International Horseshoe Crab Day 2022

PROCEEDINGS

The International Seminar on

Know the Horseshoe Crabs
Save the Horseshoe Crabs

20 June 2022 | Cox's Bazar
Seminar Hall, BORI

Bangladesh Oceanographic Research Institute
Ministry of Science and Technology
Government of the People's Republic of Bangladesh

Seminar Proceedings
On

Know the Horseshoe Crabs
Save the Horseshoe Crabs

To celebrate
The 3rd International Horseshoe Crab Day 2022

Organized by

Bangladesh Oceanographic Research Institute (BORI)
Ministry of Science and Technology

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We thank Dr. Md. Sagir Ahmed, Professor, Department of Zoology, University of Dhaka, Bangladesh, for acting as Chief Guest and Dr. Gobinda Chandra Biswal, Reader in Zoology & Principal, K M College of Basic Science, Balasore, India for acting as Keynote Speaker.

We are also thankful to Dr. Shafiqur Rahman, Principal Scientific Officer & Station Head, Marine Fisheries and Technology Station, Bangladesh Fisheries Research Institute (BFRI) and Dr. Joytirmayee Pradhan, Head, Department of Zoology, K K S Women's College, Balasore, India, for giving their insightful remarks on the Horseshoe crabs.

We extend our gratitude to the participants for their valuable presence in the seminar to make it fruitful one.

We would like to express our sincere gratitude to our colleagues, Mr. Abu Sharif Md. Mahbub-E-kibria and Mr. Md. Tarikul Islam for organizing this seminar successfully. Especial thanks to Mr. Md. Simul Bhuyan and Mr. Showmitra Chowdhury for assisting in proceedings preparation.

Sayeed Mahmood Belal Haider
Director General (Additional Secretary)
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What is Horseshoe Crab?

The only living members of the order Xiphosura are horseshoe crabs, which are members of the Limulidae family of marine and brackish water chelicerates (Kin and Baejowski, 2014; Baejowski et al. 2017; Ballesteros and Sharma, 2019).

Despite their name, they are not genuine crabs or crustaceans; they are arthropods that are most closely related to spiders and scorpions (Moore, 2017). They may live on soft, sandy, or muddy bottoms in shallow coastal waters. Horseshoe crabs are not picky eaters and will gobble up pretty much anything. They will also consume small clams and crabs as well as worms and algae (Dunlap, 1999). To eat hard food, they break it between their legs before passing it to their mouths. They lack mandibles and teeth, so they have to eat the head first. Horseshoe crabs have gizzards that grind their food before it goes into their stomachs (Walter and Proctor, 1999). They breed during spring high tides and are consumed in some parts of Asia (Botton et al. 1988). They are also used as fishing bait, fertilizer, and in science (Limulus amebocyte lysate) as well as being caught for food (Smith et al. 2017). Population losses have been attributed to coastal habitat damage and overharvesting in recent years (Smith et al. 2017). *Carcinoscorpius rotundicauda*, one horseshoe crab species, has tetrodotoxin (Qu et al. 2020; Kanchanapongkul, 2008).

Figure: Horseshoe Crab

History

Millions of years before humans, horseshoe crabs predated. The age of horseshoe crab fossils is 445 million years (Barry et al. 2020). The anatomy of today's horseshoe crabs is remarkably similar to that of earlier generations. Horseshoe crab ancestors lived 445 million years ago (Barry et al. 2020). Individual horseshoe crab does not survive for millions of years, but can live up to 20 years (Walls et al. 2002).

They evolved with other primitive arthropods known as trilobites in the shallow seas of the Paleozoic Era (540-248 million years ago) (Alam, 2007). At the time of the Mesozoic Era, or the Age of Dinosaurs, dinosaurs ruled the landscape as most marine reptile species became extinct (Roghi et al. 2020). The shallow seas around Europe were considered the place of origin for the ancestors of today's horseshoe crab species. It is thought that the first mammals also appeared at this time (Roghi et al. 2020). At the end of the Era, dinosaurs and roughly half of the planet's marine invertebrates became extinct (Carmichael et al. 2015).

During the Cenozoic Era, multiple terrestrial and marine species diversified. Several ice ages occurred during this period, and the continents took on their present form. People have evolved, but the horseshoe crab has survived (Reid, 2012). The group of Ricinulei within Arachnida, according to a molecular investigation in 2019, is the sister group of the horseshoe crab (Ballesteros et al. 2019).

Anatomy of Horseshoe Crab

The horseshoe crab has been likened to a moving armored box. They resemble the extinct and prehistoric trilobite in appearance. The crab's body is separated into three pieces from the outside. The basic body plan of a horseshoe crab consists of three parts: the prosoma, the opisthosoma and the tail (telson). As the crab matures, the exoskeleton is regularly shed.

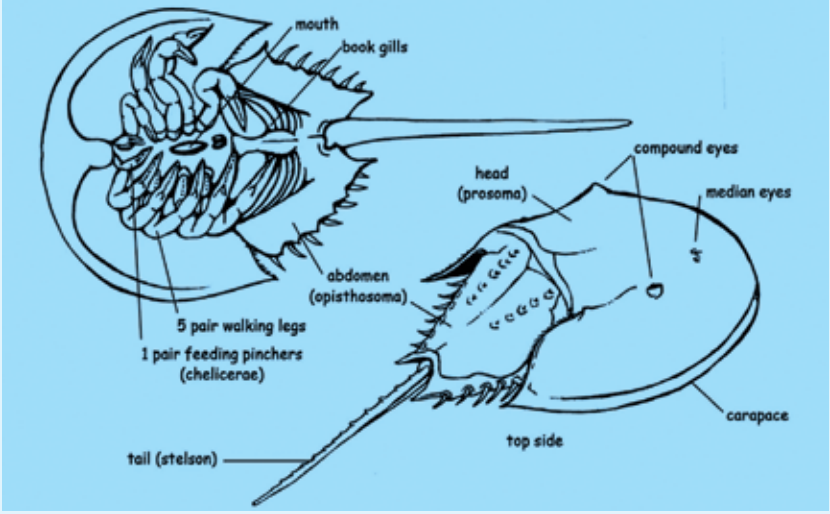


Figure: Anatomy of horseshoe crab

Prosoma (cephalothorax)

The prosoma is the large, dome-shaped frontal part at the carapace. This portion of the horseshoe crab is the biggest. It has a horseshoe-like form when viewed from the top. The prosoma's exterior features are several eyeballs.

Opisthosoma (abdomen)

The smaller rear carapace with spines on the edge is the opisthosoma. The hinge that connects the cephalothorax and abdomen forms the shell's central portion, the abdomen. Moveable spines can be seen around the margin of the abdomen when viewed from the top.

Telson (tail)

The rear extension that looks like a spike is the telson, which is commonly described as the tail (Helen & Brian, 2003). Uniquely among the horseshoe crabs, the cross section of the tail of the mangrove horseshoe crab is rounded. It is essentially triangular in the other species (Koichi & Carl, 2009). The tail is used to turn itself right side up when overturned (Kelvin et al. 2001). The terminal base of the tail is joined to the abdomen. If it goes inverted in the tidal zone, the horseshoe crab uses its telson to navigate and right itself. Contrary to what many people think, there is no poison in the tail. The telson of horseshoe crabs can occasionally be discovered to be deformed. This is frequently caused by telson damage.

Eyes

There are ten eyes in all on horseshoe crabs, which are employed for mating selection and light perception. The two lateral compound eyes are the most noticeable. These are employed throughout the spawning season for mate selection. In addition, they have two median eyes, two rudimentary lateral eyes, and an endoparietal eye on their carapace and two ventral eyes located on the underside by the mouth. Scientists believe the two ventral eyes aid in the orientation of the horseshoe crab when swimming. About 1,000 sensors, or ommatidia, are present in each compound eye. Although they are around 100 times larger, the cones and rods of the lateral eyes share a structure with human eyes. The ommatidia have evolved to alter their behavior depending on the time of day. The lateral eyes are chemically stimulated at night to significantly boost each receptor's sensitivity to light. This enables the horseshoe crab to recognize other horses in the shadows.

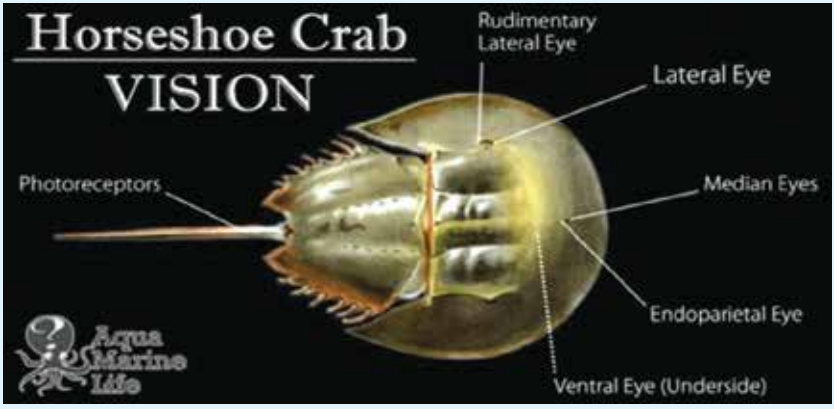


Figure: Dorsal View of Horseshoe Crab

On its prosoma's top side, the horseshoe crab has an additional five eyes. There is a simple lateral eye directly behind each lateral eye. A tiny ridge with three black spots can be seen near the front of the prosoma. One endoparietal eye and two median eyes are present. Each of these eyes is capable of detecting ultraviolet (UV) light from the sun and moonlight. They support the crab's lunar cycle observance. Their spawning period, which peaks on the new and full moons, depends on this. The purpose of the two ventral eyes, which are situated close to the mouth, is unknown. The final eye is made up of several photoreceptors that are situated on the telson. These are thought to aid in the brain's ability to synchronize with the cycle of light and dark.

Appendages

Each individual has six pairs of appendages. The first pair, the chelicerae, is relatively small and placed in front of the mouth. They are used to place food in it. The remaining five pairs of legs are placed on either side of the mouth and are used for walking/pushing. These are the pedipalps (first pair) and the pusher legs (remaining four pairs) (Koichi & Carl, 2009). Most of the appendages have straight, scissor-like claws, but in males the first and second pair of walking legs have strongly hooked "scissors", which are used for grasping the female during mating (Koichi & Carl, 2009).

Gills

A horseshoe crab's five unique pairs of gills, which are placed under its belly, are used to take in oxygen from the water. The huge flap-like structure that covers the lamellae, or leaf-like membranes, is present on each pair of gills. As the gills move, there is a gas exchange on the lamellae's surface. Each gill has about 150 lamellae, which resemble pages in a book. They are also known as book gills. Horseshoe crab larvae use their gills as paddles to move through the water.

Mouth & Legs

On the backside of its prosoma, the horseshoe crab possesses six pairs of appendages. The horseshoe crab can easily navigate around benthic sediments thanks to its five pairs of walking legs, or pediplalps. Except for the final pair, all have a little claw at the tip. As the crab digs into the marine floor, the final pair of legs includes a leaf-like structure at the end that is used to push and sweep away silt. The gnathobases, which point inward and cover the bases of each leg, direct food toward the mouth, which is situated between the legs. Food is macerated and pulverized while the legs move. Additionally, 2 tiny chelicera appendages aid in directing food into the mouth.

Circulatory System

The horseshoe crab's circulatory system is well-developed. The prosoma and abdomen are joined in the middle by a long tubular heart. On the exoskeleton and at the hinge, you can see the general shape of the heart. Blood enters the book gills, where the lamellae of each gill oxygenate the blood. Blood flows in and out of the lamellae as a result of the gills' flapping motion. The horseshoe crab's heart receives oxygenated blood back for distribution throughout the body.

Male/Female Variations

Horseshoe crabs exhibit several significant differences between males and females. The female horseshoe crab will molt an additional one or two times after reaching maturity at 9-10 years of age. The outcome is that the female crab is much bigger than the male. A modified initial pair of walking legs will also grow in the mature male horseshoe crab. The new legs have a boxing glove-like hook-like structure. During spawning, the male horseshoe crab attaches to the female's shell using the modified legs.

Males and females can be distinguished before they reach maturity based on the pattern of their vaginal pores. At the base of the first pair of book gills, behind the first-gill cover, are the pores. The genital pores on a man are white, hard, pointy features. The large convex female genital pores resemble tiny bumps in appearance.

The mangrove horseshoe crab is the smallest of the four living species of horseshoe crabs. Like the other species, females grow larger than males. On average in Peninsular Malaysia, females are about 30.5-31.5 cm (12.0-12.4 in) long, including a tail that is about 16.5-19 cm (6.5-7.5 in), and their carapace (prosoma) is about 16-17.5 cm (6.3-6.9 in) wide. In comparison, the average for males is about 28-30.5 cm (11.0-12.0 in) long, including a tail that is about 15-17.5 cm (5.9-6.9 in), and their carapace is about 14.5-15 cm (5.7-5.9 in) wide (Srijaya et al. 2010).

There are significant geographic variations in the size, but this does not follow a clear north-south or east-west pattern. Those from West Bengal in India average somewhat smaller than those from Peninsular Malaysia, with a carapace width of about 16 cm (6.3 in) and 14 cm (5.5 in) in females and males respectively. Elsewhere it averages even smaller, with the smallest reported from the Balikpapan and Belawan regions in Indonesia where the carapace width of females is about 13 cm (5.1 in) and in males 11 cm (4.3 in) (Koichi & Carl, 2009). The largest females of the species may reach up to 40 cm (16 in) in length, including the tail.

Life Cycle of Horseshoe Crab

Eggs

Compared to eggs found low on the sand, eggs laid higher on the shore, where there is more temperature variance (and warmth), develop more rapidly. Development starts when the embryo secretes a new membrane that divides the initial egg cover (chorion) and creates a clear, spherical capsule.

Larvae

The egg capsule bursts (because of aging, hatching activity, and/or sand abrasion) between 4 and 30 days after the chorion hatches, allowing the horseshoe larvae to emerge.

Juvenile

For around 6 days, the larvae primarily swim at night before settling to the bottom in the intertidal flats close to the beaches. There, roughly 20 days after breaking free from the egg capsule, they start their first molt. The first and second summers of juvenile horseshoes are often spent on these intertidal flats, where they eat just before low tide and spend the remainder of the day burrowing in the sand.

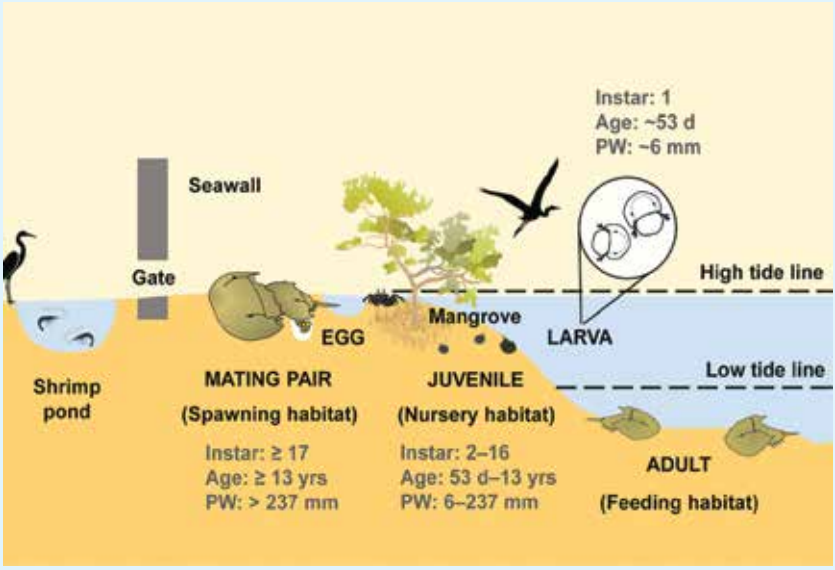


Figure: Life cycle of horseshoe crab

Adults

Young horseshoes go towards deeper waters as they mature. The first two to three years see a lot of molting, with longer intervals between molts as the horseshoe gets bigger. Before reaching sexual maturity and starting their yearly spawning trip back to the beaches, males will molt at least 16 times over 9 years (and females at least 17 times over 11 years).

Mortality

Aside from natural mortality, the industry that gathers horseshoe crabs as bait for eel and conch is currently the biggest source of death for these crabs. Horseshoe crabs are also caught and bled for medical purposes; after bleeding, these crabs are released back into the water, however, 10-15% of them perish in the process.

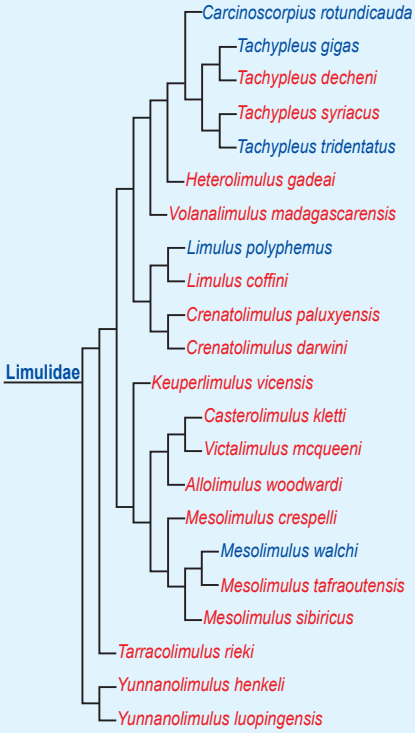
Feeding Habit of Horseshoe Crab

Mangrove horseshoe crabs are selective benthic feeders, feeding mainly on insect larvae, small fish, oligochaetes, small crabs and thin-shelled bivalves (Zhou & Brian, 2004). Lacking jaws, it grinds up the food with bristles on its legs and places it in its mouth using its chelicerae. The ingested food then enters the cuticle-lined oesophagus and then the proventriculus. The proventriculus is made up of a crop and a gizzard. The crop can expand to fit the ingested food, while the gizzard grinds the food into a pulp. Studies have found that mangrove horseshoe crabs have a strong preference for insect larvae over the other organisms on which it also feeds (Zhou & Brian, 2004).

An adult horseshoe crab diet consists of several species of bivalve molluscs (including razor clam (Ensis spp.), macoma clam (Macoma spp.), surf clam (Spisula solidissima), blue mussel (Mytilus edulis), wedge clam (Tellina spp.), fragile razor clam (Siliqua costata), soft-shelled clam (Mya arenaria) and worms (polychaete Nereis spp. and nemertean Cerebratulus spp.) Shuster, 1982; Botton & Ropes, 1988; Botton, 1984; Botton, 1988 also found vascular plant material in nearly 90% of horseshoe crabs sampled. To eat, L. polyphemus digs after its food, grasping its prey with pincer-tipped legs. The food is then crushed between the legs and pushed forward into the mouth (Shuster, 1982). Horseshoe crabs depend on benthic organisms for their nutrition. Gut-contents have been analysed from 5 crabs of each species and the major food items included bivalves, gastropods, polychaetes, a few crustaceans (mainly amphipods), a few insect larvae (tabanids) etc.; some plant matter and foraminiferan shells were also identified.

Taxonomy

Horseshoe crab ancestors resembled crustaceans but are classified as an arthropod (Selden et al. 2019). Eurypterid ancestors, including some of the world's largest arthropods, and the two families may be related (Rudkin and Young, 2009), though other research groups eurypterids as a sister group to arachnids in the Merostomata clade (Kamaruzzaman et al. 2011). Horseshoe crabs are thought to be closely related to the mysterious Chasmataspidids (Garwood and Dunlop, 2014), which have yet to be discovered (Van Roy et al. 2010). The first horseshoe crab fossils were discovered in Lower Ordovician rocks, some 480 million years ago (Van Roy et al. 2010).



All four current species of horseshoe crabs are found in the Limulidae family, which is the sole recent family of the order Xiphosura (Obst et al. 2012):

1. *Carcinoscorpius rotundicauda*
In South and Southeast Asia, the mangrove horseshoe crab can be found.

2. *Limulus polyphemus*
The Atlantic or American horseshoe crab can be found along the United States' Atlantic coast and in the Gulf of Mexico's Southeast.

3. *Tachypleus gigas*
In South and Southeast Asia, the Indo-Pacific, Indonesian, Indian, or southern horseshoe crab is found.

4. *Tachypleus tridentatus*
In Southeast and East Asia, the Chinese, Japanese, or tri-spine horseshoe crab is found.

Geographical Distribution

The horseshoe crab (Limulus polyphemus) can be found throughout the United States, living in the Atlantic Ocean along the North American coastline. Horseshoe crabs can also be found in the East and Gulf coasts as well as in Mexico, in addition to being located on the Indian and Pacific oceans. Three species of horseshoe crab can be found in Asia and the Indian and Pacific oceans.

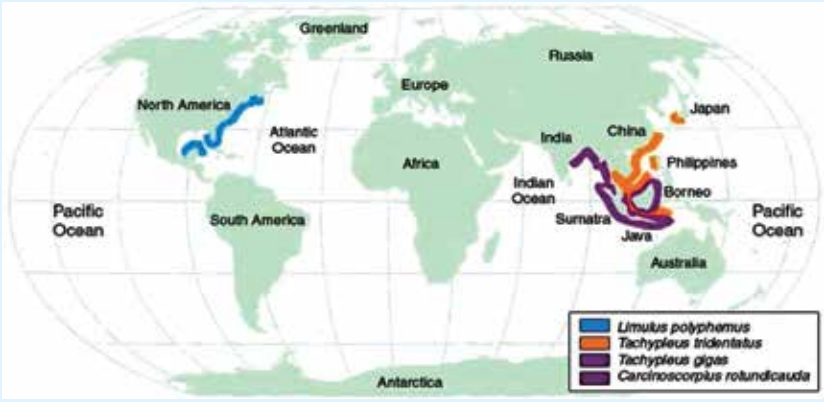


Figure: Horseshoe Crab habitat distribution Map

Importance of Horseshoe Crab

- The shorebird red knot is particularly susceptible to the effects of horseshoe crab spawning activity, particularly in the Delaware and Chesapeake Bay basins (Burger and Niles, 2017). The shorebird migration patterns have developed to coincide with peak horseshoe crab spawning activity, notably in the Delaware and Chesapeake Bay basins. These horseshoe crab beaches function as a gas station for them to refuel and continue their journey (Niles et al. 2009).
- Horseshoe crab eggs are eaten by a variety of fish species, including sea turtles, alligators, horse conchs, and sharks (Gibson et al. 2010).
- Horseshoe crabs are critical to the biomedical industry as their copper-based blue blood contains a chemical known as "Limulus Amebocyte Lysate" (Dybas, 2019). In the presence of bacterial toxins, this chemical coagulates or clumps up and is used to assess the sterility of medical equipment and all pharmaceuticals (Walls et al. 2002). If a vaccine has been contaminated by bacteria, you can be assured it hasn't been compromised. Everyone who has ever been inoculated, vaccinated, or operated on has benefitted from horseshoe crabs (Connelly, 2016).
- Scientists have been able to better understand human vision by studying the compound eyes of the horseshoe crab (Barlow, 2009)
- Horseshoe crabs have also been utilized in fisheries across the globe. In North America, the American eel and whelk fisheries use horseshoe crabs as bait over portions of the Atlantic coast, while the marine life fishery acquires live horseshoe crabs for sale as aquarium pets, research subjects, or educational specimens (John et al. 2018; Walls et al. 2002)

Ecological Importance of Horseshoe Crab

In addition to being a vital resource for migratory shorebird species, horseshoe crabs are also an integral part of their ecosystem (Moore, 2017). Horseshoe crabs, which have been around for a long time (Krisfalusi-Gannon et al. 2018), are not only important for the survival of a range of migrant shorebirds who rely on their

eggs for propulsion, but they are actually ecosystems in their own right (Moore, 2017). The carapace of Limulus polyphemus is home to scuds, ghost anemones, asteriids, snail furs, blue mussels, barnacles, sea strawberries, seal lettuce, red beard sponges, eastern oyster, northern rock barnacles, skeleton shrimp, bushy bugula, hard tube worm, flatworm, oyster drill egg, and Agardh's (Lippson and Lippson 1997).

Importance of Horseshoe Crab to Humans

Horseshoe crabs are collected by fishermen and used as bait in the Atlantic coast eel and conch fisheries (Kreamer and Michels, 2009). In Connecticut, anglers may hand-harvest horseshoe crabs during certain periods of the year. Fishing for horseshoe crabs was allowed from May 22 to July 7 in 2007, except for weekends (Fisheries Commission, 2020).

Horseshoe crab vision has been investigated extensively. The findings of this study have important consequences for surgical stitches and burn dressing creation (Liu and Passaglia, 2009). There is one particular discovery in horseshoe crab studies that is significant. Frederick Bang discovered amoebocytes, which are unique cells found in the blood of horseshoe crabs, in the 1950s (Sargent, 2006). These cells bind to bacteria to form a gel that prevents microorganisms from entering the horseshoe crab's body. These cells, which are used to test pharmaceuticals for germ contamination, may also be employed to monitor germs on a momentary basis. Limulus Amoebocyte Lysate (LAL) is now produced from horseshoe crab blood by biotechnology companies (Gauvry, 2015). NASA is currently testing the use of LAL in space to assist in astronaut diagnosis.

Causes of Decreasing Trend of Horseshoe Crab

- Overharvesting for food and bait
- Pharmaceutical industry/biomedical testing
- Red algae suffocating tides
- Coastal development and coastline erosion are destroying habitat.
- There aren't enough horseshoe crab sanctuaries.
- Changes in the climate
- Marine and Coastal Pollution

Measures to Protect Horseshoe Crab

- To safeguard horseshoe crabs from over-harvesting, a fisheries management plan is being developed.
- Manage horseshoe crab bait fisheries and put in place policies to regulate the horseshoe crab bleeding industry to prevent mortality and other negative consequences.
- Stop eating horseshoe crabs.

Status of Horseshoe Crab in Bangladesh

Its presence in Bangladesh is overlooked because there is no plan in place to preserve it or employ it in the country's burgeoning pharmaceutical industry. On the

other hand, locals use it for a variety of purposes. In the Sundarbans region, fishermen use a lace of crab tail segments to relieve rheumatic pain by tying them together. When used as fishing bait, coastal fishermen catch this crab in fishing nets and use it to catch eels and conch shells. Crab embryos deform when they are exposed to contamination in seawater.

The Maghs of the Moheskhali and Sonadia islands eat the protein-rich un-laid crab eggs fried in oil. Shorebirds feed on larvae and youngsters that emerge from the sand and migrate to the sea in March to May on full moon evenings across Bangladesh's sea beaches. The amount of the crab is declining quickly and swarms no longer appear at the juncture of rivers and canals, Bangladesh's various sea beaches. It's tragic that instead of exploiting these resources for our advantage, we are permitting them to become endangered.

It's terrible that a significant resource has been smuggled from the nation by some major worldwide rackets and local fish farms. Blue blood has not yet been harvested in Bangladesh, a cause for serious concern.

Figure: DG, BORI visited HSC breeding Gound

ABOUT THE SESSIONS

The Horseshoe Crab (HSC), a "living fossil", has been present in coastal environments for 450 million years. Two species, Tachypleus gigas and Carcinoscorpius rotundicauda, are known to be present in Bangladesh coastal mangrove areas. In Bangladesh, it is locally known as Sagar Kakra or Raj Kakra.

Scientists and researchers from India and Bangladesh, as well as local environmental volunteers, gathered on Monday, June 20, to discuss horseshoe crabs. Abu Sayeed Mohammad Sharif, Senior Scientific Officer of the Department of Biological Oceanography at Bangladesh Oceanographic Research Institute introduced the topic and welcomed the participants.

The Director General of Bangladesh Oceanographic Research Institute, Mr. Sayeed Mahmood Belal Haider presided over the seminar. Professor Dr. Md. Sagir Ahmed, Department of Zoology, University of Dhaka, was present in the seminar as chief guest. The keynote address was delivered by Dr. Govinda Chandra Biswal, Reader in zoology, K M College of basic science, on 'Know the horseshoe crab, save the horseshoe crab.' The principal scientific officer and director of the marine fisheries and technology center at Bangladesh Fisheries Research Institute (BFRI) in Cox's Bazar presented the prospects, challenges, and present conservation status quo of the Horseshoe crab in Bangladesh. Dr. Joytirmayee Pradhan, Head of Biology at K K S Women's College, Balasore, delivered a lecture on horseshoe crabs' chitin and chitosan production and application. The director general of BORI, Mr. Sayeed Mahmood Belal Haider, provided an insightful talk on horseshoe crabs and their biomedical importance. The program was concluded with some practical recommendations to conserve the horseshoe crab and produce "Carcinoscorpius Amebocyte Lysate (CAL)" in Bangladesh, as like Limulus Amebocyte Lysate (LAL) (USA) and Tachypleus Amebocyte Lysate (TAL) (China).

INAUGURAL SESSION

Welcome Address

Abu Sayeed Muhammad Sharif
Senior Scientific Officer, Bangladesh Oceanographic Research Institute

Honorable chief guest Dr. Md. Sagir Ahmed, distinguished special guests Dr. Gobinda Chandra Biswal, Dr. Shafiqur Rahaman, Dr. Joytirmayee Pradhan, and today's Honorable chair Sayeed Mahmood Belal Haider, ladies and gentlemen good morning.

Today, the 20th of June 2022, we are going to celebrate the 3rd international horseshoe crab day. As a part of this celebration, the Bangladesh Oceanographic Research Institute (BORI) has organized this seminar titled "Know the Horseshoe Crabs, Save the Horseshoe Crabs". It's a great honor and privilege for me to welcome you all on behalf of BORI to this seminar.

I am delighted to welcome Dr. Md. Sagir Ahmed, Professor, Department of Zoology, University of Dhaka, honorable chief guest of today's program. Dr. Ahmed obtained his Ph.D. from Kagoshima University in Japan and did his postdoctoral research in Japan and Germany. He has a great devotion to the Ocean Literacy, Biodiversity & Environmental Impact Assessment, Molecular Taxonomy and Phylogenetic Study, Biodiversity, Fish Biology, Fish Population Dynamics, Environmental Pollution & Sustainable Management. I am pleased to welcome our guest speaker Dr. Gobinda Chandra Biswal, Reader in Zoology, Principal K M College of Basic Science, Balashor, Odisha, connected virtually from India. He is the Director of the Association for Biodiversity Conservation & Research. Dr. Biswal was awarded his Ph.D. in the conservation of horseshoe crabs and recently completed a research project on horseshoe crabs funded by the Govt of India. He has been working as a member of the IUCN SSC horseshoe crab specialist group.

I am honored to welcome Dr. Shafiqur Rahaman, Principal Scientific Officer, and station chief, Marine Fisheries and Technology Station of Bangladesh Fisheries Research Institute (BFRI), Cox's Bazar. He has excellent contributions to fisheries and aquaculture extension.

I am privileged to welcome Dr. Joytirmayee Pradhan, Head, Department of Zoology, K K S Women's College, Balasore, Odisha, connected virtually from India. She has contributed significantly to freshwater algae, fisheries, and biotechnology.

Today's session will be chaired by Sayeed Mahmood Belal Haider, the Director General, Bangladesh Oceanographic Research Institute, and Additional Secretary to the Government of the people's republic of Bangladesh, under the Ministry of Science and Technology. May I welcome our honorable Director General to chair the session. We are grateful to him for his significant efforts in initiating this wonderful program.

I would also like to express my heartfelt appreciation and welcome to our distinguished government officials, scientists, researchers, and students from different institutions, academics, and different universities, representatives of different environment-related organizations, the journalists from different print and electronic media as well as online participants.

Horseshoe crabs are marine and brackish water arthropods, enlisted as a living fossil. They live primarily in and around the shallow coastal waters. They are not considered an endangered species, but due to their high demand, their population has seriously declined, putting them on the list of "near threatened species". Today we will learn many things about the horseshoe crab. Hope you will enjoy the session.

"Joy Bangla"

Speech of the Chief Guest

Dr. Md. Sagir Ahmed
Professor, Department of Zoology, University of Dhaka

At first, I would like to thank Mr. Sayeed Mahmood Belal Haider (Director General, BORI) for the arrangement of this time worthy seminar for the first time in Bangladesh. Probably, Horseshoe crab is the only aquatic animal in our ecosystem of economic and ecological significance, we are not yet concern about! This year the theme of International Horseshoe crabs is "Know the Horseshoe Crabs, Save the Horseshoe Crabs". This theme is very much significant in our country perspectives. As most of our local communities do not know about these invaluable biological resources which are being exist on earth from more than 450 million years ago. This creature has ecological, economic and medicinal value for us. Before we harvest any organisms from nature for human consumption or any other purpose, we must know the status of the organism in that habitat. For conservation and sustainable utilization of animal we must know its biology, population, threats, migration, pollution, and habitats. Without knowing about an animal (species), how can we conserve it? So, this theme is very much pertinent to motivate people to conserve the horseshoe crabs. Bangladesh is very reach in marine faunal diversity.

There are about 475 species of bony fishes, 50 species of cartilaginous fishes, 50 species crabs, 7 species of sea turtles, 36 species of shrimps, 5 species of lobsters, 13 species of cephalopods, 301 species of mollusks and 11 species of caetaceans (dolphins and whales) in the Bay of Bengal of Bangladesh. Worldwide there are only four species of HSC among them two species are available in our coastal

waters. They are Carcinoscorpius rotundicauda and Tachypleus gigas locally known as Rajkakra. It is very unfortunate to mention here that in most of our text books describe horseshoe crab, Limulus polyphemus living in the Atlantic Ocean along the North American coastline. They are known as living fossil as it is an organism that has remained relatively unchanged over millions of years. They even predated dinosaurs in terms of genesis. Scientists discovered that this critter possesses a feature that safeguards the organism in any adverse circumstance. This creature has certain compounds in its body that easily shield it against the attachment of bacteria and viruses. That is the reason why the organism has survived on Earth for millions of years. Therefore, the scientists reasoned that if the chemicals could be extracted, we could use them for human welfare. In fact, some countries are currently using blue blood for the application of antibiotics as a form of Limulus amebocyte lysate (LAL), an aqueous extract of HSCs blood.

I sincerely want to convey one message to you all that please consider this creature's ecological importance rather than its use as food or medicinal purposes. Please do remember that no animal is detrimental to human but we peoples are environmentally unfriendly and always trespassing animals' habitat. Over population of human and habitat destructions are the major threats for our animal extinctions. The ecosystem will not be sustainable if we do not allow all the components in the environment to persist. All living organisms in an ecosystem have a role in maintaining the ecological balance. Considering this in mind, we should think holistically to conserve HSC resources for our better future. In conclusion, I want to say, "What we say we don't do; what we do, we don't say. Let's work together to conserve the Horseshoe crab resources. Thank you

Speech of the Session Chair

Sayeed Mahmood Belal Haider

Director General, Bangladesh Oceanographic Research Institute

Mr. Belal Haider began his speech by acknowledging all the speakers on behalf of BORI. He greeted all the scientists, academicians, students, media representatives, local representatives, and stakeholders participating in the program. Mr. Haider expressed the gravity of the international horseshoe crab day and its novelty of recognition. He believes BORI being the first organization to recognize and celebrate this auspicious day will eventually accelerate the conservation, reproduction, and sustainable utilization of horseshoe crabs. BORI will strive to learn and explore this species for the welfare of mankind and nature, given the distinctiveness of its biochemical characteristics. He mentioned the keynote speaker Dr. Gobinda Chandra Biswal from Odisha, a renowned name in the Indian subcontinental horseshoe crab research. Another name referred to was Dr. Joytirmayee Pradhan from the same region, since Odisha is the global hotspot for horseshoe crab research. He also brought up Dr. Sagir Ahmed for being the first person from Bangladesh to sequence the DNA of mangrove horseshoe crab. Another speaker Dr. Shafiqur Rahman had hands-on experience in the artificial regeneration of horseshoe crabs. In the hope of learning from these resource persons in the upcoming working session, Mr. Haider adjourned the session briefly.

WORKING SESSION

Panel Discussion

Dr. Gobinda Chandra Biswal

Reader in Zoology & Principal, K M College of Basic Science, Balasore, Odisa, India

Know the Horseshoe Crabs, Save the Horseshoe Crabs

Horseshoe crab (HSC) is a marine arthropod. It comes in four different species and is available throughout the world. It is known as Raj Kakra in Bangladesh and Neel Rokto Kakra and Ram Lokkhon Kakra in India. This kind of local name is very common in India. The largest group in this globe is called the Arthropoda. Nearly 450 million years ago, the HSC began to evolve. The prosoma's front is shaped like a horseshoe, hence the name. Arthropods in particular have hemolymph, and that hemolymph contains hemocyanin. Blood appears red if it contains hemoglobin, but hemolymph, which contains copper containing pigment, is what gives blood its color. It is blue because of this. The blood is typically white, but when it comes into contact with air, it turns blue. Males are often smaller than females in terms of shape, and males have six numbers of long opisthosomatic spines, whereas females have three long spines and the remaining four are short. The second and third prosomatic appendages are altered in males to function as clasper organs, but in females, they are chelated and resemble regular walking legs. I'll demonstrate the HSC's dorsal side. Prosoma is the larger of the two carapaces, while opithosomal is the smaller one. They are joined together by a hinge. The length of the hinge varies with growth, and the telson in Tachypleus gigas, it is triangular; however, in the case of Carcinoscorpius rotundicauda, it is rounded and long. The age of HSC can be determined by measuring the lateral distance, and the age can also be determined by measuring the anal spine. I've already talked about

global distribution, but I want to reiterate a few points. Four species of HSCs are only found in the Atlantic and Indo-Pacific areas. The only Atlantic species found along the east coast of North America is the American horseshoe crab, Limulus polyphemus.

Interesting, our only exposure to Limulus has been through books. However, it is not present in our area. In the laboratory, we are keeping an eye on the Carcinoscorpius, and the situation is the same in Bangladesh as well. The second category is Tachypleus tridentatus, which is regarded as a Japanese form and is a solely pacific species in Asia. The western and southern shores of Japan have a good distribution and a very high density of it. T. tridentatus has been falling in Japan, meanwhile, as a result of widespread coastal pollution and the destruction of the breeding beach sowing to land reclamation. Along the coasts of Vietnam, the Philippines, and North Borneo, as well as from the east coast of China to the coasts of Taiwan and North Borneo, high densities of T. tridentatus have also been observed. The largest latitude distribution among the other Asian HSCs belongs to the next most well-known HSC, T. gigas. It can be found in Southeast Asia from the Bay of Bengal eastward, including India, Bangladesh, Myanmar, Malaysia, Singapore, Thailand, Vietnam, and Indonesia. It is widely distributed throughout India's east coast, particularly on the South East Coast of West Bengal and the Northern Coastal Region of Odisha.

The final and smallest of the three, the mangrove horseshoe crab is called for its distinctive habitat among mangroves. It can be found in Hong Kong, Singapore, Thailand, Bangladesh, India, Bangladesh, Myanmar, Indonesia, Malaysia, and the Philippines. It can be found in India along with the muddy and swampy parts of the mangrove region of West Bengal and Odisha. Although it occasionally migrates to brackish waters, C. rotundicauda is likewise primarily restricted to mudflats. These are Indian estuaries, and we have noted the presence of HSC there.

It has been surviving till now due to its ability to adapt to the changing environment. It could endure lengthy periods of submersion and accept variations in a wide range of temperature, salinity, and desiccation. They are known as living fossils for this reason. One of the four species, Limulus, is restricted to America alone. The other three species, however, are exclusive to the Asian continent. There are two species accessible among them. Like this are India, Bangladesh, and Myanmar. C. rotundicauda is widely distributed in Bangladesh, whereas T. gigas predominates in India. The HSC is more significant than all other species even though the world is home to a large number of marine critters. I will be able to conserve the species if we first understand it.

The HSC has some traditional and social use. HSC has been used as fertilizer in India for many years. The extract of HSC is used by the tribes and populace in coastal Odisha to treat arthritis and joint pain. You know, the tail and carapace of HSCs were employed by the Chinese and Koreans as lovely ornaments and decorative pieces. The early Indians used the carapace as a food bowl and

occasionally consumed HSC appendages many years ago. Chinese folks use hats made from T. tridentatus' carapace. Intriguingly, the egg mass of HSCs' flesh is consumed as a delicacy in Singapore, Malaysia, and Borneo. The egg mass of the HSCs is consumed by Singaporean expectant mothers to boost the fetus' immunity.

There are various scientific uses for it. According to the scientific application, the HSCs' optic nerve has special physiology that offers biomedical researchers useful data. It is utilized as a solar energy collector, and General Electric Company of the United States of America developed a video system to produce better TV images. Finally, it is employed in radar systems. The biomedical use of HSCs is the final HSCs feature. I'm aware that Belal Haider Sir would speak about his agenda, but I have less to say about the biological application. I recently learned about the Chinese people's production of protein-like substances and how they use them to cure AIDS and cancer thanks to recent publications. They are making use of everything that will be published. Belal Sir will therefore talk extensively about biomedical use. When exposed to a few Nano-grams of endotoxins, the amoebocytes in hemocytes can swiftly assemble. For the LAL (Limulus Amoebocyte Lysate) test, HSCs' blood is used.

The most expensive blood is LAL, which costs 60,000 dollars per gallon. To find endotoxin inhuman blood, we buy the LAL kit. The most expensive blood in the world is HSC blood. We are behind and spending a lot of money on LAL and TAL gear since Bangladesh, India, and Myanmar are unaware of this. Additionally, homeopathic doctors employ the hemolymph of HSC for the treatment of sleepiness, gastroenteritis, and mental weariness. Homeopathic medicine is used to treat all of these illnesses. LAL is employed by the pharmaceutical, food, and other sectors. In the biomedical and pharmaceutical industries, it is therefore crucial.

The first instar, second instar, and third instar, which continue to molt, can all be observed in the laboratory. Finally, when they are 7-8 years old, they will move to the deep sea and attend the adult. They will travel there and visit the estuary for breeding purposes, and all of these things can be researched for growth and development. The molecular aspects are important in the biomedical field; I've already talked about chitin, chitosan, and hemolymph, etc.

HSC always occurs in pairs, with the male being smaller and guiding the female in behavioral and ecological aspects. They cannot be separated. Therefore, behavioral aspects of research span a very broad field. You can conduct a study on a wide range of ecological topics, such as turbidity, salinity, temperature, and a host of other topics. One ecological topic that interests me is the dependence of numerous migratory birds on horseshoe crab eggs. It, therefore, has numerous ecological aspects.

Conservation nowadays is very alarming. You see, because we are aware of the significance of HSC, we should protect it. There is no regulation on controlled fishing activity, thus we are engaged in anthropogenic activity in the guise of development, many pilings, digging, motorized boats, and fishing nets. Human

population growth, the degradation of breeding grounds, overfishing disease, and hunting for sustenance and medicinal purposes pose challenges to the HSC population. In the USA, certain fishing birds are predators. The ventral side of HSC is eaten by some pigs, dogs, and birds in India. Another major anthropogenic factor affecting the population of HSCs is the severe degradation of sandy beaches, invasion of estuaries, and habitat damage. Another significant factor is the use of fishermen's nets during high tide. To recover HSC, there must be aware of it. We had studied T. gigas, but we knew very little about rotundicauda. The population is declining because no restrictions are coming from the government side. We should conserve since it is quite alarming. Fishermen and college students are included in conservation awareness campaigns. They will step up to protect and conserve the species if they are aware of the significance of HSC.

I attended the 4th international HSC conference in China in 2019 but there was no Bangladeshi presentation. Then I made numerous requests to Bangladeshi friends. After two years, I've made touch with a few interested scientific officers, and then esteemed Belal Haider Sir. He is quite eager and interested in carrying out all of this study. At this age, I witnessed him gathering the HSC from all of these muddy flats to observe his behavior and learn more about the HSC. I express my deep sense of gratitude to esteemed Belal Haider Sir for inviting me as a keynotes speaker on this auspicious celebration.

Thanks to all for your interest and active participation in this seminar.

Dr. Shafiqur Rahman
Principal Scientific Officer & Station Chief, Marine Fisheries and Technology Station, BFRI, Cox's Bazar

Conservation of Horseshoe Crabs: Prospects and Challenges-Bangladesh Perspective

I would like to present the prospect and challenges of HSC conservation for ecosystem management. Already, we came to know that we have two species in our region. One is Carcinoscorpius rotundicauda and another one is Tachypleus gigas. Today, I have heard about another one (Tachypleus tridentatus) that is available in India, hence there is the possibility of its occurrence in Bangladesh. So, we have to be conscious of the third one. For this, more comprehensive study is needed to make a complete checklist of the species.

In 1998, I experienced that we have Scylla serrata species but now we have Scylla olivacea also. So, we need to be more conscious of the HSC species number.

Dr. Sagir Ahmed is present here, he did the molecular work for confirming the species. So, we need to study more, though we have some limitations now. We need to explore HSC in Satkhira and other regions to identify other species. Two species we got we didn't find any toxic substance as the scientist confirmed. But through some literature review, I think we have to be careful about toxicity in Carcinoscorpius rotundicauda. The four species are already discussed so I am not going to repeat it. But one thing I want to share is the mangrove HSC is in an endangered position while in America it is vulnerable.

We have one small research project from last year. We are trying to domesticate HSC in our environment and we will do it successfully. We are using three types of habitats and they are sandy, muddy, and sandy-muddy habitats. We are feeding them properly and we are using crab meat, oyster meat, and many live feeds. We also experimented with different types of feed to know which feed is important for their gonad development. We are assuming we will be able to breed them and release them into the environment. The main importance of the species is it has high economic value and we are trying to collect endotoxin. You know a quart of LAL is being sold for 15,000 USD. In Thailand, they use it as food and sell it at a good price. But we still are not selling, if some people do that we don't know. We got some news that the sea horse and the oyster are sold by the luggage party but the actual news about HSC we don't know. The general status, American biomedical companies capture HSC 5,00,000 a year.

Asian HSC is rapidly decreasing in China, listed as endangered and currently in American HSC is listed as a vulnerable species. But in the context of Bangladesh, we don't have any information about its current status. Although the HSCs are eventually returned to the sea, conservation groups estimate that up to 30% of them die in the process. In Taiwan, adult abundance is very low and they don't even see the spawners on their beach. The juvenile population in nursery areas has also declined. In India, they also don't have the data on actual population density. Though we have seen that Odisha has the data but not updated. China is getting the species by catch, they are selling it in the restaurant. As they have cultivation, they have available HSC there. In the sense of use, they are using 5 lakhs species every year and they also released their harvest pressure. In the USA, after extracting the blood when they release it into nature, they are implementing laws for its safety.

Next is a threat, though our habitat is very suitable for HSC but we continuously degrading our habitat and it is a matter of sorrow. So, as we have knowledge, we have to protect the species at any cost and I think our journalist brothers can play an important role to protect this animal. I am very hopeful about India so I will not share the threats about them. Last night Mr. Gias (Journalist) gave me the information that from the mouth of the Bakhkhali river to Najir Tek there are 12 set bag nets, which are killing a lot of HSC every day. So, it is very shameful for us and I think the administrative body needs to be focused on that.

Now I will talk about challenges, we don't have proper data. We only worked in Cox's Bazar and Maheshkhali areas. But we don't have the data of Sundarban, I hope

there will be species. We need to work on the stock assessment. We need to be clear about it. Already we have sent some samples to Singapore to take the steps of conservative measure properly. But today I have known about Dr. Sagir Sir, who can help us to identify the species. I also request to all of you please come to us with any issues related to marine, we will help you. We are also working for controlling habitat loss. We did many awareness programs to control habitat loss. You know we are also domesticating coral and I am hopeful one day we will be succeeded to domesticate the HSC. In case of prospect, we are not only breeding the HSC, we are also rearing the juveniles. We will also work on the stock in future.

Thank you all.

Dr. Joytirmayee Pradhan
Head, Department of Zoology,
Kuntala Kumari Sabat Women's College, Balasore, Odisa, India

Chitin and Chitosan of Horseshoe Crabs: Production and Application

Horseshoe crab is very precious that's why we are celebrating this day and giving the message or awareness to the society on how to conserve it. These living creatures have very unusual forms of living systems, and numerous physiological topics can be researched. Even though they are dead, horseshoe crabs never the less carry a variety of helpful compounds for our culture.

Chitin is a type of polysaccharide and the second most abundant biological compound in nature. Numerous fungus species and exoskeleton arthropods, such as the horseshoe crab, contain it. Due to its biodegradability, toxicity, biosafety, biocompatibility, and physiological inertness, chitin and its main derivative, chitosan, are unique biopolymers whose significance is coming to light more and more. It has practical applications in agriculture, the food industry, pharmacy, medicine, bio-nanotechnology, gene therapy, cancer therapy, environmental protection, and other fields. It also has potent antibacterial and antioxidant properties. Future utilization of natural marine biomaterials will be beneficial due to their cost-effectiveness and safe effects on the environment.

The horseshoe crab is widely utilized as a biological resource in various fields. Mass harvested for eel and wheel bait in the commercial fishery. Used as fertilizer in livestock feed. It is very important as food and traditional Chinese medicine. It helps in the detection of bacterial endotoxins in vaccine preparation and detection of endotoxin concentration in environment indicator of coastal ecology. It plays a vital role in estuarine and coastal communities as a prey-predator relationship, so we

should know the structural characteristics of this horseshoe crab.

As the historical landmark, it comes from the Greek word "Chiton" which means "Coat of mail". After 40 years of Chitin, a major Chitin variant Chitosan was identified. It was named Chitosan in 1894 and a detailed chemical structure was discovered in 1950. Chitosan is very much important because of its notable structural characteristics, physiological inertness, and bioactivities with versatility. Chitin is a polysaccharide made up of beta (1-4)-N acetyl-D-glucosamine monomers that exist in nature. This is a white, nitrogenous, non-elastic, and tough material. And at last, it's crystalline naturally, consists of poly (1,4)-linked N-acetyl-2-amino-2-deoxy-D-glucose (GlcNAc) with some 2-amino-2-deoxy-D-glucoseremnants. If we study chitin with crystalline allomorphic types in nature there are 3 basic types. Alpha chitin is an anti-parallel chain and harsh structure found in crab and shrimp; Beta chitin is parallel chains that form of monocyclic crystals with intermolecular as well as intermolecular interactions which are present in diatom spines, and Gamma chitin is another type of Chitin that is a combination of parallel and anti-parallel chains and is mostly found in fungi, yeasts, and insect cocoons.

The chitin with calcium carbonate combination makes an even tougher composite as seen in crustacean and molluscan exoskeleton. From Chitin, you can convert to Chitosan by different chemical methods. It's a linear polysaccharide made up of de-acetylated and acetylated-D-glucosamine units connected by 1,4-glycosidic bonds. This chitin and Chitosan could be found in crustaceans like lobsters, shrimp, crabs, krill, barnacles, and crayfish; Insects like scorpions, ants, cockroaches, spiders, beetles, brachiopods; Molluscs like octopus, cuttlefish, clams, oysters, squids, snails. Even from algae and Microorganisms like diatoms, brown algae, fungi, bacteria. Some standard protocols are there to extract and convert. But we should modify those protocols so we could extract the maximum to the maximum amount of Chitin and Chitosan from the natural recourses and also to get their pure form of them.

Different methods are used for extraction but first of all chemical method is used. And also, enzymatic method and biological method can be used. In the chemical method, steps are de-proteinization, demineralization, and de-colorization. So, we can get the pure form of Chitosan. The enzymatic method is more costly and includes proteolytic enzymes. Biological methods can be used because some Lactobacillus and other microbes can be used and convert this protein. After the extraction of chitin, it can be converted into chitosan. There is another step of the chemical method here; demineralization, de-proteinization, de-colorization, or deodorization of chitin and after de-acetylation, it could be converted into chitosan. After the extraction, there are some steps for characterization. Determination of yield of Chitosan, determination of moisture content, determination of viscosity, ash content, FTIR spectroscopy, X-ray diffraction, energy dispersive X-ray fluorescence, and Thermo gravimetric analysis should be done for proper characterization. Then comes the Chitosan applications. In the antimicrobial application, the positively charged molecules of the chitosan interact with the negatively charged microbial cell membrane and tend to pull apart the membrane. It is also used in the delivery of

various drugs through various routes inside the body like the nasal. Used in gene therapy, cancer therapy, and siRNA technology. Most importantly used in bone regeneration, neural regenerative technology, cardiac regeneration therapy, and skin regeneration technology. The use of natural marine biomaterials in the future will be valuable because of their harmless effect and therefore has environmental advantages and is cost-effective.

Thanks to all for your patient hearing.

Figure: Potential application of Chitosan

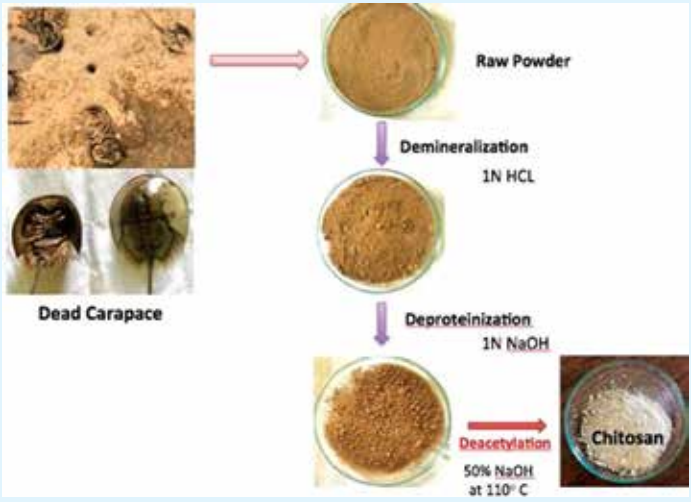


Figure: Flow chart of extraction of chitosan from carapace of horseshoe crab

Sayeed Mahmood Belal Haider
Director General (Additional Secretary),
Bangladesh Oceanographic Research Institute

Horseshoe Crabs: Biomedical Use and Importance to Human Health

My agenda is Horseshoe Crabs (HSC): Biomedical use and importance to human health. You are already aware of the biomedical applications of HSC, and Dr. Govinda Chandra Biswal and Dr. Joytirmayee Pradhan spoke about the significance of these applications. Dr. Govinda also noted in his address that I would cover the biomedical applications of HSCs and went into great detail about what those applications are. However, you were already aware of its 2-3 biomedical uses before I even started speaking.

Blue-blooded is the first, endotoxin is the second, and gram-positive and gram-negative bacteria are the third. These kinds of subjects have already been covered. I split my speech into multiple parts before starting my speech, which I will do now. I'll start by explaining how HSC came into existence and how the species was first used in biological research. Second, I'll discuss how the disease affects us, and third, I'll try to explain why HSCs are not affected by the disease, or more specifically, what mechanism exists to shield HSCs from disease. In my fourth attempt, I'll try to explain how HSCs are employed now and in the future for human welfare.

Horseshoe crabs are small, flat-backed crustaceans found along the coasts of tropical and subtropical regions around the world. They are most commonly known for their use in biomedical research, where they are used to test potential treatments for many diseases. However, horseshoe crabs also have numerous other uses that go beyond strictly medical research. For example, horseshoe crabs are often used as food sources or bait for fishing or crabbing. They serve as a unique indicator species for environmental health, as well they have been used to track ocean conditions and temperatures in remote areas. In addition, horseshoe crabs have cultural importance in some regions of the world, where they are considered symbols of luck and good fortune.

Figure: Ventral view of Horseshoe Crab

Why Injection Fever?

Injection fever is a serious bacterial infection that can occur when someone gets an injection or other medical procedure. It's usually caused by bacteria from the outside environment (such as from contaminated hands) or the inside (such as from a

blocked needle). A person who gets an injection fever might have a high fever, and they may feel sick to their stomach, chest, and throat. They might also have pain in their joints, neck, and back. The most common symptoms of injection fever are Elevated body temperature of 101°F (38°C) or higher. The fever lasts for more than 3 days. After the fever breaks, you may have some mild lasting symptoms, such as headache and muscle ache. Injection fever is serious because it can cause severe illness, including sepsis and multi-organ failure. Your best chance at avoiding this problem is to wash your hands thoroughly after you've finished getting all your shots or procedures done at the doctor's office. And if you think you might have gotten one of these infections at home, see a doctor right away.

Scientists were able to identify two distinct types of bacteria namely Gram-Positive and Gram- Negative after the invention of the microscope. One of these types of bacteria eventually caused illness. It resulted in "Injection Fever", a manifestation of an immune response to a component of this bacteria.

Difference between Gram-Positive and Gram-Negative Bacteria

Gram-positive bacteria include the majority of bacteria found in the human body, while gram- negative bacteria include those that are harmful, such as those causing urinary tract infections. The bacteria that cause skin infections are usually gram-positive, while gram-negative bacteria are more likely to cause foodborne illness. Gram-positive bacteria can be further divided into two groups: aerobic and anaerobic. Aerobic bacteria require oxygen to grow and thrive. Anaerobic bacteria do not require oxygen to survive. Gram-Positive organisms can also be divided into three categories: cocci (tiny spherical cells), bacilli (rod-shaped cells), and pleomorphic (changing shape) organisms. Gram-Negative organisms are also further divided into two categories: lipopolysaccharides (LPS), which form a protective coating on the cell surface; endotoxin, which causes inflammation and is released from the cell wall of gram-negative bacteria, after attachment to endothelial cells; and lipophilic substances, which remain inside the cell but can still cause damage when ingested by the host. Pets or humans with compromised immune systems are more likely to become infected with a gram-negative organism than those without compromised immune systems. The most common gram-negative infection in humans is a foodborne illness caused by E. coli O157:H7 or Salmonella enterica serovar Typhimurium.

Identification of Gram-Positive and Gram-Negative Bacteria

The Gram Stain test is a method used to detect bacterial colonies by staining the sample with Gram's stain. It is qualitative in nature, meaning that it can only determine whether or not bacteria are present in the sample, but not how many bacteria are present or how they were grown.

The Gram stain test requires three things: a sample, a gram stain solution (usually a 10% solution of potassium hydroxide or sodium hydroxide), and time. There are two main types of Gram Stains: gram-positive and gram-negative. Gram-Positive bacteria include organisms like Azotobacter, Bacillus, Eubacteria, and

Streptococcus. Gram-Negative bacteria include organisms like Pseudomonas, Pseudomonadaceae, Proteus, and other bacilli.

The steps for the gram stain test are as follows:

1. Prepare a 10% potassium hydroxide or sodium hydroxide solution in an appropriate container.
2. Add the prepared solution to the sample container and mix thoroughly with a wooden spoon or similar instrument.
3. Allow the solution to remain undisturbed for at least 20 minutes before proceeding to step 4.
4. The stained sample should be visible on the surface of the solution after it has had time to completely interact with the solvent in the solution. If not, repeat the process starting at step 1 until it is done.

The staining differences are due to the difference in the bacterial cell wall composition.

- Gram-Positive bacteria turn blue when stained because their cell wall is thin so the stain can penetrate and color the cell.
- Gram-Negative bacteria have an extra layer on the cell wall to prevent the stain from flowing out, so it won't turn blue.

Endotoxins

The pyrogens, or fever-producing agents, found within the outer Lipopolysaccharide (LPS) layer of the double-layered cell wall of gram-negative bacteria are known as endotoxins.

Effects of Endotoxins

Endotoxins are a bacterial toxin found only in gram-negative bacteria. Endotoxins cause fever in mammals. The immune system fights against invaders during a fever. Severe elevated temperature can cause tissue damage, shock, and death. There is no way to treat an endotoxin once it has entered the bloodstream. Antibiotics can kill bacteria, but are ineffective against endotoxins.

Figure: HSC field visit by DG, BORI

Endotoxins are found within the human digestive system. The presence of bacterial endotoxins in the blood directly is hazardous to humans. Furthermore, various drug and health devices are examined to ensure they do not contain dangerous endotoxins. An endotoxin can destroy cells, disrupt cellular metabolism and cause death or serious health problems. To avoid

introducing endotoxins into a patient's bloodstream during surgery or a routine procedure, pharmaceutical companies must perform intensive screening of all medical products.

Prior to the development of endotoxin tests for products, rabbits were the only way to test for them. A live rabbit was injected with a sample to determine the effectiveness. Temperature of the rabbit was monitored for 3 hours. A contaminated sample was rejected if the rabbit developed a fever. In the 1960's, scientists Frederik Bang and Jack Levin discovered a more effective endotoxin test. Dr. Bang discovered that gram-negative bacteria cause massive blood clotting in horseshoe crabs. Upon further research, Dr. Bang and Levin determined that white cells (amebocytes) in horseshoe crab blood formed a clot in the presence of endotoxin. Bang and Levin sought to isolate and concentrate this clotting process. Later, the potential medical applications were recognized. Pharmaceuticals now use this procedure to test for endotoxins.

How Horseshoe Crab blood responds to Endotoxins?

An infection-preventing system exists in horseshoe crabs and is simple yet powerful. Blood clots at the site of the wound in response to endotoxin. The clot encapsulates any entering bacteria. This prevents bacteria from infecting the entire body cavity.

The Blue Blood of Horseshoe Crabs

Due to hemoglobin an oxygen-carrying molecule containing iron, human blood appears red. When exposed to the air, it changes color like rusting iron. When horseshoe crab blood is inside its body, the hemocyanin molecule is copper-based and the blood is actually straw-colored. It becomes blue when oxidized. The color of HSC blood has nothing to do with its endotoxin-detecting abilities!

Bleeding of Horseshoe Crabs for Biomedical Use

HSC's are bled in the lab under sterile conditions. A needle is injected into the hinge muscle of the heart to start the blood flowing. About 30% of the blood is collected before the blood flow stops due to clotting. Blood of Horseshoe Crabs is used in biomedical research because it can be easily handled, maintained and genetically manipulated. This makes them ideal for studying the physiological effects of environmental factors on living organisms. Although, blood of horseshoe crabs has been used for biomedical research for decades, there is still more to learn about this species.

Effects of bleeding on Horseshoe Crabs

After being bled, HSCs are sent back to the water in the USA. The spawning process proceeds without any trouble. The blood cell count returns to normal in about 2-3 months. Handling mortality is about 10%, and LAL (limulus amebocyte lysate) production accounts for about 70,600 animals yearly bleeding deaths. In Asia, particularly in China, HSC are bled to death to produce TAL (Tachypleus Amebocyte Lysate), after which HSC body parts are sold as human food and dried chitin, resulting in 100% mortality.

Processing of HSC Blood Products for Biomedical Use

HSC blood products (such as platelets, red blood cells, and white blood cells) are commonly used in the treatment of various diseases. However, the processing of HSC blood products for biomedical use is still challenging because of a limited supply of human HSCs. Therefore, researchers have intensified efforts to develop new methods to improve the efficiency of HSC processing.

- Water is added to the isolated blood cells, which have been distilled, free of endotoxins.
- As water enters the cells, the cells expand and eventually rupture, or lyse.

  When a blood cell bursts, coagulogens contained in the cell are released into the liquid.
- Coagulogens are extracted from the solution and dried to form a powdered product called 'LAL'.

Future of Bangladesh in Horseshoe Crab Research

Only 30% of the horseshoe crab's blood is taken from it in the US before it is released. However, in China, where TAL is produced, people collect blood till they die. Then they prepare their food using these byproducts. From our species, we can likely also produce CAL. The fact that we can breed two species is incredibly lucky.

For the commercial production of CAL, we require natural abundance. Horseshoe crab populations are steadily declining. We should use artificial breeding or raising to boost the population. They should then be returned to their natural habitat. I think we can build a sanctuary in the next 8-10 years if we can sustain this effort for three years. Already Sonadia Island is declared an Ecologically Critical Area (ECA). To prevent unintended horseshoe crab killing, we are locating breeding grounds and raising awareness about them among local communities and fishermen. The media (print and electronic) is also attempting to raise awareness and will become more active soon.

If we can conserve this precious creature and can make good research, we can produce a very good quality lysate (CAL) that will be acceptable worldwide.

There is very limited or no published research in Bangladesh. I have to make this presentation using foreign data. Hope in next horseshoe crab day, we can use our data and own research article. I would like to thank everyone, for your patient hearing.

"Joy Bangla, Joy Bangabandhu"

Open Discussion Session

Ahmed Gias
Journalist and Leader of Horseshoe Crab Conservation Group

It is possible to earn several times the national budget every year by utilizing only one valuable animal of the Bay of Bengal like the horseshoe crab. At present millions of crabs are dying in various ways every year. Only in the area of 10 km of Nazirartek estuary and Maheshkhali channel from Majhirghat of Bankkhali river, millions of crabs are dying in Bihindi net every year. This valuable animal is suffering the same fate in other parts of the country. It is possible to bring a magical change in the economy of the country by keeping this primitive creature of the world, known as 'Living Fossil', alive in nature. We can grow millions of crabs in the Bay of Bengal every year without disturbing the breeding ground and habitat. It is urgent to create awareness about horseshoe crab among the fishermen, and local people through mass media.

Roksana Akhter Asma
Senior Programme Assistant, International Union for Conservation of Nature (IUCN), Bangladesh

I'm delighted that Professor Dr. Sagir Ahmed is here and he might be evaluating the HSC for IUCN Bangladesh. We only had a cursory understanding of the species throughout our time as students, thus today I am extremely grateful to BORI for enlightening us on the HSC. So, I want to ask Dr. Shafiqur Rahman sir whether he has ever organized an HSC community awareness campaign and if he has any future plans for the program. In response to Asma's question Dr. Shafiqur Rahman responded that while we have previously organized numerous biodiversity programs at the community level, we had not specifically organized any HSC awareness programs. Additionally, we are considering setting up an awareness program for the HSC. Thank you.

Uttam Kumar
Senior Research Associate, WorldFish, Bangladesh

The Bangladesh Oceanographic Research Institute is the ocean research community's glimmer of hope. I believe this is the first time in Bangladesh that BORI has organized a session on HSC, a species that is extremely significant from an ecological standpoint. I'm overjoyed. I want to know if the lecture taught us about

its significance. As a result, if it is communicated to a large population, we will be unaware of the topic of conservation. I work in Sonadia and Maheshkhali Island, and whenever my team and I travel there for work, we frequently see this species. Some locals who have already learned a bit about it have asked me if it is possible to export it or not. IUCN Bangladesh has already red-listed the species, and an IUCN Officer (Roksana Akhter Asma) is present at this session. He asked to Director General Sir, are there any publications describing the distribution of these species in Bangladesh? Another question: Will BORI take any action to collaborate with other stakeholders, such as World Fish and the IUCN, for such a management approach?. Thank you

Abu Sayeed Muhammad Sharif
Senior Scientific Officer, Bangladesh Oceanographic Research Institute

I like to ask one thing; you know already we can see that HSCs are very valuable in the commercial aspect. If we want to protect a species and take its economic value into account, we should assess its commercial implications because this will encourage other people to do the same. We can consider something valuable if we express its worth in terms of money or dollars. Therefore, I want to know if it is possible to economically cultivate it so that people will feel compelled to preserve it. Do you believe it is feasible along our coast, similar to Bangladesh and India?

In response to Mr. Sharif Dr. Gobinda said, If China and America can do that why not Bangladesh? If biomedical research can be accomplished then the government will be interested and you will not kill them. You can extract only 20 to 30 ml from each individual and then you will release it to the wild and they will go. They just donating blood. We can give one unit of blood every six months and we are not dying. So, we will extract the hemolymph of the HSC and we will take care of the restoration of their population by artificial breeding, rearing, and conserving their breeding ground. We will get a lot of them easily. So, this is not a problem. As it has a commercial value, you can sell and earn money, government should take initiative and also should be very cautious to restore the population of HSC. Then HSC population will be maintained and along with that, we can earn some money.

Dr. Mohammad Muslem Uddin Munna
Associate Professor, Department of Oceanography, University of Chittagong

Excellent and informative speeches were given by all four speakers. Although the subject is unfamiliar to us, the previous Director General (DG) sir made it much

simpler for the Ukhia-born participant. By listening to his voice and views, it is evident that he fully comprehended its significance. I'm also grateful that this program just made that matter the subject of awareness and conversation for the first time in Bangladesh. I consider myself quite fortunate that I joined the DG Sir when he began his investigation in Moheshkhali and Sonadia Island and performed some morphometric analyses of the species. Additionally, we submitted to MIT the HSC blue blood that was extracted. One thing I want to make clear is that although it hasn't been published, DG Sir has already gathered a lot of information despite claims to the contrary. Three species that could be discovered in Bangladesh, according to DG Sir, are compared using photos and sent to Japan for identification because morphometric studies, barcoding, and DNA sequencing could not identify them. They also have doubts about the two species, which are morphometrically unrelated to Bangladeshi species and are mostly found in Asia, specifically China and Japan. Because of the observable distortion in Bangladeshi species, Bangla HSC was given that name. I thus ask that you all first identify the species. Thank you

Ehsanul Haq
Manager, BFDC Fish Landing Centre, Cox's Bazar

Fortunately, having attended the presentation today, we are aware of this excellent resource HSC.

Actually, we had no notion of its beneficial characteristics before. My recommendation is to safeguard this invaluable creature and take the necessary steps to educate the general public about its significance. From my perspective, I can guarantee that in my fish landing facility some HSCs are present. WCS had a session a few days ago to discuss how to protect sharks and rays. We will be able to preserve this precious organism if we convey its importance to everyone. It will, in my opinion, significantly boost the economy of our country. I'm thrilled to be here at the seminar. Thank you

Moktar Mia
Local folk, Ukhiya, Cox's Bazar

I had seen the HSC trapped in fishermen's nets since I was a young child. I observe that HSCs are murdered by the seashore for no apparent reason. Additionally, I noticed that many HSCs are passing away from ignorance from Cox's bazaar to Teknaf. I'm shocked and saddened that these priceless HSCs are perishing on the Bay of Bengal shoreline because of ignorance alone.

I will make sure to tell everyone in my community and circle of acquaintances not to harm HSCs. I want to ask all of my current journalism brothers to spread the word about how important the HSCs are. Thank you

Chanchal Chowdhury
Environmentalist at GOTI, An Environmental Organization

In reality, we work across the entire nation, but I had never heard of the HSC before. I believe we will artificially hatch it to enhance its population. For biomedical purposes and other applications, it is crucial. The most crucial aspect is that we must increase awareness to safeguard this priceless species. We must safeguard them because they need 18 years to grow before being discovered alive. Brother Mokter said that since he was a young child, he has witnessed the destruction of numerous HSCs. Therefore, if we start spreading the word today to everyone, we can prevent it from being extinct. In addition, if we safeguard the species, the ecosystem's other species will also be safeguarded. Thank you all

Concluding Remarks by the Session Chair

Dr. Md. Sagir Ahmed inferred certain knowledge gaps and concerns from the lectures and discussion of the seminar:

- Morphometric and molecular identification of horseshoe crab is needed.
- Occurrence and distribution pattern (Geospatial mapping) should be determined.
- The life cycle of horseshoe crab in this region should be studied thoroughly.
- The reproductive cycle of horseshoe crab should be determined.
- Spawning and breeding ground should be identified.
- Stock assessment and population status should be known for policy-making and conservation management.
- Artificial rearing should be done to increase the population.
- Awareness should be increased among the local communities, fishermen, and authorities to protect this valuable species.
- Extraction and marketing of "Carcinoscorpius Amebocyte Lysate (CAL)" from horseshoe crab in Bangladesh like LAL (Limulus Amebocyte Lysate) (USA) and TAL (Tachypleus Amebocyte Lysate) (China) will be done.

Mr. Belal Haider, DG, BORI expressed his gratitude to everyone for all the uttered words and tacit good wills. He believes the knowledge and expertise shared with the participants will accelerate extensive research and conservation of horseshoe crabs.

Photographs of the Seminar

Honorable Guests with DG, BORI attended seminar on International Horseshoe Crab Day 2022 organized by BORI.

Mr. Sayeed Mahmood Belal Haider, DG, BORI delivered his introductory speech in the seminar

Dr. Sagir Ahmed, Professor, Department of Zoology, Dhaka University delivered speech in the seminar as Chief Guest

Dr. Shafiqur Rahman, Station Chief, MFTS, BFRI, Cox's Bazar delivered speech in the seminar as Special Guests

Mr. Sayeed Mahmood Belal Haider, DG, BORI delivered his lecture in the seminar

Mr. Abu Sayeed Muhammad Sharif, SSO, BORI delivered Welcome Address Notes in the seminar

Mr. Abu Sharif Md. Mahbub-E-Kibria SSO, BORI Conducted the seminar

A glimpse of respected participants in the seminar

A glimpse of respected participants in the seminar

Journalists from different medias were present in the seminar

Chief Guest delivering his speech in front of the participants

A glimpse of respected participants in the seminar

A glimpse of respected participants in the seminar

A glimpse of respected participants in the seminar

Participants on online platform were actively took part in the seminar

A glimpse of respected participants in the seminar

Participants on online platform were actively took part in the seminar

Chief Guest & DG, BORI showing live horseshoe crabs to the participants

Banners displayed during the seminar at BORI campus

Chief Guest & DG, BORI showing live horseshoe crabs to the participants

Live horseshoe crabs preserved in the Chemical Oceanography Laboratory

Chief Guest & DG, BORI showing live horseshoe crabs to the participants

Honorable Guests & Participants visited Horseshoe Crabs habitat at Sonadia Island, Cox's Bazar

Honorable Guests & Participants visited Horseshoe Crabs habitat at Sonadia Island, Cox's Bazar

Participants took photos with Honorable guests near Horseshoe Crabs habitat at Sonadia Island

Honorable Guests & Participants visited Horseshoe Crabs habitat at Sonadia Island, Cox's Bazar

Honorable Guests & Participants visited Horseshoe Crabs habitat at Sonadia Island, Cox's Bazar

Participants took photos with Honorable guests near Horseshoe Crabs habitat at Sonadia Island

Participants were exchanging views after visiting Horseshoe Crabs habitat at Sonadia Island

Participants were exchanging views after visiting Horseshoe Crabs habitat at Sonadia Island

BORI Scientist collected samples from the Sonadia Island, Cox's Bazar

Participants took photos near Horseshoe Crabs habitat at Sonadia Island

Honorable Guests & Participants visited Horseshoe Crabs habitat at Sonadia Island, Cox's Bazar

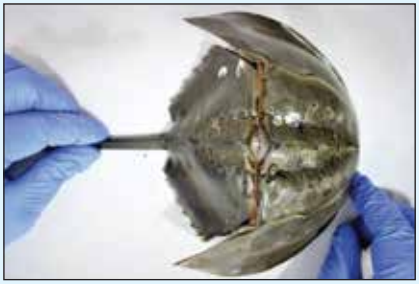
Journalists interviewed DG, BORI during Horseshoe Crabs habitat visit at Sonadia Island

Honorable Guests & Participants visited Horseshoe Crabs habitat at Sonadia Island, Cox's Bazar

Participants took photos with Honorable guests near Horseshoe Crabs habitat at Sonadia Island

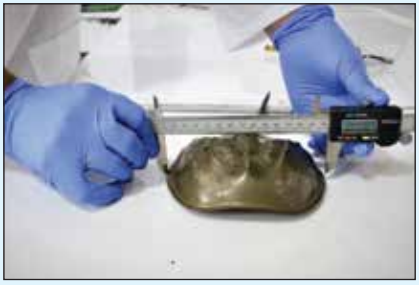
Recent Activities of BORI

Photo: Laboratory Analysis of Horseshoe Crab



Laboratory Analysis of Horseshoe Crab in the Chemical Oceanography Laboratory

Ventral view of Horseshoe Crabs observed in the Chemical Oceanography Laboratory



Laboratory Analysis of Horseshoe Crab in the Chemical Oceanography Laboratory

Laboratory Analysis of Horseshoe Crab in the Chemical Oceanography Laboratory

Laboratory Analysis of Horseshoe Crab in the Chemical Oceanography Laboratory

Blue Blood Collection of Horseshoe Crabs in the Chemical Oceanography Laboratory

Blue Blood Collection of Horseshoe Crabs in the Chemical Oceanography Laboratory

Blue Blood sample of Horseshoe Crab collected in the Chemical Oceanography Laboratory

Blue Blood sample of Horseshoe Crab collected in the Chemical Oceanography Laboratory

Blue Blood sample of Horseshoe Crab collected in the Chemical Oceanography Laboratory

Horseshoe Crab blood sample analysis in the Chemical Oceanography Laboratory

Microscopic Analysis of Blue Blood of Horseshoe Crabs in the Chemical Oceanography Laboratory

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds at Sonadia Island

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds at Sonadia Island

DG, BORI observing horseshoe crabs during Horseshoe Crabs breeding ground visit

Group of BORI Scientists with DG, BORI in a boat trip to visit Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI observing horseshoe crabs

DG, BORI observing horseshoe crabs during Horseshoe Crabs breeding ground visit

DG, BORI observing horseshoe crabs during Horseshoe Crabs breeding ground visit

Group of BORI Scientists with DG, BORI observing horseshoe crabs

Group of BORI Scientists with DG, BORI in a boat trip to visit Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI observing horseshoe crabs

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds

DG, BORI visited Horseshoe Crabs breeding grounds

BORI Scientist with DG, BORI visited Horseshoe Crabs breeding grounds

Observing Horseshoe Crabs breeding grounds at Sonadia Island

Observing juvenile Horseshoe Crab at Sonadia Island

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds

Live Horseshoe Crab in the breeding grounds

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI visited Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI in a boat trip to visit Horseshoe Crabs breeding grounds

Group of BORI Scientists with DG, BORI in a boat trip to visit Horseshoe Crabs breeding grounds

Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology visited the breeding ground of Horseshoe Crabs with BORI Scientists

Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology visited the breeding ground of Horseshoe Crabs with BORI Scientists

Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology exchanging views with BORI Scientists during Horseshoe crabs breeding ground visit

Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology visited the breeding ground of Horseshoe Crabs with BORI Scientists

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Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology visited the breeding ground of Horseshoe Crabs with BORI Scientists

Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology exchanging views with BORI Scientists

Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology visited the breeding ground of Horseshoe Crabs

Architect Yeafesh Osman, Honorable Minister, Ministry of Science & Technology exchanging views with BORI Scientists

A group of BORI Scientists on "Marine Biodiversity Research Expedition"

Media Coverage of the Seminar

বিশ্ব রাজকাঁকড়া দিবস আজ

‘জীবন্ত জীবাশ্ম’ ঘিরে সুনীল অর্থনীতির নতুন স্বপ্ন

কক্সবাজার প্রতিনিধি

বঙ্গোপসাগরের একমাত্র জীবন্ত জীবাশ্ম হর্সশো ক্র্যাব বা রাজকাঁকড়াকে ঘিরে দেশের সুনীল অর্থনীতিতে জেগেছে নতুন স্বপ্ন ও সম্ভাবনা। ইতোমধ্যে এ প্রাণীর ওষুধি গুণাগুণ কাজে লাগিয়ে দেশের অর্থনৈতিক ও জৈবপ্রযুক্তি খাতের উন্নয়নে দেশে প্রথমবারের মতো গবেষণা শুরু হয়েছে বাংলাদেশ মৎস্য গবেষণা ইন্সটিটিউট ও বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউটের উদ্যোগে। কিন্তু সাম্প্রতিককালে মানুষের আচরণের কারণে দেশের এ মূল্যবান প্রাণীটি প্রকৃতিতে পড়েছে মারাত্মক ঝুঁকির মুখে। প্রতি মাসে হাজার হাজার রাজকাঁকড়া মারা পড়ছে জেলেদের জালে। এ প্রাণী রক্ষায় গণসচেতনতা গড়ে তোলার জন্য বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউটের উদ্যোগে আজ ২০ জুন প্রথমবারের মতো দিনব্যাপী নানা অনুষ্ঠানমালার মাধ্যমে পালন করা হচ্ছে তৃতীয় ইন্টারন্যাশনাল হর্সশো ক্র্যাব ডে বা বিশ্ব রাজকাঁকড়া দিবস।

চিকিৎসা শাস্ত্রে রাজ কাঁকড়ার নীল রক্ত এক যাদুকরী বৈপ্লবিক পরিবর্তন এনেছে। এছাড়া এর শরীরের পেছনে থাকা ছোট্ট লেজটি দিয়ে তৈরি করা হয় ক্যান্সারের মহা ওষুধ। ফলে আন্তর্জাতিক বাজারে একেকটি রাজ কাঁকড়ার দাম পনের থেকে বিশ লাখ টাকা। *এর ৫ম পৃষ্ঠার ১ম কলাম*

বিশ্ব রাজকাঁকড়া দিবসে বক্তারা: ঝুঁকিতে মুল্যবান প্রাণী রাজকাঁকড়া - Coxsbazar Voice

Mostafijar

বিশ্ব রাজকাঁকড়া দিবসে বক্তারা: ঝুঁকিতে মুল্যবান প্রাণী রাজকাঁকড়া

1. *২০ জুন, ২০২২ / ১৩১ জন সংবাদটি পড়েছেন*

বিশেষ প্রতিবেদক:

আজ ২০ জুন বিশ্ব হর্সশো ক্র্যাব বা রাজকাঁকড়া দিবস। প্রথমবারের মতো কক্সবাজারে দিনব্যাপী নানা অনুষ্ঠানমালার মাধ্যমে পালন করা হচ্ছে। এ উপলক্ষে সোমবার সকালে বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউটের সম্মেলন কক্ষে কর্মশালা অনুষ্ঠিত হয়েছে।

এতে বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউটের সিনিয়র বৈজ্ঞানিক কর্মকর্তা আবু সাইয়েদ মো: শরীফ, ঢাকা বিশ্ববিদ্যালয়ের প্রাণী বিজ্ঞান বিভাগের প্রফেসর ড. মো: সগীর আহমেদ, বাংলাদেশ ম**ৎস্য গবেষণা ইন্সটিটিউট কক্সবাজারের প্রধান বৈজ্ঞানিক কর্মকর্তা ড. শফিকুর রহমান ও বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউটের মহাপরিচালক ড. সাইদ মাহমুদ বেলাল হায়দর**।

সেমিনারে বক্তারা বঙ্গোপসাগরের একমাত্র জীবন্ত জীবাশ্ম হর্সশো ক্র্যাব বা রাজকাঁকড়ার অস্থিত্ব অনেক বছর আগের। এই রাজকাঁকড়াকে ঘিরে দেশের সুনীল অর্থনীতিতে জেগেছে নতুন স্বপ্ন ও সম্ভাবনা। ইতোমধ্যে এ প্রাণীর ওষুধী গুণাগুণ কাজে লাগিয়ে দেশের অর্থনৈতিক ও জৈবপ্রযুক্তি খাতের উন্নয়নে দেশে প্রথমবারের মতো গবেষণা শুরু হয়েছে বাংলাদেশে। বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউট ও বাংলাদেশ ম**ৎস্য গবেষণা ইন্সটিটিউট এই দুটি প্রতিষ্ঠান হর্সশো ক্র্যাব বা রাজকাঁকড়া নিয়ে গবেষণা করছেন**।

এসময় সাম্প্রতিককালে মানুষের আচরণের কারণে দেশের এ মূল্যবান প্রাণীটি প্রকৃতিতে পড়েছে মারাত্মক ঝুঁকির মুখে পড়েছে বলে মতামত ব্যক্ত করেন।

প্রতিমাসে হাজার হাজার রাজকাঁকড়া মারা পড়ছে জেলেদের জালে। এ প্রাণী রক্ষায় গণসচেতনতা গড়ে তোলার জন্য বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউট উদ্যোগ গ্রহনের কথাও বলা হয়।

ভয়েস/আআ

ঔষধি গুণ ও অর্থনৈতিক কারণে বাঁচাতে হবে রাজকাঁকড়াকে

কক্সবাজারে সেমিনারে অভিমত

কক্সবাজার প্রতিনিধি | শনিবার , ২৫ জুন, ২০২২ at ৬:০৪ পূর্বাহ্ণ

হর্সশো ক্র্যাব বা রাজকাঁকড়ার মতো বঙ্গোপসাগরের মাত্র একটি মূল্যবান প্রাণীকে কাজে লাগিয়েই দেশে প্রতিবছর জাতীয় বাজেটের কয়েকগুণ আয় করা সম্ভব। বর্তমানে প্রতিবছর নানাভাবে লক্ষ লক্ষ রাজকাঁকড়া মারা যাচ্ছে। কেবল বাঁকখালী নদীর মাঝিরঘাট থেকে নাজিরারটেক মোহনা ও মহেশখালী চ্যানেলের মাত্র ১০ কিলোমিটার এলাকায় বিহিন্দি জালে মারা পড়ছে প্রতিবছর লক্ষাধিক রাজকাঁকড়া। দেশের অন্যান্য স্থানেও একই পরিণতির শিকার হচ্ছে মূল্যবান এ প্রাণীটি। 'জীবন্ত জীবাশ্ম' নামে পরিচিত পৃথিবীর এ আদি প্রাণীটিকে প্রকৃতিতে নিরিঘ্নভাবে বাঁচিয়ে রাখার মাধ্যমে দেশের অর্থনীতিতে যাদুকরী পরিবর্তন আনা সম্ভব বলে মনে করছেন সংশ্লিষ্ট বিজ্ঞানীরা। গত ২০ জুন ইন্টারন্যাশনাল হর্সশো ক্র্যাব ডে বা বিশ্ব রাজকাঁকড়া দিবস উপলক্ষে বাংলাদেশ সমুদ্র গবেষণা ইনস্টিটিউট আয়োজিত এক সেমিনারে গবেষকরা এমন মন্তব্য করেন। 'রাজকাঁকড়াকে জানি, রাজকাঁকড়াকে বাঁচাই' শীর্ষক ওই সেমিনারের দুটি পর্বে ভারত ও বাংলাদেশের বিজ্ঞানী-গবেষক ছাড়াও স্থানীয় পরিবেশ স্বেচ্ছাসেবীরা বক্তব্য দেন।

বাংলাদেশ সমুদ্র গবেষণা ইনস্টিটিউটের মহাপরিচালক (অতিরিক্ত সচিব) সমুদ্রবিজ্ঞানী সাঈদ মাহমুদ বেলাল হায়দরের সভাপতিত্বে সেমিনারে প্রধান অতিথির বক্তব্য দেন ঢাকা বিশ্ববিদ্যালয়ের প্রাণিবিদ্যা বিভাগের সভাপতি প্রফেসর ড. সগির আহমদ এবং সেমিনারে ভার্চুয়ালি উপস্থিত থেকে মূল প্রবন্ধ উপস্থাপন করেন ভারতের উড়িষ্যার কেএম কলেজ অব বেসিক সায়েন্সের অধ্যক্ষ ও রাজকাঁকড়া বিশেষজ্ঞ ড. গোবিন্দ চন্দ্র বিসওয়াল। সেমিনারে 'রাজকাঁকড়া সংরক্ষণ, সম্ভাবনা ও প্রতিবন্ধকতা' সম্পর্কে প্রবন্ধ উপস্থাপন করেন কক্সবাজারস্থ বাংলাদেশ মৎস্য গবেষণা ইনস্টিটিউটের (বিএফআরআই) সামুদ্রিক মৎস্য ও প্রযুক্তি কেন্দ্রের প্রধান বৈজ্ঞানিক কর্মকর্তা ও কেন্দ্র প্রধান ড. শফিকুর রহমান। রাজকাঁকড়ার জৈব রাসায়নিক গুণাগুণ সম্পর্কে ভার্চুয়ালি প্রবন্ধ উপস্থাপন ভারতের বালাসুর কুন্তলা কুমারী সবাত মহিলা কলেজের প্রাণিবিদ্যা বিভাগের প্রধান ড. জ্যোতির্ময়ী প্রধান। বৈজ্ঞানিক কর্মকর্তা আবু সায়ীদ মোহাম্মদ শরীফের স্বাগত বক্তব্যের মাধ্যমে শুরু হওয়া সেমিনারে রাজকাঁকড়ার বায়োমেডিক্যাল বা জৈব ওষুধি ব্যবহার ও এর গুরুত্ব সম্পর্কে আলোচনা করেন ইনস্টিটিউটের মহাপরিচালক সাঈদ মাহমুদ বেলাল হায়দর।

সেমিনারে ড. গোবিন্দ চন্দ্র বিসওয়াল বলেন, মার্কিন যুক্তরাষ্ট্রের দেখানো পথে রাজকাঁকড়ার মূল্যবান ওষুধি গুণকে কাজে লাগিয়ে ভারত-চীনসহ বিভিন্ন দেশে বায়োমেডিক্যাল প্রযুক্তি ও অর্থনৈতিক খাতে সমৃদ্ধি বয়ে আনছে। তিনি বলেন, ভারত, চীন ও আমেরিকায় যদি রাজকাঁকড়ার চাষ হতে পারে, তাহলে কেন বাংলাদেশে হবে না? রাজকাঁকড়াকে জানলে আমরা তাকে বাঁচাতে পারব বলে মনে করেন তিনি।

সাঈদ মাহমুদ বেলাল হায়দর বলেন, আমরা ইতোমধ্যে রাজকাঁকড়ার প্রজনন ও বিচরণস্থল চিহ্নিত করতে পেরেছি। তাদের জন্য একটি অভয়ারণ্য গড়ে তুলতে পারলে প্রতিবছর লক্ষ লক্ষ রাজকাঁকড়া রক্ষা পাবে। যার অর্থনৈতিক মূল্য কয়েক লক্ষ কোটি টাকা।

ড. শফিকুর রহমান বলেন, কেন্দ্রের বিজ্ঞানীরা রাজকাঁকড়ার ঘরোয়া প্রজনন প্রযুক্তি অর্জনের লক্ষ্যে নিরলসভাবে গবেষণা কাজ করে যাচ্ছেন। এরজন্য দীর্ঘ সময়ের প্রয়োজন। কারণ একটি রাজকাঁকড়া ডিম থেকে বাচ্চা হয়ে প্রাপ্ত বয়স্ক হতে ৫ থেকে ৭ বছর সময় লাগে। আর বাঁচে প্রায় ২০ বছর।

সেমিনারে উন্মুক্ত আলোচনায় আরো অংশ নেন পরিবেশবাদী স্বেচ্ছাসেবী সংগঠন 'হর্সশো ক্র্যাব কনজার্ভেশন গ্রুপ, বাংলাদেশ' এর টিম লিডার আহমদ গিয়াস, আইইউসিএন এর আসমা, ওয়ার্ল্ডফিশের উত্তম, স্বেচ্ছাসেবী পরিবেশকর্মী মোক্তার মিয়াসহ অন্যান্যরা।

২০ জুন তৃতীয় 'আর্ন্তজাতিক রাজকাঁকড়া দিবস' উপলক্ষে প্রথমবারের মতো দিনব্যাপী নানা অনুষ্ঠানমালার মাধ্যমে পালন করা হয় বাংলাদেশ সমুদ্র গবেষণা ইনস্টিটিউটের উদ্যোগে। কর্মসূচির অংশ হিসেবে সকালে উদ্বোধনী অনুষ্ঠান ও সেমিনারের পর বিকেলে শহরের বাঁকখালী নদী থেকে সোনাদিয়া দ্বীপ পর্যন্ত রাজকাঁকড়ার বিচরণস্থল পরিদর্শন ও সচেতনতামূলক প্রচারণা চালানো হয়।

বঙ্গোপসাগরের একটি প্রাণীর সদ্ব্যবহারে জাতীয় বাজেটের কয়েকগুণ বেশি অর্থ আয় করতে পারে - CBN24

আহমদ গিয়াস, *কক্সবাজার:*

হর্সশো ক্র্যাব বা রাজকাঁকড়ার মতো বঙ্গোপসাগরের মাত্র একটি মূল্যবান প্রাণীকে কাজে লাগিয়েই দেশে প্রতিবছর জাতীয় বাজেটের কয়েকগুণ আয় করা সম্ভব। বর্তমানে প্রতিবছর নানাভাবে লক্ষ লক্ষ রাজকাঁকড়া মারা যাচ্ছে কেবল বাঁকখালী নদীর মাঝিরঘাট থেকে নাজিরারটেক মোহনা ও মহেশখালী চ্যানেলের মাত্র ১০ কিলোমিটার এলাকায় বিহিন্দি জালে মারা পড়ছে প্রতিবছর লক্ষাধিক রাজকাঁকড়া। দেশের অন্যান্য স্থানেও একই পরিণতির শিকার হচ্ছে মূল্যবান এ প্রাণীটি। 'জীবন্ত জীবাশ্ম' নামে পরিচিত পৃথিবীর এ আদি প্রাণীটিকে প্রকৃতিতে নির্বিঘœভাবে বাঁচিয়ে রাখার মাধ্যমে দেশের অর্থনীতিতে যাদুকরী পরিবর্তন আনা সম্ভব বলে মনে করছেন সংশ্লিষ্ট বিজ্ঞানীরা। গতকাল সোমবার ২০ জুন ইন্টারন্যাশনাল হর্সশো ক্র্যাব ডে বা বিশ^ রাজকাঁকড়া দিবস উপলক্ষে বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউট আয়োজিত এক সেমিনারে গবেষকরা এমন মন্তব্য করেন। 'রাজকাঁকড়াকে জানি, রাজকাঁকড়াকে বাঁচাই' শীর্ষক ওই সেমিনারের দুটি পর্বে ভারত ও বাংলাদেশের বিজ্ঞানী-গবেষকরা ছাড়াও স্থানীয় পরিবেশ স্বেচ্ছাসেবীরা বক্তব্য দেন।

বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউট এর মহাপরিচালক (অতিরিক্ত সচিব) সমুদ্রবিজ্ঞানী সাঈদ মাহমুদ বেলাল হায়দরের সভাপতিত্বে অনুষ্ঠিত উক্ত সেমিনারে প্রধান অতিথির বক্তব্য দেন ঢাকা বিশ^বিদ্যালয়ের প্রাণীবিদ্যা বিভাগের সভাপতি প্রফেসর ড. সগির আহমদ এবং সেমিনারে ভার্চুয়ালি উপস্থিত থেকে মূল প্রবন্ধ উপস্থাপন করেন ভারতের উড়িষ্যার কেএম কলেজ অব বেসিক সায়েন্সের অধ্যক্ষ ও রাজকাঁকড়া বিশেষজ্ঞ ড. গোবিন্দ চন্দ্র বিসওয়াল। সেমিনারে 'রাজকাঁকড়া সংরক্ষণ, সম্ভাবনা ও প্রতিবন্ধকতা' সম্পর্কে প্রবন্ধ উপস্থাপন করেন কক্সবাজারস্থ বাংলাদেশ **মৎস্য গবেষণা ইন্সটিটিউট (বিএফআরআই) এর সামুদ্রিক মৎস্য ও প্রযুক্তি কেন্দ্রের প্রধান বৈজ্ঞানিক কর্মকর্তা ও কেন্দ্র প্রধান ড. শফিকুর রহমান**। রাজকাঁকড়ার জৈব রাসায়নিক গুণাগুণ সম্পর্কে ভার্চুয়ালি প্রবন্ধ উপস্থাপন ভারতের বালাসুর কুন্তলা কুমারী সবাত মহিলা কলেজের প্রাণীবিদ্যা বিভাগের প্রধান ড. জ্যোতিময়ী প্রধান। বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউট এর বায়োলোজিক্যাল ওশ্যানোগ্রাফিক বিভাগের সিনিয়র বৈজ্ঞানিক কর্মকর্তা আবু সায়ীদ মোহাম্মদ শরীফের স্বাগত বক্তব্যের মাধ্যমে শুরু হওয়া উক্ত সেমিনারে রাজকাঁকড়ার বায়োমেডিক্যাল বা জৈব ওষুধী ব্যবহার ও এর গুরুত্ব সম্পর্কে আলোচনা করেন ইন্সটিটিউটটির মহাপরিচালক সমুদ্রবিজ্ঞানী সাঈদ মাহমুদ বেলাল হায়দর।

সেমিনারে উড়িষ্যার কেএম কলেজ অব বেসিক সায়েন্সের অধ্যক্ষ ও রাজকাঁকড়া বিশেষজ্ঞ ড. গোবিন্দ চন্দ্র বিসওয়াল বলেন, মার্কিন যুক্তরাষ্ট্রের দেখানো পথে রাজকাঁকড়ার মূল্যবান ওষুধী গুণকে কাজে লাগিয়ে ভারত-চীনসহ বিভিন্ন দেশে বায়োমেডিক্যাল প্রযুক্তি ও অর্থনৈতিক খাতে সমৃদ্ধি বয়ে আনছে।

তিনি বলেন, ভারত, চীন ও আমেরিকায় যদি রাজকাঁকড়ার চাষ হতে পারে, তাহলে কেন বাংলাদেশে হবে না? রাজকাঁকড়াকে জানলে আমরা তাকে বাঁচাতে পারব বলে মনে করেন তিনি।

সেমিনারে বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউট এর মহাপরিচালক সাঈদ মাহমুদ বেলাল হায়দর তাদের প্রতিষ্ঠানের গত এক বছরের গবেষণা অগ্রগতি সম্পর্কে বলেন, আমরা ইতোমধ্যে রাজকাঁকড়ার প্রজনন ও বিচরণস্থল চিহ্নিত করতে পেরেছি। তাদের জন্য একটি অভয়ারণ্য গড়ে তুলতে পারলে প্রতিবছর লক্ষ লক্ষ রাজকাঁকড়া রক্ষা পাবে। যার অর্থনৈতিক মূল্য কয়েক লক্ষ কোটি টাকা।

বিএফআরআই এর সামুদ্রিক **মৎস্য ও প্রযুক্তি কেন্দ্রের প্রধান বৈজ্ঞানিক কর্মকর্তা ও কেন্দ্র প্রধান ড. শফিকুর রহমান গত এক বছরের গবেষণা অগ্রগতি তুলে ধরে বলেন, কেন্দ্রের বিজ্ঞানীরা রাজকাঁকড়ার ঘরোয়া প্রজনন প্রযুক্তি অর্জনের লক্ষ্যে নিরলসভাবে গবেষণা কাজ করে যাচ্ছেন**। এরজন্য দীর্ঘ সময়ের প্রয়োজন। কারণ একটি রাজকাঁকড়া ডিম থেকে বাচ্চা হয়ে প্রাপ্ত বয়স্ক হতে ৫ থেকে ৭ বছর সময় লাগে। আর বাঁচে প্রায় ২০ বছর।

সেমিনারে উন্মুক্ত আলোচনায় আরো অংশ নেন পরিবেশবাদী স্বেচ্ছাসেবী সংগঠন 'হর্সশো ক্র্যাব কনজার্ভেশন গ্রæপ, বাংলাদেশ' এর টিম লিডার আহমদ গিয়াস, আইইউসিএন এর আসমা, ওয়ার্ল্ডফিশের উত্তম, স্বেচ্ছাসেবী পরিবেশকর্মী মোক্তার মিয়াসহ অন্যান্যরা।

'হর্সশো ক্র্যাব কনজার্ভেশন গ্রæপ, বাংলাদেশ' এর টিম লিডার আহমদ গিয়াস বলেন, প্রজননস্থল ও আবাসস্থলকে নির্বিঘœ করেই আমরা প্রতিবছর বঙ্গোপসাগরে কয়েক কোটি রাজকাঁকড়ার প্রাচ‚র্য গড়ে তুলতে পারি। আর মাত্র এক কোটি রাজকাঁকড়ার অর্থনৈতিক মূল্য জাতীয় বাজেটের অন্তত তিন গুণ।

২০ জুন তৃতীয় 'আন্তর্জাতিক রাজকাঁকড়া দিবস' উপলক্ষে প্রথমবারের মতো দিনব্যাপী নানা অনুষ্ঠানমালার মাধ্যমে পালন করা হয় বাংলাদেশ সমুদ্র গবেষণা ইন্সটিটিউটের উদ্যোগে। কর্মসূচির অংশ হিসাবে সকালে উদ্বোধনী অনুষ্ঠান ও সেমিনারের পর বিকালে শহরের বাঁকখালী নদী থেকে সোনাদিয়া দ্বীপ পর্যন্ত রাজকাঁকড়ার বিচরণস্থল পরিদর্শন ও সচেতনতামূলক প্রচারণা চালানো হয়।

সেমিনারে উপস্থিত সকলেই যার যার অবস্থান থেকে রাজকাঁকড়া রক্ষার জন্য এবং জনগণকে উদ্বুদ্ধ করার জন্য প্রতিজ্ঞাবদ্ধ হন।

Sayeed Mahmood Belal Haider
Director General (Additional Secretary)
Bangladesh Oceanographic Research Institute (BORI)
cordially invite you to the

Hybrid Seminar on

Know the Horseshoe Crabs, Save the Horseshoe Crabs

To Celebrate

The 3rd International Horseshoe Crab Day-2022

on **Monday, 20 June 2022** from **09.00 hrs to 17.00 hrs**

Chief Guest

Dr. Md. Sagir Ahmed
Professor, Department of Zoology
University of Dhaka

Venue: Seminar Room, Institute Building

Zoom Meeting ID: 720 407 7075 (No password required)

RSVP: +880-1716-910016; Phone: 02-9614678; E-mail:dg@bori.gov.bd; Website: www.bori.gov.bd

PROGRAMME

Monday, 20 June 2022 from 09.00 hrs to 17.00 hrs

Inaugural Session

Session Chair : **Mr. Sayeed Mahmood Belal Haider**
Director General (Additional Secretary)
Bangladesh Oceanographic Research Institute
Cox's Bazar

09.30-09.35 hrs : Welcome Address
Mr. Abu Sayeed Muhammad Sharif
Senior Scientific Officer (SSO)
Biological Oceanography Division
Bangladesh Oceanographic Research Institute
Cox's Bazar

09.35-09.55 hrs : Speech by the Chief Guest
Dr. Md. Sagir Ahmed
Professor, Department of Zoology
University of Dhaka

09.55-10.00 hrs : **Concluding Remarks by the Chair**

10.00-10.15 hrs : **Refreshment**

Working Session

Session Chair : **Dr. Md. Sagir Ahmed**
Professor, Department of Zoology
University of Dhaka

10.15-11.00 hrs : Know the Horseshoe crabs, Save the Horseshoe crabs
Dr. Gobinda Chandra Biswal
Reader in Zoology &
Principal, K.M. College of Basic Science
Balasore, Odisha, India

11.00-11.30 hrs : Conservation of Horseshoe Crabs: Prospects and challenges-Bangladesh Perspectives
Dr. Shafiqur Rahman
Principle Scientific Officer & Station Chief
Marine Fisheries and Technology Station, BFRI, Cox's Bazar

11.30-12.00 hrs : Chitin and Chitosan of Horseshoe Crabs: Production and Application
Dr. Joytirmayee Pradhan
Head, Department of Zoology
Kuntala Kumari Sabat Women's College
Balasore, Odisha, India

12.00-12.30 hrs : Horseshoe Crabs: Biomedical Use and Importance to Human Health
Mr. Sayeed Mahmood Belal Haider
Director General, BORI

12.30-13.15 hrs : **Open Discussion**

13.15-13.30 hrs : **Concluding Remarks by the Chair**

13.30-15.00 hrs : **Prayer, Lunch & Taking Rest**

15.00-17.00 hrs : **Visiting Horseshoe Crab's Habitat (Sonadia Island)**

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