FAUNA *of* AUSTRALIA

38. FAMILY ACROCHORDIDAE

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DEFINITION AND GENERAL DESCRIPTION

The Acrochordidae consists of three living species, placed by most authors within the single genus, *Acrochordus*, and commonly known as file snakes. In Australia, *A. granulatus* is found in marine and estuarine areas of the Indo-Pacific and *A. arafurae* is confined to freshwater habitats. These snakes are highly modified for aquatic life, lacking the enlarged ventral scales typical of terrestrial snakes. Their scales are small, rugose and granular. The skin is loose and baggy, the trunk stout, and the eyes small and positioned dorsally as in many other aquatic snakes.

HISTORY OF DISCOVERY

Hornstedt in 1787 described the genus *Acrochordus* (from the Greek *akrochordon*, meaning wart) for the Asian species *A. javanicus*. Many workers have since followed Cuvier's recognition in 1817 of a separate genus, *Chersydrus*, for the marine species *A. granulatus*. The Australian freshwater species *Acrochordus arafurae* was not recognised as distinct until the major review of McDowell (1979). Hence, much of the early literature refers to Australian *A. arafurae* as *A. javanicus*, and the particularly inappropriate common name of 'Javan File Snake' is still widely applied.

MORPHOLOGY AND PHYSIOLOGY

External Characteristics

Australian acrochordids range in maximum body size from one metre for *A. granulatus* to two metres for *A. arafurae*. The head is short and blunt, without enlarged head shields (Fig. 38.1). Colour patterns are more distinct in neonates, fading gradually with age. Adults are mottled shades of brown dorsally, tending towards lateral striping in *A. arafurae* (Pl. 7.6), and more distinct grey-and-white banding in *A. granulatus*.

Body Wall

The body bears small non-overlapping rugose scales and is unique among snakes in having sensory, bristle-bearing tubercles on the interstitial skin, and sensory organs on the scales themselves (Schmidt 1918; McDowell 1979). The outer keratin layer of the epidermis is shed regularly. Aspects of the dorsal musculature of *A. granulatus* are described by Auffenberg (1966).

Skeletal System

McDowell (1979, 1987) described the osteology in detail. Numerous distinctive features include the constant presence of paracotylar foramina on the vertebrae, the lack of well-defined tubera costae on the ribs, and the division of the articular surface of the rib into a hemispherical dorsal portion and a wider, saddle-shaped ventral portion. The ear region is also unusual, primarily through retention of embryonic features.

Locomotion

Acrochordids are almost entirely aquatic, although both captive and wild individuals of *A. arafurae* have been seen moving short distances overland (Shine & Harlow pers. obs.). Underwater, filesnakes move about both by

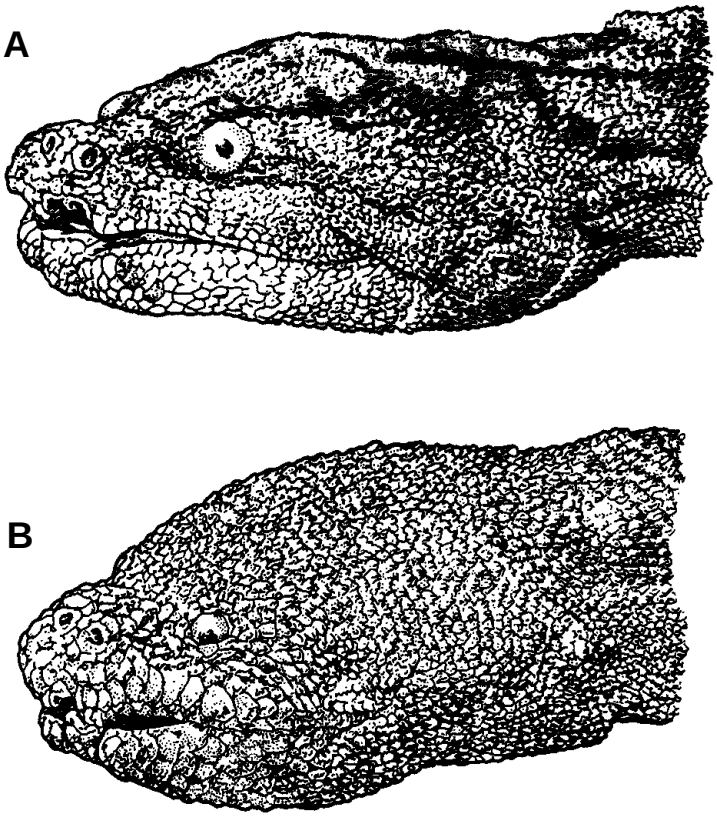

Figure 38.1 Heads of the two Australian species of *Acrochordus*. **A**, *A. granulatus*; **B**, *A. arafurae*. (After McDowell 1979) [J. Courtenay]

crawling on the bottom and by swimming in open water. The loose skin flattens out in free-swimming acrochordids to increase the lateral surface available for aquatic propulsion, and the laterally compressed tail of *A. granulatus* aids in swimming (Dowling 1960; Shine pers. obs.).

Feeding and Digestive System

Filesnakes are entirely piscivorous and the skull is highly modified, with elongate quadrates and an unusual quadrate-columellar articulation that facilitates swallowing large fishes (Savitzky 1983). Relative cranial proportions differ considerably between males and females in *A. arafurae*, apparently reflecting the profound dietary differences between the sexes (Shine 1986c; Camilleri & Shine 1990; Houston & Shine 1993). The anatomy of the acrochordid digestive system is unusual among snakes in several respects, including the close proximity of the gall bladder to the liver, and the remarkable degree of convolution of the intestine (Fig. 38.2; Bergman 1958).

Circulatory System and Respiration

The relatively posterior placement of the heart (close to midbody), may be an aquatic specialisation, because some proteroglyphous seasnakes show a similar condition (McDowell 1979). *Acrochordus* has the most extensively vascular respiratory system of any known snake (Table 37.1). The roof of the trachea bears two rows of vascular sacs (Brongersma 1952). The right lung bears vascular parenchyma for its total length, and extends to quite near the cloaca (Bergman 1958). Significant cutaneous respiration also occurs (Table 37.1).

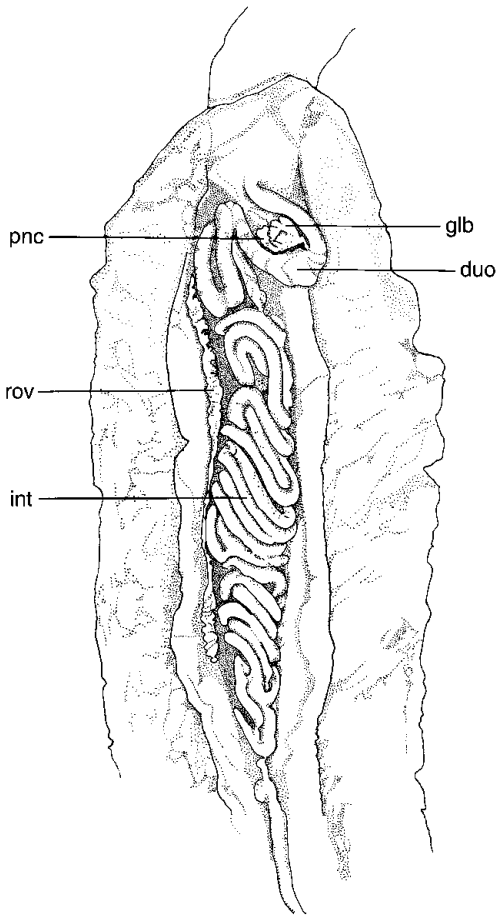

Figure 38.2 Transverse loops of the intestine of *A. javanicus* are immediately apparent on dissection. Bergman (1958) likened their appearance to those of a quadruped more than any other snake he had studied. **duo**, duodenum; **glb**, gall bladder; **int**, small intestine; **pnc**, pancreas; **rov**, right ovary. (After Bergman 1958) [J. Courtenay]

Metabolic rates are unusually low whereas blood volumes (and hence blood oxygen stores) are much higher than for other reptiles (Table 37.1). Typically, acrochordids remain underwater for long periods before moving to the surface to take several breaths in succession, thus replenishing their oxygen stores to support another long period of submersion (Glass & Johansen 1976; Feder 1980; Seymour, Dobson & Baldwin 1981).

Acrochordus arafurae maintains high and relatively stable body temperatures, averaging around 26° to 30°C (Shine & Lambeck 1985).

Excretion

The kidneys are paired and lie posteriorly in the body cavity (Bergmann 1958). Sublingual salt glands have been described in the marine species *A. granulatus* (Dunson & Dunson 1973) (Table 37.1).

Sense Organs and Nervous System

The eyes are small and positioned further anteriorly and more dorsally than are those of most other snakes. The valved nostrils are also in an anterior dorsal position, presumably an adaptation to aquatic life. The scales and interstitial skin are richly supplied with projections that appear to be sensory in structure (Schmidt 1918; McDowell 1979), and probably function in prey recognition.

Usually, captive *A. arafurae* will not strike or constrict a fish until they actually come into contact (Shine & Houston pers. obs.). The tongue is extruded to detect substances in the water and the low frequency and long duration of extrusion is apparently unique among snakes (Gove 1979). Tongue-flick frequencies in captive snakes are greatly increased when potential prey items are added to the tank (Shine pers. obs.).

Reproduction

The gonads are paired, and have been described by Bergman (1958). Paired hemipenes lie within the base of the tail when inverted, and are everted from the cloaca for intromission. Hemipenial morphology differs considerably among the three *Acrochordus* species, and is described and illustrated by McDowell (1979). Detailed information on organ sizes and placement is provided by Bergman (1958).

Filesnakes are viviparous, with highly seasonal reproduction. Litter sizes range from 11 to 25 in *A. arafurae* (Shine 1986a) and around one to eight in *A. granulatus* (Bergmann 1958; Voris & Glodek 1980; Gorman, Licht & McCollum 1981). One isolated captive female *A. arafurae* produced a viable embryo after seven years, suggesting either parthenogenesis or prolonged sperm storage (Magnusson 1979a).

NATURAL HISTORY

Life History

Field studies on *A. arafurae* in Kakadu National Park in the Northern Territory suggest that this species is a specialist with low rates of energy throughput and unusually low rates of feeding, growing and reproducing. Maturity is delayed compared to most other snakes, and is attained at more than five years in both sexes (Houston & Shine unpub. obs.). However, most adult-size females do not reproduce in most years; the proportion of reproductive animals increases with body size (Shine 1986a). Feeding occurs mainly during the wet-season and feeding rates vary annually in relation to variation in the duration of flooding. There is high year-to-year variation in body condition and reproductive frequency. Hence, the overall population is dominated by cohorts from occasional years of particularly successful reproduction. The marine *A. granulatus* also shows low feeding frequencies, prolonged gestation and less-than-annual reproduction in adult females (Bergmann 1958; Gorman *et al*. 1981).

Ecology

In Kakadu, filesnakes live in widely separated billabongs for most of the year, but can travel freely over wide areas during wet-season flooding. The snakes feed primarily at night in shallow water, especially on sleeping fishes. Adult female *A. arafurae* are much larger than males (mean snout-vent length 135 cm, 1.4 kg vs. 105 cm, 0.67 kg), have relatively larger heads, and eat much larger prey (Shine 1986c). Females also tend to be found in deeper water than males (Shine 1986c). Population densities can be extremely high, with several thousand adult filesnakes in some floodplain billabongs (Houston 1991). Arafura filesnakes are eaten by a variety of birds, mainly the sea eagles (*Haliaeetus leucogaster*) and the stork (*Ephippiorhynchus asiaticus*), reptiles, fishes and humans (Shine 1986a, 1986b).

Surprisingly, the marine *A. granulatus* shows very little sexual dimorphism either in snout-vent length or relative head size (Shine 1991b). This species is widely distributed through marine, estuarine and freshwater habitats, especially mangrove areas, and feeds mainly on gobioid fishes located by active foraging in small crevices on the sea bottom (Dunson & Minton 1978; Voris & Glodek 1980).

Behaviour

Acrochordids are typically reluctant to bite when handled, even when injured. Arafura filesnakes are active foragers, travelling slowly along the edge of the billabong at night searching for fishes (Shine 1986a). Mean daily displacement in radiotracked snakes was 68 m during the dry-season, and 166 m during the wet-season (Shine & Lambeck 1985). Fishes are seized either with the mouth or the coils, and rapidly immobilised by constriction (Dowling 1960). During the mating season, intertwined groups of one female and one to eight males may be found in shallow water among treeroots.

Economic Significance

Arafura filesnakes are popular traditional food items for aboriginal people in northern Australia. The snakes are collected by groping under logs and among weedbeds when water levels are low. Gravid females are most easily caught because of their size, and are highly prized by the hunters (Shine 1986b). Filesnakes also enter baited drum-nets and, more reliably, unbaited fyke-nets (Shine 1986a, 1986b).

Freshwater filesnakes are legally protected but marine populations may not be covered by the legislation. Natural habitats of *A. arafurae* are under threat in some areas because of introduced species, ranging from water weeds (*Salvinia molesta*) to water buffalo (*Bubalus bubalus*), and from pollution resulting from human activities. Marine filesnakes are also harvested, but primarily on a commercial basis for their skins (which make high-quality leather) and mainly in Asia rather than Australia.

BIOGEOGRAPHY AND PHYLOGENY

Distribution

Acrochordids are found from India eastward through tropical Asia to the Philippines, south through the Greater and Lesser Sunda Islands to New Guinea, northern Australia, the Bismarck Archipelago, and the Solomons. *Acrochordus arafurae* is restricted to drainages of Australia and New Guinea entering the Arafura Sea.

Affinities

Despite the array of primitive features and unique specialisations, derived character states of the vomerine apparatus and facial carotid artery in acrochordids suggest that these snakes are an early offshoot from the main colubroid (‘advanced snake’) lineage (Groombridge 1979, 1984). The symmetrical paired common carotid arteries also suggest that they are primitive colubroids (McDowell 1979). Their closest relatives may be the extinct families Nigerophiidae, Palaeopheidae and Anomalopheidae (McDowell 1987).

The three living species are all very distinctive. McDowell (1979) suggests that the two freshwater taxa may be derived from an earlier *granulatus*-like marine form.

Fossil Record

A single species, *A. dehmi*, has been described from the upper Miocene and lower Pliocene of Pakistan (Hoffstetter 1964).