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Logo Description : It symbolizes an elephant within an ecological frame of peace and harmony moving towards prosperity and posterity. **Cover photo description** (Anticlockwise from top) : 1. Dominant species found in macro-benthic samples of Chilika lake, *2. Plagiochasma appendiculatum* Lehm et Lindenb, 3. RAPD band patterns of *V. parahaemolyticus* using OPA- 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 Random primers (L-R), M- 1kb DNA ladder, 4. Albino Common krait *Bungarus caeruleus)* rescued from VilI. Nischintakoili, Cuttack, Orissa, 5. Fence Diagram of Puri District, Orissa and 6. A red line turpido fish (*Puntius denisonii*), an endangered fish displayed in a recreated aquatic ecosystem.

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EDITORIAL

Human beings have been the de facto rulers of our planet earth for ages now. Since the prehistoric stone ages, the man (homo sapiens) has evolved and developed more than perhaps any other species or at least that is how man has assessed it.

And if you look back at the entire saga of human supremacy, we have virtually taken over the world, tamed every lesser beast in hierarchy, at times even molded the nature to suit to our needs. But then the question arises whether or not our perspective is truly a holistic one. Even now a cyclone wrecks havoc, an earthquake shatters millions and issues like global warming have started sending shivers down our spines.

Over the years, the world's political and social changes have been monitored by a number of philosophers. Great thinkers like Socrates, Plato and Aristotle formulated the basic principles of political thought. Hobbs, John Locke and Karl Marx preached their own line of thoughts and concepts. Great leaders like Lenin, Nehru, Tito and Mao chose the philosophies most suited to their context and created the entire societies based on these philosophies. However unfortunately every great thinker or leader framed rules and regulations to suit just one species i.e. human beings (homo sapiens). Seldom equal importance was given for the interests of other species.

There has been a significant lack of awareness or sincerity when it comes to enriching or at least preserving nature and maintain its balance. We do not have a direct mode of communication with nature or its 'lesser beings' of lower profiles. But that does not give us the conscientious license to ignore the basic principles of our eco system or to turn a blind eye to the serious imbalances that might surface due to protracted negligence. Issues like Global warming, climate changes, diseases and loss of species are already enough reasons for concern.

An increased global temperature will shift ecosystems. Glaciers will retreat, altering water supply for habitats and millions of people and animals. Plant productivity will vitaly deteriorate, destroying fragile ecosystems. Overall, the effects are widespread and largely irreparable.

The record highs of atmospheric gases are the result of burning fossil fuels, clearing of land and agricultural activities. According to the experts, the sharp increase of dramatic global warming in the past 50 years is attributable to human activity. Energy-related carbon dioxide emissions, resulting from petroleum and natural gas, represent 82 percent of our total human-made greenhouse gas emissions. Global warming is more than just glaciers and polar bears. The Great Lake is the largest freshwater body on the planet, the single largest source of surface fresh water in the world. Scientists estimate that the lakes are warmer and water levels are declining, with no end in sight.

Hence, we urge the scientific community, environment activists, politicians to take up a more proactive role in spreading awareness and impressing upon people the hazards of further negligence. Strong legislation that caps carbon emissions and makes polluters pay for the global warming gases they produce will mobilize funds for investment and help address our collective energy, economic and climate crises. We need to build a new energy economy that cuts global warming emissions at least 80 percent by mid-century. We have no more time to lose. The administration and general public should also take up initiatives to discard the age old theories and make sincere efforts to save our mother earth.

(**R.K. Samantaray**)
Editor-in-Chief

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RANDOM AMPLIFIED POLYMORPHIC DNA-PCR TYPING OF *Vibrio parahaemolyticus* ISOLATED FROM BLACK TIGER SHRIMP *Penaeus monodon*

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ABSTRACT

Vibrio parahaemolyticus isolated from *Penaeus monodon* were selected for the genotyping using RAPD-PCR. The isolates were obtained from different organs e.g. haepatopancreas, external surface, pleopods and telson of prawn and confirmed on Thiosulphate-Citrate Bile salt-Sucrose agar supplemented with 2% NaCl. For the RAPD study, 10 decamer random primers e.g. OPA, OPB, OPC, OPG and OPH were used for screening. Out of 100 primers tested, only 58 primers showed amplification of the genomic DNA of *V. parahaemolyticus* with more than 4 bands. Maximum no of bands were produced by OPA-3 and OPG-3. DNA fingerprinting pattern of *V. parahaemolyticus* showed 3-8 polymorphic bands in 5 series of selected primers. The molecular weight of the amplified product was ranged from 0.68-6.564 kbp. RAPD technique appeared to be a fast technique for genomic study of *V. parahaemolyticus* on the basis of their form of isolation and therefore, represents a powerful tool for epidemiological studies of this pathogen.

Keywords: DNA fingerprinting, RAPD-PCR, *Vibrio parahaemolyticus.*

INTRODUCTION

Aquaculture has seen a worldwide expansion over the past two decades (Naylor *et al.,* 2000) and has become one of the major economic activities in several countries (Balcazar *et al.,* 2006). With the rapid development of aquaculture; diseases have become a major constraint and the most limiting factor for the aquaculture industry. Among the causative agents of mass mortalities, *Vibrio* has been a major force. They include several species pathogenic for human and marine animals (Urakawa *et al.,* 1997). Bacteria of the genus *Vibrio* belong to the family Vibrionaceae are ubiquitous in marine and estuarine aquatic ecosystems in which shrimp occur naturally and are also farmed. Several *Vibrio* spp. form a part of the natural biota of fish and shellfish (Otta *et al.,* 1999). Some of the *Vibrios* constitute the most important shrimp pathogen, often causing heavy mortalities in aquaculture facilities worldwide (Austin and Austin, 1993). Vibriosis diseases caused by *Vibrio* species are known to be major disease problems in farmed marine animals, including penaeid shrimp, in which they have been recognized as potential pathogens since the beginning of shrimp farming (Bondad-Reantaso *et al.,* 2005; Goarant *et al.,* 2007). *Vibrio parahaemolyticus* is an important pathogenic and halophilic Gram-negative bacterium, which cause serious episode to marine animals, such as marine fish and shellfish including shrimp (Zorrilla *et al.,* 2003; Du *et al.,* 2007; Caburlotto *et al.,* 2008). Thus, it is essential to explore an effective epidemiology and pathobiology of this microorganism.

To describe the epidemiology and pathobiology of different *Vibrio* species and strains accurately typing methods have been used like phenotypic characteristics, biochemical test and serogrouping. All these methods have their own limitation and are time consuming with poor sensitivity. On the other hand technique used to analyze the bacterial DNA such as Randomly Amplified Polymorphic DNA (RAPD) fingerprinting, Polymerase Chain Reaction (PCR), Restriction Fragment Length Polymorphism (RFLP), Pulsed Field Gel Electrophoresis (PFGE), Plasmid profiling are gaining importance in recent years as these methods are fast, sensitive and accurate results can be obtained for interpreting its pathogenecity, virulence and identification (DePaola *et al.,* 2003; Kimura *et al.,* 2008).

The PCR based screening of microorganism is the need of the hour that generates picomoles of desired DNA to several copies of DNA, present even as a single copy in the initial preparation. It is fast reliable and sensitive tool for the molecular based diagnosis and detection of pathogen including bacteia, viruses and fungus. RAPD analysis of *Vibrio* species is based on the ability of a single primer of arbitrary nucleotide sequence to generate

Technologies, INC., Alameda, USA) and 1U Taq DNA polymerase (Banglore genei Pvt.Ltd). The final volume was adjusted to 25 µl with sterilized double distilled water. The tube was then placed in the thermal cycler with programme being set as follows: one cycle of initial denaturation step at 94°C for 4 min followed by 45 cycles of 45 second of 94°C (denaturing temp.), 36°C (annealing temp.) for 45 second and 72°C (extension temp) for 1.30 minute. The cycling was concluded by an additional final extension at 72°C for 7 minute and the reaction products were stored at 4°C until further analysis.

RAPD Primers

100 randomly designed 10-mer oligonuclotide primers (Operon Technologies, INC., Alameda, USA) were used for generating RAPD fingerprints. These primers had a G+C content of 60 to 70% and that they have no self- complementary ends. Out of 100 primers tested for RAPD fingerprinting, only 54 primers were selected for better amplification

Agarose gel Electrophoresis of RAPD amplified products

4 µl of the PCR product was added to 6 µl of 1X TBE buffer and 2 µl of gel loading dye. Molecular weight marker 1kb DNA ladder was used as a size standard. The mixture was electrophoresed on 1.2% agarose gel at 100V for 1h (Sambrook *et al.,* 1989). The gel were stained with ethidium bromide and photographed on gel documentation.

RESULTS AND DISCUSSION

The shrimp aquaculture industry suffers great economic losses due to disease outbreaks. Mass mortalities are encountered in culture and hatchery operations which are associated with *Vibrios*. This species exist as normal flora in fish and shellfish, but has been recognized as an opportunistic pathogen in many marine animals. Jayprakash *et al.,* (2006) revealed an association of this genus with *M. rosenbergii* (Khuntia *et al.,* 2008) *V. parahaemolyticus* is an important and dominant pathogenic *Vibrio* present in the shrimp aquaculture system. The infections caused by this microorganism greatly hampered the commercial culture practices. The present study is aimed at characterization of *V. parahaemolyticus* with the biochemical and molecular level so that further identification of this microorganism from diseased shrimp become easier and subsequent control measure can be adopted to prevent these diseases.

V. parahaemolyticus produces a green colony on TCBS agar. From the 30 isolated, based on their colony morphology, 17 isolated are found to be similar types of biochemical properties and could be represented as one strain of *V. parahaemolyticus*. The strains showed positive results towards O/F test, oxidase test, catalase test, motility test, indole test, methyl red test, citrate utilization test, hydrolysis of starch, gelatin and casein, lysine decarboxylase test, ornithine decarboxylase test, fermentation of manitol and maltose etc. But this strain showed negative result in urease test, Voges Proskaair test, arginine dehydrolase test, H_2S gas production, and fermentation of sorbitol, sucrose, trehalose, salicin, arabinose and glycerol (Table 1). The quantitative estimation of the *V. parahaemolyticus* DNA was based on the spectrophotometric determination. The DNA samples of *V. parahaemolyticus* corresponded to 300-800 µg/ml.

Table 1: Biochemical test of *Vibrio arahaemolyticus* isolated from black tiger shrimp

Sl No.	Biochemical Test Parameter	*Vibrio parahaemolyticus*
1.	Oxidation fermentation test	+
2.	Oxidase	+
3.	Catalase	+
4.	Motility	+
5.	Urease	-
6.	TCBS growth	G
7.	Indole	+
8.	Methyl Red	+
9.	VP test	-
10.	Citrate	+
11.	Hydrolysis of starch	+
12.	Gelatin	+
13.	Casein	+
14.	Gas	-
15.	H_2S	-
16.	Arginine dehydrolase	-
17.	Lysine decarbonxylase	+
18.	Ornithine decarboxylase	+
19.	Acid from Sorbitol	-
	Sucrose	-
	Manitol	+
	Trehalose	-
	Salicin	-
	Arabinose	-
	Glycerol	-
	Maltose	+

Note: G: green; +: Positive; - : Negative

Table 2: Summary of the number and molecular weight range of amplified products of Vibrio parahaemolyticus

Name of primers	Sequence (5'-3')	Mw range (kbp) of amplified DNA fragments	Name of primers	Sequence (5'-3')	Mol.wt range (kbp) of amplified DNA fragments
OPA-01	CAGGCCCTTC	0.459-2.208	OPC-15	GACGGATCAG	0.621-2.509
OPA-02	TGCCGAGCTG	0.439-1.987	OPC-20	ACTTCGCCAC	0.436-0.925
OPA-03	AGTCAGCCAC	0.439-3.370	OPG-02	GGCACTGAGG	1.083
OPA-04	AATCGGGCTG	0.473-2.647	OPG-03	GAGCCCTCCA	0.975-6.564
OPA-05	AGGGGTCTTG	0.701-2.276	OPG-04	AGCGTGTCTG	2.456-4.015
OPA-06	GGTCCCTGAC	0.439-2.276	OPG-05	CTGAGACGGA	1.834- 3.264
OPA-07	GAAACGGGTG	0.554-1.957	OPG-06	GTGCCTAACC	NO AMPLIFICATION
OPA-08	GTGACGTAGG	0.791-2.529	OPG-08	TCACGTCCAC	2.767-3.898
OPA-09	AGGGGTCTTG	NO AMPLIFICATION	OPG-09	CTGACGTCAC	2.054-3.164
OPA-10	GGTCCCTGAC	0.507-2.175	OPG-10	AGGGCCGTCT	0.264-4.457
OPA-11	CAATCGCCGT	0.452-3.802	OPG-11	TGCCCGTCGT	0.672-4.137
OPA-12	TCGGCGATAG	0.266-1.608	OPG-12	CAGCTCACGA	2.809-4.523
OPA-13	CAGCACCCAC	0.445-2.242	OPG-13	CTCTCCGCCA	1.744-2.809
OPA-14	TCTGTGCTGG	0.445-2.242	OPG-14	GGATGAGACC	1.184-6.184
OPB-01	GTTTCGCTCC	0.963-2.758	OPG-15	ACTGGGACTC	2.981-4.199
OPB-02	TGATCCCTGG	1.913-4.852	OPG-16	AGCGTCCTCC	1.115-3.026
OPB-03	CATCCCCCTG	1.483-4.109	OPG-17	ACGACCGACA	0.537-5.096
OPB-05	TGCGCCCTTC	1.978-4.109	OPG-19	GTCAGGGCAA	4.523-5.250
OPB-06	TGCTCTGCCC	1.162-3.404	OPG-20	TCTCCCTCAG	2.849- 3.218
OPB-13	TTCCCCCGCT	1.935-2.789	OPH-02	TCGGACGTGA	0.569-0.860
OPB-14	TCCGCTCTGG	1.137-3.293	OPH-03	AGACGTCCAC	1.009-2.515
OPB-15	GGAGGGTGTT	2.728-3.293	OPH-04	GGAAGTCGCC	0.254-2.273
OPB-18	CCACAGCAGT	1.892-3.115	OPH-05	AGTCGTCCCC	1.676-3.667
OPC-02	GTGAGGCGTC	0.385-0.711	OPH-06	ACGCATCGCA	1.676-4.178
OPC-04	CCGCATCTAC	0.361-1.690	OPH-07	CTGCATCGTG	0.952-1.628
OPC-08	TGGACCGGTG	0.511-2.371	OPH-09	TGTAGCTCCC	0.625-1.995
OPC-09	CTCACCGTCC	0.493-1.472	OPH-11	CTTCCGCAGT	0.994-2.515
OPC-11	AAAGCTGCGG	0.516-2.262	OPH-12	ACGCGCATGT	0.483- 2.774
OPC-14	TGCGTGCTTG	0.573-1.107	OPH-16	TCTCCAGCTGG	0.68-1.828

characterize the different strains of *V. parahaemolyticus*

CONCLUSION

In the present study Genotyping systems including RAPD analysis may prove to be useful tools for epidemiological studies of *V. parahaemolyticus*. RAPD–PCR is easier to perform and more sensitive, inexpensive than other molecular based techniques. The common typing bands as revealed by various primers will be useful for preliminary identification purpose for unknown strains of *V. parahaemolyticus*

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FINGER PATTERN ANALYSIS IN IDENTICAL TWINS

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ABSTRACT

Finger patterns s are characteristic features of fingerprints of all human beings. In this study finger patterns of 50 pairs of identical twins have been analysed. It is observed that the twin pairs exhibit different types of finger patterns like arch, loop, whorl and composite. The study showed, most of the identical twin pairs are not completely concordant in their finger patterns. However, respective hands of two pairs out of 50 pairs (4 per cent) of identical twins exhibit 100 per cent concordance in finger patterns.

Key words : Fingerprint, finger pattern, arch, loop, whorl, composite

INTRODUCTION

Dactylography (Gr. *daktylos* – finger; *graphein* - to write) is the scientific study of fingerprints. The identification of an individual from fingerprints is still believed to a subject of mystery to the general public. The inner surface of human hand termed as palmar or thenar surface. The under surface of the foot known as plantar surface are covered with a thick layer of skin having alternate arrangement of elevations and depressions (Galton ,1895, Larson,1924, Bose, 1927, Brewester, 1936, Browne and Brock, 1953, Alexander, 1975). The elevations and depressions are known as ridges and furrows respectively (Fig.1). The ridges and furrows on the finger balls form various patterns like arch, loop, whorl and composite (Scott,1951, Bridges *et al*. 1963, Hardless, 1970, Moenssens,1975, Singh,1978, Almog *et al*.1987, Lennard et al .1988). The finger patterns of identical twins depict are not completely concordant in their finger patterns except very few cases.

MATERIALS AND METHODS

During survey and analyses of 103 pairs of twins and five sets of triplets from the year 1999 to 2005, finger patterns of 50 pairs of identical twins have been analysed . The finger prints of both right and left hands were collected on the plain white papers by using ink slab (Fig. 2). These were examined and analysed by the help of the magnifiers like dinoscan, linen tester and hand lens. Considering the similarities and dissimilarities in finger patterns of twin pairs, the percentage of concordance and discordance was calculated respectively and histogram was developed to interprete the concordance and discordance in finger patterns of identical twins.

RESULTS AND DISCUSSION

The finger prints of the twins showed four different patterns like loop, whorl, arch and twinned loop. Their similarities in respective fingers among the twins have been analysed . With respect to finger patterns, prints of right hand finger balls of 2 , 8 , 18 , 42 and 30 percent of twins showed 20, 40, 60, 80 and 100 percent of concordance respectively (Table 1) . The prints of left hand finger balls of 4 , 8 , 30 , 50 and 8 per cent of twins showed 20, 40, 60,80 and 100 percent concordance respectively in finger patterns (Table 1). Amongst 100 percent identical twins, the ratio of concordance in finger prints of right hand was 2 : 8 : 18 : 42 : 30 respectively and that of left hand was 4 : 8 : 30 : 50 : 8 respectively (Figs.3 and 4). It was further observed that only two pairs (Table 2) out of 50 pairs of twins (4%) show 100% of concordance in their corresponding right hand and left hand finger print patterns .

The palm and fingers of all human beings are characterized by ridges, furrows, and crease marks. The fingerprints offer one of the important clues for the detection of crimes. Sir Francis Galton, an English Biologist, reported fingerprints as a means of identification as an automatic sign manual and

was found to be specific to every individual. He classified the prints into three classes such as arch, loop and whorl which was subsequently divided into four groups such as arch, loop, whorl and composite (Fig . 2) by Sir Edward Richard Henry. These are designated as A, L, W and C respectively.

In arches (Fig.2i), the ridges run from one side to the other without backward recurvature. Normally, there is no delta in plain arches. In another type of arch called tented arch (Fig. 2 .ii), the ridges at the core or center have an upward thrust in the shape of a tent and ridges above the tent arranging themselves on both sides of tent or spine or axis, towards which the adjoining ridge converge. In loops, the ridges or ridge enter and exit on the same side of the pattern and there must be at least one ridge between the delta and the core. Ulnar loops slant towards the little finger and radial loops slant towards the thumb (Figs. 2 . iii and iv). However, the whorl is a pattern in which the ridges form a series of circles or spirals around the core or axis (Fig. 3.xv). There are two deltas, one on the right and then another on the left (Fig. 2 . v). Whorls can be classified according to their form of the core such as single cored, double cored and oval or elliptical (Fig. 2 . v-vii) whereas a composite pattern means combination of two or more patterns either of same or different types in one print. The composite may be classified as central pocket, lateral pocket, twinned loop and accidental (Figs.2 . viii – xi).

The classification of patterns depends on the formation of fixed points such as outer terminus (O.T.) in delta and inner terminus in core (Fig.2). When a ridge bifurcates and the two arms of the bifurcating ridge diverge causing an interspaces within which the pattern lies, the point of bifurcation is called “delta” represented by ‘D’ (Fig. 3 i-iv) whereas core means the central part of pattern . The type of core varies according to the pattern and represented as ‘ C’ (Fig. 3 .v-xx) . This is as an efficient and effective tool in forensic science for crime investigation and detection.

Among twin pairs ,finger patterns like arch , radial loop, ulnar loop,whorl, central pocket and twinned loop are observed. The study on finger patterns emphasizes most of the twin members are not completely concordant in their finger patterns except two cases . Hence , further study is suggested to know differences in ridges of the similar finger patterns of identical twins of a larger sample.

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MATERIALS AND METHODS

A total of 19 stations (Map 1) were selected from the four sectors on basis of the salinity variation. Ekman dredge (15.2 X 15.2) cm was used randomly in the selected stations for collection of bottom biota. Sample after collection was transferred to a suitable enamel container and metal sieve No. 40 was used for sieving, which retained only macro organisms. A part of the dredge sample was taken in the sieve and washed with sufficient quantity of water. After that the sieved macro-organisms were transferred into a wide mouthed bottle. The same process was followed for the residual part of the sample. Finer grade of sieve such as No. 60 was used for different size of macro-organisms. The sieved material was preserved in 5-10% formalin for further laboratory analysis.

Estimation

The preserved samples were placed in enamel tray and segregated into species, genera or groups accordingly. All the organisms were qualitatively identified under one or more of the above heads. For each individual group the number of macro-organisms per square meter was calculated as per Jhingran (1969). To estimate the total quantitative abundance of a sector the data from the selected stations were pooled together.

$$N = n / ah$$

Where, N = number of macro-organisms per square meter

n = number of macro- organisms per sample area

a = area of Ekman dredge in sq. m

h = number of hauls

The physico-chemical characteristics of water were analysed by following the standard procedure of APHA (1998).

RESULTS AND DISCUSSION

A total of 44 species of macro-benthic fauna belonging to 36 genera have been recorded from Chilika Lake during the investigation period. The range of water quality parameters is illustrated in Table 1. The diversity and the pattern of distribution of the macro-benthos are given in Table 2.

The abundance of macro-benthic fauna of the Lake fluctuated from 18316 to 24467 no./m^2 in 2003-04 and 20110 to 26042 no./m^2 in 2004-05

Table 1: Physico-chemical parameters of water from 2003 - 2005

St. No.	Water Temperature (^{0}C)	DO	pH	Total Alkalinity (ppm)	Salinity (ppm)	NO_3(ppm)	PO_4(ppm)
1	21.0-31.0	4.8-7.6	7.4-8.4	62-114	14.83-20.57	0.119-0.226	0.024-0.056
2	21.0-30.8	4.8-8.6	7.3-8.45	58-106	18.64-25.00	0.09-0.216	0.012-0.174
3	22.0-30.0	5.02-8.1	7.4-8.45	68-109	25.08-31.08	0.106-0.198	0.02-0.04
4	21.5-31.0	5.4-8.5	7.25-8.6	70-98	2.34-19.60	0.072-0.208	0.002-0.05
5	19.0-30.6	5.2-8.6	7.2-8.4	62-93	0.57-8.50	0.06-0.2	0.01-0.252
6	20.0-30.1	5.8-11.2	7.0-8.1	46-93	0.39- 0.93	0.08-0.202	0.016-0.054
7	20.1-29.4	5.4-10.7	7.15-8.4	52-95	0.57-1.95	0.044-0.178	0.022-0.128
8	19.0-29.9	5.2-10.5	7.25-8.2	58-78	1.04-17.80	0.052-0.208	0.026-0.056
9	19.0-31.0	4.48-6.4	7.35-8.5	54-94	0.72-18.32	0.056-0.116	0.012- 0.112
10	20.5-30.8	5.0-10.8	7.5-8.6	64-128	1.93-9.96	0.04-0.22	0.016-0.084
11	19.5-30.6	5.2-10.4	7.4-8.6	68-98	2.05-12.48	0.064-0.332	0.016-0.102
12	18.0-30.0	5.0-10.0	7.4-9.2	72-93	2.56-18.8	0.092-0.241	0.026-0.048
13	20.0-28.0	5.1-8.8	7.5-8.5	64-102	7.79-21.60	0.036-0.232	0.014-0.134
14	20.0-29.0	4.24-10.8	7.8-8.6	68-106	6.89-22.77	0.056-0.259	0.012-0.038
15	20.2-30.2	5.08-9.6	7.5-9.1	74-102	7.79-21.87	0.044-0.216	0.014-0.022
16	18.5-30.0	5.02-9.2	7.4-8.6	74-110	13.39-22.59	0.056-0.204	0.014-0.026
17	20.0-30.7	6.04-9.6	7.45-9.1	70-102	7.88-20.25	0.042-0.256	0.01-0.042
18	19.0-30.0	6.8-8.8	7.4-9.2	82-106	3.46-9.80	0.076-0.26	0.012-0.046
19	23.0-25.8	4.4-12.8	7.2-8.45	68-96	1.02-3.10	0.1-0.216	0.014-0.02

	SPECIES	SEASON	OC	NS	CS	SS
8	*Cerithidea singulata*	Summer	+			+
		Monsoon	+	+	+	+
		Winter	+		+	+
9	*Cerithidea obtusa*	Winter	+			
10	*Pseudonerita obtusa*	Winter	+			
11	*Stenothera deltae*	Winter	+			
12	*Stenothera blanfordiana*	Winter			+	
13	*Umbonium vestianum*	Monsoon	+			
		Winter	+			
14	*Brotia costula*	Summer		+		
		Winter		+		
15	*Timoclea imbricata*	Winter			+	
16	*Columbella duclosiana*	Winter			+	+
17	*Columbella sp.*	Summer		+	+	
		Monsoon	+	+	+	+
		Winter				+
18	*Gyraulus velifer*	Summer		+		
		Monsoon		+		
19	*Olivancillaria gibbosa*	Monsoon	+			
20	*Rapana rapiformis*	Monsoon	+			
21	*Pugilina sp.*	Monsoon			+	
22	*Larina burmana*	Monsoon	+			
		POLYCHAETA				
1	*Gammerus sp.*	Summer				+
		Monsoon	+	+	+	+
		Winter	+	+	+	+
2	*Nepthys polybranchia*	Summer	+			+
		Monsoon	+		+	+
		Winter	+	+	+	+
3	*Aeolosoma hemprichii*	Winter	+			
4	*Nereis limnicola*	Monsoon		+		
		Winter				+
5	*Tendipes tentaus*	Winter				+
6	*Sabellaria sp*	Summer				+
		Monsoon				+
		Winter				+
7	*Pareicola ventricosa*	Monsoon			+	+

(Table 2). The pattern of seasonal fluctuation was relatively higher during summer (333-13437 no./m^2 in 2003-04 and 581-14633 no./m^2 in 2004-05) followed by winter (2799- 13251 no./m^2 in 2003-04 and 3093-13066 no./m^2 in 2004-05) and monsoon (1882-8733 no./m^2 in 2003-04 and 1863-9363 no./m^2 in 2004-05). The sectoral variation was highest in Northern Sector (3585-13437 no./m^2 in 2003-04 and 4094- 14633 no./m^2 in 2004-05) followed by Central Sector (7449-13251 no./m^2 in 2003-04 and 9363-13066 no./m^2 in 2004-05), Southern Sector (2017-4116 no./m^2 in 2003-04 and 2237-4790 no./m^2 in 2004-05) and Outer Channel (333-2799 no./m^2 in 2003-04 and 581-3093 no./m^2 in 2004-05).

Table 4: Sector-wise percentage abundance of benthic groups in Chilika Lake

	GROUPS	O.C		N.S		C.S		S.S		TOTAL	
		2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05	2003-04	2004-05
Monsoon	Gastropodaa	74.34	65.75	52.55	57.55	34.16	32.32	39.67	38.75	43.13	42.08
	Bivalve	19.51	22.87	31.16	29.9	52.28	55.71	23.46	21.55	38.31	39.27
	Oligochaeta	0	0	1.39	1.91	0	0	0.8	1.17	0.45	0.67
	Amphipoda	0	0	0	0	0	0	3.23	4.89	0.73	1.16
	Mysis	0	0	0	0	0	0	0.41	0.71	0	1.02
	Insecta	0	0	0	0	0	0	0	0	0.09	0
	Polychaeta	6.22	11.38	14.89	10.65	11.27	11.97	32.41	32.94	16.21	16.64
Winter	Gastropodaa	76.77	76.17	47.64	45.54	19.12	17.82	25.15	24.78	32.97	32.37
	Bivalve	16.65	15.71	51.78	51.49	64.91	65.06	32.34	30.28	52.66	51.09
	Oligochaeta	0	0	0.89	1.06	0	0	2.37	0.91	0.47	0.38
	Amphipoda	0	0	0	0	0.25	0.51	3.59	2.75	0.54	0.64
	Mysis	0	0	0	0	0	0	0	0	0	0
	Insecta	0	0	0	0	1.13	1.21	0	0	0.61	0.61
	Polychaeta	5.39	8.12	1.77	1.92	14.59	15.4	36.54	41.29	13.08	14.91
Summer	Gastropodaa	69.97	57.83	94.9	94.7	33.55	28.4	33.07	32.45	69.52	67.64
	Bivalve	15.02	19.28	5.09	4.96	65.57	70.35	25.68	27.36	26.41	27.71
	Oligochaeta	0	0	0	0	0	0	0	0	0	0
	Amphipoda	0	0	0	0	0	0	4.96	5.95	0.43	0.52
	Mysis	0	0	0	0	0	0	2.48	2.95	0.22	0.26
	Insecta	0	0	0	0	0	0	0	0	0	0
	Polychaeta	15.02	22.89	0	0.34	0.89	1.26	33.17	31.29	3.38	3.87

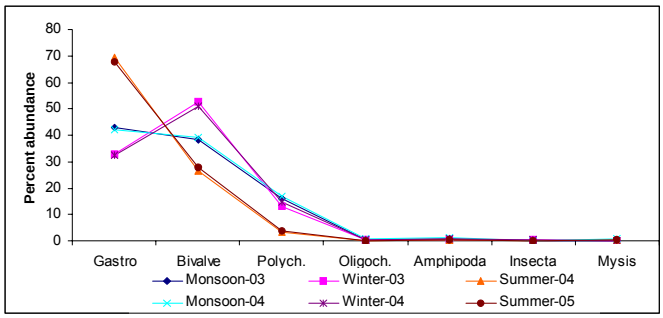

Fig 1: Percentage abundance of different groups of Benthos during 2003-05

minimum was recorded in Northern Sector 684 no/m^2 (5.09%) during summer. In 2004-05, its population ranged from 7034 no/m^2 (27.71%) during summer to 13305 no/m^2 (51.09%) during winter. Maximum abundance was recorded in Central Sector 5584 no/m^2 (70.35%) during summer and minimum was recorded in Northern Sector 726 no/m^2 (4.96%) during summer.

Polychaeta

The third most dominant group was polychaeta. In 2003-04, its population ranged from 785 no/m^2 (3.38%) during summer to 3201no/m^2 (13.08%) during winter. The maximum abundance was recorded in Southern Sector 1017 no/m^2 (36.54%) during winter and minimum was recorded in Northern Sector 100 no/m^2 (1.77%) during winter and almost negligible during summer. In 2004-05, polychaeta ranged from 983 no/m^2 (3.87%) during summer to 3347 no/m^2 (16.64%) during monsoon. Maximum abundance was recorded in Southern Sector 1500 no/m^2 (41.29%) during winter and minimum was recorded in Northern Sector 50 no/m^2 (0.34%) during summer.

Amphipoda

The next dominant group was amphipoda. In 2003-04, amphipoda almost consistent with very low fluctuation ranging from 100-133 no/m^2. Maximum abundance 100 no/m^2 (4.96%) was recorded in Southern sector during summer and minimum abundance 33 no/m^2 (0.25%) was recorded in Central sector during winter. The population was almost negligible in outer channel and Northern

1. *Mectra sp.,* 2. *Nectar sp.*, 3. *Modiolus sp.*, 4. *Parreysia sp.*5. *Neosolen sp.*, 6. *Nuculana sp.*, 7. *Macoma sp.*, 8. *Corbicula sp.*, 9. *Theora sp.*10. *Cerethidea sp.,* 11. *Umbonium sp.*, 12. *Cerethidea sp.*, 13. *Nassarius sp.*, 14. *Thiara sp.*, 15. *Brotia sp.,* 16. *Nassarius sp.*, 17. *Gyraulus sp.*, 18. *Thiara sp.,*19. *Columbella sp.,* 20. *Stenothera sp.,* 21. *Pseudonerita sp.,* 22. *Larina sp.*

Fig. 2: Dominant species found in macro-benthic samples of Chilika lake

of temperature tolerance since they normally live in a temperature regime that is closer to their upper tolerance limit. Therefore, the important variables controlling the distribution and abundance of benthic organisms in tropical regime are salinity (Parulekar and Dwivedi, 1974) and sediment stability (Alongi, 1990; Wildish and Kristmanson, 1979; Warwick and Uncles, 1980).

The pattern of seasonal fluctuation was relatively higher during summer followed by winter and monsoon. The smaller number of benthos appearing in the dredge samples, particularly during the monsoon season, may be due to the presence of macrophytes which typically harbour the majority of the invertebrate community (Kumar, 1985). The death and decay of submerged and floating weeds during the monsoon besides additional input of nutrients through surface runoff might have been responsible for greater colonization of macrobethic biota in the littoral regions of the lake (Sinha *et al.,*

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rainy seasons of 2001 to 2006 in a moist sub-humid alfisol at Phulbani in Orissa. The experiments were conducted with a set of 9 fertilizer treatments of organic and inoraganic sources viz., (1) FYM @ 5 t/ ha; (2) 10kg N (green leaf) + 35 kg N/ha (urea); (3) 20 kg N (green leaf) + 25kg N/ha (urea); (4) 30 kg N (green leaf) + 15kg N/ha (urea); (5) 10 kg N (FYM) + 35 kg N/ha (urea); (6) 20 kg N (FYM) + 25 kg N/ha (urea); (7) 30 kg N (FYM) + 15kg N/ha (urea); (8) 45 kg N/ha (urea) and (9) 45 kg N/ha (green leaf) in a randomized block design with 3 replications. Pigeonpea was grown in paired rows of 30/90 cm x 30 cm, while rice was grown in 15 cm apart rows. Five rows of rice were accommodated in inter-pair distance of 90 cm in pigeonpea crop. A seed rate of 62.5 kg/ha for rice and 20 kg/ha for pigeonpea and all other agronomic practices for the two crops were adopted (Vittal *et al.*. 2004). A recommended fertilizer dose of 45kg N/ha (urea) is normally applied for rice at the time of sowing in Orissa. The study was conducted with the twin objectives of (i) assessing the effects of monthly rainfall of June to October and fertilizer treatments on rice equivalent yield based on rice + pigeonpea intercropping; (ii) selection of an efficient fertilizer treatment for attaining maximum sustainable rice yield under moist sub-humid alfisols.

Rainfall and distribution in different years

The details of date of sowing and harvest of rice and rice and pigeon pea, crop growing period, annual rainfall, monthly rainfall of June to October, and rainy days in different years along with mean and coefficient of variation (%) over years are given in Table 1. The rainfall received in June ranged from 94 mm in 2005 to 505 mm in 2001 with a mean of 225 mm and variation of 68.7%. In July, a minimum rainfall of 129 mm was received in 2002 compared to a maximum of 798 mm in 2001 with a mean of 407 mm and variation of 57.1%. The August rainfall ranged from 140 mm in 2005 to 987 mm in 2006, while September rainfall ranged from a minimum of 125 mm in 2001 to a maximum of 572 mm in 2005. August and September received a mean rainfall of 393 and 265 mm with a variation of 76.7 and 64.9% respectively during 6 years. October received a rainfall in the range of 11mm in 2002 to 251 mm in 2005 with a mean of 137 mm and variation of 78.5% in the study. The rainfall received in different months in different years indicated that a high rainfall of 798 mm was received in July 2001 and August 2006 respectively. Similarly, an extremely low rainfall of 11 and 13 mm was received in October 2002 and 2006 respectively. The number of rainy days ranged from 58 in 2006 to 88 in 2003 under the study.

A minimum crop seasonal rainfall of 653 mm was received in 2002 compared to a maximum of 1647 mm in 2006. The total rainfall received during June to October was above a mean rainfall of 1083 mm in 2001 (1297 mm), 2005 (1269 mm) and 2006 (1647 mm), while it was below during the remaining 3 years. June received above mean rainfall of 225 mm in 2001 (505mm) and 2006 (298 mm), while July received above mean rainfall of 407 mm in 2001 (798mm), 2005 (500mm) and 2006 (413mm). August received above mean rainfall of 393 mm in 2006 (987mm), while September received above mean rainfall of 265 mm in 2003 (350 mm) and 2005 (572 mm). October received an above mean rainfall of 137 mm in 2003 (216 mm) (2004) and 251 mm (2005).

Table 1. Date of sowing and harvest of rice and pigeonpea and monthly rainfall at Phulbani

Year	Rice			Pigeonpea			ARF	RD	Jun	Jul	Aug	Sep	Oct
	DOS	DOH	CGP	DOS	DOH	CGP							
2001	22-Jun	13-Sep	84	22-Jun	4-Feb	228	1950	86	505	798	300	125	112
2002	21-Jun	23-Sep	95	21-Jun	27-Jun	221	888	64	149	129	329	135	11
2003	26-Jun	26-Sep	93	26-Jun	26-Feb	246	1452	88	117	237	358	350	216
2004	20-Jun	15-Sep	88	20-Jun	14-Feb	250	1381	69	188	364	242	229	218
2005	28-Jul	27-Oct	92	2-Jul	11-Feb	225	1629	61	94	500	140	572	251
2006	25-Jun	24-Sep	92	25-Jun	12-Jan	202	2031	58	298	413	987	176	13
Mean		91			229	1555	71	225	407	393	265	137	
CV		4.4			7.7	26.9	18.2	68.7	57.1	76.7	64.9	78.5	

DOS : Date of sowing;DOH : Date of harvest;CPG : Crop growing period; ARF : Annual rainfall (mm), RD: Rainy days; CV :Coefficient of variation (%)

crop growing period fertilizer N; and maximum yield "Y_{max}" attained by any treatment in the study period (Vittal *et al.,*2003; Maruthi Sankar *et al.,* 2006). The sustainable yield index of treatment 'i' could be given as

$$\eta_i = \left[\left(\bar{Y}_i - \Phi\right) / Y_{max}\right] * 100 \quad .....(4)$$

A fertilizer treatment which as a maximum 'h' value could be used for attaining sustainable rice yield over years. Ranks could be assigned to fertilizer treatments for (a) rice equivalent yield attained in individual years; and (b) mean rice equivalent yield, coefficient of variation and sustainable yield index of treatments over years. Based on the rank sum of each treatment,an efficient fertilizer treatment which has a minimum rank sum could be identified and prescribed for attaining maximum rice equivalent yield under moist sub-humid alfisols at Phulbani in Orissa.

RESULTS AND DISCUSSION

Effect of fertilizer treatments on crop yield in different years

Application of 30 kg N (FYM) + 15 kg N/ha (urea) gave a maximum rice equivalent yield of 5193 kg/ha under rice + pigeonpea in 2002. However, during 2001 to 2006, application of 20 kg N (FYM) +25 kg N/ha (urea) gave maximum mean rice equivalent yield of 3590 kg/ha with lowest variation of 16.8%. Application of FYM @ 5 t/ha gave a minimum mean rice equivalent yield of 2093 kg/ha with variation of 18.5%. The F-test indicated that there was a significant difference in rice equivalent yield attained by fertilizer treatments under rice + pigeonpea in all the 6 years. The rice equivalent yield attained by fertilizer treatments under rice + pigeonpea were used for calibrating regression models of yield through monthly rainfall and fertilizer N variables as postulatedin (1) to (3). The mean and coefficient of variation of rice equivalent yield along with sustainable yield index of different treatments are givenin Table 2.

Correlation of crop yield with rainfall and soil moisture variables.

Teatment wise estimates of correlation coefficients of rice equivalent yield with rainfall received in June, July,August,September and October,crop growing period, crop seasonal rainfall and time period (years) were determined (Table 3). The July rainfall had a significant negative correlation with rice equivalent yield attained by FYM @ 5 t/ha and 20 kg N (green leaf) + 25 kg N (urea). Similarly,October rainfall had a significant negative correlation with rice equivalent yield attained by 10 kg N (green leaf) + 35 kg N (urea), 30 kg N (green leaf) + 15 kg N (urea), 10 kg N (FYM) +35 kg N (urea), 30 kg N (FYM) + 15 kg N (urea) and 45 kg N (green leaf) in the study. The August rainfall had a positive correlation, while September rainfall had a negative correlation with rice equivalent yield, but were non-significant for all treatments. The crop growing period was found to have a significant positive correlation with yield attained by 10 kg N (FYM) + 35 kg N (urea), 20 kg N (FYM) + 25 kg N (urea) and T 7 : 30 kg N (FYM) + 15 kg N (urea). The analysis indicated that rice equivalent yield had no significant correlation with crop seasonal rainfall and time period (years) in the study period.

Regression models of yield through rainfall and fertilizer N variables

Regression models of yield were calibrated through monthly rainfall and fertilizer treatments as stated in (1) to (3) for each treatment (Table 4). The models were assessed based on estimates of coefficient of determination (R^2) and prediction error (F). The regression model (1) through rainfall variables gave a significant predictability of 0.57 for rice equivalent yield attained under rice + pigeon pea intercropping. The model gave a prediction error of 514 kg/ha for prediction of yield through rainfall received in different months during crop growing period. The regression model (2) through organic and inorganic fertilizer variables had a predictability of 0.26 with a prediction error of 675 kg/ha for predicting yield through different fertilizer treatments. The regression model (3) through monthly rainfall received during June to October, organic and inorganic fertilizer N variables had a significant predictability of 0.83 for rice equivalent yield. The model gave a prediction error of 340 kg/ha for predicting rice equivalent yield through rainfall and fertilizer variables.

The rainfall received in July, August and October had a significant negative influence and September rainfall had a significant positive influence on rice equivalent yield based on model (1). Based on model (2), inorganic fertilizer N and organic N through green leaf source had a significant positive influence on rice equivalent yield. Based on model (3) of rainfall and fertilizer N variables, the rainfall

as a function of (a) mean yield of treatment over years; (b) prediction error based on model (3); and (c) maximum rice equivalent yield attained by any treatment in the study period. The h values were derived by using treatment mean over years, prediction error of 340 kg/ha and maximum rice equivalent yield of 5193 kg/ha attained in the study. The sustainable yield index of fertilizer treatments are given in Table 2. The estimates indicated that application of 20 kg N (FYM) + 2 kg N/ha (urea) had a maximum sustainable yield index of 62.6% compared to other treatments. Application of 30 kg N (FYM) + 15 kg N/ha (urea0 was the 2nd best treatment with a SYI of 58.4%, while FYM @ 5 t/ha had a minimum sustainable yield index of 33.8% based on the study.

Ranking and selection an efficient treatment

Ranks were assigned to each fertilizer treatment for (a) yield attained in individual years and (b) mean yield, coefficient of variation and sustainable yield index attained over 6 years in the study.The rank sum was derived for each treatment and is given in Table 5. The rank sum indicated that 20 kg N (green leaf) + 25 kg N/ha (urea) was efficient with a minimum rank sum of 12. This comprised of a minimum rank sum of 9 for yield attained in individual years and 3 for mean yield, coefficient of variation and SYI attained over years. Application of 20 kg N (green leaf0 + 25 kg N/ha (urea) was the second best treatment with a rank sum of 30 comprising of 22 and 8 for yield attained in individual years; and mean yield, coefficient of variation of SYI over years. Application of FYM @ 5 t/ha was inferior with a maximum rank sum of 74 comprising of 53 and 21 for the two categories of ranks respectively as assigned for the superior treatment.The study has clearly indicated that application of 20kg N (FYM) + 25 kg N/ha (urea) was superior for attaining a highly sustainable rice equivalent yield of 3590 kg/ha with a sustainable yield index of 62.6% and minimum rank sum of 12 in individual and also pooled over years.

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MATERIALS AND METHODS

The study was conducted using rice (*Oryza sativa* L. var- Khandagiri) with and without amendment of chemical fertilizer to serve as a tool of phytoremediation for attenuating Cr(VI) from contaminated untreated mine waste water.

The study was undertaken at South Kaliapani chromite mine area, Sukinda valley of Jajpur district, Orissa. The plot design was made to facilitate passage of mine waste water through a series of successive cultivated plots of rice. Cr(VI) contaminated mine waste water was passed through each experimental plot (20'x25') in a zigzag pathway covering an area of 500 sq. ft en route. The rice seedlings of cv. Khandagiri were raised at the study site. Twenty five days old seedlings were transplanted with 25cm x 25cm spacing and 4 seedlings per hill.

The cultivation practice and the method of fertilizer treatment was made as per the Kharif Manual, 2006. Fertilizer N:P:K was applied in the ratio of 40:20:20 in form of urea, gromore and DAP respectively. Before fertilizer treatment the field was amended with compost at the rate of 12.5 tonnes per hectare.

The untreated mine waste waters from South Kaliapani Mines, Orissa Mining Corporation (OMC) was analyzed for pH, E.C. (electrical conductivity), TDS, PO_4^{-2} , P, NO_3-N, NO_3^-, Ca, Mg, Na and Cr^{+6} content before and after its passed through different cultivated plots of rice.

Untreated mine waste water after passing through different cultivated plots of rice was analyzed for its Cr^{+6}content using DR-890 colorimeter (APHA, 1987). The Cr^{+6} analyses were done for waste water samples collected along the flow passage covering 500, 1000, 1500 and 2000 sq. ft. and also at 75 and 100 Days after transplanting (DAT) corresponding to pre-flowering and flowering stage of rice respectively. Although the water flow to the crop fields was continuous, the Cr (VI) content significantly reduced with the growth of the crops. All the treatments were replicated thrice and the data are presented in the figures and tables with ± SEM computation.

RESULTS AND DISCUSSION

Irrigated waste water samples contaminated with Cr^{+6} were collected from different experimental plots of rice (with and without fertilizer treatment) and analyzed for its pH, Electrical Conductivity, Cr^{+6} content and total Fe content and other physicochemical properties (Table1a).

Untreated mine waste water sample (W0) exhibited highest alkalinity. The alkalinity may be due to the presence of high levels of hexavalent chromium in water (Bartlett and Kimble, 1976). Other physicochemical parameters were analyzed to assess the nutrient content of the waste water. The pH of effluent water was 8.4. The analyses of water were further assessed to estimate availability of nutrients for crop production and Cr (VI) content was high in W0 with high pH value (Table 1 b). Electrical conductivity (E.C.) was also high in contaminated irrigation water which was taken as an indices to compare relative yield of the crop. The EC was positively correlated with Ca and Mg (meq / L) and NO_3-N (mg / L) content of the water samples (Table 1b).

Cr and its compounds originate from effluents of widespread use of this metal in various industries such as metallurgical (steel, ferro- and nonferrous alloys), refractories (chrome and chrome–magnesite), and chemical (pigments, electroplating, tanning and other) industries (Zhang *et al*., 2004). Especially in the regions of open cast mining activities where chromium is released to the environment, contaminates soil and surface water as well as ground water. Chromium exists in the aqueous solution as hexavalent or trivalent forms. Many mutagenic, toxic and carcinogenic effects in biological systems caused by chromium compounds have been reported (Debatto and Luciani, 1988). Cr (VI) and Cr(III) causes various magnitudes of activity due to its ability to cross the biological membranes.

Chromium concentrations of plants growing in uncontaminated soils are usually below 1.0 mg kg^{-1} (Lepp, 1992). Concentrations depend on the plant species and the soil type. Plants grown on soils derived from ultramafic rocks have 2–36 times more chromium than in plants grown on silicic or calcareous soils (Dowdy and Larson, 1975). Excess Cr is highly toxic to animals and plants and may induce cancer and teratism (Shanker *et al.,* 2005). Toxic effects of Cr on plant growth and development include alterations in the germination process as well as in the growth of roots, stems and leaves (Panda and Patra, 1997; Panda and Patra, 2004; Nayak *et al.,* 2004; Jena *et al.,* 2004; Misra *et al*., 1994 and

was found on 100 DAT in comparison to 75 DAT. The pH values of mine waste water decreased from 8.3 to 7.2 in successive rice cultivated plots without fertilizer treatment (R-F) during its passage through 500, 1000, 1500 and 2000 sq. ft. after 75 DAT. The pH value of waste water was slightly alkaline in cultivated plots (Fig 1A&B) at 100 DAT. Electrical conductivity of irrigated mine waste varied between 0.23 mS cm^{-1} and 0.31 mS cm^{-1}.The effluent water used for irrigation of crop field was having very high Cr^{+6} content (Table 3), which might have adversely affected the crop yield.

At 100 days of transplantation the rice plants with fertilizer amendment showed more reduction in Cr(VI) content than rice without fertilizer amendment. Cr(V) content of mine waster irrigated through crop fields falls from 0.646ppm to 0.07

Table 3: Cr^{+6} and total Fe content of Irrigated Mine Waste Water Samples Collected from Different Experimental plots at 75 & 100 DAT

Treatment	Area of passage (sq. ft.)	Plot Number	Water samples	Cr^{+6} (mg/L) DAT 75	100	Total Fe (mg/L) DAT 75	100
MWS	0	-	MWS	0.65±0.01	0.646±0.05	0.74±0.02	1.29±0.02
R-F	500	1	W1	0.523±0.02	0.530±0.04	0.24±0.02	0.35±0.01
	1000	2	W2	0.516±0.02	0.510±0.02	NA	NA
	1500	3	W3	0.513±0.02	0.490±0.01	NA	NA
	2000	4	W4	0.500±0.05	0.440±0.03	NA	NA
R+F	2500	5	W5	0.440±0.04	0.350±0.02	0.34±0.01	0.28±0.05
R+F	500	6	W6	0.493±0.02	0.500±0.02	0.11±0.01	0.87±0.05
	1000	7	W7	0.486±0.01	0.430±0.01	NA	NA
	1500	8	W8	0.426±0.06	0.360±0.05	NA	NA
	2000	9	W9	0.343±0.02	0.180±0.03	NA	NA
R+F	2500	10	W10	0.306±0.01	0.070±0.06	0.22±0.01	1.24±0.03

(Values are mean ± SEM of three replicates); MWS- Mine waste water

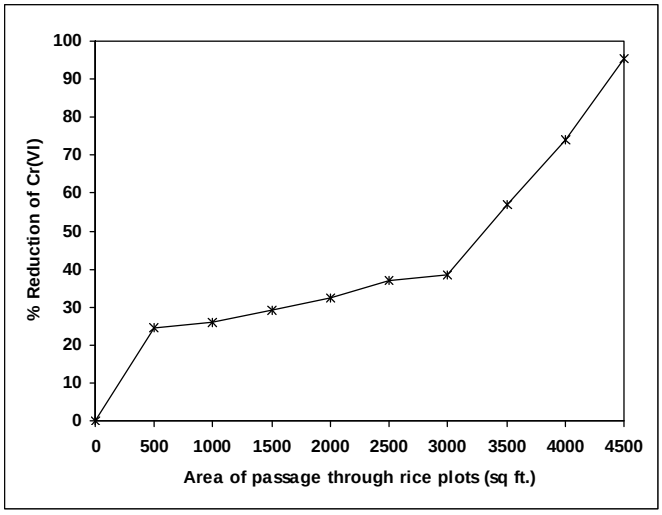

Fig. 2: Reduction of Cr^{+6} (%) in mine waste water with increasing area of passage through cultivated plots of rice with fertilizer (R+F) at flowering stage of plant growth.(100 days after transplantation).

(89%) reduction after passage through 2500 sq. ft. of cultivated plots of rice.

Attenuation of hexavalent chromium content was calculated in terms of percent reduction of Cr (VI) (Table 4) in rice plots with fertilizer treatment (R+F) that showed a significant reduction of Cr^{+6} in irrigated mine waste water after 75 and 100 DAT (Table 4).

A significant decrease in Cr(VI) content up to 89% was observed after its passage through 2500 sq. ft of R+F cultivated plots for 100 DAT whereas, the same plot showed 52 % reduction in Cr (VI) content from mine waste water at 75 DAT (pre-flowering stage). A significant reduction in Cr was found at 100 DAT (flowering stage). It was evident that Cr (VI) content of irrigated untreated mine waste water decreased with increase in progressive plant age as well as with the increase in distance and area of passage of water. The maximum reduction in Cr(VI) content of untreated mine waste water was observed in R+F plots may be due to enhanced root

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RESULTS AND DISCUSSION

In total 26 species of bryophytes including 20 liverworts, 2 hornworts and 4 mosses under 17 families and 22 genera were reported for the first time from the Khandadhar hills (Table 1). All the species had a new distributional record of occurrence. Species like *Anthoceros angustus, Conocephalum conicum, Lophocolea bidentata, Pallavicinia lyellii, Pellia epiphylla, Polytrichum juniperinum, Reboulia hemispherica* and *Targionia indica* were encountered between altitudes of 550 m to 870 m, where the forest is mostly moist deciduous type with small semi-evergreen patches having closer canopy. Four species such as *Phaeoceros laevis* ssp. *carolinianus, Asterella angusta, Heteroscyphus argutus* and *Riccardia levierii* were collected between altitudes of 250 m to 680 m indicating its adaptation towards varying micro-climatic conditions. Five species like *Riccia trichocarpa, Herpetineuron toccoae, Cyathodium cavernarum, Funaria hygrometrica* and *Riccia glauca* were collected from mining areas harbouring dry deciduous forest with more open canopy. *Dumortiera hirsuta* and *Plasiochasma appendiculatum* showed a wide range of

Table 1: Checklist of bryophytes of Baphlamali hills along with altitude variation.

Species	Class	Altitude in m (M.S.L.)	Habitat
Anthoceros angustus Steph.	HW	550 to 650	On moist soil near hill streams.
Asterella angusta (Steph.) Pande *et al.*	TL	250 to 640	On moist rocks near hill streams.
Bryum argenteum Hedw.	MS	230 to 630	On rock walls and forest floor.
Conocephalum conicum (L.) Lindb.	TL	650 to 750	Near water falls.
Cyathodium cavernarum Kunze.	TL	230 to 450	On damp soil and on forest floor.
Dumortiera hirsuta Rein Bl. et. Nees	TL	360 to 680	On the walls of water falls.
Frullania muscicola Steph.	LL	458 to 680	On moist rocks near hill streams.
Frullania squarrosa R.Br.et Nees	LL	458 to 680	On moist rocks near hill streams.
Funaria hygrometrica Hedw.	MS	480 to 625	On soil and walls.
Herpetineuron toccoae (Sull. & Lesq. in Sull.) Card	MS	380 to 540	On stones and barren rocks.
Heteroscyphus argutus (Reinw. & al.) Schiffn.	LL	262 to 650	Near hill streams, on moist rocks, tree barks and dead logs.
Lophocolea bidentata (L.) Dum.	LL	456 to 792	In hill stream walls.
Marchantia linearis Lehm. et Lindb.	TL	520 to 621	On damp soil in shady places.
Marchantia palmata Nees	TL	528 to 656	On soil, rocks and in grasses.
Pallavicinia lyellii (Hook.) Carruth.	LL	552 to 850	Attached to hill stream walls.
Pellia epiphylla (L.) Corda	TL	628 to 856	On moist and shady forest floor and epiphyllous in ferns.
Phaeoceros laevis ssp. carolinianus (Michx.) Prosk.	HW	250 to 620	On moist rocks near hill streams.
Plagiochasma appendiculatum Lehm et Lindenb.	TL	252 to 650	Terrestrial on moist and shady places near hill stream.
Polytrichum juniperinum Hedw.	MS	580 to 870	In shady hill stream rocks.
Riccardia levierii Schiffn.	TL	248 to 682	Near streams and water courses.
Riccia fluitans L.	TL	355 to 520	Aquatic, attached with hill stream walls in waterfalls.
Riccia glauca L.	TL	358 to 654	On stones and rocks.
Riccia pathankotensis Kashyap	TL	250 to 450	Moist rocks and damp grasslands.
Riccia trichocarpa M. Howe	TL	480 to 740	On moist forest floor.
Targionia hypophylla L.	TL	425 to 540	Moist walls near hill streams.
Targionia indica Udar et Gupta	TL	742 to 834	Moist walls near hill streams.

LL - Leafy liverworts, TL - Thallus liverworts, MS - Mosses, HW – Horn worts, MSL- Meter above Sea Level

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NIGHTMARE OF ELEPHANTS IN KEONJHAR DISTRICT OF ORISSA

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ABSTRACT

A number of factors such as rapid industrialization, deforestation, habitat fragmentation and lure of brewed rice are playing pivotal role for human elephant conflict (HEC) that may take disturbing forms from crop raiding and infrastructural damage, in addition to maladies in normal activities like sustaining injury while traveling to work even death of people and elephants. The elephants associated with HEC are referred to as 'problem elephants'. Asian elephants (Elephas maximus L.) are attracted to food crops because they are more palatable, more nutritious and have lower secondary defenses than in wild browse plants. More disturbances in the elephants' habitat intensifies human elephant conflict in those areas. It was recorded that despite decrease in elephant population from 2001 to 2007, the HEC cases have increased. The HEC can probably never be entirely eliminated but discouraging agricultural activities associated with high human density on lands adjacent to elephant habitat might reduce the incidents.

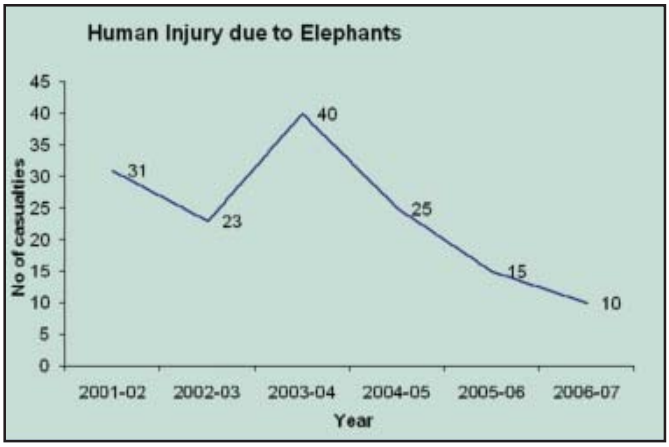
Key words: Asiatic elephants, human elephant conflict, threats, mitigation.

INTRODUCTION

Connectivity between different structural landscapes facilitates the movement of animals. This is the essential concept in the recovery and conservation of populations in fragmented habitats (Taylor *et al.,* 1993; Tischendorf and Fahrig, 2000). Habitat corridors have been suggested to restore continuity and mitigate the isolation effects of fragmentation (Wilcox, 1980). The conflicts that humans experience with both Asian and African elephants are often similar. Both species of elephants migrate seasonally in quest of water and preferred foods (Craig, 1997). Their migration patterns often extend not only beyond park or reserve boundaries, but national boundaries as well. Because elephants have great capabilities to move long distances, it is difficult to confine them to small forest habitat. Wildlife sanctuaries and even National Parks even with fences, farms adjacent to the park boundary are vulnerable to raids especially during favourable seasons of food at the optimal stage of growth (Newmark, 1994). Non-availability of food, water, frequent human elephant conflict and merciless poaching often aggravates the situation. When the corridors are fragmented and delinked to the former habitats, the elephants are carried away from their original path and enter in to the crop land area (Mishra *et al.,* 2008). Hence, the survival of the elephants is interlinked with the conservation as well as preservation of forest ecosystem. The extreme elevations at which elephants are seen in different parts of Orissa are Mahendragiri (1504 m), the highest while Chandaka (219 m) being the lowest (Swain *et al.,* 2000). The elephant prefer mainly hilly mountainous terrain and gentle moderate slope terrains. The present study is an assessment of threat to the elephant's habitats in Keonjhar district of Orissa.

MATERIALS AND METHODS

Keonjhar Forest Division (Territorial) is situated towards northern most part of Orissa (21°01' N and 22°10' N latitude and 85°11' E to 86°22' E longitude) bordering Singhbhum district of Jharkhand. This forest division is enriched with 3236 km^2 forest cover which is 39% of the geographical area of Keonjahr district and 2.07% of state. Orissa has 17% country's rich mineral resources. It has mines in 22 districts out of total 30 districts of the state with prominent mineral ores as Chromite (97%), Nickel Ore (95%), Coal (24.8%), Manganese (67.6%), Graphite (77%), Bauxite (50%), Iron Ore (34%) and Mineral Sand (33%) of all India reserve (Directorate of Geology, Govt. of Orissa) and most of these areas fall in tribal and forest rich areas of the state.



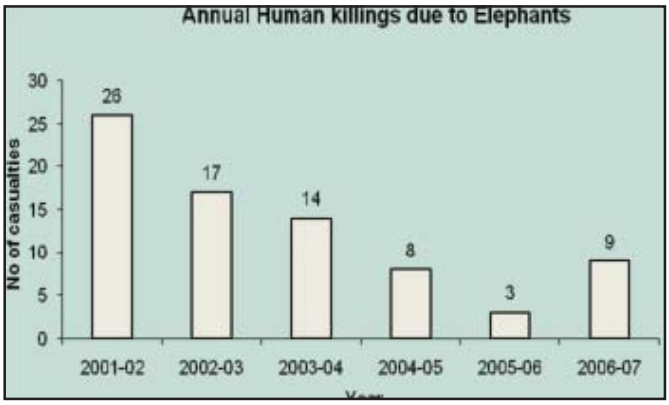


Fig 3 & 4: Annual data of human injury and killing

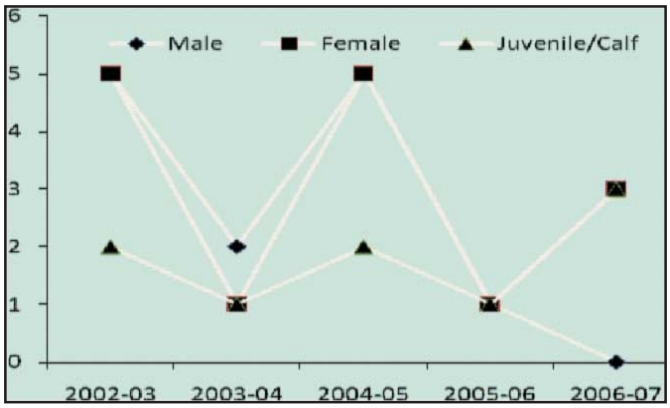


Fig. 5: showing annual death of elephants in Keonjhar Forest Division (Territorial)

evident that during the past years more number of tuskers have been killed. As tuskers, most likely are responsible for sustaining the gene pool of different viable elephant populations, its merciless killings create a great hazard for propagating the gene pool. However, less number of juveniles have been killed in recent years.

Mining

As per the Orissa Mining Corporation Ltd. (OMCL) reports, 119 mining activities are going on in Keonjhar out of which 31 have been declared non-functioning. But in reality, many illegal mining activities are going on which directly affect the forest ecosystem and its wild fauna. Extensive road traffic, more anthropogenic activities and frequent blasts are regular features of the mining activities which have combined adverse effect on the elephants habitat. In particular, heavt trucks trafficking during night time prevent the normal nocturnal movement of elephants from one forest patch to other which in fact compels the wild elephants inadvertently move towards human habitation resulting in serious HEC.

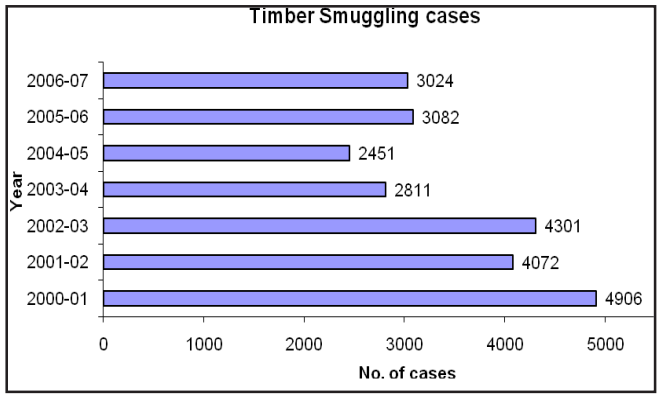


Fig. 6: Number of timber smuggling cases in Keonjhar Forest Division (Territorial)

Habitat Loss

Habitat loss is another important factor for increasing HEC, which may be due to intense mining activities and rampant timber smuggling. In Keonjhar reserved forests, slow and steady timber smuggling has undesirable impact on the elephants because of thinning of forest cover (Fig. 6). Although trend shows reduced number of smuggling cases but in reality off the records a lot of illicit feeling and timber smuggling is giving on.

CONCLUSION

Many a good reserve forests are situated within Keonjhar Forest Division. These are fragmented due to intense mining activities and establishment of camps. Furthermore, movement of thousands of mineral transporting vehicles is creating environmental hazards as well as high noise pollution. Blasting is again aggravating the distress

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SATELLITE IMAGERY ON EVALUATION OF POTENTIAL COASTAL FISHING ZONES OF ORISSA

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ABSTRACT

A study was conducted at different fishing zones of coastal Orissa to draw a comparison on availability of fish school both in terms of number of species and quantity at Potential Fishing Zone (PFZ) against Non Potential Fishing Zone (Non- PFZ) by analyzing various attributes such as the temperature, chlorophyll status, salinity, pH, suspended solids etc. It covered 5 different Potential Fishing Zones from 3 different fishing bases like Balaramgadi and Kasafal of Baleswar district and Dhamara of Bhadrak district. The study facilitated an insight to the fish availability, water characteristics, seasonal variation, fishing status etc. which would help a long way to the fishermen community of both the districts of Orissa in alleviating their livelihood and economy.

Key words: Capture fishery, satellite information, Potential Fishing Zone.

INTRODUCTION

The world fish productivity in coastal belts is enhanced by the capture. Marine fishery resources are of considerable economic importance to India and also to Orissa. Fish production in the Exclusive Economic Zone (EEZ) of the country is exploited from the inshore coastal belts. The capture fish productivity depends upon the modern technology, well equipped crafts, technically skilled fisher-men and information on fish school location at the appropriate time. Depending upon the fish population, the coastal area is differentiated in two zones like Potential Fishing Zone (PFZ) and Non-Potential Fishing Zone (Non-PFZ). The natural fishing zone is influenced by different natural and man-made coastal ecosystem disturbances. The factors like Sea Surface Temperature (SST), Fishing crafts and gears, Ocean currents, Salinity, pH, suspended solids, nutrients and water current normally influence the ecosystem.

In modern world we are getting relevant information from the satellite. The correct information about Potential Fishing Zone is available from oceanic satellite data. The satellite data gives the information on water colour, sea surface temperature, winds, wave's circulation, etc. Satellite oceanic remote sensing plays an important role in fishery research and fishery management by providing synoptic and oceanic measurements for use in evaluating environmental effects on the abundance and availability of fish populations. It was observed that fishery resource of pelagic and water column habitats contributed fairly well as compared to the demersal resources in PFZs. The per cent contribution of pelagic and water column species were found more in PFZs catch as compared to the seasonal mean catch in other areas (Solanki *et al,* 2005). Campbell (2004) studied physical and biological variability in the Namibian upwelling system during (October 1997-October 2001).

Keeping these important factors in view, a study was undertaken in two coastal districts such as Baleswar and Bhadrak of Orissa to ascertain the relevance of satellite information over technological fishing, productivity, input-output of important fish species, the impact of satellite fishing on aquatic environment.

MATERIALS AND METHODS

Under the present study, standard methods **(**Huggins, 1990) were followed for fishing technique, schedule, data acquisition, water quality and interpretation of data. Information was collected on fishing effort. Multi objective programming technique has been used to allocate different types of captured fishes by taking information from Indian National Centre for Ocean Information Services (INCOIS).

The research team of Orissa Remote Sensing Application Centre, Orissa started the work from 1st March to 1st June 2007 at the pre-monsoon period. The satellite derived Potential Fishing Zones

Table 2: Productivity of PFZ and non-PFZ Balaramgadi Fishing-Base

No.	Local name of fishes	Scientific name	PFZ(kg)	Non-PFZ (kg)	Market rate (Rs/kg)
1	Musura	*Cynoglossus microlepidontia*	5		15
2	Gadiasila	*Sardinella longiceps*	7		40
3	Marua	*Rastrelliger kanagurta*	5		10
4	Tampudi	*Euthynnus affinis*	0.5		35
5	Patia	*Gymnura microra*	6	7	15
6	Shrimp (white)	*Penaeus indicus*	10		60
7	Brown shrimp	*Metapenaeus sp.*	2		250
8	Thikiri	*Gazza minda*	3	4	25
9	Pata	*Psttodes erumet*	12		7
10	Candibahala	*Pampus argenteus*	2		55
11	Bom	*Trichiurus savala*	2		18
12	Oliary chuna	Anchovies	20		80
13	Ilish	*Hilsa ilisha*	2		120
14	Fish meal	Weed fish	30	20	-
		Total	106.5	31.00	

Table 3: The water characteristics of PFZ and non-PFZ of Balaramgadi Fishing Base

Parameters	Station-1	Station-2	Station-3	Station-4	Station-5	Mean of PFZ
Suspended solids (mg/l)	481.20	644.80	652.4	150.0	635.2	482.1
Salinity (ppm.)	30.8	30.8	30.8	30.8	28.9	30.8
Chlorophyll (a) (mg/l)	0.125	0.080	0.111	0.138	0.067	0.114
Total Chlorophyll (mg/l)	0.345	0.279	0.338	0.334	0.272	0.324
pH	7.5	7.5	7.5	7.5	7.5	7.5
Temperature (^{0}C)	28	28	28.2	28	28	28.05

Table 4: Productivity of PFZ and non-PFZ Dhamara Fishing-Base

No.	Local name of fishes	Scientific name	PFZ(kg)	Non-PFZ (kg)	Market rate (Rs/kg)
1	Musura	*Cynoglossus microlepidontia*	15		20
2	Gadiasila	*Sardinella longiceps*	4		50
3	Marua	*Rastrelliger kanagurta*	5	2	10
4	Patia	*Gymnura microra*	4.5	7	12
5	Shrimp (white)	*Penaeus indicus*	8		75
6	Brown shrimp	*Metapenaeus sp.*	10	3	260
7	Thikiri	*Gazza minda*	3.5		25
8	Pata	*Psttodes erumet*	12	4	7
9	Oliary chuna	Anchovies	10		80
10	Fish meal	Weed fish	25	10	-
		Total	97	26	

The temperature of fishing zone varied between 28-29^0 C (Suresh *et al.,* 1980). The pH of the potential fishing zone (Validation-1: 7.5; 2: 7.45 and 3; 7.55) remained almost same as non-potential fishing zone. The salinity of potential fishing zone was higher than the non-potential fishing zone. The salinity of PFZ was 30.8 ppm., 30.93 ppm. and 31.3 ppm. of Balaramgadi, Dhamara and Kasafal fishing bases respectively. From the salinity status more fishes are available in potential fishing zone. The similar result was found by Ramana (1989). (Sankarnarayan *et al.,*1969).

silicate concentration of coastal water is high due to the effect fresh run-off water from land. The phytoplankton growth depends upon the phosphate and silicate concentration of water (Martin, 1990). All the water parameters fluctuate due to seasonal changes, illegal fishing, tourism and natural coastal disturbance.

The most of the capture harvest are transported to West Bengal and Bihar for marketing while shrimps are processed locally before marketing. The year-wise status of production from the year 2004-05 to 2006-07 of Balaramgadi fishing base are given in Table 8.

A positive correlation between bottom water temperature and demersal catch was reported by (Benakappa *et al.,* 1979), Maddikery (1981) and Natheniel (1988) along different regions of Dakshina Kannada coast. (Suresh *et al.,* 1980) found good oil

Table 8: Year wise fish production of three fishing marine unit in tonnes

Year	Balaramgadi	Kasafal	Dhamara
2006 – 07	3578.5	3378.5	1085.2
2005 – 06	3378.5	3239.2	1085.8
2004 – 05	3239.2	3006.0	1001.0

sardine fishery near Mangalore when surface water temperature and salinity values ranges between 27.8 and 29.3oc and 32.59 and 34.89% respectively. Similarly optimum values of surface water temperature and salinity were observed for better catches of mackerel along different parts of Karnataka and kerala coasts, Ramana (1989). (Sankarnarayan *et al.,* 1969) noticed lowest demersal fish and prawn catches off Cochin when both temperature and oxygen of bottom waters were considerably low. (Sharma *et al.,* 1973) observed high prawn catches when the water was cooler and denser during the monsoon period.

CONCLUSION

The natural fishing ecosystem is separated by two zones like PFZ and Non-PFZ depending upon the availability of fishes. The availability is influenced by different factors, such as sea surface temperature (SST), random operation of fishing crafts and gears, ocean currents, salinity, pH, suspended solid, nutrients and water current. The fishing in satellite demarcated zones is found to be more economical than in the traditional fishing zones. Adaptation of satellite derived information for capture in identified potential fishing zones directly affect the socio-economic status and livelihood of coastal fishermen. It is necessary to empower them technically on the following lines (i) Fishermen are to be skilled in scientific navigation in marine waters, (ii) Marketing linkage and strategy to match higher harvest ensuring income level, (iii) Employment of the skilled workers practicing modern fishing techniques (iv) Frequency of environmental but man made disturbances and pollution to be reduced and more importantly (v) Fishing in proper scientific method will reduce harm caused to other aquatic animals etc.

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In the Mahanadi delta, this salt tract is covered with tidal forest known as the 'Little Sunderbans", off Paradeep-Dhamra coast. Similarly, in the Devi-Daya sector, casuarina forests and plantations are found. The forest belt all along the coast merges with a narrow belt of pasture.

THE HYDROGEOLOGIC PROCESS

A coastal aquifer system (confined, unconfined or semi confined) interfaces with the sea so that there is a direct contact between the continental fresh water and sea water and under natural undisturbed condition due to seaward gradient, fresh water discharges to the sea. The fence diagrams depicting the observed litho-logy of the Puri district of coastal Orissa and the disposition of fresh-saltwater from observed data is given in figure 1.There exists a density difference between the saline water and sea water, the density of sea water varying from 1022 to 1028 Kg/m^3. Hence in spite of the out flow of fresh water to the sea the heavier salt water flows into the aquifer from the sea.

This leads to the development of a wedge shaped body of salt water below the fresh water. The thickness of the wedge is maximum at the aquifer interface and decreases land ward and vanishes when the wedge merges with the lower boundary of the aquifer. The shape and length of the resulting fresh water salt water interface is determined by the rate of fresh water out flow into the sea. Any modification of this out flow rate induces corresponding movement of this interface. Due to excess withdrawal of groundwater, the water table decreases to enable seawater to percolate cause the interface to move upwards and vice versa. In addition to the above phenomena there exists a local phenomenon known as the salt water up coming which is depicted by the movement of the interface upwards under a pumping well. Excess pumping causes the interface to rise and encroach the well screen. However, if the pumping is discontinued and the up cone interface starts settling down, it may reach its original pre pumping position.

Intrusion of salt water occurs due to advection and hydro dynamic dispersion as shown in fig.2. In this zone the diluted sea water being lighter than the original sea water rises and moves sea ward causing salt water from the sea to flow towards transition zone. This induces a cyclic flow of salt water from sea bed to the transition zone and finally back to the sea (Todd,1980).

The current practice of evaluating ground water potential is based on GEC 97 norms. The suggested process involves a vertical discharge R and declaring a fraction of the recharge say C * R as the ground water resources. The implication of this resource is that the balance (1-C) * R goes as the evapo-transpiration and sub-surface outflow. Out flow to the sea is lumped up with other losses and decided empirically. Since the length of the salt water wedge and position of the interface depend upon the rate of out flow to the sea, the arbitrarily assigned outflow will severely affect the ground water development of the coastal aquifers (Kashyap et al., 2005). And the applicability of the GEC 97 norms in coastal aquifers needs modification in terms of proper quantitative analysis of the out flow to the sea and corresponding interface structure.

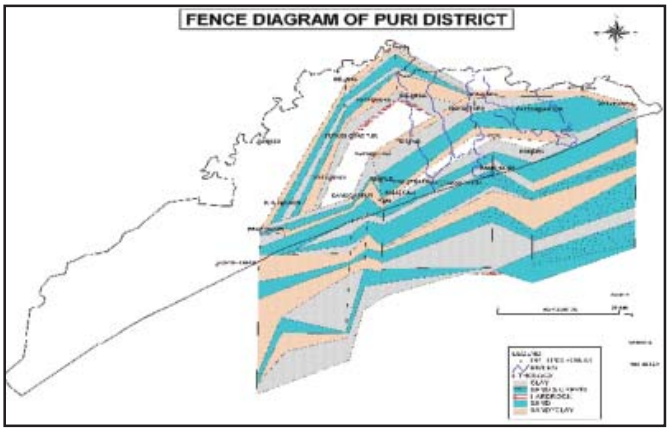

Fig. 1: Fence Diagram of Puri District

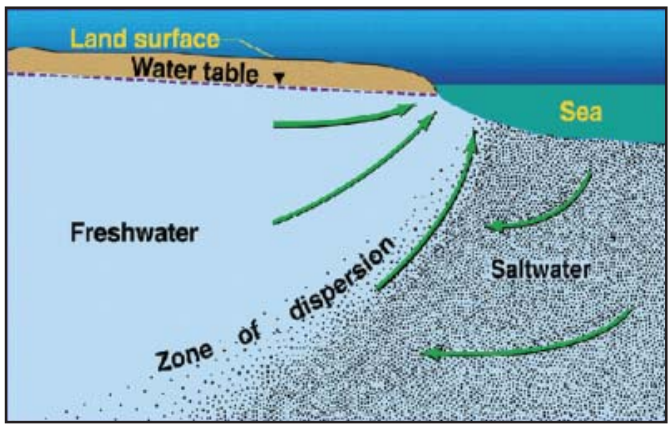

Fig. 2: Seawater Intrusion in to Fresh Water Aquifer

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FLORICULTURE-CUM-PISCICULTURE: AN INCOME GENERATION OPPORTUNITY FOR TRIBAL WOMEN OF KEONJHAR, ORISSA

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INTRODUCTION

The integration of pisci-culture with crop farming is a traditional potential for resource utilization and thereby ensuring fund generation. The fishponds besides being a potential productive unit of aquaculture, creates the best ambience with moderate irrigation facilities for raising suitable crops on its embankments. Pond dykes and adjoining areas can be used for raising horticultural crops to earn revenue. The farmer is provided with multiple farm products in addition to fish. This type of integration also shortens the investment period and minimizes the production risks. The integrated horticulture-cum-pisciculture system provides nutritional security and improves socio-economic status of weaker section of rural community, fetching about 20-25% higher returns in comparison to aquaculture (Kumar, 2006) alone. It is a proven technology of maximizing production from a unit land area more economically on a sustainable basis (Radheyshyam and Tripathi, 1992). The pond water and bottom soil are enriched with several nutritive elements and considered as high quality manure. The fertile sediment can be used as base manure for vegetables and flowering plants. Fertilization and irrigation of horticulture crops with pond sediment and water result in good growth of the fruit and vegetable crop on pond embankments (Radheshyam *et al*., 1991). Floriculture trade is an emerging industry in our country and there is a good market (both domestic and international) demand for loose and cut flowers. According to a report of the Agricultural and Processed Food Products Export Development Authority (APEDA), 2007-08, the total area under flower crops has been estimated around 34,000 hectares, which includes 24,000 hectares under traditional flowers such as marigold, jasmine, aster, rose, chrysanthemum, tuberose and 10,000 hectares under modern flowers like coronation, rose, gerbera, gladiolus, anthurium. The total business of floriculture products in India in 2005 was Rs.8174 lakhs while it increased to Rs.10117 lakhs by April 2006. More than 50% of the floriculture units are based in Karnataka, Andhra Pradesh, Tamil Nadu. West Bengal, Maharashtra while Rajasthan is also having large areas under floriculture. It is observed that the domestic flower production has been increasing significantly with each passing year (FICCI Agribusiness Information Center, 2006).

Initiative by Central Institute of Freshwater Aquaculture

Since April 2006, Central Institute of Freshwater Aquaculture (CIFA), Bhubaneswar has initiated through Department of Biotechnology (DBT), a sponsored project entitled 'Economic and livelihood development of SC/ST population through freshwater aquaculture technologies in Keonjhar and Kendrapara districts of Orissa. Both SC and ST constitute nearly 38.66% of the total population of the State. Livelihood of the typically underdeveloped men and women in the villages of these two districts depend mainly on local labour opportunities on daily wage basis of Rs 40-50 /, which cannot eradicate acute poverty leading to severe nutritional disorders. It has been presumed that implementation of such projects will lead to holistic rural development, i.e. skill development and empowerment of the targeted economically backward population and alleviate their

Table 1: Source of income of Sombari Soren during 2007-08

Components	Quantity	Rate per kg /no./l (Rs)	Income (Rs)
Flower	4,800 nos.	125/ basket	1,500
Cabbage*	20 nos.	5	100
Brinjal*	15 kg	8	120
Papaya*	30 kg	3	90
Fish*	168 kg	80	13,440
Poultry eggs (Local variety) 60-80 eggs/bird	326 nos.	2.50	815
Cow (sale of cow milk for 6 months)	540 l	12	6,480
Goat[$]	10 kg	180	1,800
Total Income			24,345
Cost for household consumption			310
Net Income			24,035

* For household consumption
[$] From sale of one goat meat

of her fish pond is attributed to addition of nutrient rich substances like poultry droppings, cow urine, cow dung and unconsumed food matter during washing of utensils. Estimation of plankton density and important physico-chemical parameters of pond water and soil have revealed that her pond is congenial and ideally suited for fish cultivation. In the month of August 2007, she was provided with 250 no. of advanced carp fingerlings each was 27-30 g in weight and 80-100 mm in length. The bigger sized fingerlings were provided from a nearby hatchery (0.5km) so as to reduce the mortality during transportation. The fish were harvested after six months of stocking in the last week of February 2008 and attained an average weight of 700g. A total of 168 kg of fish was harvested from the pond. Source of income generation for Sombari Soren is illustrated in Table 1.

She was supported with necessary aquaculture inputs and the integrated agric-fisth crop diversification technology during the tenure of this ongoing project. Smt. Soren was advised to open savings account in the nearby post-office for depositing the income generated from the integrated pisciculture activities. The novel endeavour of floriculture-cum-pisciculture has created a visible impact on enhancing productivity and economic profitability on a sustainable level. She has set an example for other tribal women in the village and in the district by initiating a modest beginning of an integrated aquaculture system with a positive attitude on self-support basis and inspired them to take up similar activities.

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Fisheries Of Chilika

The Chilika lake is vast reservoir of diverse fishes and prawns. A list of fishes and prawns and the year wise fish and prawn catch from Chilika lake are given in Table 1 and Table 2 respectively.

Landing centers :

Following are the approaching landing centers of the lagoon

i) Khurda district: Bhusandpur, Mangalajodi, Kalupada Ghat, Sorama, Borodi, Boulabandha, Nairi, Balugaon, Chandaraput.
(ii)Ganjam District: Pathora, Keshpur Sabuli, Gajapati Nagar, Gaurang Patna.
ii) Puri District: Arkhakuda, Gangadharpur, Aulupatna.

Modernized nets used in Chilika

Government has banned fishing through usage of modernized nets such as gill net, drag net, cast net, bobby net, disco net, bhekti jala, patua jala khanda jala zero net Government has also banned fishing near the lake mouth; for example Alimi Jala.

Socio-economic conditions

Thousands of tourists across the country and abroad are drawn every year to its magnificent pictures que and natural bounties, birds sanctuary and conglomeration of holy spots for pilgrims. This lagoon earlier was a part of the Bay of Bengal but breached due to shore sedimentation in course of time. In the past, boats were sailing on commercial scale from the lagoon, a place known as Manikpatna to Cambodia and Indonesia. Till date the villagers around Chilika observe an annual festival ("Bali Yatra", which means "journey to Bali" in Indonesia). 'Maa Kalijai' goddess temple venerated by the folklore and the historic temple is situated on another island at the middle of the lagoon .

The Chilika Lagoon remains a vital lifeline for more than 200,000 people who live around the lagoon in 141 villages. Ninety two primary fishery cooperatives also sustain their livelihood from the lagoon. Six types of traditional fishing methods are in practice in addition to modern technologies too. In early 1990s, the non-fisherman communities of Chilika lake filed a petition in the High Court of Orissa to take cognizance of their fishing rights in Chilika, challenging the lease system introduced by the State

Table:1 List of fishes and prawns of Chilika lake

Category	Genius	Species	Local name	Genius	Species	Local name
Fish						
	Mugil	*cephalous*	Kabala	*Osteogeniosus*	*militaris*	Sunga
	Liza	*macrolepis*	Dangala	*Plotosus*	*canius*	Kaunda
	Liza	*subviridis*	Menjee	*Wallago*	*attu*	Balia
	Rhynomugil	*corsula*	Kekenda	*Ompok*	*bimaculatus*	Pabata
	Nematalosa	*nasus*	Balanga	*Pangasius*	*pangasius*	Jalanga
	Andontosoma	*chacunda*	Babana	*Elops*	*machanata*	Nahama
	Hilsa	*ilisha*	Ilishi	*Megalops*	*cyprinoids*	Paniakhia
	Hilsa	*kelee*	Ilishi	*Channa*	*striatus*	Seula
	Lates	*calcarifer*	Bhekti	*Channa*	*marulius*	Sala
	Crenidens	*crenidens*	Dhala khuranti	*Channa*	*punctatus*	Gadisa
	Rhobdosargus	*sarba*	Khuranti	*Notopterus*	*notopterus*	Fail
	Datniodas	*quadrifasciatus*	Verenda	*Mastacembelus*	*armatus*	Todi
	Terapon	*jarbua*	Gahana	*Gerreomorpha*	*setifer*	Jagili
	Terapon	*puta*	Gahana	*Mystus*	*gulio*	Kantia
	Sillago	*sihama*	Jhudanga	*Arius*	*arius*	Singada
Prawn						
	Penaeus	*monodon*	Bagada	*Metapenaeus*	*affinis*	Morada
	Penaeus	*indicus*	Kantala	*Metapenaeus*	*dobsoni*	Panu
	Metapenaeus	*monocerous*	Morada	*Macrobrachium*	*malcumsonii*	Golda

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RESCUE OF AN ALBINO COMMON KRAIT (Bungarus caeruleus) AT ORISSAN COUNTRY SIDE

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REPORTING OF THE ALBINO KRAIT

On 5th January 2009, one white coloured snake was found near village Nischintakoili of Salepur sub-dvn.; Cuttack Sadar District 45 Kms. from Bhubaneswar. The snake Helpline team from Bhubaneswar rushed to the spot. The snake was kept confined. At the first sight looking at the mid dorsal hexagonal scales it was detected to be a common Indian krait. Due to its white coat it was taken to be an albino krait. Seven supralabial scales, 3rd and 4th touching eye, mid-dorsal hexagonal scales, round pupils in eye, smooth scaled body, head slightly broader than neck, pink coloured tongue and

Fig.1 : Albino krait in paddy field near village, Nischintakoili

presence of two tiny fangs confirmed us the species as Indian common krait (Bungarus caeruleus). So, we were happy to observe a very rare form of the particular species. This species is purely nocturnal in its habit.

ALBINISM

Albino implies a person or animal's congenital absence of pigment in the skin, hair and eyes. Albinism is basically coming from the Latin word "albus" that means white. Albino snakes are white in colour. Suffering from albinism, they are known to have patterns of red blotches on their body. Most of the albino snakes are beautiful and elegant to look at and people usually keep them as pets. Albino kraits are known to be ferocious and extremely venomous.The poison of this krait is neuro-toxic and the venom is at least ten times more powerful than that of a cobra.

REHABILITATION

Its white colour body makes it vulnerable to exposure of sun light. Thus it was kept in a special enclosure in the reptile park in Nandankanan Zoo on 7th Jan'2009. Besides, this was a specimen of research for Geneticists. Special care was taken to provide a hiding place for it. Paddy straw laid inside the enclosure over the rock for the snake to be hideout. Lights in that enclosure was permanently put off. Veterinary doctors periodically monitored its

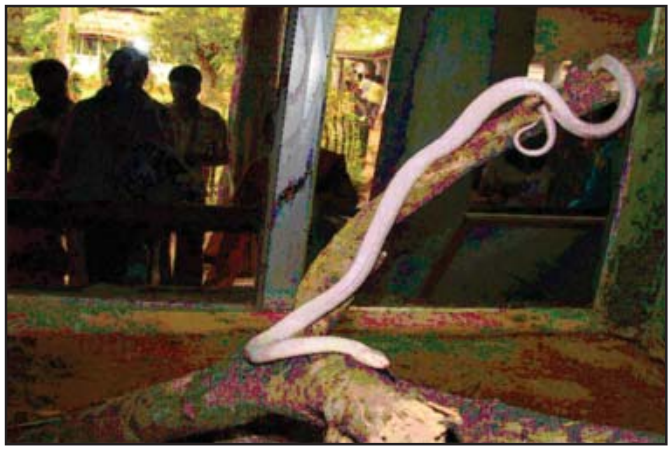

Fig.2: Snake released at Nandankanan

health status. The snake was provided with small mouse at Nandankanan where as earlier it was fed with wolf snakes (*Lycodon aulicus*) by the Snake Helpline team.

The Krishi Vigyan Kendra has the common mandate to work with farmers, farm-workers and rural youth directly as well as through field extension functionaries. The activities of the KVK include technology assessment, refinement and transfer, aiming to bridge the gap between the technology developed at the research institutions and its adoption at the field level by the farmers through demonstration of technology/ products etc. and training of farmers, rural youths and extension personnel. The eight cardinals which are generally followed by the KVKS for the capacity building of rural people.

Dissemination of desired agricultural knowledge and information

The primary goal of agricultural extension is to assist farm families in adapting new production technologies and marketing. Krishi Vigyan Kendras assume front line extension strategies to meet the information needs of farmers on all aspects of agriculture and allied sectors.

Knowledge and skill building among farmers through training

KVKs provide training not only in agriculture and allied vocations but also in other income-generating activities that may supplement the income of farm families. The methods employed in training could be formal and non-formal or a combination of both, depending upon the needs but emphasis remains on work-experience, "the programme should be operated as a plan of continuing education both in the technical and general sense" (Mehta in 1973). The training applies the principles of 'Teaching by Doing' and 'Learning by Doing'. No formal certificate or diploma is however awarded, irrespective of duration of the courses to avoid the rush for jobs instead of self employment. While designing the courses, the concept of farming system as well as farming situation are taken into account to ensure that the enterprises in which they are trained are commercially and ecologically viable, sustainable and profitable. Such vocational trainings help them to sustain themselves through self-employment and to make them self-reliant economically and thus discourages them to migrate to the urban areas (Shaji, 2001).

Depending upon the need and categories of trainees, K.V.K. imparts mainly following three types of training:

(i) Training to the practicing farmers and farm women (ii) Training to the Rural Youth (iii) Training programme for the extension functionaries

Development of technology and technology modulation through farmers participation

Most KVKs are located in rural areas and have closer interaction with heterogeneous category of farmers, entrepreneurs, homemakers and also have linkage with non-government organizations promoting low input agriculture and social upliftment through community approaches. So identification of homogeneous target or user groups is a fundamental requirement for participatory technology development taken up at grass root level.

Forerunner of conducting Front Line Demonstaration (FLD)

Demonstration is the principle based on seeing is believing which is a powerful tool to work with low literacy level farmers group. It provides a visual evidence of the superiority of the recommended technology under farmers' local condition. So the front line demonstrated technologies serve as a platform to train farmers and field extension functionaries. KVK could provide a single window service to the farming community as the centers are established within the farmers' close proximity.

A sound developing extension strategy has the flexibility of adjustments to the needs of a changing society and enhance the entrepreneurial and managerial abilities of farmers. They require a participatory style of leadership in the extension organization.

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