

STOMATOPOD CRUSTACEANS OF NORTHERN PAPUA (VOGELKOP SEASCAPE)

Stomatopods, also known as mantis shrimp, are benthic marine crustaceans that occur predominantly in coral reef and seagrass habitats in the tropical oceans of the world, though some are found in temperate waters and a few species are deep-sea specialists that occur in depths of up to 1,500 meters. Stomatopods are a diverse group, with at least 450 species representing over 100 genera in 17 families. Though related to the more commonly-known decapods such as crabs, shrimp, and lobsters, stomatopods are quite different from these groups in having two enlarged raptorial appendages (much like praying mantis insects) instead of pincers as their primary defensive and predatory appendages.

The morphology of these raptorial appendages naturally divides the stomatopods into two functional groups: the spearers and the smashers. The raptorial appendages of the spearers are lined with long, sharp teeth that are used to impale soft-bodied prey such as fish and prawns. Spearers typically live in burrows they excavate in soft-bottom habitats, where they frequently occur in monogamous pairs. The largest spearers reach up to 40 cm in length and can live for 20 years or more. Smashers are generally much smaller, with the largest reaching 17 cm, but most species are less than 6 cm. They have a hardened, calcified heel on their raptorial appendages that they use to smash apart hard-bodied prey such as crabs, snails, and other gastropods. This habit has earned them the nickname "thumbnail splitters" and "devil shrimp" in some languages, and they have even been known to smash aquarium glass with their strike, which is slightly faster than a .22 caliber bullet. The smashers live mostly on coral reefs, where they inhabit cavities in hard substrates including coral rubble and live coral. Unlike the monogamous spearers, smashers display generally promiscuous reproductive behavior.

The author has been sampling stomatopod crustaceans from around Indonesia and the Coral Triangle region for the past 14 years, focusing predominantly on the superfamily Gonodactyloidea, which includes all of the smashers. Of all the areas studied, the Vogelkop region of northern Papua, particularly the Raja Ampat Archipelago, is the most diverse by far. In 15 days of sampling from 36 sites (32 in Raja Ampat, 4 in the Biak/Padaido Islands), I collected a total of 37 gonodactyloid species (see Table 4.2.1), including five previously undescribed species, one

Table 4.2.1. Gonodactyloid stomatopods collected from Vogelkop region

Family	Species
Gonodactylidae Geisbrecht 1883	<i>Gonodactylaceus falcatus</i> (Forskål 1775)
	<i>Gonodactylaceus glabrous</i> (Brooks 1886)
	<i>Gonodactylellus affinis</i> (de Man 1902)
	<i>Gonodactylellus annularis</i> Erdmann and Manning 1998

	<i>Gonodactylellus erdmanni</i> Ah Yong 2001
	<i>Gonodactylellus espinosus</i> (Borradaile 1898)
	<i>Gonodactylellus kandi</i> Ah Yong and Erdmann 2006
	<i>Gonodactylellus micronesicus</i> (Manning 1971)
	<i>Gonodactylellus rubriguttatus</i> Erdmann and Manning 1998
	<i>Gonodactylellus snidsvongi</i> (Naiyanetr 1987)
	<i>Gonodactylellus viridis</i> (Serène 1954)
	<i>Gonodactylellus</i> sp. A (Ah Yong and Erdmann, in prep)
	<i>Gonodactylellus</i> sp. B (Erdmann, in prep)
	<i>Gonodactylopsis</i> sp. A (Erdmann, in prep)
	<i>Gonodactylus childi</i> Manning 1971
	<i>Gonodactylus chiragra</i> (Fabricius 1781)
	<i>Gonodactylus platysoma</i> (Wood-Mason 1895)
	<i>Gonodactylus smithii</i> Pocock 1893
	<i>Hoplosquilla said</i> Erdmann and Manning 1998
Odontodactylidae Manning 1980	<i>Odontodactylus cultrifer</i> (White 1851)
	<i>Odontodactylus latirostris</i> Borradaile 1907
	<i>Odontodactylus scyllarus</i> (Linnaeus 1758)
	<i>Odontodactylus</i> sp. A (Erdman, in prep)
Protosquillidae Manning 1980	<i>Chorisquilla brooksii</i> (de Man 1888)
	<i>Chorisquilla gyrosa</i> (Odhner 1923)
	<i>Chorisquilla hystrix</i> (Nobili 1899)
	<i>Chorisquilla mehtae</i> Erdmann and Manning 1998
	<i>Chorisquilla pococki</i> (Manning 1975)
	<i>Chorisquilla spinosissima</i> (Pfeffer 1888)
	<i>Chorisquilla</i> sp. A (Erdmann, in prep)
	<i>Echinosquilla guerini</i> (White 1861)
	<i>Haptosquilla glyptocercus</i> (Wood-Mason 1875)
	<i>Haptosquilla pulchella</i> (Meiers 1880)
	<i>Haptosquilla pulchra</i> (Hansen 1926)
	<i>Haptosquilla trispinosa</i> (Dana 1852)
	<i>Haptosquilla tuberosa</i> (Pocock 1893)
	<i>Haptosquilla</i> sp. A (Erdmann, in prep)
	<i>Haptosquilla</i> sp. B (Erdmann in prep)
	<i>Haptosquilla</i> sp. C (Erdmann, in prep)
	<i>Siamosquilla laevicaudata</i> (Sun and Yang 1998)
	<i>Siamosquilla</i> sp. A (Erdmann, in prep)
Pseudosquillidae Manning 1977	<i>Pseudosquilla ciliata</i> (Fabricius 1787)
	<i>Pseudosquilla megalophthalma</i> (Bigelow 1893)
	<i>Raoulserenea ornata</i> (Miers 1880)
	<i>Raoulserenea oxyrhyncha</i> (Borradaile 1898)
Takuidae Manning 1995	<i>Taku spinosocarinatus</i> (Fukuda 1909)

of which appears endemic to the Raja Ampat Archipelago. The 37 species collected represent 14 of the 24 genera and 5 of the 7 families of gonodactyloids known worldwide. This is the highest known species diversity of reef-associated stomatopods for a seascape of this size anywhere in the world. By comparison, Australia's Queensland coast has 26 known gonodactyloids (Ahyong 2001), Vietnam has 24 (Manning 1995), and the entire Caribbean area has 17 known gonodactyloids (Manning 1969, 1970; Schotte and Manning 1993). Within the Coral Triangle, the next most diverse seascapes are northern Sulawesi (32 gonodactyloids) and the Wakatobi area of southeast Sulawesi (31 gonodactyloids), both of which have been examined with more than triple the sampling effort of the Vogelkop.

Table 4.2.2 shows the known zoogeographic distributions of the stomatopod species collected from northern Papua (following the classification of Allen, 2002). While roughly 65% of the collected species have a relatively wide distribution (i.e., found at least as far as the central Pacific or Indian Ocean), another 35% show a much more restricted range (e.g., found only in the Western Pacific or within the Indo-Australian Archipelago). Fully 13% of these species are found only in eastern Indonesia, including one species apparently endemic to Raja Ampat's reefs.

Table 4.2.2. Zoogeographic distribution of stomatopod species collected from the Vogelkop region

Zoogeographic distribution	Number of species	Percentage of world total
Circumtropical	1	2.10%
Indo-west and central Pacific	7	14.90%
Indo-west Pacific	7	14.90%
East Indian and west and central Pacific	4	8.50%
East Indian and west Pacific	10	21.30%
West and central Pacific	1	2.10%
West Pacific (incl. South China Sea)	3	6.40%
Indo-Australian Archipelago	2	4.30%
Indo-Philippines	2	4.30%
Eastern Indonesia	4	8.50%
Endemic to Vogelkop	6	12.70%

The fantastic diversity of stomatopods in the Vogelkop seascape is likely a direct result of the equally impressive diversity of reef habitats represented in the area, with a sharp gradient of exposure, sedimentation, and current regimes. Among the varied habitats sampled are protected bay fringing reefs, fringing reefs subject to freshwater influx, steep walls and platform reefs with strong currents, clear water

slopes and lagoons, rocky reefs, and wave-pounded reef flats. The sheer diversity of stomatopod species alone would argue for the prioritization of this area for conservation efforts, with the strong representation of restricted range species further emphasizing the importance of protecting this unique area. Ongoing population genetic studies of stomatopods from the region should help elucidate patterns of genetic connectivity of the Vogelkop seascape with other reefs in the Coral Triangle and thereby give a clear indication of the importance of including these diverse reefs in Indonesia's developing marine protected area (MPA) network.

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9–12 km from shore, a lagoon, and a shoreline of sedimentary bays, mangroves, and rocky shores. Four hundred person-days were spent in the field collecting and sorting specimens from the intertidal to depths of 120 m. A total of 2,738 species of mollusks was collected, several times the maximum diversity published by previous expeditions to other areas. Nearly a third of all species collected were found at a single station, including the 20% of species represented by a single individual. Even with the 2,738 species found, Bouchet et al. (2002) concluded that soft-bodied species were underrepresented. Because of the specialized sampling required, cephalopods were not sampled at all. Bouchet et al. (2002) predicted the total number of mollusk species at the site could be as high as 3,971 species.

Wells (2002c) divided the tropical Indo-West Pacific into ten regional areas and surveyed the distribution of 1,268 species of mollusks in each area. The greatest diversity was in the Coral Triangle, in which 745 of the species occurred. Forty-