

Sarita Fernandes | Shaunak Modi | Gaurav Patil
Sagarshakti (Vanashakti)

Marine Biodiversity

REPORT

MARCH 26, 2019

OBSERVATIONS OF THE INTERTIDAL MARINE BIODIVERSITY IN WORLI'S ROCKY SHORES



Above: Juvenile Octopus at Worli Rocky Shores | March 2019

CONTENTS

List of Figures.....	5
1.1 Abstract.....	7
1.2 Introduction.....	7
1.3 Background.....	7
1.4 Methods.....	9
1.5 Results and Observations.....	10
1.5.1 Phylum: Mollusca; Class: Gastropoda	
i Arabian cowry <i>Mauritia arabica</i>	10
ii <i>Euchelus sp.</i>	11
iii Dwarf Turban snail <i>Turbo brunneus</i>	11
iv Nerite snail eggs <i>Nerita sp.</i>	12
v Limpet.....	13
vi <i>Eubranchus virginalis</i>	13
vii <i>Doto sp.</i>	14
1.5.2 Phylum: Mollusca; Class: bivalva	
viii Asian green mussel <i>Perna viridis</i>	15
ix Rock oysters.....	15
1.5.3 Phylum: Mollusca; Class: Cephalopoda	
x Octopus.....	16
1.5.4 Phylum: Cnidaria; Class: Anthozoa	
xi Solitary stony coral.....	17
xii Colonial stony coral.....	17
Xiii Gorgonian <i>Pseudopterogorgia fredericki</i>	18
1.5.5 Phylum: Cnidaria; Class: Actiniaria	
xiv Sea anemone.....	18

1.5.6 Phylum: Arthropoda; Class: Malacostraca

xx Maroon rock crab *Menippe rumphii*.....19
xxi Red egg crab *Atergatis integerrimus*.....19
xvii Clapping crab *Charybdis lucifera*.....20
xviii Snapping shrimp *Alpheus splendidus*.....20
xix Porcelain crab *Petrolisthes boscii*.....21

1.5.7 Phylum: Echinodermata; Class: Ophiuroidea

xx Brittle star.....21

1.5.8 Phylum: Porifera

xxi Sponge.....22
ii Sponge.....23

1.5.9 Phylum: Chordata; Class: Actinopterygii

xxii Croaker *Protonibea diacanthus*.....24
xxiii Longtail Butterfly Ray *Gymnura poeilura*.....24
xxiv Golden snapper *Lutjanus johnii*.....25
xxv Mangrove red snapper *Lutjanus argentimaculatus*.....25
xxvi Sea mullet *Mugil cephalus*.....26
xxvii Tongue sole *Cynoglossus sp.*26
xxviii Sickfish *Drepane punctata*27
xxix Wrasse *Halichoeres sp.*.....27
xxx Spotted scat *Scatophagus argus*.....28
xxxi Grouper *Epinephelus sp.*.....28
xxxii. Shortnose tripodfish *Triacanthus biaculeatus*.....29
xxxiii Barramundi *Lates calcarifer*.....29

1.5.10 Phylum: Chordata; Class: Ascidiacea	
xxiv Sea squirts.....	30
xxxvi Sea squirts.....	30
1.6 Coastal Road reclamation: Observations and Discussion.....	31
1.7 Conclusion.....	35
References.....	36

LIST OF FIGURES

Figure 1.1 : Reclamation zone map at Worli for proposed coastal road.....	6
Figure 1.2: Shoreline survey of Worli Rocky shores.....	8
Figure 1.3: Arabian Cowry (<i>M. arabica</i>) at Worli intertidal.....	9
Figure 1.4: ‘ <i>Euchelus asper</i> ’ at Worli intertidal.....	10
Figure 1.5: Dwarf turban snail at Worli intertidal.....	10
Figure 1.6: Nerite snail eggs at Worli intertidal.....	11
Figure 1.7: Limpets at Worli intertidal.....	12
Figure 1.8: Sea Slug at Worli intertidal.....	12
Figure 1.9: Nudibranch at Worli intertidal	13
Figure 1.10: Mussel at Worli intertidal.....	14
Figure 1.11: Rock Oyster at Worli intertidal.....	14
Figure 1.12, 1.13: Octopus at Worli intertidal.....	15
Figure 1.14: Solitary Stony Coral at Worli intertidal.....	16
Figure 1.15: Stony Coral Colony at Worli intertidal.....	16
Figure 1.16: Sea Fan at Worli intertidal.....	17
Figure 1.17: Sea Anemone at Worli intertidal.....	17
Figure 1.18: Maroon Rock Crab (<i>M. rumphii</i>) at Worli intertidal	18
Figure 1. 19: Red egg crab (<i>A. integerrimus</i>) at Worli intertidal.....	18
Figure 1.20: Clapping Crab at Worli intertidal	19
Figure 1.21: Snapping Shrimp at Worli intertidal.....	19
Figure 1.22: Porcelain Crab at Worli intertidal.....	20
Figure 1.23: Brittle Star at Worli intertidal	20
Figure 1.24: Sea Sponges at Worli intertidal.....	22
Figure 1.25: Sea Sponges at Worli intertidal	23
Figure 1.26: Juvenile Croakers at Worli intertidal.....	24
Figure 1.27: Butterfly Ray at Worli intertidal.....	24

Figure 1.28: Golden Snapper at Worli intertidal	25
Figure 1.29: Mangrove Red Snapper at Worli intertidal.....	25
Figure 1.30: Sea Mullet at Worli intertidal.....	26
Figure 1.31: Tongue Sole at Worli intertidal.....	26
Figure 1.32: Sickfish at Worli intertidal.....	27
Figure 1.33: Wrasse at Worli intertidal.....	27
Figure 1.34: Spotted Scats at Worli intertidal.....	28
Figure 1.35: Grouper at Worli intertidal.....	28
Figure 1.36: Shortnose Tripodfish at Worli intertidal	29
Figure 1.37: Barramundi at Worli intertidal	29
Figure 1.38: Sea Squirts at Worli intertidal.....	30
Figure 1.39: Sea Squirts at Worli intertidal	30
Figure 1.40: Reclamation at the Worli Rocky intertidal.....	31
Figure 1.41: Reclamation in the intertidal rocky shores of Worli	32
Figure 1.42: A fisherwomen oyster-fishing amidst the looming reclamation and oyster bed destruction for the coastal road.....	33
Figure 1.43: Vast spread of Sea Sponges (Porifera) observed in the Worli intertidal shores.....	34
Figure 1.44: Unique rocky intertidal shore of Worli	35

1.1 ABSTRACT

One of the last remaining chances to document the intertidal marine biodiversity of Worli remains as the looming ongoing reclamation by dumping of non-oceanic mud and destruction of the entire intertidal shore of Worli arises for the construction of the proposed coastal road. The shore was documented using GPS metadata tags on the images of intertidal species that were documented in a two hour shorewalk at the Worli rocky intertidal shores. Along with the livelihood aspect that is *sub juris* in the Bombay High Court, this report aims to establish a legal ground of evidence based on our shorewalk survey of the plethora of intertidal marine biodiversity, some of which are included under the schedule I of the Wildlife Protection Act, 1972 and CRZ I-A of the Coastal Regulation Zone Notifications 2019.

1.2 INTRODUCTION & BACKGROUND

The coastal road project will reclaim land from the sea to build an eight-lane highway that will connect South Mumbai to the suburbs (LiveMint 2019).

The Coastal road construction at Worli seaface proposes reclamation of all intertidal rocky shores, that fall under the Coastal Regulation Zone notifications of 2019 under CRZ I-B. The ongoing reclamation has impacted a threat to the artisanal fishing community of Worli. The said fishing community has approached the judiciary's bench of the Bombay High Court for relief and compensation in the risk of permanent loss of livelihoods and economical marine biodiversity

The shorewalk study aims to document the number of intertidal marine species (consumed and non-consumed) present within these rocky shores of Worli, to understand the biodiversity richness index of these bioreserves.

The Bombay High Court on Wednesday asked the Maharashtra government if it has thought of a substitute occupation for 600 fishermen families whose livelihood is under threat from the construction of the 35.6-km coastal road. (The Hindu, 2019). Although the residents of south Mumbai are up in arms against the design of the coastal road, the Brihanmumbai Municipal Corporation (BMC) asserts that it is too late to change the design. (Asian Age, 2019)

Figure 1.1 : Reclamation zone map at Worli for proposed coastal road | Source: https://portal.mcgm.gov.in/irj/portal/anonymous/qlcoastal1?guest_user=english (accessed 28/03/2019)



LEGEND:

- █ TUNNEL
- █ RAMP PORTION (TUNNEL)
- █ BRIDGE ON SEA
- █ ROAD ON STILTS
- █ LAND FILLED ROAD
- █ LAND FILLED ROAD IN MANGROVES
- █ EXISTING ROAD
- █ ELEVATED ROAD
- █ PROMENADE
- █ RECLEAMATION AREA

1.4 METHODS:

The documentation was conducted at Worli seaface: seaward side rocky shores on 24/03/2019 and 25/03/2019. The species observed and subsequently documented were done using GPS (Global positioning system). The documentation was carried out through a shorewalk accompanied by Fishermen of Worli Koliwada and marine experts on the rocky shores during the spring low tide at 7:19am on 24/03/2019 and 8am on 25/03/2019 . The documentation was carried from 7:19 am to 9:24am (2 hours, 5 minutes) on 24/03/2019 and 8:00-10:30 am (2 hours 30 minutes) on 25/03/2019

Date and Time: 7: 19am (Lowtide), 24/03/2019 | 08:00 am (Lowtide), 25/03/2019

Duration: 2 Hours, 5 minutes | 2 hours, 30 minutes

Distance: 889.24m

Location: Worli Seaface: Seaward side rocky shore (19.00477_72.813751__19°0'17" N_72°48'49" E India, Mumbai -Benreeza Building, Police Camp, Worli Sea Face, Worli, Mumbai, Maharashtra 400030, India 20190324

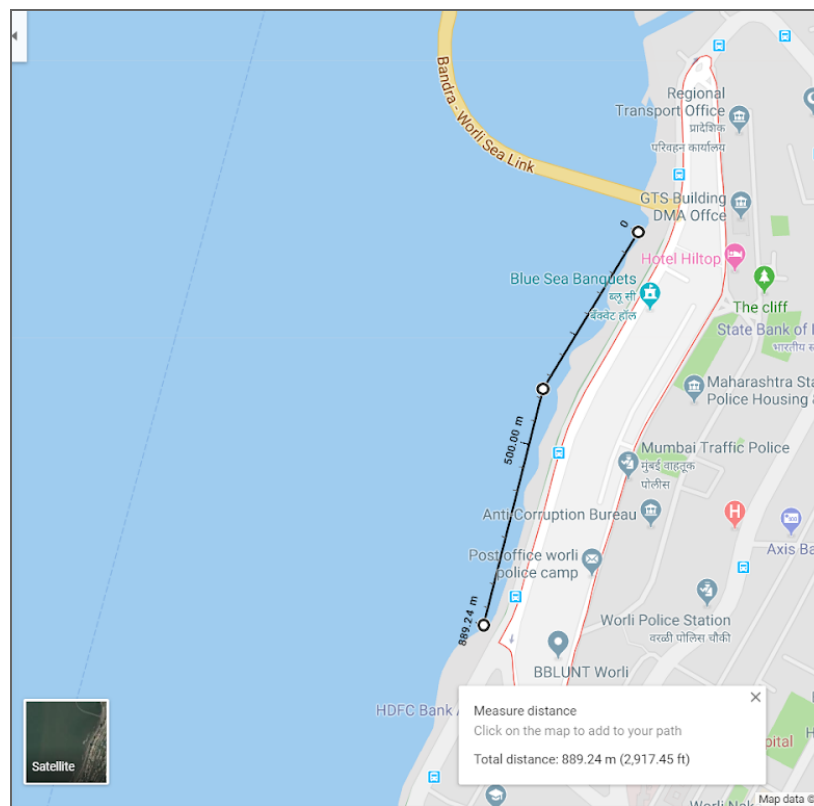


Figure 1.2: Shoreline survey of Worli Rocky shores | Source- Google Earth (accessed 26/03/2019)

1.5 RESULTS:

The shorewalk was carried out from point 19°0'17" N to 72°48'49" E in the mentioned path of documentation. The team observed and documented 36 species of intertidal marine biodiversity at low tide in the rocky shores of Worli.

All images included in the report is Primary Data collected during the shorewalk surveys on 24/.3/2019 and 25/03/2019.

Intertidal species:

1.5.1 Phylum: Mollusca; Class: Gastropoda

I. ARABIAN COWRY (*Mauritia arabica*)

Arabian Cowry (Cowry snail) is an uncommon marine intertidal species that has been infrequently documented from the rocky shores of Worli, Haji Ali, Priyadarshini Park and Marine Drive in Mumbai's intertidal. It was found in moderate abundance in the Worli intertidal rocky shores.



Figure 1.3: Arabian Cowry (*M. arabica*) at Worli intertidal | March 2019

II. *Euchelus sp.*

Many species of marine gastropods (sea snails) from the genus *Euchelus* were found in high abundance within the crevices of the rocks in the intertidal zone of Worli Seaface.



Figure 1.4: '*Euchelus asper*' at Worli intertidal | March 2019

III. DWARF TURBAN SNAIL (*Turbo brunneus*)

Dwarf turban snail (*T. brunneus*) is a relatively uncommon gastropod found on certain rocky shores of Mumbai. They belong to the family Turbinidae.



Figure 1.5: Dwarf turban snail at Worli intertidal | March 2019

IV. NERITE SNAIL EGGS (*Nerita* sp.)

Nerites have separate genders and engage in internal fertilisation. They have a complex reproductive system to achieve this, and to produce nutrition-packed eggs in protective capsules. The white circular egg capsules are sometimes seen in rock pools, under rocks and in moist crevices. Each egg capsule may have more than 30 eggs. These hatch into free-swimming larvae that only later settle down to develop into snails. (Tan Siong Kiat, 2010)

(*Nerita polita*) are listed as 'Vulnerable' on the Red List of threatened animals of Singapore. (Tan Siong Kiat, 2010)

These eggs were observed across numerous rocks in the intertidal shores of Worli during low tide.

No study on the extinction risks of such species has been carried out by the Indian wildlife board with respect to the case study of the Red List of threatened animals of Singapore.



Figure 1.6: Nerite snail eggs at Worli intertidal | March 2019

V. LIMPET (Patellogastropoda)

A typical limpet has a flattened, conical shell and sits on a hard surface, like a stone or a ship hull. The shell has no windings. The limpets can be hard to spot as they are often covered in growth. The largest limpet, *Patella mexicana* may reach a diameter of 20 cm, but most species are less than 8 cm. (Kåre Telnes, 2017)

The limpets are well adapted to a life in the intertidal zone, due to their ability to maintain humidity under the shell during hours of low tide. (Kåre Telnes, 2017)



Figure 1.7: Limpets at Worli intertidal | March 2019

VI. *Eubranthus Virginalis*

Sea Slugs also known as *Eubranthus virginalis* is characterised by the large black spots scattered over the body, cerata and tentacles. The spots often have traces of a whitish ring around them. (Abe, T. 1964)

Sea slugs were observed in several tidepools during the shorewalk survey at the rocky intertidal shores of Worli.



Figure 1.8: Sea Slug at Worli intertidal | March 2019

VII. Doto Sp.

There are more than 2,000 known species of nudibranch, and new ones are being identified almost daily. They are found throughout the world's oceans, but are most abundant in shallow, tropical waters. Their scientific name, Nudibranchia, means naked gills, and describes the feathery gills and horns that most wear on their backs. (National Geographic, 2015)



Figure 1.9: Nudibranch at Worli intertidal | March 2019

1.5.2 Phylum: Mollusca; Class: bivalva

VIII ASIAN GREEN MUSSEL (*Perna viridis*)

Several species of Mussels that belong to the Bivalve (Mollusc) family were observed in abundance at the rocky shores in Worli.

Mussel, any of numerous bivalve mollusks belonging to the marine family Mytilidae (Gaurav Shukla,2007)

Mollusca is included in Schedule I of the Wildlife Protection Act, 1972.



Figure 1.10: Mussel at Worli intertidal | March 2019

IX. ROCK OYSTERS (*Ostreidae*)

Rock Oysters belong to a family of molluscs known as 'Ostreidae', which includes 'true oysters'. Multiple species of this family were found spread across the rocky shores of Worli seabed from the sealink entry point right up till worli dairy (seaward side).



Figure 1.11: Rock Oyster at Worli intertidal | March 2019

1.5.3 Phylum: Mollusca; Class: Cephalopoda

X. OCTOPUS (Cephalopoda)

The octopus is a soft-bodied, eight-limbed mollusc of the order Octopoda. Around 300 species are recognised, and the order is grouped within the class Cephalopoda with squids, cuttlefish, and nautiloids. Most octopuses stay along the ocean's floor, although some species are pelagic, which means they live near the water's surface. Crabs, shrimps, and lobsters rank among their favorite foods, though some can attack larger prey, like sharks. (National Geographic, 2015)

Octopuses are solitary creatures that live alone in dens built from rocks, which the octopus moves into place using its powerful arms. (National Geographic, 2015)

Two Juvenile solitary octopuses were observed during the shorewalk survey and documentation at low tide in the rocky intertidals of Worli.

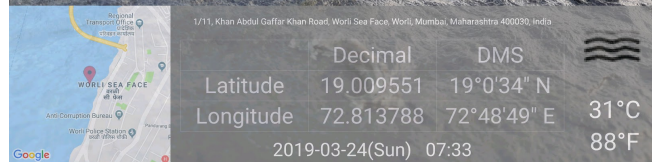
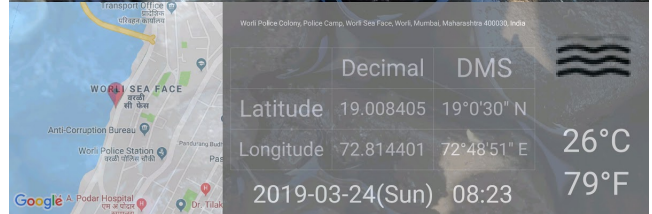


Figure 1.12, 1.13: Octopus at Worli intertidal | March 2019

1.5.4 Phylum: Cnidaria; Class: Anthozoa

XI. SOLITARY STONY CORAL (*Rhizangiidae*)

Hard corals, also called stony corals, are in the Order Scleractinia. They comprise of polyps housed in a solid calcareous skeleton (similar to an apartment building with many tenants). The polyps secrete a calcareous cup-like structure, the corallite, around itself for protection. The corallites are usually joined to each other by a calcareous material called the coenosteum. Many hard corals build massive reefs, but some build smaller structures or are encrusting (growing on other hard objects). A few form large individual polyps, as can be seen here. (Brenda Bowling, 2012)



Figure 1.14: Solitary Stony Coral at Worli intertidal | March 2019

XII. COLONIAL STONY CORAL (*Rhizangiidae*)

Hard corals, also called stony corals, are in the Order Scleractinia. Most are colonial polyps that are housed in a solid calcareous skeleton (similar to an apartment building with many tenants). The corallites of some of the solitary species are among the most beautiful designs in nature, the septa usually displaying a symmetry in multiples of six. (Brenda Bowling, 2012)

Corals and Coral reefs are included in CRZ I-A and Schedule I of the Wildlife Protection Act, 1972.

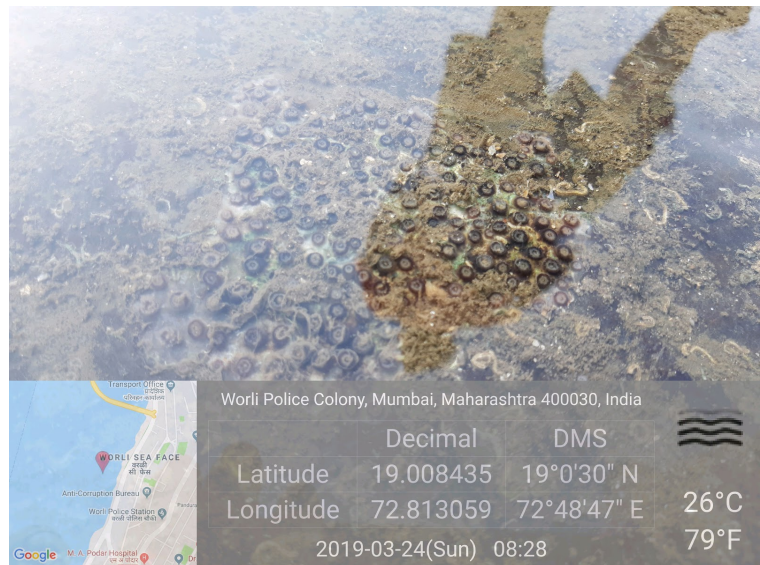


Figure 1.15: Stony Coral Colony at Worli intertidal | March 2019

XIII. GORGONIAN (*Pseudopterogorgia fredericki*)

Sea fans also called gorgonian fans – a type of coral, were found in the rocky shores of Worli during extreme low tide. Sea fan, (genus *Pseudopterogorgia*), are invertebrate marine animals of the suborder Holaxonia (class Anthozoa, phylum Cnidaria).

It is a variety of coral composed of numerous polyps—cylindrical sessile (attached) forms—that grow together in a flat fanlike pattern. Each polyp in the colony has eight tentacles.(J. Rafferty, 2015)

Sea fans are found in the shallow waters of all oceans, but they are especially abundant along the Atlantic coasts of Florida, Bermuda, and the West Indies.(J. Rafferty, 2015_

Gorgonians are included in Schedule I under the Wildlife Protection Act, 1974.



Figure 1.16: Sea Fan at Worli intertidal | March 2019

1.5.5 Phylum: Cnidaria; Class: Actiniaria

XIV. SEA ANEMONE (Actiniaria)

A close relative of coral and jellyfish, anemones are stinging polyps that spend most of their time attached to rocks on the sea bottom or on coral reefs waiting for fish to pass close enough to get ensnared in their venom-filled tentacles. (National Geographic, 2015)

There are more than 1,000 sea anemone species found throughout the world's oceans at various depths, although the largest and most varied occur in coastal tropical waters. They run the full spectrum of colors and can be as small as half an inch or as large as 6 feet across. (National Geographic, 2015)



Figure 1.17: Sea Anemone at Worli intertidal | March 2019

1.5.4 Phylum: Arthropoda; Class: Malacostraca

XV. MAROON ROCK CRAB (*Menippe rumphii*):

Maroon Rock Crabs were documented in abundance in the worli shores. Juveniles of these species were also observed indicating a good number of species habitat within the area. The artisanal fishermen of Worli were noticed catching these species of crabs for sale and consumption.



Figure 1.18: Maroon Rock Crab (*M. rumphii*) at Worli intertidal| March 2019

XVI. RED EGG CRAB (*Atergatis integerrimus*)

The Red Egg Crab (*Atergatis integerrimus*) is commonly found under rocks and in rubble. It is identified by the smooth margin of its shell, giving it an oval, egg-like shape. The claws have dark blackish tips. The flesh of this species is toxic – a result of bacteria living symbiotically within it. They have been documented in Haji Ali, Marine Drive and Worli.



(Marine Life Of Mumbai, 2017)

Figure 1. 19: Red egg crab (*A. integerrimus*) at Worli intertidal | March 2019

XVII. CLAPPING CRAB (*Chaybdis lucifera*)

Clapping Crabs are approximately 10 cm in size, found in the rocky shores in Mumbai that has been documented in Juhu and now Worli.



Figure 1.20: Clapping Crab at Worli intertidal | March 2019

XVIII. SNAPPING SHRIMP (*Alpheus splendidus*)

Snapping shrimp are crustaceans that are found in tropical and temperate seas. These shrimp, usually a muddy green color, grow to about 5 cm (2 inches) long. Their most noticeable physical feature is a claw that can grow to be half the size of the entire body length. It is this claw that gives snapping shrimp their most remarkable attribute. A snapping shrimp will quickly close its claw to produce a loud “snap” as a way to stun its prey, deter predators, and communicate with others. (Department of Applied Physics, University of Twente)



Figure 1.21: Snapping Shrimp at Worli intertidal | March 2019

***Alpheus heterochaelis* is the only known species to produce sound using this cavitation process.**

The combined sound of large aggregations of snapping shrimp is so prevalent in certain areas of the world that it interferes with underwater communications and research. (Department of Applied Physics, University of Twente).

Snapping shrimps were observed in abundance in between the crevice of the rocky intertidal shores of Worli.

XIX. PORCELAIN CRAB (*Petrolisthes boscii*)

Clapping Crabs are approximately 10 cm in size, found in the rocky shores in Mumbai that has been documented in Juhu and now Worli.



Figure 1.22: Porcelain Crab at Worli intertidal | March 2019

1.5.5 Phylum: Echinodermata; Class: Ophiuroidea

XX. BRITTLE STAR (*Ophiuroidea*)

Ophiuroids are a large group (over 1600 species) of echinoderms that includes the brittle stars (*Ophiurida*) and basket stars (*Euryalida*). (Hyman, 1955)

The more familiar *Ophiurida*, or brittle stars, usually have five arms and superficially resemble true starfish. (Hyman, 1955)

Ophiuroids are common in many shallow-water marine habitats, and include a few species which can adapt to brackish water, which is quite unusual for echinoderms. (Hyman, 1955)

The brittle star was documented solitary in the Worli rocky shores at extreme low tide.



Figure 1.23: Brittle Star at Worli intertidal | March 2019

1.5.6 Phylum: Porifera

XXI. SEA SPONGE (Porifera)

Sponges are characterized by the possession of a feeding system unique among animals. Poriferans don't have mouths; instead, they have tiny pores in their outer walls through which water is drawn. Cells in the sponge walls filter nutrients from the water as the water is pumped through the body and out other larger openings. (Bergquist, 1978)

The Worli shore observed a huge bed of sponges spread across the rocky shore during extreme low tide.



Figure 1.24: Sea Sponges at Worli intertidal | March 2019

XXII. SEA SPONGE (Porifera)

Sponges are characterized by the possession of a feeding system unique among animals. Poriferans don't have mouths; instead, they have tiny pores in their outer walls through which water is drawn. Cells in the sponge walls filter nutrients from the water as the water is pumped through the body and out other larger openings. (Bergquist ,1978)

The Worli shore observed a huge bed of sponges spread across the rocky shore during extreme low tide.

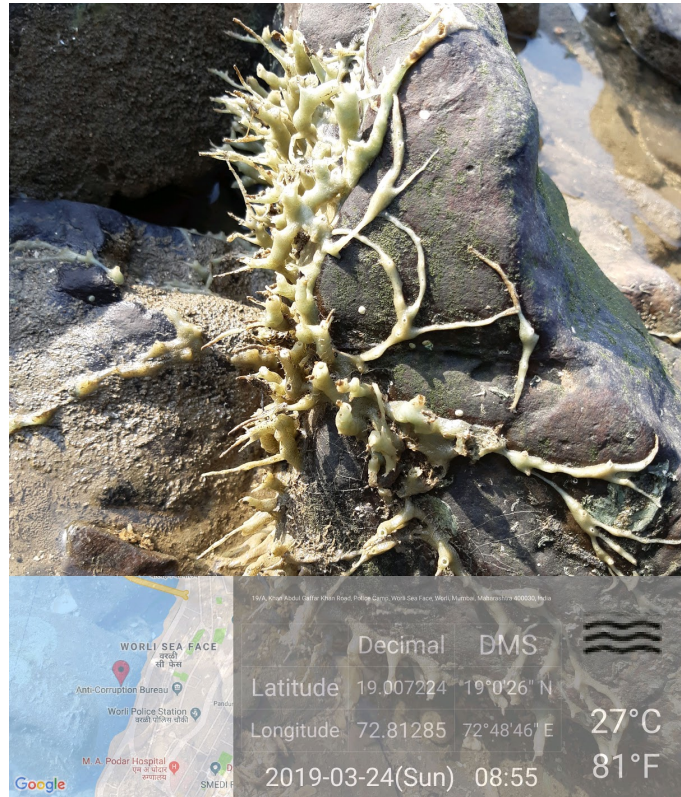


Figure 1.25: Sea Sponges at Worli intertidal | March 2019

1.5.5 Phylum: Chordata; Class: Actinopterygii

XXIII. CROAKERS (*Protonibea diacanthus*)

Blackspotted Croaker (*Protonibea diacanthus*) is one of the most important species of the family Sciaenidae found in the Indo-West Pacific: west coast of the Persian Gulf and along the coasts of India and Sri Lanka. (FishBase, 2013) (Sachinandan Dutta, 2013)

The fishing in this estuarine region is carried out in the shallow waters of the Bay of Bengal up to 70 km from the coast. (Sachinandan Dutta, 2013)

Owing to the high market price of (*P. diacanthus*), the fishermen are getting more inclined to catch this particular species. The rate of this species is so high compared to others that even a single catch can turn out to be cost-effective. (Sachinandan Dutta, 2013)

Similar trends of artisanal fishermen catching these species within the intertidal rocky shores was observed and documented in Worli.



Figure 1.26: Juvenile Croakers at Worli intertidal | March 2019

XXIV. LONGTAIL BUTTERFLY RAY (*Gymnura poeilura*)

Members of the family Gymnuridae can be found worldwide in tropical and warm temperate seas. Their range in the Atlantic includes the Black Sea, and they are widely distributed in the Pacific and Indian oceans. (Allen, 1994)

Their pectoral fins form a disc that is much broader than it is long, forming “wings” that give the family its common name, butterfly rays. These rays are marine and occasionally estuarine, found worldwide in tropical and subtropical seas. They live on the bottom in open sandy areas, where they feed on a variety of invertebrates, fishes, and other small organisms. Some bear a venomous spine on their short tails, but butterfly rays are considered far less dangerous than the long-tailed stingrays. Like other rays, butterfly rays are viviparous, giving birth to live young after nourishing them inside the uterus (Allen, 1994)



Figure 1.27: Butterfly Ray at Worli intertidal | March 2019

The Butterfly ray was observed and documented on 26/03/2019.

Although sharks and rays are included in the Wildlife Protection Act, butterfly rays are not included in the schedule or under any policy protection.

XXV. GOLDEN SNAPPER (*Lutjanus johnii*)

Golden snappers are found in marine as well as brackish environments. An adult golden snapper is a reef associated fish, while the juveniles live in intertidal regions or in estuaries. An average golden snapper grows upto 50 cm in length and can weigh upto 10 kgs.

They mainly feed on other fish, shrimps, crabs and cephalopods.



Figure 1.28: Golden Snapper at Worli intertidal | March 2019

XXVI. MANGROVE RED SNAPPER (*Lutjanus argentimaculatus*)

Adult mangrove red snappers are usually reef associates, while young adults and juveniles can be seen near estuaries, river mouths and tidal creeks. Adults often form small groups and feed on other fish and crustaceans.

They can grow upto 150 cm in length and weigh upto 8 kg. It is an economically important fish species.

Mangrove red snappers are harvested by fishermen using cast net as well as gill net.



Figure 1.29: Mangrove Red Snapper at Worli intertidal | March 2019

XXVII SEA MULLET (*Mugil cephalus*)

Sea mullets are found in marine as well as brackish environments. Adult mullets are found in the near shore region, sometimes entering into estuaries. They form large schools and feed on detritus, micro algae and benthic organisms.

The maximum length reported of mullet is 120 cms weighing upto 12 kg.

These fish are harvested by fishermen using gill net in the intertidal region.



Figure 1.30: Sea Mullet at Worli intertidal | March 2019

XXVIII. Tongue Sole (*Cynoglossus sp.*)

Tongue soles are a bottom dwelling fish species found in marine as well as brackish environments. They inhabit shallow waters with a muddy or sandy bottom. They feed on benthic invertebrates.



Figure 1.31: Tongue Sole at Worli intertidal | March 2019

XXIX. SICKLEFISH (*Drepane punctata*)

Sicklefish is a reef associated fish, but also found in brackish water environment. They are mainly found around coral and rock reefs along with sandy and muddy substrates.

They feed on invertebrates and benthic fishes.

They are harvested using cast net in the intertidal region.



Figure 1.32: Sicklefish at Worli intertidal | March 2019

XXX. WRASSE (*Halichoeres sp.*)

Halichoeres is a genus of marine, reef associated fish.

They inhabit seaward reefs and lagoons, mainly coral rich areas. Juveniles of *Halichoeres sp.* are often encountered in the exposed reef flats.

They are benthopelagic and mostly live solitary.

They feed on a variety of small invertebrates and on eggs of other fish.



Figure 1.33: Wrasse at Worli intertidal | March 2019

XXXI. SPOTTED SCAT (*Scatophagus argus*)

Spotted scat is a marine as well brackish water fish. Adults of this species are reef associated.

They also occur near harbours, mangroves and around freshwater streams. They feed mainly on worms, crustaceans, insects and plant matter.

Average length of spotted scat is 20 cm.

The dorsal fin spines are believed to be venomous by the local fishers.



Figure 1.34: Spotted Scats at Worli intertidal | March 2019

XXXII. GROUPER (*Epinephelus sp.*)

It is a marine demersal reef fish. They occur near shallow banks and poorly developed reef areas.

They are also found in silty coastal reefs and estuaries.

They are predatory and live a solitary life.

They mainly feed on other fish and can grow upto 78 cm.



Figure 1.35: Grouper at Worli intertidal | March 2019

XXXIII. SHORTNOSE TRIPODFISH (*Triacanthus biaculeatus*)

It is a demersal fish, living in marine and brackish environments.

They inhabit sandy and muddy flats in coastal and estuarine waters.

They grow upto 30 cm in length, but aren't used for consumption.

Fishers encounter them as a bycatch in the cast net, operated in the intertidal region.



Figure 1.36: Shortnose Tripodfish at Worli intertidal | March 2019

XXXIV. Barramundi (*Lates calcarifer*)

It is a demersal fish occurring both in marine as well as brackish environments.

They spawn in estuarine environment and can also inhabit rivers. They feed on other small fish and benthic invertebrates. They grow upto 200 cm in length and can weigh upto 60 kg.

It is considered as a highly priced fish on the west coast of India.



Figure 1.37: Barramundi at Worli intertidal | March 2019

1.5.10 Phylum: Chordata; Class: Ascidiacea

XXXV. SEA SQUIRTS (Ascidiacea)

Ascidians, or Sea squirts as they're commonly known are usually found on the underside of hard surfaces such as rocks and in coral rubble.

Sea squirts are complex animals. They usually have a circulatory system, a digestive system, a heart and other organs. They generate a one-way current through its body with a part of their gut modified to filter out plankton from this water flow.



Figure 1.38: Sea Squirts at Worli intertidal | March 2019

The ones documented from Worli are called colonial or compound ascidians. In some colonies, the zooids are quite independent of one another. In others, they may be connected by stem-like structures called stolons, or embedded in a common tissue so the entire colony looks like a slimy layer.

XXXVI. SEA SQUIRTS (Ascidiacea)

Ascidians, or Sea squirts as they're commonly known are usually found on the underside of hard surfaces such as rocks and in coral rubble.

Sea squirts are complex animals. They usually have a circulatory system, a digestive system, a heart and other organs. They generate a one-way current through its body with a part of their gut modified to filter out plankton from this water flow.



Figure 1.39: Sea Squirts at Worli intertidal | March 2019

The ones documented from Worli are called colonial or compound ascidians. In some colonies, the zooids are quite independent of one another. In others, they may be connected by stem-like structures called stolons, or embedded in a common tissue so the entire colony looks like a slimy layer.

1.5.25 COASTAL ROAD RECLAMATION AND ECOSYSTEM-WIDE DESTRUCTION OF INTERTIDAL ROCKY SHORES AND INTERTIDAL SPECIES IN WORLI



Figure 1.40: Reclamation at the Worli Rocky intertidal | March 2019

BASED ON OBSERVATIONS

- The Coastal Road's proposed reclamation presents a direct threat to the habitat and survival of the 36 intertidal marine species that thrive on these rocky shores for survival, breeding and nesting.
- The road is proposed to reclaim the entire intertidal rocky shores of Worli from Worli Dairy to the entrance of Bandra-Worli sea link
- The ongoing reclamation includes dumping of non-oceanic red mud that could impact the biodiversity, potentially suffocating fragile species like sea slugs, crabs and octopuses who are known to live in crevices and burrows of intertidal rocks.
- The reclamation also includes crushing of the widespread oyster beds and sea sponge habitats for a underground parking as claimed by the BMC contractors during the shorewalk survey.
- The area towards Worli Dairy (seaward side) has already been reclaimed and the process of ongoing reclamation has begun towards the other areas.
- The oyster beds crushing and dumping of non-oceanic mud are occurring at the same time of operations.



Figure 1.41: Reclamation in the intertidal rocky shores of Worli| March 2019

DISCUSSIONS

- The coastal road project is *sub judice* in the matter of the Bombay High Court 2019 between the Worli artisanal fishermen and the Brihanmumbai Mahanagar Palika (BMC)
- Intertidal areas are demarcated as CRZ I-B between the High Tide Line and Low Tide Line as per the Coastal Regulation Zone Notifications(CRZ) of 2019
- Sea cucumbers, Corals, Sea fans and Molluscs which are all intertidal species are included in the Wildlife Protection Act, 1972.



Figure 1.42: A fisherwomen oyster-fishing amidst the looming reclamation and oyster bed destruction for the coastal road.

RECOMMENDATIONS:

- I. The observations of species indicated an urgent and imperative need of conducting scientific marine research into these species and documentation of their unique characteristics.
- II. The impact the coastal road reclamation would have on the intertidal habitats is observed as a potential ‘extinction risk’ of all intertidal species in Worli’s rocky shores
- III. The construction of the road by completely reclaiming the area for parking and recreational purposes stands ‘unsustainable’ as the intertidal shore of Worli is the habitat for all 34 and more species of marine intertidal biodiversity documented.
- IV. The survey report recommends a study of sustainable methods of the coastal road construction, as observed the reclamation by dumping non-oceanic mud poses as a permanent extinction risk of all intertidal marine species of animals in Worli’s rocky shores.
- V. Some parts of the shore observed vast spreads of sea sponges and oyster beds, the former having economical value among the artisanal fisherwomen.

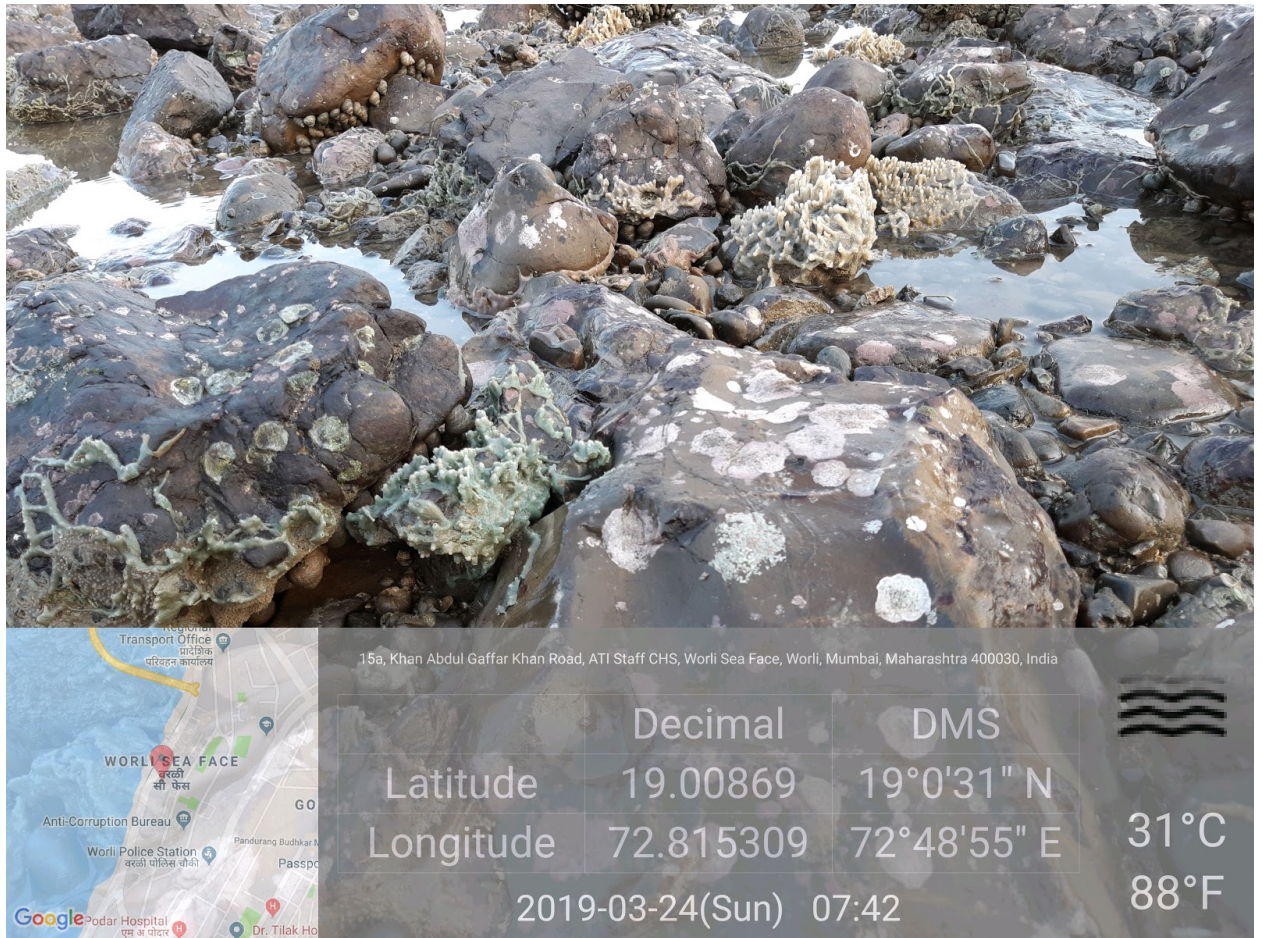


Figure 1.43: Vast spread of Sea Sponges (Porifera) observed in the Worli intertidal shores | March 2019

- VI. The observations of the shorewalk survey impugned the urgent need to halt the dumping of non-oceanic red mud onto saline intertidal rocky shores, as it would adversely impact the juveniles and intertidal species within the Worli rocky shores.

- VII. The terrain of the rocky shores observe a unique natural heritage of geology of rocks, that of a deccan plateau(62-69 million years) and proposes the age identification of their fault, folds, joints and formations to understand the rocky shores unique characteristics and their heritage value (approximately 66.2 million years)

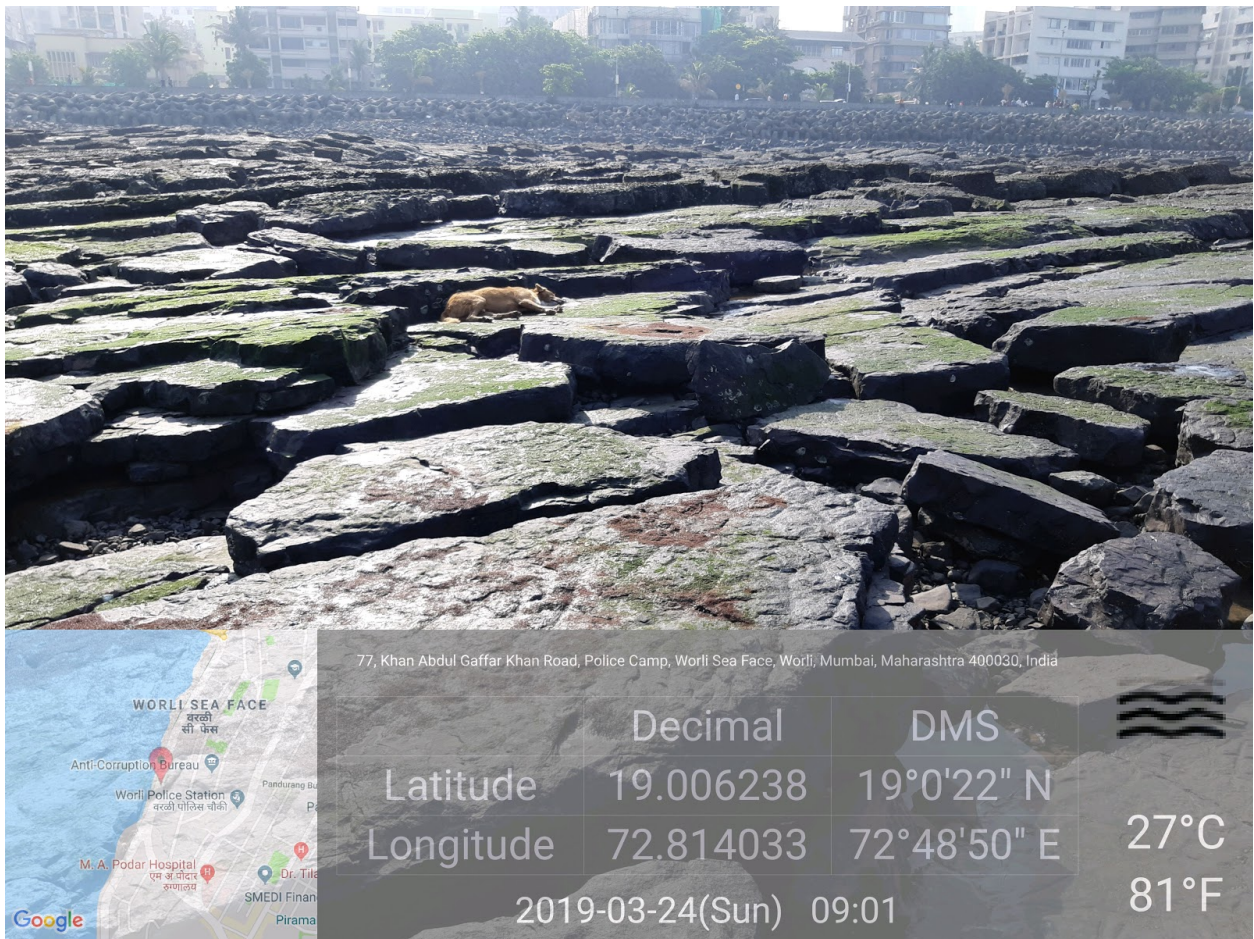


Figure 1.44: Unique rocky intertidal shore of Worli | March 2019

- VIII. The shorewalk survey carried out suggests the extension of the road beyond the intertidal shallows for preservation of the sensitive crucial intertidal marine biodiversity, most species documented do not habituate elsewhere beyond the shore, as per global marine zoologist experts.

CONCLUSION: The report's purpose is to serve as an urgent data set on the vast bioreserve of Worli's intertidal rocky shores that are protected under several coastal and wildlife laws to be preserved and safeguarded from current ongoing and future 'unsustainable' and 'extinction risk' activities.

NOTE: All images presented as primary data in the report are the copyrights of Sarita Fernandes (sarita.vanashakti@gmail.com), Shaunak Modi (shaunak.modi@gmail.com) and Gaurav Patil (gauravpatilwildlife@gmail.com)

REFERENCES:

1. <https://www.britannica.com/animal/sea-fan> (accessed 26/03/2019)
2. <http://www.seawater.no/fauna/mollusca/Patellostropoda.html> (accessed 26/03/2019)
3. <http://www.seaslugforum.net/showall/eubrviug>(accessed 26/03/2019)
4. <https://www.britannica.com/animal/mussel> (accessed 26/03/2019)
5. <https://kids.nationalgeographic.com/animals/octopus/#octopus.jpg>(accessed 26/03/2019)
6. <https://dosits.org/galleries/audio-gallery/marine-invertebrates/snapping-shrimp/>(accessed 26/03/2019)
7. <https://animaldiversity.org/accounts/Gymnuriidae/>(accessed 27/03/2019)
8. <https://www.thehindu.com/news/cities/mumbai/coastal-road-where-are-the-alternative-jobs-for-fishermen-asks-high-court/article26525703.ece> (accessed 27/03/2019)
9. <https://www.livemint.com/mint-lounge/features/will-mumbai-s-new-coastal-road-destroy-an-entire-village-1553332665335.html> (accessed 27/03/2019)
10. <https://www.nationalgeographic.com/animals/invertebrates/group/nudibranchs/>(accessed 27/03/2019)
11. <https://www.fishbase.de/summary/264>(accessed 27/03/2019)
12. <https://www.fishbase.de/summary/Lutjanus-argentimaculatus.html>(accessed 27/03/2019)
13. <https://www.fishbase.de/summary/Mugil-cephalus.html>(accessed 27/03/2019)
14. <http://www.fishbase.org/summary/5456>(accessed 27/03/2019)
15. <https://www.fishbase.de/summary/454>(accessed 27/03/2019)
16. <https://www.fishbase.se/summary/5631>(accessed 27/03/2019)
17. <https://www.fishbase.se/summary/Scatophagus-argus.html>(accessed 27/03/2019)
18. <https://www.fishbase.se/summary/Epinephelus-bleekeri.html>(accessed 27/03/2019)
19. <https://www.fishbase.se/summary/Triacanthus-biaculeatus.html>(accessed 27/03/2019)
20. <https://www.fishbase.in/summary/Lates-calcarifer.html>(accessed 27/03/2019)
21. <http://www.wildsingapore.com/wildfacts/ascidiacea/ascidiacea.htm>(accessed 27/03/2019)
22. https://portal.mcgm.gov.in/irj/portal/anonymous/qlcoastal1?guest_user=english (accessed 28/03/2019)
23. <https://www.marinelifeofmumbai.in/> (accessed 27/03/2019)

REPORT PRESENTED AND COMPILED BY:



