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Two new genera of Water Snake from North America. The subdivision of the genera *Regina* Baird and Girard, 1853 and *Nerodia* Baird and Girard, 1853 (Serpentes: Colubridae: Natricinae).

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ABSTRACT

The colubrids of North America have been the subject of taxonomic attention for decades, with numerous genera being erected for morphologically and ecologically distinct snakes.

The North American Water Snakes, once all placed in a single genus *Natrix* (e.g. Conant 1975) have since been a part of a wider break-up of that genus and been placed in several well-defined genera.

The genus *Nerodia* is clearly a paraphyletic group as confirmed by numerous studies.

The Green Water Snake currently known to most herpetologists as *Nerodia cyclopian* and the morpologically similar *N. floridana* are substantially different to all others in the established genus *Nerodia* Baird and Girard, 1853 (*sensu lato*) and have been recognised as highly distinct from the other water snakes since at least 1938 (Clay 1938).

It's been recognised for a long time that they should be placed in a separate genus.

This paper formalises that position by erecting and defining a new genus, namely *Funkus* gen. nov. to accommodate the two species.

The genus *Regina* Baird and Girard, 1853 as currently understood at start 2012 is also ambiguous, with the four known-species currently placed within the paraphyletic genus being sufficiently diverse to warrent being divided (Alfaro and Arnold, 2001).

As a result, it is herein subdivided three ways with the resurrection of *Liodytes* Cope, 1892 for the species *alleni* and *rigida*, retention of *grahamii* in *Regina* (now monotypic) and the creation of a new monotypic genus *Mariolisus* gen. nov. for the species *septemvitta*.

Keywords: Taxonomic revision; new genus; *Funkus*; *Nerodia*; *cyclopian*; *floridana*; *Regina*; *alleni*; *rigida*; *grahamii*; *septemvitta*; *Liodytes*; *Mariolisus*; Hoser; water snake; snake; genus.

INTRODUCTION

Water snakes, currently placed in the genus *Nerodia* are familiar to most herpetologists in the United States. They are defined as a group in Conant (1975) under the genus name *Natrix* and similarly defined in more recent texts and these adequately define the group for the purposes of those not familiar with these snakes.

While Water Snakes do well in captivity, they are not popular or commonly kept due to a general preference for more readily available (in the pet trade) docile species such as Corn Snakes (*Pantherophis guttatus*) and the many pythons and boas available.

While effectively harmless, many Water Snakes won't hestitate to bite when confonted by people, leading to a general reluctance for people to keep them as pets or worse still, to try to kill them when seen in the wild.

These harmless snakes live in proximity to water into which they enter when they feel threatened.

With a body that is moderate to heavy in build, they range in colour through dark green, olive, or brown dorsally and may be confused by lay people with the venomous Cottonmouth (Genus *Agkistrodon*) another native species of where they occur.

The latter, being Pitvipers have large fangs and single subcaudals, versus no fangs and all divided subcaudals in all the water snakes. Cottonmouths, being Pitvipers have the characteristic deep pit between the eye and the nostril, absent in Water Snakes.

Female water snakes usually grow larger than the males. Published studies relating to the genus *Nerodia* as widely recognised, include Lawson (1987) and others.

Numerous specific species-related studies have been conducted for most within the genus *Nerodia* as recognised to date.

Publications relevant to the Green Water Snake and Florida Green Water Snake (species *cyclopian* and the morphologically similar *floridana*) include Allen (1932), Burt (1935), Clay (1938), Dundee and Rossman (1989), Enge (2009), Goff (1936), Lawson (1987), Neill and Rose (1953), Pyron et. al. (2010), Pearson (1966), Sanderson (1993) and Thompson and Crother (1998).

Between them, their evidence provides a compelling argument to remove the taxa *cyclopian* and *floridana* from genus *Nerodia* and this is now done herein by the formal erection and diagnosis of a new genus in accordance with the Zoological Code (Ride, et. al. 1999).

GENUS *FUNKUS* GEN. NOV.

Type species: *Tropidonotus cyclopion* Duméril and Bibron, 1854

(Identified most recently as *Nerodia cyclopion* (Duméril and Bibron, 1854)).

Diagnosis: North American Water Snakes are separated from all similar snakes in the region by their keeled scales and divided anal plate.

Genus *Funkus* gen. nov. are separated from all other North American water snakes (currently placed in the genus *Nerodia*), as well as snakes in the allied genus *Regina sensu lato* and (all other snakes previously placed in the expanded genus *Natrix* as formerly recognised for North American snakes (see Conant (1975) for a definition of genus *Natrix sensu lato*)), by having one or more small scales under the eye (suboculars), giving the appearance of a ring of small plates around the eye; ventrally *Funkus* gen. nov. are brownish, yellowish or white on the anterior third, and on the remainder they are brownish, yellowish or white with yellow or white semicircles.

Ventral scale colouration varies within the genus and can be used to separate the two known species.

Adults average 76-140 cm (30-55 inches) long; there is a listed record of 188 cm (74 in.) for a specimen of the species taxon *floridana* (Conant 1975).

This genus is endemic to the south and south-eastern United States.

Clay (1938), page 177 also provided a diagnosis for the species taxon *cyclopian* which also, as slightly modified herein, diagnoses the new genus *Funkus* gen. nov.

He wrote that these snakes may be separated other North American species of water snakes by the presence of one or more subocular plates and an ill-defined dorsal color pattern of about 50 mid-dorsal bars alternating with a lateral series, which in turn is more or less in alternation with a second and lower lateral series.

The typical species (defined herein as the species *cyclopion*) is distinguished from *floridana* by having the belly brown, scale rows 27 in males and 29 in females, and subcaudals averaging 73 in males and 64 in females.

F. floridana is distinguished from *F. cyclopion* by having the belly predominantly yellow or white, scale rows 29 in males and 31 in females, and subcaudals averaging 82 in males and 73 in females.

Common names: *Funkus cyclopion* is known as the Green Water Snake.

Funkus floridana is known as the Florida Green Water Snake.

Etymology: Named in honour of Dr. Richard Funk for his many contributions to herpetology and in his role as a veterinary surgeon specializing in reptiles, for improving the health and welfare of countless captive reptiles.

It's significant that a genus of snakes is named after Dr. Funk in that I first met him at Wayne Hill's, National Reptile Breeder's Reptile expo in Orlando, Florida in August 1993, at which time I also saw my first *Funkus*.

Not only that, but Dr. Funk himself lived in Florida for many years before more recently moving to Mesa Arizona.

As I write this paper in 2012, the long-cherished legal right of people to be able to go to such events to acquire captive reptiles for pets or study is under threat and will be lost forever unless people are vigilant in protecting these rights.

It should be noted that the enemies of herpetology and the associated discipline of herpetoculture, (that is the keeping of reptiles) are often within the keeping fraternity and will for their own selfish commercial motives put the rights of other reptile keepers under threat and try to criminalize those whom they view as potential competitors.

Species in genus *Funkus* gen. nov.

Funkus cyclopian Duméril and Bibron, 1854

Funkus floridana (Goff 1936)

Separation of the species level taxa within *Funkus* gen. nov.

F. floridana is distinguished from *F. cyclopion* by having the belly predominantly yellow or white, scale rows 29 in males and 31 in females, and subcaudals averaging 82 in males and 73 in females (Clay 1938:p. 177).

F. cyclopion is distinguished from *F. floridana* by having the

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belly brown, scale rows 27 in males and 29 in females and subcaudals averaging 73 in males and 64 in females.

The two species are also separated by known distribution.

F. cyclopian is found in the Mississippi Valley from far south Illinois to the Gulf of Mexico, from the extreme south-west Alabama to south-east Texas.

F. floridana is found in the south of South Carolina to the tip of Florida, west through the Florida panhandle to Mobile Bay, Alabama.

SPECIES REMAINING IN THE GENUS *NERODIA* BAIRD AND GIRARD, 1853

Nerodia clarkii (Baird and Girard, 1853)

Nerodia erythrogaster (Forster, 1771)

Nerodia fasciata (Linnaeus, 1766)

Nerodia harteri (Trapido, 1941)

Nerodia paucimaculata (Tinkle and Conant, 1961)

Nerodia rhombifer (Hallowell, 1852)

Nerodia sipedon (Linnaeus, 1758)

Nerodia taxispilota (Holbrook, 1838)

GENUS *REGINA* BAIRD AND GIRARD 1853

The water snakes placed within this genus are quite diverse in form and habit.

Cope 1892 erected a genus *Liodytes* for the species taxa *alleni*.

Most authors since then have subsumed this genus into one or more others, most recently being the genus *Regina*, for which the significantly different type species is *R. grahamii.*

A similar situation to that just described for the genus Nerodia applies for the genus *Regina* Baird and Girard 1853 as currently understood at start 2012.

While the component species are obviously similar and related, they are sufficiently distant and differentiated to be placed in separate genera.

Differences between the four species are well-known and detailed by Alfaro and Arnold (2001), Conant (1975), Ernst, Gibbons and Dorcas (2002) and others.

While the use of more than one genus for the four species presently within *Regina* has been the preferred position of a number of recent authors, including for example Price (1983), the split has only been two-way for the four relevant species. This has been the placement of *alleni* and *rigida* within *Liodytes* on the basis of dorsal microdermatoglyphics, while retaining the other two species *grahamii* and *septemvittata* within *Regina.*

However this ignores the significant differences between the two species left within *Regina*.

Alfaro and Arnold (2001) found the genus *Regina* as defined to be paraphyletic and effectively split three ways based on their examination of mitochondrial DNA. They suggested a re-evaluation of the taxonomic status of the genus.

Pyron et. al. (2010) produced almost identical results in terms of the four species of *Regina* in their massive global assessment of snakes, but they were more preoccupied with higher level taxonomy of all snakes.

Relying on these two sets of results and the work of earlier authors, the genus *Regina*, is herein effectively split three ways as indicated in the abstract within this paper by the creation of one new genus, namely *Mariolisus* gen. nov. in accordance with the Zoological Code (Ride, et. al. 1999), and the previously mentioned resurrection of *Liodytes.*

GENUS *MARIOLISUS* GEN. NOV.

Type species: *Coluber septemvittatus* Say 1825

(Identified most recently as *Regina septemvittatus* (Say 1825)).

Diagnosis: The snakes of the genus *Mariolisus* gen. nov. are separated from others in the genus *Regina* senso lato (including *Regina* and *Liodytes* as defined herein) by the following suite of characters; the presence of keeled, pitless mid dorsal body scales, two internasal scales, venter has two longitunal stripes, not divided into half-moons and the lower dorsal scales are keeled (species taxon *septemvitta*).

By process of elimination, snakes of the genera *Regina* and *Liodytes* are separated from *Mariolisus* gen. nov. by the following: *Regina* have the following: Dorsal body scales keeled, two internasals, a single dark median stripe on the venter or no dark pigment present (species taxon *grahamii*): *Liodytes* are separated by one of the following, either 1/ smooth dorsal scales (with the possible exception of the rear of the body), one internasal and no dark pigment on the tail (species taxon *alleni*), or 2/ keeled dorsal scales, two internasals and the venter consists of two dark longitudinal stripes or rows of half moons and lower dorsal scales smooth (species taxon *rigida*)

This is a monotypic genus, the only species taxon being *M. septemvitta.*

More generally snakes of the three genera, *Mariolisus* gen. nov., *Liodytes* and *Regina* are best described as follows: Relatively short, semiaquatic somewhat fossorial crayfish predators. Adult females are usually larger and more heavily built than males. Adult females have 118-178 ventrals, 47-87 subcaudals and shorter tails that comprise 16-30 percent of the body length. The smaller, usually thinner males have 110-175 ventrals, 55-89 subcaudals and longer tails that comprise 17.5-34 percent of the body length. In these snakes the short head is only slightly distinct from the neck and comprises only 3.8-5.6 percent of the body length. The nares are small and dorso-lateral. Eye diameter is 14-17 perecent of the head length; the pupil is usually small and generally makes up about 24-50 percent of the eye diameter in adults as measured by Rossman (1963) (also reported by Ernst, Gibbons and Girard 2002). The nasal scale is partially divided by the naris and the internasal scales are narrowed anteriorly (*Liodytes alleni* has only one internasal scale). Present are a single loreal scale, 1-3 preoculars, 2-4 postoculars, 1+2(1-3) temporals, 6-9 supralabials, and 8-11 infralabials. The parietal scales may extend ventrolaterally between the postoculars and anterior temporal to narrowly touch the supralabials in some *Liodytes alleni*. All except *L. alleni* have keeled, pitless dorsal body scales; those above the anal vent and on the tail of *L. alleni* may be slightly keeled (more prominent in males) with shallow pits. These snakes usually have 19 (18-21) anterior body rows, 19 (18-21) mid body rows and 17 (15-19) preanal rows. Anal plate and subcaudals are divided. The slightly bilobed hemipenis extends 7-9 subcaudals and bears 1-2 large basal hooks and a single sulcus spermaticus.

The doral body pattern usually consists of stripes of three colours (dark brown, black or cream) with the paler lateral stripes located on the first and higher dorsal scale rows.

The colour of the venter for each species taxon is described above, but in terms of the group of snakes is either unmarked or has dark stripes, spots or half-moon shaped marks. The head is unpatterned, the smallish labials lack dark bars and there are no parietal spots.

The skull is moderately well-developed with the interorbital foramen situated below the frontals but above the parasphenoid. The parasphenoid lacks a ventral keel and the parietal bone lacks a posterior-medial ridge. The supratemporal is not reduced. The broad, flattened quadrate is little expanded dorsally. The basioccipital has no ventral process. Maxillary teeth are short, pointed to chisel-like and may be gradually enlarged toward the rear of the series. No diastema is present. Tooth counts are: maxilla 20-29, dentary 24-35, palatine 11-18 and pterygoid 16-24. The vertebrae have well developed hypapophyses and relatively narrow transverse processes which are anteroventral and rounded distally.

Common name: *Mariolisus septemvitta* is known as the Queen Snake.

Etymology: Named after George Mariolis, best known for winning or placing in various body-building competitions in his 20's and now in his 50's having spent 3 decades training champions in contests such as Joe Weider's Olympia (including the likes of Janet Kane (with Mark Ottobre) and Marie Saviane a three time winner), George Longinidis (World Champion Kick Boxer) and many others, his talent goes beyond physical training to the mental as well. As a result he's improved the lives of countless students and virtually everyone else who has had the pleasure of meeting him.

***REGINA* BAIRD AND GIRARD 1853**

Type species: *Regina grahamii* Baird and Girard 1853

This genus is now monotypic.

Common name: *Regina grahamii* is known as the Graham's Crayfish Snake.

***LIODYTES* COPE 1892**

Type species: *Regina alleni* (Garman 1874)
Species in genus *Liodytes*

Liodytes alleni

Liodytes rigida

Common names: *Liodytes alleni* is known as the Striped Crayfish Snake.

Liodytes rigida is called the Glossy Crayfish Snake.

KEY TO THE FOUR SPECIES WITHIN GENERA *REGINA, LIODYTES* AND *MARIOLISUS* GEN NOV.

(Adapted from Ernst, Gibbons and Dorcas (2002).

1. a. Dorsal body scales smooth, one internasal, no dark pigment on venter ….. *L. alleni*

b. Dorsal body scales keeled, two internasals, venter with dark stripes or no dark pigment ….. 2

2 a. A single dark median stripe on venter or no dark pigment present ….. *R. grahamii*

b. Two dark longitudinal stripes or rows of half moons on the venter ….. 3

3 a. Venter with two longitudinal rows of half moons, lower dorsal scale rows smooth ….. *L. rigida*

b. Venter with two longitudinal stripes not divided into half moons, lower dorsal scales keeled ….. *M. septemvitta*

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