

BIODIVERSITY OF TRAWLER-CAUGHT SEA SNAKES
OFF WEST COAST SABAH

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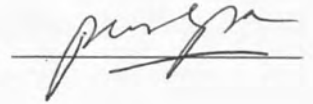
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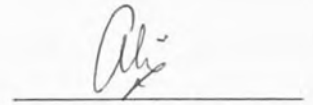
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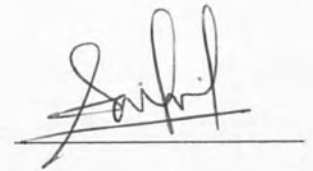
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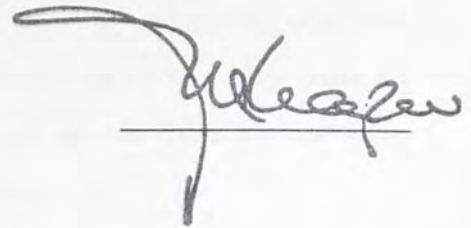
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ABSTRAK

Kajian in bertujuan untuk mengumpul maklumat terkini mengenai kepelbagaian, diet dan morfometrik ular laut yang ditangkap oleh kapal pukat tunda di pantai barat Sabah. Pengumpulan ular laut yang bermula pada bulan Oktober 2008 hingga Februari 2009 telah mengumpul sebanyak 129 spesimen yang terdiri daripada 13 spesies mewakili empat genera dari satu subfamili (Hydrophiinae) (Indeks kepelbagaian Simpson, $D_s = 0.86$). Sampel menggambarkan 72% fauna ular laut di Sabah dengan enam spesies tidak dilaporkan dalam kajian-kajian sebelumnya. Berdasarkan pembedahan 59 spesimen dari 10 spesies ular laut, kebanyakan diet ular-ular tersebut bertumpu kepada spesies mangsa yang bersifat menetap, mengorek lubang dan hidup di rekahan. Kandungan perut yang dikenal pasti adalah famili ikan Congridae, Pholidichthyidae, Nemipteridae, Batrachoididae, Ambassidae, Labridae dan Leiognathidae. Famili invetebrata Loliginidae dan telur ikan juga dijumpai. Tujuh kategori bentuk badan mangsa adalah berbentuk belut (eel), menyerupai belut (eel-like), menyerupai ikan Gobi (Goby-like), menyerupai ikan debam (surgeonfish-like), menyerupai ikan dengkis (rabbitfish-like), invetebrata dan telur ikan. Analisis morfometrik telah dilakukan kepada *Hydrophis melanocephalus* (N=25; Betina = 13; Jantan = 12) dan *Hydrophis ornatus ornatus* (N=23; Betina = 10; Jantan = 13). Keputusan ini bercanggah dengan kajian terdahulu yang mungkin dijelaskan oleh bilangan spesimen yang kecil serta spesimen-spesimen mungkin terdiri dengan subdewasa yang masih lagi membesar dalam kajian ini.



ABSTRACT

The aim of this study is to gather current information on the diversity, diet and morphometrics of trawler-caught sea snakes in the west coast of Sabah. Sea snake collections done by three bottom trawlers during the months of October 2008 to February 2009 amounted to a total of 129 specimens representing 13 species of sea snakes of four genera in one subfamily (Hydrophiinae) (Simpson's Index of diversity, $D_s = 0.86$), representing 72% of the sea snake fauna in Sabah with six species not recorded in earlier reports. Based on dissections of 59 specimens from 10 species, sea snake assemblage that occurred in this area primarily prey on species which were predominantly sedentary, benthic, burrowing or crevice dwelling. The identified prey items are fish families Congridae, Pholidichthyidae, Nemipteridae, Batrachoididae, Ambassidae, Labridae and Leiognathidae. Invertebrate family Lologinidae and fish eggs were also found in their stomachs. Seven body form categories of identified prey items are eels, eel-like fish, goby-like, surgeonfish-like, rabbitfish-like, invertebrates and fish eggs. Morphometric analyses were done for *Hydrophis melanocephalus* (N=25; Female = 13; Male = 12) and *Hydrophis ornatus ornatus* (N=23; Female = 10; Male = 13). Results show contradiction to an earlier study which might be explained by the relatively small sample size and the specimens possibly consist of subadults that were still growing.



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LIST OF SYMBOLS

Σ	=	Sum
ni	=	Number of individuals per species
N	=	Total number of individuals
S	=	Total number of species
g	=	gram
mm	=	millimetre
TL	=	Total length
SVL	=	Snout-vent length
TAL	=	Tail length
HL	=	Head length
HW	=	Head width
BW	=	Body weight
$\%$	=	percentage
$s.e.$	=	standard deviation
$\bar{x}$	=	mean value



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CHAPTER 1

INTRODUCTION

1.1 Introduction to Sea Snakes

Apart from sea turtles and saltwater crocodiles, sea snakes are one of the most successful reptiles living in the sea. They have adapted to the aquatic environment by having important morphological features that differ from the other aquatic or terrestrial snakes. These general features include the vertically flattened paddle-like tail (Rasmussen, 2001), lack or absence of ventral scales and a laterally compressed body (Heatwole, 1999). In addition, they have scales which tend to separate rather than overlapping as well as the nostrils are upward pointing and closable by flaps (Warrel, 1994). As a result, sea snakes can be found distributed throughout the world with the highest diversity in the Asia-Pacific region with at least 50 species in 15 genera (Warrel, 1994).

Sea snakes around the Asia-Pacific region consist many species from two subfamilies. They are Hydrophiinae and Laticaudinae (Rasmussen, 2001). They inhabit tropical and subtropical shallow waters along the coasts, around islands in Indian and Pacific Oceans, river mouths and can be found more than 100 miles from the sea (Tu,



1974; Rasmussen, 2001). Both subfamilies are related to each other yet differ in their morphological features.

For Hydrophiinae or the true sea snake, the body is laterally compressed (Heatwole, 1999). The nostrils are on top of the snout, the ventral scales are narrow or absent and the tail is vertically flattened paddle-like (Heatwole, 1999) (Plates 1.1, 1.2 and 1.3). Thus, the true sea snake is an excellent swimmer in sea but move awkwardly on land. The true sea snake is ovoviviparous or live-bearer where it gives birth to its young (Heatwole, 1999). Examples of true sea snake are the Short sea snake (*Lapemis curtus*), the Beaked sea snake (*Enhydrina schistosa*), the Eydoux' sea snake (*Aipysurus eydouxii*), the Blue-Grey sea snake (*Hydrophis caerulescens hybridus*) and the Yellow-Bellied sea snake (*Pelamis platurus*) (Stuebing & Inger, 1999).

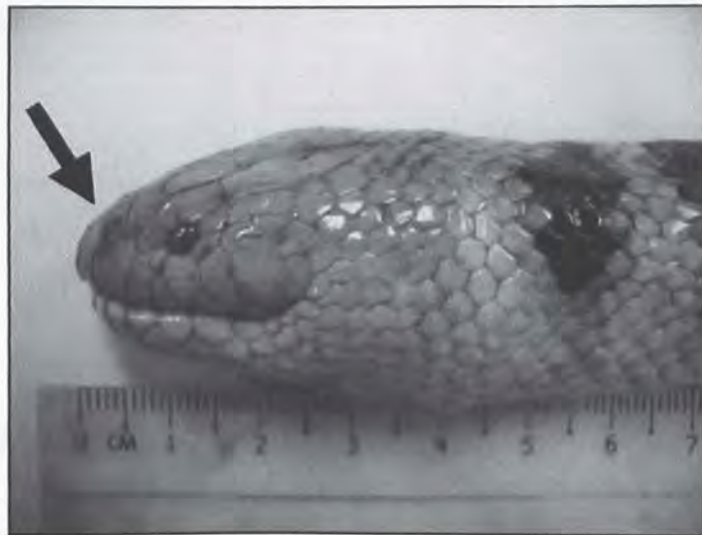


Plate 1.1 The head of the Blue-Banded sea snake (*Hydrophis cyanocinctus*). Black arrow shows the nostril that is on top of the snout.

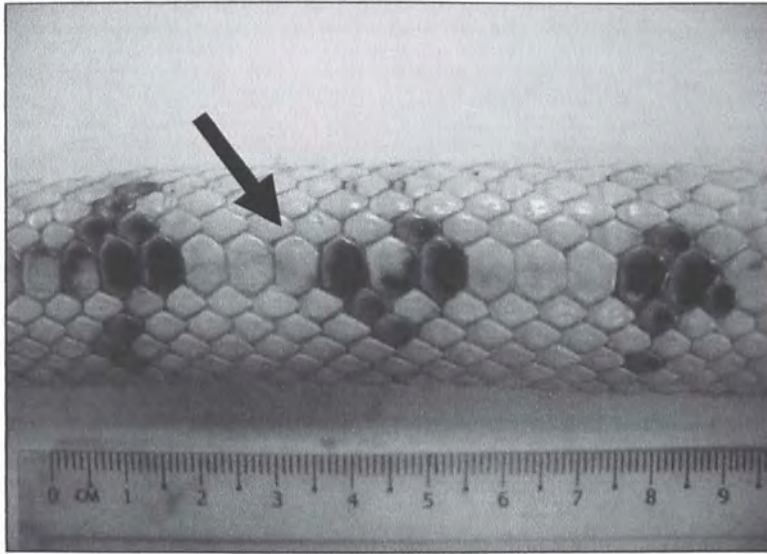


Plate 1.2 The narrow ventral scales of the Blue-Banded sea snake (*Hydrophis cyanocinctus*).

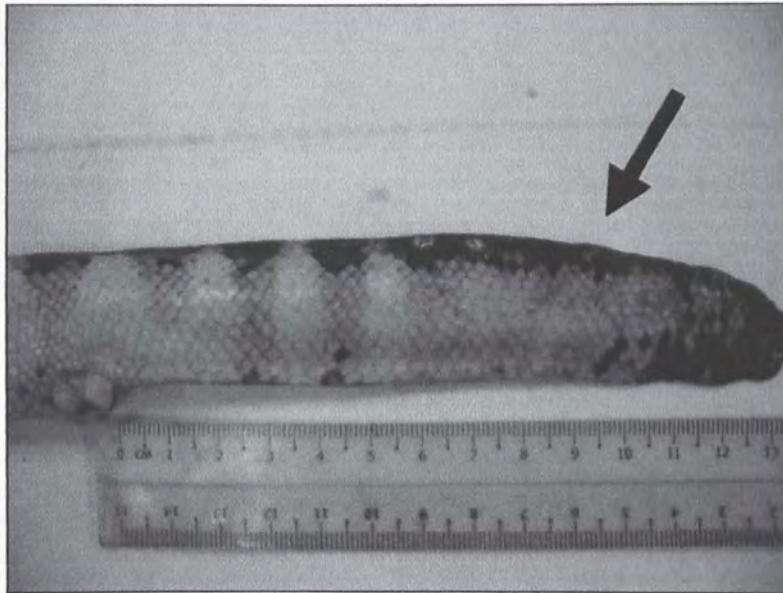


Plate 1.3 The vertically flattened paddle-like tail of the Blue-Banded sea snake (*Hydrophis cyanocinctus*).

The second subfamily is Laticaudinae or the sea krait. The sea krait has a subcylindrical body. The nostrils are on the side of snout and the ventral scales are similar to terrestrial snakes to crawl on land (Heatwole, 1999) (Plates 1.4 and 1.5). Like the true sea snake, the sea krait has a vertically flattened paddle-like tail (Heatwole, 1999) (Plate 1.6). They successfully live both on land and in the sea. Sea kraits are oviparous where they return to land to lay their eggs (Shetty & Shine, 2002b). Thus, the sea krait is considered more primitive compared to the true sea snake (Rasmussen, 2001). Examples of sea kraits are the Yellow-Lipped sea krait (*Laticauda colubrina*) and the Blue-Lipped sea krait (*Laticauda laticaudata*) (Stuebing & Inger, 1999)

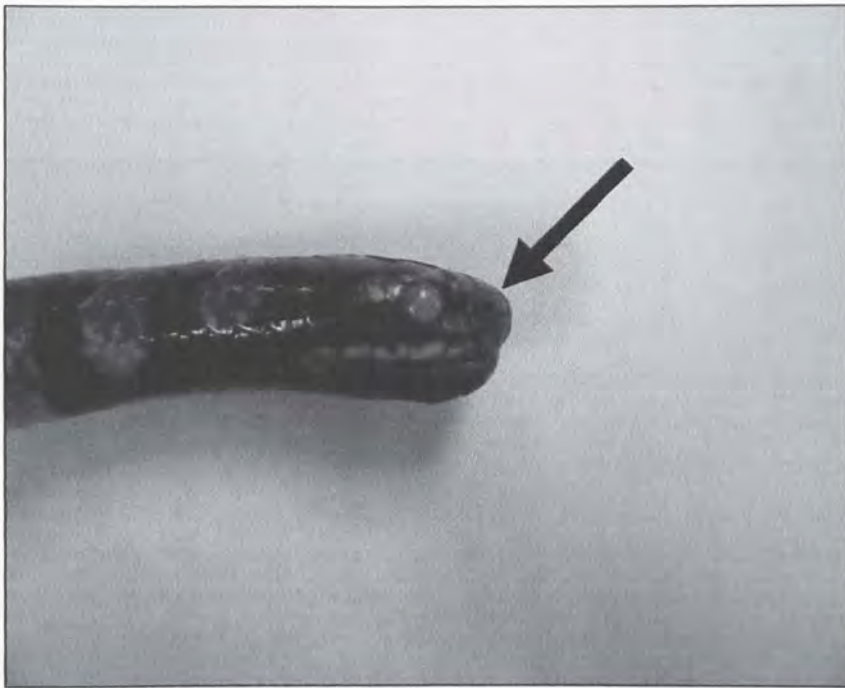


Plate 1.4 Head of the Yellow-Lipped sea krait (*Laticauda colubrina*). Black arrow shows the nostril that is on the side of the snout.

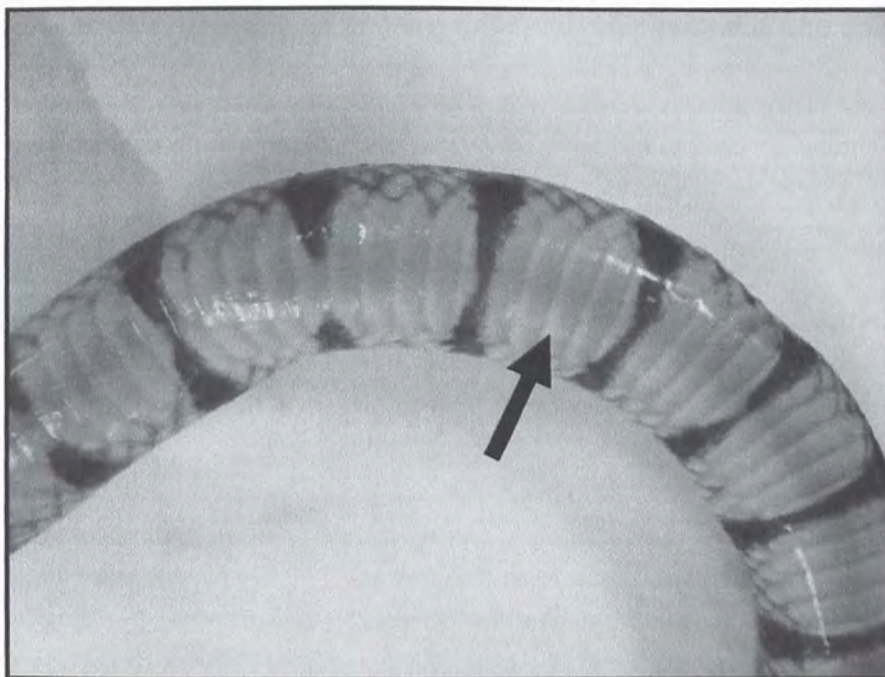


Plate 1.5 The ventral scales of the Yellow-Lipped sea krait (*Laticauda colubrina*) similar to terrestrial snakes.

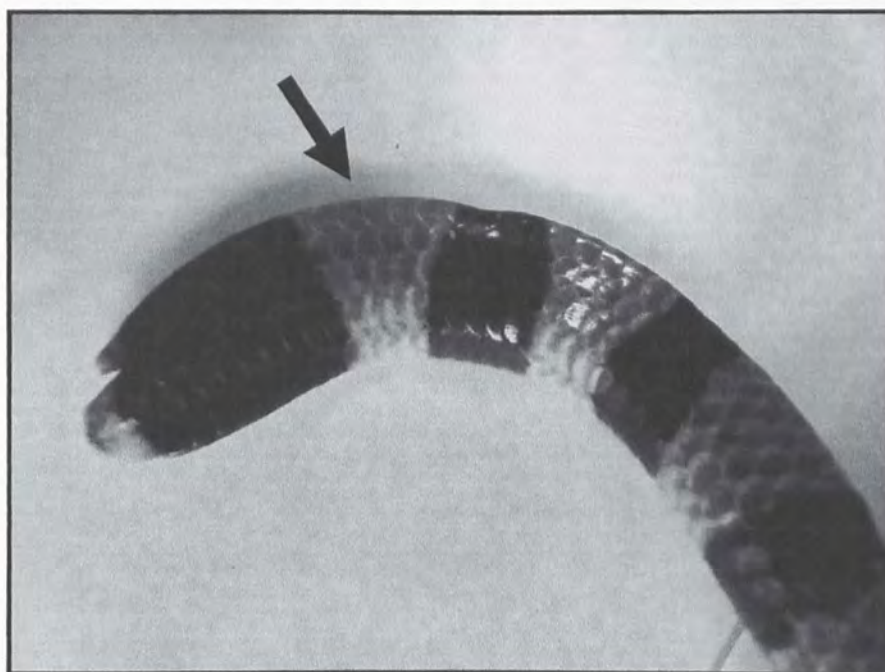


Plate 1.6 The vertically flattened paddle-like tail of the Yellow-Lipped sea krait (*Laticauda colubrina*).

Sea snakes have a reputation of being highly venomous animal and certain species are highly aggressive. For example, the Stoke's sea snake (*Astrotia stokesii*), the Beaked sea snake (*Enhydrina schistosa*) and the Ornate sea snake (*Hydrophis ornatus*) (Rasmussen, 2001). The neurotoxin venom was used to paralyze its prey (Murphy *et al.*, 1999). Once the prey is paralyzed, the sea snake will move its way to the prey's head then swallow it whole (Voris & Voris, 1983). However, there are some reports of other species of sea snake swallowing the prey tail first. For example, the Beaked sea Ssnake (*Enhydrina schistosa*) (Voris & Moffett, 1981), the Olive-Headed sea snake (*Hydrophis major*) and the Slender-Necked sea snake (*Hydrophis melanocephalus*) (Voris & Voris, 1983).

1.2 Objectives of Study

This study was carried out to gather current informations about the biological aspects of trawler-caught sea snakes in the west coast of Sabah. The specific objectives of this study are:

- a) To determine the diversity.
- b) To analyse the stomach content for diet analyses.
- c) To study the morphometric measurements of the two most dominant trawler-caught sea snake species.

1.3 Hypotheses

The hypotheses of this study are:

- a) The diversity of trawler-caught sea snakes off west coast Sabah is high.
- b) Different species of trawler-caught sea snakes may have different diet composition.
- c) Morphometric measurements of the two most dominant sea snake species caught by trawlers are gender-specific.

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