

# NEW OBSERVATIONS AND DISTRIBUTION ON *FAUNUS ATER* (LINNAEUS, 1758) (CAENOGASTROPODA: PACHYCHILIDAE) IN THE PAPUAN REGION

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## Abstract

The distribution of an aquatic cerithioid snail *Faunus ater* (Linnaeus, 1758) in the Papuan Region (Moluccas, New Guinea with its satellite islands, Bismarck Archipelago, Solomon Islands and Vanuatu) is assessed and discussed. New faunistic records and information on the ecology of the species are provided. Published records from the region are summarized.

Keywords: faunistic records, bibliography, ecology, aquatic gastropod, Papuan Region.

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## INTRODUCTION

The genus *Faunus* was originally erected by Montfort (1810: 426–428) to hold *Faunus melanopsis* Montfort, 1810, which is the type of the genus by original designation and a junior synonym of *Faunus ater* (Linnaeus, 1758). *Faunus* has been attributed subsequently to various operculate aquatic molluscan families such as Cerithiidae (Way & Purchon 1981), Melaniidae (Garg et al. 2009), Melanopsidae (Houbrick 1988, Lydeard et al. 2002, Tan & Woo 2010), Potamididae (Brandt 1974, Sriroon et al. 2005) and Thiaridae (Solem 1953, Janaki Ram & Radhakrishna 1984) until recently, when the morphological and morphological and 16S and 28S rRNA sequences-based evidence supported its placement in cerithioid family Pachychilidae (Köhler et al. 2004, Strong 2011, Strong et al. 2011). Numerous fossil species have been subsequently attributed to *Faunus* (MolluscaBase 2021).

*Faunus ater* (Figs. 1–2), originally described from ‘Asiae paludibus’, was originally placed in *Strombus* Linnaeus, 1758 by Linnaeus (1758: 745). Nowadays *Faunus* is considered monotypic in recent fauna but has multiple fossil representatives. Numerous extant taxa were subsequently synonymized with *F. ater* (Brandt 1974, Houbrick 1991, MolluscaBase 2023). Available fossil records point on a possible Tethyan origin of this species (Houbrick 1991). *Faunus ater* is widely distributed along mainland and insular coastal areas from southwestern Indian Ocean (Mauritius: Pauwels et al. 2021a, Goud et al. 2023a, Samyn et al. 2023; Reunion: Brot 1879) through the whole Southeastern Asia towards western and southern Pacific and northern Australia (Lok et al. 2011 and references therein) with occasional records from the Pacific coast of Central and South America Nicaragua: López & Urcuyo (2012); Chile: Tablado & Rodríguez (2021)) which are likely results of unintentional import, for instance, with ballast waters. Older,

limited faunistic records of *Faunus ater* from the western part of the Papuan Region (Moluccas, West New Guinea) were summarized by van Benthem Jutting (1927, 1953, 1959, 1963). General distribution of this species is summarized in Lok et al. (2011) with the exception of its southeastern extent which is briefly discussed in the present paper.

*Faunus ater* is an aquatic pachychilid with large shell of up to 90 mm, generally about 50–60 mm long (Lok et al. 2011). Embryonic whorls decollate in adult specimens. Shell black to dark brown, strongly turritiform and high spired, wall particularly thick, surface smooth with gentle, sparse axial striation, suture weakly depressed, aperture irregularly elliptical, apertural callus white to yellowish brown. The species is unique among all cerithioid genera in the possession of a conspicuous notch along the apertural edge formed by the anterior siphon at shell base and an additional, anal, sinus which is touching shell suture.

The ecology of *Faunus ater* appears well studied. The species inhabits mouths and lower course of running freshwaters, usually with a brackish influence (Houbrick 1991). It is reported to inhabit both fresh- as well as brackish water near the coast, as well as estuaries, lagoons, standing or lotic habitats, marine and coastal lakes, and mangroves, including exposed tidal mudflats (Lesson 1831, von Martens 1897, van Benthem Jutting 1956 and 1963, Brandt 1974, Ram & Radhakrishna 1984, Swennen et al. 2001, Lok et al. 2011, Das et al. 2018, Aji et al. 2023, Fig. 2A–B). On the Greater Sunda islands of Java and Sumatra this species has been observed also in ditches and freshwater ponds (van Benthem Jutting 1956). Also reported from coastal and brackish Cayangan Lake in the Philippine Coron Island from 1–1.5 m water depth on sand and rock substrate (Houbrick 1991). Records from deeper seawaters (for instance, 36 m depth as in Goud et al. (2023b)) most likely are exceptions and could potentially refer either to dead or live specimens washed from ashore by

tidal waves. *Faunus ater* is not a rarity also in drainage channels and ditches of coastal towns and villages (Lok et al. 2011). This species is often observed in high numbers of tens to hundreds per square meter (Lok et al. 2011).

The broad, muscular rostrum, large buccal mass and robust radula indicate that this species likely grazes on coarse substrata (Lok et al. 2011). *Faunus ater* is oviparous (Houbrick 1991, Köhler et al. 2004) but its reproductive biology is not studied in detail. Houbrick (1991) suggests a free-swimming larval stage considering the wide geographical distribution of *F. ater*. *Faunus ater* shells are frequently covered with Neritidae Refinesque 1815 (not necessarily only *Neritina* Lamarck, 1816 as in Houbrick 1991 and Lok et al. 2011) egg masses and those living in brackish water are sometimes observed with young oysters attached to the shells (von Martens 1897).

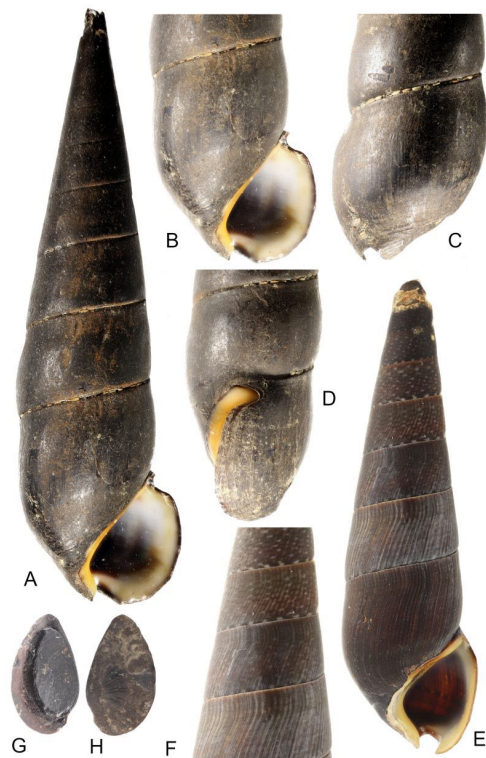
The aim of the present paper is to assess available bibliographic sources and summarize new data on the distribution and ecology of *Faunus ater* in the Papuan Region (see Material and methods).

## MATERIAL AND METHODS

*Faunus ater* (Figs. 1-2) label text is adapted by the author for some specimens and is not necessarily reproduced *verbatim*. Individual records are arranged chronologically, and geographical records are arranged from West to East and North to South. Administrative units as used in records are those for the moment corresponding observations were made and do not necessarily reflect the present administrative divisions.

Observations were made irregularly and not systematically. The number or density of observed individuals was not always noted during fieldwork. Records from Global Biodiversity Information Facility (GBIF, [gbif.org](http://gbif.org)) were also used.

Selected new material was studied and observed from collections of Latvian National Museum of Natural History, Rīga, Latvia; Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany; Naturkundemuseum Erfurt, Germany, as well as author's collection.



**Figure 1.** *Faunus ater* (Linnaeus, 1758). A–C: specimen from Nggela Sule Island, Solomon Islands (author's collection): A—shell, apertural view, B: aperture and ultimate whorl, apertural view, C: ditto, abapertural view, D: ditto, lateral view, E–H: specimen from eastern Guadalcanal, Solomon Islands (author's collection) with bleach-cleaned shell (consider different microsculpture on older and younger whorls), E: shell, apertural view, F: ditto, intermediary whorls enlarged, G: ditto, operculum, inner surface, H: ditto, operculum, outer surface [not to scale]. Images: K. Greķe.



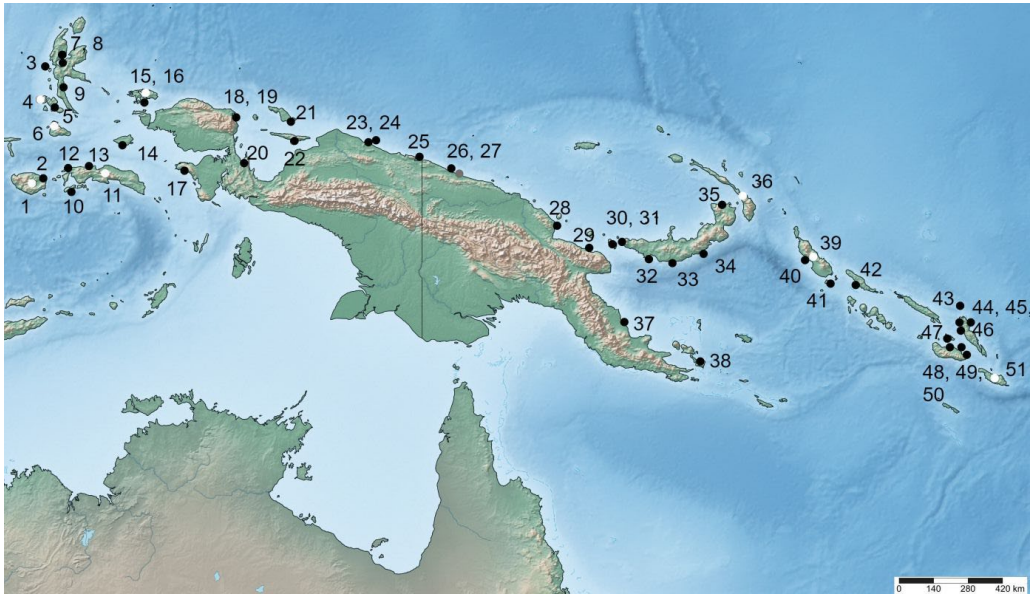
**Figure 2.** *Faunus ater* (Linnaeus, 1758), Puat-anarau, eastern Guadalcanal, Solomon Islands. A: the habitat—coastal mudflat, B: specimen density at low tide, C: close view of a specimen. Photo: D. Telnov.

All new material specimens were identified by the author. For morphological studies, a Leica S6D stereomicroscope (Leica Microsystems, Wetzlar, Germany) was used. Images *in situ* were taken using an Olympus Tough TG-6 (Olympus Corporation, Tokyo, Japan) digital camera. Habitus images *ex situ* were produced with a Canon EOS 5D SLR camera and a Canon MP-E 65 mm lens (Canon Co., Tokyo, Japan). Helicon Focus 7 software (Helicon Soft, Kharkiv, Ukraine) was used for image stacking. Further image manipulations were performed using the GNU Image Manipulation Program (GIMP, v.2.1).

The Papuan Region (for the definition and a map see Gressitt (1982), Beehler et al. (1986), Riedel (2002), Telnov (2011) and Greķe (2017)) stretches for nearly 4200 km west to east from the Moluccan islands towards the eastern Solomons and for about 1500 km north

to south from the latitude of Morotai towards that of the Louisiade Archipelago. It comprises more than 5000 islands and insular groups, from tiny, uplifted rocks to the world's largest tropical island, New Guinea (Fig. 3).

I do not pretend to have performed a comprehensive assessment of published sources on *F. ater* in the Papuan Region, but I was as accurate as possible.



**Figure 3.** Schematic distribution map of *Faunus ater* (Linnaeus, 1758) in the Papuan Region (prepared with SimpleMappr, <https://www.simplemappr.net>). White circles: island-based records (no exact locality mentioned in literature); black circles: locality-based records; grey circle: subfossil record, 1: Buru Island, 2: Buru Island, ‘Kajeli Bay’, 3: Ternate Island, all reported localities, 4: Kasiruta Island, 5: Bacan Island, Babang vill. env., 6: Obi islands, 7–8: Halmahera Island, Pediwang, Tunuo Creek (northern arm) and Loleba, Baluari Creek (north-eastern arm), 9: Halmahera Island, Tilope vill. (southern arm), 10: Ambon Island, all localities, 11: Seram Island, 12: Seram Island, Kawa Bay, 13: Seram Island, Horale vill., 14: Misool Island, Aduwat vill., 15–16: Waigeo Island and ‘Desa Warsambin’, 17: New Guinea, Onin Peninsula, Fakfak & Sekru, 18–19: New Guinea, Manokwari, ‘Port Dorey’ and Mansiam Island, 20: New Guinea, ‘Wasior at the Wandamen Bay’, 21: Biak Island, Biak ~12 km E, 22: Yapen Island, Serui, 23–24: New Guinea, Waskey River at Waskey vill. and Wakdi Islands, ‘Insoemanai Id’, 25: New Guinea, ‘Skomabo’, 26–27: New Guinea, ‘Berlinhafen’ and Aitape, 28: New Guinea, ‘Astrolabe Bai’, 29: New Guinea, ‘Kelannahafen’, 30: Umboi Island, 31: New Britain Island, ‘Lagoon Point’, 32: New Britain Island, ‘Puliebucht’, 33: New Britain Island, ‘Thileniushafen’, 34: New Britain Island, ‘Kap Beechy’, 35: New Britain Island, ‘Massavahafen’, 36: New Ireland Island, 37: New Guinea, ‘Oro Bay’, 38: D’Entrecasteaux Islands, 39: Bougainville Island, 40: Bougainville Island, ‘Torokima Point, Express Augusta Bay’, 41: Shortland Islands, 42: Choiseul Island, Sasamugga area, 43 – ‘Gower Id.’ (now Ndai), 44–46: Malaita Island, Ataa, Auki and Mbuma, 47: Nggela Sule Island, ‘Tulazi’ (Tulagi) Island, 48–50: Ruad Sua Island and Guadalcanal Island, ‘Honiara, Cruz Creek’, Aola, Marau area, Puatanarau vill. and ‘Marau Sound, Vainihaka River’, 51: Makira Island.

## RESULTS

### New and published distribution records of *Faunus ater* from the Papuan Region

#### 'Moluccas'

References. Brot (1879: 411), 'Molukken'; Tenison Woods (1888: 1087), 'Moluccas'.

#### North Moluccas, Ternate

References. Goud et al. (2023d), 'Ternate'; Sliker et al. (2023a), 'Pantai Sulamadaha'; Sliker et al. (2023b), 'Danau Tolire Kecil'.

New material studied. Indonesia E, Maluku Utara Prov., Ternate Is., Lake Tolire Kecil, W lakeside, 0°50'28"N 127°18'18"E, 2 m, coastal brackish lake.

Habitat and relative abundance. Tidal (lagune-type) lake, brown sediment and tidal mudflat.

#### North Moluccas, Halmahera

References. Orrell (2023a), 'Loleba, Baluari Creek'; Orrell (2023b), 'Pediwang, Tunuo Creek, approx. 100 Ms Upstream From Mouth Of Creek'.

New material studied. Indonesia, Maluku Utara Prov., Halmahera Is., Halmahera tengah (Central), Weda Selatan Dist., Loleo vill. SW env., Tilope vill. ~1 km S, 0°13'38"N 127°55'09"E, stream mouth; Halmahera Is., Halmahera Tengah (Central), Weda Selatan Dist., Loleo vill. SW env., ~3 km SW Tilope vill., River Tilope valley at the bridge, 0°13'28"N 127°54'47"E, fast-flowing river, on limestone rocks.

Habitat and relative abundance. Tidal mudflat, small, mussy stream, but also on limestone rocks (rapids) of a fast-flowing lowland river near mouth.

#### Nort Moluccas, Kasiruta

References. Morris (2023j), 'Kasiroeta Id.'. First record from Kasiruta.

#### North Moluccas, Bacan

References. Boettger (1891: 308), 'Batjan'; von Martens (1897: 192), 'Batjan'; Oostingh (1925: 28), 'Bachan'; van Benthem Jutting (1959: 29), 'Bacan'.

New material studied. Indonesia E, Maluku Utara Prov., Bacan Is. (central), Babang vill. env., 0°36'S 127°35'E, lowland river near the mouth.

Habitat and relative abundance. Lowland, slow-flowing river, brown sediment.

#### North Moluccas, Obi Islands

References. Goud et al. (2023e), 'Obi eilanden'; Natural History Museum (2023a), 'Obi Island' (unclear does it refer to Obira Island or to Obi Islands). First record from Obi Islands.

#### Central Moluccas, Buru

References. Lesson (1831: 360), 'Bourou'; von Martens (1897: 192), Buru; Brot (1879: 411), Buru; van Benthem Jutting (1927: 4, 14), Buru; Goud et al. (2023c), 'Mouth river, Kajeli Bay'.

#### Central Moluccas, Seram

References. Goud et al. (2023b), 'westcoast, Kawa Bay, 36 m, stony bottom, dredge, townet, shore-exploration'; Morris (2023i), 'Ceram'.

New material studied. Indonesia E, Maluku tengah Prov., Seram Utara Dist., Horale (former Saka) vill., 02°56'13"S 129°04'56"E, river mouth.

Habitat and relative abundance. Few specimens, sandy riverbank at seashore.

### Central Moluccas, Lease Islands, Ambon

References. Rumphius (1705: 101, pl. 30 fig. R), ‘Amboina’, as ‘*Strombus palustris laevis*’; Bleeker (1856: 70), ‘Amboina’, as ‘*Pierna atra*’; von Martens (1897: 192), ‘bei Weynitu auf Amboina’; Brot (1879: 411), ‘Amboyna’; Tapparone Canefri (1883: 49), ‘Amboina’; Tenison Woods (1888: 1087), ‘Amboyna’; Boettger (1891: 308), ‘Amboina’; von Martens (1897: 192), ‘bei Weynitu’; van Benthem Jutting (1953: 289), ‘Ambon!; river 2 km north of the town!’.

### Raja Ampat Islands

References. Greke (2022: 199), Aji et al. (2023: 399, 404, 417, fig. 47A–B).

### Raja Ampat Islands, Misool

New material studied. Indonesia E, Prov. Raja Ampat, Misool SW, Misool Utara Distr., Aduwey (former Adua) vill. ~700 m N, 01°58'49"S 129°54'05"E, ~100 m, degraded lowland rainforest; Misool SW, Misool Utara (North) Distr., Aduwey (former Adua) vill. ~2 km NNW, 01°58'50"S 129°55'41"E, ~100 m, degraded lowland rainforest (1 specimen is containing a crab). First record from Misool Island.

Habitat and relative abundance. Empty shells observed inland were moved here by hermit crabs.

### Raja Ampat Islands, Waigeo

References. Tapparone Canefri (1883: 49), ‘Waigheu’; Slieker et al. (2023c), ‘Desa Warsambin’.

### New Guinea

References. Lesson (1831: 360), ‘Nouvelle-Guinée’; Quoy & Gaimard (1834: 161, pl. 56 fig. 1), ‘Nouvelle-Guinée’; Tapparone Canefri (1878: 265), ‘Port Dorey’, as ‘*Melania pagoda*’; Brot (1879: 411), ‘Neu-Guinea’;

Brancsik (1894: 218), ‘Astrolabe Bai’; von Martens (1897: 192), ‘New Guinea’; Tapparone Canefri (1883: 49), ‘Port Dorey’; Tenison Woods (1888: 1087), ‘New Guinea’; Soós (1911: 351), ‘Lemien, Berlinhafen’; Leschke (1912: 120, 145), ‘Berlinhafen’, ‘Kelanahafen’; Adam & Leloup (1938: 88), ‘Ile de Mansiam, Manokwari’; van Benthem Jutting (1963: 464), ‘New Guinea’, ‘Skomabo’ (now Skaumabo), ‘Wasior at the Wandamen Bay’, ‘Sekru’, Fakfak’; Pauwels et al. (2021b), Papua New Guinea; Grant et al. (2023), ‘Papua New Guinea, Aitape District, Aitape, archaeological excavations on the Aitape Hill’; Academy of Natural Sciences (2023a), ‘Oro Province, Oro Bay’; Slieker et al. (2023d), ‘Manokwari’.

New material studied. Indonesia E, New Guinea, Papua Prov., Sarmi 76 km ESE, Waskey River at Waskey vill., 01°57'29"S 138°50'04"E, 16 m, lowland river near mouth.

### Cenderawasih Bay islands, Biak

New material studied. Indonesia E, Papua Prov., Cenderawasih Bay, Biak Is., Biak ~12 km E, 01°10'51"S 136°10'43"E, 1 m. First record from Biak Island.

Habitat and relative abundance. Few specimens, mangroves, tidal mudflat.

### Cenderawasih Bay islands, Yapen

References. van Benthem Jutting (1963: 464), ‘Japen I.: Serui’.

### New Guinea N coast, Wakde Islands

References. Morris (2023k), ‘Wake [sic!] Ids’ (misspelt Wakde) ‘Insoemanai Id’. First record from Wakde Islands.

### Bismarck Archipelago, Umboi

References. Morris (2023a), Umboi. First record from Umboi Island.

### **Bismarck Archipelago, New Britain**

References. Leschke (1912: 120), ‘Nordküste, Massavahafen’, ‘Westküste, Lagoon-Point’, ‘Südküste, Thileniushafen’, ‘Südküste, eine Seemeile westlich von Kap Beechy’, ‘Südküste, Puliebucht’.

### **Bismarck Archipelago, New Ireland**

References. Lesson (1831: 360), ‘Nouvelle-Irlande’ for *Pirena acus* Lesson, 1831, a junior synonym of *F. ater*; Brot (1879: 411), ‘Neu-Irland’; Tenison Woods (1888: 1087), ‘New Ireland’.

### **D’Entrecasteaux Islands**

References. UMMZ (2023a), ‘small stream near mouth Wediuii Village, Elologea Bay’. First record from d’Entrecasteaux Islands.

### **Solomon Islands archipelago, Bougainville**

References. von Martens (1897: 192), ‘Bougainville’; Dall (1910: 217), ‘Interior of Bougainville Island’; UMMZ (2023b), ‘Torokima Point [Cape Torokina], Express Augusta Bay’.

### **Solomon Islands archipelago**

References. Solem (1953).

### **Solomon Islands archipelago, Shortland Islands**

References. Morris (2023c), ‘Faisi’. First record from Shortland Islands.

### **Solomon Islands archipelago, Choiseul**

References. Morris (2023d), ‘mouth of Sasamanga R.’

New material studied. Solomon Islands, Choiseul Prov., Choiseul Is., Sasamugga area, Vanami vill., Vavudu stream at the mouth, 7°01’57”S 156°45’40”E, 2 m.

Habitat and relative abundance. Few individuals in a shallow stream with brackish water, in mud.

### **Solomon Islands archipelago, Nggela Sule & Tulagi**

References. Morris (2023h), ‘Tulazi [sic!] Id.’ (misspelt Tulagi).

New material studied. Solomon Islands, Central prov., Nggela Sule Is. S opposite Tulaghi, 9°04’S 160°08’E, 0 m. First records from Nggela Sule and Tulagi.

Habitat and relative abundance. Mangroves and tidal mudflat, very abundant and numerous.

### **Solomon Islands archipelago, Guadalcanal and Rua Sura**

References. Dautzenberg (1910: 29), ‘Rua-Sura’; Aiken (2011: 11), ‘Marau Sound, Vainihaka River’; Florida Museum of Natural History (2023a), ‘Guadalcanal’; Florida Museum of Natural History (2023c), ‘Honiara, Cruz Creek’; Morris (2023b), ‘Lunga R. swamp’; Natural History Museum (2023b), ‘Aola’.

New material studied. Solomon Islands, Central Prov., Guadalcanal Is., W Honiara, Botanical Garden, 9°26’00”S 159°56’29”E (1 dead specimen); Guadalcanal Is. Marau area, Puatanarau vill., 9°45’14”S 160°46’32”E, 0 m.

Habitat and relative abundance. Mangroves and tidal mudflat, very abundant and numerous (dozens of specimens per square meter).

### **Solomon Islands archipelago, Malaita & Ndai**

References. Academy of Natural Sciences (2023b), ‘Usu’usue, Ata [sic!] District’ (misspelt Ataa); Biologiezentrum Linz Oberoesterreich (2023), ‘Ata’a, Nord Malaita’; Delaware Museum of Natural History (2023a), ‘Malaita

Province, Mbuma, W Malaita Island'; Florida Museum of Natural History (2023b), 'Malaita'; Morris (2023e), 'Auki'; Morris (2023f), 'Suu'; Morris (2023g), 'Atta'; Morris (2023i), 'Gower Id.' (now Ndai). First records from Malaita and Ndai islands.

### Solomon Islands archipelago, Makira

References. Delaware Museum of Natural History (2023b), 'Makira'. First record from Makira.

## DISCUSSION

Records of *Faunus ater* are present from most of the study area (Fig. 3). The species inhabits most of the Moluccas (also Maluku), including the remote Buru Island and Obi Group, but not yet reported from Gebe and Morotai. In the Lease Islands group *F. ater* is yet only recorded from Ambon without records from Haruku, Nusa Penida and Saparua. *Faunus ater* is not recorded from Tanimbar Islands and Aru Islands. In the Raja Ampat islands yet documented from Misool and Waigeo with records still lacking from Batanta, Kofiau and, most surprisingly, Salawati. The species is present on Cenderawasih Bay Islands of Biak and Yapen, not yet recorded from Numfor. It is recorded from the north and south of Doberai Peninsula of New Guinea, occurs along the northern coast including small offshore islands (for instance, Wakde Group) towards the Papuan Peninsula in the east. Surprisingly no records yet available from the southern coast (except from Onin Peninsula in the southern Doberai) which possess the most extensive mangrove stands and mudflat areas in the study region. *Faunus ater* is not yet known from Admiralty Islands or Manus but is recorded from Bismarck Archipelago and most of the Solomon Archipelago apart from the remote Rennel Group. The species is also known from d'Entrecasteaux Islands but not from Muyua (Woodlark) and the Louisiade Archipelago.

I hypothesize that *Faunus ater* is likely present on all insular groups of the Papuan Region and occurs on most of its islands where suitable habitat is available. The species is thus not exclusively marine or freshwater and demonstrated a strong preference to brackish habitats. Distributed generally along the coastline and inhabiting mainly tidal zone (mangroves, swamps, brackish lakes, estuaries and terminal courses of streams and large rivers), *Faunus ater* appears highly tolerant to both saline oceanic and pure freshwater since the salinity and physical characteristics of waters fluctuate continuously following the tidal cycles and are regularly oppositely different.

The southern distribution extent of *F. ater* in the western Pacific is likely New Caledonia, from where *Pirena nana* Reeve, 1860, one of the junior synonyms of *F. ater*, was originally described (Reeve 1860). *Faunus ater* is also known from Vanuatu eastwards of the study area (for instance, van Benthem Jutting 1956, Florida Museum of Natural History 2023d) which possibly is the yet known eastern distribution extent of the species in the equatorial Western Pacific since no records from Fiji are known to me (but the presence of *F. ater* in Fiji is not impossible considering the available habitat and the similarities of the coastal malacofauna).

Shells of *Faunus ater* are often inhabited by hermit crabs (own observations in the study region). In the hot and moist equatorial climate hermit crabs are inhabiting not only coastal areas but also rainforest several kilometres inland (personal observations from Halmahera, Guadalcanal, Misool, New Guinea). These crabs are usually responsible for transporting coastal and marine shells to rainforests deeper inland, where these shells may later surprise unexperienced observer. Therefore, occurrence records of *F. ater* from inland areas should be treated critically and require additional confirmation.

*Faunus ater* appears a well-know source of protein for coastal people communities in New



Guinea since prehistorical times (Gerber & Schechter 2011) and are still actively consumed in the Solomon Islands (own observation—alive snails from Nggela Sule are on a regular offer at the central market in Honiara).

## CONCLUSIONS

Considering the general distribution and abundance of *F. ater* in the Papuan Region, the need for more extensive faunistic research in the areas from where this species is not yet recorded (see Discussion above) becomes obvious.

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