ANNUAL REPORT
2021-2022

KERALA UNIVERSITY OF FISHERIES AND OCEAN STUDIES

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KUFOS Annual Report 2021-2022

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KUFOS Annual report is an In-house publication.
This is a report of activities of KUFOS during 2019-2020 period

Contents

UNIVERSITY LOGO

This emblem signifies the mission, goals and motto of Kerala University of Fisheries and Ocean Studies. It symbolizes the co-existence of all forms of aquatic life and our responsibility to preserve the ecology and conserve the bio-diversity by judicious exploitation of aquatic resources for sustainable development.

The deep and light blue colours respectively represent the ocean and sky. The waves in the sea represent the dynamic nature of the sea with all its mystery and music. "All deep things are music" (Carlyle). The ocean is our planet's life belt. The very survival of the human species depends upon the maintenance of an ocean, clean and alive.

"For the sea lies all about us….. The continents themselves dissolve and pass to the sea…. In its mysterious past, it encompasses all the dim origins of life…. And receives in the end… the dead husks of that same life.For all at last return….To Oceanus, the ocean river, like the ever-flowing stream of time, the beginning and the end" (Rachel L. Carson- The Sea Around Us, 1951).

FIAT PISCIS: Let there be fish. This is the literal translation of the Latin words "FIAT PISCIS". The idea is to grow more fish with a view to ensuring food and nutritional security. As Lao-tsu, the Chinese philosopher, rightly said centuries ago: "Give a man a fish and you feed him for a day. Teach him how to fish, and you feed him for a lifetime".

CHINESE NET: It is a passive gear operated by a group and it represents team work and co-operation, symbolizing the aspirations of the traditional fisheries sector.

SHIP: Used for exploring and exploiting oceanic resources, this fully equipped vessel symbolizes the modern sector, with its sophisticated technology.

NANSEN BOTTLE: Operated through a pulley and attached to the ship, it represents the concern for maintaining water quality and the need to contain water pollution.

SHRIMP: As a foreign exchange earner, this crustacean has tremendous importance in the fishery economy of Kerala.

PEARL SPOT: 'Karimeen' (Etroplus suratensis), the State fish of Kerala, represents the dainty delicacy of the State.

CONCH: A mollusc, the shell with its mathematical patterns, used for carrying holy water during rituals, is a sublime symbol with spiritual, aesthetic, artistic, rejuvenating and medicinal values.

OPEN BOOK: It symbolizes knowledge and it signifies disinterested search for truth by research and learning.

Prof (Dr) K.Riji John
Vice Chancellor

FROM VICE CHANCELLOR'S DESK

The University has climbed back to normality after severe covid associated changes in educational programmes and associated rescheduling. The thirteenth five year plan period was over by March 2022 and the university has achieved most of the targeted plans during the period. The Centres of Excellence have performed graciously well with over 150 research publications, new products and technologies. Several training programmes and workshops were conducted in different subject areas. The University has geared up for the ensuing plan period and developed a multifaceted five-year plan proposal for 2022- 2027. The proposal encompasses establishment of new constituent colleges, Centres of Excellence and Business Incubation Centres. An exclusive Translational Research Centre has been proposed with view to harnessing the expertise of the faculty and also by attracting best talents in the field with potential to transfer knowledge to products and technologies.

With the embarkation of NEP 2020, it has become incumbent on the University to take steps in increase gross enrolment ratio (GER), introduce academic bank of credits, multiple entry and exit, student centric course curriculum development etc. In this regard, University has conducted several consultations, discussion groups and ushered new developments like increasing the umber of seats, starting of new programmes, project mode courses to name a few. IQAC has been further strengthened to meet the future needs of the University ranking.

This annaul report is throwing light on the activities planned by KUFOS during the ensuing Plan Period. KUFOS is also eagerly waiting for the establishment of a new campus at Payyanoor to meet the longstanding aspirations of the people of North Malabar.

OUR HONOURABLE CHANCELLOR

SHRI. ARIF MOHAMMAD KHAN
HON'BLE GOVERNOR OF KERALA

OUR HONOURABLE PRO CHANCELLOR

SHRI SAJI CHERIYAN
HON'BLE MINISTER FOR FISHERIES

INTRODUCTION

The Kerala University of Fisheries and Ocean studies (KUFOS) is an autonomous public funded institution established on 20th November 2010. The first Fisheries University in the country, KUFOS with its enchanting blue building stands in harmony withthe greenery at Panangad, 12 km away from Kochi city, along the National Highway-66. It provides high quality instructional programmes in fisheries, ocean sciences and allied subjects. The University now has a sprawling campus of 75 acres in the headquarters at Panangad, brackish water and marine aquaculture area spanning 50 acres at Fisheries research station, Puduveypu and extensive 10 acres at Thiruvallom near Vizhinjam.

The College of Fisheries, Panangad under the Kerala Agricultural University was the only institution in the fisheries sector in the State imparting undergraduate professional degree programme. Kerala University of Fisheries and Ocean Studies was established in November, 2010 by an Act of the Kerala State Legislative Assembly by delinking the College of Fisheries from the Kerala Agriculture University and started functioning on 01.04.2011. KUFOS was established for the development of manpower in fisheries and ocean studies and for ensuring proper and systematic instruction, teaching, training and research and extension exclusively in fisheries and ocean studies in the State of Kerala. This is the primary and principal institution of Kerala State for providing human resources with skills and technology required for sustainable developments as a Centre of Excellence for human resource development in Fisheries and Ocean Studies.It is the nodal agency to establish relationship with institutions at international level

KUFOS imparts quality education comparable with world class standards and giving significance to research oriented studies with effective meaningful and rewarding extension activities. With a view to producing technocrats of high calibre we provide highly qualified faculty, full fledged infrastructure facility and good linkages with reputed national and international institutes The academic excellence is intended to be attained by undertaking graduate and post graduate teaching and research programmes in emerging disciplines of fisheries science .With a view to meeting the requirement of state and national priorities, we are introducing specialized courses in the needy areas thereby creating professionals and experts. Results of research emerging various disciplines leading to successful technologies needto be disseminated to the end users at the grass root level

UNIVERSITY
STATUTORY OFFICERS

Prof Dr. Riji John
Vice Chancellor

Dr.B.Majoj Kumar
Registar (In-charge)

Shri Joby George
Finance Officer

Dr.Devika Pillai
Director of Research

Dr.K.P.Subashchandran
Controller of Examinatins (i/c)

Dr.Daicy C Kappen
Director of Research

Shri Mohammad Koya N.K
University Engineer

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KUFOS is the first Fisheries University formed in India and it comes under the Ministry of Fisheries. As per G.O. (P) No. 510/F & PD dated 10.05.2011 the Government of Kerala disaffiliated College of Fisheries, Panangad and Fisheries Station, Puduveypu from Kerala Agricultural University and these institutions became the part and parcel of the newly formed Kerala University of Fisheries and Ocean Studies w.e.f. 01.04.2011. The territorial jurisdiction of the University extended to the whole of the State of Kerala and the Headquarters of the University is at Kochi in Ernakulam District.

The Panangad campus, which is the Headquarters of the University, is 12 km away from Kochi city, along the NH 47and sprawls in area of 85 acres. Fisheries Station, Puduveypu having an area of 50 acres is situated in Vypeen Island (90 58 – 100 N lat. and 760 10-760 12' E long.) on the North-Western bank of Cochin bar mouth, Cochin taluk. It is at a distance of about 2 km from Vypeen-Pallippuram Road. The Arabian Sea on the West and the Cochin barmouth on the South. Besides these campuses, the Govt. have allotted 10 acres of land at Thiruvallam, near Thiruvananthapuram for setting up a Regional Station.

Kerala University of Fisheries and Ocean Studies is the primary and principal instrumentality of Kerala State in providing human resources, skills and technology required for the sustainable development of Fisheries and Ocean Studies. It acts as a centre of excellence for human resource development in Fisheries and Ocean Studies and the nodal agency to establish relationship with institutions and universities functioning at National and International level. The mission of the University is to serve as a flagship University of higher learning through demonstrated and growing excellence in teaching, research, extension, training, scholarship and creative work in Fisheries and Ocean Studies, comparable with global standards that will benefit the country and the world at large.

His Excellency, the Governor of Kerala, is the Chancellor and the Hon'ble Minister for Fisheries is the Pro-Chancellor of the University. The chief executive body of the University is the University Governing Council. The Vice Chancellor is the principal executive officer who is assisted by the Pro-Vice Chancellor, Registrar, Deans of Faculties, Controller of Examinations, Director of Research, Director of Extension, Directors of Schools, Heads of Departments, and Finance Officer.

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Mission

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Vision

- To produce professionally and technically competent manpower in Fisheries and Ocean studies to cater the needs of the fast developing sector.
- Develop entrepreneurship among the fisheries graduates by imparting hands on training and give opportunities to develop management skills through Fisheries Work Experience Programme.
- Undertake research and extension activities in the field of Fisheries and Ocean studies by undertaking research in frontier areas and by promoting interdisciplinary/ inter-departmental/ inter-institutional co-operation.

- Provide employment opportunities for the people especially fisher folk by imparting trainings on modern techniques of fishing, primary handing, preservation, production of value added fishery products, ornamental fish culture, hatchery production of seeds of various cultivable fin and shell fishes and their farming.
- Provide consultancy services so as to put into practice the technologies developed among the entrepreneurs and generate income for the institution.
- Achieve the mission and goals laid down by the University.
- Develop infrastructure facilities and inter-institutional co-operative programmes in order to make the campus the nucleus of the Fisheries and Ocean studies in the world.

Goals

- To further the advancement in learning and conduct research in fisheries, ocean studies and allied subjects .
- Impart education in fisheries and ocean studies and allied subjects.
- Formulate new courses and curriculum in fisheries and ocean studies sector in accordance with the technical advances in the respective fields
- Act as a nodal agency to establish relationship with institutions and universities functioning at national and international levels
- Act as a centre of excellence having leading role for HRD in Fisheries and Ocean studies
- Foster and encourage entrepreneurship in Fisheries and Ocean studies.

Objectives of the University

(i) making provisions for imparting education in fisheries, ocean studies and other allied branches of learning and research scholarship;

(ii) furthering the advancement of learning and conduct of research in fisheries, ocean studies and allied subjects;

(iii) undertaking extension education programmes;

(iv) to formulate new courses and curriculum in Fisheries and Ocean Studies sector in accordance with the technical advances in the respective fields;

(v) to act as nodal agency to establish relationship with Institutions and Universities functioning in national and international level;

(vi) to act as a centre of excellence having leading role for Human Resources Development in Fisheries and Ocean Studies sectors;

(vii) to foster and encourage entrepreneurship in fisheries and ocean studies sector;

(viii) to develop breeds and hybrids of ornamental fishes, prawns and oysters having features like production capacity, resisting power and good quality suitable to the environment of Kerala;

(ix) to develop farming practices, fish feeds, fish disease control, resistant and vigilant steps suitable to the sustainable farming of ornamental fishes;

(x) to preserve the fish bio-diversity of Kerala, to establish their intellectual property right to develop and utilize the possibilities of new technology like bio-technology;

(xi) to conduct study and to record and preserve the study results relating to traditional fish technology, traditional knowledge, sustainable fish protection and to foster development;

to strengthen research on fishing and related habitat and the relevant environmental factors; and (xiii)such other purposes as the University may deem necessary from time to time.

ORGANIZATION AND GOVERNANCE

Organizational Chart

The University is headed by the Vice Chancellor .The other officers of the University are the Pro Vice Chancellor, Registrar, Finance Officer, Controller of Examinations, Director of Research, Director of Extension, School Directors, University Engineer and University Librarian. The Governing Council is the supreme authority of the University, and the members of the Council are nominated by the Chancellor for a period of three years.

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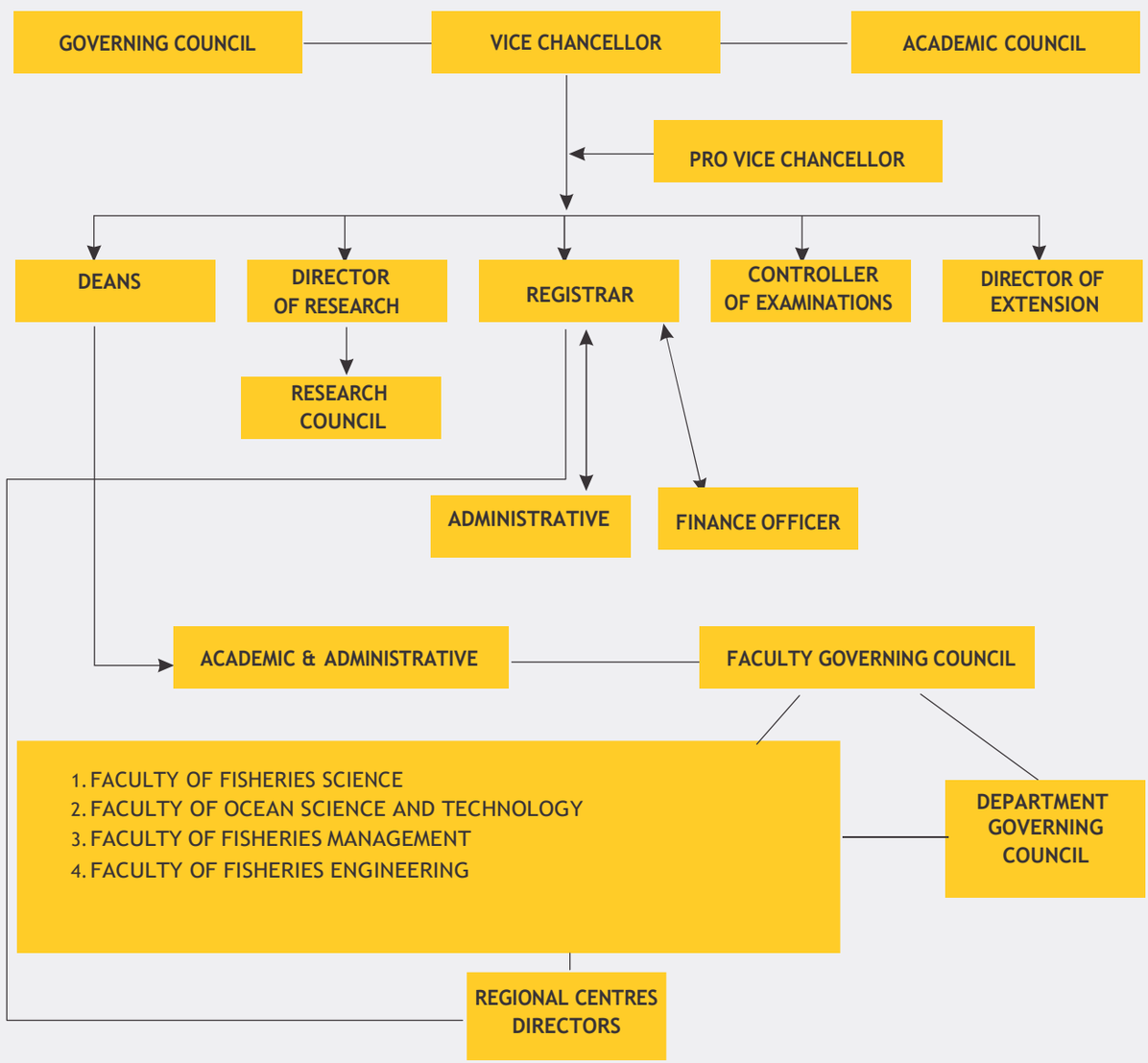

FUNCTIONING

The process involved in decision making starts at the level of the Department Governing Council. All permanent teachers of the concerned department are the members of the department governing council.

The Department Government Council shall design the syllabus and make proposal regarding the courses of study in the Department to the School Governing Council.

The Department Governing Council shall meet at least once in a month or as and when required to review the academic activities and to suggest need based curricular changes.

The School Governing Council functions above the Department Governing Council.

The Director shall carry out the decisions of the School Governing Council and co-ordinate the functions of the departments in the best interest of the School and the University.

The School Governing Council shall prescribe the qualifications of the examiners and approve the panel of examiners for external examinations.

The Director shall propose examiners for the conduct of external examinations.

The School Governing Council shall meet at least once in three months or as and when required to review the academic activities and to take decisions on need based curricular activities.

The School Governing Council shall have adequate financial powers for the functioning of the various departments under the School including power for strengthening the infrastructure, improving the teaching and research facilities and for maintaining and operating research vessel, if any.

Without prejudice to the provisions in sub-clauses mentioned above, the School Governing Council shall have the following additional powers, namely:-

a) to propose the courses of studies in the institutions maintained by the University:

b) to propose the qualifications of teachers in Schools and other institutions maintained by the University:

c) to propose the qualifications of students for admission to the various courses of studies and to the examinations and the conditions under which exemptions may be granted;

d) to make proposal for instruction and training in such branches of learning as it may think fit;

e) to make proposal for the institution of Professorships, Readerships, Lectureships and other teaching and research posts required by the University;

f) to propose schemes for the constitution or reconstitution of departments for teaching, research and extension education based on the proposals received from the Department Governing Council;

g) to exercise such other powers and perform such other functions as may be conferred or imposedon it by the Act and Statutes, Ordinances and Regulations made thereunder.

The Research Council: Research Council shall consist of the following members, namely:

(i) Director of Research who shall be the Chairman of the Council.

(ii) Directors of all Faculties;

(iii) One senior faculty member who is a recognized guide from each School nominated by the Vice Chancellor;

(iv) Director of each Regional Centre;

(v) One representative of Indian Council of Agriculture Research;
(vi) One representative of MOES;
(vii) One representative of fishery industry nominated by the Vice Chancellor; and
(viii) The Vice Chairman of the Planning Board, Government of Kerala or representative of the Board nominated by him.

(2) Research Council shall be responsible for formulating research policies, identifying thrust areas, advising possible funding agencies and monitoring and reporting the progress and quality of research to the Vice Chancellor from time to time.

The Academic Council

Subject to the provisions of this Act and Statutes, the Academic Council shall have the following powers, duties and functions.

(a) To advise the University Governing Council on all academic matters;
(b) Make regulations and to amend or repeal the same;
(c) Approve the courses of studies in the institutions maintained by the University;
(d) Approve the qualifications of teachers in schools and other institutions maintained by the University;
(e) Approve the qualifications of students for admission to the various courses of studies and to formulate conditions under which exemptions may be granted;
(f) Consider and approve proposals for the instruction and training in such branches of learning as it may think fit;
(g) Consider and approve proposals for the institution of post of Professors, Associate Professors, Assistant Professors, Readers, Lectures and other teaching and research posts, required by the University;
(h) Approve proposals for determining the degrees, diplomas and other academic distinctions that shall be granted by the University;
(i) Decide which examinations of other Universities may be accepted as equivalent to those of the University and to negotiate with other Universities for the recognition of the examinations of the University;
(j) Approve, modify or revise schemes for the constitution or reconstitution of departments for teaching, research and extension education based on the proposals received from the School Governing Council;
(k) Maintain standards regarding post graduate teaching, research and extension education;
(l) Give advice to the University in all academic matters and to submit feasibility report before the Governing Council regarding the academic programmes as recommended by the Senate in its annual meeting;
(m) Exercise such other powers and perform such other functions as may be conferred or imposed on it by the Act and Statutes, Ordinances and Regulations made there under.

The GC and the Senate are the supreme decision making bodies in the University

4.1. Campuses of KUFOS

The campus at Panangad lies on the western side and eastern side of the National Highway .The total area of this campus is 87.73 acres.It includes the already developed area in which the administrative building, academic block, the quarters, hostels etc are located. Major portion of the campus is occupied by f i sh ponds and natural mangrovevegetation. The campus is bordered on the western side by the Vemband backwater system.

4.1.2. Fisheries Station, Puduveypu

The Fisheries Stationis situated in Puthuveypu in the Vypeen island on the north-western bank of Cochin bar mouth, It is at a distance of about 2 km from Vypeen-Pallippuram road andabout 15 km away from the main campus. The Arabiansea on the west, the Cochin barmouth on the south and a canal emerging from the barmouth in the east form its main boundaries. On the northern side, the station joins the land proper of the main island. The Typical mangrove associations are characteristic of the area. This low lying area is subjected to the tidal influence of Cochin barmouth. The unique geographical position bestows on the station to embark on different aspects of fisheries research to open up new vistas. Major activities of this Station are teaching, research and extension. This Station also gives
practical training in brackish water fish farming to B.F.Sc. and M.F.Sc. students of the University. The farm area is marshy, being daily inundated by saline and brackish water intrusions. Approved research programmes on commercially important fishes, shrimps and ornamental fish are being implemented. In addition, many awareness programmes are also given to entrepreneurs. The Station is also a centre for various varieties of mangrove and associated vegetation.The campus is covered by natural mangrove vegetation comprising about 18 acres and ponds.Administrative block, laboratory,hatcheryetc. are located near the entry point of the campus.

4 .1.3 Kannur Regional Centre , Payyanur

The University decided to start two regional centres one at north Kerala and another in the south Kerala. Accordingly university submitted plan proposals for the establishment of Fisheries Training, Extension and Research Centre at Kollam and Establishment of Aquaculture Training, Extension and Research Centre at Kannur during the year 2017-18. An amount of Rs 100 lakhs was allotted for each centre by the Government. On the basis of the request from Shri C. Krishnan, respected Member of Legislative Assembly representing Payyanur in the Kerala Assembly and Shri T.Purushothaman, President, kerala Aquafarmers Federation the Univeristy constituted a high level committee consisting of Dr K.Padma kumar, Pro Vice Chancellor, KUFOS as Chariman, Dr Suresh Kumar, GC Member, Shri Joby George, Finance Officer and Shri Jayakrishnan, University Engineer as members to inspect various places at Payyanur for the establishment of the Centre. The committee visited various locations in and around Payyanur and recommended establishment of the centre at Kandankali near Payyanur, The Univeristy requested the government to acquire the necessary land for the purpose.. Dr K.Padmakumar, Pro VC who was appointed as the special officer for the regional centre was relived from duties on 30/12/2017. The 50th Governing Council meeting held on 22nd December 2017 decided to appoint Dr.B.Manoj kumar, Associate Professor as the special officer. The committee for the centre was reconstituted with Dr S,Suresh kumar, Director, SOST, Shri Joby George, Finance Officer, Shri Jayakrishnan P.S, University and Dr B.Manoj kumar, Special Officer. This committee was authorized to make visits to suitable sites and also to identify suitable buildings for functioning of the Centre. An individual offered 10 acres of land free of cost for the establishment of the Centre at Payyanur. A committee consisting of Shri A.M,Shamseer, MLA and GC, Member, Dr S.Suresh Kumar, Professor and GC member, Dr S.M..Raffy, Assistant Professor and GC member and Shri Jayakrishnan P.S. University Engineer as convenor was constituted by the Vice Chancellor for inspecting the land. The committee inspected the land and found it unsuitable as it is a wet land and full of mangroves and the University will not be able to take up construction activity in that area. The Centre started functioning from 01/03/2018 in a rented building at Payyanur.

4.1.4. Regional Station, Kollam

The proposal for establishment of KUFOS Regional center at Kollam to the fund of Rs.100Lakh was approved by the Governing Council of the University under annual plan 2017-18.The main aim of the center is to extent academic, research and extension activities of KUFOS to the Southern Districts of Kerala.

During the years 2018-19 & 2019-20 Survey was conducted for locating suitable land for the purpose and two sites were identified. The site now under the occupance of ALIND, Kundara and the site under the possession of KSITIL were found preliminarily suitable for establishing the Kollam regional center. Several meetings and discussions were conducted with the said authorities for transferring the land to the University. The Hon. Fisheries Minister and Industries Minister Convened meetings with the head officers of KSITIL, ALIND, Revenue department, Survey department etc and finally the Government issued orders for transferring 10 acres of land under the custody of KSITIL to KUFOS for setting up the regional center of the University. A team of experts from the University constituted by the Vice Chancellor has visited the said site and approved the proposed building plan.

The land was then surveyed jointly by the Revenue and Survey department and the sketch of the proposed land was forwarded by the L. R Thahasildar, Kollam. The procedure for transferring the ownership is under way at present.

The civil works of the regional center were entrusted with the KSCADC and they have already invited tender for construction of the building.

In addition, a project of cage culture under KUFOS in Ashtamudi Lake of Manroe Island is also being implemented this year. The beneficiary groups were selected with the participation of the local body and the project is successfully going on under the technical and financial support of KUFOS.

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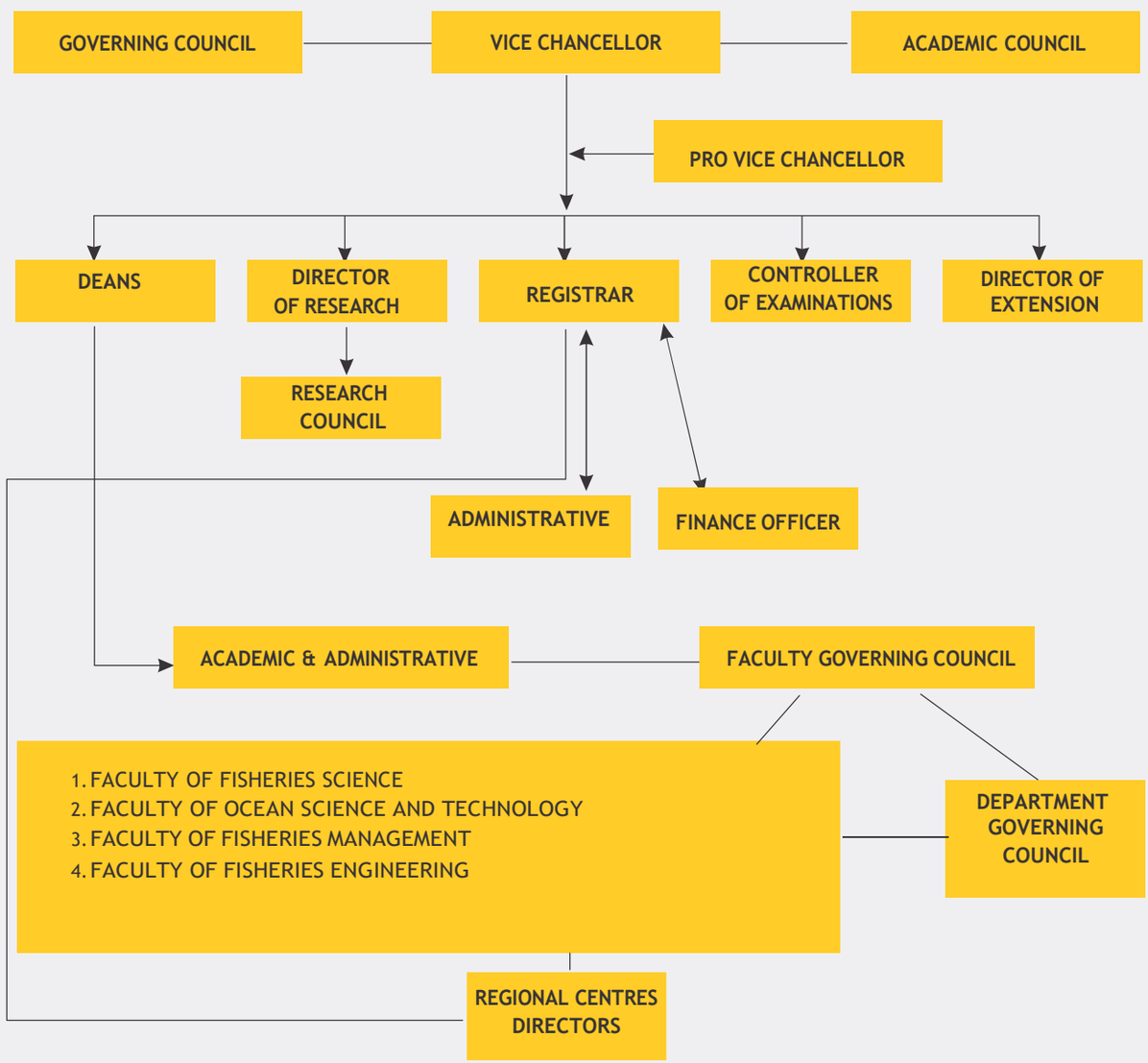

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c) to propose the qualifications of students for admission to the various courses of studies and to the examinations and the conditions under which exemptions may be granted;

d) to make proposal for instruction and training in such branches of learning as it may think fit;

e) to make proposal for the institution of Professorships, Readerships, Lectureships and other teaching and research posts required by the University;

f) to propose schemes for the constitution or reconstitution of departments for teaching, research and extension education based on the proposals received from the Department Governing Council;

g) to exercise such other powers and perform such other functions as may be conferred or imposedon it by the Act and Statutes, Ordinances and Regulations made thereunder.

The Research Council: Research Council shall consist of the following members, namely:

(i) Director of Research who shall be the Chairman of the Council.

(ii) Directors of all Faculties;

(iii) One senior faculty member who is a recognized guide from each School nominated by the Vice Chancellor;

(iv) Director of each Regional Centre;

(v) One representative of Indian Council of Agriculture Research;
(vi) One representative of MOES;
(vii) One representative of fishery industry nominated by the Vice Chancellor; and
(viii) The Vice Chairman of the Planning Board, Government of Kerala or representative of the Board nominated by him.

(2) Research Council shall be responsible for formulating research policies, identifying thrust areas, advising possible funding agencies and monitoring and reporting the progress and quality of research to the Vice Chancellor from time to time.

The Academic Council

Subject to the provisions of this Act and Statutes, the Academic Council shall have the following powers, duties and functions.

(a) To advise the University Governing Council on all academic matters;
(b) Make regulations and to amend or repeal the same;
(c) Approve the courses of studies in the institutions maintained by the University;
(d) Approve the qualifications of teachers in schools and other institutions maintained by the University;
(e) Approve the qualifications of students for admission to the various courses of studies and to formulate conditions under which exemptions may be granted;
(f) Consider and approve proposals for the instruction and training in such branches of learning as it may think fit;
(g) Consider and approve proposals for the institution of post of Professors, Associate Professors, Assistant Professors, Readers, Lectures and other teaching and research posts, required by the University;
(h) Approve proposals for determining the degrees, diplomas and other academic distinctions that shall be granted by the University;
(i) Decide which examinations of other Universities may be accepted as equivalent to those of the University and to negotiate with other Universities for the recognition of the examinations of the University;
(j) Approve, modify or revise schemes for the constitution or reconstitution of departments for teaching, research and extension education based on the proposals received from the School Governing Council;
(k) Maintain standards regarding post graduate teaching, research and extension education;
(l) Give advice to the University in all academic matters and to submit feasibility report before the Governing Council regarding the academic programmes as recommended by the Senate in its annual meeting;
(m) Exercise such other powers and perform such other functions as may be conferred or imposed on it by the Act and Statutes, Ordinances and Regulations made there under.

The GC and the Senate are the supreme decision making bodies in the University

4.1. Campuses of KUFOS

The campus at Panangad lies on the western side and eastern side of the National Highway .The total area of this campus is 87.73 acres.It includes the already developed area in which the administrative building, academic block, the quarters, hostels etc are located. Major portion of the campus is occupied by f i sh ponds and natural mangrovevegetation. The campus is bordered on the western side by the Vemband backwater system.

4.1.2. Fisheries Station, Puduveypu

The Fisheries Stationis situated in Puthuveypu in the Vypeen island on the north-western bank of Cochin bar mouth, It is at a distance of about 2 km from Vypeen-Pallippuram road andabout 15 km away from the main campus. The Arabiansea on the west, the Cochin barmouth on the south and a canal emerging from the barmouth in the east form its main boundaries. On the northern side, the station joins the land proper of the main island. The Typical mangrove associations are characteristic of the area. This low lying area is subjected to the tidal influence of Cochin barmouth. The unique geographical position bestows on the station to embark on different aspects of fisheries research to open up new vistas. Major activities of this Station are teaching, research and extension. This Station also gives
practical training in brackish water fish farming to B.F.Sc. and M.F.Sc. students of the University. The farm area is marshy, being daily inundated by saline and brackish water intrusions. Approved research programmes on commercially important fishes, shrimps and ornamental fish are being implemented. In addition, many awareness programmes are also given to entrepreneurs. The Station is also a centre for various varieties of mangrove and associated vegetation.The campus is covered by natural mangrove vegetation comprising about 18 acres and ponds.Administrative block, laboratory,hatcheryetc. are located near the entry point of the campus.

4 .1.3 Kannur Regional Centre , Payyanur

The University decided to start two regional centres one at north Kerala and another in the south Kerala. Accordingly university submitted plan proposals for the establishment of Fisheries Training, Extension and Research Centre at Kollam and Establishment of Aquaculture Training, Extension and Research Centre at Kannur during the year 2017-18. An amount of Rs 100 lakhs was allotted for each centre by the Government. On the basis of the request from Shri C. Krishnan, respected Member of Legislative Assembly representing Payyanur in the Kerala Assembly and Shri T.Purushothaman, President, kerala Aquafarmers Federation the Univeristy constituted a high level committee consisting of Dr K.Padma kumar, Pro Vice Chancellor, KUFOS as Chariman, Dr Suresh Kumar, GC Member, Shri Joby George, Finance Officer and Shri Jayakrishnan, University Engineer as members to inspect various places at Payyanur for the establishment of the Centre. The committee visited various locations in and around Payyanur and recommended establishment of the centre at Kandankali near Payyanur, The Univeristy requested the government to acquire the necessary land for the purpose.. Dr K.Padmakumar, Pro VC who was appointed as the special officer for the regional centre was relived from duties on 30/12/2017. The 50th Governing Council meeting held on 22nd December 2017 decided to appoint Dr.B.Manoj kumar, Associate Professor as the special officer. The committee for the centre was reconstituted with Dr S,Suresh kumar, Director, SOST, Shri Joby George, Finance Officer, Shri Jayakrishnan P.S, University and Dr B.Manoj kumar, Special Officer. This committee was authorized to make visits to suitable sites and also to identify suitable buildings for functioning of the Centre. An individual offered 10 acres of land free of cost for the establishment of the Centre at Payyanur. A committee consisting of Shri A.M,Shamseer, MLA and GC, Member, Dr S.Suresh Kumar, Professor and GC member, Dr S.M..Raffy, Assistant Professor and GC member and Shri Jayakrishnan P.S. University Engineer as convenor was constituted by the Vice Chancellor for inspecting the land. The committee inspected the land and found it unsuitable as it is a wet land and full of mangroves and the University will not be able to take up construction activity in that area. The Centre started functioning from 01/03/2018 in a rented building at Payyanur.

4.1.4. Regional Station, Kollam

The proposal for establishment of KUFOS Regional center at Kollam to the fund of Rs.100Lakh was approved by the Governing Council of the University under annual plan 2017-18.The main aim of the center is to extent academic, research and extension activities of KUFOS to the Southern Districts of Kerala.

During the years 2018-19 & 2019-20 Survey was conducted for locating suitable land for the purpose and two sites were identified. The site now under the occupance of ALIND, Kundara and the site under the possession of KSITIL were found preliminarily suitable for establishing the Kollam regional center. Several meetings and discussions were conducted with the said authorities for transferring the land to the University. The Hon. Fisheries Minister and Industries Minister Convened meetings with the head officers of KSITIL, ALIND, Revenue department, Survey department etc and finally the Government issued orders for transferring 10 acres of land under the custody of KSITIL to KUFOS for setting up the regional center of the University. A team of experts from the University constituted by the Vice Chancellor has visited the said site and approved the proposed building plan.

The land was then surveyed jointly by the Revenue and Survey department and the sketch of the proposed land was forwarded by the L. R Thahasildar, Kollam. The procedure for transferring the ownership is under way at present.

The civil works of the regional center were entrusted with the KSCADC and they have already invited tender for construction of the building.

In addition, a project of cage culture under KUFOS in Ashtamudi Lake of Manroe Island is also being implemented this year. The beneficiary groups were selected with the participation of the local body and the project is successfully going on under the technical and financial support of KUFOS.

The Vice-Chancellor is the Chief Executive Officer and the Registrar is the administrative head of the university. The Governing Council is the supreme authority of the Universityand that is supported by the Senate, Academic Council, Research Council, School Governing Council and Department Governing Councils. The day-to-day administration is carried out by the office of the Registrar under whom the Finance Officer, responsible for the financial management of the University functions. On the research side, the Directorate of Research, and on the extension side the Directorate of Extension coordinate the respective activities. Conduct and evaluation of examination and allied activities are vested with the Controller of Examinations. Academic activities related to the different Schools are controlled by the School Directors under whom the various Departments with the Heads of Departments function.

KUFOS started functioning on 01.04.2011 with its Head Quarters at Panangad.

The logo of KUFOS was released by Sri. K. Babu, the then Minister of Fisheries, Port &Excise, Govt. of Kerala, in a function organised at KUFOS on 20.06.2011.

Two day National Consultative Workshop for Preparation of Vision Document and Strategic Plan of KUFOS was inaugurated by Sri. K. C. Venugopal, the then Union Minister of State for Power at International Hotel, Ernakulam on 28.07.2011. Dr. E. G. Silas, Former Vice Chancellor of KeralaAgricultural University launched the new website of the University during the function.

The first Governing Council meeting of KUFOS was held on 28.03. 2012 at Thycaud Guest House, Thiruvananthapuram.

The Certificate distribution function to distribute Provisional B F Sc Degree Certificates to the 2007 batch students, were held during the function. Sri. K. Babu, the then Hon'ble Minister of Fisheries & Ports had distributed the certificates.

Authorities of The University

The following are the authorities of the University

1. the Senate
2. the University Governing Council
3. the Academic Council
4. the Research Council
5. the School Governing Councils
6. the Department Governing Councils
7. the Faculties; and such other bodies as may specified by the Statutes.

Senate

The Kerala Government.constituted the first Senate of the University as per Section o76 of KUFOS Act 5 of 2011. As per Section 10 of KUFOS Act, the Senate consists of Ex-officio Members (10 Nos.), Nominated Members (24 Nos.) and Elected Members (13 Nos.). The term of the Senate is five years from the date of its constitution by the Chancellor and the Chancellor shall reconstitute the Senate on expiry of its term. Senate shall meet at least twice a year on dates to be fixed by the Vice Chancellor and one of such meetings shall be called the annual meeting.

Members of Senate

1 The Vice Chancellor, Kerala University of Fisheries and Ocean Studies, Kochi

2 The Principal Secretary to the Governor of Kerala,Kerala Raj BhavanThiruvananthapuram

3 Private Secretary to the Minister Fisheries and Harbor Engineering Room No: 532, 3rd Floor,South Sandwich BlockSecretariat, Thiruvananthapuram

4 Adv. M.Swaraj MLA Tripunithura Assembly Constituency Tripunithura

5 Secretary to Govt. Fisheries Department Govt. Secretariat Thiruvananthapuram

6 Secretary to Govt. Higher Education Department Govt. Secretariat Thiruvananthapuram

7 Secretary to Govt. Finance Department Govt. Secretariat Thiruvananthapuram

8 Law Secretary to Govt. of Kerala Govt. Secretariat Thiruvananthapuram

9 Director of Fisheries Government of Kerala Vikas BhavanGovt. Secretariat Thiruvananthapuram

10 Dr. K Gopakumar Dean, Faculty of Ocean Science and Technology

11 Dr.K Vasudevan Dean, Faculty of Ocean EngineeringB1015,Satellite Township Kakkanadu, Kochi 682030

12 Dr. M R BhoopendranathDean, Faculty of Fisheries18/1990-B “Manjusha”, No. 10, 2nd Lane, Pratheeksha Nagar, Thoppumpady, Cochin-682005, Kerala

13 Dr. Devika Pillai Dept. of Aquatic Animal Health Management

14 Dr. K Dinesh Dept. of Aquaculture

15 Dr. M K Sajeevan Dept. of Fisheries Resource Management

16 Dr.K Ranjeet Dept. of Aquatic Environment Management

17 Sri. Mathew Sebastian Dept. of Fisheries Extension and Statistics

18 Dr. C D Suriyakala, DirectorSchool of Ocean Engineering and Underwater Technology

19 Sri.Arun Kumar M S Mannathumpatu House, Kallinmel P O, Mavelikkara, Alappuzha

20 Sri. P Vasudevan Arupathunazhi House, Vakirim Sulthanbathery, W

21 Adv. P K Khaleemuddeen, Fathima Bhavan, Ponnani, Malappuram

22 Dr. V. GabrielV M bhavan, Puthiyathura, Pulluvila PO Thiruvananthapuram- 695526

23 Smt. Vanaja KSreelekshmi, Elambichi,Thrikkarippur, Kasargode 23* Sri. T Peter, Udayam, Valkiya Veli PO, Thiruvananthapuram

24 Sri. T Manoharan, Manappattu,Neendakara PO, Chavara,Kollam

25 Sri. Sudheer N.B. Nayarassery House, Edavanakkad PO, Ernakulam

26 Adv. M K UthamanManappurathu House, Manappuram PO, Cherthala

27 Sri. B Sathyan MLA , Boys Land ,ANRA 21A, Mattada, Thiruvananthapuram

28 Sri. K Dasan MLA, Nikunjam, Muchukunnu PO, Kozhikode

Governing Council

As per letter No. GS 5-957/2011 dated 19.03.2012 of His Excellency the Governor of Kerala and Chancellor of KUFOS, the first University Governing Council was formed in accordance with the provisions contained in Section 76 of KUFOS Act 5 of 2011. The Governing Council is the supreme authority of the university and comprises of 23 members from among the category of Ex-officio Members (11 Nos.), Elected Members (4 Nos.) and Nominated Members (8 Nos.). At the outset, the Govt. have formed the KUFOS Governing Council by nominating 16 members. The University Governing Council shall be reconstituted every four years. The Governing Council shall meet at least once in a month on dates to be fixed by the Vice Chancellor after giving due notice to all members.

Members of the Governing Council (2016-2017)

The Vice Chancellor, KUFOS **Prof.(Dr.) K.Riji John** 0484 2703781 (Direct), 2700598, 2700964 , Fax:-91 484 2700337 vc@kufos.ac.in	**Shri.K.V.Sumesh .MLA** Sreekandapuram, Kannur
Secretary to Govt. of Kerala, Fisheries Department, Govt. Secretariat, Thiruvananthapuram 0471-2321129 0471-2333115 (Fax) Prlsecy.port@kerala.gov.in	The Secretary to Govt. of Kerala Higher Education Department, Govt. Secretariat Thiruvananthapuram (Mobile) Fax – 0471-2332245 sec.higheredu.kerala@gmail.com
The Secretary to Govt. of Kerala Finance Department Govt. Secretariat Thiruvananthapuram Tel.0471-2518292, 2327586 Fax 0471-2326990 prlsececy.fin@kerala.gov.in	The Law Secretary to Govt. of Kerala Govt. Secretariat Thiruvananthapuram Telephone – 0471-2518383 Fax-0471-2332955 secy@law.kerala.gov.in
The Vice President of Kerala State Council for Science and Technology and Environment Sastra Bhavan, Pattom, Thiruvananthapuram. Tel.No. 0471- 2548200, 0471-2540085 mailto@kscste.org	Adv A.M.Shamseer MLA Ameenas, PO Paral Thalassery-670671` Tel No-9447056803 Amshamseer2@gmail.com

E.T.Taison MLA
Kaipamangalam. ElanjikalKannathupadikkal
Kera PO, Kodungallur

Tel No-9846958317
Taisonthomas74@gmail.com

Dr. A.Gopalakrishnan Director
CMFRI, Kochi

Tel No 0484 2394867
director@cmfri.org.in

Dr,K.Rajesh
Asst Professor, Faculty of Fisheries Management, KUFOS

Dr.Shijo Joseph
Asst. Professor, Faculty of Ocean Science and Technology, KUFOS

Dr.S.Sureshkumar
Professor,
School of Ocean Science & Technology, KUFOS
Tel No : 9447508065
suresh.kufos@gmail.com

Dr. Pramila S
Asst Professor, School of Fisheries Science,
KUFOS

SMT.U.Prathibha MLA

Sri Muhamemd Shibily L F
Student Representative
KUFOS

Sri Anilkumar Rajendran Konnayil Rajendra
VilasamNeendakara, Kollam

Sri C.Sreekumar Unnithan
Sarangi, Cheruthana PO
Alappuzha Dist

08 meetings of the Governing Council were held during 2021-22 Financial Year

Academic Council

The Academic Council shall have general control over the academic matters of the University and be responsible for the maintenance of standards of instruction, education and examinations within the University and shall exercise such other powers and perform such other functions as may be conferred or imposed upon it by the Statutes. The Academic Council consists of 24 members from various realms. The Govt. constituted the first Academic Council .The following are the academic council members. 11 meetings have been conducted so far.

Academic Council Members

The Vice Chancellor, Chairperson	Prof.(Dr.) K.Riji John	0484 2703781 (Direct),
Fax:-91 484 2700337		
Director of Fisheries	0471-2303160	
0471-2304355(Fax)		
Director of CMFRI	0484-2394798	
Director of CIFT	0484-2666880	
Director of CMLRE	0484-2427790	
Director of NIO	0484-2390814	
Director of School of Fishery	Dr. Devika Pillai	9446111033
Environment & Head of Aquatic		
Animal Health Management		
Associate Professor and	Dr B.Manojkumar	9447525232
Head of Department of Processing Technology		
Director of School of Mgt. &	Dr. V.Ambilikumar	0484-2700598(Extn)30
Entrepreneurship		
Director of School of Ocean		
Engineering and Underwater		
Technology	Dr. C.D.Suriyakala	8281326577
Asst Professor, Department		
of Aquaculture	Dr.Binu Varghese	9447501644
Department of Aquaculture	Dr. K. Dinesh	9446032977
Associate Professor and Head,	Dr.M.K.Sajeevan	9969651349
Resource ManagementAsst Professor,		
Department of	Dr.Safeena M.P	9995203185
Associate Professor and Head,		
Department of Fisheries		
Aquatic Food Product and Technology		
Associate Professor, School of		
Management and Entrepreneurship	Smt.Alph Korath	9497793911
Associate Professor and Head,	Shri Mathew Sebastian	9495395305
Department of Fisheries	Akshaya Vijayan (FRM-2017)	9746429259
Extension & Statistics		
Asst Professor, Dept of Fisheries	Dr.Anvar Ali P.H.	9048106657
Resources Management		

Research Council

The Research Council is responsible formulating research policies, identifying thrust areas, advising possible funding agencies and monitoring and reporting the progress and quality of research to the Vice Chancellor from time to time. The Research Council shall meet at least once in six months. Research Council has not yet been constituted during the reporting period.

Officers Of The University

As per Section 30 of KUFOS Act 5 of 2011, the following shall be the Officers of the University.

i) the Chancellor
ii) the Pro-Chancellor
iii) the Vice Chancellor
iv) the Pro Vice Chancellor
v) the Deans
vi) the Registrar
vii) the Finance Officer
viii) the University Engineer
ix) the Librarian
x) the Director of Research
xi) the Director of Extension
xii) the Controller of Examinations
xiii) Heads of Departments

And such officers in service of the University as may be prescribed in the Statutes.

Faculties

There are four Faculties established in the University. The Faculties shall be the principal academic co-ordination authorities of the University in respect of studies and research in the subjects included on the Faculty and also in respect of studies and research in multi-disciplinary faculties. KUFOS has five Faculties and each Faculty comprises of the Dean, the Chairpersons of all Boards of Studies comprised in the Faculty, one member of each Board of Studies to be elected by the members of Boards of studies from among themselves out of whom at least one shall be a Post Graduate teacher and two subject experts preferably from outside the State, nominated by the Vice-Chancellor. The Dean shall be the Chairman of the Faculty. Various faculties were constituted as per the university order No.GA6/2265/15 dated 01.12.2015

I . Faculty of Fisheries Science

Dean - Dr.Rosalind George

Chairperson of all Board of studies comprised in the Faculty

1. Chairperson of Board of Studies of Dept. of Aquaculture and Biotechnology –- Member
2. Chairperson of Board of Studies in Aquaculture Nutrition and Feed Technology - - Member
3. Chairperson of Board of Studies in Aquatic Animal Health Management Member
4. Chairperson of Board of Studies in Fisheries Resource Management –Member
5. Chairperson of Board of Studies in Fishery Hydrography - Member
6. Chairperson of Board of Studies in Preservation & Packing Technology – Member
7. Dr.T.V.Sankar, Director of Research, KUFOS
8. Dr.Suresh Kumar, Professor, Fishery Hydrography, KUFOS (Board of Studies Nutrition and Feed Technology) - Member
9. Dr.Mohamed Hatha, Professor and Head, Dept. of Marine Biology, CUSAT (Board of Studies : Aquatic Animal Health Management) - Member
10. Dr.K.Madhu, Principal Scientist, CMFRI, Kochi (Board of Studies ; Aquaculture & Biotechnology) - Member
11. Dr.K.Mohankumar Prof. Dept.of Meterology, CUSAT, Kochi (Board of Studies: Fishery Hydrography) - Member
12. Dr.Shivananda Murthy, Professor and Head, Dept. of Aquaculture, College of Fisheries, Mangalore - Member

1I. Faculty of Ocean Science and Technology

Dean - Dr S.Sureshkumar

Chairperson of all Board of studies comprised in the faculty

1. Chairperson of Board of Studies in Applied Geo Science Member
2. Chairperson of Board of Studies in Biological Oceanography Member
3. Chairperson of Board of Studies in Physical Oceanography and Ocean Modeling –Member
4. Chairperson of Board of Studies in Food Science & Technology Member
5. Chairperson of Board of Studies in Marine Microbiology - Member
6. Chairperson of Board of Studies in Biotechnology and Bioinformatics - Member
7. Dr.T.V.Sankar, Director of Research, KUFOS
8. Dr.Kamalakshan, Kokkal, Joint Director, KSCSTE, Sasthra Bhavan (Board of Studies Geoscience) - Member
9. Dr.L.Harenduprakash, Director (Board of Studies in Physical Oeanography and Ocean Modeling)- Member

III Faculty of Fisheries Management

Dean Dr.V.Ambilikumar

Chairperson of all Board of studies comprised in the faculty

1. Chairperson of Board of Studies in Economics &Statistics Member
2. Chairperson of Board of Studies in Legal Studies - Member
3. Chairperson of Board of Studies in Business Administration & Management - Member
4. Prof.K.R.Muraleedharan Nair, Former Dean, Faculty of Statistics, Cochin University of Science and Technology (Board of Studies ; Economic and Statistics) - Member
5. Dr.K.B.Balakrishnan, Associate Professor, NUALS, Kochi (Board of Studies ; Legal Studies) - Member
6. Prof. P. Sudarsanan Pillai, former Dean (CUSAT) (Board ofStudies ; Business Administration and Management) - Member
7. Dr.P.T.Sreenivasan, Former Head, Dept. of Management Studies University of Madras - Member

III Faculty of Fisheries Engineering

Dean Dr.B.Manojkumar (i/c)

Chairperson of all Board of studies comprised in the faculty

1. Chairperson of Board of Studies of Remote Sensing Technology & GIS –- Member
2. Prof.Sasikumar, Course Professor and Co-ordinator of PG Programme, K.M., School of Marine Engineering, CUSAT Cochin – 22 - Member
3. Prof.V.Sundar, Dept.of Ocean Engineering, IIT, Chennai - Member

Academic Programmes

KUFOS offers two under Graduate Programmes-B.F.Sc and B.Tch-Food Technology , 34 Post Graduate Programmes in various subjects and Ph.D Programmes in subjects related to Fisheries, Ocean Studies and Management under

I. Faculty of Fisheries Science
ii. Faculty of Ocean Science and Technology
iii. Faculty of Fisheries Management
iv. Faculty of Fisheries Engineering

Courses Offered

B.F.Sc

M.F.Sc

a) M.F.Sc.Aquaculture
b) M.F.Sc. Aquatic Animal HealthManagement
c) M.F.Sc. Aquatic EnvironmentManagement
d) M.F.Sc. Fish Nutrition and FeedTechnology
e) M.F.Sc. Fish ProcessingTechnology
f) M.F.Sc. Fisheries Engineering andTechnology
g) M.F.Sc. Fisheries ResourceManagement

MSc

a) M.Sc. Biotechnology
b) M.Sc. Climate Science
c) M.Sc. Disaster Management
d) M.Sc. Earth Sciences
e) M.Sc. Environmental Sciences
f) M.Sc. Food Science andTechnology
g) M.Sc. Marine Biology
h) M.Sc. Marine Chemistry
I) M.Sc. Marine Microbiology
j) M.Sc. Physical Oceanography
k) M.Sc. Remote Sensing and GIS
l) M.Sc. Statistics

MBA

a) MBA dual specialisation (Finance/ Marketing/ Human Resource Management/ Rural Management / Fisheries BusinessManagement)
b) MBA EnergyManagement

M.Tech.

a) M.Tech. Integrated Coastal ZoneManagement
b) M.Tech. Ocean and Coastal SafetyEngineering
c) M.Tech. Coastal and HarbourEngineering

B.Tech- Food Technology

LLM

a. LLM (Maritime Law)

Diploma

a. PG Diploma in Aquarium Science andTechnology
b. PG Diploma in IndustrialAquaculture
c. Diploma in Brackish water and MarineAquaculture

Ph.D. Programmes

Doctoral degree programmes leading to Ph.D. are being offered by the five Faculties. The Faculties are
a. Faculty of Fisheries
b. Faculty of Ocean Science andTechnology
c. Faculty of Ocean Engineering
d. Faculty of Climate Variability and AquaticEcosystem
e. Faculty of Management, Humanities and Social Sciences

Post Doctroral Fellowship (PDF) Programmes

Offered by the five faculties. The faculties are
a. Faculty of Fisheries
b. Faculty of Ocean Science andTechnology
c. Faculty of Ocean Engineering
d. Faculty of Climate Variability and AquaticEcosystem
e. Faculty of Management, Humanities and Social Sciences

Degree Programmes (Admitted through NEET/KEAM)

a) Bachelor of Fisheries Science(BFSc.)
b) B.Tech. (FoodTechnology)

10. CertificateProgramme

a) Certificate course on Computer Aided Designing and Drafting (CADD)
b) Certification Programme on Entrepreneurship Development

Heads Of Departments

Sl. No.	Name & Designation	Department
1.	Dr.K.Dinesh, Associate Professor	Dept.of Aquaculture
2.	Dr.B.Manojkumar, Professor	Dept.of Fish Processing Technology
3.	Dr.Devika Pillai, Professor	Dept.of Aquatic Animal Health & Mgt.
4	Dr.M.K.Sajeevan, Associate Professor	Dept.of Fisheries Resource Management
5.	Dr.V.K.Venkitaramani, Academic Consultant	Dept.of Biological Oceanography and Biodiversity
6.	Dr.V.K.Venkitaramani, Academic Consultant	Dept.of Biotechnology
7.	Dr.V.K.Venkitaramani, Academic Consultant	Dept.of Coastal Zone Management
8.	Dr.Prasada Rao, Academic Consultant.	Dept.of Physical Oceanography and Ocean Modeling .
9.	Dr.S.Rajendran, Academic Consultant.	Dept.of Applied Geoscience
10.	Dr.S.Rajendran, Academic Consultant.	Dept.of Remote Sensing Tech.&GIS
11.	Dr.S.Rajendran, Academic Consultant.	Dept.of Disaster Mgt.
12.	Dr.K.Gopakumar, Prof.of Eminence	Dept.of. Food Science & Technology
13.	Dr.V.Ambilikumar, Associate Professor	Dept.of Business Administration and Management

Directorate of Research

RESEARCH ACHIEVEMENTS 2021-2022

The research achievements made by the faculty and research scholars in the year 2021-22 are presented herein. This is the last year of the current plan period, which started from 2017. During the plan period, KUFOS had established three Centres of Excellences in its major thrust areas, namely; CoE in Sustainable Aquaculture and Animal Health Management (CAAHM), CoE in Aquatic Resource Management and Conservation (CARMC) and CoE in Food Products Technology (CEFPT). Besides, a Centre for Bioactive Substances from Marine Organisms and a well-equipped soil and water analysis lab was also established during the plan period. Work on a multi-species finfish hatchery and indigenous ornamental fish hatchery were also initiated. In order to encourage young researchers, KUFOS has been offering post-doctoral fellowships in selected areas for a maximum period of two years. During 2021-22 too, five post-doctoral fellowships were offered.

During the year 2021-22, the number of publications has been high, with 86 quality research publications in high impact journals, 19 book chapters and 92 papers presented in conferences/seminars. The number of external aided projects in this year was 16, with the total fund from EAPs being Rs. 14.52 Cr. A state-of-art referral laboratory for aquatic animal disease diagnosis and quality testing is being established at KUFOS campus with financial assistance to the tune of Rs 975 lakhs under the Pradhan Manthri Matsya Sampada Yojana.

I. CENTRE OF EXCELLENCE IN SUSTAINABLE AQUACULTURE & AQUATIC ANIMAL HEALTH MANAGEMENT (CAAHM)

1. Establishment of Research Facilities for the Development of Captive Breeding Technology of Indigenous ornamental fishes of the Western Ghats of India for their mass production

PI **:** Dr. T V Anna Mercy, Professor Chair, CAAHM

Project Staffs : Amrutha J Nair, Junior Research Fellow.

The Western Ghats of India is one of the biodiversity hotspots of the world (Myers, 2000) and its range of hills running along India's west coast (08º 19'08'' - 21º 16'24''N to 72º 56'24''- 78º 19'40''E) is one of the richest regions in terms of its biological diversity. The Western Ghats extends 1490 km from north to south with a minimum width of 48 km and maximum of 210 km, covering a total area of 136,800 km^2 (Molur et al., 2011). Mercy *et al* (2007) has documented indigenous ornamental fishes of the Western Ghats of India. The Kerala State on the south - western corner of the Indian peninsula is crisscrossed by 44 rivers arising from the Western Ghats (41 west flowing and 3 east flowing), having an immensely rich ichthyofauna of well over 300 species, of which about 50% have ornamental and recreational value (Mercy, 2007). With the high demand and pricing of many ornamental fish, they are being harvested at greater volumes and sold at higher rates, threatening the viability and sustainability of the resources. Because of the indiscriminate exploitation from the wild many of the species has become endangered. Moreover, for a sustainable supply as per the demand hatchery production of the fish is essential. Wild collection alone cannot cater to the demand. In this context it is felt essential to develop captive breeding technology for a few prioritised indigenous ornamental fishes of the Western Ghats.

Pioneer works on the development of captive breeding technology of indigenous ornamental fishes of the WG of India has been carried out at College of Fisheries from 2000-2004 under the NATP project entitled "Germlasm inventory, evaluation and gene banking of fresh water fishes" (Mercy *et al* 2007). In this project a data base of the indigenous ornamental fishes of the Western Ghats was prepared and captive breeding technology was developed for 12 prioritised species. Captive breeding of the fish *Sahyadria denisonii* popularly known as "Miss Kerala" was also developed under another project funded by Marine Products Export development Agency (MPEDA) by College of Fisheries, Panangad which was held from 2007 -2010. (Mercy *et al* 2011). In order to continue this work on the captive breeding programmes which was initiated by the College this project was undertaken. Since there is huge demand for indigenous ornamental fishes in the international market, it is envisaged that if these fishes can be produced in captivity at a commercial level it will definitely boost the share of the species in the trade to a large extent and will naturally lead to the conservation of its germplasm.

Aim:

- Establish research facility for the development of breeding technology of indigenous ornamental fishes of Western Ghats

- Collection of prioritised species of fishes from wild and develop them to brood stock.
- Develop breeding technology for the commercial production of the species.
- To conduct training program for the transfer of developed technology to the beneficiaries

Research Progress

Renovation of existing hatchery and development of research facility

- The existing hatchery was renovated for the project and was handed over during the month of July 2021. All facilities required for the efficient running of the hatchery were procured.
- A polyhouse was also constructed for the culture of aquatic plants.

Fig 1a. Hatchery facility

Fig 1b. Hatchery facility

Fig 2. A section of the indoor glass tanks

Work progressed

a) Live feed Culture

Stock culture of important live feeds cultured are Rotifer, Moina, Daphnia, Beer eels, Grindal worm and bread worm are being maintained and mass culture is being done so that sale of live feed could also be initiated.

Fig 3a. Stock Culture of Live feed

Fig 3b. Mass culture of live feed

b) Collection of Indigenous fishes from different region and their brood stock rearing

Indigenous ornamental fishes *Puntius parrah* (20 Nos) *Puntius punctatus* and *Puntius amphibious* collected from Bhoothankettu reservoir and *Dawkinsia assimilis* (100 Nos), and *Barilius auratus* (100Nos) purchased from Mangalore were acclimatized and are being developed into brood stock.

Fig 4. *Dawkinsia assimilis*

Fig 5. *Barilius auratus*

Fig 6. *Puntius parrah*

2. Integrated System for Aquatic Animal Health Research and Management

PI **:** Dr. Devika Pillai, Professor and Head, Dept of AAHM

Project Staffs : Dr. Sneha, Project Scientist

: Dr. Divya, Project Scientist

: Ms. Asha Gopan, SRF

: Ms. RabeaNaz H

Multi-drug resistant *Klebsiella pneumoniae* isolated from farmed *Anabas cobojius* in aquaculture systems in Kerala

Klebsiella pneumoniae isolated from five aquaculture farms in Kerala were characterized. A total of 35 antibiotics belonging to 11 different classes were selected for AMR screening. The *K. pneumoniae* isolated from two aquaculture farms (Cherthala and Thuravoor) were found to be multi-drug resistant towards 30 different antibiotics. The isolates showed an elevated minimum inhibitory concentration (MIC) of up to 250 µg/ml towards different classes of antibiotics including beta-lactam, aminoglycosides, macrolides, tetracycline, cephalosporin, quinolone, sulphonamides and chloramphenicol whereas, the remaining *K. pneumoniae* isolates from other farms (Kollam, Kottayam, Vayalar) were sensitive to the tested antibiotics. For a reliable epidemiological investigation of antimicrobial resistance, molecular detection and identification of resistance encoding genes would be necessary. The PCR analysis detected the presence of *qep* gene for quinolone efflux pump, *aac* gene for aminoglycoside acetyl transferase, *parC*, *parE*, *gyrA*, *gyrB*gene for chromosomal mediated

quinolone resistance, *qnrB*, *qnrS* gene for plasmid mediated quinolone resistance, *RmpA* gene for mucoid phenotype A, *fim-H1* gene for type 1 fimbriae, *mrkD* gene for Type 3 fimbrial adhesion gene, *entB* gene for enterobactin and *Ybt* gene for yersiniabactin. The detection of antibiotic resistant bacteria with resistance genes provides evidence that aquatic environments and often, aquaculture environments can act as reservoirs of multi-drug resistant bacterial isolates. There is high possibility of transmission and dissemination to other bacteria.

Isolation, characterization and antibiotic resistance pattern of *Streptococcus agalactiae* from farmed *Oreochromis niloticus* in aquaculture systems

During the period between October 2021and January 2022, mortalities were reported in tilapia fish farms located in Ernakulam, Wayanad and Kottayam districts. Clinical signs, including abnormal swimming, lethargy, appetite loss, as well as unilateral or bilateral exophthalmia, corneal opacity, darkening of the skin, haemorrhages at the base of the fins and opercula, erosion of the skin and caudal fin were observed (Fig. 1). The CFU plate showed large numbers of very minute colonies. The colonies were confirmed by 16 S rRNA sequencing and results showed 100% similarity with *Streptococcus agalactiae*. Twenty-five antibiotic discs from thirteen classes were selected for the test based on their use in aquaculture and importance to human health. The Minimum inhibitory concentration (MIC) of isolates was determined by HiComb™ MIC strips.

Briefly, all isolates were resistant to the tested aminoglycosides, macrolides, nitrofurans, quinolones, glycopeptides, chloramphenicol, tetracyclin and sulphonamides and they showed very high range of MIC towards the tested antibiotics. Histopathological changes were observed in the liver and brain. The liver from infected fish showed infiltration of red blood cells with hepatocytic vacuolization and necrosis. Brain found infiltration of inflammatory cells, vacuolation and meningitis. On bacterial challenge, mortality, external signs of infection and behavioural abnormalities were observed. The red blood cell (RBC) count and haemoglobin count showed a reduction while, white blood cell (WBC) count increased in the diseased fish. The other hematological indices namely, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) also showed significant decrease in infected fish.

Development and Standardization of Fish Soup Powder Made from Mola (*Amblypharyngodon melitinus*, Hamilton 1822) and Its Nutritional Evaluation

Amblypharyngodon melitnus is a nutrient dense fish similar to *A. mola* and contains preformed Vitamin A as retinol and especially 3,4-dehydroretinol. Small fish can play a

major role in controlling and preventing micronutrient deficiencies. The objective of this study was to develop fish soup powder and evaluate its nutrient benefits. Nutritional characteristics and microbial studies are also being carried out. Fresh fish was collected from the culture ponds in KUFOS and were brought to the laboratory in ice. The identification of the different fish species has been carried out following specified methods by the Food and Agriculture Organization (FAO). Fishes were beheaded by knife and then washed with 1% sodium bicarbonate solution and steam cooked at100^{o}C for 10 min. After cooking, fried ingredients were incorporated and blended to make it a thick fine paste. Pour the whole mass in aluminum trays for drying in artificial dryer (55^{o}C). Powder well to get a homogenous product. Soup powder is packed in airtight flexible pouches. Reconstitution of the mix is done by boiling 5g powder in 100 ml water for 5 minutes. The nutritional profiling of the product showed that it has a high content of protein (41.54±0.02%), lipid (13.58±0.13%) and ash (12.97±0.07%) and a lower moisture value of 3.07±0.05%. The soup powder has a considerable amount of iron (1.089 µg/L), zinc (1.359 µg/L), calcium (2000 mg/kg), magnesium (1215 mg/kg), sodium (169.4 ppm),and potassium (29.1 ppm). Water activity was measured using the Novasina (LabTouch - aw) water activity meter, and aw of fish soup powder was found to be 0.516 at 31°C. The TPC of soup powder made by using *Amblypharyngodon mola* fish was 2.05x10^{9}cfu/ml. The Staphylococcus count of soup powder made by using *Amblypharyngodon mola* fish was 1x10^{8}cfu/ml.

To carryout regular health surveillance and disease monitoring in the state of Kerala: Revenue generation

A total of **Rs. 9, 19,355/** was generated as part of diagnostic services provided by the centre.

Diseased samples collected from different parts of Kerala

Etroplus suratensis with *Streptococcus agalactiae* showing exophthalmia and corneal opacity

Sea bass infected by Red Sea Bream Irido Virus (RSIV) showing enlarged spleen

Infectious Spleen and Kidney Necrosis Virus (ISKNV) detected in *Astronotus ocellatus*

3. Developing region specific organic protocols for the seed production of Penaeus monodon

PI : Dr. K. Dinesh, Professor and Head Department of Aquaculture

Project Staffs : Geeji M T, Project Scientist.

: Theresia Vincent, Field Assistant.

Objectives

- Popularizing organic shrimp culture towards increasing farmers' revenue
- Ensure the supply of quality shrimp seed produced through organic protocols
- Investigate the alternative methods to avoid eye-stalk ablation in commercial shrimp breeding
- Try different feeds of organic origin for maturation/breeding of *Penaeus monodon.*

Work done so far:

- The existing temporary organic hatchery was upgraded.
- Matured shrimps were collected from the wild for production of seed and 5 lakhs seeds were produced from wild broodstock, strictly adhering to organic protocols.
- The seeds were distributed to the beneficiaries who showed interest in taking up organic mode of shrimp culture towards buying back the shrimp brood stock from them for the continuation of the trial. One culture cycle has been successfully completed. Farmers were satisfied with the health of the seeds. Mortality was very low compared with the seeds procured from the conventional hatchery.
- Collected mature broodstock from the Organic farmers of COOP for captive breeding trials as part of the "Buy Back guarantee" agreement. Captive maturation trial is going on.

Organic certification

The authorized production of organic shrimp seed needs certification from National Programme for Organic Production (NPOP) by APEDA, GoI. The follow up procedure to get organic certification for the aforesaid hatchery is in progress with the support of COOP, Switzerland.

Developing region specific organic Protocols for seed production of *P. monodon (*2021-22)

Experiments on Broodstock maturation in captivity

Broodstock maturation system experimental set up-1 (Wet lab Dept. of Aquaculture, KUFOS)

Broodstock maturation system experimental set up-2 (COOP Hatchery)

Broodstock maturation system experimental set up-3 (Queens Hatchery)

Brood animals

System – 1 recirculating system with sandy bottom.

Brood Animals – Male and female 2:1

Female brood stock

Matured female collected for organic seed production

Collection of adults from the farm

Keeping adult shrimp in hapa

4. Developing brood bank for sustainable production of Karimeen, *Etroplus suratensis* (Bloch, 1790) and an initiation of selective breeding programme

PI **:** Dr. Binu Varghese

Project Staffs : Thiruvarasu S & Grace George – SRF

Shamil & Hareesh – Field Assistant

The project met all the milestones and objectives. In 2021-22 major thrust was given on larval rearing and optimising RAS fry and fingerling production system developed as part of the project. The influence of geographic location, aquatic media, food and feeding habits on meat quality, texture analysis, proximate composition, fatty acid and amino acid composition etc were studied from six locations. The locations studied were three from the Vembanad Lake ie from the North, Middle and South Vembanad. The other three locations were from the Southern Kerala two from Ashtamudi Lake and from Sasthamcotta. These results help to reorient the selective breeding programme by providing proper environment, food, and meat quality rather than growth alone. PIT tagging was done in juveniles and adults of Pearlspot of different localities. The packing duration and density for larvae, fry and juveniles were done in a farm condition, without chemicals or lowering temperature. The study proved efficiency and success of packing larvae for long distance transport. This hints at the possibility of having satellite seed production centres, and supply of high-quality seeds throughout the country.

5. Biotechnological interventions in Aquaculture for sustainable production

PI **:** Dr. Rejish Kumar V J, Assistant Professor

Project Staff **:** Greeshma James, Senior Research Fellow

Isolation and characterization of *Bacillus* from mangrove sediments and its potential as probiotic in aquaculture

Mangrove sediments are rich in microbial diversity. Probiotic potential of mangrove sediment microbes in aquaculture have been not yet fully explored. Several *Bacillus* species have been reported as probiotics in aquaculture for controlling the diseases and improving the water quality. The present study aimed to isolate *Bacillus* from mangrove sediments and to analyse its enzymatic and antimicrobial activity for its further application in aquaculture. Mangrove samples were collected from three locations of Ernakulam district (Madavana, Puthuvype, Kumbalam Island and Nettoor). The samples collected from Puthuvype and Kumbalam Island displayed high bacterial abundance. Biochemical analysis of sediments exhibited high total organic carbon, lipid, tannin and lignin in the sediments of Kumbalam Island and Puthuvype compared to Madavana and Nettoor. In contrast, carbohydrate level was higher in the sediments of Madavana. Biochemical characterisation of 52 isolates led to the segregation of eighteen *Bacillus* isolates under 7 groups. Upon sequencing the 16S rRNA gene, representative isolates from each group were identified as *Bacillus cereus* (OWC B (2), WCC8S (22) and WR (19)), *Bacillus safensis* (BCC 2(6)), *Bacillus pumilus* (IY (11)) and as *Bacillus velezensis* (ALC (2)). Enzyme production assays confirmed lipase activity in *Bacillus* strains WCC8S (22)), WR (19) and ALC (2); protease activity in WR (19). *Bacillus velezensis* strain ALC (2) showed antibacterial activity against *Vibrio parahaemolyticus, Edwardsiella tarda, Aeromonas salmonicida, Aeromonas hydrophila, Streptococcus agalactiae. Bacillus cereus* strain WCC8S (22) showed antibacterial activity against *V. parahaemolyticus, E. tarda* and *V. vulnificans.* This study demonstrates the potential of mangrove sediments for the isolation of *Bacillus* species for its further application in aquaculture.

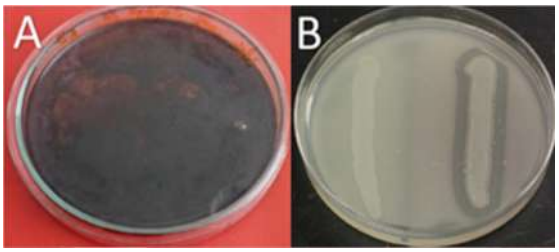


Fig. 1. Isolation of pure cultures

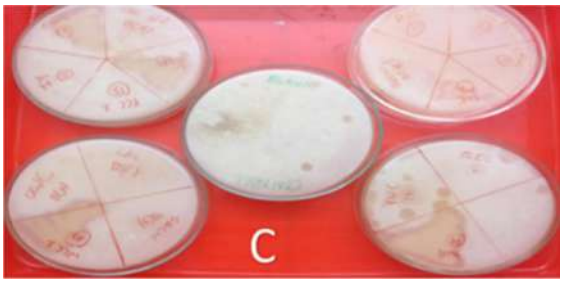


Fig. 2. Enzymatic activity of the isolates. (A) Amylase (B) Lipase (C) Protease

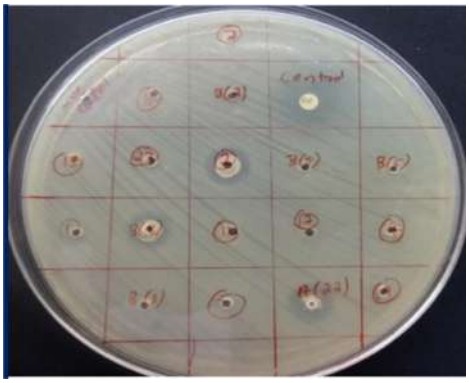


Fig.3. Antibacterial activity of the isolates

Isolation of endophytic *Bacillus* from mangroves, and its probiotic potential in aquaculture

Mangroves are rich sources of endophytic microbes. The secondary metabolites of endophytic microbes are biologically active with various applications. Probiotic potential of mangrove endophytic microbes in aquaculture have been not yet been explored. Several *Bacillus* species have been reported as probiotics in aquaculture for controlling the diseases and improving the water quality. Hence, the present study aimed to isolate endophytic *Bacillus* from mangroves and to analyze its enzymatic and antimicrobial activity for its further application in aquaculture. Biochemical analysis of mangrove samples of sediments displayed high total organic carbon, lipid, tannin and lignin in the sediments of Kumbalam Island and Puthuvype compared to Madavana. In contrast, carbohydrate level was higher in the sediments of Madavana. Biochemical characterisation of 42 isolates led to segregation of seven Bacillus isolates. Isolates S7S (34), S7SB, S7SD, S7S25 andS7R, obtained from the stem and root of *Rhizophora mucronata* and S1L obtained from the leaf of *Acanthophorus ilicifolius* were

identified as *Bacillus cereus* by 16S rRNA gene sequencing. *Bacillus* isolate from root of *R. mucronata* was identified as *Bacillus paramycoides*. Enzyme production assays confirmed protease activity in *Bacillus* strains S5R, S7S (34), S7SB, S7R, S7S25 and S1L; amylase activity in S7SB, S7SD, S7S25 and S1L; and lipase activity in S5R, S7S (34). *Bacillus strains* S7SB and S7SD displayed antibacterial activity against aquatic pathogen, *A. hydrophila*. To our knowledge this is the first report on endophytic *Bacillus cereus* and *Bacillus paramycoides* from mangroves. This study proposes the probiotic potential of endophytic *Bacillus* (S7SB, S7SD) isolates in aquaculture.

Bioaccumulation, toxicity and immune responses in *Oreochromis niloticus* exposed to polystyrene microplastic

Industrialization pollution of the aquatic ecosystem with plastics and its derivatives are of serious concern, which affects the life of aquatic organisms. The present study intended to analyse the bioaccumulation, toxicity and immune responses of *O. niloticus* exposed to polystyrene microplastic (MP). Fish were exposed to MPs at three different environmentally relevant concentrations 0.01, 0.1 and 1 mg/L for 14 days. After the exposure period, accumulation of MPs was highest in the intestine followed by gills, liver, muscle and spleen. Histological changes such as infiltration and inflammatory responses were observed in the gill, intestine, liver and spleen. The erythrogram revealed a substantial increase in the WBCs and haematocrit percentage with increase in MP concentration. An increment in the total protein value and A/G ratio was noted, indicating the deterioration of the internal organs. Increased stress responses such as the elevated blood glucose, cortisol and HSP 70 gene expression in both liver and spleen were observed with increasing concentration of MPs. Also, the increase in Serum Glutamic-Oxaloacetic Transaminase (SGOT), Serum Glutamic-Pyruvic Transaminase (SGPT) and Alkaline Phosphate (AP) confirmed the liver toxicity. The increasing concentration of MPs significantly reduced the activity of antioxidant enzyme superoxide dismutase (SOD) in liver while increasing the activities of catalase (CAT) and malondialdehyde (MDA) indicating oxidative stress. Increased respiratory burst, Myeloperoxidase [MPO], and serum lysozyme activity demonstrated the impact of microplastic on the immune system of Nile tilapia along with increased Tumor Necrosis Factor α (TNF-α) and IgM. MPs exposure inhibited the acetylcholinesterase (AChE) activity in the brain indicating the potential neurotoxicity of PS-MPs. The exposure also decreased the levels of vitellogenin and Gonadotropin hormone-releasing hormone (GNRH), which underlined the impact of MPs on the reproduction of Nile tilapia. The cytochrome P450 (cyp)

1A gene expression in the fish liver exhibited significant down regulation, which shows the level of cellular toxicity towards the microplastic. The present study clearly demonstrated the bioaccumulation, histological alterations, liver and cellular toxicity, antioxidant and immunological responses in Nile tilapia exposed to polystyrene MPs.

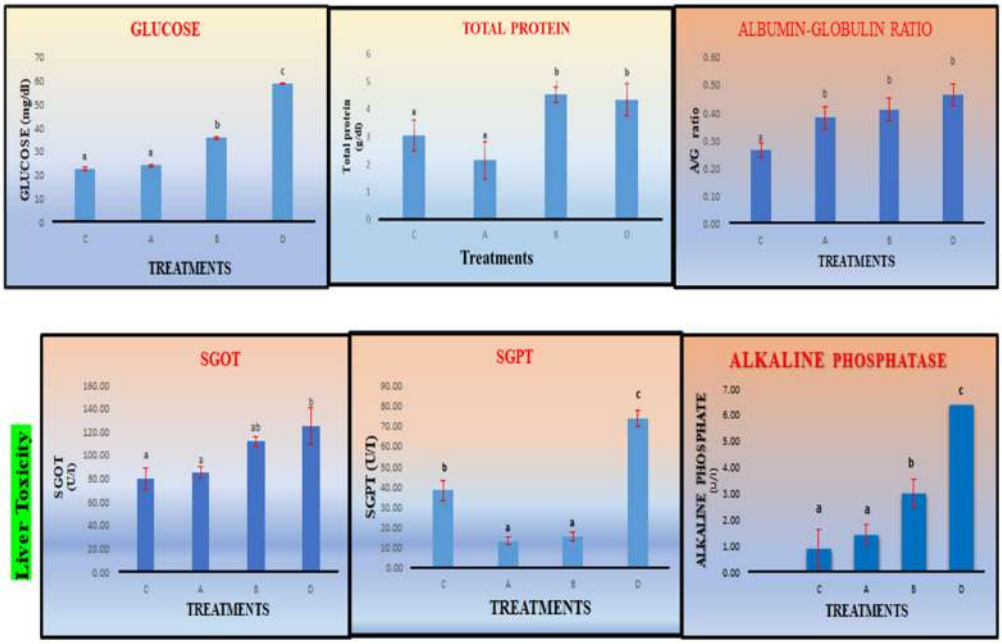


Fig.1. Serum parameters and liver toxicity of *O. niloticus* exposed to MPs for 14 days

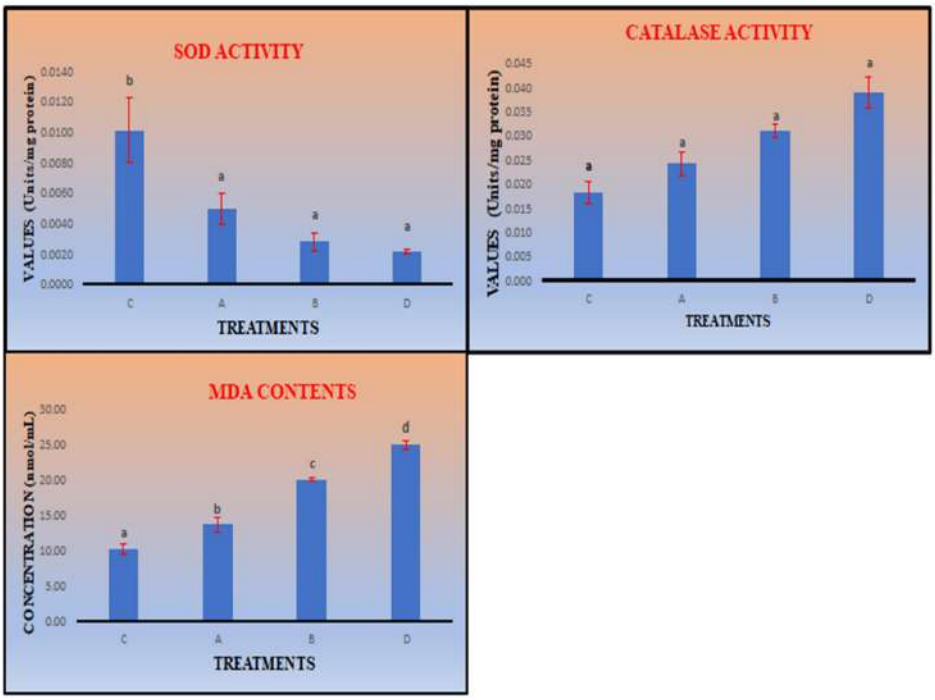


Fig.2. Oxidative stress of *O. niloticus* exposed to MPs for 14 days

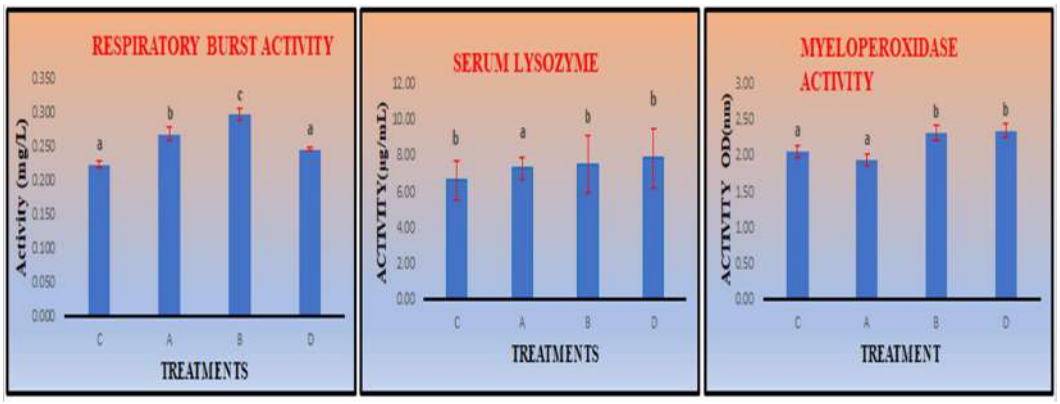


Fig.3. Immunotoxicity of *O. niloticus* exposed to MPs for 14 days

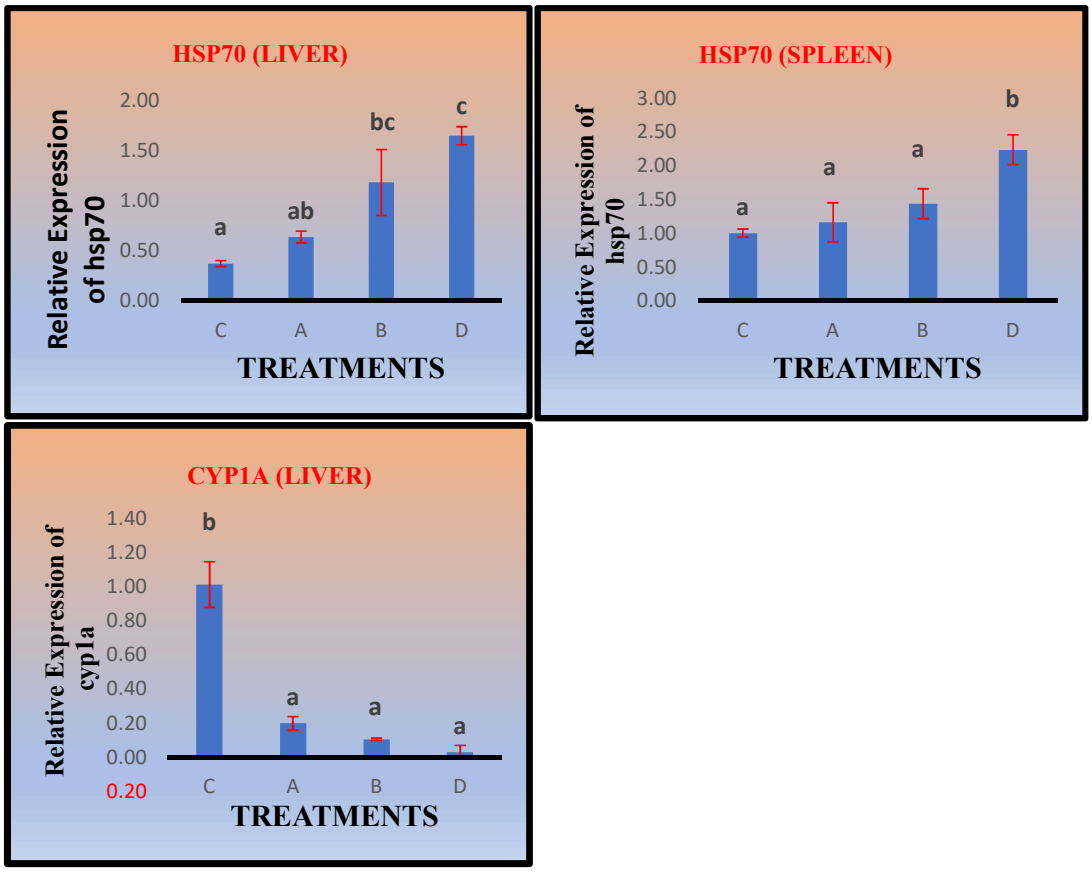


Fig.4. Gene Expression of HSP70 & CYP1A of *O. niloticus* exposed to MPs for 14 days

6. Development of sustainable aqua feed from wide spectrum raw materials and propagation of feed-based aquaculture in Kerala

PI : Dr. Chiranjiv Pradhan, Assistant Professor

Project Staff : Aswathy Babu, Senior Research Fellow

Work done

- Effect of dietary taurine supplementation on growth performance, digestive enzymes activities and antioxidant status of pangasius (*Pangasianodon hypopthalmus*) fed with fishmeal and no fishmeal diet.
- Growth performance, nutrient digestibility and activity of metabolic enzymes in Pearl spot *Etroplus suratensis*, fed carbohydrates of different complexities
- Effect of dietary chitosan on growth, nutrient utilisation and health performance in *Pangasianodon hypopthalmus*"

A pilot study for scaling up of black soldier fly (BSF) larvae meal production.

Research facility developed

1. Installation of twin screw extruder of capacity 100 kg/hr for floating feed preparation
2. A Black soldier fly larvae production unit

Twin Screw extruder

Floating feed

7. Fisheries Station Puduveypu

Marine ornamental fishes broodstock development and breeding

PI : Dr. Linoy Libini, C., and Dr. Anna Mercy, T.V.

Project Staffs : Dr. Baiju, P. T. (Project Scientist)
Ms. Siya K. Johnson (Research Fellow)
Ms. Akshaya Vijayan (Technical Assistant)
Mr. Naveen K Simon (Data Entry)

The marine ornamental industry has grown constantly in last few decades. Tropical and subtropical countries are among the world's largest exporters of marine ornamental species for the aquarium trade (Olivotto et al., 2003). Global ornamental trade is growing and this trade depends on the wild collection from the tropical reef ecosystems. It is projected that less than 10% of marine animals sell in the world are originate from captive production sector. During last decades the unsustainable capture of wild organisms to the ornamental trade have serious consequences with the degradation of habitats and populations of tropical and subtropical marine fish are being depleted worldwide to supply increasing demands of the aquarium industry. Due to the increasing demand, many studies on ornamental fishes, particularly, larval rearing and nutrition have been performed (Avella et al., 2007). The clown fishes are protandrous or they can change sex is a peculiar feature. They are born as male and dominant member of the group changes sex to female and the second largest sub-adult then becomes the functioning male (Wood and Aw, 2002). Approximately, a total of 24 million fishes and 10 million invertebrates were traded around the world (Kumar and Balasubramanian, 2009). Production of ornamentals through mariculture or marine aquaculture were suggested as relief for natural stocks depleted due to this trade (Murray et al., 2012). The Indian ornamental diversity encompasses about 400 species fish belongs to 175 genera and 50 families. Pomacentridae, is one of the largest reef fish family of tropical and subtropical seas with species diversity of 350 species under 29 genera. The clownfish species are the most demanded marine ornamentals around the world. Unfortunately, the natural stocks depended stock is the main source to meet the present demand (Abol-Munafi et al., 2011). Biologically, the clown fishes are protandrous hermaphrodites, able to change sex male to female during maturity (Fautin and Allen, 1992). The trade is also able to provide employment in rural, low-income coastal communities. The anemone fish, *Amphiprionpercula* is a tropical coral reef fish belonging to the family *Pomacentridae* fishes and anemones and subfamily *Amphiprioninae*. The family *Pomacentridae* with the species composition of 380 species belongs to 29 genera. Captive reproduction of the fish in demand in the aquarium trade stands as the only sustainable means in meeting the increasing demand as well as in replenishing the already depleted natural resources.

Fig 1. RAS culture facility for marine ornamental fishbrood stock rearing

The juveniles of clownfish species (*Amphiprionpercula* and *A. frenatus*) were procured from CMFRI Mandapam, acclimatized, and stocked in re circulatory aquaculture system (RAS) at Fisheries Station Puduveypu (fig 1). An initial length weight measurements were taken before stocking. A total of 120 *Amphiprionpercula* juveniles' size ranging between 35.2 mm, 1.23 mg, 40.78 mm, 2.28 mg and 30 juveniles of *A. frenatus* size range between 35. 95 mm, 1.25 mg and 37.55 mm, 1.42 mg was stocked in re circulatory aquaculture system at a stocking density of 10-15 animals in 1-2 tonne tanks. The fishes were grouped and fed with various diets such as a commercially formulated feed, and the fresh frozen feeds like fish roe, squid meat and clam meat. Feeding was done with diets such as a formulated feed *Varna* from CMFRI, and the fresh frozen feeds like fish roe, squid meat and clam meat three times a day at 9:00, 13:00 and 16:00 hrs. Excretory material and remnant food particles were siphoned out an hour after the feeding. Water quality parameters in the tanks were regularly checked and maintained as temperature 29 ± 1^{o}C, salinity 28 ± 1 ppt, pH 8 ± 0.2 and dissolved oxygen 6.5 ± 0.3 mgl^{-1}. The submerged objects such as tile, earthen pot, PVC pipe, etc., were placed in the bottom of the tanks to enhanced the pair formation and reduce attacking. The length-weight measurements were taken at regular intervals of 30 days. Another new RAS systems were introduced in hatchery, water quality parameters of RAS were checked regularly. Clown fish *Amphiprionpercula* and *Amphiprionfrenetus* introduced from Mandapam, after 3 months of rearing they showed remarkable reproductive behavioral changes.

Fig. 2. *Amphiprionpercula* and *Amphiprionfrenetus*

The paired fishes were separated and fed with different diet treatments (Feed 1,2, 3 and 4) such as formulated broodstock diet developed by CMFRI, Varna feed, tuna fish roe, clam meat, and squid meat for further conditioning. Length -weight measurements were taken at 30 days intervals. The fresh feed diets showed a better growth performance, Tuna roe-fed fishes showed a maximum growth rate followed by the fishes fed with clam meat (Fig. 3 and 4). All the feeds were tried are accepted well by the both fishes (*Amphiprionpercula* and *Amphiprionfrenetus*) the highest diet acceptance was noticed for the fish roe (Feed -2) and lowest was in the fishes fed with squid meat (Feed -4). Pair formation is high in fish roe fed group and lowest in Commercial Feed (Varna) fed group.

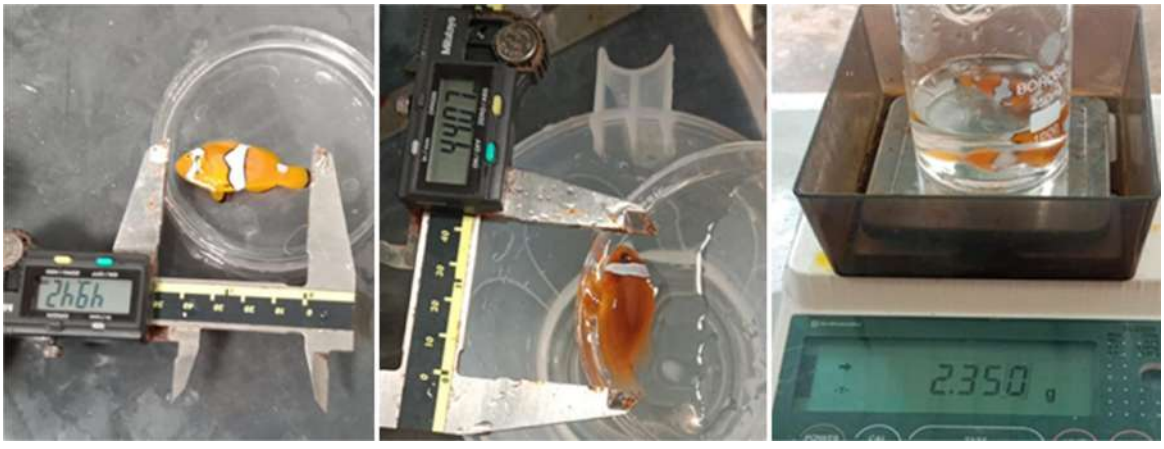


Fig. 3. Length weight measurements of clown fish species

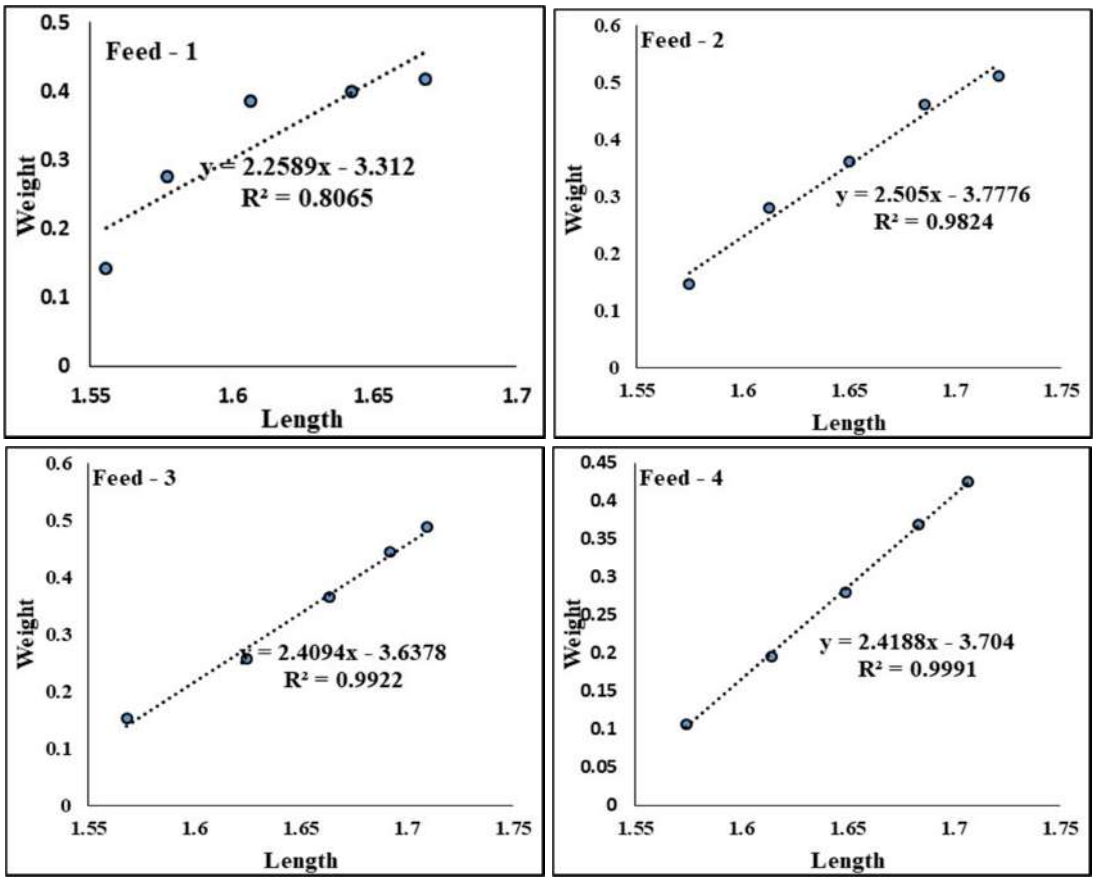


Fig 4. Length-weight relationship of tomato clown *Amphiprionfrenatus* fed with different diets

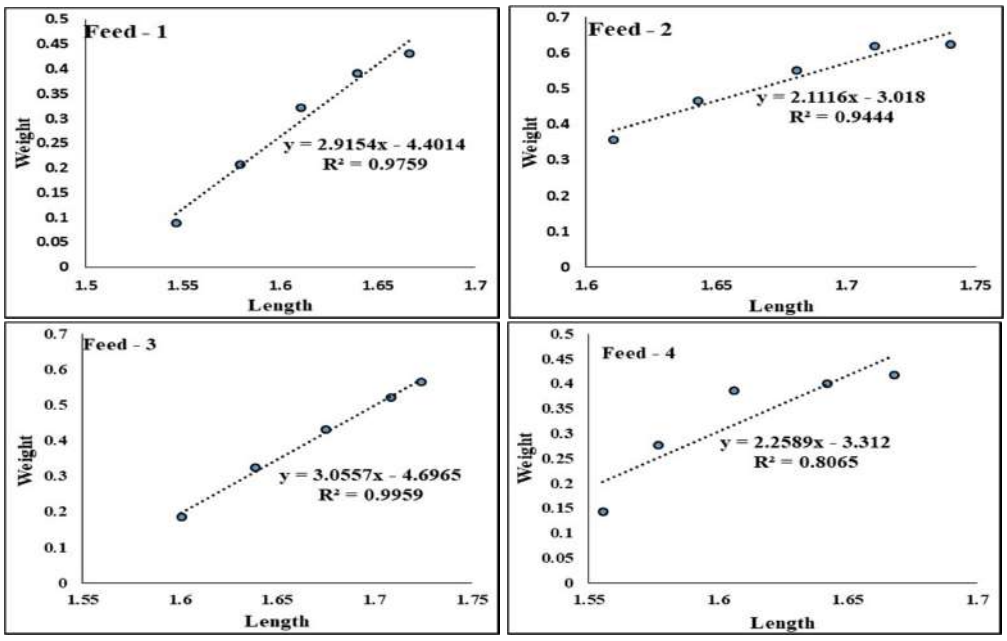


Fig 5. Length-weight relationship studies in orange clown *Amphiprionpercula* fed with different diets

Live Feed Culture unit - microalgal culture

Microalgal culture of 6 species established namely *Isochrys sisgalbana, Chaetoceros calcitrans, Pavlova salina, Chlorella autotrophica, Nanochloropsis australis* and *Dunaliella salina.* Indoor and outdoor culture done with annual production of 684 tonne with an average cell density of 45 lakh cells/ml, Stocks were also maintained. Microscope assisted unialgal isolation done through serial dilution from wild collected mixed algal population dominated by diatoms.

Fig 6. Microalgal culture in indoor and outdoor units

A basic understanding of the algal growth dynamics is necessary to carry out their culture in terms with good production to cater the needs of the hatchery seed rearing. The culture of each species and their individual growth performance was assessed and shown in fig 6. All the species were attained a good cell density within 4 to 6 day of culture and the cell density was found to be steady decreased after 9th DOC.

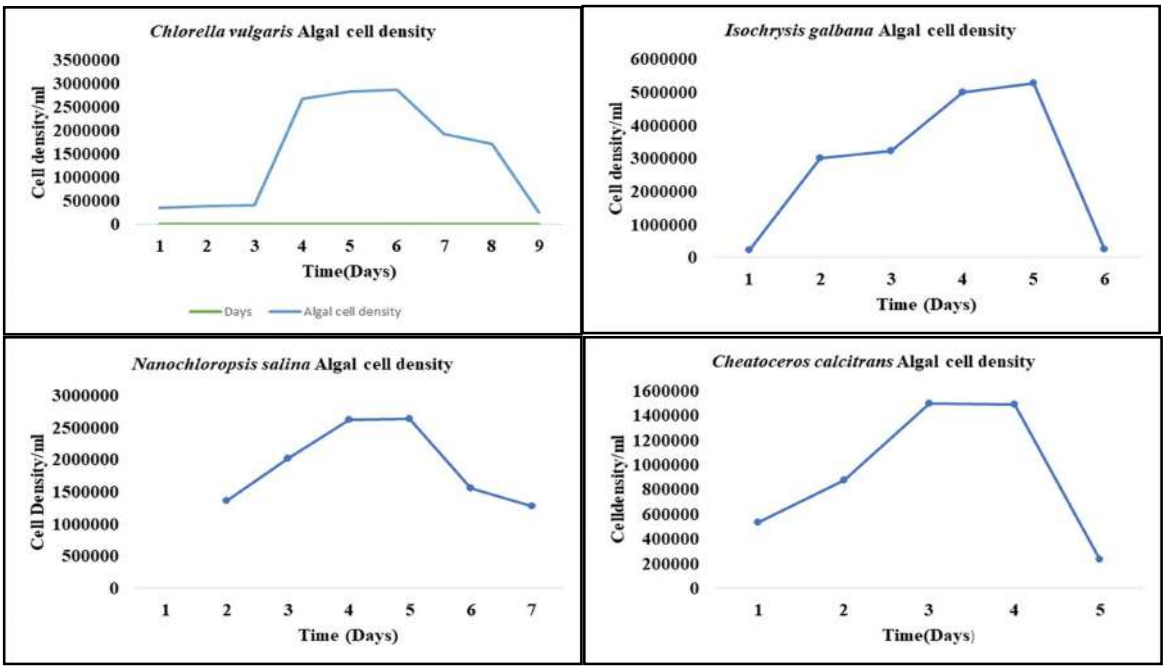


Fig. 7. Cell culture densities observed for different microalgal species in mass culture unit

Zooplankton culture unit - Rotifers

Rotifers have been used as live feed for cultured marine fish, in the last four decades. It is well known that a continuous, stable and reliable supply of nutritionally adequate rotifers is the key to the larviculture of marine finfish. Rotifers of the species *Brachiounus rotundiformis* and *B. plicatilis* are almost indispensable for larval rearing of most marine finfish. The success of rotifer cultivation is dependent on selecting the most suitable rotifer species or strain for local culture conditions, maintaining water quality in culture tanks and choosing the most appropriate culture technique.

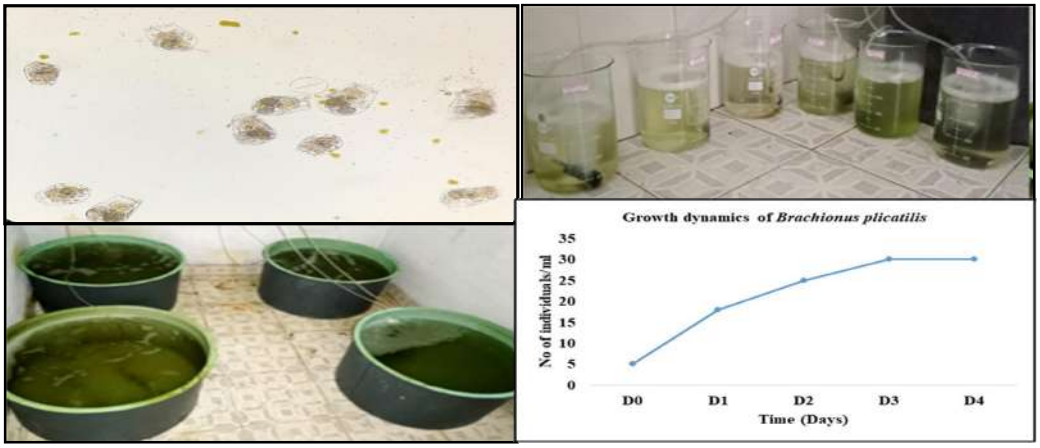


Fig 8. Growth dynamics and stock and mass culture of *Brachiounusplicatilis* with *a* microscopic view

Growth and reproductive performance of rotifers *Brachionusplicatilis* were studied in terms of algal probiotic combination diet in copra meal extract. The general nutritional profile of rotifers considered them as an inferior quality live feed but can be easily enriched with their diet and nutritional supplement before administrating in larval feeding. The present study made use of a combination diet with two commercially available probiotics PB 1(dominated by *Saccharomyces ervicia*) and PB2 (dominated by *Lactobascillus*), along with two microalgae *Isochrysisgalbana* and *Chlorella vulgaris*. The copra meal extract was used as organic source media for the formation of algal-probiotic combination diets and used in the culture of rotifers for 15 days. The growth and reproductive performance of rotifers *Brachionusplicatilis* were analysed. The better performance was noticed in the combination diet of *Isochrysisgalbana*- Probiotics, PB 1 with copra meal extract combination show a higher rotifer growth density due to the activity of probiotic consortium dominated by *Saccharomyces ervicia.*

Zooplankton culture unit - Copepods:

Copepods are a major component of the natural diet of marine fish larvae. The advantages of copepods over rotifers are that copepods have wide range of body sizes both within and between species. The early stage nauplii and copepodites can be extremely useful as initial prey for species that have very small larvae with small mouth gape at first feeding. Wild collection of zooplankton were done with the bongo net from Vypin and the copepods species were isolated by phototoxic method. Sampling and isolation of order calanoid copepods were done and culture established. Ovigerous female copepods were separated to develop monoculture. The isolated species kept for further culture.

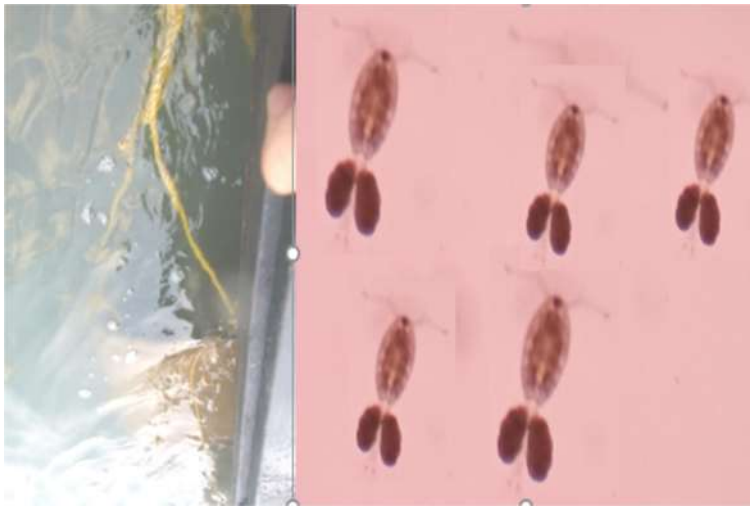


Fig.9. Wild collection of zooplankton with the bongo net *and* egg bearing copepod*s* were isolated for pure culture.

Farm made feed Experiment

Farm made feed were prepared for *Etroplus suratensis* using locally available feed ingredients such as Tapioca flour, Fish meal, jack fruit seed powder etc. Proximate composition and properties of feed were analyzed feeding experiment done Fishes reared in15 ppt salinity shows improved growth performance in terms of specific growth rate FCR for both made feed F1 and F2, growth performance is also significant.

Table 1. Feed ingredients used for formulation of experimental feeds

S.No.	Ingredients	Cost in Rs./kg	Feed 1 (%)	Feed 2 (%)
1	Fish meal 67% protein	90	45	30
2	Clam meal	140	5	5
3	Jackfruit seed powder	60	0	20
4	Tapioca flour	50	23	18
5	Corn flour	100	5	5
6	Maida	65	12	12
7	Fish oil	150	3	3
8	Binder	450	2	2
9	Supplevit-M*	180	5	5

The concept of farm made feed will open a way to farmers particularly entrepreneur farmers to experiment with jack fruit seed powder as diet component for better growth and cost effectiveness Fishmeal plays an important role as a feed ingredient in the culture feeds irrespective of its cost and supply. Attempts for finding out the suitable alternatives for the successive replacement of fish meal attain a good priority globally. In the study, the growth performance of *Etroplus suratensis* seeds was assessed with two cost-effective diets formulated with easily available sources, especially jackfruit seed powder (*Atrocarpus heterophyllus*) with a crude protein of 14%. Fishes were measured for length-weight and checked the performance and feed acceptability. In this study the experiment unit contains 3 treatments viz T1 15 ppt, T2 20ppt and T3 10 ppt. The present investigation reveals that fishes reared in 15 ppt salinity has showed improved growth performance in terms of SGR 1.123 (F1), 1.121 (F2). From the Feed conversion ratio calculated it is evident that has no mark able difference between F1(0.70) and F2(0.76). Both diets showed better performance to reduce feed cost incorporating plant protein sources and were made remarkable variations

in the growth performance. We have tried a new attempt to use jack fruit seed powder as feed ingredient in fish feed along with fish meal *E.suratensis* shows good growth performance. The concept of farm made feed will open a window to farmers particularly entrepreneur farmers to experiment with jack fruit seed powder as diet component for better growth and cost effectiveness

Fig.10. Farm made feed were prepared for *Etroplus suratensis* using locally available feed ingredients

II. CENTRE FOR AQUATIC RESOURCE MANAGEMENT & CONSERVATION (CARMC)

As part of the studies on the long-term trends in the Vembanad Wetland System (VWS), the CARMC undertook the following activities during 2021 -22.

1. **Studies on the discharge efficiency of Thottappally Spillway (TSW):** The 1310 m long, 350 m wide TSW receives floodwaters mostly from the Rivers Pamba and Achankovil that join to form a 6.2 Km long leading channel (70 m wide). A regulator cum bridge in the mid part divide the TSW to an Eastern segment that receives the floodwaters and a Western segment that discharges these waters to the Arabian Sea through a relatively narrow (132.5 m wide) bar-mouth. The Eastern segment is connected to the Kayamkulum and Vembanad estuaries through a southward trending Kayamkulum canal and a northward trending Vembanad canal (Fig-1). During active monsoon season all the regulators of TSW are kept open whereas during weak monsoon months the regulators are opened/closed as per the tide cycle (low/high tides). However, during the non-monsoon months all the regulators of TSW remain closed to prevent the landward ingression of saline water.

CARMC carried out detailed investigations on the spillway through a combination of satellite derived and in-situ data collected in the months of September 2021 (active monsoon), October 2021 (weak monsoon) and February 2022 (non-monsoon). Data on Water Level variations were gathered from tide gauges installed at different locations (Fig-1), current data using a portable current meter, Temperature and salinity profiles using a Sea Bird CTD and depth using Seechi disc measurements.Results indicate that the de-tided depth of the regulator sill is only 2.03 m below Mean Sea Level (MSL) and that the bathymetric contours of the TSW approximately corresponds with the depth of the spillway except for few patches of higher depths (Fig -2). The Sea floor immediately off the TSW bar-mouth is 4.5 m. The instantaneous water level anomaly (IWLA) in the Eastern segment of the spillway is dependent on the discharge from the leading channel, outflows through the Kayamkulam canal/ Vembanad canal and the TSW bar-mouth. When the shutter gates of the spillway are fully open (active monsoon) there is strong correlation (R^2= 0.71) between and current speed and IWLA (x axis) as explained by y= 0.906x + 18.19 whereas when the spillway gates are partially open (weak monsoon) the correlation as defined by the equation y = 1.879x + 17.91 is weak (R^2 = 0.49). When the shutters are fully closed (non-monsoon season) there is no statistically significant correlation between the variables (R^2 = 0.33). The discharge rates from TSW show an increasing trend with increments in positive IWLA attaining maximum current velocity of 155 cm/s for the surface flow and 93 cm/s for the bedflow of, as observed in the present study. Other than the inflow from the leading channel, operational status of the spillway gates and the amplitude of tides, a key factor influencing the discharge rates of the spillway is a groyne approximately 500 m north of the bar mouth which considerably reduces the flow velocity of the southward propagating coastal current during active monsoon causing the piling up of river waters (river plumes) over the coastal waters off the bar mouth which is expected to considerably reduce the IWLA of TSW.

2. **Saline water intrusion through TSW:** Landward salinity intrusion through TSW was monitored in the non-monsoon month of February 2022. Within the TSW, salinity of 17 ppt (bottom) and 1.8 ppt (surface) were recorded from the boat terminal station. Salinities of 1.6ppt (s) and 17ppt (b) was recorded at Koppara bridge, 0.3 ppt (s) & 16ppt (b) from Cheruthana, 1.6ppt (s) & 15ppt (b) at Ayaparampu, 0.2 ppt (s) & 14 ppt (b) at Payippad, 0.4 ppt (s) & 7 ppt (b) from KochuKanyattukulangara, 0.4 ppt (s) & 6.3 ppt (b) Veeyapuram and 0.3 ppt (s) & 0.5ppt (b) at Thuruthol bridge. Salinity at Pavukkara, Mannar bridge and Pallipad were zero in both surface and bottom waters (Fig – 3). During this season surface

and bottom salinities in the south sector of Vembanad Lake (Fig -6, comprehensive report of CARMC) was very low (< 1ppt) which suggest that salinity intrusion through TSW might have occurred through the Kayamkulam canal and by spill-over/seepage from the regulator gates of the spillway.

3. **Primary production:** Studies on Chlorophyll (Chl) and phytoplankton community structure from 69 stations of Central Vembanad Lake (CVL) during the monsoon season of year 2021 was undertaken by the CARMC team. The mean values of Chl-a; Chl-b and Chl-c were 0.37±0.23 mg C/m^3, 0.42 ± 0.26 mg C/m^3 and 0.49 ± 0.32 mg C/m^3 respectively. Mean cell density of phytoplankton was 108.92 x 10^3 cells/Litre comprising of diatoms (14000 to 180000 cells/L), Chlorophytes (3000 – 88000 cells/L), dinoflagellates (1000 – 42000 cells/L), Cyanophytes (1000 – 18000 cells/L) and Euglenophytes (1000 – 16000 cells/L). Percentage composition of phytoplankton is depicted in Figure-4. In all 94 phytoplankton species were encountered consisting of 39 diatom species, 30 Chlorophyte species, 14 Dinoflagellate species, 6 Cyanophyte species and 5 species of Euglenophytes.

4. **Distribution and abundance of fish egg and larvae in VL:** Percentage composition, diversity and abundance of fish egg and larvae in the CVL during pre-monsoon where much higher than in monsoon and that recorded from SVL. However, monsoon samples from CVL showed less abundance and diversity. Cypriniform larvae which were absent in pre-monsoon, where abundant in the monsoon samples which were dominated (60%) by Clupiedae larvae (Fig-5). Representatives of dominant fish larvae in the CVL are shown in Fig -6.

5. **Other activities:** During 2021-22 samples were collected from 69 stations of CVL (monsoon season) and from 69 stations of SVL (post-monsoon). Samples are being analysed. Characterization of microplastic in 30msediment samples from CVL using Raman spectroscopy is in progress.

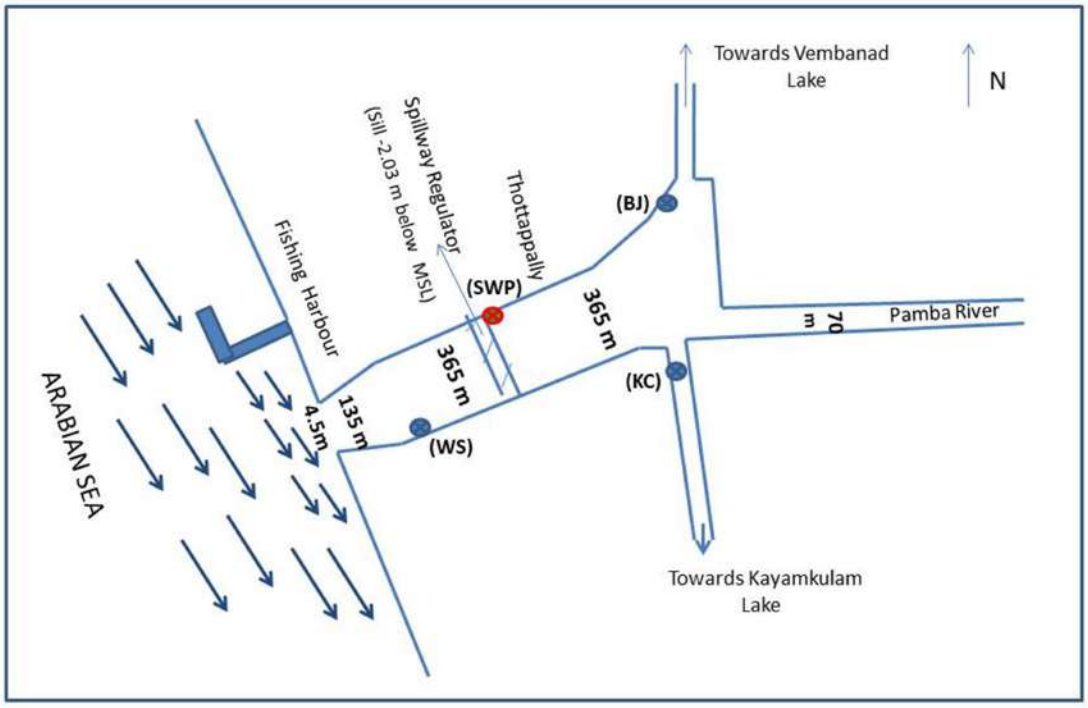


Figure -1: Sketch of Thottappally spillway showing Tide gauge stations at Boat Jetty (BJ), Kayamkulam Canal (KC), Spillway Pier (SWP) and Western Segment (WS) and the groyne north of the spillway. Sea floor off the bar mouth is 4.5 m deep.

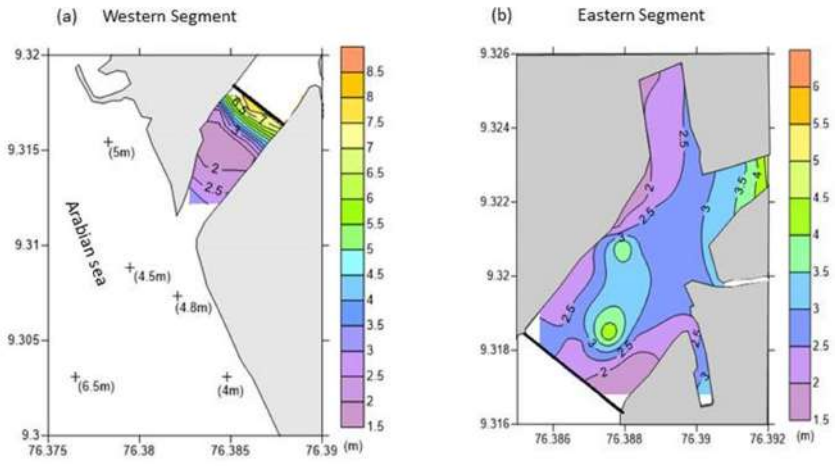


Figure -2: Bathymetry of TSW (a) Western and (b) Eastern segment

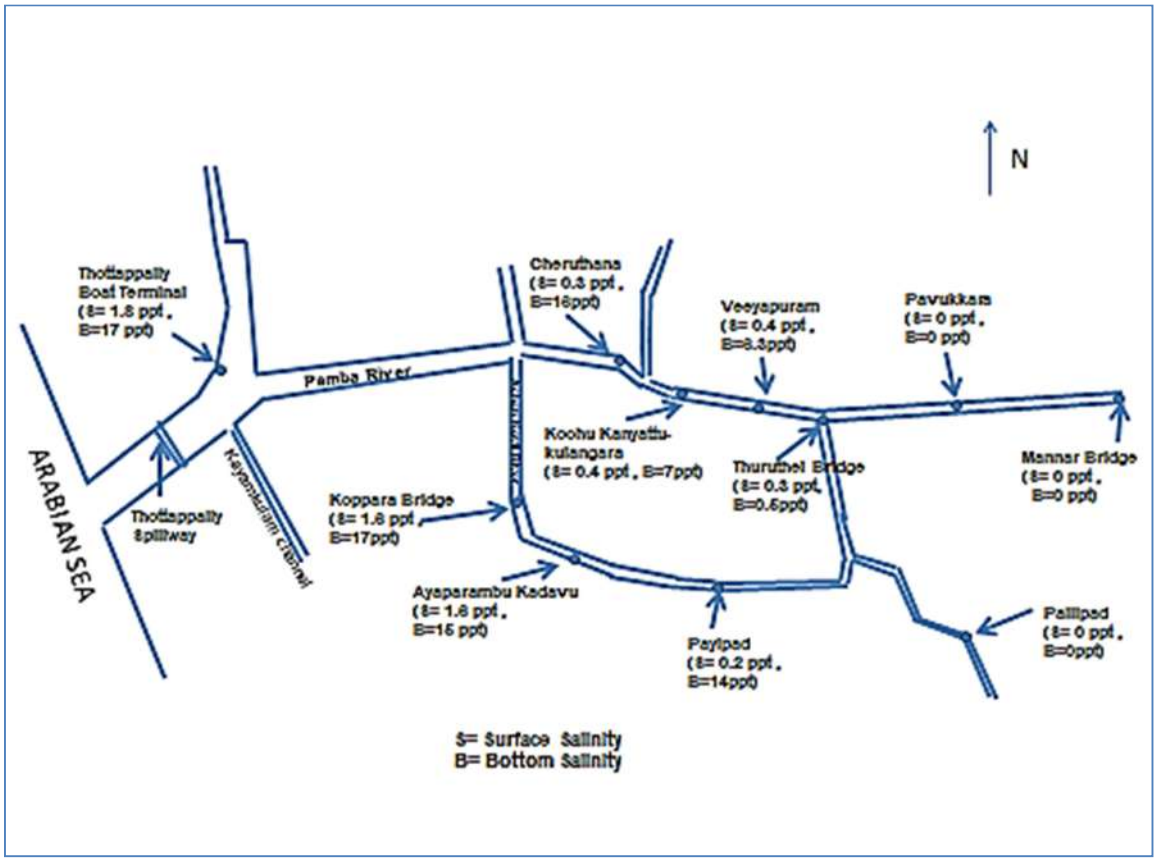


Figure -3: Schematic representation of saline water intrusion to TSW and to the Rivers Pamba & Achankovil.

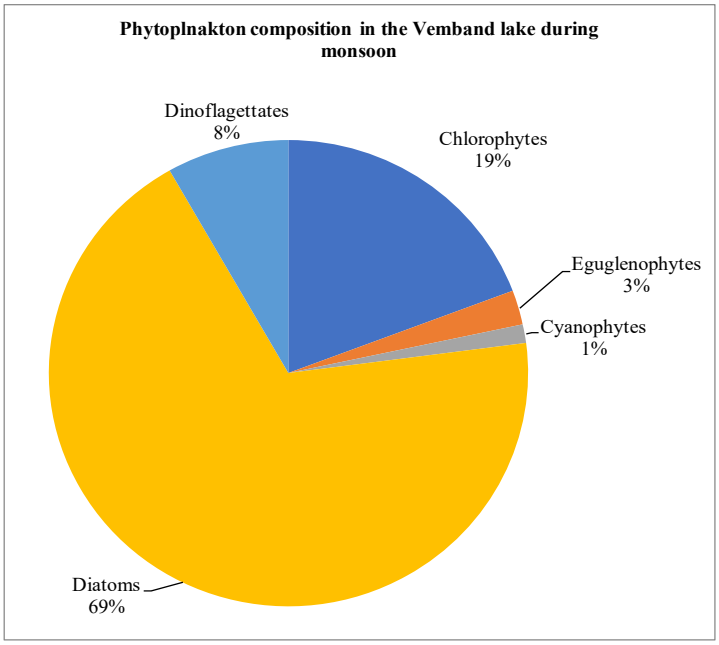


Figure -4: Percentage composition of phytoplankton groups in the Central Vembanad during the monsoon season of year 2021.

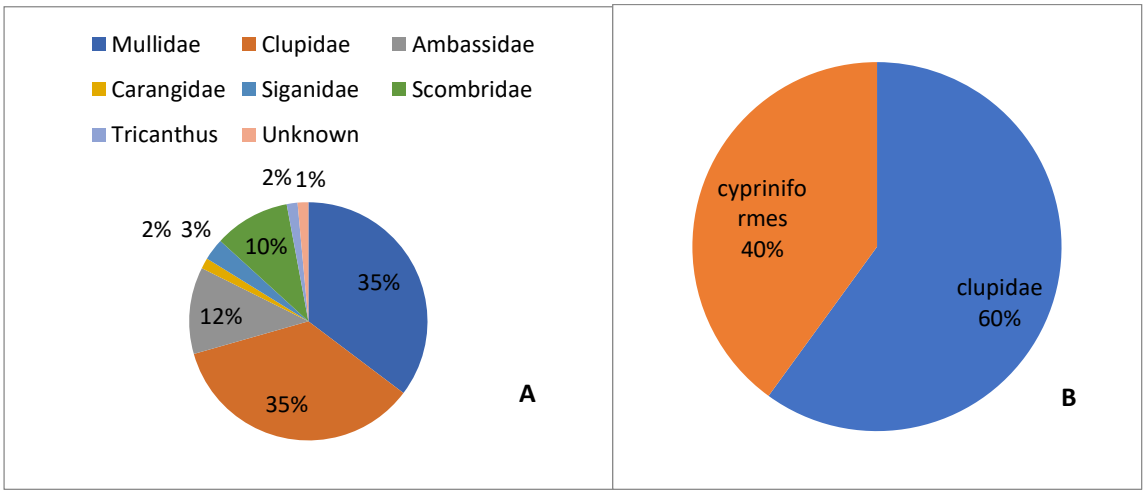


Figure -5: Percentage composition of fish larval groups in CVL during (A) pre-monsoon and (B) monsoon season of 2021.

Figure -6: Larvae of Ambassidae (b) Carangidae, (c) Clupeidae and (d) Syngnathidae from CVL.

1. **Microcosm experiments: impact of microplastics and pollution on the food - web of Vembanad and territorial waters of Kerala**

PI **:** Dr. Pramila S.

Project staffs : Anju KV

The environmental crises caused due to anthropogenic reasons are among the chief factors contributing to decline of coastal biodiversity. Influence of selected environmental stressors on the behaviour and physiology of commercially important species of finfish and shellfish and the possible ways in which these could impact the growth, biology and diversity was investigated in this project component under CARMC. Specifically, the emerging issue of microplastic pollution in the coastal ecosystems was focused, impacts of which are hitherto not understood precisely. Considering these, CARMC has identified establishment of an experimental microcosm facility as one of the components for gaining better insights into this issue. During the plan period the following activities were undertaken.

1. Establishment of the experimental facility by renovation of rooms (civil works), fabrication of glass tanks, supporting racks, blower, filter and other accessories.

2. Purchase of equipments, and consumables.

3.During the year 2021-22, investigation of microplastic contamination of black clam, *Villorita cyprinoids* from Southern part of Vembanad Lake analysis was completed. The microplastics extracted were recorded by observation and measurement under microscope. Microplastics recovered from black clam tissue samples from the southern sector of Vembanad lake, ranged in size from 40 microns to 3.1 mm. They were predominantly fibre (86.6%) type and film (13.3%) types and were coloured black (40%), blue (20%), red (13.3%), green (13.3%), and transparent (13.3%). Concentration of microplastics in clams collected from southern sector of Vembanad ranged from 0.15g to 0.25 g/ gram tissue.

4.Work on micro plastic contamination of black clam *Villorita cyprinoides* in the central Vembanad Lake has also been completed. Samples from six out 12 stations were found to show the presence of microplastics. They were also predominantly fibre type and were coloured red (46.6%) blue (33.3%), black (20%). Plastic particles ranging in size from 496

microns to 4.08 mm (microplastics) and bigger particles upto 26000 microns were extracted from the animals. Their concentration in tissues ranged from 0.142 g to 0.9 g/gram sample.

5. Based observations made in previous years and from the current years outcomes, it was established that bivalves can be used as environmental sentinel organisms or bioindicators of microplastic pollution.

6. Combined effect of water temperature and salinity on growth and survival of juvenile cyprinid fish *Systomussarana* (one of the indigenous species identified for ranching programme of KUFOS at Idamalayar reservoir) was conducted and it was found that the optimum temperature for growth of juvenile *S. sarana* was 28^0C and optimum salinity was 10 ppt.

7. The invasive mussel *Mytellastrigata* from Vembanad lake was found to ingest microplastics. In the preliminary studies it was evident that the concentration of microplastics in the invasive mussel tissue far exceeded the values reported from black clam (i) green mussel (*Pernaviridis*)and brown mussesl (*Pernaperna)* during previous years of the plan period.

Microplastic particles extracted from black clams collected from Vembanad

Experimental set up for combined effect of water temperature and salinity on growth and survival of juvenile cyprinid fish *Systomus sarana*

2. Mapping of Clam Beds of Vembanad Wetland Ecosystem

PI **:** Dr. Jayalakshmi K J

Project staff **:** Amrutha K S

The major objective of the project is to generate distribution maps of clam beds along the Vembanad wetland System. In order to achieve the objective seasonal sampling (monsoon and non-monsoon) were carried out in the southern Vembanad Lake (SVL) and Central Vembanad Lake (CVL). The abundance map of black clam were generated for CVL (monsoon and non-monsoon) and SVL (monsoon). The map shows the seasonal pattern of distribution of black clam. In the CVL irrespective of monsoon and non-monsoon the higher abundance recorded around the Perumbalam island. In the SVL the abundance showed an increasing trend from the south to the north.

3. Enumeration of Microbial Loop of Central Vembanad Lake

PI **:** Dr. V. P. Limna Mol

Project staff **:** Shireen P Mohammed

Microzooplankton are the pivotal regenerators of nutrients which fuel primary production and food sources for metazoans (Calbet 2008). They play an important in the microbial food web of the system. Similarly, microphytobenthos are found to be the dominant flora in the littoral zone, estuaries, and other shallow aquatic ecosystems and play an integral role in contributing to the productivity of shallow marine ecosystem. They also have a major role in the trophic structure of mangrove forest and its biogeochemistry. The present study intends to assess the extent of anthropogenic pressure on the microbial loop of Vembanad lake, and thereby determine the present trophic status of the lake. Enumeration of microzooplankton and microphytobenthos were carried out from samples collected from 69 stations of pre-summer monsoon and summer monsoon season. Five categories of organisms were observed during the study viz: ciliates, heterotrophic dinoflagellates, foraminiferans, rotifers and crustacean larva. During pre-monsoon season, ciliates (tintinnids) were observed to be the dominant organism followed by crustacean larvae and heterotrophic dinoflagellates. Among ciliates, tintinnids (loricate ciliates) dominated the study area, showing more abundance to the genus *Tintinnopsis*. *Tintinnopsis gracilis*, *Tintinnopsis beroidea*, *Tintinnopsis tubulosa* and *Tintinnopsis uruguayensis* were the most common species found during almost all the stations of the study. During summer monsoon season, rotifers dominated the community. Abundance of microzooplankton was markedly higher in summer monsoon compared to the pre-summer monsoon. This is due to high increase in the number of rotifers in summer monsoon. The abundance of tintinnids was higher during pre-summer monsoon compared to

summer monsoon. *Lecane inermis* belonging to the family Lecanidae are the abundant organism observed during the study. Pennate diatoms dominated the microphytobenthos community, with more dominance for raphid pennate diatoms. *Synedra robusta*, *Pleurosigma* sp, *Gyrosigma* sp, *Pinnularia* sp, *Nitzschia* sp, *Navicula* sp, *Amphora* sp, *Coscinodiscus wailessi*, *Cyclotella* sp, *Triceratium* sp were the dominant organism found during the study. Dominance of ciliates in the pre-monsoon study is related to the availability of mineral particles to construct the lorica, in addition to the presence of their preferred food. The genus *Tintinnopsis* is generally restricted to the estuarine system because of their requirement of mineral flakes to construct their lorica. During monsoon, the increased freshwater influx reduced the salinity which causes an increase in the number of rotifers. The microzooplankton plays an immense role in the microbial food web of the system. An efficient microbial loop implies a healthy productive ecosystem.

III. CENTRE OF EXCELLENCE IN FOOD PROCESSING TECHNOLOGY (CEFPT)

1. Development and physiochemical characterization of nutrient rich high protein bar using dry seeds and natural sweetener, palm jaggery

PI : Dr. Srinivasa Gopal

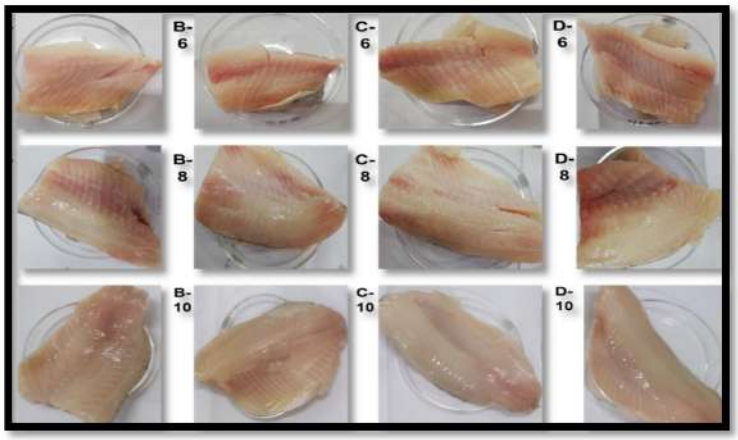
Project staffs : Ammu Dinakaran, Project Scientist
Nimisha Babu, Senior Research Fellow
Gopika P J, SRF
Divya K Vijayan, PS
Anupriya E.A, Technical Assistant

Prepared nutrient rich high protein bars using pumpkin seed, ground nut, watermelon seed, and chia seed with palm jaggery as natural sweetener. Trial and error method was used for the standardization of suitable amount of each seeds and palm jaggery required for the development of the product to obtain the best sensorial and physical characteristics. Palm

jaggery was used as sweetening agent to lower the glycemic index of the product. The protocol for the preparation of nutrient bar was standardized and storage analysis was done after vacuum packing in 50 gauge Polyester/ 315 gauge polyethylene laminate. The samples were monitored for the changes in moisture, pH, colour, texture, FFA and TBA, water activity when stored at room temperature at a regular interval of 1 week. Storage studies of the product reveals that the product can be kept for more than 8 weeks at room temperature.

Shelf-life studies of tilapia fillets coated with different concentrations of liquid smoke stored under chilled condition

The liquid smoke was prepared and concentrated using rotary flash evaporator. It was found that Liquid smoke from Coconut shell had higher polyphenol and antioxidant activity. Tilapia fillets dipped in different concentrations (0%, 10%, 20%, 30%) of liquid smoke were packed in BOPP/polyester pouches. Storage studies of tilapia fillets were carried out which includes analysis of texture, color, pH, TBA, FFA and expressible water for 18 days of storage under chilled condition(0 to 4°C). Sensory evaluation was also carried out. The control samples stored at chilled conditions had a shelf life of only 6 days. Shelf life extension of 15 days was observed in the case of liquid smoke coated samples stored in the same conditions.

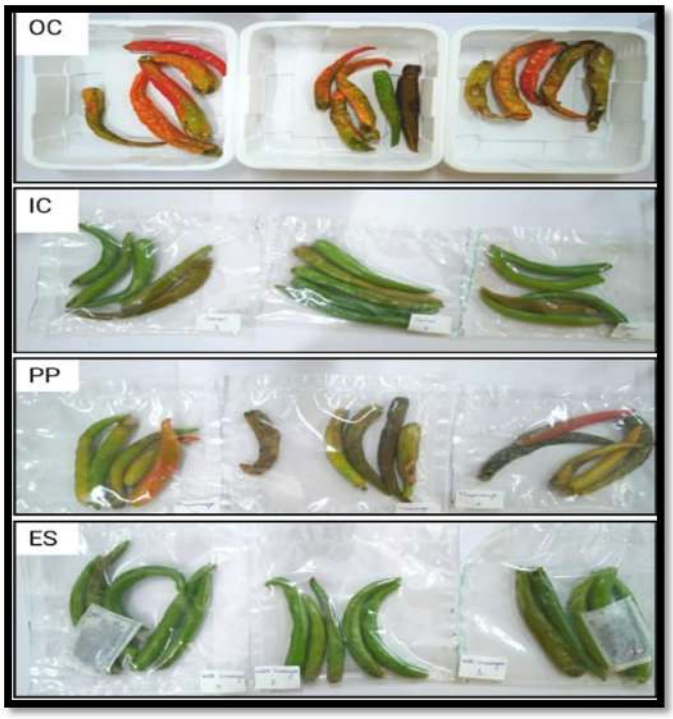


Studies on the effect of Active packaging on post-harvest shelf life of green chillies

The effect of active packaging on the post-harvest shelf life of green chillies was studied using ethylene scavengers. The chilies were packed in polyethylene pouches containing ethylene scavengers for the study. The scavengers used were Potassium permanganate and silica gel in the ratio 1:1 packed in non-woven polypropylene sachet. A comparative study on the changes in physicochemical characteristics of green chilly when packed in different modes were carried out. The different form adopted were as follows:

1) control samples kept at room temperature (without any packaging material),
2) Samples packed in 238 Gauge polyethylene pouches,
3) Prepackaging (samples packed in polyethylene pouches having 4 holes of 4 mm diameter each)
4) Samples packed in polyethylene pouches having ethylene scavengers (active packaging).

An extension of 10 days in the shelf life of sample 4 was observed when compared with that of control samples (sample 1), both stored at room temperature 27±2°C. The changes were observed in terms of physiological loss in weight, firmness, skin color, ascorbic acid, titratable acidity and total soluble solids, Capsaicin, chlorophyll, carotenoids, antioxidant activity and total polyphenol content.



Development of ready to eat tapioca puzhukku

Developed Ready to eat tapioca puzhukku in see through retort pouch using water immersion retort. The product was commercially sterile after processing to an F_0 value of 8minutes. It can be stored at room temperature without any refrigeration and added preservatives.

2. Development of functional bio-based seaweed edible films for potential food applications & shelf-life extension of fishery products

PI **:** Dr Radhika Rajasree S R

Project staff **:** Roopa Rajan, Junior Research Fellow

The present study aims to explore the utilization of available seaweed species and their extracts for successful development of functional food packaging material. As part of the study, seaweed sampling had done across the coastal regions of Kerala and collected different macroalgal varieties including green seaweeds like *Ulvareticulata, Ulvalacuta, Halimeda macroloba, Caulerpa racemosa, Chaetomorpha antennae*, red seaweeds like *Gracilaria crassa, Gracilaria edulis, Gracilaria corticata* and brown seaweeds like *Lobophora variegate, Sargassum sp., Dictyota dichotoma, Hypnea musciformis, Dictyopteris delicatula* etc. Ethanolic extracts of *Gracilaria crassa* and *Halimeda macroloba* were prepared and characterized based on yield calculation, biochemical composition, CHNS, H-NMR analysis and GC-MS profiling which enabled to identify the presence of bioactive compounds present in both extracts. Green synthesis of silver nanoparticle (AgNPs) had done with *Gracilaria crassa* extract and 1mM AgNO3 solution. The synthesis of AgNPs were confirmed with UV absorption spectrum (absorbance at 429nm) and the functional characterization and structural evaluation were done through FTIR and SEM analysis. The ethanolic extracts of *G. crassa* and *H. macroloba* were further utilized to develop films in combination with 2% chitosan solution and green synthesized AgNPs with Glycerol as the plasticizer. The developed films were subjected to physical property testing (Colour, Thickness), mechanical stability (Tensile strength, Elongation at break), Structural and morphological observation (SEM and FTIR), thermal properties (TGA), water vapor transmission rate (WVTR) and antioxidative measurements through DPPH and Total phenolic content. Effectiveness of developed films as packaging material were analysed by wrapping shrimp nuggets with films followed by shelf-life analysis done at refrigerated conditions at 4°C for 9 days. The biochemical evaluation of wrapped shrimp nuggets was done through pH, PV, TMA, TVB-N and FFA analysis, microbial quality estimated by Total plate count measurement and carried out sensorial analysis by 9-point hedonic scale method. The results shown that the films could be effectively used for storing battered and breaded products under chilled conditions for up to 7 days with lesser oxidative degradation and microbial loads. Extraction of semi-refined carrageenan (SRC) were done from *G. crassa* and *G. edulis* followed by standard protocol and subjected to yield, proximate, CHNS and NMR profiling. Standardized film preparation with SRC from *G. crassa* and 1% chitosan at different combinations with glycerol as plasticizer. The developed films were subjected to colour analysis, thickness measurement,

water sorption kinetics, oil permeability test, opacity measurement, mechanical stability, FTIR and antioxidative analysis by DPPH and Total phenolic content. Ready-to-cook and fried cutlets were sealed in *G. crassa*- chitosan based films and were subjected to shelf-life analysis upon storage in refrigerated temperature (4°C). The films were stable throughout the storage period and were able to resist the lipid degradation for upto 5 days. Prepared films with SRC from *G. edulis* at different concentrations (2 and 4%) and compared with 1% chitosan film for physical properties. Extracted ulvan polysaccharide from *U. reticulata* and developed film in combination with sodium alginate and determined its physical, spectral and thermal characteristics. Also completed the extraction of sulphated polysaccharides from the green seaweed *U. lacuta* and subjected to film formation in combination with 1.5% sodium alginate.

Sample collection- Collection of different red, brown and green seaweeds from the coastal parts of Kerala

Ulva lacuta

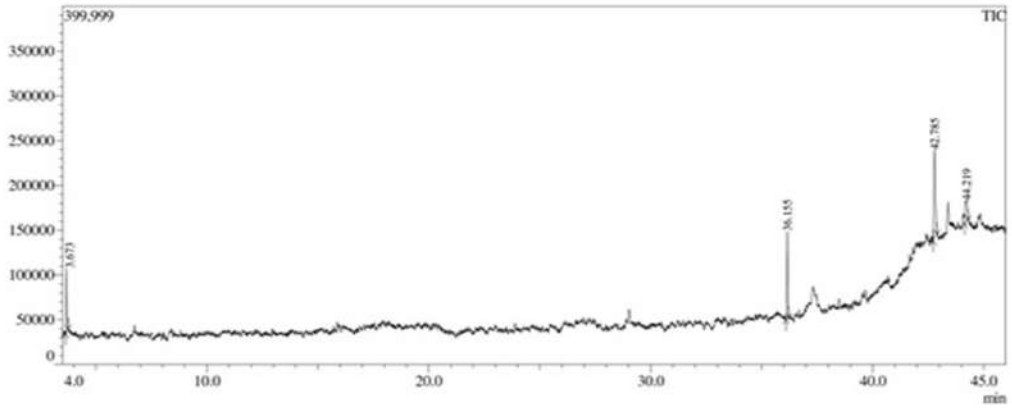
Sargassam sp.

Ulva lacuta

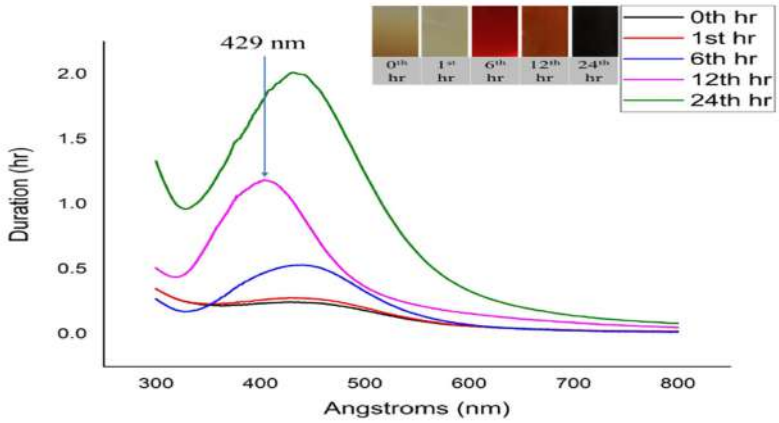
Chaetomorpha antennae

Gracilaria crassa

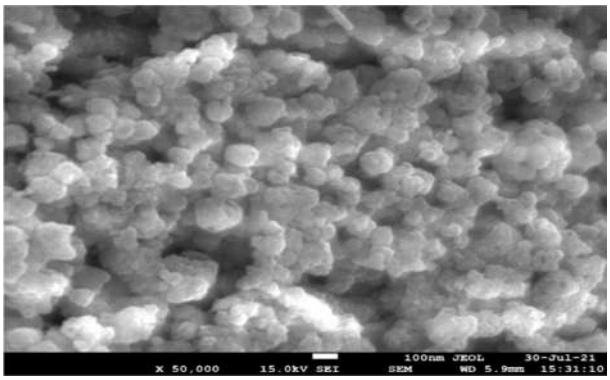
GC-MS profile of *Gracilaria crassa* extract



UV absorption spectrum of green synthesized AgNPs



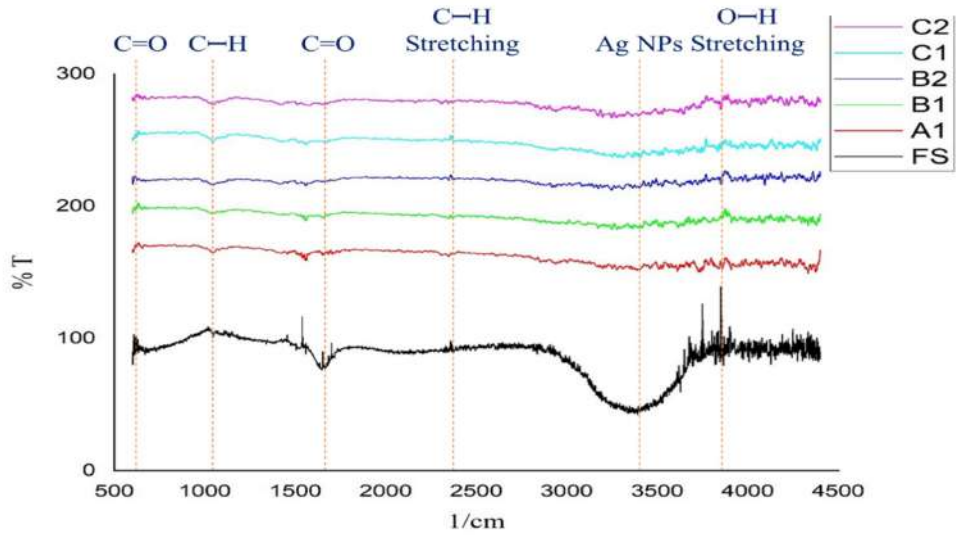
SEM micrograph of silver nanoparticles



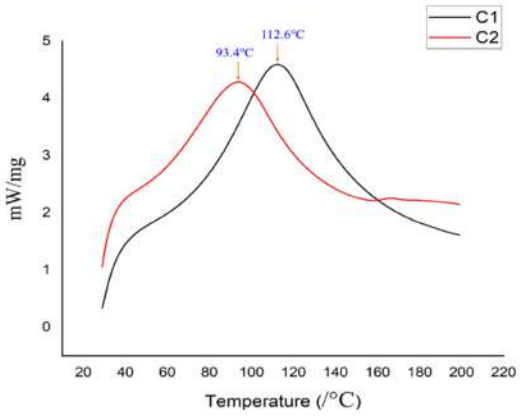
Films prepared with ethanolic extract of *Gracilaria crassa* with chitosan and silver nanoparticle

Films prepared with ethanolic extract of *Halimeda macroloba* with chitosan and silver nanoparticle

FTIR spectrum of films prepared with ethanolic extract of *Gracilaria crassa* and *Halimedama croloba* with chitosan and silver nanoparticle [FS: Chitosan film, A1: Chitosan AgNPs film, B1: *G. crassa*-Chitosan film, B2: *H. macroloba*-chitosan film, C1: *G. crassa*-chitosan/AgNPs film, C2: *H. macroloba*-chitosan/AgNPs film]



DSC image of films prepared with ethanolic extract of *Gracilaria crassa* and *Halimeda macroloba* with chitosan and silver nanoparticle [C1: *G. crassa*- chitosan/AgNPs film, C2: *H. macroloba*-chitosan/AgNPs film]

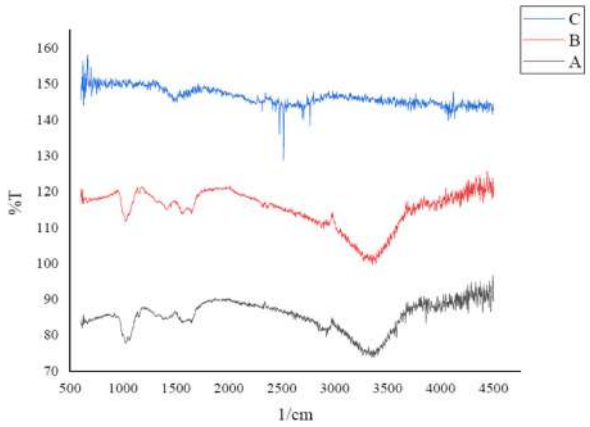


Shrimp nuggets wrapped in film prepared with ethanolic extract of *Gracilaria crassa* with chitosan and silver nanoparticle

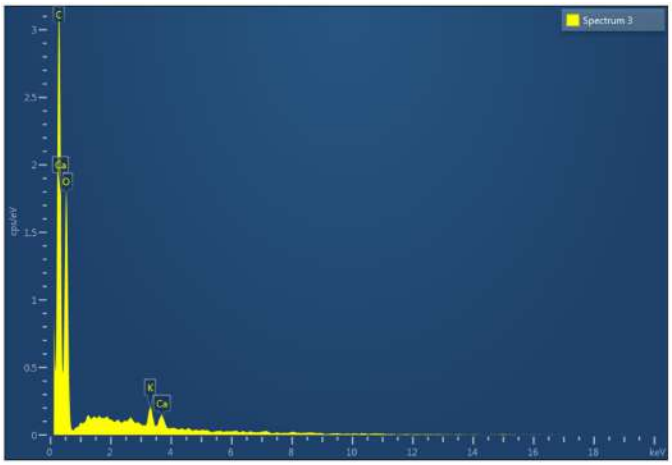
Films prepared with semi refined carrageenan from *Gracilaria crassa* and *Gracilaria edulis* with chitosan

FTIR image of *Gracilaria crassa*-chitosan film

[A: Chitosan film, B: *G. crassa and chitosan* (1:1), C: *G. crassa* and chitosan (1:4)]



SEM-EDAX of SRC film



Ready-to-cook and fried cutlets packed in *Gracilara crassa* – chitosan film

Ulvan- sodium alginate-based film

3. Development of multiplex PCR for the detection of virulent factors in Enterohemorrhagic E. coli (EHEC) from seafood

PI : Dr. Safeena M.P

Project staff : Preenanka R, Senior Research Fellow

1. Uniplex PCR and Multiplex PCR for the amplification of six virulent genes of *E. coli* O157:H7 was standardized.

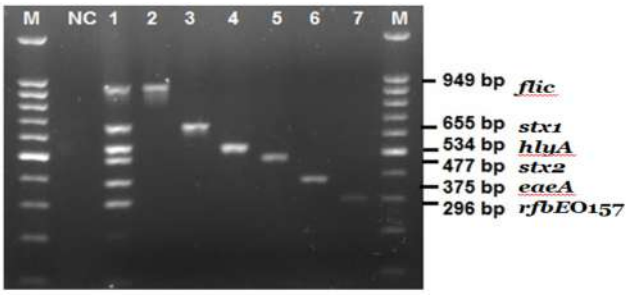


Fig. 1: Gel image for uniplex (Lane 2- 7) and multiplex PCR (Lane 1).

2. Multiplex PCR protocol developed in this study was found to be very specific and sensitive to detect only *E. coli* O157:H7 among other non-targeted pathogen *viz. Listeria monocytogenes*, *Vibrio parahemolyticus*, *Edwardsiella tarda* and Fish spoilage bacteria - *Pseudomonas aeruginosa* (Fig. 2) with a detection sensitivity limit of 120pg/µl DNA (Fig.3).

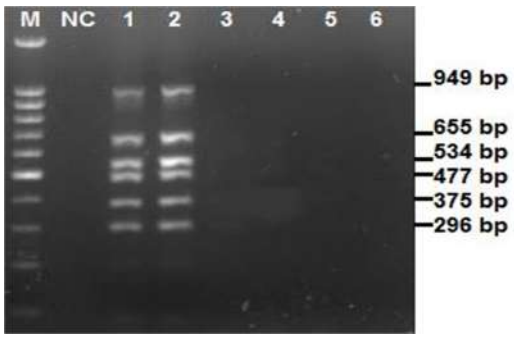


Fig. 2: Gel image showing specificity of multiplex PCR, Lane 1: template DNA in multiplex PCR is the mixture of DNA from non-targeted pathogen and *E. coli* O157:H7, Lane 2: Template DNA of *E. coli* O157:H7, Lane 3-6: Template DNA of non-targeted pathogens

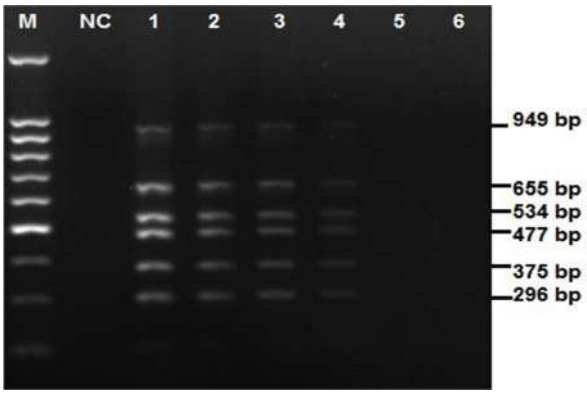


Fig. 3: Gel image showing sensitivity of multiplex PCR, Lane 1: 120 ng/µl DNA as template, Lane 2: 12 ng/µl, Lane 3: 1.2 ng/µl, Lane 4: 120 pg/µl, Lane 5: 12 pg/µl and Lane 6: 1.2 pg/µl

3. The sensitivity of the Multiplex PCR protocol to detect the *E coli* O157:H7 was found to be 2 CFU/ml in fresh seafood by spiked study (Fig. 4).

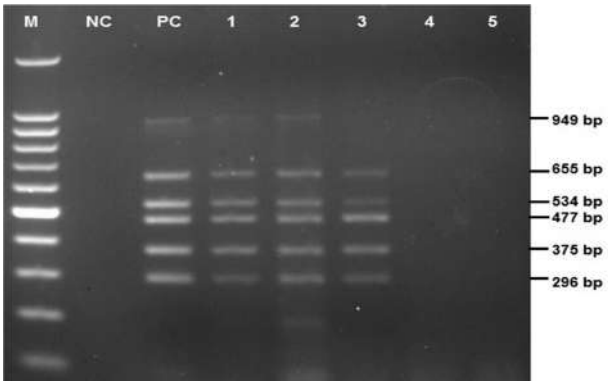


Fig 4: Gel image showing sensitivity of the spiked study, Lane 1: 310 CFU, Lane 2: 36 CFU, Lane 3: 2 CFU and Lane 4, 5: 0 CFU/25g seafood sample

4. Final validation of the developed multiplex PCR using various seafood samples

Among the 124 seafood samples and 20 poultry samples processed, no any samples got positive for *E. coli* O157:H7. Routine monitoring of the seafood is in process to screen out the presence of *E. coli* O157:H7 using the multiplex PCR protocol developed in this study.

4. Standardization and development of fortified and nutritious fish noodles and pasta for fighting malnutrition

PI **:** Dr. Blossom K L

Project staff **:** Jisto Mathew, Junior Research Fellow

Extruded food products are highly popular because of the convenience they have. Though they have huge demand, they are high in carbohydrate and do not provide much health benefits for consumers and overconsumption can lead to overweight, diabetes etc. Moreover, sometimes additives are also added in most of the noodles and pasta available in the market. In this backdrop, enriching or fortifying noodles and pasta with fish is inevitable and hence in the study, noodles and pasta were developed using wheat flour and 30 % fish (*Oreochromis niloticus*) with no added preservatives. A protein content of 14% and a shelf life of 3 months was found for the product. Apart from the development of noodles and pasta, some preliminary work was also conducted on the new project entitled" Shelf life evaluation of rice flour fortified with calcium extracted from fish bone collected from various processing plants'. Bones of yellow fin tuna, tilapia, pink perch and white snapper were collected and calcium was extracted using standard method (Kettawan et al, 2003). The calcium content of the bones were found out using flamephotometric method and tuna bones exhibited the highest calcium content (24.44%) and hence can be suggested for fortification.

Fish noodles and pasta

5. Development of value-added products from farmed Basa (Pangasius sp.) and conversion of processing waste into low-cost fish feed

PI : Dr. Abhilash Sasidharan

Project staff : Fathimath Shamna Fathima, Junior Research Fellow

Ready to transfer technologies developed

1. Kerala style Ready to Eat (RTE) Red Chilly Tilapia curry in retort pouches.
2. Cassava starch based edible packaging for fish soup.

IV. CENTRE FOR BIOACTIVE SUBSTANCES FROM MARINE ORGANISMS (CBSMO)

PI : Dr. Nevin KG, Assistant Professor, FOST

Co-PI : Dr. K Manjusha, Assistant Professor, FOST

Project staffs : Neema Job

Ashly Augustine

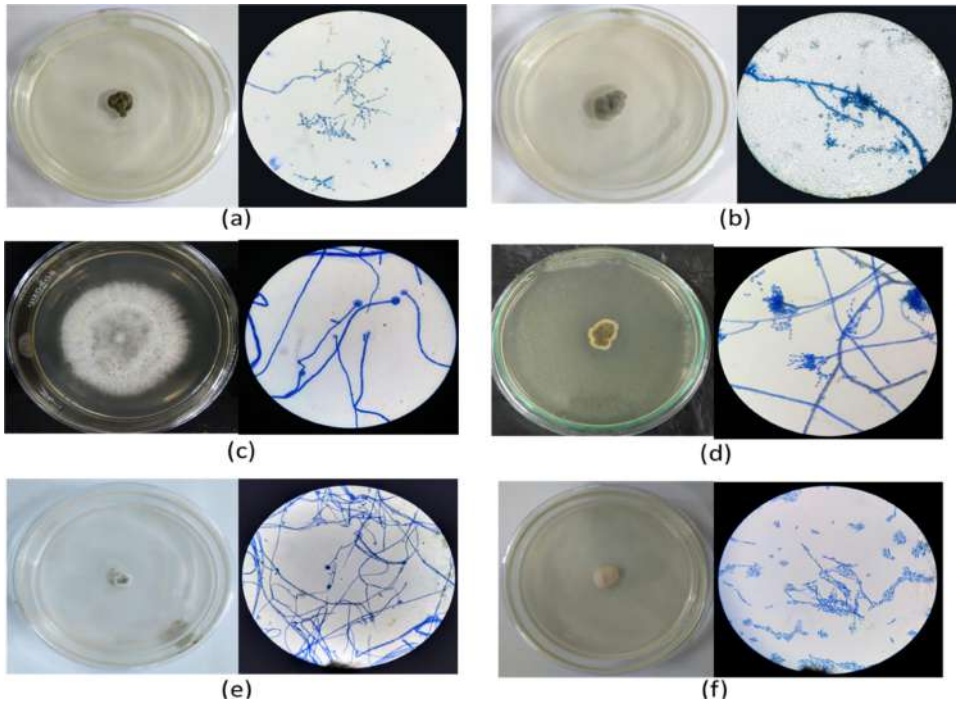
A wide array of biologically active compounds with varying degrees of action, such as anti-tumor, anti-cancer, anti-microtubule, anti-proliferative, cytotoxic, photoprotective, as well as antibiotic and antifouling properties, have been isolated to date from marine sources. Therefore, a search for novel metabolites is important as they are perceived to have minimal health risks to consumers. For the present investigation, we have collected marine sponges (alkaloid extraction), seaweeds, mangroves, and associated sediment samples for the isolation of endophytic fungi, and actinomycetes to extract and characterize their potential bioactive products.

1. Isolation and Characterization of Novel L--Asparaginase with Low Glutaminase Activity from Mangrove endophytic fungus and *in vitro* evaluation of its anticancer property

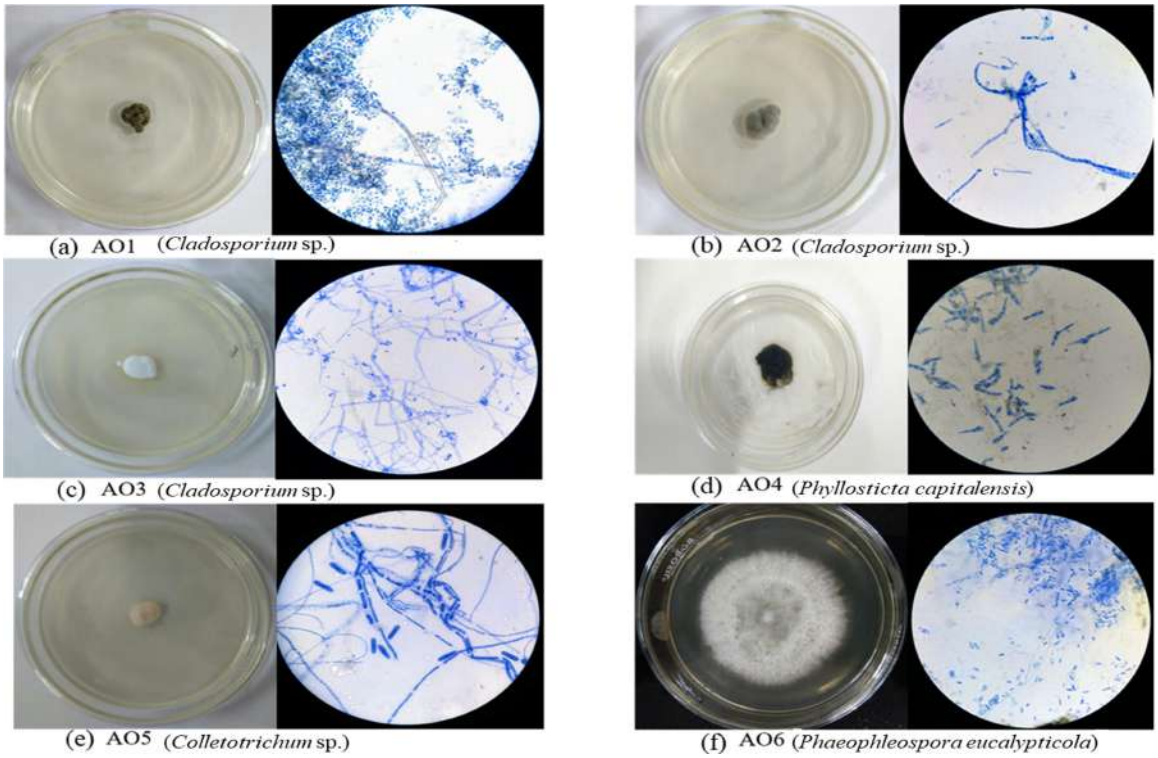
Endophytic fungi were isolated from *Rhizophora mucronata* and *Avicennia officinalis*. The leaf samples were thoroughly washed with running tap water to remove mud and debris before rinsing with sterile distilled water. All the sample surfaces were sterilized by immersing in 70% ethanol for 30 seconds followed by 4% sodium hypochlorite for 90 seconds and finally rinsed three times with sterile distilled water (Filip et al., 2003). The leaf samples were aseptically cut into small pieces of approximately (0.5x0.5) cm, blot dried, and plated onto PDA plates. The effectiveness of the surface sterilization was confirmed by making imprints of disinfected plant fragments on PDA plates. The absence of epiphytes indicates that the leaf surface was sterile. For taxonomic identification, Microscopic and macroscopic analysis of the samples was performed. The pure fungal isolates were analyzed on their morphological features like pigmentation, texture, elevation, and margin. Microscopic analysis was carried out using a Lactophenol cotton blue stain. Features like characteristics of hyphae and spores, types of spores, and features of conidia were observed

and recorded. For molecular characterization, DNA isolation of each fungal isolate that emerged from the samples was completed using the salting-out method. PCR amplification has to be done using ITS1 and ITS4 primers. Screening of endophytic fungi, for glutaminase-free L-asparaginase production, has to be tested. Further quantitative estimation and anticancer potential evaluations are the next milestones to be achieved.

Host mangrove *Rhizophora mucronata* and *Avicennia officinalis*



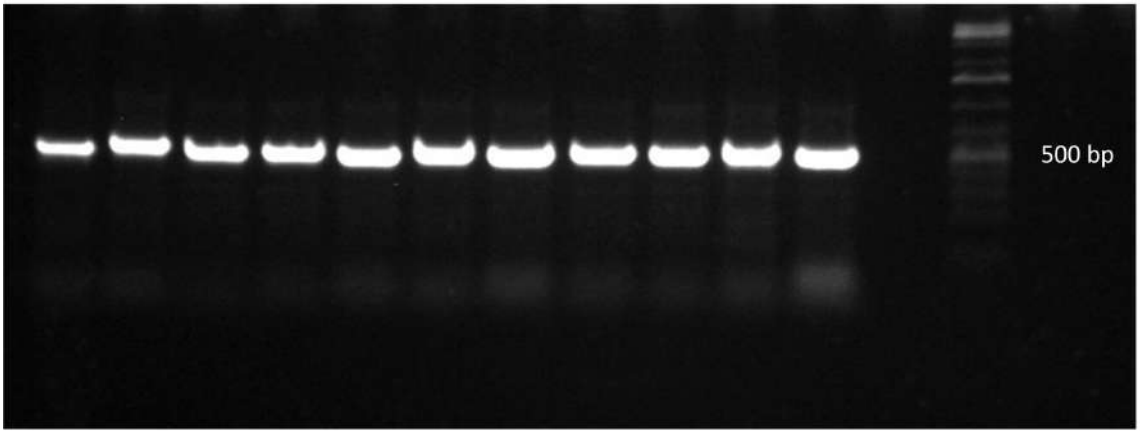
Macroscopic and Microscopic view of selected fungal isolates from Rhizophora mucronate (a) RM1A (*Cladosporium sp.*), (b) RM1B (*Cladosporium sp.)*, (c) RM2 (*Fusarium* sp.), d) RM4 (*Cladosporium sp.),* (e) RM3 (*Allophoma* sp.) and (f) RM6 (*Phaeophleospora eucalypticola*).



Macroscopic and Microscopic view of selected fungal isolates from *Avicennia officinalis* (a)AO1 (*Cladosporium sp.*), (b) AO2 (*Cladosporium sp.)*, (c) AO3 (*Fusarium* sp.), d) AO4 (*Cladosporium sp.),* (e) AO5 (*Allophoma* sp.) and (f) AO6 (*Phaeophleospora eucalypticola*).

DNA sequencing and sequence analysis

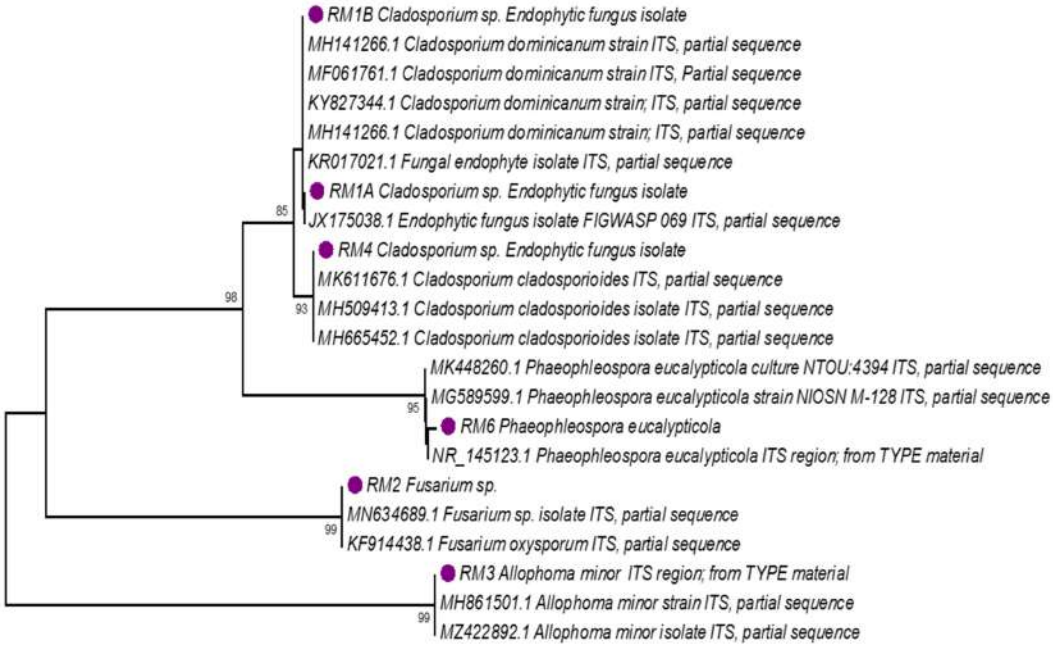
The ITS sequences were sequenced at SciGenom (Cochin, India). Before DNA sequencing, PCR amplicons were purified using appropriate purification kits (ExoSAP-IT, USB, USA) as per the manufacturer's guidelines. The sequencing was carried out employing an ABI prism model 3700 Big Dye Sequencer (Applied Biosystems, USA) at SciGenom, Kochi, India. The nucleotide sequence obtained were assembled via Gene Tool Software and the sequences were compared with those in the GenBank database using the Basic Local Alignment Search Tool (BLAST) algorithm (Altschul et al. 1990) at the National Centre for Biotechnology Information (NCBI), USA (www.ncbi.nlm.nih.gov) and CBS- KNAW Fungal Biodiversity Centre, Academy of Arts and Sciences, Netherlands (www.cbs.knaw.nl/databases).



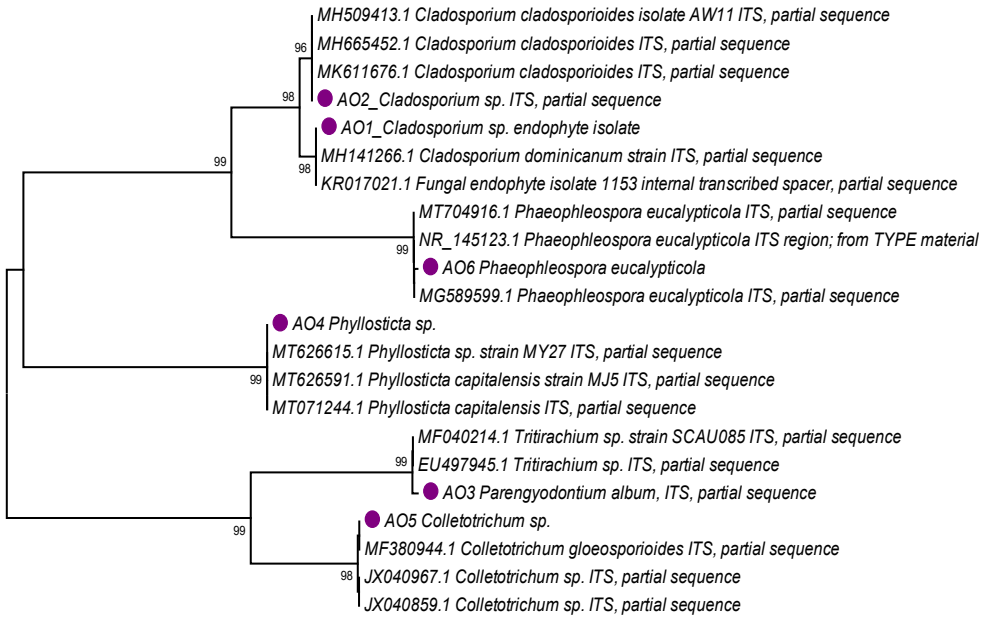
The ITS rRNA gene amplicons of approximately 550bp

Phylogenetic Analysis

ITS sequences of the endophytic isolates and homologous reference sequences were obtained from the NCBI database were aligned using ClustalW (Thompson et al. 1994) with standard parameters and the phylogenetic tree was constructed. Phylogenetic analysis was carried out using MEGA 6.06 (Molecular Evolutionary Genetics Analysis) software (Tamura et al. 2013). A phylogenetic tree was constructed with Neighbour-Joining (NJ) method using Kimura 2- state parameter and the branches of the resultant tree were evaluated by performing bootstrap analysis based on 1000 replicates (Felsenstein 1985).



Neighbour joining phylogenetic tree based on partial sequence of ITS, showing fungal endophytes from *Rhizophora mucronata*



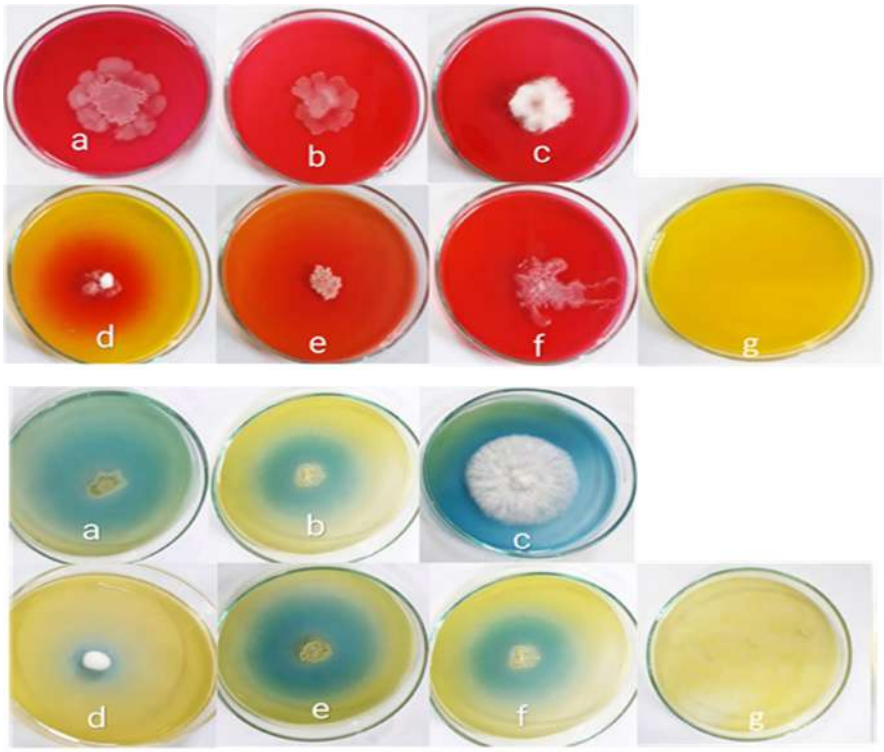
Neighbour joining phylogenetic tree based on partial sequence of ITS, showing fungal endophytes from *Avicennia officinalis*

Screening for L-asparaginase production

The primary analysis of the samples was done using Modified Czapek Dox (MCD) medium using phenol red as an indicator. About 2.5% (w/v) stock solution of the phenol red dye was prepared and the MCD medium was supplemented with 0.009% phenol red dye. The prepared media was autoclaved and poured into sterilized plates (Ashok et al., 2019). Semi-quantitative results were further verified using bromothymol blue (BTB). For this, 0.04% (w/v) of the stock solution of the bromothymol blue dye was prepared and 0.007% BTB dye was supplemented in an MCD medium. The colony diameter and zone diameter for all the test organisms were calculated by measuring the inner and outer diameter of the microorganisms' growth and enzyme production respectively after 96h of incubation. Plates were inoculated with fungal strains and incubated for 5 days. After 72 h of incubation at 26±1°C, the appearance of a pink zone (phenol red)/blue (bromothymol blue) around the fungal colony in an otherwise yellow medium indicated L-asparaginase activity (Gulati et al., 1997).

Quantitative estimation of glutaminase free L-asparaginase was done by Nesslerization in which the rate of hydrolysis of asparagine was determined by measuring released ammonia (Wriston et al., 1963). The amount of ammonia liberated was calculated using the ammonium (ammonium sulfate) standard curve. One international unit (IU) of L-asparaginase is the

amount of enzyme needed to liberate one micromole of ammonia in one minute at 27˚C (Imada et al., 1973).



MCD Plate on Phenol red and Bromo thymol blue indicator

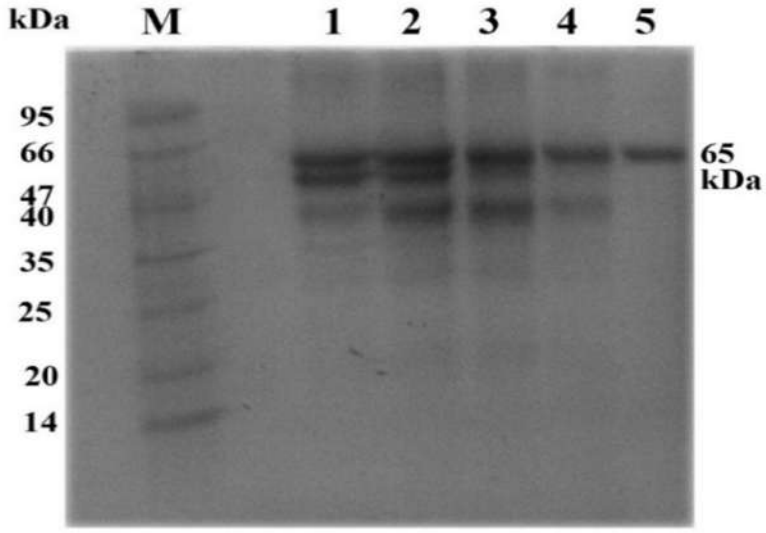
a) *Phoma* sp. b) *Cladosporium* sp. c) *Phaeophleospora eucalypticola* d) *Fusarium* sp. e) *Phyllosticta* sp. f) *Colletotrichum* sp. g) Control plates

Purification of Enzymes

All purification steps were carried out at 4 °C using crude enzyme extract. The extracellular crude enzyme was prepared at the end of the fermentation period by centrifugation at 11,000 × g for 30 min. The cell-free supernatant was used as the crude enzyme preparation. Finely powdered ammonium sulfate was slowly added to the clear supernatant obtained after centrifugation to reach 45% saturation and incubated overnight. The precipitate was collected by centrifugation at 11000 × g for 30 min, while the supernatant was brought to 55–85% saturation with ammonium sulfate. Then the precipitates were collected separately by centrifugation, dissolved in a minimal amount of 50 mM Tris-HCl buffer pH 8.4, and dialyzed overnight against the same buffer. After dialysis, the samples were used for protein

estimation and enzyme assay by the method of Lowry et al.54 and direct Nesslerization method52, respectively, and stored at 4 °C for further purification.

Further DEAE cellulose ion-exchange chromatography and Sepharose column purification are needed.



Molecular weight determination of AO 2 (*Cladosporium* Sp.)

Cloning of the L-asparaginase gene and sequence analysis

AO 2 (Cladosporium Sp.) genomic DNA was used as the template for subsequent PCR amplification. To clone the L-asparaginase gene, degenerate primers AsnDF and AsnDR (Table 1) were designed based on the conserved blocks of amino acid residues (FVVLHGTDTM and ETFGAG NAP) of known L-asparaginases using the CODEHOP (Consensus Degenerate Hybrid Oligonucleotide Primers) algorithm (http://blocks.fhcrc.org /codehop.html). A putative homologous consensus region of the L-asparaginase gene was amplified using the degenerate primers and analyzed by sequencing the PCR products. PCR conditions were as follows: a hot start at 94°C for 5 min, followed by 10 cycles of 94°C for 30 s, 60°C for 30 s, and 72°C for 1 min, with a 0.5°C decrease in annealing temperature per cycle, and then 20 cycles of 94°C for 30 s, 55°C for 30 s, and 72°C for 1 min.

2. Isolation and characterization of marine actinomycetes as a source of potent bioactive compounds

The marine environment is biologically very diverse and this rich diversity of marine environment offers the isolation of unique microorganisms, which are potential producers of novel bioactive compounds. The Discovery of such compounds derived from microbes with biomedical importance is becoming increasingly successful. Among microorganisms, actinomycetes account for about 45% of all microbial bioactive secondary metabolites. Mangrove sediment samples were collected from Kumbalam, Ernakulam. For microbiological isolation, the sediments were sub-sampled aseptically and transported to the CBSMO lab. To increase the chance of recovering the actinomycetes from the marine samples, five different media viz., Casein-Starch–Peptone- Yeast extract-Malt Extract Agar (CSPYME) Agar, Starch Casein (SCA) Agar, Starch Glycerol Inorganic Salt (SGI) Agar, Actinomycetes Isolation Agar (AIA), and Zobell Marine Agar were used for isolation purpose. The spread plate technique was employed to isolate the microorganisms and then incubated at 28ºC for 4 weeks. Isolates with characteristic colonies (tough leathery) were picked and purified by the quadrant streak method on nutrient agar plates. Gram staining was performed for all isolates and colonies with Gram-positive and fine filaments were segregated for further study.

Pure cultures of actinomycetes from mangrove sediments

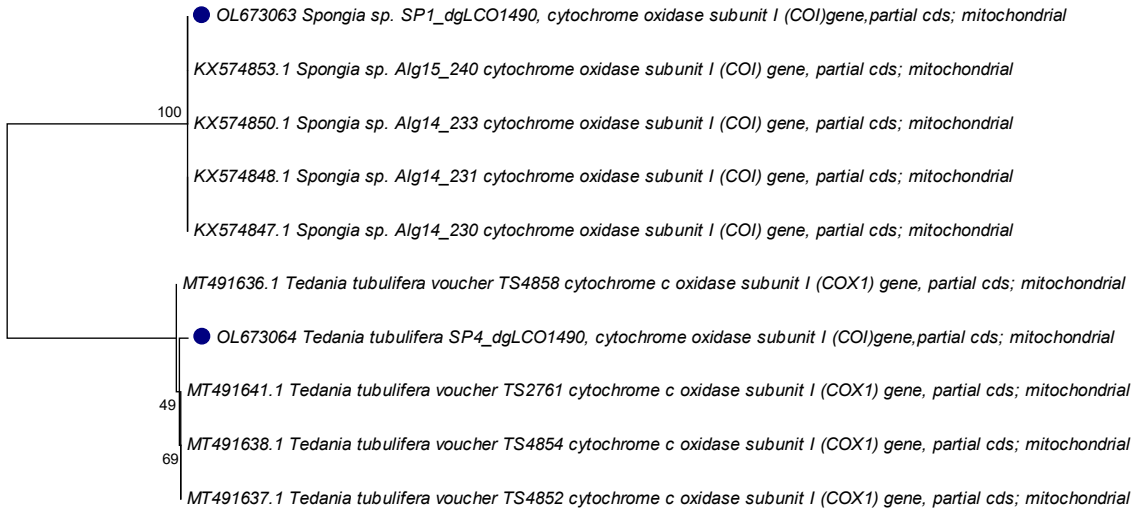
Pure isolates of actinomycetes were mass cultured for the production of secondary metabolites. Briefly, a loop full of actinomycete spores was inoculated into a seawater-based seed medium (Beef extract 3.0gL^{-1}, peptone 5.0gL^{-1}). The flasks were incubated at 20 ºC for 48 h on a rotary shaker set at 150 rpm. Subsequently, these were transferred to seawater-based fermentation medium (Yang et al. 2013) (Soybean meal 3.0gL^{-1}, Yeast Extract 3.0gL^{-1}, Proline 1.0gL^{-1}, Beef Extract 3.0gL^{-1}, Glycerol 6mL^{-1}, K2HPO4 0.5gL^{-1}, MgSO4.7H2O 0.5gL^{-1}, FeSO4.7H2O 0.5gL^{-1} CaCO3 2.0gL^{-1}, pH 7.4) and incubated at 20 ºC for 10 days on a rotary shaker at 150 rpm.

Further, at the end of fermentation, the liquid culture has to be centrifuged at 6500 x g for 5 min., and the supernatant will be extracted thrice with an equal volume of ethyl acetate (EtOAc) and the residue will be dissolved in DMSO to give a concentration of 10 mg/mL and will be used for screening for antimicrobial and cytotoxic activity. Biochemical and

molecular characterization of isolates that showed promising results have also to be performed.

3. Extraction of novel Alkaloids from Marine sponges & analysis of its bioactive potential

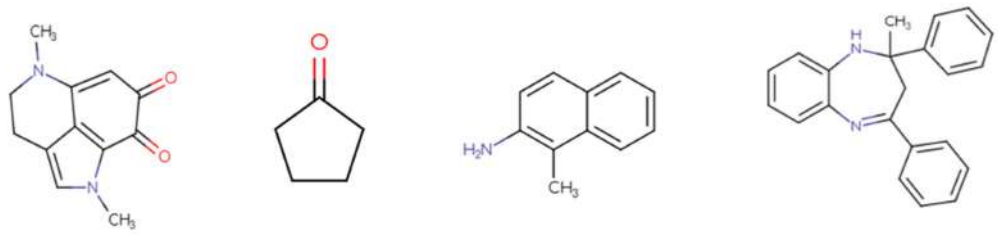
The COI locus was amplified using the universal primers LCO1490 and HCO2198 for Sponge samples SP1 and SP4. The trimmed forward sequences were aligned against the sequences in NCBI by BLAST searches. Software MEGA6.6 was used to align the sequences using ClustalW algorithm, and trim the aligned sequences to make them ready for tree construction. The alignment was exported as a MEGA format file. The Maximum Likelihood (ML) and Neighbour Joining (NJ) methods were utilized to construct the phylogenetic trees for COI mtDNA.



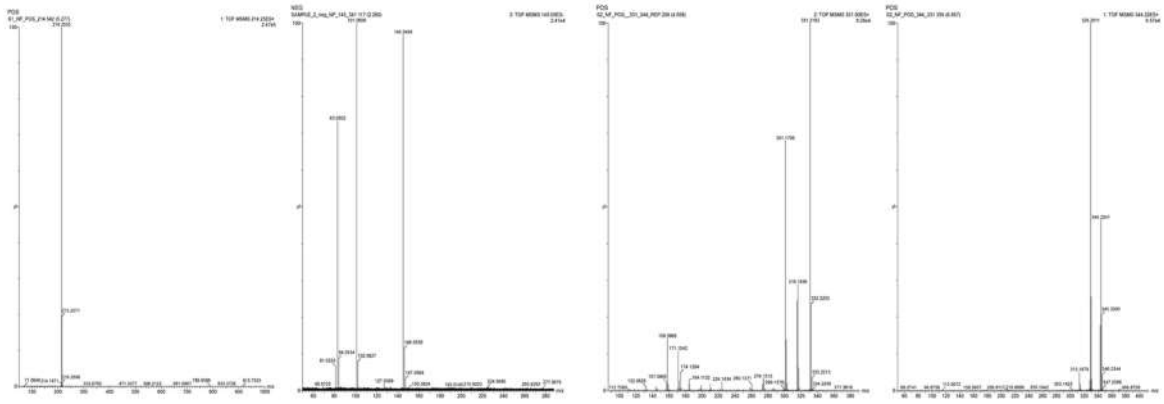
Neighbor-joining phylogenetic tree based on partial sequence of CO1, showing Marine sponge samples of Vizhinjam coast.

Samples SP1 (*Spongia* sp. GenBank Accession Number OL673063) and SP4 (*Tedania tubulifera* GenBank Accession Number OL673064) were referred for chemical characterization using Qtof LC-MS at Inter-University instrumentation center, MGU, Kottayam. Dameron A derivative with a mass of 213.2535 and molecular formula $C_{14}H_{31}N$ was derived from Fraction D of SP1 (*Spongia* sp.) Similarly from Fraction D of SP4 (*Tedania tubulifera*), 3 major compounds, Viz. Cyclopentane derivative with a mass of 83.0502 and chemical formula C_5H_8O, 2-Naphthalenamine, 1-methyl-derivative, with a mass of 158.0968 and chemical formula C11H11N and the third compound of Pyrimidine, 2-(hexahydro-4-

piperonyl-1H-1,4-diazepin-1-yl)- derivative with a mass of 313.1678 and molecular formula $C_{22}H_{20}N_2$ were identified by comparing with METLIN (Metabolite and Chemical Entity) Database, which is the largest repository of experimental tandem mass spectrometry data. Chemical structures were drawn using Chemspace software.



Damirone A | Cyclopentanone | 2-Naphthalenamine, 1-methyl- derivative | 2-methyl-2,4-diphenyl-1,3-dihydro-1,5-benzodiazepine derivative



Qtof LC-MS analysis data of SP1 and SP4 Fraction D compounds

4. Pigments from Marine Yeasts as Colour Enhancing Feed Additive for Ornamental and Shell Fishes

Skin coloration is an important feature in ornamental fishes in terms of its value. The colour of ornamental fishes when maintained in the clear waters of an aquarium gradually fades due to captive stress and lack of dietary carotenoids. Fish are incapable of synthesizing carotenoids in their body, therefore, are depending on their diet for the same. Commercially available synthetic pigments are used as feed additives but their usage is limited due to high cost and poor uptake levels and also increased awareness among consumers about the safety and environmental impacts. Due to this limitation of synthetic pigments, there is always a demand for newer natural pigment sources. Red yeasts have been identified as an ideal source as they produce large amounts of carotenoid, grow fast, and are easy to cultivate. In this study, marine yeasts isolated as part of the KSCSTE project and those isolated at KUFOS as

part of Ph.D. work were screened for pigment production. Among these 9 isolates that produced exhibited good coloration were selected after primary screening. The protocol for pigment extraction was standardized. Out of 9 red-pigmented isolates, the strains VA 242 and KU 352 were shortlisted on the basis of pigment production, biomass yield, and antioxidant activity for further study. The yeast strain VA 242 was already identified *Rhodotorulla paludigena* as part of the KSCSTE project. As the strain KU 352 was a new isolate; it was identified on a molecular basis (ITS sequence). As KU 352 was identified as *Candida albicans* it was not used for further studies. The physical parameters such pH, temperature, shaking speed, and salinity for the production of carotenoid by VA 242 were optimized using the one factor at a time method. The pH 6, temperature 28^0 C, salinity 15%, and shaking speed of 160 rpm were found to be optimum. The production of carotenoid pigment by VA 242 was carried out in YM media (production) media which yielded 118.25 µg/g of carotenoid. The carotenoid of VA 242 was extracted, purity checked by TLC, and characterized by FTIR analysis. The pigment of VA 242 was identified as β-carotene on the basis of FTIR. The antibacterial activity of the culture supernatant containing the pigment as well as the extracted β carotene from VA 242 was checked against human and fish pathogens such as *Escherichia coli, Pseudomonas* sp*., Bacillus* sp*., Salmonella* sp*., Staphylococcus* sp*., Aeromonas* sp., *Edwardsiella* sp., and *Vibrio* sp. by the disc diffusion method using acetone as control. The extracted pigment exhibited maximum antibacterial activity against pathogens such as *A. hydrophila, V. vulnificus, V. proteolyticus,* and *E. coli* whereas the culture supernatant gave maximum activity against *V. fluvialis, A. hydrophila,* and *B. cereus*. The supernatant did not exhibit any activity against *Salmonella* sp*., V. cholerae, V. parahemolyticus, V. alginolyticus, V. proteolyticus,* and *S. aureus*. As the first step to check the feasibility of applying VA 242 as color enhancing feed additive; a toxicity study was carried out on the invertebrate model organism artemia, which is also used as a live feed of ornamental fishes. From this experiment, it was found the survival rates of artemia fed with yeast VA 242 was greater than that fed with baker's yeast or even the unfed negative control. The artemia fed to 242 was also found to be colored. It is clear from this preliminary study that *Rhodotorula paludigena* is a potent mangrove isolate. Its pigment can be exploited industrially to come up with a natural eco-friendly product that can be used as color enhancing feed additive for ornamental fishes after further investigation.

Pigmented yeasts in production medium

Pigment extraction

V. EXTERNAL AIDED PROJECTS

1. Systematics, Phylogeny, Life History Traits, Distribution and Stock Assessment of Cutlass Fishes and Snake Mackerels Occurring in Indian Waters

PI : Dr. M.K Sajeevan

Project Staffs : Chitra M C, Senior research fellow, MoES Project
Eldho P S, Senior research fellow, MoES Project
Bincy M Raj, Senior research fellow, MoES Project

Funding agency : Ministry of Earth Science (MoES)

Sanctioned vide : MoES/36/OOIS/Extra/68/2018

Budget : Rs. 90,43,752/-

Duration : 4 years

Comprehensive review specifically for Trichiuroid fishes has never been attempted. Present study is an attempt for a comprehensive review of Trichiurids fishes occurring in Indian water. Proposed study may lead to discovery of new species/new record of **Trichiuroid**

fishes from Indian waters. Out of 20 species of Trichiuroids occurring in India only seven species were subjected to DNA barcoding. Present study will make an attempt to DNA barcoding of all the twenty species recorded from India Most of the studies on the fishery and biology were done on *Trichiurus lepturus* occurring in different habitats around the world. No study or less study has been carried out on the species coming under Trichiurids. A comprehensive study on the biological and fishery aspects of other Trichiuroid fishes is highly important for sustainable exploitation of these resources. Hence, present study proposes to carryout biology, fishery, age, growth and stock assessment of major Trichiuroid fishes inhabiting in Indian waters. Fishery of Trichiuroid fishes is limited to two to three coastal ribbonfishes. Deep-sea ribbonfishes, snake mackerels, snoeks, gemfishes, sackfishes, escolars and the oil fish has got the potential to become major fishery resources. Lack of knowledge on their distribution, abundance and stock structure is a major lacuna for planning the exploitation strategy and popularization of the resources. Proposed study will provide such vital information for identification and exploitation of resources.

Objectives

- To understand the systematics and interrelationships of the species.
- To understand the life history, growth, and fishery
- To study the food and feeding and reproductive biology spawning,
- To estimate the stock assessment and population dynamics of the Snake mackerels and Cutlass fishes will be including determining the sustainability of the marine fishery.

Research Progress

- Recorded nine species of cutlass fishes and six species of snake mackerel from different parts of India.
- Collected the landing data of cutlass fishes from 1950-2020 from the available resources. Information on craft gears used for the cutlass fishery of India also collected.
- Collected samples from Veravel, Nava Bhandhar, Diu, Goghla Market, Vankabara, Sassoon dock and New Ferry Wharf, Vasco De Gama, Cheruvathoor, Mapla Bay, Beypore, Ponnani, Cherthala, Chellanam, Vizhinjam, Paradwip & Digha fishing harbours.
- Samples of all fishes were collected for molecular study and DNA barcoding. DNA sequencing of following samples were done.

- Otoliths of cutlassfishes and snake mackerals were collected from fresh specimens, cleaned and air dried and also took photographs using leica stereo zoom microscope for otolith morphological studies
- The osteology of *Tentoriceps cristatus* and *Rexea bengalensis* were done and all other specimens were kept for osteological studies.
- Fish Guts were subjected to analysis for understanding the food and feeding habit of the fish.
- Fish gonads were subjected to analysis for understanding the Reproductive biology of the fish.
- Recorded length weight, sex and established length weight relationship and condition factor of Trichiuroid fishes
- Analysis of sample assessment of results, interpretation and preparation of scientific papers and reports is going on.

Labs equipment's were purchased and set up the Ageing lab at KUFOS.

2. Mycosporine-like amino acids from corals and associated dinoflagellates- their role in preventing coral bleaching -a case study of Lakshadweep archipelago

PI	**:** Dr Anu Gopinath, Assistant Professor, Dept. of AEM, FOST
Co- PI	**:** Dr. RP Sinha, Prof. and Head, Dept. of Botany, Banaras Hindu University, Varanasi Dr. Idrees Babu KK, Scientist, Department of Science and Technology, Kavaratti Dr. Phiros Shah, Assistant Professor, FOST
Scientific staffs	**:** Devika J (Junior Research Fellow) Devadas C R (Field Worker)
Funded	**:** Department of Science and Technology (SERB- CORE), Govt. of India
Duration	**:** 3 years (2022- 2025)
Budget	**:** Rs. 34,28,360 /-
Fund received	**:** Rs. 11,82,800 /- (on 24/01/2022)
Project commenced	**:** 24/01/2022
Staffs joined	**:** 04/04/2022

Coral reefs are among the oldest ecosystems on Earth. They support phenomenal biodiversity and provide irreplaceable sources of food and shelter similar to that of tropical rainforests on the land. Scientific evidence strongly suggests that global climate change is already affecting a large number of marine species and ecosystems. These observed changes are consistent with those predicted for climate change, occurring during the warmest years and giving strong indications that long-term global warming is going to alter marine ecosystems. Within a reef ecosystem, reef-building corals form mutualistic symbioses with unicellular photosynthetic dinoflagellates of the genus Symbiodinium. Several biotic and abiotic factors destabilize the symbiosis between corals and their dinoflagellate symbionts, leading to the loss of symbionts which is known as coral bleaching.

Oceanic tropical regions experience high ultraviolet radiation flux due to the thinness of the ozone layer at equatorial latitudes, and are also characterized by the high transparency of oligotrophic waters. This could result in increased levels of UV-induced damage for most living organisms producing a great impact on the photosynthetic carbon fixation by plants and consequently, on the global climate change. Organisms exposed to UVR have developed different types of photoprotective mechanisms to reduce the damaging effects of UV radiation. In many marine organisms, an important photoprotective mechanism that has been evolutionarily conserved involves UV-absorbing mycosporine-like amino acids (MAAs). Most of the reefs all around the world are under the threat of bleaching events related to global warming. Taxonomically diverse marine and terrestrial organisms have evolved the capacity to synthesize, accumulate and metabolize a variety of Mycosporine-like Amino Acids (MAA) as part of an overall strategy to diminish the direct and indirect damaging effects of environmental ultraviolet radiation.

The proposed work focuses on a highly relevant research theme – the role of MAAs in preventing coral bleaching – a case study of the Lakshadweep Archipelago. Since no such work has been done so far evaluating the role as well as characterizing MAAs from corals in India the proposed work endorses a unique nature.

Objectives

- Quantification of MAAs from corals and associated Dinoflagellates in Lakshadweep islands, Kavaratti, Kadamat, Kiltan, Suheli - spatial and temporal (seasonal) variations.
- Quantification of chlorophyll a and zooxanthellae density in the corals.
- Characterization of active MAAs in corals, analysing its role in UV protection and hence bleaching – spatial, and temporal/seasonal variations in MAA content.

Research progress

- A detailed review of literature done and published as book chapter.
- Stage 1 sampling completed (September- October 2022)
- Preliminary analysis involving confirmation studies for the presence of MAAs and analysis of general hydrographic parameters done.
- Samples prepared and sent for further HPLC analysis to the Centre of Advanced Study in Botany, BHU, Varanasi.

3. Enhancing reservoir fish production and creation of livelihood opportunities for the tribal community in the Munnar landscape through development of aquaculture practices of native fishes

PI : Dr. Anvar Ali P H- KUFOS (PI)

Co-PI : Dr. Suresh Kumar S- KUFOS (Co- PI)
Dr. LimnaMol- KUFOS (Co- PI)
Dr. Chiranjiv Pradhan- KUFOS (Co- PI)
Dr. Mithun Sukumaran – Kerala University (Co- PI)

Funding : UNDP- India High Range Mountain Landscape Project

Budget : 52.5 Lakhs

Duration : 2 years (2020-2022)

Though the state is blessed with huge diversity of native food as well as ornamental fishes having good domestic and export market, standardised captive breeding protocol is available only for a few species.

Objectives

- Develop captive breeding protocols for the prioritized commercial native fishes inhabiting reservoirs on a participatory approach.
- Capacity building of the local resident community of reservoirs on seed production and farming of native fishes
- Establishment of conservation hatcheries and cage farming facilities for the endemic edible and ornamental fishes.

The project could materialise

- Development of mass scale captive breeding protocol for two native cyprinids having food and ornamental importance
- Establishment of multispecies indigenous fish hatchery in forest area
- Capacity building of tribal people on diversified farming practices of native fishes
- Assistance to farmers by providing aquaculture inputs in the form of Silpaulin sheets, IBC containers, Biofloc units, aerators, fish seeds etc.
- Bringing of new areas under native fish farming
- Aquaranching of native fish species in River and reservoirs
- Support to farmers during Covid – 19 pandemic period with the supply of native fish seeds in five LSGDs.

4. Species Inventory, Distribution and Catch Estimation of Fish Faunal Resources of Kole Wetlands

PI : Dr. Anvar Ali P H

Co-PI : Dr. Anu Gopinath

Project staff : Goutham Krishna N (JRF)

Funding : DoECC, Government of Kerala

Budget **:** 13.32 Lakhs
Duration **:** 2 years (2020-2022)

As there is no prior information on catch composition and quantity of fish species landed in Kol wetlands, the study was conceptualised to achieve the objectives viz. 1**.** Inventory of fish faunal diversity of Kole wetlands2. Understand the nature of fishery and estimate the fish catch3. Understand the ecology of fish species in the wetland ecosystem. A revised checklist for the fish fauna is prepared. Two new species of fishes including one subterranean forms; six new records of species (Gobioid fishes) to Kerala; 3 new additions of species (Gobioid fishes) to Kole wetlands; Species distribution mapping carried out for 62 species – spatial and temporal; Diversity and abundance data for fish species of Kole wetlands. Fish catch estimation has been carried out from landing centres and paddy fields separately.

5. Establishment of Long Term 1-Hectare Plots and Its' Inventory in Shimoga, Karnataka and Nilambur, Kerala for The Validation of Nisar Forest Biomass Products

PI **:** Dr Girish Gopinath
Co-PI **:** U Surendran
Funding **:** SAC/ISRO, GoI
Budget **:** 27.50 lakhs
Duration **:** 2 years

NASA and ISRO are jointly developing a state of art L and S band space-borne Synthetic Aperture Radar (NISAR), planned for launch in January 2023. NISAR, through its repeat-pass interferometric orbits, will produce SAR data at high repeat cycle, high resolution and larger swath with capability of producing full-polarimetric data in L-band and hybrid polarimetric data in S-band. The NISAR systematic observation at L-band and S-band over Indian region will provide unprecedented time-series data through the ascending and descending orbits for the Ecosystems applications benefiting several operational activities related to agriculture, forestry, wetlands and soil moisture estimation as perceived by ISRO. NISAR data will address the critical issues of forest carbon stock estimation and monitoring carbon fluxes from vegetation disturbances; changes in the alpine vegetation tree-line;

agriculture crop monitoring and changing cropping patterns; spatio-temporal distribution of field-scale soil moisture and inundation dynamics of wetlands.

Fig. Establishment of one hector plot for forest biomass estimational Shimoga in Karnataka

6. Spectral Library Development for Forest Species Types and their Phenological Stages

PI : Dr. U Surendran,
Co-PI : Dr. K. Ch. V Naga Kumar
Dr. Girish Gopinath
Funding : SAC/ISRO, GoI,
Duration : 3 years (2019-2022)
Budget : 16.50 lakhs

Remote sensing (RS) has demonstrated its potential in mapping of forest physical and structural features and plays a critical role to understand the global carbon dynamics. Recent trends are directed towards measuring the biophysical/physiological character of forest ecosystems in order to estimate and predict the health and sustainability using hyperspectral

and other RS techniques. Hyperspectral sensor provides the reflectance spectra of leaf and canopy of the target vegetation. Due to different biological and chemical composition of leaves of different species, photon interactions will be different and absorption spectra will be observed at different wavelengths for different vegetation. Although, in visible region (400-750 nm), difference of spectra among the species will be negligible but in NIR region, it differs. Thus, using this spectral variability, spatial characterizations can be made. In fact, the spectral variations are due to the combined effect of different biochemical composition, water content, cellulose, leaf pigment etc. The center of absorption peaks, peak width and peak intensity of vegetation can help in species-wise classification.

A spectral library of tree species contains reflectance and transmittance spectra of, for example, leaves of tree species. Leaf spectra have a key role in the development and application of physically-based reflectance models, and are needed for upscaling from leaf level to canopy level spectra. Many global maps of vegetation, such as the MODIS leaf area index product rely on leaf spectra in their interpretation algorithms. In spite of the obvious need for leaf-level spectral data, lacking associated metadata have made it difficult to compare data from existing spectral libraries, thus complicating their use. Recently, there have been efforts to collect vegetation spectra, including optical properties of leaves and needles, into comprehensive open databases that gather data from different measurement campaigns and make them openly and easily available for algorithm developers and remote sensing scientists. Although laboratory measurements of leaf optical properties have been conducted for a long time, spectra of forest tree species have not been extensively measured, analysed and released for public usage in Indian scenarios. Seasonal time series spectra of different species are also not available for the hyperspectral based forest species mapping. Keeping such a view, the broad objective of this study is to develop comprehensive forest-species spectral library for developing advanced classification models for Forest-species discrimination.

Objectives

- Development of Forest-Species spectral library
- Identification/geo-tagging of mixed and homogeneous species locations
- Documentation of bio-physical, phenological and structural characteristics for forest-species discrimination.

7. National Wetland Inventory and Assessment (NWIA) Phase-II

PI : Dr. K. Ch. V Naga Kumar
Co-PI : Dr. Girish Gopinath
Funding : SAC/ISRO, GoI,
Budget : 20.76 lakhs
Date of Completion : March 2022

Wetlands played a major role in human history. It is only wetlands, whether perennial rivers or large water-bodies have always been the sites of sources of water and consequently the development of civilisations. Wetlands are among the most productive ecosystems of the world although they account only about 4 per cent of the earth's ice-free land surface. Wetlands usually occur in depressions or along rivers, lakes, and coastal waters where they are subjected to periodic flooding. Some wetlands also occur on slopes associated with the ground water seeps. Conceptually, wetlands lie between well-drained upland and permanently flooded deep waters of lakes, rivers and coastal embankments. Wetlands are among the most productive ecosystems besides being a rich repository of biodiversity, and are known to play a significant role in carbon sequestration. In view of the increasing importance of wetlands worldwide, Ministry of Environment, Forests and Climate Change, Govt. of India has given responsibility to SAC to formulate a proposal for 1:50, 000 scale wetland inventory in India using 2006-07 timeframe satellite data. A peer review has suggested for a minor change in the classification system adopted earlier (1992-92) resulting 19 wetland categories/classes while keeping identical hierarchy.

Subsequently, "National Wetland Inventory and Assessment" (NWIA) project was carried out by SAC on 1: 50 000 scale that resulted into a digital database and state-wise, and national wetland atlases based on Resourcesat-1 LISS-III data of 2006-07 timeframe. The estimated extent of wetland in the country was about 15.26 million ha.

Satellite technology has evolved over the years and currently being used to retrieve information on various hydrological parameters. Methods are being developed and experimented to measure water level, river width, flood inundation, soil moisture, water quality, evapotranspiration and ground water. There is need to develop an integrated technique towards National level water watch system to address quantity and quality of water resources.

SAtellite based RIver basin hydrological Technique and Applications (SARITA) programme formulated at SAC aims for following objectives;

- Retrieval of hydrological variables with past 20 years' time series analysis from suite of
- Indian and globally available satellites.
- Development of indigenous satellite input driven hydrological model and its calibration
- and validation in the selected river basins.
- Wetland Inventory and Change Detection.
- Hydrological experiment and establishment of hydrology lab.

8. Mangroves Community Zonation and Biophysical characterization for coast of Kerala

PI **:** Dr. K.Ch.V Naga Kumar
Co-PI **:** Dr Girish Gopinath
Funding **:** SAC/ISRO, GoI,
Budget **:** 13.61 lakhs
Date of Completion **:** June 2021

Mangroves are woody trees and shrubs that grow in the inter-tidal zones of tropical and sub-tropical regions. Duke (1992) defined a mangrove plant as "a tree, shrub, palm or ground fern, generally exceeding one and half meter in height, and which normally grows about mean sea in the inter-tidal zones of marine coastal environments, or estuarine margins". On the basis of common physiological and morphological featuresand 69 species from 27 genera, belonging to 20 families can be considered as true mangrove species. Mangroves survive in substrate salinities ranging from fresh water alongside rivers to hyper saline ponds and mudflats. Mangrove vegetation is generally inter-mixed: it is very common to find 'true mangroves' and 'mangrove associates' together in mangrove ecosystem. The distinction between these two categories is based on physiological characteristics (salt exclusion/ secretion), morphological characteristics (presence of aerial roots) and reproductive characteristics (vivipary), etc. True mangrove species are restricted only to saline and saline-fresh water regimes. Environmental and tidal conditions lead to regeneration and growth of certain mangrove species, that further forms specific mangrove communities. Mapping of mangrove communities have significance in ecological and conservation point of view. Vegetation communities are sensitive towards environmental variations in a region and changes in environmental set up due to anthropogenic or natural means may alter growth and

distribution of a species. Many other aquatic and arboreal organisms are directly dependent on mangroves for their existence.

Mapping of mangrove on global scale was started by LJNEP during 1990s, where Landsat data was used for mapping major distribution in US and Africa region. In India, first assessment of mangrove vegetation was done at 1: 250,000 scale using IRS data of 1990-93-timeframe (Nayak, 1996; Nayak and Bahuguna, 2001). Later, IRS P6 LISS-3 and LISS-4 data of the year 2005 - 2007 were used for discerning mangrove communities at scale (SAC, 2007). The study reported a net increase in the mangrove by 515 km2 during 1990-93 to 2005-2007. Considerable decrease was found in Gujarat, Karnataka, Kerala, Andhra Pradesh and Andaman and Nicobar Islands while significant increase was found for the states of Maharashtra, Goa, Tamil Nadu, Orissa and West Bengal. Mapping and inventory of Indian wetlands at 1 scale using Resourcesat-l (IRS-P6) LISS Ill data pertaining to 2006-07 has been carried out at Space Applications Centre (SAC, 2011); funded by Ministry of Environment and Forests (MoEF), Government of India. Mangroves as one of the major coastal wetlands occupy 3.09% (4714.07 sq km) of the total wetland area. Also, Forest survey of India conducts biennial mapping at 1: 50,000 scale, where mangrove vegetation has given Separate category. Recently, there has been no updation in mangrove database at national level. Ministry of Environment, Forests and Climate Change (MoEF& CC), Govt of India has stressed on the need of having national level database on mangrove on scale and also to identify areas of intense changes, with reference to previous assessments.

The present work plan has been prepared specific to state of Kerala; and the work component limits to the same.

Objectives

- Updation of dominant mangrove community zonation at 1:25000 scale for coast of Kerala
- Testing and extrapolation of existing models for biophysical characterisation

9. National network project on Submarine Groundwater Discharge (Phase I)

PI **:** Dr. Resmi T R

Co-PI **:** Dr. Girish Gopinath

Funding **:** MoES/NCESS, Govt. of India

Budget : 15.53 lakhs
Date of Completion : March 2022

Preliminary survey of the study area between the Manjeswaram River basin in Kasargod district and Chaliyar River basin of Kozhikode district of Kerala was conducted. Groundwater sampling from shallow open wells located within 500m and parallel to the coast was done. Sediment pore water was also collected along the stretch using push point sampler avoiding coastal wetland areas and inaccessible places. A total of 74 groundwater and sediment pore water samples (Kasragod: 29, Kannur: 15, Kozhikode: 30) were collected. Water level of the open wells and physicochemical parameters such as pH, EC, Temperature, salinity, DO, TDS of well and sediment pore water samples were measured in situ. Radon-222 levels were also determined in selected groundwater samples collected randomly from Kasargod and Kannur districts. The secondary data on groundwater chemistry, groundwater level etc. are also being collected and spatially represented using GIS. Various submarine groundwater discharge (SGD) zones were identified from Chaliyar to Manjeswaram River basin using hydrochemical and isotope signatures.

10. Groundwater characterization along the Coastal plain of Northern Malabar, Kerala using Isotopic Systematics

PI : Dr. Resmi T R
Co-PI : Dr. Girish Gopinath
Funding : DST/WTI, GoI
Budget : 32. lakhs
Date of Completion : March 2022

Radon, though a noble gas and ubiquitous in nature, the behaviour of ^{222}Rn in groundwater is very complex and is influenced by several factors. Hence, the ^{222}Rn activity in groundwater varies spatially from one place to another. In general, the ^{222}Rn activity in groundwater is primarily controlled by the distribution of uranium and radium present in the parent rocks. It is produced naturally from the decay of radionuclide such as ^{238}U, ^{235}U and ^{232}Th. There are three natural isotopes of radon that is radon (^{222}Rn), thoron (^{220}Rn), actinon (^{219}Rn) resulting from decay of uranium, thorium and actinium series. The half-life of a ^{222}Rn isotope is 3.8 days and also stays for some time in air and water resources, which may eventually lead to

some serious health issues in humans. Many studies have been conducted worldwide to measure and to collect preliminary range regarding the concentration levels of radon but there has been no such study carried out in the Kasaragod coast of northern Kerala, India. So, a study was carried out to find out the distribution of radon (^{222}Rn) activity in the groundwater samples from Kasaragod coast of Kerala to understand the factors affecting its distribution in different geological formations.

Hydrochemical data of groundwater collected during the pre-monsoon period shows that 72% of samples were soft according to the hardness classification, 20% were moderately hard, 5% were hard and 3% were very hard indicating different degrees of salinization. Among the ions, Na and Cl were showing high standard deviation pointing the influence of seawater. Except for one location, ionic concentration was high in surface water samples may be due to the saline water ingression in the lean flow period.

The stable isotope composition of rain water, groundwater and surface water were distinctly different in the study area. δ18O and δD of rainwater varied between -1.7 – -0.5% and -1.3 - 10.1‰ respectively, for groundwater, the variation was -2.7- 0.4‰ for δ18Oand -12.2 – 15.7‰ for δD. In surface water δ18O varied between 0.8 and 4.5‰ and δD between 9.4 and 25.4‰ respectively.

11. Molecular Taxonomic Approach for the Development of Digital Catalogue of the Coral Reef- Biota of Lakshadweep to Enable Conservation Measures

PI : Dr. S. Suresh Kumar
Co-PI : Dr. LimnaMol V P
Dr. Idrees Babu K K
Project staff : Ms. Minu Thomas
Funding : SERB, DST (Govt. of India)
Duration : 3 Years
Budget : 32.60 Lakhs

Objectives

- To provide exact taxonomic validation of the biota of coral reefs of Lakshadweep islands in multiple spatio-temporal scale
- To develop a comprehensive inventory of the major groups of animals in coral reefs of

Lakshadweep Islands

- To propose the area for conservation based on the developed database and rigorous analysis using decision support systems.

Developing a comprehensive database using integrated methodologies for accurate taxonomic assignments will improve ecological interpretations. Collecting specimens was carried out in different islands by exploratory surveys using SCUBA and snorkelling from Lakshadweep Islands. Tissue samples for DNA analysis were collected in alcohol, and voucher specimens were preserved in formalin and documented in DST, Kavaratti, UT of Lakshadweep with specific reference numbers. DNA isolation for fishes, molluscs, echinoderms, microbes and soft corals was carried out using a Genomic DNA kit by Thermofisher Scientific and CTAB salting out protocol. PCR amplification is done for COXI and Cyt b genes in fishes, 16S rRna for bacterial isolates and msh gene for soft corals. After sequencing, the data is aligned and analysed using phylogeny and genetic distance tools in software MEGA-X. Identification was carried out at species level and submitted the sequences in GenBank, NCBI.

Carried out first set of sampling along Lakshadweep islands during April 2021.

The survey was conducted in the islands during April 202. Agatti, Bangaram, Kavaratti, Kadmat, Suheli, Chetlaj, Perumal par, Amini, Kalpeni. Collected 492 tissue samples including fishes, crabs, echinoderms, shrimps, worms, corals, molluscs and seaweeds from these islands through snorkeling and SCUBA diving. Stored voucher specimens in DST, Lakshadweep and tissue samples were brought to KUFOS for molecular taxonomic analysis. After the finalization of methodology, started isolation of DNA and amplification of specific genetic sequences like COXI and Cytb for fishes, msh for softcorals and 16SrRNA for bacterial isolates in June 2021. Staging of website 'lakshadweep biota' for the digital documentation is started in September 2021. From October 2021 carried out COXI sequencing of 148 fish samples and submitted 97 sequences in Genbank, NCBI. Forward and reverse sequencing of Cytb gene of 105 fishes, msh gene of 12 softcoral samples, 16SrRNA gene of 45 bacterial isolates are also carried out. Started second set of sample collection from 18 January 2022 from the islands Kavarati, Androth, Kadmath and Agatti. Collected 1187 tissue samples. Sampling completed on 31 March 2022.

Significant Achievements

- First report of 8 fish species from Lakshadweep islands and publications are on progress.
- Submitted 97 COXI sequences of fish species in Genbank, NCBI collected from

Lakshadweep islands

- Isolated DNA and carried out sequencing of 134 fish samples, 12 soft coral species and 45 bacterial isolates
- Cyt b gene, both forward and reverse of 105 fish samples sequenced

12. Establishment of Wave Observation at Two Locations Off Kerala Coast: Verification and Dissemination of Forecast, Advisories and User Interaction Workshops

PI : Dr. S. Suresh Kumar
Co-PI : Dr. Prabhakaran M.P
Project staff : Rahul Raj G.R (Tech. Asst).
Funding : INCOIS MOES (Govt. of India)
Duration : 2018 - Ongoing
Budget : 38.70 Lakhs

Objectives

- Validation and dissemination of advisories / forecast and organizing awareness meetings related to OSF and MFAS in entire Kerala coastal region.
- Conduct user interaction meetings and collecting user feedback on OSF & MFAS.
- Assist deployment, maintenance, data collection and operation related to Wave rider buoy off Kozhikode and a new location off Kerala coast. Retrieval of wave rider buoy during emergencies and providing local coordination.
- Data collection from three major fish ports of Kerala and studies on Sardine fish stock so as to help INCOIS to develop and fine tune Sardine prediction model.

Report and Achievements-April 2021 to March 2022

- Kollam HF station New Directional Receiving Antenna Installed
- New BSNL fibre optic connection for Kollam HF station
- Separate wiring supply and new ELCB for Kollam HF station
- New Directional Receiving Antenna for Kozhikode Station
- Awareness Program conducted in various Harbours in Kollam with Fisheries Department and Coastal Police.

Buoy Retrieved and Deployment Status

- Kollam MK III Buoy was Retrieved for maintenance due to Insat data issue on 09-05-2021
- Change the Insat Antenna of Kollam Buoy and Deployed on 29-05-2021.
- New MK IV Current Meter Buoy of Kollam was deployed on 27-08-2021& old MK III Buoy retrieved on to the shore.
- Due to the loss of HF & Insat data due to unexpected water entry in to the Buoy. New MK IV Current Meter Buoy retrieved and reached to the Kollam port on 04-09-2021.
- Check Satelite communication of Retrieved MK III Buoy, it is cleaned and painted and kept in harbour for checking the continuity of the data and arrange transport to Kozhikode.
- Kozhikode Buoy entagled with fisherman's net and drifted around 700 meter and then maintaining constant position.
- Checked and verified with KUFOS team on 11-09-2021.
- For the maintenance of new MK IV Current Meter Buoy, INCOIS Scientists Mr. Arun and Mr. Jayakumar arrived Kollam from Hyderabad. With the help of them changed the entire hatch cover of MK IV Current Buoy, completed all maintenance work and Buoy was Deployed on 19-10-2021
- Transported the Battery set to Kollam from MSSRF team, Kanyakumari. Changed the entire Battery set of Kollam old MK III Buoy and transported to Kozhikode on 19-10-2021
- After reaching MK III Buoy in Kozhikode, Buoy was Deployed on 21-10-2021 by KUFOS team with the help of INCOIS persons.

Approved Annual Activity plan for 2022-23 March

- Monitoring the WRB deployed off Kerala region
- Conduct the awareness meeting, Dissemination of OSF/MFAS periodically, improvements and feedback collection
- Data collection and Sardine fish stock study

13. Development of vaccines against Tilapia Lake Virus (TiLV) and Cyprinid Herpes Virus-2 (CyHV2) of fish in Indian aquaculture system

PI : Dr. Devika Pillai

Co-PI : It is a multi-institutional project with three partners, C. Abdul Hakeem College, ICAR-CIFA and KUFOS

Project staffs : Ms. Lekshmi Haridas (JRF)
Ms. Aksa Ashly Biju (Project Assistant)

Funding : Department of Biotechnology, Government of India

Total amount : 54.18 Lakhs

Duration : 3 years

Objectives:

- Selection of fish cell lines available in DBT funded fish cell lines repository for high titre production of viruses (TiLV and CyHV-2) to develop whole virus vaccines
- Study the efficacy of viral vaccines to protect the fish from viral pathogens in laboratory trials by parenteral and oral routes
- Study the immune response to vaccine in vaccinated fish at molecular levels and antibody response
- Field evaluation of vaccines to study their efficacy to protect the fish in fish farms in Tamil nadu, Kerala and Odisha, and other states

Progress

- Fish infected with TiLV were collected from aquaculture farms.
- Primer sets were designed to study the immune gene expression in tilapia in response to infection with TiLV.
- Experimental pathogenicity was carried out with the crude tissue extract from infected fish.

14. Referral Lab for Aquatic Animal Disease Diagnosis and Quality Testing

PI : Dr. Devika Pillai

Funding : Pradhan Manthri Matsya Sampada Yojana

Budget : Rs 975 lakhs

Progress made

- Construction of the referral lab and biosecure wet lab in progress.
- Purchase of equipment for the referral lab in progress
- Manpower for the referral lab appointed
- Water quality analysis and diagnosis of diseases being carried out for aquaculture farmers and fisheries department. Fish seed quality testing is also being done.

15. Subterfish: diversity, distribution and threats to subterranean fishes of Kerala

PI **:** Dr. Rajeev Raghavan

Co-PI **:** Dr. A Bijukumar, Department of Aquatic Biology and Fisheries, University of Kerala

Dr. Siby Philip, Department of Zoology, Nirmalagiri College, Kannur

Fund allocation **:** 25 lakhs

Funding **:** Directorate of Environment and Climate Change, Government of Kerala

Start date of project **:** January 2021

Duration **:** 2 years

The Western Ghats of India, a region known for its exceptional ichthyofaunal diversity and endemism is also home to a unique assemblage of enigmatic subterranean fish (and crustacean) species, which are poorly known and documented. These include mostly blind and pigment-less representatives with obscure, and sometimes ancient evolutionary links. The subterranean fish species of Western Ghats have been *out of sight* and *out of mind*, so poorly known, that many are only known from type specimens, and absolutely no information is available on their systematics, distribution and population status. The broad aim of the proposed project is to generate baseline information on fishes of Kerala's subterranean ecosystem. This will be realised by understanding their 1) actual diversity 2) distribution patterns and 3) threats which will be determined through systematic field surveys throughout Kerala, particularly in lateritic regions. Additionally, 4) a barcode database of subterranean fish species of Kerala will be generated, to inform future conservation and management of these resources.

Major results/achievements

- Described a new species of subterranean loach, *Pangio pathala*

- Generated distribution data for six genera and 10 species of subterranean fishes of Kerala including 130 new occurrence records.
- Generated 70 genetic sequences (12s, 16s, cox1, cytb) and five mitogenomes for 10 species of subterranean fishes of Kerala
- Cleared the identity, and generated the distribution data for the enigmatic subterranean snakehead*, Aenigmachanna gollum*

16. Current status of fish diversity of Sasthamcotta Lake with particular focus on Pearl Spot, *Etroplus suratensis*

PI : Dr. Rajeev Raghavan

Co-PI : Dr. K. Ranjeet, Department of AEM, KUFOS
Dr. Anu Gopinath, Department of AEM, KUFOS
Dr. Anvar Ali, Department of FRM, KUFOS

Fund allocation : 10 Lakhs

Funding : State Wetland Authority, Government of Kerala

Start date/ duration : January 2021 to August 2021

The project has a broad aim of generating a comprehensive database on the status of fish fauna of the Sasthamkotta Lake, through realization of the following objectives – i) determine the diversity of fishes of Sasthamkotta Lake, ii) understand the spatio-temporal patterns in distribution of fishes of Sasthamkotta Lake, iii) determine the demographics and status of stocks of prioritised fishes of Sasthamkotta Lake (especially Pearl Spot, *Etroplus suratensis*, iv) evaluate the threats to critical fish habitats, especially breeding and spawning habitats in Sasthamkotta Lake, v) identify opportunities for rehabilitation and rejuvenation of fish stocks of Sasthamkotta Lake

Major results/achievements

- 24 species of fish within 17 families and 10 orders; 15 fish species form the basis of the local fishery/harvest
- Three species occurring in the Lake are under the threatened category as per the IUCN Red List.
- High levels of fishing mortality observed for *Etroplus suratensis*, with their exploitation levels near to the E_{max}.
- Time-series data show the existence of the 'fishing down the food web' phenomenon in the Lake

VI. KUFOS-ASSISTED RESEARCH PROJECTS

1. Evaluation of the impact of climate change on energy transfer between two trophic levels in a microecosystem of the Vembanad lake

PI : Dr. Limnamol V P

Project Staff : Ms. Ayana P.P

Vembanad lake, included in the Ramsar list of important wetland sites, is a highly significant economic, tourist, navigational and fishery centre of Kerala. The lake supports a huge diversity of life forms, which are intricately balanced and channelled to churn out rich fishery resources. This dynamic ecosystem is currently in a disturbed state owing to natural and anthropogenic interference. The pressures of such disturbances would be felt at all levels of the trophic structure of an ecosystem. The present study intends to assess the impact of changes in abiotic factors on the selected marine organisms and their energy conversion rates at trophic levels one and two. As an initiative, the Kumbalam microecosystem was sampled and analysed. Laboratory culture and analysis of communities representing trophic levels one and two was undertaken. During the study period, the average surface salinity was

28.5ppt and sea surface temperature was 27.2°C. The qualitative observations of phytoplankton in the study area showed the dominance of diatoms followed by dinoflagellates and blue green algae. *Coscinodiscus eccentric, Coscinodiscus wailesii, Skeletonema costatum, Pleurosigma elongatum* were found in relatively higher abundance throughout the observation. *Biddulphia rigida, Chaetoceros sp, Cyclotella sp, Cymbella sp, Detonula sp, Entomoneis sp, Fragilariopsis sp, Gonatozygon sp Gyrosigma acuminatum, Gyrosigma acuminatum, Leptocylindrus sp, Lioloma sp, Melosira varians, Melosira granulate, Navicula cuspidate, Nitzchia closterium, Nitzchia palea, Odontella mobiliensis, Pinnularia aestuarii, Pinnularia viridis, Pleurosigma elongatum, Pseudo-nitzchia sp, Skeletonema costatum, Surirella robusta, Surirella sp, Synedra ulna, Triceratium favus* were the diatoms in the sample. Dinofalgellates were the *Ceratium azoricum, Ceratium furca, Ceratium fusus, Ceratium macroceros, Noctiluca scintillans* and *Protopteridinium sp. Kirchneriella lunaris, Euglena proxima* and Oscillatoria sp were the identified blue green algae. The zooplankton diversity included Calanoids, Cycloids, Herpacticoids, Jelly fish, Sagitta sp., Amphipod, Lucifer, Fish larva and Fish egg.

2. A study on the diversity of manglicolous yeasts of KUFOS campuses

PI **:** Dr. K.Manjusha

Mangroves are a reservoir of diverse microbial communities and are regarded as the hotspot of fungal diversity. The fungi that live in mangrove ecosystem are known as manglicolous fungi. Manglicolous fungi include unicellular yeasts which may be marine or terrestrial in origin. The manglicolous yeast has superior qualities over their terrestrial counterparts as they have evolved to endure hostile environments. Notwithstanding these facts, the microbial diversity of mangroves, especially that of yeast has not been received much attention like other ecosystems. The main campus as well as the Puthuvype campus of Kerala University of Fisheries ad Ocean Studies is bestowed with quite good coverage of mangroves. Our knowledge of the diversity of manglicolous yeast isolated from these fast disappearing ecosystems and their biotic potential is quite inadequate. This study is an attempt to fill the gaps in our knowledge and build a baseline data of the manglicolous yeast diversity of KUFOS campuses.

Objectives

- To isolate and estimate the yeast associated with the mangrove environment of Main and Puthuvypin campuses of KUFOS
- To identify yeast on the basis of morphological biochemical and molecular characters
- To Prepare a baseline data on diversity of manglicolousyeast of KUFOS campuses
- To act as first step in setting up a manglicolous yeast culture collection at KUFOS.

Research Progress

In this study yeasts associated with the roots, stems, branches, leaves, barks, and flowers from 13 species of mangrove plants *Avicenniaofficinalis, Rhizophoramucronata, A.marina, Excoecariaagallocha, Kandeliacandel, R. apiculata, Sonneratia alba, Acanthus ilicifolius, Bruguieracylindrica, B. gymnorrhiza, Derris trifoliate, A. corniculata,* and *Acrostichumaureum*) found in the Puthuvype and Panangad campuses of KUFOS were isolated on Wickerham's agar. The number of Colony Forming Units per milliliter of the sample (CFU/gm) of the cultivable yeasts varied between the samples 38-43 x 10^1 CFU/gm. The maximum number of yeasts was associated with *R. mucrunata* (27%) and least with *S. alba* (0.2%). Majority of the yeasts strains were isolated from leaves (43%) and least from flower (0.4%). Out of 150 isolates the pigmented yeasts comprised of both black yeasts (2%) and red yeasts (21%). The predominant genera in this study was *Rhodotorula* (21%) followed by *Debaryomyces* (9.3%), *Kluyveromyces* (8%), *Cryptococcus* (6%), *Candida* (12%), *Rhodosporidiobolus* (3%), *Pichia* (2%), *Trichosporon* (2%), *Metchnikowia* (5%), and *Aureobasidium* (2%). Whereas the genera represented by single isolates were, *Geotrichum, Yarrowia, Saccharomycetes, Myxozyma, Lipomyces, Dipodascus, Clavispora, Lodderomyces, Ogatea, Galactomyces* and *Saitozyma*. Diversity indices of this study were analyzed; this revealed that both though the Shannon-wiener diversity (H'($\log_2$)), dominance (λ) and Peilou's evenness (J') were found to be maximum in yeast associated with *R. mucronata* the species richness(d) was maximum in yeasts from *A. officinalis*. It was interesting to note that all the yeast isolates were lipolytic (100%). Apart from that the manglicolous yeasts showed amylolytic (43%), proteolytic (22%), ureolytic (27%), and cellulolytic (27%), aryl sulphatase (9%), pectinase (7%), and ligininase (11%) activity. Variations in hydrolytic profile among yeast isolated form different plant species were noted. The extracellular enzymes produced by yeasts possess variety of applications in industrial processes. Potent producers of pullulan *(A. melanogenum)*, biosurfactant (*G. candidum)* and carotenoid pigments *(R.mucilogenosa)* were isolated in this study. It was found that yeasts associated with mangrove vegetation was highly diverse and hold a great deal of bioprospecting potential.

3. Antidiabetic Nanoformula Based on Banana Pseudostem and Inflorescence: *Efficacy evaluation after encapsulation'*

PI **:** Dr Jenny Ann John, Assistant Professor, FOST

Functional drinks are beverages with health benefits beyond their nutritional value, positively affecting one or more target functions in the body or mind to achieve an improved state of health and well-being (Cooper, 2011). Demand for natural-products-based nanoformulations is on the rise for managing metabolic disorders, considering limited side effects and ease of access. Nanoencapsulation of different phytochemicals may help to increase their solubility, bioavailability, and promisingly enhance their efficacy (Taghipour *et al*., 2019).

Banana (*Musa spp*) is a very popular tropical fruit native to South Pacific region. India is the largest producer and consumer of banana globally. However, it is estimated that, for each tonne of banana fruit harvested, approximately 4 tonnes of biomass wastes are produced. Banana pseudostem and inflorescence are potentially rich gold mines for bioactive compounds; but have still remained underutilized.

Literature survey indicated that there is a huge scope for the nanoencapsulation of bioactives from banana pseudostem and inflorescence to develop functional drinks. If successful, further studies may be carried out in *in vivo* models and subsequent commercialization of the product, which will cater to the needs of the health conscious and geriatric community, to prevent life style disease, as is the need of the hour.

Objectives

- Extraction of bioactive phytochemicals from banana pseudostem and inflorescence of *Palayamkodan variety*.
- Nanoencapsulation of extracts by spray drying and analyses of the encapsulated powder.
- Optimization of the formulation for the development of functional drink from encapsulated powder.

Research progress

Banana pseudostem and inflorescence of *Palayamkodan variety* was obtained from a local farm. Dried and powdered sample was used for extraction trials. Ultra sonication assisted extraction using different concentrations of ethanol namely 60%, 70%, 80% and 90%

and a mixture of acetone, methanol and water in the ratio 7:7:6 as solvents, for 20 min at room temperature was carried out for the banana pseudostem and inflorescence. 60 % ethanol and 80 % ethanol were identified as the suitable extraction solvents for banana pseudostem and inflorescence, respectively. Proximate composition, phenolic and flavonoid content, antioxidant activity, antidiabetic activity, HPLC and FTIR analysis of extracts were carried out. Encapsulation trials of extracts of banana pseudostem were carried out with Maltodextrin and Gum Arabic as wall material using spray drying. The drying conditions were kept constant and the suitable concentration of maltodextrin and gum arabic in the wall material solution was optimised to be 1:1. Phenolic and flavonoid content, antioxidant activity, anti-diabetic activity, process yield, particle morphology using scanning electron microscopy and FTIR analysis were carried out for the encapsulated powder. Spray drying trials for the optimisation of the total concentration of both the encapsulating agents in the stock solution and the ratio of the extract to the encapsulating agents' stock solution in the infeed solution are going on and has to be optimised using statistical tool, Response Surface Methodology. Formulation of functional drink and analysis of the final product has to be carried out.

1. A comprehensive Coastal Vulnerability Index for Selected regions of Kerala using Machine Learning Technique

PI **:** Dr. Girish Gopinath

The review of coastal vulnerability studies suggests that additional efforts are needed to ensure that future coastal vulnerability mapping assessments take a holistic methodological perspective and follow best cartographic practices, which are necessary to effectively influence coastal decision-making. Even though various institutes are conducting rigorous studies about various coastal hazards, a comprehensive coastal vulnerability map of the state is absent and the use of machine learning/deep learning in coastal vulnerability assessment is still in underdeveloped in India mainly due to reduced capacity building in this sector. Till the time, there is no comprehensive study about how many millions are under coastal vulnerability and what will be the future extent of vulnerability in the 'wake' of climate change. By considering all these factors, the present proposal is framed with the hypothesis of using AI techniques to produce a coastal vulnerability index for selected districts of Kerala. Various thematic layers are prepared for deriving the coastal vulnerability index. Thereafter preliminary field investigations were conducted in Ernakulam, Kozhikode and

Thiruvananthapuram districts for soil sample collection and field evidence of costal vulnerability and sea erosion.

Objective of the present work

•To conduct an extensive survey about costal hazard literacy among those inhabits near to costal stretch of Kerala.

•To develop a comprehensive Coastal Vulnerability Index (CVI) for selected regions of Kerala using Machine-Learning model.

Fig.1. Sand deposits inside residential area which leads house uninhabitable

Fig.2. Man-made structures for protecting the coastal area

2. Studies on the effect of dietary supplementation of leaf extract of *Murrayakoenigii and Psidium guajava* on growth, survival, tissue morphology, blood parameters and immune responses in *Etroplus suratensis*

PI **:** Dr. Gijo Ittoop

Objectives

- To identify the phytochemical constituents in the aqueous and ethanol extract of the leaves of *M. koenigii and P.guajava* growing in Ernakulam, Kerala.
- To study the antibacterial properties of aqueous and ethanol extracts of leaves of *M. koenigii*and *P. guajava*
- To understand the effect of dietary supplementation of extract of leaves of *M. koenigii* and P. guajava on growth, survival, immune responses, serological and hematological factors of *E. suratensis*
- To study the toxicity if any, on the liver, kidney and gonadal tissues.
- To isolate mRNA for further studies in immune gene expression.

Research Progress

Qualitative analysis of the aqueous extract of curry leaves demonstrated the presence of bioactive compounds like alkaloids, flavonoids, phenolic compounds, tannins and saponin but terpenoids were absent. The aqueous extract of curry leaves inhibited the growth of *A. hydrophila* (MIC) at a concentration of 0.5mg/ml. The qualitative phytochemical analysis of the aqueous extract of guava leaves revealed the presence of bioactive compounds such as alkaloids, flavonoids, phenolic compounds and saponin. There is an inhibition in the growth of the A. hydrophila (MIC) at a concentration of 0.25 mg/ml.

Toxicity and Growth studies are going on.

VII. POST-DOCTORAL RESEARCH

A. EXTERNAL FUNDED

1. Nano and microplastics prevalence as source of trace metals: a tropical - polar evaluation

PI : Dr. Manju P Nair
Mentor : Dr. Anu Gopinath
Funding : KSCSTE
Budget : Fund Allotted - Rs.14,17,200/-
Fund Received - Rs. 4,72,400/-
Duration : 3 years (2021-2024)

Plastic pollution is documented as a global environmental theme. Ocean serves as the ultimate sink of the plastic debris. Plastic item in the aquatic environment undergo continuous fragmentation from macro to micro and nanoplastics. These plastic forms can absorb toxin which impose risk to the aquatic ecosystem. This project serves as the first detailed report on the quantitative and qualitative distribution of micro and nanoplastics in the water and sediments of tropical (Kerala Coast) and polar (Antarctic and Arctic) regions. The aims of the project are (1) Quantitative and qualitative determination of micro and nanoplastics in the water and sediment samples from the selected stations of tropical and polar regions, (2) Trace metal quantification in the water and sediments of the tropical and polar regions, (3) Evaluation of micro and nanoplastics as a scavenger of trace metals from the study areas. The work progress included the completion of quantitative determination of microplastics from the Southern Ocean and Arctic Ocean samples, sampling did at Kollam and Kochi transects and quantitative determination of microplastics from the Kollam and Kochi samples.

2. Isolation and characterization of alkaloids from the mangrove plants of *Rhizoporaceae* family and investigations on their anti-bacterial and anti-diabetic activities

PI : Dr. Resmi. P;
Mentor : Dr. Anu Gopinath
Funding : KSCSTE-BLP Scheme
Budget : 14,17,200/-
Duration : 3 years

Abstract: Mangrove plants synthesise a wide variety of secondary metabolites such as terpenes, polyketides, phenolics, alkaloids, amines, and cyanogenic glycosides. Therapeutic effects of these secondary metabolites are there as on behind the usage of mangrove plants in folklore medicine. The extracts from mangroves and mangrove-dependent species possess biological activity, but the specific metabolites responsible for these bioactivities remains to be elucidated. Objectives of the present study is to separate purify and identify the alkaloids from *Rhizophora apiculata* or *Rhizophora mucronate* and to study its anti-bacterial and anti-diabetic activities. Different nitrogenous compounds were isolated from chloroform fraction of the bark of mangrove plant *Rhizophora mucronate* and are as follows: 1) Quindoline alkaloid belongs to the rare class of indoloquinoline alkaloids 2) Dicyclohexane urea (the first report of N,N'-dicyclohexyl urea from R. Mucronata) 3) Aliphatic oxygenated nitrogenous compound [M+H]+ at m/z 338.3428 4) Other nitrogenous compounds are C16H19NO2 [M+H]+ at 258.1495; C17H29NO [M+H]+ at 264.2326; C18H36NO [M+H]+ at 282.2781; C18H34NO [M+H]+ at 280.2623; C16H34NO [M+H]+ at 256.2635; C10H13N2O3 [M+H]+ at 209.1548. Different bioassays were carried out for hexane, chloroform, ethyl acetate, methanol and aqueous fractions from the bark of the plant *Rhizophora mucronata*. Antioxidant activity by DPPH and ABTS assay showed higher activity for aqueous fraction. Antimicrobial activity was assessed by agar well diffusion method against four fish and human pathogens. Among the selected pathogens greater inhibition was observed for *Flavobacterium spp*. Bulk extraction of alkaloids from *R. apicula* was completed and were submitted for NMR analysis. Bulk extraction of alkaloids from *R. mucronata* isolation is on progress. The study also gives some insight into the antidiabetic activity of *R. mucronata* and is open for further developments for formulating drugs for the treatment of diabetes.

3. Risk assessment and impacts of aquaculture species on native fish diversity in the downstream and upstream areas of Mullaperiyar Reservoir, Periyar River, Kerala

PI **:** Dr. Roshni K.

Mentor **:** Dr. Ranjeet Kutty,

Funding **:** Kerala State Council for Science, Technology and Environment (KSCSTE)

Duration **:** 3 years

Biological invasion is considered as the second most threat to biodiversity depletion worldwide. Compared to terrestrial and other aquatic ecosystems impacts of alien fish species

are more evident on freshwater habitats. On this backdrop, the present study aimed to identify alien aquatic and native fish diversity, trophic interactions between introduced aquaculture species and native fish groups, population dynamics of invasive aquaculture and native fish species and risk screening of alien aquaculture fishes using Fish Invasiveness Scoring Kit (FISK) the upstream and downstream areas of Mullaperiyar reservoir of Periyar River in Kerala.13 in species of native and 4 species of alien fishes identified from the study area. Analysis of dietary and demographic studies of five fish species has been carried out. The risk of major alien aquatic fishes has been conducted.

4. Influence of monsoon related drivers on the bio-productivity of the west coast of India

PI **:** Dr. Suneela. S.S

Mentor **:** Dr. Sureshkumar. S.

Funding **:** Department of Science and Technology, Govt. of India, New Delhi SR/WOS-A/EA-18/2018 dated 29-12-2019

Duration **:** 3 years

The seasonally varying currents induced by the seasonally varying wind influence the productivity of coastal waters of the Eastern Arabian Sea. The alongshore wind and the equatorward flowing coastal current during southwest monsoon trigger Ekman pumping leading to the upwelling of subsurface nutrient-rich water to the surface. This makes the ecosystem more productive during this period. Higher productivity of coastal waters is observed during mud bank formation. The possible relation between productivity and mudbank formation will be investigated. To understand the influence of various global and local factors on the coastal upwelling features it is proposed to carry out the research analysis utilizing scatterometer wind over the ocean, NCEP/NCAR reanalysis wind, temperature and humidity profiles, SST and daily monsoon rainfall data, for 15 years. In addition, the variability of chlorophyll-a concentration will be analysed using the satellite-derived MODIS data.

Objectives

- To investigate the spatial and temporal variations of the atmospheric and oceanic parameters associated with the southwest monsoon and their influence on the coastal waters.
- Study the influence of various global and local factors on the coastal upwelling features.

- To analyse the variability of chlorophyll-a concentrations in the coastal waters of South India.

Various Meteorological and Oceanographic parameters influencing the Indian Summer Monsoon were analysed. Spatial and temporal variations of different parameters such as wind, temperature, precipitation, divergence, vorticity, humidity, latent heat flux, sea surface temperature, sea surface height, etc were determined. The influence of these parameters on the Indian summer monsoon with special reference to the 2018 monsoon season was investigated in light of the extreme rainfall and flooding in almost the whole districts of Kerala in August 2018.

Water and sediment samples were collected daily from the mudbank region at Ambalapuzha during the monsoon period of July to September 2021 and once in 2 weeks from October to December 2021. Samples were analysed to determine the concentration of SPM in water and the particle size distribution in water and sediment samples measured using the Laser Scattering Particle Size Distribution Analyzer. Using spectrophotometry concentration of chlorophyll in the water samples was determined. Since the mudbank persisted even after the monsoon season and continued till March 2022, to analyse the state of the ocean in the mudbank region different parameters such as current speed and direction, density, salinity and temperature at every 1-meter depth were measured in the mudbank region in a transect of 3 km offshore.

B. KUFOS-PDF

1. Correlating the genetic basis of commonly consumed rice varieties of Kerala to their glycemic index

PI **:** Deepa John

Mentor **:** Dr. Maya Raman

The present research work focused on exploring traditional and popularly consumed rice varieties of Kerala for deterring their amylose content using molecular approaches. The *Waxy* (*Wx*) gene encodes the Granule-Bound Starch Synthase I (GBSSI) enzyme that primarily regulates amylose synthesis in grains. The major objective was to isolate DNA from selected rice varieties and check for the type of alleles of *Waxy* gene present in the collected rice samples using PCR based molecular markers. Glu23 was used to amplify DNA fragment

containing the 23-bp duplicate region. All the rice varieties screened showed amplification of approximately 173 bp allele which corresponds to *Wx* allele classifying them as non-waxy rice varieties. The varieties were also analyzed with Wx^{in} marker to identify intermediate-amylose cultivars. Wx^{b} allele specific primer was used to identify varieties with low amylose content. The screened samples did not produce any amplified product. Wx^{a} and Wx^{b} alleles were detected by restriction endonuclease cleavage. The amplified products were resolved and visualized in nondenaturing 8% polyacrylamide gel electrophoresis followed by silver staining method. After restriction enzyme digestion, 129 and 128bp bands were observed indicating restriction digestion which confirms the presence of Wx^{a} allele (fig.1). Amylose content or percent of amylose in rice samples was determined based on the Iodine-binding method. Gel consistency was determined based on the consistency after boiling the rice grain powdered samples in dilute alkali followed by cooling in ice water. Most of the rice varieties screened belonged to intermediate amylose content having values above 22% whereas few varieties had high amylose content. Kuruka rice had hard gel consistency, Pokuruka medium hard and Pokkali medium gel consistency whereas, all the other rice varieties showed soft gel consistency.

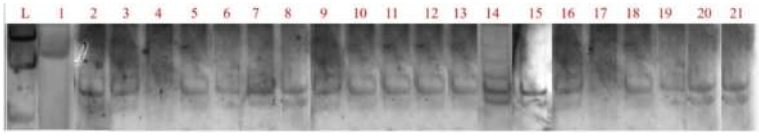


Figure 2: Restriction enzyme digestion of Waxy intron amplified PCR fragment using endonuclease AccI

L:100 bp DNA ladder
1: Mattatriveni
2: Orkayama
3: Kuthiru
4: Chellanam Chettivirippu
5: Chitteni
6: Karutha Kuruka
7: Cheruvirippu
8:Traditional virippu
9: Kuruka
10. Ponkuruka
11: Jaya
12: Uma
13: Jyothi
14: Pokkali
15: Rakthashali
16: Vyttila Kuruka
17: Kanchana
18: Ezhome
19: Shreyas
20: Bhagya

2. A Study on Corporate Social Responsibility Practices in Small Finance Banks - A Case of ESAF Small Finance Bank in Kerala

PI **:** Dr. Felice Joy

Mentor **:** Dr. V. Ambilikumar

The competition in the business world of today is stiff, and it can be quite challenging for a company to set itself apart in the eyes of its stakeholders. There is a growing need for companies to put more focus on social responsibility. In India, it is mandatory for the companies to contribute at least two percentage of their average net profit towards Corporate Social Responsibility (CSR) if the net worth is Rs. 500 crore or more or turnover is Rs 1000 crore or more or net profit is Rs 5 crore or more during the immediately preceding financial year. The Indian banking sector is interested in incorporating sustainability into their business models, but its CSR reporting practises and spending patterns are missing. Only a few banks announce their operations using triple bottom line concepts. In reality, as compared to financial ratings, the criteria for evaluating CSR practises are less uniform. This study aims to develop a model for banks to enjoy competitive edge through CSR activities by taking ESAF Small Finance Bank as a case. In this study, the CSR measurement scales are adopted for the banking industry context and based on stakeholder theory from the earlier studies. Thus, the key stakeholders are identified in the banking sector: customers (CUS), employees (EMP), shareholders (SHR), Society (SOC), and the environment (ENV).This implies that thirty-seven items of the scale were generated and used for constructing five reflective dimensions of CSR that most required by banking industries, and particularly include CSR related to customers (8 items), CSR to the employee (9 items), CSR to the shareholders (6 items), CSR to the society (6 items) and CSR to the environment (8 items). Furthermore, based on several works reviewed, the seven items selected for measuring the competitive edge (CA) dimension of the bank are through providing a high-quality service, enhanced its goodwill and reputation improved its market share and sales volume, the reasonable price provided to services or products, improvement in customer retention, contribution towards rural development and commits itself in time to market.

3. Sunlight induced integrated Advanced Oxidation Processes for the purification of water from chemical and bacterial pollutants including highly recalcitrant microplastics

PI **:** Dr. Gayathri P V

Mentor **:** Dr. Shijo Joseph

The objective of the study was to investigate the potential application of sunlight-induced advanced oxidation process (AOP), i.e., solar photocatalysis, for the removal of two emerging pharmaceutical contaminants in water; Diclofenac sodium and Chloroquine using ZnO as the catalyst. The effect of typical operational parameters such as pH, irradiation time, catalyst dosage, the concentration of pollutant, presence of oxidants, etc. was studied in detail. The physicochemical characteristics of ZnO used in the study were analyzed by X-ray Diffraction (XRD), Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Energy Dispersive X-Ray Analysis (EDAX), surface area, particle size, and pore size analysis. The study is extended to visible sunlight as the energy source using different types of pollutants of emerging concern.

Contamination of water by bacterial pollutants is another major environmental concern. The possibility of removal of Escherichia coli bacteria from water using sonocatalysis as a potential AOP is also investigated. Several semiconductor oxides such as TiO_2, ZnO, Al_2O_3, ZrO_2, nano ZnO, and nano SiO_2 were tested as catalysts. ZnO is found to be most effective for bacteria removal. Various operational parameters like catalyst dosage, the concentration of *E. Coli*, pH, effect of oxidants (H_2O_2 and persulphate), re-emergence of the bacteria, etc. have optimized for efficient removal of the bacterial pollutants.

Antibiotics have been extensively and effectively used by humans and administered to animals. Wastes from animal farms including fish farms are one of the major sources of antibiotic pollution in the environment. A survey based on a questionnaire on the usage of antibiotics in around 250 fish farms across Kerala is conducted. Analysis of the survey data is done. The degradation of antibiotics identified in the survey will be studied under solar irradiation using semiconductor oxide catalysts.

4. Dietary coriander (*Coriandrum sativum*) oil as an immunostimulant in Nile tilapia, *Oreochromis niloticus*

PI **:** Dr Sweta Das

Mentor **:** Dr Devika Pillai

Plant essential oil such as coriander (*Coriandrum sativum*) contains bioactive compounds like linalool and geranyl acetate shown to have anti-microbial and anti-inflammatory properties (Mandal and Mandal, 2015). The current work is proposed to evaluate the immune status and fatty acid profile of Nile tilapia, *Oreochromis niloticus* after dietary administration of

coriander oil-based diet. The tilapia fingerlings were fed with the five iso-nitrogenous and iso-lipidic feed with graded levels of coriander oil (0, 0.5, 1, 1.5 and 2%) twice daily for a period of 60 days in triplicate. There was a significant increase in weight gain observed in treatment containing 1.5 and 2% coriander oil-based diet. The specific growth rate (SGR) is high and feed conversion ratio (FCR) is low compared to the control (0%) in these two groups. White blood cells (WBC) and red blood cells (RBC) content did not change significantly, whereas the thrombocyte count was more in the last treatment group. Haemoglobin content, mean corpuscular haemoglobin (MCH) and mean corpuscular volume (MCV) were more in all the treated groups compared to control group. There observed no change in haematocrit value in between the groups. There was a significant decrease in glucose content in the serum in all the treated groups compared to control, while there was no change observed for other serum parameters like total protein, albumin, globulin, triglycerides, cholesterol and very low-density lipopolysaccharide (VLDL). There was a significant increase in high density lipopolysaccharide (HDL) in the last treatment group (2%). The innate immune parameters studied such as respiratory burst and myeloperoxidase activity showed an increase response in the last two treatments (1.5 and 2%). The antiprotease and lysozyme activity was high in the last three groups (1, 1.5 and 2%). The treated groups showed increased resistance (88, 94, 100, 100% in 0.5, 1, 1.5 and 2% groups respectively) post challenged with an intraperitoneal injection of 0.1 ml *Aeromonas hydrophila* at a LD_{50} dose of 5x 10^6cfu/mL compared to control group (38%). The current work advocated the use of coriander oil as a growth promoter and immunostimulator in tilapia diet.

5. Evaluation of molecular mechanisms involved in nano-plastic-induced toxicity in aquatic animals at cellular and molecular levels

PI **:** Dr. Vineetha V.P.
Mentor **:** Dr. Devika Pillai

A better basic understanding of the physiological and biochemical changes occurring as a result of nano-plastics (NPs) toxicity at the cellular and molecular level in fish is necessary for health and environmental monitoring. This project is aimed to study the effect of NPs on vital intracellular organelles such as endoplasmic reticulum (ER) and mitochondria, and the various signaling pathways leading to apoptosis in fish. The NPs were characterized using

electron microscopy, and X-ray diffraction. The acute toxicity study for 14 days with NPs in Nile tilapia at three different concentrations, displayed a significant alteration in blood parameters, serum biochemistry, immunological parameters and oxidative stress-related parameters. The histological analysis of organs such as the gill, liver, heart, and kidney also revealed significant pathological changes in a dose-dependent manner. The quantitative real time-PCR, and blotting studies are in progress to study the expression of stress and toxicity-related proteins.

VIII. RESEARCH STUDENTS – PhD PROGRAMME

Doctoral degree programme is conducted under four faculties namely, Faculty of Fisheries Science (FFS), Faculty of Fisheries Management (FFM), Faculty of Fishery Engineering (FFE), and Faculty of Ocean Science and Technology (FOST). A total of 287 students have registered in different faculties for programs leading to Ph.D., and 11 students have been awarded the Doctoral degree.

	FFS	PhD awarded	FFM	PhD awarded	FFE	FOST	PhD awarded	**Total Ph.D. registration**
2014			1	1		4	3	**5**
2015			3	3	1	5	2	**9**
2016		3	1	1	1	19	1	**21**
2017	2		5	4	2	21	2	**30**
2018	8		12		1	33		**54**
2019	14		10		Nil	26		**50**
2020	11		34		2	40		**87**
2021	30		11		2	32		**75**
Total	**65**		**77**		**9**	**180**		**331**

KUFOS has 149 research guides for facilitating research leading to Ph.D. with 40 of them from KUFOS and the remaining 109 from the Approved Research Centres.

IX. APPROVED RESEARCH CENTERS

KUFOS has 14 approved research centres for facilitating research in areas coming under the mandate of the university. Research is undertaken at these centres by the students registered with KUFOS.

S.No.	Centers	No. of Ph.D. guides
1	Central Institute of Fisheries Technology (CIFT), Kochi	23
2	Centre for Marine Living Resources and Ecology (CMLRE), Kochi	5
3	Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Kochi	-
4	Central Marine Fisheries Research Institute (CMFRI), Kochi	24
5	Govt. Law College, Ernakulam (Maritime Law)	2
6	Indian National Centre for Ocean Information Service (INCOIS), Hyderabad	15
7	National Bureau of Fish Genetic Resources (NBFGR), Kochi.	7
8	Indian Institute of Spices Research (IISR), Kozhikode.	5
9	Nansen Environmental Research Centre India (NERCI), Kochi	2
10	Sree Narayana Gurukulam College of Engineering (SNGCE), Kadayiruppu, Ernakulam	7
11	Holy Grace Academy of Management Studies, Thrissur.	3

12	Naipunya Business School, Thrissur.	3
13	St. Albert's College, Ernakulam (Department of Fisheries and Aquaculture & Department of Management)	9
14	Leads College of Management, Palakkad.	4

X. LIST OF PAPERS PUBLISHED

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BOOK CHAPTERS

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25. Christy Ouseph, Jayalakshmi, "Diversity, Distribution and Abundance of Bivalves in The Vembanad Backwaters", Poster, Conservation of Life Below water perspective on systematic and sustainable livelihood and citizen Science, (COLIBA 2021) March 18-20 2021, organized by Dept. of Aquatic Biology and Fisheries, Trivandrum
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60. Neema Job, Ashly Augustine, Nevin KG. (2021). Hidden mycobiont of mangrove, Avicennia officinalis as a source of anticancer enzyme L-asparaginase. Proceedings of the 34th Kerala Science Congress. 386-387.
61. Nevin KG Presented a paper on Cardio-protective effects of p-Coumaric Acid in Doxorubicin Administered Non-tumor and Tumor Bearing mice Recent Biochemical Approaches in Therapeutics-VIII (RBAT-VIII). Thiruvananthapuram-Jan 18-21, 2022.
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64. Princy M John, Gireesh R, VN Sanjeevan, Anu Gopinath. (2022). Presented a paper on “Levels, sources and influence mechanisms of Copper, Nickel and Zinc in the surficial

sediments of Prydz Bay, East Antarctica" in the 10th SCAR Open Science Conference organized by National Center for Polar and Ocean Research (NCPOR) held on 1st to 10th August 2022.

65. Princy M John, Gireesh R, V.N. Sanjeevan, Anu Gopinath. (2022). Present a paper on "Distribution of Vanadium in the surficial sediments of Prydz bay, Indian sector of the Southern ocean" in the national seminar on Reorienting the Strategies towards Sustainable Aquaculture and Fisheries, KUFOS on 6th to 7th January 2022.
66. Princy M John, Vishnu Murali, Priya Varghese, Anu Gopinath. (2021). Presented a paper on "spatial and seasonal trends of trace metals in the surficial sediments from off kochi - geochemistry and environmental implications" in the 7th National Conference of the Ocean Society of India (OSICON-21) organized by National Center for Polar and Ocean Research (NCPOR) held on 12th -14th August 2021.
67. RabeaNaz H. Presented a poster on topic **'**Development and standardisation of fish soup powder made from *Amblypharyngodonmola* fish and its nutritional evaluation' on National seminar conducted at KUFOS on 'Reorienting the strategies towards sustainable aquaculture and fisheries' held on 7th January 2022.
68. Rakesh CG, Rehna A, Gijo Ittoop, Divya V Haridas, Keerthana KM, Devika Pillai (2022). A case study of Digenean trematode metacercariae parasite infestation in nursery reared Catlacatla and Labeorohita under the session Environmnetal and Health Concerns in Fisheries in the National Seminar on 'Reorienting the strategies towards sustainable aquaculture and fisheries" organized by Kerala University of Fisheries and Ocean Studies (KUFOS) in association with Department of Fisheries, Government of Kerala, India
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71. Roopa Rajan, Arunachalasivamani, P. and Radhika Rajasree, S.R. (2021 October 26-27). Physico-chemical characteristics of food packaging films developed with *Gracilaria crassa* and chitosan for the preservation of fishery product (Conference presentation abstract). In: Proceedings of 9th national and the 1st international Iranian Conference of Ichthyology (ICI 2021). pp: 970.

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73. Roopa Rajan, Arunachalasivamani, P., Fathima Asharaf and Radhika Rajasree, S.R. (2022 January 6-7). Development and characterization of *Halimedamacroloba* based film incorporated with chitosan and silver nanoparticle for the shelf-life extension of battered and breaded shrimp products (Conference presentation abstract). In: Proceedings of National Seminar on "Reorienting the strategies towards sustainable aquaculture and fisheries".
74. Roopa Rajan, Arunachalasivamani, P., Fathima Asharaf and Radhika Rajasree, S.R. (2022 March 24-25). Spectral and antioxidant properties of *Gracillaria crasa* based functional films reinforced with chitosan for food packaging application- A comparative study (Poster presentation). Conference on biotechnological innovations in Agriculture, Environment and Health (CBIAEH 2022).
75. Sajeevan MK, Chitra MC, Bincy M Raj and Eldho PS presented paper on "Review on the Trichiuroid fishes from India" on KUFOS national seminar 2022 at KUFOS
76. Satkar Sagar, Nibin O, Gijo Ittoop, Vineetha VP and Devika Pillai (2022). Comparative hematological and immunological study of Nile tilapia in different culture systems under the session Environmnetal and Health Concerns in Fisheries in the National Seminar on 'Reorienting the strategies towards sustainable aquaculture and fisheries" organized by Kerala University of Fisheries and Ocean Studies (KUFOS) in association with Department of Fisheries, Government of Kerala, India
77. Sharma L, Ali APH. (2022). Life history traits of Indian Cypriniformes: review and data synthesis. National Seminar on "Reorienting the strategies towards sustainable aquaculture and fisheries" 6th and 7th January 2022. Jointly organized by KUFOS and Department of Fisheries, Government of Kerala.
78. Sharma L, Krishna G, Melbinlal, Ali APH, Prabhakaran MP. (2022). Diversity, richness and abundance of fish species in the exploited fishery of Kole wetland, part of Vembanad – Kole, a Ramsar site in Kerala, India. Lakeview Envirothorn Conclave – LAEC- 2022, International seminar on wetlands and mangroves fish: Deliberations on sustainability and Conservation. 24-26 March 2022, Sacred Heart College, Thevara, Kochi, Kerala, India. Kerala.

79. Shijina P. N, Ferolin J. G, Surya C, Nair S. N, Rehna A, Gijo Ittoop and Devika Pillai (2022). Acute toxicity of Potassium permanganate in *Etroplus suratensis* under the session Environmental and Health Concerns in Fisheries in the National Seminar on 'Reorienting the strategies towards sustainable aquaculture and fisheries" organized by Kerala University of Fisheries and Ocean Studies (KUFOS) in association with Department of Fisheries, Government of Kerala, India
80. Shijina P.N., Rehna, A., Nair, S, N., Gijo Ittoop and Devika Pillai. Improvement of therapeutic efficacy and Pharmaceutical incompatibility of Clove oil for water borne anaesthesia in fish using ethanol. Presentations of Annual National Conference on Sustainable Ecosystems, Aquaculture, Fisheries and Fisherflok ANCOSEAFF, 28th and 29th January 2022.
81. Sibi T. Baby and Prabhakaran M. P. (2022). Crown-of-thorns Sea star *Acanthaster planci,* a bourgeoning threat to coral reef in Agatti atoll, Lakshadweep archipelago. National Seminar onn *Reorienting the Strategies Towards Sustainable Aquaculture and Fisheries* held at Kerala University of Fisheries and Ocean Studies, Kochi.
82. Siya K Johnson, Akshaya Vijayan, Baiju, P.T. and C. Linoy Libini (2022). Growth and reproductive performance of *Brachionus plicatilis* using algal probiotic combination diet in copra meal extract. In proceedings of National seminar on Reorienting the strategies towards sustainable Aquaculture and Fisheries. p.40-41, 06-07th January 2022.
83. Sneha K G, Rakesh C G and Devika Pillai Participated in the National seminar conducted at KUFOS on 'Reorienting the strategies towards sustainable aquaculture and fisheries' held on 7th January 2022 and presented a paper entitled "Multidrug-resistant *Klebsiella pneumoniae* isolated from farmed *Anabas cobojius* in Kerala aquaculture systems: A case study".
84. Suneela S. S. and Sureshkumar. S. 'Salient features of the mudbank in Alappuzha during the SW monsoon season of 2021' was presented in the International Symposium on Tropical Meteorology (INTROMET 2021) on Changing Climate: Consequences and Challenges conducted by CUSAT during the period November 23-26, 2021.
85. Surendran U and Girish Gopinath (2022). Drought analysis based on Drought indices in Humid tropical regions of India under changing climate scenario, National Seminar on Reorienting the strategies towards Sustainable Aquaculture and Fisheries, under theme Climate Change, 6 to 7th January 2022, p 95
86. Surendran, U and Gopinath, G (2021). Soil Discrimination and property estimation using hyperspectral Data in Humid Tropical Regions of Kerala. International Conference on Ecological Informatics (ICEI 2020+1), Online November 9-13, 2021, P 36-37

87. Swetha K.C., K.J. Jayalakshmi, "An Overview on Finfish Diversity of Important estuaries Along The South West Coast Of India", Poster, Conservation of Life Below water perspective on systematic and sustainable livelihood and citizen Science, (COLIBA 2021) March 18-20 2021, organized by Dept. of Aquatic Biology and Fisheries, Trivandrum.
88. Swetha T V, Remitha Rajan and Girish Gopinath (2021). Groundwater Quality Assessment and Water Quality Index (WQI) Mapping of Phreatic Aquifer System of Palakkad District, "Granary of Kerala, In HYDRO 2021 INTERNATIONAL scheduled to be held at SVNIT Surat, Gujarat, India during December 23-25, 2021.
89. Tejaswi HN, Vineetha VP, Devika Pillai, (2022). 'Evaluation of protective efficacy of *Asparagus racemosus* against deltamethrin-induced toxicity in Nile tilapia *(Oreochromis niloticus)*'. Poster in Reorienting the strategies towards sustainable aquaculture and fisheries, organized by KUFOS on 6-7 January, 2022.
90. Thiruvarasu S, Grace George and Binu Varghese, (2022). Occurrence of Harpacticoid copepod, *Nitokraaffinis* Gurney, 1927 from Cochin Backwaters and assessing its suitability as live feed. National seminar on Reorienting strategies towards sustainable Aquaculture and Fisheries, 6-7 January 2022, Kochi.
91. Vishnu R, Sreelekshmy S, Greeshma James, Jiffriya M.J, Rejish Kumar V.J (2022). Isolation and characterization of Bacillus from mangrove sediments and its potential as probiotics in aquaculture. Presented in National Seminar on Reorienting the Strategies Towards Sustainable Aquaculture and Fisheries, held at KUFOS, Kochi on 6-7 January 2022.
92. Vishnu R, Greeshma James, Sreelekshmy S, Jifiriya M J, Rejish Kumar VJ (2022). Endophytic Bacillus from Mangroves, And Its Probiotic Potential In Aquaculture. Presented in International Seminar on Wetlands and Mangroves: Deliberations on sustainability and conservation, held at Sacred Heart College (Autonomous), Kochi on 24-26 March 2022.

WORKSHOP/TRAINING

1. Training Program on Ornamental fish Culture
   - A training program for three days on "Ornamental fish culture" was conducted by CAAHM for the beneficiaries from 28th to 30th December, 2021.
   - The number of participants was limited to 20 due to the Covid 19 restrictions.

Fig. Ornamental fish culture training

Fig. Participants of training program

2. Abhilash Sasidharan conducted a session on "Exposure to the Technical & Commercial Aspects of Mussel Based Value Added Products" at one day online awareness program (31st August 2021) organized by District Industry Council (DIC), Kasargode, Department of Industries and Commerce, Government of Kerala.
3. Abhilash Sasidharan conducted a session on "Exposure to the Technical & Commercial Aspects of Fish Based Value Added Products" at one day online awareness program on "Agro Business – Food Processing Incubation Program – ARISE" (27th July 2021) organized by Kerala Institute for Entrepreneurship Development (KIED), Department of Industries and Commerce, Government of Kerala.
4. Abhilash Sasidharan conducted a session on "Exposure to the Technical & Commercial Aspects of Fish Based Value Added Products" at one day online awareness program on "Agro Business – Food Processing Incubation Program – ARISE" (30th June 2021) organized by Kerala Institute for Entrepreneurship Development (KIED), Department of Industries and Commerce, Government of Kerala.
5. Abhilash Sasidharan conducted a session on "Food Labelling & Certification" on 21st February 2022 during the five day training program on 'Agriculture, Poultry & Animal Husbandary and Fisheries based Entrepreneurship activities' held from 17.02.2022 to 21.02.2022 organised as part of the ICAR KUFOS SC Sub Plan project at Kerala University of Fsiheries & Ocean Studies (KUFOS), Kerala.
6. Abhilash Sasidharan conducted a session on "Seafood Based Entrepreneurship Opportunities" on 14st February 2022 during the four day training program on 'Agriculture, Poultry & Animal Husbandry and Fisheries based Entrepreneurship activities' held from 14.02.2022 to 17.02.2022 organized as part of the ICAR KUFOS SC Sub Plan project at Kerala University of Fsiheries & Ocean Studies (KUFOS), Kerala in association with Dr. Mukundan's Institute for Food Safety & Technology (MIFT).

7. Abhilash Sasidharan conducted a session on "Seafood Value Addition" on 10th March 2022 as a part of Institution –Village linkage program of Kerala Agricultural University at Krishi Vigyan Kendr, Malappuram, Kerala.
8. Abhilash Sasidharan did Online Awareness program on "Seafood Entrepreneurship opportunities" for 26 participants on 14.12.2021, Kerala University of Fisheries and Ocean Studies, Panangad.
9. Abhilash Sasidharan Organised a two days training program for 40 Women Self Help Group members on "Seafood Value Addition" on 10th & 11th March 2022 as a part of Institution – Village linkage program of Kerala Agricultural University at Krishi Vigyan Kendr, Malappuram, Kerala.
10. Akshaya Vijayan Technical assistant, assisted and attended training on ornamental fish breeding on 31st December 2021 at KUFOS Panangad.
11. Amrutha J Nair, JRF attended training program on "Ornamental fish culture" conducted by CAAHM during 28-30 December, 2021.
12. Asha G. Attended Hands on training on 'Basic and advance computational tools for molecular genetics' from 3-10 January 2022 organized by Fish Genetics and Biotechnology Division, ICAR-CIFE Mumbai.
13. Ayana P.P. and Shireen Mohammed attended Training program an introduction to R and its applications in Quantitative ecology on 28th and 29th March 2022 was organized by Ocean Society of India, Kochi chapter.
14. Ayana P.P. attended International level webinar organized by department of Zoology, Maharashtra college of Arts, Science and Commerce, Mumbai on Occasion of "International Day of action for Rivers" 14th March 2022.
15. Chitra MC, Bincy M Raj and Eldho PS participated in KUFOS national seminar 2022 at KUFOS.
16. Chitra MC, Bincy M Raj and Eldho PS participated in the online International Workshop on Ichthyotaxonomy 2021 organised by University of Kerala und KUFOS.
17. Dr. Anvar Ali P H - Sensitization cum training Programme for tribal farmers on farming and conservation of indigenous fishes under UNDP Project – 3rd April 2021
18. Dr. Anvar Ali P H - Sensitization cum training Programme for tribal farmers on farming and conservation of indigenous fishes under UNDP Project – 9thApril 2021
19. Dr. Anvar Ali P H - Sensitization cum training Programme for tribal farmers on farming and conservation of indigenous fishes under UNDP Project – 22nd June 2021

20. Dr. Anvar Ali P H - Sensitization cum training Programme for tribal farmers on farming and conservation of indigenous fishes under UNDP Project – 9th November 2021
21. Dr. Anvar Ali P H - Sensitization cum training Programme for tribal farmers on farming and conservation of indigenous fishes under UNDP Project – 15th December 2021
22. Dr. Anvar Ali P H - Sensitization cum training Programme for tribal farmers on farming and conservation of indigenous fishes under UNDP Project – 15th December 2021
23. Dr. Anvar Ali P H - Sensitization cum training Programme for tribal farmers on farming and conservation of indigenous fishes under UNDP Project – 18th February 2022
24. Dr. Binu Varghese attended Status and Trends in Freshwater Aquaculture, Fisheries Dept Staff Training, 5.10.21 NIFAM – DoF
25. Dr. Binu Varghese Carp- attended Broodstock management and Breeding Techniques, Fisheries Dept Staff Training, 7.10.21, NIFAM –DoF.
26. Dr. Binu Varghese Entrepreneurship opportunities in ornamental fish sector Technology Based Entrepreneurship Development Programme, 6.10.2021CASRED-DST.
27. Dr. Binu Varghese Entrepreneurship opportunities in ornamental fish sector Technology Based Entrepreneurship Development Programme, 26.11.21CASRED-DST.
28. Dr. Binu Varghese Freshwater Aquaculture Practices and Karimeen Krishi ToT workshop on Aquaculture, 12.11.2021 ICICI Foundation-KUFOS
29. Dr. Deepa John - One month online Training and Internship on Research by MSME Technology Development Centre. July 5- August 5, 2021.
30. Dr. Deepa John- Five days digital workshop on Realtime PCR and data analysis organized by Merck High- End Skill Development Centre. June 21- June 25, 2021.
31. Dr. Deepa John- GUJCOST sponsored online National workshop cum hands on training on design and development of Nano-carriers. Date- 20th February 2021
32. Dr. Felice Joy- International conference on Block Chain and Crypto Currency (ICBC) organised by P. G Department of Commerce, Rajagiri College of Management and Applied Sciences, Kakkanad, February 3rd, 2021.
33. Dr. Felice Joy- Online international workshop on Structural Equation Model and Confirmatory Factor Analysis using AMOS organised by Inspire Softech solutions, December 18th - 20th, 2021.
34. Dr. Felice Joy- Ten days online workshop on Modelling and Forecasting Time Series using E-Views organised by P.G and Research Department of Commerce, St. Peter's College, Kolenchery. June-August 2021.

35. Dr. Felice Joy- Three days International online workshop on Multivariate Analysis and its Interpretation using SPSS organised by Global Institute of Statistical Solutions August 20th - 22nd, 2021.
36. Dr. Felice Joy- Two days international webinar International Virtual Conference on Corporate Sustainability and Responsibility organised by Department of Commerce and Management Studies, Malabar College of Advanced Studies, Vengara in Collaboration with Kerala State Higher Education Council, December10th - 11th, 2021.
37. Dr. Gayathri PV - DST-PURSE sponsored Workshop on Membrane Separation Process organized by School of Environmental Studies, CUSAT, 8th-9th December 2021.
38. Dr. Gayathri PV - Golden Jubilee Celebratory Author Workshop on Writing Quality Research Articles & Identifying Relevant Journals to Read and Publish In- organized by University Library, CUSAT, 14th December 2021.
39. Dr. Gayathri PV - Participated in Pre-Workshop on Emerging Contaminants in Water Resources Management on 24th February 2022 / National Seminar on Hydrology Focal theme on Changing Climate and Extreme Hydrological Events in virtual mode organized by Department of Geophysics, Andhra University,24th -26th February 2022.
40. Dr. Girish Gopinath - Coursera: Global Environmental Management, Technical University of Denmark (DTU), 5-week programme; Grade: 89.5%; Completed on 20 June 2021
41. Dr. Girish Gopinath - Coursera: Natural Attenuation of Groundwater Contaminants: New Paradigms, Technologies, and Applications Rice University, 9-week programme; Grade: 78.9 % Completed on July 22 2021
42. Dr. Girish Gopinath - Coursera: Programming for Everybody (Getting Started with Python), University of Michigan,4-week programme; Grade: 100 % Completed on 14th November 2021
43. Dr. Girish Gopinath - Massive Open Online Course (MOOC), Basic Module (Track I) on Geospatial Applications for Disaster Risk Management (Phase II), Jointly organized by Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) and United Nation Platform for Space based Information for Disaster Management & Emergency response (UN-SPIDER), Completed on 30th September 2021.
44. Dr. Girish Gopinath - Massive Open Online Course (MOOC), Basic Module (Track II) on Geospatial Applications for Disaster Risk Management (Phase II), Jointly organized by Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP) and United Nation Platform for Space based Information for Disaster Management & Emergency response (UN-SPIDER), Completed on 2nd October 2021.

45. Dr. Girish Gopinath attended 10 days virtual training program on “Rainfall data analysis using different packages of R-software” from 12th to 22nd July 2021 organized by Centre fat Water Resources Development and Management, Kozhikode, Kerala.
46. Dr. Girish Gopinath attended an online meeting on 19.06.2021 on Mapping of S&T needs-Kerala', working group on SDG-14, organised by Kerala State Council for Science, Technology & Environment (KSCSTE) Sasthra Bhavan, Pattom
47. Dr. Girish Gopinath attended Executive Committee meeting of Association of Hydrologist of India (AHI) on 09/December/2021
48. Dr. Girish Gopinath attended meeting of the 1st Doctoral Committee Meeting for Ms. V. R. Remya (Reg. No. PA2113001013001) Ph.D. Part time (External) research scholar on 08th December 2021 at 3.00 pm in online mode through zoom meeting by SRMIST, Tamil Nadu.
49. Dr. Girish Gopinath attended meeting of the State Action Plan of Climate Change (SAPCC) on 21/10/2021 by Directorate of Environment and Climate Change, Govt. of Kerala
50. Dr. Girish Gopinath attended meeting of the State Action Plan of Climate Change (SAPCC) on 09/03/2022 by Directorate of Environment and Climate Change, Govt. of Kerala
51. Dr. Girish Gopinath attended one day online Webinar on ‘Covid 19 and Environment’ in connection with the inauguration of Environment Division of IRTC, Palakkad on 3rd August 2021.
52. Dr. Girish Gopinath attended two days online Webinar in connection with the World Water Week 2021 organized by Environment Division, IRTC, Palakkad during 26th and 27th August 2021.
53. Dr. Girish Gopinath participated in Panel discussion Chaired by Prof. M S Mohan Kumar, IISc in connection with National Seminar on ‘Water Resources Management- Challenges and the way forward’ by the Association of Hydrologists of India (AHI), on 26th February 2022
54. Dr. Jenny attended One month online Internship in ‘Research Training’ organized by Ministry of Micro, small and Medium Enterprises (MSME), Govt. of India from 5th July, 2021 to 5th Aug. 2021.
55. Dr. Jenny participated in 2-day Training Program on “Transforming Agri- business with Artificial Intelligence, Machine Learning and Block Chain Technologies”, organized by National Institute of Agricultural Extension Management (MANAGE), Hyderabad from 15-16 Feb, 2021.
56. Dr. Jenny participated in the 28th Indian Convention of Food Scientists and Technologists (ICFoST) on ‘Emerging and Adoptable Technologies for Sustainable Agro Food Industries

and Economy (EAT-SAFE), Aurangabad, Maharashtra from 20-22 Jan, 2022.

57. Dr. Jenny participated in the International Web-Workshop on "Innovative and Emerging Technologies for Food Safety and Nutritional Quality" organized by ICAR-National Dairy Research Institute on 12th, 13th and 25th May, 2021.
58. Dr. Jenny participated in Two weeks online Faculty Development Programme on 'Pedagogy and Research Methods' organized by AMET University, from 24-05-2021 to 06-06-2021 and obtained Grade A+.
59. Dr. Manju P Nair - Molecular Spectroscopy in Practice: Raman and IR imaging Theory and Applications, a joint virtual conference organized by Spectroscopy magazine, the Society for Applied Spectroscopy (SAS), and the Colentz Society on July 27 and 28, 2021.
60. Dr. Manju P Nair - National Online Workshop on R programming for statistical data analysis organised by St. Xavier's College of Management & Technology, Digha Ghat, Patna in association with Lore & Ed Research Associates, Kottayam from 23 – 31 March 2022.
61. Dr. Neema Job -Participated in the ONWARD's international training for 'Monitoring the microbial quality of water' online from 11/02/2022 to 28/02/22
62. Dr. Neema Job participated in the training programme on Computational Biology and Bioinformatics by DBT-BIC, National Centre for Aquatic Animal Health, CUSAT, KERALA from 22/02/22 to 14/03/22.
63. Dr. Rejish VJ completed Online refresher course on "Outcome based education and technology in higher education", organized by Guru Angad Dev Teaching Learning Centre & SGBT Khalsa College, University of Delhi under Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT) of Ministry of Education from July 14 to August 3, 2021 (14 days).
64. Dr. Resmi P - Handled two sessions on the topic "Soil types in aquaculture and their analytical options available" and "Analytical instruments in soil analysis" on 21st December 2021 in an online training program on "Soil, water analysis & Disease management" organised by KUFOS and Director of fisheries, Aluva.
65. Dr. Suneela. S.S attended the online training course on 'Fundamentals of Ocean Modeling' held from 27th September -1st October 2021, organized by the International Training Centre for Operational Oceanography (ITCOocean), ESSO-INCOIS, Hyderabad, India.
66. Dr. V. P. Limna Mol attended the First Lecture of the ICAR-CIFRI Platinum Jubilee Lecture delivered by Dr. S. Ayyappan on August 03, 2021.

67. Dr. V. P. Limna Mol attended the World Antimicrobial Awareness week lecture and celebrations organized by AAHM, KUFOS on November 24, 2021.
68. Dr. V. P. Limna Mol attended Webinar on "DELNET Resources and Services" jointly organized by DELNET and KUFOS.
69. Dr. V. P. Limna Mol Attended Webinar on "Implementing UN SDG 14.3: Protecting Communities and Livelihoods from the Threat of a Changing Ocean" organised by the United Nations in connection with World Oceans Day 2021.
70. Dr. V. P. Limna Mol attended Webinar on "Restoration of Aquatic Ecosystems" organisd by Bhoomitrasena Club, S.N.M. College, Maliankara in connection with World Environment Day, 2021 on 09/06/2021.
71. Dr. V. P. Limna Mol attended Webinar on Effective Utilisation of e-Resources via MyLOFT on August 06 2021.
72. Dr. V.P. Limna Mol attended the national seminar on 'Reorienting the strategies towards sustainable aquaculture and fisheries' held at KUFOS, Panangad from January 06-07, 2022.
73. Dr. V.P. Limna Mol Attended Webinar on "Ecosystem Restoration" organised by CWRDM, Calicut in connection with World Environment Day 2021 on 05/06/2021.
74. Dr. V.P. Limna Mol organized the PG Orientation programme for M.Sc. Marine Biology from November 01 to 03, 2021.
75. Dr. Vineetha V.P. participated in Five Days Faculty Enrichment Programme (FFP) on Cutting Edge Science in Cellular and Molecular Biomedicine organized by Amity University from 27-31st July, 2021.
76. Muhammad. P. Safeena attended one month online internship in "Research training", organized by MSME-Technology development (PPDC), GOVT. of India Organization during 5th July 2021 to 5th August 2021.
77. Siya K. Johnson, Research fellow and, Akshaya Vijayan, Technical assistant attended a National workshop on "Ethics and Regulatory Guidelines for Animal Experimentation" (online Mode) in 30th October 2021

ARTICLE PUBLISHED IN MAGAZINES

1. Felice Joy, V. Ambilikumar, 2021.Corporate Social Responsibility (CSR) Practices of Small Finance Banks in India, SPAST Abstracts, 1(01).
2. Gayathry K.S. and Jenny Ann John (2021). Banana Pseudostem: Prospects of Value Addition. *Kerala Karshakan,* 8 (10): 42-47.

3. Jenny Ann John (2021). A peek into 'Future foods': Special emphasis on air protein and cultured meat. Food Tech Times. AFST(I) Newsletter, 1: 6.
4. Pradhan, C. and Sasidharan, A (2021). Sensory characteristics: a novel way of evaluation of food fishes. "Sasthra-The Indian Journal of Science and Technology 2 (3): 53-58.
5. Raju Kurian M., Felice Joy, 2021. Local Government: A Review of Indian System, Sambodhi (UGC Care Journal), 44 (03): 224-232.

INVITED TALKS/PANELLIST/RADIO TALK

1. Dr. Anna Mercy T.V. participated in the Webinar as a panellist and presented a paper on "Ornamental Fisheries in India SWOT analysis" in the National Virtual Consultation on "Indian Ornamental Fisheries 2.0- The Way Forward" organised from 22nd to -24th April 2021 by The ICAR-Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha in association with the Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, New Delhi and the National Fisheries Development Board (NFDB), Hyderabad
2. Dr. Anu Gopinath – "At the Top of the World". An Environment Awareness Webinar on World Environment Day by Department of Chemistry, Newman College, Thodupuzha on 05.06.2021.
3. Dr. Anu Gopinath – "FT-IR: Principles and Applications". Bioinstrumentation Frontiers 2021 by National Institute of Plant Science and Technology (NIPST) Mahatma Gandhi University, Kottayam, Kerala, India St. Joseph's College (Autonomous) Irinjalakuda, Thrissur, Kerala, India University of Calicut Thenjipalam, Malappuram, Kerala, Kerala Police Academy, Thrissur on 24.7.2021.
4. Dr. Anu Gopinath – "Impacts of macroand microplastics in the marine environment". Immersion course focusing on SDG – 14 (Life Below Water). School of Sustainability, XIM University, Odisha on July 03, 2021.
5. Dr. Anu Gopinath – "Indian Arctic Expedition- My experiences as a Team Member". AGORA-2021 Multidisciplinary Annual Seminar Series at Sree Narayana College, Kollam on 11.05.2021.
6. Dr. Anu Gopinath – "Kakkam Mannnin Vinnin Pali". World Ozone day celebration in All India Radio on 18.09.2021.
7. Dr. Anu Gopinath – "Oceans and the Plastic Pollution". 50 th Anniversary celebrations of Environmental talks of Parishath, Kerala Sasthra Parishath on 08.07.2021.
8. Dr. Anvar Ali P H - Breeding of endemic fish species of Western Ghats – Success story of KUFOS- National Seminar on "Reorienting the strategies towards sustainable aquaculture and

fisheries" – KUFOS and Department of Fisheries, Government of Kerala 6th and 7th January 2022.

9. Dr. Binu Varghese - Karimeen krishi – What farmers should know? AIR FM Kochi in Kisanvani15.9.2021
10. Dr. Binu Varghese - Prospects of Karimeen farming in Kerala. AIR FM Kochi in Kisanvani14.9.2021
11. Dr. Binu Varghese Ornamental Fish Culture – Prospects and Issues – Programme Lead Ornamental Fish Culture 24.7.21 MalayalaManorama/ Karshakasree.
12. Dr. Girish Gopinath - Delivered a lecture on 'Applications of Geospatial Technology in Natural Resources Management' as part of the monthly scientific lecture series organised by the Geological Society of Kerala on Friday, the 27th August 2021.
13. Dr. Girish Gopinath -Delivered a lecture a session on topic "Geospatial Technology for Disaster Risk Mapping" on 12-11-2021 AN (2:00 PM - 5:00 PM) in connection with Short Term Course in Disaster Management and Climate Change from 09.11.2021 to 15.11.2021 for the teachers by UGC-Human Resource Development Centre, Kannur University, Kerala
14. Dr. Girish Gopinath -Delivered a lecture on 'Remote Sensing and Digital Image Processing with a special reference to Natural Resource Management (NRM) ' in connection with 3 days online training on "Application of RS and GIS in Natural Resource Management (NRM) to Soil Survey and Soil Conservation, GoK from October 11th to 13th 202, Organized by CWRDM, Kozhikode on 12th October 2021.
15. Dr. Girish Gopinath -Delivered a lecture on "Application of Geospatial Technology in EIA" on 13-03-2022, in connection with Sate level Workshop on EIA Techniques and Processes", during 09-13th March 2022, Organized by School of Environmental Sciences, Mahatma Gandhi University, Kottayam in Association with Directorate of Environment and Climate Change, Govt. of Kerala
16. Dr. Girish Gopinath -Delivered a lecture on "Application of Remote Sensing for Agricultural Water Management and understanding Climate Change Impact" on 16-11-2021, in connection with Training program on Advances in Agricultural Water Management through Integrated approaches under changing Climate (15th November to 25th November 2021), Organised by KSCSTE-Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala.
17. Dr. Girish Gopinath -Delivered a lecture on "Application of Remote Sensing in Groundwater Studies" on 20-12-2021, in connection with WRMTP Online Training Course on Groundwater Development, Conservation and Management during December 20 - 24, 2021

Organized by KSCSTE-Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala.

18. Dr. Girish Gopinath -Delivered a lecture on "Application of Remote Sensing in irrigated Agriculture" on 10-01-2022, in connection with WRMTP Online Training Course on Application of Decision Support System in Irrigated Agriculture during 10th January to 12th January 2022. Organized by KSCSTE-Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala.
19. Dr. Girish Gopinath -Delivered a lecture on "Geospatial Technology in Disaster Risk Mapping" on 17-01-2022, in connection with WRMTP Online Training Course on "Introduction to Disaster Management with Emphasis to Water Related Disaster", 17-19 January 2022. Organized by KSCSTE-Centre for Water Resources Development and Management (CWRDM), Kozhikode, Kerala.
20. Dr. Girish Gopinath -Delivered a lecture on "Geospatial Technology –An Overview" on 07-03-2022, in connection with Certificate Course on "Remote Sensing and GIS for Land and Ocean Observations, and Climate Modelling", during 07-11 March 2022, Sponsored by DoEC, GoK, organized by organized by the Department of Climate Variability and Aquatic Ecosystems, KUFOS. Kerala.
21. Dr. Girish Gopinath -Delivered a lecture on "Satellite Remote Sensing" in connection with Pre-Vocational Education programme for KV Port Trust, Cochin on 15-11-2021
22. Dr. Girish Gopinath -Delivered a lecture on Disaster risk mapping using GIS and other web based application ' in connection with 4 days online training on "ICT tools for Knowledge Management and Control of Emerging Zoonoses and Animal Health threats from September 20-23, 2021 by Kerala Veterinary and Animal Sciences University and National Institute of Agricultural Extension Management MANAGE (an autonomous organization of Ministry of Agriculture & Farmers Welfare, Government of India) on 21st September 2021.
23. Dr. Girish Gopinath -Invited talk on "Geospatial Technology in Disaster Risk Mapping" on 25-02-2022, in connection with Dr. R Satheesh Memorial Lecture Series, Organized by School of Environmental Sciences, Mahatma Gandhi University, Kottayam
24. Dr. Girish Gopinath -Invited talk on Application of Geospatial Technology in Water Resources Management with reference to Climate Smart Agriculture on 03.02.2022, in connection with DST sponsored training programme on "Soil and Water Conservation Technologies for Climate Smart Agriculture in the context of Extreme Weather Events" during 24th January 2021 to 4th February, 2022, organised by ICAR-IISWC, Research Centre, Udhagamandalam, Ootty, Tamil Nadu

25. Dr. Girish Gopinath -Invited talk on Application of Remote Sensing and GIS in Agriculture on 14.03.2022, in connection with Karyashala -High-End workshop on "Novel concepts and innovative technologies in Agricultural Water Management for climate smart agriculture" during 14th to 26th March 2022, organized by CWRDM Kozhikode, sponsored by Science & Engineering Research Board (SERB), DST, GoI
26. Dr. Girish Gopinath -Invited talk on Geospatial Technology for Water Resources Management on 02.12.2021, in connection with International Conference on Recent Advances in Water Science and Technology (ICRAWST-2021) during 02-03 December, 2021, organized by the Department of Civil Engineering, Sri Shakthi Institute of Engineering and Technology, L&T By-Pass, Coimbatore-641062, Tamil Nadu, India.
27. Dr. Girish Gopinath -Invited talk on Mapping Flood – 2018 and analysis of Landslides in Kerala in connection with Brainstorming session on "Extreme Rainfall Induced Flooding, Soil Erosion and Land Degradation" on 29th Jan.2022, organized by the ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Udhagamandalam.
28. Dr. Girish Gopinath -Lead Speaker on Geospatial Technology in Water Resources Management in a Session on "Application of remote sensing and GIS in environmental monitoring" (on 30th October 2021) in connection with three-day International Conference on Earth and Environment in Anthropocene (ICEEA-2021) during 29th to 31st October 2021, organized by Central University of Karnataka & University of Madras.
29. Dr. Girish Gopinath -Lead Talk on "Geospatial Technology for Natural Resources Management" for technical session Geo-spatial Techniques and Earth Observations (GTE) on 26.11.2021, in connection with INTROMET 2021, International Symposium on Tropical Meteorology, Changing Climate: Consequences and Challenges (C4-21).
30. Dr. Girish Gopinath -Talk on Tracking the Environment from Space in connection with one-day webinar session was held on 5th June 2021 in association with the World environment day organized by P.G department of Applied Geology, GEMS Arts and Science College, Malapuram, Kerala
31. Dr. Pradhan C - "Commercial production of fish feed and challenges". Online technology-based entrepreneurship development programme. Sponsored by National Science and Technology Entrepreneurship Development Board (NSTEDB), Department of Science and Technology, Ministry of Science and Technology, Govt. of India. Organised by Department of Fish Processing technology and CASRED, Directorate of Research, KUFOS, 25th August-11th October, 2021.

32. Dr. Pradhan C - "Fish as Nutritional Food'. Online talk organized by NFDB-MANAGE Aqua One Centre, AOC Kolkata, Kolkata, India on 25th September, 2021
33. Dr. Pradhan C - "Fish Nutrition 360 degree". Online talk organized by Amity Institute of Marine Science and Technology, Uttar Pradesh, India on 6th March, 2021.
34. Dr. Pramila S - "Various challenges like overcapitalization of fishing inputs. 54th batch of staff training for the staff of Kerala state fisheries department. 12-11-2021, 2pm to 3.30 pm.
35. Dr. Rejish VJ delivered the Invited talk on Application of probiotics and immunostimulants in aquaculture in National Seminar on Reorienting the Strategies Towards Sustainable Aquaculture and Fisheries, held at KUFOS, Kochi on 6-7 January 2022
36. Dr. Resmi P- invited talk in Christ college, IJK during the inauguration of Research orientation Club INSPIRE on the topic "Research opportunities India and abroad" organised by department of Chemistry on 26th July 2021.
37. Dr. V. P. Limna Mol Inaugurated the Zoology Association of SNM College Maliankara and delivered an invited lecture on the topic "Sustainable Utilization of Water Resources in the Face of Changing Climate Scenario" on March 31, 2022.
38. Dr. Vineetha V.P. delivered Invited talk on 'Nanotoxicity of titanium dioxide in aquatic animals' at 4th Webinar on Agriculture, Food and Aqua organized by Coalesce Research group, US from 29-30th July, 2021.

AWARDS/ RECOGNITIONS RECEIVED

1. Best poster award for the poster titled, "Fish communities reveal the ecological quality of a small temporarily closed tropical estuary before and after the largest flood event of the century in the national seminar" by Kiranya B. and others at "Reorienting the Strategies towards the Sustainable Aquaculture & Fisheries". Conducted by KUFOS, in the session Aquatic Biodiversity Conservation
2. Best poster award Sooraj NS, Vineetha VP, Devika Pillai, 2022. 'Linking aquatic pollution and declining fisheries in Cochin estuary: Impact on fish health'. Poster in Reorienting the strategies towards sustainable aquaculture and fisheries, organized by KUFOS on 6-7 January, 2022.
3. Dr. Devika Pillai is nominated as an expert in the Technical Expert Committee for Aquaculture and Marine Biotechnology of the Department of Biotechnology, Government of India
4. Dr. Devika Pillai is nominated to the State Plan for Centre of Excellence in Microbiome Research representing the Aquaculture and Aquatic Environment Sector

5. Dr. Devika Pillai is the Chairperson of the State Disease Surveillance team for Aquatic Animal Diseases
6. Dr. Devika Pillai was nominated as the nodal officer for 'Antimicrobial Resistance' in the Aquaculture and Fisheries Sector of the State for control of antimicrobial resistance in different sectors (Kerala Antimicrobial Resistance Strategic Action Plan KARSAP).
7. Dr. Girish Gopinath- Chaired a Session on 'Digital Science for Environment', on 11th November 2021 in connection with 11th International Conference on Ecological Informatics (ICEI 2020+1) during 09-13 November 2021, organized by Kerala University of Digital Sciences Innovation and Technology [Digital University Kerala].
8. Dr. Girish Gopinath- Chaired a Session on 'TS-8C: Disaster Management and Climate Change (DMC)', on 26th November 2021 in connection with INTROMET 2021, International Symposium on Tropical Meteorology, Changing Climate: Consequences and Challenges (C4-21)
9. Dr. Girish Gopinath- Chaired a session on 2nd December 2021 in connection with International Conference on Recent Advances in Water Science and Technology (ICRAWST-2021) during 02-03 December, 2021, organized by the Department of Civil Engineering, Sri Shakthi Institute of Engineering and Technology, L&T By-Pass, Coimbatore-641062, Tamil Nadu, India.
10. Dr. Girish Gopinath- Chairman for conducting the Open Defence of Sri. Aju C.D under the faculty of Geology, Kerala University on 15th December 2021
11. Dr. Girish Gopinath- Chairman for Ph.D. Open Defence and Public Viva-Voce of Prasanth RS, Department of Geology, University of Kerala, on 16th March 2022 (vide UO No. No.Ac.E.II/4/29520/21 dated 3/3/2022).
12. Dr. Girish Gopinath- Co- Chaired a Session on "Water quality monitoring and management during extreme events with special reference to Emerging contaminants" in connection with 38th & 39th AHI Annual Convention and National Seminar on "Hydrology" Focal theme on 'Changing Climate and Extreme Hydrological Event during 25th to 26th February 2022, organized by Association of Hydrologist of India (AHI) and Andhra University
13. Dr. Girish Gopinath- Co-chaired a Session on "Application of remote sensing and GIS in environmental monitoring" (on 30th October 2021) in connection with three day International Conference on Earth and Environment in Anthropocene (ICEEA-2021) during 29th to 31st October 2021, organized by Central University of Karnataka & University of Madras.
14. Dr. Girish Gopinath- Co-chaired a Session on Climate Change and Fishery on 07/01/2022 in connection National Seminar on Reorienting the strategies towards Sustainable Aquaculture

and Fisheries, under theme Climate Change during 6th to 7th January 2022, Organized by Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi

15. Dr. Girish Gopinath- Executive member of Association of Hydrologists in India (AHI)
16. Dr. Girish Gopinath- Executive member of Indian Meteorological Society (IMS) Cochin Chapter
17. Dr. Girish Gopinath- Expert Member of the syllabus committee for MSc. Applied Geology Programme, under the Department of Geology, School of Environmental Sciences, M. G. University on 07-03-2022
18. Dr. Girish Gopinath- External examiner for final Viva Voce examination of Ms. Ms. Shereena Joshi (2015-20-026), College of Climate Change and Environmental Science, Kerala Agricultural University (KAU) on 24th January 2022 at 2.00 pm, through online mode.
19. Dr. Girish Gopinath- External examiner for final viva voce examination of Ms. Smrithy M.G. (2016-20-017), College of Climate Change and Environmental Science, KAU on 09th December 2021 at 2.30 pm, through online mode.
20. Dr. Girish Gopinath- External examiner for final viva voce examination of Mr. Rhoit N (2015-20-010), College of Climate Change and Environmental Science, KAU on 18th October 2021 at 02.30 pm, through online mode.
21. Dr. Girish Gopinath- External examiner for final viva voce examination of Ms. Suja Mary James (2015-20-010), College of Climate Change and Environmental Science, KAU on 12th August 2021 at 10.30 am, through online mode.
22. Dr. Girish Gopinath- External Examiner for MSc Applied Geology, Practical and Viva examinations at Christ College, Irinjalakuda during 21/12/2021 to 22/12/2022
23. Dr. Girish Gopinath- External Examiner for MSc Applied Geology, Practical and Viva examinations at Christ College, Irinjalakuda during 21/12/2021 to 22/12/2022
24. Dr. Girish Gopinath- External Examiner for MSc Applied Geology, project/Dissertation/ viva and Practical examinations at Christ Colleage, Irinjalakuda during 16/08/2021 to 18/08/2021
25. Dr. Girish Gopinath- External examiner of Ph.D Viva Voce Mr. G.Sakthivel (403114054), Full Time Ph.D. Scholar, Department of Civil Engineering, National Institute of Technology (NIT), Tiruchirappalli, through online mode on 28/02/2022
26. Dr. Girish Gopinath- External examiner of Ph.D. Viva-Voce examination of Ms. Nitika Mundetia (2013PHDES03), Research Scholar, Department of Environmental Science, School of Earth Sciences, Central University of Rajasthan, Kishangarh, Ajmer; Title: Impact of

Climate and Land Use Change on Water Resources – A Case of Khari River Basin, Rajasthan on 25th October 2021.

27. Dr. Girish Gopinath- External examiner of the course work examination of research scholars of Department of Marine Geology & Geophysics, School of Marine Sciences, Cochin University of Science and Technology (CUSAT), Lakeside Campus, Kochi - 682 016, June 2021
28. Dr. Girish Gopinath- External expert to assess the performance of scientists working in Rubber Research Institute of India to award higher grade under career improvement scheme at Rubber Research Institute of Inia, Kottayam, Kerala on 10th February 2022.
29. Dr. Girish Gopinath- External Member in the Selection Board for a Junior Research Fellow (JRF) in a DST-SERB funded project in the Department of Marine Geology and Geophysics, Cochin University of Science and Technology, Cochin, on 7th September 2021.
30. Dr. Girish Gopinath- External examiner for the External Project Valuation and conduct of Viva voce (ONLINE Mode) of Fourth Semester M.Sc degree in Computer Science with specialization in Geospatial Analytics on June 16 2021**,** . Indian Institute of Information technology and Management-Kerala, Technopark, Trivandrum-695581.
31. Dr. Girish Gopinath- Member of Board of Studies in Marine Geology and Geophysics, Cochin University of Science and Technology (CUSAT) with effect from 04.11.2019 for a period of 4 years.
32. Dr. Girish Gopinath- Member of committee constituted by KSCSTE office order No. 31/2021/KSCSTE Thiruvananthapuram, dated 07/04/2021, to frame views/suggestion on the 'Draft Geospatial Policy' prepared by Department of Science and Technology (DST), Govt. of India
33. Dr. Girish Gopinath- Member of committee constituted by KSCSTE office on 29/04/2021 for Mapping of S&T needs-Kerala', working group on SDG-14
34. Dr. Girish Gopinath- Member of local organizing committee of INTROMET-2021 with the theme Changing Climate: Consequences and Challenges.
35. Dr. Girish Gopinath- Member of the First Doctoral Committee meeting of Mr. Harikrishna S, Full Time Research Scholar in Centre for Applied Geology, The Gandhigram Rural Institute Deemed to be University in Online mode on 25.02.2022.
36. Dr. Girish Gopinath- Subject Expert in Brain Storming Session on 29th January, 2022 in connection with National Level Online Brainstorming session on "Extreme Rainfall Induced Flooding, Soil Erosion and Land Degradation" organized by the ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Udhagamandalam.

37. Dr. Linoy Libini group won best paper award for "Growth and reproductive performance of *Brachionusplicatilis* using algal probiotic combination diet in copra meal extract" in the national seminar" Reorienting the strategies towards sustainable Aquaculture and Fisheries, Jan 6-7, 2022.
38. Dr. Rajeev Raghavan is listed in the World's Top 2% scientists Rankings published by Stanford University.
39. Dr. Vineetha V.P. served as a 'Reviewer for the abstracts' and 'Chaired a technical session' under Life Sciences in the International Conference on Humans and Technology: A holistic and symbiotic Approach to sustainable Development (ICHT 2022) on 20th Jan 2022 organized by MES college Marampally, Aluva from 17-22 Jan, 2022.
40. Editor: Gopakumar K., Maya Raman and Balagopal Gopakumar (2022). Food Processing and Preservation Technology. Narendra Publishers.
41. Princy M. John, SRF: Best paper award in the International seminar on Wetlands and Mangroves: Deliberations on sustainability and Conservation (LAEC-2022) for the paper "Current trends in the distribution level of Organochlorine and Organophosphate pesticides in the central sector of Vembanad Lake".
42. Princy M. John, SRF: Best paper award in the national seminar on Reorienting the strategies towards sustainable aquaculture and fisheries for the paper "Spatial variations of nutrients and Dissolved Oxygen in the southern and central sectors of Vembanad Lake – Inter monsoonal evaluation. Seminar organized by KUFOS in January 2022.

ACTIVITIES AT KUFOS

1. Convenor: Dr. Maya Raman, Co-ordinator: Dr Jenny Ann John conducted National Webinar on "Creating Food and Nutrition Security for a Sustainable Future" in collaboration with the Association of Indian Universities (AIU), New Delhi, on Jan 11th and 12th, 2022.
2. Convenors: Dr Jenny Ann John, Dr Sruthi R.S. and Dr P.T. Mathew organized Webinar on "GC, HPLC and ICP-Techniques and Instrumentation in Analytical Chemistry" on Feb 22-23, 2022.
3. Dr Jenny Ann John organized webinar and online contests on the occasion of 'World Food Day' on 7th June, 2021. Jointly organized by Faculty of Ocean Science and Technology and Faculty of Fisheries Engineering.
4. Dr. Anu Gopinath – "Impacts of macro and microplastics in the marine environment". World Nature Conservation Day by School of Ocean Science and Technology, KUFOS on 28.07.2021

5. Dr. Binu Varghese conducted a class on Karimeen breeding and rearing on 22.7.21, Fish Farmers Day 2021 at KUFOS
6. Dr. Girish Gopinath- Coordinator for 5006th Webinar series on "SAR Data Processing" on 26th to 30th May 2021, EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
7. Dr. Girish Gopinath- Coordinator for 69th IIRS Outreach Programme on RS and GIS Applications, 2nd to 20th November 2021, EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
8. Dr. Girish Gopinath- Coordinator for 76th " GIS for Supply Chain Management" during 26th to 30th April 2021, EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
9. Dr. Girish Gopinath- Coordinator for 77th "Geospatial Technology for Archeological studies" during 17th May 2021 to 21st May 2021, EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
10. Dr. Girish Gopinath- Coordinator for 80th "Earth Observation for Carbon Cycle Studies" during 21st June 2021 to 25th June 2021, EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
11. Dr. Girish Gopinath- Coordinator for 81st "Overview of Web GIS Technology" during 21st June 2021 to 2nd July 2021, EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
12. Dr. Girish Gopinath- Coordinator for 93rd course on "Geo-informatics for Biodiversity Conservation Planning", during 06-12-2021 to 17-12-2021 by EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
13. Dr. Girish Gopinath- Coordinator for 94th course on "Overview of Geoprocessing using Python", during 17-01-2022 to 28-01-2022 by EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
14. Dr. Girish Gopinath- Coordinator for 95th course on Global Navigation Satellite System and Location based services during 21-02-2022 to o4-03-2022 by EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.
15. Dr. Girish Gopinath- Coordinator for 96th course on Hyperspectral and Microwave Remote Sensing Techniques for Geological Studies during 07-03-2022 to 17-03-2022 by EDUSAT programme, Indian Institute of Remote Sensing (IIRS), Dehradun, Nodal Institute, KUFOS, Puthuvypin Campus.

16. Dr. V. P. Limna Mol and Dr. Nevin K. G. organised a Webinar on Microscopy entitled "Advanced Microscopic Techniques for Cellular Research" from February 14 – 15, 2022, in collaboration with inBiotek Microsystems, Kochi.
17. Dr. V. P. Limna Mol and Dr. T.K. Sirajudheen organized the World Oceans Day 2021 (Online competitions, Ocean Day Discussion and Ocean Day lecture) from June 08 to 10, 2021.
18. Dr. Phiros Shah acted as Co- Convenor and conducted classes for the "Certificate course on Remote sensing and GIS for Land and Ocean Observations and Climate Modelling at Department of Climate Variability and Aquatic Ecosystems, FOST from 07/03/2022 to 11/03/2022
19. A hands-on training program for 20 participants (Scientist, Assistant professors and research scholars) on "Age determination of fishes using otolith" was conducted at KUFOS from 21st – 24th March 2022 organized by MoES-KUFOS project and Dept. of FRM, Kerala University of fisheries and Ocean Studies (KUFOS).Inauguration of the training program was done by Pro. (Dr.) K. Riji John, Vice-chancellor of the KUFOS in the presence of Prof. (Dr.) B. Manoj Kumar, Registrar KUFOS, Prof. (Dr.) M. Roselind George, Dean Faculty of fisheries,Prof. (Dr.) Devika Pillai, Director of Research and Dr.M.K. Sajeevan, Associate professor, Head of Dept. of FRM, KUFOS, and Principal Investigator of MoES, Twenty participants from the Fishery Survey of India, MES college, Madhurai Kamaraj University and KUFOS were attented the training programme. Detailed account on methodology of otolith extraction, polishing and reading of growth rings were explained to the participants. Hands on training provoded practical skill to the traininees to determine age and growth of fishes using otolith. In addition to faculty from NIOT, Egypt, faculty from KUFOS, CUSAT, CMLRE, ZSI, CMFRI and SH College Thevara attended the training programme as resource person. Research scholars of KUFOS-MoES research project attended the practical session.


Inauguration ceremony of
Hands on training on
age determination
of fishes using otolith

GenBank Submissions

1. GenBank accession number OL673063. Neema, J., Ashly Augustine, and Nevin KG (2021), *Spongia* sp.
2. GenBank accession number OL673064. Neema, J., Ashly Augustine, and Nevin KG (2021), *Tedania tubulifera.*
3. GenBank accession number OM149796 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Cladosporium* sp.
4. GenBank accession number OM149797 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Cladosporium* sp.
5. GenBank accession number OM149798 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Parengyodontium album*
6. GenBank accession number OM149799 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Phyllosticta* sp.
7. GenBank accession number OM149800 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Colletotrichum* sp.

8. GenBank accession number OM149801 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Phaeophleospora eucalypticola*
9. GenBank accession number OM149802 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Cladosporium* sp.
10. GenBank accession number OM149803 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Cladosporium* sp.
11. GenBank accession number OM149804 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Fusarium* sp.
12. GenBank accession number OM149805 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Allophoma minor*
13. GenBank accession number OM149806 Neema, J., Ashly Augustine, Abhirami Ramdas, Divya Raju and Nevin KG (2022), *Cladosporium* sp.

PROJECT SANCTIONED DURING THE YEAR

1. Project Title: "Unravelling signatures of growth and salinity adaptation in *Etroplus suratensis* through omics approaches"
   Name of PI: Dr. Anvar Ali P H
   Co-PI: Dr. Chiranjiv Pradhan
   Funding agency: Department of Biotechnology, Ministry of Science and Technology, Government of India
   Duration: 3 Years
   Amount sanctioned: 3.7 Lakhs
2. Project Title: "Mycosporine like amino acids from Corals and associated Dinoflagellates- Their Role in preventing Coral Bleaching- A Case study of Lakshadweep Archipelago"
   Funding Agency: DST SERB
   PI: Dr. Anu Gopinath
   Co-PI: Dr. Phiros Shah
3. Project title: Remote Sensing and GIS for Land and Ocean Observations and Climate Modelling.
   PI: Dr. Shijo Joseph
   Funding agency: Department of Environment and Climate Change, Government of Kerala for 5 days training program.
   Amount sanctioned: 1.10 Lakhs.

DIRECTORATE OF EXTENSION

Details of Extension activities carried out during 2021-2022

Introduction

In many instances, lack of awareness about the improved technology acts as a major constraint in the adoption of various practices, hindering the development of the concerned sector. Tremendous developments are taking place in many fields and transfer of the same to the stakeholders quickly in an efficient manner is imperative for the progress of the country. In this context, extension, the vital link connecting the technological development with the production system plays a crucial role.

Fisheries sector has witnessed tremendous developments both in aquaculture and capture fisheries. Though so many institutions, State/Central/NGO's are engaged in the transfer of various technologies aimed at the development and welfare of the fish farmers and fisher folk, it has not yet reached to the desired extent as envisioned. Despite their efforts, fisheries sector continues to be one of the most backward areas. Lack of awareness about various welfare schemes implemented by State/Central Government agencies still continues to be a major barrier in availing the benefits from different agencies, hindering their socio economic development. One of the remedies is to strengthen the extension services to the community. Taking into account of these aspects, Kerala University of Fisheries and Ocean Studies (KUFOS) has implemented various extension projects aimed at the total development of the fisheries sector. These projects have helped in creating mass awareness about the various technologies in the field of fisheries, augmenting the fish production and protein supply to the community by adopting innovative aquaculture practices in an eco-friendly and sustainable manner, creating more employment opportunities in the concerned field, leading to an increase their income and improvement in the quality of life and ensuring livelihood security to them.

2.Extension Projects

Directorate of Extension, Kerala University of Fisheries and Ocean Studies (KUFOS) has implemented the following Plan Projects funded by Government of Kerala during the year 2020-21.

I.Village Adoption for Empowerment and Capacity Building Ensuring Livelihood of Fisherfolk in Central Kerala

Kerala University of Fisheries and Ocean Studies (KUFOS) is implementing the Plan Project " Village Adoption for Empowerment and Capacity Building Ensuring Livelihood of Fisherfolk in Central Kerala" from the year 2015 onwards. The major objectives of the project are promoting diversified aquaculture practices and allied activities in an eco- friendly and sustainable manner so as to increase the fish production of the State, creating more employment opportunities to the fish farmers and fisherfolk, thus ensuring livelihood security to them. The project also focuses on transfer of post harvest technologies to the target group with a view to ensure better quality products both for domestic and export market and helps in providing gainful employment by establishing small scale units along the coastal area. While promoting these activities special emphasis is being given for women empowerment also. Every year the University is adopting 2-3 villages and implementing the activities by establishing demonstration centers on various practices in ideal locations so as to develop interest among the farming communities and to motivate them in adopting the technologies. All these activities are being carried out with the cooperstion and participation of the locxal bodies.

In view of the visit of the peer review team for ICAR accreditation of the Faculty of Fisheries Science, KUFOS, the activities of the said project during the year 2021-22, focused mainly on promoting aquaculture activities in Kumbalam village. Though the Covid 19 restrictions imposed during the above period acted as a major constraint in field work viz. visiting and selecting ideal locations and promoting aquaculture activities, the University could establish seven pen culture and five cage culture demonstration units in pearl spot, seabass and GIFT tilapia farming at different locations of the village. Various inputs like netting materials, cages, GI frames, floats, seeds of pearl spot, seabass, and GIFT tilapia, feed and other accessories necessary for establishing demonstration units were distributed to the beneficiary farmers who were selected through the Panchayath. Continuous monitoring and periodic growth assessment were also carried out throughout the culture period. The idea behind establishing demonstration units is to convince the farmers about the utility and feasibility of the technology and to motivate them in adopting various aquaculture practices in an ecofriendly and sustainable manner. Harvesting of some of the units in pen culture and cage culture was carried out during the month of December 2021 and the results were encouraging.

Stocking the penculture unit at Chathamma, Panangad by Prof. (Dr.)K Riji John, honorable Vice Chancellor, KUFOS.

Distribution of netting material and feed to the beneficiary farmers

Harvesting of the Cage culture demonstration unit (Seabass) at Chathamma by the honorable Vice Chancellor Prof.(Dr.) K. Riji John on 22/12/2021

Training programme on "Advanced techniques in brackish water aquaculture"

As part of the project a training programme on "Advanced techniques in brackish water aquaculture" for the fish farmers was organized at KUFOS Head quarters from 3/3/2022 to 5/3/2022. The programme was jointly organized by the Directorate of Extension and Faculty of Fisheries Science, KUFOS. Dr. Daisy C Kappan the Director of Extension welcomed the dignitaries and farmers and explained details of training programme. The programme was inaugurated by Prof.(Dr.) K. Riji John, honorable Vice Chancellor of KUFOS and presided over by Dr.B.Manojkumar, Registrar, KUFOS. Dr. Devika Pillai, Director of Research and Dr, Rosalind George, Dean Faculty of Fisheries offered felicitations. and Dr.Gijo Ittoop, Principal Investigator of the project expressed vote of thanks on this occasion.

The sessions include Problems and prospects of brackish water aquaculture, Principles of aquaculture, Biofloc culture, Pen and cage culture ,Seed production and culture of Pearl Spot, activities of Department of Fisheries, Brackish water shrimp culture, mussel culture, feed formulation and preparation, preparation of Value added products and marketing, fish and shrimp diseases which were engaged by Smt Dona P, Guest Faculty of Department of Fisheries Extension, Economics and Statistics,,Smt. Shalumol Salas, Guest Faculty of Department of Fisheries Extension, Economics and Statistic, Sri M. Shaji, Retd. Joint director MPEDA, Sri.Saneer N S, Fishing Technology Asst.,Dr. Anwar Ali, Assistant Professor Department of Fishery Resouce Management,Smt. Divya T Babu, Department of Fisheries, Sri. Ragesh C. G. Research Fellow, Dr. Bindhi S Kumar, Training Associate, Sri.Vishnu R Nair, Research Associate CIFT and Dr. Safeena M. P. Assistant professor, Department of Fish Processing Technology. On the last day of the training programme a field visit to the western campus of KUFOS where the brackish water shrimp farms are located was also organized. Prof.(Dr.)BManojkumar Registrar, KUFOS distributed the certificates to the participats. Altogether 20 farmers attended the training programme.

II.Earn While You Learn (EWYL)

The concept of this programme is to develop entrepreneurship among the students undergoing various courses in the University. Aquaculture and allied subjects dominate in their curriculum and a thorough hands-on exposure in the field will enable them to understand the basic concepts through a more practical oriented approach, to prepare them as capable professionals and turn them to job creators than job seekers. This programme, apart from giving practical exposure, will also enable them to be self-sufficient, confident and efficient managers. Kerala University of Fisheries and Ocean Studies (KUFOS) is implementing this project by utilizing the infrastructure facilities available in the University.

Earn While You Learn Programme- Guidelines

Preamble : Earn While You Learn programme is envisaged to strengthen the link between learning process and field oriented farming practices. This will reinforce the instructional curricula discharge at class room on the one hand and lab to land on the other. It will also help to improve the farming practices by getting innovative ideas from the students (land to lab).This mechanism will help the students to acquire professional competency in the field of fisheries and allied areas.

- Students of KUFOS will be entrusted with this programme and it will be voluntary in nature.Participating students will be given certificate.
- Areas identified for Earn While You Learn Programme are
  1.Aquaculture- mono/polyculture variety species
  2.Integrated farming
  3.Cage/Penculture
  4.Ornamental Fish Culture
  5.Aquaponics
  6.Value addition
- The students will be grouped into batches of 10 each and each group can opt one of the above mentioned areas of activity
- Sales will be through Amenity Centre, KUFOS.
- Service of labourers can be availed of during the period of the programme as per requirement
- Sixty percent of the profit generated through the programme shall be disbursed to the students.
- Remaining portion of the profit and input cost shall be refunded to the University.
- Periodic maintenance of the infrastructure facilities shall be done by the University
- The programme will be jointly implemented by the Directorate of Extension and school concerned
- There shall be a report authenticated by the monitoring committee.
- There shall be a stock register maintained by the faculty concerned, countersigned by the Director of the respective school.
- The programme shall be monitored by a committee consisting of the Director of Extension as the chairman and a faculty member as convener and one faculty nominated

by the honorable Vice Chancellor. Director of the school concerned shall be an Ex-Officio member

During the year 2020-21, the activities of EWYL were on a low key as students were unavailable on the campus during the first half of the year due to COVID restrictions. Later, though the students were available they were engaged in continuous practical classes and examinations. Hence, certain low intensity activities were planned in line with the relaxed covid protocols. Students were involved in ongoing activities like rearing Karimeen, ornamental fishes, tilapia, etc. Apart from these new initiatives in rearing Murrels, high density tilapia culture and propagation of Aquatic plants were undertaken by a group of students. As part of the programme, six tanks and a microscope were procured in the Finnancial Year.

Currently the following activities are ongoing.

- Rearing and seed production of Karimeen, *Etroplus suratensis*
- Rearing of Red Tilapia
- Propagation of aquatic plants and aquarium fishes
- Culture of murrels

III.Establishment of Farm Radio Station for Hastening Fisheries development in the State

As part of the Plan Project "Farm Radio", a well equipped Audio Video Recording Studio with all facilities both for audio and video recording has started functioning during the year 2018 onwards. Currently a Cameraman cum NLE Editor and a Production Associate are working in this project . In addition to documenting the activities and achievements of the university in teaching research and extension, instructional films in diversified aquaculture activities, production of value added fishery products etc are also taken for transferring the technologies to the fish farmers and fisherfolk along the coastal area. Two short films in cage aquaculture and penculture of ten minutes duration has already produced. Video recording of the production of value added fishery products, fresh water fish farming, Vannamei shrimp farming etc. are are going on. Since the lack of adequate knowledge about the various technologies in the field of fisheries sector still acts as a major constraint in the wide spread adoption various technologies, such an approach in communicating different technologies through Audio Visual aids to the target group will definitely help in increasing the rate of adoption of practices, leading to increased production from the fisheries sector. As per the decision of Governing Council, Directorate of Extension is outsourcing the above facilities to various institutions and started creating income to the University. An amount of Rs.1,66,875/- (One lakh sixty six thousand eight hundred and seventy

five only) has been earned during the year 2021-22 by outsourcing the studio facilities. The following activities were carried out during the year 2021-22.

APRIL-2021

- Photography of send off arranged by the Staff club on 30th April 2021

MAY -2021

- Photography of Consultation Meeting on "Comprehensive Development of Chellanam Panchayat through Scientific Interventions" on 29/05/2021

JUNE-2021

- Videography and photography of Inauguration of pen culture units established at Chathamma as part of village adoption program of KUFOS on 23/06/2021
- Video editing of Documentary film about pen culture on 25/06/2021

JULY-2021

- Videography of visuals required for the production of video film on fresh water farming on 08/07/2021
- Video editing of short film on "Fresh Water Fish Culture" on 09/07/2021
- Voice recording of Prof. (Dr.)Daisy C Kappen, Director of Extension for broadcasting a talk on "Employment opportunities in Fisheries sector" through AIR on 12/07/2021.
- Videography and photography of project proposal meeting and campus visit of Shri. Saji Cherian, honorable Minister of Fisheries, Culture and Youth Affairs at Puthuvypin campus on15/07/2021
- Photography and Videography of Life Time Achievement Award giving ceremony on the occasion of the celebrations of the " Farmers day" on 22/07/2021

AUGUST -2021

- Videography and photography of 7th convocation of KUFOS on 12/08/2021
- Sorting and editing of photos of 7th convocation on 13th , 16th and 17th August 2021 for uploading in the university website and displaying in the university lobby.
- Photography of Independence Day celebrations conducted in KUFOS on 15/08/2021
- Video editing of 7th convocation on 13th , 16th , 17th , 25th , 26th August 2021
- Photography of distribution of inputs to the participants (SC/ST) of the training programme on "Ornamental fish farming" organized by NBFGRI and KUFOS on 16/08/2021.
- Photography of Hon'ble Vice Chancellor of KUFOS for uploading in the KUFOS website on 17/08/ 2021
- Video shooting of SWOYAM MOOC programme for IGNOU Cochin regional center on 26/08/2021
- Video editing of SWOYAM MOOC video for IGNOU Cochin regional center on 27/08/2021

- Video shooting and editing of SWOYAM MOOC programme for IGNOU Cochin regional center on 28/08/2021
- Video shooting and editing of SWOYAM MOOC programme for IGNOU Cochin regional center on 31/08/ 2021

SEPTEMBER-2021

- Video shooting and editing of SWOYAM MOOC programme for IGNOU Cochin regional center from 1st to 4th September 2021
- Video editing of SWOYAM MOOC programme for IGNOU Cochin regional center on 06/ 09/2021
- Video shooting of KUFOS MOOC Programme on "canning" by DrAbhilashSashidharan on 07/09/2021
- Video recording of "fish pasta making process" on 08/09/2021 for engaging classes to the entrepreneurs through online in the workshop "DST-TEDP" organized by CASRED, KUFOS
- Video recording of quality testing process of different packaging material on 14/09/2021for engaging classes to the entrepreneurs through online in the workshop "DST-TEDP" organized by CASRED, KUFOS
- Audio recording and editing of above videos from 15th to 18th , 23rd , 28th and 29th September 2021
- Photography of the inauguration of the agricultural programme by Honorable Prime Minister of India Sri. Narendra Modi on 28/09/2021organized by ICAR through online.

OCTOBER -2021

- Video shooting of SWOYAM MOOC programme for IGNOU Cochin regional center on 1st October 2021
- Video editing of SWOYAM MOOC programme for IGNOU Cochin regional center on 4th and 5th October 2021
- Video shooting of the training program on "Value added fish products" for the fish farmers conducted at KUFOS Regional center, Payyanur on 07/10/2021
- Photography of the Research Council meeting on 11/10/2021
- Video shooting of KUFOS MOOC Programme on "Canning Part 02" by DrAbhilash Sashidharan on 13/10/2021
- Video editing of KUFOS MOOC Programme on "Canning Part 02" by Dr Abhilash Sashidharan on 16th ,18th ,20th ,22nd ,25th and 26th October 2021
- Photography of NCC programme on 23/10/2021.

NOVEMBER -2021

- Photography of "Kerala Piravidinam and Malayalabhakshadinacharanam" on 01/11/2021
- Photography of the book release "Costal Kerala" by Prof.(Dr.) K Riji John, Hon'ble VC, KUFOS written by PhD Scholars of various Universities on 2nd November 2021.
- Photography of MoU Signing with CWRDM on 05/11/2021
- Photography of seed stocking at Edamalayar dam on 09/11/2021 as part of the project "Enhancing reservoir for production and creation of livelihood opportunities for the tribal people in Munnar landscape through diversified farming practices of native fishes."

- Photography of Extension Council meeting on 18th November 2021
- Photography of the Inauguration of the Music Class organized by Staff club,KUFOS on 18th November 2021
- Photography of Manappuram group's scholarship distribution to the students organized by Faculty of Fisheries Management on 19th November 2021
- Video editing of MOOC Programme by DrAbhilashSasidharan on 22nd and 23rd November 2021
- Photography of the "World Anti-microbial Awareness week-2021"programme on 24th November 2021
- Photography of the smart class room of the plan project "MOOC" on 24th November 2021 for including in the annual report-2020-21.
- Audio Recording and Editing for AIDS Awareness programme conducted by NSS unit of KUFOS on 29th and 30th November 2021.

DECEMBER - 2021

- Photography of AIDS Awareness programme jointly organized by NSS KUFOS and District Health Department on 1st December 2021.
- Photography of "Hands-on training in mendeley" organized by Department of Business Administration and Management FFM, KUFOS on 1st December 2021
- Photography of "National Agriculture Education Day" programme organized by Directorate of Extension and Faculty of Fisheries Science at Panangad Vocational Higher Secondary School on 3rd December 2021
- Photography of Training for NSS Volunteers on " Identifying poor people" conducted by Kumbalam Gramapanchayath and Kerala Institute of Local Administration on 6th December 2021
- Photography of Field visit of the Director of Extension on 7th December 2021 for providing advices to the farmers at various places in Kumbalam GramaPunchayat where cage and pen culture demonstration units are established
- Photography of Inauguration of "Inter Department Football Championship 2021" organized by Department of Physical Education, KUFOS on 21st December 2021
- Photography and Videography of harvesting of Pen culture demonstration unit at Cheppanam on 21st December 2021
- Photography and Videography of harvesting of cage culture demonstration unit at Chathamma on 22nd December 2021
- Photography of Prize distribution of "Inter Department Football Championship 2021" organized by Department of Physical Education, KUFOS on 23rd December 2021
- Photography of the Training on ornamental fish culture conducted by CAAHM on 31st December 2021.

JANUARY-2022

- Photography of new year celebration at KUFOS on 1st January 2022.

- Photography of the Prime Minister's online address at the release of 10th installment of financial benefit under PM-KISAN scheme on 1st January 2022.
- Photography of distribution of netting material to fish farmers by the Director of Extension under village adoption project on 4th January 2022.
- Photography and videography of national seminar on "Reorienting the Strategies Towards Sustainable Aquaculture and Fisheries" Organized by Faculty of Fisheries science on 6th and 7th January 2022.
- Photography of "Entrepreneurship Training Programme in Bakery Production" organized by CASRED and CEFPT from 12th to 14th January 2022.
- Photography and videography of "One Day State Level Awareness Program on PMMSY" organized by NCDC Thiruvananthapuram Regional centre on 13th January 2022
- Video editing of "One Day State Level Awareness Program on PMMSY" organized by NCDC Thiruvananthapuram Regional centre on 19th and 20th January 2022
- Photography of Republic Day program on 26th January 2022
- Sorting of appropriate photos taken during the month January 2022 for displaying in the TV installed in the administrative block and for other purposes on 27th and 28th January 2022

FEBRUARY 2022

- Photography of seed distribution and stocking at Chathamma under the plan project "Villiage adoption" on 5th February 2022.
- Photography of workshop on " Writing for Media" on 8th and 9th February 2022.
- Photography of workshop on "Ornamental Fish Farming" under the ICAR SC/ST Sub plan project on 10th February 2022.
- Photography and videography of three day workshop on " Brackish Water Fish Farming- Advanced Techniques" from 16th to 18th February 2022.
- Videography of Fish pickle recipe video for Department of Fish Processing Technology on 25th February 2022.
- Photography of Seminar on" Preparation of a Framework for Comprehensive Development of Chellanam as a Model Village".

MARCH - 2022

- Photography of three day training for farmers on " Brackish Water Fish Farming- Advanced Techniques" organized by Directorate of Extension and Faculty of Fisheries Science from 3rd to 5th March 2022.
- Photography of "Entrepreneurship Training Programme in Bakery Products" organized by CASRED and CEFPT from 3rd to 5th March 2022.
- Photography of Women's day programme organized by staff club on 8th March 2022.
- Photography of "Sensitization Workshop on Entrepreneurship Development" organized by Department of Fish Processing Technology and CASRED from 15th to 18th March 2022
- Photography of "Seminar & Panel Discussion on Blue economy- Fisheries and Ocean Governance" organized by Pandit Karuppan Chair , Centre For Field Consultancy and Data Analysis and Directorate of Extension on 16th March 2022.
- Photography of meeting and discussion of University authorities with Canara Bank officials on 25th March 2022.

Women's day celebration at Karmasadan, Alleppy on 8/3/2022

As part the Village Adoption Programme of KUFOS, Andhakaranazhi region in Pattanakkad Panchayath of Alleppy District had been adopted during the year 2017-18 . For providing gainful employment to the women folk along the coastal area of this region, four fish drying units consisting of 41 beneficiaries had also been started in the this Panchayath which is a Tsunami effected area, under the leadership of Fr.Xavier Kudiamssery, Former Extension Council member and Director, ADS, Alleppy Karmasadan. During his visit at KUFOS on 5th March 2022, he had informed that they are planning to celebrate the "Women's Day" on 8th March 2022 in a befitting manner and requested the Director of Extension to conduct a colloquium on "Problems faced by the fisher women and their solutions" to these beneficiaries as a follow up programme which had already been implemented during the year 2017-18. With the permission of the honorable Vice Chancellor, Directorate of Extension, KUFOS has organized a colloquium "UJJWALA-2022" on 8/3/2022 at Karmasadan, Alleppy for the womenfolk along the coastal areas of Andhkaranazhi region. The programme started at 10.30 am. Fr.Xavier Kudiamssery, Director, Radio Neythal welcomed the gathering followed by self introduction by the participants. Director of Extension, Dr.Daisy C Kappen inaugurated the programme. Mr. Gireesh U R, Alleppy District Mission Coordinator, Department of Fisheries, Alappuzha gave a brief introduction about the developmental

activities of the Department of Fisheries for the upliftment of fisherfolk along the coastal area and also the various problems faced by the fisherfolk with special emphasis on drudgeries of the women folk. There were discussions on the various problems viz..middlemen exploitation, lack of awareness about the various schemes implemented by various institutions, lack of saving mentality among the fisherfolk, occupational health hazards, marginalization of fisherfolk, hesitance of the new generation towards fishing, fish marketing allied sectors etc. Altogether 40 women fisherfolk attended the programme. Later on, this programme was broadcasted through RADIO NEYTHAL 107.8 FM , Community Radio Station,Alappuzha to give wide publicity and also to make aware of the authorities and concerned people about the drudjeries/problems faced by the womenfolk along the coastal area.

IV. Establishment of Fisheries Technical, Portal and Knowledge Centre

Fisherfolk engaged in fishing activities both in the inland sector as well as in the marine fisheries sector require timely information while carrying out their fishing operations. Similarly, innovations in the aquaculture including improvement in the existing practices have to be transferred in an effective manner to the fish farmers with the objective of increasing their per capita income, augmenting the fish production of the State, thus ensuring their livelihood security. Also, the dwindling catches in the marine sector indicate the necessity of creating awareness about responsible fisheries among the fisherfolk so as to avoid over-exploitation and to conserve the fishery resources for the future generation . Equally important is the post - harvest technology, as the fish is a highly perishable item, following hygienic handling practices through out the various steps in fish processing is highly essential to ensure a better quality product both for domestic and export market which plays a major role in export earnings of the country.

In the above scenario, establishment of a Fisheries Technical Portal and Knowledge Centre at KUFOS will act as a single window in disseminating all the relevant information and technologies in the field of fisheries to the fisherfolk and fish farmers. It can be transferred to them through publications, conducting awareness and training programmes etc. The research findings, extension activities, academic programmes etc. of the University can be stored as digital files in the center for further use. It will also work as an audio-video library for the use of local people and students. In addition to these, the production of video films in the diversified sectors of fisheries viz. aquaculture and marine capture sector and distributing the same to the public and various institutions engaged in the development of fisheries sector through the centre will contribute to the dissemination of information at a faster rate leading to much progress in the fisheries sector. The Audio Video Recording Studio established at KUFOS has started the production of video films on the above mentioned sectors which can be disseminated among the farming community and fisherfolk through the Portal and Knowledge center established at KUFOS. The center can also provide information on the functions of various institutions/ agencies working in the field of fisheries including their welfare activities. In addition to these, problems/constraints of the stakeholders in the respective field which require scientific interventions can also be conveyed back to the University for conducting research and offering solutions to them through this center . As part of the project the following activities were carried out.

One day workshop on " Writing for Media"

A one day workshop on "writing for media" for the faculties, PG students and Research Scholars of KUFOS was organized at seminar hall, KUFOS in two batches on 8th and 9th February 2022. Sri Mangad Ratnakaran,Senior Media Person and Writer and Sri Raju E R. Director, Public Relations,KUFOS engaged classes to the participants.

Introduction to communication theories, Mass communication and media, writing for media Difference between writing for media and writing in literature, Art of story telling in media, art of writing popular science article for media were the sessions included for the workshop. Altogether 54 participants attended the programme. The objective of the workshop was to improve the popular article writing skill to publish in mass media for the faculties, PG students and Researchers

Sri Mangad Ratnakaran engaging classes to the participants

Participants of the training programme.

2.Web Telecasting of the Prime Ministers talk on 1/1/2022

ICAR had directed all AUs/Instts/KVKs to make arrangements for the web telecasting of the programme- live streaming of the release of 10th installment of PM-KISSAN financial benefit on January 1st by the honorable Prime Minister of India. It was also informed that he shall address the farmers and scientists, teachers on that day. In this connection all Vice Chancellors were requested to ask their faculty, KVKs and invite at least 100 farmers to campus for attending the programme. As per the direction of the honorable Vice Chancellor, KUFOS, Directorate of Extension had made arrangements for the web telecasting of the programme in KUFOS Seminar hall. The programme started at 12.30pm. Altogether 75 participants including farmers, officials etc. attended the programme. The honorable Prime Minister inaugurated the release of the 10th installment of Kissan Samman at 12.30pm There were reciprocal speech by the Farmer Producing Organizations od different States viz Haryana, Tamilnadu etc.

Web Telecasting of the Prime Ministers talk on 1/1/2022

V.Farm Advisory Services

Lack of knowledge about the improved practices in aquaculture and allied sectors acts as an important constraint in the adoption of better management practices for increasing the fish production of the State. At the same, time the technologies which are production - oriented should be promoted in an eco - friendly and sustainable manner. Creating awareness on freshwater and brackish water farming, mariculture, post- harvest technologies, responsible fisheries, need to conserve the fishery resources, judicious exploitation of the fishery wealth etc. plays a vital role in the total development of fisheries sector . Such information can be provided fruitfully to the farmers and fisherfolk by way of publications, conducting training cum demonstration programmes, showing video films, motivating them by distributing various inputs etc. On account of the Covid 19 pandemic during the year 2020-21, the activities of the center were limited . The following programmes were organized.

1.Fish Farmers day on 22nd July 2021

It was in 2001 that the Government of India declared July 10th as "Fish Farmers Day" to honour the scientists, Hiralal Choudhary, and Dr.K.H.Alikunjhi who successfully conducted induced - breeding in Indian major carps during the year 1957.Every year KUFOS is celebrating "Fish Farmers Day" in a befitting manner.Due to Covid pandemic19, during the year 2021,KUFOS celebrated "Fish Farmers Day" on , 22nd July by organizing a one day training programme on " culture of commercially important fishes" through online for the fish farmers. The programme was Inaugurated by Prof.(Dr.)K Riji John, the honorable Vice chancellor of KUFOS and presided over by Dr.B Manojkumar, Registrar, KUFOS.Prof. (Dr.) Daisy.C.Kappen, welcomed the dignitaries and participants to the programme . A life time achievement award in aquaculture was also executed in this occasion. Applications were invited from the aqua farmers all over the State and a selection committee was constituted for the same. The committee scrutinized the applications received and considering the achievements in the field of aquaculture, Sri T. Purushothaman, Chairman of the Aquaculture Development Cooperative Society (ADCOS) was selected for the award Dr.Devika Pillai, Director of research and Sri. Joby George , Finance Officer, offered felicitations during this function. A Reciprocal speech was also delivered by the award winner. Dr.K.Dinesh, HOD, Department of Aquaculture expressed vote of thanks . Technical sessions on the following topics were also arranged.

a. Breeding of indigenous fishes by Dr.Anwar Ali P H, Asst.Professor,Department of Fishery Resource Management, Faculty of Fishery Science
b. Seed production of pearlspot by Dr.Binu Varghese, Asst.Professor, Department of Aquaculture.Fishery ,Faculty of Fishery Science
c. Health management in Aquaculture by Dr.Safeene MP, Asst.Professor,Department of Fish Processing Technology, Faculty of Fishery Science

Honoring the Life time achievement award winner Sri T. Purushothaman, Chairman of the Aquaculture Development Cooperative Society (ADCOS) by the honorable Vice Chancellor, KUFOS

2. Celebrations of the Agricultural Education Day on December 3rd 2021

There has been a direction from Indian Council of Agricultural Research (ICAR) to observe the 3rd December of every year as "Agricultural Education Day" which is the birthday of the first Union Minister of Agriculture of India in 1946 and the first President of independent India Bharath Ratna, Dr. Rajendra Prasad. It is also directed that the day may be celebrated by inviting school children to the University and they may be engaged in a day long activities as debate competition, essay writing, exhibitions, interaction with the agricultural scientists, policy makers etc. and exposition to inspiring lecturers by reputed professionals.

From 2016 onwards KUFOS has been celebrating Agricultural Education Day in a befitting manner by inviting the students from various schools, colleges etc. and providing opportunity to them to familiarize with the activities and achievements of the University in teaching, research and extension. Such an approach will help to develop interest among the students in aquaculture and allied sectors of fisheries and also to choose fisheries as their professional and research career towards engaging themselves in the relevant sectors of fisheries.

In connection with this programme, KUFOs has been organizing an "Open Day" celebration every year on December 3rd and more than thousands of students, faculties, staff including public visit the University on that day.

As the COVID situation has improved significantly this year, it was decided to conduct an offline programme as part of the Agricultural Education Day-2021.Vocational Higher Secondary School, Panangad, situated 2 km away from the University campus was selected for organizing the programme. The school has more than 1000 students on the roll mainly belonging to backward families. Out of the total students, 100 students from various disciplines of vocational higher secondary stream were invited for the programme which was conducted outdoors under a tree shade. The event was inaugurated by Prof. (Dr.) Rosalind George, Dean, Faculty of Fisheries Science and the ICAR Nodal Officer of KUFOS in which Prof. (Dr.) Daisy C Kappen, Director of Extension, KUFOS delivered the presidential address. School Principal Mrs. Rethi Devi L. has proposed the welcome address and Dr. K. Dinesh, Associate Professor and Head, Department of Aquaculture felicitated the function. Mr. Rajeev V.R. of Panangad Vocational Higher Secondary Scholl proposed the vote of thanks. In her inaugural speech Dr. Rosalind has elaborately discussed the history and significance of agricultural education in India, which has a history of more than 150 years. India could stride well in various fields of agriculture towards multiplying the productivity in terms of food grains, nuts, milk, meat, eggs and fish. As all we know during the independence and immediate post-independence period our country was suffering from famines, killing lacks of people in different parts of the country. But the scientifically designed Agricultural education programmes have given a boost for improving the farmer's income, which have made our country proud among global nations. Fisheries and Aquaculture, being the most dependable source of food production, special emphasis is given for its comprehensive growth through well formulated farmers friendly programmes. Prime Ministers Matsya Sampadha Yojana (PMMSY) with a total outlay of Rs. 20,050 Crores for a period of five years is a typical example of the Government initiative to promote the sector. So the sector has immense potential for a student to pursue their future carrier.

Dr. Daisy C Kappen in her presidential address has motivated the students by explaining the career opportunities. Since the fisheries education has three integral components like teaching, research and extension, all sorts of students can fit to into the sector in one way or the other depending on their taste and passion.

After the outdoor inaugural session, the students were shifted to a class room for an official lecture on the opportunities of aquarium fish production which was delivered by Dr. K. Dinesh. The topics covered where identification of fishes, food and feeding, fish seed production, nursery rearing and

marketing of ornamental fishes. Students were given awareness on the possibility of taking up part time income generating programmes using aquarium fish production and sales during their leisure hours, at the same time not sacrificing their time for studies or self-enrichment.

In addition to the above session, the online programme pertaining to the National Agricultural Education Day organized from 2.00 to 5.00 pm by ICAR was watched by thousands of students from Kerala belonging to high school, higher secondary, graduation and post-graduation and their teachers using the link provided. The programme was jointly organized by the Directorate of Extension, Department of Aquaculture and the Faculty of Fisheries, KUFOS.

Inaugural Session

Dr.K Dinesh,HOD,Department of Aquaculture engaging classes on "Ornamental Fish Culture"

3.Training programme on "Advanced Techniques in Brackish water Aquaculture"

As part of the plan project entitled "Farm Advisory services", three days training program on "Advanced techniques in Brackish water Aquaculture" was conducted offline during 16-18th February 2022. The training programme started by welcome speech by Prof. (Dr.) Daisy C. Kappen, the Director of Extension, KUFOS and presided over by Dr. B Manoj Kumar, Registrar, KUFOS. The honorable Vice Chancellor of KUFOS Prof. (Dr.) K Riji John inaugurated the programme. Prof. (Dr.) M Rosalind George, Dean , Faculty of Fisheries Science and Prof. (Dr.) Devika Pillai, the Director of Research KUFOS offered felicitations. At the end of the inaugural function Dr. Safeena, M.P. Principal investigator of the project, proposed vote of thanks followed by lecture sessions by Sri. Dona P., (Guest Faculty,

KUFOS), Sri. Shalumol Salus (Guest Faculty, KUFOS), Sri. M. Shaji (Rtd. Joint Director, MPEDA) and Prof. (Dr.) Daisy C. Kappen, on various topics viz. "Basic principles of brackish water fish culture", "Scope and problems in brackish water shrimp and fish culture", "Biofloc culture of fish/ vannamei" and "Cage Aquaculture" . For the second day sessions were conducted on "Seed production and farming of Pearl spot" by Dr. Anver Ali P.H. (Assistant Professor, KUFOS), "The activities of Dept. of Fisheries" by Sri. Ramya K.D (AFEO, Dept. of Fisheries Ernakulum), "Brackish water shrimp culture" by Dr. Linoy Libini. (Assistant Professor, KUFOS) and "Clam culture" by Dr. Bindi S Kumar (Training Associate, KUFOS). On the third day, the session was started with a lecture on "Fish feed preparation" by Dr. Bindi S Kumar, followed by the lectures on the topics "Fish culture and marketing" by Sri. Vishnu R Nair (Research Associate, CIFT) and "Brackish water fish Diseases and their management" by Dr. Safeena, M.P (Assistant Professor, KUFOS).After the completion of the training sessions the certificates were distributed to the participants by the Registrar KUFOS and a field visit was also arranged to the KUFOS western campus to familiarize the participants about the different aquaculture practices going on in the University. Twenty two farmers attended the training and the programme came to an end by 4.00pm on 18th February 2022.

Inauguration of the training programme on " Advanced Techniques in Aquaculture" by the honorable Vice Chancellor of KUFOS,Prof.(Dr.)K.Riji John (left) and Dr Anwar Ali, Asst Professor, Department of Fisheries Resource Management engaging the session on "Pearlspot farming" (Right)

VI.Exhibition Unit

Kerala University of Fisheries and Ocean Studies is participating in various exhibitions organized by different Govt./NGO/Private institutions right from its inception. Besides these the university is also conducting exhibitions so as to make aware of the people about the research activities and the various technologies available at KUFOS. Conducting such events in the field of fisheries will aid in the development of fisheries sector through transfer of technologies to the farming community, creating awareness on environmental protection, conservation of fisheries resources, sustainability etc. Aquaclinics arranging along with exhibitions ensure the service of the experts working in different sectors of fisheries which will help in solving the problems of the farmers. The exhibition unit established at KUFOS has rich collections of specimens, models of various fishing crafts and gears, visual aids showing the activities and achievements of KUFOS, aquarium tanks for setting up of aquariums while participating in exhibitions including a TV for the display of various activities in the field of teaching, research and extension. Due to the Covid 19 restrictions imposed during the year 2021-22, conducting exhibitions by different organizations/institutions were limited and KUFOS has participated only in two exhibitions.

1."EDUCATIONAL CONCLAVE 2021" organized by Malayalam Communications Ltd. Alappuzha.

Malayalam Communications Ltd. a public limited company, had informed that they were conducting an exhibition "EDUCATIONAL CONCLAVE 2021" at Alleppy on 17/9/2021 and requested KUFOS to participate in event and put up a stall. Considering the necessity of giving wide publicity of the various courses of the KUFOS, the University had participated and put up a stall showing the educational programmes offered by KUFOS. An educational programme promotional material (Audio- Video) had also produced for the same.

2."MATSYAMELA" organized by Aquaculture Development Cooperative Society (ADCOS) at Payyannur

Aquaculture Development Cooperative Society (ADCOS), one of leading aquaculture cooperative societies working in northern Kerala informed that they are planning to start a new freshwater hatchery at Kunhimangalam near Payyanur. Also informed that the hatchery will be inaugurated by Sri.Saji Cheriyan, Honble Minister for Fisheries, Culture and Youth affairs,Govt. of Kerala on 14th January 2022. In connection

with this inaugural function, they were planning to hold a big event under the banner of "MATSYAMELA" on 13th and 14th February2021 and requested KUFOS to participate in the event and put up a stall. The major objective of the programme was to create awareness among the local communities on the merits of using fresh fish for meeting their dietary needs and to provide support to the farmers to get trained in the value addition of their products for getting a good market. Considering the need for creating mass awareness among the people the activities of the University in education, research extension etc. and to give wide publicity regarding the activities of the KUFOS Regional Center which is already established at Payyanur during the year 2016,Univeristy had participated in the exhibition and put up a stall. More over it was also necessary to give wide publicity among the people in the northern Kerala about the new College which is going to start at Payyanur during the year 2022-23.

The inaugural function of the Freshwater Fish Rearing Center was organized at Kunnimangalam Parambath, Payyanur. Sri. Saji Cherian, honourable Minister of Fisheries, Culture and Youth affairs Govt. of Kerala, inaugurated the Rearing Center on 14/1/2022 at 9 am. Sri.M.Vigin MLA presided the function and Sri T.Purushothaman, Chairman, ADCOS welcomed the dignitaries and farmers. Sri Rajmohan Unnithan, MP was the chief Guest of the day. Smt.A Prarthana, President, Kunnimangalam Grama Panchayath,Sri P K Sheeba, member Kunnimangalam Grama Panchayath,Sri. M V Jayarajan secretary,CPI(M) Kannoor District Committee,Sri.Martin George, President DCC,,Sri C K Ramesan Master, Karshakamorcha Jilla President, Thavam Balakrishnan, CPI Jilla Executive Member Adv.Abdulkareem Cheleri, General secretary IUML, Kannoore jilla Committee, Sri.C Krishnan Ex MLA,Sri T V Rajesh Ex MLA,Sri K Padmanabhan Former President, Madai Rural Bank, Sri V Kunjikrishnan, President Velloor bank, Dr K K Vijayan, Chairman, ADCOS advisory committee, Dr B Manojkumar, Registrar, KUFOS, Smt C K Shyni, DD Fisheries, Kannoor, Smt.V Rajitha,Asst.Regiastrar, Fisheries Co operative Society, Sri K X Sebastian General secretary, KAAF offered felicitations in the presence of Sri T K Madhusoodanan,MLA and SriM Rajagopal MLA.

The exhibition programme scheduled on 13th and 14th was inaugurated by Smt.P P Divya, District Panchayath President and presided over by P V Valsala, President, Payyanur

block Panchayath. Sri.K.V Jyothiskumar,Director ADCOS welcomed the dignitaries and participants. Sri. C P Shiju, Sri K P Reena,Sri M V Deepu, members of the Block Panchayath, Dr.M K Mukundan, Former Director, CIFT and Dr.Dinesh Kaippilly, Special Officer,KUFOS Regional Center and Sri Pramod,Director ADCOS offered felicitations. Sri.Sasidharan,Kattoor,General Manager proposed vote of thanks. A training programmeof two days duration on "production of value added fishery products" were also arranged for the farmers. A stall of size 3m x 3m. was allotted to KUFOS to showcase the activities of the University. The exhibition was scheduled from 9am to 8pm. Models of various fishing crafts, gears, cage culture etc. were exhibited in the stall. Visual aids showing the activities and achievements of the University in the field of teaching, research and extension were displayed. Brochures and leaflets on technologies developed and standardized at KUFOS like Cage culture of pearlspot, seabass, giant trevally etc were distributed to the public as part of the transfer of technology process. Since the Directorate of Extension does not have sufficient man power for setting up the stall, the service of two technical hands were availed for two days for setting up the stall and engaging stall duty.

VI.Centre for Field Consultancy and Data Analysis

Taking into account the need for creating a single window system for providing fisheries sector data and the growing demand for consultancy for data analysis in fisheries and allied sector, Faculty of Management Studies, KUFOS launched a Centre for "Field Consultancy and Data Analysis" during the XII Plan period. The center aims to document, analyze and publish data both from primary and secondary sources relating to fisheries and allied sectors. Providing consultancy service on data analysis and interpretation is also envisioned.

The major objectives are

- To collect world and region-wise fisheries sector data relating to resources, production, fisheries trade, etc.
- Collect data on total fish production in India and Kerala, species - wise and category wise and its documentation.
- Collect data relating to marine products export, fishery resources, fisherfolk, etc., of Kerala and India and its documentation.
- Undertake data analysis for industry, researchers, and other agencies on demand.
- Impart training and development services on demand.
- Take up consultancy services in Project preparation and evaluation.
- To suggest policy measures based on the findings of the study

Due to Covid 19 Pandemic,the activities of the Center was limited during the period 2021-22

VIII.Setting up of Cage culture units for production and training in two geographical zones of Kerala for further demonstration and popularization of the technology.

The current project is envisaged to establish cage culture units in two geographical zones of Kerala; North zone and South zone. In North zone, Payyannur, Kannur District has been selected and in South zone, Mundrothuruth, Kollam was selected for the implementation of the project. The programme is being operated under the Plan Project of Kerala University of Fisheries Ocean Studies (KUFOS) funded exclusively by Government of Kerala. The project was started in January 2019. The major objective of the project is to train interested beneficiaries in two geographical zones of Kerala (Kannur and Kollam Districts) and establish cage culture

units for further demonstration and popularization of the technology which was successfully demonstrated by the Directorate of Extension, KUFOS elsewhere. The lead researcher of the programme is Dr. K. Dinesh, Associate Professor and Head, Department of Aquaculture and the Co Investigators are Dr. Daisy C Kappen, Professor and Director of Extension, KUFOS, Dr. B. Manoj Kumar, Registrar, KUFOS and Mr. Prasannan, Special Officer of Kollam Regional Centre of KUFOS. The supporting personnel include one Senior Research Fellow (SRF), Miss. Keerthana T.A. and two Field Assistants, Mr. Al Ameen and Mrs. Chinju Lal. The SRF joined the office on 01.01.2019 and two Field Assistants on 29.12.2018 & 30.12.2018 respectively. Keerthana T.A. (SRF) and Al Ameen N. (Field Assistant) were directed to attend the duty in Regional Centre of KUFOS in Payyanur, Kannur and Chinju Lal (Field Assistant) was directed to work in Kollam.

Work done so far-Activities and Achievements

- As the first phase personal surveys were carried out at both stations (Kollam and Payyannur) to assess the interest of the beneficiaries, collect data on existing fish culture practices in the region and the problems faced so far, immediate need of the farmers, status of market and current problems facing by farmers in the areas like availability of inputs, disease occurrences, training and marketing related to fish farming.
- At Payyannur, 'Thuruthi' was the area selected for the implementation of the project and at Kollam 'Mandrothuruth' island was the area selected. Both the area is economically backward and most of the inhabitants are below poverty line.
- The inputs for the projects were procured from various agencies adhering to the Government norms. In both sites 6 units (3 cages in a single unit) were erected with the dimension of 2x2x1.5 m for a single cage. Each cage unit were allotted to a single group comprises 3 people. Altogether 6 groups of beneficiaries were formed at each site. The fish seed, feed, equipment and other necessary inputs were also distributed to the beneficiaries.
- A total number of 4230 *Lates calcarifer were* stocked with a stocking density of 250 no. of seed/ cage at Kollam. In Payyannur, only 4 units were stocked with *Lates calcarifer* with a stocking density of 350/ cage, The culture period was from November to June.

- The project team has provided all the necessary technical support to the beneficiaries. Regular monitoring of water quality, feeding pattern and health of animals were also done.
- The harvest from both sites were done at the first week of June. A total of 385 Kg of fish were harvest from Payyannur site and a total of 394 Kg fish were harvested from Kollam site. The weight of the fish varies from 1400 g to 350 g/ fish and the length of fish were 44 cm to 17 cm / fish. The beneficiaries from both the sites got the highest farm gate price available in the market.
- Conducted a one-day seminar to all beneficiaries at Payyanur on 28/11/2021 and at Kollam on 09/01/2021 to give advice to them with the help of a cage culture expert.
- The harvest from both sites were done at the first week of June. A total of 385 Kg of fish were harvest from Payyannur site on 06/06/2021. The culture period was from November 2020 to June 2021.
- In Kollam, three groups were harvested, Vellimangalam west group was fully harvested and a total of 300 kg of fish on 22/08/2021 and Vellimangalam (15/06/2021) & Kandramkani group (28/08/2021) were partially harvested. Other groups are continuing the farming.
- In, Payyanur Conducted a review meeting with the beneficiaries to assess the benefits achieved from the first culture cycle and the pros and cons related with the implementation method adopted on 20/09/2021
- In Payyanur and Kollam, the cleaning and other maintenance works of all the cages and other inputs are going on.
- A review meeting was conducted at KUFOS Regional Centre, Payyanur on 28th February 2022 and presented research activities which include completed, ongoing and future research works. The Principal Investigator evaluated the work progress of each activity and opined necessary suggestions.
- As part of the project a Preliminary study of Biofouling of *Mytella strigata* started at Payyyanur cage culture unit site with help of KUFOS Regional Centre on February 2022.
- One of our trained beneficiaries from Payyanur started their cage culture unit. They stocked in two cages with naturally collected *Etroplus suratensis on March15,2022*

- The research team regularly visit various farms and ponds in the Kannur and Kasaragod districts for analysing the physio chemical parameters of water and to find out the problems and issues being faced by the aquaculture farmers in their culture systems..

IX.Maintenance of Museum/Aquarium –

The AGK Menon Memorial Museum of Aquatic Animals established at KUFOS during the year 2016 houses a rich collection of finfish and shellfish specimens from marine and inland waters of India which are on display and attracting school and college students , researchers and the general public. The main objective is to impart education and awareness among them about aquatic bio diversity and to build up their competence and confidence

The ornamental fish culture and aquarium keeping have assumed considerable significance as an international hobby and all these have been proved to be lucrative in the global trade scenario. Though the ornamental fish trade with a turnover of US $ 8 billion and an annual growth rate of 8 percent offers lot of scope for development, India's share in ornamental fish trade is estimated to be less than 1% of the global trade and the major part of the export trade is based on wild collection. Taking into account this, KUFOS focused on popularizing and developing entrepreneurship in ornamental fish culture and conducting training cum demonstration programmes on ornamental fish culture with a view to enabling them in starting small - scale units. The public aquarium at KUFOS named after the visionary, former hon;ble Vice Chancellor of Kerala Agricultural University, Dr. A.M Michel is an exhibition-cum-education center on ornamental fishes. It was opened to the public at a function held on 4th April,2013 by Shri. K.Babu, hon'ble Minister for Fisheries, Ports and Excise, Govt. of Kerala to mark the second anniversary of KUFOS. The complex consists of two wings with a total of 46 tanks of assorted sizes-20 each of the size 4'x2'x2.5', four of the size 7'x2'x2' and two plasma tanks. The entrance has a central Koi pond stocked with a variety of koi fish and two beautiful artificial waterfalls. Nearly 1500 fish of different aquatic environment comprising well over 25 species of indigenous and exotic freshwater fishes, such as loach, Miss Kerala, barb, gold fish freshwater shark, angel fish tetras, guppy,platy molly, swordtail, arowana, pacu, yellow sun catfish, eel, severum, dollar fish, different varieties of cichlids, gouramies, parrot fish, oscar devil fish, giant freshwater prawn, brackishwater fishes viz. Mullet, milk fish, pearlspot and marine fish like damsel, clownfish, sea anemone, tentacle anemone, butterfly fish, banner fish surgeon fish etc. are on display in combination with several indigenous and exotic aquatic plants set in different styles. In order to make the project self sustainable, a nominal entry fee of Rs.20/- for adults, Rs.10/- for children of the age 5-15 years

and Rs.5/- for students (visiting in groups of not less than ten) is being charged. The fishes kept in the Public Aquarium in addition to providing entertainment to those visiting, also motivate the people to start small scale units. Along with the public aquarium, models of different crafts, gears and photographs showing the activities and achievements of KUFOS in teaching, research and extension are also displayed in a separate building which attracts students, public and officers from different institutions. In addition to this, Faculties of various departments of KUFOS are using this facility to engage classes to the B F Sc students. Since the Public aquarium was closed intermittently in many days due to covid 19 pandemic, only regular monitoring like maintenance of water quality parameters, feeding the live fishes were carried out during the year 2021-22

X.Development of Instructional Farm –

The Project on Modernization of Instructional Farm operating under the Department of Aquaculture is a prestigious project of the University funded by the Directorate of Extension with the major objective of improving and updating the instructional farm of the University. Having been blessed with sufficient quantity of brackish and freshwater, our instructional farm has been practicing the culture of freshwater fishes like Catla, Rohu, Mrigal, Common Carp, Pangasius, Tilapia, Murrel, Olive Barb etc. and shrimps like *P. vannamei* and *P. monodon* and brackishwater fishes like *Lates calcarifer* and *Etroplus surratensis.* The farming is mainly practiced to give hands on training to the students and also to generate internal revenue for the University. As part of the various courses under the Department of Aquaculture, students are regularly deployed in the instructional farm for improving and improvising their skills in seed production, nursery rearing and grow out operations. Students are given the opportunities to do their own aquaculture entrepreneurship during the eight semester of B F Sc programme. So there is an absolute requirement of updating the farming techniques and protocols for attaining the appreciable fisheries professionalism among the students. The farm facilities are also used for Earn While You Learn programme, Post Graduate, PhD research. Through the current project, new farming strategies like Pen culture and Cage culture was taken up to demonstrate the technology to the students and farming community. Regular training programmes are organized for the needy people in aquaculture and allied activities. Two areas with the individual plot size of 5 cents each were cleared and deepened for the installation of cage and pen. One of the major activities undertaken during the plan period was the stocking of the installed pen in the farm premises. The species stocked is *Lates calcarifer* and grow out culture is in progress. A portion of the labour requirement of the farm was met from this fund. It is necessary to continue this project for modernizing the farm further.

XI.Farmers Training Centre

Conducting training to the fisherfolk and fish farmers is an important means for increasing the level of knowledge and rate of adoption of better management practices which, in turn, will help to augment fish production of the State, increasing the income of the farmers, creating more employment opportunities to them and improving the quality of the product for export etc . If such training programmes are residential in nature, it would result in the efficient utilization of more time in a day. As part of the transfer of technology process, KUFOS is conducting various training programmes on aquaculture, harvest and post - harvest technologies under the various extension plan projects. Farmers from all over the State of Kerala are attending these programmes. While organizing these training programmes providing accommodation in the University campus acts as a major constraint which could be overcome by establishing a Farmers Training Centre having all facilities. A Farmers Training Center for imparting residential training to the farmers is established at Puthuveypu Campus of the University.

While conducting training programmes to the farmers under the different plan projects of the University, field visit, which is an integral component for motivating and attracting more and more farmers towards various aquaculture practices, is also arranging. For this purpose the University has established training cum demonstration centers in selected areas of the villages which has already been adopted by the University. As part of the project "Farmers Training

Center" various inputs viz. fish seed, feed etc. were distributed to the beneficiary farmers of these demonstration units and sign boards to these centers were installed to give wide publicity among the people.

XII.Model fish processing plant and training center

The fisheries sector, both in the inland and marine sectors of Kerala State provides enormous employment opportunities to the people. Unlike the other products, the very low shelf life of the harvested fish acts as a major constraint in marketing the diversified fishery products both in the domestic and export market. The fishes can be stored only for a few hours after it reaches the ground. Thus, knowledge on the shelf life of the fishes and different ways to preserve it for ensuring better quality product are very important and essential to transfer the same to the target group. The above project aims to provide better solutions to these problems by making the fisherfolk aware of the ways of preservation of fish and preparation of various value - added fishery products under hygienic conditions. It will definitely help in creating more employment opportunities to the fisherfolk including the womenfolk along the coastal areas of the State and and lower sections of the society, thus leading to women empowerment and uplifting of the society. Equipment for imparting quality training on various aspects of post - harvest technologies were purchased and facilities established under this project is utilizing for imparting quality training to the fisherfolk including the women and students on various aspects viz. techniques of preservation, preparation of value added products, handling of processing and laboratory equipment, quality evaluation methods, sanitation and marketing practices etc. As part of this project the following training programmes were organized.

1.Training programme on "Seafood Entrepreneurship Opportunities"

As part of the plan project "Model Fish Processing Plant and Training Centre", one day online training program on "Seafood Entrepreneurship Opportunities" was conducted on 14th December 2021. The training programme was started with welcome speech by Prof. (Dr.) Radhika Rajasree S R, HOD, Fish Processing Technology, KUFOS and presided over by Dr. B Manoj Kumar, Registrar, KUFOS. Prof. (Dr.) K Riji John, honorable Vice Chancellor, KUFOS and chief guest of the day inaugurated the programme followed by felicitations by Dr. Daisy C Kappen (Director of Extension) and Prof. (Dr.) M Rosalind George, Dean ,Faculty of Fisheries.Science. Lecture sessions were handled by Dr. Abhilash Sasidharan, Principal

Investigator,Dr. T K Sreenivasa Gopal, Professor Chair, CEFPT, KUFOS and T R Ananthanarayanan Iyer Food Technology, Food Safety & Business expert, Foodastha on various topics including Introduction to Seafood Entrepreneurship, Food Packaging and Retail marketing respectively. Twenty four participants attended the programme. The programme came to an end by 3.00pm on 14th December 2021.

2Training programme on "Seafood Value Addition"

Two day skill development training programme on "Seafood Value Addition" was conducted on 10th and 11th March, 2022 at ICAR-KVK (KAU) Thavanur, Malappuram.The training programme started on 10th March 2022 with formal inauguration by Dr.Ibrahimkutty C, Programme Coordinator at ICAR-KVK (KAU), Thavanur, presided by Dr.Lilia Baby, Assistant Professor, ICAR-KVK (KAU),Thavanur. It was followed by a lecture session on value addition of seafood by Dr. Abhilash Sasidharan PI of the project. For the first day, a session on "waste management and value addition" was provided, followed by hands on training on the same topic. 50 participants of the training programme were divided into small groups of ten for imparting skillful training in the preparation of Fish, Shrimp and lemon dates pickles.Battered and breaded products including fish Cutlet, Shrimp Fritters, Butterfly Shrimp, shrimp tail On were also prepared.The methods of preparation of fish mince and cutting of Butterfly Shrimp, Shrimp tail On were demonstrated. The programme came to an end by 4.30pm on 11th March 2022.

Introductory Session

Hands On Training

Final Session

3. **Preparation of Do it Yourself (DIY)training videos on processing and value addition of fish**

The following value added products were selected for the production of DIY videos.

Name of the products selected for the production of DIY training videos

1. Fish pickle
2. Fish balls
3. Battered and breaded fish fillet
4. Fish burger
5. Fish sausage
6. Fish finger
7. Battered and breaded squid rings
8. Fish biriyani
9. Fish fritters

Demonstration videos on fish pickle and fish balls were produced and production of DIY videos of the other items are going on.

In order to improve quality the training booklet on "Value addition of fish", already prepared, a thorough review of the books, "Book on Tropical fishery products by Dr. K. Gopakumar "and" Value added fish products by Subhendu Datta" was carried out and relevant details were included.

Video Shooting Stills

4. Setting up of model fish & fish products sales outlet at Amenity centre, KUFOS

Model fish processing plant and training Centre (MFPTC) along with the plan project Earn While You Learn(EWYL) has established a facility **"Model fish and fish products sales outlet"**at Amenity Centre, KUFOS. This facility has started functioning at Madavana junction that can be utilized by the entrepreneurs as well as the BFSc students under the "Entrepreneurship Learning Programme" for test marketing. Main aim of the outlet is to make the fish and fish products available for the consumers at reasonable rate at the right time and in the right place.

License and FSSAI Registration of Model fish & fish products sales outlet has been renewed. The renovation work including setting up of polycarbon sheet in the outer area, purchase and installation of equipments such as three FRP tanks for keeping live fish, Tea and Coffee vending machine, Microwave Oven, Generator were done. The outlet is now fully functional with sale of live fish, value added fish products prepared by Students and Research Scholars of the University which includes Dried Fish, Cookies etc.

Model Fish & Fish Products Sales Outlet, KUFOS

Pandit Karuppan Chair

The Pandit Karuppan Chair started functioning on 26/7/2013 with the objectives of developing the fisheries sector and conserve fishery wealth, documenting the traditional knowledge of fishers, empowering the fisherfolk for socio economic advancement etc. As part of the activities of the Chair, information on indigenous technical knowledge and dying wisdom pertaining to various oceanographic aspects having impact on fisheries were unearthed, conducted traditional fisherfolk meet, awareness campaign, group discussions, seminar highlighting the need to protect aquatic resources for livelihood and security, exhibitions etc. Since the outbreak of Covid 19 Pandemic in the fisheries sector during the year 2020 created crisis in all spheres of fisheries viz. production, processing, marketing etc. it was highly essential to study its consequences by executing appropriate projects especially in the coastal areas of the Kerala State. In view of this, the following two projects funded by State Government were included under the Pandit Karuppan Chair during the year 2020-21.

1.Business strategies and models for managing fisheries sector and marketing of fish products: A study with special emphasis on COVID- 19 Outbreak in Kerala"

Fishery sector in India is an important source of food and nutritional security. More than nine million active fishers directly depend on fisheries for their livelihood of which 80% are small scale fishers. The outbreak of the Covid-19 pandemic has stunned the global fisheries sector and country like India is not an exception to that. Trade has faltered as transport restriction prevents supply chain from moving product from one place to another. The pandemic has largely affected the fishers and fish workers mainly in the form of loss of income, and occupation, lower wages, etc.

The above project under the Pandit Karuppan Chair of Directorate of Extension was proposed to study the impact of Covid-19 on marketing of fish and fish products in Kerala, the need for upgrading infrastructural requirements for fishing community in the State, identify the reasons for disruption in the supply chain of fish due to lockdown and develop a model for logistics of fish and to formulate business strategies to prevent future risk of pandemics similar to covid-19 outbreak.

For the implementation of the project, Miss.Geeja K J,Research Associate joined in the projet on 28th October 2021. The following activities were carried out during the period of 2021-22

- In the first three months an extensive literature survey was carried out to identify the impact of COVID-19 on marketing of fish and fishery products in Kerala. Since the COVID-19 is a new

phenomenon there were a few studies based on the topic. Therefore, the identification of gap with respective concerns was difficult to get an overall picture of the situation.

- Due to the lack of literatures and to get a broader picture of the study various fish markets of Ernakulum District was visited which includes Chellanam, Chembumukk, Vypin, Kannamaly, Andhakaranazhy, Palluruthy and other small fish markets in the vicinity of the University. The study mainly covered 39 organized fish markets in a broader perspective.

- Collected data from the fishermen and the fish markets, developed a questionnaire and a pilot survey has been conducted.

- Based on the available literatures and other studies, relevant variables has been formulated for preparing a model which would help the study. Initiatives for conducting survey in the identified areas are being carried out.

Survey and Data Collection

2.Livelihood Status of Marine Fisherfolk in Kerala in the Post COVID-19

Fisheries sector contributes significantly to the national economy while providing the livelihood to approximately 14.49 million people in the economy. Fishery sector alone has employed 145 million people and contributed to 1.07% of the GDP and generated export earnings of Rs. 334.4 billion. This sector contributes not only to the income and employment of the State but also providing economic and nutritious food security, foreign exchange earner and stimulant to the growth of ancillary industries. Kerala stood at third in terms of marine fishery production. The marine sector of the State alone constitutes about 8.46 lakh people who earn their livelihood from capture and allied works in marine fisheries in the 222 fishing villages situated along the coastline of the state, which comes to about 2.51% of the State's total population. The number of fishermen households is estimated to be 1.61 lakhs. The sector is basically informal in nature and there are around 1.91 lakh active fishermen working in the State and almost an equal number of people are presently engaged in fishery related activities such as vending, processing and marketing. Sustainability of the State legitimately needs to address the vulnerability of the fisherfolk. However, the outbreak of Covid 19 and the resultant nationwide lockdown has greatly affected the livelihoods of fishing communities across the country, particularly in the State. Marine fishery is among the many economic sectors languishing due to the impact of Covid 19. The input supply chain is also broken. Basically, the marine fishery value chain depends extensively on collective activities that involve a large number of people. The lockdown imposed on March 24, 2020, and the subsequent extensions, which were followed by the trawl ban, disrupted the livelihoods of fisherfolks particularly on food systems, storage and market chains, both locally and regionally. The impact of the novel corona virus is yet to unfold in its full ferocity and there is every chance is there to continue its economic repercussions even up to two years. Not to mention, it has already severely affected the livelihood of all the stakeholders, particularly the fisherfolks. The present study proposed at this juncture.

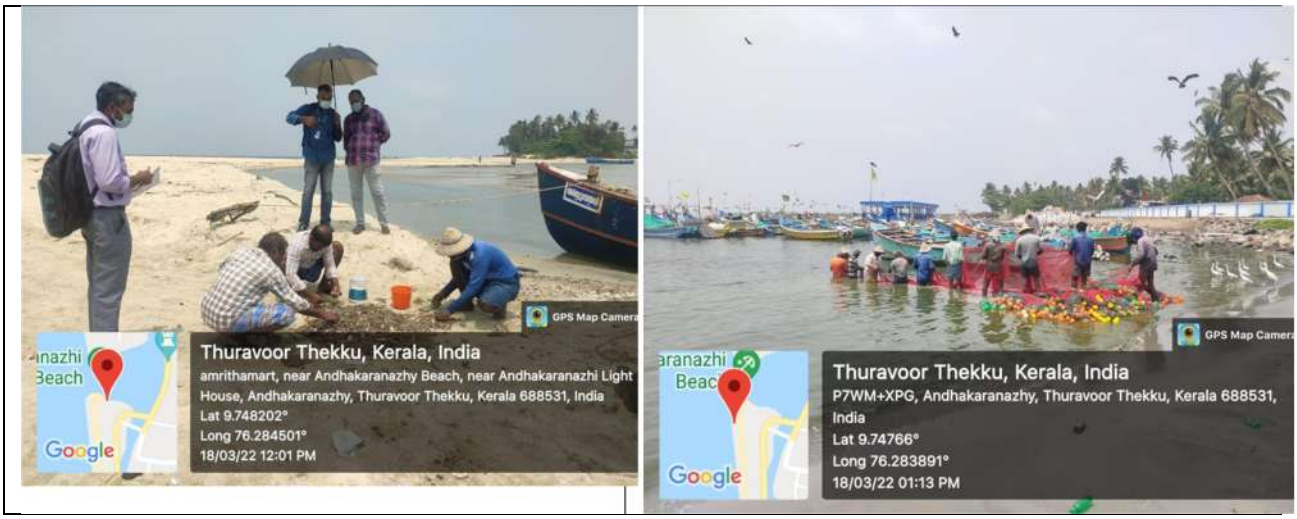
The overall objective of this study is to understand the livelihood status of the marine fisherfolk in Kerala in the post Covid 19 period. Specifically, the study aims to understand the,

a) Pattern of employment and income distribution of the marine fisheries sector,
b) Social and economic life of the fisherfolk

The Research Associate Mr.Ambrose T.V has joined on 26th November, 2021. The aim of the survey was to assess the impact of Covid -19 on fishermen communities. Literature collection was completed, prepared the draft questionnaire and a pilot study was conducted in the major and minor fish Landing canters in Andhakaranazhi and Chellanam regions of the Alleppy and Ernakulam Districts, during the period from March to April 2022. Based on the pilot study necessary modifications were made in the questionnaire. There are eight fishing villages in Ernakulam District and four fishing villages in Alappuzha District. Data were collected from the 48 respondents belonging to Chellanam, Cheriyakadavu, Fortkochi, Kandakadavu, Kannamali,Manasserry,Njarakkal,Thoppumpady of Ernakulam District and Azheekal, Pallithodu, Thuravoor, Kattoor of Alappuzha District.

From the survey it was understood that more than90 percentage of the fishermen community consist of traditional fishermen. Major contribution in Pelagic fishery comes from in on board motorized vessels which resembles mechanized boats. Gill nets are used in small motorized vessels, where as seine nets are used in inboard vessels. It is identified that there is an increase in the number of 'Ponthvalloms' in Alappuzha District after covid-19 outbreaks. The fishing community in this area faces several financial, social, fishing and infrastructure related constraints.

Survey and data collection

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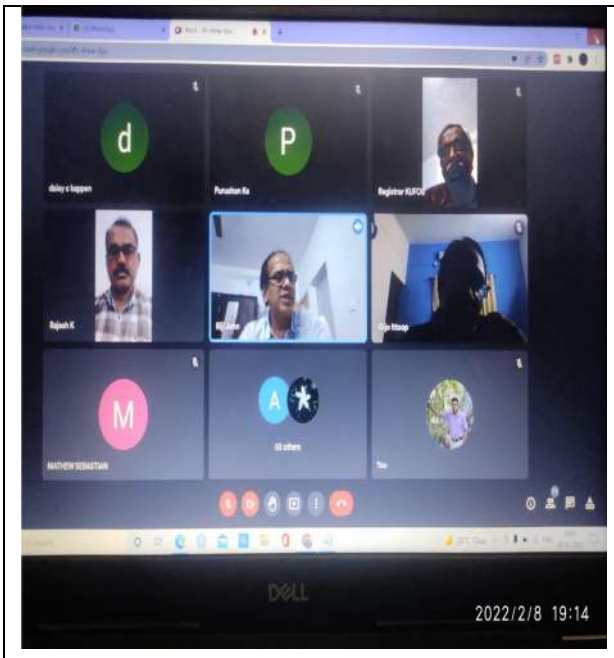
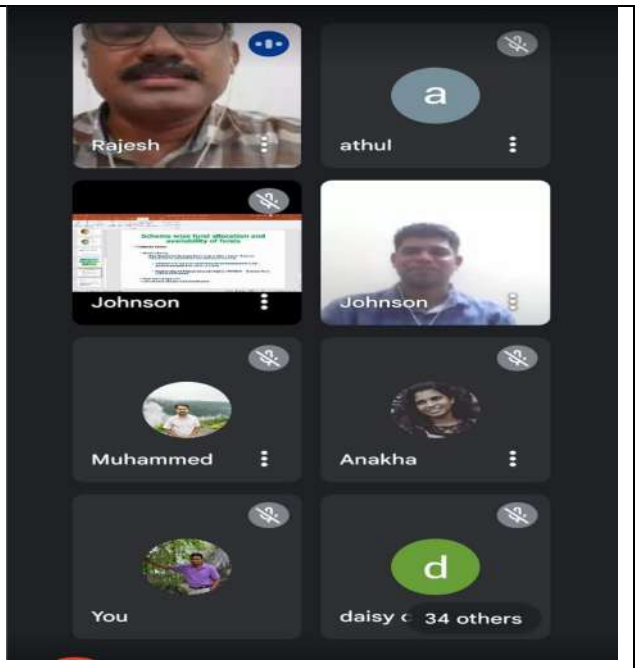
The pilot study conducted in this area showed that the average size of the family of the fishermen both in the Alappuzha and Ernakulum Districts was almost same i.e. four.The head of the family mainly depend on fisheries as their main occupation and other source of income were less. The results showed that thirteen percentage of the families in Ernakulum District had income from their family members also. The average fishing days/month in Alappuzha was 22 and in Ernakulam it was 19 . In both Districts almost 50% of the days in a month, fishermen came with empty hands which cause increase in their liabilities affecting their livelihood security. Regarding the assistance from the Govt. 50% of the fishermen in Aleppy District openioned that they did not get any assistance from the Govt. during the Covid 19 period, while the remaining said that they got assistance from the Govt. both in terms of money and goods (food kit and rations). In Ernakulam District 83 % of the respondents reported that they got assistance from the Govt. both in terms of money and goods (food kit and rations)and received some other services like hospital facilities. They also received assistance from voluntary and non-government organisations.

In association with the plan project Centre of Data Analysis and Field Consultancy two programmes were organized.

1.One day webinar on "Union budget and coastal areas" on 8th February, 2022.

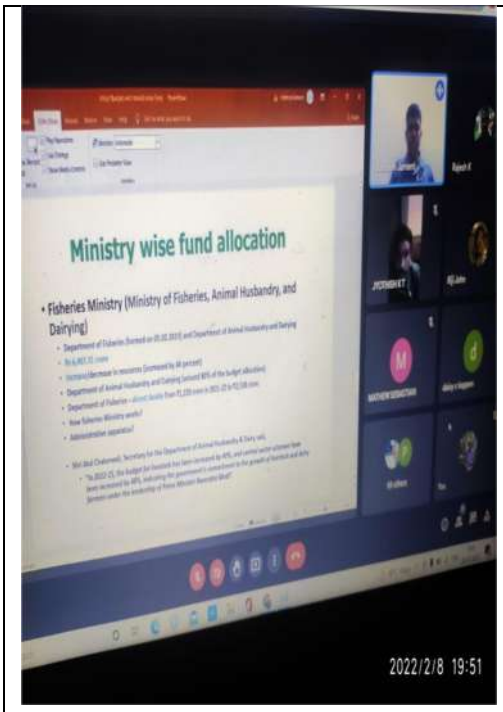
The registration for the participants was done through the Google meet links. Whats app and email were collected and sent the links to communities .Morethan100 research scholars and fisheries experts from various institutes participated in the programme. The programme started at 7pm on 08th February 2022. The Director of Extension Prof.(Dr) Daisy C Kappen welcomed all the dignitaries of the programme. A special welcome was given to the chief guest of the day Dr.Johnson Jament, Research Associate, School of Global Studies, University of Sussex, UK. Prof.(Dr) K. Riji John,Ho'nble Vice Chancellor of KUFOS, Panangad inaugurated the function.

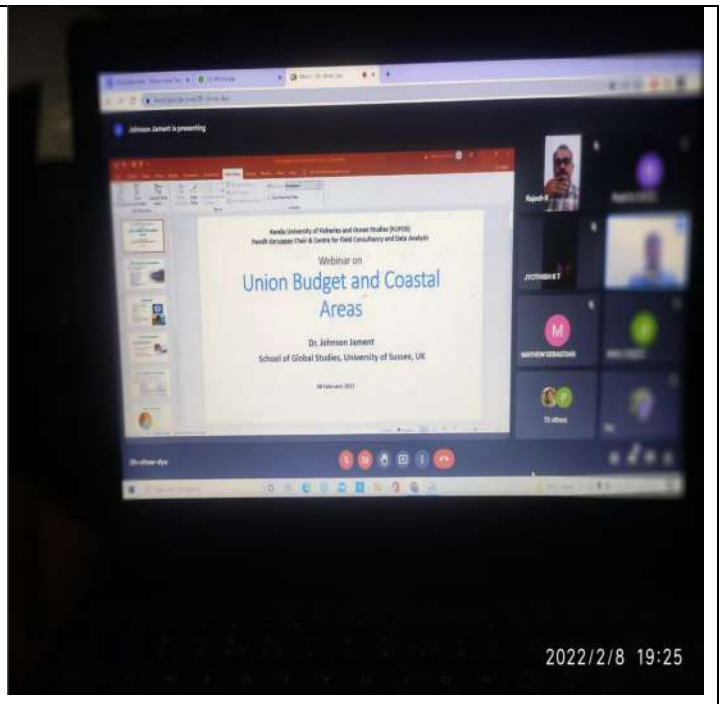




UNION BUDGET 2022 AND COASTAL AREAS

The Union Budget for 2022-23 was presented by Finance Minister Nirmala Sitharaman on 1st February 2022. Start-ups for agricultural and rural enterprises will be funded by NABARD. Indian farmers will receive substantial benefits from the usage of Kisan Drones for crop assessments, spraying of insecticides, and digitalisation of land records. Wheat and paddy farmers will receive direct payments worth Rs.2.37 lakh crore for minimum support price. The budget for National Coastal Mission, which was nearly doubled in the last fiscal at Rs 200 crore was reduced by Rs 5 crore this year and stood at Rs 195 crore for 2022-23. In 2020-21, the NCM was allotted Rs 103 crore and the government doubled it in 2021-22 at Rs 200 crore. Regarding the announcement related to the Department of Fisheries, Union FAHD Minister said that the overall budget of the D/Fisheries for the financial year 2022-23 has been increased by 73% in comparison to the allocation of Rs. 1220 crore during the year 2021-22.





The Registrar of KUFOS Prof.(Dr)B.Manoj Kumar delivered the felicitation for the programme. The webinar was concluded by delivering the vote of thanks by Dr.Rajesh K , Principal Investigator of Center for Field Consultancy and Data Analysis. He expressed heartfelt gratitude towards the support and guidance by the authorities and also the effort taken by the coordinators. The programme ended at 8.15 PM 8th February 2022.

2.One day seminar and panel discussion on "Blue Economy: Fisheries and Ocean Governance", on 16th March, 2022.

The World Bank defines the blue economy as a healthy system that sustainably maintains and utilizes marine resources with the goal of economic growth, better livelihood and employment. Countries around the world today consider the ocean as a storehouse of resources. Therefore, the blue economy is an integral part of the future of coastal countries, including India,and of Kerala.

To examine how the blue economy is going to affect the life of the coastal region, Pandit Karuppan Chair in association with Centre for Field Consultancy and Data Analysis under the Directorate of Extension of Kerala University of Fisheries and Ocean Studies organized a one day seminar on **"BLUE ECONOMY-FISHERIES & OCEAN GOVERNANCE"** on 16th March 2022 at KUFOS seminar hall.

The registration for the students was done through the Google forms. Still there was spot registration from 9 am for the students who came up all long way from other institutes. More than 100 students and research scholars from various institutes participated in the

programme.


The inaugral session started by 10 am. Dr.Rajesh K , Principal Investigator of Pandit Karuppan Centre welcomed all the dignitaries. A special welcome was given to the chief guest of the day Dr. C Ramachandran, Principal Scientist, CMFRI, Kochi. The presidential address was supposed to be delivered by Prof.(Dr) B. Manoj Kumar, Registrar of KUFOS. In his absence the programme continued with the inaugural ceremony by lighting the lamp by honourable Vice Chancellor of KUFOS Prof.(Dr) K. Riji John and other delegates on the Dias.

After the lightening of the lamp, the Hon. Vice Chancellor delivered the inaugural speech. Being the Fisheries and Ocean University, KUFOS is ready to explore the maximum potential of blue economy. Understanding the right meaning of blue economy is inevitable for sustainable development of fisheries sector. The Director of Extension Prof. (Dr) Daisy C Kappen delivered the felicitation for the programme. The extension activities of the University usually used to involve only fisherfolk and fish farmers. Realizing the importance of Blue Economy now a days , the Pandit Karuppan Chair & Centre for Field Consultancy and Data Analysis under the Directorate of Extension took a new initiative to

involve the students also which is inevitable for the development of fisheries sector in future. The inaugural session was concluded by delivering the vote of thanks by Dr. Anoop K K, Asst Professor & Principal Investigator .He expressed heartfelt gratitude towards the support and guidance by the authorities and also the effort taken by the coordination committee. Inaugural function concluded at 10.30 am. During the break tea and snacks were distributed among the audience.

BLUE ECONOMY- FISHERIES & OCEAN GOVERNANCE

After the inaugural ceremony the seminar started at 10.45 am. Dr. C Ramachandran, Principal Scientist, CMFRI, Kochi, delivered the seminar. The average land area of our country is 3.2 million km. Land area of up to 200 nautical miles falls within the economic zone of the respective countries which do not actually include the high Seas, so that another two million square kilometres also comes under the purview of our country. Hence our country has an area of five million square kilometres, including land and sea. It has been only 13,000 years since man began to cultivate. But it has been about one lakh years since fishing started. So the history of fishing is really vast. Blue economy is a developmental thinking that has been heard more and more in recent times. Normally the sea is depended for fish and later on fuel. The bottom of the oceans is being explored by considering it as important forms of energy in the future. There is a big competition taking place today in the High Seas Zone, which is claimed by all countries. It is only when our country gains the capacity to compete, then only we can experience the infinite possibilities of the Blue Economy. The 169 Nation Clubs in the world can play a big role in this. The oceans are a vast storehouse of human food. As part of the Blue Economy, it is imperative that economic efforts be made to address the current plight of fishermen who are still living in poverty.

Countries and international organizations must make decisions that will have a major impact on the daily lives of the children of the sea, who live by the sea in search of oil and minerals. Environmental exploration and mining should be considered. Blue economy thinking must move forward while maintaining the chances of human survival beyond the excessive profits of the monopoly capitalists. We must discover the infinite possibilities of the sea and carry out appropriate research activities by universities and technical institutes. Microbe's, drugs, the food of tomorrow, are all at sea. To develop and find them carefully we need to make the centers experts. The morning session was extended up to 1.30pm and it was participatory in nature. Students cleared their doubts and queries. After the lunch the seminar got resumed with panel discussion. Students were grouped into five groups and they were asked to discuss their view points on blue economy. Each group presented their ideas and perception on blue economy with respect to their field of study which includes management, economics and marine biology. The suggestions put forward by various groups are listed below.

•Blue economy presupposes sustainability as well as profitability by exploring the marine resources.

- Research and development should be encouraged in this field.
- Programmes involving fishermen and other stakeholders should be promoted.
- Waste management and treatment should be promoted.

- Nutritional deficiency should be met by means of blue economy.
- Sea Bed Mining can result in acidification.
- Mining regimes should be used in a controlled manner.
- CRZ notification needs more clarity regarding the existing constructions.
- Drugs which are made of marine resources can be later used as bioweapons.
- Each coastal region is different therefore universal programmes are not possible.
- Funding can be used for the social upliftment of the dependent communities.

• Wild exploration of blue economy has immense potential to reach the goal of $5 trillion economy.

• Research and Development department should focus more on exploration of undiscovered marine resources.

•Enhance the skill development with the incorporation of indigenous knowledge of fishermen.

The valedictory session started at 4 pm. The certificates were distributed to the participants by the Director of Extension Dr. Daisy C Kappen and Principal Investigator of PKC Dr. Rajesh K. The feedbacks were collected from the students.

XIV.Massive open online courses

For India to emerge as a knowledge super power of the world in the shortest possible time it is imperative to convert our demographic advantage into knowledge powerhouse by nurturing and honing our working population into knowledge or knowledge enabled working population. With an ever expanding field of knowledge, the knowledge and skill sets required by an individual to successfully lead life has also expanded, throwing up challenges of learning more and more throughout one's life. Add to

that challenges of pedagogy being faced by the teachers to package more and more for the uptake by the students within the same amount of time available. Fortunately, the ICT as a tool in education is available to us at this juncture

The **Massive Open Online Courses (MOOC)** are online course aimed at large-scale (*massive*) interactive participation (enrolment) and open access via the web. In addition to traditional course materials, MOOCs could be certificate courses or non-certificate courses that provides an interactive user-friendly discussion forum for students, professors and teaching assistants and immediate feed-back platform for quizzes and assignments. MOOC courses generally are presented through videos, e-books, quick assessments, and discussion forums. All these work hand in hand to deliver information to an influential network of people with common interests. This has been instrumental in helping students, professionals, and several others in gaining a thorough understanding in the respective areas. MOOCs are widely researched development in distance education, first introduced in 2008, that emerged as a popular mode of learning in 2012.

Learning online has become a necessity, especially during these pandemic times. And even without that, the traditional classroom learning in itself can be quite limiting. With the furthering of technology, it only makes sense to exploit the internet for learning purposes. More so, the world has become a global village where information is the new currency. There is a need to get information across the globe without distance, space, or time being a major constraint.

MOOC in KUFOS

Vision:

Provide high quality, affordable education at large scale

Mission:

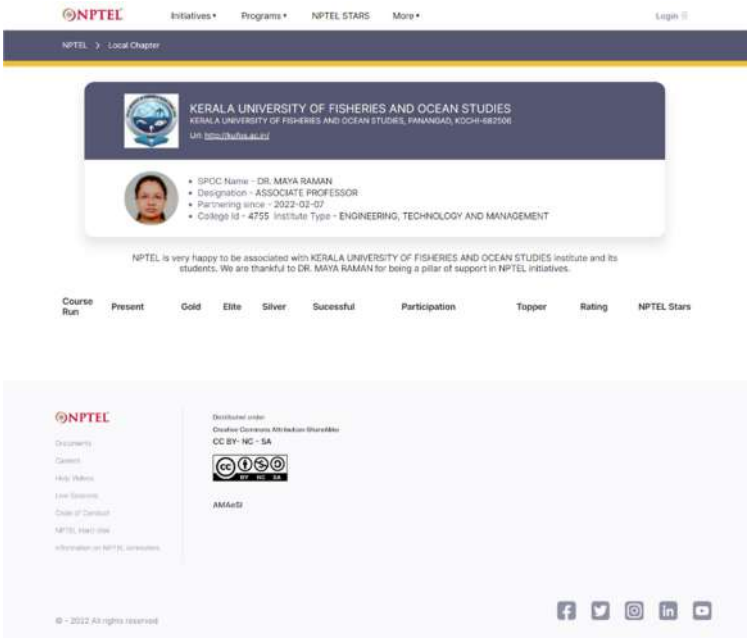
Establish KUFOS Massive Open Online Course Platform/Centre (KUFOS *e-learning centre*). An education platform for delivering online courses in Fisheries, Ocean Studies and Allied subjects targeting unlimited participation and open access.

MOOC Office at KUFOS

MOOC Recording Facility at KUFOS

Steps taken

Kerala University of Fisheries and Ocean Studies has been recognized as a NPTEL Local Chapter (LC ID: 4755). Dr. Maya Raman (Associate Professor, Dept. of Food Science and Technology) as a SPOC (Single Point of Contact) in NPTEL Local Chapter, from April 2022.



- In association with Director of Planning, purchased furniture (30 pieces of chair cum desk for SWAYAM PRABHA class room) and fixing dish antenna.
- Infrastructure development for MOOC room –KSCADC (in progress).
- Recording for online Courses (Dr. Abhilash Sasidharan) (in progress)
- Purchase of equipment for MOOC initiated for the FY 2022-23.
- Initiatives for training and implementation of MOOC website (MOODLE).
- Two MOOC courses sent to NPTEL (IITM, National Coordinators) for approval.

Benefits Under LC

- Credit Transfer for students who take NPTEL Online Courses. Universities can make their own policy to implement the credit transfer.
- NPTEL provides toppers with the opportunity to gain rich research experiences with faculty from prestigious IITs and IISc.
- The students, who are registered under LC and have appeared for at least one NPTEL exam are eligible for free soft skill training programme. This will be helpful for them during placement.

- The fee waiver is provided to those students (or in bulk) studying at institutes that partner with NPTEL as Local Chapters.
- Support for the conduct of seminars/webinars by SPOC relevant to MOOC
- LC Interaction with NPTEL Coordinators on every Thursday

Book Exhibition on 1/11/2021

Extension Council Meeting

The first meeting of the reconstituted Extension Council was held on 18/11/2021 at 11am in the Conference hall, KUFOS.The following members attended the meeting.

1.Dr.Riji John	-Honorable Vice- Chancellor
2. Dr.B.Manoj Kumar	-Registrar, Special Invitee
3.Dr.C.Ramachandran	- Principal Scientist, CMFRI, Kochi
4.Shri.T.Purushothaman	- Fish Farmer Representative
5.Shri.Raju K S	- Fisherman Representative
6. Dr.Daisy C.Kappen	- Director of Extension i/c
7.Dr.Devika Pillai	- Director of Research
8.Dr.S.SureshKumar	- Dean,Faculty of Ocean Science and Technology
9.Dr.Rosalind George M	-Dean, Dean Faculty of Fisheries

10.Dr.Suryakala C D -Dean, Faculty of Fisheries Engineering

11.Dr.V. Ambilikumar -Dean, Faculty of Fisheries Management

12.Dr. Linoy Libini -Head Fisheries Station, Puduveypu

13.Dr.Dr.K. Dinesh -Special Officer, Regional Center, Payyannur

Honorable Vice Chancellor chaired the meeting ,welcomed all the members and briefed about the purpose of the meeting. He suggested that the extension activities should mainly focus on the problems of fish farmers and bring it in research study for finding solutions for the problems faced by them.Dr.C.Ramachandran, Principal Scientist,ICAR-CMFRI, suggested to strengthen the extension activities by linking with the Department of Fisheries. He also emphasized the need for updating the KUFOS website so as to give wide publicity of the extension activities. Shri.T.Purushothaman, Fish Farmer Representative, pointed the necessity for focusing the problems of the farmer and requested to adopt one village from the Kasaragod District in the forthcoming 14th five year plan of KUFOS as the farmers in the this District are facing severe problems due to incidence of diseases. Shri. K S Raju , Representative of the fishermen explained the problems faced by the fishermen community due to natural calamities like Okhi, Corona etc. and requested to conduct a research study about the climate variations that occurring in the sea. Also requested to install cold storage facilities along the coastal area as they are facing difficulty in marketing their catch which fetches very low price during the peak availability. Registrar, KUFOS informed that as part of the 14th plan project the Department of Fisheries has taken necessary steps for installing adequate storage facilities to the fisherfolk. Training fishermen in sea rescue operations as the University does not have expertize in this field it requires further study for which a committee shall be constituted to identify the areas in which the KUFOS can associate and collaborate with the Department of Fisheries.

The Principal Investigators presented the achievements of their extension projects.

1. Farm Advisory services (PI Dr.Safeena M P) - decided to examine the possibilities of providing online advices to the farmers. (Action – Dr.Safeene M P)

2.Village Adoption for Empowerment and Capacity Building Ensuring livelihood of Fisherfolk in Central Kerala(PI Dr.Giji Ittoop) - Decided to adopt 2-3 villages/ year (Action - Dr Gijo Ittoop)

3.EWYL(PIs Dr Binu Varghese, Dr.Abhilash Sasidharan & Dr. S Sureshkumar)- To ensure the students participation it is decided to introduce the program from the BFSc first semester onwards and to give incentives like certificate of participation and grace marks to the students. (Action- Dean, Faculty of Fisheries Science)

4.Center for Studies in Gender Concerns and Entrepreneurship Development in Fisheries (PI Dr.Shyni K)- To identify and locate a specific area initially for starting the work.(Action - Dr.Shyni K)

5.Museum and Aquarium(PI Dr.Rajeev Raghavan)- To expand the facilities for accommodating more specimens, aquariums etc. (Action – UE and Dr.Rajeeve Raghavan)

6.Exhibition Unit (PI Dr.Jayalakshmi K J) – To take urgent action for allotting space for keeping the exhibits and to explore the possibilities of starting a mobile training unit (Action –Registrar and Dr. Jayalakshi K J)

7.Audio Video Recording Studio (PI Dr.Daisy C Kappen)– To fix a target for producing instructional films in the field of aquaculture and fish processing and also to upload the films already produced by KUFOS in the website (Action – Director of Extension)

8. Strengthening Aquaculture Value Chains for improving socio economic status of coastal communities(PI Dr.Linoy Libini)- Define the particular aquaculture activity like oyster culture, cage culture etc. and to make the project more specific(Action Dr.Liniy Libini)

9.Waste to wealth(PI Dr.Radhika Rajasree) - A Zero waste approach & value addition of fish processing discards for entrepreneurship development. - As the project submitted include both research and extension component it is decided to modify the proposal by excluding the research component and to resubmit. (Action – Dr.Radhika Rajasree)

10.Center for Field Consultancy and Data Analysis and Pandit Karuppan Chair (PI Dr K Rajesh)- To take urgent steps to appoint project staff for the speedy implementation of the project. (Action- Registrar)

The meeting ended at 5pm.

Conclusion

Kerala University of Fisheries and Ocean Studies (KUFOS), the first Fisheries University in the country is established for the development fisheries and ocean studies in the State of Kerala. The University has excellence in the field of teaching , research and extension so far. Directorate of Extension under KUFOS at present is implementing 14 extension projects funded by Government of Kerala aimed at the integrated development of the community, viz. social, cultural, financial etc. These projects significantly contributed to improving the quality of life of the fisherfolk and fish farmers and also helped in enhancing their socio economic status and welfare. The projects like “Village Adoption for empowerment and Capacity building ensuring livelihood of Fisherfolk in Central Kerala” aimed at empowering the fish farmers of the

Panchayaths also helped to preserve the indigenous fish species that are facing threat leading to their extinction.

The Directorate of Extension has introduced an environment - friendly farming system focusing freshwater fish/prawn culture, brackish water fish/shrimp culture, ornamental fish culture, cage culture integrated farming etc. by utilizing the water resources available in private and public sectors of the villages. Besides being efficient in transfer of relevant technology to the fisherfolk including women beneficiaries it was with a gender sensitive approach that the projects were implemented. Through constant and continuous effort the rate of adoption of the technologies by the farmers in the adopted villages increased to a great extent and the technology gap existing at present between the research system and the farmers could be minimized.The Audio Video Recording Studio established at KUFOS is being utilized for documenting the activities and achievements of KUFOS in teaching research and extension which are mandatory to the University.It also plays a significant role in income generation by out sourcing the facilities to other institutions. Public aquarium, museum, instructional farms in the University is being utilized for the educational purpose of the University and other institutions and imparting training of the farmers as well. In future, with constant efforts by providing adequate extension services to the community, KUFOS can change the existing scenario of the fisheries sector, which is one of the most backward area next to tribal and can make a landmark in the total development of this sector.

FACULTY OF FISHERIES SCIENCE

The College of Fisheries (COF) was estatblished on 10th October 1979 at Mannuthy, Thrisur under the Kerala Agricultural University. After functioning at Mannuthy initially, COF was shifted to Panangad, Kochi the present location of the Head Quarters of KUFOS, in May 1981. The College of Fisheires initially started professional degree program B.F.Sc (Bachelor of Fisheries Science) and later M.FSc (Master of Fisheries Science) in the disciplines of Aquaculture, Fish Processing Technology, Fisheries Resource Management, Fishery Hydrography and Fisheries Extension. The College of Fisheries also started Ph.D programmes in Aquaculture, Fisheries Resource Management and Fish Processing Technology. The College of Fisheries had the following Departments namely Department of Aquaculture, Department of Fish Processing Technology, Department of Fishery Biology, Department of Fishing Technology, Department of Fishery Engineering, Department of Fishery Hydrography and Department of Management studies. All the academic programs of the College of Fisheries were accredited under ICAR.

Kerala University of Fisheries and Ocean Studies was established in Novermber, 2010 by an Act of the Kerala State Legislative Assembly by delinking the College of Fisheries, Panangad, from the Kerala Agricultural University and started functioning in 01.04.2011. From then onwards the academic programs offered by the College of Fisheries Panangad was offered from the Faculty of Fisheries Science with seven departments under the faculty as per the fifth deans committee report of the ICAR. The departments are 1.Aquaculture, , 2. Aquatic Animal Health Management,3. Aquatic Environment Management 4.Fish Processing Technology, 5.Fisheries Resource Management, 6.Fish Engineering and Fishing Technology and7. Fisheries Extension, Economics and Statistics.

The Faculty of Fisheries Science offered Bachelor of Fisheries Science program with an intake capacity of 80 students. Masters degree program Master of Fisheries Science was offered in 7 disciplines during the current academic year. Four departments offered PhD program during the year.

Department of Aquaculture

History: Department of Aquaculture was established way back in 1979 as a constituent Department of College of Fisheries, Panangad and was brought under the Faculty of Fisheries of Kerala University of Fisheries and Ocean Studies in 2011. Aquaculture is one of the major Departments under the Faculty with maximum number of courses and credits. Vision: Aquaculture being the most promising food production sector of the present era, producing trained human power deserves utmost attention. Mission: The Department of Aquaculture has been indulging in the trained human power development in the aquaculture sector through conducting Diploma, UG, PG and PhD programmes.

Department of Aquatic Animal Health Management

Teaching research and extension in aquatic animal health

Department of Aquatic Environment Management

Department of Aquatic Environment Management is one of the primary departments established under the Faculty of Fisheries in the Kerala University of Fisheries and Ocean Studies during 2011. Earlier known as the Department of Fishery Hydrography in the erstwhile College of Fisheries under Kerala Agricultural University, the Department has its origin since the commencement of the College of Fisheries, Panangad in 1979. The department started offering the post graduate programme from

2000 onwards. The Department was later renamed to Department of Aquatic Environment Management during 2017 after the adoption of ICAR Fifth Deans Committee report. Since its inception the department has contributed to various aspects of environmental studies especially assessing the aquatic environment health, biodiversity assessment and conservation, pollution monitoring programmes, impact of climate change, eco-toxicology, atmospheric science, water quality management in fish/shrimp cultural systems, environmental biotechnology, integrated coastal zone management and disaster management. Presently this department is supporting one B.F.Sc. programme and offering one M.F.Sc. (Aquatic Environment Management), and Ph.D. programmes under ICAR stream. The staff of this department have proficiency in freshwater and marine ecosystem studies and the theme area of their expertise are in subjects related to Freshwater Ecology, Marine Biology, Chemical Oceanography and Coastal Resource Management.

Objectives:

1. To promote quality education in Aquatic Environment Management (UG & PG)
2. To impart the contemporary research in long-term monitoring of aquatic ecosystems, aquatic biodiversity assessment and management, aquatic pollution, environmental biotechnology, integrated coastal zone management etc.
3. To conduct training programmes on environmental impact assessment, evaluation of health of aquatic environment and the management of aquatic resources.

Department of Fish Processing Technology

The Department of Fish Processing Technology offers courses related to Fish Processing Technology and to undertake research projects in fish processing technology for the benefit of stakeholders from the industry & other entrepreneurs and to organize training programmes for the women self-help groups, fisherfolk & others to generate employment opportunity. The Department of Fish Processing Technology came into existence from the origin of the institution in 1979 and offering programmes for Under Graduate (B.F.Sc.) Post Graduate (M.F.Sc.,) and PhD students. The current focus of the Department is towards developing new products suitable for commercialization, exploring nutraceuticals from marine biowaste resources, addressing the quality issues and pathogenic contamination faced by the seafood processing industry.

Objectives:

1. To impart quality education in Fish Processing Technology (B.F.Sc., M.F.Sc. and Ph.D. programmes)
2. To carry out priority-based research projects / schemes to develop need-based technology and refinement of existing ones in post-harvest fish utilization and consumption
3. To organize training programmes in fisheries trade particularly in fish processing for the women self-help groups, fisherfolk, entrepreneurs and others to generate employment opportunities.

Department of Fisheries Extension Economics and Statistics

The Department has been offering courses at undergraduate level.

Objectives:

1. To understand and apply the basic concept of extension in fisheries sector
2. To understand and apply the statistical methods or techniques for the proper application in research methodology

3. To understand and apply socially relevant principles of project formulation, economics and marketing to ensure profitability of a business enterprise and create awareness on corporate readiness program, fisheries governance and policies
4. To develop practical, theoretical skills in Physical Education

I. Departments: Structure- Strength

Department of Fisheries Extension	The Department has four regular faculties
Economics and Statistics	As part of the RAWE programme students carry out data collection from the emerging and need based areas of fishery extension and such data are being analysed which may empower them to perform good researches. Pedagogy is being performed with adoption of internet facilities to update knowledge of students.
Department of Aquaculture	Three academic programmes remain offered under the Department of Aquaculture including Bachelor of Fisheries Science (B.F.Sc.) which is the flagship course of the University. The two Master of Fisheries Science programmes ((M.F.Sc.) offered by the Department are M.F.Sc in Aquaculture and M.F.Sc. in Fish Nutrition and Feed Technology. The Department of Aquaculture also offers Doctoral programmes leading to Ph.D. through one-year course work and two years of research.
Department of Fish Processing Technology	The Department has 1 Professor and 4 Assistant Professors and offering programmes for Under Graduate (B.F.Sc.) Post Graduate (M.F.Sc.,) and PhD students
Department of Aquatic Animal Health Management	Professor 1 Assistant Professor 1 Adjunct faculty 1 Contract Faculty 1
Department of Aquatic Environment Management	The staff strength comprise of an Associate Professor, two Assistant Professors, and a Guest faculty

II. Department – General Details

Faculty of Fisheries Science- For the Year 2020-2021
Departments and Teaching Faculty

Sl. No	Department	Name of Faculty	Designation
		Dr.M.Rosalind George	**Dean, Faculty of Fisheries Science**
1.	Department of Aquaculture	Dr. K. Dinesh	Assoc. Professor & Head
2.		Dr. S. Shyama	Professor
3.		Dr. K.R. Salin	Assistant Professor (On leave)
4.		Dr. Chiranjiv Pradhan	Assistant Professor
5.		Dr. Binu Vargeese	Assistant Professor
6.		Dr. Rejish Kumar V. J	Assistant Professor
7.		Dr.Linoy Libini C	Assistant Professor
8.	Department of Fisheries Resource Management	Dr. M.K. Sajeevan	Assoc. Professor & Head
9.		Dr. Jayalakshmi K J	Assistant Professor
10.		Dr. Pramila S	Assistant Professor
11.		Dr. Rajeev Raghavan	Assistant Professor
12.		Dr.Anwar Ali P.H	Assistant Professor
13.	Department of Fish Processing Technology	Dr.Radhika Rajasree S.R	Professor & Head
14.		Dr.Safeena M.P	Assistant Professor
15.		Dr. Blossom K.L	Assistant Professor
16.		Dr.E.Punnadath Preetham	Assistant Professor
17.		Dr.Abhilash Sasidharan	Assistant Professor
18.		Dr.Shiny K	Assistant Professor
19.	Department of Aquatic Environment Management	Dr. K Ranjeet	Assoc. Professor & Head
20.		Dr.Anu Gopinath	Assistant Professor
21.		Dr.M.P.Prabhakaran	Assistant Professor
22.	Department Of Aquatic Animal Health Management	Dr. Devika Pillai	Professor & Head (i/c)
23.		Dr.Rehna A	Assistant Professor (On Contract)
24.	Department of Fish Engineering	Sri. Mathew Sebastian	Assoc. Professor & Head (i/c)
25.		Dr. Manoj Kumar	Assoc. Professor (Registrar i/c)

26.		Mrs. Amritha Krishnan	Asst.Professor (Contractual)
	Department of Fisheries Extension,Economic & Statistics	Sri. Mathew Sebastian	Assoc. Professor & Head
27.		Dr. Daisy.C.Kappen	Professor (Director Extension i/c)
28.		Dr.V. Ambilikumar	Professor

Students Strength

BFSc Year 1: 80
BFSc Year 2: 80
BFSc Year 3: 80
BFSc Year 4: 80

MFSc Aquaculture Year 1: 14
MFSc Aquaculture Year 2: 8

MFSc Fish Nutrition and Feed Technology Year 1: 6
MFSc Fish Nutrition and Feed Technology Year 2: 4

MFSc Aquatic Animal Health Management Year 1: 8
MFSc Aquatic Animal Health Management Year 2: 8

MFSc Fisheries Resource Management Year 1: 8
MFSc Fisheries Resource Management Year 2: 8

MFSc Aquatic Environment Management Year 1: 9
MFSc Aquatic Environment Management Year 2: 10

MFSc Fisheries Engineering and Technology Year 1: 2
MFSc Fisheries Engineering and Technology Year 2: 4

MFSc Fish Processing Technology Year 1: 8
MFSc Fish Processing Technology: 5

PhD 2017: 2
PhD 2018: 7
PhD 2019: 14
PhD 2020: 9
PhD 2021: 29

FACULTY OF OCEAN SCIENCE AND TECHNOLOGY

Kerala University of Fisheries and Ocean Studies was established in Novermber, 2010 by an Act of the Kerala State Legislative Assembly by delinking the College of Fisheries, Panangad, from the Kerala Agricultural University and started functioning in 01.04.2011.

The Faculty was constituted under the KUFOS Act 2010 by Government of Kerala and KUFOS first statute 2013 to offer academic, research and extension programmes in various aspects of Food Science and Technology, Biological oceanography, Physical Oceanography, Biodiversity, Marine Microbiology, Biotechnology, Applied Geology and Marine Chemistry and related fields. The Faculty is presently offering 11 M.Sc. programmes and PhD in respective subjects. The man power requirements in the field of Ocean studies and Food Sciences are huge and hence the postgraduate programmes have great relevance. The students are given intensive hands on training in Central and National Research Institutes such as,CMFRI, NIO, CIFT, INCOIS and CIFNET . While pursuing these courses the students get to learn practical aspects of Ocean studies and food sciences such as how to go about sampling, analyzing samples, climate change predictions etc. The students successfully completing these courses will be equipped to find jobs in leading National and International research
institutions, organizations, industries and universities.

Course: Applied Geology	M.Sc. Applied Geology programme deals basically with subjects such as geology, geophysics, oceanography, remote sensing, climate change and polar science and concerned with the study of the earth, its composition or any of its changing aspects. Applied Geology plays a significant role in various spheres from measuring the physical properties of the Earth and understanding the history and modifications of our planet to studying, assessing and predicting natural/man-made disasters (volcanoes, earthquakes, hurricanes, floods, landslides, tsunamis) to studying past climates, current global warming and future climate change to discovering and exploring precious and valuable natural resources (oil, natural gas, fuels, metals, minerals, ground water). They are also at the forefront of resource mapping, remote sensing, recycling technology and computer simulations. Candidates with M.Sc. Applied Geology have excellent career prospects as they are trained professionals with excellent international career opportunities. Within India, they can work in many scientific organizations like ONGC, NGRI, GSI, IIG, NIO, NIOT, NCAOR, INCOIS, NGRI, AMD, NCESS and other State Departments (CWRDM, State Groundwater Department, Mining and Geology Department etc.). They can also join for Ph.D and pursue their research.
Course: Biotechnology	M.Sc. Biotechnology programme offers courses that will enable students to get placed in various reputed National and International Organizations. Here they get to learn about various aspects of biotechnology and its applications in various fields.
Course: Climate Science	Emerging research has indicated that the excessive dependence on fossil fuels have resulted in the rapid increase in the global temperature in the recent decades, giving rise to extreme weather events such as floods, droughts and severe cyclonic storms. It is projected that under the current warming scenario, the intensity and frequency of these extreme events are going to increase in the coming years. Therefore, it is essential to have a comprehensive knowledge on the fundamental process that governs the Earth's climate system and the factors affecting the climate change. The curriculum of this course is designed to include the relevant concepts in meteorology, oceanography, Remote

	Sensing & GIS, climate sustainability etc. Different forecast models used to predict the state of the atmosphere are also included in the syllabus. In the final semester, the students will be given an opportunity to perform their dissertation work at a leading State/Central Govt. research institution in a topic covered in the curriculum.
Course: Disaster Management	The broad aim of the Earth sciences is to understand the present features and past evolution of Earth and to use this knowledge, where appropriate, for the benefit of humankind. The course offered will provide significant contributions to the nation through innovative and transformative research in earth sciences, excellent education for future geoscientists and for the general public as well as service to humanity through expansion and dissemination of geoscience knowledge. The mission of the Department of Earth Sciences is to contribute quality instruction and scientific expertise in the geosciences, both now and for the future, to meeting global challenges in supplies of natural resources, mitigation of natural hazards, protection of the environment, and public awareness of science. The Department's goals are to provide an effective post graduate training programs that prepare students for successful careers in science, education, technology and public service; to conduct high quality scientific research and effectively communicate results, through publication, to both academic and public audiences and to extend technical assistance to state, public and private organizations. The programme has a strong practical component within which there is specialist training in a wide variety of field and laboratory techniques.It is an advanced course of study that can lead to employment in the public or private sector. The curriculum includes contents from the syllabus of various competitive examinations such as UGC-CSIR NET and UPSC geologists and GATE. It also includes recent innovations and practices adopted by the industry especially in the fields of petroleum exploration, geotechnical, and mineral exploration.
Course: Environmental Sciences	The Environmental Sciences programme is intended to create a cadre of trained professionals who are equipped to deal with scientific, technological, legal, socio-economic and policy aspects related to environment and resource management. The programme will also provide students with a deep understanding of the complex set of circumstances that impact environmental issues, and how environmental decisions and policies attempt to find a balance between environmental conservation and economic development. The curriculum has been designed seamlessly by integrating the concept of sustainable development in an inter-disciplinary framework with an emphasis on research and application. It addresses the growing need for professionals in society who can apply best management practices drawn from various disciplines to create innovative solutions for a sustainable future.
Course: Food Science and Technology	Food safety, security and quality assurance have today become subject of national importance. However, implementation needs skilled man power. There is now an urgent need to accomplish this task. M.Sc. Food Science and Technology offers great scope for employment as managers and quality control personnel needed for the food processing industries as there is ever growing demand for processed foods in coming years. It provides students with learning experiences that help instill deep interests in learning different areas of food processing technology such as fruits and vegetable

processing technology, cereals, oil seeds processing technology, fish processing technology etc.; develop broad and balanced knowledge and understanding of key concepts, principles, and theories related to food science and technology; and equip students with appropriate tools of analysis to tackle issues and problems in the field of food science and technology; develop in students the ability to apply the knowledge and skills they have acquired to the solution of specific theoretical and applied problems in the area; provide students with the knowledge and skill base that would enable them to undertake further studies in the subject and related areas or in multidisciplinary areas that involve food science and technology and help develop a range of generic skills that are relevant to wage employment, self- employment and entrepreneurship.

Course: Marine Biology

MSc. Biological Oceanography and Biodiversity Course was started in 2012 under the School of Ocean Science and Technology. Duration of the course is 4 semesters. Presently this course has been renamed as M.Sc Marine Biology owing to the uniformity of this course at All India level. The course is designed to introduce students to the biodiversity found in the marine environment and to study their interactions and adaptations in the context of community ecology. Fishes, invertebrates, reptiles, mammals and marine algae will be the major groups encountered. Field work will be the main activity and attention will be given to collection methodology, identification, sampling techniques, research design and other useful field skills. Lectures, lab work, discussions and readings will th supplement the field work, as will an independent research project during the 4 semesters. Marine Biology careers in India are enormous and diverse. In this field there are various jobs in India especially in education, research and industry. The manpower requirement in this area is huge, hence the course has great relevance with options for MSc Degree holders to become scientists/faculties. Besides opportunities in academic and R&D institutions, students who have their degree in MSc Marine Biology can also enter into aquaculture industry. Those who like to be an entrepreneur, can also take up aquaculture, ornamental fish culture and fish culture trade.

Course: Marine Chemistry

M.Sc. Marine chemistry is a post graduate course, under the Faculty of Ocean Science and Technology (FOST) and focuses on the study of the chemical processes of the oceans. The syllabus, apart from General Chemistry (~70%) include chemical composition of seawater, the biochemical cycles in the ocean, effects of pollutants, impacts of chemical process on marine organisms, ocean acidification and climate change, marine natural products etc.

The overall aims of master's degree programme in Marine Chemistry are to provide students with learning experiences that help instill deep interests in learning various disciplines in marine sciences including marine chemistry, biogeochemistry, marine pollution, isotope geochemistry, instrumentation techniques etc.; develop broad and balanced knowledge and understanding of key chemical concepts, principles, and theories related to chemistry;and equip students with appropriate tools of analysis to tackle issues and problems in the field of marine chemistry; develop in students the ability to apply the knowledge and skills they have acquired to the solution of specific theoretical and applied problems in the area; provide students with the knowledge and skill base that would enable them to undertake further studies in the subject and related areas or in multidisciplinary areas that involve chemistry and help develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

Course: Marine Microbiology

Marine Microbiology is a study of the smallest groups of organisms that reside

	in the vast marine environment. This course helps students to understand and appreciate the diverse groups of prokaryotic and eukaryotic microbes and the roles they play in the functioning of marine food webs, biogeochemical cycles, causing disease, climate change, the fate of pollutants, bioremediation and successful maintenance of our biosphere. The course, Marine Microbiology gives special emphasis on Microbial Taxonomy & Diversity, Marine Microbial Ecology, Microbial Diseases, Immunology, Molecular Biology & Recombinant DNA technology, Bioinformatics & Biostatistics, Food & Industrial Microbiology, Bioactive substances and drugs from sea. The course was started in 2014 and called Marine Microbiology and Marine drugs. Then adjunct faculty like Dr. Rajendran N and Dr Sanjeev and other guest faculty helped in establishing the department**.** The course aims to produce students with sound academic knowledge, technical skill, confidence and enthusiasm to explore the marine microbial world and allied areas; equipped to face challenges and contribute in their own way to the betterment of the society through the rigorous course work, practical and other academic activities offered by the department.
Course: Physical Oceanography	Covering more than 70% of the earth surface, oceans play a major role in regulating the climate and the distribution of food resources. Further, the human society is faced with severe challenges from rising sea levels, extreme storm events, warming oceanic waters, altered ecosystems and increasing ocean acidification. Realizing the significance of oceans and its physical processes, the Department of Physical Oceanography, KUFOS offers a unique post-graduate course in Physical Oceanography integrating observational, theoretical and modelling aspects of oceans. The goal of physical Oceanography is to provide a systematic understanding oceanic process, its interaction with atmosphere and quantitative description of the oceanic movements using observations and modelling. Basic knowledge of Physical Oceanography is crucial to understanding of many biological, geological and chemical processes in the Oceans. Besides, the physical processes of the ocean influence the distribution of rainfall, droughts and the development of storms, cyclones. Basically, Physical Oceanography involves the application of physics and mathematics to study oceans. In addition to the descriptive learning of oceans, hands on training also be given in observing, data analysis and interpretation of oceanic phenomena. Modern techniques like remote sensing, satellite oceanography and computer applications in oceanography for data analysis and numerical modelling of the oceanic processes are appropriately incorporated in the course of study. The curriculum includes field visits, Institutional visits and dissertation work at the final semester of the course. This course will equip students with the skills they need to join the workforce as ocean scientist as well as provide strong foundation for students to pursue doctoral research in Oceanography. The successful completion of the course will offer opportunities to join with National Institutes and private companies which are working on ocean related fields.
Course: Remote Sensing and GIS	This is a recently introduced course and has an immense scope. The students are trained to get opportunities in National and International Institutes.

Faculty: Structure-

Applied Geology	There is a course coordinator (a regular faculty), an adjunct and two guest faculty. The Department offers Masters programmes. The students are encouraged to undertake projects and dissertation studies.
Biotechnology	The course activities are coordinated by a regular faculty, an adjunct and three guest faculty. The Department offers Masters programmes.
Climate Science	The course activities are coordinated by a regular faculty, two adjunct and three guest faculty. The Department offers Masters and Ph.D programmes.
Disaster Management	The course is managed by one regular faculty and a contract faculty. The course offers Masters and Ph.D programmes
Environmental Sciences	The course activities are coordinated by a regular faculty, two adjunct and four guest faculty. The Department offers Masters and Ph.D programmes.
Food Science and Technology	The course is management by two regular faculty, two adjunct and four guest faculty. The Department offers Masters and Ph.D programmes. As a part of the curriculum, the students are encouraged to undertake Industrial and Lab Visits, which enable them to get familiar with the various organizational set ups, research activities, etc. As part of the EWS programme students get first-hand experience of the processing, marketing, and consumer preferences of various food products. They are also given HACCP training. Pedagogy is being performed with adoption of internet facilities to update knowledge of students.
Marine Biology	The course activities are coordinated by a regular faculty, an adjunct and three guest faculty. The Department offers Masters and Ph.D programmes. They are encouraged to undertake cruise, sample collection and analyses. Pedagogy is being performed with adoption of internet facilities to update knowledge of students.
Marine Chemistry	The course activities are coordinated by one regular faculty, an adjunct, one contract and four guest faculty. The Department offers Masters programmes. The students are directed to visit labs and organizations to get first-hand experiences.
Marine Microbiology	The course is management by two regular faculty and four guest faculty. The Department offers Masters and Ph.D programme. Pedagogy is being performed with adoption of internet facilities to update knowledge of students.
Physical Oceanography	The course is managed by one regular faculty and four adjunct faculty. The Department offers Masters and Ph.D programme. Pedagogy is being performed with adoption of internet facilities to update knowledge of students.
Remote Sensing and GIS	The course is managed by two regular faculty and an adjunct faculty. The Department offers Masters and Ph.D programmes.

Students Strength

MSc Biotechnology Year 1: 18
MSc Biotechnology Year 2: 15

MSc Marine Microbiology Year 1: 24
MSc Marine Microbiology Year 2: 14

MSc Physical Oceanography Year 1: 11
MSc Physical Oceanography Year 2: 10

MSc Marine Chemistry Year 1: 18
MSc Marine Chemistry Year 2: 17

MSc Marine Biology Year 1: 31
MSc Marine Biology Year 2: 29

MSc Earth Science Year 1: 14
MSc Earth Science Year 2: 5

MSc Remote Sensing and GIS Year 1: 13
MSc Remote Sensing and GIS Year 2: 10

MSc Food Science and Technology Year 1: 34
MSc Food Science and Technology Year 2: 32

MSc Climate Science Year 1: 12
MSc Climate Science Year 2: 10

MSc Environmental Science Year 1: 19
MSc Environmental Science Year 2: 15

MSc Disaster Management Year 1: 12
MSc Disaster Management Year 2: 10

PhD 2017: 21
PhD 2018: 32
PhD 2019: 27
PhD 2020: 40
PhD 2021: 34

Faculty of Fisheries Engineering

Staff strength

Dean In-charge : Prof (Dr) B. Manojkumar

Associate Professor : -

Assistant professor :-

Adjunct faculty :1 for M Tech Dr.Sivadas

Dr.Prasad Rao(Guest Service from SOST)

Dr.Pankajaction(Guest Service from SOST)

B Tech Food Tech Dr.D D Nambuthiri(" "Service from SOST)

Dr.P T Mathews(" " Service from SOST)

Dr.Jenny John (Service from SOST)

Dr.Maya Raman (Service from SOST)

Contract/Guest faculty	:	6(o/c) /	7(G)
			1. Ms.Sowbhagya
		1.Er.RashidaRejuwa	2.Dr.Aishwarya Rao
		2.Er.Bhavya Francis	3.Dr.Subin
		3.Er.Mridhula Murali	4.Ms.Soumya
		4.Er.Solomon Francis	5.Dr.Deepak
		5.Dr.LinuSalim	6.Mr.Ananthanarayanan
			7.Er.Linda
Trade Instructors	:	2(o/c)	
		1.Er.K S Sijith	
		2.Er.AbhishKalathil	

STUDENTS STRENGTH

B.Tech. Food Technology Year 1: 40

B.Tech. Food Technology Year 2: 45

B.Tech. Food Technology Year: 44

B.Tech. Food Technology Year 4: 44

M.Tech. in Ocean and Coastal Safety Engineering Year 1: 3

M.Tech. in Coastal and Harbour Engineering Year 1: 13
M.Tech. in Coastal and Harbour Engineering Year 2: 4
M.Tech. in Coastal and Harbour Engineering Year 3: 5

PhD 2017: 2
PhD 2018: 1
PhD 2019: 0
PhD 2020: 2

FACULTY OF FISHERIES MANAGEMENT

The mandate of the Faculty of Fisheries Management is teaching, research and extension. The focus areas are business management, fish marketing & trade, fisheries economics, cooperative management, maritime and fisheries laws, socio-economics of the fisher folk & other stakeholders, statistics, entrepreneurship development and information technology. The School of Management & Entrepreneurship started functioning from the Academic year 2012-13 by launching an MBA Programme. The name of the School was changed to Faculty of Fisheries Management through the ordinance issued by the Government of Kerala.

Academic Programs

The Faculty of Fisheries Management offers five Post Graduate programs and Ph. D. Programme in various disciplines under its three Departments as per the details given below.

Department	PG Programs	Ph.D
Department of Business Administration and Management	M.B.A. (Dual Specialization)	Management, Commerce and Economics
Department of Economics and Statistics	M.Sc. (Statistics)	Nil
Department of Legal Studies	L.L.M. (Maritime Law)	Law

Inter school programme

The school offers courses as an inter school program for the various undergraduate and Post Graduate programs such as B. F.Sc, M.Sc., M.Tech courses run by the other six schools/ Faculties of the University.

Faculty Members:

Dr. V. Ambili Kumar, Professor and Director i/c of SME		
Department of Business Administration and Management	**Department of Extension, Economics and Statistics**	**Department of Legal Studies**
Dr. Afsal E. M., Associate Professor & Head of DBMS	Sri. Mathew Sebastian, Associate Professor, Head of E&S	Ms. Ashamol V., Assistant Professor on contract
Dr. Rajesh K., Assistant Professor	Mrs.Ambily Jose: Guest Faculty	Ann Lauretta Correya, Guest Faculty
Dr Anoop K.K., Assistant Professor	Mrs.Sethulakshmi Bahuleyan : Guest Faculty	
Ms.Ansiya Haneefa, Guest Faculty	Ms.Rosmin Raju : Guest Faculty	
Sri M Krishnanunny, Guest Faculty	Mrs. Sowbhagya S. Prabhu: Guest Faculty	
Dr Geetha Jose, Guest Faculty	Prof (Dr.) K.R.Muraleedharan Nair, Adjunct , Faculty	
Smt Anjali M.A., Guest Faculty	Ms.Mehra P.M., Guest Faculty	
Dr A Jominy, Guest Faculty	Mrs.Aruna K.N.	
Ms.Sneha Stanly, Guest Faculty		

Students Strength

MSc Statistics Year 1: 9
MSc Statistics Year 2: 4

M.B.A. Dual Specialization - Finance, Marketing, Human Resource Management, Rural Management and Fisheries Business Management
Year 1: 43
Year 2: 40

LLM Maritime Law Year 1:
LLM Maritime Law Year 2: 16

PhD 2017: 9
PhD 2018: 12
PhD 2019: 9
PhD 2020: 25

Research Centers of the School

1. 'Centre for Livelihood Security and Development Issues among Fisher folk of Kerala'
2. 'Centre for Field Consultancy and Data Analysis'

KUFOS has signed a MoU with Manappuram Foundation. Based on which, three students from the general category and three students belonging to the fishermen community undergoing MBA programme are eligible to receive the **Manappuram Foundation** Scholarship. The amount of Scholarship is Rs.4000/- per month. This scholarship will be awarded on the basis of the eligible students in each semester.

Faculty of Fisheries Engineering

Staff strength

Dean In-charge : Prof (Dr) B. Manojkumar

Associate Professor : -

Assistant professor :-

Adjunct faculty :1 for M Tech Dr.Sivadas

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		4.Er.Solomon Francis	5.Dr.Deepak
		5.Dr.LinuSalim	6.Mr.Ananthanarayanan
			7.Er.Linda
Trade Instructors	:	2(o/c)	
		1.Er.K S Sijith	
		2.Er.AbhishKalathil	

STUDENTS STRENGTH

B.Tech. Food Technology Year 1: 40

B.Tech. Food Technology Year 2: 45

B.Tech. Food Technology Year: 44

B.Tech. Food Technology Year 4: 44

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M.Tech. in Coastal and Harbour Engineering Year 2: 4
M.Tech. in Coastal and Harbour Engineering Year 3: 5

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PhD 2018: 1
PhD 2019: 0
PhD 2020: 2

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Ms.Sneha Stanly, Guest Faculty		

Students Strength

MSc Statistics Year 1: 9
MSc Statistics Year 2: 4

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Year 2: 40

LLM Maritime Law Year 1:
LLM Maritime Law Year 2: 16

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PhD 2018: 12
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NCC

World Environment Day

The World Environment Day was celebrated on 5th June 2022. Hon'ble vice Chancellor Dr. K. Riji.K.John officially inaugurated the programme by planting a sapling followed by Sub Lt (Dr.) Chiranjiv Pradhan and cadets planted the saplings and watered it. The cadets promised to take the initiative of saving the environment.

Yoga Day

NCC KUFOS unit celebrated international Yoga Day on 21st June 2022 and the session was held at campus with an active participation. The event was held in presence of ANO Sub Lt. (Dr.) Chiranjiv Pradhan and Dr. Arun Kumar, Assistant Professor, Dept. of Physical Education. The session started at 6 am and it began with a brief introduction of Yoga day by Dr. Chiranjiv Pradhan and Dr. Arun Kumar who emphasized the importance of Yoga and physical exercises in our daily life. Under the guidance of Dr. Arun Kumar, yoga demonstrations were started with the yoga prayers after which some warm up exercises and asana were performed by the cadets.

Scuba Diving Campaign Report

As part of the Scuba Diving Awareness campaign,
NCC Unit KUFOS and Department of Physical Education organized a workshop on scuba diving in collaboration with Aqualeo Dive Centre, Kochi on 8th July 2022. Joseph Delish, Manager of Aqualeo dive Centre and their team took half an hour session on the basics of Scuba diving activities such as Scuba Diving potential, benefits, equipment used and safety signs. Following that diving session was held at the swimming pool under the guidance of Aqualeo Dive Centre professionals which was a great opportunity for the cadets and also for their physical and mental wellbeing.


WELCOME
All Staff & Students of
KERALA UNIVERSITY
OF
FISHERIES & OCEAN STUDIES


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FISHERIES & OCEAN STUDIES
KUFOS

N S S

World Environment Day

Activities of the National Service Scheme (NSS) got initiated with the observance of World Environment Day Celebrations on 5th June 2021. World Environment Day was celebrated by NSS volunteers in their houses by planting trees. The main purpose of the celebration was to spread awareness about the need to protect the environment and the ways to do it. NSS volunteers became a model for other students in the university. The volunteers also prepared an enchanting video of this programme. The Programme was a great success and has certainly made a difference to the way we view our environment.

Anaemia Campaign

NSS units of Kerala University Of Fisheries And Ocean Studies conducted Anaemia campaign in association with Integrated Child Development Service (IDCS) in Kumbalam Panchayat and NetProFan (Network of professionals of food and nutrition).This campaign was held on June 19,2021 through Google meet platform.

The formal function started at 12pm.The ICDS coordinator Smt. Asha addressed the gathered speakers and NSS volunteers of the Institution and registered them for being a part of the movement. The main speakers of this campaign were Dr. Liza Thomas (Pediatrician and Adolescent specialist Little Flower Annex Hospital, Aluva) and Ms. Priyanka PS (Assistant professor, St. Teresa's college Ernakulam). Dr. Liza Thomas Mainly spoke about the causes and reasons for Anaemia disease. Ms. Priyanka PS conducted Quiz session and spoke about the diet to prevent anaemia. Active participation of the NSS volunteers and the students from

all departments of university made the programme a grand success. The program was coordinated by Dr. Rejish kumar V.J, Program officer, NSS KUFOS.

International Yoga Day

In connection with 7th International yoga day, NSS unit of KUFOS has organized an online training programme 'Health and focus through yoga meditation 'on June 21, 2021. The programme was conducted through Zoom platform. The programme started at 4.30pm with the NSS song by NSS volunteer Sreelekshmi T K, Dr. Rejish Kumar V.J, NSS programme coordinator of KUFOS has delivered the cordial welcome address. Hon'ble Vice Chancellor of KUFOS ,Prof. Dr. Riji John inaugurated the programme. The message of the day was given by Anish P.S, Art of living faculty. He is the coordinator of Mission Zindagi programme and Prison Smart programme. In his talk he emphasized on the importance of yoga for a healthy life. Dr.B.Manojkumar, Registrar KUFOS offered the felicitations. Vote of thanks was given by Aishwarya AG,NSS volunteer. practical session was conducted through the Zoom meeting. Anish PS and Kumari Damodar, the faculty of Art of Living, Ernakulam led the programme. The programme was about 1 hour followed by 30 min training session. More than 100 students participated in the programme.

10:10:58 • 95%

ജന്മഭൂമി 3/11

ഷാജി, കൃഷ്ണപ്രസാദ്, പി.ബി. ഗോപിനാഥ്, ആല ങ്ങാട് ബ്ലോക്ക് പഞ്ചായത്തംഗം കെ.ആർ. രാമചന്ദ്രൻ എന്നിവർ പങ്കെടുത്തു.

കൊച്ചി: ഏഴാമത് അന്താരാഷ്ട്ര യോഗാദിനാചരണ ത്തിന്റെ ഭാഗമായി കേരള ഫിഷറീസ് സമുദ്ര പഠന സർവകലാശാലയിൽ (കുഫോസ്) ഹെൽത്ത് ആൻറ് ഫോക്കസ് ത്രൂ യോഗ ആൻറ് മെഡിറ്റേഷൻ -ഓൺ ലൈൻ പരിശീലന പരിപാടി സംഘടിപ്പിച്ചു. വൈസ് ചാൻസലർ ഡോ. കെ. റിജി ജോൺ ഉദ്ഘാടനം ചെ യ്തു. ആർട്ട് ഓഫ് ലിവിങ് ഫാക്കൽറ്റി അനിഷ് പി. എസ്. ഓൺലൈൻ യോഗ പരിശീലന പരിപാ ടിക്ക് നേതൃത്വം നൽകി. കുഫോസ് രജിസ്ട്രാർ ഡോ. ബി. മനോജ് കുമാർ, എൻഎസ്എസ് പ്രോ ഗ്രാം കോർഡിനേറ്റർ ഡോ. രജിഷ് കുമാർ വി. ജെ എന്നിവർ പങ്കെടുത്തു. നൂറോളം വിദ്യാർഥികൾ ഓൺ ലൈൻ യോഗ പരിശീനത്തിൽ പങ്കെടുത്തു.

Protest against dowry and domestic violence

There is an increasing report on dowry related issues and domestic violence against women in Kerala and India. NSS KUFOS volunteers conveyed their protest on domestic violence against women through pledge and posters. About hundreds of NSS volunteers participated in the protest. The protest was held on 4th July 2021. There was active participation of students from all departments of university. An inspiring video made by the volunteers widely circulated in the social media. The program was coordinated by Dr. Rejish kumar VJ, NSS

program officer, KUFOS

Cheer for India for Tokyo Olympic 2021

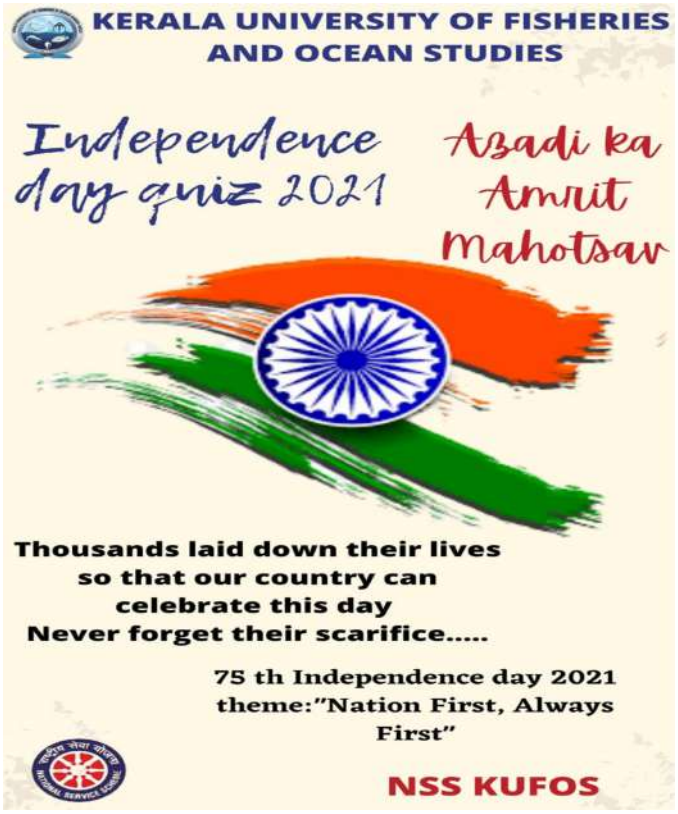
NSS volunteers of KUFOS has prepared videos to cheer our Indian team at Tokyo. The video has been uploaded in the social media and NSS RD WhatsApp group.

Convocation programme

Hon'ble Governor Shri. Arif Mohammed Khan was the chief guest of 7th Convocation Ceremony of KUFOS. NSS volunteers assisted in the smooth conduct of convocation programme which was held on 12th August 2021.

Independence Day Celebrations (Azadi ka Amrut Mahotsav)

Our 75 years of independence 'Azadi ka Amrut Mahotsav' was celebrated at KUFOS with great enthusiasm and patriotic fervour on the 15th day of August 2021. The programme commenced with the NCC parade and the majestic tri-colour national flag was hoisted by Vice-Chancellor, Prof. Dr Riji John accompanied by the heart-stirring national anthem. The VC addressed the gathering appealing to the nationalistic spirit and urging to take pride in being an Indian and fulfilling one's duty with responsibility. In his brief and bright speech, he emphasized the need of understanding our capabilities to contribute more to the country as fisheries students. This was followed by the patriotic song by the NSS volunteers and the speech by the NCC cadet evoked the feeling of patriotism among one and all. NCC and NSS songs gave more colours to the programme. The NSS organized an online quiz programme and crafted a video on 'Unity in diversity at KUFOS' which depicted the students who hail from different parts of India. Librarian Dr. Kujumuhammad was the programme coordinator and vote of thanks delivered by Prof. Dr. Subash Chandran, Controller of examination, KUFOS.. The covid protocol was strictly followed throughout the event.


KERALA UNIVERSITY OF FISHERIES AND OCEAN STUDIES
Independence day quiz 2021
Azadi ka Amrit Mahotsav
Thousands laid down their lives so that our country can celebrate this day
Never forget their scarifice.....
75 th Independence day 2021 theme:"Nation First, Always First"
NSS KUFOS

Rendering of the National Anthem of India

All NSS volunteers contributed their individual rendering of "National Anthem of India", in connection with 75th Independence Day celebrations "Azadi ka Amrut Mahotsav" organized by Ministry of Education, Govt. of India.

"No to dowry" poster competition

As per the order of Hon'ble Governor NSS KUFOS has organized a poster competition on "No TO DOWRY". Entries were invited from August 10-15. Altogether ten entries were received. A committee has been constituted and best three posters has been selected and submitted to the Governor office for further evaluation.

NSS volunteers of KUFOS bagged prizes in National NSS Meet 2021

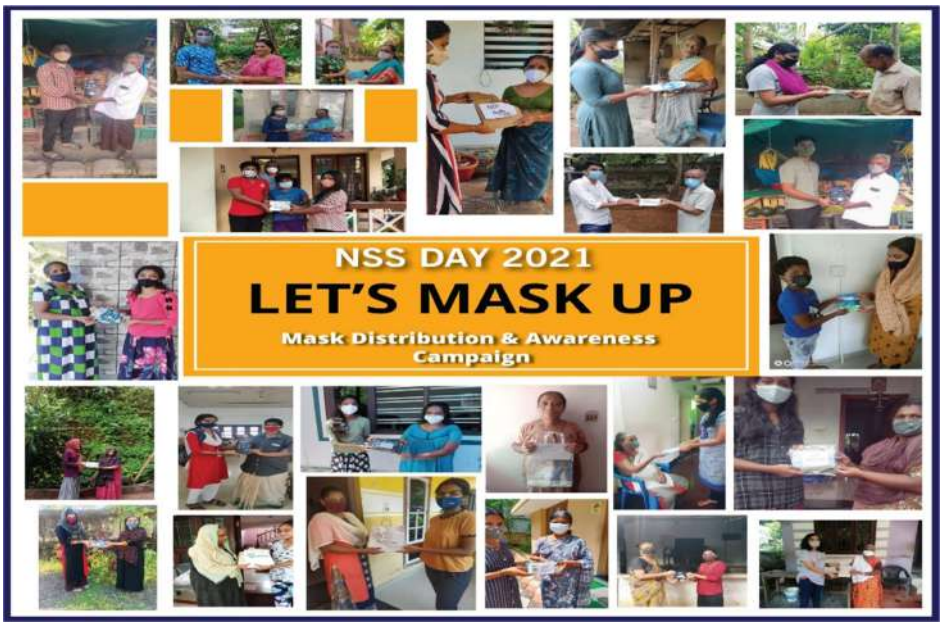
NSS KUFOS Volunteers participated in National NSS MEET 2021 organized by NSS Units No.150 and 31 of St Xaviers College Palayamkottai, Tamil Nādu from 20th September 2021 to 24th September 2021 via online. NSS volunteers Pragati Kumari and Vidya Vijayan (BFSc 2019 batch) bagged prizes in the National NSS Meet. Pragati Kumari got First prize in Quiz competition and third prize in Slogan writing, while Vidya Vijayan won first prize in Poster making.

Vidya Vijayan

Pragati Kumari

NSS Day celebration 2021

NSS units of KUFOS celebrated National NSS DAY on 24th September 2021 with a campaign “Lets Mask Up” to curb the COVID 19. NSS volunteers distributed cloth masks and created awareness among the public regarding the importance of wearing masks and other precautions to prevent the spread of COVID 19 pandemic



Clean India Programme 2021

National Service Scheme, Kerala University of Fisheries and Ocean Studies has celebrated Gandhi Jayanthi on 2nd October 2021. Fifty-five NSS Volunteers gathered at KUFOS to commemorate Gandhiji's 152nd birthday. The programme was started at 9 AM in the academic block with the speech of Dr Rejish Kumar, NSS Programme Officer KUFOS emphasizing the importance of cleanliness and the duties to be fulfilled by the NSS volunteers. As a part of Clean India Programme NSS volunteers were divided into two groups for collecting the plastic wastes. One group conducted a Plogging Run while another group engaged in Campus cleaning. The Plogging Run started from Panangad Police station and ended in Lakeshore Hospital. The Campus cleaning was conducted in all the three Campuses. The Programme ended at 1.00 pm. At the end we were able to collect more than 30kg of plastic waste.


PLOGGING RUN
NSS KUFOS
2021


GANDHI JAYANTHI
CELEBRATION
2 OCTOBER
2021

National Unity Day

On 1 st November 2021, NSS volunteers gathered in the western campus, Infront of the aquarium at 4.30 pm to celebrate the national Unity Day. The national Unity Day also known as Rastriya Ekta Diwas is celebrated on October 31 to mark the birth anniversary of Sardar Patel. The objective is to maintain the nation's unity and aims to spread awareness about Patel's contribution, who played a crucial role in the integration of India. The programme coordinator Dr Rejish sir explained about the significance of this day and also welcomed the NSS new programme officer Dr Abhilash sir. The volunteers took the pledge to preserve the unity, integrity and security of the nation.

Constitution Day

Every year on November 26th, Constitution Day, also known as 'Samvidhan Divas,' is celebrated in our country to honour the adoption of the Indian Constitution. The Constituent Assembly of India enacted the Indian Constitution on November 26, 1949, and it went into effect on January 26, 1950. To promote constitutional ideas among citizens, NSS volunteers assembled in the Western Campus at 4.30 PM on 26 th November in front of the Aquarium. The Programme coordinator Dr Rejish sir described the importance of Constitution Day and how we can contribute to the development of our Nation. The Pledge was delivered by the Programme officer Dr Abhilash Sir. The Volunteers got the spirit to protect the Indian laws and were also inspired to know more about the Indian constitution.

World AIDS DAY District level Inauguration 2021

Every year, on 1 December, the world commemorates World AIDS Day. This day reminds us that HIV infection still exists in society and that there is still a lot to be done to prevent HIV and protect those infected. The message of World AIDS Day 2021 is " End inequalities, End AIDS, End Pandemics"

The district-level inauguration of the World AIDS Day was held at 11 am on 1 December 2021, at the KUFOS seminar hall organized by the Kochi District Health Department, KUFOS NNS Unit and the District AIDS Control Unit. The ceremony was started with a flash mob of NSS KUFOS Volunteers followed by the flash mob of Govt Nursing School Ernakulam. The official programme was started with the welcome speech of District TB and AIDS control officer Dr Sarath G Rao followed by the presidential address of Mrs. Baby Thampi, Palluruthy Block Panchayat President. Prof. Dr Riji John , Vice-Chancellor, KUFOS officially inaugurated the function by lighting the lamp.

Red Ribbon wearing ceremony, which is the symbol of solidarity and support towards the people living with HIV, was done by Mr. K. S Radhakrishnan the Kumbalam Gramapanchayath President. The District Medical officer, Ernakulam Dr Jayasree V delivered the keynote address. She emphasized on how to overcome treat the AIDS patients

and the role of society to prevent the HIV. National Health Mission District Program Manager Dr. Sajith John administered the oath

KUFOS Registrar Dr. B. Manoj Kumar, Mrs. Mettilda Michael Chairperson of Standing committee on health Pallurythy Block Panchayath, Mrs. K. P Karmali Teacher the Vice president of Kumbalam Gramapanchayath, M.M. Faisal Chairperson of Standing committee on health Kumbalam Gramapanchayath and K. P Pradeepan ward member of Kumbalam Gramapanchayath greeted the gathering. Each of them emphasized to stop the HIV stigma by speaking up and taking action against stigmatizing words or actions.

The programme was accompanied by a flash mob, skit, street drama and awareness poster display. Prizes were distributed on the district level Flash mob and Poster Making competitions. Ernakulam Govt. Nursing School, Sree Sudheendra College of Nursing, Govt. Law College Ernakulam won the first three places. Vivek Vijayan bagged the first prize on poster competition. NSS KUFOS and District Aids Prevention and control unit team (DACU) Performed the street play, which was given the extra colors to the program. Mrs. Sreeja C. M, the District Education and Media Officer delivered the vote of thanks.

കുഫോസിൽ ജില്ലാതല എയ്ഡ്സ് ദിനാചരണം

കൊച്ചി ● ജില്ലാ ആരോഗ്യ വകുപ്പ്, കുഫോസ് എൻഎൻഎസ് യൂണിറ്റ്, ജില്ലാ എയ്ഡ്സ് നിയന്ത്രണ യൂണിറ്റ് എന്നിവയുടെ നേതൃത്വത്തിൽ സംഘടിപ്പിച്ച എയ്ഡ്സ് ദിനാചരണത്തിന്റെ ജില്ലാതല ഉദ്ഘാടനം പനങ്ങാട് കുഫോസിൽ വൈസ് ചാൻസലർ ഡോ. റിജി ജോൺ നിർവഹിച്ചു.

പള്ളുരുത്തി ബ്ലോക്ക് പഞ്ചായത്ത് പ്രസിഡന്റ് ബേബി തമ്പി അധ്യക്ഷത വഹിച്ചു. ജില്ലാ മെഡിക്കൽ ഓഫിസർ ഡോ. ജയശ്രീ മുഖ്യപ്രഭാഷണം നടത്തി. കുമ്പളം പഞ്ചായത്ത് പ്രസിഡന്റ് കെ.എസ്. രാധാകൃഷ്ണൻ റെഡ് റിബൺ അണിയിക്കൽ ചടങ്ങ് ഉദ്ഘാടനം ചെയ്തു.

ദേശീയ ആരോഗ്യ ദൗത്യം ജില്ലാ പ്രോഗ്രാം മാനേജർ ഡോ. സജിത് ജോൺ പ്രതിജ്ഞ ചൊല്ലിക്കൊടുത്തു. കുഫോസ് റജിസ്ട്രാർ ഡോ. ബി.മനോജ് കുമാർ, ജില്ലാ ടി ബി ആൻഡ് എയ്ഡ്സ് കൺട്രോൾ ഓഫിസർ ഡോ. ശരത് ജി റാവു, ജില്ലാ എജ്യുക്കേഷൻ മീഡിയ ഓഫിസർ ശ്രീജ, മെറ്റിൽഡ മൈക്കിൾ, കാർമ്മലി, എം.എം. ഫൈസൽ, കെ.പി പ്രദീപൻ, എന്നിവർ പ്രസംഗിച്ചു.

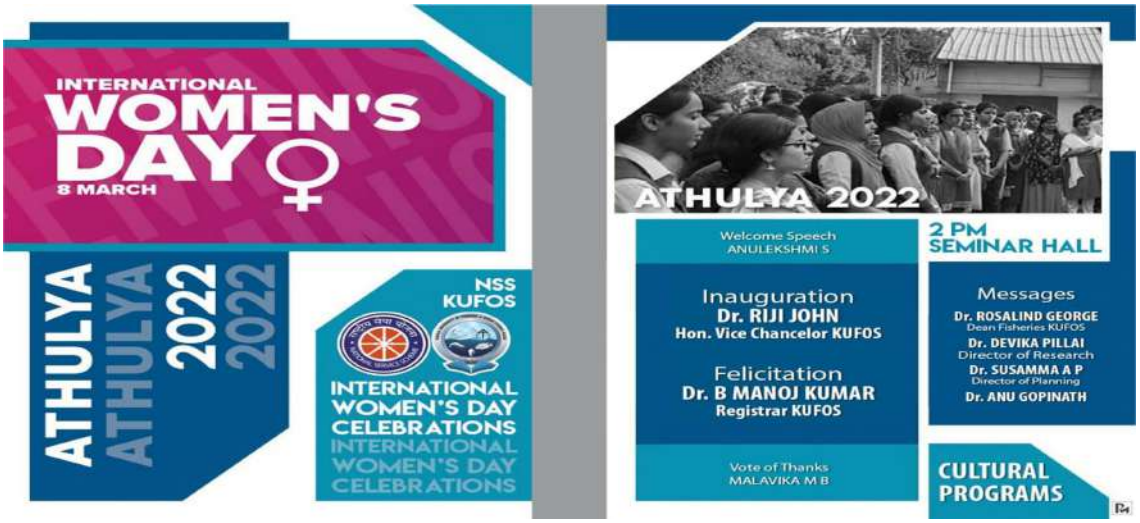
ഉദ്ഘാടനത്തോട് അനുബന്ധിച്ച് ഫ്ലാഷ് മോബ്, സ്കിറ്റ്, തെരുവ് നാടകം, ബോധവൽക്കരണ പോസ്റ്റർ പ്രദർശനം തുടങ്ങിയവ സംഘടിപ്പിച്ചു.

ജില്ലാതല ഫ്ലാഷ് മോബ് മത്സരത്തിൽ എറണാകുളം ഗവ. നഴ്സിങ് സ്കൂൾ, ശുചിത്ര നഴ്സിങ് കോളജ്, ഗവ. ലോ കോളജ് എന്നിവർ ആദ്യ മൂന്ന് സ്ഥാനങ്ങൾ നേടി.

International Women's Day "ATHULYA" 2022

NSS KUFOS celebrated International Womens DAY "ATHULYA" 2022 on March 8 2022. The function was inaugurated by Hon. Vice-chancellor of KUFOS Prof. Dr. Riji John. Felicitation was given by Dr. B. Manoj Kumar, Registrar, KUFOS. Dr. Roslind George (Dean Faculty of Fisheries), Dr. Devika Pillai (Director of Research), Dr. Susamma AP (Director of Planning) and Dr. Anu Gopinath (Assistant Professor) delivered women's day messages. NSS volunteer Anulekshmi S welcome the gathering and Malavika MB expressed

Vote of Thanks. The inaugural function was followed by different cultural activities of NSS volunteers.



Seventh Convocation

Govornor of Kerala and Chancellor of Universities in the State inaugurates the seventh convocation of Kerala University of Fisheries and Ocean Studies (KUFOS) at main campus, Panangad August 12, 2021. KUFOS Vice Chancellor Dr.K.Riji John, State Fisheries Minister and Pro Chancellor of KUFOS Saji Cherian and KUFOS Controller of Exams Dr.P.Subashchandran are also present in the picture. Governor Arif Muhammed Khan conferred degrees in the convocation to 386 students who have completed their courses during 2019-20 academic year

OTHER EVENTS DURING 2021-2022

KSSP and KUFOS jointly organized Inland fisheries workshop

Kerala Sasthra Sahitya Parishath (KSSP) and Kerala University of Fisheries and Ocean Studies (KUFOS) have jointly organized an one day state level workshop on Inland fisheries and aquaculture Development of Kerala on June 06, 2022. The workshop was held at KUFOS seminar hall and the purpose of the workshop was to draw a vision document on the future of fisheries sector of Kerala .

K.Babu MLA and former Fisheries Minister inaugurated the workshop, in which fisheries scientists and farmers across the state presented their ideas to improve aquaculture production in a sustainable way by sharing their thoughts to improve inland fisheries of Kerala Dr.K.Riji John, vice chancellor of KUFOS presided over the inaugural function . Registrar Dr.B.Manojkumar, Aquaculture Dept Head Dr.K.Dinesh, KSSP representatives Professor P.K.Raveendran, Dr.N.Shaji and Kumbalam Grama Panchayath President K.S.Radhakrishnan were among the speakers of the occasion.

Apart from the Inland fisheries sector, other topics to discussed in the workshop were –Aquaculture : appraisal of technologies for a sustainable future and Fish based livelihood options. The workshop urged to the State Gove to form Vembanad Lake Authority immediately to protect inland fisheries sector of central Kerala.

KUFOS and Bay of Bengal Programme signed MoU on May 08, 2022

Kerala University of Fisheries and Ocean Studies (KUFOS) and Chennai based Bay of Bengal Programme (BOBP-IGO) singed Memorandum of Understanding (MoU) to cooperate and work together in areas of common interest.

The Bay of Bengal Programme Inter- Governmental Organization (BOBP- IGO) evolved from the erstwhile Bay of Bengal Programme of the Food and Agriculture Organization (FAO) of the United Nations (UN). The core objectives of the IGO are to increase awareness and knowledge of the needs, benefits and practices of coastal fisheries management; enhance skills through training and education; transfer appropriate technologies and techniques for development of small-scale fisheries; establish a regional information networking; and promote women's participation in coastal fisheries development at all levels.

The BOBP-IGO is a unique regional fisheries body, specifically mandated to assist the member countries in increasing the livelihood opportunities and improving the quality of life of the small- scale/ artisanal fisher folk in the Bay of Bengal region. Our forerunner, the BOBP, with a relentless focus on quality and objectivity, has already set international benchmarks in execution of programs and activities in the field of small-scale fisheries that has translated into measurable benefits for the member countries. Currently, member governments are Bangladesh, India, Maldives and Sri Lanka.

The MoU was signed and exchanged in Chennai on May 08, 2022 by KUFOS Fisheries Faculty Dean Dr.Rosalind George and BOBP-IGO Director Dr.P.Krishnan in the presence of KUFOS Vice Chancellor Dr.K.Riji John . Mr. Ahmed Shifaz, Director, Min. of Fisheries, Marine Resources & Agriculture, Male, The Maldives, Dr. Md. Sharif Uddin, Director, Marine Fisheries Officer, Department of Fisheries, Bangladesh, Mr. Dhammika Ranatunga, Director General (Technical), Ministry of Fisheries, Sri Lanka , Mr Subrata Bhowmik, Joint Secretary, Department of Fisheries, Bangladesh.

KUFOS Conducts seminar and panel discussion on Blue Economy (March 16, 2022)

To examine how the Blue Economy is going to affect the life of the coastal region of Kerala, Pandit Karuppan Chair in association with Centre for Field Consultancy and Data Analysis under the Directorate of Extension of Kerala University of Fisheries and Ocean Studies organized a one day seminar on "Blue Economy - Fisheries and Ocean Governance on 16th March 2022 at KUFOS seminar hall. More than 100 students and research scholars from various institutes participated in the programme

KUFOS and CWRDM sign MoU on research collaboration

The Kerala University of Fisheries and Ocean Studies (KUFOS) has signed a Memorandum of Understanding (MoU) with the Centre for Water Resources Development and Management (CWRDM) on collaborating in academic and research studies. The MoU was signed and exchanged between the KUFOS Registrar Dr.B.Manojkumar and the CWRDM Executive Director Dr Manoj P Samuel in the presence of Vice-Chancellor Dr.K.Riji John in a meeting held at the university head quarters at Panangad on November 5,2021.

The CWRDM is a research organisation under the Kerala State Council for Science, Technology and Environment (KSCSTE) located at Kunnamangalam in Kozhikode, which is working with a mission to enhance the quality of life by ensuring water security for all and responsible for the studies related to water resources management in theState of Kerala.

Dr. K.Riji John, KUFOS Vice Chancellor said according to the agreement signed, KUFOS and CWRDM will collaborate in studies in various fields of Aquatic ecosystem management (including Aquatic pollution monitoring and abatement, Water quality management, Climate change Studies, Wetland management, Wastewater management, Coastal processes and Coastal zone management, Restoration of degraded ecosystems),Water-Energy-GHG-Food nexus/systems, Water distribution, allocation and economics, Remote Sensing & Geospatial sciences, Ocean science and technology, Ocean engineering and underwater technologies, Both institutions will also joint hands in extension activities like Farm advisory services, Portal and knowledge centre, Conservation and popularization of indigenous technologies, Development and demonstration of Model Training Centres, Early warning and forecasting systems for fishermen and agriculture, Empowerment and Capacity building for ensuring livelihood of local people, Popularizing scientific knowledge, Trainings and other allied areas of mutual interest. students of KUFOS can use the research facilities at CRWDM and all the research Scholars admitted in CWRDM are eligible to register for Ph.D. under the respective faculties of KUFOS. Scientists at CWRDS will be awarded title of recognised research guides of KUFOS and they will be visiting faculties / professorsof KUFOS in their area of specialization.

KUFOS Director of Research Dr Devika Pillai, Dean of Ocean Science and Technology Dr.S.Sureshkumar, Dean of Under Water Studies Dr.C.D.Suriyakala, Associate Professor Dr.Girish Gopinath, CWRDM Scientist Dr.K.R.Renjith were also present in the function, in which the MoU was signed and exchanged.

Department of Climate Variability and Aquatic Ecosystems of KUFOS has conducted certificate course on Remote Sensing and GIS at Puduvype Campus (7-11 March, 2022).

Fish age determination workshop (21-24 March 2022)

A hands-on training program for 20 participants (Scientist, Assistant professors and research scholars) on "Age determination of fishes using otolith" was conducted at KUFOS from 21st – 24th March 2022 organized by MoES-KUFOS project and Dept. of FRM, Kerala University of fisheries and Ocean Studies (KUFOS). Inauguration of the training program was done by Pro. (Dr.) K. Riji John, Vice-chancellor of the KUFOS in the presence of Prof. (Dr.)B.Manoj Kumar, Registrar KUFOS, Prof. (Dr.) M. Roselind George, Dean Faculty of fisheries,Prof. (Dr.) Devika Pillai, Director of Research and Dr.M.K. Sajeevan, Associate

professor, Head of Dept. of FRM, KUFOS, and Principal Investigator of MoES, Twenty participants from the Fishery Survey of India, MES college, Madhurai Kamaraj University and KUFOS were attented the training programme. Detailed account on methodology of otolith extraction, polishing and reading of growth rings were explained to the participants. Hands on training provoded practical skill to the traininees to determine age and growth of fishes using otolith. In addition to faculty from NIOT, Egypt, faculty from KUFOS, CUSAT, CMLRE, ZSI, CMFRI and SH College Thevara attended the training programme as resource person. Research scholars of KUFOS-MoES research project attended the practical session.

Training in Bakery Production

The KUFOS Centre for Advanced studies and Research in Entrepreneurship Development((CASRED) in Fisheries, Agri- business and Allied Sectors in association with Centre for Food Processing Technology conducted two batches of 3 dayshands on training in Bakery products. The first batch training was held during January 12-14, 2022
(15 participats) and second batch training (14 participants) was held during March 3-5, The trainer was Mr. Joshy Varghese The participants benefited with new products, techniques for preparation of various bakery products- such as basic sponge, pizza, fruit presentation, Arabian sweets, Swiss rolls, apple cobbler etc. They were also given theory classes on entrepreneurship challenges, marketing strategies, digital marketing and packaging technologies for different food products.

French delegates visits KUFOS on May 23,2022.

The delegation included Consul General of France Lise Talbot , Attaché for Science and Higher Education François-Xavier and France Campus Manager Sabari Kishore. The team held talks with Vice-Chancellor Dr K Riji John on cooperation of KUFOS with various French universities. The team also visited the hatcheries and instructional farms of KUFOS

National Seminar on *Reorienting the Strategies towards Sustainable Aquaculture and Fisheries*

Kerala University of Fisheries and Ocean Studies (KUFOS) and State Fisheries Department have joined hands to work together to develop a suitable fisheries culture for the State and reorient aquaculture strategies accordingly. To accelerate the attempts, think-tanks of fisheries sector from across the country including scientists, industrialists and farmers gathered two days at KUFOS on January 6 and 7 to attend a two day national seminar on Reorienting the strategies towards sustainable aquaculture and fisheries', which drafted the reorientation strategies for a better fisheries model. As many as 300 scientists, industrialists, farmers and fisheries department officials participated in the strategy reorientation exercise. State Fisheries Minister and Pro Chancellor of KUFOS Mr.Saji Cheriyan inaugurated the national seminar at 4 pm on January 06.

Fisheries Minister Shri Saji Cherian inaugurates National Seminar on *Reorienting the Strategies towards Sustainable Aquaculture and Fisheries* held at KUFOS during January 6 and 7, 2022.

While welcoming the gathering, Vice Chancellor Dr.K.RijiJohn, said, KUFOS, being the first fisheries and ocean studies university in the Country , has the responsibility to play a key roleto re-orient the Indian aquaculture scenario to newer directions by setting up a better state level model, which can multiply the income of farming community in a sustainable way. Registrar Dr.B.Manoj Kumar, Fisheries Dean Dr.Rosalind George, State Fisheries Director R.Girija IAS were spoke on the occasion.