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Title A preliminary study on the sea snake bycatches (Serpentes: *Hydrophis*) across time and space in the Coromandel Coast of southeastern India

Authors S.R. Ganesh[1*], Nikita Jukenti[2], Joselin Blessy[3], Duraisamy Ramamoorthy[3], Ebai Chinnathambi[4], L. Evangelin Rebecca[4], P. Revathi[4], J. Vikram[4], V. Deepak Samuel[2]

[1] Kalinga Foundation, Guddekeri, Agumbe, Shivamogga district – 577 411, Karnataka, India
[2] National Centre for Sustainable Coastal Management (NSCSM), Anna University Campus, Chennai – 600025, Tamil Nadu, India
[3] Dept. of Ecology & Environment, Pondicherry University, Kalapet, Puducherry – 605 014, India
[4] Dept. of Zoology, Presidency College, No. 100, Kamarajar Salai, Chepauk, Chennai – 600 005, Tamil Nadu, India

*Corresponding author: snakeranglerr@gmail.com

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Abstract We examined the dynamics of sea snake bycatches in two locations in the Coromandel Coast of southeastern India, namely, Chennai and Puducherry, with an emphasis on two variables — time and space. For the time variable, we conducted multiple surveys in Chennai for both long (3650 days apart, 2009–10 vs. 2019–20) and short (45 days, May–June 2024) timelines. For the space variable, we surveyed a relatively lower intensity fishing site of Puducherry (150 km south; January–April 2023). We recorded a total of 98 bycatches representing nine snake species, over a period of 189 days. Rate of snake bycatches per day saw a reduction in long-term timeline: 33/49 days (67.3% in 2009–10) vs. 22/40 days (55% in 2019–20), in short-term timeline: 16/39 days (41% in fishing ban period) and in space: 27/61 days (44.2%). Number of snake mortalities was relatively similar everywhere: 14/33 snakes (42.4% in 2009–10), 10/22 snakes (45.4% in 2019–20) in Chennai, 11/27 snakes (40.7% January–April 2023) in Puducherry, except during the fishing ban period: 5/16 snakes (31.2% May–June 2024). Bycatch rates with respect to various types of fishing gears and vessels are major avenues for future improvements. This preliminary study warrants much more detailed investigations to find out the bycatch frequencies and mortality rates of sea snakes in the Coromandel Coast.

Keywords Chennai, entanglement, fishing ban, mortality, non-target species, Puducherry

Introduction

Unregulated and unchecked fishing in the sea is known to drastically deplete fish and other marine fauna. While commercially targeted species are sought after by fishermen, a lot of other non-target fauna also fall victim to fishing during the process (Alverson 1994). This phenomenon is called bycatch (Crowder & Murawski, 1998; Davies et al. 2009). Often, such non-targeted bycatch fishing activities also deplete the populations of these organisms. One such group of animals is sea snakes (Milton, 2001; Fry et al., 2001). Sea snakes caught in bycatch frequently die, chiefly due to drowning (Wassenberg et al., 2001). Interventions such as bycatch reduction devices installed in fishing nets have given successful results (Milton et al., 2009; Heales et al., 2008). Although sea snakes often are frequently killed in large numbers as bycatch along the coastlines of the Indian subcontinent, there is limited data on the actual numbers (Auliya et al., 2024). While studies to this effect have been conducted in the west coast of India (Dsouza et al., 2021; Dsouza & Rao, 2021; Rao et al., 2021), there is a dearth of studies on the subject from the east coast (Auliya et al., 2024).

Fishermen release sea snakes into the sea if they observe any in their nets while fishing. Sea snakes are not brought to the shore as they cannot be used in any way by the fishermen (Kannan & Rajagopalan, 2008). In these areas, fishing is typically carried out using multiple fishing gears, and large and mechanised vessels to small and semi- or non-mechanised ones (Infantina et al., 2016).

A 1–2 month-long fishing ban period is also followed every year to not harm the breeding of the marine life, as a means of resource sustainability. This annual fishing ban is a legal suspension period during which no fishermen of large mechanised trawlers are permitted to enter the sea and fish (Vivekanandan, 2019), though the effectiveness of the ban in properly capturing the native marine faunal breeding period has been questioned in the west coast (Gangal et al., 2023). Meanwhile, the small-scale boats locally called ‘vallam’ plied by artisanal fisherman are exempted from this move and can continue to fish to a good extent within their usual (small) area of operation, close to the shore. On the east coast, the ban period is from April to June, while on the west coast, it is from June to July (Vivekanandan et al., 2010).

Many kinds of fisheries and fishing vessels operate in the Coromandel Coast, including large vessels involved in deep-trawl fisheries, medium-sized mechanised boats, and smaller boats that may or may not be mechanised or motor boats (Pohl, 2007). Gill nets, seine nets, dip nets, trawl nets, cast nets, and bag nets of various sizes are operational in the southern part of the Coromandel Coast. Haul days and frequency of operation also varies from daily trips, in the case of smaller boats, to those lasting over a week or so, in the case of larger vessels (Dharmaraja et al., 1987). Non-target species of fishes and crustaceans regularly feature in bycatches (Kodeeswaran et al., 2020; Pillai et al., 2014). Many studies have reported sea snake trapping in fishing nets in this region. However, gaps still exist in understanding the characteristics of fishing practices that may influence snake bycatch intensities. This study aims to document and quantify the sea snake fauna that get entangled in nets as bycatches, and compare the diversity and numbers across time (year-round surveys with a decade’s gap; short-term surveys) and space, and between two regions of higher (Greater Chennai) and lower (Puducherry) fishing intensities.

Literature Review

Our literature review shows that from the Tamil Nadu (incl. Puducherry) Coast, approximately 12 studies have been conducted on sea snakes, spanning over two centuries 1820 to 2015, and covering about 700 km of coastline from Chennai in the north to Tuticorin in the south. These studies range from single observation reports to multi-year studies. M'Kenzie (1820) first reported on the bites of two sea snake species from the Chennai Coast. This was followed by Jerdon (1854), who reported six species of sea snakes along the Chennai Coast. Aiyar (1906), and then shortly afterwards Wall (1917), also reported on sea snakes along the Chennai Coast. After a few decades, Murthy (1978) again reported on the same. Kalaiarasan & Kanakasabai (1994) reported on seasonal variations of sea snake catches from the Chennai Coast. Lobo (2006) reported on sea snakes in the Gulf of Mannar, to the south. Karthikeyan et al. (2008), and Karthikeyan & Blasubramanian (2008) reported on sightings and behaviour of sea snakes in the Parangipettai Coast. Kannan & Rajagopalan (2008) reported on sea snake sightings during a voyage, including from the Chennai Coast in the east. Venkatraman & Padmanaban (2009) reported the occurrence of *Hydrophis ornatus* in Chennai. Damotharan et al. (2010) reported on sea snakes from the Porto Novo Coast. Muthukumaran et al. (2015) reported on bycatch problems of *Hydrophis. schistosus* from the Puducherry Coast. Lastly, Venkatraman et al. (2015) reported on seasonal variations of sea snake catches in the Chennai Coast.

Study Area

This study was conducted in regions centred around two cities situated along the Coromandel Coast of southeastern India, on the shores of the Bay of Bengal (Figure 1; Table 1). Chennai the capital city of Tamil Nadu state, formerly known as Madras, has well-populated beaches and shoreline. Sampling here was done all along the Greater Chennai Coast between Pulicat (13.421, 80.328) in the north and Kovalam (12.802, 80.250) in the south, covering a span of 80 km, with 23 sampling sites. This region, politically encompasses parts of the adjacent Tiruvallur district in the northern fringes and Chengelpet district in the southern fringes. The entire stretch is referred to as Greater Chennai for the purposes of this study. Chennai was selected as the location for the intense fishing.

Puducherry, a Union Territory, was chosen as the low intensity fishing site to study the sea snake bycatch problem. Field sampling here was done between Anaichankuppam (12.058, 79.881) in the north and Nallavadukuppam (11.854, 79.811) in the south, covering 12 sampling sites. This region encompasses Villupuram district of Tamil Nadu state and Puducherry Union Territory, but was considered as Puducherry for the purposes of this study. Together, these two regions, Chennai and Puducherry, form part of a shelf that stretches for 200 km along the Coromandel Coast. This stretch of coastline, including both the study areas, has a variety of land use types, such as tourist beaches, fishing hamlets, fish landing sites, sea ports, harbours, and so on. Sampling sites with fishing hamlets, fish landing sites, or non-tourist beaches with fishermen occupancies were chosen for surveys. The number of suitable areas selected as sampling sites was proportionately more in Puducherry (n = 13, 30 km span) than in Greater Chennai (n = 23, 80 km span). This is because along the Greater Chennai Coast, long stretches in the northern and central parts were occupied by harbours and in the south by beachside resorts, with no suitability or access for surveys. General information on fish landing sites and harbours in the study area is in Venkatraman & Padmanaban (2015).

Table 1. Sampling sites across the various districts and study areas, with geo-coordinates and land usage. Values in columns 4–7 represent number (#) of sampling days; X – no sampling done.

Study Area / District	Sampling Sites	Lat-Long. readings	# in 09-10	# in 19-20	# in 2023	# in 2024	Land use Type
North Chennai (Tiruvallur district)	Pazhaverkadu	13.421, 80.328	X	2	X	X	Village
	Koraikuppam	13.381, 80.333	X	2	X	X	Village
	Karungali	13.363, 80.338	X	2	X	X	Village
	Kalanji	13.339, 80.341	X	2	X	X	Village
	Ennore	13.223, 80.328	X	2	X	X	Town
Chennai (proper)	Thiruvottriyur	13.168, 80.311	1	2	X	5	Town
	Kasimedu	13.122, 80.299	1	2	X	1	City
	Foreshore estate	13.038, 80.281	4	2	X	9	City
	Pattinapakkam	13.020, 80.278	4	2	X	10	City
	Ururkuppam	13.005, 80.274	4	2	X	3	City
	Thiruvanmiyur	12.984, 80.269	4	2	X	2	City
	Kottivakkam	12.966, 80.265	4	2	X	0	City
	Palavakkam	12.962, 80.264	3	2	X	0	City
	Neelangarai	12.949, 80.261	3	2	X	0	City
	Vettuvankeni	12.936, 80.259	3	2	X	0	City
	Injambakkam	12.921, 80.257	3	2	X	0	City
	Akkarai	12.898, 80.254	3	1	X	0	Town
South Chennai (Chengelpet district)	Uthandi	12.873, 80.251	2	1	X	0	Town
	Kanathur	12.871, 80.250	2	1	X	0	Town
	Juhu beach	12.855, 80.249	2	1	X	0	Town
	Jagannath beach	12.844, 80.248	1	1	X	0	Town
	Karaikattukuppam	12.821, 80.247	1	1	X	2	Village
	Kovalam	12.802, 80.250	4	2	X	2	Village
Puducherry	Anichankuppam	12.058, 79.881	X	X	6	X	Village
	Kanakachettikulam	12.039, 79.873	X	X	4	X	Village
	Periya kalapet	12.027, 79.867	X	X	6	X	Village
	Chinna kalapet	12.014, 79.860	X	X	4	X	Village
	Pillaichavady	12.004, 79.856	X	X	6	X	Village
	Bommayapalayam	11.998, 79.854	X	X	6	X	Village
	Mudaliarchavady	11.987, 79.849	X	X	5	X	Village
	Thandirayankuppam	11.971, 79.845	X	X	4	X	Village
	Nadukuppam	11.964, 79.842	X	X	5	X	Town
	Vaithikuppam	11.950, 79.838	X	X	5	X	Town
	Vambakeerapalayam	11.923, 79.834	X	X	5	X	Town
	Veerampattinam	11.893, 79.827	X	X	5	X	Town
	Nallavadukuppam	11.854, 79.811	X	X	5	X	Town

Study Methods

We documented the sea snakes that were caught unintentionally as fishing bycatches and the individuals that were washed ashore, alive or dead, along the coast of the study area. Data were

collected based on the incidence of sea snake catches during fishing, or based on information of a snake being washed ashore, provided by the fishermen with whom the contact details of the investigating team were shared. Contact details were provided to the fishermen to share by WhatsApp (Acton & Koum, 2009), photos or videos of sea snakes whenever they were caught as fishing bycatches.

Surveys in 2009–10 were more direct observations by the survey team themselves, since WhatsApp use was not yet that prevalent in these areas. Field surveys were carried out typically 3 or 4 times a month, targeting one site per visit, and lasting about 4 hours. Surveys were carried out in Greater Chennai during the years 2009–10 (year-round), 2019–20 (year-round), and in May–June 2024, whereas those in Puducherry were carried out in January–April 2023 (Table 2). Within the Chennai region, surveys were not carried out in the northern fringes (Tiruvallur district) during 2009–10 and 2024, but only during 2019–20. Attempts to survey Greater Chennai's beaches in 2021 during the days of Covid-19 lockdown relaxation spells (Rajan et al., 2022) were mostly unsuccessful owing to cessation of fishing activities and were, therefore, subsequently abandoned. Species identification of observed snakes was conducted using standard literature (Daniel, 2002; Das, 2002; Whitaker & Captain, 2004; Ganesh et al., 2019; Mondal et al., 2022, 2023).

Table 2. Sampling inputs from sea snake surveys in the Coromandel Coast, southeastern India

Study Areas	Sampling Sites	Distance span (km)	Sampling Year(s)	Sampling days	Sampling months	Sampling personnel
Chennai	18	40	2009-10	49	12	1
Chennai	23	80	2019-20	40	12	2
Chennai	10	40	2024	39	2	4
Puducherry	12	30	2023	61	4	1

Results

We recorded a total of 98 bycatches representing 9 snake species, over a period of 189 days (Figures 2–3; Table 3). The recorded species were: *Hydrophis caerulescens* (n = 4), *Hydrophis curtus* (n = 4), *Hydrophis cyanocinctus* (n = 14), *Hydrophis fasciatus* (n = 6), *Hydrophis lapemoides* (n = 1), *Hydrophis ornatus* (n = 6), *Hydrophis platurus* (n = 4), *Hydrophis schistosus* (n = 42) and *Hydrophis spiralis* (n = 7). The most scarcely sighted one was *Hydrophis lapemoides* with just 1 sighting (1.3%), whereas the most frequently sighted species was *Hydrophis schistosus*, which contributed to almost half (47.7%) of the total bycatches. The remaining seven species had relatively lower fluctuations in their frequencies, ranging from 4 (4.5%) to 7 (7.9%) sightings.

The 98 bycatches, recorded over a period of 189 days, equates to 52% bycatch per day, or realistically, 1 bycatch per 2 days. Analysed separately, the rate of snake bycatches per day reduced in the long-term (33/49 days (67.3% in 2009–10) vs. 22/40 days (55% in 2019–20)), short-term timeline (16/39 days or 41% during the fishing ban period) and in space (27/61 days or 44.2%). Number of snake mortalities was relatively similar everywhere: 14/33 snakes (42.4% in 2009–10), 10/22 snakes (45.4% in 2019–20) in Chennai, and 11/27 snakes (40.7% January–April 2023) in Puducherry, except during the fishing ban period: 5/16 snakes (31.2% May–June 2024).

As regards the number of species recorded, it was seen to be related to the seasons. The two year-round studies, in 2009–10 and 2019–20, fared much better in terms of species richness

(8 and 6 species, respectively). Whereas surveys with narrow seasonal span (2–4 months) showed low number of species (3–4 spp.). The number of sampling days was not seen to improve or override the seasonal factor, as a 40-day, year-round study in 2019–20 fetched 6 species, but an almost similar (39-day) study lasting only for a one-and-a-half-month period, fetched only 3 species. Both studies were conducted in Chennai, albeit with a different number of sampling sites, and their timelines overlapped during closely related years (2019–20 and 2024). Comparing the two year-round studies within Chennai makes this apparent. The first documentation in 2009–10 had fewer sampling sites (18 sites), but higher species richness (8 spp.), while the next documentation in 2019–20 had more sampling sites (23 sites), but lower species richness (6 spp.). However, it remains to be tested if deterioration of conditions, such as higher fishing intensity, modernised practices, and any impacts on sea snake populations during the decade that lapsed, may be a factor responsible for this reduced value in the latter study.

Table 3. Sighting frequencies of sea snakes along the Coromandel Coast across time (Chennai 2009–10 vs. 2019–20 vs. ban period 2024) and space (Chennai vs. Puducherry)

Timelines	**2009–10 Chennai**			**2019–20 Chennai**			**2024 Chennai ban**			**2023 Puducherry**		
Snake Species	**Live**	**Dead**	**Total**	**Live**	**Dead**	**Total**	**Live**	**Dead**	**Total**	**Live**	**Dead**	**Total**
H. caerulescens	4	0	4	0	0	0	0	0	0	0	0	0
H. curtus	1	2	3	0	1	1	0	0	0	0	0	0
H. cyanocinctus	1	3	4	1	0	1	1	2	3	2	4	6
H. fasciatus	2	4	6	0	0	0	0	0	0	0	0	0
H. lapemoides	0	0	0	0	0	0	0	1	1	0	0	0
H. ornatus	1	1	2	1	0	1	0	0	0	2	1	3
H. platurus	1	0	1	3	0	3	0	0	0	0	0	0
H. schistosus	2	8	10	3	10	13	4	8	12	7	10	17
H. spiralis	2	1	3	2	1	3	0	0	0	0	1	1
Total (9 spp.)	14	19	**33**	10	12	**22**	5	11	**16**	11	16	**27**

A region-wise comparison (Chennai vs. Puducherry) of the number of sea snake species and /or bycatches could not be attempted as other factors like seasonality, sampling days and number and nature of sampling sites, varied. Furthermore, the two sites were selected keeping in mind the different land use types observed on the beaches, and the ensuing variations in fishing intensities, indicated by the number of vessels operational, as well as the gear types used. In terms of number of sampling sites (12 vs. 10), the distance (40 vs. 30 km) as well as seasons (4 vs. 2 months) covered, the Pondicherry sampling bout resembled the Chennai fishing ban period survey in 2024 the most. Additionally, in terms of the outputs viz., species richness (3 vs. 4 spp.), the Pondicherry surveys resembled the Chennai fishing ban period survey the most. However, in terms of the number of sampling days (61 vs. 49 days in 2009–10) and that of bycatches (16 vs. 22 snakes in 2019–20), the Pondicherry survey was more similar to either of the long-term studies in Chennai.

Discussion

Several studies have documented sea snake species along the Coromandel Coast region of the Indian coastline. However, only a few, such as those by M'Kenzie (1820), Aiyar (1906), and Wall (1917), provided first-hand field data. Others, like Karthikeyan and Balasubramanian (2007), were ex-situ observations. Notably, one of the sites, Chennai, has also been the focus of previous research conducted in the same area. M'Kenzie (1820) reported on two sea snakes from the Chennai Coast, and their bites, viz. *Microcephalophis gracilis* and "*Hydrus major*" [sic]; the identity of the latter is not clear. To the best of our knowledge, the allied species, *Hydrophis stokesii* (Gray, 1838) has not been reported from the Chennai Coast precisely (also see Ganesh, 2025). Jerdon (1854) reported *Laticauda colubrina, H. schistosus, H. lapemoides, H. nigrocinctus, H. platurus* and *M. gracilis* from Madras. But for this dubious record, no other study reports *Laticauda* spp. from the Tamil Nadu Coast (Mondal et al., 2022, 2023). Aiyar (1906) reported the same species as we did, except for *Hydrophis viperinus, Hydrophis jerdoni*, and *Microcephalophis cantoris*, which were absent in our dataset. We sighted *H. lapemoides,* which was absent in Aiyar's list. Aiyar (1906) reported that sea snake occurrences are aseasonal, year-round, though more common in the colder months of October–February, and that big sea snakes often approach the shore at night, as attested by night time fishermen.

Wall (1917) also listed 9 species from the Chennai Coast, but not the exact ones we recorded; the differences being the presence of *H. jerdoni, M. gracilis, M. cantoris* and the absence of *H. lapemiodes*. Wall (1917) surveyed in June–July and gathered 192 sea snakes, with densities ranging from 1 to 81 individuals per species. Interestingly, Wall (1917) who reported of having paid his aides for the snakes, stated that *H. schistosus* was excluded from payment owing to its very abundant occurrence here. He also reported *H. curtus* as the next most common species (81; 42%), whereas it was *H. cyanocinctus* in our data. Murthy (1978) reported 10 species from Chennai Coast. Most match with ours, except as follows: *H. jerdoni, H. viperinus,* and *M. garcilis* were recorded by him, but were absent in our dataset. Likewise, *H. lapemodies* was recorded by us, but not by Murthy (1978). Recently Kalaiarasan & Kanakasabai (1999) and Kannan & Rajagopalan (2008) reported 8 and 4 species, respectively, all of which were seen by us, but for *Microcephalophis*. Venkatraman & Padmanaban (2009) reported a new record of *H. ornatus* from Chennai, which, however, has been recorded earlier (Murthy, 1978; Whitaker & Captain, 2004).

The one long-term, large-scale study was that by Venkatraman & Padmanaban (2015), who sampled 120 km of coastline in northern Tamil Nadu, from 2009 to 2013, and reported 209 snake specimens represented by 9 species (excluding the homalopsid *Cerberus rhynchops*). We also recorded all the species reported by Venkatraman & Padmanaban (2015) except *M. gracilis*, while they did not record *H. lapemoides*, which we recorded. The dominance of *H. schistosus* in the bycatch is once again attested by their study (also see Wall 1917), similar to our observations. Venkatraman & Padmanaban (2015) reported *H. spiralis* to be the second most common species, followed by *H. cyanocinctus*, while, in our study, *H. cyanocinctus* was the second most common, and *H. spiralis* was the third in the list. *Hydrophis platurus* was a singleton species in Venkatraman & Padmanaban (2015), while in ours, it was *H. lapemoides*. To our knowledge, this study has assembled the largest ever dataset on sea snakes of the east coast, in recent days. They also reported on seasonal variations in bycatch frequencies and their finding was that the highest monthly

frequency, 68 (32.5%), was in June. June at least partly overlaps with the fishing ban period here (Vivekanandan, 2019), seconding the findings by Gangal et al. (2023) from the west coast.

Coming to the second site of our study, there have not been many prior studies on sea snakes in Puducherry, but there have been several nearby. The southernmost sampling site in Venkatraman & Padmanaban (2015) was Kadalur, which is 25 geodesic km south of Puducherry, thereby spatially encompassing this area as well. However, area-specific snake records were not given by Venkatraman & Padmanaban (2015). Mondal et al. (2023) reported old museum material of *H. jerdoni, H. viperinus, H. lapemodies, M. gracilis,* and *M. cantoris* from near Karaikal and Porto Novo, just south of Puducherry. We did not record any of these species in our study in Pondicherry, but one species, *H. lapemodies*, was recorded in Chennai by us. A comparatively more recent, detailed study is available from the Pamban Gulf near Palk Strait, which is about 350 km south from Puduchery. This study, Lobo (2006), reported 10 species, but not the exact ones we report herein. Lobo (2006) reported *H. viperinus* and *M. gracilis*, whereas we do not. Lobo (2006) is also one of the few studies to report *H. lapemodies* from the Tamil Nadu Coast, as we do. Also, none of the species we reported were absent in Lobo's dataset.

Overall, our study in the Coromandel Coast is significant given that this is one of the few studies to furnish quantitative data on sea snake occurrences, that too bycatches. Future longer-term studies over larger areas in the Coromandel Coast will shed more light on this under-studied problem of sea snake bycatches. Two previous studies, one short-term (Wall, 1917) and one long term (Venkatraman & Padmanaban, 2015), report more sea snake specimens than we did. Taking an aspect-specific approach, compared to the sea snake bycatch studies from India's west coast (Dsouza & Rao., 2021; Dsouza et al., 2021; Rao et al., 2021), our data also attests that *H. schistosus* is the most common species (see Wall 1917; Venkatraman & Padmanaban, 2015). It is acknowledged that adequate details about the various types of fishing vessels and fishing gears deployed (Dharmaraja et al., 1987; Pohl, 2007; Infantina et al., 2016) and the direct bearing that these factors have on the sea snake bycatch will add a lot more to this preliminary study reported here. Future attempts to improve and further on the lines of the current study could factor-in these aspects suitably.

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References

ACTON, B., & KOUM, J. (2009). WhatsApp. *Yahoo*. www.whataspp.com

AIYAR, T. V. R. (1907). Notes on Sea Snakes caught at Madras. *Journal & Proceedings of the Asiatic Society of Bengal*, 2: 69–72.

ALVERSON, D. L. (1994). *A global assessment of fisheries bycatch and discards* (Vol. 339). Food & Agriculture Org.

AULIYA, M., RASMUSSEN, A. R., SANDERS, K. L., & LOBO, A. S. (2024). Challenges of regulating commercial use of marine elapid snakes in the Indo-Pacific. *Conservation Biology*, *38*(5), e14336.

CROWDER, L. B., & MURAWSKI, S. A. (1998). Fisheries bycatch: implications for management. *Fisheries*, 23(6), 8–17.

DANIEL, J.C. (2002). *The Book of Indian Reptiles and Amphibians*. Oxford University Press, Mumbai, India, 238 pp.

DAMOTHARAN, P., ARUMUGAM, M., VIJAYLAKSHMI, S., & BALASUBRAMANIAN, T. (2010). Diversity, biology, and ecology of sea snakes (Hydrophiidae) distributed along the Parangipettai Coast, southeast coast of India. International *Journal of Current Research*, 4, 62–69.

DAS, I. (2002). *A Photographic Guide to Snakes and other Reptiles of India*. New Holland publications, London, UK, 144 pp.

DAVIES, R. W. D., CRIPPS, S. J., NICKSON, A., & PORTER, G. (2009). Defining and estimating global marine fisheries bycatch. *Marine Policy*, 33(4), 661–672.

DHARMARAJA, S.K., VIJAYALAKSHMI, K., HAJA NAJEEMUDEEN, S., PRASAD, C.J., SEYNUDEEN, M.B., ANANDAN, K., KARTHIKEYAN, M. & BALAKRISHNAN, G. (1987). Appraisal of the Marine Fisheries of Tamil Nadu and Puducherry. *CMFRI Special publication*, (34), 1–63.

DSOUZA, S., & RAO, C. (2021). Demographics and reproductive biology of *Hydrophis schistosus* may make it more resilient to bycatch effects than other sea snakes. *Regional Studies in Marine Science*, 47, 101948.

DSOUZA, S., RAO, C., MANOHARAKRISHNAN, M., & SHANKER, K. (2021). Resource use and the impacts of fisheries on two sympatric sea snake species on the west coast of India. *Marine Biology*, 168(9), 146.

FRY, G. C., MILTON, D. A., & WASSENBERG, T. J. (2001). The reproductive biology and diet of sea snake bycatch of prawn trawling in northern Australia: characteristics important for assessing the impacts on populations. *Pacific conservation biology*, 7(1), 55–73.

GANESH, S.R. (2025). On a forgotten record of Stoke's sea snake *Hydrophis stokesii* (Gray, 1846) from the Kerala Coast, southwestern India (Squamata: Elapidae). *Zootaxa*, 5637(2), 394–398.

GANESH, S. R., NANDHINI, T., SAMUEL, V. DEEPAK., SREERAJ, C. R., ABHILASH, K. R., PURVAJA, R., & RAMESH, R. (2019). Marine snakes of Indian coasts: historical resume, systematic checklist, toxinology, status, and identification key. *Journal of Threatened Taxa*, 11(1), 13132–13150.

GANGAL, M., SURI, V., & ARTHUR, R. (2023). How well does Indian fisheries policy engage with fisheries biology? Exploring the science-policy interface of coastal capture fisheries along the west coast of India. *Marine Policy*, 156, 105796.

HEALES, D. S., GREGOR, R., WAKEFORD, J., WANG, Y. G., YARROW, J., & MILTON, D. A. (2008). Tropical prawn trawl bycatch of fish and sea snakes reduced by Yarrow Fisheye Bycatch Reduction Device. *Fisheries Research*, 89(1), 76–83.

INFANTINA, J. A., JAYARAMAN, R., UMAMAHESWARI, T., VISWANATHA, B. S., & RANJITH, L. (2016). Governance of marine fisheries in India: Special reference to Tamil Nadu. *Indian Journal of Geo-Marine Science*, 45(10), 1225–1233.

JERDON, T.C. (1854). Catalogue of the Reptiles inhabiting the Peninsula of India. Part 2. *Journal of the Asiatic Society of Bengal* xxii: 522–534.

KALAIARASAN, V. & KANAKASABAI, R. (1994). Seasonal availability of sea snakes (family: Hydrophidae) in the Madras waters. *Cobra*, 16: 18–19.

KANNAN, P., & RAJAGOPALAN, M. (2008). Distribution of Sea Snakes in the Indian Coastal Waters. *Scientific Transactions in Environment and Technovation*, 1(4), 218–223.

KARTHIKEYAN, & BALASUBRAMANIAN. (2008). Feeding and reproductive behavior of captive sea snakes *Hydrophis cyanocinctus*. *Applied Herpetology*, 5(1), 75–80.

KARTHIKEYAN, R., VIJAYALAKSHMI, S., & BALASUBRAMANIAN, T. (2008). Feeding and parturition of female annulated sea snake *Hydrophis cyanocinctus* in captivity. *Current Science*, 660–664.

KODEESWARAN, P., JAYAKUMAR, N., & RANJITH, L. (2020). Assessing the ichthyofaunal diversity and trophic level from trawl bycatch of Chennai Fishing Harbour, Southeast Coast of India. *Regional Studies in Marine Science*, 40, 101530.

LOBO, A. S. (2006). Sea snakes of the Gulf of Mannar Marine National Park. The species and their conservation. *A Report Submitted to The Rufford Foundation, UK, 67pp*.

M'KENZIE, D. (1820). An account of venomous sea snakes on the coast of Madras. *Asiatic Researches*, 13: 329–336.

MILTON, D. A. (2001). Assessing the susceptibility to fishing of populations of rare trawl bycatch: sea snakes caught by Australia's Northern Prawn Fishery. *Biological Conservation*, 101(3), 281–290.

MILTON, D. A., FRY, G. C., & DELL, Q. (2009). Reducing impacts of trawling on protected sea snakes: by-catch reduction devices improve escapement and survival. *Marine and Freshwater Research*, 60(8), 824–832.

MONDAL, S., GANESH, S.R., SETHY, P.G.S., RAGHUNATHAN, C., RAHA, S., & SARKAR, S. (2022). Redescriptions of the type specimens of synonymous nominal taxa of sea snakes (Serpentes: Elapidae: *Hydrophis, Laticauda*) at the Zoological Survey of India. *Zootaxa*, 5169(4): 301–321.

MONDAL, S., GANESH, S. R., & RAGHUNATHAN, C. (2023). Some rare species of sea snakes (Squamata: Serpentes: Elapidae: Hydrophiinae: *Hydrophis, Microcephalophis*) from the Indian Coasts and nearby waters, lodged in major systematic Indian zoological collections. *Bonn zoological Bulletin*, 72(2): 209–222.

MURTHY, T.S.N. (1977). On sea snakes occurring in Madras waters. *Journal of the Marine Biological Association of India* 19: 68–72.

MUTHUKUMARAN, M., RAO, A. V. B., & ALEXANDAR, R. (2015). Threats of passive fishing activities on sea snake *Enhydrina schistosa* (Daudin 1803) of Puducherry coast, India. *International Journal of Pure and Applied Zoology*, 3(1), 53–58.

PILLAI, S. L., KIZHAKUDAN, S. J., RADHAKRISHNAN, E. V., & THIRUMILU, P. (2014). Crustacean bycatch from trawl fishery along north Tamil Nadu coast. *Indian Journal of Fisheries*, 61(2), 7–13.

POHL, H. (2007). From the Kattumaram to the Fibre-Teppa—Changes in Boatbuilding Traditions on India's East Coast. *International Journal of Nautical Archaeology*, 36(2), 382–408.

RAJAN, H. M., KARTHIKEYAN, N., SATISH, S., & VASNA, J. (2022). Comparison of First and Second Waves of COVID-19 in Metropolitan Chennai City. *Indian Journal of Ecology*, 49(2), 643–646.

RAO, C., DSOUZA, S., GUPTA, T., MANOHARAKRISHNAN, M., & LOBO, A. S. (2021). Fisheries induced shift in sea snake community assemblages along the Konkan coast, India. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 31(9), 2402–2411.

VAN CAO, N., THIEN TAO, N., MOORE, A., MONTOYA, A., RASMUSSEN, A.R., BROAD, K., VORIS, H.K. & TAKACS, Z. (2014). Sea snake harvest in the gulf of Thailand. *Conservation Biology*, 28(6), 1677–1687.

VENKATRAMAN, C., & PADMANABAN, P. (2009). Cochin Banded Sea Snake *Hydrophis ornatus* (Gray, 1842): a new record for Chennai Coast, East Coast of India (Reptilia: Serpentes: Hydrophiidae). *Journal of Scientific Transactions in Environment & Technovation*, 3(1), 48–49.

VENKATRAMAN, C., PADMANABAN, P., & SIVAPERUMAN, C. (2015). Seasonal abundance of sea snakes on the Chennai Coast, Southern India. In *Marine Faunal Diversity in India* (pp. 249–259). Academic Press.

VIVEKANANDAN, E. (2019). Seasonal Fishing Ban: Need for collecting and applying right type of scientific information. *Marine Fisheries Information Service; Technical and Extension Series*, (240), 7–16.

VIVEKANANDAN, E., NARAYANAKUMAR, R., NAJMUDEEN, T. M., JAYASANKAR, J., & RAMACHANDRAN, C. (2010). Marine fisheries policy brief-2; Seasonal fishing ban. *CMFRI Special Publication*, 103, 1–44.

WALL, F. (1918). Notes on a collection of sea snakes from Madras. *Journal of the Bombay Natural History Society*, 26: 599–607.

WASSENBERG, T. J., MILTON, D. A., & BURRIDGE, C. Y. (2001). Survival rates of sea snakes caught by demersal trawlers in northern and eastern Australia. *Biological Conservation*, 100(3), 271–280.

WHITAKER, R. & CAPTAIN, A. (2004). *Snakes of India – The Field Guide*. Draco Books, Chengalpet, South India. 481 pp.

Figures

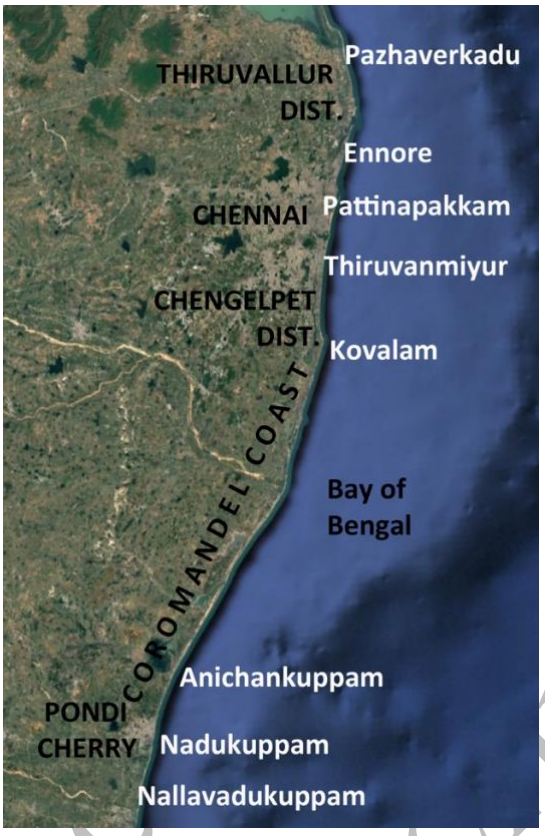

Figure 1. Map of the Coromandel Coast, depicting the study area: Chennai-Puducherry beach, India; sampling sites at the north-south limits are named in white, and midpoint of the zones are in black text.

Figure 2. Fishing net collection content sorties, before (left) and after (right) segregation of edible, commercially-viable, human-consumption grade fishes and non-target bycatch refuse.

Figure 3. Some examples of sea snake bycatches noted in this study: (a) *H. schistosus* and (b) *H. cyanocinctus* removed from nets, onto the boat by fishermen; (c) *H. ornatus* with target fish species; snakes entangled in nets of various seine types, (d) subadult *H. schistosus*, (e) *H. cyanocinctus*, (f) adult *H. schistosus*; (g) *H. lapemoides* – the only individual recorded in the entire study, a rare singleton species.