## KARWAR RESEARCH CENTRE OF CMFRI, KARWAR BACKGROUND INORMATION FOR THE QUINQUENNIAL REVIEW TEAM (QRT) 2009-14

### **1. INTRODUCTION**

Karnataka with its three coastal districts is one of the eight maritime states in India and stands fifth with regard to marine fish landings. The coastline of the three districts amount to 300 km with a continental shelf of 27,000 sq. km and an EEZ of 87,000 sq. km. Further there are 8000 ha of brackish water area also in the state. The area from Bhatkal in the south to Majali in the north falls within the operational of the Karwar Research Centre of CMFRI, Karwar, as does the coastal area of Goa state, which has 87 km with a continental shelf area of 10,000 sq. km. The major resources include mackerel, oil sardine, flat fishes and crustaceans. The marine fishery sector has developed rapidly, and the fish landings have increased from 80,000 M tonnes (1956-1957) to 4,74,981 M tonnes (2012) and that of Goa is 72307 tonnes.

#### **1.1. HISTORICAL BACKGROUND**

The Karwar centre was established in 1948, along with the inception of the CMFRI. The centre was declared as "Mackerel Research Unit" and it concentrated on the fishery of this major resource along the Karnataka coast. In 1965 the centre was upgraded to a sub-station and in course of time, renamed as Karwar Research Centre. The Centre has its own building at Baithkol and also a leased property of 2.5 acres at Kajubagh. The buildings and infrastructure available at Karwar was outdated and since 2009 these buildings were partially renovated and infrastructure for research work is being further enhanced.

#### **Details of land/buildings**

1. Main Office near Aligadda beach, Karwar

Area: 13 guntas (33 cents) in Survey No: 1380/2 KA: Assessment No.1-13-0

- i. One Office cum lab building, One Microbiology lab building, One Museum building and One building housing Store, Cold store etc.
- 2. Annex office at Kodibag

2.5 acres of land leased from the Forest department in Survey number: F.S.No.108 A; 2.5 Acres.

- i. One Semi permanent hatchery building.
- ii. One temporary nursery shed

#### **1.2. MANDATE AND OBJECTIVES OF THE CENTRE**

- i. To monitor and assess capture fishery resources, potential and production of Uttara Kannada district and Goa state.
- ii. To develop sea farming technologies for fin fish and shell fish resources
- iii. To provide training to farmers, fishermen, entrepreneurs, researchers and government officials on open sea cage farming
- iv. To conduct environmental monitoring, identification of cultivable resources and mariculture sites.
- v. To provide consultancy services to government departments, entrepreneurs and industries in open Sea cage farming.
- vi. To develop linkages and collaborate with other research organisations, government departments and Universities, including the foreign laboratories.

Over the years the scope of research work has expanded to include monitoring of landings other than mackerels, to detailed studies of the hydro graphic features, biodiversity and transfer of technology to mariculturists. From the late seventies and early eighties, the Karwar Research Centre also concentrated on culture of shrimps, molluscs and crabs and provided technologies to the fishermen, farmers and entrepreneurs in the states of Karnataka, Goa and Maharashtra. The expansion of Mussel culture and Shrimp culture in these three states had the contribution of Karwar Research Centre also. The contributions made by Karwar Research Centre in the capture fisheries research is evident from the publications made by the scientists and technical staff worked in this centre since its inception. The centre evolved itself from a capture fisheries research centre to a major culture fisheries centre since 2009 to address the issues of declining catches and livelihood issues to the fishermen community.

Considering the ideal environmental and geographical conditions during the year 2008-09 mariculture research was initiated at Karwar especially research related to open sea cage farming and allied activities. Initially two cages were experimentally launched off Keni near Ankola and the centre did farming experiments with *Fenneropenaeus indicus*. Although the growth rate was encouraging the outbreak of white spot inside the cage resulted in total mortality and the experiment was wound up and the cages shifted to Karwar. A new site outside the break water of Karwar port was identified and after studying the environment, bottom profile and current pattern.

Initially 4 cages were installed in the area and later 8 more cages were added and developed this area into a fully fledged marine farm for conducting experimental farming of fin fishes and shell fishes. Since Sea cage farming was a new concept in the country many of the technical issues were to be studied, perfected and used so as to have a perfect sea cage farming technology available to the country. Ever since 2009-10 Karwar research centre devoted its man power and facilities to attain this goal and today the centre had developed and perfected a number of technologies tor the successful implementation of open sea cage farming all along e Indian coast line. Today the centre supports three state governments i.e. Maharashtra, Goa and Karnataka states in implementing open sea cage farming under various schemes like RKVY, NPM and NFDB schemes. Although it was back breaking work for the last 5 years today we are proud because our work is shining as a new light in the horizon for the downtrodden fishermen community of our country.

## 2. Staff Strength.

#### **Scientists**

2009-10

SI.No	Name	Designation	Division
1	Dr. V.S.Kakati	Principal Scientist	Marine Biodiversity
2	Dr. K.K.Philipose	Senior Scientist	Crustacean Fishery
3	Dr. S.R. Krupesha Sharma	Scientist (SS)	Marine Biotechnology
4	Dr. Miriam Paul Sreeram	Scientist (SS)	Marine Biodiversity

2010-11

SI.No	Name	Designation	Division
1	Dr. K.K.Philipose	Senior Scientist	Crustacean Fishery
2	Dr. S.R.Krupesha Sharma	Scientist (SS)	Marine Biotechnology
3	Dr. M.A. Pradeep	Scientist	Marine Biotechnology
4	Dr. Divu D.	Scientist	Mariculture

2011-12

SI.No	Name	Designation	Division
1	Dr. K.K.Philipose	Senior Scientist	Crustacean Fishery
2	Dr. S.R.Krupesha Sharma	Scientist (SS)	Marine Biotechnology
3	Dr.Jaysree Loka	Senior Scientist	Mariculture
4	Dr. Divu D.	Scientist	Mariculture

2012-13

SI.No	Name	Designation	Division
1	Dr. K.K.Philipose	Principal Scientist	Mariculture
2	Dr. S.R.Krupesha Sharma	Senior Scientist	Marine Biotechnology
3	Dr.Jaysree Loka	Senior Scientist	Mariculture
4	Dr.T.Senthil Murugan	Senior Scientist	Mariculture
5	Dr. Divu D.	Scientist	Mariculture

Technical

SI.No	Name	Designation	Division
1	K.C.Pandurangachar	Senior Technical Assistant (T-4)	Fishery Resources
			Assessment
2	C.K.Dinesh	Senior Technical Assistant (T-4)	Crustacean Fishery
3	Narayan. G.Vaidya	Senior Technical Assistant (T-4)	Demersal Fishery
4	Sthyanarayana. V.Pai	Senior Technical Assistant (T-4)	Fishery Resources
			Assessment
5	Prakash. C. Shetty	Technical Assistant (T-3)	Fishery Resources
			Assessment
6	Chandrakant. G.Ulvekar	Junior Technical Assistant(T-2)	Fishery Resources
			Assessment
7	Mohan. E.Durgekar	Junior Technical Assistant(T-2)	Fishery Resources
			Assessment

SI.No	Name	Designation	Division
1	K.C.Pandurangachar	Technical Officer (T-5)	Fishery Resources
			Assessment
2	C.K.Dinesh	Technical Officer (T-5)	Crustacean Fishery
3	Narayan. G.Vaidya	Technical Officer (T-5)	Demersal Fishery
4	Sthyanarayana V.Pai	Senior Technical Assistant (T-4)	Fishery Resources
			Assessment
5	Prakash. C. Shetty	Senior Technical Assistant (T-4)	Fishery Resources
			Assessment
6	Chandrakant. G.Ulvekar	Technical Assistant (T-3)	Fishery Resources
			Assessment
7	Mohan. E.Durgekar	Technical Assistant (T-3)	Fishery Resources
			Assessment
8	Narasimhulu Sadhu	Technical Assistant (T-3)	Mariculture
9	Sonali S.Mhaddolkar	Technical Assistant (T-3)	Mariculture
10	Kodi Srinivas Rao	Technical Assistant (T-3)	Mariculture
11	Laxman S. Korabu	Junior Technical Assistant (T-2) Skin	Mariculture

		Diver	
12	N.Selvakumar	Field Assistant(T-1)	Mariculture
13	Dhanya G.	Field Assistant(T-1)	MBTD

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3	Narayan. G.Vaidya	Technical Officer (T-5)	Demersal Fishery
4	Sthyanarayana V.Pai	Senior Technical Assistant (T-4)	Fishery Resources
			Assessment
5	Prakash. C. Shetty	Senior Technical Assistant (T-4)	Fishery Resources
			Assessment
6	Chandrakant. G.Ulvekar	Technical Assistant (T-3)	Fishery Resources
			Assessment
7	Mohan. E.Durgekar	Technical Assistant (T-3)	Fishery Resources
			Assessment
8	Narasimhulu Sadhu	Technical Assistant (T-3)	Mariculture
9	Sonali S.Mhaddolkar	Technical Assistant (T-3)	FEMD
10	Kodi Srinivas Rao	Technical Assistant (T-3)	Mariculture
11	Laxman S. Korabu	Junior Technical Assistant (T-2) Skin	Mariculture
		Diver	
12	N.Selvakumar	Field Assistant(T-1)	Mariculture
13	Dhanya G.	Field Assistant(T-1)	MBTD

SI.No	Name	Designation	Division
1	Mahendra Fofandi	Technical Officer (T-6)	Mariculture
2	K.C.Pandurangachar	Technical Officer (T-5)	Fishery Resources
			Assessment
3	C.K.Dinesh	Technical Officer (T-5)	Crustacean Fishery
4	Narayan. G.Vaidya	Technical Officer (T-5)	Demersal Fishery
5	Sthyanarayana V.Pai	Senior Technical Assistant (T-4)	Fishery Resources
			Assessment

6	Prakash. C. Shetty	Senior Technical Assistant (T-4)	Fishery Resources Assessment
7	Chandrakant. G.Ulvekar	Technical Assistant (T-3)	Fishery Resources Assessment
8	Mohan. E.Durgekar	Technical Assistant (T-3)	Fishery Resources Assessment
9	Narasimhulu Sadhu	Technical Assistant (T-3)	Mariculture
10	Sonali S.Mhaddolkar	Technical Assistant (T-3)	FEMD
11	Kodi Srinivas Rao	Technical Assistant (T-3)	Mariculture
12	Laxman S.Korabu	Junior Technical Assistant (T-2) Skin Diver	Mariculture
13	N.Selvakumar	Field Assistant(T-1)	Mariculture
14	Dhanya G.	Field Assistant(T-1)	MBTD

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2	K.C.Pandurangachar	Technical Officer	Fishery Resources
			Assessment
3	C.K.Dinesh	Technical Officer	Crustacean Fishery
4	Narayan. G.Vaidya	Technical Officer	Demersal Fishery
5	Sthyanarayana V.Pai	Technical Officer	Fishery Resources
			Assessment
6	Prakash. C. Shetty	Senior Technical Assistant	Fishery Resources
			Assessment
7	Chandrakant. G.Ulvekar	Technical Assistant	Fishery Resources
			Assessment
8	Mohan. E.Durgekar	Technical Assistant	Fishery Resources
			Assessment
9	Narasimhulu Sadhu	Technical Assistant	Mariculture
10	Sonali S.Mhaddolkar	Technical Assistant	FEMD
11	Kodi Srinivas Rao	Technical Assistant	Mariculture
12	Laxman S.Korabu	Senior Technician- Skin Diver	Mariculture

13	N.Selvakumar	Technician	Mariculture
14	Rajendra. D.Hulswar	Technician	Pelagic Fisheries
15	Pramila. H.Borkar	Technician	MBTD

## Ministerial

2009-10

SI.No	Name	
1	Gangadhar B. Naik	Assistant

#### 2010-11

SI.No	Name	Designation
1	Gangadhar B.Naik	Assistant
2	Ratan. P.Naik	Lower Division Clerk
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#### 2011-12

SI.No	Name	Designation
1	Gangadhar B.Naik	Assistant
2	Ratan .P.Naik	Lower Division Clerk

#### 2012-13

SI.No	Name	Designation
1	Gangadhar B.Naik	Assistant Administrative Officer
2	N.K.Harris	Assistant
3	Ratan .P.Naik	Lower Division Clerk

2013-14

SI.No	Name	Designation
1	N.K.Harris	Assistant
2	Ratan .P.Naik	Lower Division Clerk

## Supporting

SI.No	Name	Designation
1	Gopi X.Chodankar	Skilled Supporting Staff
2	Subash .K.Naik	Skilled Supporting Staff
3	Somayya Gonda	Skilled Supporting Staff
4	Rajendra .D.Hulswar	Skilled Supporting Staff
5	Pramila.H.Borkar	Skilled Supporting Staff
6	Somi Harizan	Skilled Supporting Staff

7	Ramakant .S,Harikantra	Skilled Supporting Staff
8	Suresh.R.Majalikar	Skilled Supporting Staff
9	Vijayalaxmi .Y.Gamanagatti	Skilled Supporting Staff
10	Nandini N.Mayekar	
11	Gopi X.Chodankar	Skilled Supporting Staff

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9	Vijayalaxmi .Y.Gamanagatti	Skilled Supporting Staff
10	Nandini Mayekar	Skilled Supporting Staff
0044.4	<u> </u>	

#### 2011-12

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1	Gopi X.Chodankar	Skilled Supporting Staff
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5	Suresh. R.Majalikar	Skilled Supporting Staff
6	Vijayalaxmi. Y.Gamanagatti	Skilled Supporting Staff
7	Nandini N.Mayekar	Skilled Supporting Staff
8	T.P.Renilkumar	Skilled Supporting Staff

## 3. Budget (2009 – 2014)

## Budget of Karwar Research Centre from 2009 to 2014

Year	PLAN	NON PLAN	PLAN	NICRA	NICRA	IRGS	Total
			EQUIPME		EQUIPM	EQUIP	
			NTS		ENTS	MENTS	
2009-	1657572	10527931	213923				1,23,99,426
10							
2010-	1937729	10592193	1688089	1400725	3351074		1,89,69,810
11							
2011-	1241325	11402462	2328854	2965340	2525459		2,04,63,440
12							
2012-	6804394	10338626	1998374	3250000			2,23,91,394
13							

2013- 14	10237393	32319799	2664628	2550000	44850	698972	4,85,15,642
Total	21878413	75181011	8893868	10166065	5921383	698972	12,27,39,7712

## 4. Research programmes for the period under review (2009-2014)

## 4.1. Completed research projects (11th plan)

SI.No	Project title	Institute/externally funded
1	Management Advisories for sustaining marine fisheries of	Institute
	Karnataka and Goa (PEL/IDP/02)	
2	Assessment of biodiversity and ecological changes in open sea	Institute
	cage farming	
3	Pathogen profiling, diagnostics and health management in	Institute
	maricultured finfish and shell fish (MBTD/PATH/01)	
4	Resource damage assessment in marine fisheries: impact of	Institute
	selective fishing of juvenile sand bycatch and discards in trawl	
	fisheries (CF/IDP/02).	
5	Development of brood stock, captive breeding and seed	Institute
	production techniques for selected marine food fishes and	
	ornamental fishes (MD/IDP/03).	
6	Innovations in sea cage farming and development of sustainable	Institute
	Capture Based Aquaculture systems (CBA) (MD/IDP/04)	
7	Development of knowledge based information system for marine	Institute
	fisheries sustainability	
8	Understanding the threatened coral reef ecosystems of southern	Institute
	India and designing interventions aimed at their restoration.	
9	Open sea floating cage farm for R & D in marine finfish and	МоА
	shellfish production	
10	Flow of matter through trophic levels and biogeochemical cycle in	MoES
	marine and estuarine eco systems	
11	National Initiative on Climate Resilient Agriculture	ICAR
12	Rapid EIA study on the pilot project of MPEDA on open sea	Consultancy project.

	offshore cage farming off Karwar coast	Client: MPED	A
13	Development of fresh water, brackish water and marine aquarium	Surat	Municipal
	at Surat (Consultancy Project)	Corporation	

SI.No	Project title	Institute/externally
		funded
1	Management Advisories for sustaining marine fisheries of	Institute
	Karnataka and Goa (PEL/IDP/02)	
2	Assessment of biodiversity and ecological changes in open sea	Institute
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3	Pathogen profiling, diagnostics and health management in	Institute
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	production techniques for selected marine food fishes and	
	ornamental fishes (MD/IDP/03).	
6	Innovations in sea cage farming and development of sustainable	Institute
	Capture Based Aquaculture systems (CBA) (MD/IDP/04)	
7	Development of knowledge based information system for marine	Institute
	fisheries sustainability	
8	Understanding the threatened coral reef ecosystems of southern	Institute
	India and designing interventions aimed at their restoration.	
9	Open sea floating cage farm for R & D in marine finfish and	МоА
	shellfish production	
10	Flow of matter through trophic levels and biogeochemical cycle in	MoES
	marine and estuarine eco systems	
11	National Initiative on Climate Resilient Agriculture	ICAR
12	Rapid EIA study on the pilot project of MPEDA on open sea	Consultancy project.
	offshore cage farming off Karwar coast	Client: MPEDA
13	Development of fresh water, brackish water and marine aquarium	Surat Municipal
	at Surat (Consultancy Project)	Corporation

SI.No	Project title	Institute/externally
		funded
1	Management Advisories for sustaining marine fisheries of	Institute
	Karnataka and Goa (PEL/IDP/02)	
2	Assessment of biodiversity and ecological changes in open sea	Institute
	cage farming	
3	Pathogen profiling, diagnostics and health management in	Institute
	maricultured finfish and shell fish (MBTD/PATH/01)	
4	Resource damage assessment in marine fisheries: impact of	Institute
	selective fishing of juvenile sand bycatch and discards in trawl	
	fisheries (CF/IDP/02).	
5	Development of brood stock, captive breeding and seed	Institute
	production techniques for selected marine food fishes and	
	ornamental fishes (MD/IDP/03).	
6	Innovations in sea cage farming and development of sustainable	Institute
	Capture Based Aquaculture systems (CBA) (MD/IDP/04)	
7	Development of knowledge based information system for marine	Institute
	fisheries sustainability	
8	Understanding the threatened coral reef ecosystems of southern	Institute
	India and designing interventions aimed at their restoration.	
9	Open sea floating cage farm for R & D in marine finfish and	МоА
	shellfish production	
10	Flow of matter through trophic levels and biogeochemical cycle in	MoES
	marine and estuarine eco systems	
11	National Initiative on Climate Resilient Agriculture	ICAR
12	Development of fresh water, brackish water and marine aquarium	Surat Municipal
	at Surat (Consultancy Project)	Corporation

## 4.2. On-going research projects

SI.	Project title	Institute/externally
No		funded
1	GIS based resource mapping of distribution and abundance of fin	Institute

	fishes and shellfishes off Indian coast for suggesting operational	
	based strategies for fisheries management (FISHCM-	
	FRISIL201200900009)	
2	Development and standardization of seed production technologies of	Institute
	selected high value finfishes and shellfishes	
	(FISHCMFRISIL2012202400024)	
3	Innovations in sea cage farming and coastal mariculture	Institute
	(FISHCMFRISIL201202500025)	
4	Health Management in selected finfish and shellfish for mariculture	Institute
	and Aquariculture & bio prospecting from marine resources	
	(FISHCMFRISIL201202600026)	
5	Aquatic feed biotechnology for mariculture and aquaculture	Institute
	(FISHCMFRISIL 2012 02 700027)	
6	Integrated Approaches for Improving the Reproductive Performance	Institute
	of Selected Marine Food Fishes (FISHCMFRISIL201202600026)	
7	Development of fishery management plans for sustaining marine	Institute
	fisheries of Karnataka and Goa (FISHCMFRISIL201200600006	
8	Gis based management advisory support information system FOR	Institute
	THE MARINE FISHERIES SECTOR	
9	Development of fishery management plans (FMPs) for the bivalve	Institute
	fisheries of India	
10	Flow of matter through trophic levels and biogeochemical cycle in	MoES
	marine and estuarine eco systems	
11	National Initiative on Climate Resilient Agriculture	ICAR
12	Development of fresh water, brackish water and marine aquarium at	Surat Municipal
	Surat (Consultancy Project)	Corporation

SI.No	Project title	Institute/externally funded
1	GIS based resource mapping of distribution and abundance of fin	Institute
	fishes and shellfishes off Indian coast for suggesting operational	
	based strategies for fisheries management (FISHCM-	
	FRISIL201200900009)	
2	Development and standardization of seed production	Institute

	technologies of selected high value finfishes and shellfishes	
	(FISHCMFRISIL2012202400024)	
3	Innovations in sea cage farming and coastal mariculture	Institute
	(FISHCMFRISIL201202500025)	
4	Health Management in selected finfish and shellfish for	Institute
	mariculture and Aquariculture & bio prospecting from marine	
	resources (FISHCMFRISIL201202600026)	
5	Aquatic feed biotechnology for mariculture and aquaculture	Institute
	(FISHCMFRISIL 2012 02 700027)	
6	Integrated Approaches for Improving the Reproductive	Institute
	Performance of Selected Marine Food Fishes	
	(FISHCMFRISIL201202600026)	
7	Development of fishery management plans for sustaining marine	Institute
	fisheries of Karnataka and Goa (FISHCMFRISIL201200600006	
8	GIS based management advisory support information system	Institute
	FOR THE MARINE FISHERIES SECTOR	
9	Development of fishery management plans (FMPs) for the bivalve	Institute
	fisheries of India	
10	Flow of matter through trophic levels and biogeochemical cycle in	MoES
	marine and estuarine eco systems	
11	National Initiative on Climate Resilient Agriculture	ICAR
12	Development of fresh water, brackish water and marine aquarium	Surat Municipal
	at Surat (Consultancy Project)	Corporation

## 5. Research achievements for the period 2009-2014:

## i. Capture Fisheries

## i.i. Pelagic Fisheries Division:

Project Title: Management Advisories for sustaining marine fisheries of

Karnataka and Goa.

Project Code: PEL/IDP/02

Location: Karwar.

#### Period: April 2009 to March 2012

## **Trawl fishery**

The estimated single day trawl catch at Karwar during the period from April 2009-March 2012 was 18806.15 t by an effort of (46775 units) 233875 hrs.(CPUE 402.06kg) (C/hr 80.41kg). The catch was highest in 2010-11 and lowest in 2009-10.

#### Crustaceans:

**Prawns:** During the period a total of 3900.8t of Prawns were landed with a CPUE of 83.40 kg forming 20.74 %.

Among prawns landed, M.dobsoni was the dominant 1859.04 t(CPUE 39.74 kg, 9.89 %), followed by P.stylifera 1242.6t(CPUE 26.56kg, 6.60 %), M.affinis 530.3t(CPUE 11.34 kg, 2.82 %), P.indicus 201.5t(CPUE 4.31kg, 1.07%), M.monoceros 50.5t(CPUE 1.08kg, 0.27%), P.merguiensis 16.4t(CPUE 0.35kg, 0.02 %) and P.monodon 0.5t (CPUE 0.01kg, 0.003 %) of all the catch of trawler landings.

**1.** *P.merguiensis*: The size ranged from 125-180mm with modes150-154. The sex ratio 1:2.73. The female maturity condition was Immature 80%, Mature 10% and 10% spent.

2. *P.indicus:* The size ranged from 95-184mm with modes110-114. The sex ratio 1:2.75. The female maturity condition was Immature 100%.

3. *P.affinis:* The size ranged from 90-149mm with mode140-144.The sex ratio 1:2.29The female maturity condition was Immature 51.46%,Mature,32.7% and 15.84% spent

4. *M.dobsoni:The* size ranged from 50-119mm with modes a 90-94. The Sex ratio 1:1.34. The female maturity conditions was, Immature 69.81%, Mature 16.29% and 13.90% spent.

5. *P.stylifera*: The size ranged from 60-109mm with modes at 95-99. The Sex ratio 1:3.15. The female maturity conditions was, Immature 51.4%, Mature 32.4% and 16.2% spent.

Crabs: During the period a total of 608.5t of Crabs were landed with a CPUE of 13.01 kg forming 3.24 % .

Among Crabs landed, P.pelagicus was the dominant 386.42 t(CPUE 8.26 kg, 2.05 %), followed by P.sanguinolentus 164.07t(CPUE 3.51kg, 0.87 %), and C.cruciata 58.05t(CPUE 1.24 kg, 0.31 %).

#### P.pelagicus :

The size ranged from 65-139mm with modes at 80-84 and 85-89. The sex ratio was 1:0.9 (M:F) with female maturity stage 83.33% immature, 16.67% spent.

#### P.sanguinolentus

The size ranged from 70-139mm with modes at 100-104. The sex ratio was 1:0.75(M:F) with female maturity stage 63.67% immature, 16.67% mature and 16.66 % spent. (Proforma p-3a)

## Molluscs

Loligo duvacelii :

During the period a total of 590.6t of Loligo duvaucelii were landed with a CPUE of 12.63 kg forming 3.14 % .

The size ranged from 65-249 mm (mantle length) with modes at 115-119 and 125-129mm. The sex ratio was 1:1.2 (M:F) by trawlers at Karwar Fishery harbour.

## i. ii. Purse-seine fishery

The estimated Purse-seine catch at Karwar during the period from April 2009-March 2012 was 42092.7 t by an effort of 17834 units forming a CPUE 2360.25kg. The catch was highest in 2010-11 and lowest in 2009-10.

#### Rastrelliger kanagurta::

- During the period under report, at Karwar fish landing centre a total of 8749.1t of R.kanagurta landed by 17834 purse-seines forming a CPUE of 490.59 kg forming 20.79.
- <u>Biology</u>: The size ranged from 125-274mm with modes at 175-179 and 180-184. The sex ratio 1:1.46. The female maturity condition was, Immature 67.99 %, Mature, 10.94% and 21.07 spent.

#### Sardinella longiceps:

- During the period under report, at Karwar fish landing centre a total of 29526.6t of Sardinella longiceps landed by 17834 purse-seines forming a CPUE of 1655.6 kg forming 70.15 %.
- <u>Biology</u>: The size ranged from 85-209mm with modes at 110-114. The sex ratio 1:0.99. The female maturity condition was, Immature 38.96 %, Mature, 44.4% and 16.64 spent.

#### Biology:

#### 1. S.commersoni (by Purse-seiners) at Karwar fish landing centre

The size ranged from 210-319mm with modes at 230-234. The fishes landed were juveniles as fishes examined were indeterminate.

#### 2. S.commersoni (by Gillnetters)at Karwar

The size ranged from 430-659mm with modes at 530-539 and 450-459 with an average fish weight of 1.283 kg per fish.

#### Project summary of FMPS during March2012- April 2014

#### Molluscan fisheries division

#### Project code:FISHCMFRISIL201201200012

#### Project Title: Development of fishery Management plans (FMPs) for the bivalve fisheries of India

The main objective is to Study Resource and biology of estuarine clam species of Uttar Kannada From following estuaries during March **2012-April 2014 :**Gangavali, Aghanashini, Kali estuary& Sharavathi .

**Achievements:** Kali and Aghanashini estuaries are covered during the period. The detailed study on resources & biology of estuarine clams was done.

#### Aghanashini estuary:

During the period under report fishing season was observed from October to May

The clam resources consisted of *Paphia malabarica, Meretrix meretrix, Meretrix casta as major* species

The clam fishery dominated by *P.malabarica* 70%, with total length ranged from 23.78mm to 32.90mm followed by *M.casta* 15%, size range 22.7 to 36.5mm and *M.meretrix* 15% 19.2mm-31.7mm during the period March 2012 to April 2013.

During 2013 -2014 the clam fishery decreased due to many reasons. One of the reasons may be shell mining. Till September 2013 the clam fishing is observed but from October 2013 to march2014 there was no fishery. The fisherman depending on this clam fishery of the area requested the mining authority to stop the shell mining. So the clam fishery is recovering after 3-4 months and the fishing started from April 2014 onwards.

#### Kali estuary

Fishing season was observed from October to May. The clam resources consisted of - *Paphia malabarica*, *Meretrix meretrix*, *Meretrix casta*, *Perna viridis* as major species. The clam fishery dominated by *P.malabarica* 53.88 %, with total length ranged from 24.49mm to 32.91mm followed by *M.casta* 31.12%, size range 26.56 to 34.53mm and *M.meretrix* 10% size range19.16-31.74, *P.viridis* 5% with size range33.47 - 52.61mm.

Revival of *P. malabarica was* noticed in Kali estuary after five years gap: Paphia malabarica (Chemnitz,1782),was dominant in Kali estuary before 2008. During 2005-06 and 2006-07 P. malabarica the percentage catch was about 51.01 and 46.11 respectively. But later it disappeared from the fishery and during 2012 this was again observed in the fishery.

For first time incursion of green mussel Perna viridis into the estuary was observed.



Green Mussels from Kali estuary

Also the juvenile fishing of Clams was observed during November to January month.

#### **Clams from Aghanashini:**



Clams from Kali estuary:



Paphia malabarica

Meretrix sp.

P.viridis

## ii. Culture Fisheries

During the reporting period scientists of the centre was seriously involved in culture fisheries research. The centre was trying to make cage culture technologies so as to make cage farming affordable to the ordinary fishermen. The centre is engaged in development of cost effective cages, advanced mooring technologies and improved nursery rearing system required for open sea cage farming. Cage culture technologies developed at Karwar Research Centre during the period 2009 to 2014 include:

1. **Six meter metal square cages**: Metal square cages were designed with varying degrees of success. The shortcomings of these cage types include breakages due to more numbers of joints and less culture space available.

2. Six meter circular steel cages: The continuous research efforts of the centre resulted in development of six meter diameter cages made of galvanized iron and floated with pressurized barrels which brought down the cost of cage fabrication by several fold when compared to cages

made using high density polyethylene (HDPE). Total cultivable volume in a 6 m cage is 141 m<sup>3</sup> with a stocking capacity of 5000 Asian seabass.

3. **Six meter dismantlable type cages**: Research on cage design lead to further refining cage fabrication with development of steel cages which can be dismantled and re-assembled. High quality stainless steel nut and bolt were used to assemble the three pieces of cage frames. These type cages can be brought to the shore after dismantling during off season and after proper maintenance, the cages can be re-assembled and moored again for the next crop.

4. **Ten meter dismantlable type cages**: Further advancement in cage designing resulted in development of 10 m dismantlable steel cages fabricated as 6 pieces with a cultivable volume of 392 m<sup>3</sup> and stocking capacity of 15000 seabass.

5. **Twelve meter dismantlable type cages**: Research on upgrading the cage design resulted in 12 m steel cages with a cultivable volume of 565 m<sup>3</sup> and stocking capacity of 35000 seabass.

6. Advanced mooring technology: Innovations in cage mooring lead to improved mooring technology by which cage can withstand adverse sea conditions. Each cage is connected to 12 concrete blocks (each weighing 180 kg) placed on the sea floor. Four concrete blocks were connected with a GI chain of 14 mm thickness and three groups of four blocks each were connected to a common ring. From this ring the chain is connected to a pressurized fiber barrel which constitutes the float by a 40 meter chain. The first float is connected to a second float by a 20 meter chain and from this float the three chains are connected to the cage. A concrete block weighing 180 Kg suspended in the water column between these two floats acts as a shock absorber.

**7.** Nursery rearing of Asian seabass and cobia seeds in indoor tanks: Asian seabass and cobia are to be nursery reared for a period of 3-4 weeks before they are stocked in cages. Consistent research efforts lead to standardization of nursery rearing protocols to rear seabass seeds upto 12 cm with 100 % survival by periodic size grading and perfecting other managemental strategies like feeding, tank husbandry etc.

8. **Rearing of Asian seabass in open sea cages**: Perfected open sea cage culture of Asian seabass in 6 meter metal cages with an FCR of 1.5 and survival of 70 %.

9. **Rearing of Cobia in open sea cages**: Perfected open sea cage culture of cobia (*Rachycentron canadum*) in 6 meter metal cages by standardizing the stocking densities.

10. **Cannulation techniques of red snapper**, sea breams and cobia was further refined to understand the maturity stages for standardizing breeding protocols of these species.

11. **Systematic health monitoring of cage cultured finfish** at marine cage farm off Karwar was done by regular analysis of sediment, water and fish samples for bacterial load, pathogenic bacteria and protozoa. In addition to total bacterial loads, total Vibrio loads of the sediment was also enumerated.

11. **Identified and reported infestation of cage reared Asian seabass** gills with monogenic fluke *Pseudorhabdosynochus sp.* by 18S rDNA amplification and sequencing using an ITS primer. The reported fluke did not show similarity with any of the reported monogenic flukes in seabass. Detailed histopathological characterization of the infestation made.

12) Vibriyosis caused by Vibrio harveyi was identified for the first time in cage cultured brood stocks of red snappers, *Lutjanus argentimaculatus*. The pathogen was confirmed by a specially designed nested PCR as well as 16S rRNA amplification and sequencing. Biochemical and histopathological characterization of the isolate was also done. It was proved that the outbreak of the disease was associated with handling and increased water temperature.

13) For the first time, a disease of cage reared cobia (*Rachycentron canadum*) caused by *Photobactirium damselae subsp damselae* was reported from India. The pathogen was isolated from kidney, liver, brain and heart blood of moribund specimens and confirmed based on biochemical and molecular characterization. Molecular characterization was done by 16S rDNA amplification and sequencing. Histological characterization of the disease was done.

14) Microbial enumeration of sediment at the cage culture site and a reference site was done to ascertain the impact of cage culture on the bacterial density. It was demonstrated that the bacterial load of the sediment at the cage site was significantly higher than the reference site throughout the years except during October to December. The bacterial load of the cage water was significantly higher than the reference water during August, September and October when compared to rest of the months.

**15)** Fourteen different planktonic organisms were found in the marine farm. Intense bloom of dinoflagellates in the month of June and July 2009 followed by copepods and diatoms was recorded. Among benthos, gastropods were dominant group followed by Polychaetes and bivalves.

- **16) Patents filed:** Developed a galvanized 6 m cage for finfish culture in open sea. Patent application No. 5196/CHE/2012
- 17) Gene bank submissions:

	Authors	Sequence definition	Accession No
1	Sharma K.S.R, Sadhu, N, Dube, P, Vijayan K.K. and Philipose,K.K	Molecular characterization of pathogenic Photobactirium damselae sub sp damselae isolated from diseased Cobia ( <i>Rachycentron</i> <i>canadum</i> ) cultured in floating sea	KC466554
		cages	
2	Sharma K.S.R, Rathore, G, Dev K	Infection of cage reared Asian	JF260912
	Verma, Sadu, N and Philipose,K.K.	seabass with Vibrio alginolyticus	
3	Sharma K.S.R Sadu, N, Dube, P	<i>Vibrio harveyi</i> infection in red snapper, <i>Lutjanus argentimaculatus</i> reared in floating cages off Karwar, India	KC345010
4	Sharma K.S.R Thomas S, Sadhu,	Bacterial Biodiversity of Mandovi of	KC178716
	N, Dube, P and Philipose,K.K	Goa India	
5	Sharma K.S.R Thomas S, Sadhu,	Bacterial Biodiversity in open sea	KC178717
	N, Dube, P and Philipose,K.K	sediment of Goa India	

## 6. Publications:

- S. R. Krupesha Sharma, Seema Jayaprakash,K. K. Philipose and E. V. Radhakrishnan (2009) Effect of salinity and pH on selected immune functions of the Indian white shrimp, *Fenneropenaeus indicus* (H. Milne Edwards, 1837). *Indian J. Fish.*, *56*(*3*): 183-187.
- 2. P.S.Swathi Lekshmi, Lingappa and C.G. Ulvekar (2009) New Fish meal plant at Karwar to process oil sardine. *Marine Fisheries Information Service, T& E Ser*, 199:13-15.

- **3.** P. Shetty, C.K Dinesh, V.S.Kakati and S.M. Paul (2009) Baleen whale washed ashore at Dona Paula, Goa. Marine Fisheries Information Service, T& E Series, 20: 30.
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   Shoreseine (Yendi) operations during the monsoons at Karwar, Uttar Kannada District of Karnataka. *Marine Fisheries Information Service, T & E Ser*, 206: 15-18.
- S. R. Krupesha Sharma, M. K. Anil and A. Udayakumar (2009) A report on swimbladder disorder in the honeycomb grouper, *Epinephelus merra*. *Marine Fisheries Information Service T&E Ser.* 202:16.

#### **Total publications: 5**

#### 2010-11

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- S.R. Krupesha Sharma, K.M. Shankar, M.L. Sathyanarayana, A.K. Sahoo, Rajreddy Patil, H.D. Narayanaswamy and Suguna Rao (2010) Evaluation of immune response and resistance to diseases in tiger shrimp, *Penaeus monodon* fed with biofilm of *Vibrio alginolyticus*. Fish Shellfish Immunol., 29: 724-732.
- K.K.Philipose, S.R.Krupesha Sharma (2010) Experiments in cost-effective open sea cage design at Karwar Bay- Maximizing returns. Cadalmin- CMFRI Newsletter No. 125. April-June 2010, 125-126
- **9.** Miriam Paul Sreeram , V.S.Kakati , N.G.Vaidya, C.K.Dinesh and S.V.Pai (2011)Whale shark landings in Uttar Kannada, Karnataka. *Marine Fisheries Information Service, T & E Ser*, 208:12-13.
- S. R. Krupesha Sharma, K. K. Philipose and N. G. Vaidya (2011) Sperm whale Physeter macrocephalus washed ashore at Devbagh, Karnataka. Marine Fisheries Information Service T&E Ser. 210:22-23.

#### **Total publications: 5**

#### 2011-12

 S. R. Krupesha Sharma, K. M. Shankar, M. L. Sathyanarayana, Raj Reddy Patil, H. D. Narayana Swamy and Suguna Rao (2011) Development of biofilm of *Vibrio alginolyticus* for oral immunostimulation of shrimp. *Aquacult. Int.*, (2011) 19:421–430.

- Rajreddy Patil a, K.M. Shankar a, S.R. Krupesha Sharma, Amod Kulkarni, Prakash Patil,
   B. Naveen Kumar and A.K. Sahoo (2011) Epitope analysis of white spot syndrome virus of *Penaeus monodon* by in vivo neutralization assay employing a panel of monoclonal antibodies. *Fish& Shellfish Immunol.*, 30 (2011) 1007-1013.
- N.G.Vaidya, and S.M. Maddolkar (2011) Unusual occurrence of large size oilsardine (Sardinella longiceps) at Karwar, Uttar Kannada coast of Karnataka. Marine Fisheries Information Service, T & E series, 209: 17.
- **14.** N.G. Vaidya (2011) Longbeak common dolphin *Delphinus capensis* (Gray, 1828) stranded at Karwar, Karnataka. *Marine Fisheries Information Service, T & E Ser*, 210: 22.
- K.K.Joshi, Rekha J.Nair, E.M.A.Samad, Sujita Thomas, V.S.Kakati, S.Jasmine, Molly Verghese, Miriam Paul S., Sandhya Sukumaran, Rani Mary George and Mary K.Manisseri (Eds.) The Carangids of India – A Monograph. Central Marine Fisheries Research Institute.2011.
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- E.V.Radhakrishnan, A.P.Dineshbabu, Shoba Joe Kizhakudan, P.P.Manojkumar, Sujitha Thomas, G.Maheswarudu, K.K.Philipose, S.Lakshmi Pillai, Rekha D.Chakraborty, R.Sathiadhas, Shubhadeep Ghosh, R.Thangavelu, J.Jayasankar and Gyanaranjan Dash. (2011) Reducing bycatch and discards: a priority for marine fisheries of India. In: Book of Abstracts -9<sup>th</sup> Indian Fisheries Forum. 1.
- K.K.Philipose and S.R.Krupesha Sharma, D.Divu, N.Sadhu and G.Syda Rao. (2011)
   Culture of Asian seabass, Lates calcarifer (Bloch) in open sea floating net cages off Karwar, South India. In: Book of Abstracts -9<sup>th</sup> Indian Fisheries Forum. 76-77.
- S.R.Krupesha Sharma and K.K.Philipose. (2011) Gill pathology of Asian seabass, Lates calcarifer (Bloch) infected with monogenean fluke, Diplectanum sp. In open sea cage Culture. In: Book of Abstracts -9<sup>th</sup> Indian Fisheries Forum. 192-193.
- 20. K.K.Philipose, S.R.Krupesha Sharma, Jayasree Loka, Divu Damodaran, Narayan G.Vaidya, Sonali S.Mhaddolkar, Narasimhulu Sadhu and Praveen Dube. (2011)

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- 22. K.K.Philipose and S.R.Krupesha Sharma (2011) Development of innovative low cost cages for promoting open sea cage culture along the Indian coast.In: Training manual on open Sea Cage Culture of Marine Finfish and Shellfish. 7 to 16 March 2011, Karwar Research Centre of CMFRI, Karwar. 93-96
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- 24. S.R.Krupesha Sharma and K.K.Philipose (2011) Diseases and their management in cage culture of marine finfish and shellfish. In: Training manual on open Sea Cage Culture of Marine Finfish and Shellfish. 7 to 16 March 2011, Karwar Research Centre of CMFRI, Karwar. 93-96, 126-137
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- 27. K. K. Philipose, S. R. Krupesha Sharma, Jayasree Loka, Divu Damodaran, G. Syda Rao, Narayan G. Vaidya, Sonali S. Mhaddolkar, Narasimhulu Sadhu And Praveen Dube (2012) Observations on variations in physico-chemical water parameters of marine fish cage farm off Karwar. *Indian J. Fish.*, 59(1) : 83-88.
- **28.** S. M. Sonali, N. G. Vaidya, S. R. Krupesha Sharma and K. K. Philipose (2012) Observation on a deformed specimen of grey bamboo shark Chiloscyllium griseum, Muller &

Henle, 1838 from the Arabian Sea off Karwar, Karnataka. *Marine Fisheries Information Service, T&E Ser.* 213:13.

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- **30.** N.G. Vaidya,N Sadhu, P.N.Dube and S.V.Pai (2012) Stranding of Spinner dolphin, *Stenella longirostris* (Gray, 1828) at Karwar, Karnataka. *Marine Fisheries Information Service*, *T&E Ser*. 213:16.
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- 32. S.R.Krupesha Sharma, N.Sadhu and K.K.Philipose (2012) Diseases and their management in cage culture. In: Handbook on Open Sea Cage Culture. K.K.Philipose, J.Loka, D.Divu and S.R.Krupesha Sharma (Eds). Pp.125-136
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- 34. Jayasree Loka, N.G.Vaidya and K.K.Philipose (2012) Site and Species selection criteria for Cage Culture. In: Handbook on Open Sea Cage Culture. K.K.Philipose, J.Loka, D.Divu and S.R.Krupesha Sharma (Eds). Pp.27-36
- 35. एस.एम.सोनाली, एन.जी.वेध्या, एस.आर. कृपेश शर्मा और के.के.फिलिप्पोस (2012) कर्नाटक में कारवार से दूर अरब समुद्र से धूसर बाम्बू सुरा काईलोसिलियम ग्रीसियम मल्लेर और हेन्ले, 1838 के एक विरूप नमूने पर अवलोकन. समुद्री मात्स्यकी सूचना सेवा त. व.वी. अंक संख्या 213.
- 36. E.V.Radhakrishnan, V.D. Deshmukh, G. Maheswarudu Josileen Jose, A.P. Dineshbabu, K.K.Philipose, P.T Sarada, S.L.Pillai, K.N.Saleela, R.D. Chakraborty, G.Dash, C.K. Sajeev, P. Thirumilu, B. Sreedhara, Y. Muniyappa, A.D.Sawant, N.G. Vaidya, R.J. Dias, J.B. Verma, K.G. Baby, C. Unnikrishnan, N.P.Ramachandran, A. Vairamani, A.Palanichamy, M. Radhakrishnan and B.Raju (2012) Prawn fauna (Crustacea: Decapoda) of India An annotated checklist of the Penaeoid, Sergestoid, Stenopodid and Caridean prawns. *J. Marine Biol. Assocn India*, 54 (1). 50-72

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- **39.** S.R. Krupesha Sharma, Narasimhulu Sadu, Praveen Dube and K.K.Philipose (2013) Foreign objects observed in the stomach of a cobia (*Rachycentron canadum*) reared in sea cage at Karwar. *Marine Fisheries Information Service T&E Ser.*, No. 216:8-9.
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- **42.** Sonali S. Mhaddolkar, N.G. Vaidya, S.R. Krupesha Sharma, and K.K. Philipose (2013). A Note on deformity in Narrow barred Spanish mackerel, *Scomberomorus commerson* (Lacepède, 1800). *Marine Fisheries Information Service T&E Ser.*, No. 218: 26-27.
- **43.** Praveen, N. Dube, S.R. Krupesha Sharma, and K.K. Philipose, (2013). A note on the ocean sunfish, *Mola mola* (Linnaeus, 1758) landed at Karwar, west coast of India. *Marine Fisheries Information Service T&E Ser.*, No. 217: 31-32.
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- **45.** S.M. Mhaddolkar, N.G. Vaidya N.G. and K.K.Philipose (2013) Revival of short neck clam Paphia malabarica Chemnitz, 1782 in Kali estuary, Karwar, Karnataka. *Marine Fisheries Information Service T&E Ser.*, No. 216: 7-8.
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- **48.** G.Syda Rao, Imelda Joseph, K.K.Philipose and M.Sureshkumar (Eds.) Cage Aquaculture in India. Central Marine Fisheries Research Institute.2013.
- 49. Narasimhulu Sadhu, S. R. Krupesha Sharma, Shoji Joseph, Praveen Dube and K. K. Philipose (2014) Chronic stress due to high stocking density in open sea cage farming induces variation in biochemical and immunological functions in Asian seabass (*Lates calcarifer*, Bloch). Fish Physiol. Biochem., DOI 10.1007/s10695-014-9909-8.
- 50. S.R.Krupesha sharma, M.A. Pradeep, Jayasree loka, A.K.Sahoo, P. N. Dube, N. Sadhu and K.K.Philipose (2014) Association of *Vibrio harveyi* in mortality of mangrove red snapper (*Lutjanus argentimaculatus*, Forsskål, 1775) cultured in open sea cages: a case of first record from. *Ind. J. Fish.* (Accepted for publication).

Total publications: 4





Papers published during the period of report

## 7. Awards/Honours - Nil

## 8. Production Process, Technologies developed with credited scientists

Karwar Research Centre of CMFRI is engaged in development of cost effective cages, advanced mooring technologies and improved nursery rearing system required for open sea cage farming. Cage culture technologies developed at Karwar Research Centre during the period 2009 to 2014 include:

1. **Six meter metal square cages**: Metal square cages were designed with varying degrees of success. The shortcomings of these cage types include breakages due to more numbers of joints and less culture space available.



6 meter square cage

2. **Six meter circular steel cages**: The continuous research efforts of the centre resulted in development of six meter diameter cages made of galvanized iron and floated with pressurized barrels which brought down the cost of cage fabrication by several fold when compared to cages made using high density polyethylene (HDPE). Total cultivable volume in a 6 m cage is 141 m<sup>3</sup> with a stocking capacity of 5000 Asian seabass.

3. **Six meter dismantlable type cages**: Research on cage design lead to further refining cage fabrication with development of steel cages which can be dismantled and re-assembled. High quality stainless steel nut and bolt were used to assemble the three pieces of cage frames. These type cages can be brought to the shore after dismantling during off season and after proper maintenance, the cages can be re-assembled and moored again for the next crop.







6 meter steel cage

 Ten meter dismantlable type cages: Further advancement in cage designing resulted in development of 10 m dismantlable steel cages fabricated as 6 pieces with a cultivable volume of 392 m<sup>3</sup> and stocking capacity of 15000 seabass.





5. Twelve meter dismantlable type cages: Research on upgrading the cage design resulted in
12 m steel cages with a cultivable volume of 565 m<sup>3</sup> and stocking capacity of 35000 seabass.

#### 6. Advanced mooring technology:



Advanced Mooring design

Innovations in cage mooring lead to improved mooring technology by which cage can withstand adverse sea conditions. Each cage is connected to 12 concrete blocks (each weighing 180 kg) placed on the sea floor. Four concrete blocks were connected with a GI chain of 14 mm thickness and three groups of four blocks each were connected to a common ring. From this ring the chain is connected to a pressurized fiber barrel which constitutes the float by a 40 meter chain.

The first float is connected to a second float by a 20 meter chain and from this float the three chains are connected to the cage. A concrete block weighing 180 Kg suspended in the water column between these two floats acts as a shock absorber.

vii. Nursery rearing of Asian seabass and cobia seeds in indoor tanks: Asian seabass and cobia are to be nursery reared for a period of 3-4 weeks before they are stocked in cages. Consistent research efforts lead to standardization of nursery rearing protocols to rear seabass seeds upto 12 cm with 100 % survival by periodic size grading and perfecting other managemental strategies like feeding, tank husbandry etc.



Nursery rearing of Asian Sea bass

viii. **Rearing of Asian seabass in open sea cages**: Perfected open sea cage culture of Asian seabass in 6 meter metal cages with an FCR of 1.5 and survival of 70 %.



ix. **Rearing of Cobia in open sea cages**: Perfected open sea cage culture of cobia (*Rachycentron canadum*) in 6 meter metal cages by standardizing the stocking densities.



10. **Cannulation techniques of red snapper**, sea breams and cobia was further refined to understand the maturity stages for standardizing breeding protocols of these species.

11. **Systematic health monitoring of cage cultured finfish** at marine cage farm off Karwar was done by regular analysis of sediment, water and fish samples for bacterial load, pathogenic bacteria and protozoa. In addition to total bacterial loads, total Vibrio loads of the sediment was also enumerated.

11. **Identified and reported infestation of cage reared Asian seabass** gills with monogenic fluke *Pseudorhabdosynochus sp.* by 18S rDNA amplification and sequencing using an ITS primer. The reported fluke did not show similarity with any of the reported monogenic flukes in seabass. Detailed histopathological characterization of the infestation made.

12) Vibriyosis caused by Vibrio harveyi was identified for the first time in cage cultured brood stocks of red snappers, *Lutjanus argentimaculatus*. The pathogen was confirmed by a specially designed nested PCR as well as 16S rRNA amplification and sequencing. Biochemical and histopathological characterization of the isolate was also done. It was proved that the outbreak of the disease was associated with handling and increased water temperature.

13) For the first time, a disease of cage reared cobia (*Rachycentron canadum*) caused by *Photobactirium damselae subsp damselae* was reported from India. The pathogen was isolated from kidney, liver, brain and heart blood of moribund specimens and confirmed based on biochemical and molecular characterization. Molecular characterization was done by 16S rDNA amplification and sequencing. Histological characterization of the disease was done.

**14)** Microbial enumeration of sediment at the cage culture site and a reference site was done to ascertain the impact of cage culture on the bacterial density. It was demonstrated that the bacterial load of the sediment at the cage site was significantly higher than the reference site throughout the years except during October to December. The bacterial load of the cage water was

significantly higher than the reference water during August, September and October when compared to rest of the months.

**15)** Fourteen different planktonic organisms were found in the marine farm. Intense bloom of dinoflagellates in the month of June and July 2009 followed by copepods and diatoms was recorded. Among benthos, gastropods were dominant group followed by Polychaetes and bivalves.

**16) Patents filed:** Developed a galvanized 6 m cage for finfish culture in open sea. Patent application No. 5196/CHE/2012

#### 17) Gene bank submissions:

	Authors	Sequence definition	Accession No
1	Sharma K.S.R, Sadhu, N, Dube, P,	Molecular characterization of	KC466554
	Vijayan K.K. and Philipose,K.K	pathogenic Photobactirium damselae	
		sub sp damselae isolated from	
		diseased Cobia (Rachycentron	
		canadum) cultured in floating sea	
		cages	
2	Sharma K.S.R, Rathore, G, Dev K	Infection of cage reared Asian	JF260912
	Verma, Sadu, N and Philipose,K.K.	seabass with Vibrio alginolyticus	
3	Sharma K.S.R Sadu, N, Dube, P	Vibrio harveyi infection in red	KC345010
		snapper, Lutjanus argentimaculatus	
		reared in floating cages off Karwar,	
		India	
4	Charma KCD Thomas C Cadhu	Destarial Diadivaraity of Mandavi of	VC170714
4	Sharma K.S.R Thomas S, Saunu,		KC1/8/10
	N, Dube, P and Philipose,K.K	Goa India	
5	Sharma K.S.R Thomas S, Sadhu,	Bacterial Biodiversity in open sea	KC178717
	N, Dube, P and Philipose,K.K	sediment of Goa India	

## 9. Infrastructure and physical facilities planned and developed during the period under review commensurate with the mandate.

#### 9.1. Renovation of the old office cum laboratory building.

Karwar research centre although started in 1948 was lacking in basic facilities like good laboratories, administrative offices, library and other facilities. With the development of cage culture related work additional facilities were essential. Institute had taken special care in renovating the old facilities without losing the old charm of the centre. New facilities like microbiology lab, biotechnology lab, Museum, Library, Conference room, Training hall, guest room, hatchery, nursery etc were added and transformed the centre to a state of the art research facility. The renovated lab-cum administrative building was inaugurated by Dr.S.Ayyappan, Secretary, DARE and DG,ICAR on 01-09-2012 in the presence of Dr.B.Meenakumari, DDG,fisheries, Dr.Madan Mohan ADG(MFY), Dr.G.Syda Rao, Director, CMFRI, Dr.K.K.Philipose, Scientist in Charge, Karwar Research Centre.





Dr.S.Ayyappan, Secretary DARE and DG, ICAR inaugurating the renovated lab- cum, Administrative building of Karwar research centre



Renovated building of Karwar Research Centre

#### 9.2. New Microbiology Laboratory

A new microbiology laboratory to study the cage related microbial studies was established in one of the semi permanent building available in the centre with state of the art equipments.



#### Microbiology Laboratory

#### 9.3. Marine Biotechnology Lab

Cage related biotechnology works are needed to understand diseases, environmental problems and also to understand fish related issues. A modern biotechnology lab with all modern equipments was established at the research centre to cater these needs. At present this lab looks after the farming related issues in Karnataka, Goa and Maharashtra.



**Biotechnology Laboratory** 

#### 9.4. Marine Museum

Karwar Research centre was established along with the inception of CMFRI. Rare specimens collected since early fifties are available at the centre. These specimens are to be preserved for the benefit of the posterity systematically and scientifically. Although space is a major constraint a reasonably good museum was developed at Karwar in one of the semi permanent building available in the centre.



Museum

#### 9.5. New Library

The centre had an excellent collection of journals and books relating to Fisheries, Oceanography and related topics from reputed journals both from India and abroad. Historical data of environment, fishery, Planktonology etc are well preserved in the centre. A new library was developed in the centre to house all

these publications systematically. The library is open to students and other researchers from University and colleges also. Internet facility with e-library facility is made available in the library.



#### 9.6. New Committee Room

A new committee room was developed for conducting staff meeting, SRC,s, Video conferencing and other important meetings of the centre.



#### 9.7. Training Hall

Karwar centre regularly conducts training programme for fishermen, farmers and fisheries department staff of various maritime states in open sea cage farming. These training programmes helped the trainees to establish cage culture activities at various parts of the country.



Training Hall

#### 9.8. Cold Store

Availability of feed during the ban period was a very serious issue facing the cage farming activities of the centre. Brood stock fishes is to be maintained during these period and to solve the storage of feed a cold store was established at Karwar at a cost of Rs. 6,98,000.



Cold Store

#### 9.9. Marine Farm

The centre had established the first marine cage farm of the country outside Karwar bay in the year 20110. Presently this farm has more than 30 cages various dimensions and species cultured are Cobia, Sea bass, Pompano, Snapper and green Mussel Perna viridis. This farm is being used as a training facility to train farmers from various parts of the country.



Marine Farm of CMFRI

## 9.10. Marine Hatchery Complex



Marine Hatchery Complex



A view of the nursery



A view of the nursery reared fishes

The centre had about 2.5 acre land leased from the forest department available at Kajubag, Karwar with an old shed in that. As a first thing a permanent sea water pumping system was established there. Later FRP tanks of various dimensions were sourced and the old shed was converted into a functional nursery. Later when nursery rearing became a major issue to support cage faming a nursery of 50000 seeds was established there. During the year 2013 this nursery become functional and nearly 100,000 seeds were nursery reared here and supplied to the farmers of Goa and Karnataka. This nursery is being further upgraded to 100,000 seeds with NFDB assistance.

## 10. Human Resource development efforts for different categories of staff Training cum Workshops attended by the Staff of Karwar Research Centre:

#### 10.1. International Programmes:

- Dr. S.R.Krupesha Sharma, Senior Scientist, KRC, was deputed to University of Stirling, U.K for a three month period from August to November 2010 under NAIP Programme by ICAR, New Delhi.
- Dr. Jayasree Loka Senior Scientist, KRC, deputed to NOVA University Fort Lauderdale, Florida, USA for a three month period from October 2013 to January 2014 under NAIP Programme by ICAR, New Delhi.
- Dr. Divu Damodaran Scientist, KRC, deputed for an NAIP International training on "Marker Assisted Selection (Fisheries)" at Institute of Aquaculture, University of Sterling from 30/10/2013 till 28/01/2014

S.No	Training Programme	Place and duration	Scientific Staff	Technical staff
1	cage culture programme	Mandapam Regional	-	Narayan G.Vaidya,
		Centre of CMFRI,		Technical Officer
		Mandapam Camp		
		04.05.2009 to		
		04.06.2009.		
2	Zonal workshop cum training on	H.Quarters Cochin	-	1. K.C.Pandurangachar,
	"skill enhancement for marine	November 2009.		2.Satyanarayan V.Pai &
	fisheries resources data			3.Chandrakant G.Ulvekar
	collections along with marine			(FRAD Staff)
	fisheries census 2010."			
3	Bycatch: its impact on Marine	Mangalore Research	-	1. Narayan G.Vaidya,
	Fisheries"	Centre of CMFRI,		Technical Officer,
		Mangalore on 18 <sup>th</sup>		2. Sonali S.Mhaddolkar,
		August 2010		Technical Assistant

#### **10.2. National Programmes:**

4	Prawn taxonomy: recent	H.Q. Cochin from	Dr.Divu Damodaran	Narayan G.Vaidya,
	advances and revision of	14.2.2011 to	Scientist	Technical Officer
	nomenclature	19.2.2011		
5	Cannulation, breeding and larval	Mandapam Regional	Dr. Jayasree Loka,	1. Mr. Narasimhulu Sadhu,
	rearing of finfish	Centre of CMFRI	Senior Scientist	Technical Assistant
		during		2. Mr. Srinivasa Rao, K.,
		20.7.2011-3.8.2011.		Technical Assistant
6	Techniques and Methodologies	Mangalore Research	1. Dr. Jayasree Loka	1. Narayan G.Vaidya,
	in fishery biology of finfishes and	Centre of CMFRI	Senior Scientist	Technical Officer,
	shellfishes	15th – 17th	2. Dr.Divu Damodaran	2.Ms. Sonali S.Mhaddolkar,
		September, 2011	Scientist	Technical Assistant
				3. Praveen Dube, Research
				Scholar, NICRA Project
7	Marine Zooplankton collection	CMFRI, HQ. Cochin,	-	Narayan G.Vaidya,
	and identification" funded by	13.2.2012 to		Technical Officer
	NICRA and organized	17.2.2012		
8	NICRA technology demonstration	IIHR Bangalore	1. Dr. K.K.Philipose,	-
		August 2012	Principal Scientist and	
			Scientist In Charge	
			2. Dr. S.R.Krupesha	
			Sharma, Senior	
			Scientist	
9	National Brain storming	NAAS complex New	1. Dr. K.K.Philipose,	-
	mariculture development in India	Delhi,	Principal Scientist and	
		August 2012.	Scientist In Charge	
			2. Dr. S.R.Krupesha	
			Sharma, Senior	
			Scientist	
10	e publication for IJF editorial	Head quarters,	Dr. Jayasree Loka	-
	committee members	Cochin	Senior Scientist	
		17-18, May 2012		
11	Live feed production for	CIBA, Chennai	Dr. Senthil Murugan,	-
	Larviculture of brackish water	29.10.12 to 2.11.12	Senior Scientist	
	finfishes			
12	GIS based resource mapping of	Mangalore Research	Dr. Senthil Murugan,	1. Narayan G.Vaidya,
	distribution and abundance of	Centre of CMFRI,	Senior Scientist	Technical Officer,
	finfishes and shellfishes off	Mangalore, Karnataka		2. Sonali S.Mhaddolkar,
	Indian coast	on 17-18 August 2012		Technical Assistant

13	Taxonomy of Exploited Marine	Mangalore Research	-		1.Narayan	G.Vaidya,
	Fishery Resources"	Centre of CMFRI			Technical	Officer, 2.Ms.
		26 <sup>th</sup> to 30 <sup>th</sup> August			Sonali	S.Mhaddolkar,
		2013			Technical A	ssistant
14	Image pearl Production	Vizhinjam Research	Dr.Divu	Damodaran,	-	
		Centre of CMFRI	Scientist			
		19 to 21 <sup>st</sup> February,				
		2014				

11. Budget and finance: Allocations to various heads to be given along with details and budget for the years covering the review period along with the status report on resource generation and project based budgeting implementation.

Budget 2009-2010	Plan	Non Plan
Establishment charges		100,0,000
Plan Contingencies, infrastructure etc	1832467	
Infrastructure		527931
Other Charges	10,000	250000
ТА	146482	90670
Budget 2010-2011	Plan	Non Plan
Infrastructure	434139	260083
Communication	48108	28424
Repairs and Maintenance	23067	128508
Other Miscellaneous	434915	458434
Research & Op Expenses	214030	99655
Operational Expenses	20583	500794
T A Bill	250000	50000
Budget 2011-2012	Plan	Non Plan
Infrastructure	0	938305
Communication	11031	73886
Other	679150	275873
Other Miscellaneous	568258	421749
Research & Op Expenses	391950	225333

Operational Expenses	274326	162163
Other Research Expenses	249750	163799
T A Bill	300000	100000
Budget 2012-2013	Plan	Non Plan
Infrastructure	825633	503546
Communication	35691	18654
Repairs and Maintenance	0	50200
Other	71481	9209
Other Miscellaneous	1890392	188822
Research Expenses	671535	101630
Operational Expenses	776859	272089
Other Research Expenses	776859	272089
T A Bill	600000	50000
Budget 2013-2014	Plan	Non Plan
Infrastructure	1685023	885505
Communication	43176	5154
Repairs and Maintenance	0	172144
Other	1036933	504415
T A Bill	480500	196623
NICRA	2103766	46861
Operational Expenses	431585	343836
Research Expenses	1001099	818922

#### **Revenue Generation**

Year	Revenue generated (`)
2009-2010	4,41,000=00
2010-2011	4,40,000=00
2011-2012	21,93,335=00
2012-2013	9,50,625=00
2013-2014	6,51,453=00
Total	46,76,413=00

#### 12. SWOT Analysis

#### Strength

#### i. Historical data

Karwar Research Centre is one of the oldest Research Centres of CMFRI. Over the years it had excelled in its research activities in pelagic fishes and eminent scientists worked at this centre and left behind a wealth of information relating to fisheries and environment. Probably no other centre has such an information wealth with them. Hence when we planned mariculture development at Karwar these information become useful in planning our activities.

#### ii. Dedicated Staff

Karwar once a bristling centre of capture and culture fisheries activities have lost its glory due to lack of vision and planning. The institute decided to utilize its full potential in terms of environment and man power and decided to take up mariculture activities at Karwar in a big way. The technical and supporting staffs working at Karwar was so dedicated, they extended their unconditional support in the scientific works we planned at Karwar. Within a short span of time Karwar became the national leader in mariculture and now provides its knowhow to many states.

#### iii. Ideal environmental features

Karwar is blessed with a partially protected bay with ideal depth and water quality conditions to take up open sea cage farming. That was a great strength of the centre.

#### iv. Office cum laboratory building

The office cum laboratory building is right in the beach front so accessibility to sea is very good. This also is a great strength.

#### v. Availability of land for development

The centre has about 2.5 acre land at Kajubag. In this land there was an old sea water pumping line. This was renovated and the facilities available at this land was converted into a hatchery. Availability of this land was a great strength.

#### vi. Excellent support and cooperation from the fishermen community

The cooperation of the fishermen community is excellent at Karwar for CMFRI. That is a great strength.

#### vii. Support from State and Central Agencies

Within a very short span of time we have developed excellent rapport with state and central agencies. This is also a great strength for the centre.

#### Weakness

#### i. Availability of enough Staff

Availability of scientific, technical and supporting staff is a critical factor for the centres growth. With research programmes stretching from Ratnagiri to Kumta man power is our most critical weakness

#### ii. Availability of advanced equipments to support cage farming activities

Cage farming requires very sophisticated equipments to monitor the environment. Although we have sourced a number of equipments still this os our weak point.

#### iii. Availability of a finfish hatchery

Presently the finfish seed requirement for the three states for which Karwar centre is extending technical support is about 8,00,000 seed. At present part of this requirement is met from different hatcheries in the east coast including CMFRI's Mandapam hatchery and the remaining through wild collection. This one of our weakness at present.

#### **Opportunities**

#### i. Potential for Mariculture Research

Mariculture is going to be the way forward in marine fisheries. Karwar Research Centre had developed a number of technologies and these technologies are being extended to all maritime states for developing open sea cage culture. The centre has tremendous opportunities in the field of mariculture.

#### ii. Presence of large number of estuaries and brackish water bodies

Uttarkannada and Goa is blessed with large number of estuaries and brackish water bodies. These are areas of opportunities for developing and demonstration of coastal mariculture technologies.

#### iii. Opportunity to demonstrate mariculture technologies

Karwar is situated in a potential mariculture zone extending from Ratnagiri to Bhatkal. In this 600 KM coast line the population density along the coast line is low and has large number of protected bays where open sea cage culture can be established. This area offers immense opportunity to the centre.

#### iv. Establishing a Marine finfish hatchery

CMFRI can establish a marine fin fish hatchery at Karwar to meet the farming and demonstration needs of this area. Once the technology is demonstrated to private hatchery owners probably CMFRI can restrict its actions to Research and developmental activities.

#### Threats

#### i. Manpower

A foreseeable threat to the centre is its shortage of manpower itself. Some of the technical and all of the scientific staff is from other parts of the country. Once these people move away from Karwar an efficient second line is required to carry forward. This is a foreseeable threat to the great work the centre is doing.

#### ii. Availability of funds

Mariculture requires modern equipments and farming related materials. Loosing priority may cause a serious threat for the achievements CMFRI made in the field.

#### iii. Climate change

Climate change is a serious issue facing the fisheries sector. Any adverse and unpredictable situation may arise and can be a serious threat to the centres success.

- Frequency of staff meetings: Monthly staff meetings are conducted for the staff of KRC of CMFRI during the report period.
- 14. Facilities available for staff including housing in campus, travel, office,

education facilities for children etc.: Toyota Innova was used for the purpose of

transporting scientists, staff, samples and equipment to and from areas of field survey or events held.

# 15. Participation of scientific staff in National and International conferences (gives details and problems and suggestions for the future)

a. Participation of scientific staff in seminars/symposia and conferences:

S.N	Title of the	National /	Place and	Scientists participated	
0	Conference	International	Duration	from the centre	
				Name	Designation
1	Diseases in Asian	International	Mangalore,	Dr. Krupesha Sharma	Senior
	Aquaculture		21-25	Senior Scientist	Scientist
			November, 2011		
2	Indian Fisheries	International	Chennai	Dr. K.K.Philipose	Principal
	Forum (Asian		19 <sup>th</sup> -23 <sup>rd</sup>		Scientist &
	Fisheries Forum,		December 2011		Scientist In
	Indian Branch)				Charge
				Dr. Krupesha Sharma	Senior
					Scientist

		Dr. Jayasree Loka	Senior
			Scientist
		Dr.Divu Damodaran	Scientist

## b. Workshops / Symposia / Seminars/Meetings participated by the scientific staff:

S.N	Title of the Workshop	Place	Duration	Scientific Staff		
0						
				Name	Designation	l
1	National seminar on	Karnataka	17.03.2010	Dr. K.K.Philipose	Principal	
	biodiversity conservation	Biodiversity			Scientist	and
		Board			Scientist	In
		Mangalore			Charge	
2	Consultative Meeting on	FAO NFDB	23-24 <sup>th</sup>	Dr. K.K.Philipose	Principal	
	Development of Fisheries	Mission	March 2010		Scientist	and
	in India	consultative			Scientist	In
		Meeting on			Charge	
3	NFDB Meeting on Open	NFDB,	29.04.10 -	Dr. K.K.Philipose	Principal	
	sea cage farming	Hyderabad	30.4.2010		Scientist	and
					Scientist	In
					Charge	
4	National workshop on	Karwar	17 & 18	Dr. K.K.Philipose	Principal	
	"Open Sea Cage Farming"	Research	July, 2010.		Scientist	and
	(NBFD sponsored)	Centre of			Scientist	In
		CMFRI			Charge	
				Dr. S.R.Krupesha	Senior Scie	entist
				Sharma		
				Dr.Divu	Scientist	
				Damodaran		
5	NFDB Meeting on Open	NFDB,	10.08.10 –	Dr. K.K.Philipose	Principal	
	sea cage farming	Hyderabad	11.8.2010		Scientist	and
					Scientist	In
					Charge	
6	Workshop on open sea	MSSRF	21.10.10	Dr. K.K.Philipose	Principal	

	farming	foundation,			Scientist and
		Chennai			Scientist In
					Charge
7	NICRA workshop	Head Qrts,	4.2.2011 -	Dr. K.K.Philipose	Principal
		CMFRI,	5.2.2011		Scientist and
		Cochin			Scientist In
					Charge
8	Workshop on Crustacean	Head Qrts,	14.2.2011	Dr. K.K.Philipose	Principal
	taxonomy	CMFRI			Scientist and
		Cochin			Scientist In
					Charge
9	Molecular sub typing of	ICAR	20-23	Dr. S.R.Krupesha	Senior Scientist
	microbes using pulsed	Research	August	Sharma	
	field gel electrophoresis	Complex for	2011		
		Goa,			
10	Techniques and	Mangalore	15th – 17th	Dr. Jayasree	Senior Scientist
	Methodologies in fishery	Research	September,	Loka	
	biology of finfishes and	Centre of	2011		
	shellfishes	CMFRI			
				Dr.Divu	Scientist
				Damodaran	
11	Workshop cum training	Head	17-18, May	Dr. Jayasree	Senior Scientist
	programme on e	quarters,	2012	Loka	
	publication for IJF editorial	Cochin			
	committee members				
12	NICRA brainstorming	Head	May 2012	Dr. Jayasree	Senior Scientist
	workshop	quarters,		Loka	
		Cochin			
13	NICRA brainstorming	Head	July 2012	Dr. Jayasree	Senior Scientist
	workshop	quarters,		Loka	
		Cochin			
14	Review workshop on	Karwar	23.5.2012	Dr. K.K.Philipose	Principal

	Innovations in cage	Research			Scientist and
	farming	Centre of			Scientist In
		CMFRI			Charge
				Dr. S.R.Krupesha	Senior Scientist
				Sharma	
				Dr.Senthil	Senior Scientist
				Murugan	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	
15	Workshop on NICRA	IIHR	August	Dr. K.K.Philipose	Principal
	technology demonstration	Bangalore	2012		Scientist and
					Scientist In
					Charge
				Dr. S.R.Krupesha	Senior Scientist
				Sharma	
16	National Brain storming	NAAS	August	Dr. K.K.Philipose	Principal
	mariculture development	complex New	2012.		Scientist and
		Delhi			Scientist In
					Charge
				Dr. S.R.Krupesha	Senior Scientist
				Sharma	
17	Thermal power project	Mundra	September	Dr. K.K.Philipose	Principal
	organized by TATA power		2012		Scientist and
					Scientist In
					Charge
18	National consultation	Indian council	1st	Dr. K.K.Philipose	Principal
	programme "Integrated	of Agricultural	September		Scientist and
	development of	Research,	2012 at		Scientist In
	Uttarkannada district"	New Delhi	Karwar.		Charge
				Dr. S.R.Krupesha	Senior Scientist

				Sharma	
				Dr.Senthil	Senior Scientist
				Murugan	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	
19	Popularisation of Open	NFDB, at	4-5 October	Dr. K.K.Philipose	Principal
	Sea Cage Culture	Karwar R.C.	2012.		Scientist and
					Scientist In
					Charge
				Dr. S.R.Krupesha	Senior Scientist
				Sharma	
				Dr.Senthil	Senior Scientist
				Murugan	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	
20	Mariculture workshop on	Karwar	5.12.12 to	Dr. K.K.Philipose	Principal
	Innovations in cage	Research	7.12.12		Scientist and
	farming.	Centre of			Scientist In
		CMFRI			Charge
				Dr. S.R.Krupesha	Senior Scientist
				Sharma	
				Dr.Senthil	Senior Scientist
				Murugan	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	
21	Revalidation of fish catch	DAHD,	6 <sup>th</sup>	Dr. K.K.Philipose	Principal
	potential from Inland and	Ministry of	September		Scientist and

	Marine cages	Agriculture,	2013		Scientist In
		Govt f India			Charge
		New Delhi			
22	Workshop on species	Mandapam	4-5 <sup>th</sup>	Dr. K.K.Philipose	Principal
	prioritization for	Regional	November		Scientist and
	Mariculture	Centre of	2013		Scientist In
		CMFRI			Charge
		Mandapam			
23	National cage validation	Ministry of	29.1.2014	Dr. K.K.Philipose	Principal
	committee meeting	Agriculture,			Scientist and
		Govt f India			Scientist In
		New Delhi			Charge
24	Aqua Goa Mega Fish	Directorate of	301.1.2014-	Dr. K.K.Philipose	Principal
	Festival	Fisheries	2.2.2014 at		Scientist and
		Govt. of Goa,	Navelim,		Scientist In
		CO-	Salcette,		Charge
		sponsored by	Goa		
		National			
		Fisheries			
		Development			
		Board,			
		Hyderabad,			
		Govt. of India			
				Dr. S.R.Krupesha	Senior Scientist
				Sharma	
				Dr.Senthil	Senior Scientist
				Murugan	
				Dr. Jayasree	Senior Scientist
				Loka	
25	Coastal Biodiversity	Karnataka	24.2.2014 at	Dr. K.K.Philipose	Principal
	Conservation	Biodiversity	Karwar		Scientist and
		Board, Govt. of			Scientist In
		karnataka in			Charge

		association			
		with			
		Karwar			
		Research			
		Centre of			
		CMFRI,			
		Karwar			
				Dr. S.R.Krupesha	Senior Scientist
				Sharma	
				Dr.Senthil	Senior Scientist
				Murugan	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	
26	NICRA TDC Review Meeting	CRIDA,	3.3.2014	Dr. K.K.Philipose	Principal
		Hyderabad			Scientist and
					Scientist In
					Charge

## c. Expert talk by the scientific staff in National Training Programmes and workshops:

S.No	Title of the	Place	Duration	Scientific Staff	
	Workshop				
				Name	Designation
1	Aqua marine	FIRMA and Kochi	3 hrs	Dr. K.K.Philipose	Principal
	Export meet	International Airport,			Scientist and
		Kochi			Scientist In
					Charge
2	Open sea cage	Vizhinjam Research	29.10.2010	Dr. K.K.Philipose	Principal
	culture	Centre, Vizhinjam			Scientist and
					Scientist In
					Charge
3	Prospects o	Zilla Panchayat	24.11.2010	Dr. K.K.Philipose	Principal
	ornamental fisl	Uttarkannada			Scientist and
	culture i	district			Scientist In

	Karnataka				Charge
4	Task force meeting	Uttarkannada	16.1.2011	Dr. K.K.Philipose	Principal
		district			Scientist and
					Scientist In
					Charge

d. Meetings attended by the scientific staff:

S.N	Meetings	Place	Duration	Scientific Staff		
0						
				Name	Designation	n
1	NTNU Team of Norway on	Cochin	9.2.2011	Dr. K.K.Philipose	Principal	
	Open sea cage culture				Scientist	and
	prospects				Scientist	In
					Charge	
2	District Task force meeting	Karwar	3.3.2011	Dr. K.K.Philipose	Principal	
					Scientist	and
					Scientist	In
					Charge	
3.	Executive committee meeting	BFFDA,	26.3.2011	Dr. K.K.Philipose	Principal	
		Uttarkannada			Scientist	and
					Scientist	In
					Charge	
4.	Asian Seabass culture	CIBA at Harwada,	November	Dr. K.K.Philipose,	Principal	
			2012		Scientist	and
					Scientist	In
					Charge	
				Dr. S.R.Krupesha	Senior	
				Sharma	Scientist	
5.	Industry meet on cage nets	Garware Wall	>>>>	Dr. K.K.Philipose,	Principal	
	for open sea culture	Rope Ltd,			Scientist	and
		Maharastra			Scientist	In
					Charge	
6	Inaugural function of open sea	Ratnagiri	25.1.2014	Dr. K.K.Philipose,	Principal	
	cage culture programme	Maharastra			Scientist	and
					Scientist	In

				Charge
		Dr.	S.R.Krupesha	Senior
		Shar	ma	Scientist

## e. Hindi workshops participated by Staff of KRC

S.N	Title of the	Place	Duration	Scientific Staff	
0	Workshop				
				Name	Designation
1	Hindi workshop	Karwar	2010	Dr. K.K.Philipose	Principal Scientist and
	TOLIC meetings				Scientist In Charge
2	Hindi workshop	Karwar	30.9.2010	Dr. K.K.Philipose	Principal Scientist and
					Scientist In Charge
				Dr.S.R.Krupesha	Senior Scientist
				Sharma	
				Dr.Divu	Scientist
				Damodaran	
3	Hindi workshop	Karwar	2011	Dr. K.K.Philipose	Principal Scientist and
	TOLIC meetings				Scientist In Charge
4	Hindi seminar	NPCIL,	6/11/12	Dr.Divu	Scientist
		Kaiga		Damodaran	
5	Hindi workshop	Karwar	31/03/2012,	Dr. K.K.Philipose	Principal Scientist and
		Research			Scientist In Charge
		Centre			
				Dr.S.R.Krupesha	Senior Scientist
				Sharma	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	
6	Hindi workshop	Karwar	22/06/2012 .	Dr. K.K.Philipose	Principal Scientist and
		Research			Scientist In Charge

		Centre			
				Dr.S.R.Krupesha	Senior Scientist
				Sharma	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	
7	Hindi workshop	Karwar	28/09/2012	Dr. K.K.Philipose	Principal Scientist and
		Research			Scientist In Charge
		Centre			
				Dr.S.R.Krupesha	Senior Scientist
				Sharma	
				Dr. Jayasree	Senior Scientist
				Loka	
8	"Hindi UNICODE	BSNL	20/6/2012	Dr.Divu	Scientist
	usage on	Karwar		Damodaran	
	Computers				
9	Hindi workshop	NPCIL,	30.10.2012	Dr.Divu	Scientist
		Kaiga		Damodaran	
10	Hindi workshop	NPCIL,	26.12.2012	Dr.Divu	Scientist
		Kaiga		Damodaran	
11	Hindi workshop	NPCIL,	10/01/2013	Dr.Divu	Scientist
		Kaiga		Damodaran	
11	TOLIC Hindi	Syndicate	24/01/2013	Dr.Divu	Scientist
	workshop	Bank,		Damodaran	
		Karwar			
	Hindi workshop	KRC,	28.9.2013	Dr. K.K.Philipose	Principal Scientist and
		Karwar			Scientist In Charge
				Dr.	Senior Scientist
				S.R.Krupesha	
				Sharma	
				Dr. Senthil	Senior Scientist

				Murugan	
				Dr.Divu	Scientist
				Damodaran	
12	38 <sup>th</sup> meeting of	Syndicate	28.11.2013	Dr.	Senior Scientist
	TOLIC Hindi	Bank,		S.R.Krupesha	
	workshop	Karwar		Sharma	
				Sri Vaidya G	Technical Officer
				Narayan	
	Hindi workshop	KRC,	19.3.2014	Dr. K.K.Philipose	Principal Scientist and
		Karwar			Scientist In Charge
				Dr.	Senior Scientist
				S.R.Krupesha	
				Sharma	
				Dr. Senthil	Senior Scientist
				Murugan	
				Dr. Jayasree	Senior Scientist
				Loka	
				Dr.Divu	Scientist
				Damodaran	

#### f. Major events organized by the Centre:

The centre organized several workshops, brainstorming sessions, exhibitions and training programmes on Open sea cage culture development and expansion all over India. Exhibition. The centre had organized for the first time in the history of ICAR a national consultation for the integrated development of Uttarkannada district in September 2012, in which Directors and Scientists from 15 ICAR research institutes participated and a project titled "Uthan" was formulated for the overall integrated development of the district.

- 1. Stake holders meet on the impact of fishing ban conducted by FSI on 21.12.2009 at KRC of CMFRI, Karwar.
- 2. Cage harvest festival of open sea cage culture was inaugurated by Shri. Anand Asnotikar, Hon. Minister for fisheries, Govt. of Karnataka in July 2010
- 3. National workshop on "Open Sea Cage Farming" held on 17 & 18 July, 2010.

- 4. National work shop on open sea cage farming in July 2010 organized by Karwar Research Centre of CMFRI, Karwar.
- "Krishi Mela Fishery exhibition" conducted by Agriculture, Horticulture, and Fisheries Department, Karwar in collaboration with NFDB, Hyderabad from 9<sup>th</sup>, 10<sup>th</sup> and 11<sup>th</sup> of October 2010 at Karwar Beach.
- 6. National Consultation on "Integrated Development of Uttarkannada District" conducted by ICAR, New Delhi in association with Govt. of Karnataka during December, 2012.
- 7. Three mariculture workshops and several Training Programmes on open sea cage farming and were organized at the Karwar RC of CMFRI.
- 8. Dr.S.Ayyappan, Secretary, DARE and DG ICAR visited the Karwar marine farm on 02-09-2012.
- 9. Smt. Imkongla Jamir, Deputy Commissioner of Uttarkannada visited the Karwar marine farm during 2013.
- 10. Dr. Paul Pandian, Executive Director, NFDB, Hyderabad visited the Karwar marine farm during 2013.
- 11. Honourable Minister of Agriculture, Sri Sharad Pawar visited the Karwar marine farm during April 2013.
- 12. Shri Shreeshan Raghavan, Joint Secretary Department of Biotechnology, Government of India, visited Karwar Center and marine farm during December 2013
- 13. 15 member Norwegian delegation visited Karwar Center and marine farm during January 2014
- 14. Karwar Research Centre participated in the Aqua Goa Mega fish festival, 2014 at Navelim, Goa.
- 15. Karwar Research Centre hosted Coastal Biodiversity Conservation organized by Karnataka Biodiversity Board, Karnataka on 18<sup>th</sup> February 2014.

#### 16. Sports, recreational research and vocational health facilities to the

**Staff:** Facilities are created for the staff to play sports as a part of this, a recreational club has been formed at Annexe building. All the staff members are being actively participating in all recreational programmes and sports conducted at the centre.

#### 17. Collaboration with others:

**a.** Local Institutions in the area (educational, research and infrastructural facilities) : The centre provides all the laboratory facilities for the P.G students of Department of Studies in marine Biology, Karnataka University, P.G. Centre, Karwar and other Fishery Departments from Maharastra, Goa and Kerala.

1. District Administration

2. Department of Fisheries, Govt of Karnataka

- 3. Dept. Of Fisheries, Govt. of Kerala
- 4. Dept. Of Fisheries, Govt. of Goa

#### b. National Institutes and agricultural universities:

- 1. Central Institute of Brackish water Aquaculture
- 2. Indian Council of Agricultural Research Complex, Goa
- 3. Marine Export Product Development Authority
- 4. Karnataka Biodiversity Board
- 5. Department of Animal Husbandry and Fisheries (DAAHDF), New Delhi
- 6. National Fisheries Development Board, Hyderabad
- 7. Fishery Survey of India
- 8. College of Fisheries, Mangalore
- 9. College of Fisheries, Ratnagiri

#### c. International institutions:

- 1. Dr. S.R.Krupesha Sharma, Senior Scientist, KRC, was deputed to University of Stirling, U.K for a three month period from August to November 2010 under NAIP Programme by ICAR, New Delhi.
- Dr. Jayasree Loka Senior Scientist, KRC, deputed to NOVA University Fort Lauderdale, Florida, USA for a three month period from October 2013 to January 2014 under NAIP Programme by ICAR, New Delhi.
- Dr. Divu Damodaran Scientist, KRC, deputed for an NAIP International training on "Marker Assisted Selection (Fisheries)" at Institute of Aquaculture, University of Sterling from 30/10/2013 till 28/01/2014

4. Norwegian delegation team visited to Karwar Research Centre of CMFRI, Marine Farm of CMFRI and Marine Hatchery Complex of Karwar Research Centre on 8th January 2014.

**d. Extension and development agencies**: Collaborated with Fisheries Development agencies of Karnataka, Goa, Maharastra, Tamilnadu and Kerala and expanding cage culture programmes of marine finfish along the coasts of all these three states.

Major agencies of collaboration under cage farming are:

- 1. Maharastra Fisheries Development Board
- 2. State Fisheries Department of Goa and
- 3. Karnataka Fisheries Development Board
- 4. National Fisheries Development Board
- 5. Matsyafed, Kerala State Cooperative Federation for Fisheries Development Limited
- 6. Rajiv Gandhi Centre for Aquaculture, Srikali, Tamil Nadu (A Society under MPEDA)

**e. Research extension linkages**: Comment on the usefulness of extension activities and such collaborations and suggestions for further improvement:

Collaborated with Government organizations like Karnataka Fisheries Development Board, Maharastra Fisheries Development Board and state fisheries department of Karnataka, Maharastra and Goa. Fishermen and farmers are given the cages and consultancy services for the cage farming technologies including designing, nursery rearing, feeding and net exchange technologies etc.). Under the TTC programme, the centre has trained self- help Groups, Sthree Shakti, fishermen and shrimps farmers of Uttara Kannada district in Mussel Farming. Participatory programmes also carried out by Karwar Research Centre and many farmers and entrepreneurs got trained under this programme, initiated the cage farming in their respective areas

# 18. Training programmes organized (date, subject, no. of beneficiaries, source of fund, duration, impact of training programme)

SI.N	Date	Subject	No. of	Source of	Duration	Impact of training
0			benefic	fund		
			iaries			
1	7.3.2011	Open sea cage	30	NFDB	7.3.11 to	All the participants are given
		farming of marine			16.3.11	hands on training on cage
		finfish and shellfish			(10 days)	farming of marine finfishes and
						all are supported with
						consultancy services from KRC
						of services for sustainable cage
						culture
2	October	Open Sea cage	20	NICRA	5 days	All the participants are given
	2011	culture				hands on training on cage
						farming of marine finfishes
3	November2	Open Sea cage	19	NICRA	5 days	All the participants are given
	011	culture				hands on training on nursery
						rearing, mooring, transportation
						and cage farming of marine
						finfishes
4	November2	Open Sea cage	18	NICRA	5 days	All the participants are given
	011	culture				hands on training on nursery
						rearing, mooring, transportation

						and cage farming of marine
						finfishes
5	November2	Open Sea cage	16	NICRA	5 days	All the participants are given
	011	culture				hands on training on cage
						farming of marine finfishes
5	December	Open Sea cage	6	NICRA	3 days	All the participants are given
	2011	culture				hands on training on cage
						farming of marine finfishes
6	December	Open Sea cage	12	NICRA	5 days	All the participants are given
	2011	culture				hands on training on cage
						farming of marine finfishes
7	December	Open Sea cage	18	NICRA	7 days	All the participants are given
	2011	culture				hands on training on cage
						farming of marine finfishes
8	January	Open Sea cage	17	NICRA	5 days	All the participants are given
	2012	culture				hands on training on cage
						farming of marine finfishes
9	27.2.2012	Open Sea cage	20	NICRA	27.2.2012	All the participants are given
		culture			to	hands on training on cage
					3.3.2012	farming of marine finfishes
					(5 days)	
10	19.3.2012	Open sea cage	15	NICRA	19.3.2012	All the participants are given
		farming of marine			to	hands on training on cage
		finfish and shellfish			24.3.2012	farming of marine finfishes and
					(6 days)	initiated cage farming as an
						alternate source of fishing
11	27.3.2012	Open sea cage	20	NICRA	27.3.2012-	All the participants are given
		farming of marine			29.3.2012	hands on training on cage
		finfish and shellfish			3 days	farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
12	26.7.12	Open sea cage	20	NICRA	26.7.12 to	All the participants are given
		farming of marine			28.7.12	hands on training on cage

		finfish and shellfish			(3 days)	farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
13	10.9.2012	Open sea cage	13	NICRA	10.9.2012-	All the participants are given
		farming of marine			14.9.2012	hands on training on cage
		finfish and shellfish				farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
14	28.9.2012	Open sea cage	20	NICRA	28.9.2012	All the participants are given
		farming of marine			- 30.9.201	hands on training on cage
		finfish and shellfish				farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
15	10.1.13	Open sea cage	13	NICRA	10.1.13 to	All the participants are given
		farming of marine			11.1.13	hands on training on cage
		finfish and shellfish			(2 days)	farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
16	15.1.13	Open sea cage	20	NICRA	15.1.13 to	All the participants are given
		farming of marine			19.1.13	hands on training on cage
		finfish and shellfish			(5days)	farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
17	22.1.13	Open sea cage	12	NICRA	22.1.13 to	All the participants are given
		farming of marine			26.1.13	hands on training on cage
		finfish and shellfish			(6 days)	farming of marine finfishes
18	4.2.13	Open sea cage	23	NICRA	4.2.13 to	All the participants are given
		farming of marine			8.2.13	hands on training on cage
		finfish and shellfish			(5 Days)	farming of marine finfishes
19	30.5.13	Open sea cage	16	NICRA	30.5.13 to	All the participants are given
		farming of marine			1.6.13	hands on training on cage
		finfish and shellfish			(3 days)	farming of marine finfishes

20	17.6.13	Open sea cage	24	NICRA	17.6.13 to	All the participants are given
		farming of marine			21.6.13	hands on training on cage
		finfish and shellfish			(5 days)	farming of marine finfishes
21	25.6.13	Open sea cage	19	NICRA	25.6.13 to	All the participants are given
		farming of marine			29.6.13	hands on training on cage
		finfish and shellfish			(5 days)	farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
22	8.7.13	Open sea cage	22	NICRA	8.7.13 to	All the participants are given
		farming of marine			12	hands on training on cage
		finfish and shellfish			.7.13	farming of marine finfishes and
					(5 days)	initiated cage farming as an
						alternate source of fishing
23	5.8.13	Open sea cage	15	Mumbai	5.8.13 to	All the participants are given
		farming of marine		Maharastra	9.8.13	hands on training on cage
		finfish and shellfish		(HRD)	(5 days)	farming of marine finfishes and
						all are supported with
						consultancy services from KRC
						of services for sustainable cage
						culture
24	12.10.13	Open sea cage	10	NICRA	12.10.13 -	All the participants are given
		farming of marine			15.10.13	hands on training on cage
		finfish and shellfish			(4 days)	farming of marine finfishes and
						initiated cage farming as an
						alternate source of fishing
25	15.1.14	Open sea cage	16	Maharastra	15.1.14 to	All the participants are given
		farming of marine		(HRD)	18.1.14	hands on training on cage
		finfish and shellfish			(4 days)	farming of marine finfishes and
						all are supported with
						consultancy services from KRC
						of services for sustainable cage
						culture
26	25.2.14	Open sea cage	20	NICRA	25.2.14 to	All the participants are given

farming of marine	1.3.14	hands on training on cage
finfish and shellfish	(5 days)	farming of marine finfishes and
		initiated cage farming as an
		alternate source of fishing

## 19. Consultancies:

1. Rapid EIA Study on the Pilot Project of MPEDA on Open Sea Offshore Cage Culture off Karwar Coast **for** MPEDA, Kochi.- **To** conduct intensive sampling of hydrological, biological and physicochemical characteristics of the said water body in order to advise the client the suitability of the site for the proposed offshore cage culture of finfishes.

2. Marine Fisheries census" work along with fishermen village Infrastructure census in April-May of 2010 under DAHD programme.

3. Surat consultancy project for aquarium – Development of fresh and brackish and marine aquarium for Surat Municipal Corporation, Surat, Gujarat. 2010

4. Development of Oceanarium for Surat Municipal Corporation, Surat, Gujarat. 2010

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