Aden, Oman, and throughout the Arabian-Persian Gulf from the Straits of Hormuz to Kuwait.

Ecology. Benthic on sand, gravel, clay, rocks, rock-sand, pearl-oyster banks, algal bottoms, and corals (*Acropora* and *Pocillopora* spp.), coral rubble; from the low intertidal zone down to 58 m.

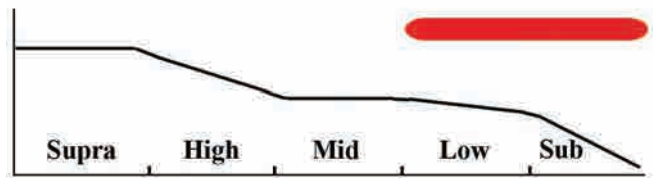


Figure 433. Bathymetric distribution of the species.

Remarks. *Thalamita iranica* is a small species of *Thalamita*, which can easily be recognized in the field by the presence of a bright blue band on the outer (third) maxilliped. This crab sometimes inhabits living corals, such as *Acropora* spp. and *Pocillopora* spp. (Spiridonov and Neumann 2008). Excellent illustrations of the general morphology of *T. iranica* can be found in Stephensen (1946), Apel and Spiridonov (1998) and Naderloo (2017).

Most Relevant References. Stephensen 1946; Apel and Spiridonov 1998; Spiridonov and Neumann 2008; Naderloo and Türkay 2012; Naderloo 2017.

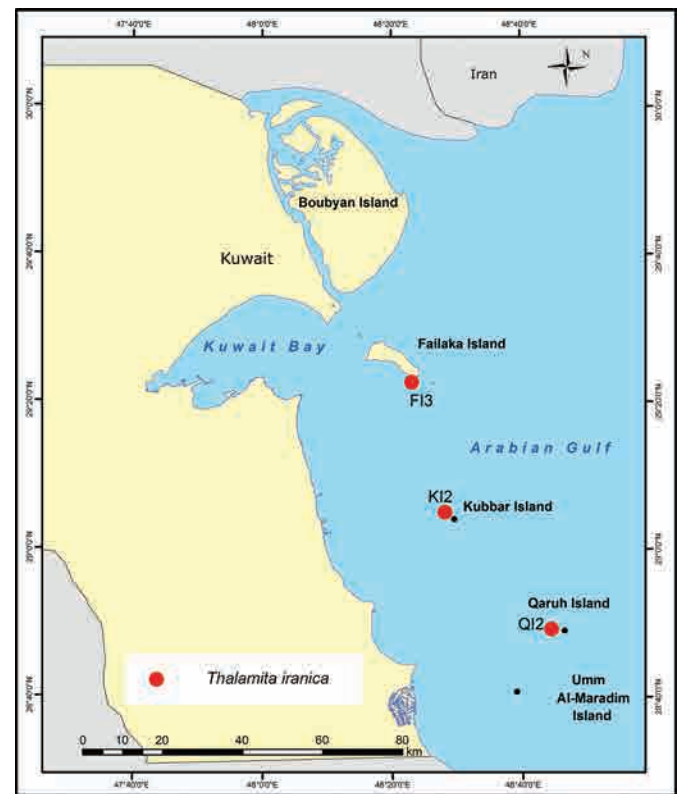


Figure 434. Presently known records of *Thalamita iranica* in Kuwait.

Family Portunidae

Thalamita savignyi A. Milne-Edwards, 1861

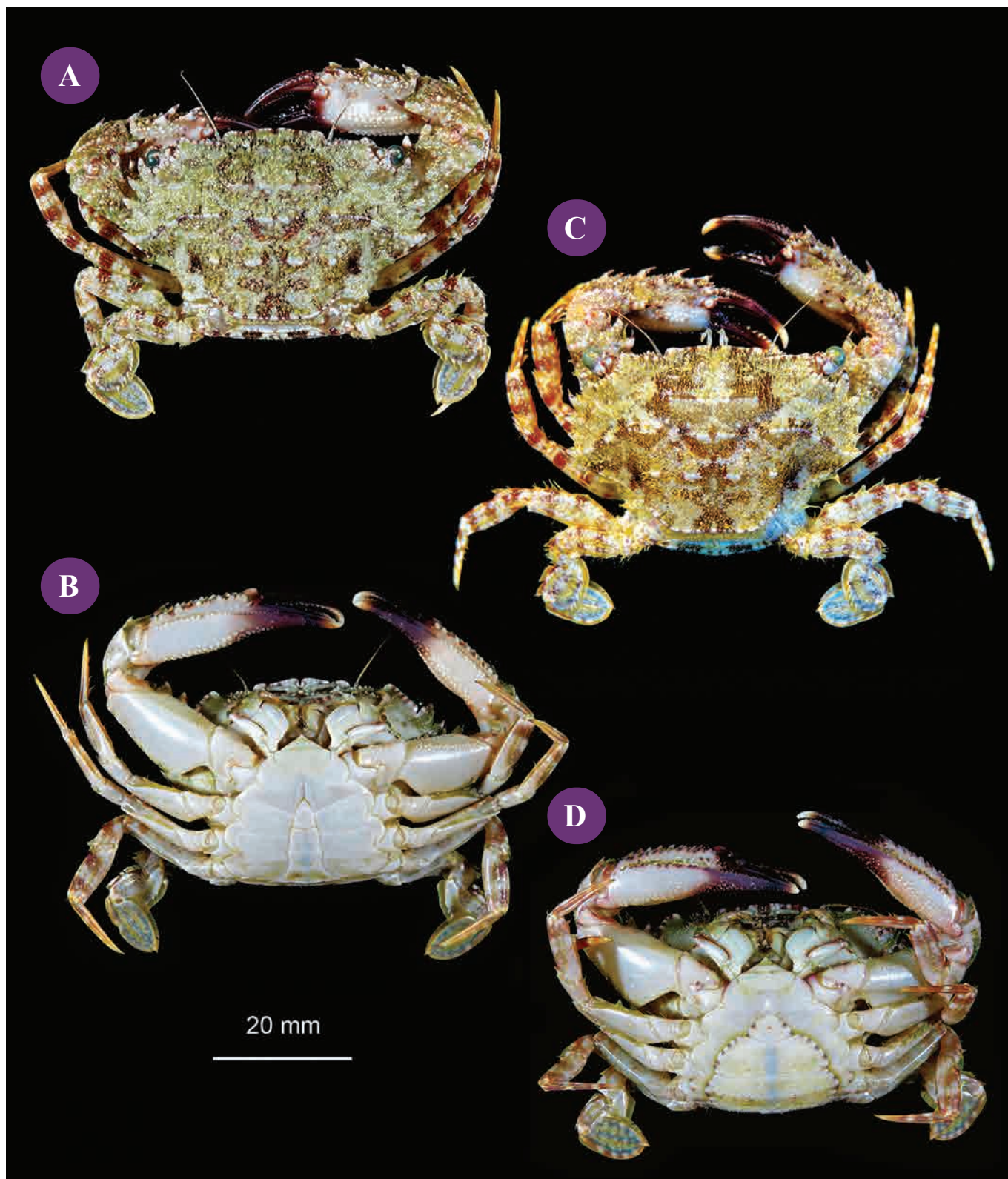


Figure 435. Male of *Thalamita savignyi* A. Milne-Edwards, 1861 in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Thalamita admete* var. *savignyi* A. Milne-Edwards, 1861.

Common Name. Savigny's swimming crab.

Main Diagnostic Features.

1. Carapace 1.6–1.7 times as broad as long; anterior and mesobranchial carapace ridges present, markedly granular; anterolateral margin with 5 sharp teeth, 2nd and 3rd broadest, 4th only slightly smaller than the others, 5th longest, curved, sharp, directed anteriorly.
2. Front with 2 markedly concave frontal lobes.
3. Basal antennal article markedly longer than orbit, with ridge made up of large conical granules.
4. Chelipeds unequal in size.
5. Ambulatory legs (pereiopods 2–5) with disto-posterior margin of merus angled and disto-posterior margin of propodus spiniform; dactyli of pereiopods 2–4 rather broad, slightly curved; natatory leg (pereiopod 5) with posterior margin of propodus armed with up to 8 spinules.
6. Colour in life: carapace and ambulatory legs marbled with brown and white to pale yellowish; cheliped fingers with reddish-brown base, dark-brown median part, and pale fingertips.
7. Size: maximal carapace width/length: 53 mm/31.5 mm for males, 54.5 mm/34 mm for females.

Distribution. Western Indian Ocean: from the Red Sea and East Africa to the Arabian-Persian Gulf and the Arabian Sea.

Ecology. Benthic on hard bottoms, including rocks, cobble, rubble, and corals; in the low intertidal and shallow subtidal zone (0.5–10 m).

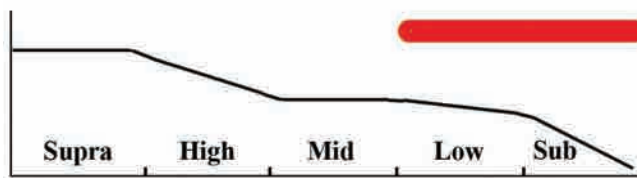


Figure 436. Bathymetric distribution of the species.

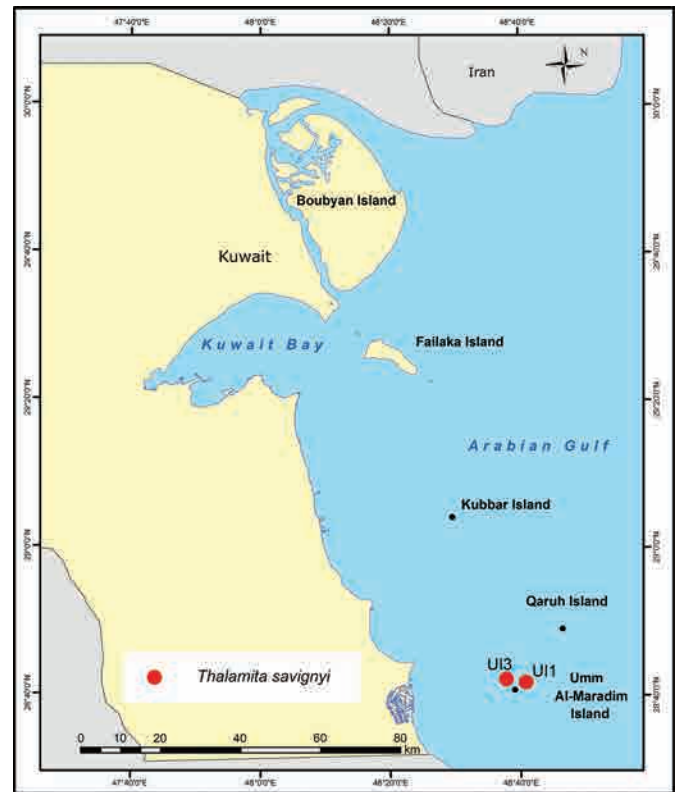


Figure 437. Presently known records of *Thalamita savignyi* in Kuwait.

Remarks. *Thalamita savignyi* is morphologically similar to the common Indo-West Pacific *T. admete*, although significantly larger. In addition, *T. savignyi* has concave frontal lobes; whereas, in *T. admete*, they are straight. Similar to the previous species, *T. savignyi* may occasionally be found inside living corals (Spiridonov and Neumann 2008). For a complete taxonomic account and/or illustrations of the species, see Apel and Spiridonov (1998) and Naderloo (2017).

Most Relevant References. Apel and Spiridonov 1998; Spiridonov and Neumann 2008; Naderloo 2017.



Figure 438. *Thalamita savignyi* from Failaka Island (A) and Umm Al-Maradim Island (B), Kuwait. Photographs by Arthur Anker (A) and Valeriy Skryabin (B).

Family Portunidae

Thranita rubridens (Apel and Spiridonov, 1998)



Figure 439. Female of *Thranita rubridens* (Apel and Spiridonov, 1998) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Thalamita rubridens* Apel and Spiridonov, 1998.

Main Diagnostic Features.

1. Carapace 1.5–1.6 times as wide as long, smooth, with some pilosity in larger specimens; frontal, protogastric, mesogastric, metagastric, and epibranchial carapace ridges present, faintly granular; anterolateral margin with 5 sharp, black-tipped teeth.
2. Front (excluding inner supraorbital lobes) distinctly wider than posterior margin, straight or slightly produced, subdivided into 6 lobes, median and submedian lobes broadly truncate, lateral lobes rounded.
3. Chelipeds unequal; merus with 3 strong spines on anterior surface.
4. Colour in life: background beige to greenish, with bright pink or reddish markings along the frontal edge.
5. Size: maximal carapace width/length: 73 mm/46 mm for males, 60 mm/37 mm for females.

Distribution. Western Indian Ocean: endemic to the Arabian-Persian Gulf.

Ecology. Benthic on various hard substrates, especially rocky shores and coral reefs; from the low intertidal zone to at least 9 m.

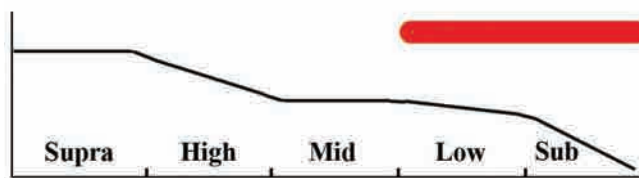


Figure 440. Bathymetric distribution of the species.

Remarks. *Thranita rubridens* is very close to *T. cerasma* from South-East Asia and Japan, and both species share many morphological features, and therefore, are probably related to the common and widespread Indo-West Pacific *T. prymna* (Apel and Spiridonov 1998). It must be noted that the genus *Thranita* was recovered as being embedded within *Thalamita* in the recent molecular phylogeny of the Portunidae by Evans (2018) and maybe eventually synonymised; in this case, the name of the species would return to the originally proposed name, *Thalamita rubridens*.

Most Relevant References. Apel and Spiridonov 1998; Naderloo and Türkay 2012; Naderloo 2017; Evans 2018.

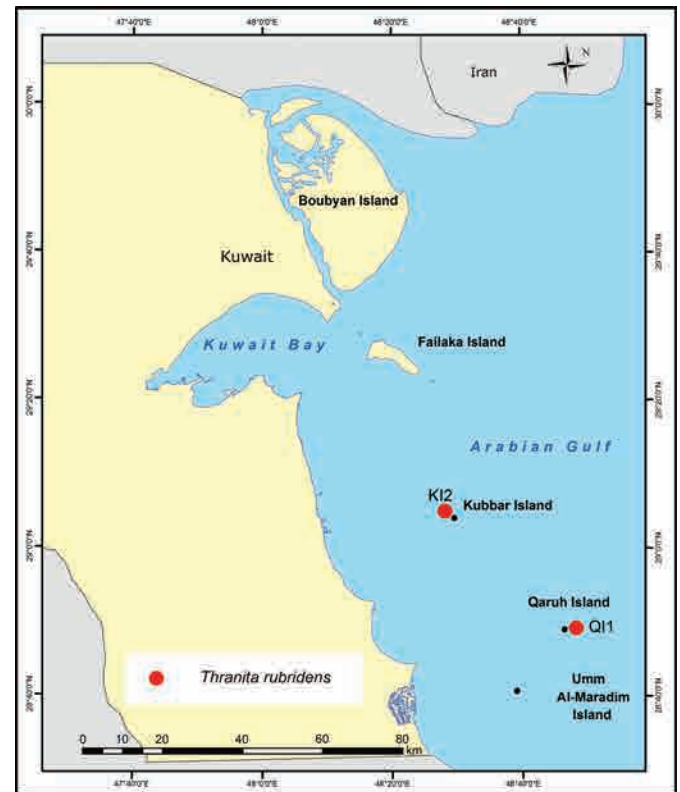


Figure 441. Presently known records of *Thranita rubridens* in Kuwait.



Figure 442. Clawless male of *Thranita rubridens* in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Family Tetraliidae

Tetralia cavimana Heller, 1860

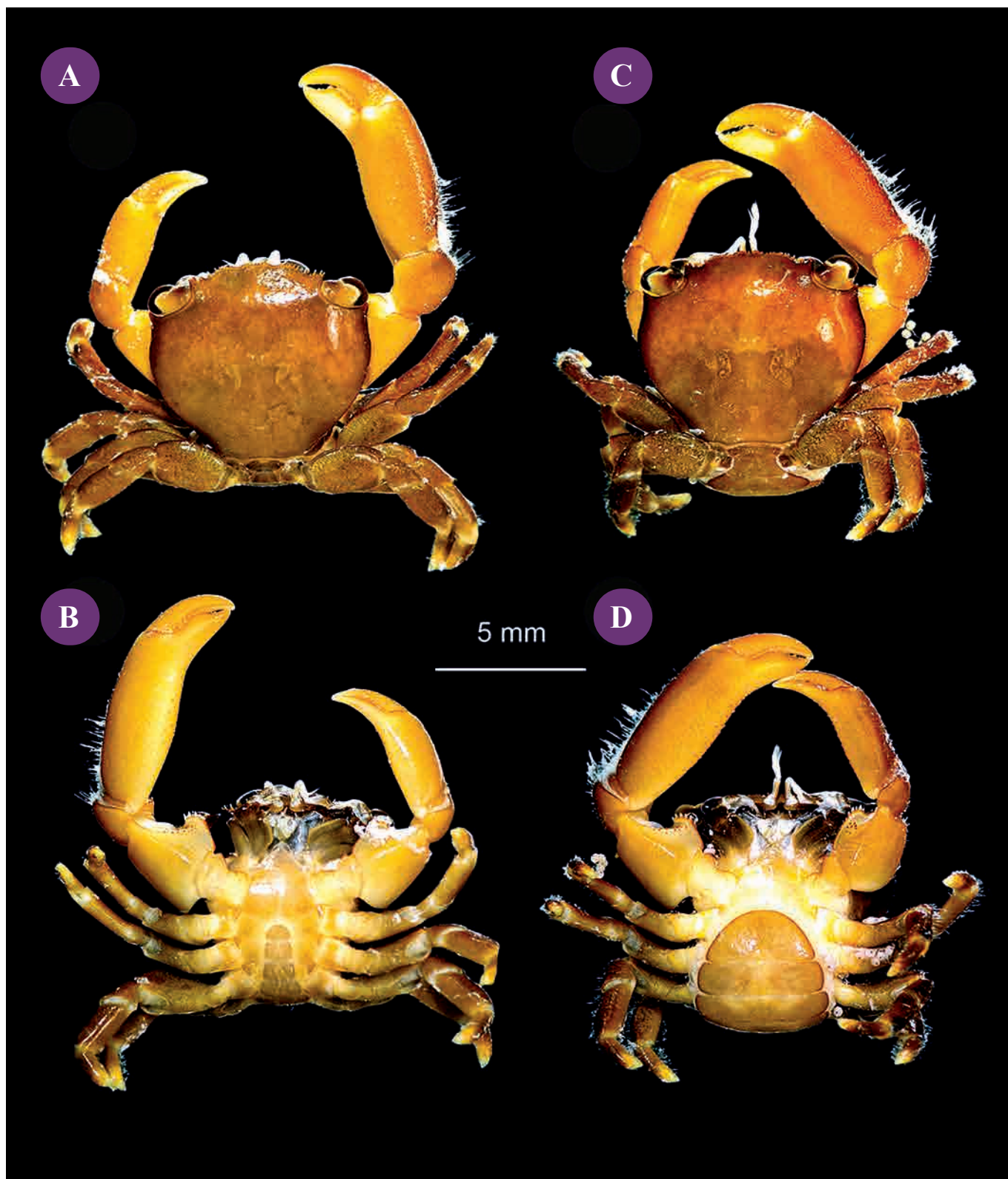


Figure 443. Male of *Tetralia cavimana* Heller, 1860 in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Heller's coral crab.

Main Diagnostic Features.

1. Carapace trapezoid, wider than long, strongly flattened dorsally, smooth; lateral margin sharp, arcuate; anterolateral margin ending anteriorly in prominent, sharp postorbital angle.
2. Frontal margin sinuous, dentate, prominent beyond supraorbital angle and separated from it by a well-defined gap; frontal pectination larger laterally; supraorbital angle crenulate.
3. First maxilliped with obliquely cut endopod; third article of outer (third) maxilliped rounded.
4. Chelipeds unequal in size; distal anterior angle of merus distinctly crested, prominently dentate.
5. Male gonopod (G1) curved, distal third fringed with setae.
6. Colour: yellowish to pale brownish, with margins rimmed with orange; cheliped dactylus red-orange.
7. Size: maximal carapace width/length ca. 7 mm/7.5 mm for males and 6.5 mm/8 mm for females.

Distribution. Western Indian Ocean: from the Red Sea and the Gulf of Aden to Seychelles and the Arabian Sea, including the Arabian-Persian Gulf.

Ecology. Benthic on coral reefs; lowest intertidal zone to at least 14 m; obligate associate of corals (*Acropora* spp.).

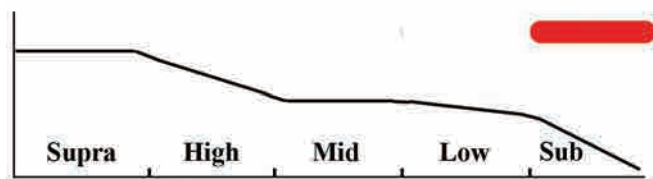


Figure 444. Bathymetric distribution of the species.

Remarks. *Tetralia cavimana* was often confused with *T. glaberrima*, but according to Galil (1988), *T. cavimana* is unique among the species of *Tetralia* in possessing a well-defined, prominently cut supraorbital angle; a jutting crest on the distal angle of the cheliped merus; and an obliquely cut endopod of the maxilliped 1. For good illustrations of this species, see Paulson (1875), Galil (1988) and Naderloo (2017).

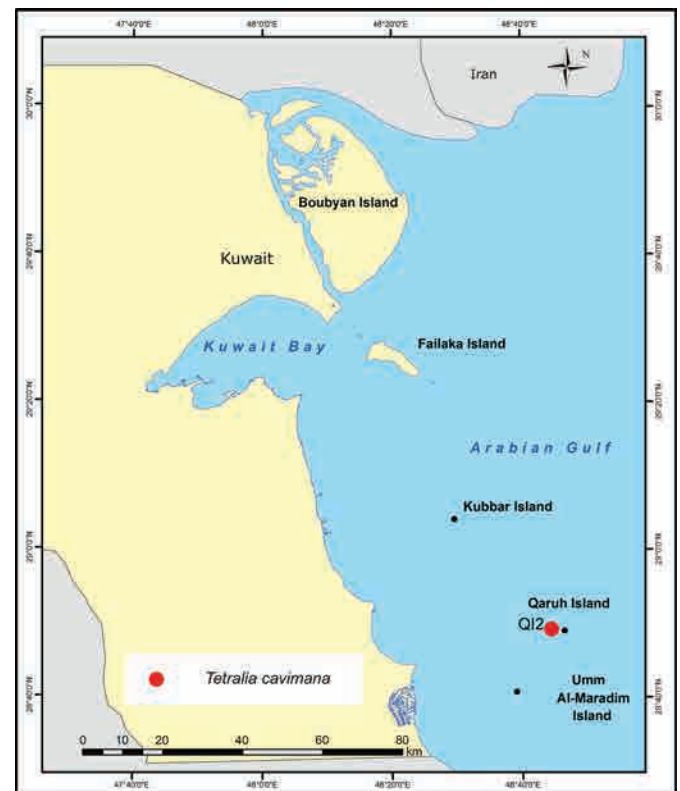


Figure 445. Presently known record of *Tetralia cavimana* in Kuwait.

Most Relevant References. Paulson 1875; Galil 1988; Castro 1999; Naderloo 2017.



Figure 446. *Tetralia cavimana* in situ at Qaruh Island, Kuwait (A, B). Photographs by Husain Alqallaf.



Figure 447. *Tetrulia cavimana* in situ off Qaruh Island, Kuwait.
Photograph by Faisal Al-Sarraf.



Figure 448. *Tetralia cavimana* in situ off Qaruh Island, Kuwait.
Photograph by Maryam Fahad AlMashaan AlMeshaweh.

Family Xanthidae

Actaea jacquelinae Guinot, 1976

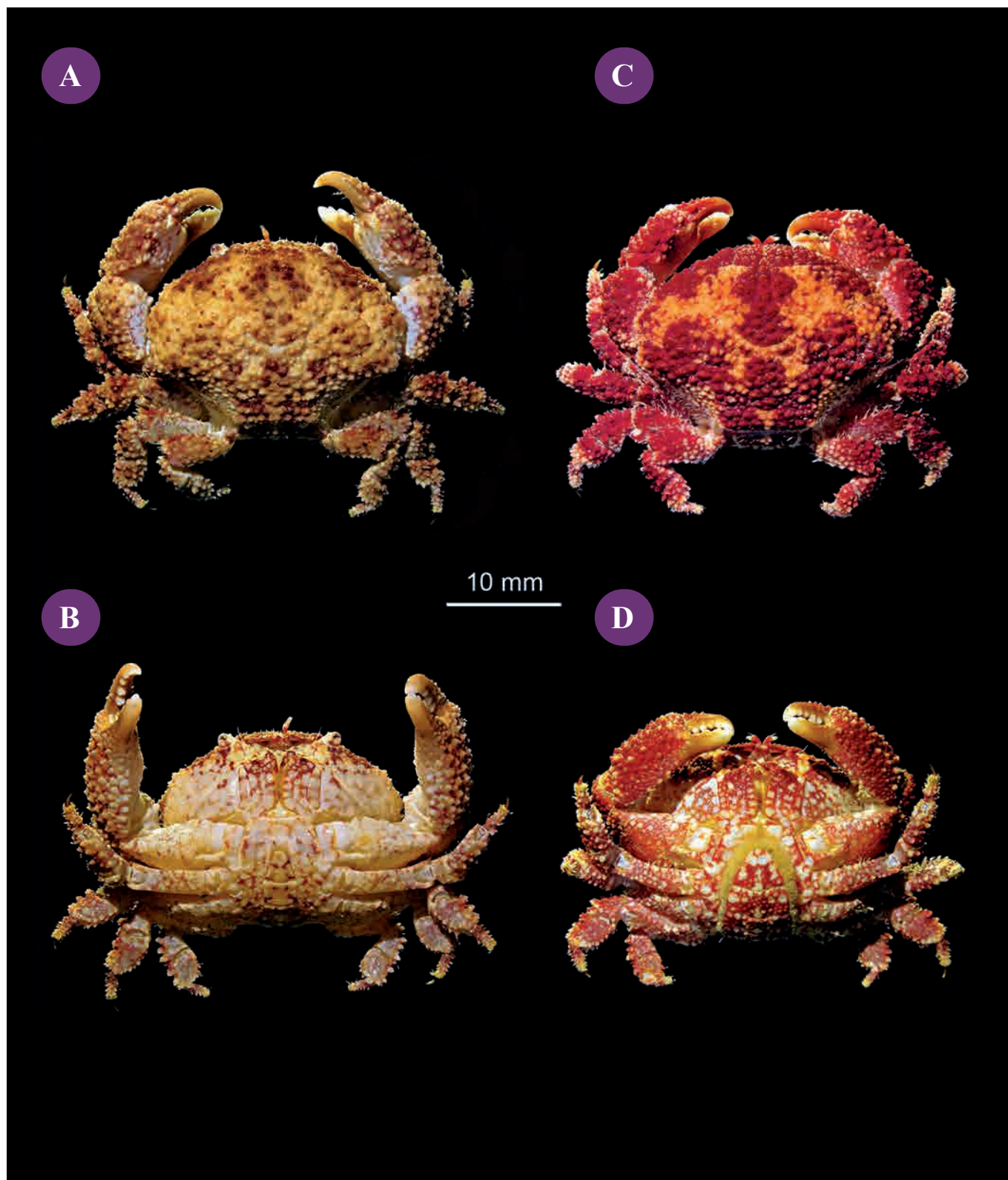


Figure 449. Male of *Actaea jacquelinae* Guinot, 1976 in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Jacqueline's spiny-legged rock crab.

Main Diagnostic Features.

1. Carapace ovoid; dorsal region covered with large, smooth, rounded, petaloid, closely confluent tubercles; carapace regions demarcated by narrow furrows; anterolateral margin slightly arcuate, divided into 4 poorly defined, tuberculate, rounded lobes; posterolateral margin shorter, slightly concave, bearing a prominent row of tubercles.
2. Front strongly deflexed, about 0.35 times carapace width, bilobed.
3. Chelipeds subequal, robust, strongly tuberculate.
4. Ambulatory legs (pereiopods 2–5) densely tuberculate, with larger, conical tubercles dorsally on carpus and propodus.
5. Colour in life: carapace yellowish with prominent purplish brown or red-brown blotches on orbital and cardiac regions; chelipeds and ambulatory legs similarly coloured; cheliped fingers dark brown to black in males, paler in females.
6. Size: males measuring up to 17.5 mm/23 mm and females up to 16.5 mm/22.5 mm of carapace length/width, respectively.

Distribution. Northern Indian Ocean: from Arabian-Persian Gulf to India.

Ecology. Benthic on rocky bottom; most commonly found in the mid-intertidal zone.

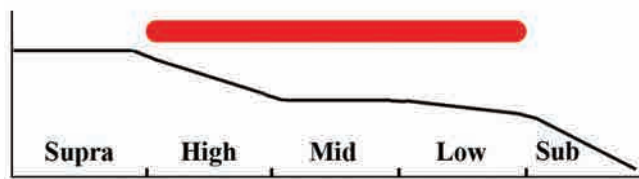


Figure 450. Bathymetric distribution of the species.

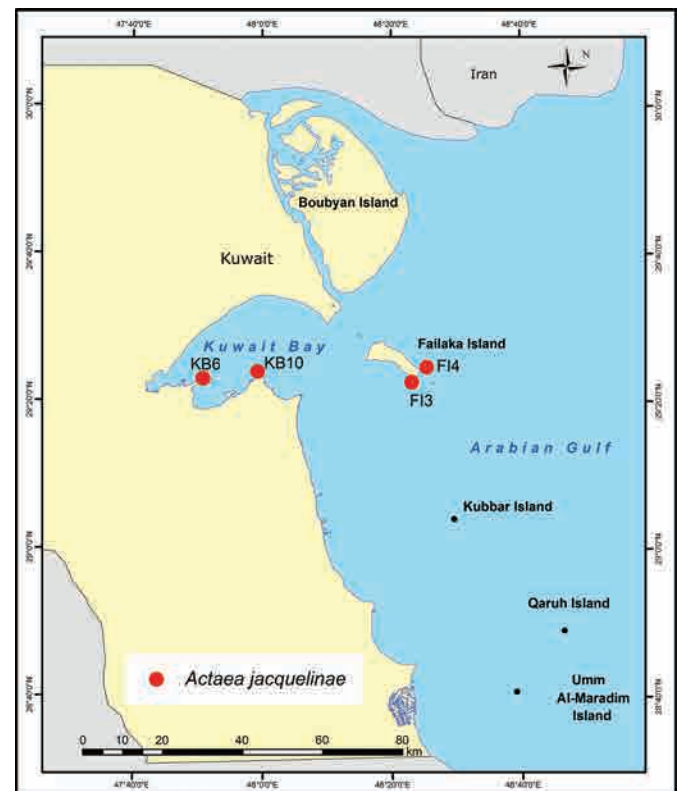


Figure 451. Presently known records of *Actaea jacquelinae* in Kuwait.

Remarks. We tentatively followed Naderloo (2017) in identifying the Kuwaiti material as *Actaea jacquelinae* and not as *A. savignii* (also known as *A. savignyi*), as did Stephensen (1946) and several other authors prior to Guinot's (1976) publication, including Jones (1986a) and Al-Kandari et al. (2017). The differences between the two species are indeed minor and the validity of these two species still needs to be confirmed, for example, genetically.

Most Relevant References. Stephensen (1946, as *A. savignyi*); Guinot 1976; Jones 1986a (as *A. savignyi*); Naderloo 2017.



Figure 452. Frontal view of *Actaea jacquelinae* from Failaka Island, Kuwait. Photograph by Valeriy Skryabin.

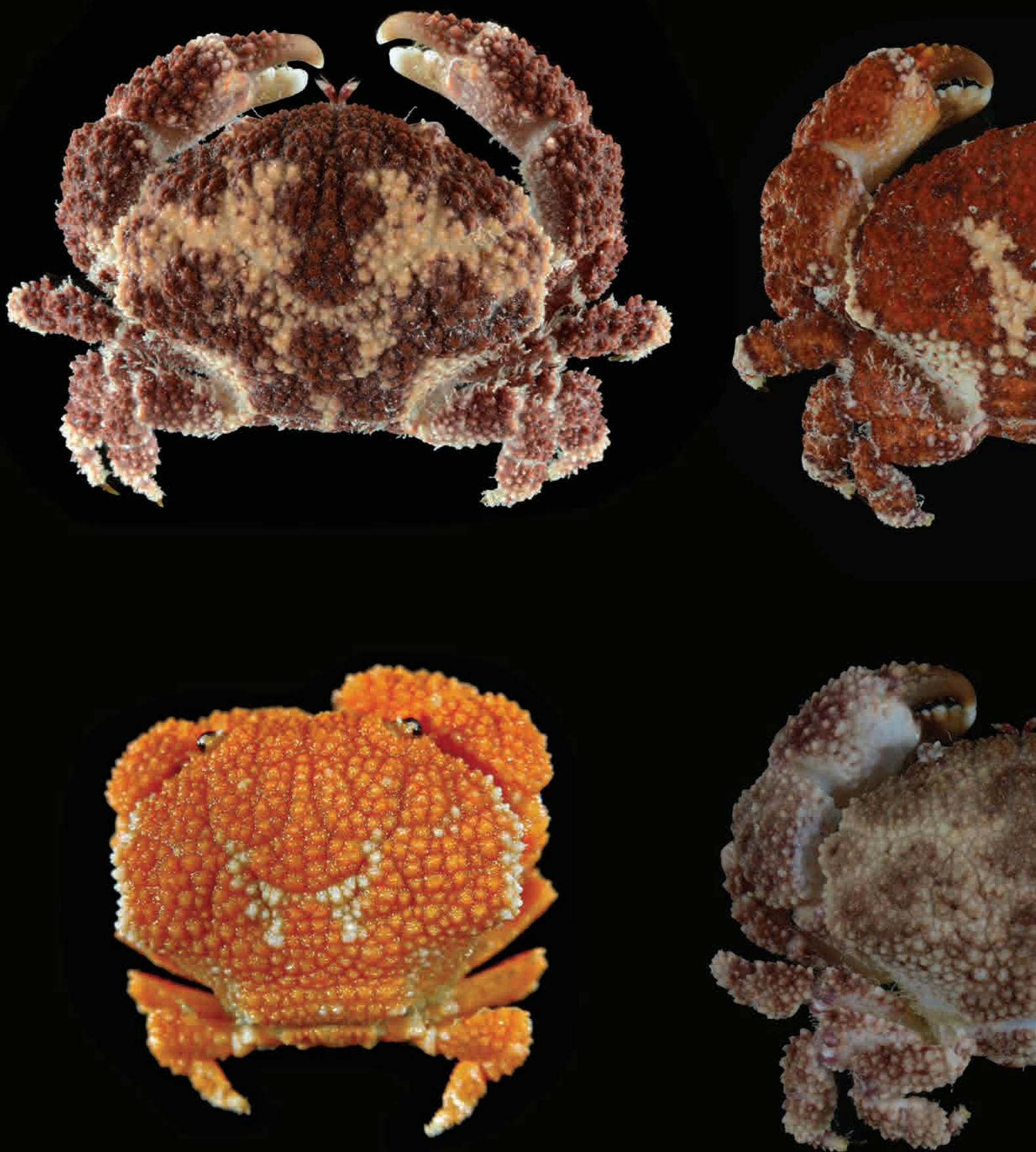
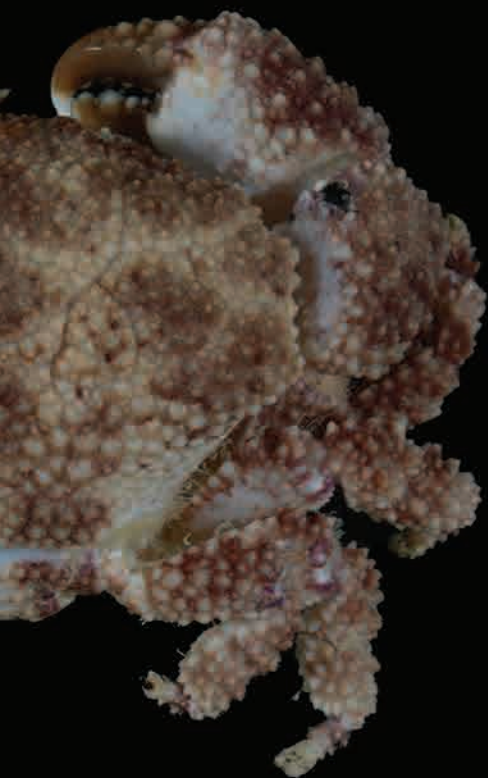
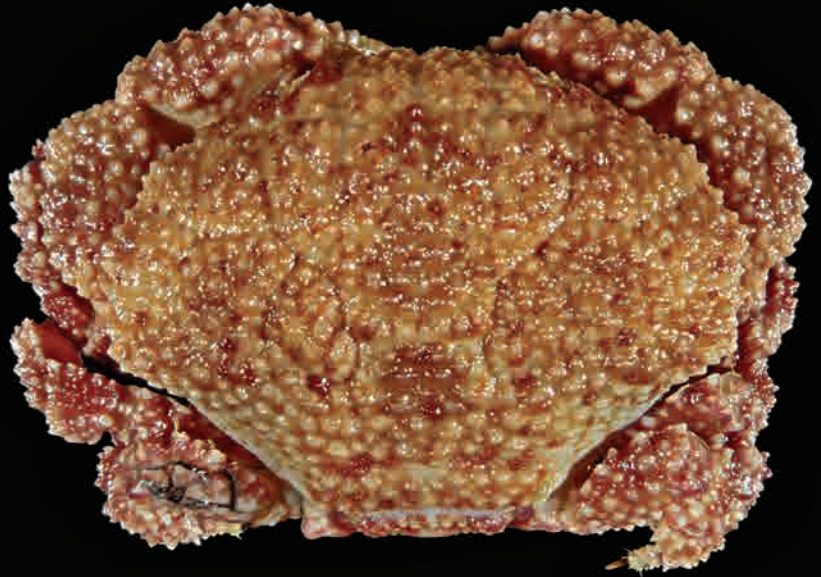


Figure 453. Colour variations of *Actaea jacquelinae*, all six specimens from Kuwait. Photographs by Valeriy Skryabin.



Family Xanthidae

Atergatis laevigatus A. Milne-Edwards, 1865

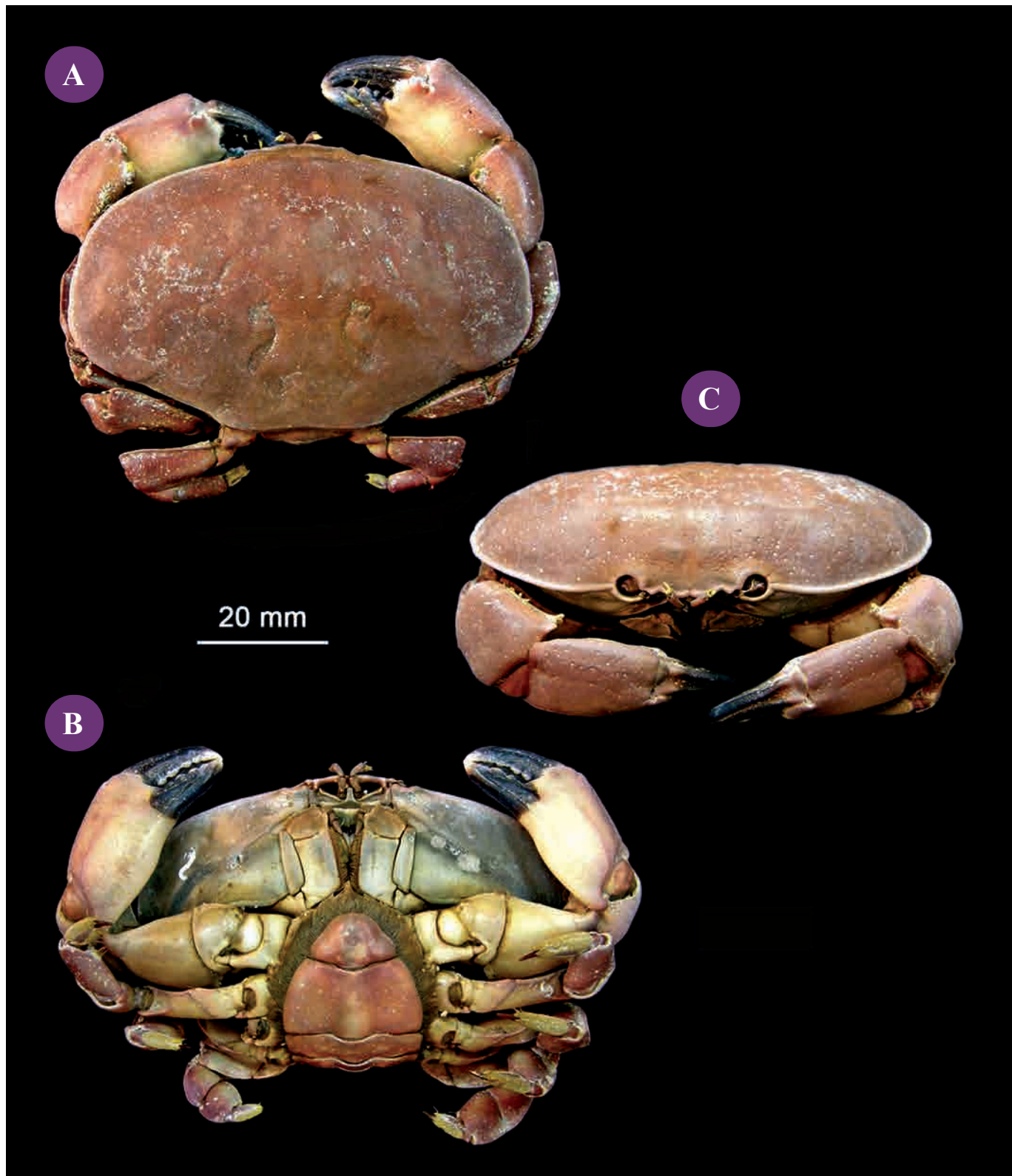


Figure 454. Female of *Atergatis laevigatus* A. Milne-Edwards, 1865 in dorsal (A), ventral (B) and frontal (C) views, Kuwait. Photographs by Valeriy Skryabin.

Common Names. Bashful crab; elliptical stone crab.

Main Diagnostic Features.

1. Carapace domed, enlarged, much wider than long, elliptical, without clear indication of regions; surface finely pitted; anterolateral and posterolateral margins unarmed, gently curved.
2. Front sloping, slightly sinuous, with broad median lobes.
3. Chelipeds smooth; palms slightly keeled dorsally, with slightly hollowed, spoon-shaped fingers.
4. Walking legs (pereiopods 2–5) short, with sharp ridges.
5. Colour in life: dorsal surface of carapace, chelipeds, and ambulatory legs dark pink-red to red-brown, with paler pits; ventral side yellowish.
6. Size: length/width reaching 70 mm/110 mm in males, 52 mm/86 mm in females.

Distribution. Western Indian Ocean from the Red Sea to the Arabian-Persian Gulf and India.

Ecology. Benthic on hard bottoms; lower intertidal and shallow subtidal zones, to at least 20 m.

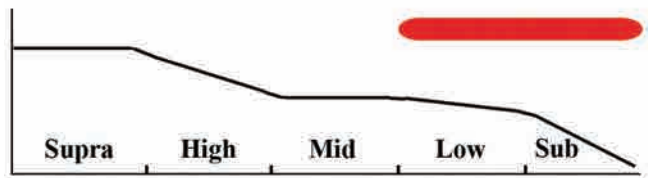


Figure 455. Bathymetric distribution of the species.

Remarks. Among the three species of *Atergatis* reported from the Arabian-Persian Gulf (Naderloo et al. 2016; Naderloo 2017), *A. laevigatus* is the only one lacking any trace of an epibranchial tooth, which is indicated in *A. integerrimus* and more noticeable, albeit blunt, in *A. ocyroe*. In fact, these three species have been confused several times in the past (Naderloo 2017), whereas *A. laevigatus* was confused with *A. roseus* (Tirmizi and Ghani 1996; Khot and Jaiswar 2021). Additional illustrations of *A. laevigatus*, including a colour photograph *in situ* at low tide, were published by Naderloo (2017) and Khot and Jaiswar (2021).

Most Relevant References. Milne-Edwards 1865; Tirmizi and Ghani 1996 (as *A. roseus*); Naderloo 2017; Khot and Jaiswar 2021.

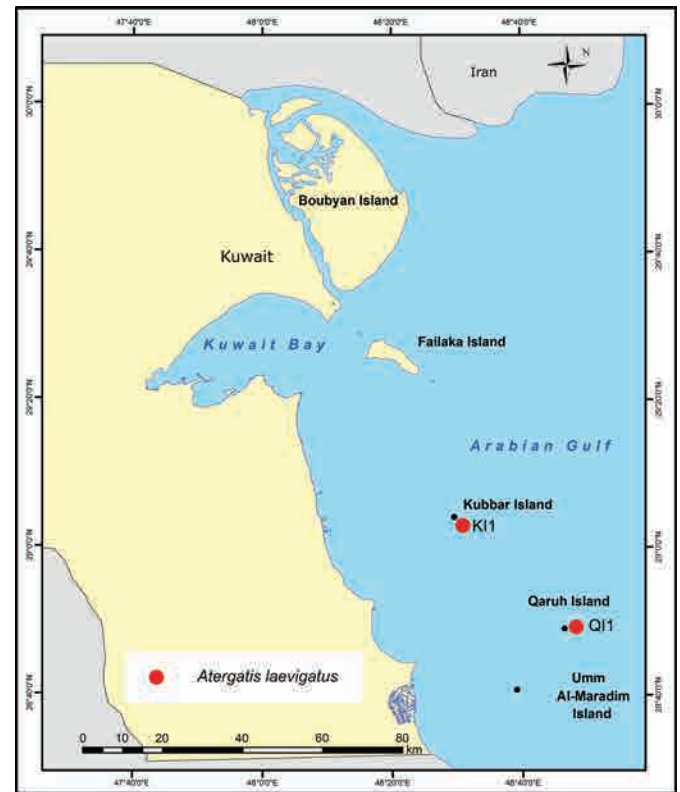


Figure 456. Presently known records of *Atergatis laevigatus* in Kuwait.



Figure 457. *Atergatis laevigatus* on a coral reef at Qaruh Island. Photograph by Faisal Al-Sarraf.



Family Xanthidae

Chlorodiella nigra (Forskål, 1775)

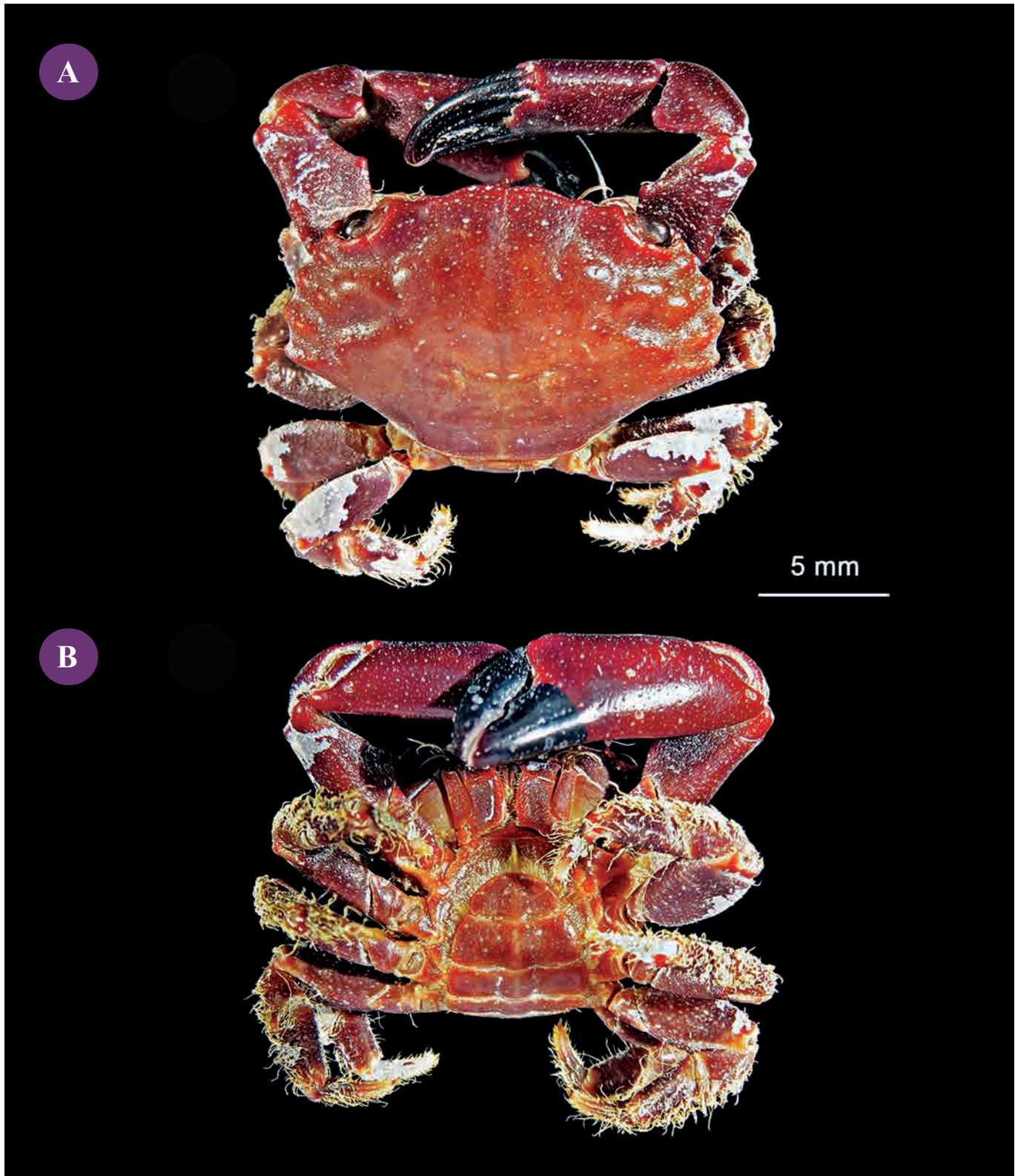


Figure 458. Female of *Chlorodiella nigra* (Forskål, 1775) in dorsal (A) and ventral (B) views, Kuwait. Preserved specimens. Photographs by Valeriy Skryabin.

Synonym. *Cancer niger* (Forskål, 1775).

Common Name. Blackish coral crab.

Main Diagnostic Features.

1. Carapace ovoid; dorsal surface relatively smooth, with faint tubercles on the anterolateral region; anterolateral margin with 4 blunt teeth.
2. Front faintly bilobed, broader than the posterior margin of carapace.
3. Chelipeds relatively long, smooth, and unequal; fingertips broad, spoon-shaped.
4. Walking legs (pereiopods 2–5) robust, setose; anterior margin of merus and carpus without spine.
5. Colour in life: carapace, chelipeds, and walking legs dark-brown or black; fingers black.
6. Size: maximal carapace width and length about 10.5 mm and 17 mm, respectively.

Distribution. Indo-West Pacific: from the Red Sea and South Africa to Japan, Hawaii, and French Polynesia.

Ecology. Benthic on hard bottoms, such as living and dead corals; usually dwelling deep in crevices of corals and coral rubble; shallow subtidal from 0.5 to 12 m, rarely in the intertidal zone.

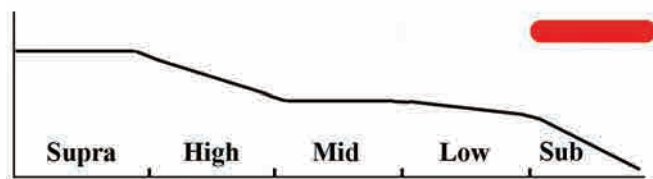


Figure 459. Bathymetric distribution of the species.

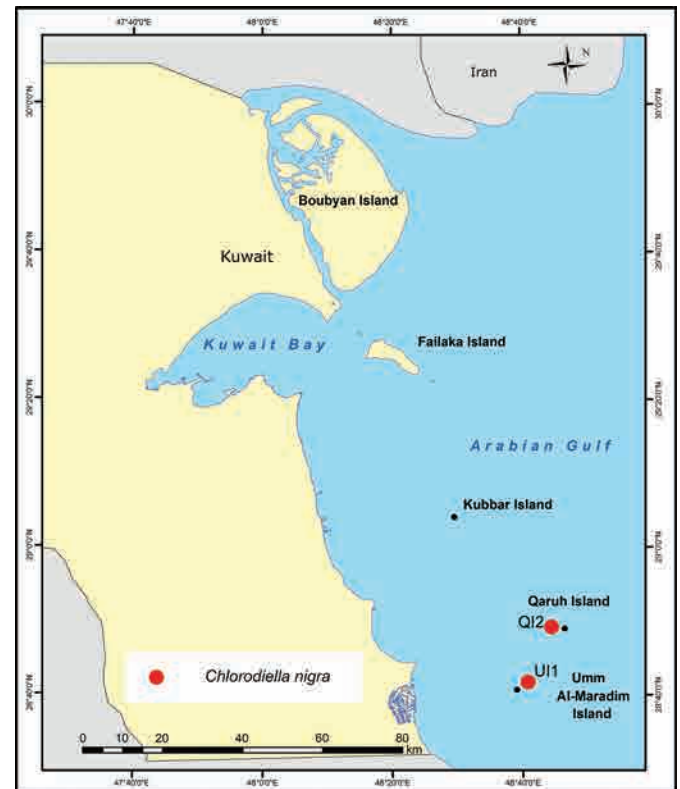


Figure 460. Presently known records of *Chlorodiella nigra* in Kuwait.

Remarks. *Chlorodiella nigra* is one of the most common and widespread Indo-Pacific coral-associated crabs, recognisable by its dark brown or black colour (Serène 1984; Naderloo 2017; Poupin et al. 2018).

Most Relevant References. Serène 1984; Neumann and Spiridonov 1999; Naderloo 2017; Poupin et al. 2018.



Figure 461. Male of *Chlorodiella nigra* in dorsal (A) and ventral (B) views, Oman. Photographs by Arthur Anker.

Family Xanthidae

Cyclodius drachi (Guinot, 1964)

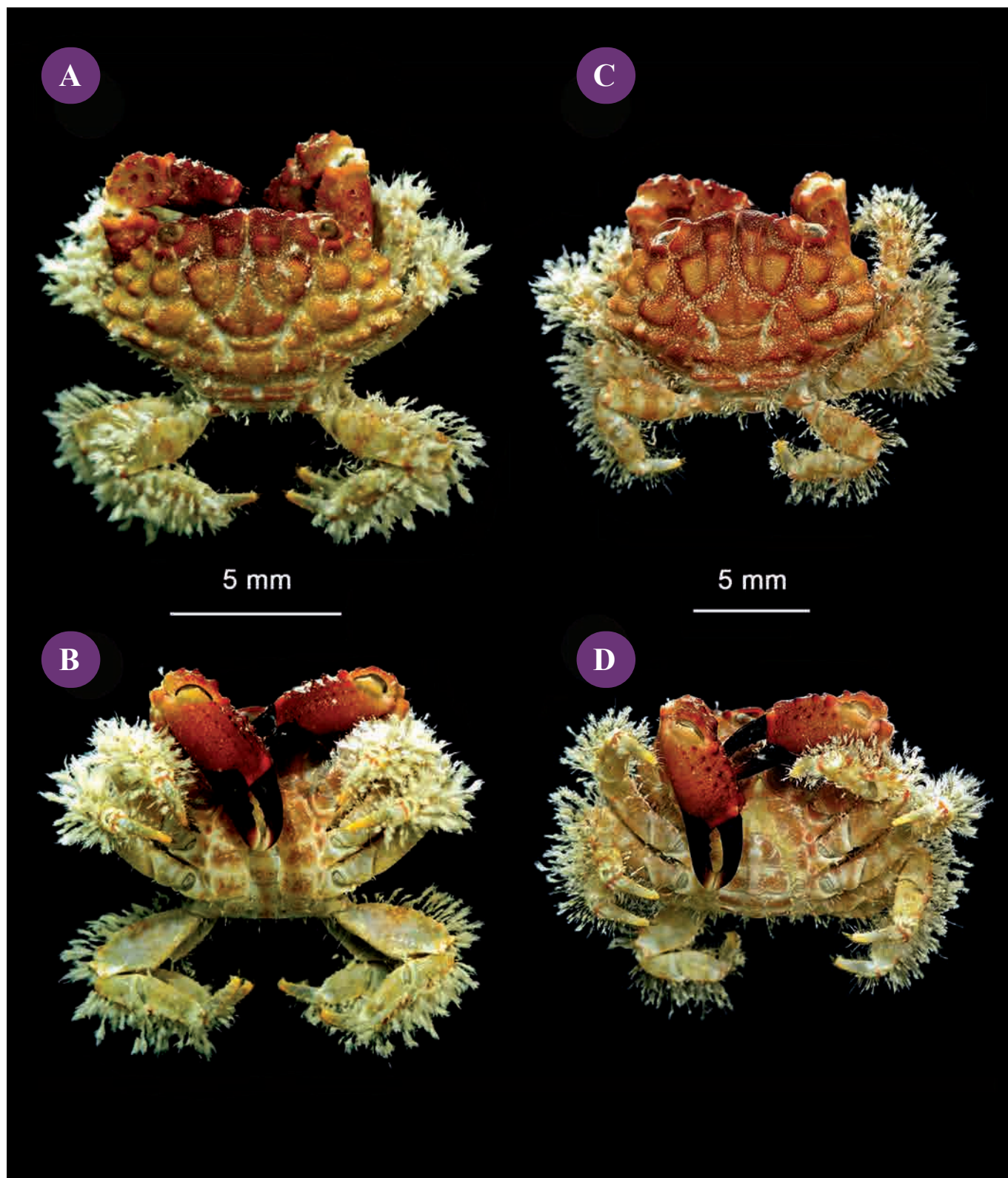


Figure 462. Male of *Cyclodius drachi* (Guinot, 1964) in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Phymodius drachi* Guinot, 1964.

Main Diagnostic Features.

1. Carapace ovoid; dorsal surface markedly uneven, heavily tuberculate, tubercles flattened, rounded, or subconical; anterolateral margin with 4 blunt teeth, last 2 more produced.
2. Front as broad as posterior margin of carapace.
3. Chelipeds relatively short, covered with large tubercles; fingertips conspicuously spoon-shaped.
4. Walking legs (pereiopods 2–5) covered with thick setae; anterior margins of merus and carpus armed with spines.
5. Male gonopod (G1) adorned distally with long plumose setae, with spatulate tip.
6. Colour in life: carapace overall brownish, darker anteriorly, especially near frontal area; chelipeds dark red-brown; walking legs pale yellow with brown banding.
7. Size: maximal carapace length/width ca. 6 mm/9 mm for males and 8 mm/11.5 mm for females.

Distribution. Western Indian Ocean from the Red Sea and Madagascar to the South-China Sea and Christmas Island.

Ecology. Benthic on rocky bottoms (rocky shores, cobbles, and coral reefs); low intertidal zone to 3 m.

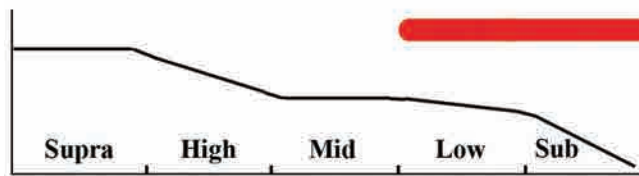


Figure 463. Bathymetric distribution of the species.

Remarks. *Cyclodius drachi* is one of the many similar-looking, dorsally tuberculate stone crabs from several genera (*Cyclodius*, *Paractaea*, etc.). Their identification requires a careful comparison of the number, size, and disposition of the tubercles, as well as the examination of the male gonopods, especially G1 (Guinot 1964; Naderloo 2017).

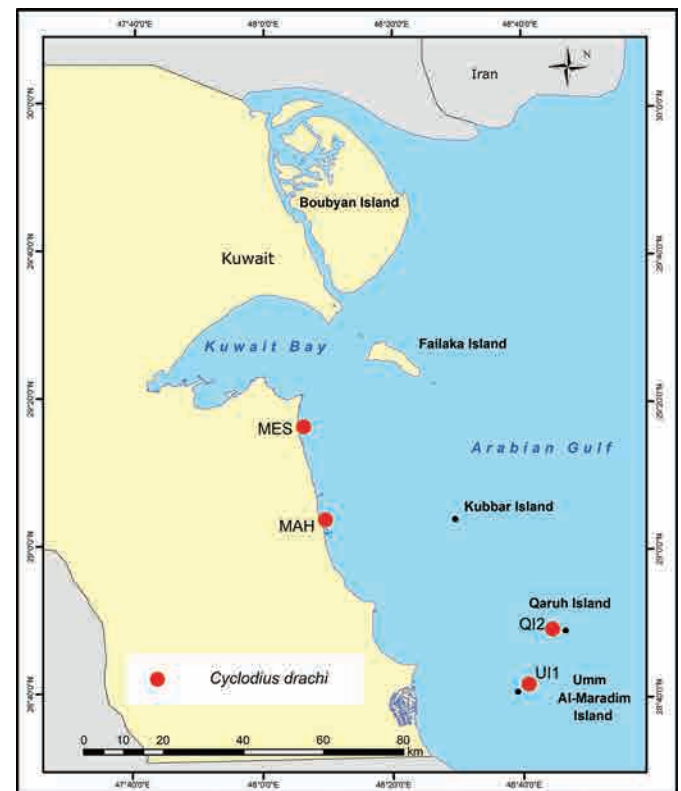


Figure 464. Presently known records of *Cyclodius drachi* in Kuwait.

The identification of the Kuwaiti material was based on the original account of Guinot (1964) and photographs from Naderloo (2017) and Poupin et al. (2018). A somewhat differently coloured crab from Christmas Island was reported as *C. drachi* by Mendoza et al. (2014), who noted that the tuberculation of the carapace and other characters are variable or difficult to discern in *Cyclodius*. Therefore, the correct identification of *C. drachi* is based on the diagnostic features of the male gonopod (G1).

Most Relevant References. Guinot 1964; Mendoza et al. 2014; Naderloo 2017; Poupin et al. 2018.



Figure 465. Dorsal view of *Cyclodius drachi*, Kuwait. Photograph by Arthur Anker.

Family Xanthidae

Leptodius exaratus (H. Milne Edwards, 1834)

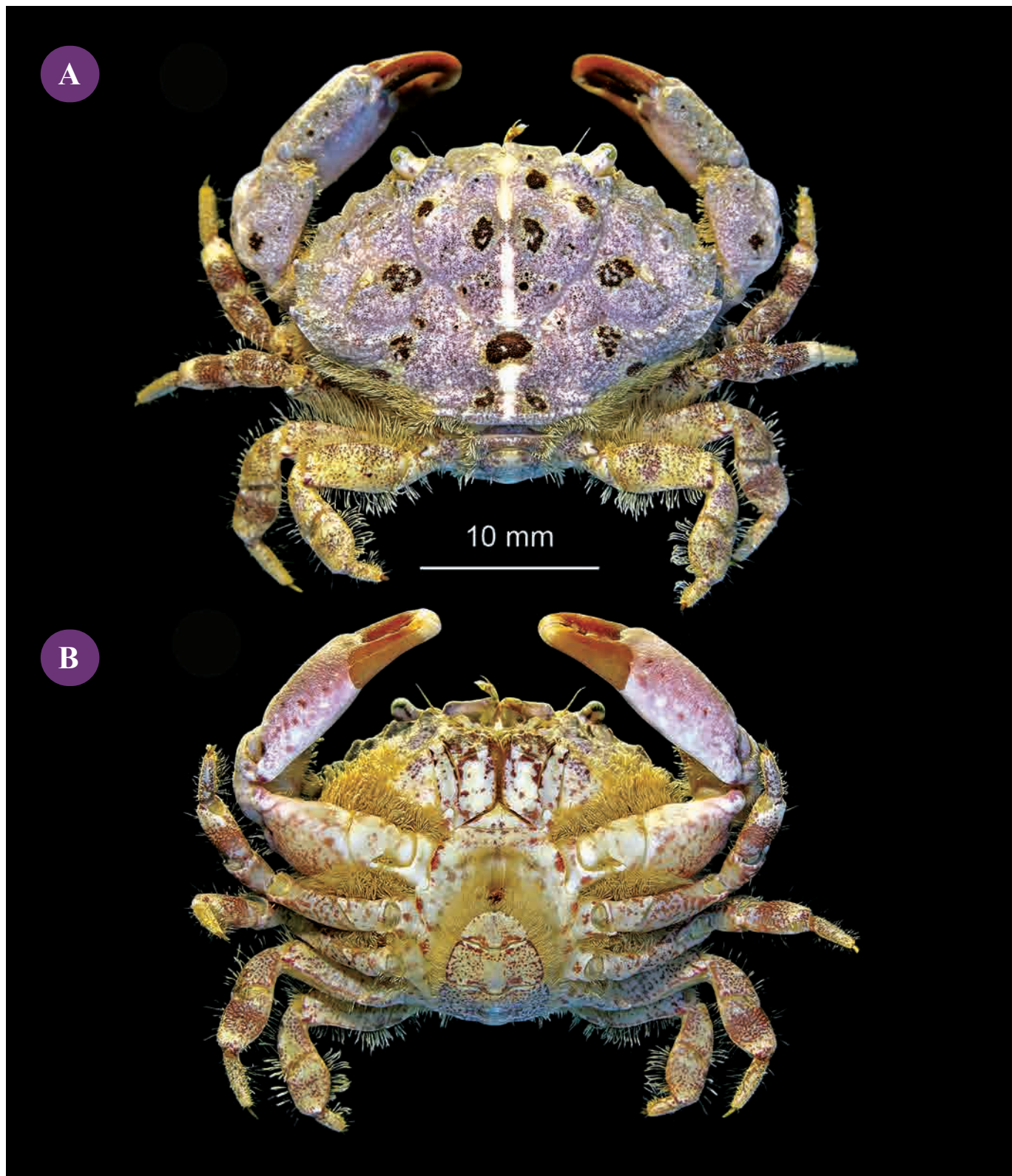


Figure 466. Female of *Leptodius exaratus* (H. Milne Edwards, 1834) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Chlorodius exaratus* H. Milne Edwards, 1834; *Xantho exaratus* (H. Milne Edwards, 1834); *Cancer inaequalis* Audouin, 1826; *Leptodius lividus* Paulson, 1875.

Common Name. Western fan round crab.

Main Diagnostic Features.

1. Carapace transversely subovate, about 1.5–1.6 times as broad as long; dorsal surface convex, finely granular, rugose, particularly at anterior and lateral regions; regions well defined, separated by distinct grooves; anterolateral margin with 4 broad, triangular teeth; posterolateral margin somewhat concave, granular.
2. Front about 0.2–0.3 times as broad as carapace width, almost quadridentate.
3. Chelipeds with fingers stout, darkly coloured.
4. First male gonopod (G1) with 6 curved spinules and long apical lobe in subdistal position, and with 8–10 mushroom-shaped marginal tubercles on one side.
5. Colour: variable, usually pale brown, grey, or dark grey-olive, sometimes with lilac, pink, or orange tones; dark spots and patches present or absent.
6. Size: maximal carapace length/width, 18 mm/27.5 mm.

Distribution. Western Indian Ocean from the Red Sea and South Africa to India.

Ecology. Benthic on hard bottoms (rocky and mixed sand-rocky-cobble shores, and coral reefs) from the high intertidal to shallow subtidal zones (0–6 m).

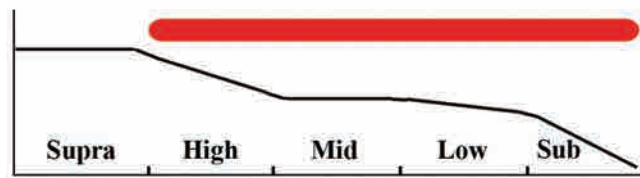


Figure 467. Bathymetric distribution of the species.

Remarks. *Leptodius exaratus* is one of the most frequently seen xanthid crabs, omnipresent in the intertidal and shallow subtidal areas across its distribution range spanning most of the tropical and subtropical western Indian Ocean, with many collection localities in Kuwait (Fig. 468) and throughout the Arabian-Persian Gulf (Naderloo and Türkay 2012; Naderloo 2017). Its almost morphologically identical sister species, *Leptodius affinis*, occurs from the eastern Indian Ocean (Myanmar) and western Australia to Japan and Hawaii (Lee et al. 2013). The shape of the first male gonopod (G1) is the only reliable character for the differentiation of *L. exaratus* from *L. affinis*.

Most Relevant References. Naderloo and Türkay 2012; Lee et al. 2013; Naderloo 2017.

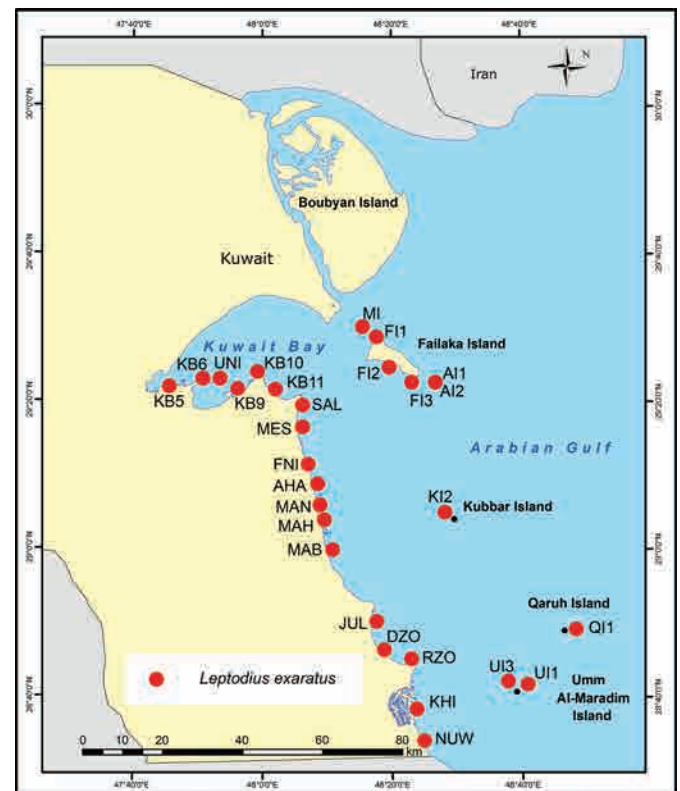


Figure 468. Presently known records of *Leptodius exaratus* in Kuwait.



Figure 469. *Leptodius exaratus* in situ, Auha Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 470. *Leptodius exaratus* in situ on the eastern coast of Failaka Island, Kuwait. Photograph by Arafat AlShuaibi.



Figure 471. *Leptodius exaratus* in situ in the rocky intertidal area of eastern Failaka Island, Kuwait. Photographs by Arafat AlShuaibi.



Family Xanthidae

Medaeops neglectus (Balss, 1922)



Figure 472. Female of *Medaeops neglectus* (Balss, 1922) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Xantho neglectus* Balss, 1922.

Main Diagnostic Features.

1. Carapace hexagonal, somewhat depressed, 1.5 times wider than long, with well-defined regions; dorsal regions of granulose near edges, with pilose transverse ridges; anterolateral margin convex with 4 triangular teeth; posterior margin 3 times wider than frontal margin, pubescent, central part slightly concave.
2. Front narrow, about 0.2 times as long as maximal carapace width, bilobed; post-frontal region with 2 deep lateral grooves and 1 median, posteriorly bifurcating groove.
3. Chelipeds subequal in size, robust.
4. Ambulatory legs (pereiopods 2–5) stout, flattened.
5. Colour in life: yellowish, with brown fingers.
6. Size: maximal carapace width/length ca. 11.5 mm/17.5 mm for males and 10.5 mm/15.5 mm for females.

Distribution. Western Indian Ocean: from the Red Sea and Madagascar to the Arabian-Persian Gulf.

Ecology. Benthic on rocky bottom, mainly in the low intertidal zone.

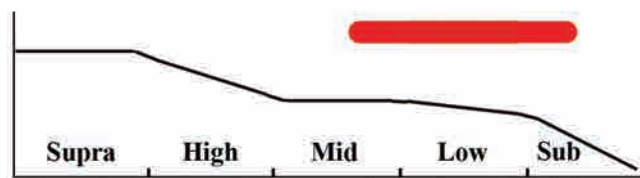


Figure 473. Bathymetric distribution of the species.

Remarks. *Medaeops neglectus* was recorded from Kuwait under the name *M. granulosus* by Jones (1986a); however, the drawings provided by D.A. Jones show *M. neglectus*. It is presently unknown if the real *M. granulosus* occurs in the Arabian-Persian Gulf, since specimens from UAE identified by Apel (2001) were re-identified as *M. neglectus* (Naderloo and Türkay 2012) and since the former species was not listed by Naderloo (2017). Generally, a taxonomic revision is needed to clarify the taxonomic status of the seven presently known and valid species of *Medaeops* (Guinot 1967; Serène 1984; Mendoza et al. 2009; Naderloo and Türkay 2012).

Most Relevant References. Balss 1922; Mendoza et al. 2009; Naderloo and Türkay 2012; Naderloo 2017.

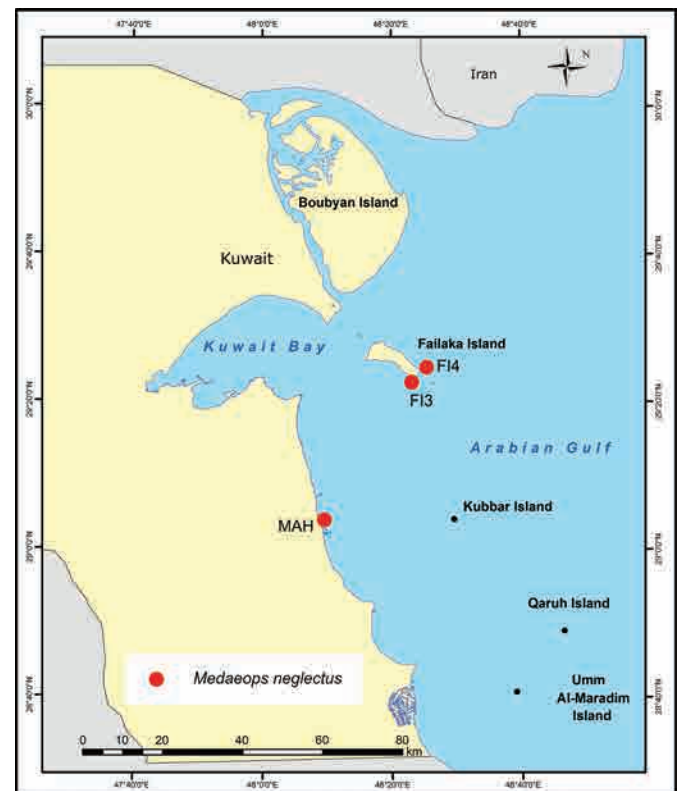


Figure 474. Presently known records of *Medaeops neglectus* in Kuwait.

Family Xanthidae

Psaumis cavipes (Dana, 1852)

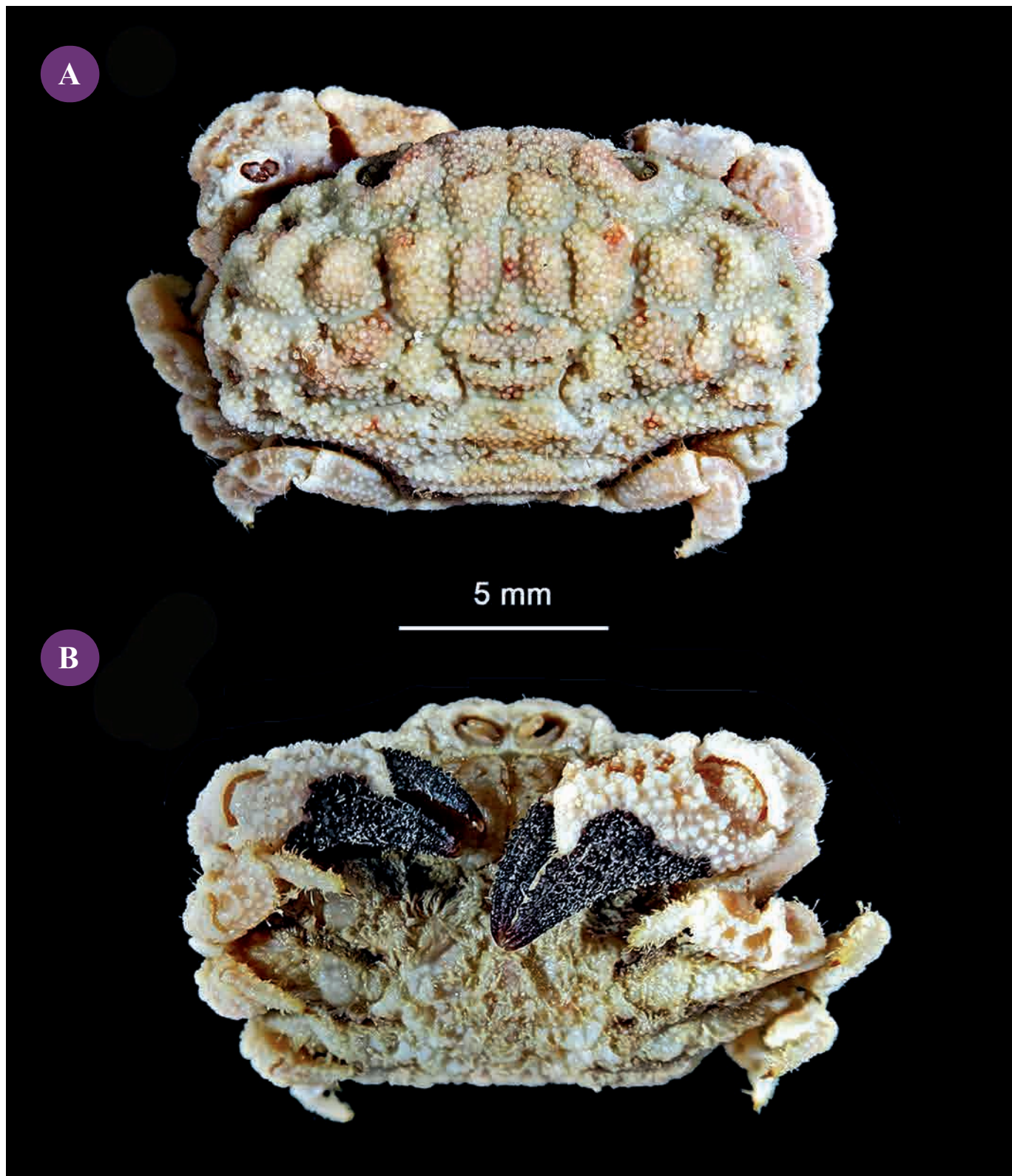


Figure 475. Male of *Psaumis cavipes* (Dana, 1852) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Actaeodes cavipes* Dana, 1852; *Actaea cavipes* (Dana, 1852); *Actaea cellulosa* Dana, 1852; *Actaea schmardae* Heller, 1860; *Glyptoxanthus cymbifer* Rathbun, 1914.

Common Name. Pit-legged crab.

Main Diagnostic Features.

1. Body almost entirely covered with small globular granules.
2. Carapace deeply areolate; protogastric regions subdivided into 2 oblong lobules by longitudinal furrow; branchial region with 6 lobules of irregular size; anterolateral margin with 4 small tuberculiform teeth posterior to extra-orbital angle; posterolateral margin with deep depression for the accommodation of last 3 pairs of walking legs.
3. Frontal lobes obliquely truncate, separated by broad, shallow V-shaped incision.
4. Chelipeds relatively small, subequal in size; carpus with large excavation on lateral surface.
5. Walking legs (pereiopods 2–5) with carpus and propodus, each with deep excavation on dorso-anterior surface.
6. Colour: pale brown with pinkish or orange tinge; cheliped fingers dark brown or blackish.
7. Size: small crab, maximal carapace length/width about 9 mm/15 mm.

Distribution. Indo-West Pacific: from the Red Sea to Madagascar to Japan, Samoa, and Australia.

Ecology. Benthic on hard bottoms, usually on coral reefs and adjacent coral rubble flats; low intertidal zone and adjacent shallow subtidal zone (to 5 m or so).

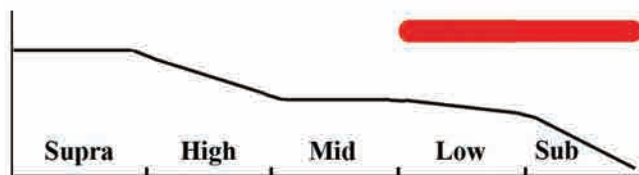


Figure 476. Bathymetric distribution of the species.

Remarks. *Psaumis cavipes* is a small, cryptic, and morphologically distinct crab, most commonly collected from under the coral rubble or extracted from crevices of dead corals. The general shape and excavated legs (nicely shown by Maenosono 2021), as well as the colouration of *P. cavipes*, significantly contribute to the crab's remarkable camouflage: in the natural habitat, it looks indeed like a small fragment of coral rubble. The species is quite common in the western Indian Ocean, as many recent records show (e.g. Poupin et al. 2018).

Most Relevant References. Heller 1860; Naderloo 2017; Poupin et al. 2018; Maenosono 2021.

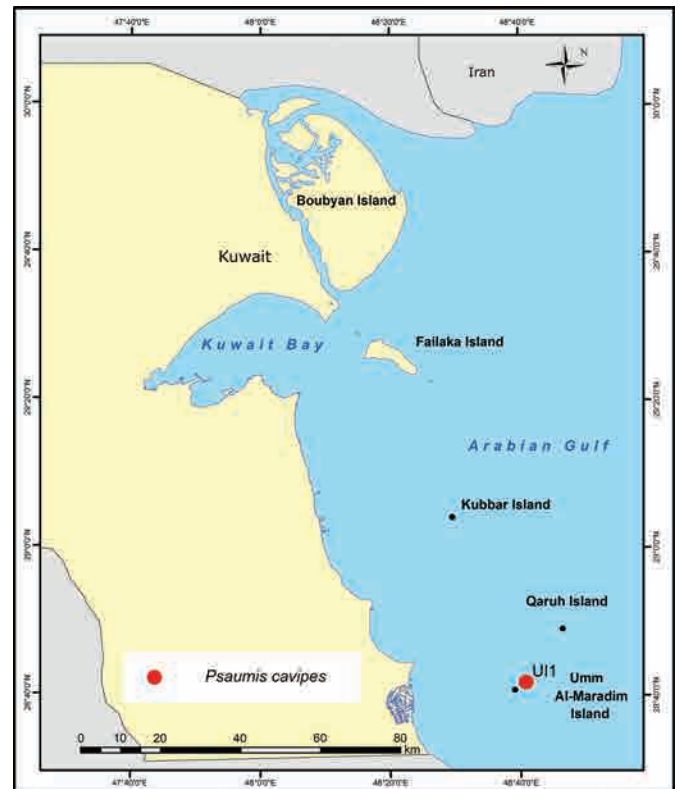


Figure 477. Presently known record of *Psaumis cavipes* in Kuwait.



Figure 478. *Psaumis cavipes* from Oman, in dorsal view. Photograph by Arthur Anker.

Family Grapsidae

Grapsus albolineatus Latreille in Milbert, 1812

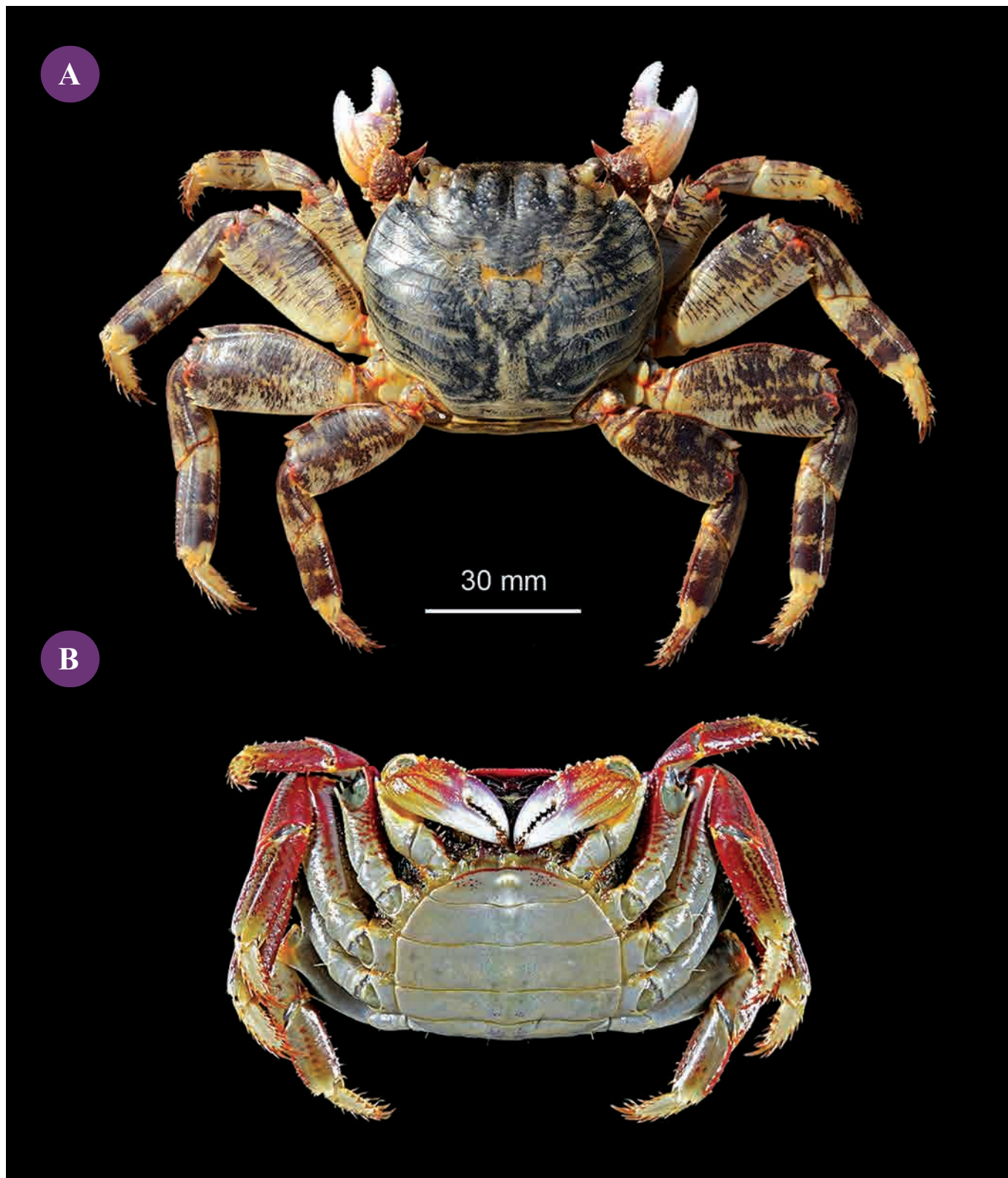


Figure 479. Female of *Grapsus albolineatus* Latreille in Milbert, 1812 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Grapse albo-lineatus* Latreille in Milbert, 1812; *Cancer strigosus* Herbst, 1799; *Grapsus strigosus* (Herbst, 1799); *Goniopsis flavipes* MacLeay, 1838; *Grapsus peroni* H. Milne Edwards, 1853; *Grapsus longipes* Stimpson, 1858.

Common Name. Sally-light-foot crab.

Main Diagnostic Features.

1. Carapace circular, with numerous oblique-transverse ridges; lateral margins markedly arched; external infraorbital angle with acute tooth.
2. Frontal margin with 4 folds.
3. Chelipeds small compared to body, with short, flattened claws.
4. Ambulatory legs (pereiopods 2–5) elongated, with pointed dactyli.
5. Pleonite 5 about 2.3 times as wide as long.
6. Male gonopod (G1) slightly curved.
7. Colour in life: carapace dark blue or dark green to almost black, with pale greenish or yellowish spots and bands on ridges and cardiac region; chelipeds yellow with reddish markings, fingers white and violet; walking legs yellowish with red-purple banding and mottling.
8. Size: large crabs, maximal carapace width about 55 mm for males and 64 mm for females.

Distribution. Indo-West Pacific: from the Red Sea and East Africa to Japan, Indonesia, Australia, and Hawaii.

Ecology. Benthic on rocky shores and artificial substrates (jetties, walls, etc.), mainly in the high and mid-intertidal zone; often seen on rocks near the water edge.

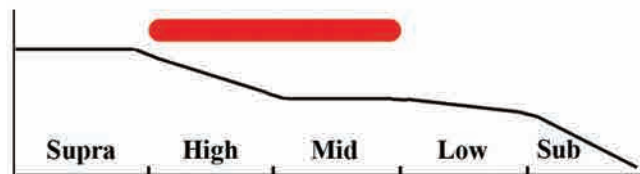


Figure 480. Bathymetric distribution of the species.

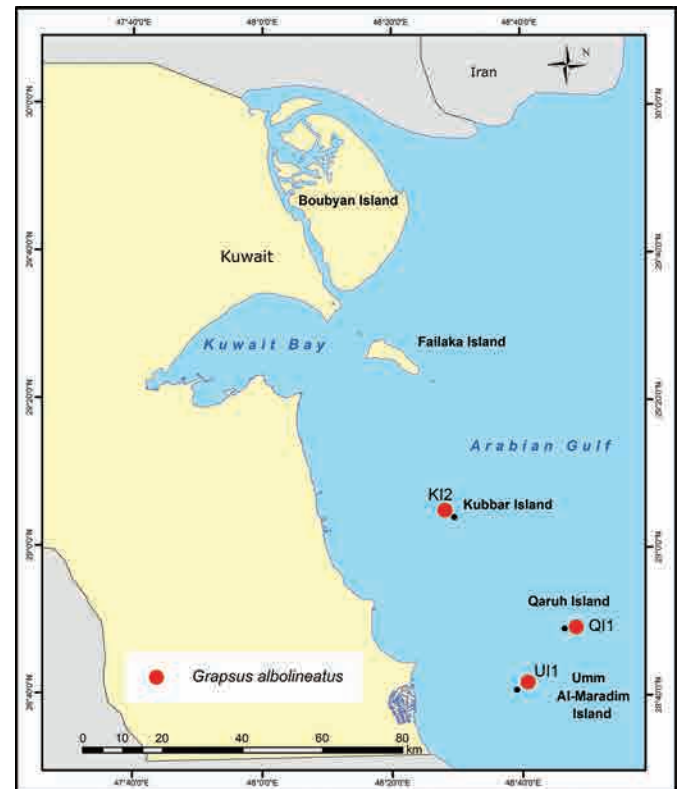


Figure 481. Presently known records of *Grapsus albolineatus* in Kuwait.

Remarks. The Sally Lightfoot crab is one of the most familiar and the most agile tropical crabs and is often observed scavenging on intertidal and supratidal rocks outside of the water.

Most Relevant References. Jones 1986a; Naderloo 2017.



Figure 482. *Grapsus albolineatus* in situ on coastal rocks of Umm Al-Maradim Island, Kuwait. Photograph by Valeriy Skryabin.



Figure 483. *Grapsus albolineatus* in situ on coastal rocks of Qaruh Island, Kuwait.
Photograph by Abdulaziz Alyousef.



Family Grapsidae

Metopograpsus messor (Forskål, 1775)



Figure 484. Male of *Metopograpsus messor* (Forskål, 1775) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari.



Figure 485. Female of *Metopograpsus messor* (Forskål, 1775) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari.

Synonyms. *Cancer messor* Forskål, 1775; *Eurycarcinus messor* (Forskål, 1775); *Grapsus gaimardi* Audouin, 1826; *Grapsus (Pachygrapsus) aethiopicus* Hilgendorf, 1869.

Common Name. Forskål's shore crab.

Main Diagnostic Features.

1. Carapace trapezoidal, 1.3 times as wide as long; branchial regions rugose; anterolateral margins distinctly covering posteriorly; inner infraorbital margin with a conspicuous keel on the outer surface.
2. Frontal margin 1.4 times as wide as the posterior margin, with 2 indistinct lobes.
3. Male pleon with pleonite 3 longer than pleonite 4.
4. Genital opening of females with operculum distinctly elevated, finger-shaped.
5. Male chelipeds unequal; female chelipeds subequal; inner (mesial) margin of merus with row a of sharp spines distally.
6. Walking legs (pereiopods 2–5) robust, flattened; merus expanded, armed with teeth on the disto-posterior margin.
7. Male gonopod (G1) with a small apical process, sharply directed outwards.
8. Colour in life: carapace dark blue to black with yellowish or greenish spots, chelipeds dark red wine; ambulatory legs grey-yellow with dark purple-red dots and blotches.
9. Size: both males and females reach approximately 23 mm/30 mm of carapace length/width.

Distribution. Western Indian Ocean: from the Red Sea and Madagascar to the Arabian-Persian Gulf and Andaman Islands.

Ecology. Benthic on rocky bottom; mainly on rocky shores and rocky reefs; mainly in the intertidal zone.

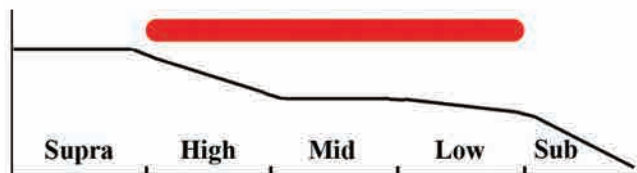


Figure 486. Bathymetric distribution of the species.

Remarks. *Metopograpsus messor* is one of two species of the small grapsid genus *Metopograpsus*, reported from the northern Arabian-Persian Gulf; the other was previously known as *M. thukuhar* (Owen, 1839) (Jones 1986a; Naderloo 2017). However, all records of *M. thukuhar* from the Arabian-Persian Gulf most likely represent the recently described *M. cannicci* Innocenti, Schubart and Fratini, 2020, which is the western Indian Ocean sister species of the real *M. thukuhar* distributed from India to Hawaii and French Polynesia (Innocenti et al. 2020). The two species present in Kuwait, i.e. *M. messor* and *M. cannicci*, are ecologically separated, with *M. messor* found mainly on rocky shores and *M. cannicci* preferring muddier habitats, such as mangroves, especially those with rocky platforms and with the abundance of mud-covered rocks). Naderloo (2017) provided a morphological key to separate *M. cannicci* (as *M. thukuhar*) from *M. messor*, involving the general shape of the carapace, the presence/absence of a keel on the infra-orbital, the configuration of the male gonopod (G1), and some other features. Another good distinguishing

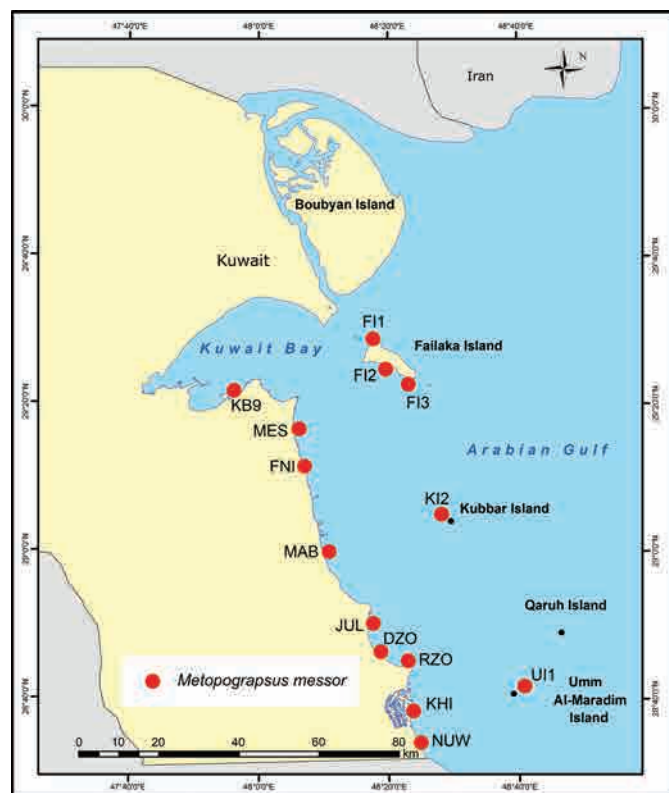


Figure 487. Presently known records of *Metopograpsus messor* in Kuwait.

characteristic chelae's colour, which are dark wine red in *M. messor* and more violet in *M. cannicci* (see Bouchard et al. 2013: Fig. 21) and *M. thukuhar*.

Most Relevant References. [for both *M. messor* and *M. cannicci*]. Crosnier 1965; Holthuis 1977; Vannini and Valmori 1981; Jones 1986a; Fratini et al. 2000 (as *M. thukuhar*); Naderloo et al. 2011; Naderloo 2017; Innocenti et al. 2020.



Figure 488. Female of *Metopograpsus messor* in frontal view from the Saudi Arabian of the Red Sea (A); and male in frontal view from French Polynesia. Photographs by Arthur Anker.



Figure 489. *Metopograpsus messor* in situ, Kuwait. Photograph by Arafat AlShuaibi.



Figure 490. *Metopograpsus messor* in situ, Kuwait. Photograph by Valeriy Skryabin.



Figure 491. *Metopograpsus messor* in situ, Kuwait. Photograph by AM Team.

Family Sesarmidae

Nanosesarma sarii Naderloo and Türkay, 2009

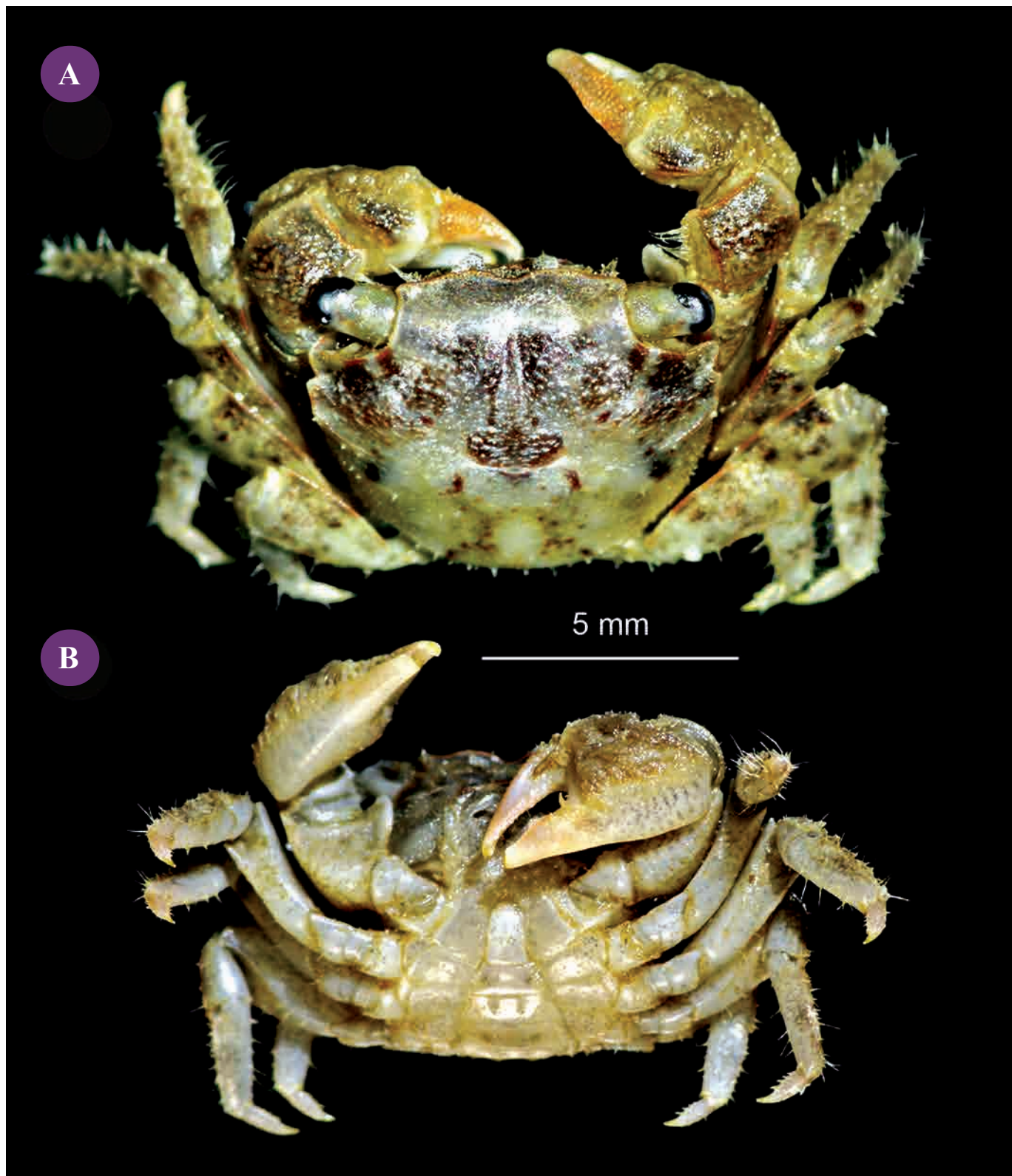


Figure 492. Male of *Nanosesarma sarii* Naderloo and Türkay, 2009 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Sari's dwarf crab.

Main Diagnostic Features.

1. Carapace quadrate, slightly broader than long (CW/CL 1.13–1.17), evenly convex, sparsely covered with fine short plumose setae; carapace regions well defined; anterolateral margin with 2 teeth (including tooth of extra-orbital angle).
2. Front with two wide lobes.
3. Basal antennal article long.
4. Third maxilliped covering buccal cavity.
5. Male chelipeds subequal, robust; female chelipeds small, and slender.
6. Male pleon triangular, with 6 segments.
7. Colour in life: carapace pale brown, darker anteriorly; dactylus of chelipeds pale orange dorsally.
8. Size: maximal carapace length/width ca. 9 mm/10 mm for males; 8.5 mm/9.5 mm for females.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to Pakistan.

Ecology. Benthic on hard and mixed bottoms; on rocky shores, coral rubble flats, and mangroves; typically in the mid-intertidal zone; usually under rocks and rubble, among mangrove roots, under decaying wood, etc.

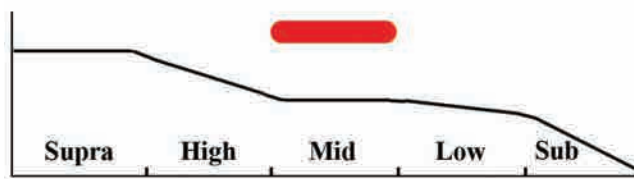


Figure 493. Bathymetric distribution of the species.

Remarks. *Nanosesarma sarii* differs from its congeners *N. minutum* and *N. jousseaumei* (the latter species is also present in the Arabian-Persian Gulf) by the cheliped palm having a longitudinal granular ridge, the dorsal surface of the dactylus being covered with small tubercles, and the male sixth pleonite relatively wide and the seventh unusually elongated (Naderloo and Türkay 2009, 2012; Naderloo 2017).

Most Relevant References. Naderloo and Türkay 2009; Naderloo and Türkay 2012; Naderloo 2017.



Figure 496. *Nanosesarma sarii* from Umm Al-Namil Island, Kuwait. Photograph by Manal Al-Kandari.

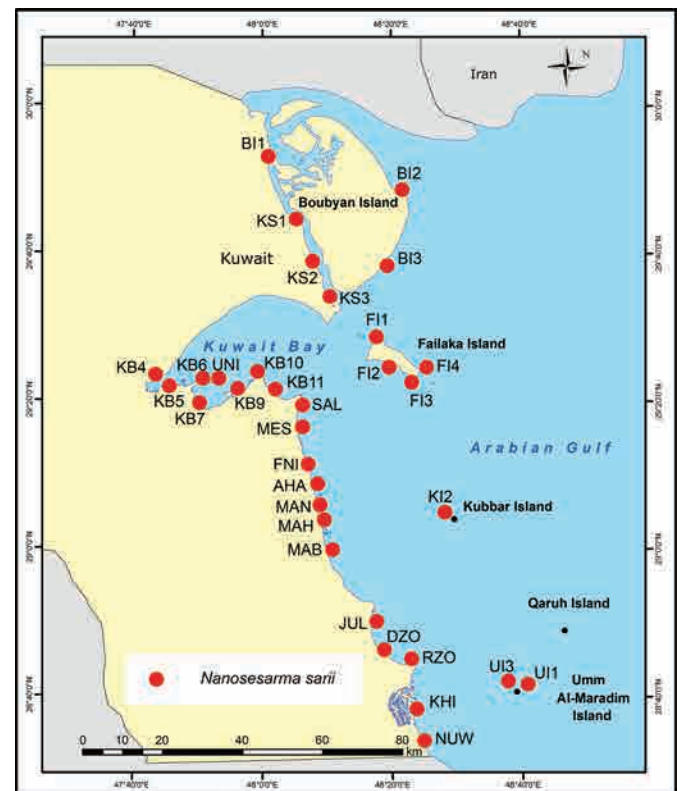


Figure 494. Presently known records of *Nanosesarma sarii* in Kuwait.



Figure 495. *Nanosesarma sarii* in situ on an oyster reef in Sulaibikhat Bay, Kuwait. Photograph by Igor Polikarpov.



Figure 497. *Nanosesarma sarii* in situ in the intertidal area of Umm Al-Namil Island, Kuwait. Photograph by Manal Al-Kandari.

Family Sesarmidae

Parasesarma persicum Naderloo and Schubart, 2010

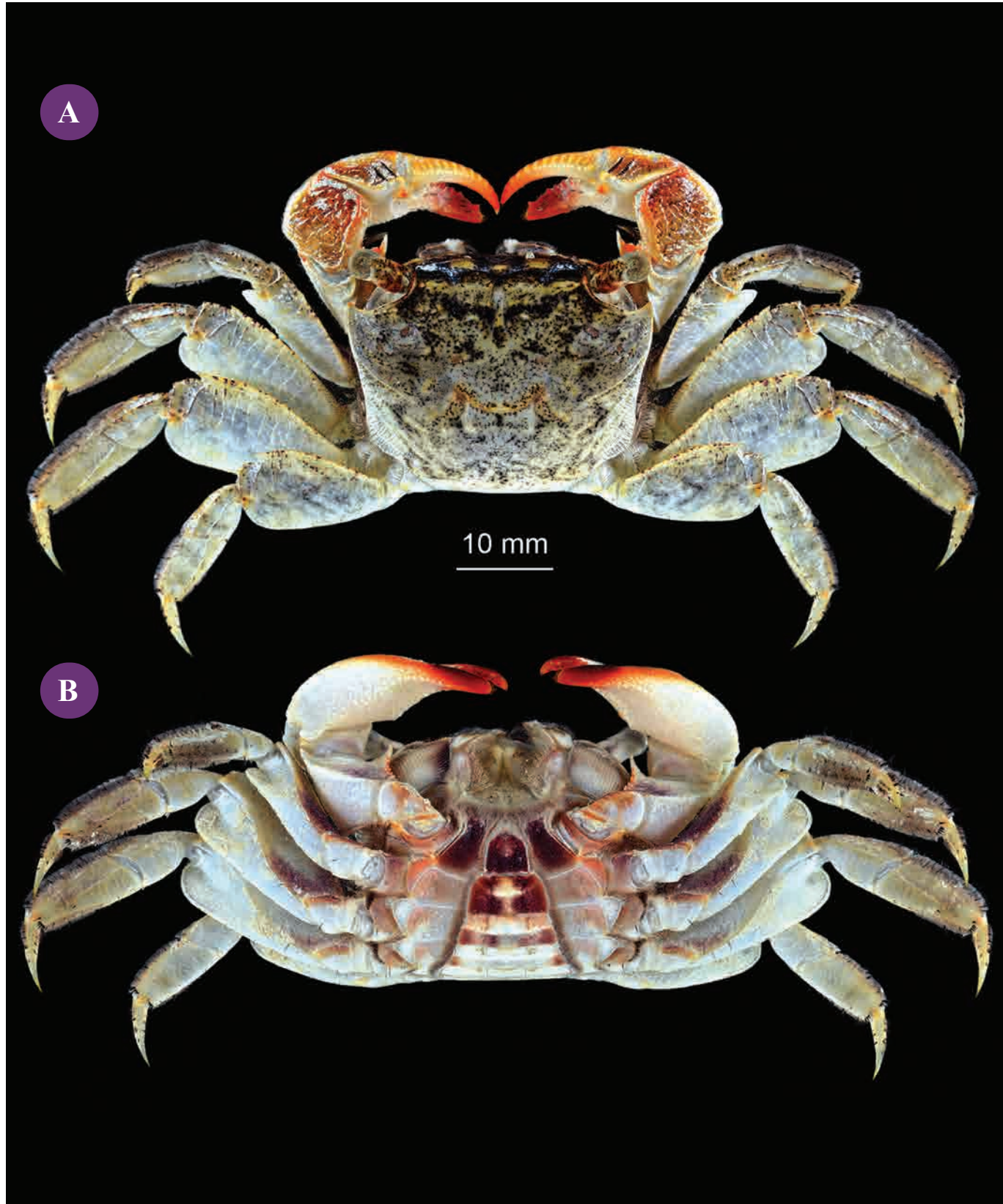


Figure 498. Male of *Parasesarma persicum* Naderloo and Schubart, 2010 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari.

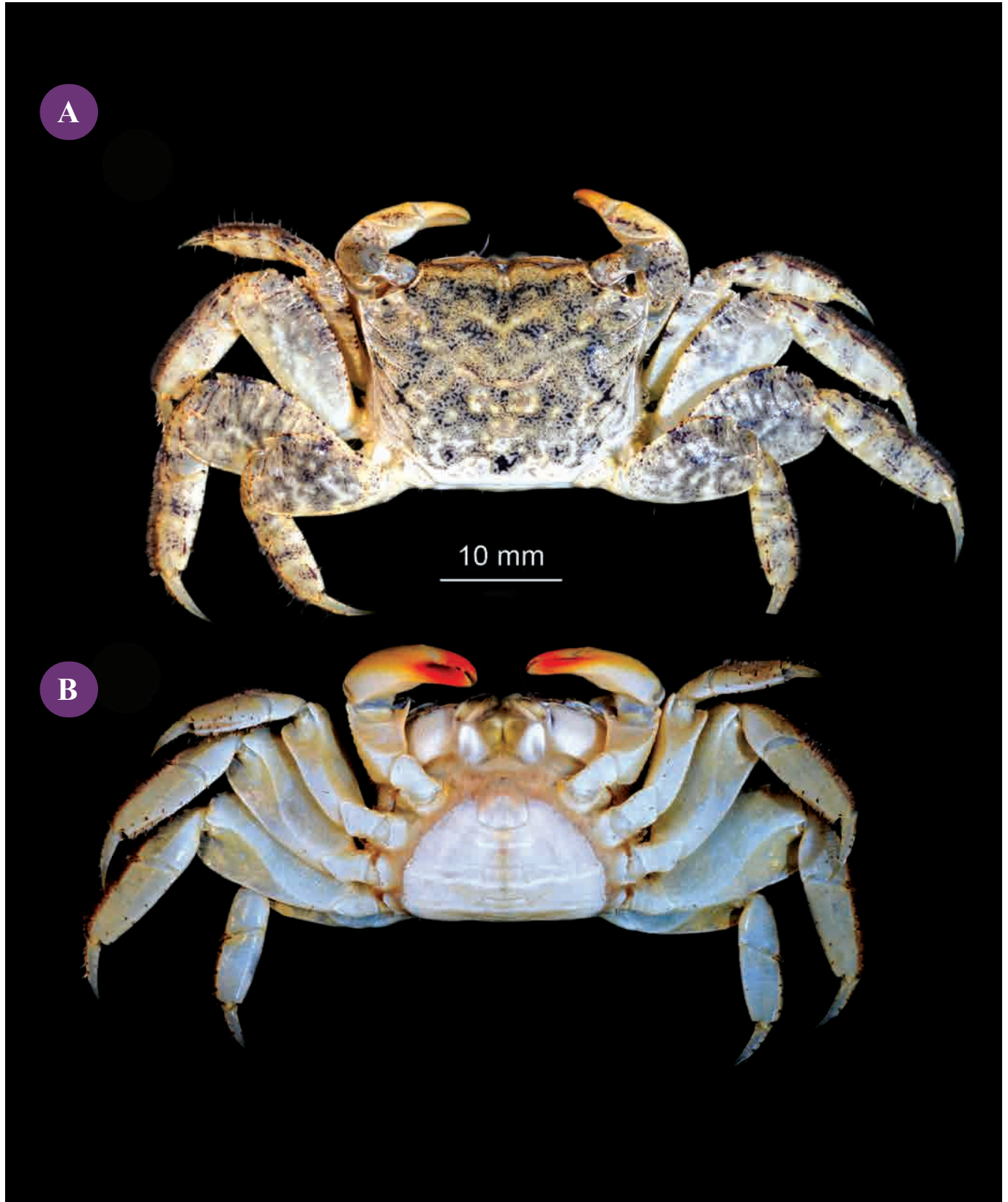


Figure 499. Female of *Parasesarma persicum* Naderloo and Schubart, 2010 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari.

Common Name. Shatt-Al-Arab mud crab.

Main Diagnostic Features.

1. Carapace squarish, about 1.3 times as broad as long; dorsal surface convex, smooth, carapace regions well defined; lateral margin straight or slightly divergent posterior to extra-orbital tooth, but more convergent posteriorly.
2. Frontal margin longer than posterior margin of carapace, widely bilobed.
3. Eyestalks relatively short.
4. Chelipeds equal to subequal in both sexes.
5. Walking legs (pereiopods 2–5) very short, stout; merus flat, expanded, and unarmed.
6. Male pleon short, triangular.
7. Colour pattern: carapace and ambulatory legs grey-yellowish with dark grey and black mottling and spots; carapace usually noticeably darker than legs; chelipeds cream-coloured at base, dorsal surface of carpus and palm reddish brown, dactylus orange, pollex deep purple-red.
8. Size: maximal carapace length/width approximately 26.5 mm/33.5 mm for males and 19.5 mm/26 mm for females.

Distribution. Western Indian Ocean from the Arabian-Persian Gulf to Pakistan.

Ecology. Benthic on muddy bottoms (mudflats, and mangroves); high and mid-intertidal zones; lives in burrows dug into mud, especially under large rocks or debris on mudflats or on muddy banks of mangrove streams.

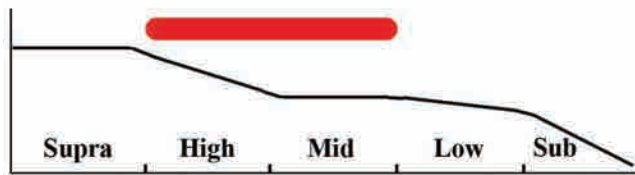


Figure 500. Bathymetric distribution of the species.

Remarks. *Parasesarma persicum* belongs to the broad-legged species group of the genus *Parasesarma* (Naderloo and Schubart 2010; see also Rahayu and Ng 2010) and can be separated from the other species in this group, essentially by the characters of the first male gonopod (G1). *Parasesarma persicum* was formerly known from Kuwait under the name “*P. plicatum*” (Jones 1986a), a closely related species from India and South-East Asia (Rahayu and Ng 2010). It is the only species of *Parasesarma* present in the Arabian-Persian Gulf and appears to be restricted to the Shatt-Al-Arab area of Kuwait, Iraq and Iran (Apel 2001; Naderloo and Türkay 2012; Naderloo 2017).

Most Relevant References. Jones 1986a; Apel 2001 (both as *P. plicatum*); Naderloo and Schubart 2010; Naderloo and Türkay 2012; Naderloo 2017.

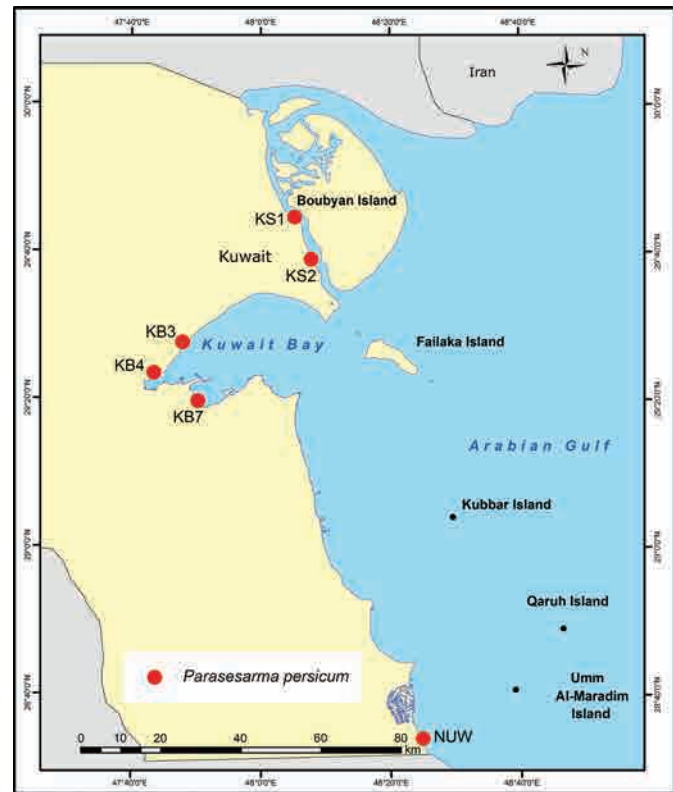


Figure 501. Presently known records of *Parasesarma persicum* in Kuwait.



Figure 502. *Parasesarma persicum*: male from Khor Al-Subiyah (A); female *in situ* at burrow entrance, Al-Kuwaisat (B), Kuwait. Photographs by Manal Al-Kandari (A) and Abdulrahman Yousef (B).



Figure 503. *Parasesarma persicum* inside its burrow *in situ* off Khor Al Subiyah (A); burrows of various crabs, including *P. persicum*, near Al-Kuwaisat (B), Kuwait. Photographs by Valeriy Skryabin.

Family Varunidae

Eriocheir hepuensis Dai, 1991



Figure 504. Male of *Eriocheir hepuensis* Dai, 1991 in dorsal (A) and ventral (B) views, Al-Kuwaisat, Kuwait. Photograph by Abdulrahman Yousef.

Synonym. *Eriocheir japonicus hepuensis* Dai, 1991.

Common Name. Hepu mitten crab.

Main Diagnostic Features.

1. Carapace squarish; overall dorsal surface convex; carapace regions well-defined; anterolateral margins with 4 teeth (including extra-orbital tooth).
2. Frontal margin with 4 broad teeth, lateral longer and sharper, and broad, V-shaped, median cleft.
3. Third maxilliped with broad ischium and merus; exopod narrow.
4. Chelipeds subequal; distal portion of carpus and dorsal and lateral (outer) surfaces of palm with dense covering of thick setae.
5. Ambulatory legs (pereiopods 2–5) broad, stout, with long thick setae on anterior and posterior margins of carpi and propodi.
6. Male gonopod (G1) long, slender; apex complex, sloping shoulder shaped in lateral view, with short, chitinous prominence.
7. Colour in life: yellowish brown; carapace darker than walking legs and chelipeds; chelae dark brown due to dense setation; fingers whitish.
8. Size: carapace width/length reaching 73 mm/68 mm in males and 75.5 mm/72 mm in females.

Distribution. Indo - West Pacific; native to southern China and northern Vietnam; introduced to Iraq, Iran, UAE, and Kuwait in the Arabian-Persian Gulf, and also to Korea and Japan.

Ecology. Benthic, catadromous, living mostly in fresh water, but migrating to salt water for mating and spawning (larval development in marine waters); typically observed on mudflats throughout the intertidal zone, but also observed in the shallow subtidal zone down to 10 m.

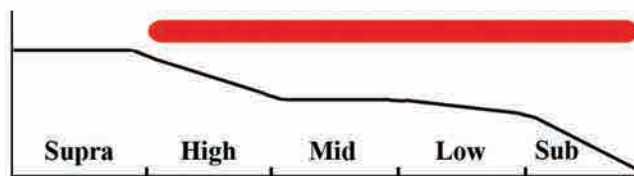


Figure 505. Bathymetric distribution of the species.

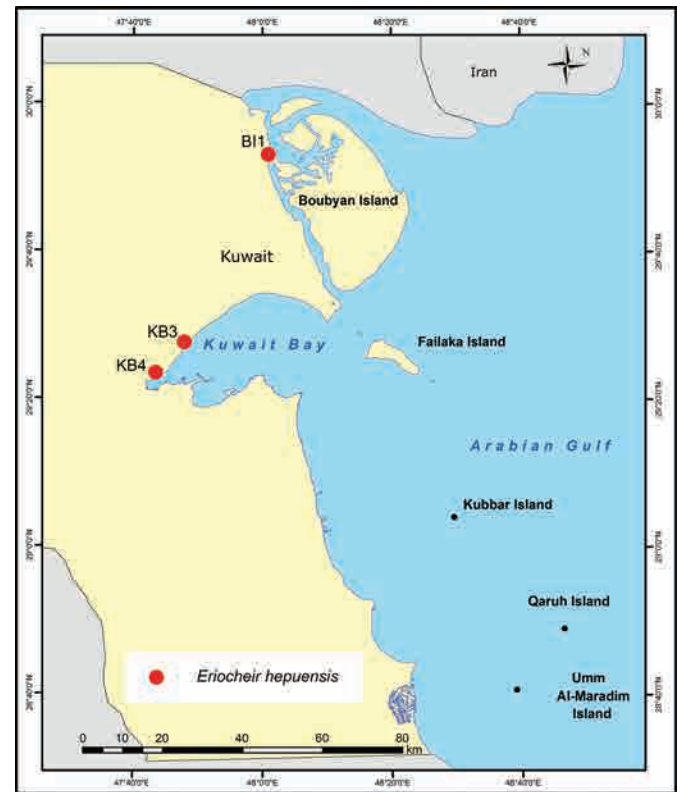


Figure 506. Presently known records of *Eriocheir hepuensis* in Kuwait.

Remarks. *Eriocheir hepuensis* may have been present for over 30 years in the Shatt-Al-Arab delta in Iraq and has now become well established in Kuwait, Iraq, and Iran (Apel and Bishop 2006; Naser et al. 2012; Naderloo 2014). Another species of mitten crab, *E. sinensis*, the Chinese mitten crab, successfully invaded not only the temperate regions in central and northern Europe and North America, but also Singapore (Guo et al. 1997; Clark 2012; Low et al. 2013). All records of *E. sinensis* from the Arabian-Persian Gulf were misidentifications and are now referred to as *E. hepuensis* (Naderloo 2017).

Most Relevant References. Dai 1991; Guo et al. 1997; Apel and Bishop 2006 (as *E. sinensis*); Naser et al. 2012; Naderloo 2014; Naderloo 2017.



Figure 507. *Eriocheir hepuensis* on green algae in Al-Judailiat, Kuwait. Photograph by Valeriy Skryabin.

Family Varunidae

Metaplax indica H. Milne Edwards, 1852



Figure 508. Male of *Metaplax indica* H. Milne Edwards, 1852 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Metaplex indicus* H. Milne Edwards, 1852.

Main Diagnostic Features.

1. Carapace rectangular, wider than long (CB/CL about 1.5); carapace regions distinct; anterolateral margin with 4 teeth (including extra-orbital tooth), gradually becoming smaller posteriorly.
2. Front bilobed, short, about 0.25 of maximal carapace width, gently deflexed.
3. Chelipeds equal or subequal in size, fairly large, elongated, especially in adult males; merus long, slender; chela somewhat compressed, elongated, with somewhat twisted fingers.
4. Walking legs (pereopods 2–5) long, flattened; second and third walking legs (P3–4) longest and more robust than others.
5. Male pleon with somites 3–5 fused somites.
6. Male gonopod (G1) moderately stout, gently curved outwards.
7. Colour in life: carapace, chelipeds, and ambulatory legs brownish; ventral surface greyish pinkish.
8. Size: largest males at carapace width / length 15 mm / 22.5 mm.

Distribution. Western Indian Ocean from the Arabian-Persian Gulf to India.

Ecology. Benthic on muddy substrates; usually in the mid-intertidal zone; in burrows on open mudflats and mangrove flats.

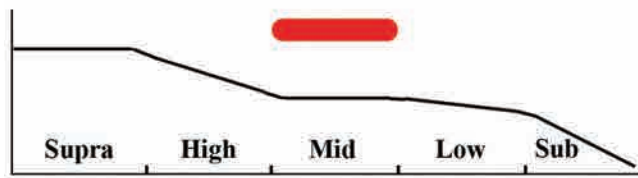


Figure 509. Bathymetric distribution of the species.

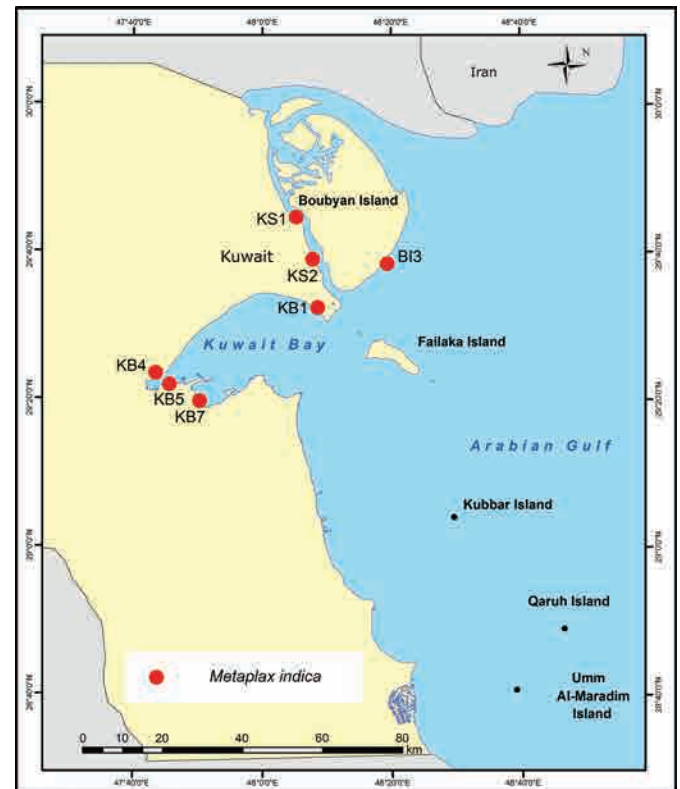


Figure 510. Presently known records of *Metaplex indica* in Kuwait.

Remarks. *Metaplex indica* is a well-known crab in Kuwait, with the first records from the 1980s (Clayton 1986; Jones 1986a). In the Shatt-Al-Arab delta, this crab species was recorded just south of Basrah, Iraq (Al Maliky et al. 2016), indicating that it can tolerate very low salinities.

Most Relevant References. Clayton 1986; Jones 1986a; Naderloo and Türkay 2012; Al-Maliky et al. 2016; Naderloo 2017.



Figure 511. *Metaplex indica* in defensive posture on the muddy sand in Kuwait Bay, Kuwait. Photograph by David A. Jones.

Family Camptandriidae

Leptochryseus kuwaitense (Jones and Clayton, 1983)

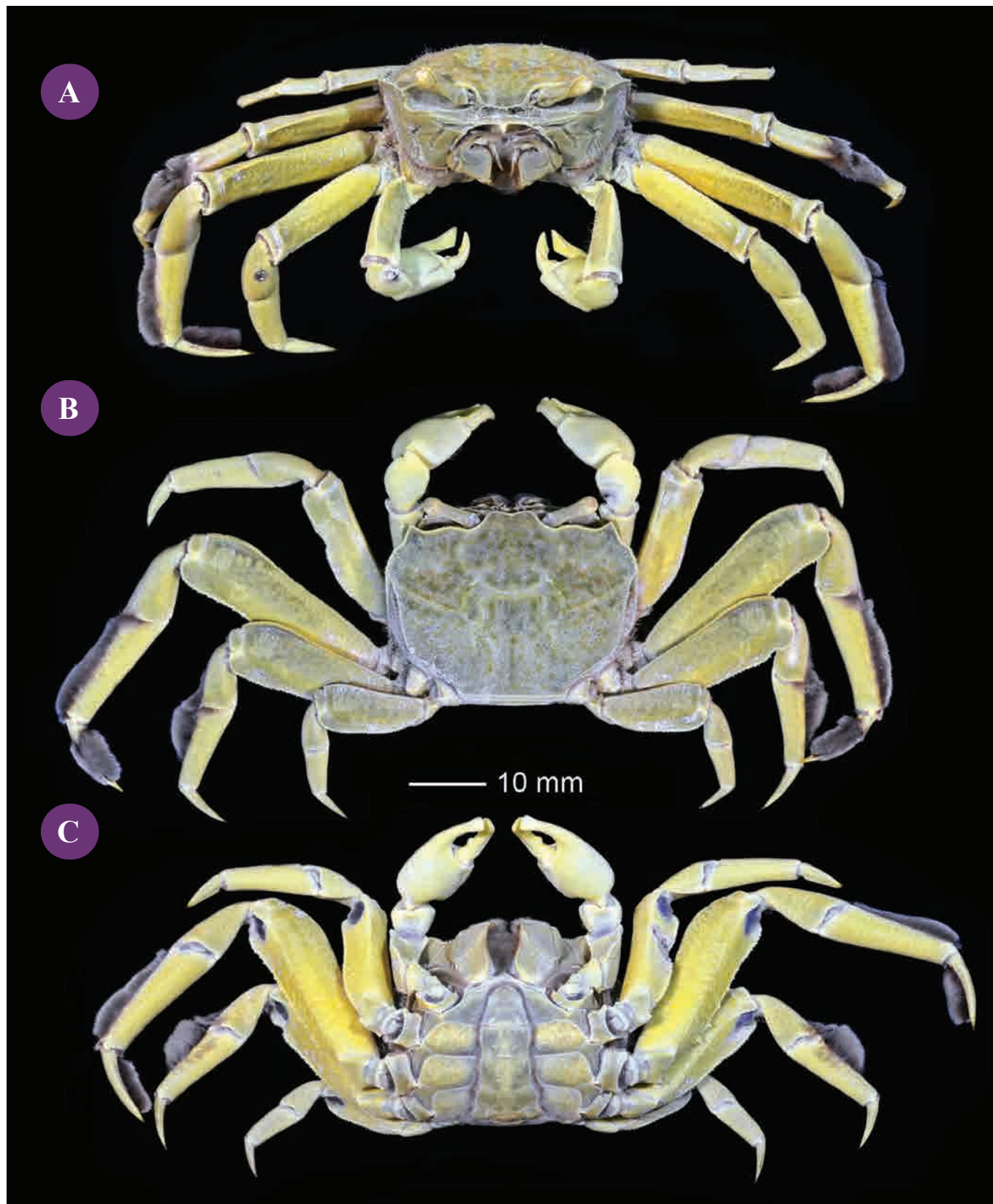


Figure 512. Male of *Leptochryseus kuwaitense* (Jones and Clayton, 1983) in frontal (A), dorsal (B) and ventral (C) views, Kuwait. Photographs by Manal Al-Kandari.



Figure 513. Female of *Leptochryseus kuwaitense* (Jones and Clayton, 1983) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Manal Al-Kandari.

Synonym. *Cleistostoma kuwaitense* Jones and Clayton, 1983.

Common Name. Kuwaiti saltmarsh crab.

Main Diagnostic Features.

1. Carapace subquadrate, somewhat rounded laterally, slightly wider than long, with single extra-orbital tooth; dorsal surface smooth with shallow transverse mesogastric groove and scattered short setae on branchial regions; lateral, supraorbital and infraorbital margins minutely granulate; pterygostomial region granulate with sulcus originating at the edge of buccal cavity and running laterally and ventrally.
2. Front about 0.3 times as long as anterior margin, bilobed, with shallow median concavity.
3. Male pleon smoothly tapering towards terminal somite, latter completely covering gonopods; first pleonite not wider than the remaining pleonites, reaching coxae of P5; all pleonites and telson free in both sexes.
4. Third maxilliped with merus longer than ischium; dactylus slender.
5. Chelipeds of adults sexually dimorphic; chelae of adult males enlarged, propodus quadrate, strongly granulate; fingers gaping, dactylus armed with tooth on cutting edges; chelae of subadult males and females not enlarged, feebly granulate; fingers gaping.
6. Second and third ambulatory pereopods (P3 and P4) longest and most robust; meri greatly flattened, serrated on anterior and especially posterior margins; dorso-anterior surface of carpi and propodi of legs P3 and P4 and carpus of P5 covered with thick mats of short setae.
7. Male gonopod (G1) strongly recurved, with quadrate tip overlapping shaft.
8. Colour in life: carapace greenish or yellowish-grey; chelipeds and walking legs golden yellow; setal mats on walking legs dark brown.
9. Size: maximal carapace width / length about 50 / 45 mm.

Distribution. North-western Indian Ocean: from the Arabian-Persian Gulf to western India.

Ecology. Semi-terrestrial crab restricted to intertidal mudflats and muddy near-shore saltmarshes; lives in extensive, spacious burrows.

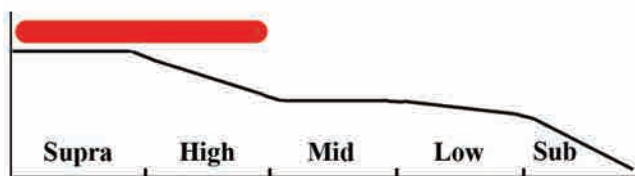


Figure 514. Bathymetric distribution of the species.

Remarks. *Leptochryseus kuwaitense* was initially observed from Kuwait by Jones and Clayton (1983), who assigned this species to the genus *Cleistostoma*. The monotypic genus *Leptochryseus* was later proposed later by Al-Khayat and Jones (1996) to accommodate *L. kuwaitense*. The validity of *Leptochryseus* was not recognized by Ng et al. (2008); however, one year later, the genus was re-established by Ng et al. (2009). *Leptochryseus kuwaitense* is one of the most remarkable crabs

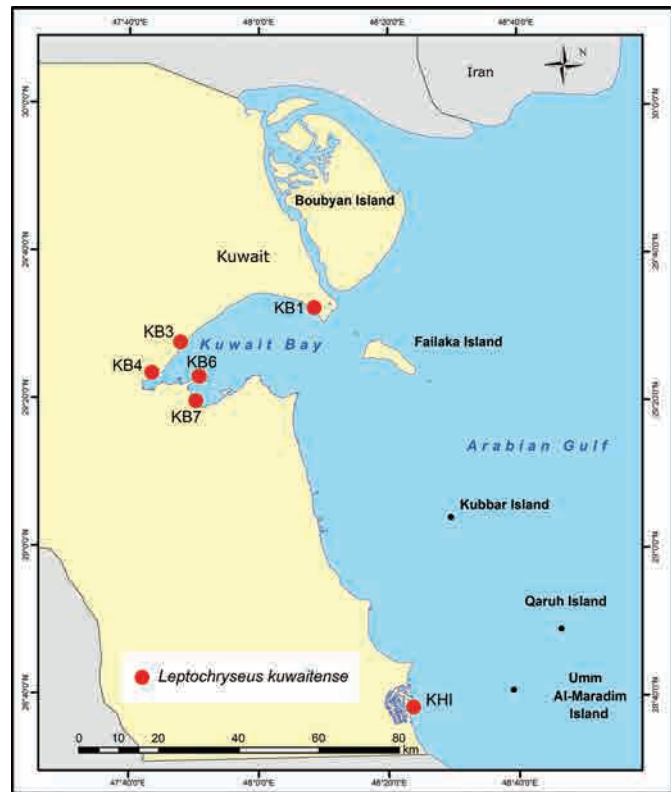


Figure 515. Presently known records of *Leptochryseus kuwaitense* in Kuwait.

of Kuwait and appears to be restricted to the north-western part of the Indian Ocean, ranging from Kuwait to western India (Trivedi et al. 2017), although the record of *L. kuwaitense* from the Gulf of Oman (Ismail and Ahmed 1993) was based on a misidentified specimen of *N. dotilliformis* (Apel 2001).

Most Relevant References. Jones and Clayton 1983; Al-Khayat and Jones 1996; Ng et al. 2009; Naderloo and Türkay 2012; Naderloo 2017; Trivedi et al. 2017.

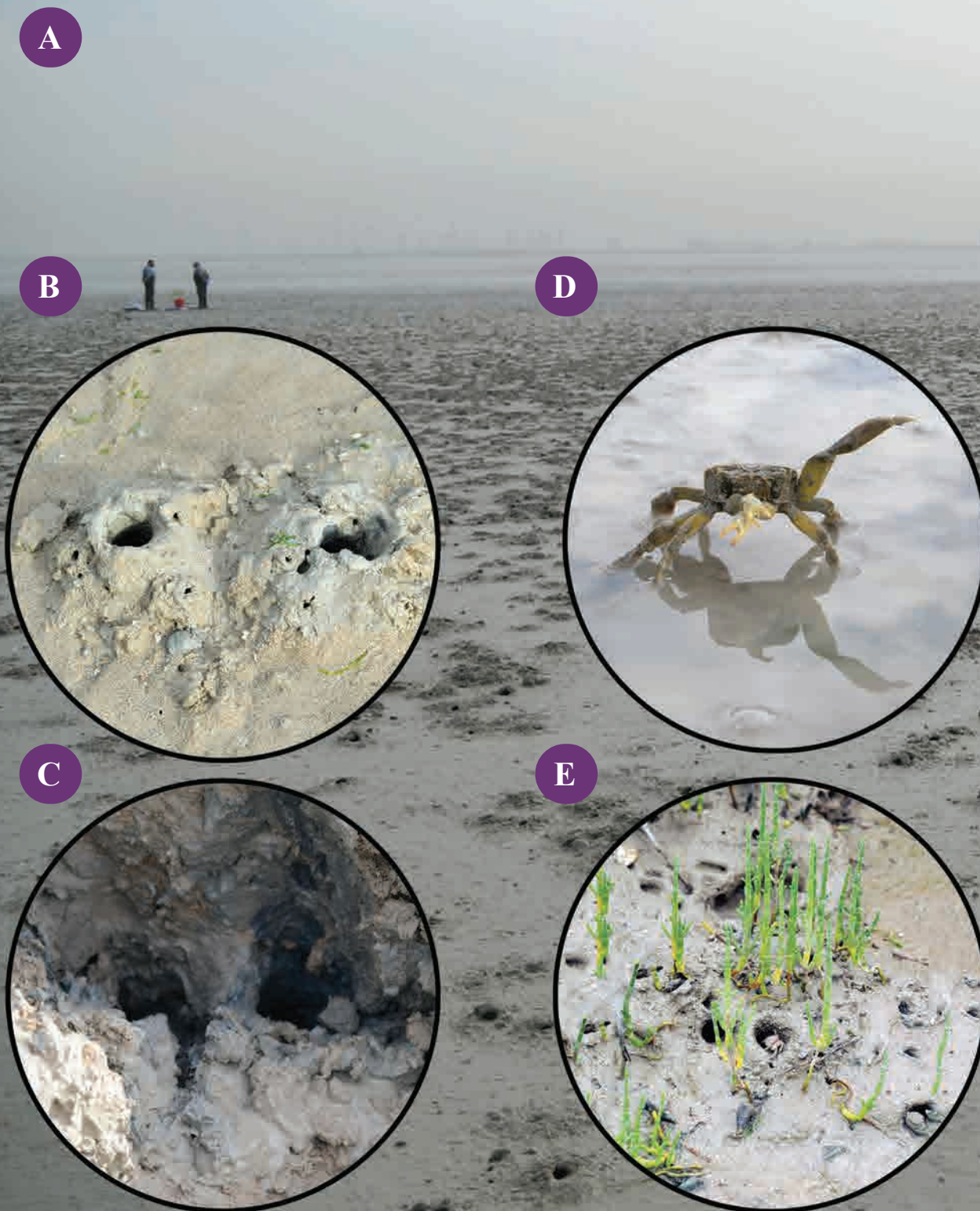


Figure 516. Female (A) and male (B) of *Leptochryseus kuwaitense* in situ near Al-Khiran, Kuwait. Photographs by AM team.



Figure 517. Two males of *Leptochryseus kuwaitense* *in situ* in Sulaibikhat Bay, Kuwait. Photograph by Manal Al-Kandari.

Figure 518. Population of *Leptochryseus kuwaitense* in Sulaibikhat Bay, Kuwait: tidal mudflat exposed at low tide, typical habitat of the species (A); burrow entrances (B, C); three different males (D, F, H); salt marsh with halophytes, where some crabs are dwelling (E); small group of crabs (G). Photographs by Abdulrahman Yousef (A, B, C, F), Manal Al-Kandari (D), Igor Polikarpov (E, G).



F



H



G



Family Camptandriidae

Manningis arabicum (Jones and Clayton, 1983)



Figure 519. Male of *Manningis arabicum* (Jones and Clayton, 1983) in dorsal (A) and ventral (B) views, Kuwait. Preserved specimen. Photographs by Valeriy Skryabin.

Synonym. *Paracleistostoma arabicum* Jones and Clayton, 1983.

Common Name. Small Arabian mudflat crab.

Main Diagnostic Features.

1. Carapace transversely oval, 1.6–1.7 times as wide as long.
2. Front broad, about 0.3 times as long as maximal carapace width, straight; lateral angle of front continuing as infraorbital angle.
3. Posteromedian tooth of epistome broadly triangular; lateral margins concave.
4. Male pleon with all pleonites and telson free; sutures between pleonites 2–4 complete.
5. Chelipeds equal in size and shape; chela subrectangular in adult males, with fingers largely gaping.
6. Second and third ambulatory pereopods (P3 and P4) longest and most robust; meri greatly flattened, rugose on anterior but smooth on posterior margins.
7. Male gonopod (G1) with distal third strongly bent, armed with hook-like spinules.
8. Colour in life: dorsal surface of carapace sandy yellow with greyish tinge; ventral surface and ambulatory legs creamy yellowish.
9. Size: carapace width of the largest specimens about 9 mm.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to India.

Ecology. Benthic on muddy bottoms (estuarine and marine mudflats); mid- and low intertidal zones.

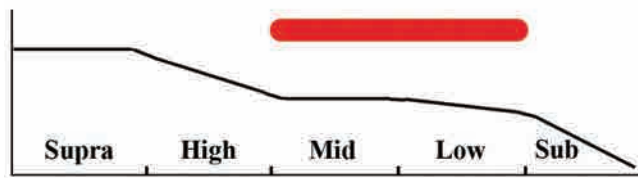


Figure 520. Bathymetric distribution of the species.

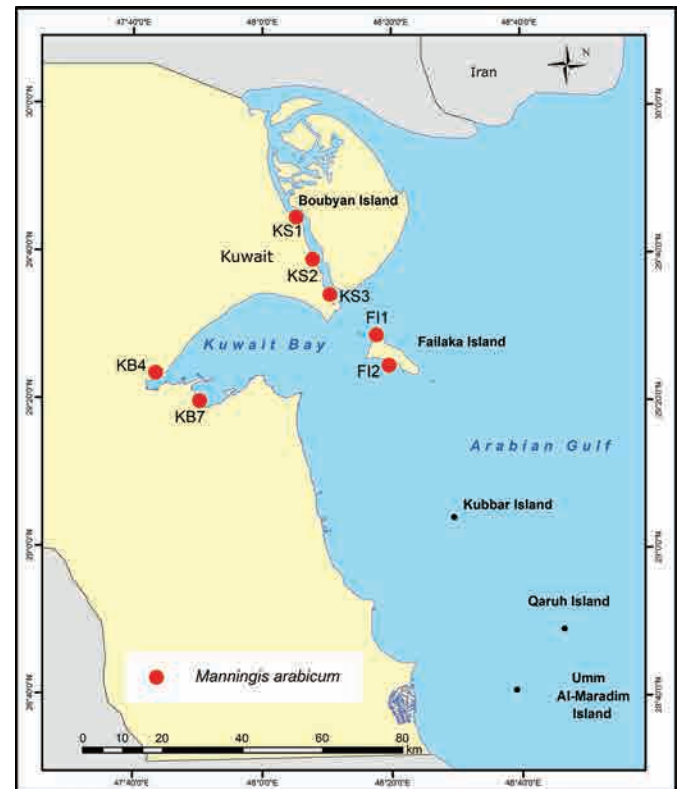


Figure 521. Presently known records of *Manningis arabicum* in Kuwait.

Remarks. *Manningis arabicum* is a small camptandriid crab restricted to the north-western part of the Indian Ocean. The species was originally recorded from Kuwait (Jones and Clayton 1983) and only recently reported from Gujarat, India (Patel et al. 2021).

Most Relevant References. Jones and Clayton 1983; Ng et al. 2009; Naderloo and Türkay 2012; Naderloo 2017; Patel et al. 2021.



Figure 522. Typical habitat of *Manningis arabicum*, Ras Al-Humar, Kuwait. Photograph by Valeriy Skryabin.

Family Camptandriidae

Nasima dotilliformis (Alcock, 1900)

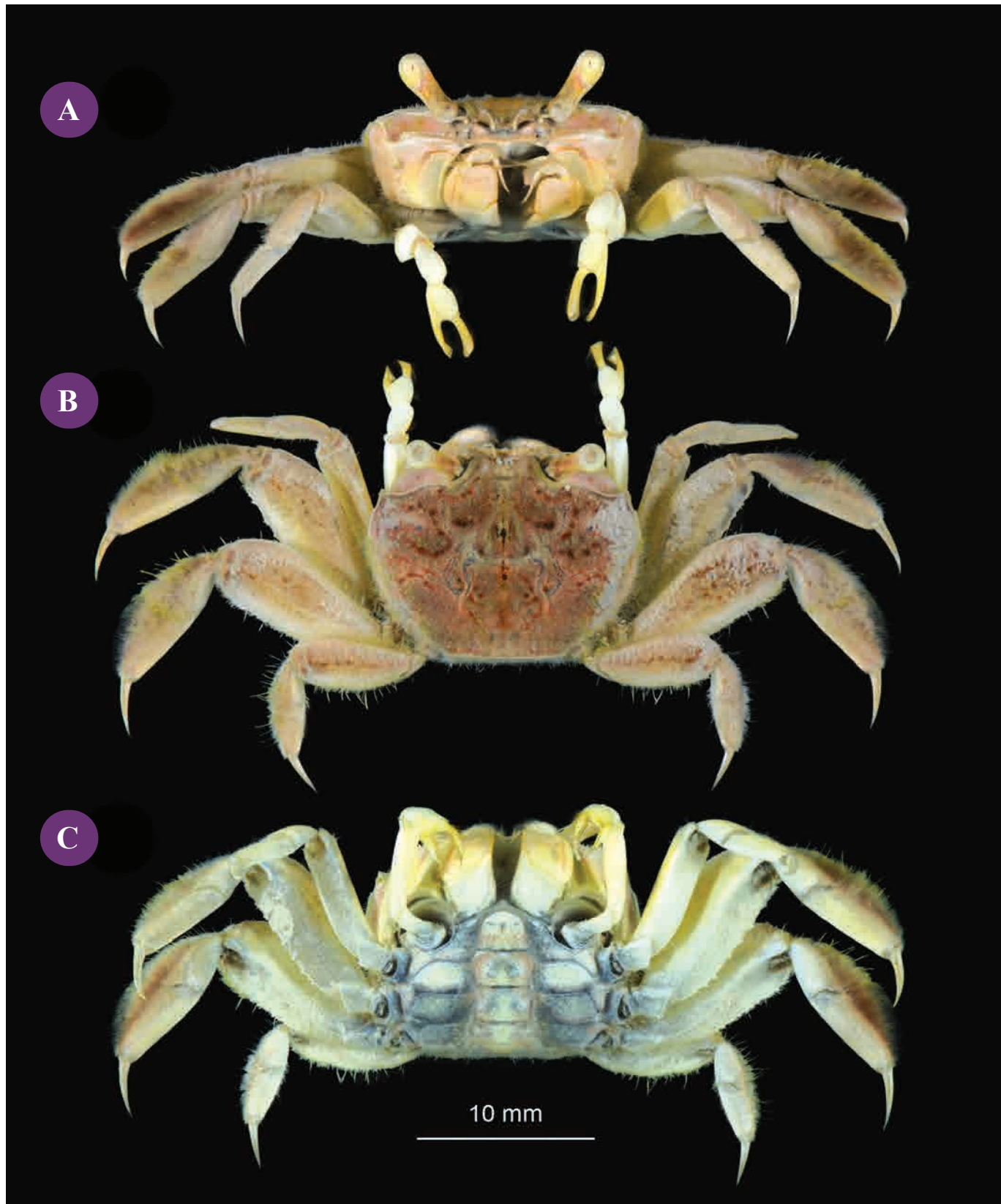


Figure 523. Male of *Nasima dotilliformis* (Alcock, 1900) in frontal (A), dorsal (B) and ventral (C) views, Sulaibikhat Bay, Kuwait. Photographs by Arthur Anker.

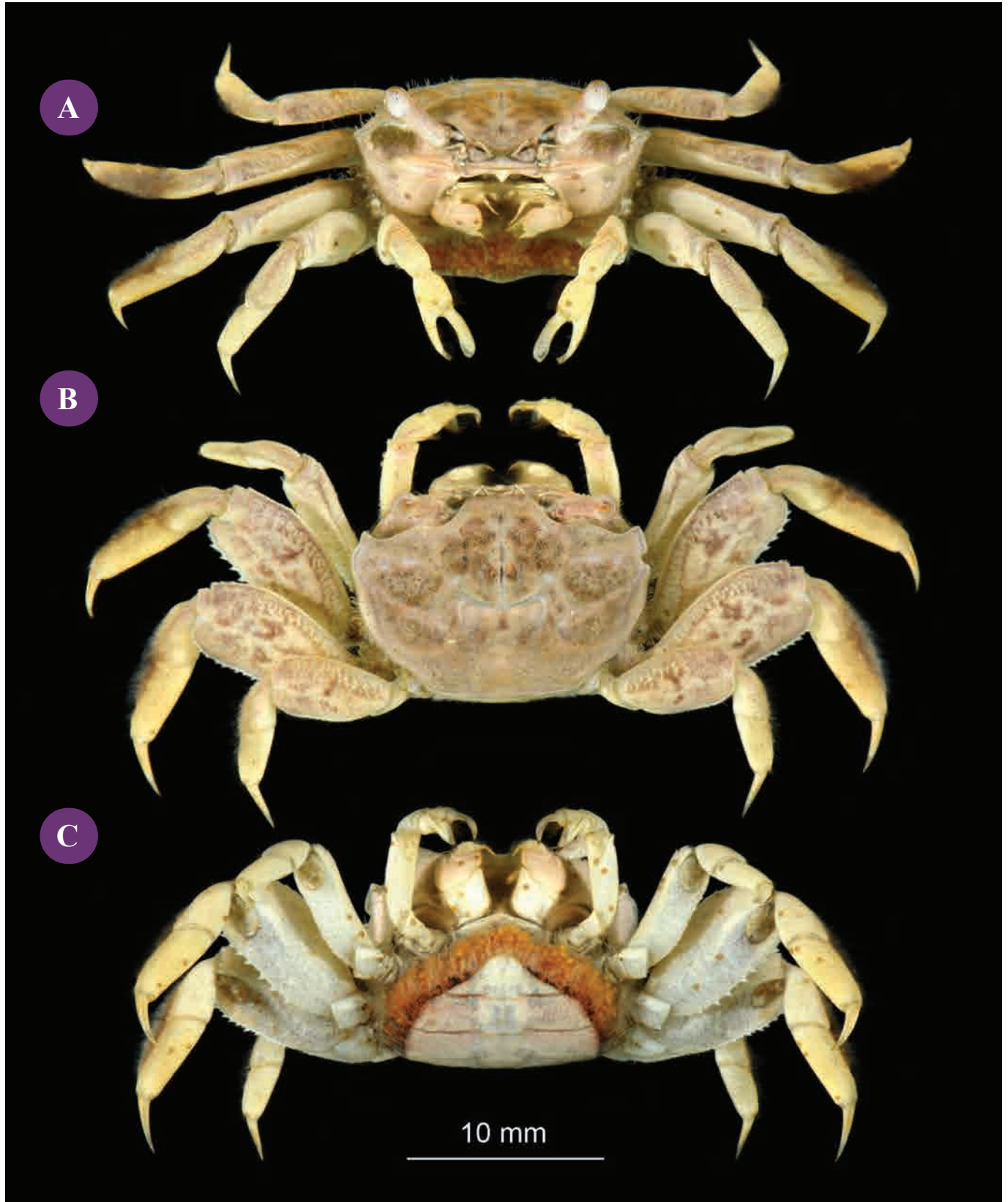


Figure 524. Ovigerous female of *Nasima dotilliformis* (Alcock, 1900) in frontal (A), dorsal (B) and ventral (C) views, Sulaibikhat Bay, Kuwait. Photographs by Arthur Anker.

Synonym. *Cleistostoma dotilliforme* Alcock, 1900.

Common Name. Nasima's mudflat crab.

Main Diagnostic Features.

1. Carapace about 1.3 times as wide as long, slightly depressed, smooth; carapace regions poorly defined; lateral margin almost straight posterior to small tooth below produced extra-orbital angle; posterolateral margin strongly convergent.
2. Front 0.25–0.3 times of the greatest carapace width, shallowly concave.
3. Male pleon narrow; somites 2–4 fused; somite 6 with limited mobility with somite 5; telson free.
4. Chelipeds small in both sexes; chela not inflated; fingers gaping, with a row of setae on cutting edges.
5. Second and third ambulatory pereopods (P3 and P4) longest and most robust; meri greatly flattened, toothed on disto-anterior and posterior margins; dorso-anterior surface of carpi and propodi of legs P3 and P4 and carpus of P5 covered with thick mats of short setae.
6. Male gonopod (G1) with distal half strongly bent, forming almost complete loop; distal portion with small curved spinules.
7. Colour in life: carapace bluish grey or yellowish with brown dots; chelipeds and walking legs yellowish, setal mats brown.
8. Size: maximal carapace length/width 11.5 mm/15 mm for males and 11 mm/15.5 mm for females.

Distribution. Northern Indian Ocean: from the Arabian-Persian Gulf to India.

Ecology. Benthic on muddy bottoms, on mudflats, and silty sandflats; typically in high and mid-intertidal zones.

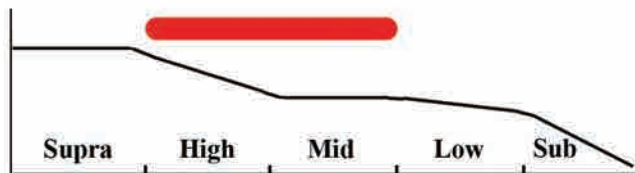


Figure 525. Bathymetric distribution of the species.

Remarks. The morphological differentiation between the four monotypic camptandriid genera *Nasima*, *Leptochryseus*, *Manningis* and *Opusia* is highly problematic, and the characters used are relatively minor and sometimes rather subjective (see discussions in Manning 1991; Ng et al. 2009). The affinities between *N. dotilliformis* and *L. kuwaitense* are obvious and include, for instance, the presence of dense setal mats on the walking legs (P3–5). The biology and ecology of *N. dotilliformis* were studied in detail from Sulaibikhat Bay, west of Kuwait City (Snowden and Clayton 1995), whereas its distributional range was recently extended to India (Trivedi et al. 2017).

Most Relevant References. Alcock 1900; Stephensen 1946; Jones and Clayton 1983; Manning 1991; Snowden and Clayton 1995; Ng et al. 2009; Naderloo and Türkay 2012; Naderloo 2017; Trivedi et al. 2017.

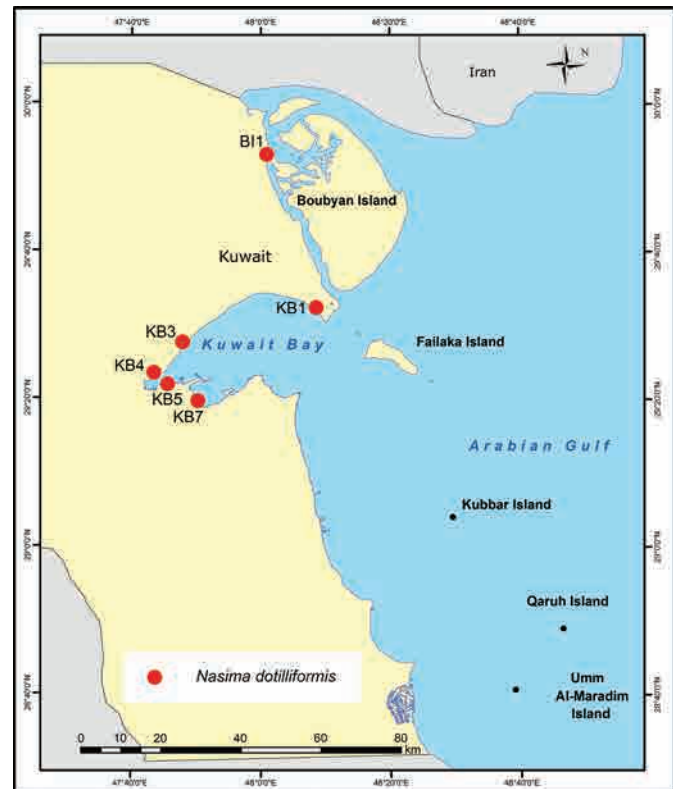


Figure 526. Presently known records of *Nasima dotilliformis* in Kuwait.



Figure 527. *Nasima dotilliformis* (tentative identification) in its burrow, Sulaibikhat Bay, Kuwait. Photographs by Igor Polikarpov.

Family Camptandriidae

Opusia indica (Alcock, 1900)

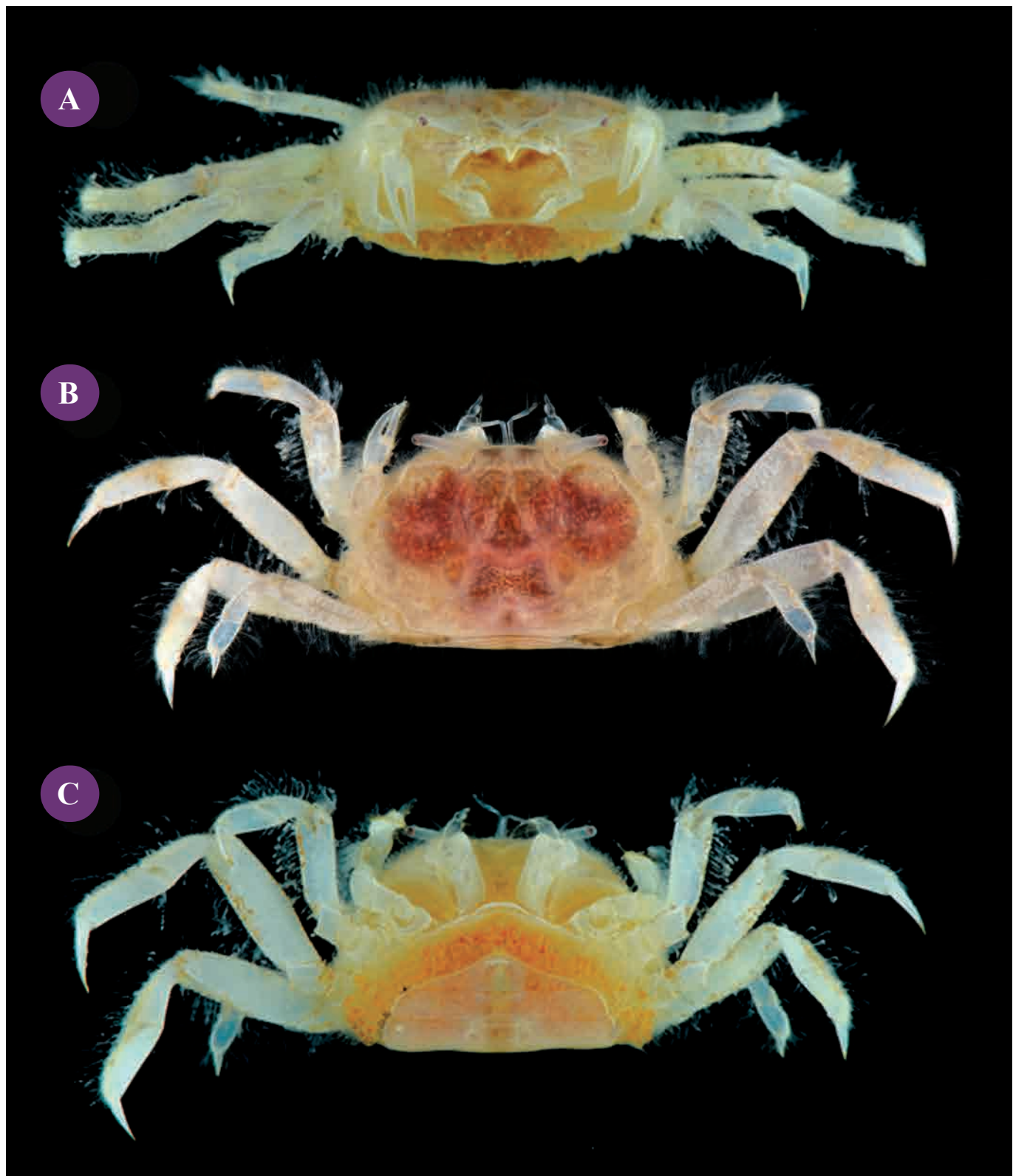


Figure 528. Ovigerous female of *Opusia indica* (Alcock, 1900) in frontal (A), dorsal (B) and ventral (C) views, Sulaibikhat Bay, Kuwait. Photographs by Arthur Anker.

Synonyms. *Tylodiplax indica* Alcock, 1900; *Opusia indicum* (Alcock, 1900).

Common Name. Alcock's mudflat crab.

Main Diagnostic Features.

1. Carapace about 1.5 times as wide as long; dorsal surface slightly convex, patchily setose or pubescent; carapace regions weakly demarcated by grooves; lateral margin of carapace strongly convex.
2. Front straight to slightly convex, about 0.25 length of maximal carapace width.
3. Eyestalks small, narrow; cornea reduced.
4. Male pleon narrow; all somites and telson free.
5. Chelipeds not sexually dimorphic, very small; chela not swollen, with rows of setae on dorsal and ventral margins and straight fingers.
6. Second walking leg (pereiopod 3) longest and more robust than the other walking legs; merus, carpus and propodus with setal brushes (especially in males).
7. Male gonopod (G1) with distal half strongly bent, forming almost complete loop; distal portion with small spinules.
8. Colour in life: sandy yellowish to pale brown.
9. Size: male reaching 7 mm/12 mm and females reaching 8 mm /14 mm of carapace length/width, respectively.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to India.

Ecology. Benthic on muddy bottom, typically on mudflats and muddy sandflats; throughout the intertidal zone.

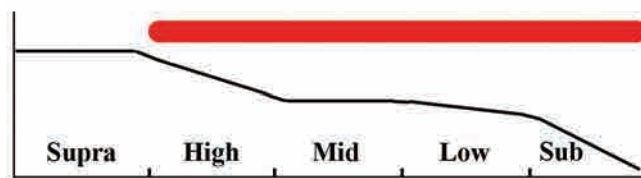


Figure 529. Bathymetric distribution of the species.

Remarks. *Opusia indica* is a small, but very distinctive mudflat crab, distinguishable from other camptandriid genera present in the region by the pubescent carapace, slender eyestalks and straight cheliped fingers (Ng et al. 2009; Naderloo 2017; Trivedi et al. 2017).

Most Relevant References. Alcock 1900; Ng et al. 2009; Naderloo and Türkay 2012; Naderloo 2017; Trivedi et al. 2017.

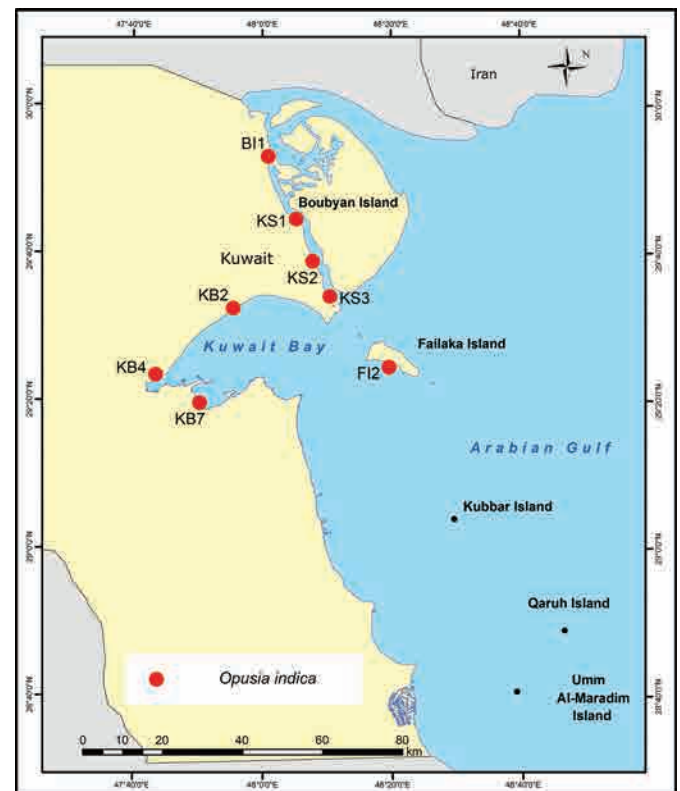


Figure 530. Presently known records of *Opusia indica* in Kuwait.

Family Dotillidae

Dotilla blanfordi Alcock, 1900

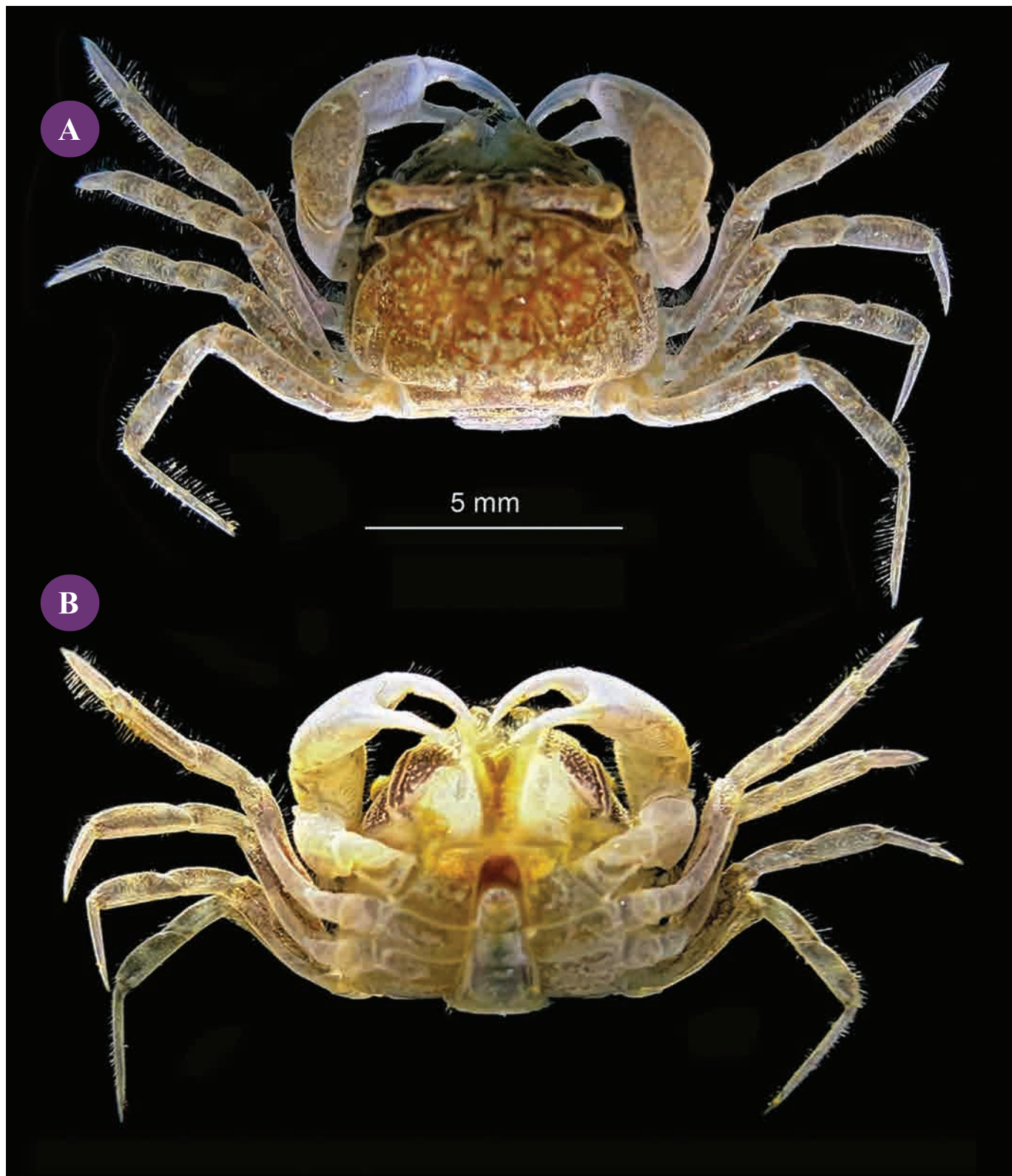


Figure 531. Male of *Dotilla blanfordi* Alcock, 1900 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Blanford's sand bubbler crab.

Main Diagnostic Features.

1. Carapace distinctly raised, cubical, transversely oval in dorsal view; dorsal surface areolate, grooved; flanks finely granular; subhepatic and pterygostomial regions with characteristic convoluted sculpture; orbits shallow; extra-orbital angle marked by sharp tooth.
2. Thoracic sternum without tympanal organs.
3. Eyestalks robust, moderately long, about half of maximal carapace width, with large cornea.
4. Third maxilliped expanded, bulging anteriorly; outer surface finely granular; merus twice as long as is chium.
5. Chelipeds moderately elongated, equal, subsymmetrical; chelae markedly curved, with fingers slightly longer than palm.
6. Ambulatory legs (pereiopods 2–5) slender, elongated; meri with tympanal organs on dorsal surface.
7. Colour in life: carapace mottled with brown and pale yellow; chelipeds and walking legs paler, greyish yellow; chela fingers hyaline white.
8. Size: maximal carapace width/length, 6.5 mm/8.7 mm.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on sandy bottoms, typically on extensive sandflats; in high intertidal zones; feeding by filtering sand through mouthparts and leaving behind characteristic sand balls.

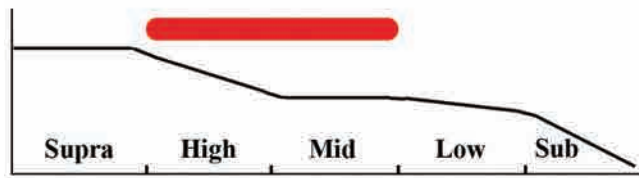


Figure 532. Bathymetric distribution of the species.

Remarks. One of the most striking and unique features of *Dotilla blanfordi* and several other sand-bubbler crabs is the presence of large membranous disks equivalent to tympana

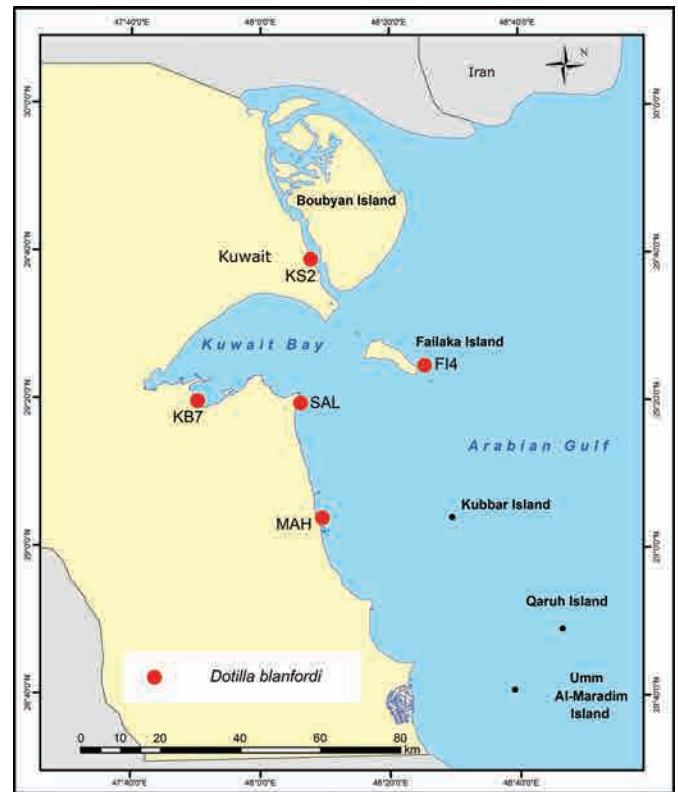


Figure 533. Presently known records of *Dotilla blanfordi* in Kuwait.

on the meri of the walking legs, which act as gas windows (Maitland 1986). The ecology of the species was studied in detail in India by Altevogt (1957). The only other species of *Dotilla* present in the Arabian-Persian Gulf, but not yet reported from Kuwait, is *D. sulcata* (= *D. affinis*), which differs from *D. blanfordi* in having a different configuration of grooves on the carapace (Kemp 1919; Altevogt 1957), the entire surface of the third maxilliped merus gyrous-sulcate (when compared to only the outer half of the merus gyrous-sulcate in *D. blanfordi*) and the cheliped fingers not longer than the palm (which is longer than the palm in *D. blanfordi*) (Alcock 1900).

Most Relevant References. Alcock, 1900; Kemp 1919; Altevogt 1957; Jones 1986a,b; Maitland 1986; Naderloo and Türkay 2012; Naderloo 2017.



Figure 534. Male of *Dotilla blanfordi* from Sulaibikhat Bay in frontal view (A) and typical burrows of *D. blanfordi* in situ off Khor Al Subiyah (B), Kuwait. Photographs by Arthur Anker (A) and Valeriy Skryabin (B).

Family Dotillidae

Ilyoplax stevensi (Kemp, 1919)



Figure 535. Male of *Ilyoplax stevensi* (Kemp, 1919) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

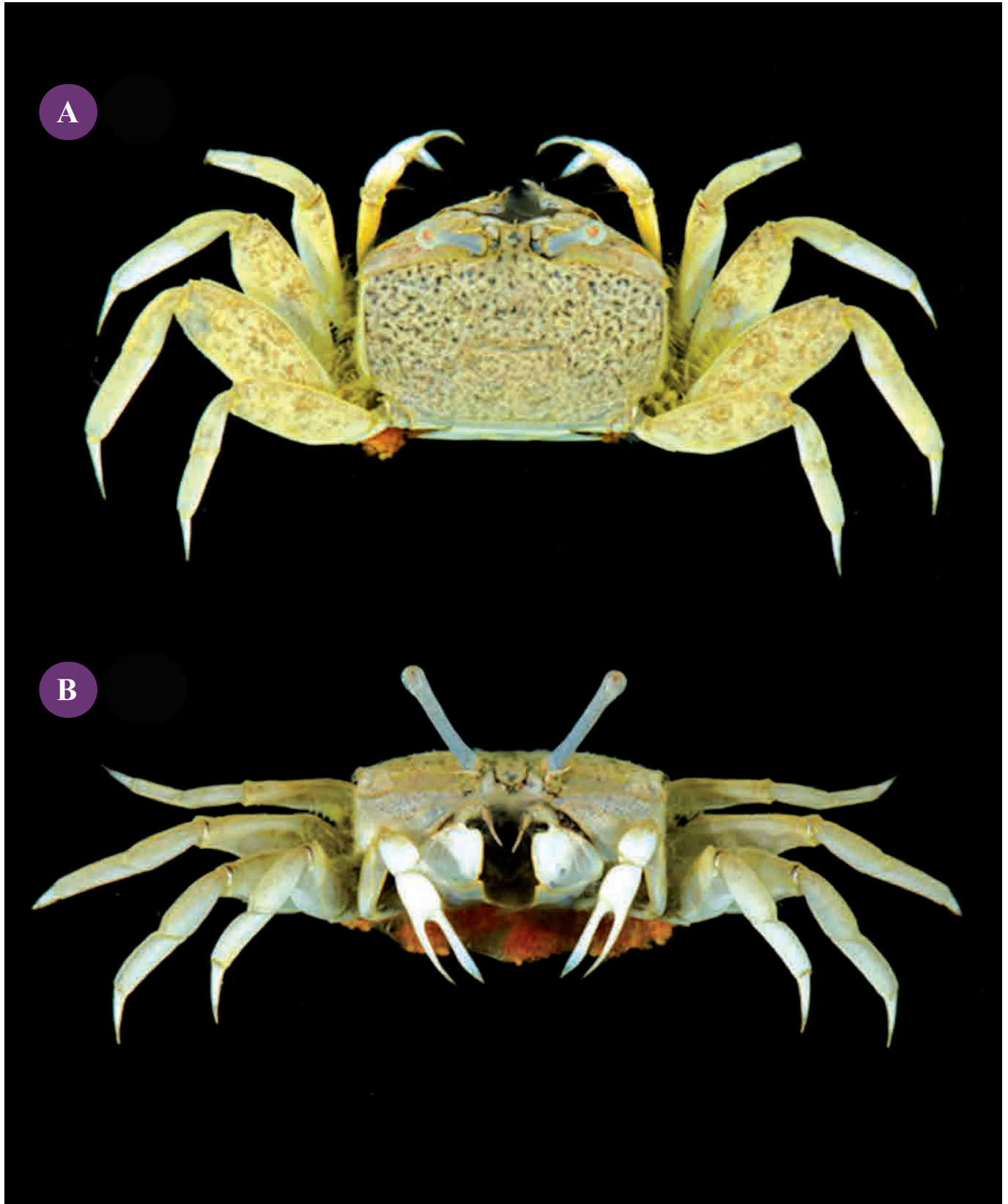


Figure 536. Ovigerous female of *Ilyoplax stevensi* (Kemp, 1919) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Arthur Anker.

Synonym. *Tympanomerus stevensi* Kemp, 1919.

Common Name. Steven's mudflat crab.

Main Diagnostic Features.

1. Carapace transversely oblong; about half as long as wide; dorsal surface slightly convex, feebly sculptured; lateral margin straight below sharp extra-orbital tooth; posterolateral margin convergent.
2. Front obliquely deflexed, narrow, at most 0.1 as long as maximal carapace width.
3. Third maxillipeds medium-sized, not bulged anteriorly; merus longer than ischium.
4. Chelipeds stouter than walking legs in both sexes, without tympanum on the dorsal surface of merus.
5. Male gonopod (G1) with apical part gently bent outwards.
6. Colour in life: pale grey with brown-orange spots; chelae hyaline white with pinkish tinge; legs yellowish mottled with grey and brown.
7. Size: maximal carapace length/width of males, 4.5 mm/7 mm, and of females, 5 mm/8 mm.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on muddy bottom in high and middle intertidal zones.

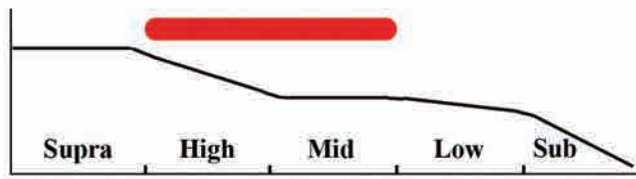


Figure 537. Bathymetric distribution of the species.

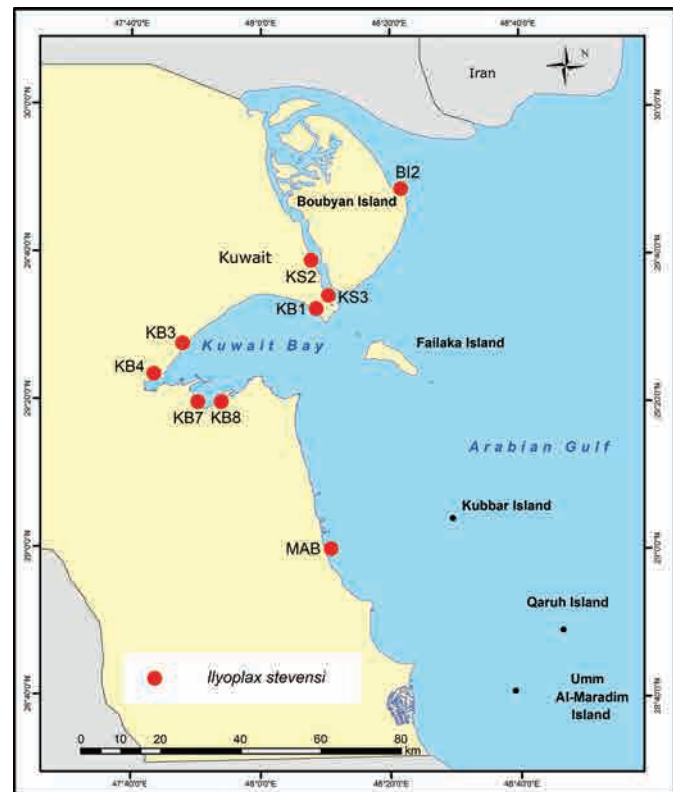


Figure 538. Presently known records of *Ilyoplax stevensi* in Kuwait.

Remarks. Two morphologically similar species of the genus *Ilyoplax* have been reported from Kuwait, namely, *I. stevensi* and *I. frater* (Jones 1986a; Clayton 1986; Naderloo and Türkay 2012). They can be separated by the narrower front in *I. stevensi*, which is not more than 0.10 of the maximal carapace width which is not no less than 0.14 in *I. frater*. In addition, the male of *I. stevensi* possess patches of tomentum (pilosity) on the carpus and propodus of the second walking leg (P3), which are absent in *I. frater* (Kemp 1919; Naderloo 2017).

Most Relevant References. Kemp 1919; Jones 1986a; Clayton 1986; Naderloo and Türkay 2012; Naderloo 2017.



Figure 539. Possibly *Ilyoplax* cf. *frater* in situ on mudflats of Al-Doha, Kuwait. Photograph by Abdulaziz Alyousef.



Figure 540. Burrows of *Ilyoplax stevensi*, Kuwait. Photograph by David A. Jones.

Family Dotillidae

Scopimera crabricauda Alcock, 1900



Figure 541. Male of *Scopimera crabricauda* Alcock, 1900 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Common Name. Indian sand bubbler crab.

Main Diagnostic Features.

1. Carapace cubical, subpentagonal in dorsal view; carapace regions poorly indicated, mid-dorsal region symmetrically puckered or vesiculous; sidewalls and pterygostomial region granular, without convoluted sculpture; orbits moderately broad and deep, upper border oblique, lower border prominent, finely denticulate; extra-orbital angle with poorly marked/reduced tooth.
2. Thoracic sternum without tympanal organs.
3. Eyestalks robust, moderately long, about 0.4 of maximal carapace width, markedly broadening distally, with large cornea.
4. Third maxilliped expanded, bulging anteriorly; merus shorter than ischium; outer surface smooth.
5. Chelipeds moderately elongated (especially in adult males), equal, subsymmetrical; merus with large tympanum on the inner (mesial) surface and small tympanum on the outer (external) surface; chelae markedly curved, with fingers shorter than palm.
6. Ambulatory legs (pereiopods 2–5) slender, elongated; meri with non-ridged tympanal organs on the dorsal surface.
7. Colour in life: carapace dark silvery or bluish grey; chelipeds and walking legs paler, greyish with blackish and yellow spots; chela fingers whitish.
8. Size: maximal carapace width/length, 6.5 mm/10 mm.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on sandy bottoms, typically on sheltered sandflats; in high and mid-intertidal zones; feeding by filtering sand through mouthparts and leaving behind characteristic sand balls.

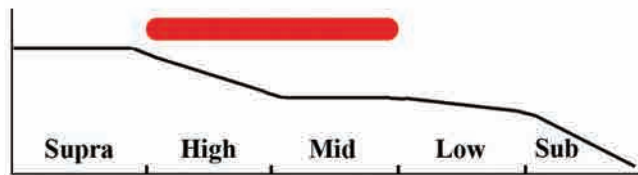


Figure 542. Bathymetric distribution of the species.

Remarks. Similar to the previous species, *Scopimera crabricauda* is a sand-bubbler crab with gas-exchanging tympana on the walking legs (Alcock 1900; Maitland 1986).



Figure 544. Two males of *Scopimera crabricauda* in situ at Khor Al Subiyah (A) and Sulaibikhat Bay (B); typical burrow with small sand pellets around at Al-Kuwaisat (C), Kuwait. Photographs by Valeriy Skryabin (A, C) and Igor Polikarpov (B).

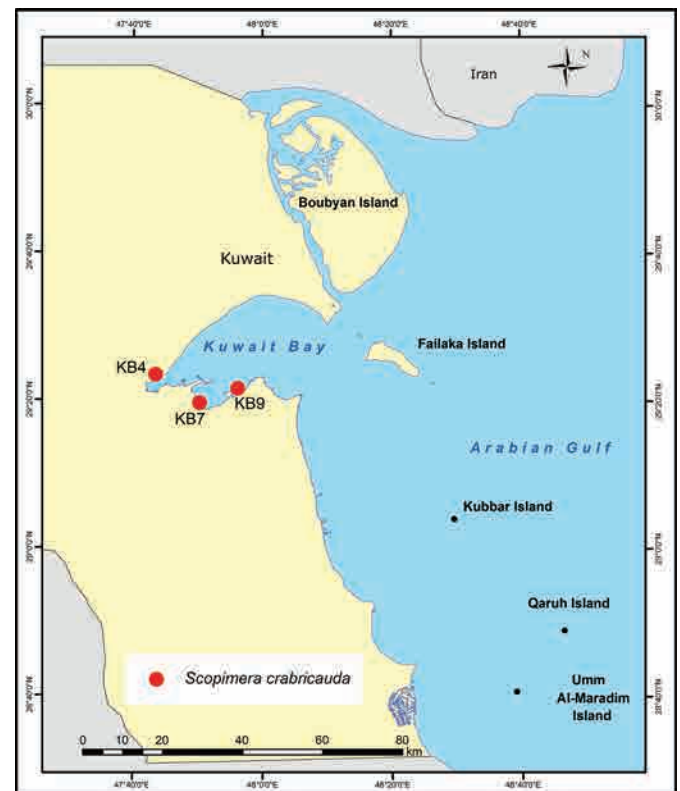


Figure 543. Presently known records of *Scopimera crabricauda* in Kuwait.

Most Relevant References. Alcock, 1900; Kemp 1919; Jones, 1986a,b; Maitland 1986. Naderloo 2017.



Family Macrophthalmidae

Ilyograpsus rhizophorae Barnard, 1955



Figure 545. Damaged preserved specimen of *Ilyograpsus rhizophorae* Barnard, 1955, Kuwait. Photograph by Valeriy Skryabin.

Common Name. Barnard's mangrove crab.

Main Diagnostic Features.

1. Carapace suboctagonal, 1.2–1.3 times as wide as long; regions faintly indicated; gastro-cardiac groove distinct; lateral margins generally convex, with 4 blunt lateral teeth.
2. Front prominent, feebly bilobed.
3. Chelipeds of adult males moderately large, robust; those of ovigerous females slender; palm and fingers with rows of setae on mesial surface.
4. Ambulatory legs (pereiopods 2–5) moderately long, slender; merus flattened, armed with sharp distal tooth on the dorsal (anterior) margin.
5. Colour in life inconspicuous: carapace pale brownish; ambulatory legs yellowish.
6. Size: maximal carapace length of males 6.5 mm, and that of females, 7.4 mm.

Distribution. Western Indian Ocean: from the Red Sea and Madagascar to the Arabian-Persian Gulf and Pakistan.

Ecology. Benthic on muddy bottom; throughout the intertidal zone; in small burrows in mud among mangroves or muddy rocks.

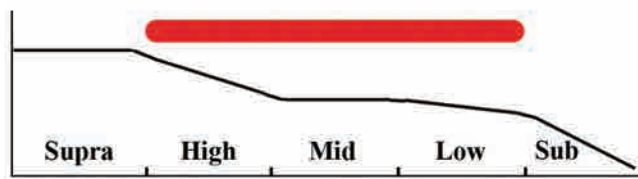


Figure 546. Bathymetric distribution of the species.

Remarks. *Ilyograpsus rhizophorae* is a small and rather inconspicuous mudflat crab, which has been, so far, recorded from the country only from the inner Kuwait Bay and Shatt-Al-Arab area in Kuwait. The species is widespread throughout the Arabian-Persian Gulf, with multiple records from Iran and the adjacent Gulf of Oman (Naderloo et al. 2011; Naderloo and Türkay 2012; Naderloo 2017). For illustrations of the general morphology of *I. rhizophorae* see Barnard (1955), Komai and Wada (2008), and Naderloo (2017).

Most Relevant References. Barnard 1955; Komai and Wada 2008; Naderloo et al. 2011; Naderloo and Türkay 2012; Naderloo 2017.

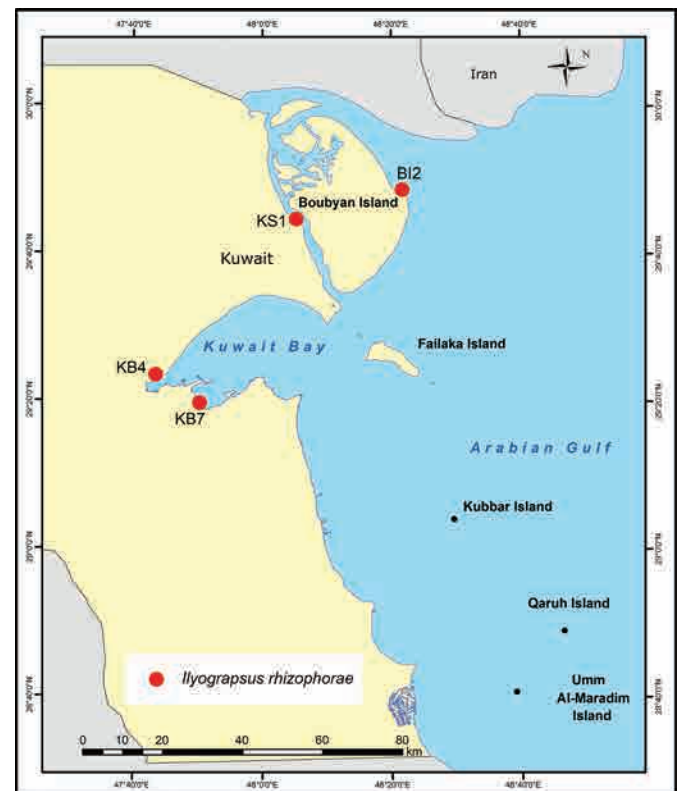


Figure 547. Presently known records of *Ilyograpsus rhizophorae* in Kuwait.

Family Macrophthalmidae

Macrophthalmus depressus Rüppell, 1830

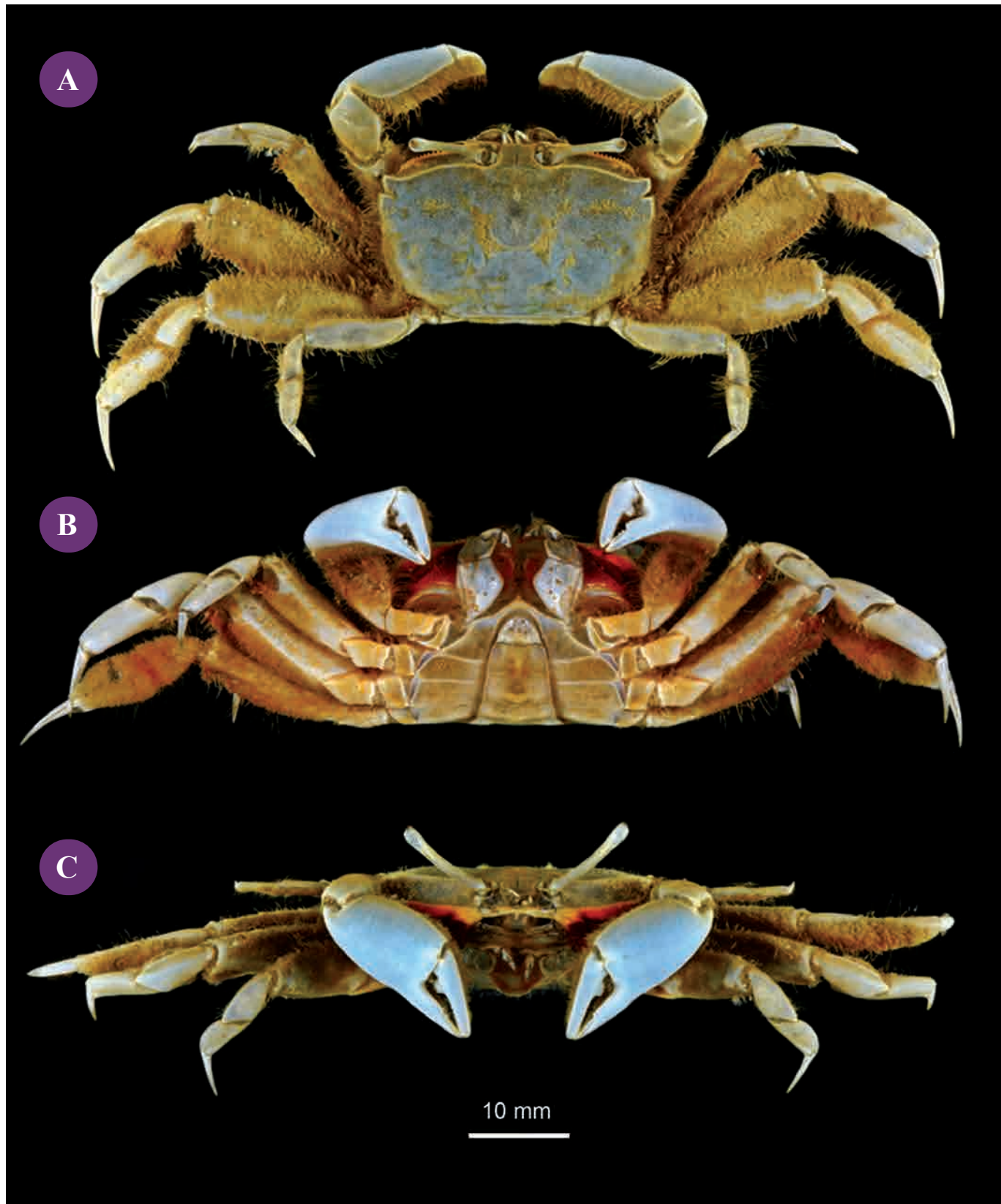


Figure 548. Male of *Macrophthalmus depressus* Rüppell, 1830 in dorsal (A), ventral (B), and frontal (C) views, Kuwait Bay, Kuwait. Photographs by Arthur Anker.

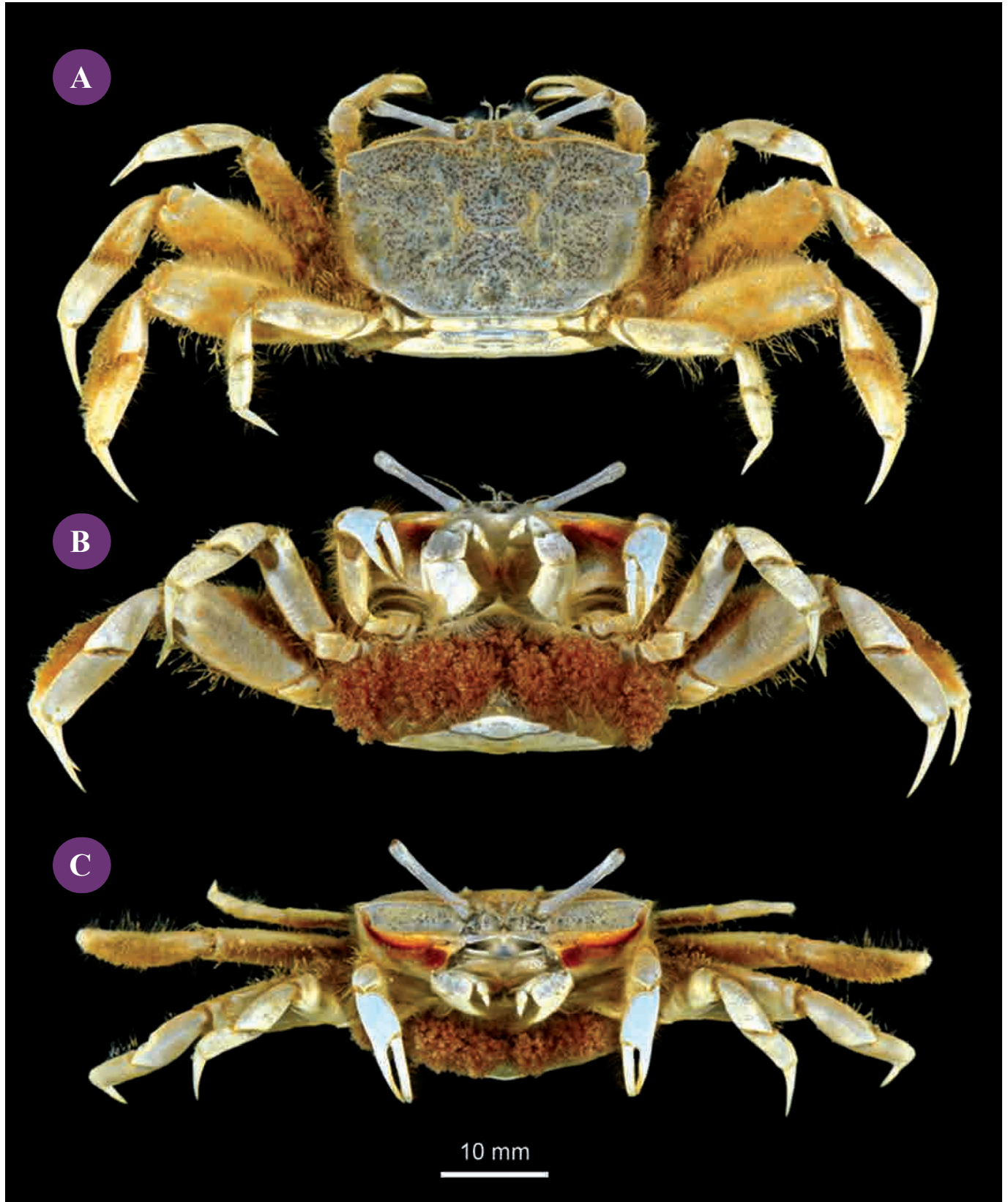


Figure 549. Ovigerous female of *Macrophthalmus depressus* Rüppell, 1830 in dorsal (A), ventral (B), and frontal (C) views, Kuwait Bay, Kuwait. Photographs by Arthur Anker.

Synonyms. *Macrophthalmus (Mareotis) depressus* Rüppell, 1830; *Macrophthalmus affinis* Guérin-Méneville, 1838.

Common Name. Blue-clawed sentinel crab.

Main Diagnostic Features.

1. Carapace about 1.5 times as wide as long; lateral margin with 3 teeth (including tooth on extra-orbital angle).
2. Front narrow, about 0.12 times as wide as carapace, straight.
3. Eyestalks narrow, moderately elongated (compared to some other species).
4. Chelipeds stout, subequal; surface of palm setose in males, smooth in females; fingers largely gaping in males.
5. Ambulatory legs (pereiopods 2–5) relatively long, flattened, covered by dense setae; merus much broader than carpus and propodus.
6. Colour in life: dorsal surface of carapace, chelipeds, and ambulatory legs pale brown; suborbital region of carapace brick red in females and orange in females; outer (frontal) surface of chelae pale sky blue (brighter in males); thoracic sternum of male, orange-brown.
7. Size: maximal carapace length/width, 16 mm/26.5 mm for males, 15 mm/26.5 mm for females.

Distribution. Western Indian Ocean: from the Red Sea and South Africa to the Arabian-Persian Gulf and western India.

Ecology. Benthic on muddy or muddy-sandy bottoms; throughout intertidal zone; lives in simple, self-dug burrows in mud or muddy sand.

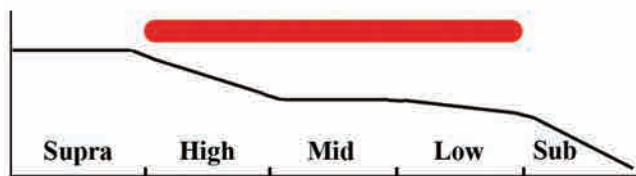


Figure 550. Bathymetric distribution of the species.

Remarks. The lower intertidal zone of the northern Gulf mudflats is commonly called “the *Macrophthalmus depressus* zone” by marine biologists and ecologists working in the area. This sentinel crab was recorded from Kuwait by Jones (1986) and is indeed very common on mudflats and sandflats of the north-western Indian Ocean. In the field, *M. depressus* can be easily recognized by its sky-blue claws.

Most Relevant References. Naderloo and Türkay 2012; Naderloo 2017.

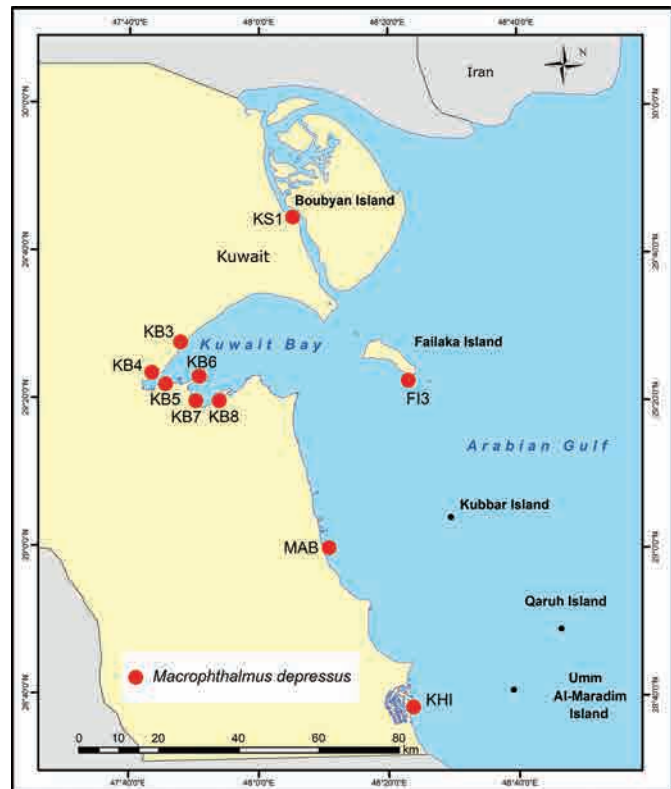


Figure 551. Presently known records of *Macrophthalmus depressus* in Kuwait.



Figure 552. Adult male of *Macrophthalmus depressus* in frontal view, Kuwait. Photograph by Arthur Anker.



Figure 553. Feeding behaviour of *Macrophthalmus depressus* displayed by a male from Sulaibikhat Bay, Kuwait. Photograph by Igor Polikarpov.

B



C



E



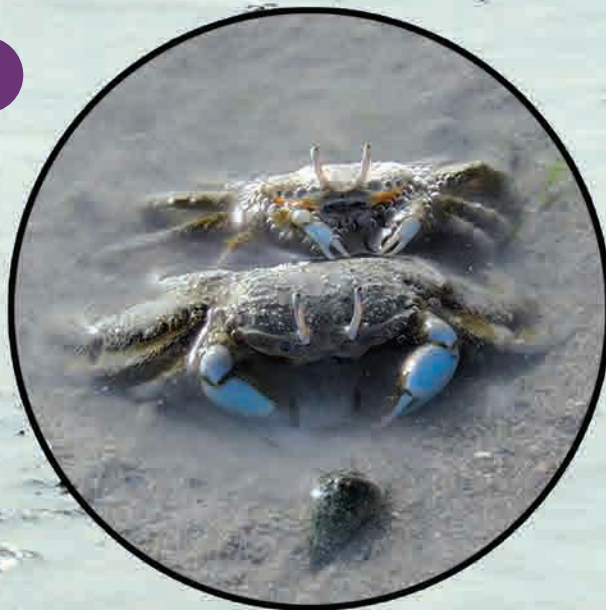
G



H



Figure 554. Population of *Macrophthalmus depressus* in Sulaibikhat Bay, Kuwait: “*Macrophthalmus depressus* zone” (A); male partially buried in the sand (B); defensive display of male (C); small group of crabs (D); male near the burrow entrance (E, G); feeding behaviour of males (F); male hiding under a cluster of *Pirenella cingulata* (Gmelin, 1791) (H); male and female (I and J). Photographs by Igor Polikarpov.



A

Family Macrophthalmidae

Macrophthalmus laevis A. Milne-Edwards, 1867

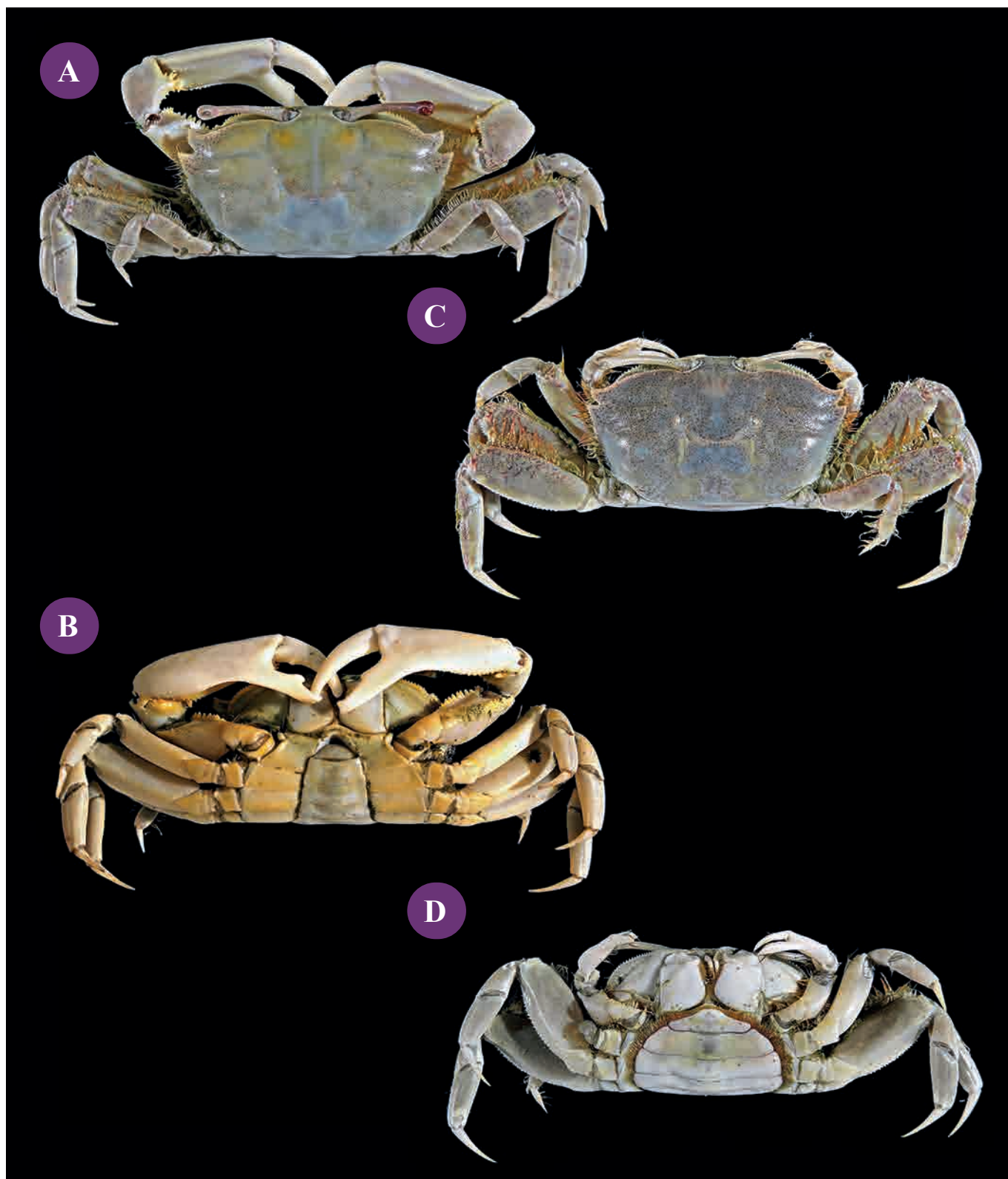


Figure 555. Male of *Macrophthalmus laevis* A. Milne-Edwards, 1867 in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Macrophthalmus (Mareotis) laevis* A. Milne Edwards, 1867; *Macrophthalmus (Macrophthalmus) resilli* Pretzmann, 1971.

Common Name. Buff-clawed sentinel crab.

Main Diagnostic Features.

1. Carapace about 1.7 times as wide as long; carapace regions well marked; dorsal surface covered with minute granules; lateral margin convex with 3 teeth (including tooth on extra-orbital angle; posterior margin straight, about half carapace width.
2. Front narrow, only 0.1 of carapace width, straight.
3. Eyestalks narrow, moderately elongated (compared to some other species).
4. Male chelipeds equal but stouter than walking legs, finely granular; anterior margin of merus toothed; palm without setae on the inner surface; fingers largely gaping in males.
5. Ambulatory legs (pereiopods 2–5) relatively long, flattened; merus broader than carpus and propodus, armed with 1 subterminal spine on upper (anterior) margin.
6. Colour in life: carapace bluish grey with pale buff areas; chelipeds and walking legs hyaline with buff or pale pink-purple tinge; setae on the margins of carapace, brownish orange.
7. Size: maximal carapace length/width at least 12.5 x 21 mm.

Distribution. Western Indian Ocean: from Oman and the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on muddy-sandy bottoms; high to lower intertidal zone; lives in simple, self-dug burrows, sometimes burying in muddy sand in the open or under rocks.

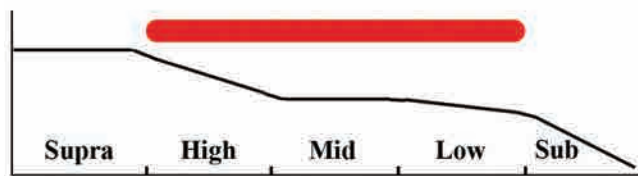


Figure 556. Bathymetric distribution of the species.

Remarks. *Macrophthalmus laevis* is often found in the same habitat as of *M. sulcatus* (see following pages), i.e. muddy sand with broken shells rather than just mud, which is the preferred habitat of *M. depressus*. The three species of sentinel crabs (*Macrophthalmus*) present in Kuwait may be distinguished using the morphology-based key in Naderloo (2017). The general morphology of *M. laevis* was illustrated by various authors, especially Barnes (1976), Tirmizi and Ghani (1988) and Naderloo (2017).

Most Relevant References. A. Milne-Edwards 1867; Barnes 1976; Tirmizi and Ghani 1988; Apel 2001; Naderloo and Türkay 2012; Naderloo 2017.

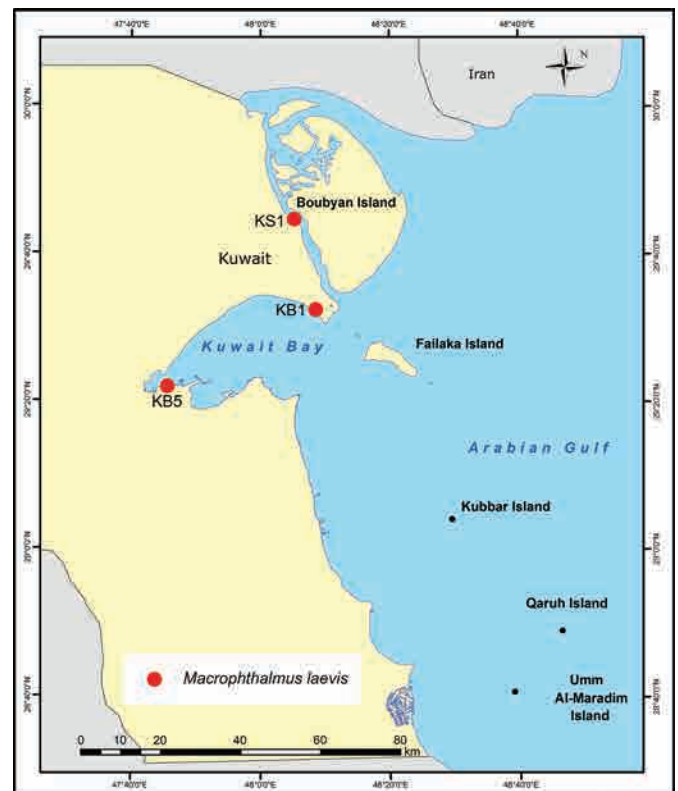


Figure 557. Presently known records of *Macrophthalmus laevis* in Kuwait.

Family Macrophthalmidae

Macrophthalmus sulcatus H. Milne Edwards, 1852

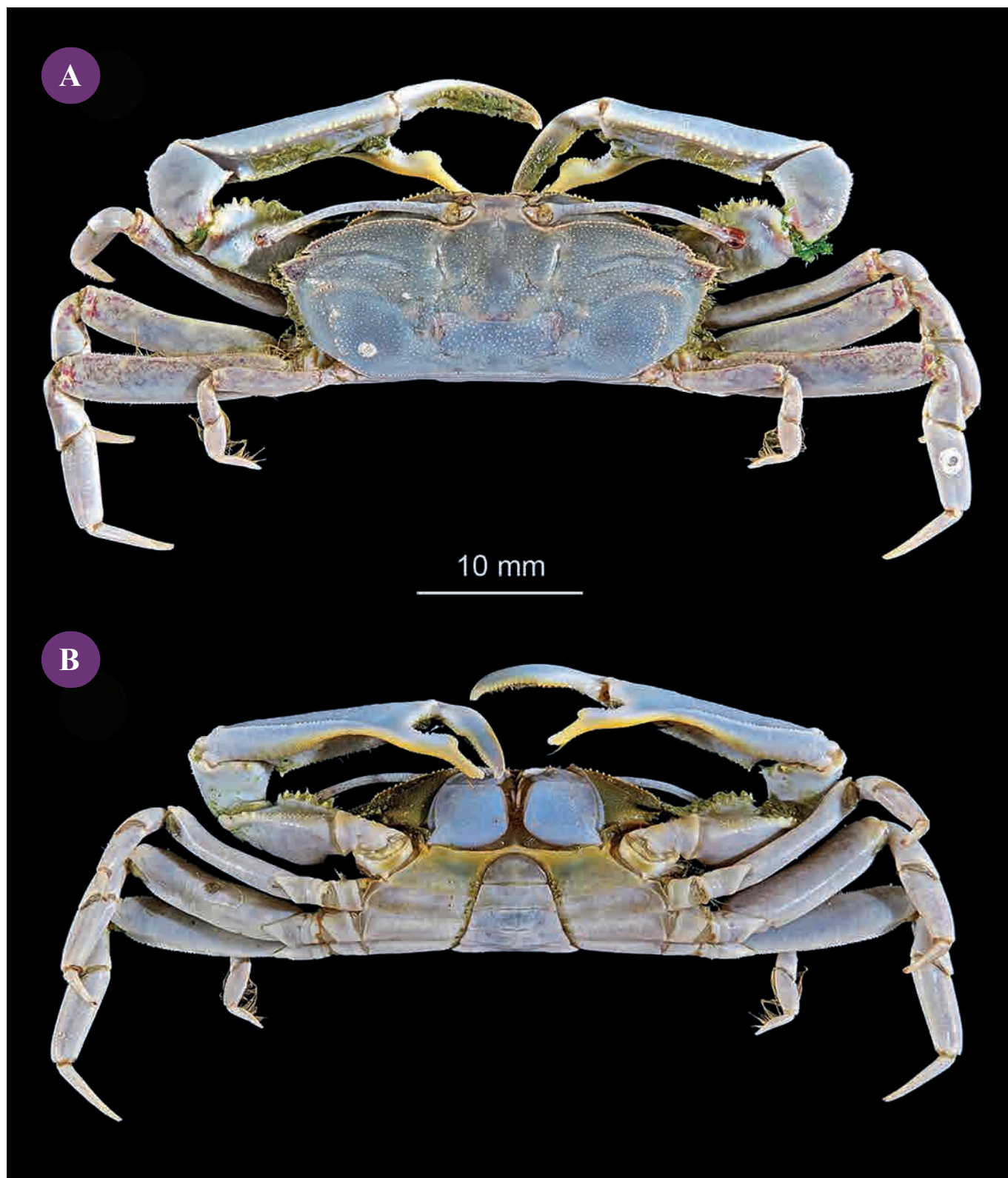


Figure 558. Male of *Macrophthalmus sulcatus* H. Milne Edwards, 1852 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Macrophthalmus (Macrophthalmus) sulcatus* H. Milne Edwards, 1852; *Macrophthalmus dilatatus sulcatus* H. Milne Edwards, 1852.

Common Name. Bluish sentinel crab.

Main Diagnostic Features.

1. Carapace much wider than long, width/length ratio about 2.3; carapace regions well defined; dorsal surface finely granulated; anterolateral margin with 3 teeth (including tooth on extra-orbital angle).
2. Front narrow, about 0.12 times as wide as carapace, straight.
3. Eyestalks very long, narrow, 0.4 as long as carapace width.
4. Chelipeds equal in size, elongated, stout; anterior margin of merus toothed; inner (mesial) surface of merus, palm, and dactylus with short tomentum (fields of hair-like setae); fingers largely gaping in adult males.
5. Ambulatory legs (pereiopods 2–5) long, stout, flattened, and sparsely covered by setae; merus not much broader than carpus and propodus.
6. Colour in life: carapace bluish grey with minute yellow dots; chelipeds pale bluish; walking legs pale reddish.
7. Size: maximal carapace length/width at least 11.5 x 27 mm.

Distribution. Indian Ocean: from Mauritius to the Arabian-Persian Gulf and through Pakistan and India to western Malaysia.

Ecology. Benthic on muddy and muddy-sandy bottoms; mainly in the mid-intertidal zone; lives in simple, self-dug burrows in mud or muddy sand.

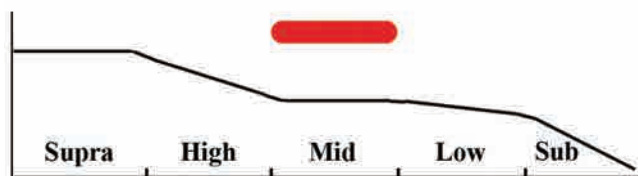


Figure 559. Bathymetric distribution of the species.



Figure 561. *Macrophthalmus sulcatus* on an exposed mudflat of Sulaibikhat Bay, Kuwait. Photograph by Igor Polikarpov.

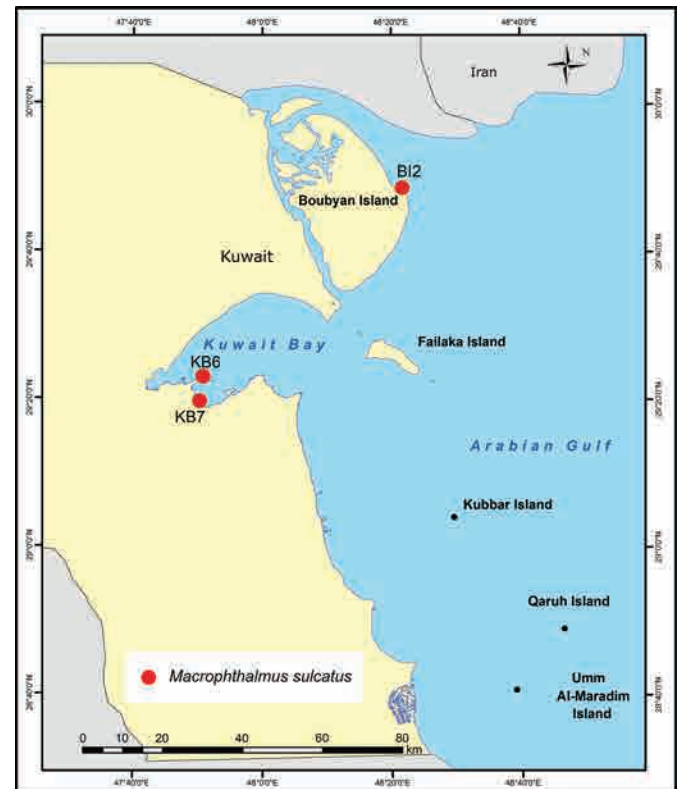


Figure 560. Presently known records of *Macrophthalmus sulcatus* in Kuwait.

Remarks. *Macrophthalmus sulcatus* was reported from Kuwait by both Clayton (1986) and Jones (1986a) under the name *M. grandidieri*, a closely related species with several records from the Arabian-Persian Gulf (Naderloo 2017). This sentinel crab has remarkably elongated, narrow eyestalks, one of its main distinguishing features among the Kuwaiti species of *Macrophthalmus*.

Most Relevant References. Clayton 1986; Jones 1986a (both as *M. grandidieri*); Naderloo and Türkay 2012; Naderloo 2017.

Family Macrophthalmidae

Venitus dentipes (Lucas in Guérin-Méneville, 1836)

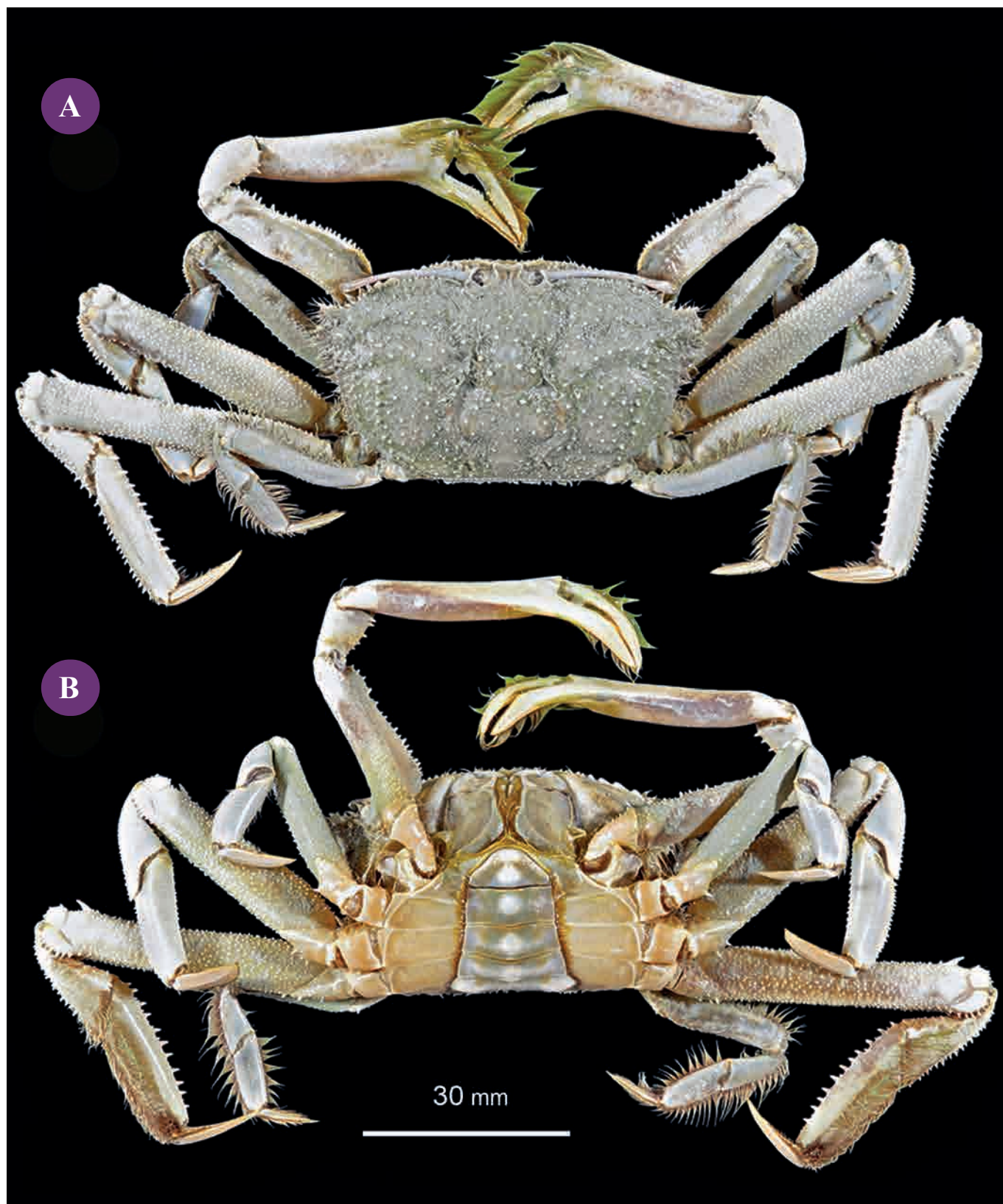


Figure 562. Male of *Venitus dentipes* (Lucas in Guérin-Méneville, 1836) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

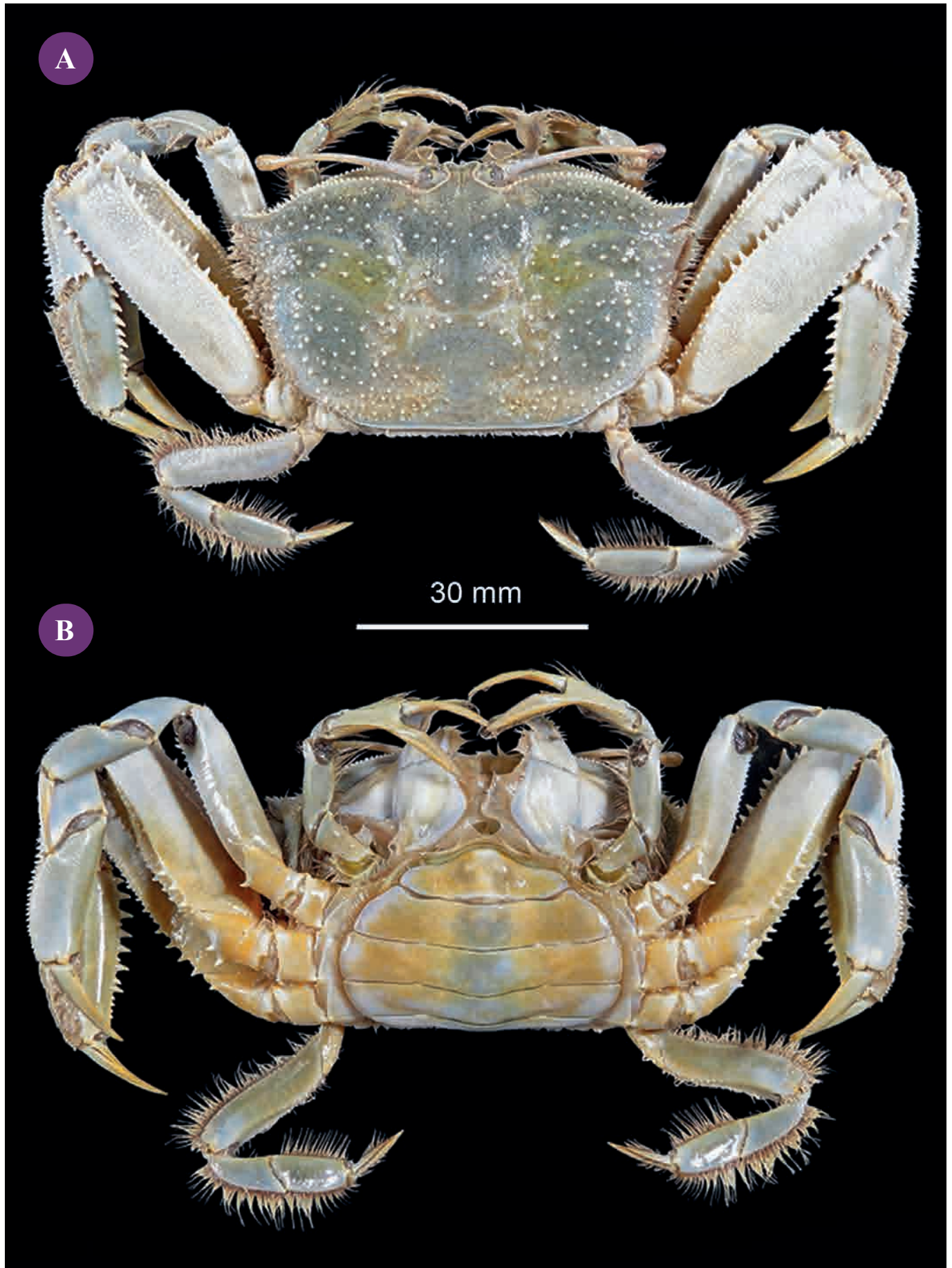


Figure 563. Female of *Venitus dentipes* (Lucas in Guérin-Méneville, 1836) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Macrophthalmus dentipes* Lucas in Guérin, 1836; *Macrophthalmus (Venitus) dentipes* Lucas in Guérin, 1836; *Macrophthalmus rouxii* Lucas in Guérin, 1836; *Macrophthalmus pectinipes* Guérin-Ménéville, 1838; *Macrophthalmus simplicipes* Guérin-Ménéville, 1838; *Macrophthalmus guerini* H. Milne Edwards, 1852.

Common Name. Rugose sentinel crab.

Main Diagnostic Features.

1. Carapace 1.6–1.7 times as wide as long, slightly convex, covered by large granules and tubercles in the form of blunt conical teeth; carapace regions well defined; anterolateral margin with 3 teeth (including large tooth on extra-orbital angle); anterior and lateral margins finely toothed.
2. Frontal region remarkably deflexed downwards, smooth; front very narrow, only about 0.06–0.07 times as wide as carapace, straight.
3. Eyestalks slender, moderately elongated, not reaching extra-orbital angle, small relative to body.
4. Chelipeds equal in size, elongated, stout; anterior margin of merus toothed; inner (mesial) distal surface of palm and upper (dorsal) margin of dactylus with longitudinal row of dense setae; fingers largely gaping in adult males.
5. Ambulatory legs (pereiopods 2–5) long, stout, somewhat flattened; merus not much broader than carpus and propodus, finely granulated; carpus and propodus markedly toothed on both anterior and posterior margins.
6. Colour in life: dorsal surface of carapace and walking legs dull grey with greenish tinge or spots.
7. Size: males reaching 40 mm/65 mm of carapace length / width, respectively; females slightly smaller.

Distribution. Western Indian Ocean: from Oman and the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on muddy bottoms, typically on mudflats and mangroves; high to low intertidal zone; in large burrows with the opening of approximately 10 cm in diameter, marked by “sloppy” mud-pool and mound of excavated mud.

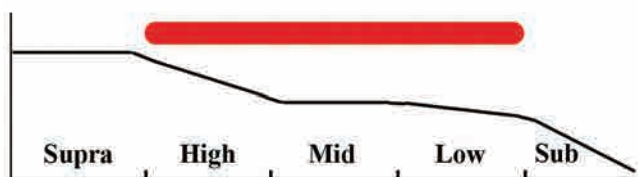


Figure 564. Bathymetric distribution of the species.

Remarks. The five species of the genus *Venitus* (formerly subgenus of *Macrophthalmus*) differ from all the species presently assigned to *Macrophthalmus* essentially by the strongly granulated/tuberculated carapace, very narrow front, strongly toothed walking legs (especially the carpus and propodus of P3 and P4) and comparatively small, slender eyestalks (Barnes 1976). In addition, most of them, including *V. dentipes*, are also larger than *Macrophthalmus* spp. However, recognizing *Venitus* as a separate genus is problematic as it is shown to be nested within *Macrophthalmus* (McLay et al. 2010).

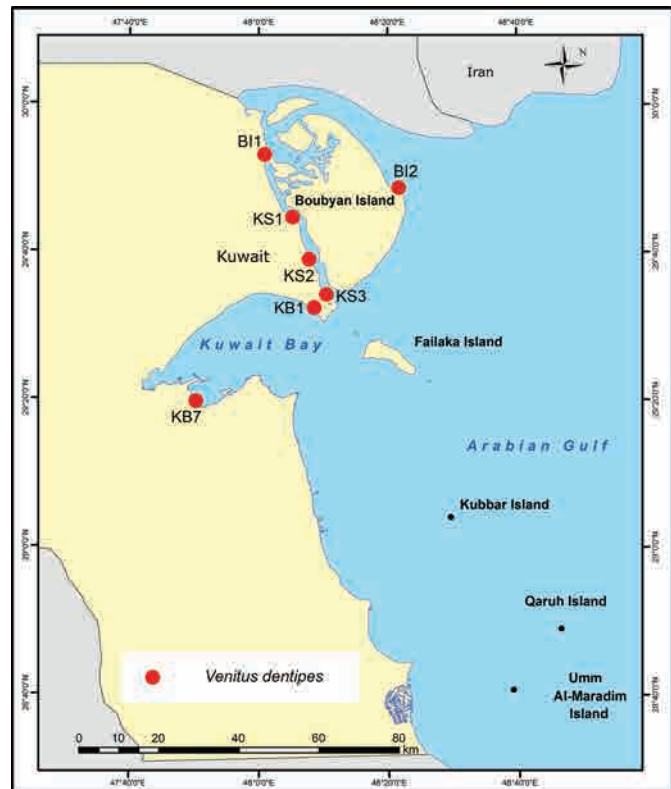


Figure 565. Presently known records of *Venitus dentipes* in Kuwait.

Most Relevant References. Jones (1986a, as *M. pectinipes*); Naderloo et al. 2011; Naderloo and Türkay 2012; Naderloo 2017.



Figure 566. *Venitus dentipes* in situ in Khor Al-Subiyah, Kuwait (A, B). Photographs by Valeriy Skryabin.



Figure 567. Male of *Venitus dentipes* on a mudflat near Khor Al-Subiyah, Kuwait. Photograph by Valeriy Skryabin.

A

B

C



Figure 568. Population of *Venitus dentipes* in Khor Al-Subiyah, Kuwait: tidal mudflat, typical habitat of the species (A); large group of crabs (B); male foraging on mud (C); crab largely submerged by water, using its long eyestalks to monitor the neighbourhood (D); and rivalry between two males for the possession of burrow, Kuwait (E). Photographs by Valeriy Skryabin.



Family Ocypodidae

Austruca iranica (Pretzmann, 1971)



Figure 569. Male of *Austruca iranica* (Pretzmann, 1971) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Arthur Anker.

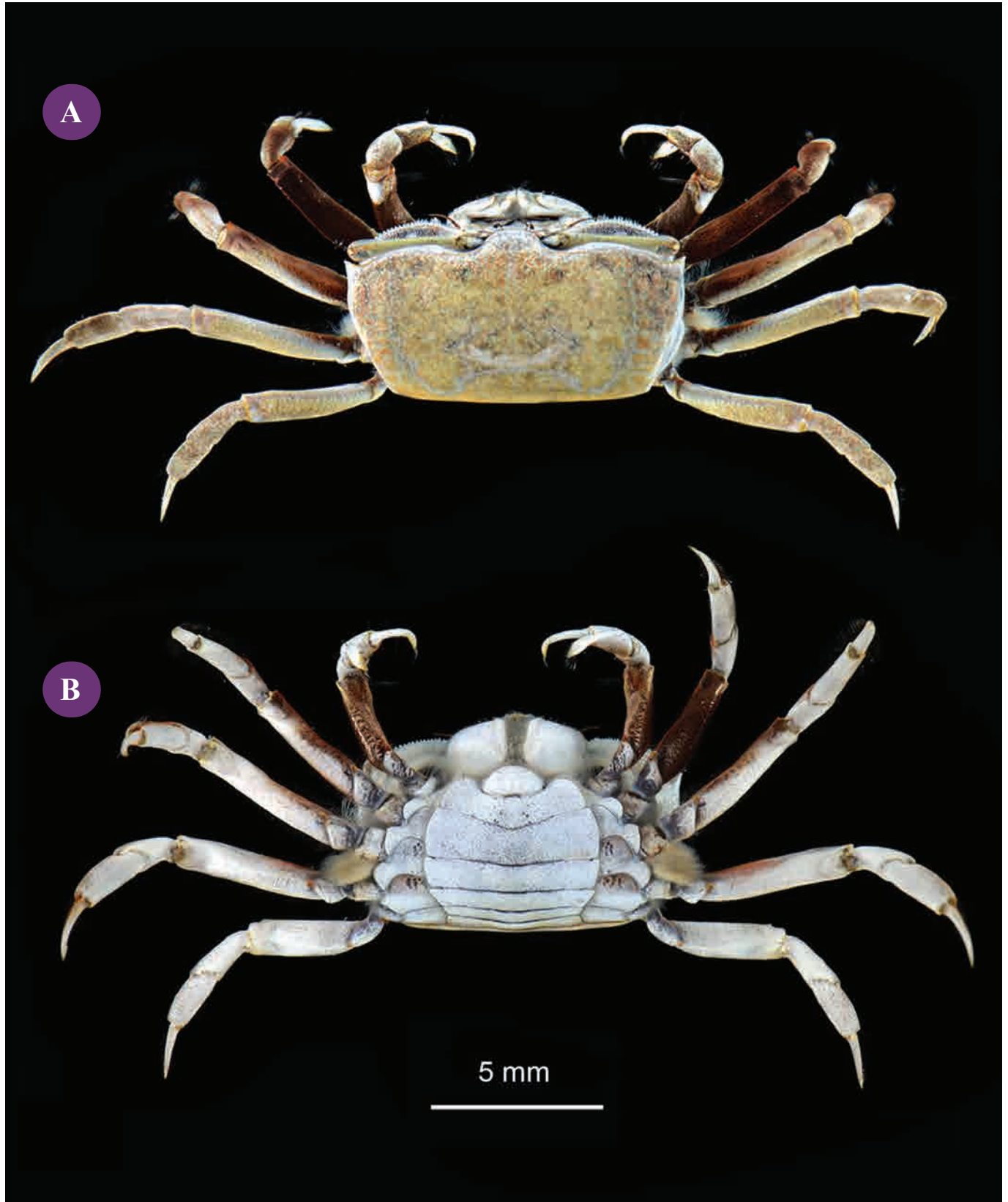


Figure 570. Female of *Austruca iranica* (Pretzmann, 1971) in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Uca (Austruca) iranica* Pretzmann, 1971; *Uca annulipes iranica* Pretzmann, 1971.

Common Name. Iranian fiddler crab.

Main Diagnostic Features.

1. Carapace transversely rectangular, about 0.6 times as long as wide; anterolateral margin weakly arched, nearly straight; extra-orbital tooth strong, sharp; posterolateral margin slightly convergent, nearly straight, distinctly crested.
2. Front broad, deflexed, broadly rounded.
3. Male major chela (waving claw) with palm lacking supra-marginal groove adjacent to lower border, with shallow depression near the base of pollex and oblique granular ridge on the inner palmar surface; fingers elongated, longer than carapace width and strongly gaping in adult males; pollex with small subdistal tooth near tip.
4. Male gonopod (G1) with large subdistal finger-like process and 2 small distal lobes opposed to the larger lobe.
5. Colour in life: dorsal surface of male carapace bluish grey; major chela white-yellow; minor chela red; ambulatory legs red anteriorly, greyish posteriorly; dorsal surface of female carapace pale yellow.
6. Size: males reaching about 12 mm/20 mm and females about 13 mm / 16 mm, of carapace length/width, respectively.

Distribution. Western Indian Ocean: restricted to the Arabian-Persian Gulf and the adjacent Gulf of Oman.

Ecology. Benthic on sand and sand-mud bottoms of sand- and mudflats and mangroves; most common in the high intertidal zone; in simple burrows.



Figure 571. Bathymetric distribution of the species.

Remarks. Six species of fiddler crabs were registered from the Arabian-Persian Gulf, with two of them occurring in Kuwait: *A. iranica* and *A. sindensis* (see following pages). These two species can be easily distinguished by a suite of morphological characters and the colour pattern (Naderloo 2017). The taxonomic history and subgeneric assignment of *A. iranica* were discussed by Naderloo et al. (2010). The population structure and dynamics of *A. iranica* were recently studied in the extensive mangroves on the Iranian side of the Arabian-Persian Gulf (Saeedi et al. 2018).

Most Relevant References. Pretzmann 1971; Naderloo et al. 2010; Naderloo and Türkay 2012; Naderloo 2017; Saeedi et al. 2018.

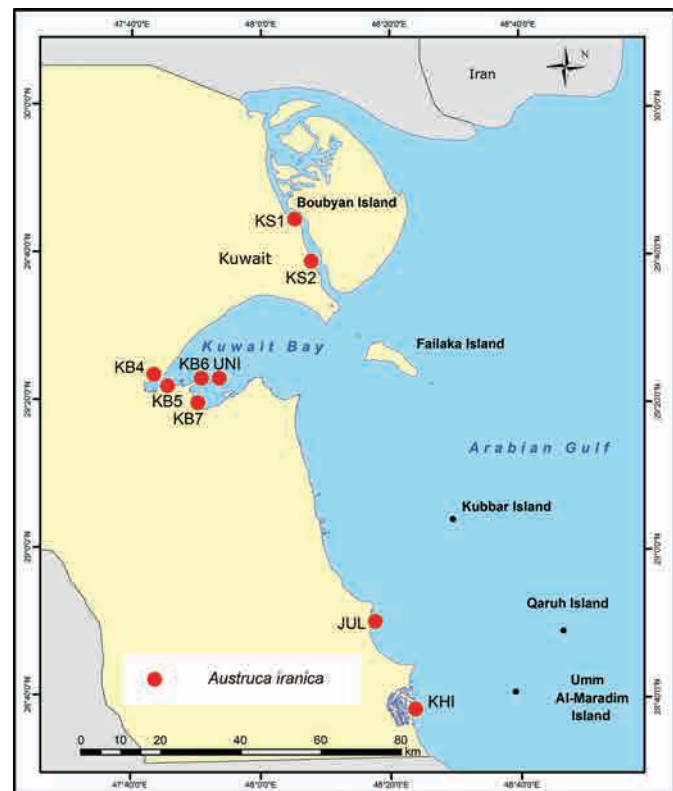


Figure 572. Presently known records of *Austruca iranica* in Kuwait.



Figure 573. Typical burrow of *Austruca iranica* with sand pellets scattered around, Khor Al-Subiyah, Kuwait. Photograph by Manal Al-Kandari.



Figure 574. Territorial fight between two males of *Austruca iranica* in Sulaibikhat Bay, Kuwait. Photograph by Abdulaziz Alyousef.

A

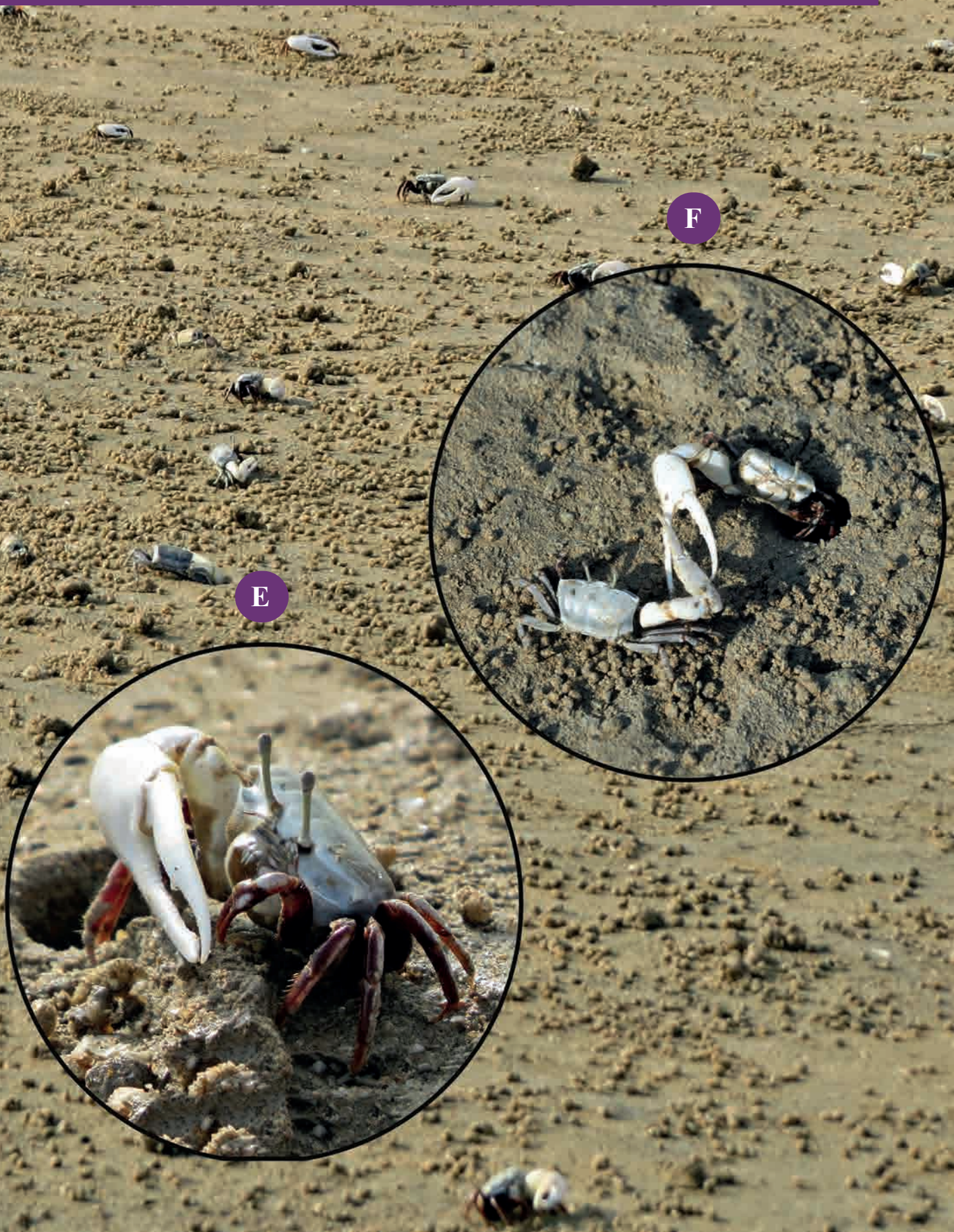
B

C

D



Figure 575. Population of *Austruca iranica* in Khor Al-Subiyah, Kuwait: group of fiddler crabs on exposed sand flat (A, B); large male with fully developed major (waving) claw near the entrance to its burrow (C); female feeding on some organic matter in the sand (D); average-sized male near its burrow (E); territorial fight between two males (F). Photographs by Valeriy Skryabin.



Family Ocypodidae

Austruca sindensis (Alcock, 1900)

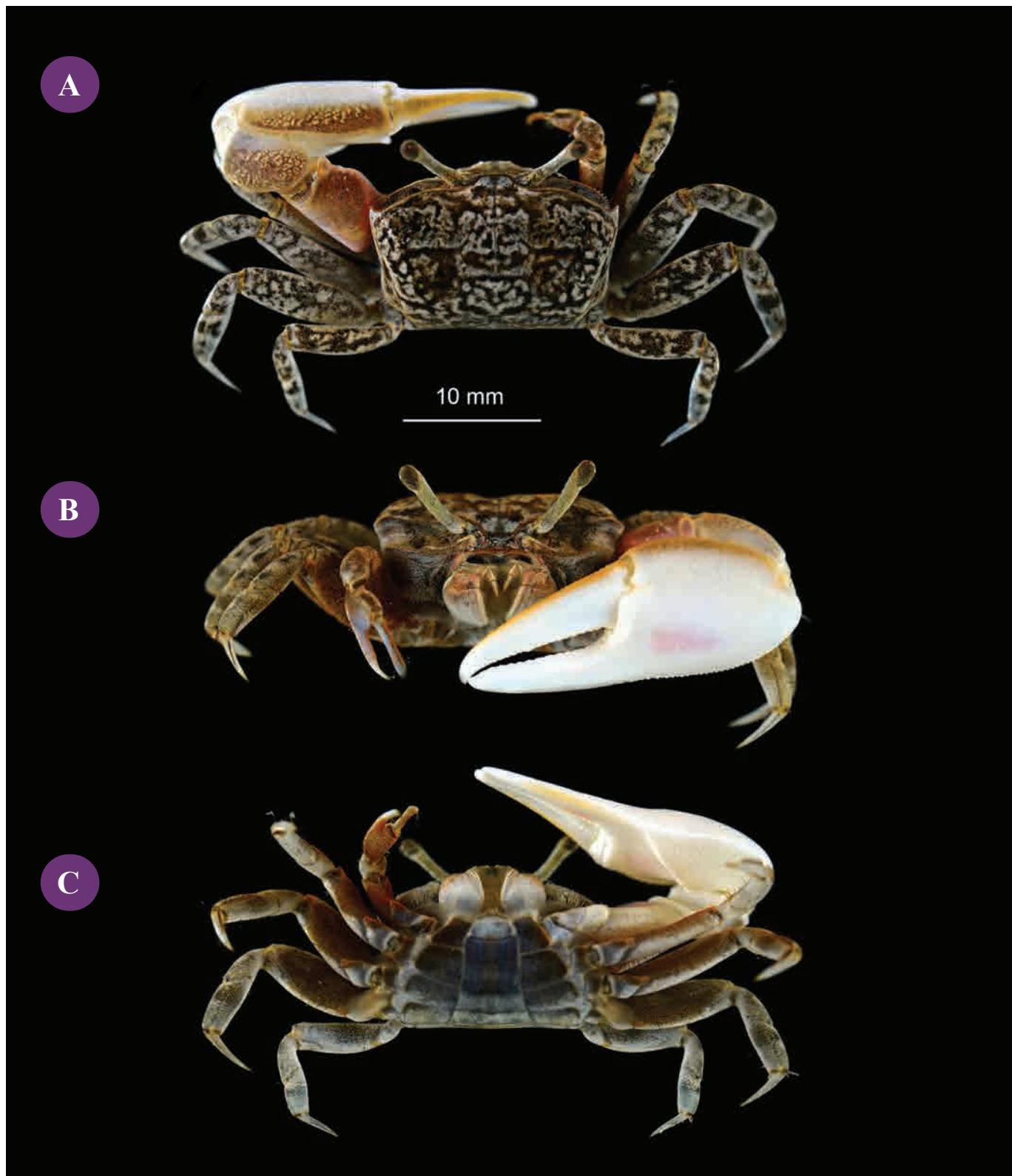


Figure 576. Male of *Austruca sindensis* (Alcock, 1900) in dorsal (A), frontal (B) and ventral (C) views, Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Gelasimus inversus* var. *sindensis* Alcock 1900; *Uca sindensis* (Alcock, 1900); *Uca (Amphiuca) sindensis* (Alcock, 1900); *Uca (Paraleptuca) sindensis* (Alcock, 1900); *Uca (Austruca) sindensis* (Alcock, 1900).

Common Name. Sindh fiddler crab.

Main Diagnostic Features.

1. Carapace about 1.3 times as wide as long; anterolateral margin moderately sharp; extra-orbital tooth strong, sharp; posterolateral margin gently convergent, nearly straight.
2. Front broad, deflexed, almost straight.
3. Male major chela (waving claw) with palm smooth on the outer surface, without depression near the base of pollex and granular ridge on the inner palmar surface; fingers moderately long, not exceeding carapace width in adult males, feebly gaping, with simple fingertips.
4. Male gonopod (G1) with small subdistal process.
5. Colour pattern: dorsal surface of carapace and walking legs grey mottled with white and black; upper dorsal surface of major cheliped with large yellow-brown markings; the outer surface of major chela largely hyaline white, sometimes with pinkish markings on the palm near pollex base.
6. Size: males reaching about 11.5 mm/18 mm, and females about 12 mm/15 mm, of carapace length/width, respectively.

Distribution. Western Indian Ocean: ranging from the inside of the Arabian-Persian Gulf to Pakistan.

Ecology. Benthic on mud and mud-sand bottoms, typically on mudflats and in mangroves; high intertidal zone; lives in small, simple, shaft-like burrows.

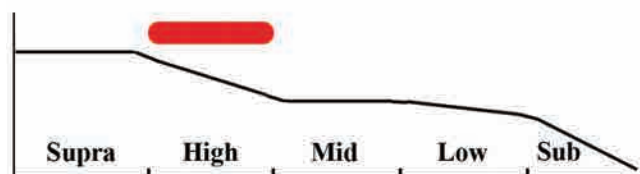


Figure 577. Bathymetric distribution of the species.

Remarks. After some confusion about the generic assignment of the species described initially by Alcock (1900) as *Gelasimus inversus* var. *sindensis*, the taxon was finally accommodated within the genus *Austruca* (Crane 1975; Naderloo and Türkay 2012; Shih et al. 2016; Naderloo 2017). The species was thoroughly redescribed by Collins et al. (1984), who also provided notes on its ecology in the Kuwait Bay.

Most Relevant References. Alcock 1900; Crane 1975; Collins et al. 1984; Naderloo and Türkay 2012; Shih et al. 2016; Naderloo 2017.

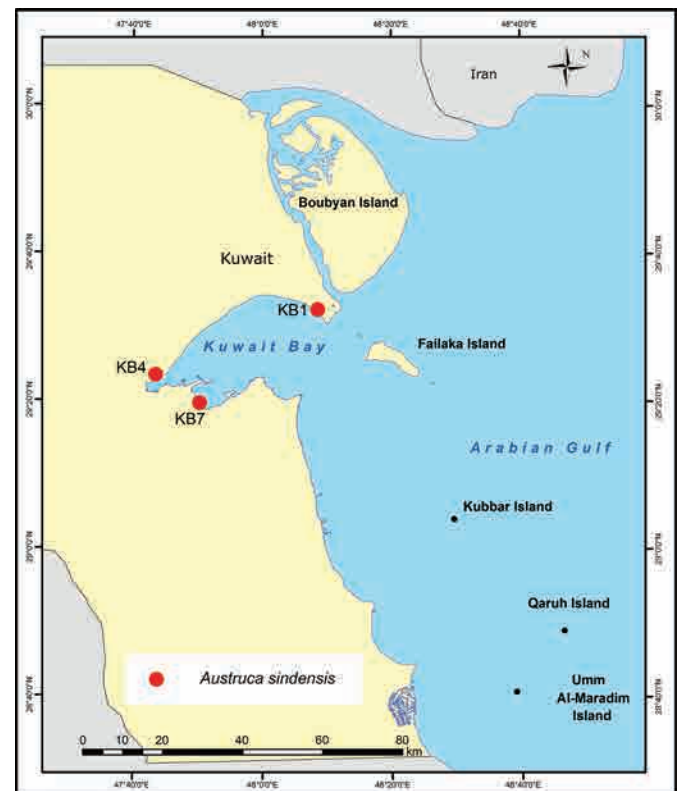


Figure 578. Presently known records of *Austruca sindensis* in Kuwait.



Figure 579. Male of *Austruca sindensis* near its burrow in Sulaibikhat Bay, Kuwait. Photograph by Igor Polikarpov.

A



B



C



Figure 580. Fiddler crabs of Kuwait. Male of *Austruca sindensis* in frontal view (A); male of *A. sindensis* fighting with male of *Leptochryseus kuwaitense* near Al-Khiran (B); female of *Austruca iranica* near its pellets, Sulaibikhat Bay, Kuwait. Photographs by AM team (A, B) and Manal Al-Kandari (C).

Family Ocypodidae

Ocypode rotundata Miers, 1882

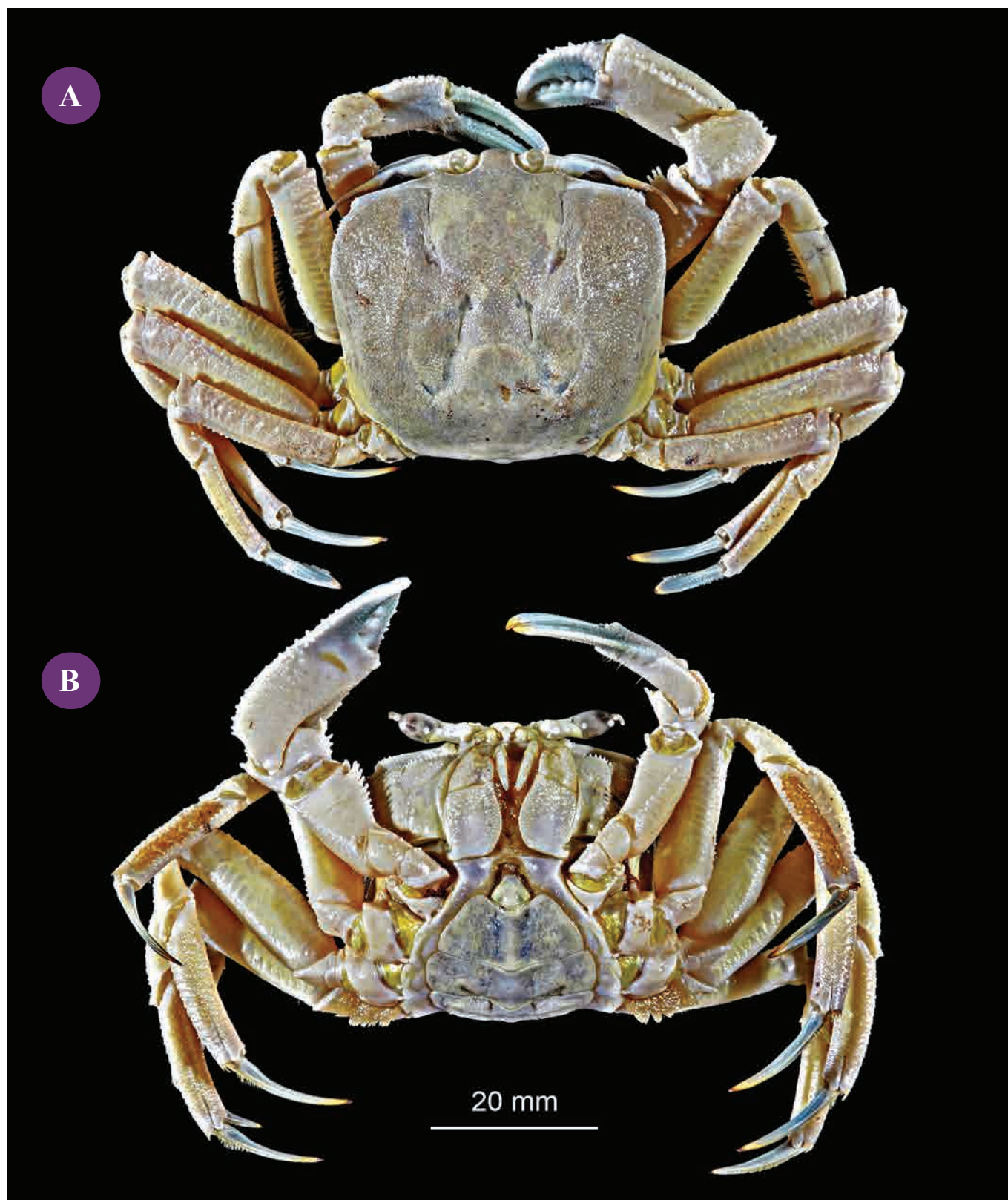


Figure 581. Female of *Ocypode rotundata* Miers, 1882 in dorsal (A) and ventral (B) views, Kuwait. Photographs by Valeriy Skryabin.

Synonym. *Ocypode rotundata* var. *arabica* Nobili, 1906.

Common Name. Rounded ghost crab.

Main Diagnostic Features.

1. Carapace subquadrate, with anterolateral angles notched; dorsal surface granulated, granules large; carapace regions well marked.
2. Eyestalks robust, long, with corniform (horn-like) extensions, latter shorter than cornea.
3. Chelipeds somewhat unequal; upper inner (dorsomesial) edge of merus with conical tubercles; length of stridulating organ less than half of maximal palm height; carpus with spines/serrations more numerous on the inner angle, but more marked on the outer angle.
4. First pair of ambulatory legs (pereiopods 2) with setal brush on propodi; meri of the first 3 legs moderately broad; dactyli of all ambulatory legs flattened dorsoventrally.
5. Colour in life: beige-yellow with pinkish tinge; chela fingers and dactyli of walking legs bluish grey.
6. Size: males reaching 33 mm/38 mm and females reaching 38 mm/41 mm in carapace length/width.

Distribution. Western Indian Ocean: from Oman and the Arabian-Persian Gulf to Pakistan and India.

Ecology. Well-known, large shore crab inhabiting supralittoral sand beaches; more common on offshore islands; lives in large, complex burrows; omnivorous: scavenger with carnivorous tendencies.

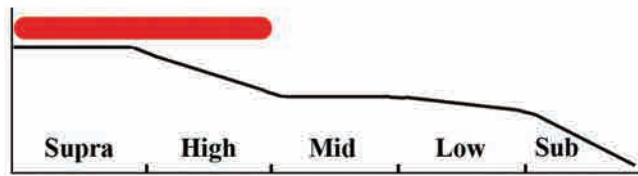


Figure 582. Bathymetric distribution of the species.

Remarks. One of the more distinctive features of *Ocypode rotundata* is the relative high length-to-width ratio of the meri of the first three pairs of walking legs (pereiopods 2, 3 and 4); in other words, the meri of these legs are not as broad as those of the other species of *Ocypode* (Yousuf et al. 2007; Naderloo 2017). Some aspects of ecology and biology of *O. rotundata* were studied by Naderi et al. (2020). Males build large conical towers (Fig. 586, A, B, C) during the breeding season. The mating behaviour of *Ocypode* spp. usually includes a precopulatory courtship ritual involving both olfactory and tactile cues. Stridulation with claws is often used as a warning signal; however, males also use both stridulation and percussion (drumming) during courtship (Taylor et al. 2019).

Most Relevant References. Miers 1882; Yousuf et al. 2007; Naderloo and Türkay 2012; Naderloo 2017; Naderi et al. 2020.

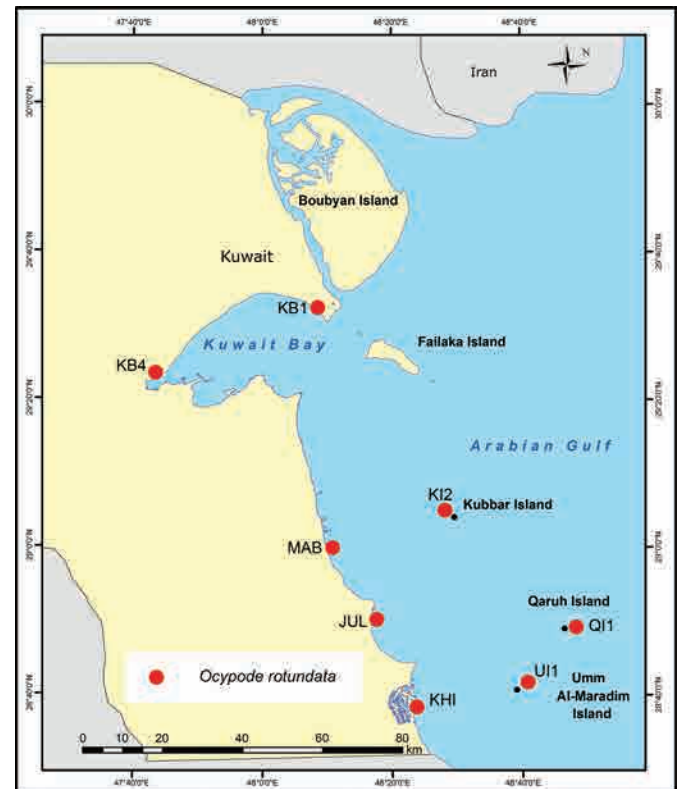
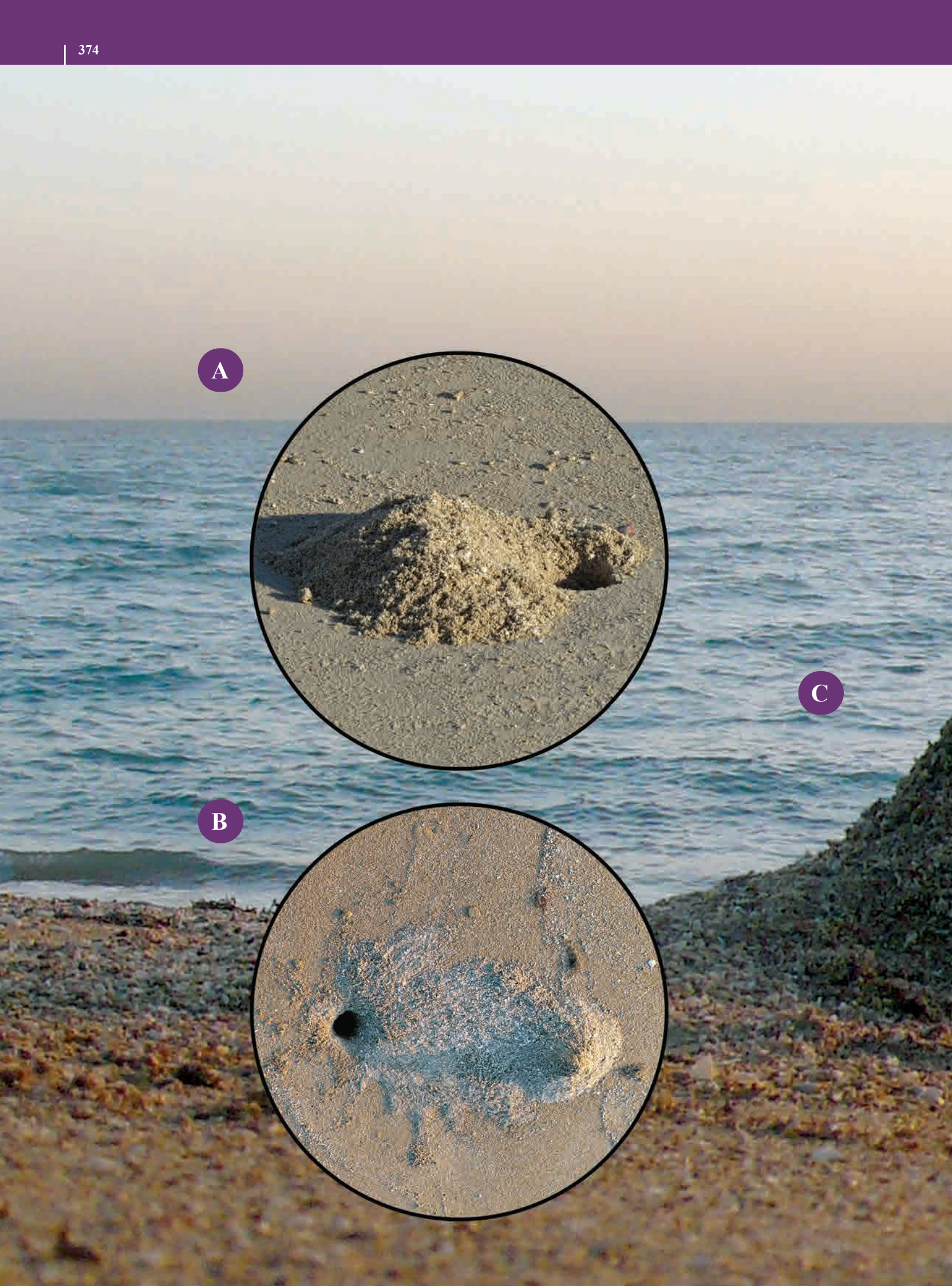


Figure 583. Presently known records of *Ocypode rotundata* in Kuwait.



Figure 584. Ghost crab *Ocypode rotundata* on a sandy beach of Kubbar Island, Kuwait. Photograph by Abdulrahman Youssef.



A

C

B

Figure 585. Population of ghost crab *Ocypode rotundata* in Kubbar Island, Kuwait: sand towers built by male crabs (A-C); different adult males (D and E). Photographs by Abdulrahman Yousif (A, B, C, D) and Valeriy Skryabin (E).

D



E





Figure 586. *Ocypode rotundata* at night on one of the Kuwaiti offshore islands. Photograph by Mohammed AlSaleh.





Figure 587. *Ocypode rotundata* surprised at night, in a defensive posture, Kuwait. Photograph by Husain Alqallaf.





Figure 588. *Ocypode rotundata* in the surf zone on one of the Kuwait's sand shores.
Photograph by Husain Alqallaf



Family Xenophthalmidae

Xenophthalmus wolffi Takeda and Miyake, 1970

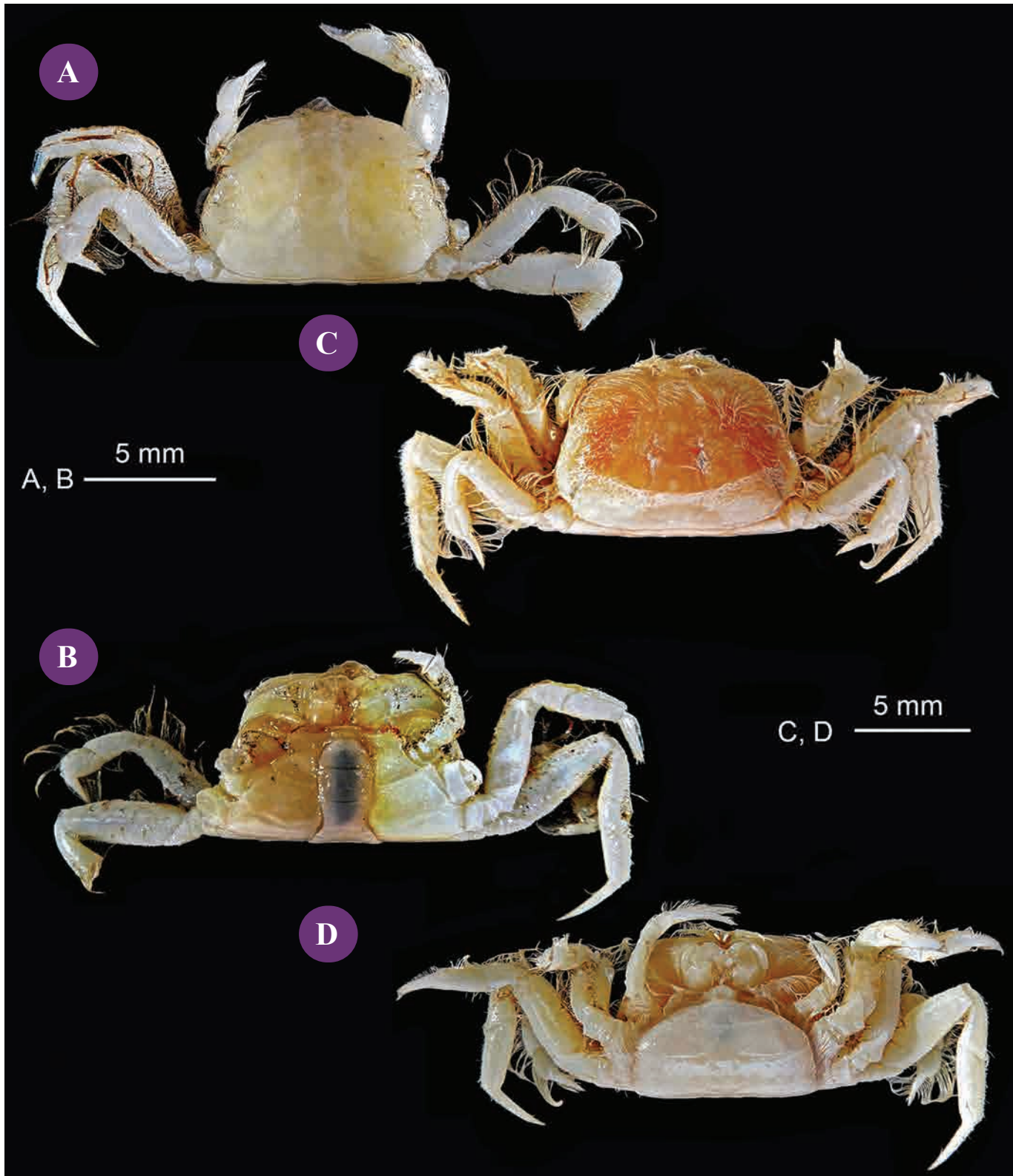


Figure 589. Male of *Xenophthalmus wolffi* Takeda and Miyake, 1970 in dorsal (A) and ventral (B) views; female in dorsal (C) and ventral (D) views, Kuwait. Preserved and partly damaged specimens. Photographs by Valeriy Skryabin.

Common Name. Wolff's blind mudflat crab.

Main Diagnostic Features.

1. Carapace transversely subrectangular; dorsal surface slightly convex, smooth; lateral margin entire, without indentation.
2. Front narrow, deflexed; orbits directed longitudinally posteriorly, narrow.
3. Pleon of males and females with 6 free somites + telson.
4. Eyestalks swollen, ovate; cornea poorly developed.
5. Third maxillipeds completely covering buccal cavern.
6. Chelipeds nearly equal, relatively small; upper margin of merus sharp, with long plumose setae; palm swollen; fingers short, gaping when closed.
7. Walking legs (pereiopods 2–5) flattened, P3 longest; margins with plumose setae; merus with gently serrated dorsal margin; dactyli of P2 and P3 falciform.
8. Colour in life: pale brown.
9. Size: maximal carapace length/width of males, 5.2 mm/6.2 mm, and those of females, 4.2 mm/5.9 mm.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on muddy substrate, on shallow mudflats and deeper muddy bottoms; low intertidal to subtidal areas (maximal recorded depth: 70 m); possibly infaunal life-style.

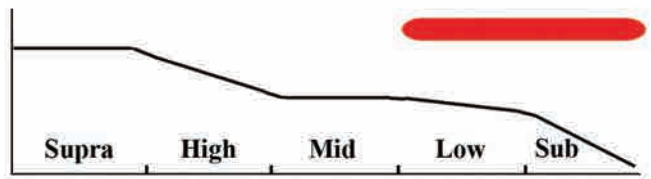


Figure 590. Bathymetric distribution of the species.

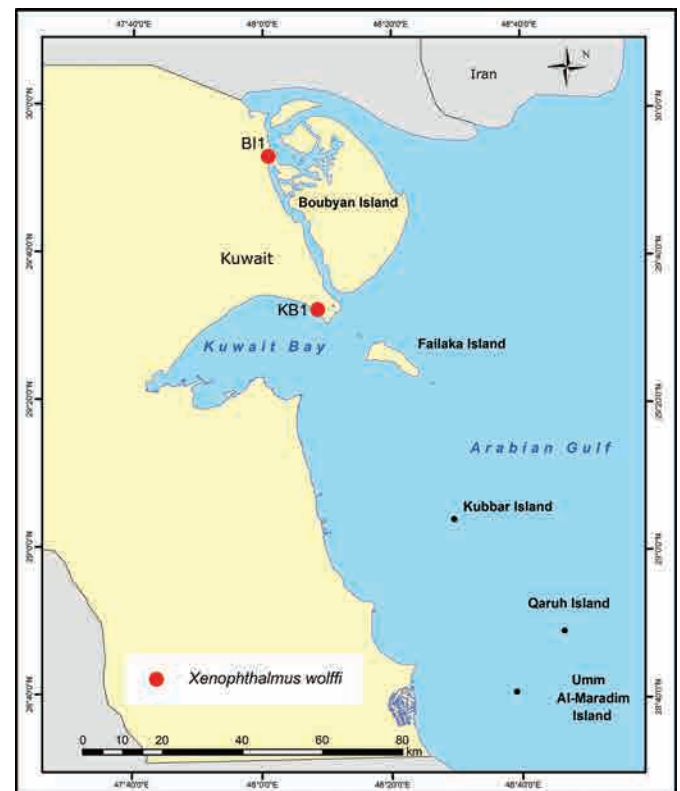


Figure 591. Presently known records of *Xenophthalmus wolffi* in Kuwait.

Remarks. *Xenophthalmus wolffi* is the only member of the peculiar small crab family Xenophthalmidae present in the Arabian-Persian Gulf region (Naderloo 2017). The species identification in this family is challenging and requires an expert. For illustrations of the general morphology of *X. wolffi* see Takeda and Miyake (1970), Ghani and Tirmizi (1995b) and Khot et al. (2019).

Most Relevant References. Takeda and Miyake 1970; Ghani and Tirmizi 1995b; Naderloo 2017; Khot et al. 2019.



Figure 592. Mudflats of northern Boubiyan Island in Kuwait, typical habitat of *Xenophthalmus wolffi*. Photograph by Valeriy Skryabin.

Family Pinnotheridae

Arcotheres tivelae (Gordon, 1936)



Figure 593. Female of *Arcotheres tivelae* (Gordon, 1936) in dorsal (A) and ventral (B) views, Kuwait Bay. Photographs by Valeriy Skryabin.

Synonym. *Pinnotheres tivelae* Gordon, 1936.

Common Name. Venus clam pea crab.

Main Diagnostic Features.

1. Carapace smooth, soft, glabrous, and convex antero-posteriorly, almost flat transversely, except at sides, here sloping obliquely downwards; posterior margin slightly concave in its middle.
2. Front broad, rounded.
3. Eyes very small, not visible in the dorsal aspect.
4. Chelipeds equal in size, more robust than walking legs.
5. Colour in life: pale beige, with orange inner organs visible by translucence.
6. Size: females reaching 9 mm/11 mm of carapace length/width.

Distribution. Western Indian Ocean: from the Arabian-Persian Gulf to Pakistan and India.

Ecology. Benthic on sand-mud bottoms; mostly intertidal sand- and mudflats; commensal inside the mantle cavity of sediment-dwelling bivalve molluscs of the family Veneridae known as venus clams, such as *Protapes cor* (Fig. 596) and *Callista umbonella* (formerly known as *Amiantis umbonella*) (Saeedi and Ardalan 2010).

Remarks. *Arcotheres tivelae*, described initially from Oman, was previously confused with the closely related *A. placunae*, originally recorded from India (Naderloo and Türkay 2012; Naderloo 2017). The general biology of *A. tivelae*, including various aspects of the species' symbiotic life-style, was extensively studied by Saeedi and Ardalan (2010).

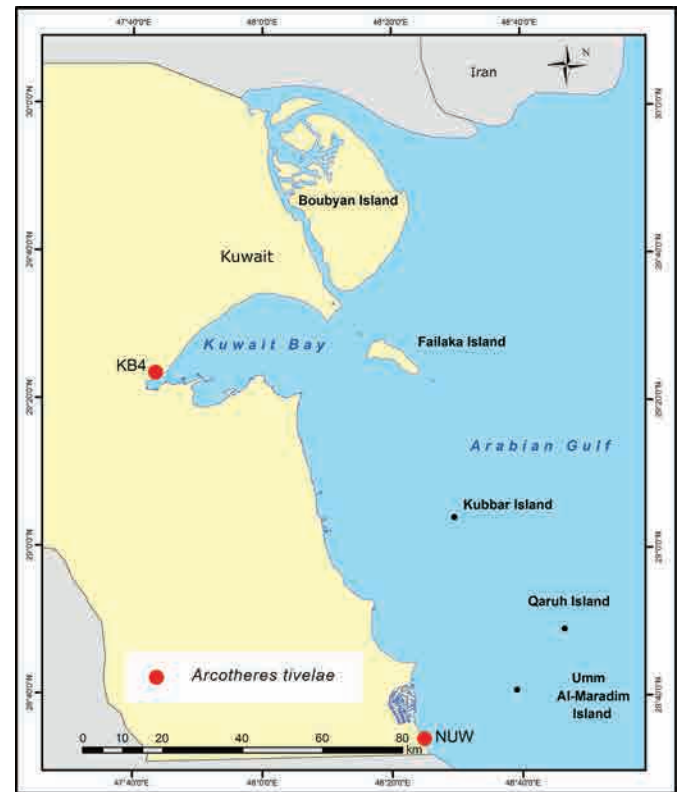


Figure 594. Presently known records of *Arcotheres tivelae* in Kuwait.

Most Relevant References. Gordon 1936; Saeedi and Ardalan 2010; Naderloo and Türkay 2012 (as *A. placunae*); Naderloo 2017.



Figure 595. *Arcotheres tivelae* inside its clam host, *Protapes cor*, Kuwait Bay. Photographs by Valeriy Skryabin.

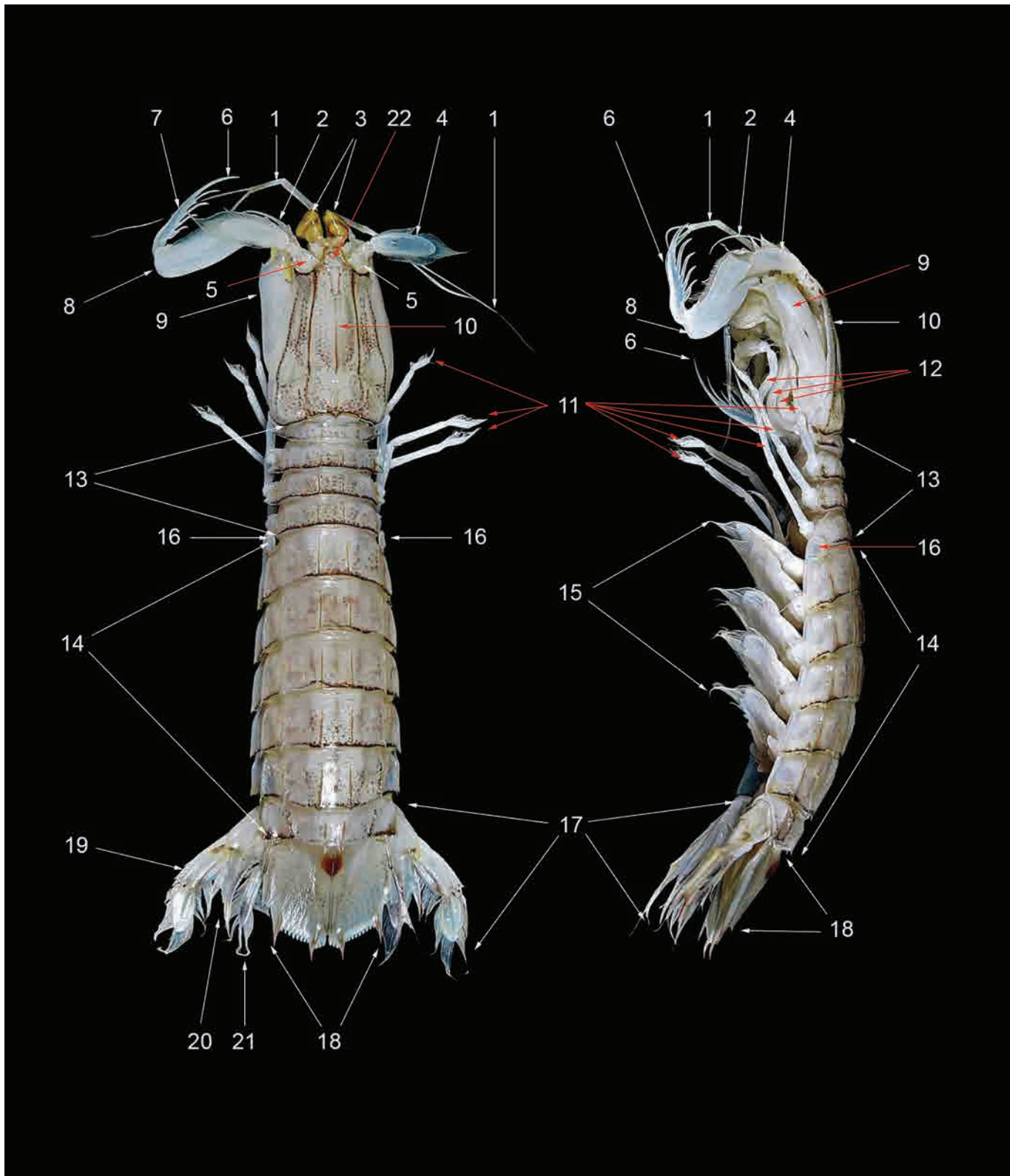


Figure 596. General morphology of Stomatopoda exemplified by *Oratosquilla interrupta* (Squillaidae).

- | | | |
|-----------------------|-----------------------|---------------|
| 1. Antennule. | 9. Merus. | 17. Uropod. |
| 2. Antenna. | 10. Carapace. | 18. Telson. |
| 3. Eye. | 11. Pereopods. | 19. Exopod. |
| 4. Antennal scale. | 12. Maxillipeds 3-5. | 20. Protopod. |
| 5. Antennal protopod. | 13. Thoracic somites. | 21. Endopod. |
| 6. Raptorial claw. | 14. Pleonites. | |
| 7. Dactylus. | 15. Pleopods. | |
| 8. Propodus. | 16. Pleural plate. | |

Subclass Hoplocarida

Order Stomatopoda (Mantis shrimps)

Figure 597. Smith's reef mantis shrimp *Gonodactylus smithii* hiding in a coral reef crevice near Kubbar Island, Kuwait.
Photograph by Faisal Al-Sarraf.



Family Eurysquillidae

Manningia amabilis Holthuis, 1967

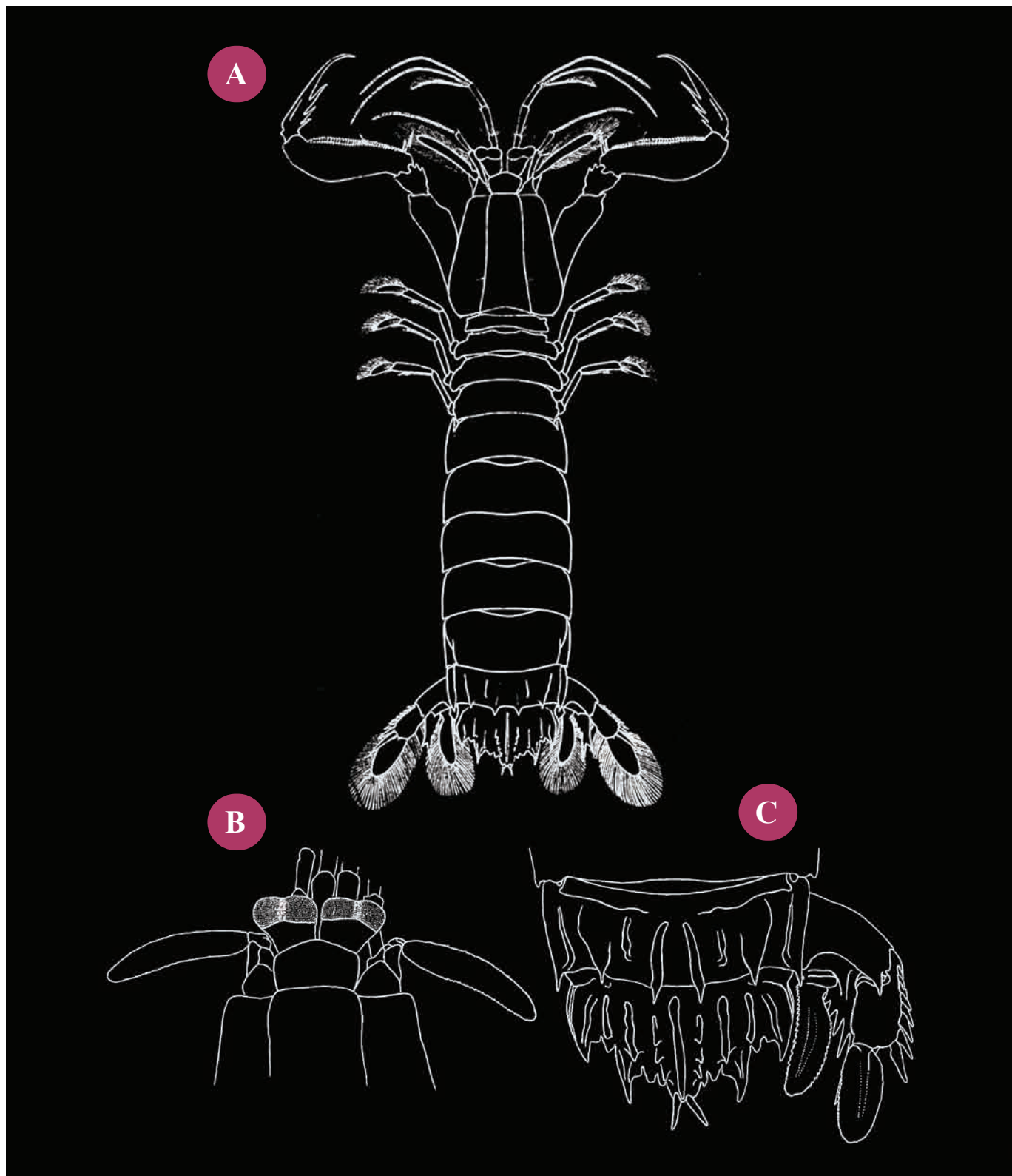


Figure 598. *Manningia amabilis* Holthuis, 1967 in dorsal view (A), with details of the frontal region (B) and telson + uropod (C). Reproduced from Holthuis (1967) [A] and Cappola and Manning (1994) [B, C].

Common Name. Manning's reef mantis shrimp.

Main Diagnostic Features.

1. Rostral plate broadly rounded, without apical spine, not bilobed.
2. Eyestalks widening distally, bipartite.
3. Raptorial legs of spearer type; dactylus armed with 4 sharp teeth.
4. Sixth abdominal somite with unarmed carina between submedian and intermediate carinae.
5. Telson with 3 longitudinal dorsal carinae between accessory median and marginal carinae.
6. Size: maximal total body length about 60 mm.

Distribution. Northwestern Indian Ocean from the Red Sea and Somalia to the Arabian-Persian Gulf and India.

Ecology. Benthic, on exposed rocky shores, from the mid-intertidal to shallow subtidal zones (probably less than 5 m); under rocks and dead corals, in rocky tide-pools, under *Cymodocea* roots, etc.

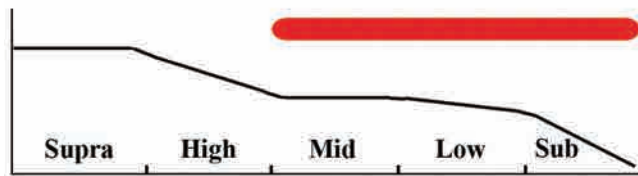


Figure 599. Bathymetric distribution of the species.

Remarks. *Manningia amabilis* is a relatively large, intertidal, but at the same time, rarely collected mantis shrimp, with relatively few specimens collected from some localities in the north-western Indian Ocean (Cappola and Manning 1994), including a single specimen collected from one of the southern offshore islands of Kuwait by Al-Kandari et al. (2020b) recently. This species can be distinguished from its congener *M. arabica* Manning, 1990, which is presumed to be endemic to the Arabian-Persian Gulf (although not yet recorded from Kuwait), by the rostral plate lacking an apical spine. Illustrations of the general morphology of *M. amabilis* can be found in Holthuis (1967) and Cappola and Manning (1994).

Most Relevant References. Holthuis 1967; Cappola and Manning 1994; Al-Kandari et al. 2020b.

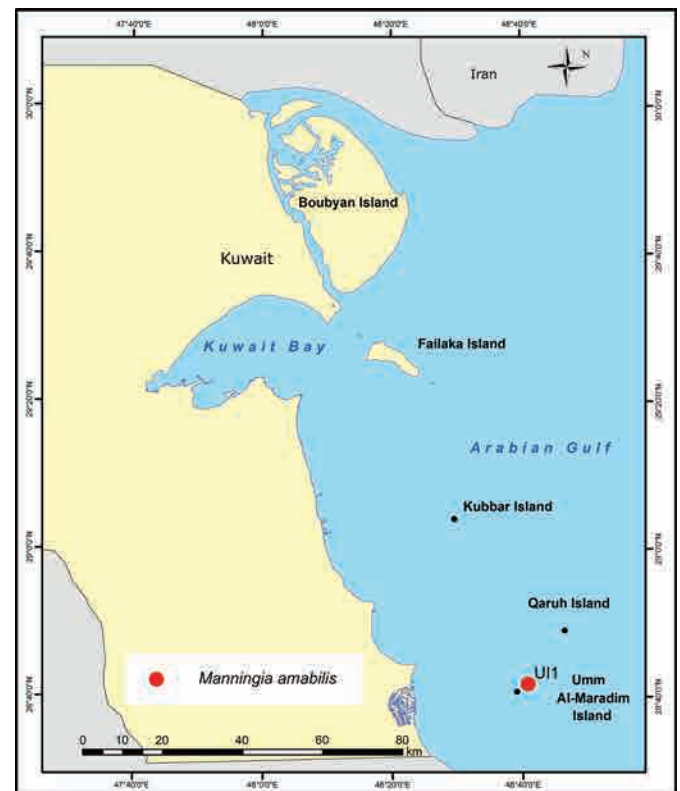


Figure 600. Presently known record of *Manningia amabilis* in Kuwait.

Family Gonodactylidae

Gonodactylellus demanii (Henderson, 1893)

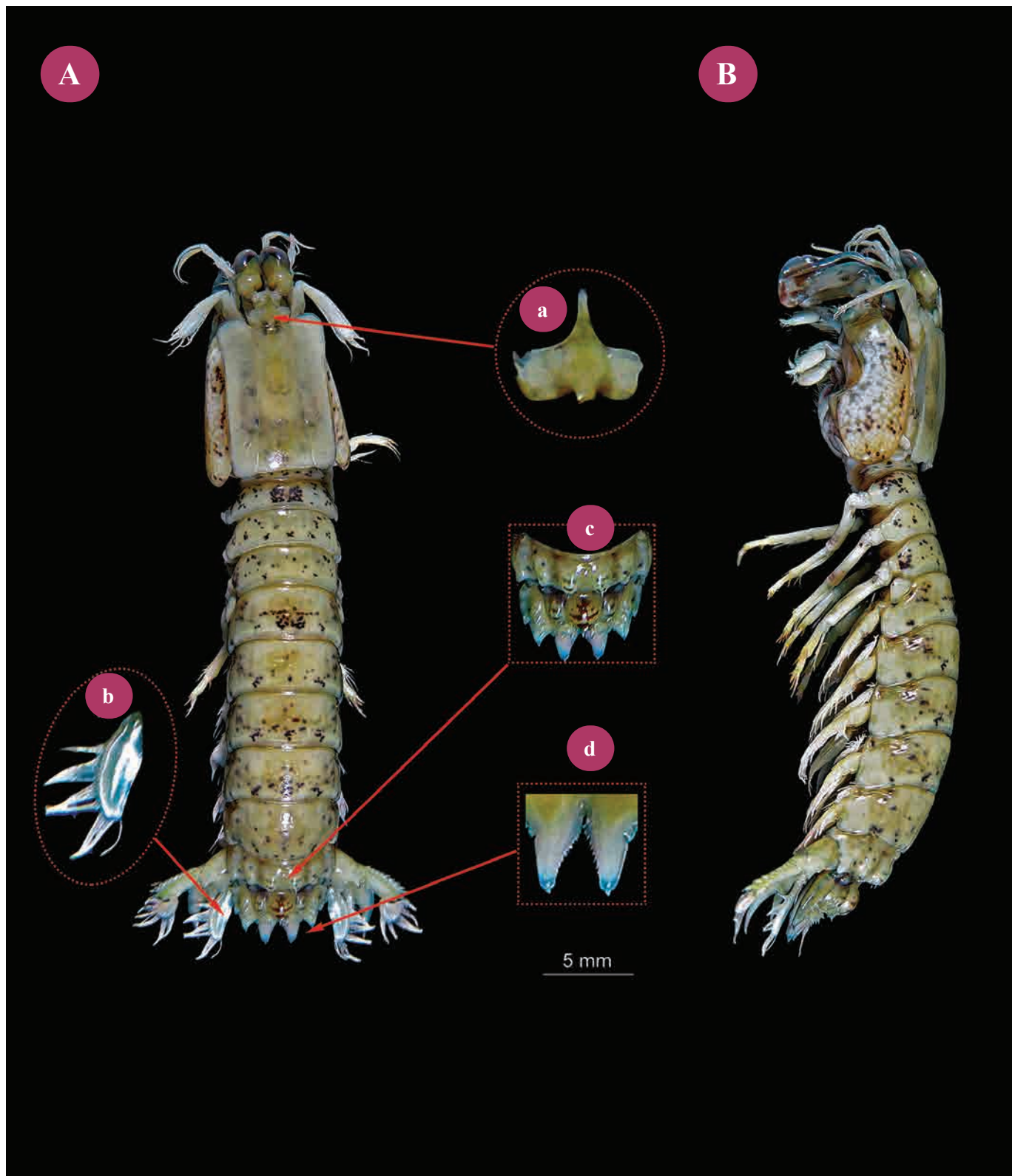


Figure 601. *Gonodactylellus demanii* (Henderson, 1893) in dorsal (A) and lateral (B) views, with details of the rostral plate (a), uropod (b), and telson (c, d), Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Gonodactylus demani* Henderson, 1893; *Gonodactylus demani demani* Henderson, 1893.

Common Name. De Man's reef mantis shrimp.

Main Diagnostic Features.

1. Basal portion of rostral plate with anterior margins almost transverse; anterolateral angles subacute but rounded; median spine needle-like.
2. Eyes not particularly enlarged.
3. Raptorial legs ending in smasher-type claw.
4. Telson with median keel swollen and bearing small spines; submedian teeth poorly or not carinate.
5. Mesial margin of uropodal endopod with 1-10 proximal setae; posterolateral angle of proximal exopod segment ending in a prominent spine.
6. Colour: greenish brown with darker brownish or blackish spots.
7. Size: maximal total body length is about 24 mm for males and 30 mm for females.

Distribution. Western Indian Ocean from the Red Sea eastwards to the Arabian-Persian Gulf and India and southwards to Mozambique and Madagascar.

Ecology. Benthic, on rocky shores and coral rubble flats, most commonly encountered in the mid-and low intertidal zones; but also inhabiting shallow subtidal zone down to at least 3 m; under or in crevices of rocks and dead corals.

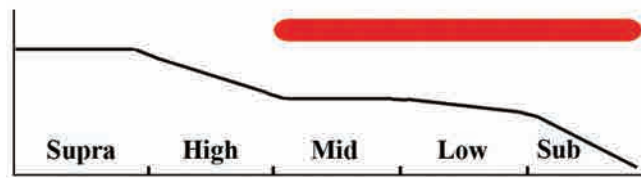


Figure 602. Bathymetric distribution of the species.

Remarks. In the western Indian Ocean, *Gonodactylellus demanii* is one of the most widespread shallow-water stomatopod. Not surprisingly, this species was one of the first to be recorded from Kuwait's waters (Jones 1986a). The somewhat confusing synonymy of *G. demanii* has been discussed by Manning (1967), who also provided good illustrations of the most important morphological characters, and more recently also by Al-Kandari et al. (2020b).

Most Relevant References. Henderson 1893; Manning 1967; Jones 1986a; Al-Kandari et al. 2020b; Trivedi et al. 2020.

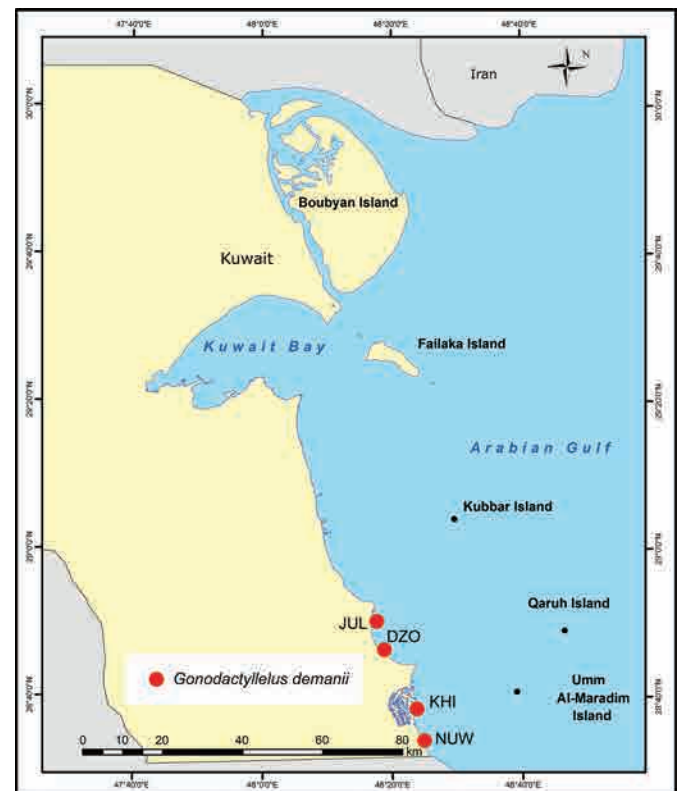


Figure 603. Presently known records of *Gonodactylellus demanii* in Kuwait.

Family Gonodactylidae

Gonodactylus botti Manning, 1975

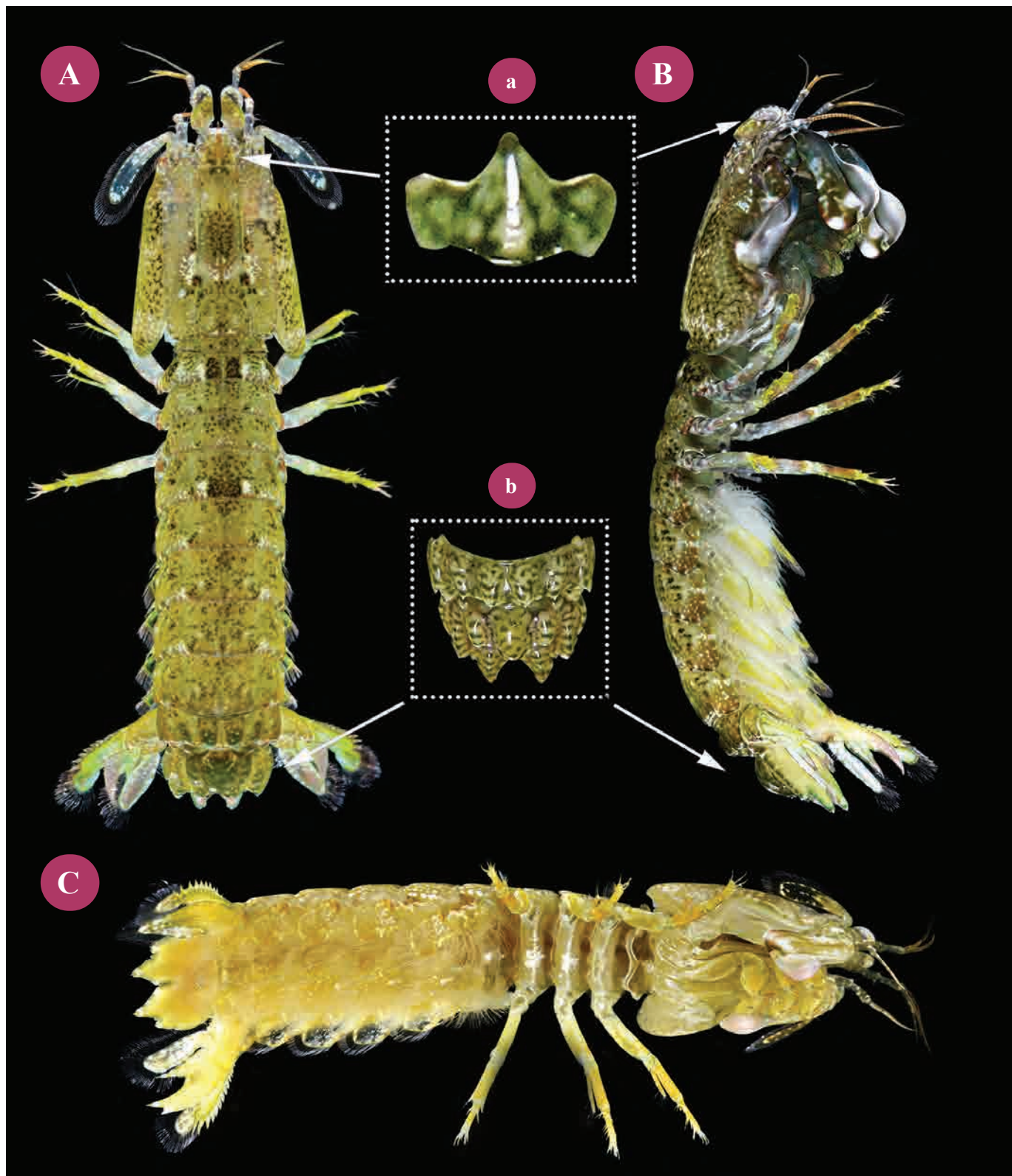


Figure 604. *Gonodactylus botti* Manning, 1975 in dorsal (A), lateral (B), and ventral (C) views, with details of the rostral plate (a) and telson (b), Kuwait. Photographs by Valeriy Skryabin.

Common Name. Bott's reef mantis shrimp.

Main Diagnostic Features.

1. Rostral plate with sharp median spine; anterolateral angle broadly rounded.
2. Transverse ocular scales.
3. Raptorial legs ending in a smasher-type claw.
4. Telson with strongly inflated median and submedian carinae in both sexes.
5. Colour: variable from golden-greenish to dark green or greenish-brownish with fine whitish mottling; two darker dorso-median patches present on the first and fourth andominal somites.
6. Size: maximal total body length 79 mm (more often up to 63 mm for males and up to 65 for females).

Distribution. Western Indian Ocean from the Red Sea and the Arabian-Persian Gulf to Pakistan and South Africa.

Ecology. Benthic, on rocky shores and coral rubble flats, most commonly encountered in the mid- and low intertidal zones; also inhabiting shallow subtidal zone down to at least 13.5 m; under or in crevices of rocks and dead corals.

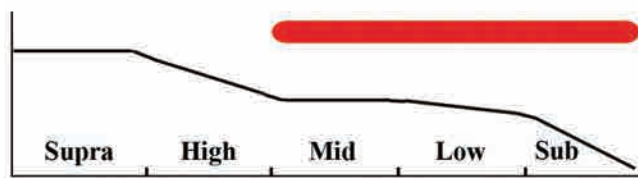


Figure 605. Bathymetric distribution of the species.

Remarks. *Gonodactylus botti* is both common and widespread in the western Indian Ocean, with several records from the Arabian-Persian Gulf, including Kuwait (e.g. Manning 1990; Cappola and Manning 1994; Ah Yong 2005; Al-Kandari et al. 2020b). According to Ah Yong (2001), the Indonesian type locality of *G. botti* is probably erroneous due to mislabelled type specimens and this species is known with certainty only on the west of Pakistan (Ah Yong 2005). Good illustrations of the most important morphological characters can be found in Manning (1975) and Manning and Lewinsohn (1986); in addition, a high-resolution colour photograph of *G. botti* was published by Al-Kandari et al. (2020b). The species is closely related to *G. chiragra* (Fabricius, 1781), which may not be present in the northern Arabian Gulf.

Most Relevant References. Manning 1975; Manning and Lewinsohn 1986; Cappola and Manning 1994; Ah Yong 2001; Ah Yong 2005; Al-Kandari et al. 2020b.

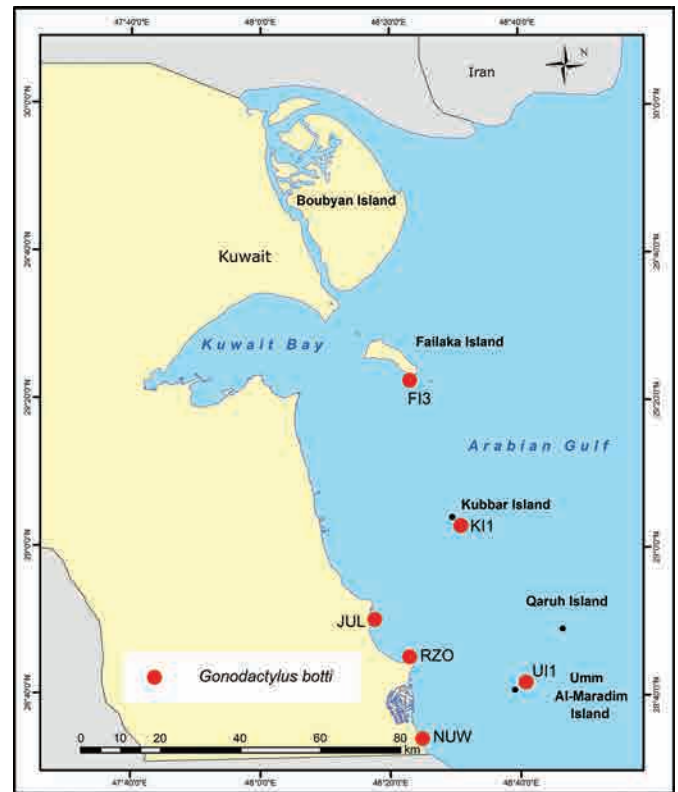


Figure 606. Presently known records of *Gonodactylus botti* in Kuwait.



Figure 607. *Gonodactylus botti* leaving its shelter, a rock crevice, Kuwait. Photograph by Abdulrahman Yousef.

Family Gonodactylidae

Gonodactylus smithii Pocock, 1893

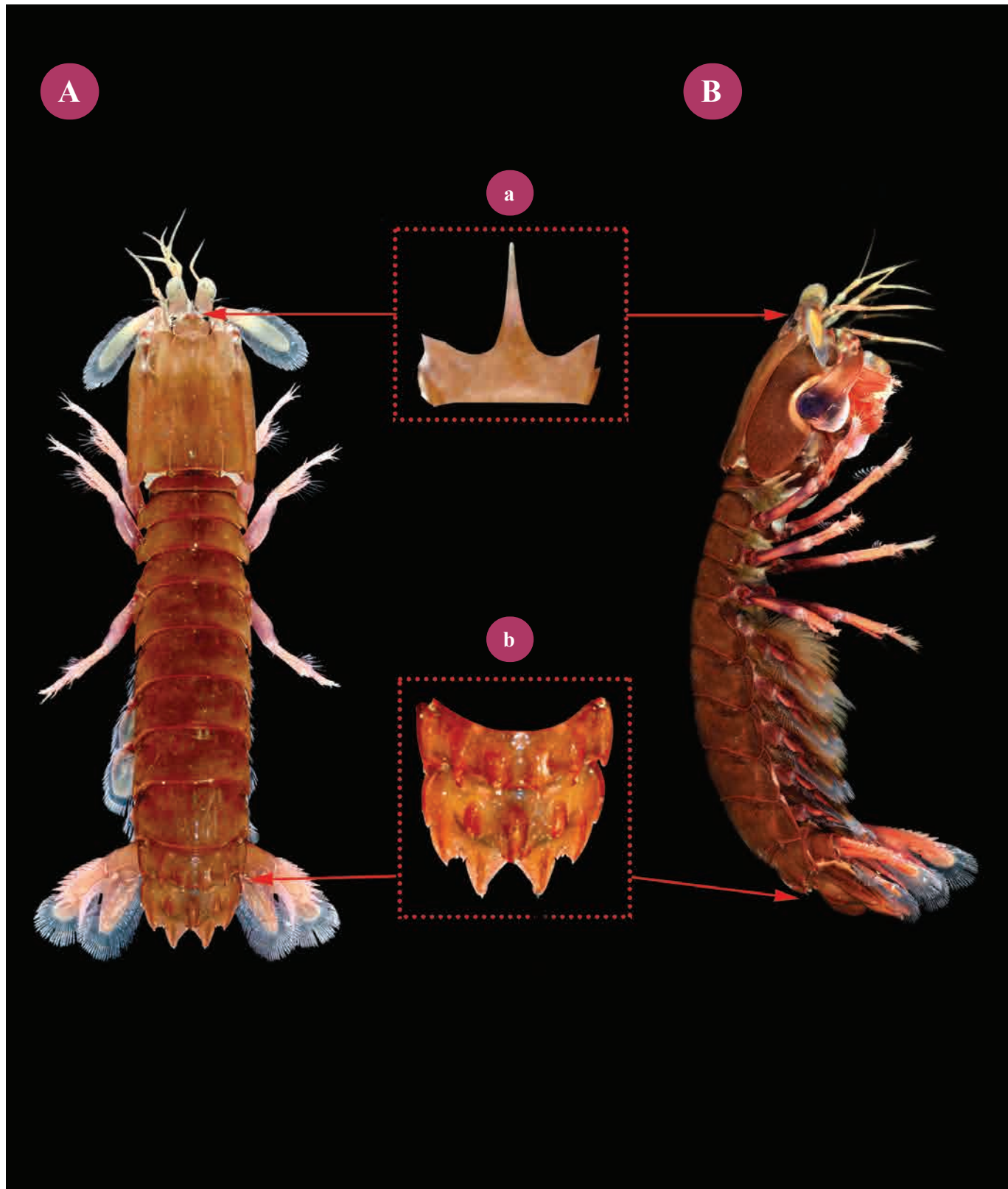


Figure 608. *Gonodactylus smithii* Pocock, 1893 in dorsal (A) and lateral (B) views, with details of rostral plate (a) and telson (b), Kuwait. Photographs by Manal Al-Kandari.

Synonyms. *Gonodactylus chiragra* var. *anancyrus* Borradaile, 1900; *Gonodactylus minikoensis* Ghosh, 1990; *Gonodactylus arabica* Ghosh, 1990.

Common Name. Smith's reef mantis shrimp.

Main Diagnostic Features.

1. Rostral plate trident-shaped, with anterior margins concave; median spine slender, needle-like.
2. Ocular scales broad, flattened, separate.
3. Raptorial legs ending in smasher-type claw.
4. Telson with dorsal carinae sharp or cristate dorsally; mid-dorsal carina usually armed posteriorly with a stout spine.
5. Uropodal exopod with distal segment's lateral margin armed with 10–13 movable spines.
6. Colouration usually uniform but quite variable, often pale, bright or dark green, but also in purple-reddish, olive-brown or red-brownish tones; raptorial claw with violet tinge.
7. Size: maximal total body length about 84 mm.

Distribution. Indo-West Pacific from the Red Sea and Mozambique Channel to Australia, New Caledonia, and Japan.

Ecology. Benthic, on rocky and mixed rocky-sand shores, coral reefs, and adjacent coral rubble flats, from the mid-intertidal zone to 62 m; under or in crevices of rocks and dead corals, also in sponges or among branches of living corals and similar shelters.

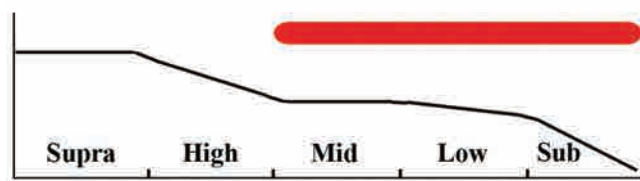


Figure 609. Bathymetric distribution of the species.

Remarks. *Gonodactylus smithii* is one of the most common and widespread shallow-water stomatopods in the Indo-West Pacific, recorded from several localities in the Arabian-Persian Gulf, including Kuwait (Al-Kandari et al. 2020b and references therein).

Ahyong (2001) provided excellent illustrations of the most important morphological characters of the species, with photographs published, for instance, by Poupin et al. (2019) and Al-Kandari et al. (2020b). Interestingly, the reddish or purplish tinge of some specimens may be due to the occupied microhabitat they occupy, such as pink-coloured sponges.

Most Relevant References. Pocock 1893; Ahyong 2001; Al-Kandari et al. 2020b; Trivedi et al. 2020.

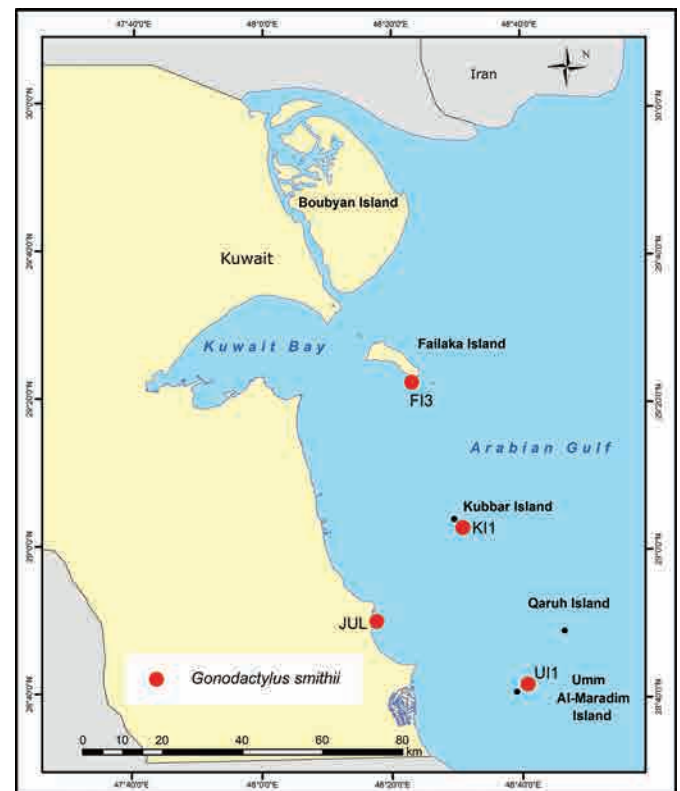


Figure 610. Presently known records of *Gonodactylus smithii* in Kuwait.



Figure 611. Smith's reef mantis shrimp, *Gonodactylus smithii*, on Kuwaiti rocky reefs: male and female found under a rock near Al-Julaia'a (A); particularly colourful individual from Kubbar Island (B). Photographs by AM team (A) and Husain Alqallaf (B).



Figure 612. Frontal view of Smith's reef mantis shrimp, *Gonodactylus smithi*, on a reef off Kubbar Island, Kuwait. Photograph by Eslam Basuny.

Figure 613. Frontal view of Smith's reef mantis shrimp, *Gonodactylus smithii*, on a rocky reef off Mudayrah reef, Kuwait. Photograph by Eslam Basuny.



Family Nannosquillidae

Bigelowina phalangium (Fabricius, 1798)

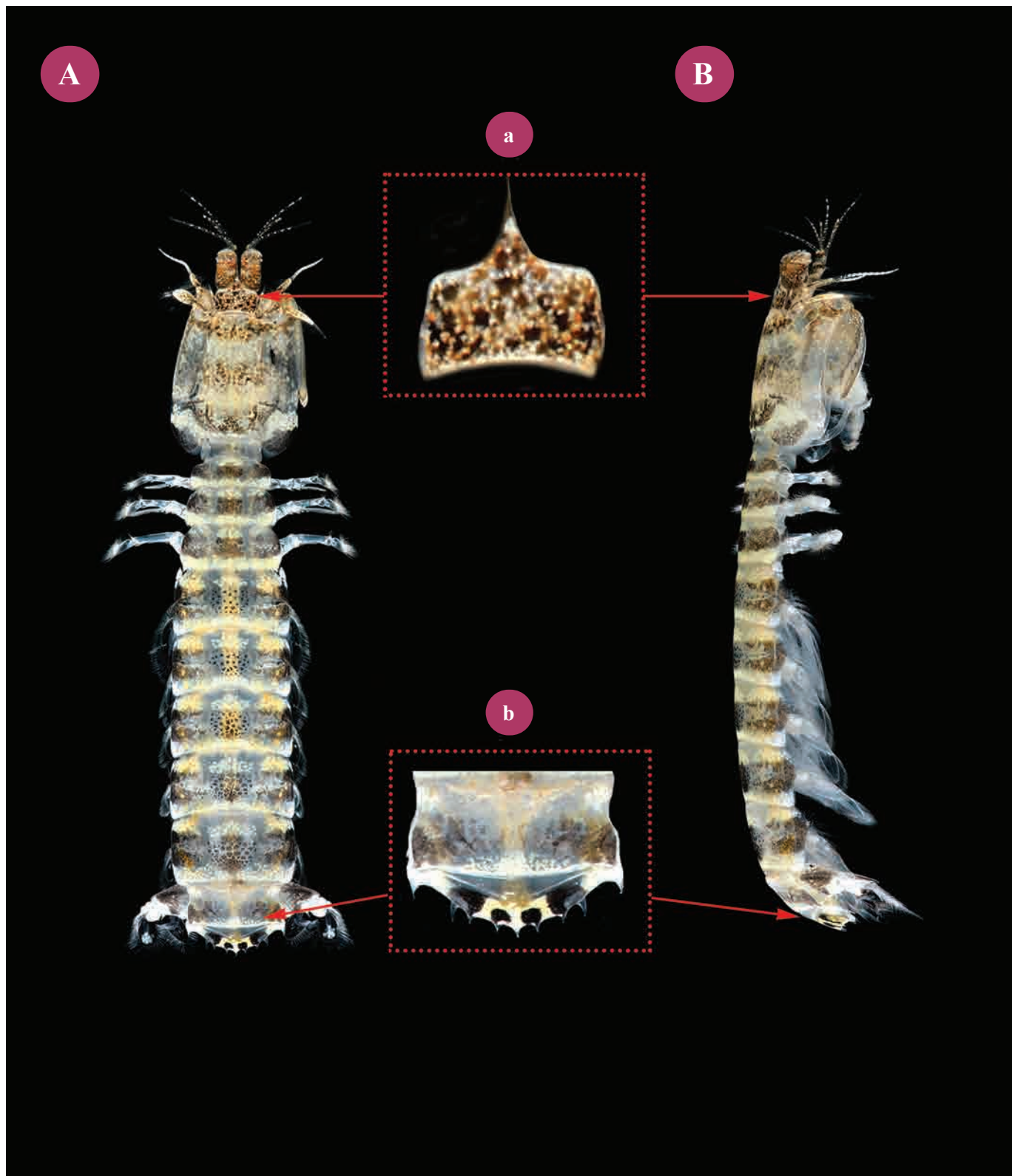


Figure 614. Female of *Bigelowina phalangium* (Fabricius, 1798) in dorsal (A) and lateral (B) views, with details of rostral plate (a) and telson (b), Failaka Island, Kuwait. Photographs by Arthur Anker.

Synonyms. *Squilla phalangium* Fabricius, 1798; *Lysiosquilla acanthocarpus* Miers, 1880; *Acanthosquilla humesi* Manning, 1968; *Acanthosquilla dighaensis* Ghosh, 1998.

Common Name. Lesser striped burrowing mantis shrimp.

Main Diagnostic Features.

1. Body flattened, slender.
2. Rostral plate trapezoid, with slender apical spine.
3. Ocular scales narrow, separate.
4. Raptorial claw of spearer type; dactylus armed with 6–8 sharp teeth.
5. Telson with 5–7 denticles on either side of the mid-line; first and third “intermediate denticle” on the higher plane and slightly larger and than the second and fourth.
6. Uropodal exopod with proximal segment’s lateral margin with 6–7 movable spines.
7. Colour pattern: entire body with transverse bands ranging in intensity from pale to very dark, and from pale brown to almost black; telson with 2 characteristic black spots on the white area.
8. Size: maximal total body length about 80 mm, but usually smaller.

Distribution. Indo-West Pacific from Oman, the Arabian-Persian Gulf and Madagascar to Australia and Vietnam.

Ecology. Benthic, on sandy and sandy-muddy bottoms, from the mid-intertidal zone to shallow subtidal zone (10 m); infaunal, i.e. living in simple, U-shaped burrows.

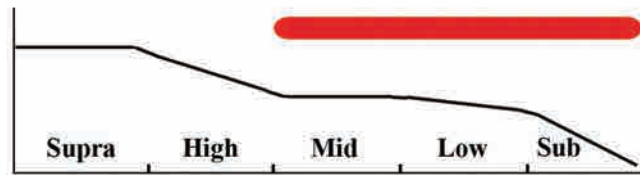


Figure 615. Bathymetric distribution of the species.

Remarks. Holthuis (2000) fixed the identity of “*Squilla phalangium*”, one of the several obscure species originally described by Fabricius (1798). *Bigelowina phalangium* is a

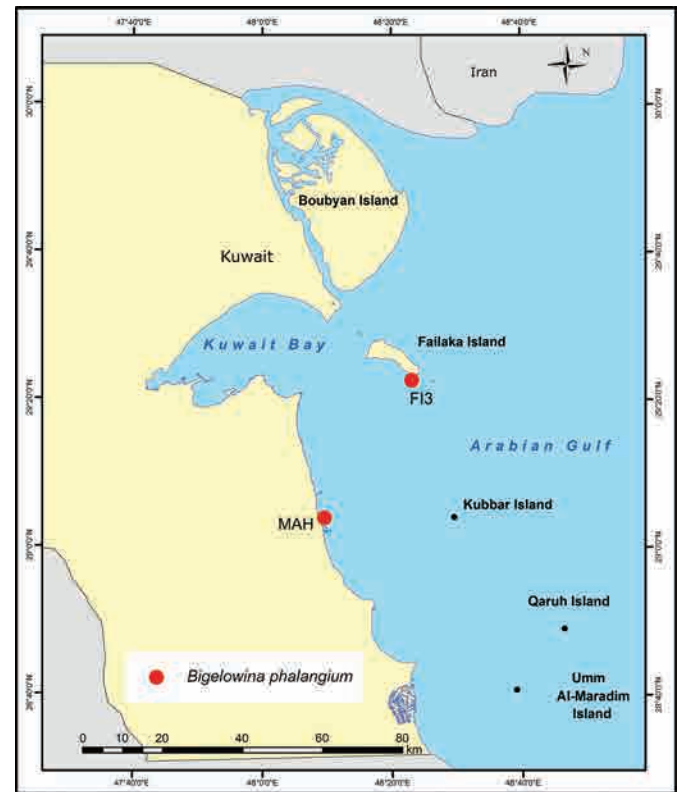


Figure 616. Presently known records of *Bigelowina phalangium* in Kuwait.

widespread infaunal mantis shrimp, recorded from the western Indian Ocean to the western Pacific (Ahyong 2001). This species is observed in the Arabian-Persian Gulf, based on the records from Saudi Arabia (Manning 1990, as *Acanthosquilla acanthocarpus* (Claus, 1871)) and Kuwait (Al-Kandari et al. 2020b). Illustrations, diagnosis and an exhaustive synonymy of *B. phalangium* can be found in Ahyong (2001); for additional synonymy and records from India, see Trivedi et al. (2020). The burrows of *B. phalangium* may occasionally harbour commensal alpheid shrimps (Đuriš and Anker 2014).

Most Relevant References. Ahyong 2001; Manning 1990; Holthuis 2000; Ahyong 2001; Al-Kandari et al. 2020b; Trivedi et al. 2020.



Figure 617. Mud-sand flat with deeper pools among rocks on the eastern shore of Failaka Island, Kuwait, typical habitat of *Bigelowina phalangium*.

Family Squillidae

Cloridina ichneumon (Fabricius, 1798)



Figure 618. *Cloridina ichneumon* (Fabricius, 1798), specimen from Oman in dorsal view (A), with detail of telson and uropods (B). Photographs by Arthur Anker.

Synonyms. *Squilla ichneumon* Fabricius, 1798; *Clorida microphthalma* (H. Milne Edwards, 1837).

Common Name. Ichneumon burrowing mantis shrimp.

Main Diagnostic Features.

1. Rostral plate as long as or longer than broad.
2. Apices of dorsal processes of antennular somite produced as acute spines.
3. Eyestalks with proximolateral margin markedly inflated; cornea small.
4. Raptorial legs ending in spearer-type claw; dactylus armed with 4–5 sharp teeth.
5. Telson with an irregular dorsolateral surface, with 1 inflated median carina, several short, bump-like carinae, as well as additional bumps and tubercles.
6. Colour in life: pale brown-greenish to straw yellow with scarce dark markings.
7. Size: maximal total body length about 70 mm.

Distribution. Indo-West Pacific from East Africa and the Arabian-Persian Gulf to New Caledonia.

Ecology. Benthic, on muddy bottoms from the upper intertidal zone to 10 m; in burrows.

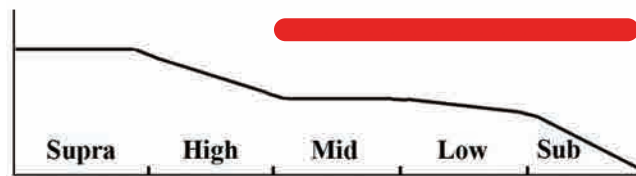


Figure 619. Bathymetric distribution of the species.

Remarks. Similar to the previous species, it was Holthuis (2000) who fixed the taxonomic identity of the species described by Fabricius (1798) as “*Squilla ichneumon*”. Despite being a widespread species and occurring in very shallow water, *Cloridina ichneumon* is a relatively infrequently seen highly cryptic cryptic (infaunal) stomatopod, characterized by tiny eyes. Within the Arabian-Persian Gulf, *C. ichneumon* is recorded from the Straits of Hormuz, the United Arab Emirates, and Kuwait (Manning 1990, reported as *Clorida microphthalma*; Al-Kandari et al. 2020b). Illustrations of the species’ morphology can be found in Tirmizi et al. (1994) and Ahyong (2016).

Most Relevant References. Tirmizi et al. 1994; Holthuis 2000; Ahyong 2016; Al-Kandari et al. 2020b; Trivedi et al. 2020.

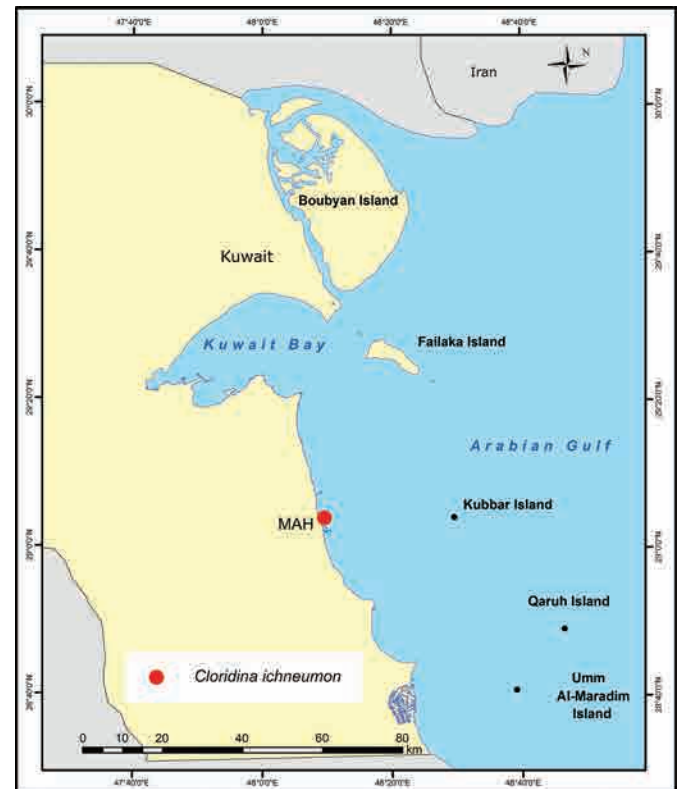


Figure 620. Presently known record of *Cloridina ichneumon* in Kuwait.

Family Squillidae

Oratosquillina interrupta (Kemp, 1911)



Figure 621. *Oratosquillina interrupta* (Kemp, 1911) in dorsal (A) and lateral (B) views, with details of the raptorial claw (a) and telson (b), Kuwait. Photographs by Valeriy Skryabin.

Synonyms. *Squilla interrupta* Kemp, 1911; *Oratosquilla arabica* Ahmed, 1971.

Main Diagnostic Features.

1. Carapace with branches of anterior bifurcation of mid-dorsal carina distinct; dorsal integument lightly pitted.
2. Rostral plate broader than long or as long as broad.
3. Raptorial claw of spearer type; carpus with dorsal carina subdivided into 2 triangular lobes; dactylus with 6 sharp teeth.
4. Telson with prelateral lobe slightly shorter to slightly longer than the margin of lateral tooth; dorsolateral surface without supplementary longitudinal carinae; ventral surface with short, smooth postanal carina, without supplementary ventral carinae.
5. Uropodal protopod with terminal spines; lobe on the lateral margin of inner terminal spine rounded, proximal margin straight or convex; exopod with proximal segment's outer margin armed with 7–9 movable spines.
6. Colour in life: buff to pale brownish or olive greenish; telson with dark brown median spot proximally.
7. Size: total length possibly reaching 150 mm (145 mm confirmed).

Distribution. Indo-West Pacific from the Arabian-Persian Gulf and India to China, Taiwan, and eastern Australia.

Ecology. Benthic, on muddy and sandy-muddy bottoms, from the lowest part of the intertidal zone (rare) to the subtidal zone, down to at least 25 m; in spacious, U-shaped burrows.

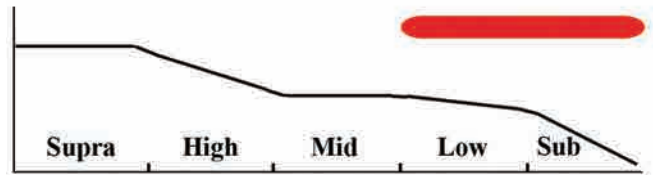


Figure 622. Bathymetric distribution of the species.

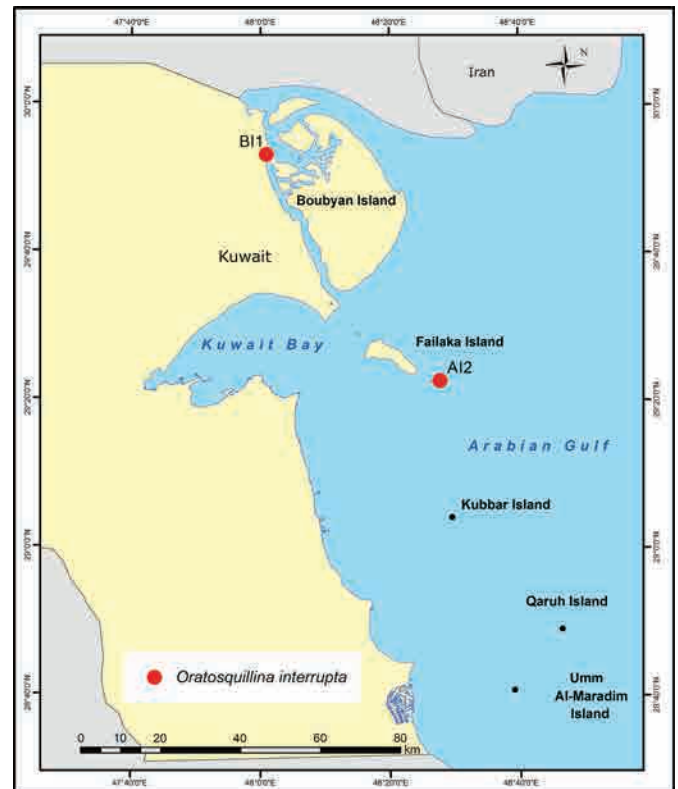


Figure 623. Presently known records of *Oratosquilla interrupta* in Kuwait.

Remarks. *Oratosquilla interrupta* is the largest mantis shrimps in Kuwait, easily overreaching 10 cm in length. Ah Yong (2001) provided the complete account of the species, with illustrations, diagnosis, and exhaustive synonymy.

Most Relevant References. Kemp 1911; Manning 1990; Ah Yong 2001.



Figure 624. Typical habitats of *Oratosquilla interrupta* on sandy-muddy flats of Auha Island (A) and muddy flat of the northern coast of Boubyan Island (B), Kuwait. Photographs by Valeriy Skryabin.

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IDENTIFICATION GUIDE

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CRUSTACEANS OF KUWAITCIRRIPIEDIA (BALANOMORPHA), DECAPODA,
STOMATOPODA

Al-Kandari, M., Anker, A. Khvorov, S., Skryabin, V.

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