

Marine and coastal aquatic biodiversity of Karnataka

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Karnataka State

Karnataka State has a 300 km long coastline and is a frontline state in marine fisheries development.

Historically known as the 'mackerel coast', it has a continental shelf area of 25,000 km².

About 80% of the shelf area lies between 0 and 72 m depth.

Its contribution to the total marine fish production of the country has varied from 6 to 14 % annually.

Geo-location of sampling sites

Grid No	Inter-tidal	Lat (°N)	Long (°E)	Code
G1	Mangalore	12.99889	74.79389	IT1
G2	Mulki	13.02917	74.78861	IT2
G3	Malpe	13.36556	74.6975	IT3
G4	Kundapura	13.60778	74.67611	IT4
G5	Baindur	13.87333	74.61528	IT5
G6	Murdeshwar	14.09806	74.49083	IT6
G7	Kumta	14.43778	74.38583	IT7
G8	Ankola	14.65889	74.28306	IT8
G9	Karwar	14.88889	74.10278	IT9
	Estuary			
G1	Netravati-Gurupur	12.83972	74.82889	E1
G2	Mulki	13.07361	74.78222	E2
G3	Swarna-Sita	13.33972	74.71056	E3
G4	Chakra-Haladi-Kollur	13.64306	74.65861	E4
G5	Vankatapur	13.98333	74.56167	E5
G7	Saravati-Badgani	14.28139	74.44333	E6
G8	Aganashini	14.50056	74.31528	E7
G9	Kali	14.80444	74.12000	E8

Geo-location of sampling sites..contd

	Sea/sub tidal			
G1	Mangalore	12.92000	74.80111	S1
G2	Mulki	13.70111	74.76889	S2
G3	Malpe	13.33972	74.70889	S3
G4	Kundapura	13.63278	74.13500	S4
G5	Baindur	13.98417	74.56167	S5
G6	Murdeshwar	14.08861	74.33389	S6
G7	Kumta	14.29861	74.38500	S7
G8	Ankola	14.50694	74.31639	S8
G9	Karwar	14.73361	74.01556	S9
	Island			
G3	St.Mary's	13.38194	74.68250	IS1
G6	Netrani	14.01500	74.33278	IS2
G8	Kukre	14.70611	74.24583	IS3
G9	Devgad	14.82250	74.06444	IS4
G9	Kurmagad	14.84833	74.10111	IS5

Sampling methods

The entire coastal water is divided into nine equal sampling grids of 0.15° starting from south to north.

From each grid flora and fauna were collected to cover the intertidal, subtidal, estuarine and island ecosystems using the standard sampling procedures.

The latitude and longitude of the sampling stations were fixed using GPS.

Specimens were identified up to species level using standard procedure.

Microscopic specimens were identified with the help of light microscope. Photo micrographs of important specimens were taken using digital camera.

Flora

- Total of 62 phytoplankton species were observed and out of which 5 species were toxic capable of producing paralytic Shell fish poisoning if they bloom.
- A total of 78 species of seaweeds and 2 species of sea grasses were observed.
- Intertidal rocks along the Islands registered fairly good flora of brown seaweeds dominated by *Sargassum ilicifolium*, having economic importance for extracting algin.



No. of phytoplankton species from different grids along Karnataka

Grid no & location		Inter-tidal	Sea	Island
G1 Mangalore	14	10	27	
G2 Mulki	35	11	29	
G3 Malpe	28	13	35	14
G4 Kundapura	17	16	8	
G5 Byndoor	14	12	11	
G6 Murdeswar	-	11	8	16
G7 Kumta	22	11	10	
G8 Ankola	20	12	10	14
G9 Karwar	26	14	11	16

Number of seaweed species from each sampling grid along Karnataka coast.

Grid no & location	Estuary	Inter-tidal	Sea	Island
G1 Mangalore	14	10	27	
G2 Mulki	35	11	29	
G3 Malpe	28	13	35	14
G4 Kundapura	17	16	8	
G5 Byndoor	14	12	11	
G6 Murdeswar	-	11	8	16
G7 Kumta	22	11	10	
G8 Ankola	20	12	10	14
G9 Karwar	26	14	11	16

Zooplankton

- Total of 115 zooplankton species belonging to 56 families were recorded from the Karnataka coast.
- Generally, maximum zooplankton biodiversity was observed in the marine environment compared to the estuaries.



- **Six species of Demospongia sponges coming under 6 families were collected from the Karnataka coast.**
- **Twenty-five species of sea anemones were collected and identified from the intertidal, sea and island ecosystems along Karnataka coast.**
- **Three species of bryozoans under the order cheilostomata were collected and identified from the Karnataka coast.**



Sponges collected from Karnataka

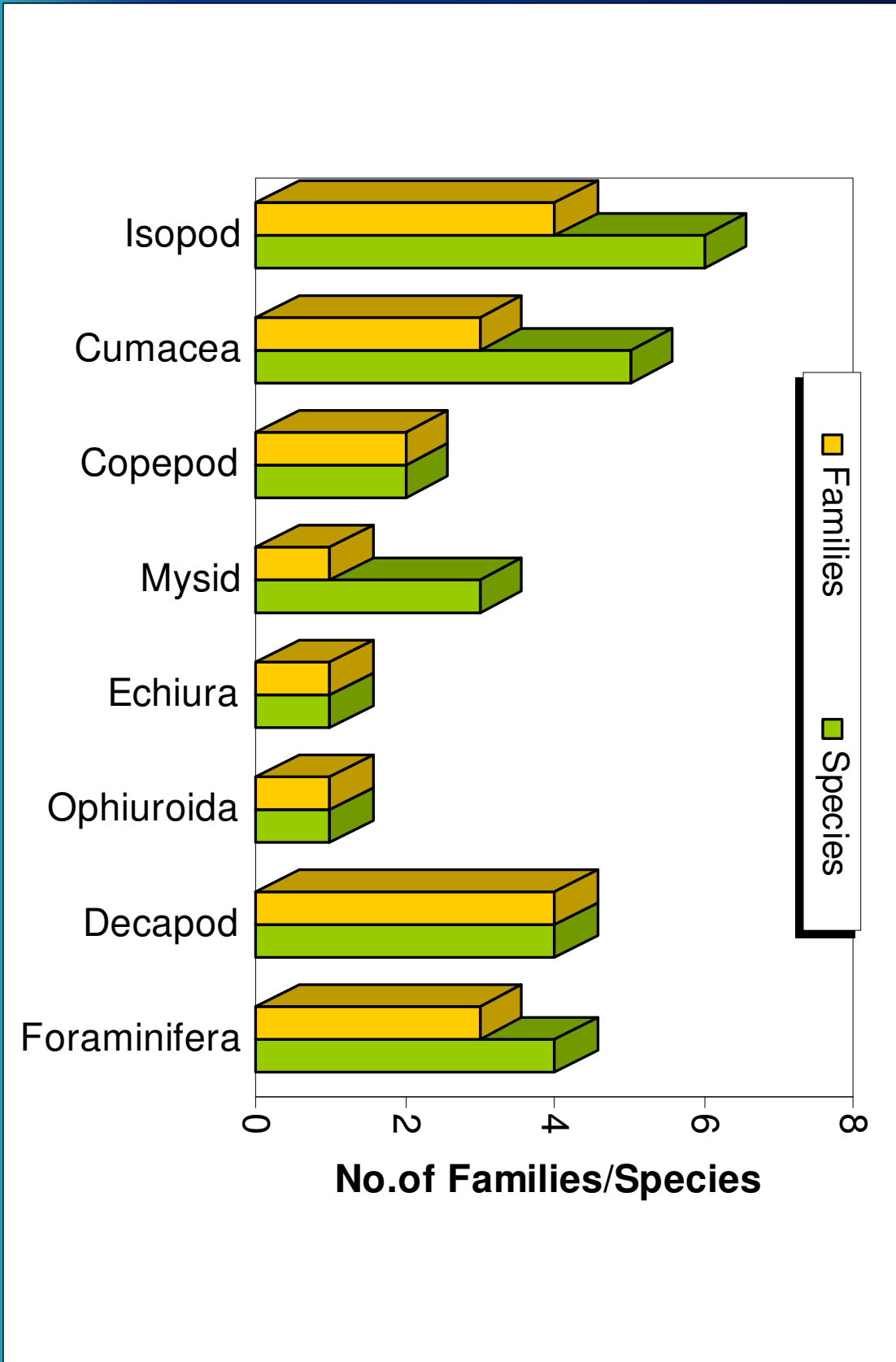
	Scientific name	Class	Order	Family	IT	Sea	IS
1	<i>Axinyssia flabelliformes</i>	Demospongiae	Epipolasidae	Sollasellidae			√
2	<i>Halisarca</i> sp	Demospongiae	Halisarcida	Halisarcidae	√	√	√
3	<i>Acanthella elongata</i>	Demospongiae	Poecilosclerida	Hymeniacidonidae			√
4	<i>Echinodictylum longistylum</i>	Demospongiae	Poecilosclerida	Phorbaridae			√
5	<i>Raspailia hornelli</i>	Demospongiae	Poecilosclerida	Raspailiidae			√
6	<i>Adocia</i> sp	Demospongiae	Poecilosclerida	Adociidae	√	√	√



Benthic organisms

- **Polychaetes were the most dominant of the benthic faunal groups recorded along the Karnataka coast. Nearly 143 species of polychaetes belonging to 34 different families were recorded in the present study.**
- **Four species of nematodes and 1 species nemertians were recorded.**

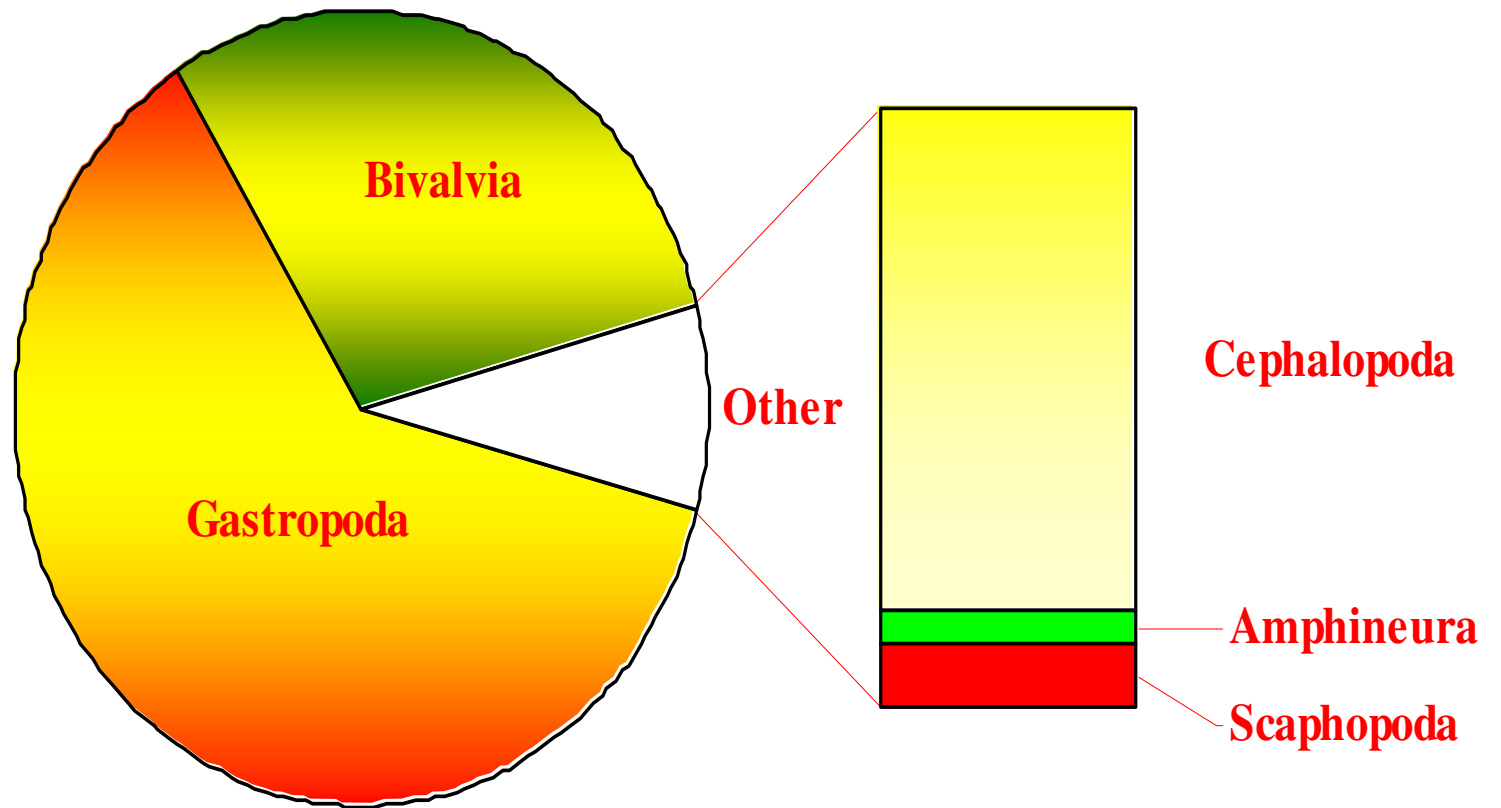




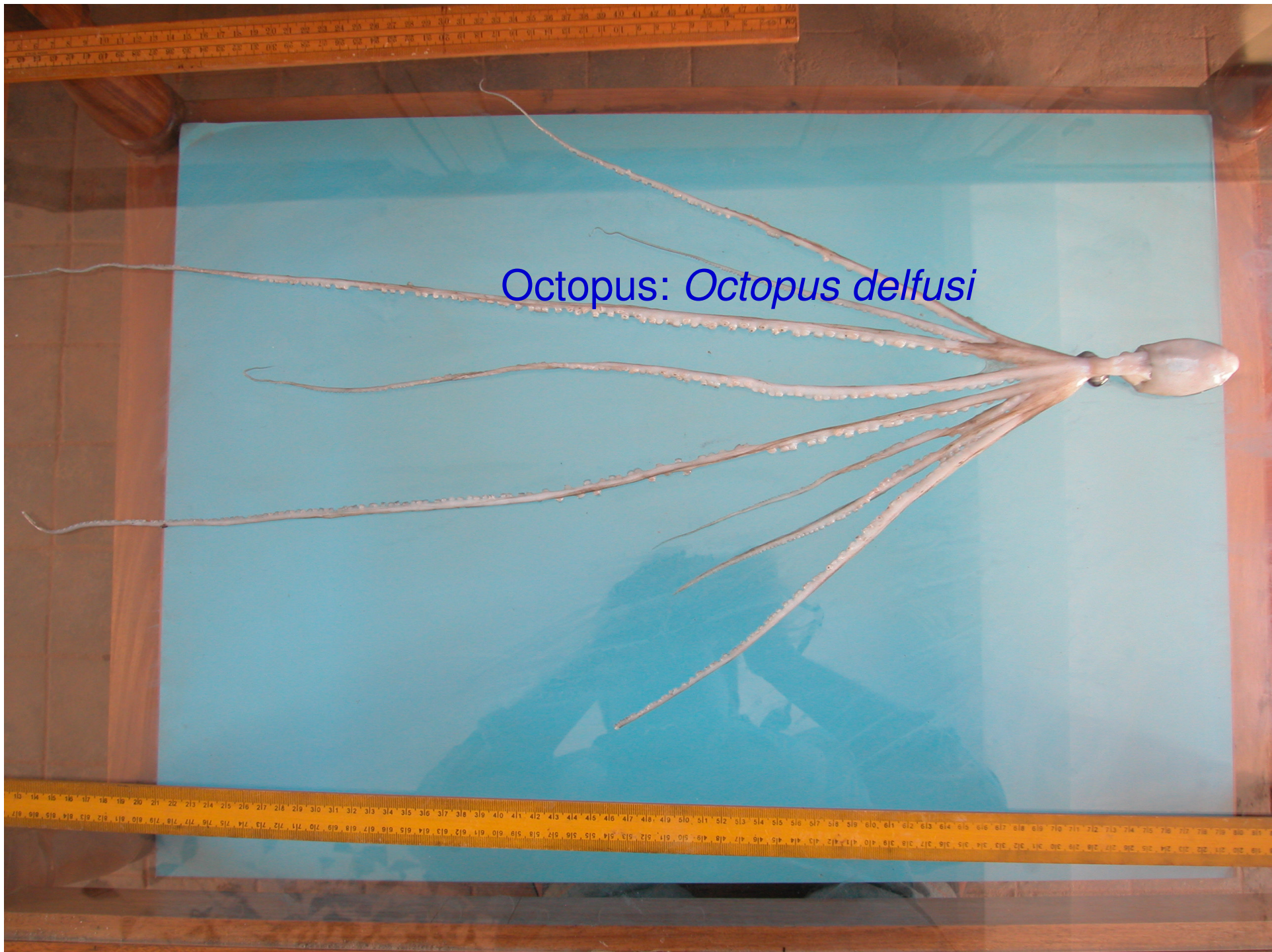
Molluscs

- **Total of 234 molluscan species were recorded belonging to 65 families and 132 genera, of which 145 are gastropods, 70 are bivalves, 16 are cephalopods, a single species of polyplacophores and two species of scaphopods.**
- **The Class Gastropoda accounted for 62% of the molluscan diversity followed by Bivalvia (30%); Cephalopoda (7%) and Amphineura & Scaphopoda (1%).**





Octopus: *Octopus delfusi*

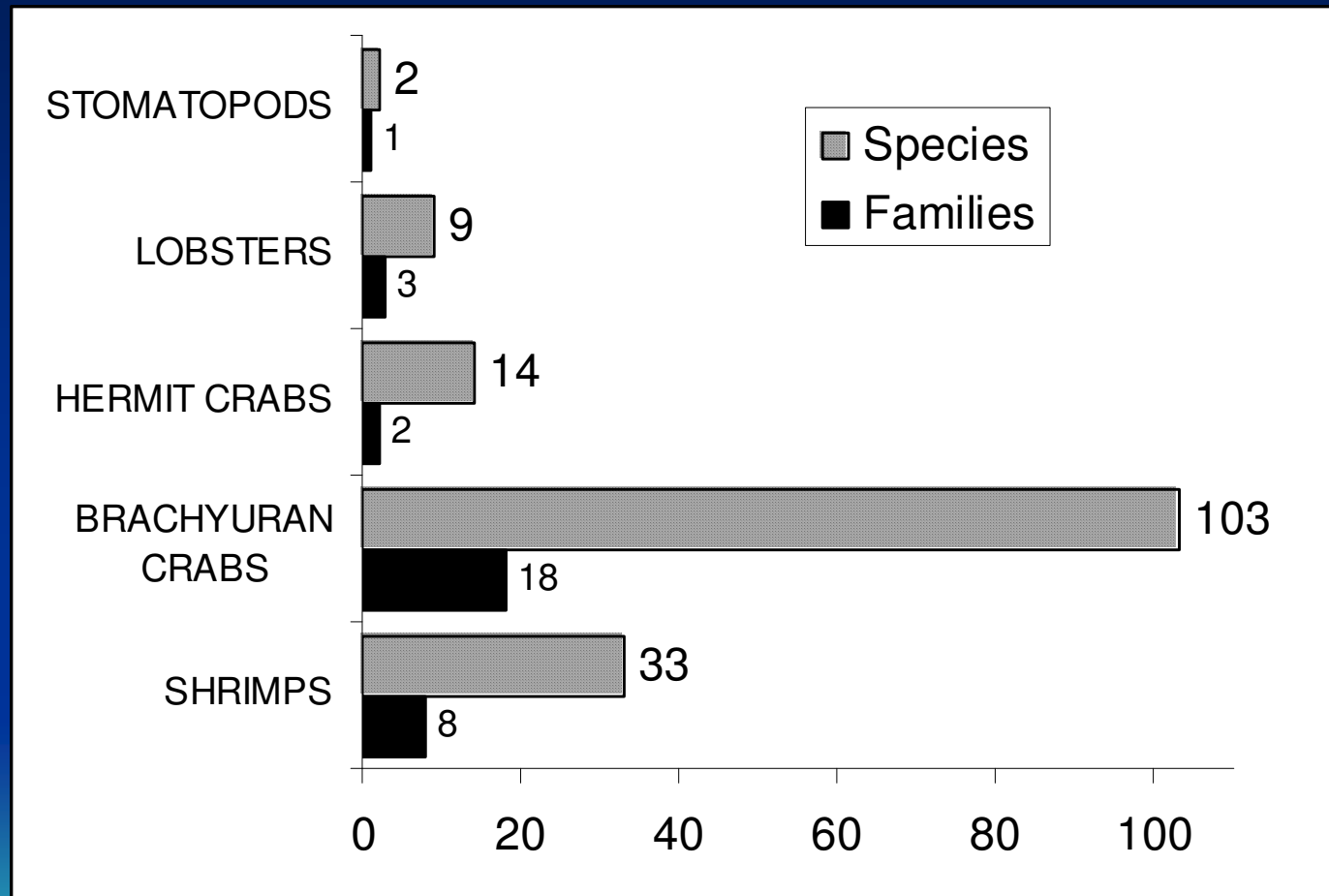


Crustaceans

- **Along Karnataka coast, 19 species of shrimps belonging to 4 families; 13 species of brachyuran crabs belonging to 9 families and one hermit crab species belonging to Diogenidae family were collected from estuaries.**
- **A total of 29 species of shrimps, belonging 6 families were collected from coastal and marine zones of Karnataka. Penaeidae was the largest family with 16 species.**



Distribution of larger crustaceans in the sub-tidal area along the Karnataka coast



List of larger crustacean species recorded for the first time from Karnataka coast

Sl. no.	Group	Family	Species
1	Shrimps	Penaeidae	<i>Parapenaeus fiissuroides indicus</i>
2	Shrimps	<i>Rhynchocinetidae</i>	<i>Rhynchocinetes durbanensis</i>
3	Shrimps	<i>Pandalidae</i>	<i>Heterocarpoides levimana</i>
4	Crabs	<i>Portunidae</i>	<i>Portunus monomia gracillimanus</i>
5	Crabs	<i>Carpiliidae</i>	<i>Carpilius convexus</i>
6	Crabs	<i>Carpiliidae</i>	<i>Carpilius maculates</i>

- **Five species of starfishes were identified from intertidal, island and sea collections.**
- **Two species of Sea urchins coming under two families were collected and identified. .**
- **Only one species of sea cucumber, *Holothuria leucospilota* was recorded from the coast.**



List of Chaetognaths identified from Karnataka coast

Sl.no	Scientific name	Class	Order	Family	Sea	Is	Es
1	<i>Krohnitta subtilis</i> (Grassi)	Sagittoidea	Aphragmophora	Krohnittidae	√	√	√
2	<i>Sagitta bedoti</i> Berneck	Sagittoidea	Aphragmophora	Sagittidae	√	√	√
4	<i>Sagitta elegans</i> Verrill	Sagittoidea	Aphragmophora	Sagittidae	√	√	√
5	<i>Sagitta enflata</i> Grassi	Sagittoidea	Aphragmophora	Sagittidae	√	√	√
6	<i>Sagitta maxima</i>	Sagittoidea	Aphragmophora	Sagittidae	√	√	√



List of ascidians identified from Karnataka coast

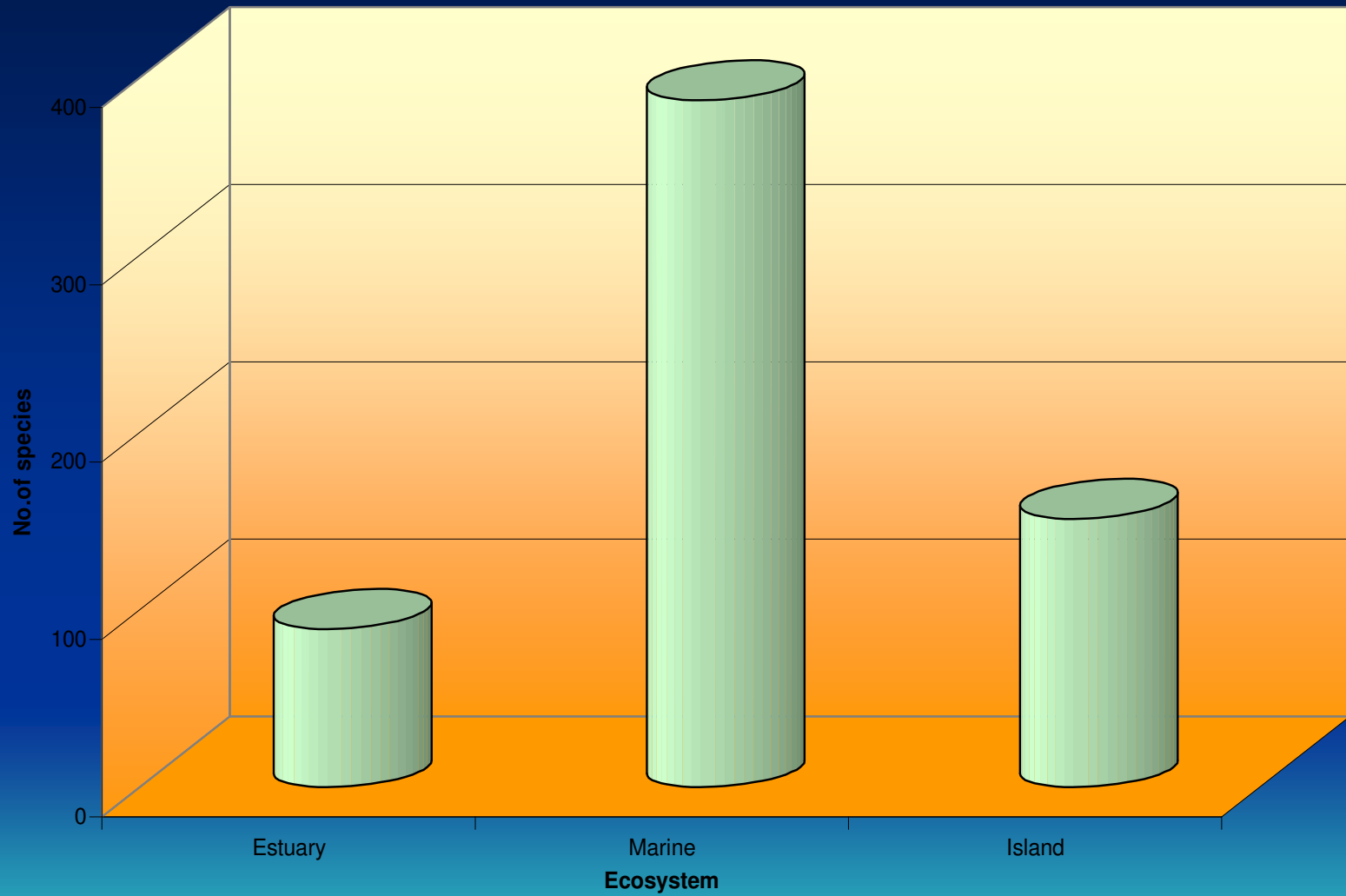
Sl.no	Species	Class	Order	Family	Es	Sea	IT	IS
1	<i>Diplosoma listeranium</i>	Ascidiacea	Aplousobranchia	Didemnidae		√		
2	<i>Polyclinum indicum</i>	Ascidiacea	Aplousobranchia	Polyclinidae		√		
3	<i>Diplosoma macdonaldi</i>	Ascidiacea	Aplousobranchiata	Didemnidae		√		
4	<i>Symplegma viride</i>	Ascidiacea	Pleurogona	Styelidae		√		
5	<i>Botryllus schlosseri</i>	Ascidiacea	Pleurogona	Styelidae		√		
6	<i>Styela bicolor</i>	Ascidiacea	Pleurogona	Styelidae		√		

Fishes

- **Three hundred and ninety (390) fish species belonging to 24 orders and 118 families were collected and identified from the coast, which forms 15.3% of the coastal fishes reported from Indian coast.**
- **Consisted of 40 elasmobranch species (sharks, rays and skates) and 350 bony fishes.**



Fig.1.Fish species number in different ecosystem



List of threatened/vulnerable fishes

No	Species	Status
1	<i>Carcharhinus hemiodon</i>	Critically endangered (IUCN)
2	<i>Alopias vulpinus</i>	Data Deficient (IUCN)
3	<i>Carcharhinus amboinensis</i>	Data Deficient (IUCN)
4	<i>Carcharhinus limbatus</i>	Lower Risk/Near threatened(IUCN)
5	<i>Carcharhinus melanopterus</i>	Lower Risk/Near threatened(IUCN)
6	<i>Galeocerdo cuvieri</i>	Lower Risk/Near threatened(IUCN)
7	<i>Carcharhinus dussumieri</i>	Near Threatened (IUCN)
8	<i>Carcharhinus macloti</i>	Near Threatened (IUCN)
9	<i>Carcharhinus sealei</i>	Near Threatened (IUCN)
10	<i>Carcharhinus longimanus</i>	Vulnerable (IUCN)
11	<i>Chiloscyllium griseum</i>	Near Threatened (IUCN)
12	<i>Chiloscyllium indicum</i>	Near Threatened (IUCN)
13	<i>Dasyatis zugei</i>	Near Threatened (IUCN)
14	<i>Hippocampus kuda</i>	Vulnerable (IUCN)
15	<i>Hippocampus histrix</i>	Data Deficient (IUCN)
16	<i>Sphyrna lewini</i>	Lower Risk/Near threatened(IUCN)
17	<i>Sphyrna mokarran</i>	Data Deficient (IUCN)
18	<i>Mobula mobular</i>	Vulnerable (IUCN)
19	<i>Rhina ancylostoma</i>	Vulnerable (IUCN)
20	<i>Rhincodon typus</i>	Vulnerable (IUCN)
21	<i>Rhinobatos typus</i>	Vulnerable (IUCN)
22	<i>Rhynchobatus djiddensis</i>	Vulnerable (IUCN)
23	<i>Stegostoma fasciatum</i>	Vulnerable (IUCN)
24	<i>Galeocerdo cuvier</i>	Lower Risk/Near threatened(IUCN)
25	<i>Scoliodon laticaudus</i>	Lower Risk/Near threatened(IUCN)
26	<i>Aetobatus narinari</i>	Data Deficient (IUCN)
27	<i>Manta birostris</i>	Data Deficient (IUCN)

Marine reptiles

- Three species of sea turtles belonging to a single family (Cheloniidae) have been recorded (endangered).
- Three species of sea snakes belonging to a single family (Hydrophiidae) was recorded.



Species of marine reptiles recorded along the Karnataka coast

Sl. No.	Species	Family	Common name
Sea turtles			
1	<i>Chelonia mydas</i>	Cheloniidae	Green turtle
2	<i>Lepidochelys olivacea</i>	Cheloniidae	Olive ridley turtle
3	<i>Eretmochelys imbricata</i>	Cheloniidae	Hawksbill turtle
Sea snakes			
5	<i>Hydrophis spiralis</i>	Hydrophiidae	Yellow sea snake
6	<i>Hydrophis cyanocinctus</i>	Hydrophiidae	Annulated sea snake
7	<i>Hydrophis schistosa</i>	Hydrophiidae	Net-biter sea snake

Mammals

Dolphin	Common name	IUCN Red list status
<i>Sousa chinensis</i>	Indopacific Humpback	DD-Data Deficient
<i>Stenella longirostris</i>	Spinner dolphin	LR/cd-Lower Risk (conservation dependent)
<i>Tursiops truncatus</i>	Bottlenose	DD-Data Deficient
Porpoise		
<i>Neophocaena phocaenoides</i>	Finless porpoise	DD-Data Deficient
Whales		
<i>Balaenoptera edeni</i>	Byrde whale	Not in Red list
<i>Balaenoptera acutorostrata</i>	Minke whale	LR/nt- Lower Risk (near threatened)
<i>Balaenoptera musculus</i>	Blue whale	EN- Endagered
<i>Physeter macrocephalus</i>	Sperm whale	Not in Red list

Netrani Island

**Studied using professional divers
Baracuda Diving India, Goa**



Murdeshwar Mavalli

19 km away from the shore

N 14° 00'' 56; E 74° 19'' 47



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Netrani Island

**Netrani Island is situated just off Murdeshwar,
nearly 19 km away from the shore.**

Area < 2 sq. km.

Sea depths ranging from 6 to 40 meters.

Visibility from 15 to 30 meters

**Organisms: Corals, Giant clam, Napoleon wrasse,
Angelfish, Turtles, Barracuda, Moray Eels etc.**

Coral Distribution west coast

- Ratnagiri
- Malvan
- Redi

- Netrani Island (off Muredeshwar)
- Gaveshani Bank (off Malpe)



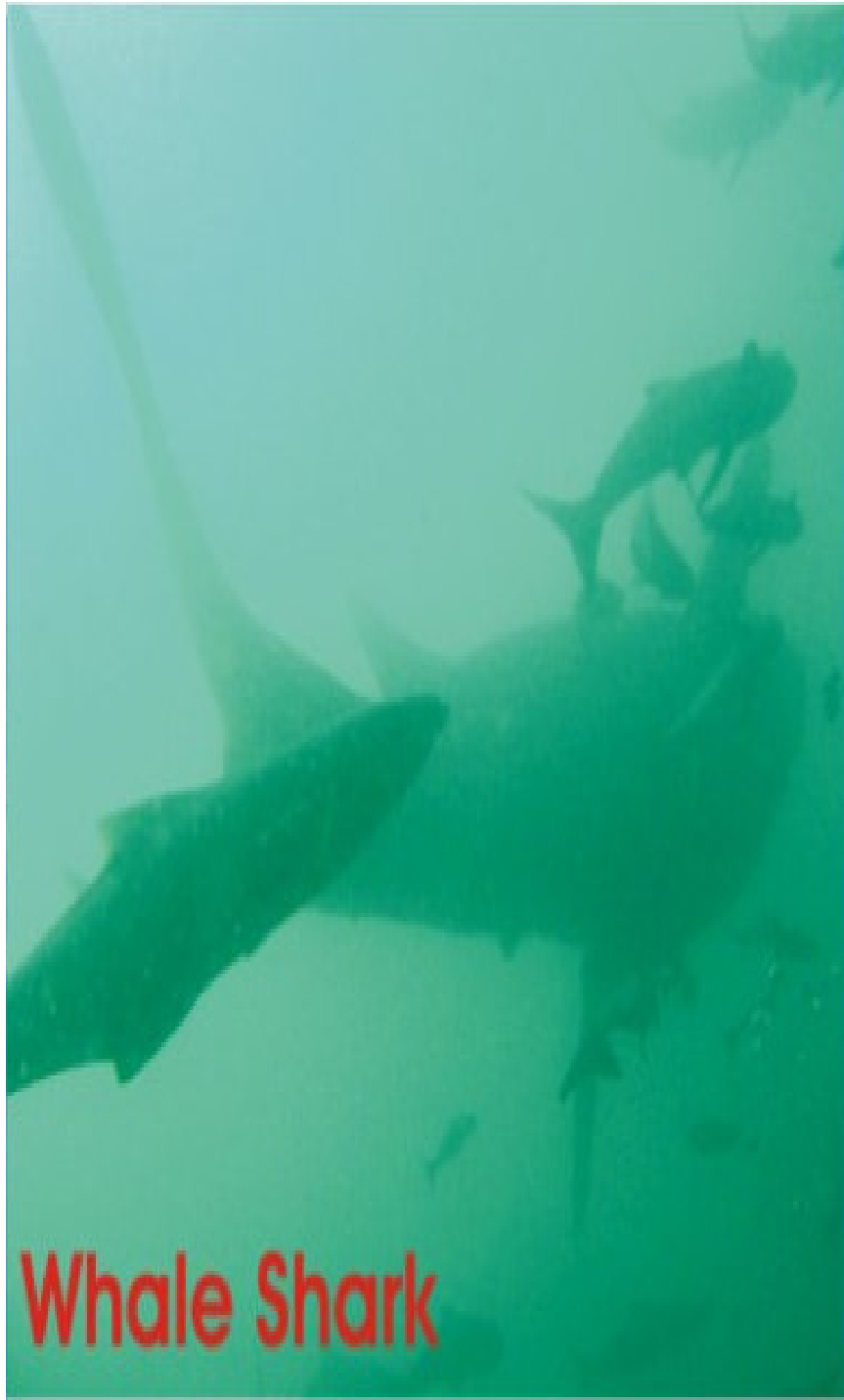
Diversity of coral reef- India

Locations	Total Genus
Palk Bay	21
Gulf of Mannar	26
L.D. Island	28
Andaman Is	25
Nicobar Is	42
Gulf of Kutch	20
Ctrl. West Coast	8
Gaveshani Bank	5
Netrani Is	12

Coral fishes

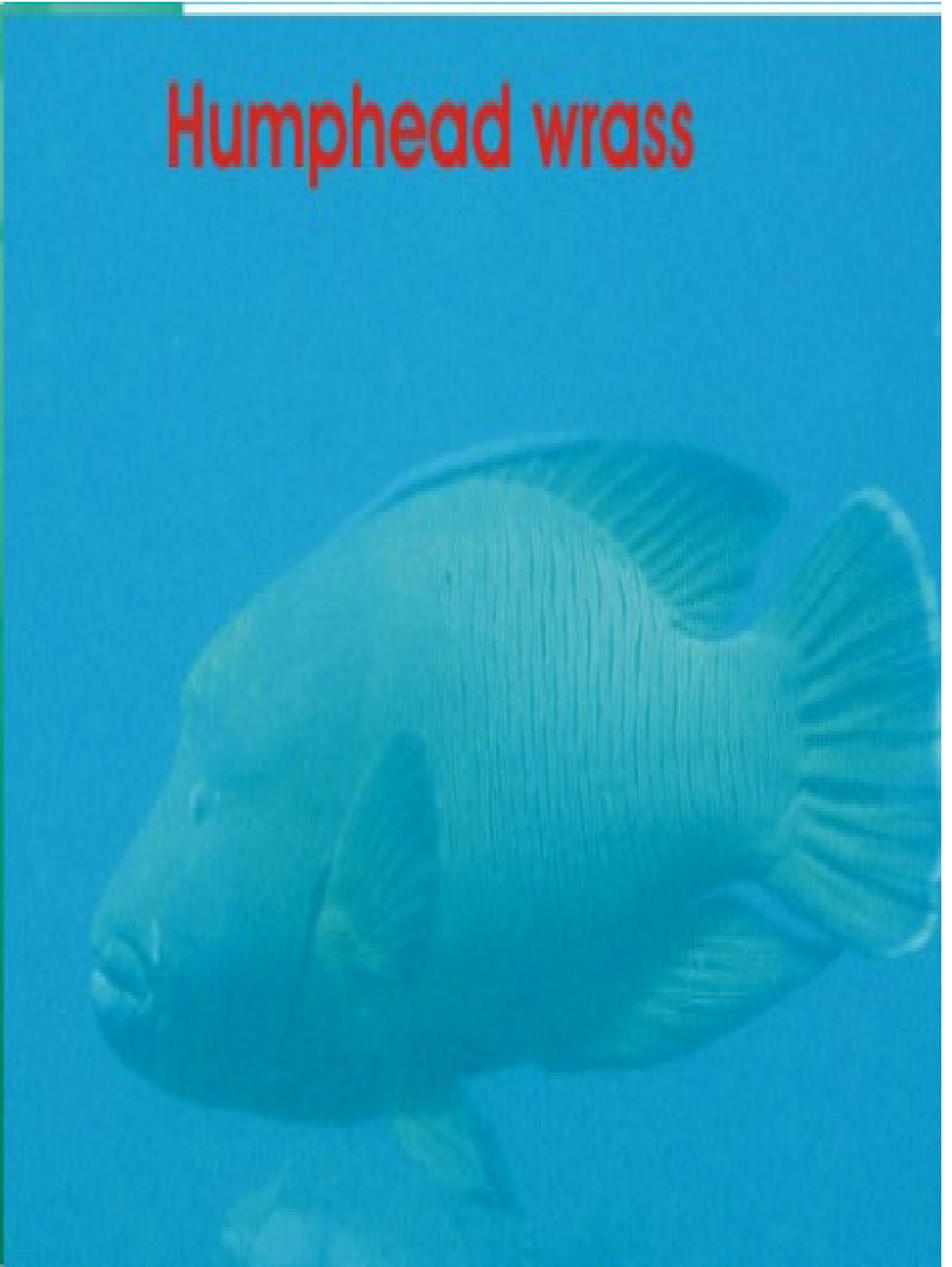
- Total of 89 coral associated fishes were recorded from the area in which 27 species were new record from the Indian coast.
- Four fish Genus were reported for the first time from Indian coast.
- Out of the nine grouper fish species identified from this island, two species such as *Cheilinus undulates* (endangered) and *Rhincodon typus* (vulnerable) are included in the IUCN red list.





Whale Shark

Humphead wrass



Coral species

- Total of 14 coral species and 4 sponge species collected & identified.
- Total of 15 bivalve species, 48 gastropod species and 8 nudibrach species collected & identified.
- Several small giant clams (*Tridacna maxima*) which are protected under the Indian Wildlife (Protection) Act and included in the IUCN Invertebrate Red Data Book as 'Lower Risk: Conservation Dependent' species was observed from this area.



No. of species recorded from Netrani Island

Sl.no	Group	No. of species
1	Phytoplankton	16
2	Seaweed	7
3	Porifera- Sponges	6
4	Scyphozoa- Jelly fish	12
5	Ctenophora	2
6	Anthozoa- sea anemones	2
7	Cnidaria	7
8	Holothuria	1
9	Zooplankton	2
10	Nudibranch Molluscs	8
11	Bivalve Molluscs	15
12	Gastropod Molluscs	48
13	Cephalopod Molluscs	3
14	Shrimp	12
15	Crabs	17
16	Lobster	4
17	Sea snake	3
18	Finfish	92

Destruction of the Island



No	Taxa	Karnataka	India	%
1	Cholorophyta	25	216	12
2	Rhodophyta	30	434	7
3	Cyanaophyta	2		
4	Phaeophyta	21	191	11
5	Crysophyta	57		
6	Tracheophyta	2		
7	Dinoflagellata	6	90	7
8	Porifera	6	486	1
9	Cnidaria	73	842	9
10	Ctenophora	2	12	17
11	Rhizopoda	11		
12	Nemertea	1		
13	Ciliophora	3		
14	Nematoda	4		

No	Taxa	Karnataka	India	%
15	Brachiopoda	1		
16	Annelida	143	378	38
17	Echiura	2	33	6
18	Chaetognatha	5	30	17
19	Mollusca	259	3370	8
20	Bryozoa	3	200	2
21	Echinodermata	11	765	1
22	Arthropoda	310	3448	9
23	Protochordata	6	119	5
24	Pisces	389	2546	15
25	Reptilia	6	15	40
26	Mammalia	8	25	32
	Total	1,386	16,173	9

Conclusion & recommendation

- ❑ This was a first large scale scientific study conducted on the marine biodiversity along the Karnataka coast.
- ❑ The giant clam *Tridacna maxima* was reported for the first time from the coast.
- ❑ The candy shrimps, *Rhynchocinetes durbanensis*, collected from Nethrani island was the first record from the coast. This is a commercially important ornamental species, which is having heavy demand all over the world.
- ❑ False rose shrimp', *Parapenaeus fiissuroides indicus*, 'Doredotes shrimp' *Heterocarpoides levimana*, 'Hairy crab' *Portunus monomia gracillimanus* and coral crabs, *Carpilius convexus* and *Carpilius maculates* were recorded for the first time from the coast.



- **Underwater surveys carried out at Netrani Island revealed the presence very rich and diverse coral ecosystem. For the entire west coast it is a very unique biodiversity rich area showing some of the very rare species.**
- **The Netrani Island ecosystem is under threat due to Indian Navy's shelling/shooting practice exercise. This should be stopped immediately for saving this unique ecosystem.**
- **Netrani Island has to be protected as a marine reserve with regulated ecotourism. A detailed investigation is again required to completely document the marine biodiversity of the area covering all seasons.**



- Sea birds which are abundant in the coastal areas and play a vital role on the ecological interaction of the coastal areas could not be covered in the present study.
- The turtles come to shore for laying the eggs during their breeding season. There are several sandy beaches ideal for nesting of turtles. Human activities in those beaches should be restricted.
- Rapid shore based advancement like large scale reclamation, construction of seawater barriers pollution of various origin is changing the nature of estuarine ecosystem, which in may reduces number of survival of the estuarine dependant marine crustaceans.



- The accidental introduction of exotic plankton species through ballast water carried by foreign ships arriving in New Mangalore and Karwar port pose bio-invasion threat along Karnataka coast.
- Sea-level rise due to climate change may increase the salinity profile of the estuaries. Twenty eight zooplankton species are having limited distribution in estuaries.
- Targeted fishery for marine dolphins exist in some areas. This should be stopped.
- **Groups like bryozoans, echinoderms, barnacles, hermit crabs are least studied from Karnataka waters. Due to limitations of the present study, several species might have been missed in our sampling. Therefore while taking up further studies, these groups should be given priority.**

