

## **The cephalopods of Guam**

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**Abstract**—The cephalopod fauna of Guam is reviewed and 21 species recorded from the island together with an additional species known at present only from Pagan (Northern Mariana Islands). The known fauna is comprised of one cuttlefish, one neritic squid and 19 species of octopus. At present only three of the octopus species are identified to species; several of the unidentified species are undescribed.

### **Introduction**

To date, the cephalopod fauna of Guam has received little attention. The only publication on Guam's cephalopods is Corner & Moore's (1980) study on the reproductive behavior of *Sepia latimanus*. The discovery of an arm-autotomizing octopus in 1991 led to a study of this species (Ward 1998), as well as a general survey of the nearshore cephalopods of Guam. The results of this survey are reported here.

### **Methods**

Species were differentiated using standard morphological characters. Octopus species are arranged in the species groupings of Norman & Sweeney (1997). Descriptions of each species-group are summarized from that paper. The taxonomy of many octopus species-groups remains poor, due to their nature: few hard body parts and a highly developed capacity for skin color and texture changes. Norman (1992a, 1992b, 1992c, 1993a, 1993b, 1993c, 1993d) has refined descriptive tools for octopuses, allowing meaningful species groupings to be made.

### **Results**

A provisional list of 19 octopus species is presented. It is considered to be an understatement of the total number of octopus species in Guam; the majority are undescribed species. Several specimens that were in poor condition or were apparently still in their pelagic juvenile stage, were not included, as important morphological information could not be determined for them. Additional species

doubtless remain to be collected, given that several species are known from single specimens.

Specimens have been deposited at the Florida Museum of Natural History, University of Florida (UF), U.S. National Museum of Natural History (USNM), and Museum of Victoria, Melbourne (NMV). Only a single voucher is listed for each species in this publication, although additional material of several is available. Cited photographs by G. Paulay (GP###:##) and Linda Ward (LAW###/###/###:##) are housed at the Florida Museum of Natural History, University of Florida (UF), are on the WWW at: <http://www.flmnh.ufl.edu/reefs>, and are also available on the Marine Biodiversity of Guam CD-ROM copublication.

### **A Preliminary Checklist of the Cephalopods of Guam**

Order Sepioidea

Family Sepiidae

Genus *Sepia*

*Sepia latimanus* Quoy & Gaimard, 1832

UF 284882. Fore reef off Glass breakwater, 10-15m. See Corner & Moore (1980) for a study on the reproductive behavior of *Sepia latimanus* on Guam.

Order Teuthoidea

Family Loliginidae

Genus *Sepioteuthis*

*Sepioteuthis lessoniana* Lesson, 1830

USNM 574179. Common around Guam. Photo voucher (egg capsules): GP362:33

Order Octopoda

Family Octopodidae

Genus *Octopus*

*Octopus aegina* species-group Robson, 1929

Small to medium size octopuses (mantle length (ML) typically < 80 mm) with relatively short arms (typically 2-3x ML). Skin is sculptured in regular low and round papillae or regular raised patches defined by distinct grooves ('patch and groove sculpture'). Many species possess ocelli (false eye spots) and dark lines along the dorsal edges of arms 1-3. Members of this group occur throughout warmer (tropical and warm temperate) waters of the Atlantic, Indian, and Pacific Oceans.

*Octopus* sp. 1

UF 288782. Commonwealth of Northern Mariana Islands: Pagan Island, under overhang on wall, 28 m. Light red octopus with scattered papillae on head and elongate mantle (10mm ML); sole undifferentiated specimen approximately 35 mm TL; arms subequal in length; deep webs (deepest web is 8 mm, 33% of longest arm R3); 61-81 suckers per arm; no enlarged suckers. Eyes are slightly stalked; gill lamellae count is 10. No photo.

*Octopus* sp. 2

UF 288741. Guam, no locality data. Small red spots on dark beige dorsal mantle, head, and arm crown; dark red ocelli surrounded by white ring on arm crown between arm pairs 2 and 3; arm length moderate (2.9 x ML); moderately deep webs (deepest web is 37 mm, 23% of longest arm, L3). Eyes are small, mantle shape is globose; proximal half of arms are robust, the distal half slender. The sole specimen, a 51 mm ML incomplete sub-mature male, has 9 gill lamellae, enlarged suckers (6-9 from mouth) on arm pairs 2 and 3, but arm R3 is not hectocotylized. No photo.

*Octopus horridus* species-group Norman, 1993

Small to medium size octopuses (ML < 70 mm) with 5-7 gill lamellae, elongate arms (3.5-7x ML) and the capacity to autotomize these arms at a set level close to the arm base (within 5-10 suckers from the mouth). Mature males possess distinctly enlarged suckers on arms 2 and 3. Skin is typically highly sculptured, often bearing long branched primary papillae. The taxonomy of this species-group is very poor. Members of the group appear to be restricted to the tropical waters of the Indo-West Pacific region, from the Red Sea and east Africa to Hawaii and the Tuamotu Archipelago.

*Octopus abaculus* Norman & Sweeney 1997

UF 288777. Guam: Pago Bay fore reef, 3m. The sole specimen is a tiny (11 mm ML) submature male with hectocotylized arm R3 having 95 suckers, approximately the same length as arm L3, with no enlarged suckers. Sucker counts on four complete arms are 110-128. Mantle is long and slender, eyes stalked so that head is slightly broader than mantle. Arms are long and slender (3.9x ML), ventral arms longer than dorsal arms (AF 4>3=2≥1); 5-6 gill lamellae. No evidence of arm autotomy on this specimen. Photo: GP539-2, GP583:15,22-29.

*Octopus* sp. 3

USNM 885669. Guam: Pago Bay reef flat. Small (ML to at least 35 mm), beige octopus with sculptured skin and moderately long arms (3.3-4.3x ML), ventral pair usually longest to dorsal pair shortest (AF 4=3>2>1), enlarged suckers (2 or more of suckers 8-12) on mature male arm pairs 2 and 3; typically 110-170 suckers per arm, and 100-130 suckers on hectocotyized arm R3. This species autotomizes arms 4-7 suckers from the mouth; has shallow-to-moderate webs (10%-20% of longest arm), 5-6 gill lamellae, and W shape funnel organ. Females produces deposit 2000-5000 2-mm eggs in festoons of approximately 100 per string. This species is common on the reef flats around Guam (Ward, 1998). Photo: GP403-37, LAW4/25/95:20 (of future holotype), LAW2/26/96:23, LAW3/2/95:33, LAW4/25/95:15.

*Octopus* sp. 4

UF 288729. Guam: Pago Bay reef flat. White octopus which attains larger size (ML to at least 53 mm) than *O.* sp 3 and autotomizes arms 4-6 suckers from the mouth. Mature male arm pairs 2 and 3 (rarely all 4 pair) show enlarged suckers (8-12 from mouth). Arms are moderately long (3.3-3.9x ML), with shallow webs (11%-13% of longest arm). Funnel organ is W shape; gills have 5-6 lamellae. This species is relatively common on the reef flats around Guam. Photo: LAW1/93:41.

*Octopus* sp. 5

UF 288787. Guam: Merizo, reef flat near Fofos Islet. Light red octopus, with papillae on dorsal lower mantle, head, and arm crown. The sole specimen is a 42 mm ML brooding female of very gelatinous texture, with approximately 13,000 3-mm eggs in festoons of about 100 eggs each. Arms are moderately broad and long (4.0 x ML), ventral arms somewhat longer than dorsal arms, and 159-219 suckers per arm. Three arms are autotomized 6 suckers from the mouth; webs are shallow (deepest of 3 intact webs is 20 mm, 12% of longest intact arm, L3). Funnel organ is W shape, and gill lamellae count is 6-7. A great deal of watery fluid lies under the loose arm skin. Photo: GP410:27-30.

*Octopus* sp. 6

UF 288759. Guam: Tumon Bay moat. Small (35 mm ML) beige octopus with subtle blue-green color and iridescence on head and mantle. Mantle is amphora shape, arms are longer (5.7x ML) and more robust than *O.* sp. 3; sucker counts are 170-253 on 5 complete arms, ventral arms longer than dorsal arms (AF 4>1=2). Arms autotomize at 2-6 suckers from the mouth; webs are shallow (deepest of 3 intact webs is 20 mm, 8% of the longest intact arm R4); funnel

organ is W shape, and gill lamellae count is 5-6. The sole specimen deposited approximately 2,000 small (2 mm) eggs in captivity. Photo: LAW9/19/94:14.

*Octopus macropus* species-group Robson, 1929

Medium to large size octopuses (up to 10 kg) in which the dorsal arms are distinctly longer and more robust than the ventral pair (arm formula 1>2>3>4); high gill counts (10-15 per demibranch). Males do not possess enlarged suckers. Most species are nocturnal and feed on a broad range of prey from bivalves and crustaceans to fish and other octopuses. Species of this group occur in most tropical and temperate waters of the world.

*Octopus ornatus* Gould, 1852

USNM 1008158. Guam: Pago Bay reef flat. Large nocturnal octopus with elongate mantle and long arms (5.4 x ML), dorsal arms much longer than ventral arms (AF 1>2>3>4); 135 suckers on hectocotylized arm R3; 11-12 gill lamellae. Body color is dark rosy-orange with pale longitudinal bars on dorsal mantle. Relatively common on the reef flats around Guam. No photo.

*Octopus* sp. 7

UF 288728. Guam: Pago Bay reef flat. A red-orange octopus with larger and smaller white spots on all dorsal surfaces; the width of its rather long ovoid mantle equals its head width. The first pair of arms is very robust and long; the second pair less so; pairs 3 and 4 are quite slender and shorter (AF 1>2>3>4); arm lengths are 2.5-4.2 x ML. The single specimen, a 60 mm ML (>300 mm TL, 150 g weight) mature male, has no enlarged suckers. Hectocotylized arm R3 is just over half as long as arm L3, and has 85 suckers, compared to arm L3 sucker count of approximately 150 (only arm R3 was complete when the animal was preserved.) Webs are moderately shallow (deepest web is 13% of estimated length of longest arm). Funnel organ is W shape, and gill lamellae count is 7-8. The octopus was active at night, and occasionally modified its color and pattern to an all-over light rose shade, except for the dorsal surfaces of arms L1 and R1, colored dark brick-red; brick-red arm-width lines continued from the dorsal arms up the arm crown, the sides of the head, including the eye area, meeting at the mantle tip; the mid-section of mantle, head, and L1-R1 arm crown remained the light rose shade. This octopus (in captivity 6 months) ate several bivalves: *Grafiarium pectinatum*, *Isogmomon perna*, *Codakia tigerina*, *Asaphis violens*, small mussels, and even a *Cypraea moneta* cowrie, in addition to several species of crabs. Photo: GP 410-32,33, LAW10/7/95:19.

*Octopus* sp. 8

UF 288789. Guam: Agaña boat basin. The sole specimen, found at night, is an undifferentiated, large (112 mm ML) octopus with elongated ovoid mantle which is nearly twice as wide as the head, and a pair of dorsal mantle white spots just distal of the broadest mantle area. Arms are moderately long (4.3x ML); 252-270 suckers per arm; no enlarged suckers. Dorsal arms are much longer than ventral arms (AF 1>2>3>4); webs shallow (deepest web is 52 mm, 8% of longest arm R1); gill lamellae count is 10-11. Locally called “sand octopus”, this octopus is a uniformly light beige color. No photo.

*Octopus* sp. 9

NMV no catalog number (5 specimens deposited 28 Sep 1994). Guam: Pago Bay reef flat. Robust red octopus with globose mantle, active at night; 28-47 mm ML in 5 specimens. Arms are moderately long (3.5-5.0x ML), 158-191 suckers per arm; dorsal arms longer than ventral arms (AF 1>2>3≥); Length of male hectocotylyzed arm R3 is 50-70% length of arm L3, with approximately half the number of suckers (83-100) as arm L3; enlarged suckers (13-28 from mouth) on male pair 1 arms. This species is seen occasionally at night on Guam reef flats. Known only from 5 specimens. No photo.

*Octopus* sp. 10

UF 288736. Guam: Pago Bay reef flat. Robust red octopus active at night with diamond shape mantle and small eyes; ML 29-50 mm in 3 specimens. Arms are moderately long (3.3-4.1 ML) and quite muscular, dorsal arms longer than ventral arms (AF 1≥2>3≥4); sucker counts 155-190. Webs are moderately deep (deepest web 18-19% of longest arm); funnel organ is W shape; 9-11 gill lamellae. Length of male hectocotylyzed arm R3 is two-thirds the length of arm L3, with approximately half the number of suckers (77-79) as arm L3; no enlarged suckers on male arms. This species is known from three specimens; it is seen occasionally at night on Guam reef flats. No photo.

*Octopus vitiensis* species-group

Very robust, muscular octopuses (to at least 60 mm ML) with large eyes and a very broad head, (often broader than mantle). Arms of moderate length (4-5x ML); arm pairs 2, 3, 4 approximately equal in length, and longer than arm pair 1; typically maroon to purple-black on dorsal surfaces; small diamond of small papillae on dorsal mantle; 7-9 gill lamellae.

*Octopus cf. vitiensis* Hoyle, 1885

UF 288791. Guam: Piti Bay moat, under rock, 4 m. Small (19 and 25 mm ML), dark, robust octopus with very large eyes, papillae cone at tip of dorsal mantle, two frontal white spots forming a figure 8 on arm crown between pair 1 arms, subtle light horizontal arm stripes on brown-gray body. Moderately long robust arms (3.6x ML), subequal in length, dorsal arms slightly shorter than ventral arms; 119-158 suckers per arm. Webs deep (deepest web is 28 mm, 26% of longest complete arm, R2); head width equal to mantle width. Arm R3 on sole male specimen is the same length as L3, but with 25% fewer suckers (90), and no enlarged suckers; 6-7 gill lamellae. This species is known from two specimens; it is rare on the reef flats of Guam. Photo: LAW2/10/98:20,22.

*Octopus vulgaris* species-group Robson, 1929

Large octopuses (to 10 kg) with moderate to long arms (4-7x ML). Lateral and ventral arms longer and more robust than dorsal pair. Moderate gill count of 8-11 lamellae per demibranch. Mature males possess enlarged suckers on arm pairs 2 and 3 and sometimes 4. Skin highly sculptured; full dorsal and frontal white spots present. Diamond of primary papillae on dorsal mantle. The group includes a number of ocellate species.

*Octopus cyanea* Gray, 1849

UF 288724. Guam: Adelup reef flat. Large octopus (180 mm ML); arms long (the only complete arm, hectocotylized arm R3 is 4.4 x ML), the proximal half of arms is robust; 202 suckers on arm R3. Moderately deep webs (deepest web is 16% of longest arm); enlarged suckers (11-12 from the mouth) on arm pairs 2 and 3, sucker 12 on arm pair 4; 10 gill lamellae. Ocellus present as plain black oval spot surrounded by pale ring and dark outer ring. Diamond of primary papillae on dorsal mantle. Common on reef flats and fore reefs around Guam. Photo: GP516-9,10; RFM-144a, RFM-180-6,9, GP586-18.

Pygmy *Octopus* Species

Taxa are mature at tiny to small sizes (ML < 30 mm). A common lineage is not suggested; dwarfism has evidently arisen in multiple evolutionary lines.

*Octopus cf. bocki* Adam, 1941

UF 288772. Guam: Piti channel, 2-3 m. Sole specimen is tiny (11 mm ML) male octopus with 87-101 suckers on normal arms, 61 suckers on hectocotylized arm R3, and enlarged suckers (5 and 6 from mouth) on arm pairs 2 and 3. Crucifix papillae pattern in center of squarish mantle. Arms of moderate length (2.9x ML); dorsal arms shorter than other subequal arms (AF 4=3=2>1); 5 gill

lamellae. Irregular blue spots are seen on dorsal mantle, head, and arm crown of live animal. Photo: GP591-16.

*Octopus* sp. 11

UF 288735. Guam: Tumon Bay moat. Tiny (ML to at least 18 mm, weight to at least 4 g) red, nocturnal octopus with approximately equal length, short arms (1.5-2.2x ML), moderately deep webs; 47-71 suckers on normal arms, 41-51 on hectocotylized arms of two males. The mantle is globose in shape; eyes are not stalked. Dorsal mantle, head, and arm crown covered with tiny papillae; funnel organ W shape; 4-5 gill lamellae. One female deposited approximately 2,000 small (2 mm) eggs on 10 mm strings of approximately 40 eggs each; two mature males have no enlarged suckers. Characters of these specimens are consistent with characters of *O. wolfi* Wülker, 1913, except that filiform processes on sucker rims at arm tips were not observed on the two mature males, as is described for *O. wolfi*. Neither were founder chromatophores observed on the ventral mantle, funnel, and head, as in *O. wolfi*. This species is occasionally encountered at night on moats on Guam. Photo: GP357-13, GP580-12, LAW4/12/95:35, P. Schupp stubby1, stubby2.

*Octopus* sp. 12

UF 288770. Guam: Pago Bay fore reef, 10 m. The sole specimen is a tiny (9 mm ML) submature male with tiny papillae on dorsal and ventral mantle, head, and arms. Arms are short (1.5 x ML), ventral pair slightly longer than dorsal pair (AF  $4 \geq 3 > 2 \geq 1$ ); 32-43 suckers per arm, 38 suckers on submature male arm R3; no enlarged suckers. Webs are deep (deepest web is 33% of longest arms L4 and R4); 5 gill lamellae. No photo.

Unplaced *Octopus* Taxa

*Octopus* sp. 13

UF 288780. Guam: Fadian reef flat. Large (67 mm ML) octopus with regular yellow spots on dark purple brown background, and raised papillae on dorsal mantle and arms, and very small eyes. The sole specimen is a female with narrow head and cylindrical mantle. Its arms are moderately long (3.2x ML); lateral arms slightly longer than dorsal and ventral arms (WF  $3 > 2 \geq 1 \geq 4$ ); sucker counts are 191-223 on 5 complete arms. Webs are moderately deep (deepest web is 17% of longest arm R2); funnel organ W shape; 6-7 gill lamellae. Ovarian eggs 2.5-3.0 mm long. This species shares several characteristics with the *Octopus vitiensis* species group, except that it is larger, and instead of very large eyes, its eyes are very small. Photo: LAW9/1/96:21,22, LAW9/9/96:31.

*Octopus* sp. 14

UF 288758. Guam: Haputo (dredged 60-70 fm). Small (21 mm ML) pale red octopus with scattered papillae on mantle and head, and translucent skin. The sole undifferentiated specimen has short arms (1.4 x ML), subequal in length; 56-78 suckers on complete arms, W shape funnel organ; 7 gill lamellae. No photo.

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