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# Guide to the Dangerous and Venomous Marine Animals of India



VENKATARAMAN K., RAGHUNATHAN C., SREERAJ C.R., RAGHURAMAN R.

ZOOLOGICAL SURVEY OF INDIA

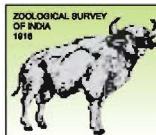


# Guide to the Dangerous and Venomous Marine Animals of India

VENKATARAMAN K.\*, RAGHUNATHAN C., SREERAJ C.R., RAGHURAMAN R.

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डॉ. बालकृष्ण पिसुपाटी  
अध्यक्ष

Dr. Balakrishna Pisupati  
Chairman

## FOREWORD

The venomous and poisonous animals have always been a subject of fear and fascination for man. During the past three decades, considerable progress has been made in our understanding of the chemistry and physio-pharmacology of the animal toxins. Marine ecosystem in temperate and tropical waters harbors a large number of such animals that have both venoms and poisons.

Conodonts, a large group of tiny extinct marine animals that lived up to 500 million years ago, are considered likely to be the world's first venomous animals. On the basis of laboratory experiments or human encounters, there are said to be more than 1200 marine animals known to be venomous or poisonous. These range from unicellular protists to chordates. While their numbers may sometimes be quite large they do not produce major ecological effects by virtue of their toxicity alone. However, lack of information about marine animals that are venomous and/or poisonous cause significant amount of confusion in the minds of non-experts causing considerable damage to such animals that are nonpoisonous or venomous.

With respect to Indian seas, there are no valid data on such marine diversity, especially poisonous or venomous animals. Neither are there much reliable public health statistics on bites, stings or poisonings by marine organisms. In order to fulfill this gap, the Zoological Survey of India is bringing out this field guide on the venomous and poisonous marine animals with pictorial representations of species from phylum Porifera to Chordata. This book is the first of its kind, providing information on identification, danger, symptoms, treatment, habitat and distribution of these species reported from Indian waters.

This field guide gives a vivid account of the characteristic features of venomous and poisonous marine animals that will be of help taxonomists, students and researchers to identify the species concerned accurately upto species level.

I sincerely believe that this publication will be a valuable document for all those who involve in marine biodiversity studies as well as physicians and human health care departments. Launching this publication on 22 May 2012 (International Day for Biological Diversity) that has a thematic focus on coastal and marine biodiversity is laudable.



(Balakrishna Pisupati)

Chairman

April 30, 2012

National Biodiversity Authority



**Dr. K. VENKATARAMAN**  
Director



**Government of India**  
**Ministry of Environment and Forests**  
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## PREFACE

The term venomous animal is usually applied to those creatures capable of producing a poison in a highly developed secretory organ or group of cells and which can deliver this toxin during a biting or stinging act. Poisonous animals are generally regarded to be those whose tissues, either in part or in their entirety are toxic. In reality, all venomous animals are poisonous but not all poisonous animals are venomous. There are several types of potential negative interactions associated with marine organisms including physical pain, disease, envenomation, myiasis, allergic reactions, psychological disorders, and death. Physical pain- bites, piercings, and stings caused by a wide variety of invertebrates can produce varying amounts of suffering among victims. Symptoms can range from mild annoyance to incapacitation. Although such physical trauma generally is not lethal, it may render a victim incapable of normal activity, and it can result in psychological disturbance among certain individuals.

Threats from animals encompass two broad categories: point source threats and psychological threats. Point source threats are those that can cause physical injury or death in a brief period of time. The sting of a wasp, and transmission of deadly disease agents are two examples of point source threats. Psychological threats, by comparison, are those that do not kill or directly threaten health, but rather present unpleasant situations for people to the extent that routine functioning is impaired. Both point source and psychological threats have the real potential to disrupt.

The purpose of this guide is to present the reader with a basic yet sound understanding of the dangerous types of marine animals that may be encountered during fishing, marine surveying and while conducting marine biological field observations. Brief descriptions of the physical and behavioral characteristics of these animals are presented. This field guide only considers those animals which pose a threat from direct contact and does not address toxic responses from food or contact allergies, or consumption of certain poisonous animals.

This book is intended to be a primary and expeditious information source for researchers in marine sciences and physicians for identification related to surveillance and public health matters associated with invertebrates of medical importance. Treatment guidelines, where presented, are based on current available information. Practitioners have the sole responsibility to ensure the correct dosages of medicines are provided, and they also should ensure correct treatment regimes by consulting the most recent appropriate information sources.

This book details the marine animals which are poisonous and venomous in nature reported from Indian seas, along with the type of danger posed by the animals and immediate medical attention, if affected them. I sincerely hope that this guide adds to the interest of the students, researchers and also medical practitioners.

May, 2012



(K. Venkataraman)

No.	CONTENTS	Page
<b>1</b>	<b>INTRODUCTION</b>	1
	Types of Negative Interaction with marine fauna	3
	1. Envenomations	3
	2. Bites	4
	3. Irritations	4
	4. Poisonings	4
	5. Electric shock	5
	Risk of Marine Animals	5
	Facts and Stats on Marine Hazards	5
	Types of marine ecosystem in India	6
	Coastal ecosystems	7
	Mangrove forest	7
	Sea grass bed	9
	Coral Reef	10
	Pelagic and benthic ecosystems	11
<b>2</b>	<b>DANGEROUS AND VENOMOUS MARINE ANIMALS</b>	14
	1. Porifera	14
	2. Coelenterata	17
	2.1. Jellyfish	20
	2.2. Portuguese man-of-war	24
	2.3. Sea Anemones	26
	2.4. Sea ferns	30
	2.5. Corals	32
	3. Bryozoa	35
	4. Annelida	36
	4.1. Bristle worms	36
	5. Mollusca	40
	5.1. Squids, octopuses and cuttle fishes	40
	5.2. Cone shells	43
	5.3. Nudibranchs or Seaslugs	48
	5.4. Pteropods	50
	6. Echinodermata	52
	6.1. Sea stars and brittle stars	53
	6.2. Sea urchins	59
	6.3. Sea cucumbers	61
	7. Chordata	64
	7.1. Fishes (Dangerous-Those which bite or attack)	64
	7.1.1. Sharks	64
	7.1.2. Barracuda	69
	7.1.3. Trigger fishes	71
	7.1.4. Moray eels	74
	7.2. Fishes (Venomous- Those which sting)	76
	7.2.1. Scorpaenidae	76

7.2.2. Rabbit fishes	...	79
7.2.3. Surgeons fishes	...	82
7.2.4. Sting rays	...	85
7.2.5. Electric rays	...	87
7.2.6. Striped cat fish	...	89
7.2.7. Puffer fishes	...	91
7.3. Sea snakes	...	94
7.4. Crocodile	...	97
<b>3 APPENDICES</b>	...	99
1. Pressure bandage + Immobilization technique	...	99
2. First Aid Materials	...	99
<b>4 ACKNOWLEDGMENTS</b>	...	103
<b>5 REFERENCES</b>	...	103

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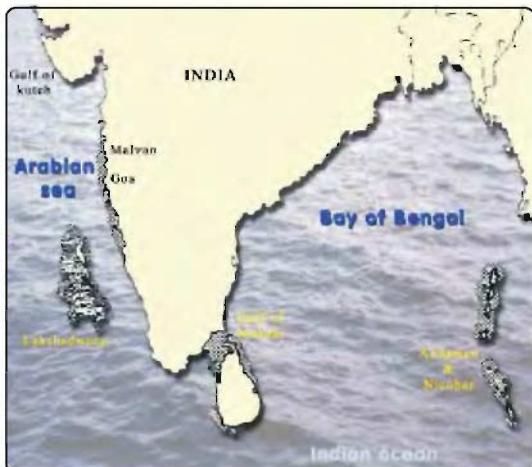
## Illustrative Icons used in this book

	Venomous Organisms		Identification
	Non-Venomous Organisms		Danger
	Envenomation		Symptoms
	Bites		Treatment
	Irritation		Species recorded in India
	Poisoning		Distribution in India
	Electric shock		World Distribution
			Habitat

# 1. INTRODUCTION

India is one among 17 mega-biodiversity countries and harbours four of 34 hot-spots of the richest and highly endangered eco-regions of the world. Among the Asian countries, India is perhaps the only one that has a long record of inventories of coastal and marine biodiversity dating back to at least two centuries. In terms of marine environment, India has a coastline of about 8000 km, an Exclusive Economic Zone (EEZ) of 2.02 million km<sup>2</sup> adjoining the continental regions and the offshore islands and a very wide range of coastal ecosystems such as estuaries, lagoons, mangroves, backwaters, salt marshes, rocky coasts, sandy stretches and coral reefs, which are characterized by unique biotic and abiotic properties and processes (Fig. 1). Probable estimates of species diversity have been variously arrived at, by extrapolation of known number of species from a section of the habitat to others. With microbes, such estimates are even less certain. It is likely that more than 99% of the potentially existing microbes are not amenable for detection with the conventional methods and even the number of the known ones has been on the increase. In all probability, the number of species from all groups and all habitats of seas could be of the order of several million but we know only a fraction of that for certain. Even the most recent and most global inventory, the Ocean Bio-geographical Information System (OBIS), has no more than 40,000 species listed. What is unknown of the diversity, thus, far exceeds what is known.

Study of marine fauna in India has drawn greater attention from the 18<sup>th</sup> century onwards. This was achieved due to many surveys and expeditions conducted in the country by westerners in particular by British. The introduction of Surgeon Naturalist in the expedition ships helped the marine research to flourish in varied fields of fauna and flora. Out of 34 phyla, 32 are reported in the marine ecosystems of the world. However, in India major studies have been conducted only on the commercially important organisms such as crustaceans, molluscs, holothurians and higher vertebrates. Focus of studies was not made on many minor phyla, which are not important for commercial purposes. For example, species of different minor phyla 'which live as the interstitial fauna' are not reported till today due to lack of expertise in the field.



**Fig. 1** Map showing the coastal areas of India

There are many marine animals which are dangerous to eat, to be eaten by, or to touch. The diver who is content to observe or photograph the creatures of this undersea environment will rarely have his safety threatened by them. The knowledge about the dangers in the sea will help the people who are visiting the sea to stay safe about them.

Two types of risks can be distinguished in relation to dangerous aquatic species. The first type of risk is infectious disease transmitted by species with life cycles that are linked to the aquatic environment. The second type is injury or intoxication (e.g., ciguatera, histamine poisoning, shellfish etc.) resulting from direct encounters with large animals or venomous species (Bowles and Swabyfield, 2006; Lim and Kumarasinghe, 2007; Fautin *et al.*, 2009; Edmond *et al.*, 2010). Injuries from encounters with dangerous aquatic organisms are generally sustained in one of the following ways:

1. Accidentally brushing past a venomous sessile or floating organism when swimming;
2. Entering waters frequented by dangerous jellyfish (e.g., box jellyfish);
3. Inadvertently treading on a stingray, weaver fish or sea urchin;
4. Unnecessary handling of venomous organisms during seashore exploration;

5. Invading the territory of large animals when swimming or at the waterside;
6. Swimming in waters used as hunting grounds by large predators; or
7. Intentionally interfering with or provoking, dangerous aquatic organisms.

Perceived risks involving dangerous aquatic organisms may have important economic repercussions in areas that depend to a large extent on recreational tourism as a source of income.

## Types of Negative Interaction with Marine Fauna

### 1. Envenomations



Envenomation, the injection of venom into the body through either bites and/or stings, is perhaps the most rapid and immediate deleterious response invertebrates can inflict on humans. The response of such envenomations can range from mild irritation and limited necrosis of tissue to systemic failure and death. The venoms producing these conditions are broadly grouped as either neurotoxic or necrotic. Neurotoxic venoms are those that negatively affect the nervous system while necrotic venoms are those that destroy blood and tissue. Occasionally, the venom of some invertebrates contains both neuotoxic and necrotic properties (Figs. 2 & 3)



Fig. 2 : Common scorpion fish, *Pterois antennata*

## **2. Bites**



Bites, piercings and stings caused by a wide variety of invertebrates can produce varying amounts of suffering among victims. Symptoms can range from mild annoyance to incapacitation. Although such physical trauma generally is not lethal, it may render a victim incapable of normal activity, and it can result in psychological disturbance among certain individuals.

## **3. Irritations**



Urtication is a physiological response to contact with toxins of certain invertebrate body parts, such as nematocysts (stinging cells) of jellyfish and corals. Urtication can cause a painful burning and itchy skin eruption, or hives, at the point of contact. Although rarely fatal, urtication can be debilitating and may result in systemic shock in some individuals. Allergic reactions occur primarily through contact with venom, saliva, or certain body parts of invertebrates such as setae. Reactions can be either localized (wheals, swelling) or systemic (anaphylactic shock), and the range of severity, including death, is broad.

Common medicines used for allergic reactions are

1. Epinephrine (Adrenaline) should be administered for severe reaction (EpiPen-injectable allergy kit)
2. Prednisone (Corticosteroid) can be administered for severe reaction (4-6 hr onset delay)
3. Benadryl (Diphenhydramine) should be administered by mouth for mild reaction; this drug is a mild sedative (drowsiness)
4. Beware of the danger of adverse drug interaction leading to abnormal heart rhythm

## **4. Poisoning**



Poisoning forms of the marine animals are very frequent. The signs of seafood poisoning are:

1. Allergic reactions, tingling around mouth
2. Headache, dizziness

3. Abdominal cramps and burning, diarrhea
4. Vomiting, nausea
5. Paralysis
6. Muscle and joint aches
7. Reversal of hot and cold sensations, chills and fever



Fig. 3: Common puffer fish *Diodon hystrix*, which causes sea food poisoning as well as envenomation

## 5. Electric shock



This happens mainly from the electric rays and so mainly a threat for the divers. Electric rays discharges of higher voltage as salt water. It is with such a battery that an average electric ray may electrocute larger prey with a current of up to 30 amperes and a voltage of 50 to 200 volts, a similar effect to dropping a mains-powered hair dryer into a bathtub.

## Risk of Marine Animals

The relative risk caused by certain marine animals and necessary attention to be paid for affected human are given in Table 1. However the individual reactions to hazardous marine life injuries may vary due to age and health of the person, susceptibility to the venom or injury, possible allergic reaction and previous exposure to venom.

**Table 1** Relative risk to humans caused by marine animals.

Organism	Discomfort	Requires Further Medical Attention	May require emergency Medical attention
<b>Non-Venomous organisms</b>			
Sharks		Yes	✓
Barracudas		Yes	
Groupers		Yes	
Piranhas		Yes	
Eels		Yes	
Electric Fish		Yes	✓
Crocodile		Yes	✓
<b>Venomous Organism</b>			
Sponges	Yes	Yes	
Hydroids	Yes	Yes	
Portuguese man-of-war	Yes	Yes	✓
Jelly fish	Yes	Yes	✓
Corals	Yes	Yes	
Sea anemones	Yes	Yes	
Blue ringed octopus		Yes	✓
Cone shells	Yes	Yes	✓
Bristle worms	Yes	Yes	
Crown of thorn star fish	Yes	Yes	
Sea urchin		Yes	✓
Sting rays		Yes	✓
Stone fishes	Yes	Yes	✓
Other spiny fish	Yes	Yes	
Surgeon fish		Yes	
Sea snakes		Yes	✓

(✓ - Associated / probably associated with fatalities)

## Facts and Stats on Marine Hazards

- Box jellyfish have been known to kill people within three minutes, blue-ringed octopus in 30 minutes and puffer fish (eaten) in 17 minutes.
- At least 65 people have been killed by box jellyfish in the last century, over 30 of them on beaches between Mackay and Cairns.
- Aboriginal people long knew about box jellyfish, but it was not until after the death of a five-year-old boy at Cardwell, in 1955, that *Chironex fleckeri* was identified by scientists. The irukandji (*Carukia barnesi*) was first scientifically identified in 1961 by Cairns doctor, John Barnes. He named it after the local Irukandji Aboriginal people.

4. Toad/puffer fishes are not only poisonous to eat but can, with their beak-like mouths, remove toes and fingers. Ancient laws worldwide forbade consumption of these species - fish without scales are classed as 'unclean' in the Old Testament.
5. At the base of the tails of the aptly named surgeon fish are razor sharp blades which can inflict nasty cuts. No venom, however, is involved.
6. One can more likely to die from a box jellyfish sting than a shark attack. Reef sharks are not normally aggressive to humans but should be treated with respect. Night swimming and carrying bleeding fish underwater are prone to shark attacks.

## **Types of Marine Ecosystem in India**

### **Coastal ecosystems**

Coastal zone represents 18% of the earth's total surface, providing space for 60% of the human population, since about 70% of the world cities with population more than 1.6 million are located in the coastal zone. 90% of the world's fish catch is obtained from this zone. Interestingly, the hydrosphere of the coastal zone is only about 8% but represents about 18 to 33% of the total primary production. This zone is bio-geo-chemically more important as it buries and mineralizes 80-90% of organic matter and the approximate carbonate deposition is estimated to be 50%. This area also receives discharges of suspended matter, associated with elevated levels of pollutants, from major rivers and this accounts for 75 to 90 %. This zone has high biological potential as it serves as the feeding, nursery and spawning grounds with rich biodiversity with an intermediary biotope between marine and freshwater environments (Table 2).

Coastal ecosystem plays a vital role in India's economy in view of its resources, productive habitats and rich biodiversity. India has a coastline of 8,000 km and of this the mainland accounts for 5,422 km. Lakshadweep coast extends up to 132 km and Andaman and Nicobar Islands have a coastline of 1,962 km. Nearly 250 million people dwell within a distance of 50km from the coast. The coastal area is assuming greater importance in recent years, due to

the increasing human population, large-scale urbanization and accelerated developmental activities. The coastal regions have become a place of hectic human activity and the coastal ecosystems are now highly disturbed and very much threatened. The present approach to the management of coastal resources is not capable of sustainable development and therefore the coastal environments and resources are being rapidly degraded and eroded in India (Venkataraman, 2007; Venkataraman and Wafar, 2005).

The Indian mainland coast is divided into two segments – the west coast and the east coast. The west coast is along the Arabian Sea and the east coast is along the Bay of Bengal. Other than these two mainland coasts, there are three island groups such as Lakshadweep in the south Arabian Sea, Andaman and Nicobar in the eastern Bay of Bengal. The east and west coasts are markedly different in their geomorphology. The west coast is composed of heavy surf and rocky shores and headlands. The east coast is generally shelving with beaches, lagoons, deltas and marshes. It is also relatively low lying with extensive alluvial plains and deltas. The physical feature of the Indian coasts is characterized by different types of coastal and shore ecosystems like promontories (near Beypore in Kerala State), sand spits (at Karnataka and Andhra Pradesh), barrier beaches (along the Kerala coast), bayments (Mirya bay in Maharashtra), estuaries and offshore islands.

Indian sub-continent has a long coastline of about 8000 km covering the 9 maritime states and the Union Territories of the Andaman and Nicobar and the Lakshadweep Islands. Further, the coastal zone of India is also endowed with a wide range of coastal ecosystems such as estuaries, lagoons, mangroves, backwaters, salt marshes, rocky coasts, sandy stretches and coral reefs which are characterized by unique biotic and abiotic properties and processes. More than half the Indian coastline is sandy. The west coast is predominantly rocky consisting of silt covered rocky flats or lime stone rocks, often with overhanging cliffs formed of green to black basalt. Sandy areas, rivers, creeks interrupt the rocky coast, and back waters. On the east coast, small stretches of rocky formations occur along Tamil Nadu and Andhra Pradesh.

The areas under major ecosystem/habitat categories of the coast are given below:

Table 2 Different coastal and marine ecosystems in India

Catagories	Area in Sq. Km.	Catagories	Area in Sq. Km.
Mudflat	2961	Flood prone area	3437
Beach/Spit	1465	Coastal Dunes	2509
Shoad/Bar	93	Reclaimed Area	1212
Coral Reef	1270	Paleo Beach Ridges	434
Mangroves	3979	Paleo Mudflats	6821
Marsh vegetation	370	Strand Plain	1378
Mudflat with vegetation	6125	Salt affected area	697
Beach Vegetation	290	Salt pans	1617
Lagoon/Backwaters	2132		

## Mangroves

Mangroves are one of the most extraordinary ecological formations occurring almost exclusively in the tropics. Like the tropical rain forests, the mangroves have also played a very important role in the economics of our coastal population for thousands of years, providing them with a wide variety of goods and services including wood production, support for commercial and subsistence fisheries, aquaculture, salt production, shore-line and coastal erosion control.

India has only 2.66% of the world's mangroves, 6.42% of mangroves exist in the South and Southeast Asia, 9.83% in America, 17.29% in West Africa, 25.69% in Australia and 46.65% of mangroves in east Africa and the Middle East. The total area of mangroves in India is estimated to be 4,827 square km. The east coast is endowed with the world's largest mangrove forest - the Gangetic Sunderbans in West Bengal. The Sunderbans mangroves are of the delta type. The 2109 sq. km area of Sunderbans has 30 of the 50 species of the true mangroves in the world. The mangrove area in Orissa is nearly 200 sq. km in extent and its degradation is placed at 20 sq. km over ten years, as per recent estimates. Andhra Pradesh has about 582 square km of mangrove area. The area under mangrove ecosystem in Tamil Nadu is about 225 sq. km. One of the largest and most unspoiled mangrove forests in Tamil Nadu is at



Fig. 4 Mangrove *Rhizophora apiculata*

Pitchavaram in Cuddalore district, spread over an area of 1100 ha. Out of India's total area under the mangroves, about 57% are found on the east coast, 23% on the west coast and the remaining 20% the Andaman and Nicobar Islands. There are three types of mangroves in India namely deltaic, backwater-estuarine and insular. The deltaic mangroves occur on the east coast (Bay of Bengal) where the mighty rivers make the delta. The backwater-estuarine type of mangroves that exists in the west coast is characterized by typical funnel-shaped estuaries of major rivers (Indus, Narmada, Tapti) or backwaters, creeks, and neritic inlets. The insular mangroves are present in the Andaman and Nicobar Islands, where many tidal estuaries, small rivers, neritic islets, and lagoons support a rich mangrove flora (Fig. 4).

### Sea grass bed

Sea grasses occur in the infra-tidal and mid-tidal zones of shallow and sheltered localities of sea, gulf, bays, backwaters and lagoons. They are submerged monocotyledonous plants adapted to the marine environment for completion of their life cycle under water. They occur along the east and west coasts and Andaman and Nicobar Islands. They form a dense meadow on the sandy and coral rubble bottoms and sometime in the crevices under water. In India, the earlier studies revealed that about 14 species are found



Fig. 5 Sea grass ecosystem, *Halophila* sp.

along the India coast. The dominant species are *Cymodium rotundata*, *Enhalus acoroides*, *Halodule pinifolia pinifolia*, *H. uninervis*, *H. wightii*, *Halophila beccarii*, *H. deeciciens*, *H. ovalis*, *H. ovata*, *H. stipulacea*, *Syringodium isoetifolium*, *Thalassia hemprichii* and others. About 9 species of seagrass are extensively found in the Andaman and Nicobar Islands. The unique ecological importance of the seagrass for the conservation of rare and endangered animals like marine turtles, dugongs, some common echinoderms, juvenile prawns and fishes is very well known.

## Coral Reefs

In India, all the three major reef types (atoll, fringing and barrier) are found, and the region includes some of the most diverse, extensive and least disturbed reef areas of the Indian Ocean and many of them are among the least scientifically known. The mainland coast of India has two widely separated areas containing reefs: the Gulf of Kachchh in the northwest, which has some of the most northerly reefs in the world, and Palk Bay and Gulf of Mannar in the southeast. There are patches of reef growth on the west coast - for example, the coral reefs at Malvan. The Andaman and Nicobar have fringing reefs around many islands, and a long barrier reef (329 km) on the west coast. The reefs are poorly known scientifically but may prove to be the



**Fig. 6** Coral reef ecosystem, *Acropora formosa*

most diverse in India and possibly in the best condition. The Lakshadweep has extensive reefs but these are equally poorly known (Fig. 6).

### **Pelagic and benthic ecosystems**

The fauna of the marine ecosystem is not evenly distributed throughout the oceans. It is estimated that 90 percent of marine species live in about 50 million sq. km of the total 352 million sq. km. The patterns of biodiversity are determined by the availability of light in the sea. The pelagic ecosystem is dominated by plankton, which is classified on the basis of size as picoplankton (0.2-2 mm), nanoplankton (2-20 mm) microplankton (20-200 mm) and mesoplankton (>200mm). Mesoplankton includes copepods, rotifers etc. Larvae of many benthic invertebrates represent mesoplankton.

Plankton occurs everywhere in the sea and they differ only in the species composition and relative abundance. Pelagic life also includes nekton represented by shrimp fish, squid, cuttle fish, reptiles, whales and sea cows. Pelagic life thus has a tremendous diversity in form and function. Dominant taxa in the nekton are fishes represented by about 4000 species in the Indian Ocean - of which about 50% occur in the Indian seas. A majority of these species occurs in coastal waters supporting valuable fisheries. Among

reptiles, sea snakes and turtles are important and represented by 50 and seven species in the world respectively. These are generally oceanic forms but majorities of these often swim near to the shore and visit the shore at some part of their lives. About 26 species of snakes belonging to the family Hydrophiidae and five species of sea turtles are reported from seas around India. The seashore offers a veritable feeding and breeding ground for a number of birds. From the available data, it has been inferred that there are 12 families, 38 genera and 145 species of seabirds that occur, in the coastal ecosystem.



**Sandy shore, Havelock Island, Andaman**

## 2. DANGEROUS AND VENOMOUS MARINE ANIMALS

### 1. PORIFERA



About a dozen species of marine sponges distributed in eight different families are reported to have toxic properties. Most species of sponge are harmless to humans, although there are around 12 species thought to be toxic. These include *Micronia prolifera*, *Tedania ignis* and *Fibulila* sp. Sponges constitute the phylum Porifera, and have been defined as sessile metazoans (multi-celled animals) that have water intake and outlet openings connected by chambers lined with choanocytes, cells with whip-like flagella. However, a few carnivorous sponges have lost these water flow systems and the choanocytes. All known living sponges can remodel their bodies, as most types of their cells can move within their bodies and a few can change from one type to another.



Their body consist of jelly-like mesohyl sandwiched between two thin layers of cells. While all animals have unspecialized cells that can transform into specialized cells, sponges are unique in having some specialized cells, but can also have specialized cells that can transform into other types, often migrating between the main cell layers and the mesohyl in the process. Sponges do not have nervous, digestive or circulatory systems. Instead, most rely on maintaining a constant water flow through their bodies to obtain food and oxygen and to remove wastes, and the shapes of their bodies are adapted to maximize the efficiency of the water flow.



If these species are touched they cause redness and swelling and may also cause joint pain.



Reported responses associated with these sponges involve an almost immediate skin irritation and contact dermatitis similar to that observed following contact with poison ivy. Initial symptoms usually include redness at the contact area followed by stiffness in the finger joints (if handled) and localized swelling. Blisters often develop within a few hours.



Treatment of the wounds with antiseptic lotions or dilute acetic acid (vinegar) will help ease the itching and burning. Antibiotic ointments may be necessary for the blisters. Toxic responses are strictly from accidental contact or handling of suspect sponges.



Family: Tedaniidae Ridley and Dendy, 1886

Genus: *Tedania* Gray, 1867

1. *Tedania (Tedania) anhelans* (Liberkuhn, 1859) – (Fig. 7)

Family: Desmacellidae Ridley & Dendy, 1886

Genus: *Biemna* Gray, 1867

2. *Biemna annexa* (Schmidt, 1870)

3. *Biemna fistulosa* Topsent, 1897

4. *Biemna fortis* (Topsent, 1897)

5. *Biemna lipsosigma* Burton, 1928

6. *Biemna microstyla* Thomas, 1984

7. *Biemna tubulata* (Dendy, 1905)



Andaman and Nicobar Islands



Tropical Indo-West Pacific



Mainly intertidal and coral reef areas

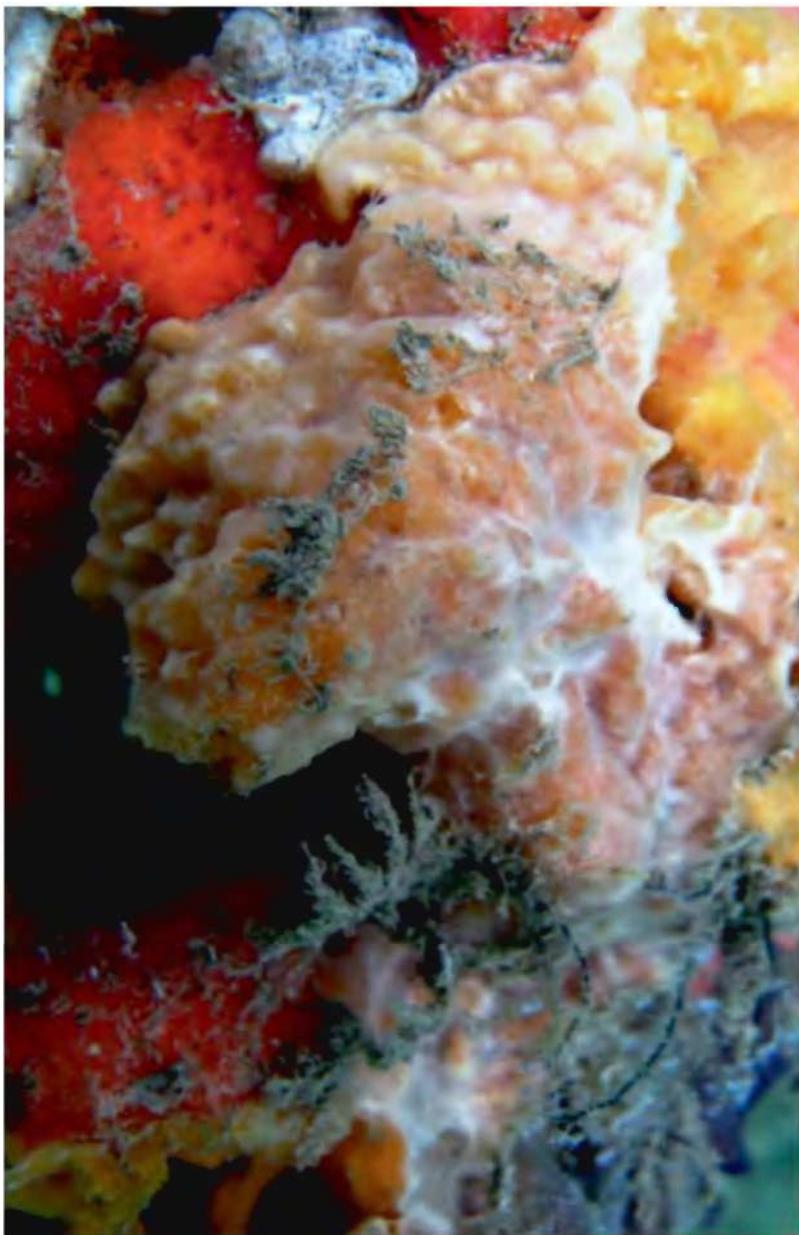


Fig. 7 One of the toxic marine sponges, *Tedania anhelans*

## 2. COELENTERATA



The Phylum Cnidaria, or coelenterates, includes the jellyfish, corals and sea anemones, and numbers over 9,000 species. They are among the most primitive of animals and they are distributed largely in marine systems worldwide. A few species of no medical importance occur in freshwater. They may be conveniently divided into two groups including attached such as coral, and free-swimming medusae (true jellyfish) Coelenterates are carnivorous animals that have developed sophisticated envenomation mechanisms to compensate for their relatively fragile body structures. A large number of cnidarians can produce painful and dangerous stings to humans. The characteristic stinging cells or nematocysts consist of a minute capsule within which is a coiled, barbed tube. When activated, this barbed tube penetrates into the victim and acts as the conduit for the injection of venom. Millions of nematocysts maybe present on the body of a single cnidarians.

Some jellyfish can be extremely dangerous and can kill a person in only a few minutes or less. The sea wasp (*Chironex fleckeri*) is considered to be among the most dangerous of marine animals. Symptoms associated with stinging are highly variable and can range from mild irritation and rashes to severe pain, systemic shock, and death. Other symptoms are known to include headache, abdominal pain, general discomfort and muscle cramps, chills, fever, nervousness and hysteria, diarrhea, vomiting, and cyanosis. Lesions and welts are common at the location of the sting. Although most lesions dissipate within a few hours, the skin may remain reddened for a day or so.



### ***Mild envenomation***

1. Seen with most common jellyfish types.
2. Skin irritation is the major symptom.
3. The Portuguese man-of-war and the box jellyfish can cause envenomation from mild to severe, depending on the degree of exposure to the tentacles.

### ***Moderate envenomation***

Skin symptoms occur in addition to multiple organ systems

1. Neurologic: headache, vertigo, ataxia, nerve palsies, paresthesias, paralysis, coma, and seizures.
2. Cardiovascular: hypotension, arterial spasm, arrhythmias, and CHF
3. Respiratory: rhinitis, bronchospasm, oropharyngeal and laryngeal edema, and respiratory failure
4. Musculoskeletal: myalgias, arthralgias, and muscle spasm
5. Gastrointestinal: nausea, emesis, and diarrhea
6. Other: ocular symptoms and renal failure have also occurred

### ***Severe envenomation***

1. Occurs most commonly due to highly toxic species.
2. Less commonly seen with the Portuguese man-of-war, but can occur with significant exposure.
3. Though rare, deaths due to the Portuguese man-of-war occur in the young, old or those with anaphylaxis in addition to envenomation.
4. Presents as more severe manifestations of moderate envenomation.

***The following dermatologic signs and symptoms are the most common finding in jellyfish envenomations.***

1. Paresthesias, pruritus, and “burning” or “stinging” pain.
2. Red-brown tentacle marks are noted.
3. Vesicles, urticaria, and petechiae can occur
4. In severe cases, ulceration and necrosis can occur.



1. Rinse the wound with seawater.
2. Remove tentacles with a gloved or otherwise protected hand.
3. Acetic acid 5% (vinegar) should be poured on the sting and tentacles as described below:
  - a. It inactivates the nematocysts and toxin for jellyfish. Apply continuously until the pain resolves.
  - b. It may not decrease the pain of a *Chironex* (box jellyfish) sting, but will halt the envenomation process.
  - c. It has been theorized to worsen the release of venom in Portuguese man-of-war stings, so should be used with extreme caution on these stings or tentacles.
4. Isopropyl alcohol can be utilized if acetic acid is not available. However, this should not be used for *Chironex*.
5. Once inactivated, the nematocysts should be removed.
  - a. This is best done by applying shaving cream or baking soda and shaving off the nematocysts.
  - b. If nothing else is available, make a paste of sand and scrape it off with a straight edge.
6. In Portuguese man-of-war stings, hot water (45°C) may be utilized to effectively reduce pain after removal of nematocysts and irrigation of the sting area.
7. Cold packs may also decrease pain.
8. Because of the severe toxicity of *Chironex*, anti-venom is often used in the pre-hospital environment in geographic areas where the creature is ubiquitous.

## 2.1. Jellyfish



The common moon jellyfish, *Aurelia aurita*, is generally considered to be harmless. However, this species occasionally has been known to sting people in various parts of India. All jellyfish sting their prey using nematocysts, also called cnidocysts, stinging structures located in specialized cells called cnidocytes, which are characteristic of all Cnidaria. Contact with a jellyfish tentacle can trigger millions of nematocysts to pierce the skin and inject venom, yet only some species have a sting that will cause an adverse reaction in humans.



Jellyfish have several different morphologies that represent several different cnidarian classes including the Scyphozoa (over 200 species), Staurozoa (about 50 species), Cubozoa (about 20 species), and Hydrozoa (about 1000–1500 species that make jellyfish and many more that do not). Most Jellyfish do not have specialized digestive, osmoregulatory, central nervous, respiratory, or circulatory systems. They digest using the gastro-dermal lining of the gastro-vascular cavity, where nutrients are absorbed. They have limited control over movement, but can use their hydrostatic skeleton to accomplish movement through contraction-pulsations of the bell-like body; some species actively swim most of the time, while others are passive much of the time.



Stings cause instant local pain that may last for up to 30 minutes with residual pain lasting for several days afterward. Encrusted lesions become obvious within a few days and post-inflammatory darkly pigmented skin may still be visible for up to two weeks after the sting.



Severe pain is a predominant feature of a Chironex sting peaking in intensity at 15 minutes but persisting for up to 12 hours. Rapid heartbeat and high blood pressure that begin at the onset of envenomation are superseded by an unusually slow heartbeat, other heart anomalies, pulmonary edema, and shock resulting from the failure of the heart to pump an adequate amount of blood. Also, neuromuscular paralysis may lead to respiratory arrest. Loss of consciousness may ensue rapidly and death may occur within a few minutes of being stung. The skin characteristically shows a beaded or ladder pattern of red, purple or brown whiplash lesions with a frosty appearance reflecting the pattern of nematocysts on the tentacles (Fig.8). Among survivors, these skin lesions subsequently progress over several days until they develop into ulcers and widespread tissue necrosis which heal slowly over several months, often with significant residual pigmentation and scarring.



Management of stinging victims must commence as soon as possible following envenomation. Vinegar should be poured liberally over the affected part in order to inactivate nematocysts. Several other substances have been tried including tea, urine, cola drinks and aluminum sulphate. However, none of these remedies have been shown to be effective and indeed they may make the situation worse by activating un-discharged nematocysts. Freshwater or alcohol must never be poured onto the affected part. Tentacles adhering to the patient should be removed manually and with caution to prevent further stinging, including the care provider. Basic life support measures, including cardiopulmonary resuscitation (CPR) may be required. Following first aid measures, hospitalization is usually required and may involve advanced life support measures such as intubation and ventilation. Irregular heartbeat should be treated with appropriate agents and large doses of intravenous narcotic analgesics are generally required to control pain. Skin and tissue

lesions are treated conventionally but may subsequently require surgical debridement and grafting.



#### Class : Hydrozoa (Fig. 9)

1. *Porpita portpita* (Linnaeus)
2. *Velella velella* (Linnaeus)
3. *Antenella secondaria* (Gmelin)
4. *Anthohydra psammobianta* Salvin-Plawen and Rao
5. *Clytia noliformis* (Mc Vrady)
6. *Halamohydra andamanensis* Rao
7. *Halamohydra chauhanii* Rao
8. *Hebella crateroides* Ritchie
9. *Laomedea (Obelia) brixiata*
10. *Macrorhynchia philippina* (Kirchenpaure)
11. *Macrorhynchia phoenacea* (Busk)
12. *Monoserius pennarius* Linnaeus
13. *Nigellastrum mutulatum* (Busk)
14. *Sertularella polyzonias* var. *cornuta* Ritchie
15. *Serularella guardridens* var. *cornuta* Ritchie

#### Class : Scyphozoa

16. *Pelagia noctiluca* Peron and Lesveur
17. *Chrysaora quinquecirrha* Desor
18. *Aurelia solidia* Browne
19. *Crambionella stuhlamanni* Chun
20. *Rhizostoma* sp.
21. *Acromitus flagellates* (Haeckel)
22. *Chiropsalmus quadrimanus* Agassiz



All along the coasts of India, most of the species are seasonal



Jellyfishes are found in every ocean from surface to deep waters



Most of the jellyfishes are pelagic and so cause harm to the swimmers and divers



**Fig. 8** Clinical photographs shows inflamed linear superficial ulcers with overlying crusts on the left forearm of a patient who had jelly fish sting. (Courtesy: Singapore Medical Journal(Left))



**Fig. 9** Some of the common jelly fishes

## 2.2. Portuguese man-of-war



*Physalia physalis*

Portuguese man-of-war *Physalia physalis*, is a large hydroid jellyfish characterized by a large bluish gas filled sac (pneumatophore) that acts like a sail to drive the animals though the water and often towards shore. The stings can produce extremely painful and debilitating stings.



It is distinguished by a contractile horizontal float (Pneumatophore) and the single large main tentacle (cormidi).



Their long tentacles reach up to 10m in length and are responsible for stings causing severe pain followed by a dull ache that involves the joints.



The sting site develops a red line with white lesions that may resemble a ladder-like pattern, and small wheals may develop that resemble a string of beads. A systemic syndrome lasts for up to 24 hours and comprises hypotension (sometimes shock), abnormally fast heart beat, chills, muscle cramps, nausea and vomiting, irritability and confusion. Deaths have been reported from respiratory failure.



Treatment is mainly supportive but may require advanced life support measures in some cases. Local corticosteroid creams may reduce inflammation. Patients should be hospitalized and possibly admitted to intensive care depending on the severity of the systemic syndrome.



Order: Siphonophora  
Family: Physaliidae  
*1. Physalia physalis* (Linnaeus, 1758), Fig. 10



Reported from all along the coasts of India



Although they can be found anywhere in the open ocean, they are most commonly found in the tropical and subtropical regions of the Pacific and Indian Oceans, and the northern Atlantic Gulf Stream. The Physalia has been found as far north as the Bay of Fundy and the Hebrides.

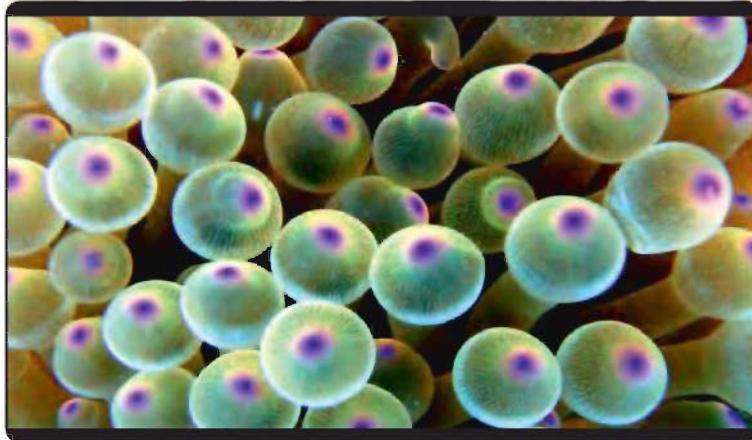


Pelagic



Fig. 10 *Physalia physalis* with the extended pneumatophores

## 2.3. Sea anemones



Sea anemones are a group of water-dwelling, predatory animals of the order Actiniaria; they are named after the anemone, a terrestrial flower. They are common in the Rocky intertidal areas, rock pools and the coral reefs of India. Most species inhabit tropical reefs, although there are species adapted to relatively cold waters, intertidal reefs, and sand/kelp environments.



A sea anemone is a polyp attached at the bottom to the surface beneath it by an adhesive foot, called a basal disc, with a column shaped body ending in an oral disc. The mouth is in the middle of the oral disc surrounded by tentacles armed with many cnidocytes, which are cells that function as a defense and as a means to capture prey. Cnidocytes contain nematocysts.



The stings of some sea anemones can be dangerous, causing pain and incapacity. Fortunately most sea anemones have nematocysts that are too weak to penetrate human skin (Fig. 11).



Initial symptoms vary from a prickly sensation to severe pain. The afflicted area can become red, swollen, and blistered. Stings by the more dangerous anemones can cause shock and respiratory distress. *Balloon corallimorphs*, *Amplexidiscus*

*fenestrafer*, a colonial mushroom anemone, produce stinging threads capable of penetrating wetsuits of unsuspecting divers causing significant stinging. In some victims, such stings have been known to cause long-term neurological damage.



Treatment for sea anemone stings is the same as for jellyfish.



Fig. 12

1. *Actinogeton sultana* (Carlgren)
2. *Anemonia indicus* Parulekar
3. *Anthopleura asiatica* Uchida
4. *Anthopleura midori* Uchida
5. *Anthopleura pacifica* Uchida
6. *Anthopleura panikkarii* Parulekar
7. *Bunodosoma granulifera* (Lesseur)
8. *Cribrinopsis robertii* Parulekar
9. *Paracondylactis indicus* Dave
10. *Entacmaea quadricolor* (Ruppell and Leuckart)
11. *Actinodendron arboreum* (Quoy and Gaimard)
12. *Cryptodendrum adhaesivum* Milne Edwards
13. *Stichodactyla gigantea* (Forsskal)
14. *Stichodactyla haddoni* (Saville – Kent)
15. *Heteractis magnifica* (Quoy and Gaimard)



Reported from all along the coasts of India



Circum tropical



Mostly intertidal and rocky/coral reef ecosystem. But the animals are found in almost all the ecosystem up to the deep waters.



**Fig. 11** Clinical photograph shows crusted plaques with eschar on the right leg of a patient who had a sea anemone sting. (Courtesy: Singapore Medical Journal)



**Fig. 12a** *Antipatharia* sp., *Heteractis magnifica* (from top)



Fig. 12b *Entacmaea quadricolor*, *Amplexidiscus fenestrafer*, *Cryptodendron adhaesivum*, (from top)

## 2.4. Sea Ferns



*Eudendria sp.*

Among the more common sessile hydroid colonies are the Cypress Sea Fern, *Aglaophenia cupressina*, and the White-Stinging Sea Fern, *Lytocarpus philippinus*, of the central and southern Pacific Ocean. These animals have delicate fronds with rows of tiny polyps along each limb. Despite their delicate appearance, the slightest brush against one of these hydroid colonies causes immediate pain.



They generally have delicate fronds with rows of tiny polyps along each 'limb'. The slightest brush against a hydroid causes instantaneous pain and quite often the diver is not aware what produced the painful stinging feeling. Colonies erect, main stem simple or branched, bearing side branches.



A few sessile hydroid colonies are capable of inflicting dangerous stings to people.



The stinging begins as a patchy area of reddened skin and can develop into wheals within 30 minutes. The affected area may take up to a month to heal.



Local anesthetic ointment is effective as a pain reliever.



*Pennaria* sp. (Fig. 13) and *Eudendrium* sp. (Fig. 14).



All along the coasts and Island ecosystems where rocky intertidal areas and coral reefs are present.



Tropical or semitropical



Common encounter in the rocky intertidal areas and the coral reefs.



Fig. 13 *Pennaria* sp.



Fig. 14 *Eudendria* sp.

## 2.5. Corals



*Millepora sp.*

Corals are a diverse group of marine sessile coelenterates who secrete calcareous, rock-like shelters that can occur in such densities as to create islands and atolls. The Great Barrier Reef of Australia is composed of the calcareous limestone deposits of dead and living corals. One of the most common fire corals distributed in warm oceans around the world is *Millepora* (Fig. 15)



Solitary or colonial with a calcareous exoskeleton (corallum). The calices (concavities of the corallum which contains the polyps) regularly subdivided by calcareous radial septa. They are closely related to the sea anemones. In contrast to sea anemones, stony corals produce a calcium carbonate skeleton. The skeleton provides the colony with a uniform substrate on which the living colony rests. The sclerosepta may contribute to the adherence of the polyps within the thecal cups and provide some protection against grazing predators when the polyps are withdrawn.



Wherever corals occur they can pose two potential threats to people. Many corals both dead and alive are very sharp and can produce serious cuts to unprotected areas of the body. These types of corals are especially dangerous in tropical regions of the Pacific Ocean. Precaution should be taken in areas where these

corals occur and signs posted on beaches warning of dangerous corals should be taken seriously. The other type of dangerous corals produces stings when accidentally contacted.



Stings feel like burns and generally produce reddened inflamed patches on the skin where the contact occurred.



Local anesthetic ointment is effective as a pain reliever, but victims may require additional medical treatment in severe cases.



More than 300 species of corals are reported from India. The stinging coral *Millepora* sp. also reported from India (Fig.16).



Gulf of Kachch, Goa, Lakshadweep, Gulf of Mannar and Andaman & Nicobar Islands.



Circum tropical



Benthic, Sub-tidal up to 60 meters (with an exception of deep sea ahermatypic corals).



Fig. 15 *Millepora* sp. (Fire coral)



**Fig. 16** *Millepora exssesa, Acropora hyacinthus* (1<sup>st</sup> row from left)  
*Anacropora reticulata, Stylophora pistillata* (2<sup>nd</sup> row from left)  
*Merulina ampliata, Seriatopora hystrix* (3<sup>rd</sup> row from left)

### 3. BRYOZOA



Bryozoans (Phylum Ectoprocta) are colonial animals found in both freshwater and marine habitats. Bryozoans are the largest and the most common of the lophophorate phyla which contains approximately 4000 living species. They are colonial and sessile animals, and the individuals composing the colonies are usually less than 0.5 mm.



Individuals in bryozoan (ectoproct) colonies are called zooids, since they are not fully independent animals. All colonies contain autozooids, which are responsible for feeding and excretion. Colonies of some classes have various types of non-feeding specialist zooids, some of which are hatcheries for fertilized eggs, and some classes also have special zooids for defense of the colony.



A single marine species, *Alcyonium gelatinosum* (Family Alcyoniidae), can produce irritating erythematous dermatitis when contacted.



The allergic response typically follows repeated exposures to these animals and not one time encounters.



Topical antihistamine treatments are recommended for treatment.



It is to be noted that vast stretches of the long Indian coastline still remain unexplored and biology and ecology of several species still remain uninvestigated.



Most marine species live in tropical waters, but a few occur in oceanic trenches, and others are found in polar waters.



Hard surfaces—rock, shells, coral, and wood. A few also live on soft bottom. Most marine species live in tropical waters at depths <100 m. However, a few have been found in deep-sea trenches, especially around cold seeps, and others near the poles.

## 4. ANELIDA



*Phyllodoce quadraticeps*

### 4.1. Bristle worms

Polychaete worms are very common marine animals, but their secretive habits result in their being overlooked by casual. Certain free-living marine worms known as fire worms (Class Polychaeta, *Hermodice carunculata*, *Eurythoë complanata*) have hollow, toxin-filled setae that cause painful stings when they break human skin. Another group of marine polychaetes do not sting with their setae but they inflict painful bites with a pair of fangs located at the tip of an eversible proboscis. Worms belonging to this group include *Eunice aphroditois*, *Onuphis teres*, and *Glycera* sp. The fangs of *Glycera* sp. are equipped with venom glands and their bites are reportedly similar to that of a wasp sting.



The generalized polychaete is perfectly metamerized, with each of the cylindrical body segments being identical and each bearing a pair of lateral, fleshy, paddle-like appendages called parapodia. At the anterior of the worm is a well developed prostomium, which bears eyes, antennae and a pair of palps. The mouth is located on the ventral side of the body between the prostomium and a post oral region which is called the peristomium. Polychaetes can be errant (free living) or sedentary, although the distinction is not always sharp. The errant polychaetes include some species that are strictly pelagic, some that crawl about beneath rocks and shells, and some that are active burrowers in sand and mud.



The retractable setae can be extended by the worm when they are threatened.



Reactions to the venom may include a long-lasting burning sensation and associated inflammation, itching, and numbness, in addition to the possibility of secondary infection. The burning sensation typically last several hours but can last several days in some cases.



Remedies for the burning include removing the offending setae from the skin using a pair of forceps or sticky tape, and gently soaking the affected area with isopropyl alcohol, vinegar, or diluted (10%) ammonia. Topical benzocaine can relieve pain, and antibiotic ointment should be applied to the wound to minimize the possibility of a secondary infection. Prior to removing the offending setae, the skin should not be rubbed as this only aggravates the stinging.



Fig. 17

1. *Eunice indica* Kinberg, 1865
2. *Maldane cristata* Treadwale, 1923
3. *Euclymene lombricooides* (Quatrefages, 1865)
4. *Ophelia agulhana* Day, 1961
5. *Ophelia acuminata* Oersted, 1843
6. *Protodorvillea biarticulata* Day, 1963
7. *Diopatra cupria punctifera* Ehlers, 1908
8. *Diopatra monroi* Day, 1960
9. *Marphysia purcellana* Willey, 1904
10. *Ninoe* sp.
11. *Lumbrineries magalhaensis* Kinberg, 1865
12. *Onuphis holobranchiata* Marenzeller, 1879
13. *Sthenelais boa* (Johnston, 1839)
14. *Sthenelais limicola* (Ehlers, 1864)
15. *Pseudoeurythoe* sp.
16. *Eupanthalis kinbergi* McIntosh, 1876
17. *Panthalis oerstedi capensis* McIntosh, 1925
18. *Glycera tesselata* Grube, 1863
19. *Glycera convolute* Keferstein, 1862
20. *Glycera nataliensis* Day, 1957

21. *Hemipodus* sp.
22. *Nephthys dibrnachis* Grube, 1877
23. *Nephthys lyrochaeta* Fauvel, 1902
24. *Nephthys sphaerocirrata* Wesenberg Lund, 1949
25. *Nereis* sp.
26. *Tyloneries bogoyawlenski* Fauvel, 1911
27. *Ancistrosyllis constrictata* Southern, 1921
28. *Ancistrosyllis parva* Day, 1963
29. *Synelmis dineti* Katzmann, 1974
30. *Owenia fusiformis* Delle Chiaje, 1842
31. *Jasmineira* sp.
32. *Magelone cincta* Ehlers, 1908
33. *Magelone papillicornis* Muller, 1858
34. *Poecilochaetus serpenes* Allen, 1904
35. *Prionospio sexoculata* Augner, 1918
36. *Phyllodoce quadraticeps*
37. *Polydora* sp.
38. *Diplocirrus capensis* Day, 1961
39. *Diplocirrus* sp.
40. *Pherusa* sp.
41. *Terebellides stromei* Sars, 1835
42. *Scalibregma inflatum* Rathke, 1843



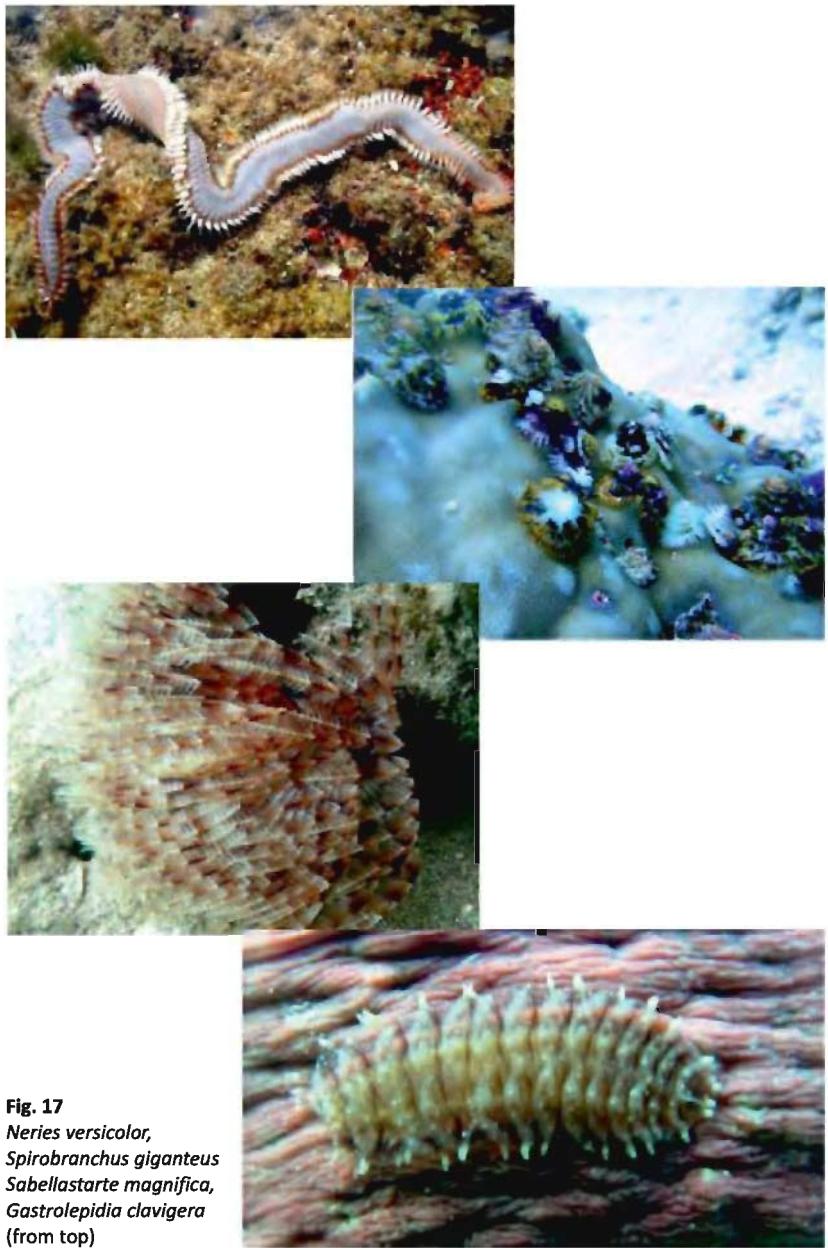
All along the coasts of India including the Island ecosystems



Polychaete worms are found in all the oceans of Earth at all the depth from intertidal to deep sea. None of them can tolerate freshwater.



Mostly benthic (either free living or lives in burrow), Very common in the intertidal rocky areas.



**Fig. 17**  
*Neries versicolor*,  
*Spirobranchus giganteus*,  
*Sabellastarte magnifica*,  
*Gastrolepidia clavigera*  
(from top)

## 5. MOLLUSCA



*Sepia latimanus*

Most potentially harmful mollusks belong to the Class Gastropoda which includes the marine cone snails, pteropods, nudibranchs, and several genera of freshwater snails.

### 5.1. Squids, octopuses and cuttlefishes

There are over 70,000 described species in the Phylum Mollusca that are distributed worldwide in terrestrial and aquatic habitats. However, only a few species can cause injury and potential death to people through envenomation or as a host of certain parasites. All of these molluscs are aquatic and occur in marine or freshwater habitats. Squids, octopuses and cuttlefishes belonging to the Class Cephalopoda of molluscs. There are only about 650 living species of cephalopods, as compared to the more than 7500 different fossil forms.



The head projects into a circle, or crown, of large prehensile tentacles, or arms, which are homologous to the anterior of the foot of other molluscs. The visceral hump is located posterior. Most cephalopods swim by rapidly expelling water from the mantle cavity.



Several members of the Class: Cephalopoda (squids, octopuses, cuttlefishes) are capable of inflicting painful and potentially dangerous bites with their hardened tooth-like beaks. The salivary glands associated with the beaks are used to kill or immobilize prey items, and they will inflict painful bites to people when threatened or handled.



Symptoms stemming from envenomation include pain, stinging and burning sensations and swelling related to the original bite, as well as nausea, vomiting, diarrhea, fever, headache, and chills. Some victims have reported blurred vision, difficulty talking, and loss of feeling in the extremities. Other victims may develop convulsions, respiratory distress, and paralysis. Death can occur, but mortality rates attributed to cephalopods is generally less than one percent.



Recovery normally is complete within 2 days.



Fig. 18

Family OCTOPODIDAE d'Orbigny, 1845

1. *Octopus arborescens* (Hoyle)
  2. *Octopus globosus* Apelloef
  3. *Octopus microphthalmus* Goodrich
  4. *Octopus niveus* Lesson
  5. *Octopus prashadi* Adam
  6. *Octopus rugosus* (Bose)
  7. *Octopus vulgaris* Lamarck
  8. *Octopus (Callistoctopus) cyaneus* (Gray)
  9. *Danoctopus hoylei* (Berry)
  10. *Benthoctopus profundorum* Robson
  11. *Teretoctopus alcocki* Robson
- Family LOLIGINIDAE
12. *Loligo duvaucelii* d' Orbigny
  13. *Sepioteuthis lessoniana* Lesson

Family SEPIIDAE Keferstein, 1866

14. *Sepia aculeata* Ferussac & d' orbigny

15. *Sepia pharaonis* Ehrenberg

16. *Sepiella inermis* (Ferussac & d'Orbigny)

Family SEPIOIDAE Leach, 1817

17. *Euprymna berryi* Sasaki

18. *Inioteuthis japonica* Verrill

19. *Inioteuthis maculosa* Goodrich

Family SEPIADARIIDAE Fischer, 1882

20. *Sepiadarium kochii* Steenstrup



All along the coasts of India including the Island ecosystems



Cephalopods are found in all the oceans of Earth. None of them can tolerate freshwater.



Although some cephalopods, such as the octopus have secondarily assumed a less bottom dwelling habit, the class as a whole is adapted for swimming existence.



Fig. 18 *Octopus cyanea* (top left), *Sepia* sp. (top right) and *Sepia latimanus* (bottom)



## 5.2. Cone shells

Cone shells are widely distributed in the southern Pacific and Indian Oceans but the species most dangerous to people are found in the western and southwestern Pacific from Japan to Australia. Cone shells are predatory on fish and other creatures that they attack with a detachable, sharp tooth equipped with a venom gland. This dart-like tooth can be operated more rapidly than a person can react so cone shells should never be picked-up or held with an unprotected hand. The most dangerous species hunt fish using harpoon-like teeth and a poison gland. Others hunt and eat marine worms or molluscs.



As the name indicates the species is conic shaped and belongs to the super family Conacea (Toxoglossa). These are advanced marine gastropods, in which the radula, the rasping organ of the snails, normally used for scrapping food off surfaces, has been modified for injection of venom into the prey. Cone snails having three types of feeding habits (worm feeding, mollusk feeding and fish feeding) are available in Indian waters. Among these the vermivorous (worm feeding) are more predominant than others and they are of less threat to humans than other two groups.



Cone shells are the most dangerous gastropods to humans because they are capable of stinging humans with painful and potentially fatal results. Several species in genus *Conus* are capable of inflicting severe envenomations to people.



Stings by cone shells results in only a very small puncture mark and, in most cases, they occur on the hand when they are picked-up. At onset the sting produces immediate sharp, burning pain. Some victims may report no such pain initially, and the initial symptoms only manifest as numbness that extends rapidly up the arm. Other symptoms may include a rapidly developing flaccid paralysis along with difficulty in speech and blurred vision. Most patients do not experience any respiratory difficulty. Loss of sensation and complete absence of reflexes may accompany paralysis. Swelling and skin discoloration has been recorded among some victims. In non-fatal cases most symptoms disappear within 24 hours. In fatal

cases, death typically occurs in less than 12 hours and usually in 6 hours or less. Serious and sometimes lethal stings have been reported for at least 14 species of *Conus*. However, the geography cone (*Conus geographicus*) is most commonly implicated in severe stinging cases among people.



Recovery may take from hours to weeks depending on the species and amount of venom delivered.



Figs. 19 & 20

1. *Conus achatinus* Gmelin, 1791
2. *Conus aculeiformis* Reeve, 1844
3. *Conus acutangulus* Lamarck, 1810
4. *Conus amadis* Gmelin, 1791
5. *Conus araneosus* [Lightfoot], 1786
6. *Conus arenatus* Hwass in Bruguière, 1792
7. *Conus asiaticus* da Motta, 1985
8. *Conus augur* [Lightfoot], 1786
9. *Conus aulicus* Linnaeus, 1758
10. *Conus australis* Holten, 1802
11. *Conus bayani* Jousseaume, 1872
12. *Conus bengalensis* (Okutani, 1968)
13. *Conus betulinus* Linnaeus, 1758
14. *Conus biliosus* [Röding, 1798]
15. *Conus characteristicus* Fischer Von Waldheim, 1807
16. *Conus cossorus* Sowerby I, 1833
17. *Conus coronatus* Gmelin, 1791
18. *Conus dictator* Melvill, 1898
19. *Conus ebraeus* Linnaeus, 1758
20. *Conus eburneus* Hwass in Bruguière, 1792
21. *Conus eucoronatus* Sowerby III, 1903
22. *Conus eximius* Reeve, 1849
23. *Conus figulinus* Linnaeus, 1758
24. *Conus frigidus* Reeve, 1848
25. *Conus geographus* Linnaeus, 1758
26. *Conus gubernator* Hwass in Bruguière, 1792
27. *Conus hyaena* Hwass in Bruguière, 1792

28. *Conus imperialis* Linnaeus, 1758
29. *Conus inscriptus* Reeve, 1843
30. *Conus lentiginosus* Reeve, 1844
31. *Conus leopardus* Röding, 1798
32. *Conus litoglyphus* Hwass in Bruguière, 1792
33. *Conus lividus* Hwass in Bruguière, 1792
34. *Conus longurionis* Kiener, 1845
35. *Conus loroisii* Kiener, 1845
36. *Conus madagascariensis* Sowerby II, 1858
37. *Conus malacanus* Hwass in Bruguière, 1792
38. *Conus marmoreus* Linnaeus, 1758
39. *Conus miles* Linnaeus, 1758
40. *Conus milneedwardsi* Jousseaume, 1894
41. *Conus mitratus* Hwass in Bruguière, 1792
42. *Conus monile* Hwass in Bruguière, 1792
43. *Conus nussatella* Linnaeus, 1758
44. *Conus pertusus* Hwass in Bruguière, 1792
45. *Conus praecellens* A. Adams, 1854
46. *Conus pretiosus* Nevill and Nevill, 1874
47. *Conus quercinus* [Lightfoot], 1786
48. *Conus rattus* Hwass in Bruguière, 1792
49. *Conus striatus* Linnaeus, 1758
50. *Conus striolatus* Kiener, 1845
51. *Conus suratensis* Hwass in Bruguière, 1792
52. *Conus terebra* Born, 1778
53. *Conus tessulatus* Born, 1778
54. *Conus textile* Linnaeus, 1758
55. *Conus tuticorinensis* Röckel & Korn, 1990
56. *Conus vexillum* Gmelin, 1791
57. *Conus vimineus* Reeve, 1849
58. *Conus violaceus* Gmelin, 1791
59. *Conus virgo* Linnaeus, 1758
60. *Conus zeylanicus* Gmelin, 1791



All along the coasts of India including the Island ecosystems



Conus snails are mostly tropical in distribution and reach its greatest diversity in the Western Indo-Pacific Region.



This genus is found in all tropical and subtropical seas from tidal waters to deeper areas, living on sand or among rocks or coral reefs. When living on sand, these snails will bury themselves with only the siphon protruding from the surface. Many tropical cone snails live in or near coral reefs. Some species are found under rocks in the lower intertidal and shallow sub-tidal zones.



Fig. 19 *Conus araneosus nicobaricus*, *C. andamanensis*, *C. arenatus* (1<sup>st</sup> row from left)  
*C. bandanus*, *C. canonicus*, *C. capitaneus*, (2<sup>nd</sup> row from left)  
*C. chaldaeus*, *C. ebraeus*, *C. eburneus*, (3<sup>rd</sup> row from left)  
*C. figulinus*, *C. geographus*, *C. litteratus*(4<sup>th</sup> row from left)



Fig. 20 *Conus marmoreus*, *C. miles*, *C. miliaris*(1<sup>st</sup> row from left)  
*C. musicus*, *C. nobilis*, *C. pennaceus* (2<sup>nd</sup> row from left)  
*C. pertusus*, *C. rutilus*, *C. striatus* (3<sup>rd</sup> row from left)  
*C. striolatus*, *Conus morta*, *C. textile* (4<sup>th</sup> row from left)



### 5.3. Nudibranchs or Sea Slugs

Nudibranchs, or sea slugs, particularly the genera *Aeolidia*, *Glaucus*, and *Hermissenda*, feed on various coelenterates and then incorporate the stinging nematocysts into their own bodies for defensive purposes. Nudibranchs often are brightly colored animals but specific identification is difficult and therefore contact with any of these animals should be avoided.



Nudibranchs can be readily identified by the absence of shells and visible gills which protrudes from the body. Aeolid nudibranchs lack distinct gills and utilize cerata for respiration and defense. The cerata contain branches of the digestive tract that transport undeveloped nematocysts acquired from coelenterate prey, where they are stored at the ceratal tips. The nematocysts are then utilized for the self defense.



A sting from one of these nudibranchs is not unlike that of the coelenterate itself.



The irritations are of short duration, no need of special medical attention.



Fig. 21

1. *Aeolidiella alba* Risbec, 1928
2. *Antaeaeolidiella foulisi* (Angas, 1864)
3. *Antaeaeolidiella indica* (Bergh 1888)
4. *Baeolidia palythoae* Gosliner, 1985
5. *Cerberilla ambonensis* Bergh, 1905
6. *Cerberilla annulata* (Quoy and Gaimard, 1832)
7. *Eolidina mannarensis* Rao and Alagarswami, 1960
8. *Aeolidia effulgens* (Kelaart, 1858)
9. *Aeolidia smedleyi* (Kelaart, 1858)
10. *Aeolidia husseyi* Kelaart, 1858
11. *Spurilla salaamica* Rudman, 1982
12. *Glaucus atlanticus* Forster, 1777
13. *Glaucus marinus* (Dupont, 1763)



Gujarat, Maharashtra, Lakshadweep, Tamil Nadu, Andhra Pradesh and Andaman & Nicobar Islands.



Circum global



Most of them are associated with coral reef and the genus *Glaucus* is a pelagic form found in the ocean mainly feeding on the jellyfishes and portuguese man of war.



Fig. 21 *Flabellina exoptata*, *Aeolidiella alba* (1st row from left)  
*Cerberilla amboinensis*, *Cerberilla annulata* (2nd row from left)  
*Phidiana militaris*, *Pteraeolidia ianthina* (3rd row from left)



## 5.4. Pteropods

Pteropods (ex. *Creseis acicula*), or sea butterflies (Fig. 22), are small snails occurring in oceans worldwide.



This sea butterflies (Clade Thecosomata) have a shell, while the Gymnosomata are without a shell. The two clades are in reality not very closely related, despite a superficial similarity, in that they are pelagic, small and transparent, and both groups swim using wing-like flaps (parapodia) which protrude from their bodies.



They can inflict irritating stings causing a raised (maculopapular) rash, but generally this self-resolves and there are no more serious symptoms.



They primarily are a nuisance and not a significant medical threat.



1. *Creseis acicula* (Rang, 1826)
2. *Creseis acicula acicula*
3. *Creseis cherchari* (Bows, 1886)
4. *Creseis virgula* (Rang, 1828)
5. *Creseis virgula conica* Eschscholtz, 1829
6. *Creseis virgula constricta* (Chen and Be, 1964)
7. *Clio cuspidata* (Bosc, 1862)
8. *Clio convexa* (Boas, 1886)
9. *Clio pyramidata* Linnaeus, 1767
10. *Hyalocylis striata* (Rang, 1828)
11. *Styliola subula* Quoy and Gaimard, 1827



Reported from Andaman waters but likely to occur in the entire Indian waters



Circum-global



Pelagic and swims in the water column. When they are plenty in the inshore waters, they form nuisance to the swimmers and divers.



**Fig. 22:** Some of the common pteropods (*Cresies* sp.)  
Courtesy: Ocean Defender Hawaii (2011)

## 6. ECHINODERMATA



Members of the phylum echinodermata are among the most familiar marine invertebrates, and such forms as the sea stars have become virtually a symbol of the sea life. Echinoderms are exclusively marine and largely bottom dwellers. All are relatively large animals, most being at least several centimeters in diameter. The most striking characteristic of the group is their pentamerous radial symmetry.

**Table 3** List of echinoderms reported from India

Class	No. of Species			
	Shallow water		Deep water	Total
	Soft bottom	Hard bottom	Soft bottom	
Crinoidea	4	34	27	65
Asteroidea	25	58	75	158
Ophiuroidea	29	59	64	152
Echinoidea	36	27	50	113
Holothuroidea	24	55	82	161
Total	118	233	298	649

**Table 4** Habitat wise Echinoderm Fauna of Different classes

State	No. of Species in each class					
	Crinoidea	Asteroidea	Ophiuroidea	Echinoidea	Holothuroidea	Total
Gujarat	4	9	13	3	8	37
Maharashtra	1	2	6	3	9	21
Goa	1	4	3	3	5	16
Karnataka	5	5	3	8	6	27
Lakshadweep	5	38	34	29	34	140
Kerala	4	10	15	22	23	74
Tamil Nadu	15	55	35	40	48	193
Andhra Pradesh	4	15	19	24	15	77
Orissa	6	11	13	16	6	52
West Bengal	0	7	7	5	4	23
A & N Islands	50	101	104	79	90	424

## 6.1. Sea stars and brittle stars



Most species of sea stars (Class Asteroidea) are harmless, but a common tropical Indo-Pacific species, *Acanthaster planci* (crown-of-thorns starfish) has venomous spines capable of causing extremely painful wounds. This species can grow to more than 1 foot (300 mm) in diameter, and is distinct from most starfish in having more than a dozen spiny arms (Figs. 23–25).



Sea stars are typically pentamerous, with most species possessing five arms that grade into the disc. However a greater number of arms are characteristic of many asteroids. Unlike those of brittle stars, the arms of asteroids are not sharply set off from the central disc – that is, the width of the arm usually increases towards the base and grades into the disc. In most species the arm length ranges from one to three times the diameter of the central disc.



Contact with the venomous spines of this creature is dangerous. The Mosaic Sea Star, *Plectaster decanus* can cause a skin rash if handled with bare hands, and the Chain-Link Brittle Star, *Ophiomastix annulifera*, (Class Ophiuroidea) has been reported to have caused deaths in small animals. Contact with this species or its body fluids should be avoided.



Causes severe pain, swelling, profuse and frequent vomiting, numbness and occasionally paralysis. In some victims, pain has been known to last for several days. The sharp spines are capable of penetrating gloves, boots and wetsuits.



Immersing the afflicted body part in hot water can reduce the pain, but this may not be practical in some situations. Medical attention is usually required for severe envenomations.



Starfish occur across a broad depth range from the intertidal to abyssal depths (>6000 m).

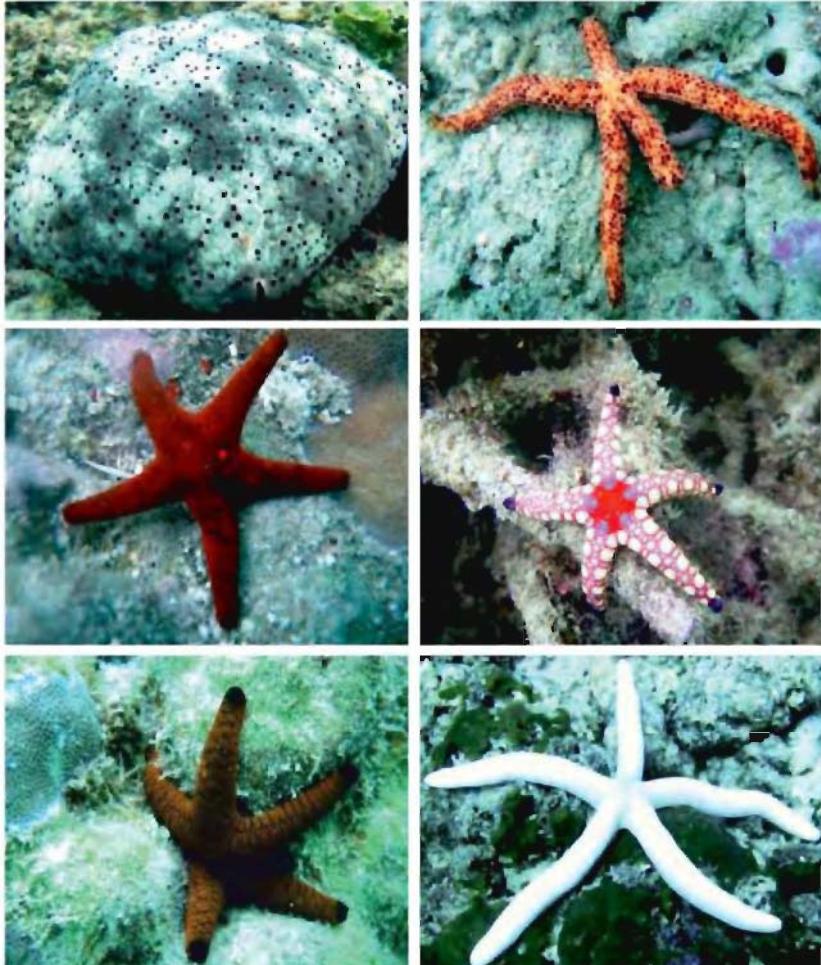


Fig. 23: *Calculta novaguineae*, *Linckia multifora*, (1st row from left)  
*Fromia milleporella*, *Linckia guildingi*, (2nd row from left)  
*Fromia indica*, *Fromia monilis* (3rd row from left)



Fig. 24a *Ophiocoma dentata*, *Ophiothrix purpurea*, *Ophiactis modesta*, (from top)



**Fig. 24b** *Ophiarachna affinis*, *Ophiocoma erinaceus*, *Macrophiothrix propinqua* (from top)



Fig. 25a *Pontiometra andersoni*, *Comanthina schlegeli*, *Comaster mutibrachiatus* (from top)



**Fig. 25b** *Capillaster multiradiatus*, *Colobometra discolor*, *Comanthina nobilis* (from top)



## 6.2. Sea urchins

Sea urchin belongs to the class Echinoidea, which are free moving echinoderms. The name echinoidea, which means “like a hedgehog” is derived from the fact that the bodies of these animals are covered with spines (Fig. 26).



In the class Echinoidea, the spherical or flattened body is not drawn out into arms. The surface is covered with movable spines, which articulate on a test of sutured ossicles. Ambulacral areas containing the podia alternate with interambulacral areas arranged in meridians around the body. The plates of the test are perforated for the exit of gametes and for the canals connecting podia and ampullae.



Similar to the starfishes, some species of sea urchins (Class Echinoidea) have toxic spines and/or minute stalked appendages (pedicellariae), both of which can cause envenomation. The spines also are brittle and can break-off into the skin, resulting in additional physical trauma.



Symptoms associated with stinging include general discomfort, nausea, vomiting, and diarrhea, and headaches. Species in the urchin Family Toxopneustidae have short thick spines that project outward through a display of flower-like pedicellariae. These structures have hook-like jaws that can deliver venom resulting in severe pain, respiratory distress, paralysis, and occasionally death.



A common treatment for sea urchin envenomation is to immerse the punctured area in water heated to a temperature barely tolerable to the touch. Local anesthesia also can be used to alleviate pain. Spines and pedicellariae should be removed from the wound as soon as possible because they continue to release venom until they are removed, and surgical exploration of the wounds may be necessary in severe cases. Local antibiotic therapy after removal of the spines reduces chances of secondary infection.



Found mostly in hard bottom areas, such as rocky intertidal areas, rocky sub-tidal areas and coral reefs.



**Fig. 26** *Arbacia punctulata*, *Diadema setosum* (1<sup>st</sup> row from left)  
*Echinodiscus auritus*, *Mespilia globulus*, (2<sup>nd</sup> row from left)  
*Echinometra mathaei*, *Echinothrix calamaris* (3<sup>rd</sup> row from left)



### 6.3. Sea Cucumbers



The echinoderm group known to be dangerous to people is the sea cucumbers (Class Holothuroidea), although dangerous encounters with these animals are rare (Figs. 27 and 28).



Like echinoids, the body of the holothuroids is not drawn out into arms, and the mouth and anus are located at opposite poles. Also, there are ambulacral and interambulacral areas arranged meridionally around the polar axis. However holothuroids are distinguished from other echinoderms in having the polar axis greatly lengthened, which results in the body having an elongated cucumber shape.



Most problems associated with sea cucumbers are due to consuming the flesh of poisonous species that may result in death. However, some species when threatened or handled will eviscerate their intestines and white sticky threads used for defensive purposes.



These threads and excreted mucus contain a toxin known as holothurian which can cause skin and eye irritation. Reported reactions to the toxin include burning, inflammation, redness, intense pain, and damage to the eyes sometimes causing blindness. Some species of sea cucumbers also ingest other stinging animals and incorporate and excrete those toxins for their own defense.



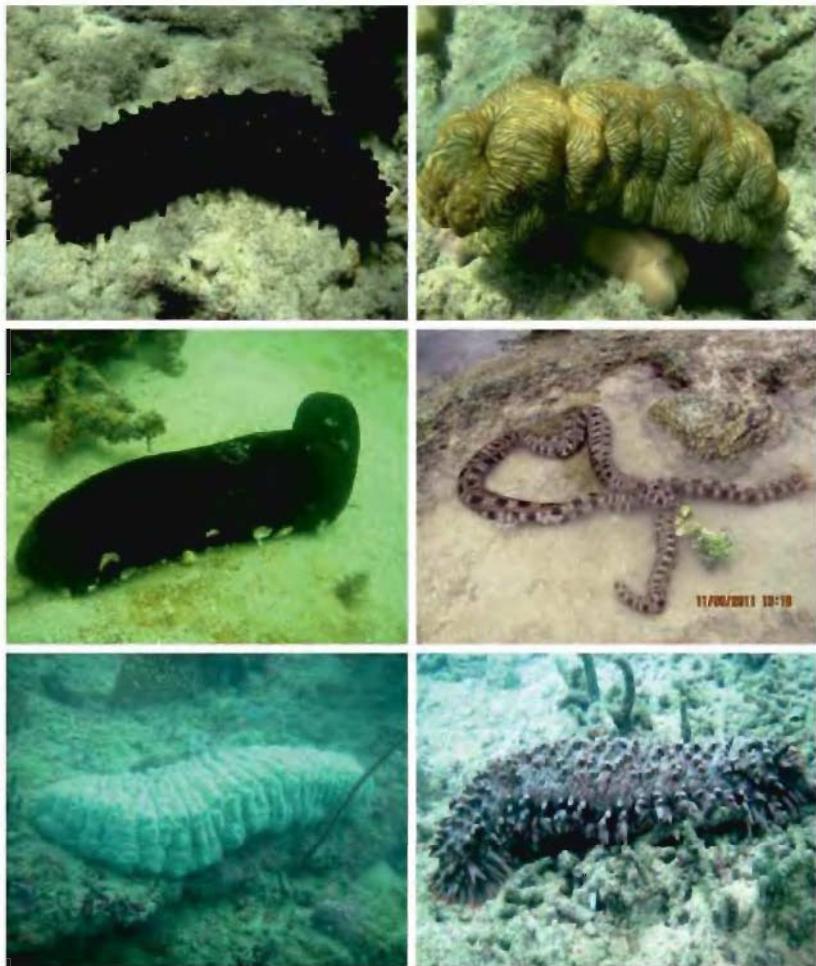
Treat the effected and affected area with disinfectant if the skin is broken. If it has come into contact with the visceral liquid it will appear similar to chemical burns, treat with copious irrigation.



Sea cucumbers are relatively sluggish animals and live on the bottom surface or burrow in sand and mud. Many hard bottom forms live beneath stones and some such as species of *Holothuria*, *Cucumaria* and *Psolus* are so sedentary that the podia are more used for attachment than for locomotion.



**Fig. 27** A threatened sea cumber *Bohadschia marmorata* with intestine eviscerated and white sticky threads.



**Fig. 28** *Stichopus chloronotus*, *S. vastus* (1<sup>st</sup> row from left)  
*S. variegatus*, *Thelenota ananas*, (2<sup>nd</sup> row from left)  
*Holothuria atra*, *Synapta maculata* (3<sup>rd</sup> row from left)

## 7. CHORDATA



### 7.1. Fishes (Dangerous - Those which bite or attack)

There are three types of potentially dangerous marine fish - those that bite, those that sting, and others that are poisonous to eat (Rao *et al*, 2000; Devi and Rao, 2003; Dam Roy *et al*, 2009)

#### 7.1.1. Sharks

Although encounters with sharks are common place in diving, shark attacks on skin and scuba divers are not common. Many of the attacks recorded have been associated with spear fishing or shell harvesting, situations in which vibrations and chemicals given off by the wounded marine animal are likely to attract sharks. There are approximately 1,200 known living and valid species of shark-like fishes, cartilaginous fishes, or chondrichthyans, which form the Class Chondrichthyes. These include at least 50 species of ghost sharks, silver sharks, elephant fish, chimaeras or ratfish (order Chimaeriformes), over 600 species of batoids, flat sharks, or winged sharks (Order Rajiformes), and nearly 500 species of non-batoid, ordinary or traditional sharks. The living shark-like fishes are included in 10 orders, 60 families, and 186 genera.



Courtesy: National Geographic (Photography: Brain Skerry)



Sharks are fishes with a full cartilaginous skeleton and a highly streamlined body. The class Chondrichthyes, from Greek chondros, cartilage, and ichthos, fish, a major taxonomic group of aquatic, gill-breathing, jawed, finned vertebrates with primarily cartilaginous skeletons, 1 to 7 external gill openings, oral teeth in transverse rows on their jaws, and mostly small, tooth-like scales or dermal denticles. Chondrichthyes include the living elasmobranchs and holocephalans and their numerous fossil relatives, and also can be termed shark-like fishes or simply sharks. The term shark generally used for cylindrical or flattened cartilaginous fishes with 5 to 7 external gill openings on the sides of their heads, pectoral fins that are not attached to the head above the gill openings, and a large, stout tail with a large caudal fin; that is, all living elasmobranchs except the rays or batoids. Living sharks in this sense are all members of the Neoselachii, the modern sharks and rays. Shark is also used loosely for fossil chondrichthyans that are not neoselachians but have a shark-like form, and even for 'spiny sharks' (acanthodians) and for certain teleosts. Rays are essentially flattened sharks with the pectoral fins attached to their heads and are cladistically nested within the squalomorph sharks, while living chimaeras are the immediate sister group of living neoselachians and are called ghost sharks or silver sharks.



In a large proportion of attacks on divers the victim was unaware of the presence of the shark until he was actually bitten. Several behavior patterns preceding shark attacks have been documented. In some cases the shark circles the victim and occasionally bumps him (presumably to gain some sensory information about the nature of this unfamiliar but potential food source), before attacking. In many tropical species, sharks may exhibit a threat display (agonistic), apparently in response to a territorial invasion by the diver. This is characterized by the shark swimming with an irregular jerking motion, accompanied by an arched back, head up and pectoral fins pointed downwards. This type of behavior is the signal for the diver who wishes to experience old age, to depart the area. The seriousness of the injury depends on the size of the shark and the ferocity of the attack. Sharks larger than 2 meters in length

have extremely powerful jaws equipped with razor sharp teeth which are easily capable of severing limbs or biting large pieces out of the torso. In spite of this, there have been many instances of divers surviving bites from sharks in excess of 4 meters in length. In some of these, the divers sustained severe lacerations from the puncture wounds of the teeth but no further injury. A shark of this size could easily bite a diver in two, so it appears that in some cases the shark will maul a victim and then not persevere, perhaps due to distaste for wet suit material or other items of the diver's paraphernalia. The blood loss from the massive lacerations accompanying shark attack is severe and immediate. Major blood vessels are frequently torn and generalized bleeding issues from the tissue laceration. Blood loss is often torrential and pulsates from severed arteries.

The victim will display clinical features of severe blood loss — pale clammy skin, a rapid weak pulse, low blood pressure and rapid respiration. Fatality occurs in 25% of cases.



The principles of successful management of shark attack victims were first described by Australian and South African authorities following their combined experiences. They are:

**Stop the blood loss:** This must be done by rescuers at the site of the attack. Bleeding which is oozing or welling up from a wound can be stopped by applying a clean cloth pad to the wound and pressing firmly with the hand or applying a tight bandage. Spurting arterial bleeders up to about 3 mm in size can also be stopped by a pressure bandage or pad. Larger arterial bleeders can be stopped by the application of pressure by a finger or thumb. Bleeding from major blood vessels (the size of a finger) can be stopped by pinching the end of the vessel between finger and thumb, or a tourniquet if a limb is involved. Tourniquets have to be released every 10–20 minutes to let blood return to normal tissues.

**Resuscitate the victim at the site of the attack:** Immobilization is advised. Once the victim is in a place of safety (boat or shore) it is vital that he/she not be moved further. Bundling a victim into the back of vehicle for a bumpy ride to hospital has resulted in death of the victim on many occasions.



### Figs. 29a & b

#### Family: Carcharhinidae (Requiem Sharks)

1. *Carcharhinus albimarginatus* (Ruppell, 1837)
2. *Carcharhinus amblyrhynchos* (Bleeker, 1856)
3. *Carcharhinus brevipinna* (Muller & Henle, 1839)
4. *Carcharhinus dussumieri* (Muller & Henle, 1839)
5. *Carcharhinus hemiodon* (Valenciennes, 1839)
6. *Carcharhinus limbatus* (Muller & Henle, 1839) (Fig. 29a)
7. *Carcharhinus longimanus* (Poey, 1816)
8. *Carcharhinus maculoti* (Muller & Henle, 1839)
9. *Carcharhinus melanopterus* (Quoy & Gaimard, 1824)
10. *Carcharhinus sealei* (Pietschmann, 1913)
11. *Carcharhinus sorrah* (Muller & Henle, 1839)
12. *Galeocerdo cuvieri* (Peron & Le Sueur, 1822)
13. *Glyptis gangeticus* (Muller & Henle, 1839)
14. *Loxodon macrorhinus* Muller & Henle, 1839
15. *Negaprion acutidens* (Ruppell, 1837)
16. *Prionace glauca* (Linnaeus, 1758)
17. *Rhizoprionodon acutus* (Ruppell, 1837)
18. *Rhizoprionodon oligolinx* Springer, 1964
19. *Scoliodon laticaudus* (Muller & Hanle, 1838)
20. *Triaenodon obesus* (Ruppell, 1837)

#### Family: Scyliorhinidae (Cat sharks)

21. *Apristurus investigatoris* (Misra, 1962)
22. *Haelurus hispidus* (Alcock, 1891)

#### Family: Hemigaleidae

23. *Chaenogaleus macrostoma* (Bleeker, 1852)

#### Family: Sphyrnidae (Hammer-headed Sharks)

24. *Eusphyra blochii* (Cuvier, 1816)
25. *Sphyrna lewini* (Griffith & Smith, 1834)
26. *Sphyrna mokarran* (Ruppell, 1837)
27. *Sphyrna tudes* (Valencinnes, 1822)
28. *Sphyrna zygaena* (Linnaeus, 1758)

### Order: LAMNIFORMES

#### Family: Lamnidae (Mackerel Sharks)

29. *Isurus oxyrinchus* Rafinesque, 1810

**Family: Alopiidae (Thresher Sharks)**

**30. *Alopias vulpinus* (Bonnaterre, 1788)**

**31. *Alopias superciliatus* (Fig. 29b)**

**Order: SQUALIFORMES**

**Family: Squalidae (Dogfishes)**

**32. *Squalus megalops* (Mac Leay, 1881)**



Shark species are reported from all the coastal states and Island groups of India.



Sharks are found in all seas.



Sharks are common down to depths of 2,000 m, and some live even deeper, but they are almost entirely absent below 3,000 m. The deepest confirmed report of a shark is a Portuguese dogfish at 3,700 m



**Fig. 29a *Carcharhinus limbatus***



**Fig. 29b *Alopias superciliatus***



## 7.1.2. Barracuda

Barracudas are known for their large size and fearsome appearance. Its body is long, fairly compressed, and covered with small, smooth scales. Some species could reach up to 1.8m in length and 30 cm in width. Barracudas are voracious, opportunistic predators relying on surprise and short bursts of speed (up to 43 km/h) to overtake their prey. Like sharks, some species of barracuda are presumed to be dangerous to swimmers. Barracudas are scavengers, and may mistake snorkelers for large predators, following them in hopes of eating the remains of their prey. Hand feeding or touching large barracuda in general is to be avoided. Spear fishing around barracudas can also be dangerous, as they are quite capable of ripping a chunk from a wounded fish thrashing on a spear.



Body elongate, usually slightly compressed. Head very long, with long snout; mouth large, with lower jaw projecting beyond upper. Strong canine teeth in jaws and on palatines, of unequal size. Scales small, cycloid; lateral line well developed, nearly straight. Two widely separated dorsal fins, the first with 5 strong spines, usually beginning just behind pelvic fins; the second opposite anal fin; pelvic fins closer to pectoral fin base than to anal fin origin; caudal fin forked. Color: usually brown/blue or silver/grey, lighter below. Body sometimes with vertical bars. Fins sometimes yellow, black or grey.



Barracuda attacks mainly occur due to mistaken identity – silver jewellery or watches are taken for small fish and attacked. These attacks can be quite serious as they are very fast moving fish with extremely sharp teeth.



If they are severe injuries should be treated by a doctor, and stitches may be required. Less serious bites should be cleaned and covered and monitored for infection. If possible see a doctor for anti tetanus.



Fig. 30

Family: Sphyraenidae (Barracudas)

1. *Sphyraena acutipinnis* Day, 1876

2. *Sphyraena barracuda* (Walbaum, 1792)

3. *Sphyraena chrysotaenia* Klunzinger, 1884
4. *Sphyraena flavicauda* Ruppell, 1838
5. *Sphyraena forsteri* Cuvier, 1829
6. *Sphyraena jello* Cuvier, 1829
7. *Sphyraena obtusata* Cuvier, 1829
8. *Sphyraena putnamiae* Jordan & Seale, 1905
9. *Sphyraena quenie* Klunzinger, 1870



Oceanic and coastal environments of the Indian waters and in the near shore waters of the Island ecosystems.



This group of fishes is found in tropical and subtropical oceans worldwide.



Pelagic.



Fig. 30 *Sphyraena quenie*



### 7.1.3. Trigger fishes

Triggerfish attacks occur when divers enter the territory of the fish's nest during the breeding season. Male Triggerfish guard the nest, which is a depression in the sand, and the territory spreads upwards like a cone so always swim around, not over, the nest. The most territorial species is the Titan Triggerfish.



Small or medium-sized fishes, usually less than 40 cm in length, with usually deep, compressed bodies encased in a tough armour of minute to moderate rough scales. Mouth small, terminal, teeth not fused together. First (spinous) dorsal fin reduced to 1 to 3 spines, the first often capable of being locked by the second. Pelvic fins absent or fused into a single rudimentary spine or shield-like plate. Gill opening is a small slit in front of pectoral fin base.



Triggerfish teeth are very sharp and can inflict painful cuts.



Wounds should be cleaned and covered and monitored for infection.



Fig. 31

Family: Balistidae (Triggerfishes)

1. *Abalistes stellaris* (Bloch & Schneider, 1801)
2. *Abalistes stellatus* (Lacepede, 1798)
3. *Balistes vetula* Linnaeus, 1758
4. *Balistapus undulates* (Park, 1797)
5. *Balistoides conspicillum* (Bloch & Schneider, 1801)
6. *Balistoides viridescens* (Bloch & Schneider, 1801)
7. *Canthidermis maculatus* (Bloch, 1786)
8. *Melichthys indicus* Randall & Klausewitz, 1973
9. *Melichthys vidua* (Solander, 1844)
10. *Melichthys niger* (Bloch, 1786)
11. *Odonus niger* (Ruppell, 1836)

12. *Pseudobalistes flavimarginatus* (Ruppell, 1829)
13. *Pseudobalistes fuscus* (Bloch & Schneider, 1801)
14. *Rhinecanthus aculeatus* (Linnaeus, 1758)
15. *Rhinecanthus rectangulus* (Bloch & Schneider, 1801)
16. *Rhinecanthus verrucosus* (Linnaeus, 1758)
17. *Sufflamen bursa* (Bloch & Schneider, 1801)
18. *Sufflamen chrysopterus* (Bloch & Schneider, 1801)
19. *Sufflamen fraenatus* (Latreille, 1804)



All along the Indian waters



They inhabit tropical and subtropical oceans throughout the world, with the greatest species richness in the Indo-Pacific.



Most are found in relatively shallow, coastal habitats, especially at coral reefs, but a few, such as the aptly named oceanic triggerfish (*Canthidermis maculata*), are pelagic.



Fig. 31a *Balistoides undulates*, *Balistoides conspicillum* (from left)



**Fig. 31b**  
*B. viridescens*  
*Odonus niger*,  
*Rhinecanthus aculeatus*,  
*Sufflamen chrysopterum* (from top)



#### 7.1.4. Moray eels

The Morays are frequently thought of as particularly vicious or ill-tempered animals. In truth, morays hide from humans in crevices and would rather flee than fight. Morays are shy and secretive, and attack humans only in self-defense or mistaken identity. The largest in terms of total mass is the giant moray (*Gymnothorax javanicus*), which reaches almost 3 m and can weigh over 36 kg. Morays have poor vision and rely mostly on their acute sense of smell, making distinguishing between fingers and held food difficult; numerous divers have lost fingers while attempting hand feedings.



Body elongate, snake like and robust in many species; scaleless; tail compressed; dorsal fin origin before gill opening; dorsal and anal fins continuous with caudal; pectoral fins absent; mouth moderate; posterior nostrils either a slit or tube situated above or before eye; teeth small, conical, molariform or depressible fangs; head pores common; gill opening as a mid lateral pore.



Moray eels bite when provoked or scared, usually because divers are too close or putting their hands on the moray's hole. Eels that have eaten certain types of toxic algae, or more frequently that have eaten fishes that have eaten some of these algae, can cause ciguatera fish poisoning if eaten.



Bites have no venom and should be cleaned, covered and monitored for infection.



Fig. 32

Family: Muraenidae (Moray eels)

1. *Echidna nebulosa* (Ahl. 1789)
2. *Muraena nigra* Day, 1870
3. *Gymnomuraena zebra* (Shaw, 1797)
4. *Gymnothorax favagineus* Bloch & Sch., 1801
5. *Gymnothorax fimbriatus* (Bennett, 1832)
6. *Gymnothorax flavimarginatus* (Ruppell, 1830)
7. *Gymnothorax hepaticus* (Ruppell, 1830)
8. *Gymnothorax javanicus* (Bleeker, 1859)
9. *Gymnothorax pictus* (Ahl, 1789)
10. *Gymnothorax richardsonii* (Bleeker, 1852)

11. *Gymnothorax ruepelliae* (McClelland, 1844)
12. *Gymnothorax thyrsoideus* (Richardson, 1845)
13. *Gymnothorax tile* (Hamilton-Buchanan, 1822)
14. *Gymnothorax undulates* (Lacepede, 1803)
15. *Rhinomuraena quaesita* Garman, 1888
16. *Scuticaria tigrina* (Lesson, 1828)
17. *Strophidon sathete* (Bleeker, 1854)
18. *Uropterygus conicolor* Ruppell, 1838
19. *Uropterygus macrocephalus* (Bleeker, 1865)
20. *Uropterygus marmoratus* (Lacepede, 1803)



West coast of India, Lakshadweep Islands, Gulf of Mannar and Andaman & Nicobar Islands.



Moray eels are cosmopolitan, found in both tropical and temperate seas, although the largest species richness is at reefs in warm oceans.



Morays rest in crevices during the day and hunt nocturnally, although they may ensnare small fish and crustaceans that pass near them during the day. They live at depths of up to several hundred meters, where they spend most of their time concealed inside crevices and niche.



Fig. 32 *Gymnothorax favagineus*, *G. flavimarginatus* (1<sup>st</sup> row from left)  
*G. javanicus*, *C. flavimarginatus* (2<sup>nd</sup> row from left)

## 7.2. Fishes (Venomous - Those which sting)

### 7.2.1. Scorpaenidae (Scorpion fish, Stone fish and Lion fishes)



Scorpion fishes include many of the world's most venomous species. As the name suggests, scorpion fish have a type of "sting" in the form of sharp spines coated with venomous mucus. The spines of and pelvic fins all have venom glands at their bases.



Body slightly compressed to robust; head with spines and ridges; margin of pre-opercle with 3-5 spines; a row of spines below eye on bony ridge; single dorsal, notched strongly at end of spinous part; gill membranes free from isthmus.



Stonefish, Scorpion fish and Lionfish have venomous fin spines. They do not attack divers but are dangerous when stumbled upon; Stonefish and Scorpion fish are difficult to spot and most injuries occur when they are stepped on or touched. If contact with the fish's spines breaks the skin venom may enter the wound. The severity of an injury depends on the species that inflicts it—stonefish can be lethal.



A scorpion fish sting causes intense pain and swelling at the site of the sting. Swelling can spread to affect an entire arm or leg within minutes. Other symptoms can include: Blood pressure changes -- may be high or low, delirium, diarrhea, fainting, heart rate changes -- may be fast or slow, nausea and vomiting, paralysis, seizures and shortness of breath.



Scorpion fish injuries should be immersed in hot water (around 45°C) for 60-90 minutes. This denatures the venom and reduces pain and swelling (pain relief is most effective with lionfish and least effective with stonefish). Wounds should be cleaned and medical advice sought. More serious stings can cause vomiting, weakness, shortness of breath or unconsciousness.



Fig. 33

**Family: Scorpaenidae (Scorpionfishes or Rockfishes)**

1. *Dendrochirus brachypterus* (Cuvier, 1829)
2. *Dendrochirus zebra* (Cuvier, 1829)
3. *Pontinus hexanema* (Gunther, 1880)
4. *Pterois antennata* (Bloch, 1787)
5. *Pterois miles* (Bennett, 1828)
6. *Pterois lunulata* Temminck & Schlegel, 1843
7. *Pterois radiata* Cuvier, 1829
8. *Pterois russellii* Bennett, 1831
9. *Pterois volitans* (Linnaeus, 1758)
10. *Scorpaena haplodactylus* Bleeker, 1852
11. *Scorpaena neglecta* Temminck & Schlegel, 1843
12. *Scorpaena picta* Cuvier, 1829
13. *Scorpaenodes guamensis* (Quoy & Gaimard, 1824)
14. *Scorpaenodes smithi* Eschmeyer & Rama Rao, 1972
15. *Scorpaeopsis cirrhosa* (Thunberg, 1793)
16. *Scorpaeopsis gibbosa* (Bloch & Schneider, 1801)
17. *Scorpaeopsis oxycephalus* (Bleeker, 1849)
18. *Scorpaeopsis venosa* (Cuvier, 1829)
19. *Sebastapistes rhodochrous* (Gunther, 1871)
20. *Sebastapistes strongia* (Cuvier, 1829)
21. *Sebastes stoliczkae* Day, 1875



Most of the species are restricted to Andaman and Nicobar Islands, Lakshadweep Islands and Gulf of Kachchh in the coral reef areas, but many species of stone fishes are found in the rocky intertidal and sub-tidal areas of Indian coast.



They are widespread in tropical and temperate seas, but mostly found in the Indo-Pacific.



Most species are bottom-dwellers that feed on crustaceans and smaller fish. Many inhabit shallow waters, but a few live as deep as 2,200 m.



Fig. 33 *Dendrochirus zebra*, *Pterois antennata*, (1<sup>st</sup> row from left)  
*P. miles*, *P. volitan* (2<sup>nd</sup> row from left),  
*Scorpaenopsis gibbosa*, *Taenianotus triacanthus*.(3<sup>rd</sup> row from left)



## 7.2.2. Rabbit fishes

Rabbit fish (Siganidae), found in shallow lagoons, have small, hare-like mouths, large dark eyes, and a peaceful temperament. They are colorful, and have well developed, venomous dorsal and anal fin spines. Most species have either bright colors or a complex and interesting pattern. The dorsal fin bears 13 spines with 10 rays behind, while the anal fin has 7 spines and 9 rays behind; the fin spines are equipped with well-developed venom glands.



Spiny-rayed fishes with a compressed, oval body covered with minute, thin, cycloid scales (smooth to touch). Mouth small, with a row of close-set teeth in each jaw. Dorsal fin with 13 spines and about 10 soft rays; a sharp spine projecting forward immediately in front of dorsal fin (sometimes covered by skin); pelvic fins with 2 strong spines, separated by 3 soft fin rays; anal fin with 7 spines and about 9 soft rays. All species of *Siganus* have poison glands connected with the fin spines.



Rabbit fish have venomous dorsal and anal spines so needs to take most care when handling fish catches or preparing them to eat.



The sting is painful, but not life threatening.



Immersion in hot water should reduce pain or swelling.



Fig. 34

Family: Siganidae (Rabbitfishes)

1. *Siganus argenteus* (Quoy & Gaimard, 1825)
2. *Siganus canaliculatus* (Park, 1797)
3. *Siganus corallinus* (Valenciennes, 1835)
4. *Siganus fuscescens* (Houssay, 1782)

5. *Siganus guttatus* (Bloch,1787)
6. *Siganus javus* (Linnaeus,1766)
7. *Siganus labyrinthodes* (Bleeker,1853)
8. *Siganus magnificus* (Burgess,1877)
9. *Siganus puelloides* Woodland & Randall,1979
10. *Siganus spinus* (Linnaeus,1758)
11. *Siganus stellatus* (Forsskal, 1775)
12. *Siganus vermiculatus* (Valenciennes,1835)
13. *Siganus virgatus* (Valenciennes,1835)
14. *Siganus vulpinus* (schlegel & Muller,1845)



Coral reef ecosystems of India.



Rabbit fishes are found in shallow lagoons in the Indo-Pacific and eastern Mediterranean.



All rabbit fish are diurnal, some live in school, while others live more solitary lives among the corals. They are herbivorous, feeding on benthic algae in the wild.



Fig. 34 *Siganus canaliculatus*, *S. guttatus*, (1<sup>st</sup> row from left)



**Fig. 34** (From top)

*S. javus,*  
*S. stellatus,*  
*S. vermicularis,*  
*S. virgatus.*



### 7.2.3. Surgeon fishes

The distinctive characteristic of the family (Acanthuridae) is the spines, one or more on either side of the tail, which are dangerously sharp. The dorsal, anal and caudal fins are large, extending for most of the length of the body. The small mouths have a single row of teeth used for grazing on algae. Surgeon fishes sometimes feed as solitary individuals, but they also often travel and feed in schools. It has been suggested that feeding in schools is a mechanism for overwhelming the highly aggressive defense responses of small territorial damselfishes that vigorously guard small patches of algae on coral reefs. These fishes can grow quickly in aquariums so it is advisable to check the average growth size and suitability before adding to a marine aquarium.



Body ovate to oblong and compressed; sides of caudal peduncle with a scalpel like spine which folds into a groove; dorsal profile of head steep; eyes high on head; teeth spatulate with denticulate edges are slender and numerous with expanded incurved teeth; no teeth on palate; dorsal and anal fins continuous and unnotched; scales very small.



Some species of Surgeonfish have pairs of razor sharp retractable blades at the base of the tail, so take care when handling fish catches.



There is no venom; so wounds can be cleaned, covered and monitored for infection.



Fig. 35

Family: Acanthuridae (Surgeonfishes, Tangs, Unicornfishes)

1. *Acanthurus dussumieri* Valenciennes, 1835
2. *Acanthurus mata* (Cuvier, 1829)
3. *Acanthurus bariene* Lesson, 1830
4. *Acanthurus coeruleus* Bloch & Schneider, 1801
5. *Acanthurus japonicas* Schmidt, 1931
6. *Acanthurus leucosternon* Bennett, 1833

7. *Acanthurus lineatus* (Linnaeus, 1758)
8. *Acanthurus nigricauda* Dunker & Mohr, 1929
9. *Acanthurus nigrofasciatus* (Forsskal, 1775)
10. *Acanthurus olivaceus* Bloch & Schneider, 1801
11. *Acanthurus pyroferus* Kittlitz, 1843
12. *Acanthurus thompsoni* (Fowler, 1923)
13. *Acanthurus triostegus* (Linnaeus, 1758)
14. *Acanthurus tristis* Randall, 1993
15. *Acanthurus xanthopterus* Valenciennes, 1835
16. *Ctenochaetus cyanochelius* Randall & Clements, 2001
17. *Ctenochaetus striatus* (Quoy & Gaimard, 1825)
18. *Ctenochaetus strigosus* (Bennett, 1828)
19. *Naso annulatus* (Quoy & Gaimard, 1825)
20. *Naso brachycentron* (Valenciennes, 1835)
21. *Naso brevirostris* (Valenciennes, 1835)
22. *Naso elegans* (Ruppell, 1829)
23. *Naso hexacanthus* (Bleeker, 1855)
24. *Naso lituratus* (Forster, 1801)
25. *Naso lopezi* Herre, 1927
26. *Naso tuberosus* Lacepede, 1802
27. *Naso unicornis* (Forsskal, 1775)
28. *Naso vlamingi* (Valenciennes, 1835)
29. *Paracanththus hepatus* (Linnaeus, 1766)
30. *Zebrasoma desjardinii* (Bennett, 1836)
31. *Zebrasoma scopas* (Cuvier, 1835)



Coral reef ecosystems of India



Tropical coral reef ecosystem.



All the species of this family are living in tropical seas, usually around coral reefs.



Fig. 35 *Acanthurus leucosternon*, *A. lineatus* (1<sup>st</sup> row from left); *A. mata*, *A. tristegus* (2<sup>nd</sup> row from left); *A. xanthopterus*, *Naso brachycentron*, (3<sup>rd</sup> row from left); *N. lituratus*, *N. tuberosus*. (4<sup>th</sup> row from left)



#### 7.2.4. Sting Rays

The sting rays are a group of rays, which are cartilaginous fishes related to sharks. They are classified in the suborder Myliobatoidei of the order Myliobatiformes. Most stingrays have one or more barbed stings (modified from dermal denticles) on the tail, which is used exclusively in self-defense (Fig. 36). The stinger may reach a length of approximately 35 cm, and its underside has two grooves with venom glands. The stinger is covered with a thin layer of skin, the integumentary sheath, in which the venom is concentrated. A few members of the suborder, such as the manta rays and the porcupine ray, do not have stings. Because their eyes are on top of their bodies and their mouths on the undersides, stingrays cannot see their prey; instead, they use smell and electro-receptors (Ampullae of Lorenzini) similar to those of sharks.



Body greatly flattened; pectoral fins expanded and fused with head and trunk; snout angular or rounded; dorsal fins two or one, or none in some species; tail thick or slender and whip like, with a sting.



Sting rays have one or more sharp detachable spines on the basal part of a whip-like tail. They only attack when touched when they flick the tail round and inflict injury.



The spines contain venom that can cause vomiting, diarrhoea, low-blood pressure and cardiovascular collapse.



Wounds should be immersed in hot water (45oC) for 30- 90 minutes until the pain subsides. Gently extract obvious pieces of the stinger and clean the wound with soap and water. Apply a dressing and seek professional medical help. Patients may require pain relief and if medical help is not readily available (12 hours or more away) start a course of antibiotics.



Fig. 37

Family: Dasyatidae (Stingrays)

1. *Dasyatis kuhlii* (Muller & Henle, 1841)
2. *Dasyatis thetidis* Ogilby, 1899
3. *Dasyatis zugei* (Muller & Henle 1814)

4. *Gymnura poecilura* (Shaw, 1804)
5. *Himantura gerrardi* (Gray, 1851)
6. *Himantura imbricata* (Bloch & Schneider, 1801)
7. *Himantura uarnak* (Forsskal, 1775)
8. *Pastinachus sephen* (Forsskal, 1775)
9. *Taeniura lymma* (Forsskal, 1775)
10. *Taeniura meyeni* (Muller & Henle, 1841)



All along the coasts of India including the Island ecosystems.



Stingrays are common in coastal tropical and subtropical marine waters throughout the world, and also includes species found in warmer temperate oceans.



Coral reefs are favorite feeding grounds and are usually shared with sharks during high tide. Stingrays settle on the bottom while feeding, often leaving only their eyes and tail visible.



**Fig. 36** Photograph shows a retro serrated spine of the stingray's tail recovered from the base of the ulcer in a patient. (Courtesy: Singapore Medical Journal)



**Fig. 37** *Hypolophus sephen*



### 7.2.5. Electric Rays

The electric rays are a group of rays, flattened cartilaginous fish with enlarged pectoral fins, comprising the order Torpediniformes. They are known for being capable of producing an electric discharge, ranging from as little as 8 volts up to 220 volts depending on species, used to stun prey and for defense. The electrogenic properties of electric rays have been known since antiquity. The ancient Greeks used electric rays to numb the pain of childbirth and operations.



Head, body and pectoral fins form a rounded, soft and oval disc; two large electric organs in the disc; nasal flaps broad; nasal curtain short; mouth narrow and transverse; gill openings on underside of disc; one or no dorsal fins; caudal fin large; tail large and strong.



Electric Rays are capable of delivering a dangerous electric shock. They are often almost entirely buried in sand and difficult to spot, so care should be taken where there is a sandy bottom. It should be treated with caution, especially at night when it is active, and has been known to charge at divers with its mouth agape if harassed. It is not known to be responsible for any fatalities, but may have been involved in several unexplained, fatal diving accidents.



The shock generated by the electric ray can be enough to knock down an adult human.



If shocked divers should leave the water and treat the person concerned for shock.



Order: TORPEDINIFORMES

Family: Narcinidae (Electric rays)  
*Narke* sp.(Fig. 38)



Found in all the areas of Indian coasts.



Common in the tropical and temperate waters.



Electric rays are found from shallow coastal waters down to at least 1,000 m depth.



**Fig. 38** *Narke* sp.



### 7.2.6. Striped Catfish

These groups of fishes are named for their prominent barbels, which resemble a cat's whiskers, catfish range in size and behavior. Catfish are of considerable commercial importance; many of the larger species are farmed or fished for food.



Body elongate and compressed, naked or covered with bony plates; eyes small, majority of the fishes have barbells extending from each side of the upper and lower jaws; spines often present at front of the dorsal and pectoral fins; no ventral fin spine; adipose dorsal fin usually present; pectoral fin low in position.



Catfish have venomous spines in the pectoral and dorsal fins. Injuries are usually caused when divers accidentally touch the fish.



Immerse injury in hot water to reduce pain and swelling.



Family: Plotosidae (Eel catfishes)

1. *Plotosus canius* Hamilton-Buchanan, 1822
2. *Plotosus lineatus* (Thunberg, 1787) (Fig. 39)



Recorded from most parts of Indian waters.



Extant catfish species live in inland or coastal waters of every continent except Antarctica.



Coastal waters.



**Fig. 39** *Plotosus lineatus*



### 7.2.7. Puffer fishes

Puffer fish belong to Tetraodontidae family. This fish look just like other fish when in normal situation but when they are threatened their body swells like a balloon. We can identify one conspicuous physical appearance of this fish that they have short spines around their body. Puffer fish live in almost all seas in the world including in some rivers in Southeast Asia and Africa. People in some countries make delicacies out of puffer fish meat such as 'fugu' (in Japan) and bok (in Korea) although they have to prepare it with extra care.



Capable of inflate body by swallowing air or water to form an almost spherical ball. Teeth fused into a beak like dental plate with a median suture in each jaw; dorsal and anal fins positioned posterior; no ventral fins; no spines in fins; skin tough and scaleless, often with small spinules.



Puffer fish produces deadly toxin called Tetrodotoxin, this deadly toxin is produced by a gland and distributed to some body organs. Tetrodotoxin in puffer fish is mostly found in liver, blood, gonads, spines and skin.



Tetrodotoxin is highly specific in binding to the sodium ion ( $\text{Na}^+$ ) channels in the cells. It acts as a competitive inhibitor by mimicking the  $\text{Na}^+$  ion and blocking the  $\text{Na}^+$  ion channels, thus preventing the flow of  $\text{Na}^+$  ions. This causes the failure of the transmission of nerve impulses, eventually leading to death. The symptoms of Tetrodotoxin poisoning can be loosely divided into 4 stages.

**Immediate:** Slight numbness of lips and tongue

**Stage 1:** Increasing paresthesia in face and extremities; Sensations of lightness and floating; Headache, nausea, severe abdominal pain, diarrhoea and/or vomiting

**Stage 2:** Increasing paralysis; Motor dysfunction with weakness, hypoventilation and speech difficulties; convulsions, mental impairment, cardiac dysfunction

**Stage 3:** Central nervous system (CNS) dysfunction; Complete paralysis; Death (usually occurs between ranges of 20 minutes to 8 hours, where a person could still be conscious or in certain cases completely lucid before death).



Immediate medical attention is required as it leads to lethal



Figs. 40 & 41

Family: Tetraodontidae (Puffers)

1. *Arothron diadematus* (Ruppell, 1829)
2. *Arothron hispidus* (Linnaeus, 1758)
3. *Arothron immaculatus* (Bloch & Schneider, 1801)
4. *Arothron mappa* (Lesson, 1831)
5. *Arothron nigropunctatus* (Bloch & Schneider, 1801)
6. *Arothron reticularis* (Bloch & Scheider, 1801)
7. *Arothron stellatus* (Bloch & Schneider, 1801)
8. *Canthigaster bennetti* (Bloch, 1854)
9. *Canthigaster coronata* (Vaillant and Sauvage, 1835)
10. *Canthigaster investigatoris* (Annandale & Jenkins, 1910)
11. *Canthigaster paupa* (Bleeker, 1848)
12. *Canthigaster solandri* (Richardson, 1845)
13. *Canthigaster valentini* (Bleeker, 1853)
14. *Chelondon patoca* (Hamilton-Buchanan, 1822)
15. *Lagocephalus guentheri* Miranda-Ribeiro, 1915
16. *Lagocephalus inermis* (schlegel, 1850)
17. *Lagocephalus lunaris* (Bloch & Schneider, 1801)
18. *Lagocephalus scleratus* (Forster, 1788)
19. *Tetradon fluviatilis* Hamilton-Buchanan, 1822
20. *Tetradon palembangensis* Bleeker, 1852
21. *Torquigener hypselogeneion* (Bleeker, 1852)
22. *Diodon hystrix* (Linnaeus, 1758) (Fig. 40)
23. *Diodon liturosus* Shaw, 1804 (Fig. 41)
24. *Diodon holocanthus* (Linnaeus, 1758)



Found all along the coasts of India.



They are most diverse in the tropics and relatively uncommon in the temperate zone and absent in cold waters.



Although most species live in inshore and estuarine waters, 29 species spend their entire life cycles in freshwater.



Fig. 40 *Diodon hystrix*



Fig. 41 *Diodon liturosus*



### 7.3. Sea snakes

No need to fear of sea snakes when swimming at the beach or in the sea since sea snakes rarely attack human. The cases of sea snake bites happen when fisherman tried to rid the snake from their fishing net. This water snake has paddle-like tail or compressed lateral body that makes it look like an eel. Sea snakes do not have gills so that they must come to the surface to breathe. Among the sea snakes are species with the most potent venoms of all snakes. Some have gentle dispositions and bite only when provoked, while others are much more aggressive. Sea snakes are predators and play a key trophic role in near-shore marine ecosystems. Most species of sea snakes feed on fish; some prefer fish eggs, crustaceans and mollusks.



Sea snakes are often misidentified as eels. They can be easily identified by the absence of gills and the presence of dorso-ventrally flattened tail in contrast to the laterally flattened tails in the terrestrial counterparts.



Sea snake bites are not uncommon in the Indo-Pacific ocean waters. In certain areas, sea snakes will approach divers underwater. These advances may be inspired by curiosity, as it is rare for sea snakes to bite divers without provocation. They will retaliate if grabbed. The venom of sea snakes is more potent than that of the cobra. Even when bites occur, the presence of short fangs at the back of the mouth deprives many sea snakes of an efficient way of delivering this venom into humans. Often venom is not injected, despite the biting.



Early symptoms of sea snake bites include headache, thick-feeling tongue, thirst, sweating and vomiting. If envenomation occurs, symptoms may become evident within minutes to hours after the bite. Muscle weakness leading to paralysis, including respiratory muscle paralysis and asphyxia, and finally cardiac failure may follow the bite. Occasionally the sea snake bite itself results in severe lacerations and blood loss.



The pressure bandage + immobilisation technique (See Appendices for details) will delay the symptoms until medical assistance, resuscitation facilities and antivenom can be acquired. Mouth to mouth respiration is the major

requirement. The victim should be taken to hospital as soon as possible. Serious cases should be treated with sea snake anti-venom (made by Commonwealth Serum Laboratories (CSL) – Australia).



1. *Astrotia stokesii* (Gray, 1846)
2. *Enhydrina schistosa* (Daudin, 1803)
3. *Hydrophis caerulescens* (Shaw, 1802)
4. *Hydrophis stricticollis* (Gunther, 1864)
5. *Hydrophis cyanocinctus* Daudin, 1803
6. *Hydrophis fasciatus* (Schneider, 1799)
7. *Hydrophis lapemoides* (Gray, 1849)
8. *Hydrophis mamillaris* (Daudin, 1803)
9. *Hydrophis nigrocinctus* Daudin, 1803
10. *Hydrophis obscurus* (Daudin, 1803)
11. *Hydrophis oranatus* (Gray, 1842)
12. *Hydrophis spiralis* (Shaw, 1802)
13. *Hydrophis gracilis* (Shaw, 1802)
14. *Hydrophis cantoris* Gunther, 1864
15. *Kerilia jerdonii* (Gray, 1849)
16. *Lapemis curtus* (Shaw, 1802)
17. *Pelamis platurus* (Linnaeus, 1766)
18. *Praescutata viperina* (Schmidt, 1852)
19. *Laticauda colubrina* (Schneider, 1799) (Fig. 42a&b)
20. *Laticauda laticaudata* (Linnaeus, 1758)
21. *Acrochordus granulatus* (Schneider, 1799)
22. *Cerberus rynchops* (Schneider, 1799)



Reported from all the coastal states of India and the Island groups also.



Sea snakes are the most successful marine reptiles inhabiting the warm tropical waters of the world. However, they are not found in the Atlantic Ocean, Red Sea and the Mediterranean Sea.



Coral reef, Intertidal areas and Sandy and muddy beaches.



Fig. 42a *Laticauda colubrina* (Yellow lipped banded sea krait)



Fig. 42b *Laticauda colubrina*

## 7.4. Crocodiles

The largest species of crocodile is the saltwater crocodile. *Crocodylus porosus* inhabit coastal rivers and swamps, the open sea and island shorelines, and their distribution extends well inland via major rivers and floodplain billabongs into freshwater rivers, creeks and swamps. In the wild, females normally reach maturity at 2.3 m total length and approximately 12 years of age.



Fig. 43 A warning signal about the crocodile attack. (South Andaman)



The saltwater crocodile has a longer muzzle than the mugger crocodile: its length is twice its breadth at the base. The saltwater crocodile has fewer armor plates on its neck than other crocodilians, and its broad body contrasts with that of most other lean crocodiles, leading to early unverified assumptions that the reptile was an alligator.



The saltwater crocodile is an opportunistic apex predator capable of taking nearly any animal that enters its territory, either in the water or on dry land. They are known to attack humans who enter the crocodiles' territory. There have also been recent, less-publicised attacks in Borneo, Sumatra, eastern India (Andaman Islands), and in Myanmar (Fig. 43).



It depends on the degree of attack by the crocodile.



*Crocodylus porosus* (Schneider, 1801) – Fig. 44



Sunderbans, Orissa and Andaman and Nicobar Islands



Saltwater crocodile (*Crocodylus porosus*) are found from Sri Lanka and the east coast of India in the west to the Caroline Islands in the east and from Myanmar and south-east Asia in the north to Australia in the south.



Mangrove associated animal.



**Fig. 44** Saltwater crocodile (*Crocodylus porosus*)

## **3. APPENDICES**

### **1. PRESSURE BANDAGE + IMMOBILISATION TECHNIQUE**

This is used to delay the absorption of venom from a wound. A bandage (preferably stretchable) is applied over the bite and then wrapped around the limb (and extending up the limb) tight enough to block the drainage vessels (lymphatics). The pressure is approximately the same as that used to treat a sprained ankle.

Care must be taken not to put the bandage on so tight that it causes pain and cuts off circulation. For this reason the technique is not applicable to painful, swollen bites that already have circulation impairment.

The limb should then be immobilized with a splint to prevent any local muscle movement (this spreads the venom despite the bandage).

The pressure bandage + immobilization of a limb should be continued until the victim has knowledgeable medical personnel and facilities available to cope with the envenomation.

This happens as the bandage is released and the venom moves into the bloodstream. The doctors may well administer anti-venom (if available), before removing the bandage.

The technique is especially applicable to sea snake, blue ringed octopus and cone shell bites.

A variant may be used if the bite is on the torso, with a pad and bandage to produce the pressure.

## **2. FIRST AID MATERIALS**

Certain drugs and equipment are of value in a sea going researchers/naturalists and could reasonably be expected to acquire and carry these on diving expeditions (Figs. 45a-c). Training in the use of these, as well as in resuscitation, is of great importance.

1. For shark attack or trauma, large sized thick cotton pads (more than 20 cm square) with 10 cm crepe bandages (6 of each) are useful to make pressure dressings to stop bleeding and also for pressure bandages to reduce venom absorption. If obtainable, shell dressings of the type

used by the military are ideal for this purpose. They can sometimes be obtained from army disposal stores.

2. A rubber bandage 10 cm wide ("esmarch" bandage obtainable from a medical equipment supplier) for use as a tourniquet. When wrapped tightly around the limb this is the best form of tourniquet. It covers a wide area, effectively stopping blood flow to the limb while minimizing damage to tissues under the tourniquet.
3. Small adhesive skin dressings such as Elastoplasts or Band-Aids.
4. Surgical instruments — scissors, artery forceps, fine forceps, disposable scalpel blade, disposable syringes and needles.
5. An aluminized thermal blanket such as a "Space blanket" to protect divers suffering from hypothermia.
6. Heat packs — of value in treating fish and jellyfish stings.
7. Cold packs — of value in treating jelly fish sting and general muscular strains.
8. Eye irrigation solution.
9. Torch, pen and paper (for recording purposes).
10. Household vinegar, preferably in a one liter container, to neutralize adherent stinging cells of box jelly fish and some other jelly fish. Household bleach is useful for sterilizing coral cuts.
11. Local anesthetic spray or ointment (Lignocaine) to relieve the pain from minor stings from animals such as Portuguese man-o'-war and other jellyfish stings. Solacaine or other anti-burn preparations such as Tannic acid sprays may be efficacious for this purpose.
12. Topical antibiotic powder to prevent infection from coral cuts and other minor injuries.
13. Skin antiseptic solution such as chlorhexidine for cleaning wounds contaminated with dirt.
14. Broad spectrum antibiotic tablets (e.g. Erythromycine, Doxycycline) to initiate treatment for serious infections, otitis externa, otitis media, sinusitis, and coral cuts etc.
15. Prophylactic ear drops such as commercial preparations of Aqua Ear, Vosol or Otic Domoboro.

16. Therapeutic ear drops, including antibiotic and steroid combination, for outer ear infections.
17. Local anaesthetic for injection such as Lignocaine 1% (without adrenalin) for wounds from stone fish and other fish stings. Up to 15 ml of this solution can be injected into the stung area in an adult and repeated every 2 hours if necessary.
18. Anti-venoms — depending on the geographical location.
19. Anti-diarrhoea tablets such as Diphenoxylate ("Lomotil") or Loperamide ("Imodium").
20. Analgesics (pain killers) such as Paracetamol (Acetaminophen). Aspirin, or drugs containing this substance, may be unpredictable and hazardous and are best avoided.
21. Ultra-violet blocking sunscreen (SP15+ or greater). A 1% hydrocortisone cream is useful to treat sunburn, allergic dermatitis or itching.
22. Anti-Seasickness tablets.
23. Decongestants — pseudoephedrine tablets, and topical nasal sprays. Topical antibacterial and antifungal preparations, such as Cicatrin or Neosporin.



Fig. 45a ZSI researcher encounters a squid underwater (Diglipur, Andaman)



**Fig. 45b** Maintenance of proper buoyancy and taking care not to touch the animals always makes the diver safety, ZSI researcher monitor the corals underwater.



**Fig. 45c** ZSI researchers engaged in marine faunal studies

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