SALAMANDRA **47**(4) | 193–198 | 20 November 2011 | ISSN 0036–3375

Preliminary observations on the reproductive biology of six species of Sri Lankan sea snakes (Elapidae: Hydrophiinae)

Anslem de Silva [1], Kanishka D. B. Ukuwela [2], Abyerami Sivaruban [3] & Kate L. Sanders [2]

[1)] 15/1 Dolosbage Road, Gampola, Sri Lanka
[2)] Darling building, School of Earth and Environmental Sciences, University of Adelaide, SA 5005, Australia
[3)] Department of Zoology, Faculty of Science, University of Jaffna, Sri Lanka

Corresponding author: Anslem de Silva, e-mail: kalds@sltnet.lk

Manuscript received: 19 April 2011

Abstract. We report on observations on the reproductive biology of viviparous sea snakes (Hydrophiinae) collected from marine fishing bycatches in Sri Lanka. Reproductive conditions were classified only in females by checking for the presence of eggs, embryos and vitellogenic follicles. A total of 33 specimens belonging to six species (*Enhydrina schistosa, Hydrophis cyanocinctus, Hydrophis fasciatus, Hydrophis gracilis, Lapemis curtus* and *Thalassophina viperina*) were represented by individuals in active reproductive condition. The total number of eggs and embryos in females ranged from 3 to 16; the lowest number of eggs was observed in *T. viperina* and the highest in *E. schistosa*. These findings are among the first to be recorded for some species of sea snakes in the South Asian region.

Key words: Sea snakes, Sri Lanka, reproduction, ovoviviparity, gravid, eggs, vitellogenic follicles

Introduction

The 'true' sea snakes (Hydrophiinae) are a recent, secondarily marine radiation of ~60 species occupying a wide range of mostly coastal habitats throughout the Indo-West Pacific (de Silva 1994, Heatwole 1999, Sanders et al. 2008). Many of these marine habitats suffer from intensive and destructive fishing and land-use practices that potentially threaten sea snakes (Heatwole 1997, Wassenberg et al. 1994). There have been alarming declines in several species, and a recent IUCN Red List Assessment listed 40% of sea snakes as "Data Deficient" (http://www.iucnredlist.org/). Basic knowledge of sea snake life histories, taxonomy and distribution ranges is thus urgently needed if these vulnerable species are to be adequately conserved.

Unlike the sea kraits (*Laticauda*), 'true' sea snakes are ovoviviparous and bear fully developed live young at sea (Heatwole 1999). Ovoviviparity is plesiomorphic in hydrophiine sea snakes as they are phylogenetically nested within an ovoviviparous clade of the terrestrial Australasian elapids (Keogh et al. 1998, Sanders et al. 2008). Current understanding of sea snake reproductive biology is still in its infancy: data on breeding habitats, seasonality and reproductive output are scant and reproductive behaviour is well-understood only in a few of the 63 species currently recognised (Burns & Heatwole 2000, Karthikayan et al. 2008, Lemen & Voris 1981, Masunaga & Ota 2003, Voris & Jayne 1979, Ward 2001).

Nineteen species of marine snakes in three families (1 acrochordid, 2 homalopsids and 16 elapids (15 in Hydrophiinae and 1 in *Laticauda*)) are known to inhabit the costal waters of Sri Lanka (Das & de Silva 2011, Abyerami & Shivashanthini 2008). Except for a few anecdotal notes and brief accounts by Wall (1921a and 1921b), the reproductive biology of Sri Lankan marine snakes is poorly documented. In this communication, we report preliminary observations on the sex, reproductive status and reproduction of six species of hydrophiine sea snakes collected as fishing bycatches in different coastal regions of Sri Lanka. We believe that the observations reported here will contribute to the knowledge of the natural history and benefit the conservation status of Sri Lankan sea snakes.

Materials and methods

The specimens described in this account were collected as bycatches from coastal marine fishing at five localities in Sri Lanka between March of 2010 and January of 2011 (see Table 1 for collection localities and dates). The details of the collection localities provided here are based on the information we obtained for the specimens from fishermen, but could actually lie between 4–5 km off the coast. This work represents the preliminary phase of an ongoing island-wide survey of Sri Lankan marine snakes by the authors (AdS, KLS and KDBU). After taking tissue samples for molecular studies, specimens were fixed in 10% Formalin solution and later transferred to 70% Isopropyl alcohol for preservation. Identification of specimens is based upon published diagnostic keys (Smith 1926, Rasmussen 2001, Somaweera & Somaweera 2009) and follows the nomenclature of Rasmussen (2001). Snout–vent lengths (SVL) and tail lengths (TL) were recorded in millimetres and taken with a measuring tape. The specimens

Table 1. List of specimens in active reproductive condition and their respective collection dates and localities

Species	Field No.	Date of collection	Collection Locality
E. schistosa	KLS0004	27.Mar.2010	Puttlam Lagoon, Sri Lanka
	KLS0087	27.Mar.2010	Puttlam Lagoon, Sri Lanka
	KLS0007	25.Jun.2010	Pubudugama, Puttlam, Sri Lanka
	KLS0018	24.Jun.2010	Kudiramalai, Puttlam, Sri Lanka
	KLS0020	24.Jun.2010	Kudiramalai, Puttlam, Sri Lanka
	KLS0023	23.Jun.2010	Kudiramalai, Puttlam, Sri Lanka
	KLS0025	24.Jun.2010	Kudiramalai, Puttlam, Sri Lanka
	KLS0026	24.Jun.2010	Kudiramalai, Puttlam, Sri Lanka
	KLS0087	27.Mar.2010	Puttlam Lagoon, Sri Lanka
H. cyanocintus	KLS0060	07.May.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0061	24.Oct.2010	Kirinda, Hambantota, Sri Lanka
	KLS0065	07.May.2010	Valvettithurai, Jaffna, Sri Lanka
H. fasciatus	KLS0022	08.May.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0075	08.May.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0076	07.May.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0098	08.Dec.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0102	08.Dec.2010	Valvettithurai, Jaffna, Sri Lanka
H. gracilis	KLS0100	09.Dec.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0101	09.Dec.2010	Valvettithurai, Jaffna, Sri Lanka
L. curtus	KLS0003	07.May.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0010	25.Oct.2009	Pottuvil, Ampara, Sri Lanka
	KLS0045	29.Mar.2010	Pulmodai, Trincomalee, Sri Lanka
	KLS0047	24.Oct.2010	Kirinda, Hambantota, Sri Lanka
	KLS0050	28.Apr.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0051	28.Oct.2010	Point Pedro, Jaffna, Sri Lanka
	KLS0052	07.May.2010	Valvettithurai, Jaffna, Sri Lanka
T. viperina	KLS0078	28.Apr.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0079	28.Apr.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0081	07.May.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0082	29.Apr.2010	Point Pedro, Jaffna, Sri Lanka
	KLS0083	30.Apr.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0084	07.May.2010	Valvettithurai, Jaffna, Sri Lanka
	KLS0085	28.Apr.2010	Valvettithurai, Jaffna, Sri Lanka

were dissected in the laboratory to classify gut contents, sex and reproductive status. The reproductive status was identified only in females by checking for eggs, embryos and vitellogenic follicles. It was not possible to evaluate the reproductive status of males because their being fixed in formalin made it difficult to distinguish between turgid and flaccid testes and identify sperm in the efferent ducts. The lengths and widths of the eggs were measured in millimetres by means of a Mitutoyo digital Vernier calliper. All the specimens described in this account will eventually be deposited in the Zoology Department of the National Museum of Sri Lanka and the Museum of the Department of Wildlife Conservation Training Center, Giritale, Sri Lanka.

Results

A total of 104 specimens comprising 10 species were collected during the course of the survey; of these, six species (33 specimens) were represented by individuals in active reproductive condition (see Table 2). The remaining four species (*Hydrophis spiralis, H. lapemoides, H. ornatus, Pelamis platura*) were represented by non-reproductive females and are omitted from the descriptions below.

Enhydrina schistosa (Daudin, 1803)

During the course of the survey, 17 specimens of *E. schistosa* were collected. Twelve of these were females and four were males. Two specimens (KLS0004, KLS0087) collected in March 2010 contained 10 and 11 vitellogenic follicles, respectively. Five specimens collected in June 2010 from two different locations in the Puttlam Lagoon, Sri Lanka, were gravid. Their numbers of eggs ranged from 7–16. The total lengths (TOTL) of the gravid females ranged from 1011–1893 mm with a mean of 1161 mm. Mean lengths and widths of the eggs were 32.41 (±4.04) and 26.00 mm (±4.33), respectively (Figure 1A).

Table 2. Details of gravid female specimens, eggs and embryos.

Species	Field No.	Length (mm)		No. of eggs	No. of embryos	Avg. egg size (mm)		Avg. embryo measurements (mm)	
		SVL	TL			Length	Width	SVL	TL
E. schistosa	KLS0007	983	122	10	–	30.18	24.38	–	–
	KLS0018	1,128	143	11	–	37.63	30.25	–	–
	KLS0020	1142	141	15	–	25.87	20.93		
	KLS0023	909	115	14	–	25.47	22.85	–	–
	KLS0025	890	121	7	–	31.47	25.66	–	–
	KLS0026	1,774	119	16	–	32.60	26.10	–	–
H. cyanocinctus	KLS0060	1,181	104	–	5	–	–	287.83	52.00
H. fasciatus	KLS0098	925	68	4	–	32.68	18.14	–	–
	KLS0102	920	67	7	–	29.48	16.98	–	–
H. gracilis	KLS0100	880	73	4	–	22.49	9.34	–	–
L. curtus	KLS0006	648	79	4	–	10.39	5.25	–	–
	KLS0046	678	64	10	–	42.71	22.11	–	–
T. viperina	KLS0078	582	68	–	2	–	–	211.00	33.50
	KLS0079	692	81	–	6	–	–	229.60	33.80
	KLS0081	590	74	1	2	34.49		239.00	34.00

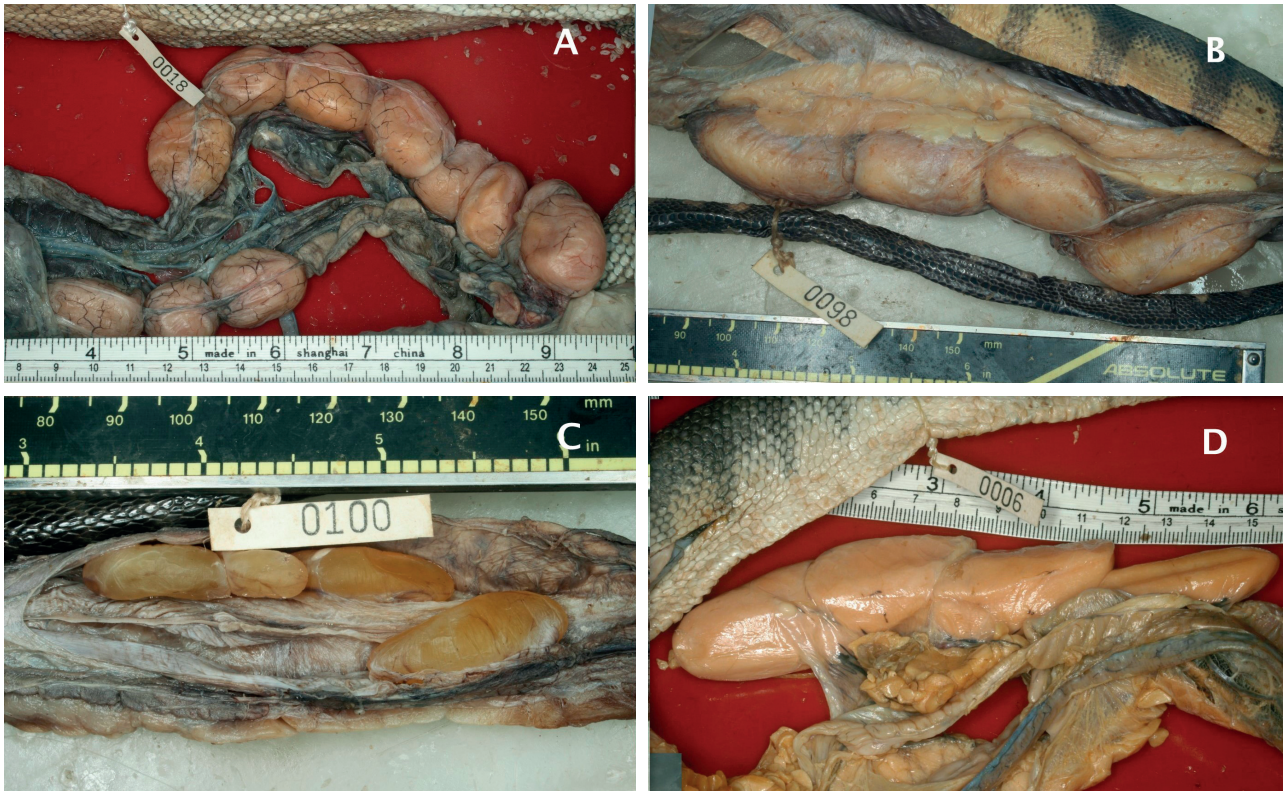

Figure 1. Sea snake eggs: A: of *Enhydrina schistosa*, B: of *Hydrophis fasciatus*, C: of *Hydrophis gracilis*, D: of *Lapemis curtus*.

Hydrophis cyanocinctus (Daudin, 1803)

Twelve specimens of *H. cyanocinctus* were collected in different coastal waters in the north and south of the island: eight were females and three were males. Two females, KLS0061 and KLS0065, contained 15 and 18 vitellogenic follicles, respectively. One specimen (KLS0060) with a total length of 1285 mm contained five fully developed embryos. The specimens KLS0060 and KLS0065 were collected in early May of 2010 and KLS0061 was collected in late

October of 2010. The total lengths of the females in active reproductive condition ranged between 965 and 1285 mm. The mean SVL and TL of the fully developed embryos were 287.83 and 52.00 mm, respectively (Figure 2 A and B).

Hydrophis fasciatus (Schneider, 1799)

Out of the eight specimens of *H. fasciatus* collected during the survey, five were females and three were males. Three females collected in the first week of May 2010 from Velvettithurai, Jaffna, contained vitellogenic follicles. Two specimens (KLS0098 and KLS0102) collected from the same locality on 8 December 2010 contained four and seven eggs, respectively. The total lengths of the females bearing eggs and vitellogenic follicles ranged between 757 and 993 mm. Mean lengths and widths of the eggs were 30.93 and 16.88 mm, respectively (Figure 1B).

Hydrophis gracilis (Shaw, 1802)

Six specimens of *H. gracilis* were collected from two different coastal areas of Sri Lanka. Two of these were females collected from Valvettithurai, Jaffna, on 9 December 2010. One (KLS0101) contained vitellogenic follicles and the other specimen (KLS0100) contained four eggs with mean lengths and widths of 22.49 and 9.34 mm, respectively (Figure 1C).

Lapemis curtus (Shaw, 1802)

Twenty-one specimens of *L. curtus* were collected from different coastal regions of Sri Lanka during the survey period. Of these, eleven were females and nine were males. Seven females collected in March, April, May and October of 2010 contained vitellogenic follicles. Two females, KLS0006 and KLS0046, which were collected in March and April 2010, contained four and ten eggs, respectively. The total lengths of gravid females and females with vitellogenic follicles ranged between 539 and 911 mm. The mean lengths and widths of the eggs were 23.72 and 12.24 mm, respectively (Figure 1D).

Thalassophina viperina (Schmidt, 1852)

Nine specimens of *T. viperina* were collected from the northern coastal regions of Sri Lanka during the survey. Of these, seven were females ranging between 598 and 773 mm in total length. Four females contained vitellogenic follicles and three contained between two and six embryos and eggs. KLS0081 had two embryos and an egg. The average SVL and TL of the embryos (n = 9) were 227.56 and 33.78 mm, respectively. All of these specimens were collected in late April and early May of 2010 from Velvetiturai, Jaffna (Figure 2 C and D).

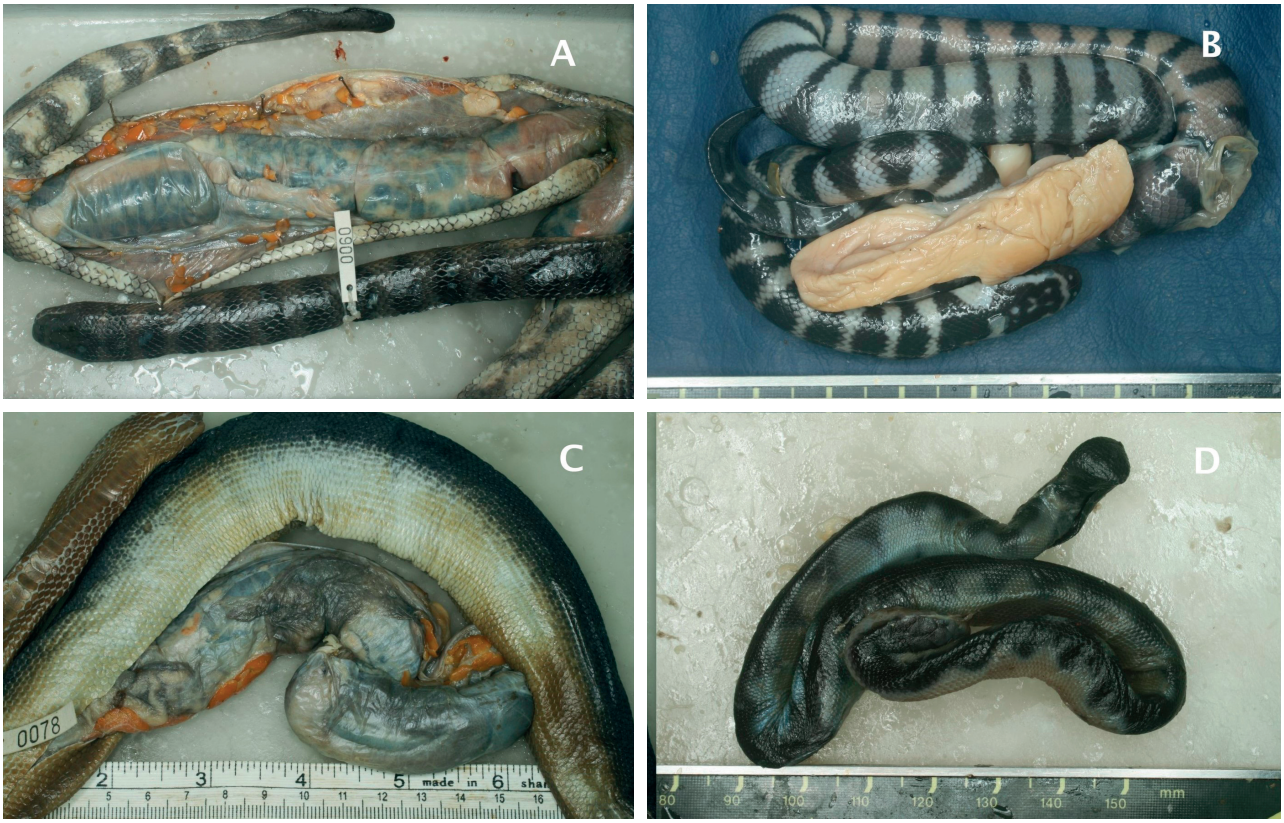

Figure 2. Sea snake embryos; A: Embryos of *Hydrophis cyanocinctus* in situ, B: an embryo of *Hydrophis cyanocinctus* ex situ, C: Embryos of *Thalassophina viperina* in situ, D: an embryo of *Thalassophina viperina* ex situ.

Discussion

In this communication, we report new observations on the reproductive biology of six species of sea snakes. These findings are among the first to be recorded for sea snakes of the South Asian region. However, our sampling is not sufficient to infer population age structures, sex ratios or seasonal reproductive cycles. The following discussion also carries the caveat that our comparisons with published observations on Southeast Asian and Australian sea snake populations are based on small sample sizes that might not be representative of reproductive patterns in these species.

Our observations on the reproductive biology of *Enhydrina schistosa* in the Puttlam Lagoon, northwestern Sri Lanka, indicates a possible season of birth between June and August. Collection of females with vitellogenic follicles in March and gravid females with well-developed eggs in June support this assumption. However, gravid females of *E. schistosa* were observed off the Malay Peninsula in January, February and March and the highest number of gravid females were seen in January–February (Lemen & Voris 1981, Voris & Jayne 1979). According to Voris & Jayne (1979), gestation occurs from November to February, females give birth in January–March, and litter sizes are around 30 or even more. A litter size of 30 is very high compared to our observations made in Sri Lanka. The highest litter size in our sample of gravid females was 16. According to Bergman (1943), the average number of eggs in the uterine tubes is five in *E. schistosa* collected from Java, Indonesia. A single female captured on the west coast of India contained 19 eggs with an average diameter of 42 mm (Padate et al. 2009). In Sri Lanka, Wall (1921) reported that 4 to 9 young are born in February, measuring 254 to 279 mm in TL. However, Wall's observations on the reproduction of Indian and Sri Lanka sea snakes does not fall within our range of observations with respect to breeding season.

Only three specimens of *H. cyanocinctus* in active reproductive condition were present in our sample. The only gravid female in our sample was collected in early May. However, gravid females of *H. cyanocinctus* appear on the Malay Peninsula from January through April, and the highest numbers of gravid females are observed in March–April (Lemen & Voris 1981). Our observation comes close to this season, but more specimens are required for further study. According to Bergman (1943), the average number of eggs in the uterine tubes was ten in *H. cyanocinctus* collected from Java, Indonesia. In a study conducted on captive *H. cyanocinctus,* which had been collected from the Coromandel coast in South India, females gave birth to 3–5 young during January and February (Karthikayan et al. 2008). Karthikayan et al. (2008) further add that the TOTL of neonate males was 382 mm and 469 mm in females. Wall (1921b) reported that three females from India had three, eight and nine embryos, respectively. According to Deraniyagala (1955), *H. cyanocinctus* in Sri Lanka produce 3 to 16 live young of 381 mm in TOTL at birth. Our observations on litter size and size at birth generally agree with the results of Deraniyagala (1955), Wall (1921b) and Karthikayan et al. (2008).

Five females of *H. fasciatus* in active reproductive condition were present in our sample. The three females with vitellogenic follicles were collected in May, and two gravid females were collected in December. Although data is insufficient to deduce a reproductive season, we presume that this species probably gives birth from January through March. In the Malay Peninsula, gravid females of *H. fasciatus* were observed from January through April,, with high numbers of gravid females being collected in February and March (Lemen & Voris 1981). Wall (1921) reported of a gravid female with 4 eggs that had been collected on the coast of Madras (now Chennai), India, in June; this is consistent with our observation of four and seven eggs in Sri Lankan specimens. Our observations and suggestions of a reproductive season agrees with the observations on *H. fasciatus* from West Malaysia.

The two females of *H. gracilis* in our collection were in an active reproductive condition at the time of their collection in December. One was gravid with eggs and the other contained vitellogenic follicles. In a previous study conducted at the same locality by Abyerami & Shivashanthini (2008), one of the 15 specimens of *H. gracilis* that were collected in February contained four embryos. In a study by Lemen & Voris (1981), a specimen collected of the Malay Peninsula in March–April was gravid. Wall (1921) reported that in India, *H. gracilis* usually gives birth to one to occasionally six young in July and August and newborns have a TOTL of between 330 and 380 mm.

Nine of the 11 females of *Lapemis curtus* collected in our study were in an active reproductive condition. The two gravid females collected in the survey were sampled in March and April, while females with vitellogenic follicles were collected in March, April, May and October. In the Malay Peninsula, gravid females of *L. "hardwickii"* (a junior synonym of *L. curtus*) were collected from January to April. However, the highest numbers of gravid females were observed in January through March (Lemen & Voris 1981). Bergman (1943) found two eggs in the uterine tubes of *L. "hardwickii"* (*curtus*) collected from Java, Indonesia. The gestation period of *L. "hardwickii"* (*curtus*) from northern Australia falls into the period of September to December, and the average number of offspring per litter is 8.5 (Ward 2001). As far as Sri Lanka is concerned, Wall (1921a) reported on a female *L. curtus* measuring 635 mm in TOTL that had been collected in February and contained four eggs measuring 32 × 13 mm. Wall (1921b) further added that young were born between May and August, and embryos had a TOTL of between 215 and 355 mm. According to Deraniyagala (1955), *L. curtus* bears one or two young between May and August and neonates measure ~445 mm in TOTL. Our data is insufficient to suggest a reproductive season in the study region, but our preliminary results generally agree with the observations made by previous authors in Sri Lanka and West Malaysia.

All of the seven female specimens of *T. viperina* collected during the survey were in active reproductive condition. Four specimens contained vitellogenic follicles and three contained embryos and eggs. All of these specimens were collected in late April and early May. Despite its wide distribution from the South China seas to the Arabian Gulf, very few reports are available on the reproductive biology of *T. viperina*. According to Lemen & Voris (1981), gravid females of *T. viperina* were only collected in March and April on the Malay Peninsula. Our observations on this

species agree with the reproductive seasonality of peninsular Malaysia populations. However, further sampling is needed to verify this.

The preliminary data presented here are based on the first phase of a survey conducted by the authors on the marine snakes of Sri Lanka. It is envisaged that on completion of the second phase of this survey, more extensive sampling will allow more detailed analyses of the individual species' mating and birthing seasons and habitat requirements, sex ratios, and relationships among reproductive output and other life history traits. Although sea snakes are harvested for skins in other regions of Asia (Auliya 2011), all the specimens reported here were collected as bycatches of local fishing and we found no evidence of deliberate harvest. However, the high volumes of sea snakes in bycatches indicate that fishing-related mortality poses a significant threat to these species in Sri Lanka. Improved knowledge of their reproductive ecology is urgently needed to assess the impact of these losses on sea snake populations in the waters surrounding Sri Lanka.

Acknowledgements

We thank the Department of Wildlife Conservation of Sri Lanka for the permit (WL/3/2/1/14/12 to AdS) to carry out research in Sri Lanka and acknowledge the grant from the Mohamed Bin Zayed Species Conservation Fund to AdS. The Australian Research Council is gratefully acknowledged for their Discovery Project grant to KLS. We appreciate the assistance granted us by the Sri Lankan Ministry of Defence, Capt. H. M. P. Senaratne, Lt. Commander H. K. D. S. P. Bandara and K. B. M. Lasantha of the Sri Lanka Navy and other naval officers who helped us during our fieldwork in the northern regions of Sri Lanka. We are very grateful to Pushpalingam Surenthar and Kamalakkanan Rahavan for their assistance in Jaffna and to the many fishermen who helped us throughout the survey.

References

Abyeramy, S. & K. Sivashanthini (2008): Current status of Marine snakes from Jaffna Peninsula, Sri Lanka with description of the hitherto unrecorded *Hydrophis fasciatus fasciatus* (Schneider, 1799). – International Journal of Zoological Research, **4**: 214–224.

Auliya, M. (2011): *Lapemis curtus* (Sepentes: Elapidae) harvested in West Malaysia. – Seas snake specialist group Newsletter. – March issue: 6–8.

Bergman, R. A. M. (1943): The breeding habits of sea snakes. – Copeia, **3**: 156–160.

Burns, G. & H. Heatwole (2000): Growth, sexual dimorphism, and population biology of the olive sea snake, *Aipysurus laevis*, on the Great Barrier Reef of Australia. – Amphibia-Reptilia, **21**: 289–300.

Das, I. & A. de Silva (2011): A photographic guide to snakes and other reptiles of Sri Lanka. – New Holland, UK.

Heatwole, H. (1997): Marine Snakes: Are They a Sustainable Resource?. – Wildlife Society Bulletin, **25**: 766–772.

Heatwole, H. (1999): Sea Snakes, 2nd edition. – University of New South Wales Press, Sydney, Australia.

Deraniyagala, P. E. P. (1955): A Coloured Atlas of Some Vertebrates from Ceylon. Vol. III, Serpentoid Reptilia. – Ceylon National Museums, Colombo.

de Silva, A. (1994): An account of the sea snakes (Serpentes: Hydrophiidae) of Sri Lanka. – pp. 234–249 in Gopalakrishnakone, P. (ed.): Sea Snake Toxinology. – Singapore, National University of Singapore.

Karthikayan, R., S. Vijayalakshmi & T. Balasubramanian (2008): Feeding and parturition of female annulated sea snake *Hydrophis cyanocinctus* in captivity. – Current Science, **95**: 660–664.

IUCN (2010): IUCN Red List of Threatened Species. Version 2010.4. – Available online at http://www.iucnredlist.org. Downloaded on 31 March 2011.

Keogh, J. S., R. Shine & S. Donnellan (1998): Phylogenetic Relationships of terrestrial Australo-Papuan Elapid Snakes (Subfamily Hydrophiinae) based on Cytochrome b and 16S rRNA Sequences. – Molecular Phylogenetics and Evolution, **10**: 67–81.

Lemen, C. A. & H. K. Voris (1981): A comparison of reproductive strategies among marine snakes. – Journal of Animal Ecology, **50**: 89–101.

Masunaga, G. & H. Ota (2003): Growth and Reproduction of the Sea Snake, *Emydocephalus ijimae*, in the Central Ryukyus, Japan: a Mark and Recapture Study. – Zoological Science, **20**: 461–470.

Rasmussen, A. R. (2001): Sea snakes. – pp. 3987–4000 in Carpenter, K. E. & V. H. Niem (eds.): Living Marine resources of the Western central Pacific, Vol. 6, Bony fishes part 4 (Labridae to Latimeridae), estuarine crocodiles, sea turtles, sea snakes and marine mammals. – Rome, Food and Agriculture Organization.

Sanders K. L. & M. S. Y. Lee (2008): Molecular evidence for a rapid late-Miocene radiation of Australasian venomous snakes (Elapidae, Colubroidea). – Molecular Phylogenetics and Evolution, **46**: 1180–1188.

Sanders, K. L., M. S. Y. Lee, R. Leys, R. Foster & J. S. Keogh (2008): Molecular phylogeny and divergence dates for Australasian elapids and sea snakes (Hydrophiinae): evidence from seven genes for rapid evolutionary radiations. – Journal of Evolutionary Biology, **21**: 682–695.

Smith, M. (1926): Monograph of the sea-snakes (Hydrophidae). – Taylor and Francis, London, UK.

Somaweera, R. & N. Somaweera (2009): An overview of Sri Lankan snakes with an annotated checklist and a field key. – Taprobanica, **1**: 43–54.

Padate, V.P., L.V. Baragi & C.U. Rivonker (2009): Biological aspects of sea snakes caught incidentally by commercial trawlers off Goa, west coast of India. – Journal of Threatened Taxa, **1**: 609–616.

Voris, H. K. & B. C. Jayne (1979): Growth, reproduction and population structure of a marine snake *Enhydrina schistosa* (Hydrophidae). – Copeia, **2**: 307–318.

Wall, F. (1921a): Notes on some Ceylon snakes recently acquired by the Colombo Museum. – Spoila Zeylanica, **11**: 405–406.

Wall, F. (1921b): Ophidia Taprobanica or the Snakes of Ceylon. – H.R. Cottle, Govt. printer Colombo.

Ward, T. M. (2001): Age structures and reproductive patterns of two species of sea snakes, *Lapemis hardwickii* Grey (1836) and *Hydrophis elegans* (Grey 1842), incidentally captured by prawn trawlers in northern Australia. – Marine & Freshwater Research, **52**: 193–203.

Wassenberg, T. J., J. P. Salini, H. Heatwole & J. D. Kerr (1994): Incidental capture of sea-snakes (Hydrophiidae) by prawn trawlers in the Gulf of Carpentaria, Australia. – Australian Journal of Marine and Freshwater Research, **45**: 429–443.