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Karaikudi – 630 003, Tamil Nadu, India

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Department of Fisheries Science

Newsletter

MATSYA

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Department Profile

About the Department

The Department of Fisheries Science was established in 2018 with the primary objective of cultivating proficient and skilled professionals in the fields of Fisheries and Aquaculture, including inland and marine segments. Prof. C. Govindasamy was the first Head of the Department and retired in June 2020. After him, Prof. E. Kannapiran successfully serving as the Head of the Department. It is steadfast in its commitment to provide excellent Postgraduate programmes. Operating under the Choice-Based Credit System, the department offers a Master of Science in Fisheries Science Programme, accommodating a capacity of 20 students. It maintains the aquarium and fish tanks in the entire University campus which provide therapeutic effects as it lowers blood pressure, reduces stress and has a calming effect on people. It maintains percolation tank for the culture of freshwater fishes.

Vision

To encourage sustainable fisheries and robust aquaculture practices for the constant supply of high-quality fish for everyone that complements the economic prosperity of the fishery business.

Mission

- To impart skill-based training across all fisheries sectors.
- To empower the fisheries sector through the dissemination of scientific knowledge, the application of cutting-edge technologies, skill development initiatives, and community engagement.
- To promote responsible fisheries practices and ensure a sustainable and thriving future for aquatic ecosystems and stakeholders.

Programs Offered

- M.Sc. Fisheries Science (Two year)

Faculty Members

S. No	Name	Designation
1	Dr. E. Kannapiran	Professor & Head i/c
2	Dr. R. Srinivasan	Adjunct Faculty
3	Dr. R. Kumar	Adjunct Faculty
4	Dr. N. Padmini	Adjunct Faculty
5	Dr. P. Marimuthu	Adjunct Faculty

Field Visits

Field visits were conducted for the students of I- MSc Fisheries Science to facilitate experimental learning and practical knowledge under the supervision of Dr. R. Kumar, Dr. N. Padmini, Dr. R. Srinivasan, Dr. P. Marimuthu, Adjunct Faculties in the Department of Fisheries Science, Alagappa University, Karaikudi and Dr. K. Kannan, Assistant Professor, Department of Zoology, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu They were actively engaged in the learning process, demonstrating a keen interest and eagerness to acquire new knowledge.

Mandapam- Fish Landing Centre

The first year M.Sc students of Fisheries Science Department, Alagappa University, Tamil Nadu, had a privilege to visit for the first time to the Mandapam fish landing centre, Ramanathapuram, Tamil Nadu, India on the 7th October, 2022. The students came across a variety of marine finfish and shellfishes belonging to different families and also learnt about their taxonomic characteristics, which helped them to acquire knowledge and interest in taxonomy. Coming back to marketing point of view, the students also learnt about the demand of different type of marine fishes along with their price per kilogram. An essence of joy and curiosity filled the students' eyes as they wanted to learn more about the fishes. The educational trip to the landing centre ended successfully and the faculty members guided the students to their next destination.



Dr. K. Kannan explaining about identification of fishes at Mandapam fish landing centre

Krusadai Island- Coral Reef Ecosystem

Located in Mandapam, Ramanathapuram district (latitude 9°12'N 79°10'E; longitude 9.20°N 79.17°E). It is an uninhabited island located close to Swami Vivekananda Memorial Kunthukal. It is one of the 21 islands in the Gulf of Mannar Marine National Park and is also known as the 'Biologists Paradise'. The first year M.Sc students of Fisheries Science Department, Alagappa University, Tamil Nadu, visited the island on the 7th October, 2022. The students were very keen to observe the biodiversity of the island and was much excited to see the unique coral reef ecosystem. On entering the Krusadai island, which took them around 30 minutes from Kunthukal in a boat ride, they filled themselves with excitement and joy when they saw the marine museum. Later, they were astonished to see the preserved fish specimens and the marine mammalian bones, especially of the whale. The tour was guided by the local villagers as they helped the faculty members and students to identify different plants and gave a detailed idea about the island and its significance. Overall, the students benefitted themselves as they came across such spectacular nature for the first time that was preserved by the Govt., villagers and the tourists



Coral reef viewing from boat near the Krusadai Island

ICAR- Central Marine Fisheries Research Institute, Regional Centre - Mandapam

The first year M.Sc. students of Fisheries Science Department, Alagappa University, Tamil Nadu, was privileged enough to visit the regional centre of the ICAR- Central Marine Fisheries Research Institute in Mandapam, Ramanathapuram, Tamil Nadu, India (latitude 9°16'14"N; longitude 79°7'10"E) on the 7th October, 2022. The students highly benefitted themselves at the CMFRI marine biodiversity museum as they learnt about the taxonomic characteristics of different marine finfish, shellfish and corals. Besides these, they also learnt about the techniques of collection, preservation, cataloguing and displaying of the specimens.

The marine museum also displayed a skeletal structure of the sea cow (*Dugong dugon*) and sperm whale (*Physeter macrocephalus*), which took the students to a different level of excitement. Followed by this, the students next saw the ornamental aquarium setup of the CMFRI where they came across different marine ornamental fishes. The vibrant colours and unique pattern, shape and sizes of the ornamental fishes attracted the interest of the students.



Visit to ICAR - Central Marine Fisheries Research Institute, Mandapam Regional Centre

Karankadu Mangrove

The Karankadu mangrove (latitude 9°36'N; longitude 78°83'E) is situated in the Palk Bay region (latitude 9°55'-10°45'N; longitude 78°58'-79°55'E) of southeast coast of India. The ecosystem comprises of a diverse marine as well as terrestrial organisms including finfish, shellfish, molluscs and different varieties of birds. The students of first year M.Sc. Fisheries Science in the Department, Alagappa University, Tamil Nadu visited the mangrove ecosystem on the 16th October, 2022. Among the different varieties, the Karankadu region had a rich diversity of *Avicennia marina*, a type of Black mangrove. The biodiversity of the Karankadu mangrove amazed the students as they sailed through a boat observing the nature. The faculty members guided them along the journey.



Visit to Karankadu Mangrove

Thondi Fish Market

The Thondi fish market is located in Kurumilangudi, Pasipattinam, Vattanam area of Ramanathapuram, Tamil Nadu India (latitude 9.7380⁰ N; longitude 79.0182⁰ E). The first year students visited the local fish market in Thondi on the 16th October, 2022. The small fish market displayed a huge variety of commercially important catches from the marine waters. The faculty members guided the students and helped them to identify the fishes and shellfishes based on their taxonomic characteristics. This type of field teaching technique not only put an interest in the students about fishes, but also encouraged and made them aware how taxonomy played an important role in fish identification

Thondi- Landing Centre and Fishermen Village to Collect Socio-Economic Status of Fishermen

During this visit on the 16th October, 2022, a list of questionnaire was prepared by the students prior to visiting the Thondi fish market. Based on the questions, the students interviewed the local fishermen at the landing centre to assessed their lifestyle and socio-economic position in the society. The questions were very respectfully interrogated to the fisher folks and their response were recorded.

Shrimp Farm- Gokulam, Karankadu

The Gokulam shrimp farm is located in Karankadu, Tamil Nadu. The students of first year visited this shrimp farm along with the departmental faculty members on the 16th October, 2022. The farm displayed an intensive shrimp farming technique especially the white leg shrimp (*Litopenaeus vannamei*). The farm extended over an area of three acres land and comprised of 8-9 ponds. The farm manager shared a detailed idea about different ponds and the techniques involved in farming of shrimp. The stocking density, physico-chemical parameters, feeding rate, growing to marketable size and the overall management techniques were clearly described by the farm manager. The students were keen to learn more as they gained in depth knowledge about the intensive shrimp culture technique.

Fish have great memories

- Some species of fish can recognize and remember humans that give them food rewards.
- Cleaner fish can recognize their clients that they regularly clean, which can be up to 100 different fish. The clients also remember and recognize their specific cleaner.
- Fish can also remember musical tunes

Aquagri Processing Private Limited, Manamadurai

An industrial visit to Aquagri Processing Private Limited, a Seaweed processing plant in Manamadurai (latitude 22.5726460 N; longitude 88.3638950 E) was organized by the Dept. of Fisheries Science, Alagappa University to introduce the students towards seaweed industry. The trip was commenced on the 5th November, 2022 and was guided by the faculty members of the department along with the assistance of Mrs. Devika. In the plant, the students got to know about *Kappaphycus alvarezii*, a type of red seaweed that was being processed in the industry and the valuable uses of carrageenan, an approved food additive that played an essential role in food processing industries. The students were also amazed to know about the Sagarica liquid, which was manufactured in the industry utilizing the red and brown seaweed that was used to promote plant growth. The students came across twenty-two different products that were manufactured in Aquagri processing plant utilizing the seaweeds. In an industrial level, various protocols needed to be maintained regarding processing, so every answer to a question could not be recorded. Next, the students were introduced to four different laboratories which included the analytical lab, quality control lab, quality assurance lab and finally the R&D food and agri division. Overall, it gave an exposure to the students as they learnt about many uses of seaweed and they got to know about the technical aspects inside a processing industry.



Visit to AquAgri Processing Pvt. Ltd.

Kochi Trip

On 15.02.2023, first year M.Sc. Fisheries Science students along teaching staff and Dr. Kannan, assistant Professor, Kongunadu Arts and Science College, Coimbatore started from Karaikudi to Kochi by train. The students were provided accommodation at ICAR-CIFT guest house.



Centre for Marine Living Resources & Ecology (CMLRE)

On 16.02.2023 forenoon, the students visited the Centre for Marine Living Resources & Ecology (CMLRE), a research institute in Kochi. Dr. Sendhil Kumar, Scientist D, CMLRE explained the activities and facilities available at CMLRE. CMLRE under the Ministry of Earth Sciences, Govt. of India has been organizing, coordinating and promoting ocean development activities in the country.



ICAR- Central Marine Fisheries Research Institute, Kochi & ICAR- National Bureau of Fish Genetic Resources

On 16.02.2023 afternoon, students visited ICAR-Central Marine Fisheries Research Institute at Kochi. The National Marine Biodiversity Museum at CMFRI is one of the oldest museums in the country. Marine Biodiversity Museum offers a glimpse of the biodiversity of the Indian seas displaying specimens collected from marine environments and estuaries. The collections, arranged systematically for a better understanding of the resources.

Later the students visited the Peninsular Aquatic Genetic Resources, Kochi Centre of the ICAR- National Bureau of Fish Genetic Resources which is housed in the premises of the Central Marine Fisheries Research Institute, Kochi. The centre has been undertaking research activities pertaining to genetic characterization, conservation and cataloguing of the peninsular and marine fish genetic resources. Dr. T.T. Ajith Kumar, Head and Scientist In-Charge of ICAR-NBFGR explained that the centre has been undertaking research activities pertaining to genetic characterization, conservation and cataloguing of the peninsular and marine fish genetic resources.



*Visit to ICAR - Central Marine Fisheries Research Institute &
ICAR- National Bureau of Fish Genetic Resources , Kochi*

ICAR-Central Institute of Fisheries Technology (CIFT), Kochi

On 17.02.2023, the students visited Central Institute of Fisheries Technology (CIFT) in Matsyapuri, Willingdon Island, Kochi. CIFT is a subsidiary of Indian Council of Agricultural Research (ICAR). CIFT is an autonomous organization established by the Government of India, engaged in research related to fishing and fish processing in the country.



Visit to ICAR-Central Institute of Fisheries Technology (CIFT), Kochi

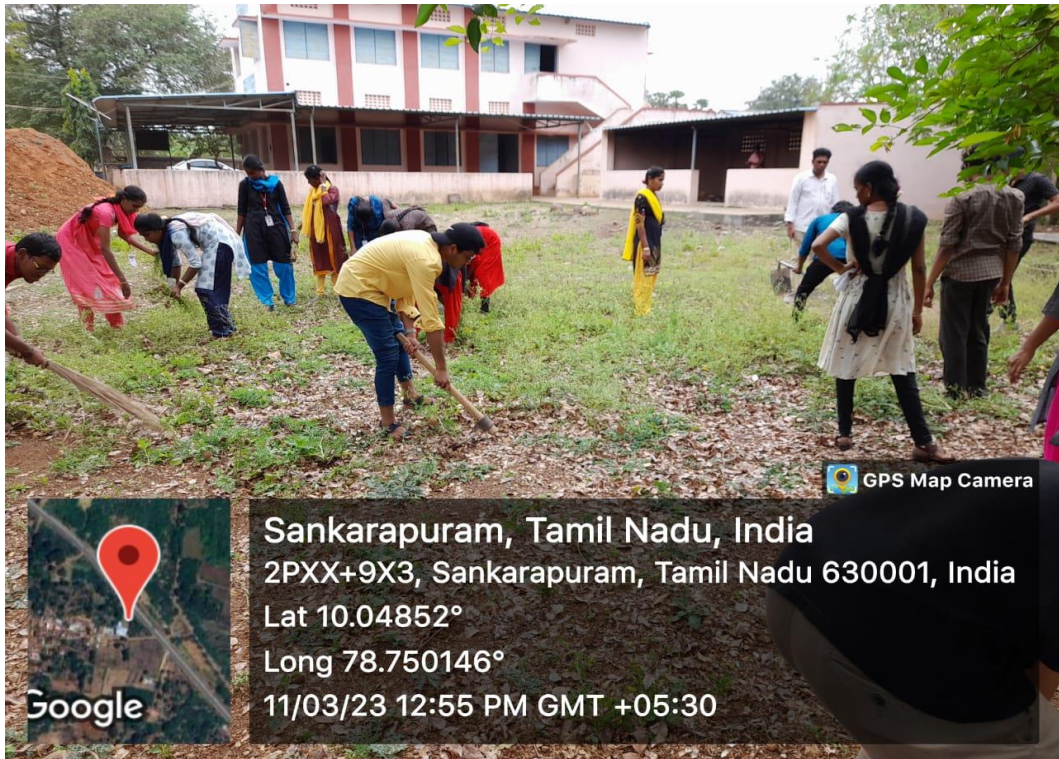
Events

Village Extension Programme

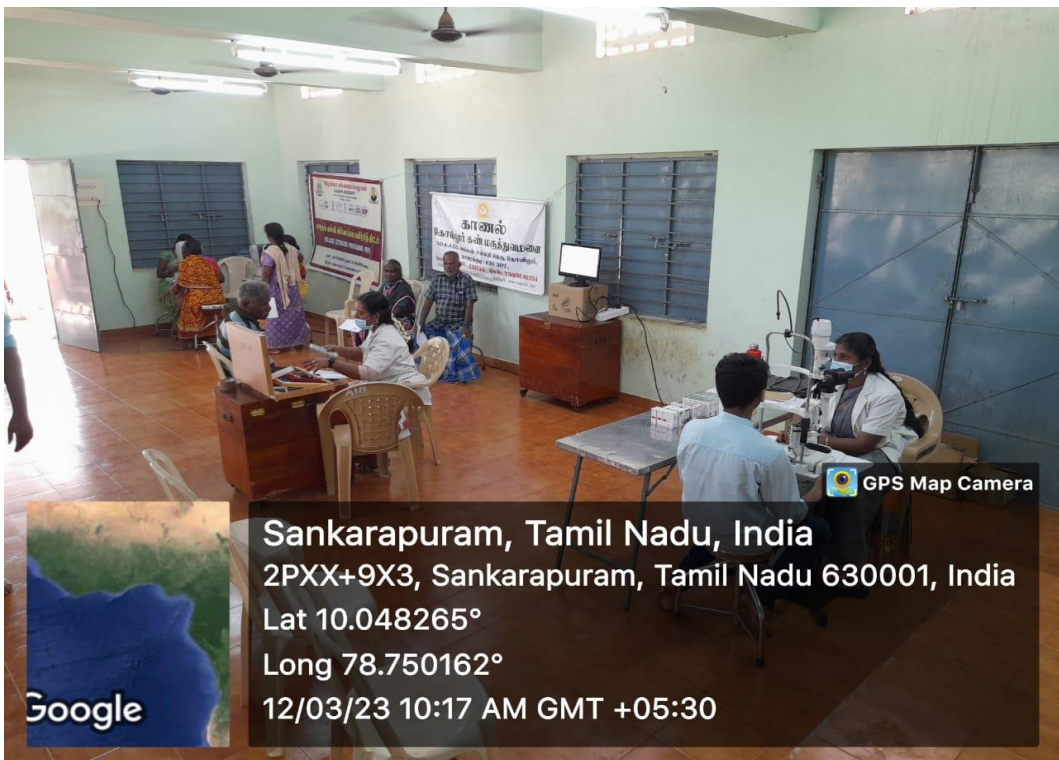
For the academic year 2022-23, Department of Fisheries Science along with the Department of Animal Health and Management and Department of Tamil, Alagappa University organized this programme from 10th to 12th March 2023 in Sankarapuram village, Sivaganga District. . Dr. R. Kumar, Dr. R. Srinivasan, and Dr. N. Padmini, Adjunct Faculties, Department of Fisheries Science co-ordinated the activities of the students of the Department of Fisheries Science. Students created awareness on cleanliness and environment protection through beautification of the premises of the primary school, Sankarapuram village on 10.03.2023. The premises of the society hall of Sankarapuram village was cleaned by the students and tree saplings were planted around the society hall on 11.03.2023. An eye checkup campaign was conducted in collaboration with Kaanal Koviloor Eye Hospital for the people in Sankarapuram village on 12.03.2023 and free medicines were distributed to the needy.



VEP activities in the Primary School, Sankarapuram



Cleaning the premises of Society Hall in Sankarapuram village



Eye checkup campaign was conducted in collaboration with Kaanal Koviloor Eye Hospital in the Sankarapuram village

National Science Day

National Science Day is celebrated in India on February 28 each year to mark the discovery of the Raman Effect by Indian physicist Sir C. V. Raman on 28 February 1928. On 28th February, 2023, students prepared a model of aquaponics and explained the operation and uses to our Hon'ble Vice Chancellor, Prof. G. Ravi and visitors. Preserved specimens of various types of finfish and shellfishes and scuba diving equipments were displayed for the public. Students from various schools visited the Department.



Students explaining the working model of Aquaponics to our Hon'ble Vice Chancellor Prof. G. Ravi

Facts About Fish

- There are over 30,000 species of fish.
- Most fish are cold-blooded
- They can be found in the sea, lakes, rivers, streams and ponds
- Fish breathe through their gills
- Most fish don't have eyelids
- The biggest fish is a whale shark which can be as heavy as 18.7 tonnes
- The world's smallest fish is *Paedocypris progenetica*. Mature females measure just 7.9 millimeters

The Seminar and Quiz Club

Dr. R. Kumar, the co-ordinator of the Seminar and Quiz club conducted quiz every week on Friday. First year and second year students of M.Sc. Fisheries science were divided into 5 groups by lottery method. In the first round of quiz, the quiz master asks the question (question number randomly selected by the group members). In the second round, each group member will be given chance to pose question to the other groups. The correct answering group will be awarded marks. The final winning group members will be awarded with a prize.



Our HOD, Prof. E. Kannapiran distributing prizes to the winners of the Quiz competition

The Environment club

To reduce the use of single-use plastics, the students were encouraged to use fountain pens. Single use plastic pens disposal boxes were arranged in all the classrooms in the Science Campus and they were collected periodically.



Students collecting single use plastic pens

Teachers Day



Teacher's day celebration on 05th September 2022

Pongal Celebration

Prof. E. Kannapiran, Head i/c, staff and students actively participated in the Pongal celebrations.



Freshers Day Celebration

The Department of Fisheries Science at Alagappa University organised the Fresher's Day celebration on 11th September, 2023. The event was hosted to welcome the new batch of M.Sc. students through cultural programs and games. Faculty members and II year students interacted with the freshers to help them settle in smoothly



Parents and Alumni Meet

All the parents attended the Parents-Teachers Meet conducted online for their convenience of the parents who are living in other states. Parents were satisfied with the activities and facilities of the Department. Parents gave a very good feedback about the Department and the Faculty members. For the Alumni Meet, few alumni students joined the meeting through online.

ARTICLES

FABRICATION OF AQUARIUM TANK

Dr. R. Srinivasan

Adjunct Faculty, Department of Fisheries Science

Ornamental fish tank is otherwise called an aquarium. An aquarium is a set up in which ornamental fishes of aesthetic value are displayed for recreation. Essential factors for tank construction are the size and shape of the tank, thickness of the glass, the volume of water, and the density of fish that it holds.

Types of ornamental fish tanks

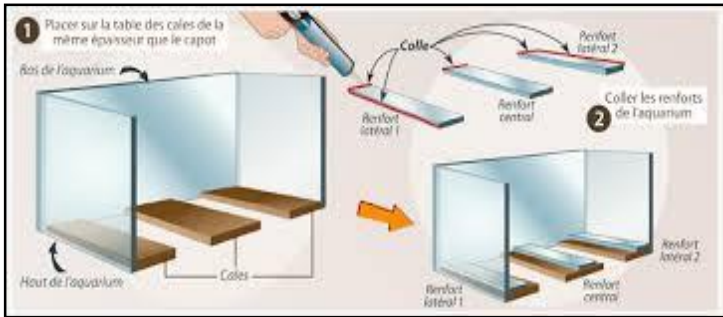
Aquarium can be made of different materials like glass, concrete, wood, fiberglass, acrylic sheet etc., depending on its location, cost and durability. The minimum considerable size (cm) of an aquarium is 60 x 30 x 30 (LxBxH). The water volume required by an individual fish should be kept in mind while designing either an aquarium or pool.

Standard Aquarium Size

S. No.	Aquarium Size in (cm)			Capacity (Liter)	Thickness of glass (in mm)
	Length	Breadth	Height		
1	45	25	25	30	5
2	60	30	30	40	6
3	90	30	30	100	6
4	120	45	60	400	10
5	180	45	60	480	12

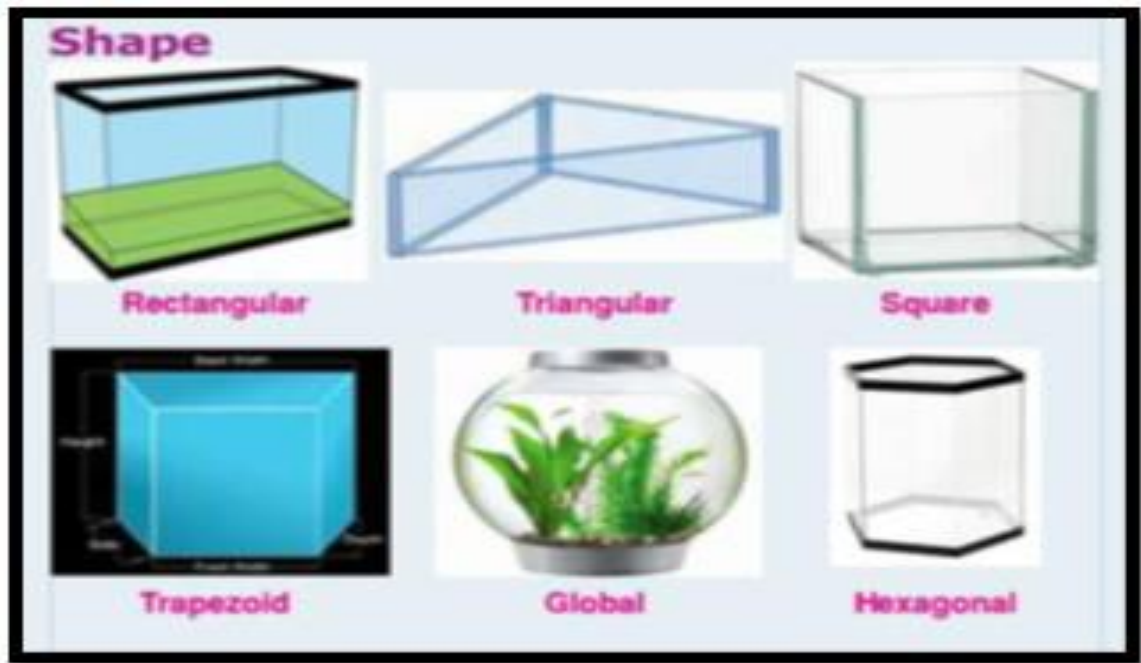
Glass tank

They are either all glass tanks or metal framed ones. In the metal (steel or iron) framed tanks glass panels are held in place with putty (battery compound). On the other hand in all glass tanks, glass walls are fitted together edge-to-edge using silicone rubber adhesive. Now-a-days, all-glass tanks have completely vanished due to the popularity of metal-framed tanks, which are known for their slim appearance and suitability for keeping marine fishes also.



Shape of aquarium tanks

The shape of the aquarium tank may be circular, square, rectangular, oval, hexagonal or octagonal. However, rectangular tanks are preferred as they provide sufficient area for free swimming of the fishes.



Construction of all glass aquarium tank

These are constructed with only glass sheets. Rectangular all glass tanks are made with a glass wall thickness of 5 - 10 mm. In all glass tanks, the cut glass walls are filled together with synthetic rubbery sealant called silicone gum. Prior to fabrication of the tank, sidewalls of the tank are arranged so as to have the desired shape. The glass walls are tied with a rope in order to keep the correct shape of the tank. Then the bottom sheet of the tank is kept flat below the arranged sidewalls so as to get the desired and correct shape of the tank. A cut thermocoel sheet is kept at the bottom to rest the temporarily tied glass sheets. Now the silicone sealant is evenly applied all along the inner vertical and horizontal cut ends with the help of a hand applicator. Care must be taken to see that the joining ends of the glass pieces are free of oil, moisture or stains. A good sealant compound binds the glass walls in 10 to 20 minutes. However, a curing time of about 10 hrs is required to keep the set tank in position and water should be poured only after 24 hours.

Important Aquarium Accessories

Glass, Substrate, Light Arrangements, Thermometer, Heater with thermostats, Aerator, Filters, Stones Hoot and Aquarium plants



BIVALVES

Dr. R. Kumar

Adjunct Faculty, Department of Fisheries Science

Bivalves are the second most diverse group of molluscs inhabiting marine and freshwater ecosystems. Bivalves belong to the class Bivalvia or Pelecypoda that includes economically important clams, oysters, scallops, and mussels. More than 20,000 species of bivalves are reported. They can be found in marine, estuarine, and freshwater ecosystems. They have been used for centuries as food and jewellery (pearl necklace). Since the bivalves are filter-feeders, they greatly reduce the algal blooming and eutrophication. They also act as vectors of various disease as they accumulate toxic substances and microorganisms.

Morphology

The bivalve shell consists of two valves that are hinged dorsally. However, some species the shells are greatly reduced or absent as in case of shipworms. Clams are smaller in size (1-3 inches) whereas mussels can grow up to 15 cm. Oysters refer to any of the bivalve mollusks with rough irregular shells that are often eaten raw. They lack a distinct head and radula. They have three ganglion diffused in the visceral mass. With the help of adductor muscles (usually two, sometimes one) the bivalves control the opening and closing the valves at their will. Clams are strong muscular foot which helps in burying in the sand. Mussels have byssus thread on their foot which helps in attaching them permanently to hard surfaces such as stones, jetties or shells of other mussels. They have two siphons, inhalant siphon through which water is carried into the pallial cavity and the exhalant siphon through which the water, waste products and gametes are expelled from the pallial cavity. Scallops have sensory tentacles for sensing the chemical changes in water and up to 200 pallial eyes on soft body parts next to the edges of their shells.

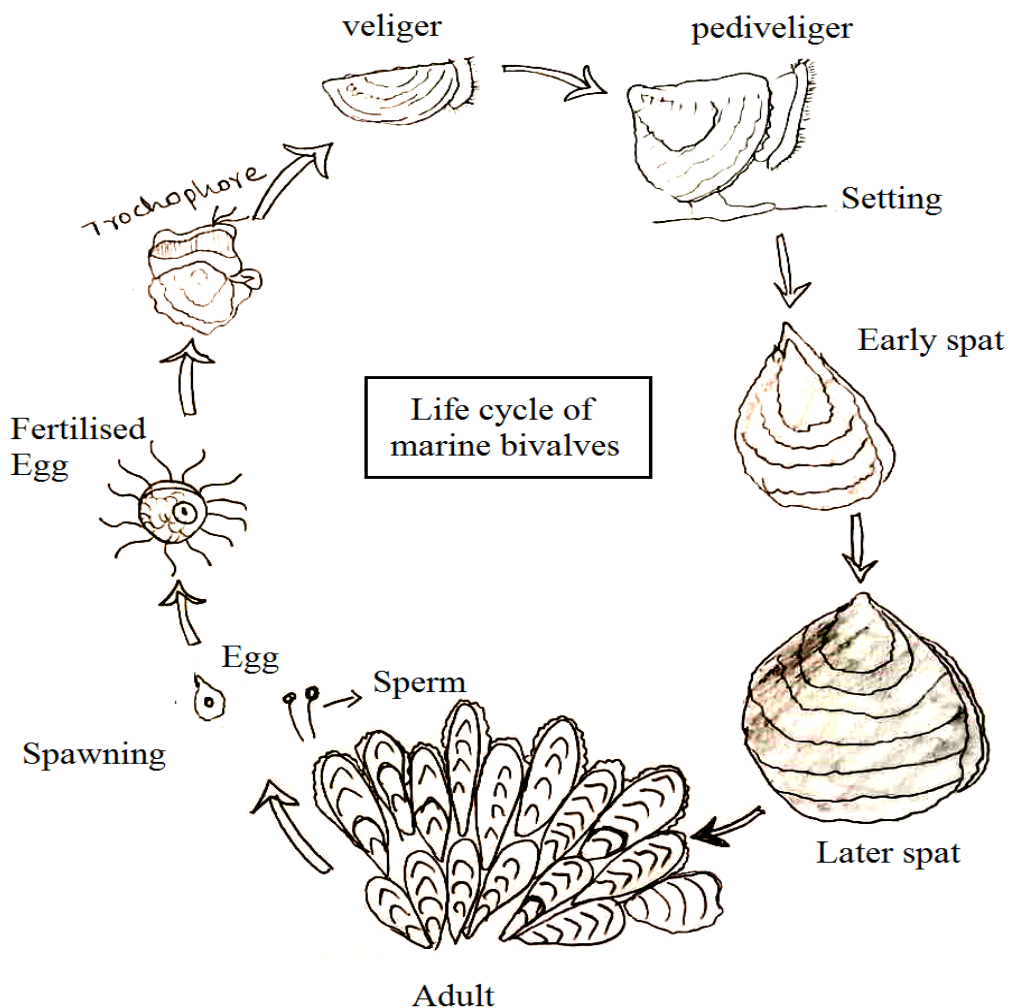


Food and feeding

Bivalves are filter feeders. They use a pair of huge gills to capture food particles (detritus and its associated bacteria as well as small animals) suspended in the water. The food particles are mixed with mucus and pass it to the oesophagus. A single mussel can filter 1.75 litres of water in an hour.

Reproductive biology

Bivalves are hermaphroditic or have separate sexes. In case of dioecious organisms, external fertilization happens by the release of eggs and sperm into the water. Embryos develop in the water column and go through trochophore and veliger larval stages. Some species of bivalves retain their eggs in the pallial cavity and draw in sperm with the inhalant water current. In case of small freshwater clams, the larvae develop in special pouches inside the shell. Freshwater mussels have glochidial larvae stage which attaches to fish as ectoparasites for development.





Length-weight relationship of flying fishes (Exocoetidae) from Bay of Bengal, Eastern Indian Ocean

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Abstract

The Length-weight relationship is a commonly used tool for fishery data analysis especially for fish population stock assessment study to support developing fisheries management policy and sustainable fishery. Flying fishes are considered as commercially and ecologically important species across the globe. The Length-weight relationships of flying fish is very rare and even limited to the Bay of Bengal. Length-weight relationship parameters were analysed for four flying fish species from the Southeast coast of India, Bay of Bengal. The samples were collected from March 2020 to January 2021 from different landing centres such as Tuticorin, Mandapam and Chennai along the Southeast coast of India by drift gill net, and commercial trawls. Samples were captured in the depth range between 30 and 200 m. Values of the parameter b ranged from 2.852 for *Cheilopogon abei* to 3.1263 for *Cheilopogon suttoni* indicating the allometric growth. The present study provides length-weight relationship of species *Cheilopogon abei*, *Cheilopogon furcatus*, *Cheilopogon cyanopterus* and *Cheilopogon suttoni* for the first time.

Keywords Bay of Bengal · *Cheilopogon* sp. · Eastern Indian Ocean · Flying fish · Length-weight relationship.

Introduction

The Length-weight relationship is a commonly used tool for fishery data analysis especially for fish population stock assessment study to support developing fisheries management policy and sustainable fishery (Froese 2006). The Length-weight relationship differ among the fish species depending on the inherited body shape and within the species based on the type of ecological characters, environmental parameters and biological factors (Eduardo et al. 2018; Kannan et al. 2021), especially on gonadal development, feeding rate, maturity condition and might change over seasons or even days (Beyer 1987; De Giosa et al. 2014).

The flying fishes are epipelagic group which spread with oceanic and inshore waters particularly in tropical and subtropical waters around the globe. They are regarded as ecologically and commercially important species. They are an important fishery resource in Indonesia, Japan, Korea, China, West Africa (Gibbs 1978), USA and South India (BOBLME 2015; Shakhovskoy 2018). Apart as food, it is usually used as bait to capture larger predatory fish species which are of high commercial value and their eggs are used for the production of local caviar. Besides their commercial importance, the flying fishes are crucial components in the epipelagic food chain. The Length-weight relationships of flying fish group of the family Exocoetidae is very rare and even limited to the Bay of Bengal (Rao and Basheeruddin 1973; Vinoth and Ramachandra Prabu 2014; Mahadevan et al. 2020). The present study provides length-weight parameters for flying fishes from Bay of Bengal. This information will enhance management and conservation to allow future comparisons between populations of the same species in future.

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Exopolymeric substances production by *Bacillus cereus* KMS3-1 enhanced its biosorption efficiency in removing Cd^{2+} and Pb^{2+} in single and binary metal mixtures

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ABSTRACT

The present study investigated the growth, exopolymeric substance (EPS) production, and biosorption efficiency of strain *Bacillus cereus* KMS3-1 in the Cd^{2+} and Pb^{2+} ions containing single and binary metal-treated broth (50 mg/L). In addition, the interaction of the KMS3-1 strain with Cd^{2+} and Pb^{2+} ions in single and binary metal-treated broths was investigated using SEM-EDS, FTIR, and XRD analyses. The results showed that the biosorption efficiency (%) and EPS production of KMS3-1 biomass in both single and binary metal-treated broths had increased with increasing incubation time and were higher for Pb^{2+} ions than for Cd^{2+} ions. In the single and binary metal-treated broths, the maximum biosorption efficiency of KMS3-1 for Pb^{2+} ions were 70.8% and 46.3%, respectively, while for Cd^{2+} ions, they were 29.3% and 16.8%, respectively, after 72 h. Moreover, the biosorption efficiency of strain KMS3-1 for both metal ions was dependent on its EPS production and peaked at the maximum EPS production. The copious EPS production by KMS3-1 was observed in metal-treated media (50 mg/L), in the following order: Pb^{2+} ions (1925.7 $\mu\text{g}/\text{mL}$) > binary metal mixtures (1286.8 $\mu\text{g}/\text{mL}$) > Cd^{2+} ions (1185.5 $\mu\text{g}/\text{mL}$), > control (1099 $\mu\text{g}/\text{mL}$) after 72 h of incubation. This result indicates that the metal biosorption efficiency of the KMS3-1 strain was enhanced by the increased EPS production in the surrounding metal-treated broth. SEM-EDS and FTIR characterization studies revealed that the KMS3-1 biomass effectively adsorbed Cd^{2+} and Pb^{2+} ions from the medium by interacting with their surface functional groups (hydroxyl, carbonyl, carboxyl, amide, and phosphate). Moreover, the biosorbed Cd^{2+} and Pb^{2+} ions were transformed into CdS and PbS , respectively, by the KMS3-1 biomass. This study suggests that the *Bacillus cereus* KMS3-1 strain may be a promising candidate for the treatment of metal contamination.

1. Introduction

Heavy metal pollution can readily be caused by wastewater from households, agriculture, and various metal processing industries such as mineral processing, paint and polyvinyl chloride manufacturing, and metal coating, which have dangerous consequences on public health and ecological balance (Sharma et al., 2022). Once heavy metals enter the ecosystem, it is quite difficult to remove them completely. Cadmium and lead, both considered environmental pollutants and commonly used in

industrial processes, can be harmful to human health when they accumulate in living tissues (Costa et al., 2020). Cadmium and lead enter the environment through natural and anthropogenic sources. In particular, cadmium is released to the environment through natural sources such as erosion and weathering of rock material (15,000 metric tons), volcanic eruptions (820 metric tonnes), and forest fires (70 metric tons). Anthropogenic cadmium emissions to the environment are mainly from coal combustion, smelting, fuel combustion, fertilizer, and cement industries (Hayat et al., 2019). On the other hand, the lead processing

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Synthesis, characterization, cytotoxicity, and antimicrobial studies of green synthesized silver nanoparticles using red seaweed *Champia parvula*

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Abstract

Phytochemical substances in seaweeds have a wide range of pharmacological properties and are involved in a unique eco-friendly technique to produce stable, less harmful metal nanoparticles. The antioxidant-rich phytochemical elements in red seaweed *Champia parvula* extract have garnered attention for their potential functions in the prevention of human diseases. This research explores the phytoconstituent contents of *C. parvula* aqueous extract as well as its ability to synthesize silver nanoparticles, and its antioxidant, antimicrobial, and anticancer properties are investigated. The seaweed extract was analyzed for total phenols (2.02 ± 0.11 mg/g), flavonoids (1.72 ± 0.05 mg/g), tannins ($1.55 \pm$ mg/g), anthocyanin (0.79 ± 0.21 mg/g), and total chlorophyll (0.7 ± 0.04 mg/g) contents. The biosynthesized *C. parvula*-mediated silver nanoparticles (Cp-AgNPs) were characterized by various spectroscopic techniques. The surface plasmonic resonance (SPR) band of Cp-AgNPs was observed at 425 nm using UV spectroscopy. The face-centered cubic (FCC) and crystalline structure were identified by X-ray diffraction (XRD) analysis. Scanning electron microscopy (SEM) confirmed the morphology of Cp-AgNPs as round in shape with 79 nm size. The biomolecules in the algae extract and Cp-AgNPs were identified with the help of FT-IR analysis, which confirms the presence of phenolic, proteins and amine compounds. Zeta potential analysis proved that the biosynthesized Cp-AgNPs were extremely stable due to the surface charge of nanoparticles (-35.2 mV). The Cp-AgNPs showed greater free radical scavenging ability due to the presence of bioactive molecules such as phenols, flavonoids, tannins, and anthocyanin in algae extract. Cp-AgNPs exhibited the highest antimicrobial activity against *Streptococcus mutans*, *Staphylococcus aureus*, and *Candida albicans* at 100 μ g/mL. Furthermore, Cp-AgNPs demonstrated anticancer activity against human lung (A549) cancer and colon (HT-29) cancer cells. The half-maximal inhibitory for lung cancer was found at 21.54 μ g/mL, and for colon cancer it was found at 42.36 μ g/mL. These findings confirmed that the synthesized Cp-AgNPs have a wide range of pharmacological activities and might be used as target drug carriers.

Keywords *Champia parvula* · Biological synthesis · Silver nanoparticles · Antioxidants · Antimicrobial · Lung and colon cancer

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