CIFT Vision 2030

Central Institute of Fisheries Technology

(Indian Council of Agricultural Research)

Cochin, India

CIFT Vision 2030

Central Institute of Fisheries Technology
(Indian Council of Agricultural Research)
CIFT Junction, Matsyapuri, P.O.
Cochin-682 029, India

2011

CIFT Vision 2030

Central Institute of Fisheries Technology,

CIFT Junction, Matsyapuri, P. O.
Cochin – 682 029, India.

Phone : 91 (0)484-2666845
Fax : 91 (0)484-2668212
E-mail : cift@ciftmail.org; enk_ciftaris@sancharnet.in

ISBN : 978-81-905878-4-6

Published by : Dr. T.K. Srinivasa Gopal
Director
Central Institute of Fisheries Technology
Cochin

Compilation and editing : Dr. Nikita Gopal and
Dr. M.R. Boopendranath

Printers : Niseema Printers & Publishers
Cochin-682 018

Foreword

The diverse challenges and constraints such as growing population; increasing food, feed and fodder needs; natural resource degradation; climate change; new parasites; slow growth in farm income and new global trade regulations demand a paradigm shift in formulating and implementing the agricultural research programmes. The emerging scenario necessitates the institutions of ICAR to have perspective vision which could be translated through proactive, novel and innovative research approach based on cutting edge science. In this endeavour, all of the institutions of ICAR, have revised and prepared respective Vision-2030 documents highlighting the issues and strategies relevant for the next twenty years.

Fisheries has been identified as the sunrise sector of Indian agriculture and has been consistently performing well in the past few years by making substantial contribution to the Agricultural GDP. New approaches for development of harvest and post-harvest technologies are needed in the context of changes that are taking place in the fisheries and aquaculture. The nutritional consciousness among consumers is increasing and fish is fast becoming a much sought after food and it is necessary to respond to these demands. The sector must also provide sustainable livelihood to the people dependent on it.

The Central Institute of Fisheries Technology has been devoting itself to research in the area of harvest and post harvest technologies in fisheries and has done commendable work over a period exceeding five decades. It is time to review the strategies and fine-tune the programmes to respond to the changing scenario. As we step into the XII Plan, it is only fitting that we in ICAR as well as at the level of individual institutes look back at the programmes and suitably modify them to incorporate the hopes and aspirations of all stakeholders in the sector.

It is expected that the analytical approach and forward looking concepts presented in the *'Vision 2030'* document will prove useful for the researchers, policymakers and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security with a human touch.

20th June, 2011
New Delhi

Dr. S. Ayyappan
Secretary, Department of Agricultural Research and Education (DARE) and Director General,
Indian Council of Agricultural Research
Krishi Bhavan, Dr. Rajendra Prasad road, New Delhi-110 114

Preface

The Central Institute of Fisheries Technology is the only national institute under the Indian Council of Agricultural Research that is dedicated to research and extension activities in fisheries harvest and post harvest sectors. The Institute has been instrumental in modernising both the fishing and fish processing sectors in the country and continues to support both these industries through need based research and technology interventions. The interventions have resulted in better harvesting and utilization of fishery resources.

The Institute has been revisiting its research priorities to make it more realistic and focused on problems that these two very dynamic sectors have to face. The *Vision 2020* and the *Vision 2025* were efforts in this direction, where the research priorities were redefined and programmes were drawn based on them. Understanding the need to keep pace with the frontier areas of science, the Institute's programmes have also included activities in the areas like biotechnology, molecular biology, nanotechnology and GIS based applications.

The *CIFT Vision 2030* envisions the changes that may take place in the sector during the next two decades, and the thrust that is to be given in the core areas of research in the harvest and post-harvest aspects of fisheries and aquaculture and in the emerging areas, to respond proactively to the sectoral needs. The Institute will focus on responsible fishing systems and conservation technologies, total utilisation of harvested resources, bioactive substances, green technologies, quality systems to ensure food safety, technology commercialization, policy support and capacity building.

I would like to place on record my sincere gratitude to Dr. S. Ayyappan, Secretary, Department of Agricultural Research

and Education (DARE) and Director General, Indian Council of Agricultural Research for his vision and leadership. I would also like to thank Dr. B. Meenakuamari, Deputy Director General (Fisheries), Indian Council of Agricultural Research for her guidance in preparation of this document.

All the Heads of Divisions, Scientists-in-Charge of Research Centres and Scientists of the Institute have contributed to the development of this document. I appreciate the efforts taken by Dr. M. R. Boopendranath and Dr. Nikita Gopal in compiling and editing the document. I hope that this document will give the necessary direction in planning and implementation of the research and extension activities of the Institute to support a vibrant and sustainable fisheries sector in India.

18 June 2011
New Delhi

Dr. T.K. Srinivasa Gopal
Director
Central Institute of Fisheries Technology
CIFT Junction, Matsyapuri, P.O., Cochin - 682 029

Preamble

India is the third largest producer of fish in the world and the second largest producer from aquaculture. The contribution of fisheries to the GDP during 2009-10 was 0.8 per cent. The fishery has emerged as a sunrise sector which provides food, employment and economic benefits to large sections of the society. It is a source of livelihood for about 15 million people engaged fully, partially or in subsidiary activities pertaining to the sector. Besides, an equal number are engaged in ancillary activities in fisheries and aquaculture (DAHDF, 2009). Total fish production in 2009-10 stood at 7.85 million tonnes comprising of 4.87 million tonnes from Inland and 2.98 million tonnes from Marine sector (GoI, 2011). The export of fish and fish based products have shown a steady growth and during 2009-10, 678436 tonnes of seafood valued at ₹10048.53 crore (USD 2132.84 million) were exported to nearly 100 countries (MPEDA, 2011). There has been significant growth in the seafood processing sector which at present consists of 369 processing plants of which 236 are EU approved meeting the world's highest quality standards.

The Central Institute of Fisheries Technology has played a pivotal role in the technological development and modernization of both the harvest and post-harvest sectors in fisheries from its nascent stage, by actively engaging in need based technology development as well as transfer. The Institute continues to be responsive to the dynamic changes that are taking place in the fisheries sector.

The *CIFT Vision 2030* attempts to delineate the key challenges and opportunities in the harvest and post-harvest sectors of Indian fisheries in the next two decades and to facilitate a strategic framework for articulating the role of CIFT in promoting harmonious and equitable development in the sector.

Contents

Fisheries Scenario

Fisheries is a major source of food and provides employment and economic benefits to large sections of the society in India. Fish is also very significant nutritionally, being an important source of quality proteins and fats as well as vitamins and minerals (Hebbeln *et al.*, 2007; Roos *et al.*, 2007), though consumption still tends to be low at the national level.

In the primary sector, the production has witnessed a plateauing of catches from the marine and inland capture fisheries while showing an increasing trend in aquaculture production. The scenario in the marine sector is that unbridled expansion of fishing effort is taking place leading to depletion of resources and inter-sectoral conflicts due to open access nature of the fisheries. About 2,43,939 fishing crafts of various sizes and classes are under operation (CMFRI, 2006). Problems of juvenile finfish mortality and bycatch and discards increased with the intensification of shrimp trawling. The need for sustainability and conservation of resources have taken centre stage in the shelf fisheries.

In the inland sector, the productivity of riverine systems remain low and there is general agreement among fishery experts that the overall production from Indian reservoirs could be substantially raised, with adequate management measures such as optimum fishing effort, responsible fishing, stocking support and mesh size regulation. Fishing implements employed for inland fisheries of India are traditional and are mostly of non-selective type, and also include prohibited practices like fishing with poison and explosives. Fishing crafts are largely traditional with fibreglass canoes catching up in certain areas.

Emerging trends and issues in aquaculture are organic aquaculture; integrated agriculture-aquaculture; open sea cage culture; live transportation of crabs, lobsters and finfishes; marine and freshwater ornamentals; impact of aquatic invasive alien species and associated trans-boundary pathogens.

India's exports of marine fish and fish products rose from ₹ 25 million in 1950-51 to ₹ 1,00,485 million during 2009-10 (MPEDA, 2011). The export basket which was earlier dominated by shrimp, has diversified to frozen finfish, squid, cuttlefish, fillets and other products. However, shrimp continues to dominate the value realization from the export sector. Diversification into value added products has not really taken off in the country. Low capacity utilization of the industry as a result of non-availability of sufficient raw material continues to be an issue, even though imports have been liberalized

(CIFT, 2006). The industry has been facing imposition of newer standards by importing countries and the additional costs of compliance has affected profitability. Adopting food safety systems will become imperative in the coming years with the emergence of newer pathogens.

The industry is also increasingly turning to the domestic sector. Marketing, especially in the domestic sector has been characterized by complex channels and multiple players. The standards of hygiene and sanitation leave a lot to be desired. The setting up of the National Fisheries Development Board gave an impetus to development of domestic markets and one of the critical areas in this process is the development of standards which can be implemented and monitored, for building a network of high quality, world class markets.

International trade requirements like traceability are going to be essential for products to enter major importing markets and to ensure seafood safety. Certification and ecolabelling of fishery products will be directly related to better management practices. These, if implemented in a fair and practical way, sensitive to the needs of small producers, may provide opportunities to support responsible development of the sector, addressing negative environmental and social concerns. Principles, criteria and standards need to be developed and approaches to certification has to be harmonized, within the region.

The potential for isolation of bioactive substances from the vast and diverse aquatic resources is being discovered with scientific advancements in this area of research (Proksch *et al*., 2003; Jimeno *et al*., 2004). Since India is blessed with a wide range of aquatic systems and resources this area holds great potential for research (Selvin *et al*., 2009).

Emerging issues and challenges in the fisheries sector

Immediate and long-term requirements of fisheries sector include (i) sustainability of the fishery resources – marine and inland, (ii) continued optimization of fishing gear for marine, inland and the aquaculture sector, in terms of selectivity and environmental footprint, (iii) conservation of biodiversity through optimization of fishing effort, prevention of capture of juveniles and non-targeted catches by suitable technical measures, (iv) development of harvest and postharvest technologies for the nonconventional deep sea resources, (v) enhancement of shelf fishery resources, (vi) value addition along the value chain, (vii) utilization of fishery wastes (viii) ensuring environmental safety in harvest and post-harvest operations, (ix) energy conservation in fish production and post-harvest sectors, (x) ensuring aquatic food safety and traceability, (xi) responsible utilization of landed fish,

(xii) minimizing harvest and post-harvest losses, (xiii) suitable inputs for policy formulation and (xiv) effective transfer of technology. Likely scenario in the fisheries sector during the next two decades may include the following:

- Further intensification of fishing pressure in the shelf and deep seas is possible in the next few decades, due to addition of fishing units and enhancement of fishing efficiency in terms of vessel capacities, fishing power of gear systems and acoustic and satellite based fish detection systems and electronic navigation systems. This may raise issues of long term sustainability and impact on biodiversity and may result in diminishing returns in terms of landings and catch per unit effort.
- There will be increasing demand for development and implementation of conservation technologies for minimising negative impacts of fishing on resources, biodiversity and environment. These may include technologies for bycatch reduction, protection of vulnerable species, minimising energy use in harvest and post-harvest operations and minimising environmental impacts and materials protection technologies.
- Problems of scarcity and cost of timber resources for boat building, biodegradation and corrosion may further aggravate and may require intensive work on alternate boat building materials.
- Climate change is likely to show its impacts causing regime shifts of certain commercial species which may affect their regional availability and abundance, which in turn may impact on the fish harvesting and processing sectors, either negatively or positively.
- Requirement for the regionalisation and implementation of the FAO Code of Conduct for Responsible Fisheries, adoption and implementation of Ecosystem based Fisheries Management (EFM) and effective control of illegal, unreported and unregulated (IUU) fishing to management of fisheries may come to the forefront.
- Fishery certification, ecolabelling and traceability may become important issues influencing international seafood trade from India, in the next few years and expertise and infrastructure may have to be developed to address these issues on national and international level.
- Reservoir fisheries may get a boost, due to its high potential in enhancement of national fish production. Cluster based integration in harvest and post harvest operations, value addition and marketing, under value chain concept may have to be evolved.

- Factors affecting riverine fish production such as pollution, destructive fishing and overfishing may aggravate in the next few decades and may need management redressel.
- Unconventional resources such as oceanic cephalopods and myctophids may become significant sources of seafood supply in the next few decades, in the context of stagnation and shortfall in the availability of traditional fishery resources, and these developments may demand appropriate technology interventions for their sustainable harvesting, value addition and utilisation.
- Further enhancement in India-based tuna fishing effort may take place in Indian Ocean region and accompanying effort in improving harvesting and processing of high value tuna products may be required.
- Advanced techniques for seafood preservation such as non-thermal processing may become available and widely applied in seafood processing and preservation. Value addition will be the key principle in guiding product development. A zero-waste approach will be warranted with fishery waste also converted to economical products. Packaging will play an important role in determining consumer acceptability with respect to perceptions on safety as well as maintenance of quality.
- Newer products that have wide ranging applications may be available from the large aquatic resources, including microbes. These can be exploited for human good.
- There is need to mainstream fish in the food habits of the Indian population with better understanding of the role of fish in decreasing malnutrition and improving health and creation of awareness about its significance.
- Seafood safety issues may bring in newer challenges with the emergence of new forms and variants of pathogens. The issue will also come into focus with increasing stress on the domestic market for promotion of seafood products.
- Increased awareness of consumer regarding the usefulness of fish as a source of nutrition and the changing demands for newer and convenient products that are easy to cook or consume will call for intensified efforts in this area.

- The national and international policy regimes vis-à-vis trade, climate change, conservation and environment are changing rapidly and these will continue to have an impact on the fisheries sector of the country.
- The traditional systems of technology transfer will undergo changes and innovative models including public-private partnerships will evolve making the process of technology commercialization more dynamic and a truly two way process.
- Intellectual Property protection will see new challenges in the face of the need for judicious commercialization and responding to societal needs.

The Central Institute of Fisheries Technology has been sensitive to the dynamic changes that are taking place in fisheries sector and has endeavoured to reframe the strategies and fine-tune the research framework in order to address emerging challenges.

Central Institute of Fisheries Technology

The Central Institute of Fisheries Technology (CIFT) is the only national Institute working on all aspects related to harvest and post harvest technologies in fish. The CIFT was set up as Central Fisheries Technological Research Station on the recommendations of a high power committee constituted by the Ministry of Food and Agriculture, Government of India. It started functioning at Cochin on 29th April 1957, under the Department of Agriculture of the then Ministry of Food and Agriculture. The initial complement of craft and gear researchers was expanded to include the fish processing in 1958 and extension in 1961. The Institute was given its present name in 1962. The administrative control of the Institute was brought under the Indian Council of Agricultural Research from 1st October, 1967. The Headquarters of the Institute is at Cochin with Research Centres at Veraval (Gujarat), Visakhapatnam (Andhra Pradesh) and Mumbai (Maharashtra). Research work of the Institute is orchestrated through seven Divsions *viz.*, (i) Fishing Technology Division, (ii) Fish Processing Division, (iii) Quality Assurance & Management Division, (iv) Biochemistry and Nutrition Division, (v) Microbiology, Fermentation and Biotechnology Division, (vi) Engineering Division and (vii) Extension, Information and Statistics Division.

Mandate

The Institute functions with the following mandate:

i. To conduct basic, strategic and applied research in fishing and fish processing.

ii. To develop designs for fuel efficient fishing vessels and fishing gear for responsible fishing.

iii. To develop technologies for commercial isolation of bioactive compounds and industrially important products from fish and fishery wastes.

iv. To design innovative implements and machineries for fishing and fish processing and pilot plants for facilitating commercialization of technologies developed.

v. To do advanced research in food safety in fish and fishery products.

vi. To provide training and consultancy services in fishing and fish processing.

The Institute has well equipped laboratories with modern, sophisticated, state-of-the-art equipment for both fundamental and applied research, an

excellent library, a workshop and an animal house, an Agricultural Knowledge Management Centre (AKMC) and Agricultural Technology Information Centre (ATIC). The laboratories of the Institute also cater to the needs of the industry by testing processed fishery products, ice, water, and other materials like fishing gear and craft materials, packaging materials, marine paints, fishing craft and engines. A Business Planning & Devlopment (BPD) Unit is also functional in the Institute to ensure commercialization of technologies on a public-private partnership mode. The Institute also facilitates IP management of ICAR Institutes in the Southern region through the Zonal Technology Management Centre (ZTMC).

The impact of CIFT on the development of fishing, seafood processing, seafood safety and quality control in India is well recognised. The Institute played an important role in facilitating mechanisation and modernisation of fishing fleet and introduction of durable synthetic fishing gear materials and improved gear designs and practices in Indian fisheries. The Institute's interventions have resulted in the adoption of improved methods of trawling, purse seining, gill netting, lining and trap operations and efficient vessel designs; improved methods of fish curing, fish processing, fish based value added products, fish waste utilisation and packaging; sanitary and hygienic standards based on microbiological and biochemical quality parameters and HACCP. CIFT has gained recognition for the production of bioactive and pharmaceutical compounds from aquatic resources. The Institute has developed several instruments and machineries for meeting specific needs of fishing and fish processing sectors. Recent focus has been on development of conservation technologies such as energy efficient fishing vessels, bycatch reduction technologies, juvenile excluder devices, turtle excluder devices, energy efficient fishing gears, renewable energy based fish processing systems such as solar fish dryers and utilisation of fishery byproducts and fishery wastes, intelligent and active pacakging systems and development of innovative quality systems.

Research Centres in different parts of the country caters to redressel of location specific technological problems faced by the industries. CIFT gained the status as referral laboratory in fishery technology. It is also accredited by National Accreditation Board for Laboratories (NABL). The Institute conducts regular need based training programes in responsible fishing techniques, fish processing, value added fish based products, quality assurance systems, fisheries microbiobiology and biochemistry and stakeholder empowerment programmes particularly targeting women and weaker sections with specific programmes for backward areas of Islands and North East region of the country. CIFT has been awarded as best Institute in the ICAR system twice, in the years of 2000 and 2006.

CIFT Vision 2030

Vision

To facilitate sustainable harvesting and total utilization of fishery resources through innovations in harvest and post harvest technologies.

Mission

Ensure responsible harvesting of fishery resources through eco-friendly, energy efficient and economical means; ensure total utilization of the harvested fish through appropriate processing, value addition, packaging and waste utilization; ensure food safety and nutritional security to the consumer and minimise carbon and water footprint per unit volume; and to ensure equitable benefits to the stakeholders, across the value chain.

Focus

To achieve the Vision and Mission envisaged, CIFT will function with the following in focus:

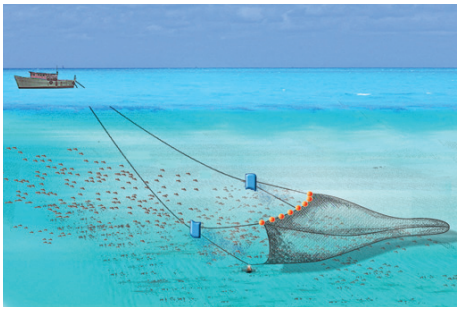
- Develop technologies for responsible harvesting of fishery resources from marine, inland and aquaculture systems.
- Provide technologies for total utilization of harvested fishery resources.
- Facilitate introduction of green technologies in the fishing and fish processing sectors, to minimise carbon footprint of seafood.
- Prospect the aquatic resources for bioactive molecules and novel genes of pharmacological, nutraceutical or industrial value.
- Develop quality systems and standards appropriate for export and domestic markets.
- Facilitate technology commercialization through means such as consultancies, training, demonstration and extension education, semi-commercial production facilities for private incubatees, through proactive Public-Private partnership.
- Capacity building of the scientific manpower as well as the stakeholders.

Keeping in view the Vision for the Institute as well as the Mission it has set for itself, a number of focal areas have been identified. The Institute will

programme its research activities on the following major focus areas to achieve the CIFT Vision 2030.

Conservation technologies for capture fisheries

Negative impacts of unregulated fishing and use of destructive fishing on resource sustainability, conservation of biodiversity and environment are well known. There is an increasing demand for development and implementation of conservation technologies for minimising negative impacts of fishing on resources, biodiversity and environment. These may include technologies for bycatch reduction, protection of vulnerable species and ecofriendly fishing. The requirement for the regionalisation and implementation of the FAO Code of Conduct for Responsible Fisheries, adoption and implementation of Ecosystem based Fisheries Management (EFM) and effective control of Illegal, Unreported and Unregulated (IUU) fishing need to come to the forefront, in evolving policy framework.



Ecofriendly trawl system

Standardisation and certification of fishing systems

Standardisation and certification of fishing craft and gear are essential for effective management of fishing effort. Craft-gear combinations targeting different fisheries need to be optimised in terms of number of units and standardised in terms and fishing power and capacities. Intensification of research in identifying alternative materials for craft and gear is required.

Total utilization of harvested fishery resources

Seventy per cent of the harvested fish are channeled into the domestic market. The rest goes for other purposes including export and fishmeal preparation. There is wastage of the harvested fish, along the entire value chain, starting from the point of capture, landing centres or harbours to the markets and consumer, with losses estimated to be upto 20 % (CIFT, 2005). This is loss of precious animal protein that can be useful in maintaining the nutritional security of the country. The country is now looking for models which will include zero loss along the value-chain by ensuring total utilization, including the utilisation of waste generated for developing useful products.

Value addition

Surimi based Analogue products

Processing adds value to the harvested resource. It has been one of the strengths of the Institute and various new products have been standardized that can be taken up by entrepreneurs at various scales of production. Emerging species in aquaculture and hitherto untapped species from wild caught production will be given more importance for product development and standardization. An important aspect of value addition is ready to eat, ready to cook and ready to fry products. New areas in packaging like active packaging will be actively explored to improve shelf life as well as meet consumer demands; consumer preferences affecting product development itself.

Utilization of fish processing wastes and low value bycatch

Encapsulated PUFA

It has been demonstrated that the low value bycatch and waste generated from fish processing can be used to develop novel products of high value in domestic and international markets, such as chitosan, glucosamine hydrochloride, gelatin, polyunsaturated fatty acid (PUFA), squalene, fish meal and oil. Attempts to extract new and useful compounds from waste will continue to be an area for future research. Assessment of losses from time to time will provide information for policy input into this area.

Bio-molecules and novel genes

The potential of the aquatic domain as the basis for development of new bioactive substances and novel genes is largely unexplored in India. Research will focus on the creation of products and processes from marine organisms through integrated application of techniques from biochemistry, molecular and cellular biology and bioinformatics. Some of the products are being intensively studied to evaluate their effects on health. Results of many epidemiologic studies have shown protective effects of marine organisms-based diets on cardiovascular disease. Marine bio-molecules can also be used

for bio-remediation, on the basis of biodegradation pathways, that lead to the breakdown of organic pollutants.

Quality assurance and seafood safety

Food safety encompasses various aspects of quality assurance and elimination of microbial, chemical and physical hazards. Providing safe fish and fishery products to domestic and export markets is of primary importance in an era of growing consumer awareness about food borne infections. The seafood safety standards for the export market are well developed and have been meeting international standards. However, the seafood safety standards for domestic market is still evolving and the Institute's contribution in this context will be significant. The maintenance and management of quality along the entire value chain is thus essential for ensuring food safety. Emerging pathogens continue to pose a threat to human health and well being. Besides, techniques for rapid detection of hazards of various kinds, developing standards for processes and products are an integral part of the food safety system. Consumer awareness on these aspects must also be created, as an informed consumer provides the best impetus for effective implementation.

Hygienic handling of seafood

Biosecurity

With the emergence of aquaculture as a major source of fish production, good aquaculture practices are necessary. Proper surveillance of aquaculture systems to prevent contamination and disease outbreak is essential and research activities in this area will be required. The risk of new pathogens necessitates constant surveillance for their detection using molecular techniques.

Mitigation of climate change impacts in fisheries - focus on green technologies

Climate change is likely to show its impacts causing regime shifts of certain commercial species which may affect their regional availability and abundance, which in turn may impact on the processing sector either negatively or positively. Short term and long term mitigation measures for climate change impacts on capture fisheries and aquaculture and measures to sustain the contribution of these sectors to food security, requires further policy initiatives.


Solar dryer

With climate change becoming an increasingly tangible phenomenon, impacting the environment, including the aquatic ecosystems, the stress on green technologies is increasing. This is essential for reducing the carbon footprint of the sector. Energy requirements are high in both the fish harvest and post harvest sectors. World capture fisheries consumes about 50 billion litres of fuel annually releasing an estimated 134 million tonnes of CO_2 into the atmosphere (Tyedmers *et al.*, 2005) while Indian fishing fleet consumes 1220 million litres releasing an estimated 3.17 million tonnes of CO_2 into the atmosphere (Meenakumari *et al.*, 2009). Energy is the major component in the operational expenditure of the fishing sector. The processing sector also uses energy for various processes in the production chain. Green technologies will be a way to reduce the energy use and efficiency of the fishing and fish processing sectors, thereby reducing the carbon footprint.

Frontier technologies

Technology interventions and products through biotechnology, including new molecular techniques, nano-technology and use of remote sensing, GIS and information and communication technologies(ICTs) are increasing in the fisheries sector as well. Research in these frontier areas will be necessary to face the challenges as well as utilize the opportunities that these emerging areas of science offer, to find solutions to problems in the sector, and are to be integrated into the technology development process of the Institute.

Fishery certification, ecolabelling and traceability

Fishery certification, ecolabelling and traceability may become important issues influencing international seafood trade from India, in the next few years and necessary policy framework, technology expertise and infrastructure need to be developed to address these issues at the national and international level.

Enhancing inland fish production

Reservoir fisheries has high potential in enhancement of national fish production. Deficiencies in the legal framework and policies for leasing could be limiting factors and difficulties in cluster based integration in harvest and post harvest operations, value addition and marketing, under value chain

concept have to be resolved. Factors affecting riverine fish production such as pollution, destructive fishing and overfishing will need management redressel based on technology advisory and facilitating policy framework; and mechanisms for effective utilisation and value addition for domestic and export markets.

Harvest and post-harvest technologies for unconventional and under-utilized resources

Most of the conventional fishery resources, particularly in the shelf region, are under severe fishing pressure and scope for enhancement in production is limited. Unconventional resources such as oceanic cephalopods and myctophids may become significant seafood resources, in the context of stagnation and shortfall in the availability of traditional fishery resources, in the next few decades. This development may demand appropriate technology and policy interventions for their sustainable harvesting, value addition and utilisation. Policy fine tuning may also be required to facilitate further enhancement in India-based tuna fishing effort, in Indian Ocean region with technology inputs in harvesting and processing for production of high value tuna products.

Fish roll developed from Myctophid mince

Technology transfer and commercialization

The gap between technology development and transfer will have to be reduced. In addition to extension activities including training, innovative systems of technology transfer are evolving. ICTs will be used for technology transfer and models developed for the fisheries sector.

Technologies developed have to be commercialized for the Institute to achieve its ultimate goal in nation building. The commercialization environment is undergoing rapid change with issues of sharing and protecting Intellectual Property, promotion of public-private

Technology transfer

partnerships and agri-business incubation. These pose challenges just as they offer opportunities the Institute in view of the diversity of stakeholders.

Knowledge management

Management of the IP assets of the Institute will be given importance in the changing global scenario, while the needs of the nation will always be the driving force of all activities of the Institute. Assistance will also be provided to other ICAR institutes in management of their respective IPs. Semi-commercial and commercial level production lines of important products and processes will be set up on project mode by the Institute to foster better private-public partnership.

Zonal Technology Management initiative

Policy environment and framework

The fisheries sector operates within the larger national and international policy framework and is directly and indirectly impacted by it. International regulations like catch certification and traceability has affected exports and also will have an impact on local policies. Trade pacts at regional levels have an impact on the markets. Responses to these challenges and the capacity to be built to exploit the opportunities have to receive necessary impetus through appropriate policy analysis. Development of comprehensive fisheries data bases will be taken up to facilitate policy planning.

❑

Strategy and Framework

The strategy for achieving the Vision of the Institute will be as follows and is further elaborated in Annexure 1:

- Conducting focused, need based and demand driven research programmes in developing harvest and post-harvest technologies for marine, inland and aquaculture resources and in the area of food safety.
  - Research programme formulation with stakeholder participation and prioritization of research programmes to be undertaken at Institute level
    i. Continued development of responsible fishing systems for inland and marine capture fisheries incorporating principles of bycatch reduction, protection of biodiversity, minimisation of environmental impacts and energy conservation.
    ii. Development of appropriate harvesting systems and strategies for aquaculture.
    iii. Standardisation of craft-gear combinations in terms of fishing power and capacities.
    iv. Development and standardisation of processing technologies for emerging species from aquaculture and less utilized species from inland and marine capture fisheries.
    v. Continued development of processes for utilization of processing waste and low value bycatch for isolation of novel potentially commercial products.
    vi. Continued development of appropriate packaging technologies for improvement of consumer appeal and better storage.
    vii. Developing food safety standards for the domestic market along the value chain and standards for processes and products.
    viii. Rapid techniques for identification of hazards and surveillance of aquatic systems.
- Carry out basic research for isolation of useful bioactive substances and novel genes
  - Extraction and characterization of bio-molecules and genes for therapeutically and industrially significant biological activities, including

anti-inflammatory, antiviral, anti-bacterial, anti-oxidant and anti-coagulant activities.

- Use of bio-molecules for bioremediation of polluted aquatic ecosystems

- Focused research on green technologies
  - Development of 'green fishing vessels' with built-in energy saving design features, fuel saving technologies and practices for existing fleet and alternate sources of energy for propulsion of fishing vessels and onboard fish processing.
  - Development of green technologies and practices for the fish processing sector, including fuel saving, recycling and reuse of process water.
- Efficient technology transfer and policy analysis
  - Developing innovative models for technology transfer based on need evaluation and impact assessment.
  - Technology incubation
  - IP management
  - Sectoral level analysis of impacts of policies
- Capacity building for stakeholders
  - Responsible fishing
  - Fish processing, packaging and value addition
  - Fishery waste utilisation
  - Energy conservation in fishing and fish processing
  - Food safety and quality

Epilogue

The Central Institute of Fisheries Technology has played a vital role in the modernisation of Indian fisheries and in the development of both the fishing and fish processing industries to its present stature. While the fisheries sector is facing challenges in terms of excess capacity, resource depletion and changes in the fisheries environment in the coastal waters, under-utilised and unutilised resources in the deeper waters hold potential along with rapid expansion envisaged in the aquaculture sector and culture based capture fisheries from reservoirs. This calls for dual strategies of application of resource conservation technologies in the shelf waters under an appropriate management plan and diversification of fishing to under-utilised resources such as mesopelagics, cephalopods and large pelagics in the deeper waters. Greater focus is required for development of appropriate post-harvest technologies for the new and under-utilised resources and for handling the probable production enhancements from aquaculture and culture based capture fisheries. Seafood safety systems and standards for the domestic market require focused attention, while continuous attention is required to deal with emerging challenges in terms of stricter quality standards, compliance requirements and policy changes by the importing nations. Expanding aquaculture and culture based capture fisheries would bring in its own challenges in terms of the need for development of region specific harvesting systems, market specific processing, value addition, product development, and quality assurance systems. Minimisation of harvest and post-harvest losses and conservation of energy in the harvest and post-harvest operations would be important policy objectives and technology challenges for the future. Creating an enabling environment for technology commercialization and IP management would require the Institute to be proactive and responsive. CIFT with its unique blend of technological capabilities is in a strategic position to facilitate and support the technological transformation that is projected to take place within the next two decades in Indian fisheries and in making it a viable economic activity. ❑

REFERENCES

CIFT (2005) Assessment of harvest and post harvest losses – Marine Fisheries, Report of the National Agricultural Technology Project, CIFT, Cochin: 122 p.

CIFT (2006) Fisheries Policy Update, Vol. 1, No.1, CIFT, Cochin

CMFRI (2006) Marine Fisheries Census 2005 Part-1, CMFRI, Cochin: 97 p.

DAHDF (2009) Handbook on Fisheries Statistics 2008, Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Government of India, New Delhi: 170 p.

Jimeno, J., Faircloth, G., Sousa-Faro, F.J.M., Scheuer, P. and Rinehart, K. (2004) New marine derived anti-cancer therapeutics – A journey from the sea to clinical trials, Marine Drugs 2(1): 14-29

GoI (2011) Agriculture and Food Management, In: Economic Survey 2010-11, Chapter 8, Government of India, New Delhi: 187-216. Available at http://indiabudget.nic.in

Hebbeln, J.R., Davis, J.M., Steer C., Emmet, P., Rogers, I., Williams, C. and Golding, J. (2007) Maternal seafood consumption in pregnancy and neuro-developmental outcomes in childhood (ALSPAC study): an obsevational cohort study, Lancet 369(9561): 578-585.

Meenakumari, B., Boopendranath, M.R., Pravin, P., Thomas, S.N. and Edwin, L. (Eds) (2009) Handbook of Fishing Technology, Central Institute of Fisheries Technology, Cochin: 380 p.

MPEDA (2011) Export of marine products from India 2009-10, Marine Products Export Development Authority, Cochin. www.mpeda.com. (accessed on 10.6.2011)

Proksch, P., Ebel, R., Erada, R.A, Schupp, P., Lin, W.H., Sudarsono Wray V. and Steube, K. (2003) Detection of pharmacologically active natural products using ecology. Selected examples from Indo Pacific marine invertebrates and sponge-derived fungi, Pure Applied Chemistry, 75(2-3), 343:352

Roos, N., Wahab, M.A., Chamnan, C. and Thilsted, S.H.(2007) The role of fish in food-based strategies to combat vitamin A and mineral deficiencies in developing countries, J. Nutr. 137 (4): 1106-1109

Selvin, J., Shanmughapriya, S., Gandhimathi, S., Kiran, G.S., Ravji, T.R., Natarajaseenivasan, K. and Hema, T.A., (2009) Optimization and production of novel antimicrobial agents from sponge associated marine actinomycetes *Nocardiopsis dassonvillei* MAD08. Appl. Microbiol. Biotechnol. 83: 435-445.

Tyedmers, P.H., Watson, R. and Pauly, D. (2005) Fuelling global fishing fleets. Ambio 34(8): 635–638

Annexure 1: Strategic Framework

Goal	Approach	Performance measure
Responsible harvesting for marine and inland capture fisheries.	Evolution of next generation of fuel efficient fishing vessels for different fishery zones and fishery sectors (artisanal, small mechanized and industrial). Development of resource-specific fishing gear incorporating principles of bycatch reduction, protection of biodiversity, minimisation of environmental impacts and energy efficiency.	Optimised craft and gear combinations for the marine and inland capture fisheries.
	Control of corrosion and bio-deterioration, including nano-technology applications.	Technologies for corrosion and bio-deterioration control.
Responsible harvesting systems for aquaculture.	Selection of netting materials for aquaculture use. Optimization fishing units appropriate for culture systems. Fishing gear for weed fish eradication and control of predatory fishes.	Optimised harvesting systems for (a) harvesting of cultured fish of marketable size and (b) weed fish eradication, from different aquaculture systems.
Total utilization of landed fishery resources.	Formulation, quality evaluation, shelf life evaluation for value added products from fish.	Value added products from fish.
	Product identification, formulation, process optimization, quality and shelf life evaluation of products from fishery wastes.	High value products from fishery wastes.
	Retortable pouches, laminates and polymers incorportaing nano-materials, MAP, *sous vide*, hurdle packaging technologies.	Innovative packaging technologies.
	Innovative and novel processing techniques for consumer safe products and process validation.	New processing techniques for processed and packaged products.
	Studies on handling, packaging and transportation of live fish.	Live fish transportation model.
Improved nutritional security of the population.	Nutritional profiling of Indian fish and shellfish. Consumer awareness campaign on role of fish in human nutrition.	Enhanced consumer awareness and preferences for fish and fish based products.
Bio-molecules and novel genes from aquatic sources.	Collection of marine organisms, such as micro-algae and macro-algae, cyanobacteria, sea anemones, tunicates and fish from the Indian Ocean and extraction, isolation and characterization of useful bioactives. Transcriptome profiling of aquatic bacteria; technology for production of enzymes.	Bio-molecules and genes having therapeutically and industrially significant biological activities, including anti-inflammatory, antiviral , antibacterial, anti-oxidant and anticoagulant activities.

Goal	Approach	Performance measure
Food safety.	Refinement in the detection methods for antibiotic residues and bacterial inhibitors in farmed and processed fish.	Fool-proof detection of antibiotic residues and bacterial inhibitors in farmed and processed fish.
	Development of Farm-to-Fork Food Safety Management System (FSMS) protocols for traceable and safe fish and fishery products and controlling food safety hazards with validated control measures.	Optimized Farm-to-Fork Food Safety Management System (FSMS) designs specific for seafood processing.
	Development of quality standards for marketing of fish and fishery products for domestic sector.	Standards for domestically marketed fish for adoption by food legislating authorities.
	Monitoring emerging pathogenic microorganisms in fish landing centres, fish markets and production centres.	Trends of biological hazards; spatial and temporal variation of hazards in fishery environments.
	Modeling of specific pathogen growth and survival patterns in seafood with respect to various preservation methods.	Prediction of survival of pathogens in stand-alone and multiple hurdle scenarios.
	Modern molecular approaches and pathogenomics of emerging strains.	Improvement in seafood safety and pathogenomics data of major seafood borne pathogens.
Reducing carbon footprint of the fishery sector.	Optimisation of fuel efficient vessel design.	New fuel efficient 'green fishing vessel' design.
	Package of practices for operational fuel savings, for existing fleet. Development of low drag trawl systems.	Adoption of fuel saving practices in fishing.
	Energy audit of fishing systems and fish processing systems. Alternate fuel and renewable energy sources for fishing and fish processing.	Adoption of fuel efficient processing practices. Reduction in carbon footprint and improvement in energy efficiency in fish production and fish processing.
	Reusing and recycling process waste water and development of a water budget for fish processing industry.	Reduction in water footprint in fish processing.
	Development of efficient microbial consortia for effluent treatment in seafood processing.	Enhanced biological filtration. Energy efficient and space optimized ETP.
	Alternate fuel for fishing and fish processing operations.	Processes for biofuel from marine algae and fishery wastes.
Biosecurity for farm environment and seafood products.	Screening for algal toxin, pathogenic microorganism, pesticides, antibiotics, prions and heavy metals in aquaculture systems, source verification, development of rapid test methods and mapping in GIS platform.	Database on the hazard profile of the aquaculture environment; protocol for hazard determination; Biomarkers for antibiotics and pesticide residues.

Goal	Approach	Performance measure
Transfer of technology (ToT).	ToT through traditional and innovative extension models.	Generic and specific ToT models.
	Awareness campaigns in the technologies developed through traditional and innovative extension models.	Increased awareness and adoption.
	Commercialisation of technologies through semi-commercial and commercial level process/production lines in public-private partnership mode.	Detailed project reports for commercialisation. Effective adoption of technologies.
Improving preparedness and competitiveness of the fisheries sector.	Policy analysis *vis-à-vis* trade, climate change and other development dimensions.	Policy briefs.
	Assessment of losses in the fish value chain.	Estimates of fish losses.

ISBN 978-81-905878-4-6

Central Institute of Fisheries Technology

(Indian Council of Agricultural Research)
CIFT Junction, Matsyapuri, P.O. Cochin-682 029, India

Phone: 0484-2666845; Fax: 0484-2668212; E-mail: cift@ciftmail.org
URL : www.cift.res.in