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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. A group of magnificient melon barbs (*Puntius fasciatus*), 2. Hand rearing of orphaned elephant calf 'Anant' at Nandankanan (Rescued from Joda, Keonjhar Forest Division in the aftermath of a train accident where the calf lost his parents). 3. Giant squirrel of Satkosia Gorge Sanctuary 4. Derivation and differentiation of Catla ES cells; Developing embryo at mid-blastula stage, stem cell patches 5. World Wetland Day 2008 Celebration at Nandankanan near Kanjia lake. 7. A red line turpido fish (*Puntius denisonii*), an endangered fish displayed in a recreated aquatic ecosystem.

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EDITORIAL

Wildlives have always become important components of the environment. But there is a general lack of knowledge in the field of conservation of nature and values and benefits of wild lives around the globe even though different nations and international bodies have taken several initiatives time and again towards preservation of the same. Most of the creatures live in the world's oceans and rivers. Crocodiles, turtles, sharks, dolphins, whales, shell fish, eels, octopus, shrimps, salmon, tilapias, oysters, trouts,herrings, clams and thousand other species make the seas the hottest biological spots less undiscovered. But people round the globe in the name of sailing, fishing, sports, establishing ports and industries in the sea coast pose innumerable threats to the abundant marine species. Damage of huge marine species might result in long term harm to the viability of the coast to the species. Infrastructural projects such as large ports and off-shore oil explorations would certainly raise a big concern to the marine environment. Sometimes there are natural calamities like Tsunami, Rita, Hurricane that cause massive damage to the marine eco-system. Some other times, seismic waves disturb and displace many species out of their original abode. Tsunami caused a drastic decrease in the number of dolphins in the Indian sea coast. There's a wonderful world exists under water. Considering the immense biological wealth that is at stake, it is vital and urgent to restore the seas the world over. Internationally many voluntary organizations and forest wings of many state administrations should address urgently for restoration of different aquatic habitat for future generations. E-planet ever since its publication has always tried to give a better coverage to aquatic species but in vein. Thanks to the dedicated efforts of some of our scientists who could finally make it possible to address the issues in the ensuing publication in a manner never before.

(R. K. Samantaray)
Editor-in-chief

INSTRUCTIONS FOR PREPARTION OF THE MANUSCRIPTS

1. Manuscripts should be in MS Word, 10th Arial font, on one side only, double-spaced with 30mm margin on all sides, on A-4 sized paper. Hard copy should be submitted along with soft copy to Editor -In- Chief.
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3. The manuscripts should be organized in the following manner:

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   - The manuscripts should be devided into the following sections —

   i. Introduction ii.Materials and Methods
   iii. Results / Observations
   iv. Discussion/inference
   v. Acknowledgement
   vi. References

   - Tables, Figures caption / legends, should be typed on separate pages.
   - All measurements should be given in standard international units.
   - Scientific names of genus and species should be in italics and it should not be underlined.
   - Words and phrases of origin other than English and not in common use (eg.*in vitro*, *in vivo*, *in situ*) should be in italic.
4. Tables: All tables should be numbered consecutively in Arabic numerals in order of their appearance in the text and should have a descriptive title. Experimental details (not mentioned in the text) may be given below the table as a legend.
5. Figures and Photographs:

   (i) Figures should be numbered consecutively in Arabic numerals in order of appearance in the text. Original figures should be drawn with Indian ink on tracing paper of A-4 size. Photographs of line drawings are not acceptable.

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6. References :

   i) References in the text should be cited as author (Brahmam and Samantaray, 1998) or (Samantray et al, 2003)

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7. General Science Section : The contributors should note that the references are also desired in this section

GENETIC FINGERPRINTING OF *Aeromonas hydrophila* ISOLATED FROM DISEASED FRESHWATER FISHES OF EASTERN INDIA

A. Thankappan[1], B. K. Das[2]*, H. K. Barman[3] and S. K. Samal[4]

ABSTRACT

Aeromonas hydrophila strains isolated from diseased fishes exhibiting different symptoms like haemorrhagic septicaemia, abdominal dropsy, exopthalmia, ulcerations and abdominal distensions were studied for their DNA fingerprinting patterns. The diseased fishes were collected from Central Institute of Freshwater Aquaculture farm complex, commercial farms of Puri, Orissa and Andhra Pradesh. Out of the twenty random decamer primers of OPC series screened against genomic DNA of *A. hydrophila*, five primers amplified and produced good, consistent and reproducible fingerprints. The greatest number of amplified fragments (8 bands) was found with the use of primers OPC 13 in Ah1; OPC 20 in Ah2, Ah3, Ah5, Ah7, Ah8 and Ah10. The minimum numbers of amplified bands were observed in Ah2, Ah5, Ah6, Ah7, and Ah9 with use of primer OPC 14 (3 bands). The molecular weight of the amplified fragments of different strains of *A. hydrophila* against all the primers ranged from 0.35-2.70 kb. The amplified bands with molecular weights 1.10, 1.40 and 1.95 kb were common in all the strains of *A. hydrophila* with primer OPC 13; 1.0 and 1.50 kb; with primer OPC 19; 0.90, 1.40 and 1.70 kb; with primer OPC 20; 0.98 and 1.23 kb; in Ah2 and Ah3 using OPC 19 and 1.35, 2.20 kb; using primer OPC 11 respectively. The genetic similarity among all the strains of *A. hydrophila* varied from 0.134-0.436. The clear, distinct and reproducible DNA fragments generated by selected primers can be used as standard for identifying new strains of *A. hydrophila*.

Keywords : *Aeromonas hydrophila*, RAPD-PCR, genomic DNA, primer, epidemiological study

INTRODUCTION

Aeromonas hydrophila, a member of the family *Aeromonadaceae*, is a Gram negative motile rod-shaped bacterium having the capacity to infect cold blooded vertebrates, mammals and exist freely in water (Ho *et al.,* 1990; Joseph and Carnahan, 2000; Ko *et al.,* 2000). It is considered to be the principal cause of bacterial haemorrhagic septicemia in freshwater fish (Frerichs, 1989; Austin and Austin, 1993; Angra *et al*., 1995) and has been reported in association with various ulcerative conditions including epizootic ulcerative syndrome (EUS) in Thailand, Philippines and India (Laobrera and Gacutan, 1987; Lio-po *et al*., 1992; Das and Mukherjee, 1997; Nayak *et al*., 1999) and red spot disease in Australia (Cahill, 1987). Fish diseases caused by *A. hydrophila* is considered to be a major economic problem, but it is difficult to distinguish direct losses from those caused by secondary infections (Amin *et al*., 1985; Aguilera-Arreola *et al.,* 2005). Amplification of specific segment of DNA by means of polymerase chain reaction (PCR) provides a highly sensitive and specific tool for detection of microorganisms from different sources. Discrimination methods based on genotypic differences are not affected by the physiological state of bacterium and can be easily standardized. Randomly amplified polymorphic DNA (RAPD) patterns have been successfully employed for discriminating strains of a number of finfish and shellfish bacterial pathogens (Aznar *et al*., 1993) and they have potential use in epidemiological studies. *A. hydrophila* isolates are phenotypically, serologically and genetically quite diverse due to its heterogeneous nature. Methods like phenotyping, protein analysis and serotyping show contradictory results, in such a situation strain characterization by genetic and molecular methods like Randomly Amplified Polymorphic DNA in association with PCR (RAPD-PCR), Restriction Fragment Length Polymorphism (RFLP), Ribotyping and Pulse field gel electrophoresis (PFGE) were done, as these methods are simple, rapid and specific. Szczuka and Kaznowski (2004) evaluated random amplified polymorphic DNA PCR, repetitive extragenic palindromic sequence PCR and enterobacterial repetitive intergenic consensus sequence PCR methods for fingerprinting of *Aeromonas* sp. isolates. The cytolytic enterotoxin aerolysin and virulent genes in *Aeromonas* sp. was detected (Kingombe *et al*., 1999; Albert *et al*., 2000; Watanabe *et al.,* 2004)

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4. Senior Research Fellow, Regional Medical Research Centre (ICMR), Bhubaneswar, India

In this study, we have demonstrated that both rapid and clear differentiation of *A. hydrophila* from related bacterial species, as well as an efficient intraspecific-typing of *A. hydrophila* strains can be achieved by using RAPD fingerprinting technique (Williams *et al*., 1990), depending on the primers used. This method can be useful for identification of unknown *A. hydrophila* strains in epidemiological studies.

MATERIALS AND METHODS

Isolation of bacteria

The bacterial isolates obtained from diseased fishes were identified as *Aeromonas hydrophila* based on the phenotypic and biochemical characters as described in the Bergey's Manual of Systematic Bacteriology (Krieg and Holt, 1984) and using microbial identification kit (Microsoft Corporation, Redmons, WA 98073) and Multiscan (340/ MMC). Pure cultures of *A. hydrophila* strains were further streaked on Rimler Shott's medium (HiMedia, India) to study the colony morphology. Out of the twenty five isolates screened, only twelve were selected based on the variability in reaction to different substrates. The sources of isolates used in this study are listed in Table-1.Reference strain of *Aeromonas hydrophila* (MTCC 646) was procured from Institute of Microbial Technology, Chandigarh, India. Pure isolates of two *Pseudomonas* sp. used in the present study were obtained from Aquatic Animal Health Division, Central Institute of Freshwater Aquaculture, Orissa, India.

Tab - 1 : Isolation of Aeromonas hydrophila from different sources

Sl. No.	Isolate code	Source of isolation	Organs	Area of collection
1.	Ah1	*Cirrhinus mrigala*	Skin lesion	CIFA* Pond
2.	Ah2	*Channa punctatus*	Skin lesion	Commercial fish farm, Puri District, India
3.	Ah3	*Channa punctatus*	Skin lesion	Commercial fish farm, Puri District, India
4.	Ah4	*Channa punctatus*	Liver	CIFA wet laboratory
5.	Ah5	*Channa punctatus*	Skin lesion	CIFA wet laboratory
6.	Ah6	*Clarias batrachus*	Skin lesion	CIFA catfish unit
7.	Ah7	*Carassius auratus*	Kidney	CIFA aquarium unit
8.	Ah8	*Carassius auratus*	Intestine	CIFA aquarium unit
9.	Ah9	*Channa punctatus*	Kidney	CIFA wet laboratory
10.	Ah10	*Channa marulius*	Skin lesion	Andhra Pradesh
11.	Ah11	*Channa* species	Skin lesion	CIFA wet laboratory
12.	Ah12	*Channa marulius*	Skin lesion	Andhra Pradesh

*CIFA –Central Institute of Freshwater Aquaculture.

Genomic DNA preparation

Chromosomal DNA of bacteria was isolated following the procedure described by Sambrook *et al., (*1989) with some modifications. The bacterial cultures were grown in 5 ml Brain heart infusion (BHI, HiMedia, India) broth at 37°C for 18-24 h with periodic shaking in a shaker waterbath. Bacterial cells were separated by centrifugation at 10,000xg at 4°C for 10 min. The pellet obtained was resuspended in 467ml of TE buffer (10m mol Tris Cl (pH 8.0), 1 m mol EDTA (pH 8.0). Then 30 ml of 10% SDS and 3ml proteinase K (20mg ml^{-1}, BDH) were added and incubated at 37°C for 1h. After incubation, the samples were mixed with an equal volume of phenol: chloroform: isoamylalcohol (25:24:1) and centrifuged at 10,000xg for 15 min at room temperature. The top aqueous phase was collected in a microcentrifuge tube (Eppendorf) and 1/10 volume of 3M sodium acetate (pH 5.2, Merck; Germany) was added followed by exactly two volumes of isopropanol (BDH) to precipitate the DNA. The precipitate was recovered by centrifuging at 10,000xg for 10 min, washed with 70% alcohol and air dried. Then 50 ml of TE buffer was added and RNAase treatment was given. The samples were incubated at 37°C for 1 h. Subsequently phenol: chloroform method as described above was followed to isolate pure DNA. The DNA samples were quantified by spectrophotometric method by measuring optical density at 260 nm. Finally DNA of each isolate was dissolved and final concentration was adjusted to 25 ng/ml for amplification reactions.

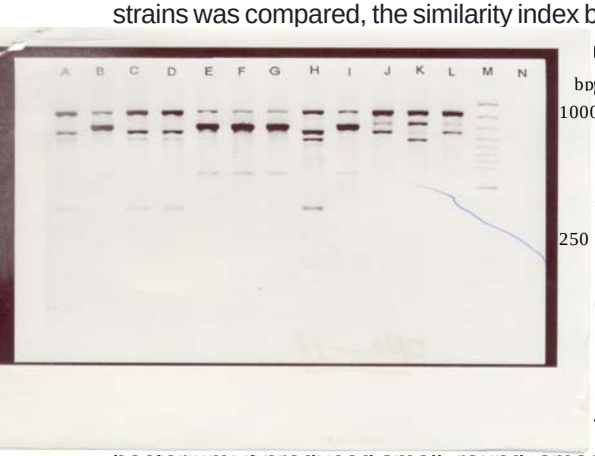
RAPD assay

Randomly Amplified Polymorphic DNA analysis was performed according to Williams et al*.,* (1990). Amplification was done in a thermal cycler (Gene Amp. PCR system 2400, Perkin, USA) with programme being set as: One cycle of initial denaturation at 94°C for 4 minutes followed by amplification for 45 cycles; each cycle taking 45s at 94°C, 45s at 36°C and 1 min 30 sec at 72°C (for denaturation, annealing and extension respectively) for completion. Amplification was conducted by an additional final extension at 72°C for 7 minutes. The PCR reaction was carried out in a final volume of 25ml containing 25 ng of purified template DNA, 2.5 ml of 10X PCR buffer, 100mm each dNTPs, 5 pmol primer and 1 U Taq DNA polymerase.

Amplified products were analysed by electrophoresis technique using 1.5% agarose gel and stained with ethidium bromide (0.5 ìg/ml, BDH). As the gel run was over, the amplified fragments were visualized and photographs were taken. Commercially available decamer oligonucleotide primer (OPC Series) procured from Operon Inc, USA was used. Initially RAPD analysis was done involving 20 different primers with two strains of *A. hydrophila* to detect the primers that could differentiate the strains. Five primers OPC-11 (AAAGCTGCGG), OPC-13 (AAGCCTCGTC), OPC-14 (TGCGTGCTTC), OPC-19 (GTTGCCAGCC) and OPC-20 (ACTTCGCCAC), which produced most distinguishable pattern, were chosen for the analysis of all other isolates. Primer OPC-13 only was used to amplify two species of *Pseudomonas*, reference strain MTCC 646. RAPD analysis was repeated twice for all the selected primers. Negative control without template DNA was also included in all the reaction set ups.

Data analysis

Images of the gels were captured by gel documentation system (UVI soft). Determination of molecular weights of amplified bands was done by comparing each of them with the known molecular weight marker (1 kb ladder, MBI Fermentas, SM 0313). The RAPD patterns between different strains was compared, the similarity index between isolates



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ıort rod-shaped bacterium; it produced small, round, smooth, convex and transluscent colonies on Rimler Shott's medium. It showed motility and produced acid in reaction with different sugars such as sucrose, rhamnose, mannose, maltose, lactose and galactose; showed positive reactions towards Cytochrome oxidase, O/F test, resistance to vibriostatic compound 2,4 diamino-6,7 diisopropyl pteridine (O/129) and novobiocin.

The amplified bands having molecular weights 0.45, 0.95, 1.10, 1.40, 1.95 and 2.70 kb were common in six strains of *A. hydrophila* and *A. hydrophila* MTCC 646; whereas the above fingerprinting pattern was not seen in two *Pseudomonas* species (Fig. 1).

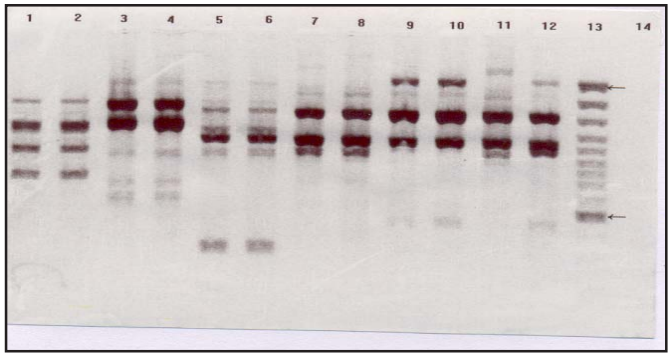

Fig.1: Band pattern obtained after RAPD amplified with primer OPC-13 on *Pseudomonas sp* (Lane 1 &2), *Pseudomonas sp* (Lane 1 & 2), *A. hydrophila* MTCC 646 (Lane 5 & 6) and six strains of *A. hydrophila*, Ah1-Ah12 (Lane 7 - 12). Lane 13 1 kb DNA ladder. Lane 14 Negative control

The amplified bands 1.35 and 2.20 kb was common in all the strains of *A. hydrophila* (Ah1-Ah12) amplified with primer OPC 11 (Fig. 2).

Fig. 2. Result of RAPD amplification of 12 strains of *A. hydrophila* DNA with primer OPC-11. A-L: 12 strains of *A. hydrophila,* (Ah1-Ah12) M- Marker, N- Negative control

The molecular bands 0.60 and 1.15 kb was common in Ah2, Ah5, Ah6, Ah7 and Ah9; 0.35 and 1.00 kb was common in Ah1, Ah3, Ah4 and Ah9. The amplified bands 0.85, 1.10, 1.40 and 1.95 kb was common in all the strains of *A. hydrophila* using primer OPC 13 (Fig. 3).

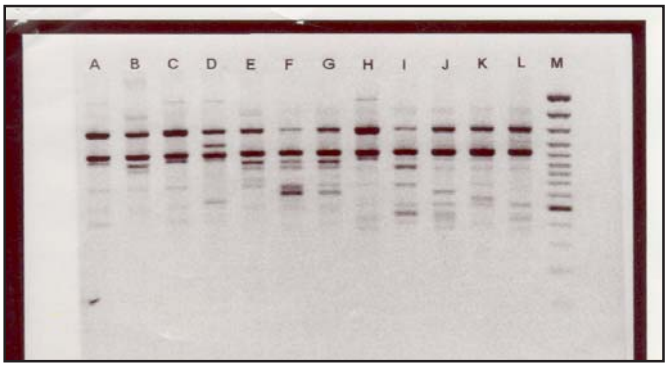

Fig.3. Result of RAPD amplification of 12 strains of *A. hydrophila* DNA with primer OPC-13. A-L: 12 strains of *A. hydrophila,* (Ah1-Ah12) M- Marker, N- Negative control

0.45, 0.50, 0.95 kb bands were found to be common in Ah1, Ah9, Ah10, Ah11 and Ah12. The amplified bands 0.98

and 1.23 kb was common in all the strains of *A. hydrophila* (Fig. 4).

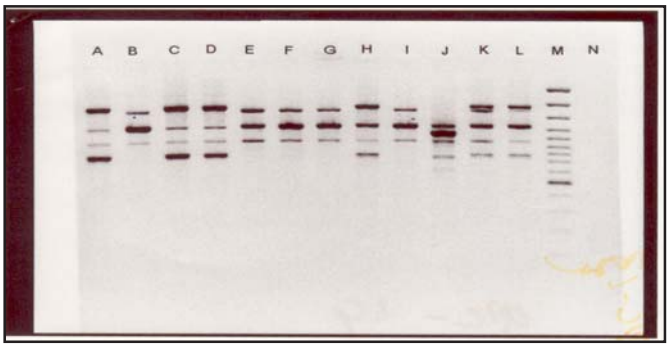

Fig.4: Result of RAPD amplification of 12 strains of *A. hydrophila* DNA with primer OPC-14. A-L: 12 strains of *A. hydrophila,* (Ah1-Ah12) M- Marker, N- Negative control

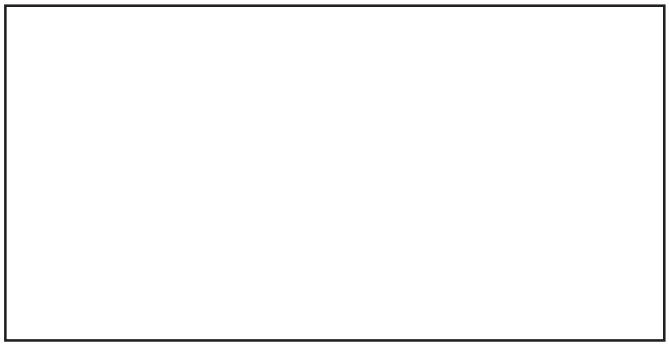

Fig.5. Result of RAPD amplification of 12 strains of *A. hydrophila* DNA with primer OPC-19. A-L: 12 strains of *A. hydrophila,* (Ah1-Ah12) M- Marker, N- Negative control

primer OPC 14 produced the common bands 0.76, 1.85 and 2.50 kb in Ah1, Ah3, Ah4 and Ah8. The amplified bands 0.95, 1.00 and 1.50 kb were common in all the strains of *A. hydrophila* (Fig. 5)

Fig.6. Result of RAPD amplification of 12 strains of *A. hydrophila* DNA with primer OPC-20. A-L: 12 strains of *A. hydrophila,* (Ah1-Ah12) M- Marker, N- Negative control

using primer OPC 19; the bands 0.65, 0.85 and 2.70 kb was common in Ah2, Ah4, Ah5, Ah6, Ah7 and Ah9. The amplified fragments 0.90, 1.40, 1.70 and 1.95 kb were common in all the strains of *A. hydrophila* using primer OPC 20 as observed in (Fig. 6); The fragments 0.55, 0.60, 0.85 and 2.16 kb amplified fragments were common in Ah2, Ah4, Ah5, Ah6, Ah7 and Ah8.

In the RAPD-PCR analysis, out of the 20 primers screened, only 5 primers were selected based on their ability to produce consistent and distinguishable fingerprint patterns. The selected primers were OPC-11, OPC-13, OPC-14, OPC-19 and OPC-20. While OPC-05 and OPC-07 did not amplify at all, other primers produced only one or two bands. The genomic DNA of reference strain *A. hydrophila* MTCC 646, two *Pseudomonas* species and six strains of *A. hydrophila* were amplified with the primer OPC-13, so as to compare the RAPD profiles of few *A. hydrophila* isolates with the reference strain and the unrelated *Pseudomonas* sp. Similar DNA fragment profiles were obtained for the six strains of *A. hydrophila* and for the reference strain. With each primer, the number of amplified bands varied from a minimum of 3 to a maximum of 8 and the molecular weight of the fragments ranged from 0.35kb to 2.70kb. All the tested primers could produce 2-3 amplified bands common to all isolates. In some cases, isolate-specific unique bands were seen. A minimum of one unique band for the isolate Ah5 and Ah8 was observed with primer OPC-19 whereas primers OPC-11, OPC-13, OPC-14 and OPC-20 produced one unique bands for the strains Ah8, Ah1, Ah10 and Ah11 respectively. The average number of amplified bands per primer varied from 5.2-6.4.

One-way ANOVA analysis of banding patterns of twelve strains of *A. hydrophila* using five primers showed significant difference from each other at 0.01% level. The distance matrix created from genetic similarity using twelve strains of *A. hydrophila* is shown in Table - 2. The genetic similarity value among the strains varied from 0.134-0.436. From the distance matrix, it can be concluded that Ah1, Ah3, Ah4 and Ah8 were clearly related, though the above strains were isolated from three different sources i.e. *Cirrhinus mrigala*, *Channa punctatus* and *Carassius auratus*. Strains Ah2, Ah5, Ah6, Ah7, Ah9 and Ah11 were closely related, though these belonged to different sources of isolation i.e. *Channa punctatus*, *Carassius auratus*, *Clarius batrachus* and *Channa* species. Strains Ah10 and Ah12 were closely related as the two belonged to same source of isolation i.e. *Channa marulius*. Strains Ah4, Ah9, Ah10 and Ah11 were distancely related, though these strains belonged to same source of isolation i.e. *Channa* species.

RAPD assay has mostly been used for intra species (among bacterium) determination in epidemiological studies and is one of the promising methods for distinguishing individual bacterial strain. In the present study, RAPD assay was chosen to type twelve strains of *A. hydrophila* isolated from diseased fishes. All the strains could be typed using the selected primers. But out of 20 primers screened, except

OPC-11, OPC-13, OPC-14, OPC- 19 and OPC-20; others did not amplify or had very poor reproducibility. Such diversity among short random primers had been recorded earlier (Oakey *et al*., 1998). All the selected primers could generate isolate-specific bands in few isolates. The presence of band specific to a particular *A. hydrophila* isolate will definitely aid in epidemiological studies. But in this present study the unique bands generated could not be linked to any particular source, as the sample size was small. Further studies on cloning and sequencing of these unique bands may lead to designing of suitable primers, which may be helpful in PCR based diagnosis of bacterial fish diseases. RAPD-PCR had been successfully used in the epidemiological studies of microorganisms such as *Campylobacter* sp. (Mazurier and Wernars, 1992) and *Aeromonas salmonicida* (Hanninnen *et al.,* 1995).

Table - 2 : Distance matrix created from genetic similarity

Strains	Ah1	Ah2	Ah3	Ah4	Ah5	Ah6	Ah7	Ah8	Ah9	Ah10	Ah11	Ah12
Ah1	0											
Ah2	0.364	0										
Ah3	0.013	0.349	0									
Ah4	0.068	0.400	0.080	0								
Ah5	0.373	0.035	0.382	0.407	0							
Ah6	0.319	0.095	0.328	0.324	0.107	0						
Ah7	0.363	0.051	0.348	0.371	0.084	0.127	0					
Ah8	0.047	0.190	0.033	0.087	0.373	0.324	0.393	0				
Ah9	0.390	0.075	0.398	0.333	0.085	0.147	0.155	0.363	0			
Ah10	0.393	0.287	0.427	0.403	0.430	0.413	0.456	0.413	0.397	0		
Ah11	0.415	0.254	0.397	0.427	0.289	0.306	0.280	0.417	0.230	0.305	0	
Ah12	0.347	0.191	0.383	0.359	0.390	0.397	0.463	0.374	0.354	0.108	0.322	0

N.B. Ah1- Ah12: Twelve strains of *A. hydrophila*

Even though the isolates showed difference in biochemical properties with respect to few substrates, the selected primers could not produce isolate-specific bands with all the twelve strains. Further studies can be carried out using wide range of arbitrary primers for identification of isolate-specific RAPD bands. Results obtained in this study on *A. hydrophila* showed the presence of a wide variety of DNA segment profiles on gel depending on the primer used and the isolates investigated. This is in accordance with previous studies conducted on *A. hydrophila* at molecular level (Oakey *et al*., 1998). All the primers have been found to produce amplified fragments common to all strains, but heterogeneity between strains was always seen. Based on this observation, it can be suggested that under high stringent conditions, it may be possible to produce a species-specific amplified band for all strains using any of the selected primers. At this stage, the common bands generated by different primers cannot be connoted as species-specific marker. Oakey *et al.,* (1998) found in a test that a single RAPD-PCR band showing multiple fragments of similar size even being different in nucleotide sequence.

Band specificity was tested by comparing *A. hydrophila* RAPD profiles with those of other pathogenic microorganism (*Pseudomonas* sp) under the same amplification conditions. The primer OPC 13 did not show RAPD profiles similar to six *A. hydrophila* strains tested whereas similar profiles were found between isolates under study and the reference strain. Therefore, this technique could be used as a tool for differentiating microorganism under a particular laboratory condition. The wide genetic diversity observed among the strains of *A. hydrophila* (with the help of molecular typing methods) could be used as a strategy for epidemiological investigations. The RAPD analysis can be used to characterize the isolates from diseased fish samples rapidly with confirmation by better discriminating, albeit more time-consuming other molecular methods. RAPD has several advantages over other techniques that have been used along or various combinations for identifying *A. hydrophila* such as phenotypic investigations (Popoff and Veron, 1976) or DNA/ DNA hybridization studies (Popoff *et al.,* 1981). This fingerprinting method is sensitive and quite reliable and this study revealed the existence of a wide heterogeneity within *A. hydrophila* strains, despite isolation from a geographically restricted area. The analysis of twelve strains of *A. hydrophila* using five primers revealed some clear, distinct and unique fingerprinting patterns, which could be used as markers in epidemiological studies relating to *A. hydrophila* infection in cultivable aquatic organisms.

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EXISTENCE AND DERIVATION OF EMBRYONIC STEM CELL LIKE CELL IN INDIAN MAJOR CARP *Catla catla* (HAM)

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ABSTRACT

The unique feature of embryonic stem (ES) cells to become any type of cells makes them a favourable tool for basic and applied research. ES cells were shown to be valuable in development of knock out animals. So far the identification and complete characterization of ES cells have been limited to few animals such as mice, primates and humans. But it has been elusive in various other vertebrates. The existence of ES like cells in fish has been reported in some fishes. Here we derived ES-like cells from a commercially important fish Catla, *Catla catla*. An optimum *in vitro* culture condition for derivation of these cells has been tried with different combinations of media and other additives. Finally, a novel cellular environment has been created for *Catla catla* ES like cells (CCES) and they were characterized with various tools *viz*. alkaline phosphatase activity, immunocytochemistry and differentiation ability. The present study will have direct applications in production of transgenic and other desired aquatic animals.

Key words : Catla, ES cells, *in vitro* culture, derivation, AP activity

INTRODUCTION

The history of stem cell research had a benign beginning in the mid 1800's with the discovery that some cells could generate other cells. Embryonic stem (ES) cells are undifferentiated cells derived from early embryonic cells of a developing embryo. They provide an efficient tool for genome manipulation with many applications in biotechnology and a virtual cell factory for other studies. When ES cells colonize germ cells in chimeras, transgenic animals with modified phenotypes are generated and used either for functional genomic studies or for improving productivity in commercial settings (Alvarez *et al*., 2006). ES cells represent a bridge between *in vitro and in vivo* manipulations of animal genomes and have enormous potential for basic biomedical research, species conservation and genetic engineering of livestock (Hong *et al*., 2000). This ES cell technology has currently become an invaluable tool for discovering the biological function of genes by developing knock out models that are relevant to humans (Muller, 1999). ES cell technology can be an alternative approach to preserve biodiversity where gamete cryopreservation is not possible.

The first ES cell lines were derived from the inner cell mass of preimplantation mouse embryos and cultured on either a feeder layer (Evans and Kauffman, 1981) or in embryonic carcinoma (EC) cell-conditioned medium (Martin, 1981). Later on ES cell technology has been extended to other vertebrate species. Among them fish are attractive model organisms due to external fertilization, high fecundity, large transparent embryos and rapid development. ES cell lines have been developed in many fish like zebrafish (Collodi *et al.*, 1992), medaka (Wakamatsu *et al*., 1994), sea perch (Chen *et al*., 2003), sea bream (Chen *et al.*, 2003), sea bass and flounder (Chen *et al*., 2004). ES cells in fish are characterized in a similar pattern to mammalian ES cells by their proliferation, chromosome complement, AP staining, telomerase activity, specific gene expression, immunocytochemistry of cell surface antigens and induction of cell differentiation. Hence fish ES cells can act as mammalian complements. Again it appears that ES cells upto 10 days in culture are efficient for contribution to many cell lineages including the germ line (Hong *et al*., 2004). In many aspects fish ES cells are similar to mammalian ES cells e.g., ubiquitous expression of oct-4 promoter (Hong *et al*., 2004). ES cell technology; especially in commercially important fish is to improve the productivity by targeting genes related to commercial traits, such as growth and disease resistance. Here, we report the existence of ES

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like cells and its *in vitro* culture system in a commercially important carp, *Catla catla* that is cultured extensively in the Indian sub-continent.

MATERIALS AND METHODS

Induced Breeding and Artificial Fertilization

The brood fish of Indian major carp, *Catla catla* used in this study was reared in earthen ponds (0.2 ha) of the Central Institute of Freshwater Aquaculture, Bhubaneswar, India. In the monsoon season brood fishes are selected by checking the maturity status of the brood males (free oozing condition of semen) and females (swollen abdomen). Each time 2-4 males and females were brought to the hatchery and administered intra-peritoneal with ovaprim (Salmon GnRH + Domperidone, Syndel Laboratories, Canada) at a rate of 0.25 ml / kg and 0.5 ml / kg body weight to males and females respectively. After 5-6 h of hormone injection, the semen and egg was collected on a dry sterilized petridish. Fertilization was done by mixing the milt and eggs of catla with a bird feather while slowly adding water to it and washed with sterile Dulbecco's phosphate buffered saline (DPBS pH -7.4, Sigma, USA).

Media conditions and supplements

For embryonic cell culture different media, supplemented with fetal bovine serum, growth factors, fish serum and fish embryo extract were tested for their efficiency with all components of Collodi *et al*., 1992 , used for zebrafish ES cells. In this experiment different combinations of L-15, DMEM, Ham's F12 (LDF) (1:1:1, 2:1:1, 1:2:1 & 1:1:2) were tested. With these combinations of media different concentration of FBS (5 %, 10 % & 15 %) have been tried. The detail composition of condition media is shown below.

Conditioned media used for CCES cells

Basic medium,

L-15: 2, DMEM: 1, Ham's F12: 1

Proteins

FBS: 10%, LIF: 10ng/ml, bFGF: 10ng/ml, Fish Serum: 1%, Fish Embryo Extract: 1mg/ml

Antibiotics

Penicillin/Streptomycin: 100IU/100µg/ml, Amphotericin B:

Other Components

Sodium pyruvate: 1mM, Sodium Selenite: 2 to 8 nM, HEPES: 15 mM, L-Glutamine:2mM, Non essential amino acid: 1mM, ß-mercaptoethanol: 1mM

Primary culture of embryonic cells and its maintenance

Approximately 100 to 200 embryos (at 256 cell stage) of 2 h post fertilization were taken for cell culture. For collection of blastomeres, the embryos were disinfected with 70 % ethanol, washed 7-8 times with D-PBS and pipetted with a wide mouth sterilized pipette to rupture the chorion and release the blastomeres. To get single cells gentle pipetting was done one or two times. Now cells were seeded on a 0.1 % gelatin coated six well plate (Nunc) with the complete growth medium comprising of L-15, DMEM with high glucose and Ham's F-12 in different ratios, different % of FBS, 15 mM Hepes, 100 IU/ml penicillin, 0.1mg/ml streptomycin, 1 % catla embryo extract, 8 nM sodium selenite, 10 ng/ml basic human fibroblast growth factor (bFGF), 10 ng/ml human leukemia inhibitory factor (hLIF), 1mM ß-mercaptoethanol, 1mM sodium pyruvate, 1mM non-essential amino acid (All from Sigma, USA). The methods followed were modified from Collodi *et al*., (1992) to suit our conditions after preliminary studies. The cell suspension was incubated at 28 °C. The medium was changed on every third day and passaging of cells done after reaching 95 % confluence.

Preparation of embryo extract

Approximately 300 embryos were washed with 70% isopropanol to avoid contamination and washed repeatedly in PBS (pH 7.2), homogenized in a 2ml eppendorf and centrifuged at 20,000×g for 10 min. the debris was removed and supernatant was filtered by 0.4µm and then 0.2µm. Protein concentrations were determined by the method of Bradford. The final solution was made to a concentration of 10mg/ml and stored at -20 º C following a standard protocol (Fan *et al*., 2004).

Growth Studies

The effect of different media combinations and FBS concentration on cell growth and pluripotency was tested upto 10^{th} passage. Cells were seeded on a 24 well plate at a density of $1X10^5$ no. of cells/ml with different combinations and incubated for 48 hours for cell attachment. Thereafter, on every passage the cell density was measured in a hemocytometer under a microscope after addition of 0.1ml of 0.25 % trypsin and 0.2 % of EDTA to each well.

Alkaline Phosphatase Activity

Cultured cells were washed twice with PBS, fixed in 1 % glutaraldehyde solution for 10 min, washed again with PBS and then stained in dark with 0.38mM 5-bromo-4-chloro-3-indolyphosphate p-toluidine salt and 0.4mM Nitro blue tetrazolium (BCIP/NBT, Roche Molecular Biochemical) in 100mM Tris-HCl buffer at pH 9.5, 100 mM NaCl and 5 mM $MgCl_2$. Cells were observed under an inverted microscope.

Immunocytochemical Analysis

Cell surface markers like SSEA-1, SSEA-3, TRA1-60 and TRA1-81 (Chemicon International, Inc. USA) were analyzed for pluripotency by immunofluorescent method. Cells from culture dish were fixed in 4 % paraformaldehyde for 15 min at 4 ºC, washed with 1X rinse buffer (20mM Tris HCl, pH 7.4, 0.15g NaCl, 0.05 % Tween-20), permeabilised with Triton X-100 for 10 min at room temperature as a blocking solution. The primary antibodies were diluted at a working concentration, incubated for 1h at room temperature, washed 3 to 4 times with rinse buffer. Fluorescence Isothyocyanite (FITC) labeled goat anti-mouse IgG was used as a secondary antibody, appropriate to the isotype of primary antibody. Stained cells were observed under an inverted microscope attached with fluorescent light at excitation wave length of 490nm (FITC). 200 colonies were observed at each experimental group with different markers.

Cell Differentiation

To induce differentiation of ES like cells, the cells were seeded with low density (10^5) or high density (5×10^7) and then cultured for 3 weeks with regular change of media. After 2 days of culture 2 µM all-trans retinoic acid (Sigma) and observed under microscope. Control cultures were seeded on gelatin coated 6 well plates without retinoic acid.

RESULTS

Growth Kinetic Studies

With different combinations of LDF and FBS, LDF in 2:1:1 and 10% FBS showed maximum proliferation of 4.5×10^5 cells/ml in comparison to other combinations are shown in Table - 1. Although with increasing FBS concentration proliferation was more, but cell were more differentiated. Here, higher percentage of L-15 medium suited the proliferation rate compared to DMEM and Ham's F12.

Table - 1 : Concentration and media conditions used for *in vitro* culture of catla ES cells, different concentration of media and FBS

Sl.No	LDF (ratio)	FBS (%)	Number of Cells
1	1:1:1	5	2,30,000
2		10	322000
3		15	345000
4	2:1:1	5	250,000
5		10	420,000
6		15	401,000
7	1:2:1	5	2,45000
8		10	290000
9		15	310000
10	1:1:2	5	189000
11		10	246000
12		15	278000

Derivation of ES like cells

To develop ES like cells mid-blastula stage embryos (Fig. 1a) were used. Approximately 100 embryos were inoculated into the well of 6 well plates. Cells in appropriate conditions with 10 % FBS and LDF in 2:1:1 ratio showed better proliferation than all other combinations with all growth factors as shown in the Table-1.

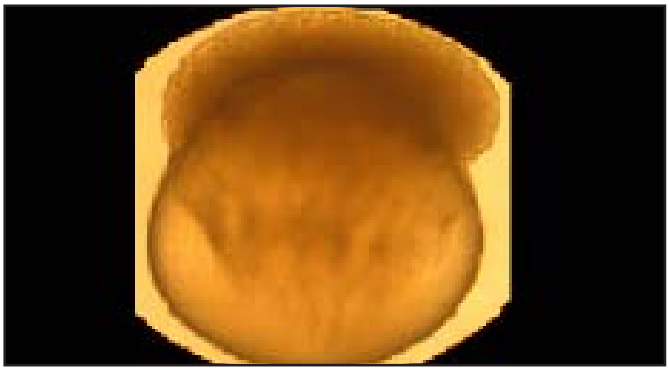

Fig. 1 (a): Derivation and differentiation of catla ES cells. Developing embryo at mid-blastula stage, Stem cell patches

Cells with higher concentration of FBS showed more differentiated cells. The blastomeres having diameters of 20-40µm aggregated after 12-24 h of seeding. They adhered to the gelatin coated surface after 24-48 h post seeding. After about 3 days rounded or polygonal cells having dense nucleus and sparse cytoplasm were observed in close proximities. On subsequent days these cells formed compact colonies of smaller cell size (Fig.1b).

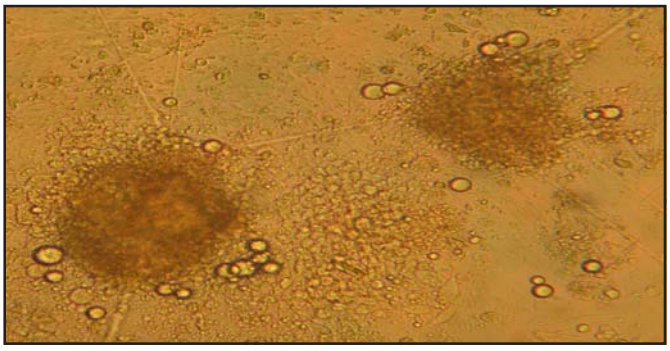

Fig. 1 (b) : Derivation and differentiation of catla ES cells. Developing embryo at mid-blastula stage, Fibroblastic like cells

As their densities increased, cells became smaller in size having fibroblast like morphology (10µm) (Fig.1c). They become multi layered and proliferated in a pyramidal fashion in the centre of the plate. After a culture of more than 40 days with more than 10 passages, CCES cells displayed stable growth and ES-like morphology.

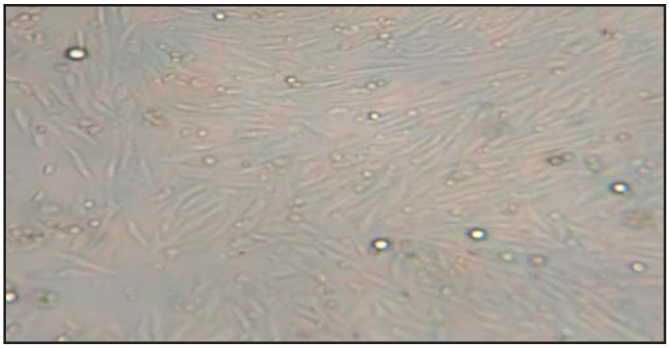

Fig.1(c) : Derivation and differentiation of catla ES cells. Developing embryo at mid-blastula stage, neuron like cells

Differentiation potential of CCES cells

Cells with low density differentiate into fibroblastic (Fig.1c) or neuron like cells (Fig. 1d). RA treated CCES cells loose their colony like morphology

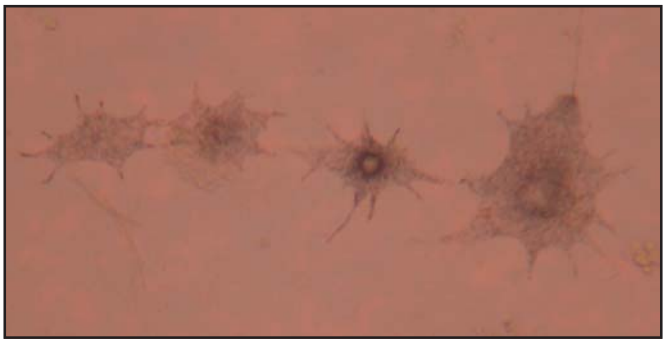

Fig. 1(d): Derivation and differentiation of catla ES cells. Developing embryo at mid-blastula stage. RA treated CCES cells loose their colony like morphology and differentiate into various cell types including neuronlike, musclelike and many more un-identified cells

and differentiate into various cell types including neuron like, muscle like and many more unidentified cells (Fig 2a).

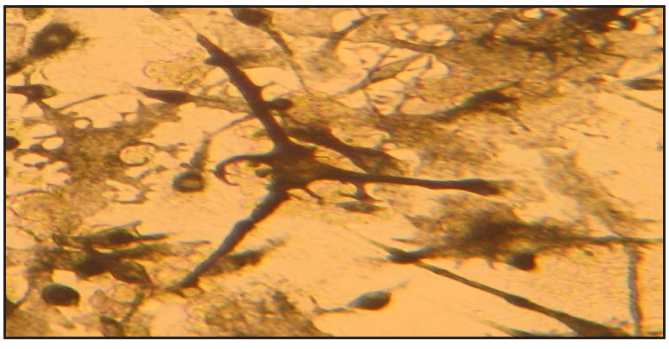

Fig. 2 (a) :Differentiation and characterization of catla ES cells. a. Mixture of cells on RA induction

But when the cells were grown with high density it differentiated into epithelial cells (Fig 2b).

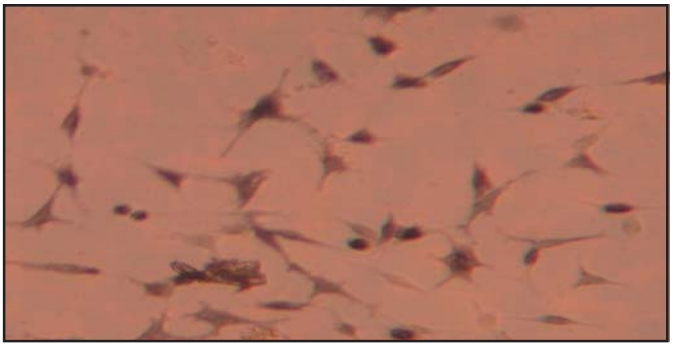

Fig. 2 (b) :Differentiation and characterization of catla ES cells. melanocytes

ES cell like colonies and alkaline phosphatase activity

Colony forming ability is an important feature of ES-like cells. At higher seeding density the cells were grown into ES like colonies after 1 week of plating. Most of the cells in colony morphology exhibited strong alkaline phosphatase activity (Fig. 2c) similar to mice. These colonies were tightly compacted and uniform in morphology.

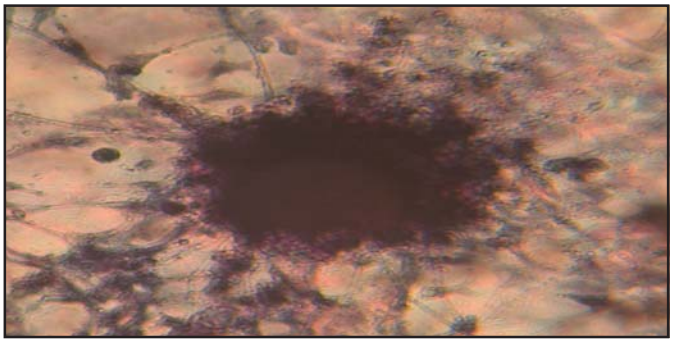

Fig. 2 (c): Differentiation and characterization of catla ES cells. Stem Cell patch showing strong Alkaline phosphatase activity

Immuno-cytochemistry

Extensive expression of SSEA-1 and TRA1-60 was observed in the CCES cells (Fig.2d).

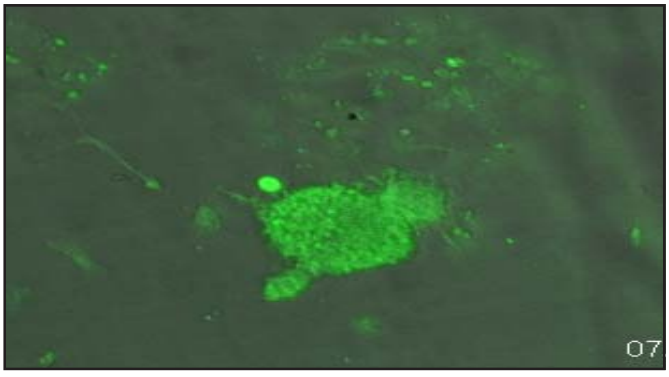

Fig. 2 (d) : Differentiation and characterization of catla ES cells. Stem Cell patch showing TRA-1-60 antibody staining.

Other epitopes (SSEA-3 and TRA1-81) did not show positive reactions indicating their unsuitability for characterization of *catla* ES cells. However, there are reports of other epitopes in human, but in fish no report is available for these epitopes. A systematic study to identify fish ES cells by any of these markers has not been attempted.

DISCUSSION

Establishment of ES cell lines in mice by Evans and Kauffman (1981) and by Martin (1981) have been recognized as powerful experimental systems in vertebrate developmental biology. The genetic manipulations of these ES cells, via homologous recombination, allows the site directed integration of foreign gene into the genome of host and knock out of specific gene from host genome. Thus, ES cells provide a promising approach for production of transgenic animals with site directed mutation and study of gene function during embryogenesis (Muller, 1999). The ES cells has been attracting the attention of fish breeders and molecular biologists due to its high potentiality. The present study reports a protocol for ES like cell culture system derived from mid-blastula stage embryos. In appropriate conditions a stable cell culture system for catla ES cells has been developed and maintained till 40 days. The existence of ES cells has been reported in few aquatic species, however, there is no reports in economic important freshwater species. Initially feeder layers were used for ES cell culture. But later on a feeder free system has been developed with a conditioned medium (Hong *et al*., 1996). The present study demonstrated a feeder free system for derivation of ES like cells. Much effort has been made to develop ES cell line in several species. The existence of fish ES cells has been confirmed in zebrafish, medaka, sea perch, sea bass and sea bream (Hong *et al*., 2000).

CCES cells possess high AP activity which is an indicator of pluripotency in mouse ES cells. However, their heterogenic AP activity demonstrates the differentiation cells in continuous culture. *In vitro* differentiation ability is one of the most important criteria for evaluating the pluripotency of ES cells in fish. The differentiation pattern has been attained with RA and with different seeding densities (Wakamatsu *et al*., 1994; Hong *et al*., 1996). The immunocytochemistry to observe cell surface antigen expression is a new approach in this species. This method has been used to characterize ES cells in human (Draper *et al*., 2004). The present study report for the first time a ES like colonies in a Indian major carp, *Catla catla* that needs further characterization by molecular methods and transplantation to produce ES cell chimera.

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A SURVEY OF SOME MAJOR BACTERIAL DISEASES IN KEY FRESHWATER AQUACULTURE ZONES OF INDIA: ANDHRA PRADESH, WEST BENGAL AND ORISSA.

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ABSTRACT

Indian major carps constitute prime component of Indian freshwater aquaculture system. Due to rapid intensification they suffer from many disease problems among which bacterial diseases cause enormous economic loss in terms of morbidity and mortality. Investigations on incidences of some important bacterial diseases in three major aquaculture zones of India i.e. states of Orissa (zone-I), Andhra Pradesh (zone-II) and West Bengal (zone-III) over last seven years, revealed 21±2.7% to be bacterial gill disease followed by columnaris (13.8±0.88%), ulcerative conditions (12.5±1.21%), fin rot/tail rot (11.9±1.18%), dropsy (11.4±1.18%) and septicemia conditions (8.14±0.79%). Diseases either due to mixed bacterial infections or other causes were restricted to 6.57±2.71% and 14.1±2.46%, respectively. *Aeromonas hydrophila* and *Edwardisiella tarda* isolates of both virulent and nonvirulent types were frequently isolated from the diseased fishes affected with dropsy, ulcerative, fin rot/tail rot and septicaemic conditions, respectively in all the three species of Indian major carps. *Flavobacterium branchiophilum* and *Flavobacterium columnarae* were isolated from cases with bacterial gill disease and columnaris, respectively. The serosurveillance study against specific pathogen by competitive ELISA showed 75% of the test sera positive for *A. hydrophila* antibodies followed by *F. branchiophilum* (74.04%), and positive antibodies for *E tarda,* (58.3%) and *Pseudomonas fluorescens* (46.6%), respectively. The percentage of occurrence of different diseases in three different zones over the years did not vary significantly ($p<0.01$) except bacterial gill disease. Zone-wise, there was also no significant variation in incidence of each disease ($p<0.01$).

Keywords: Bacterial diseases, freshwater Aquaculture, Indian major carps, Seroincidence

INTRODUCTION

Aquaculture has developed from an extensively low capital practice to large intensive culture with a wide range of cultured species. However, one deterrent to successful aquaculture is the occurrence of infectious diseases among cultured fish species, which lead to poor economic viability of the aquaculture industry (Snieszko, 1974).

In India, aquaculture has grown considerably in the past few years with culture of Indian major carps as the important component species. These include *Catla catla, Labeo rohita* and *Cirrhinus mrigala*. Diseases are the major constraints for aquaculture loss in India (Otta *et al.*, 2003). Bacterial diseases are also considered to be major cause of mortality in fish (Grisez and Ollevier, 1995). Different reported diseases of Indian major carps include ulcer (Manohar *et al.*, 1976), Dropsy (Kumar *et al.*, 1986a), bacterial gill disease (Swain *et al.,* 2003a), hemorrhagic septicemia (Sahoo *et al.*, 1998), Columnaris (Kumar *et al.*, 1986b) etc. Also a wide range of bacteria belonging to the genus such as *Aeromonas, Pseudomonas, Flavobacterium, Enterobacter, Staphylococcus, Streptococcus, Edwardsiella, Moraxella, Myxobacter* and *Escherichia* have been found to be isolated form different fish disease conditions. Among them *Aeromonas, Flavobacterium* and *Edwardsiella* are found to cause severe morbidity and mortality and are associated with many disease conditions (Swain and Nayak, 2003). In aquaculture, the etiology of any disease condition is many times very complex. A single bacterium is often reported to cause different types of infection and lesions. *A. hydrophila,* a freshwater fish pathogen, is found to be primarily associated with or is a secondary invader of various disease conditions such as hemorrhagic septicemia, dropsy, ulcers and ulcerative syndrome, etc (Aoki, 1974; Egusa, 1978). Moreover, the infection by a particular organism may be affected by so many factors including water quality parameters. Therefore,

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both conventional and serological studies are often necessary for confirmational identification of a disease. Inspite of wide occurrence of diseases in these species and their association with production loss, no information is available to date on their incidence pattern. Moreover, no systemic approach has been made earlier in this regard. The present investigation was therefore, carried out with the following objectives, such as; (i) Rate of occurrence and distribution of different bacterial diseases of fish, (ii) Zone-wise and time-wise occurrence of each disease and (iii)Seroincidence of some of these bacterial infections in Indian major carps.

MATERIALS AND METHODS

Collection of data through farmer's participatory approach

The study was conducted in three major aquaculture zones of India viz. coastal areas of Orissa (Zone I), 925sq kilometer area of Kolleru lake of Andhra Pradesh (Zone II), freshwater and wastewater aquaculture areas of West Bengal (Zone III) from the year 1999 to 2005. Information regarding the different culture practices was collected from progressive fish farmers and state fisheries department officials in a prescribed format.

Sample collection

Samples for bacteriological isolation and serological studies were collected from the outbreaks and sporadic incidences of diseases in all the three species Indian major carps i.e., rohu (*L. rohita*), catla (*C. catla*), and mrigal (*C. mrigala*). Blood was collected randomly from 300 fishes / year (average body weight ranging from 250gm to 1kg) for screening of antibodies against the different pathogens.

Isolation, identification and characterization of bacteria

Tissue samples such as gill, kidney, heart, tail, fin, muscle and septicaemic blood as well as peritoneal fluid were collected from diseased fishes in brain heart infusion broth (Hi- media, India). Bacterial species associated with diseased conditions were isolated, identified and characterized through standard microbiological methods (Collins and Lyne, 1970; Cruickshank et al., 1975).

Bacteria:

One virulent strain each of *A. hydrophila, E. tarda, F. branchiophilum, F. columnare* and *P. fluorescens* obtained from the Fish Health Management Division, Central Institute of Freshwater Aquaculture, Bhubaneswar, Orissa, India were used in the present investigation as reference stains.

Bacterial antigens:

The reference strains of *A. hydrophila, E. tarda, P. fluorescens, F. columnarae* and *F. branchiophilum* were used for preparation of whole cell antigens. Bacteria was grown separately in BHI broth for 24 h and centrifuged at 10,000 X g for 10 min. The bacterial pellet was washed twice in phosphate buffer saline (PBS, pH 7.2) and finally suspended in PBS. They were inactivated with 1% (v/v) formalin at 4°C for 18 h and the viability was checked in nutrient agar plates.

ELISA antigen:

The formalin killed bacterin prepared as above was sonicated at 30 Hz for 10 min and the supernatant was collected after centrifuging at 10,000 X g for 10 min and passed through the cellulose triacetate ultra filter of 20 kD (Sartorius, Germany).The filtrate obtained was used as ELISA antigen. This procedure was used in order to avoid the cross-reactive antigen evident among most of the Gram –ve bacteria (Swain et al, 2003b) and stored at -20^0C till further use. The protein content was estimated by the standard method of Lowry et al, (1951).

Antisera:

Antisera against bacterial whole cells for each bacterial species was raised in rabbit and rohu as per the methods of Chen et al, (1997) and Lund et al*.,* (1991), respectively. Briefly, rabbits (6-8 months old) were separately injected intramuscularly with 0.5 ml of bacterial whole cell (10^9 CFU/ml) antigen emulsified with equal volume of Freund's complete adjuvant followed by two boosters with Freund's incomplete adjuvant at fortnight intervals. The rabbits were bled for serum through ear veins 15 days after second booster. Similarly in 10 rohu fingerlings (Avg. wt.100-150 gm), maintained in 1000l plastic pools, with constant aeration and artificial diet, were immunized intraperitoneally with 0.1ml of adjuvated antigen as used in rabbit. The immunization schedule was same as for rabbit. The pH and temperature of the rearing pools varied from 7.4-7.8 and 26-29^0C, respectively. After immunization serum was collected through cardiac puncture**.** Antibody titre in the blood sera was checked by agglutination and ELISA test. Antisera raised against whole cells were mixed with an equal volume of packed heterologous bacterial cells, incubated at 37°C for 1h with constant stirring, centrifuged at 10,000 X g for 10 min and the supernatant was used as adsorbed sera for use in serological tests such as competitive ELISA and agglutination test.

Detection of antibodies by Competitive ELISA

Competitive ELISA was done as per the method of Swain and Nayak (2003). The microtitre plates (Nunc, Denmark) were coated overnight with antigen (1ìg/ml) and blocked with 1% bovine serum albumin dissolved in PBS (pH-7.2) for 2 h at 37°C. After washing in PBS- T, 50ml each of test fish sera and rabbit sera (1:200 dilution) were added, simultaneously in duplicate wells of microtitre plates and incubated for 45 min at 37°C. A 0% competition test was done with only rabbit sera where five wells were added with 50ml of rabbit sera (1:200 dilution) for 45 min. at 37°C. In another set a 100% competition test was done in five wells where 50ml each of hyperimmune antisera raised in both fish and rabbit were added simultaneously as above. The plates were washed in PBS-T and 50 ml of anti-rabbit conjugate (1:500 dilution) was added. They were incubated further for 45 min at 37°C washed thoroughly and 50 ml of substrate solution (5mg of O-phenylenediamine dihydrochloride and 10 ml of H_2O_2 (38%V/V) in 5 ml of acetate buffer, pH 5.0) was added. The plates were incubated at 37°C for 5 min in the dark and the optical density (OD) was recorded at 450/655 nm in a micro plate reader (BIORAD, USA). The results of test sera were calculated by expressing the percentage of inhibition (P.I) as follows.

P.I.= 100- [(mean O.D of test sera/mean O.D.of 0% competition) x100]. The results were interpreted as positive if the values were higher than 50 & negative if less than 50.

Statistical analysis

The zone-wise incidence of different diseases during the entire observation period were analysed and means were compared using one-way analysis of variance (ANOVA) and Duncan's multiple range test (DMRT) using the statistical analysis system (SAS) software (Version 6.12) (SAS, 1991)

RESULTS

During the investigation over the period of last seven years (1999-2005); different bacterial diseases such as dropsy, columnaris, ulcer, septicemia, fin rot/tail rot, bacterial gill disease and diseases due to mixed bacterial infections were recorded in all the three-aquaculture zones. The overall occurrence of these diseases over the entire observation period in each zone has been given in Fig 1, 2 & 3. The incidence of these diseases in all the three zones over the period is also given in Table-1, where the overall mean± standard error of the disease incidence in three aquaculture zones did not show much variation ($p<0.01$) except for bacterial gill disease.

Table -1: Overall incidences of some bacterial diseases in three major aquaculture zones of IndiaD

Diseases	% of incidence(Mean±SE)
Dropsy	11.4±1.18^{bc}
Columnaris	13.8±0.88^{b}
Ulcer	12.5±1.21^{bc}
Septicemia	8.14±00.79^{bc}
Fin rot/ Tail rot	11.9±1.18^{bc}
Mixed bacterial infections	6.57±2.71^{bc}
Bacterial gill disease	21±2.7^{a}
Others	14.1±2.4^{b}

N.B. Means bearing the same superscript are not significantly different

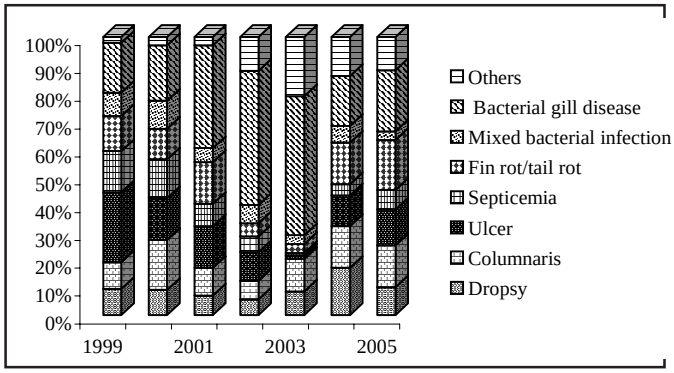

Fig. 1:Year-wise percentage occurrence different bacterial diseases in Indian major carps of zone - I

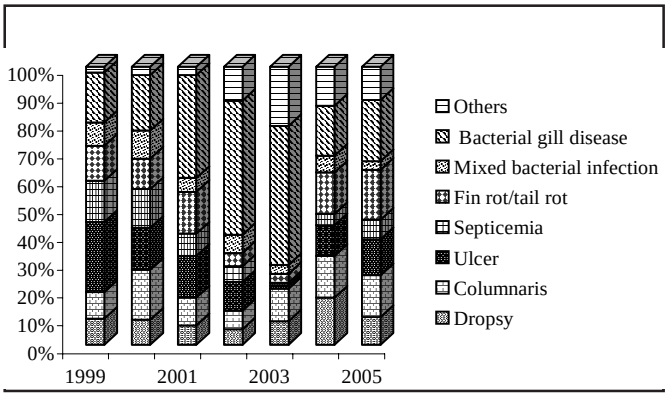

Fig. 2: Year-wise percentage occurrence different bacterial diseases in Indian major carps of zone - II

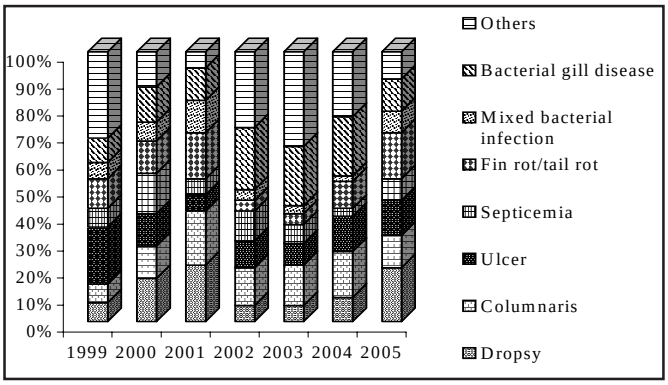

Fig. 3. Year-wise percentage occurrence different bacterial diseases in Indian major carps of zone - III

Zone-wise incidence of these diseases over the entire observation period is given in the Table 3. Among the three zones there was no variation in the incidence of each disease. Therefore, superscript has not been assigned to mean of the incidence of disease in Table - 2.

Table - 2 : Zone-wise incidence of different bacterial diseases

Diseases	Zone-I	Zone-II	Zone-III
Dropsy	12.7±2.21[a]	9.4±1.36[b]	12.1±2.52[abc]
Columnaris	15.4±1.52[a]	12.1±1.48[b]	13.8±1.56[abc]
Ulcer	12.8±2.13[a]	12.8±2.58[b]	11.8±1.81[abc]
Septicemia	8.57±0.86[a]	7.71±1.83[b]	8.14±1.45[bc]
Fin rot/ Tail rot	13.8±2.17[a]	11.28±2.07[b]	10.7±2.02[bc]
Mixed bacterial infections	7.71±4.51[a]	6.0±0.97[b]	6.0±1.29[c]
Bacterial gill disease	16.8±4.22[a]	30.2±5.46[a]	16.14±2.24[ab]
Others	11.71±4.5[a]	9.57±2.62[b]	21.14±4.32[a]

N. B. Means bearing the same superscript are not significantly different column- wise ($p<0.01$). Means in a row did not differ significantly ($p<0.01$), therefore, superscript has not been assigned.

Zone-wise analysis revealed that the disease incidence in zone-1 did not differ significantly ($p<0.01$). In zone-II, only bacterial gill disease showed higher incidence than rest of the diseases. However, in zone-III, the incidence of diseases showed a little variation among themselves.

On bacteriological study, *A. hydrophila* was isolated from the diseased fishes affected with dropsy, ulcerative, septicaemia, and fin rot/tail rot diseases from all the fish species of Indian major carps, whereas bacteria like *F. branchiophilum* and *F. columnarae* isolated from fishes affected with gill disease and columnaris cases, respectively. Bacteria like *P. aeruginosa, P. fluorescens, E. tarda, E .coli* and *F. columnarae* were routinely isolated from ulcerative and septicaemic conditions of fishes. (Table - 3)

Table -3: Different bacteria isolated from disease-affected Indian major carps

Sl No.	Disease	Organs of fish from where bacteria isolated	Bacteria isolated
1.	Bacterial gill disease	Gill	*F. branchiophilum*
2.	Dropsy	Peritoneal fluid Kidney, Liver, Blood	*A. hydrophila* *P. sorbia* *P.aeruginosa*
3.	Ulcerative and Septicemia conditions	Deep skin lesion, Blood	*P.aeruginosa* *P. fluorescens,* *E. tarda,* *A hydrophila,* *E.coli,* *F. columnare*
4.	Columnaris	Kidney	*F. columnarae*
5.	Tail rot/fin rot	Tail/Fin lesions	*A. hydrophila*

The serosurveillance study for specific antibody against various pathogens by competitive ELISA indicated 74.07% of the sera samples to be positive for *F. branchiophilum* antibodies, while 58.3%, 75 % and 46.6% of sera samples were positive for *E. tarda, A. hydrophila* and *P. fluorescens* antibodies, respectively (Fig. 4).

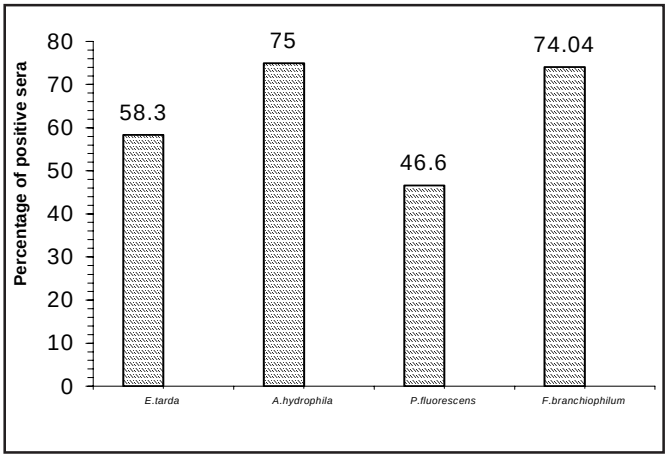

Fig. 4: Detection of antibodies against different bacterial infections of fish by competitive ELISA

DISCUSSION

Disease prevalence in a population is dependent on the interaction of complex environmental factors like pollutants, chemical and biological wastes and the nature of pathogens. Sound aquaculture practices of any country depend on the intensive management practices adopted by farmers and guided by effective health management and disease surveillance policies. In India also, aquaculture has been practiced in intensive scale in some areas with outbreak of many diseases round the year among which bacterial diseases pose enormous threat. No systematic study till date has been done to map out the occurrence of these diseases inspite of huge economic loss. The present investigation was therefore, briefly aimed to identify the incidence and occurrence of some of the important bacterial diseases in order to know their status so that further study in this regard can be initiated. During the present investigation we could observe the deteriorated water qualities in most of the affected ponds due to excessive use of organic manures and feeds in all the three zones sampled. The preliminary identification of bacterial disease was done by symptoms, gross patho-morphological changes followed by bacteriological identification. The diseases recorded during the investigation period of seven years (1999 to 2005) were columnaris (13.8±0.88%), bacterial gill disease (21±2.7%), dropsy (11.4±1.18%), fin rot/tail rot (11.9±1.18%), septicaemia (8.14±0.795) and ulcerative (12.5±1.21%) cases. Diseases either due to mixed

bacterial infection or other causes were restricted to 6.57±2.71% and 14.1±2.46%, respectively. The incidence of acute abdominal dropsy as recorded earlier (Shome *et al*., 1996; Shome *et al*., 1999 and Gopalkrishna, 1961) in Indian major carps was observed in zone I II& III. Zone-wise, there was no variation in occurrence of each disease. Moreover, incidence of all the bacterial diseases over the years did not show much variation ($p<0.01$). During the investigation the highest percentage of diseased samples were found to be affected with gill diseases and among different zones, zone-II had quite high incidence of bacterial gill disease particularly during the year 2002 and 2003. On bacteriological study of gill diseases, a Gram negative, yellow-pigmented filamentous *F. branchiophilum* was found to be responsible for the onset of this disease. The bacterium is one of the causative agents of this economically important disease, responsible for high mortalities in a wide range of fishes (Bernardet and Grimont, 1989; Bullock, 1990). The serosurveillance study showed 74.04% fishes to be positive for *F. branchiophilum* antibodies.

A number of factors are responsible for the establishment of bacterial gill disease including bacterial load, environmental condition, high organic load, and water temperature (Arp, 1988; Huh and Wakabayashi, 1989; Toranzo and Barja, 1993).

A wide range of bacteria *A. hydrophila, E. tarda, P.fluorescens* were frequently isolated from fin rot/tail rot, ulcerative and septicemic conditions of the fishes. Besides this, *A. hydrophila* isolates were frequently isolated from septicemic blood and body fluids of dropsy-affected fishes, irrespective of fish species. Moreover, all the sera collected from fishes with dropsy were positive for *A. hydrophila* antibodies, A. *hydrophila*, a ubiquitous freshwater bacterium, might be primarily or secondarily associated with infection leading to ulceration in skin, tail and fin and was found to be seropositive in 75% of the tested samples.

Serological tests are very popular in screening disease incidence/diagnosis of disease in veterinary and medical practices, but limited in aquaculture practices. The sero surveillance study using a competitive ELISA found out the incidence and occurrence of some of these bacterial infections. From the above study it is concluded that Indian major carps were affected by a wide range of bacterial pathogens and disease due to the bacteria are very well occurring in these species over the years in all the aquaculture regions of India The poor environment and management practices are the main predisposing factors for these diseases. Hence, proper care has to be taken in order to avoid the losses due to these bacterial diseases.

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ANTIBACTERIAL STUDIES OF *Alstonia scholaris R. BR.* AGAINST DERMATOLOGICAL PATHOGENS

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ABSTRACT

Extracts [petroleum ether (PE), benzene (BN), chloroform (CL), ethanol 95% (ET) and Purified water (AQ)] of stem bark of *Alstonia scholaris R. Br*. (Family: Apocynaceae) were investigated for antibacterial activity against *Staphylococcus aureus*, *Streptococcus pyrogenes*, *Enterococcus faecalis*, *Propionibacterium acnes, Klebsiella pneumoniae* and *Pseudomonas aeruginosa*_by determining minimum inhibitory concentration (MIC) by macrodilution method. The MIC of extracts for antibacterial activity was PE (500 to 1000), BN (62.5-250), CL (125-1000), ET (250-1000) mcg/ml and much higher for aqueous extract. Benzene extract exhibited significant inhibition against most of the tested bacteria in comparison to other extracts. An attempt has been made to compare the activity with that of standards in terms of zone of inhibition by disc diffusion method.

Keywords : antibacterial activity, stem bark extracts, zone of inhibition, *Alstonia scholaris*

INTRODUCTION

Alstonia scholaris R. Br. (Family apocynaceae) is an evergreen tree, 40-60 ft. tall, branched, leaves are in whole and bark grey and rough, found throughout India in forests and plains and also in many other countries (Kirtikar and Basu, 1976).

Bark and leaves are used to treat headache, influenza, bronchitis, pneumonia, and fresh latex is applied locally on boils for suppuration (Maheswari, 2000). The plant is a constituent of Ayush-64 effective in micro-filaraemia (Pandey, 1991). The bark has been reported to have antileishmanial (Singha, 1992), anticancer and hypoglycemic activity (Akhtar and Bano, 2002). The present study is intended to determine the antibacterial activity of the stem bark against selected dermatological pathogens and compare it with the standards. The stem bark of *Alstonia scholaris* was cut and removed from a fully grown plant during the month of February from Bhubaneswar. The tree along with bark was authenticated in Central Research Institute (Ayurveda), Bhubaneswar.

MATERIAL AND METHODS

Experimental Design

The bark was collected in bulk, washed with tap water for proper cleaning and dried under shade. The dried bark was powdered with the help of a mechanical grinder. The coarse powder was then extracted successively in Soxhlet apparatus using petroleum ether (PE), benzene (BN), chloroform(CL), ethanol 95%(ET) and purified water(AQ). The extracts were filtered and concentrated to dryness under vacuum. The in-vitro antibacterial screening was carried out using selected superficial dermatological pathogens including bacteria such as *Staphylococcus aureus* (Sa), *Streptococcus pyogenes* (Sp), *Enterococcus faecalis* (Ef), *Propionibacterium acnes* (Pacnes), *Klebsiella pneumoniae* (Kp) and *Pseudomonas aeruginosa* (Pa) obtained from M.T.C.C. Institute of Microbial Technology, Chandigarh, and from standard laboratory maintained in the Dept. of Microbiology , Utkal University, Bhubaneswar

Macrodilution technique for MIC determination

One thousand mcg/mL solution of each extract was prepared by dissolving in 6% DMSO solution and by two fold serial dilution method a range of 8 solutions from 7.8 to 1000 mcg/mL were prepared using same solvent. 0.5 ml each of above solutions was taken in test tubes. 0.5 ml of respective sterile broth was added to each followed by inoculation using 50 mcL of overnight respective broth culture of bacteria. One test tube containing the inoculated broth with solvent as positive control and one without inoculation as negative control were used. All tubes were incubated at 37^0C for 24 hours. The test tubes were observed for appearance of turbidity in comparison to both positive and negative controls. The minimum concentration showing no turbidity (no growth of microorganism) was considered as MIC. For confirmation, respective solutions of each tube were subcultured on respective sterile agar plates and incubated as mentioned above (Janssen et al., 1986). Plates showing no growth with respect to lowest concentration confirm the MIC value and are given in Table 1.

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Table-1: MIC values in mcg/ml and Zone of Inhibition in mm of various extracts of Alstonia scholaris

Sr. No.	Bacterial Strains	MIC values (mcg/ml)					Zone of Inhibition in mm					
		PE	BN	CL	ET	AQ	PE	BN	CL	ET	AQ	SD
1	Sa	1000	125	1000	500	—	8	17.7	9.7	12.3	ND	29
2	Sp	—	125	250	1000	—	ND	18.7	15.7	9.3	ND	21.3
3	Ef	1000	250	1000	—	—	8.3	15.3	9.3	ND	ND	36
4	Pac	500	62.5	500	250	1000	11	21	12	15	8	26.3
5	Kp	500	62.5	500	1000	—	12	22	11.3	8.3	ND	36.7
6	Pa	1000	250	125	1000	—	8.3	14.3	16	8	ND	33.3

Sa : *Staphylococcus aureus* , Sp: *Streptococcus pyogenes* , Ef : *Enterococcus faecalis* , Pac: *Propionibacterium acnes*, ,Kp: *Klebsiella pneumoniae* , Pa: *Pseudomonas aeruginosa* PE : petroleum ether, BN : benzene, CH : chloroform, ET : ethanol 95% , AQ : purified water, SD : standard (Ciprofloxacin 10 mcg per disc)

Disc Diffusion method for zone of inhibition determination:

Antibacterial activity of the extracts were tested separately using disc diffusion method (Murray *et al.,* 1995; Bauer *et al.,* 1966). 100 mg/ml solution of respective extract were prepared by dissolving in 6% DMSO. Paper discs of 6mm dia. (Whatman No.1) were sterilized, impregnated with 10mcl (1000mcg /disc.) of 6% DMSO stock solution of extracts, dried and placed on the surface of inoculated petri plates [Nutrient agar plates(for P. acnes, Thyoglycolate agar plate) were prepared and sterilized. Plates were inoculated using corresponding broth cultures of bacteria]. Discs of standard (HiMedia, Bombay) such as ciprofloxacin (Cf) 10 mcg was similarly placed on respective plates. The plates were kept for incubation at 37^0 C for 24 hr. The assessment of antibacterial activity was based on the measurement of diameter of zone of inhibition formed around the disc. The tests were carried out in aseptic environment and in triplicate and average values of overall observations were recorded in Table-1.

RESULTS

The results of the study indicated the presence of antibacterial properties of various extracts. The MIC value of different extracts against tested pathogens as recorded in Table-1 showed that benzene extract inhibits the bacterial growth at a comparatively lower concentration (62.5-250 mcg/mL) than chloroform (125-1000 mcg/mL). Pet. ether and aqueous extract showed very poor inhibitory effect. While comparing the zone of inhibition (Table-1 and Fig-1) with the standard (Ciprofloxacin, 10 mcg), the benzene extract showed 14.3-22 mm zone of inhibition against all bacteria with highest inhibition against *Klebsiella pneumoniae*(22 mm) followed by *Propionibacterium* acnes(21 mm), *Staphylococcus aureus* (17.7 mm) and *Streptococcus pyogenes* (18.7mm). The zone of inhibition for Ciprofloxacin was 21.3-36.7 mm.

DISCUSSION

The broad spectrum antbacterial activity exhibited by the benzene extract may be attributed to the constituents like alkaloids, phytosterols, fats etc. which either due to their individual or combined action. The results confirm the ethnomedicinal claim of the bark of *Alstonia scholaris* to have antbacterial activity in skin diseases. Further studies aimed at development of herbal creams of the active extract.

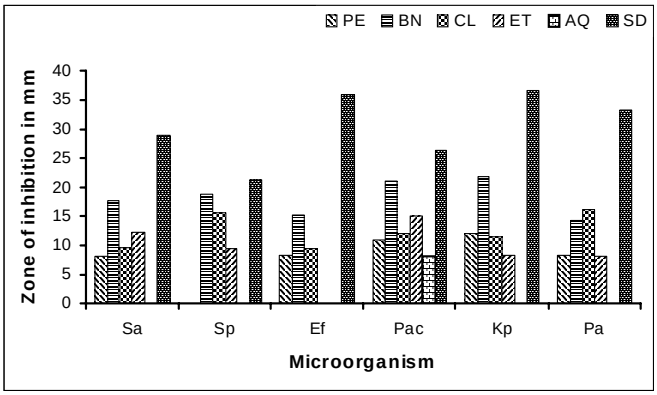

Fig. 1: Histogram depicting the comparative zone of inhibition of extracts of Alstonia scholaris R. BR against bacterial strains

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INDIGENOUS ORNAMENTAL FISHES: STATUS, ISSUES AND STRATEGIES FOR PROPAGATION AND CONSERVATION

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ABSTRACT

The ornamental fish is an emerging area of research and development owing to its growing popularity in the country. Entrepreneurs in the country have shown interest in the utilization of the indigenous ornamental fishes for economic development of the country. But, there are many areas of concern in the conservation and utilization of indigenous fishes as irrational exploitation of it may lead to the depletion of these vital resources. There are two streams of strategies for the conservation of the resource, i.e through in-situ and in-vivo conservation and development of breeding technology. This paper reviews the status and issues involved in the propagation and conservation of the indigenous ornamental fishes in India.

Key words : ornamental fish, biodiversity, conservation, breeding technology

INTRODUCTION

Ornamental fishes form an important commercial component of aquaculture, providing for aesthetic requirements and upkeep of the environment. Nowadays keeping ornamental fish in aquarium and garden pool is a fashion. New varieties of fish are brought in the purview of ornamental fishes over the period of time. Out of this, only few species are bred in captive conditions and rest are traded after collection from natural water bodies like lakes, wetlands, rivers, stream, flooded lowlands etc. The traders and exporters of the indigenous ornamental fishes are banking upon rampant exploitation of these fishes from the natural ecosystem. If this continues, there is a serious apprehension that we may loose our indigenous stocks. Therefore, conservation of the indigenous ornamental fishes is a key to sustain the ornamental fish industry both within and outside the country. Two basic strategies are adopted for the conservation and propagation of these vital resources i.e in-situ and in-vivo conservation and development of the breeding technology. Many initiatives are taken by the national and international research and developmental agencies on various strategies to conserve the indigenous ornamental fishery resources. The present paper reviews the issues, strategies and initiatives in the conservation and propagation of the indigenous ornamental fishes in India. India possesses a rich fish biodiversity of about 2118 species, out of which more than 600 species are distributed in freshwater lotic and lentic systems . The country further possesses a rich diversity of non-food colourful fish as prospective candidate species for ornamental purposes, with over 100 varieties of indigenous species and similar number of exotic species that can be bred in captivity. Such a large fish biodiversity in the country is supported by the presence of vast natural freshwater resources comprising 2.36 million ha ponds and tanks, 1.3 million ha beels, jheels and derelict waters in addition to 0.12 million canals, 2.05 million ha reservoirs and 75,000 km stretch of rivers (FAO, 2000). It offers a greater scope for utilization and commercial production of the fishes in comparison to those of other potential countries like Singapore, Sri Lanka, Malaysia, Indonesia and many African countries.

BIODIVERSITY OF INDIGENOUS SPECIES OF INDIA

The indigenous fishes are distributed across all parts of the country but few regions are considered to be hotspot of these resources. It is estimated that about 33% are available in North-Eastern region, 24% in Southern region, 23% in Eastern region, 6% in Western region, 3% Northern region, 2% in Central region and 10% throughout India (Swain, 2006). The two pockets of North-Eastern Hill region and the Western Ghats remained unexplored to a large extent and still many fishes are untapped. Out of 806 fish species inhabiting in freshwaters of India, the total fish species reported from North Eastern States consist of 114 genera belonging to 38 families and 10 orders; the number of fishes include 217 in Assam, 167 in Arunachal pradesh, 165 in Meghalaya, 134 in Tripura, 121 in Manipur, 68 in Nagaland, 48 in Mizoram and 29 in Sikkim, some of them being commonly found at more than one places (Pers. comm. NERC, CIFRI, Guwahati, Assam). Out of the total number, 196 species are considered as ornamental. Sinha

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(1994) in his comprehensive review gave a list of 230 fishes available from North Eastern region. Recently Nath and Dey (1989) recorded a total of 131 species from the drainages of Arunachal Pradesh. Mahanta *et. al* (1998) recorded altogether 187 fish species from Assam and neighbouring NEH regions of India. Department of Fisheries, Government of Nagaland has identified 90 endemic fishes in the State of which many are very colourful and can be considered as ornamental fishes (Senli, 2005). Vishwanath, (2003) has recorded 200 species of fishes available in Manipur out of which majority are small sized and colourful hill stream fishes. At present, 58 species of indigenous ornamental fishes occurring in the North East are being exported as reported by MPEDA, India. Similarly, in Western Ghats, out of 287 species, 192 species are demarcated as endemic. Of the 153 fishes listed from Western Ghats, 106 species endemic to peninsular India (with reference to Western Ghats) are ornamental in nature. College of Fisheries, Pasangad, Kerala have collected 57 species of freshwater fishes from the Western Ghats and studied their behaviour and feeding habits in captive conditions. Forty-seven of them were recommended as ideal for ornamental fish industry (Gopalakrishnan and Ponniah, 2000, Mercy *et. al*. 2001).

Ornamental fish breeding centers and the related trade has been confined in and around the metropolitan cities like Kolkata, Chennai and Mumbai obviously due to ready urban market and availability of international airports for both import and export business. Kolkata has been the gateway of import of popular aquarium fishes from different countries, from where they are distributed to other places.

It has also been noticed that Indian ornamental fishes having aesthetic values are of greater demand in international market for aquarium keeping. The main markets are the United States of America, the United Kingdom, Belgium, Italy, Japan, China, Australia and South Africa. Many Indian species like catfish, dwarf gouramis, and barbs are popular abroad and fetch good price.

PROSPECTS OF COMMERCIAL PRODUCTION IN INDIA

Export of ornamental fishes from the country presently is mainly confined to freshwater varieties and the export is limited to the fishes inhabiting in freshwaters in the North-Eastern states (85%) and a few bred varieties of exotic species (15%). As the country possesses vast resources in terms of natural water bodies and species diversity, we have a great potential to increase the level of export of about US $ 30 million, i.e. about Rs. 110 crore every year (Swain *et. al* 2006). Systematic studies on the biology of most of the varieties of ornamental fish are yet to be made. It is imperative to adopt a rational exploitation strategy from natural freshwater resources where the indigenous varieties are available. The strategy should be made on propagation of some of the colourful varieties of ornamental fishes in the captivity after knowing their exact feeding habit and biology. Through this measure, we may proceed towards conservation of the resources.

ECONOMIC PROSPECTS OF ORNAMENTAL FISH

Off late ornamental fishes have been recognized as the important avenue for the income and employment generation in the country. The economic activities of ornamental fish culture involve a complete chain of the entrepreneurs and enterprises i.e. fish collectors from natural water bodies, local traders, exporters, manufacturers of the aquarium, fish breeders, ornamental fish farmers, vendors etc. With the increase in income and urbanization, the habit of keeping ornamental fishes has been increasing at rapid pace. The sector has a lot of potential in terms of wealth generation as economic activities can be widened within the scope of limited volume of water. The price fetched by ornamental fishes is much more than the food fishes indicating high degree of economic efficiency vis-à-vis resource consumption in the sector. Till today, a very limited study has been conducted on economics and economic prospects of ornamental fishes.

According to John Dawes, Secretary-General of the non-profit organization Ornamental Fish International based in Singapore, the common thinking of general mass is that the aquarium industry depletes and destroys marine life whereas in fact, it has far less impact than commercial fishing. The average retail price for food fish was between US$ 14,500-16,500/t, but ornamental fish typically is traded at US$ 1.8 million/t. Lack of information plays a major part in misconceptions about the trade, spurring global efforts for more accurate data.

TENETS OF SUSTAINABLE HARVEST OF WILD SPECIES

There are many issues involved in the sustainable harvest of wild species. Few principles and practices of the eco-friendly utilization of fish biodiversity are as follows:

(i) Freshwater fishes can be sustainably harvested as long as natural habitats (including the breeding grounds) are conserved. Therefore, knowledge about the habitat, ecology, food and feeding habits and feeding behaviour, breeding season and size at maturity stage, reproductive physiology (including fecundity) etc. of important species need to be gathered first.

(ii) The fishes pass through two phases in terms of the population dynamics, i.e growing and collapse phases.

Typically, the growing phase is just after spawning during the monsoon season and young ones are seen in the nature. This phase is vulnerable to both inter- and intra-specific competition and predation. Growing phase is the phase in which certain species can be harvested with less immediate and direct impact to the long-term survival of the population. During the collapse phase many individuals die due to lack of water and other resources. This is a particularly appropriate juncture to harvest, not only because many of the fishes will die, but also it is relatively easier for fishermen to catch them since the water table is low.

(iii) Most species of tropical freshwater fishes are not annual fish, and the typical lifespan of smaller fishes is anywhere between two to five years. Therefore, fish collected during the collapse phase may not have much impact on the population size of the species. Its effect on the ecosystem may be minimal due to small size of the fish. Proper harvesting techniques will certainly reduce high mortality rates and the threat to survivability of the species can be avoided.

(iv) Care should be taken to minimize the mortality in wild-caught fishes. The actual harvesting process has to be improved. The nature of the aquarium market today is that high quality fish are in demand, even if prices lie somewhat in higher side.

(v) Improved technology of harvest and proper acclimatization of the fishes are necessary before export to ensure a high percentage of survival on arrival at the destination.

(vi) Improvement in packing technology allows highly stocked fishes to remain alive for longer periods. This involves not only the technology concerned and water quality but also more appropriate use of anesthetics and chemicals during transportation.

(vii) Freshwater fishes in general are relatively easy to acclimatize if critical detail of its natural habitat type is known.

DEVELOPMENT OF BREEDING TECHNOLOGY OF INDIGENOUS SPECIES

Central Institute of Freshwater Aquaculture (CIFA) is a premier research Institute in the country working in research and development of different aspects of freshwater aquaculture and ornamental fish breeding and its nutrition-related research since last two decades. The role played by the ornamental fish unit of this institute ensures promotion of hobby of fish keeping, entrepreneurial development through conducting many national and international training programmes, development of policy by interacting with various state agencies for popularizing the ornamental fish sector in the country. Special efforts are being made to breed some of the indigenous varieties in captive condition. Success in breeding and larval rearing has been achieved in a dozen of ornamental fishes endemic of North Eastern India (Table-1). Successful breeding and larval rearing of the spiny eel *Mastacembelus armatus* have been achieved by the Institute. Some success on brood stock development of Y-loach (*Botia lohachata*), Yellowtail Scissortail (*Rasbora rasbora*) and many indigenous ornamental fishes of commercial importance has been made but breeding experiments are yet to be conducted. A hybridization programme was successfully taken up between two indigenous barbs to observe any change of body colour or fin pattern. In F1 generation, it has been observed that the spot in caudal peduncle region in the hybrids was more prominent and surrounded by golden colour ring. The species are kept in a controlled condition for further research. The indigenous fish species(s) that could be successfully bred and reared at CIFA are *Brachydanio rerio* (Zebra fish), *Puntius conchonius* (Rosy barb), *Colisa fasciata* (Banded gourami), *Colisa lalia* (Dwarf gourami), *Parlucioma daniconius* (Black line rasbora), *Esomus barbatus* (Flying barb), *Danio aequipinnatus* (Giant danio), *Danio devario* (Torquoise danio), *Puntius sophore* (Sophore barb), *Puntius ticto* (Two spot barb), *Badis badis* (Chameleon fish) and *Puntius fasciatus* (Melon barb).. Larval rearing of *Ompak pabda* is successfully done by the Kalyani centre of CIFA leading towards commercialization. Efforts are being made in the Institute to standardize the breeding experiments of the important indigenous varieties like *Puntius denisonii and Puntius filamentosus* (Swain *et. al.,* 2008).

Besides CIFA, other institutions like College of Fisheries, Raha, Assam has been able to breed few ornamental fish species including Peacock eel of North Eastern India (Das and Kalita 2003). Some indigenous ornamental fish species like *Chaca chaca* (Sane and Bhide, 1992) and *Colisa chuna* (Sane, 1962) are also bred by the NGO "Sanjeevan" at Mumbai leading to their commercialization in small scale. It is high time to develop breeding technology of many indigenous varieties which are depleting from nature. Unless the technology of commercial breeding of an Indian species is made, it is difficult to conserve our indigenous fish biodiversity as well as adoption of programmes on entrepreneurial scale for export.

Table: 1 Distribution of Indian freshwater ornamental fishes (Swain, et.al, 2008)

Common name	Scientific name	Distribution
Black knife fish	*Notopterus notopterus*	All over India
Scaly barb	*Gonoproktopterus lithopidos*	South Karnataka
Red tailed silver shark	*Gonoproktopterus curmuca*	Western Ghat
Red gilled violet shark	*Labeo boga*	Ganga river
All black shark	*Labeo calbasu*	Northern India
Pencil gold labeo	*Labeo nandina*	Assam
Hi fin barb	*Oreichthys cosuatis*	Eastern India
Black border tail orange cap	*Osteochilichthys nashii*	Western Ghats of Karnataka
Four spot barb	*Puntius arulius tambraparnei*	Rivers of Tamilnadu
Indian rosy barb	*Puntius conchonius*	Eastern India
Red line torpedo fish	*Puntius denisoni*	Kerala
Long snouted barb	*Puntius dorsalis*	Krishna River System
Green swamp barb	*Puntius chola*	North Eastern India
Melon barb	*Puntius faciatus faciatus*	Nilgiri hill, streams in Kerala and Karnataka
Black spot barb	*Puntius filamentosus madraspatensis*	Karnataka
Filament barb	*Puntius filamentosus assimillis*	South Kerala
Malini's barb	*Puntius mahecola*	Annamalai hills
Neon hatchet	*Chela cachius*	Assam
Chaguni	*Chagunius chagunio*	Nagaland
Gangetic mud eel	*Monopterus cuchia*	North eastern India
Burjors brilliance	*Chela dadiburjori*	Kerala, Goa
Blue dot hill trout	*Barilius bakeri*	Western Ghat, Kerala
Silver trout	*Barilius barna*	Nagaland
Shacra baril	*Barilius scacra*	Nagaland
Spotted trout	*Barilius tileo*	Nagaland and Ar. Pradesh
Half banded	*Barilius vagra*	Nagaland
Zebra danio	*Brachydanio rerio*	All over India
Giant danio	*Danio aequipinnatus*	North eastern India
Moustached danio	*Danio dangila*	Bihar , Assam
Torquoise danio	*Danio devario*	Eastern India
Naga danio	*Danio nagaensis*	Nagaland
Malabar danio	*Danio malabaricus*	Wetern Ghats
South Indian flying barb	*Esomus barbatus*	Tamilnadu, Karnataka
Mustached rasbora	*Esomus daniconius*	Assam
Slender rasbora	*Parluciosoma daniconius*	Throughout India
Black line rasbora	*Parluciosoma labiosa*	Nasik dist of Maharastra
Rhinocerous algaeater	*Garra bicornuta*	Thunga river , Karnataka
Cauvery gara	*Garra mcclellandi*	North Eastern India
Naga gara	*Garra naganensis*	Nagaland
Gotyla gara	*Garra gotyla*	North eastern India
Khasi gara	*Garra lissorhynchus*	Meghalaya and Nagaland
Sidewinder loach	*Aborichthys bijulensis*	Garo hills, Meghalaya
Puma loach	*Acanthocobitis rubidipinnis*	Upper Assam
Leopard loach	*Acanthocobitis botia*	North eastern India
Black line loach	*Nemachelius anguilla*	Krishna river, South India
Burmese stone loach	*Balitora burmanica*	Nagaland
Grey's stone loach	*Balitora brucei*	Nagaland
Jayantia loach	*Nemacheilus reticulofasciatus*	Meghalaya and Nagaland
Corica loach	*Nemacheilus corica*	Assam, Arunachal Pradesh and Meghalaya
Penguin loach	*Nemacheilus penguensis*	Manipur
Manipur loach	*Nemacheilus manipurensis*	Manipur and Nagaland
Banded loach	*Shistura beavani*	North Bengal
Polka dotted loach	*Schistura corica*	North Bengal
Ring loach	*Shistura denisoni dayi*	Bihar
Olivaceous loach	*Schistura devdevi*	Teesta river drainage
Many banded loach	*Schistura multifaciatus*	Eastern Himalayas
Victory loach	*Shistura scaturigina*	Eastern sub Himalayas
Fascinating loach	*Schistura semiarmatus*	Cauvery river in South India
Savanna loach	*Shistura savana*	Assam, Arunachal Pradesh, Meghalaya and Manipur
Long snouted loach	*Nemachilichthys ruppelli*	Karnataka
Black panther loach	*Shistura yenjitee*	Bhutan
Grizzled loach	*Shistura sikmaiensis*	Manipur Valley
Zodiac loach	*Mesonoemacheilus triangularis*	Western Ghats, Kerala
Tail spot loach	*Lepidocephalus annandalei*	Upper Assam
Goalpara loach	*Lepidocephalus goalparensis*	Goalpara Assam, Orissa
Panther loach	*Lepidocephalus gunthea*	Northern and Eastern India
Indian coolie loach	*Pangio pangia*	North-East Bengal, Eastern Madhya Pradesh
Jaguar loach	*Somileptes gongota*	North Bengal ,Assam
Twin banded loach	*Botia rostrata*	Assam
Y-loach	*Botia lohachata*	Indus and Ganga drainage
Tiger loach	*Botia birdi*	Punjab, North India
Golden banded loach	*Botia dario*	Assam,Bengal, Bihar,Orissa
Striped loach	*Botia striata*	Tunga river, Kolhapur, Maharastra
Blyth's loach	*Botia berdmorei*	Nagaland
Velvet catfish	*Rita pavimentatus*	Andhra Pradesh
Butter catfish	*Ompok bimaculatus*	Throughout India
Gulper catfish	*Ompak pabda*	North east India
Indian tiger shark	*Pangasius pangasius*	Large rivers of India
Giant river catfish	*Bagarius yarelli*	Throughout India
Thread tail catfish	*Conta conta*	Upper Assam
Clown catfish	*Gagata cenia*	North and North east India
Black line catfish	*Glyptothorax anamaliensis*	Anamalai hills, Kerala
Copper catfish	*Glyptothorax telchitta*	Northern India, Orissa
Butterfly catfish	*Hara hara*	Northern India
Elongated mouth catfish	*Hara horai*	North Bengal

Common name	Scientific name	Distribution
Dwarf anchor catfish	*Hara jerdoni*	North Eastern India
Giant mouth catfish	*Hara filamentosa*	Dibru river Assam
Cheetah catfish	*Laguvia shawi*	Darjeeling, N. Bengal
Longtail fighting catfish	*Olyra longicaudata*	Manipur, upper Meghalaya
Fighting catfish	*Olyra horai*	Meghalaya
Devil catfish	*Chaca chaca*	Bengal, Assam ,Orissa, Bihar
Red half beak	*Dermogenys pusillus*	HooglyEastury, Bengal, Orissa
Long nosed needle fish	*Xenentodon cancila*	Most places in India
Cobra snakehead	*Channa butleri*	Assam
Georgette snakehead	*Channa stewarti*	Upper Assam and Manipur
Spotted snakehead	*Channa barca*	Assam
Goldline snakehead	*Channa orientalis*	Eastern orissa, Assam, Manipur and Nagaland
Rainbow snakehead	*Channa blehari*	Upper Assam
Stripped panchax	*Aplocheilius lineatus*	Orissa,West and S. India
Red panchax	*Aplocheilius panchax*	Orissa, North & Eastern India
Day's panchax	*Aplocheilius dayi*	Kerala
Jewel panchax	*Aplocheilius parvus*	Karnataka
Hi fin glass fish	*Pseudambassis ranga*	Throughout India
Giant glass fish	*Parambasis thomassi*	Western Ghat
Finger fish	*Monodactylus argenteus*	Indo west Pacific
Spotted scat	*Swcatophagus argus argus*	Esturies, Chilka (Orissa)
Red scat	*Scatophagus argus rubrifrons*	Hooghlyestuary,Chilka
Leaf fish	*Nandus nandus*	Throughout India
Yellow sunfish	*Pristolepis marginata*	Kerala
Dwarf chameleon	*Badis badis badis*	North east, Orissa, Bengal
Red chameleon fish	*Badis burmanicus*	Upper assam
Noble gourami	*Ctenops nobilis*	Eastern India
Striped gourami	*Colisa fasciata*	Eastern India
Dwarf gourami	*Colisa lalia*	Throughout India
Honey gourami	*Colisa sota*	North east India
Peacock eel	*Macrognathus aral*	Eastern India
Red tailed eel	*Macrognathus jacobbi*	North Bengal, Orissa
Tyre track eel	*Mastacembelus armatus*	Bengal, Orissa, Bihar
Spiny green eel	*Mastacembelus pancalus*	Throughout India
Topaz puffer	*Chelondon steindachneri*	Hooghly, Orissa
Burmese puffer	*Chelonodon nigroviridis*	Gangetic delta, Orissa
Emerald puffer	*Tetradon cutcutia*	North-Eastern India

LIVE GERMPLASM AT AQUARIUM AT CIFA

CIFA has established a research-based aquarium for education and conservation of indigenous ornamental fish diversity of the country. It is opened to the public. The displayed aquaria are biotope based, where few natural aquatic inhabitants like fishes and plants are displayed with an ecosystem concept. Natural conditions are created in aquarium and fishes are induced to breed naturally. Fishes are kept in such a simulated habitat that they spawn and provide parental care to the eggs and offsprings. Few indigenous barbs like danios and rasboras breed in aquaria kept in such a manner; they feel as if dwelling in natural conditions (habitat). It is a collection and conservation centre for indigenous ornamental fish germplasm and plants from different parts of the country and an awareness centre for common public regarding their safeguard and propagation.

DISSEMINATION PROGRAMME BY CIFA

CIFA regularly conducts training and awareness programmes relating to conservation and breeding of the important species. Within the years 2000 and 2008, the Institute has trained more than 1000 people exclusively on ornamental fishes and in addition to this, more than 5000 people has been provided basic information on ornamental fishes during other training programmes. A large number of demonstration programmes are being conducted throughout the country including North Eastern hill region. Few fibre-glass reinforced plastic (FRP) hatcheries are newly established in Meghalaya, Arunachal Pradesh, Dimapur and Silchar under NEH developmental programme. New ornamental fish backyard units have been established in many parts of the country under the technical guidance of CIFA. A large number of awareness programmes are being conducted in many villages to adopt backyard technology of ornamental fish breeding and farming. Besides, information are being disseminated through scientific and popular publications (booklets), talk shows and exclusive television programmes.

INTERVENTION IN CURING DISEASE AND HEALTH MANAGEMENT

In any hatchery system or production unit, it is a must to identify and cure certain pathological disorders in fishes caused by bacteria, fungus, parasites and virus. CIFA is playing a vital role in controlling many diseases occurring in the ornamental fishes in aquarium. A medicine namely 'CIFACURE' has been developed and commercialized as a control measure of many bacterial and fungal diseases. Department of Biotechnology, New Delhi has funded a Project on Investigations on Viral Infections in Koi carps, where a large number of Koi carps are being screened from all over India to detect the presence of Koi Herpes virus. Development of a medicine to prevent fin rot disease in the fish is in process at this Institute.

SUGGESTIONS FOR CONSERVATION OF WILD FISH SPECIES

Of all the live fish species that have ever existed on earth, some are found in plenty, some are endangered and some others have got extinct. Conservation of neither the former nor the latter is an issue but it is important to focus on conservation of the endangered fishes. When the endangered species are considered, it can again be categorized into three groups i.e. species approaching endangerment, species typically endangered and species on the verge of extinction.

When the issue of conservation is addressed, it is more or less directed towards the species that are 'typically endangered'. However, in the context of the indigenous self-recruiting ornamental fish species, conservation of all the three categories of endangered species needs to be addressed. Some suggestions for scientifically tackling these issues are as follows:

(i) After gathering adequate information on the habitat, biology, feeding and reproductive behaviour of the target fish species, their captive breeding strategies could be scientifically thought of; methods can be devised and processes standardized.

(ii) Successful rearing of larvae, young ones and juveniles of ornamental fishes in captivity needs to be taken up. The food and feeding behaviour of each developmental stage of the target fish must be studied and food and feed preference must be recorded.

(iii) After conducting successful breeding trials and completely studying the species' attributes, the species can be ranched in suitable locations in open water systems to allow multiplication of the endangered species in natural environment.

(iv) During rainy (fish breeding) season, harvest of wild species for commercial purpose must be strictly regulated and legislated. This will ensure a steady and sustainable supply of the species from natural environment.

(v) In line with the concept of social forestry, social fisheries (participatory natural resource conservation strategy) needs to be devised by the Research Institutes in collaboration with the State Fisheries departments, Forest departments and the State & Central Ministries of Water Resources. This would provide legal power to the local communities for the protection of natural water bodies and the inhabiting natural resource from being subjected to excessive exploitation.

(vi) Indiscriminate mine explosions, poisoning of natural water bodies, *viz*., hill streams (natural flowing waters) etc. for easy harvest of food fish in the ecologically vulnerable areas are potential precursors for the extinction or at least endangerment of valuable self-recruiting indigenous ornamental fish.

(vii) Knowledge dissemination is one of the important aspects for successful ornamental fishery. Therefore areas are to be sorted out, where such ornamental fishes are available and continuous training and motivation programmes are to be conducted for knowledge on conservation and optimum level of harvest of such fishes.

Sustainable harvest of wild fish populations is possible, if the managers and government officers have sufficient knowledge and foresight of the future disasters. There are certain fish dealers who only collect a limited number of species and fully acclimatize them before sale to customers overseas. But still there are some, who overexploit the natural resource whereupon the issue of endangerment looms large. To understand the fact that the natural resource is ours, the environment that we live in is ours and we being the caretakers, the safeguard of nature and its resources should be our concern. The most plausible solution to the issue of ornamental fish biodiversity conservation is collection of a limited number from the nature, feed and culture them in captivity, study their behaviour and life cycle, breed them and further utilise them for trade and other economic activities or let them to remain safe in the wild nature. Therefore our slogan is always for the nature and environment and we say**....** "Nature's wonderful creation, ornamental fish; let's save and propagate them".

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RESCUE OF A GUN SHOT INJURED SLOTH BEAR *(Melursus ursinus)* FROM NUAPADA, ORISSA, ITS SUCCESSFUL TREATMENT, TRANSLOCATION AND REHABILITATION

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INTRODUCTION

One of a male bear cub of 2 months age abandoned by mother was presented to Gurukul Ashram, Amsena, Nuapada district, Orissa by some tribals. There after the cub has been reared successfully with all the love and affection of the inhabitants and the cub reached adulthood. Later in an undone situation, this particular bear named 'Jamboo' was shot at from close quarter by the Personal Security Officer (PSO)of the Collector, Nuapada at Gurkul Ashram, Amsena. This might be completely a different case but India has been a soft target of poaching of different wild animals. Over the years, Orissa has experienced many shoot out cases of wild animals either for trading or for games and habitual shikar. Recently, a wild tigress got multiple gun shot injuries at Satkosia Wild Life Sanctuary, Orissa(Samantaray *et al,* 2008; Reitz 2005 and 2006). Due to the timely intervention of Nandankanan Zoo authorities, it was rescued and rehabilitated at the zoo since last one and half years, but it suffered from posterior paresis and could not stand and has been passing its life inside a cage. Here in, the capture, treatment, health monitoring, successful translocation and rehabilitation of the aforesaid captive sloth bear have been vividly described.

WILDLIFE LAWS AND REGULATIONS

Sloth bears as per its endangered status have been taken in Schedule I category of Wild Life (Protection Act)-1972 and enlisted in red data book of IUCN as highly endangered category. Many states of India do have bear habitats and Orissa is one of the important sloth bear habitat of the country. It is found in the districts like Keonjhar, Dhenkanal, Mayurbhanj, Sambalpur, Subarnpur, Phulbani, Boudh, Kalahandi, Koraput, Malkangiri, Rayagada, Nabarangpur, Nayagarh etc. During 19th century, large group of bears with cubs were roaming in the jungle, sitting on the branches, crossing roads which clearly signify that Orissa has a rich bear habitat. On the onset of 20th century the numbers have been substantially reduced. After enactment of Wildlife (Protection Act) the number of Madaries playing bears on the street for their livelihood have been significantly reduced.

As we know, without the permission of Zoo Authorities of India, neither any schedule animals can be kept privately nor any wild animal establishment can be opened of its own. Wild Life (Protection Act) has been very stringent with the number of amendments over the years. There are more than a hundred different types of zoos running in the country under a definite guidelines. The apex body is a statutory body i.e. Central Zoo Authority of Government of India. It monitors the activities of the zoos. However, if some people and establishment have already kept certain animals, a circular was floated by the Department of Forests and Environment to delare their captive establishment status before the concerned Chief Wild Life Warden. At Gurukul Ashram, Amsena, Nuapada Swamiji, the chief Administrator of the ashram had applied to keep 2 number of bears and 2 numbers of pea cocks through Divisional Forest Officer (DFO), Khariar to get ownership certificate during 2003. During 2004, he met the DFO twice to expedite the matter. The Divisional Forest Officer was not satisfied with the standards required for the purpose and hence, the proposal was rejected by the then Chief Wild Life Warden (Orissa).In many instances the government norms could not reach to all quarters in time and similarly in many instances, out of ignorance different wild animals have been maintained at different places of the country without necessary clearance. Gurkul Ashram, Amsena was one of such establishment which was maintaining some of the wild animals without the said clearance even though there were certain correspondences from both the end.

LOCATION

Gurukula Ashram, Amsena situated at Khariar road in the district of Nuapada. This particular ashram was established in the year 1968. A long stretch of land with buildings and infrastructure have come up over the time with assistance of many people and organisations. Also the ashram has got a prayer hall, an exercise yard ,a library, a goshala (old cattle rehabilitation center), hostel, kanya gurukul, Ramdulari Brajakishore Hospital etc. Student here study sitting on the ground under canopy of thickly distributed mango and other fruit bearing trees. All

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around the ashram, a boundary wall having a magnificent huge gate to the road point was giving a completeness of a campus. A small chamber, attached to the gate was the center where the finest of ayurvedic medicines, medicinal tea, pure ghee prepared from cow milk and some other medicinal preparations were available. Inside the campus, a small museum runs in the first floor and the ground floor was a completely open platform for morning exercises. In the early morning the students of different age group chant sermons and perform puja(worship) in their prescribed manner. With the fragrance of essence stick the campus becomes lively and give an asthetic fervour. Afternoon, many other teachings and preachings go on inside the campus. During Utsav, some selected families are introduced to the Vedic Dharm and grand gala religious programmes were performed through out the days. Vegeterian food is served to all the inhabitants. Students maintain a good dairy unit, vegetable gardens and orchard besides their routine work. Ashram udyan consists of two acres of land. All around it, boundary is there. In one corner of udyan, a prani udyan is established. It is having different size of small enclosures which accommodates monkeys, hares, gunia pigs, pea fowls, doves etc. Besides this, a comparatively larger house having two rooms with a pucca boundary wall to the front side is there to accommodate this male bear named Jamboo. Two chambers are separated by a partition wall. Inside this chamber, feeding platform and drinkers are made available. One door is there in one side but other side wall is of less height for viewing of visitors. Both the chambers are having a front yard for movement, play and a free exercise covered by a boundary wall. In one side only there is a iron gate for entry of the staff for feeding and other logistics. Initially two male bears were there and after death of one bear, this male bear Jamboo was all alone using both the chambers. Usually students used to look after the feeding and management of the bear on shieft basis. In some cases if a particular student had a knack for animal care, then he was entrusted with the said job. A student Balaram Pangi having the said quality was looking after the pet bear since long.

ANIMAL HISTORY

During the year 2001, this particular male bear of 4 months old was produced to the ashram. Gracefully it was reared and looked after by the ashramites. In annual Utsav, the students show samarkala (war tricks) apart from many other different shows, Jamboo being the centre of attraction. During April 2006 in an instance, some visitors threw stones and the incidence created a long lasting negative impact on its behavioural aspects. Jamboo's anguish continued from that day. After a couple of week, when the care taker (student) entered the bear enclosure's gate, the bear attacked and severely bitten his leg. In fact, to whom it was having heaven of likingness, it betrayed that day. The biting impact was such that till today the boy was not in a position to walk properly. Over this incidence, later on a change, Balaram Pangi was selected and entrusted with the job with the advice of taking necessary precautions.

THE INCIDENCE

On 25.6.2006 afternoon, the Collector and District Magistrate, Nuapada paid a visit to the ashram. Later they came to the Prani udyan. The bear was inside the open space covered by a boundary wall. Balaram Pangi, the care taker was present to feed the animal. Iron gate is usually locked from outside and inside locking arrangement was not there. Often, during feeding time the door remain just closed. Since the door used to be open during feeding hour, almost daily the bear come out and move around the uddyan freely. Students are very friendly with the bear. Even though it comes in contact of number of visitors, it does not harm anybody. During Utsav (annual ceremony), amidst the crowd this pet bear Jamboo used to roam all around the ashram playfully. On the eventful day i.e. 25.6.2006, the keeper has just fed the animal inside. Collector and District magistrate, Nuapada had come to the park with his friends and relatives. As reported during course of feeding the collector was present outside the bear house boundary and taking photographs on a little higher platform. After accepting the feed the animal accompanied his master on to the door. Then both of them came out as usual. Here, the collector was in one side i.e. the wall side where the higher platform for visitors was there and the bear was in the adjacent door side. Suddenly Jamboo came nearer to the collector. With the move all the relatives dispersed with fear and went far to save themselves. Balaram could not sense any danger because Jamboo happens to be friendly with visitors. The bear lifted his fore legs to the body of collector front to front. Probably with the fear, the collector fell down. Jamboo rode over his body and started biting abruptly. The District Magistrate although literally surrendered himself completely screamed looking forward for the last help from his Personal Security Officer. As a part of protecting his boss, the police personnel on duty (although initially ran away), hearing the cry of his master came little closure. Circumstantial evidence indicated that with mixed emotions, he shot at

Fig. 3 : Treatment provided through honey

Dexamethasone sodium (dexona 3 tabs daily), nimesulide (nise 3 tabs daily) were given for 4 days. Betadine mouth wash sprayed to the tongue at the affected part locally and betadine liquid sprayed to the bullet shot injury at leg for fast healing. Himax lotion was sprayed to the injury site at leg to check flies and further maggot invasion. Zincovit, ostocal-B12, liv-52 syrup, glucon-D, electral powder were given as supportive therapy. The doctor and the team from Nandankanan had to stay for 5 days and treat the animal over there considering the emergency of the case. Semi-solid food prepared of rice and milk, honey, milk and bread mix were given as food and medicines were preferred to be given through honey and milk. On day 4 it was observed that the tongue injury was healed up. There was reduced lameness. Ooze out noticed at point of bullet hit injury at leg. Then for thorough examination partially sedated the animal by giving drug xylazine HCl. (100 mg) and Ketamine HCl. (200mg) as injectable taking all care. Undertaking sedation from the gate side, examined closely that a marked perforation at left thigh laterally. Hence, the case was recommended for x-ray investigation and further surgical intervention. Also planning process started to translocate it too Nandankanan Zoological Park for better investigation and treatment.

TRANSLOCATION

On the dated 29th June 2006, in the afternoon the cage with the bear Jamboo was loaded to a truck and the cage was tied from all sides to save from more jerks during transportation and it was directed to drive the vehicle slowly. We left Khariar Road at 4.30 PM . During the night a tarpolin cover was extended to avoid severe wind. Four side ventilation was extended. From early morning, at N.H.42 It was noticed that when other vehicles used to overtake or vehicle the bear used to scream loudly. We reached Nalco township at 8 AM. To our utter dismay, there was labour union strike and vehicles were stranded for miles together. It was all hot and humid condition and the animal became restless. Immediately provided water with glucon-D, honey, anti-stress drug restobal and electral powder in the pot inside the enclosure. Jamboo drank half of the fluid and after a while became little stable. We talked to the top management of National Alluminium Compny,Angul regarding the gravity of the situation. Some how the management allowed our vehicle through their company campus gate following a bypass road we reached to the National Highway. Again we broke journey at Chowduar town ship to check the health condition and gave some supplementation. Finally we reached Nandankanan at about 2 P.M. of 30.06.06, unloaded and released the animal at the isolation ward.

TRANQUILIZATION, RADIOGRAPHIC INVESTIGATION AND TREATMENT

On 01.06.2006 the injured bear was presented to Department of Surgery, Orissa Veterinary College, Bhubaneswar at 8.45 AM in a cage, being transported by a truck. The animal was anaesthetized using a combination of Atropine sulphate 2.0 ml(1.3mg), Xylazine HCl 300mg and Ketamine HCl 5oomg as a single dose by I/M at 8.40 AM. The animal became recumbent at 8.45 AM and complete sedation was achieved by 8.47 AM.

Fig.4 : Radiograph of left hind leg

The Animal was removed from the cage and transported to x-ray room by a wheeled trolley after recording the temperature, pulse and respiration. TPR was recorded to be 100.4^0 F, respiration 12/min, pulse 76/min and heart rate 80/min. Radiographs were taken in lateral and ventro-dorsal views and processed. No bullets could be located in the leg or thigh regions. Test with metal detector was conducted which did not indicated any metallic objects in the body. Complete examination was done after clipping the hair and the following wounds were identified.

(i) A bullet shot wound of 1 cm. dia on the left lateral region below the level of the ischial arch and the exit wound of about 2 cm. was located on the medial aspect of the thigh.

(ii) Tongue was injured with the free portion nearly half the width on the left side injuring the

Fig. 5 : Cut wound of tongue healed up

lateral aspect of the lip also nearer to the commissure. By this time the wound was in the healing stage. The injury of the lip was about 1 ½" in oblique angle.

(iii) There was a bruise of about 1 1/2" by the side of the neck on right side. No bullet has penetrated into the neck. The wounds at the tongue, lip and neck regions were applied with Terramycin liquid as they were superficial.

(iv) The wound at the left hindlimb were cleaned, exudates were collected into a sterile syringe for anti-biotic sensitivity test.

Fig. 6 : Cleaning of bullet wound through the track showing entry and exit point

The wounds were cleaned thoroughly and irrigated with terramycin liquid after shaving the area. There was no trace of suppuration in the track though it was 10 days old. It is pertinent to mention here with that since bear was uner going treatment right from 27th June, all the injuries were substantially improved.

FEED RECOMMENDATION AND WOUND MANAGEMENT

It was confirmed that there was no bullets inside. Also a panel of doctors from Orissa Veterinary College opined that since the animal got better treatment right from the beginning including regular dressing from one side of the track, there's no suppuration through out the track and also the tongue was already healed up. Hence, only dressing, parenteral anti-biotics, fly repellent locally, oral vitamins continued for another week. Dressing continued. Finally after a couple of week the thigh injury was healed up completely.

CONCLUSION

Wild animals of Orissa get traumatic injuries mainly because of poaching. But this particular case is a very rare kind of happening. The Personal Security Officer of the District Magistrate shoot from close range to protect his master. One at the most positive aspect of the incidence was that the Collector, Nuapara got a second life and the animal was also survived. Since it was clear cut gun shot wound, there was possibility of lead poisoning, septicemia and supposedly many other complicacies.With the Immediate action of Anti-Depredation Team quick and aunthetic treatment and with timely ivestigation from Orissa Veterinary College, the bear was completely cured. Further, lots of churning were made. PCCF(WL) and CWLW(Orissa) made spot review of the situation staying at the circuit house for almost 4-5 days. Divisional Forest Officer was directed to review the status of the establishment. It was revealed that the Gurukul has applied to Central Zoo Authority for availing permission to get zoo status which which was denied after careful evaluation. Hence, Immediately action was taken to arrange transfer of many other animals like deer, pea fowls etc. from Gurukul Ashram, Amsena which was immediately complied. Now the rescued sloth Jamboo is gracefully living at Nandankanan Zoological Park and leading a normal life. Till many days Ashramites were coming just to take a glimse of their loving friend. But from zoo ethical point of view, further they are not allowed to closely meet their friend. Now, the bear is turning into wild habits and awaiting to be released to the future Bear Safari, possibly coming up in near future at Nandankanan.

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EFFECT OF ACID RAIN ON WILDLIFE AND THE ECOSYSTEM

K. K. Sardar[1] and N. Sahoo[2]

INTRODUCTION

Acid rain, a high content of sulphuric acid, is produced when sulphur dioxide combines with hydrogen. Sulphur dioxide is released from natural sources, such as volcanoes, sea spray and rotting vegetation. Burning fossil fuels such as coal and oil also produce it. Once released, sulphuric acid mixes with hydrogen, a gas that is already in the atmosphere. The resulting sulphuric acid falls back down to the earth as a pollutant, acid rain. Rain is acidic in nature because carbon dioxide, found normally in the earth's atmosphere, reacts with water to form carbonic acid. While "pure" rain's acidity is pH 5.6-5.7, actual pH readings vary from place to place depending upon the type and amount of other gases present in the air, such as sulphur oxide and nitrogen oxides. The acid in acid rain comes from two kinds of air pollutants namely sulphur dioxide and nitrogen oxides (Economopoulos, 1993).

Acid-rain does not affect one place in the environment but it causes widespread problems. Damage by acid-rain is most likely seen in water environments such as small ponds, streams and lakes. When acid-rain falls it flows through small ponds, streams and lakes right after it hits the fields, roads and buildings. But sometimes acid-rain can fall directly in the water. When acid-rain falls more and more, it affects wildlife significantly. Because acid-rain causes the loss of acid-sensitive organisms, food may also be affected. The soil will dry up and stay hard until it is watered. If this continues then there will be no more plants on earth and no more plants would invite a serious fall on of other living beings on earth.

One of the serious side effects of acid rain on human is "respiratory" problems such as affection of nose, throat irritation, dry coughs, headaches and asthma governed by emission of the dioxide and nitrogen oxide. Polluted rainfall is especially harmful to those who suffer from asthma or those who have a hard time breathing. But even healthy people can have their lungs damaged by acid air and rain. Acid rain can aggravate a person's ability to breathe which could lead to death. The only cost-effective solution to the problem, according to the environmentalists, is to reduce emissions at their point of origin (Postel, 1984).

FORMATION OF ACID-RAIN AND KIND OF DESTRUCTION CAUSED

Acid rain is formed from pollution that has risen into the atmosphere and reach cloud, hence forming acid rain. When the rain falls it contains acid in it. The sulphur and nitrogen that mainly contribute to the acid rain enter the atmosphere. This pollution mainly comes from the burning of fossil fuels such as coal, gas and oil and from vehicles well. For example the exhausts of different vehicles rise into the atmosphere which then reacts with the water in the clouds to create the acid rain. The demand for electricity and huge number of vehicles on road lead to lot of poluting substances that are going into our atmosphere and this is a major contributing factor of acid rain. The areas worst affected by acid rain are North America and Europe. This is because the developed countries use more for electricity and vehicles but generally the third world counties are worst affected viz. the rivers, lakes, tropical forests and wildlife habitation. Acid rain is quickening up the process of erosion which means that wildlife habitation, ecosystem and green environment may wear away a lot sooner than expected.

The worst measurement of acid rain has been recorded to be pH 2. The more sulphuric and nitric acids present, the higher the acidity of the rain. Battery acid is about 1 acidity and lemon juice is around 2 acidity. Regular rain is between 5 and 6 acidity. Acid rain is somewhere between 2 and 5.5. The worst case of acid rain ever recorded was in Wheeling, West Virginia where the rain had an acidity of 2.2. These levels of acidity seriously harm plants, trees and all other life. The interactions between living organisms and the chemistry of their aquatic habitats are extremely complex. If the number of one species or group of species changes in response to acidification, then the ecosystem of the entire water and land body is likely to be affected through the predator-prey relationships of the food web (Bourodimos E L, 1974). At first, the effects of acid deposition may be almost imperceptible, but as acidity increases, more and more wildlife habitation, different species and the green environment as a whole may decline or disappear.

Acid rain forms when molecules of oxidized sulphur and/or nitrogen in the atmosphere combine with water, forming acidic compounds that dissolve in the water and becomes rain. Typical sulphur compounds (SO_2 and SO_3)

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get into the atmosphere from both natural (i.e., volcanoes, windblown dust containing gypsum which has SO_4 ions in it, etc..) and non-natural (i.e., burning of coal, refining of metal ores) sources. Nitrogen compounds also get into the atmosphere and form acids, although the natural sources are much more limited. The biggest non-natural source is burning fossil fuels, especially gasoline.

Acid rain or more precisely acid precipitation, is the word used to describe rainfall that has a pH level of less than 5.6. This form of air pollution is currently a subject of great concern and controversy because of its worldwide environmental implication. Acid rain poses health risks to people and nature. Danger of acid rain is that it contains the remains of toxic metals. When there is acid rain, toxic remains are absorbed by fruits, vegetables, and livestock and passed on to human consumers. Consumption of these toxic metals, such as mercury, for example, can lead to brain damage, kidney problems, and even death. When acid rain occurs, it does not immediately effect acidity in lakes and streams. The water dilutes the acid; so only over a long period of time can the water become too acidic. In the spring, something called acid shock can happen. Snow, that contains acid, can build up and when it melts all the acid runs into the streams and lakes at one time. When acid levels are too high it can kill small organisms like algae. When the algae dies, the animals that live on algae die of starvation.

Health damage to animal kingdom, vegetation and crops have prompted concern about the health effects of contaminants in humans. While there are approximately two million chemicals being used worldwide, there are very few studies undertaken in their long-term effects on human health, particularly concerning the effects of pesticides, polychlorinated biphenyls, dioxins and lead in combination with each other or how they interact with other factors in human health. The contaminant safety guidelines are based on animal studies and it is further difficult to state the level of human affection.

The short-term danger from acid rain happen mostly to forest and lake ecosystems. With the loss of these ecosystems that effectively moderate the pH of surface run-off water in many areas, the effect of acid rain on local water supplies could become more pronounced in future. Another problem encountered in human and animal kingdom is to breathe in smog, acid rain in one of its many forms. Acid rain can also harm people indirectly and this happens when people eat fish caught in affected lakes or rivers. Also, if the water source is acidic enough, it would damage the copper or lead pipes to harm human usage. It also washes aluminum into the water supply. Birds can be harmed if they live in affected waters or feed on fish living in affected waters.

A significant proportion of eastern Canada's forests has been affected; and considerable damage to buildings and monuments has been documented. The Canadian Council of Resource and Environment Ministers has established 20 kg/hectare per year as the target for Canadian sulphur dioxide loading. In eastern Canada, 96 % of the land with high capability for forestry is subject to acidic deposition in excess of 20 kg/ha per year. In recent years, important instances of dieback and declines in growth rate have been noted in sugar maple groves in parts of Canada that receive high levels of these and other air pollutants, such as ozone. Significant growth declines in northern Ontario forests, most notable over the past 30 years, coincide with a period of rapidly increasing industrialization and urbanization across many provinces.

The effects of acid rain have been encountered in parts of the United States, Germany, Czechoslovakia, Netherlands, Switzerland, Australia, Yugoslavia and elsewhere. It is also becoming a significant problem in Japan and China and in southeast Asia. Rain with a pH of 4.5 and below has been reported in Chinese cities. Sulphur dioxide emissions were reported in 1979 to have nearly tripled in India since the early 1960s, making them only slightly less than the then-current emissions from the Federal Republic of Germany.

EFFECTS OF ACID RAIN ON WILD LIFE AND HUMAN HEALTH

Acid rain affects the wildlife health in many ways. The term acid rain does not convey the true nature of the problem and therefore scientists use the term "acid depositions". This is because the acid which has formed due to pollution may return to the earth as a solid or a gas and not just as rain. Depending upon the climatic conditions it could also come down as rain, fog, or snow, and in the wet form it is known as "acid precipitation". All living organisms are interdependent on each other. If a lower life form is killed, other species that depend on it will also be affected. Every animal up the food chain will be affected. Due to the effects of acid rain, animals which depend on plants for their food also begin to suffer. Tree dwelling birds and animals also begin to languish due to loss of habitat.

Mankind depends upon plants and animals for food. Due to acid rain the entire fish stocks in certain lakes have been wiped out. The economic livelihood of people who depended on fish and other aquatic life suffers as a result. Eating fish which may have been contaminated by mercury can cause serious health problems. Apart from the loss of plant and animal life as food sources, acid rain gets into the food we eat, the water we drink, as well as the air we breathe. Huma being suffer from asthma because of the acid contamination. Aluminum which dissolves more easily in acid rain as compared to pure rainfall, has been linked to Alzheimer's disease. The treatment of urban water supplies may not include removal of elements like aluminum, and so is a serious problem in cities too. The long term effects

from the damage of acid rain are that we can loose our tropical rainforests and our wildlife too. Whenever any acid rain is getting into our rivers, streams and lakes, some of the fish may be killed or harmed which means that the birds will be affected because they have no fish to eat. In the long run some of fish and birds species could be extinct from earth.

OTHER EFFECTS

All living being whether living or non living on earth are affected either directly or indirectly by acid rain. Even buildings, bridges and other structures are affected. In cities, paint from buildings have peeled off and colours of cars have faded due to the effects of acid rain. From the Taj Mahal to the empire state building the acid rain causes corrosion, fracturing, and discoloration in the structures. Temples, murals, and ancient inscriptions which had previously survived for centuries are now showing severe signs of corrosion. In some parts of Poland, trains are required to run slowly, as the tracks are badly damaged due to corrosion caused by acid rain.

POSSIBLE MEASURES TO BE TAKEN TO PREVENT ACID RAIN

The bottom line is that all things on earth are being affected by this problem. There is a consensus amongest the environmental groups, and public on the increased effects of the havoc caused by acid rain. Many counties the world over have drawn up certain plans to tackle this problem. Lakes that have become highly acidic, can be treated by adding large quantities of alkaline substances like quicklime, in a process called liming. It has not been successful where the lake is very large, making this procedure economically unfeasible. In many other lakes where the flushing rate of the lake waters is too large result in the lake becoming acidic again.

Acid rain is mainly a result of air pollution and this is all caused by humans. Certain measures have been carried out by the government and the environment agencies to prevent the damage of acid rain. Some of the nations are trying to invest in different ways of producing energy alternatives. These include electric cars and producing electricity through different methods other than by burning fossil fuels.

If attempts to clean our air continue, rain may return to normal and acidic lakes over a period of time would return to normal. But if our attempts to clean up contaminants are failed, we may loose our natural resources. A reduction in use of vehicles will reduce the amount of emission caused by our vehicles. Ensure that your vehicle is properly tuned, and fitted with a catalytic converter, to reduce the emissions.

We have to reduce the use of electric power by switching off lights, and other electrical appliances when not required. We must not leave your televisions, VCRs, microwave ovens or music systems on stand-by when not required. Reducing power consumption will reduce the amount of coal burnt to produce electricity and thus reduce the amount of pollution. The more environmentally friendly way. Electricity we have saved can be used elsewhere thus benefiting nature. Increasing awareness would slove this global problem in some extent. Suitable legislation to ensure that industries keep their emissions within limits.

Several industries have added scrubbers to their smoke stacks to reduce the amount of sulphur dioxide dumped in the atmosphere. Specially designed catalytic converters are used to ensure that the gases coming out from exhaust pipes of automobiles are rendered harmless. Several industries which use coal as fuel have begun to wash the coal before using it thereby reducing the amount of sulphur present in it and consequently the amount of emissions. Usage of coal with a low sulphur content also reduces the problem.

CONCLUSION

Attempt was taken to provide a primer on acid rain for the ecologists, zoo and wildlife veterinarians, environmental biologists to act upon on war footing. There are several ways to reduce acid deposition, starting from societal changes to individual action. Scientific studies are invited to asses the level of acid deposition. National seminars, symposia, conferences, might draw some conclusion in this score for energy efficiency and alternative energy sources should be intervened. The cutting edge of protecting the environment from acid deposition will continue to develop and implement cost-effective mechanisms to cut emissions and reduce their impact on the environment. One of the first steps is to understand the problem and its solutions. However, like many environmental problems, acid deposition is caused by the cumulative actions of millions of individual human beings. Therefore, each individual should enrich their knowledge and aware themselves to become a part of the solution.

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BAEL CULTIVATION IN DRY AREAS TO FIGHT MALNUTRITION

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INTRODUCTION

Bael *(Aegle marmelos corr.)* is an indigenous fruit of India. It belongs to Citrus family Rutaceae. It is cosmopolitan in distribution, cultivated throughout the Indian subcontinent and has a great mythological significance. This fruit is mostly associated with Hindu sentiment specifically among the worshippers of Lord Shiva. All the plant parts i.e. barks, leaf, root, fruit, gum and seed are therapeutically important because of its marmelosin content. The plant can tolerate aridity and possess capacity to grow absolutely as like that in rainfed conditions (Chadha, 1996). There is immense scope for processing of the fruit, which has not received attention.

In summer and early rainy season, bael emerges as one of the most important fruits of India. Apart from its appetizing ability and nutritive value, this fruit can add flavour and diversity to our diet. Vital micronutrients, vitamins and minerals can be obtained through consumption of bael fruit which is particularly a cheap source of essential elements like Ca, Mg, Cu. Zn, Fe, Mn, Vitamin E, C and β-Carotene. Consumption of Bael is beneficial for heart (Jauhari 1971), kidney as well as nervous, digestive, respiratory and immune systems of human body. bael is one of the seasonal arid fruit and an economical source of nutritive elements required for combating malnutritional disorders. Bael fruit is a hard-shelled berry filled with soft yellow to orange sweet pulp. Seeds are closely packed and surrounded by slimy mucilage.

CLIMATE AND SOIL

It is mostly grown in subtropical climate where winter is mild and summer is hot and dry. Bael does not grow in high altitudes, like in places located 1500 mt above mean sea level. Well-drained sandy loam soil is considered best for its growth, however being a hardy tree it survives in stony wastelands, alkaline soil and even in swampy areas where other fruit trees fail to grow.

CULTIVARS

There are few standard varieties of bael which have been developed only by State Agricultural Universities located at Pantnagar, Faizabad and Kalyani (Jauhari 1969). However many unfamiliar non-standardized different types of bael are grown throughout the country. It is useful for grower to select best suitable variety with big to large fruit size for commercial plantation and processing. Few popular varieties developed after promising selection procedure are given in Table 1.

Table - 1: popular varietes of bael.

Cultivar	Fruit type	Fruit weight (kg)	Pulp %	Total soluble sugar (Brix)	Asorbic acid (mg/ 100 gm pulp)	Other specificity
Bengol Bael-13	Oblong-large	1.5-2	75-80	38	15	Thorny tall tree, early maturing
Pant Sujata	Oval-big	0.8-1.2	70-73	30	18	Precocious heavy bearer medium-dense type with bigger thorns
Pant Shivani	Oval-large	1.5-2	68-70	34	13	Heavy bearer tall tree
Pant Aparna	Spherical-smal	0.2-0.5	60-65	34	15	Thorn less, dwarf and heavy bearer tree
Pant Urbashi	Ovoid-large	1.5-2	65-70	38	13	Midseason, tall and heavy bearer tree
Narendra Bael-5	Spherical-medium	0.8-1.2	60-65	38	13	Dwarf spreading tree
Narendra Bael-9	Oval-medium	1.0-1.5	60-65	40	14	Pink color rind, early bearing type

Excluding the above-mentioned varieties, Mirzapuri, Rampuri, Khamaria, Kagzi Gonda, Faizabadi, KB-11 and Ayodhya are also famous in northern India (Parma, 1982).

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PROPAGATION AND PLANTING

Bael is generally raised from seed. Fungicide-treated freshly extracted seeds are sown in nursery bed. Seeds have no dormancy and germinate in hypogeal way within 3-4 weeks after sowing. In the second month, strong and stout seedlings are selected and planted in polybags filled with normal pot mix soil; after 8-10 months, vigorous growing seedlings are ready for transplanting in the main field. Root suckers of bael tree can be separated during rainy season and planted in pits. One day patch budding has proved best. Grafting of bael can be successful when grafted over *Aegle fraeglegabonesis* and *Aeglopsis chevalieri*. Planting is done in pits of 45-50 cm depth at 8-10 m spacing during the onset of monsoon. Life saving irrigation may be necessary till the establishment of seedlings during long dry spell and hot summer months (Singh 2003).

CULTURAL AND NUTRITIONAL PRACTICES

Bael plants have enough capacity to tolerate arid conditions, however in order to achieve good yield, rainwater collection is usually practiced by creating micro- catchment area around the tree. Young plantations should remain free from weeds. Commonly the interspace areas are covered with legume crops, green manure crops or forage crops. Farmers can get additional income from this practice and also young plants will be saved from weeds. To give erect shape to the plant, lateral branches on trunk of each plant within one metre height from the ground are removed. Pruning is not a general practice in seed plants, but it is needed to avoid cross branching and to discard dead, diseased, weak and broken branches. Lateral vegetative growths from root stocks of grafted plants are regularly pruned.

Being a hardy plant, farmers normally do not opt for fertilization to bael plants, however it would definitely respond to good fertilization practice. At the time of planting, each pit should be filled with 15-20 kg well rotten compost or farmyard manure (FYM) and 200-300gm phosphorous for better establishment. Cultivation in shallow conditions and application of 20-30kg FYM or compost per annum per plant during the onset of rainy season will be beneficial.

FRUITING BEHAVIOUR AND PRODUCTION

Bael tree blooms in summer in between May and June and fruit takes a long time (10-11 months) to mature and ripe. Fruit has three distinct growth stages. In the initial two months, growth is slow; then the fruit picks up fast growth in the next 4-5 months, in the rest 4-5 months growth remains stationary. A seedling tree required 7-8 years to bear fruits while root sucker, budded and grafted plants can bear fruits 2-3 years earlier. It takes about 12 years for a bael tree to reach its maximum size. Plant of small-fruit type bears more number of fruits than large-fruit type. In a good monsoon year, a grown-up tree in well-matured condition can produce 300-500 fruits, which can weigh around 150-200kg.

Grading of bael fruits are commonly made on the basis of organoleptic characters, viz. general appearance, skin colour and texture, taste and flavour of pulp (Singh 1992). Ripe fruits are harvested and transported with care so that cracks do not develop on its pericarp. However bael fruits can be kept for a long period in store, they are known to withstand transport and marketing hazards.

DISEASE AND PEST PROBLEM

Though disease and pests do not severely affect hardy bael trees, but sometimes leaves, fruits, twinges, thorns has been reported to be infested by bacteria belonging to genus *Xanthomonas*. It can be easily controlled by spraying recommended antibiotics during pre- and post-monsoon time after removing severely affected plant parts. Occasionally leaf eating caterpillars, leaf rollers can affect the plants during rainy season. Insect pests infest the bael trees more in humid than and arid regions. 'Fruit drop' is a common problem in bael but there is no perfect remedy for it. Fruit splitting is another problem which occurs just before harvesting. It can be tackled by early harvesting of fruits or by spraying potassium sulphate and potassium borate twice in a year.

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APPLICATION OF REMOTE SENSING AND GIS IN AGRICULTURE MANAGEMENT

S. S. Jiban Dash

INTRODUCTION

The use of remote sensing techniques, image processing, computer mapping and overlays to make inventories of land use and to improve land and water management has increasing potential. Advantages of these techniques include greater geometric resolution and potential time and money savings. The increasing capabilities of personal computers and workstations (hardware and software) and the greater availability of databases have simplified the application of these techniques. In this application, a geographical information system (GIS) was used to facilitate the identification of critical non-point source areas of pollution by sediment-related nutrients. This critical source area information might then be used to aid in the development of non-point source control strategies or for monitoring programme design. The GIS functions help in managing the spatial data and visualizing the results. The software developed allows the evaluation and presentation of any equivalent spatial dataset and does not require special computer skills (Kalogirou 2002 and Wandahwa et al*1996*). Incoming solar radiation (insolation) is fundamental to most physical and biophysical processes because of its role in energy and water balance. We calculated insolation maps from digital elevation models, using an insolation model that accounts for atmospheric conditions, elevation, surface orientation, and influences of surrounding topography. In agricultural field to achieve food, nutrition, environmental security and combating drought we have to emphasise on these following factors.

(i) Alternate crops resistant to natural climatic variability
(ii) Results yield certainty and creates water harvesting potential.
(iii) Ensures food, nutrition and environmental security
(iv) Checks labour migration and regulates labour requirements.
(v) Assured return during lean period .
(vi) Minimizes effects of biotic stress like weed, pest and diseases.
(vii) Sustains soil fertility

REMOTE SENSING IN AGRICULTURE MANAGEMENT

Remote Sensing is the acquisition of data for deriving information about objects or materials without physical contact. The science of remote sensing has three essential components

(a) Signals

Signals are carriers of information about an object. For remote sensing purposes, four different types of signals are used *viz*., (i) disturbance in a force field; (ii) acoustic signal, (iii) particulate signal, and (iv) electromagnetic signal. For agricultural remote sensing from a comparatively large distance electromagnetic signals are usually used. The entire range of electromagnetic spectrum is given in Table-1.

Table -1: Electromagnetic spectrum

Spectral region	Main interaction mechanism application	Examples of remote sensing
y - rays	Atomic	Mapping of radio
X - rays	processes	Active materials
Ultraviolet(UV)	Electronic processes	Presence of H and He in atmospheres
Visible(VIS),	Electronic processes	Surface chemical
Near infrared (NIR)	vibrational molecular processes	Composition, vegetation cover, biological properties
Mid infrared (MIR)	Vibrational, Vibration rotational processes	Surface chemical composition, atmospheric chemical composition
Thermal IR	Thermal emission, Vibrational and rotational processes	Surface heat capacity, surface temperature, atmospheric temperature, atmospheric and surface constituents
Microwave	Rotational processes, thermal emission, scattering, conduction	Atmospheric constituents, surface temperature, surface physical properties, atmospheric precipitation
Radio frequency	Scattering, conduction ionospheric effect	Surface physical properties surface sounding, ionospheric sounding.

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(b) Sensors

A multitude of sensors are available today for monitoring our natural endowments: land, water and air. The sensors are mounted on platform, which can be classified into three different categories.

(i) Ground observation platform: Hand-held, cherry picker, portable masts, towers;

(ii) Air-borne observation platform: balloon drones (short sky spy), aircraft, high altitude sounding rockets.

(ii) Space-borne observation platform: Manned and unmanned satellites.

A sensor is a device comprising of optical component or system of optical component or system and a detector with electronic circuitry. All sensors employed on earth observation platforms use electromagnetic radiation (EMR) to observe the land features. The entire electromagnetic spectrum (EMS) is divided into different wavelength regions which are broadly known by different names, viz., visible, near infrared (NIR), thermal infrared (TIR), microwave (MW) etc.

(c) Sensing (Analysis)

Based on spectral signature and radiometric resolution, different objects are identified on the image. Earlier people used to analyze the data through visual interpretation. Now a days several image processing software (ERDAS, GEOMETICA, ENVI etc.) are available for digital image processing.

Digital image processing involves the manipulation and interpretation of digital images with the aid of a computer. Compared to the earlier used visual or electro-optical methods of image analysis, digital processing has the following distinct merits.

(i) Digital processing has the greatest potential for preserving the correct radiometry and the maximum resolution of the images.

(ii) Digital processing is fast and accurate and yet flexible to cater to the analysis requirement.

(iii) The general availability of computer permits different investigators to perform repeatable and quantifiable analyses on common imagery.

TERRAIN CHARACTERIZATION OF AN AGRICULTURAL RESOURCE AREA

Two types of classifications are generally used for terrain characterization of an agricultural field i.e (i) supervised classification (ii) unsupervised classification

(i) Supervised classification

In supervised classification, one must rely on his own pattern recognition skills and a prior knowledge of the data for classification. The location of a specific characteristics, such as a land cover type, may be known through ground truthing. Ground truthing refers to the acquisition of knowledge about the study area from fieldwork analysis, aerial photography, or personal experience. Ground truth data is considered to be the most accurate data available about the area one wants to study. Ground truth data should be collected at the same time as the remotely-sensed data, so that the data corresponds as much as possible. Some ground truth data may not be accurate due to errors, inaccuracies, and human error. Global positioning system (GPS) receivers are useful tools to conduct ground truth studies and collect training sites.

(ii) Unsupervised classification

Unsupervised image classifiers do not always provide the desired number of truly representative classes. Aggregation can be used to combine separate classes into one class after a classification. A common approach in unsupervised classification is to generate as many cluster classes as possible. With the benefit of reference data or first-hand knowledge of the scene, the analyst then aggregates the spectral clusters into meaningful thematic classes. The clarity of understanding about an object is dependant on certain fundamental properties of images such as (i) scale and (ii) resolution. The scale for remote sensing purpose can be delineated into (i) small scale (>1:500,000) 1cm=5km or more (ii) Intermediate scale (1:50,000 to 1: 500,000) 1cm=0.5 to 5 km (iii) Large scale (<1:50,000) 1cm=0.5 km or less. The resolutions may be (a) spatial resolution, (b) spectral resolution, (c) radiometric resolution and (d) temporal resolution.

SPECTRAL INDICES FOR AGRICULTURAL RESOURCE MANAGEMENT

The earth's surface cover receives both direct and indirect solar irradiance (i.e. radiation that is incident on the surface of interest). Some of this irradiance is reflected, some is absorbed and some is transmitted. The ability of different surfaces to reflect, absorb and transmit this radiation varies considerably thus presenting a method of identifying and extracting information about these surfaces. The radiation reflected by these surfaces, termed as the

radiant existence is usually expressed in unitless reflectance values as given below:

$$\text{Reflectance} = \frac{\text{Radiant existence}}{\text{Irradiance}}$$

The spectral reflectance in terms of indices is useful for crop growth and development monitoring, yield predictions and extracting phonological information. The important spectral indices for agriculture resources management is given in Table-2.

Table 2: Important Spectral indices for agriculture resources management

S.No.	Spectral Index	Formula
1	Simple subtraction	Infrared (IR) – Red (R)
2	Simple division (infrared/red ratio)	Infrared (IR)/Red(R)
3	Complex division	IR / R + other wavelengths
4	Normalized difference Vegetation index	NDVI = (IR – R)/(IR + R)
5	Difference– difference Index	DD=(2xMSS7-MSS6) - (MSS5-MSS4)
6	Green-red ratio vegetation index	GRVI = Green/Red
7	Soil adjusted vegetation index	SAVI = (NIR-R) 1.5/ (NIR+Red+0.5)
8	4 – space tasseled cap	
	(i) Soil brightness index	BR = 0.43 MSS 4 + 0.63 MSS 5 +0.59 MSS6 + 0.26 MSS 7
	(ii) Greenness index	Gn = -0.29 MSS4 – 0.56 MSS 5 +0.60 MSS6 + 0.49 MSS 7

THERMAL INDICES FOR SOIL AND CROP CHARACTERIZATION OF AGRICULTURAL FIELDS

The following are the thermal indices for soil and crop characterization of agricultural fields.

Canopy-air temperature difference (CATD)

CATD is an indicator of crop water stress. This index has been used by several workers for monitoring water stress in different crops.

Stress degree day (SDD)

SDD is the cumulative difference between the canopy and the air temperatures accumulated over a given period of time. , as given below

$$SDD = \sum_{t=x}^{Y} (T_c - T_a)_i$$

Where Tc and Ta are the canopy and air temperatures measured one hour after solar noon on day I accumulated for x – y day growth stage of the crop.

Canopy temperature variability (CTV)

It is the variability of temperature encountered in a field during a particular measurement period. It is expressed as the standard deviation of mid-day canopy temperature within a field. (Blaquiere *et.al* 1972)

Temperature-stress day (TSD)

It is defined as the temperature differences between a stressed plot and a nonstressed reference plot. Use of well watered plot as reference compensates for environmental effects. It needs to be in the vicinity of the field to be irrigated. In corn plots when the average of all canopy temperatures measured in stressed plot during a particular time period were 1°C warmer than the average canopy temperatures of the well watered plot (Pinde *et al 2002)*. Their experiments indicated that both CTV and TSD methods could be used to evaluate water stress.

Crop water stress index (CWSI):

The crop water stress index (CSWI) is based on the fact that the canopy air temperature difference is linearly related to the air vapour pressure deficit (VPD). This relation derived from energy balance consideration can be expressed as below.

$$T_c - T_s = \frac{\gamma_a R_n}{pCp} \cdot \frac{\gamma(1 + r_c / r_a)}{\Delta + \gamma(1 + r_c / r_a)} \frac{VPD}{\Delta + \gamma(1 + r_c / r_a)}$$

Where, r_a and r_c are the aerodynamic and canopy resistances ($s.m^{-1}$), R_n is the net radiation ($W.m^{-2}$). C_p is the volumetric heat capacity of air ($J.\ m^{-3}\ c^{-1}$). g is the psychrometric constant ($P_a.\ c^{-1}$) and D is the slope of the temperature saturated vapour pressure relation ($P_a.C^{-1}$).

The mathematical equivalent of the proposed equation and later used to derive crop water stress index as:

$$\text{CWSI} = 1 - \frac{ETa}{ETp} = \frac{r[1 + r(r_c/r_a) - y]}{\Delta + \gamma[1 + (\gamma_c / \gamma_a)]}$$

Where ETa is actual evapo-transpiration. ETp is potential evapo-transpiration γ is psychro metric constant (paC^{-1}, r_c is the canopy resistance (sec m^{-1})., r_a is the aerodynamic resistance (sec m^{-1}) and Δ is the slope of saturated vapour pressure temperature relation ($Pa°C^{-1}$).

MORPHOMETRIC ANALYIS USING REMOTE SENSING AND GIS

The mapping of drainage pattern of watershed for morphometric analysis can be done by using satellite data or from topographical map. Earlier many researchers performed quantitative analysis of drainage network using manual methods like area measurement using grid method or using planimeter and length measurement using thread length, Opsiometer, Ruler and Digital Curvimeter etc. But these methods are very tedious and time consuming (Usery *et al* 1995). It is more difficult if the map is on higher scale like 1:50,000 0r 1:25,000. To overcome the problem, GIS technique is used for agriculture land morphometric analysis.

ESTIMATION OF SOIL LOSS USING REMOTE SENSING AND GIS

Estimation of soil loss from the watershed to identify priority area for establishment of soil and water conservation measures for agricultural proposes. The widely adopted USLE model (RKLSCP) is used to estimate soil erosion. From the average annual rainfall and maximum 30-miniute intensity of rainfall, the R is calculated. The erodibility factor (K), topographic factor (LS), and cover management factor (C) are extracted form different sources.

ESTIMATION OF SEDIMENT YIELD INDEX USING REMOTE SENSING AND GIS

Quantitative estimate of sediment yield index (SYI) is carried out after computing two derived parameters; firstly the erosivity (measure of erosion intensity units) and secondly a delivery ratio indicating transportability of sediment to the dam reservoir. Area weightage value of each erosion intensity unit and sediment yield index of the watersheds are calculated using the following formulae;

$$SYI = E \times Dr \times 100$$

where, E = the erosivity of mapping unit, Aei = the area if the ith erosion mapping unit, Wei = the weightage assigned to ith mapping unit, Aw = the area of the watershed, SYI = the sediment yield index, and Dr = the delivery ratio.

LAND USE PLANNING IN AGRICULTURAL LAND USING REMOTE SENSING AND GIS TOOLS

Proper inventory of natural resources data like land use, soil, slope hydrogeomorphology, groundwater resources, climate, etc. can be made using GIS in the form of separate layers. With the help of integrated GIS coverage of different thematic maps and based on some decision rules, alternative site specific land and water resources development can be suggested on watershed or block basis. Keeping existing land use and land cover as a base and considering the limitation and potential of other factors for development, alternative site-specific land use system like agro-forestry, silvipasture, multiple cropping, agro-horticulture, plantation crops, fodder plantation etc. may be recommended (Messing *et al* 2003). Water harvesting and soil-water conservation measures can also be suggested on the basis of soil, slope, hydrogeomorphological information.

REMOTE SENSING APPLICATION IN WATER RESOURCES PLANNING IN AGRICULTURE LOCATION

Remote sensing techniques, complementing the ground based data collection methods, can provide adequate, reliable and time effective information on water resources, which includes inventory of surface and ground water resources (Kontoes 1993). High altitude aerial photography and satellite remote sensing have been used for mapping surface water bodies such as reservoirs, lakes and tanks over large areas. Investigation for ground water requires comprehensive information on soil, vegetation, geology etc. On the other hand, the hydrological application of Remote Sensing can be divided into two groups:

Direct indicator

Refer to the detection of physical properties directly associated with ground water or the ground water environment. Persistence of green vegetation during the dry season may indicate shallow water table conditions. The excessive soil moisture in a given region could be an indicator of shallow aquifers. The detection of recharges and discharge zones is also directly linked with the movement of the ground water.

Indirect indicator

Other than the climatological factors the movement of surface and subsurface water is controlled by the geomorphology (landforms) and geology (lithology and

structures) of the region. The indirect indicators essentially refer to the interpretation of these hydrogeological factors.

REMOTE SENSING APPLICATIONS IN AQUIFER CHARACTERIZATION

The presence of broad shallow valleys, alluvial cores, alluvial fans etc. suggest the availability of fluvial deposits, which form good shallow aquifers. The information extracted about the lineaments, the dykes, outcrop pattern like circular will be of great hydro-geological significance and will help in locating deep aquifers.

MICROWAVE REMOTE SENSING FOR SOIL MOISTURE DETERMINATION

The dielectric properties of a medium determine the propagation characteristics for electromagnetic waves in the medium, and as a result they affect the emissive and reflective properties at the surface. Thus these latter two quantities for a soil will depend on its moisture content, and they can be measured in the microwave region of the spectrum by radiometric (passive) and radar (active) techniques. This physical relationship between microwave response and soil moisture plus the ability of the microwave sensors to penetrate clouds, make them very attractive for use as soil moisture sensors (Cools *et al* 2003).

GENERATION OF DIGITAL ELEVATION MODEL

The Digital Elevation Model (DEM) represents a data base from which various secondary products are derived e.g., contours profiles, volumes, slope, hill shading, 3D scenes, perspective view, etc. A special class of application relates to the intersection of DEMs with other spatial or planiertric data like cadastral properties, land use, vegetation cover, traffic lines, etc. DEM also forms a base of technical modelling for many natural and induced processes of our environment such as climate, water, flood, disaster monitoring, etc. DEM data can be extracted from terrain directly or from images of the terrain (photographs or remote sensing). There are mainly three techniques for acquiring DEM data.

CONCLUSION

Remote sensing and GIS technique provides an effective means of handling spatial and non-spatial data. It can be effectively used for; terrain characterization of an agricultural resource areas; agriculture resources management; soil and crop characterization of agriculture fields; Morphometric analysis of agricultural areas; estimation of soil loss; estimation of sediment yield index; aquifer characterization; soil moisture determination in agriculture fields; generation of digital elevation model; land use planning in agriculture areas and resources planning in asgriculture location. Today many research organizations are moving agricultural land information into remote sensing and GIS. Land information is an integral part of government, non-profit, and private sector activities. Adopting remete sensing and GIS techniques can advance broader social purposes by making more effective public decisions. The remote sensing and GIS techniques are helpful for our agriculture engineers of natural resource development and management and protection of environment.

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ROLE OF KRISHI VIGYAN KENDRA IN CHANGING THE PROFILE OF RURAL FOLKS OF SUBARNAPUR DISTRICT, ORISSA

B. R. Samantaray[1] and S. C. Mohapatra[2]

INTRODUCTION

Agricultural extension has long been recognized as an arm of agricultural research that facilitates the transfer of technology from laboratories and experimental stations to farmers and also bridging the gap between scientists and farmers in the larger interest of improving the standard of living of a vast majority of rural people. The village based scientific agricultural institution called as farm science center is popularly known as KVK which plays the role model in the transfer of technology from laboratory to farmer's field with respect to agriculture and allied disciplines like, Horticulture, Fishery, Animal Husbandary etc. Krishi Vigyan Kendra, Sonepur was established on 1st July 2005 at Badajhinki, Sonepur, Subarnapur under the administrative control of Orissa University of Agriculture and Technology (O.U.A.T.), Bhubaneswar, with cent percent financial support of staff salary, infrastructure and contingency by Ministry of Agriculture, Government of India through Indian Council of Agricultural Research (ICAR), New Delhi and the land of the institute is given by Government of Orissa (Department of Agriculture) with an aim to fulfill the following objectives to empower the rural people.

MODUS OPERANDI

Programme coordinator is the head of K. V .K. family and coordinates work of all the scientists for smooth functioning of K.V.K. as well as for the benefit of rural people of that particular area. He takes the leading role in keeping liaison with other line departments for coordination and effective implementation of different programmes of K.V.K. in the adopted village. The work of KVK is based on adopted village concept, each adopted village represents one particular agro-eco situation of the district. As per the guidelines, KVK Sonepur has selected 5 (Chasagotha, Panisiali, Arjunpur, Lakarma and Ichhapur) economically, culturally and technologically backward villages situated within 20 km radius of K.V.K. Before the selection of adopted village, detailed survey of the villages was carried out to study the socio-economic, cultural status and resource potential of these villages using Participatory Rural Appraisal (PRA) tool through active participation of the villagers like the drawing of village map population, animal resources, school, colleges etc. which in turn helped the scientists to prioritize the problems, prepare the projects according to their need and solve their farm problems through different on farm testing (OFT), front line demonstration(FLD) and training programs. Besides the adopted villages, KVK Sonepur has also intervened in the villages like Jhinki, Phulmuthi, Haladipalli, Banka Bija, Aiganjori, Anandapur, Singhari, Sasamura, Sahajbahal, Nandanmal, Gadia, Karlakhaman, Laturpet, Kirtipur, Marichpur. As there is no KVK in Bolangir district, KVK Sonepur is also assigned to look after the sub division of Bolangir district till the establishment of KVK there.

MAIN OBJECTIVES OF KRISHI VIGYAN KENDRA, SONEPUR

(i) To keep intact the research extension linkages and to provide new and important information to the extension agencies and NGOs for wider circulation in that locality for the betterment of rural people.

(ii) To identify important problems of the locality as per the need of farmers and prioritization of the identified problems as per their importance based on the agro climatic zone and agro ecological situation.

(iii) To act as an intermediary organization in farmers' capacity building by imparting need based training program on agriculture and allied sectors for the refinement of knowledge and well to develop eagerness to adopt new technologies.

(iv) To prepare different extension models and verify these models in the farmers' field with their participation to create confidence among them.

(v) To demonstrate new improved technology to the farmers as well as to the extension agencies directly in the farmers' field with their active participation and also with the involvement of block level extension workers.

(vi) To collect feedback from the farmers and extension agencies and to communicate these message to research scientists for modification of technology and to keep good relation with all the line departments for better transfer of technology and minimization of the gap.

Apart from the mandatory works the other works which have been performed by KVK without hampering the routine work are:

(vii)To produce quality seeds and planting materials in KVK farm by utilizing ICAR revolving fund.

(viii)To provide technical support to line departments as and when necessary.

(ix)To conduct sponsored training (short and long duration) programmes on agriculture and allied field with direct financial support of government and some cases non-government organisations, self help group and individuals.

(x)To provide consultancy service to individual farmer, group

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of farmers and private companies on different income generation activities and innovative technologies on farm sectors.
(xi)To be part of the executive body of all central government funded schemes / projects, operated by the line departments like -(ATMA), NFSM, NHM, RKVY, Cotton mini mission, Pani Panchayat, Water shed, NFDP, ICDP etc.
(xii)To document and survey different activities going on in agricultural and allied disciplines in the district.

TRAINNING THROUGH FIELD DEMONSTRATION

"Seeing is believing" is the basic philosophy of field demonstrations. Only proven technologies are therefore selected for field demonstrations. Field demonstrations educate farmers through results obtained in terms of crop varieties resistant to disease and pest, quality of the grains and overall higher yields. In addition, it also educate the farmers in term of input-output ratio and economic gains in terms of net returns. Basically, there are two types of field demonstrations.

STEPS IN CONDUCTING FIELD DEMONSTRATION

Apart from the special learning session inside class, distribution of land layout, fild demonstration is taken up. Since field demonstration is often used as an extension method, it is sometimes laid out in a routine manner. A well conducted demonstration should help the scientists to give finishing touch to changing attitude of farmers and extension workers and improve their knowledge, understanding and skills. The following steps need to be followed in conducting field demonstration.

A. PLANNING PHASE

Know the vicinity:

The scientists develop an understanding of the farmers, their farming systems, resources and establish rapport with them which is essential to gather information on cropping system, present level of use of inputs and productivity of major crops of the area. There are different ways of knowing vicinity, such as; (i) Visiting villages and farmers, (ii) Collection of information using PRA tools, (iii) Meeting people individually and in groups, (iv) Meeting opinion leaders, (v) Exchanging information with local extension workers and (vi) Consulting office records of population and basic agriculture.

Selection of technologies

Only proven technologies that have higher potentialities in terms of yield, disease resistance, quality and can fit in the existing farming systems and situations of the area should be taken into account. The technology should be frontier ones i.e. recently released technologies or such which are at advance stage of release and much superior than the technology being already in use.

Select demonstration site

Demonstration sites which are selected are easily accessible for the farmers and extension workers. Place of demonstration site should have a all around good number of farmers of all categories of land holding and status. Demonstration must never be conducted in a single farmer's plot. Attention should be given to farm size, layout of the field, soil type, fertility status, irrigation facilities and drainage system.

Select Demonstration Farmers

A group of farmers' land holdings in the selected demonstration block and those who are willing to cooperate in conduct of demonstration should be selected. Demonstration farmers should be selected finally by holding a meeting in the village where the purpose of demonstration should be clearly stated and suggestion sought from farmers.

Finalise package of practices

This is an important step in planning the field demonstrations in which new technologies from the ICAR Institute/ State Agricultural Universities (SAUs) are collected and ensure these technologies are frontier ones showing substantial increase in yields. Involve as many scientists of the research station in the discussion as possible. This will help in working out minute details of sequences of method demonstration required, identification of important tasks/practices in which presence of scientists should be necessary and critical input for demonstration.

Prepare for demonstration

Critical inputs are those agricultural inputs which are vital to help the selected technologies to exhibit its production potentialities on farmer's field and not earlier being used by the farmers. Only critical inputs are supplied by the scientists. The farmers themselves arrange other inputs.

B. CONDUCTING PHASE

Layout of Demonstration

Special training programme are arranged for all farmers in whose plots demonstrations are to be laid.

Harvesting

The farmers are asked to estimate the yield and to say in what way the demonstrated technologies are superior than the earlier ones. Are they satisfied with the performance of the technologies? What lessons they have learned from the demonstration? Will they advice other fellow farmers to adopt this practice? Will they exchange the seed materials of new variety with other fellow farmers? What are the expected profits? Will it be more than what they used to get from their own practices? What are the difficulties in following the demonstrated practices? Idea is to ascertain as to what extent farmers are satisfied with the demonstrated technology and what is the possibility of their continued adoption. Generally farmers may revert to old practices in the absence of follow-up. They need information reinforcement, timely supply of inputs or on-the-spot guidance. So group approach in follow-up is always carried out to give better results.

Information card

The information card which is maintained by KVK contains basic information about the demonstration site viz. previous crops and varieties grown, fertility status of the plots, present productivity of crops, size of holdings of each farmers in the demonstration block, extent of use of inputs etc and also contain detail information of demonstration like size of block, variety of crop, seed rate, sowing date, inputs applied, irrigation schedule followed, intercultural operation performed, plant protection measures taken, date of maturity, date of harvesting, incidence of disease and pests, average numbers of tillers, yield of crops etc.

Salient achievements since 2005

The over all achivements are presented in the table- 1, 2 & 3 and fig. 1

Table - 1: Training for Practicing farmers and farm women

Year	No.of Programme	No. of Trainees	Total Man days
2005-06	18	350	1050
2006-07	26	630	1890
2007-08	33	725	2175

Table - 2: Training for extension functionaries

Year	No. of Programme	No. of Trainees	Total Man days
2005-06	01	10	30
2006-07	06	60	180
2007-08	11	110	330

Table - 3: Sponsored Training

Year	No. of Programme	No. of Trainees	Total Man days
2006-07	03	240	480
2007-08	04	242	484

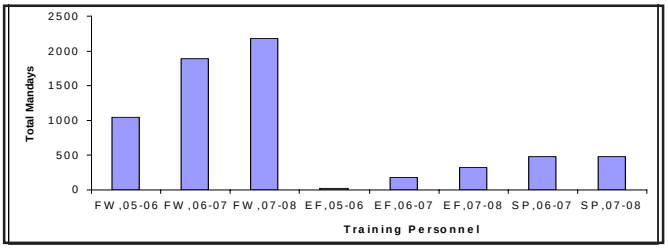

Fig. - 1: showing the salient achivements since 2005 to 2008

INTRODUCTION OF IMPROVED VARIETIES IN THE DISTRICT

Following agricultural products have been used for demonstration just to share the result later for creating better awarness.

Paddy : Pratikshya (142 days), Jogesh (89 days), Sidhanta (92 days), Scented Paddy :Pusa Sugandha Pusa Basumati.

Ragi : Bhairabi (98 days), Sugarcane : Nayana (11% Sucrose), Toria : Parvati, Turmeric : Surama, Mangoginger : Amba, Pumpkin : Pusa Biswas, Pusa Nabin, Papaya : Pusa Majesty, Pusa Nanha, Madhubala and Ranchidwarf, Tomato : BT-10, BT-12.

RECOMMENDATIONS

(i) Application of 50% RDF with azospirillum in transplanted paddy gave 10% more yield than sole application of fertilizer.

(ii) Storage of pulses with dried neem leaves gave 26% more intact grain than conventional method of storing.

(iii) Growing of turmeric as alley cropped with magnessium gave 13% more rhizome yield than sole cropping.

(iv) application of Nimin with urea to the paddy resulted 8% increase in yield than sole application of urea.

(v) Introduction of improved sickle for harvesting of paddy increased the area coverage to the tune of 30%.

(vi) Use of paddy thresher increased the harvesting efficiency to about 42% over local check.

(vii) Introduction of oyster mushroom as an alternative source of income.

(viii) Under good agricultural practice variety “Sonalika” out yielded 55% more over the degenerated local wheat varieties.

(ix)Paddy yield was increased 57% through proper balance dose of fertilizer management in medium land agro ecosituation during winter season.

(x) Growing of seasonal vegetable and growing papaya, drum stick, lime and kunduri (coccinia) in kitchen garden ensured the nutritional security to the farming family.

(xi) Composite fish culture with proper stocking ratio and feed management resulted in 32% higher fish yield.

(xii) One year old teak stump increase sapling survivability to the extent of 17%.

(xiii) I PM in Paddy through use of biopesticides and bioagent has been popularized.

(xiv) Introduction of improved variety of Arhar (US-1), Sesamum (Uma), Greengram (Nayagada Selection) and Toria (Parvati) with proper package of practices increased the yield to the tune of 51.2%, 69%, 88.5% and 83.3% over the local varieties and farmers practice respectively.

(xv) Propagation of bamboo through culm/flute method could be possible for large scale introduction over the conventional rhizome propagation.

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IMPACT OF GLOBAL WARMING UPON AQUATIC RESOURCES - AN OVERVIEW

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INTRODUCTION

In recent years in media, prediction and consensus of global warming, i.e. the greenhouse effect has superceded all other concerns relating to changing environment. Minor constituents of the atmosphere, like carbon dioxide, methane and water vapour allow solar radiation to come in but trap the longer wavelengths of the sun and resulting thermal re-radiation from the earth to a considerable extent. Ozone depletion in the stratosphere caused a significant increase in ultraviolet radiation reaching earth's surface (Brahmam, 2008). It is a well-established fact that industrial activities over the past century have resulted in increasing atmospheric concentrations of greenhouse gases, which has further led to a sharp rise in mean global temperatures over the last fifty years. The increase in greenhouse gases like carbon dioxide has been implicated to the burning of natural gas and fossil fuels such as oil and coal, and changes in land use, such as cutting down forests to make way for agriculture and other developmental activities including housing. Carbon-dioxide emissions from developing countries have increased by 32% during 1990 and 1998. Agriculture is said to be primarily responsible for increases in methane and nitrous oxide gases. Methane, volume per volume is considered to be far more harmful than Carbon dioxide. Increasing abundance of these gases affect the radiation balance at the earth's surface (Mitchell, 1989). The other human-influenced greenhouse gases include hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

The average global temperature has increased by 0.3 to 0.6^0 C between 1890-1990. Global temperatures are expected to increase 2.1 to 4.8 degrees C by the year 2050. The consequential results can be massive. Rising temperatures will change global weather patterns, which are having a direct control and effect on water supplies, agriculture and life forms. The General Circulation Models of the atmosphere indicates that increase in Carbon dioxide level can effect a greater frequency of heavy rainfall or extreme precipitation. It may also effect an increased rate of evaporation in many parts of the world. If the latter exceeds the former, soil will become drier, water level in lakes will drop and river will carry less water. Lakes and open water ponds may turn into damp land. In a drier climate, agrofarmers will be forced to increase the rate of irrigation. This process will further lower the water table in lakes and rivers. Once the river flow decreases, concentration of pollutants in it will rise. All such processes will definitely worsen the natural habitat of fishes. Desertification, frequency and severity of droughts and harmful heat waves will increase. Snow and glacier melt in the Himalayas-Karakoram range may also result in changes in the flows of the Indus, Brahmaputra, Ganges and Mekong, which sustain major riverine and floodplain fisheries. The harmful impacts of greenhouse-gas pollutants can have its influence on the whole world.

GENERAL IMPACT ON MANKIND

Increasing global temperatures causes the thermal expansion of seawater and the melting of icecaps, which will result in rising sea level. Effects of global warming on sea levels are clearly accelerating, as is evidenced by the fact that global sea levels rose 6 to 9 inches in the 20th century. A doubling of pre-industrial CO_2 concentration (550 ppm) is predicted to result in a sea level rise of greater than 40 inches. Sea levels worldwide have been predicted to rise between 7 and 23 inches by the year 2100 and will continue to rise. Consequently, fierce storms will become more frequent and river flooding will increase in some areas. Rising sea levels will cause millions of people in coastal areas to leave their homes. It will cause land to be lost due to erosion. Many small island nations lack the coastal defense systems to cope with higher water levels. Thus rising waters might force the occupants of such islands to migrate (as refugees) elsewhere. There are currently 46 million people around the world who are at risk due to flooding from storm surges. With a sea level rise by one and a half feet, about 92 million people will be at risk. Flooding will contaminate water supplies in some areas and give rise to infectious water-borne diseases in humans. Rising temperatures will increase the congeniality of breeding environment of mosquitoes and other disease-

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bearing insects; more people are likely to be exposed to diseases like malaria, dengue fever and encephalitis.

In tropical and subtropical regions, food production is expected to change substantially as a result of climate change. The variety of crops that can be grown in a particular region is predicted to decline. Developing countries that currently struggle with issues of global warming will not be able to adapt to these circumstances. Global warming is likely to exacerbate inadequate access to food, water, health care and income in continent like Africa and other developing countries.

IMPACT UPON LAND AND AQUATIC LIFE FORMS

Increased levels of carbon dioxide in the atmosphere will change the pH balance of seawater, making it slightly more acidic. According to marine biologists, a shift toward greater acidity can threaten the survival of coral reefs and plankton. Due to global warming, ideal temperature and precipitation ranges that are suitable for survival of present life forms is expected to shift rapidly. It may result in decline in biodiversity and in the goods and services provided by most ecosystems. Most plants, birds and fishes will rarely find a favourable temperature for their survival (Das *et al.,* 2007). Climate change will definitely have impact upon the behaviour and biological traits of animals and plants. Coral reefs support huge diversity of marine fish world over. Climate warming has been reported to cause coral bleaching. In this process, a decline in the abundance of symbiotic bacteria occurs upon which the corals depend for their growth. A significant change in the abundance of some fishes has been observed in locations where intense coral bleaching has occurred. On account of warm weather, an increased number of female hatchlings of turtles have been found to be produced. Thus turtles can be considered to be at risk of global warming.

IMPACT UPON SHELL FISHES

The world's fisheries generate over US $ 130 billion annually and contribute significantly to the economies of many developing countries. Following the acid rain issue, a new acid environmental problem has arisen which means: the oceans are turning sourer. Because of the increasing anthropogenic release of carbon dioxide, more than one-third of this greenhouse gas is finding its way into the ocean. The resulting carbonic acid gas is acidifying the surface water. The past two centuries of industrialization showed a decrease of 0.1 unit of pH of sea water. The average acidity of the ocean level is presently above 8. It has been estimated that the sea absorbs 25 million tons of Carbon dioxide every day. If this continues at the same rate, the Intergovernmental Panel on Climate Change has predicted a further decline of pH value of upto 0.35 by the end of the century. In such water, calcification of sea life that needs calcium carbonate to strengthen their shell (like mussels) or skeleton (like corals) have been found to be hindered and get slower. The additional Carbon dioxide makes the water more acidic, decreases the carbonate (CO_3^{2-}) concentration in the water, which in turn impedes the deposition of calcium carbonate on the animals. If this shell or in other words, their armour does not get strengthened, they will not be able to escape from the grasp of predators (Combes *et al.,* 2005). By the year 2100, mussels and oysters are expected to calcify their shells 25% and 10% respectively slower than the current rate. An experimental exposure of edible mussels and Pacific oysters to more acid conditions for a few hours have resulted in immediate diminishing of shell calcification. A diminished yield of these species from natural waters will have a large financial impact as these are considered as economically important food commodity. Besides that, these vulnerable species are important components of biodiversity along the shorelines. As a long-term impact of global warming and sea temperature rise on reef coral and fish communities, species diversity of the fish community has been found to decrease by 50 per cent in the heavily impacted locations. Smaller fishes have been observed to reduce in number more quickly than larger species; their decreased availability has started to have a negative effect on the food chain.

IMPACT UPON FIN FISHES

The white fish trawlersmen on Yorkshire coast, United Kingdom have opined that sea temperatures in the North sea are rising and this has led to increase in warm water fish such as red mullet, specially in the southern section of the North sea. On account of warm weather, changing natural food production in oceans can restrict the food supply of many aquatic species and threaten their existence. Global warming is reported to have a significant impact on Australian marine life. The warmer oceans, changes in currents, disruption of reproductive cycles and mass migration of species are capable of affecting marine faunal diversity in southeast Australia. The nesting sea turtles, yellow-fin tuna, dugongs and stinging jellyfish are some of the marine species which have started moving southwards as seas are getting warmer. In Tasmania, salmon farming in commercial terms has been reported to become largely unviable as the ocean will get warmed, the predicted one to two degrees over the next thirty years. If global warming continues, the threat on those finfish

population will increase which are already stressed on account of overfishing, pollution and loss of natural habitat. Adding to the cause, there will be changes in rainfall and current pattern. The effect of slightly warmer water on fish and aquatic ecosystems can prove severe, which in turn will affect the global food supply and economic stability of many developing countries.

INSUFFICIENCY OF FOOD AND OXYGEN

Fishes are sensitive to water temperature. It has been described that when fish comes in contact with water that proves too cold for them, their metabolism slows down and they become sluggish. As the surrounding water warms up, their metabolism and appetite speeds up, they intake and digest food more rapidly and grow at a faster rate. But incidentally, fishes need a great amount of food and oxygen to support this higher metabolism. Marine fishes like salmon, whitefish and perch are all expected to grow much slowly if natural food supply does not increase with rise in water temperature (McGregor, 2007). Fish filter oxygen from the water they are swimming in, but the dissolved oxygen concentration in water decreases with rise in temperature. Thus there will be inadequacy of oxygen in warmed-up water, hindering natural breathing process of fishes. CSIRO records have indicated the declining oxygen content in ocean depths of 500-1500 mts. An observed decrease in herbivorous fishes controlling algal over-abundance has become a subject of concern. Global warming has been reported to diminish natural productivity in Lake Tanganyika, East Africa. Since the beginning of the twentieth century, a rise in surface-water temperature in the lake has increased the stability of the water column. A regional decrease in wind velocity has contributed to reduced mixing and decreasing deep-water nutrient upwelling. Carbon isotope records in sediment cores have suggested that primary productivity may have decreased by about 20%, implying a roughly 30% decrease in fish yields (O' Reilley *et al*, 2003). Reports have described that an increase of water temperature by 1-2 ^{0}C is capable of causing fish kills in great numbers, especially in shallow aquaculture ponds and shallow confined systems of the Amazon and Mekong rivers. Due to respiration of aquatic plants and algae, such lentic aquatic ecosystems experience low levels of oxygen overnight, and when these waters get warm, combination of increased metabolic (food) demand for fishes and reduced dissolved oxygen concentration can lead to deficiency of oxygen, dropping below the minimum desirable level. Inadequacy of food matter and dissolved oxygen in warmed-up water obstructs the normal reproductive ability of fishes. Many fishes will produce only less offspring as temperature rises and some may not be able to reproduce at all. Fishes like salmon, catfish and sturgeon cannot spawn at all if water temperatures in winter do not drop below a certain level. Under uncongenial conditions, tropical fish like guppies have been found to produce smaller broods and frequency of ovulation in female grass carps decrease. Imbalance of water temperatures is stressful to fishes, which are likely to cause inhibition of reproductive function, cessation of ovulation, depression of reproductive hormones in blood stream and ovarian failure (Dr Praveen Maurye, Sr. Scientist, CIFRI, Barrackpore; Personal communication).

FORCED MIGRATION FOR FISHES

Climate change is forecasted to cause a substantial shift in fish habitats and disruption of the current pattern of aquatic plant and fish distribution. With rise in global temperature, some fishes may be able to shift locally in search of a comfortable environment, either by moving to deeper zones or by heading upriver towards cool upstream waters. Capelin, a coldwater fish will swim long distances to remain in water that is between minus 1 - 2 ^{0} C, which is their suitable state of survival. Even a slight increase in global temperature is expected to shift the habitat ranges of many economically important valuable marine fishes. Highly warmed-up waters have caused Pacific salmon harvests in much less amount in the southern part of their range. Fishes like cod, plaice and halibut are expected to become scarce in ocean waters of United States and Southern Canada in near future, and cods will probably no more be found in the southern north sea, which is known to be one of their main spawning areas. Suitable habitats for the trouts, whitefish and seabass in the United States are expected to decline by as much as 50% due to the effects of global warming (NRDC, 2008). The Cape anchovy has been one of the prominent items in fish catches off of the South Africa Cape since mid 1960's, but this fishery is expected to be affected as climate change will cause alteration in wind patterns in this region. Climate change has been reported to be responsible for the less survivability of North-Western Mediterranean fisheries as water temperature and sea level is on rise and water flow getting reduced. Warmer temperature is likely to cause economically important coldwater fishes such as hake and cod to migrate and shift their natural location range. They may be unable to survive in North-Western Mediterranean waters. Catfish and trout are the two most important commercially cultured freshwater fishes in the United States. High water temperatures in culture systems during summer months may lead to shortage in their production in this region.

INFECTION CAUSED TO FIN FISHES

Incidentally when water temperature begins to climb, many parasites and microbes capable of causing fish diseases grow at a fast rate, become numerous and more

virulent. In such a condition, fishes whose immune systems have got already stressed by warmed-up water, low oxygen availability and crowding become more susceptible to infections and diseases. There may occur fish mortality due to consumption of toxic blue-green algae; such nuisance algae will increase in amount in warmer waters and will result in dissolved oxygen depletion. Human health may deteriorate from eating poisoned fish unknowingly. It has been found that in muscle of Arctic char, concentration of cadmium and lead remain higher when maintained in water with high temperatures. Fishes in warmer water has been reported to become more capable of accumulating mercury in their body. Toxicity of natural foreign chemicals or xenobiotics to fish has been reported to alter with changes in water temperature. In higher temperature, uptake of xenobiotics increases through increased metabolic rate and decrease in oxygen solubility. Fish species in polar region are very sensitive; they are uniquely adapted to narrow cold temperature ranges and well-oxygenated water, they may become vulnerable to even slight increases in water temperature. Species like emerald rockcod and stripped rockcod cannot survive when temperatures climb only a few degrees above 0^0 C. With rise in temperature, freshwater species that are incapable of migrating to cooler waters will have to remain in hot water. Fish migration may not be possible from many isolated freshwater lakes and wetlands.

A CASE STUDY AT KENDRAPARA

In village ponds, water temperature value was found to be an unusual 34.5^0 C in the first week of August, that too in late evening time. The large water bodies were having only one meter water depth during this time. Small water bodies of around 0.3-0.4 acre in area were found to lie almost in a dewatered state. We have experienced in carp breeding experiments that when pond water having 34^0 C temperature is intaken into indoor circular fish breeding and incubation chambers, male and female fishes could be made to mate safely, fertilized eggs could be obtained, but the eggs were found to hatch much before the normal time interval (incubation time) and the hatched out larvae could only survive for the next four to five hours. It is no doubt that the high water temperature and partially turbid water are responsible for the mortality of entire mass of carp larvae (Sarangi et al., 2008). This may be an indication that earth is getting warmer slowly but surely.

OTHER ISSUES

Temperature dependant sex determination has been observed in fishes, a rise in water temperature of just above 1.5^0 C can change the male to female ratio from 1: 1 to 3:1. In the sensitive fish like South American pejerrey, an increase of 4^0 C can result in a population that is 98% male (Alvarez et al., 2008).

Based on the impacts of temperature rise,

(i) it seems likely that many finfishes in natural waters will become harder to find; (ii) the valuable and commercially important coldwater species will begin to be replaced by more adaptable and less valuable warmwater fishes; (iii) With a 1^0 C rise in water temperature, the marine catfishes may permanently shift their natural habitat zone and move about 240 km northwards from southern part of United States of America, much far away from the original location where infrastructure for fish harvest have been established. This can largely cause harm to the fish industry in the southern United States of America (100 million $ catfish turnover). A 1^0 C increase in water temperature has led to polarward distributional shift for the coldwater migratory fishes Atlantic herring and Atlantic mackerel by about 110 km. With a water temperature rise by 1^0 C, seven important inland warm water fishes in USA have been reported to face temperature above their survival limits. It has led to decline in inland fisheries.

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GREEN BUILDINGS IN INDIAN PERSPECTIVE AND ITS POTENTIALITIES

A. K. Sabat[1] and S. Nayak[2]

INTRODUCTION

Housing and building conditions reflect the living standards of a society. Buildings consume space and natural resources. Construction of building has a substantial impact on the environment. Much energy is used in the production of building materials such as cement, steel, aluminum, wood products, plastics, paints etc., movement of building materials and components to the site of construction and operation of plant and equipment on the site. During construction, workers are exposed to a wide range of pollutants (particulates) and noise. Nearby residents also are subjected to extensive noise and air pollution. Building tenants consume water, generate wastewater and solid wastes. Buildings also consume energy, release carbon dioxide and radon. Ultimately, if and when buildings are demolished, rubble, debris etc.are hauled away and disposed at sea or in a abandoned quarries. It has been found that building construction, renovation and operation consume more of the earth's resources than any other human activity. Each year, buildings account for 40% of global natural resource consumption, 40% of energy consumption and generation of 60% of green house gas emission. Building sector thus generate millions of tones of greenhouse gases, toxic air emissions, water pollutants, and solid wastes. No other sector has a greater impact on the global environment or faces a greater obligation to improve its environmental performance.Table -1 summarizes the key environmental impacts associated with the Building construction. Therefore one should learn how to construct a building with the environment in mind which will make a big difference for the global environment. A Green Building is the answer to such question. Green Building can be best defined (Bhatt and Bhatt, 2007) as highest performance, lowest environmental impact, project specific solution for a given budget, climate, location, community and function. Green building is also called as "Sustainable Building" or "Environmental Building". It is a building which has a net zero impact on the sustainability of natural systems that support our economy.

Table-1: Environmental Impacts of Construction of Building

Environmental impacts	Description	Potential Impact on Air	Water	Soils and land cover
Extracting raw materials	Sand and gravel	Particulate emissions	Water courses near quarries are altered	Landscape degradation
Manufacturing building material	Cement production	Particulate emissions, CO_2, SO_2 and NO_2	-	Deposition of dust
Constructing buildings	Transporting materials Buildings sites	NO_2 and CO_2 emissions Noise, particulate emissions	- -	Taking up new areas of land -
Using buildings	Energy consumption Water consumption Wear and tear of materials	CO_2 emissions - Asbestos fibers, indoor radon emissions	- Waste water discharges containing detergents and organic mater -	- - -
Demolishing buildings		Noise, particulate emissions	-	Demolition waste to be land filled or reused for sea reclamation.

Source: Adapted from the Environment in France, French Institute for the Environment (IFEN, 1999)

BENEFITS OF GREEN BUILDING

The benefits of Green Building are as follows have been described in the following paragraphs:

Environmental benefit

i) Enhance and protect natural habitats, ii) Improve air and water quality, iii) Reduce solid waste, iv) Conserve natural resources, v) Decrease greenhouse gas emissions

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Cost benefits

i) Green buildings consume at least 30% to 40% less energy compare to conventional buildings, ii) Green Buildings consume 20% to 30% less water iii) Improve employee productivity and satisfaction by 12-15%, iv) Optimize life-cycle economic performance

Quality of Life benefits

i) Improve air, thermal and acoustic environments, ii) Enhance occupant comfort and health, iii) Advance community health, vitality and aesthetics

CONSTRUCTION OF GREEN BUILDINGS

Green building can be constructed using the following strategies:

Site selection

i) Start by selecting a site well suited to take advantage of mass transit

ii) Select/layout building site with emphasis on good drainage, no known in-ground pollutants, and to promote useful solar access

iii) Protect and retain existing landscaping and natural features

Energy efficiency

Following are the recommendations to matain better engery efficiency level:

i) Passive design strategies can dramatically affect building energy performance. These measures include building shape and orientation, passive solar design, and the use of natural lighting.

ii) Insist upon air-sealed construction and have a "blower door" test done to confirm quality.

iii) Require Installation of an appropriate controlled mechanical ventilation system (cold or very hot climates this should be a heat-recovery ventilator type).

iv) Choose energy-efficient windows

v) Plan for effective natural lighting in the home's layout of floor spaces and windows and skylights.

vi) Install insulate doors, and use double-pane glass in doors with vision panes. Design for "passive solar" where the homes architectural features help seasonally heat and cool the interior.

vii) Install high-efficiency lighting systems with advances lighting controls. Include motion sensors tied to dimmable lighting controls. Task lighting reduces general overhead light levels.

viii) Use a properly sized and energy-efficient heat/cooling system in conjunction with a thermally efficient building shell. Maximize light colors for roofing and wall finish materials; install high R-value wall and ceiling insulation; and use minimal glass on east and west exposures.

ix) Consider alternative energy sources such as photovoltaic and fuel cells that are now available in new products and applications. Renewable energy source provide a great symbol of emerging technologies for the future. Specify your builder to use locally produced building products and other "green" building materials with greater recycled content, and home systems.

x) Use drought resistant landscaping and planting that shade the home without significantly reducing the amount of winter sun for south facing windows. Computer modeling is an extremely useful tool in optimizing design of electrical and mechanical systems and the building shell.

Materials efficiency

The following strategies should be followed to achieve higher material defficiency.

i) Select sustainable construction materials and products by evaluating several characteristics such as reused and recycled content, zero or low off gassing of harmful air emissions, zero or low toxicity, sustainable harvested materials, high recylclability, durability, longevity and local production. Such products promote resource conservation and efficiency. Using recycled-content products also helps develop markets for recycled materials that are being diverted from landfills

ii) Use dimensional planning and other materials efficiency strategies. These strategies reduce the amount of building materials needed and cut construction costs. Reuse and recycle construction and demolition materials. For example, using insert demolition materials as a base course for a parking lot keeps materials out of landfills and costs less.

iii) Design with adequate space to facilitate recycling collection and to incorporate a solid waste management programme that prevents waste generation.

Water efficiency

The following steps should be taken to achieve this goal.

i) Design for dual plumbing to use recycled water for toilet flushing or a gray water system that recovers rainwater or other non-potable water for site irrigation.

ii) Minimize wastewater by using ultra low-flush toilets, low-flow shower heads and other water conserving fixtures.

iii) Use recalculating systems for centralized hot water distribution.

iv) Install point-of-use hot water heating systems for more distant locations.

v) Use a water budget approach that schedules irrigation system for landscaping.

vi) Meter the landscape separately from buildings. Use micro-irrigation (which excludes sprinklers and high-pressure sprayers) to supply water in non-turf areas.

GREEN BUILDINGS IN INDIA

The 'Green Building' concept is gradually gaining momentum in India from a humble beginning of 20,000 sq.ft of green footprint in the country in the year 2003, to a staggering 10 million sq.ft. expected by the end of 2008 and hence green buildings are well poised to reach scalar heights.

Today a variety of green building projects are coming up in the country – residential complexes, exhibition centers, hospitals, educational institutions, laboratories, Information Technology parks, airports, government buildings and corporate offices. Some prominent Green Buildings certified as per the rating system of LEED (Leadership in energy and environmental design), developed by the US Green Building Council has been shown in Table-2.

Table - 2 : Prominent green buildings of India

Sl. No.	Name	Location	Square Ft.	Building usage	Rating Awarded
1.	CII-Sohrabji Godrej Green Business Centre	Hyderabad	20,000	Office	Platinum
2.	ITC Green Centre	Gurgaon	1,70,000	Corporate Office	Platinum
3.	Grundfos Pumps India Pvt. Limited	Chennai	32,000	Corporate Office	Gold
4.	Wipro Technologies	Gurgaon	1,75,000	Office for software development	Platinum
5.	NEG Micon India Pvt. Limited	Chennai	18,000	Corporate Office	Gold

There is a tremendous potential for construction of Green building in India. The projected growth potential of green buildings in India is shown in Table-3.

Table-3: The projected growth potential of green buildings in India

Year	Project Certified Green Buildings (Nos. per year)	Estimated Market Potential in million US $
2005	10	40
2006	20	80
2007	30	120
2008	45	180
2009	70	280
2010	100	400

GREEN BUILDING MATERIALS AND EQUIPMENT IN INDIA

While constructing Green Buildings in India the availability of materials and equipment is one of the major issues to be addressed. A few green materials and equipment available in the country, to name a few are fly-ash cement, fly-ash block,recycled aluminum, recycled steel, recycled tiles, low VOC paints, bamboo based products, HFC based high efficiency chillers, building controls, green roof, recycled wood, etc. However there is a huge market for green materials, which is still untapped. Typical examples are – Composting toilets, waterless urinals, low VOC adhesives & sealants, CRI certified carpets, FSC Certified wood, high albedo roof paints, BIPV, CTI certified cooling towers, living machines etc.

FACTORS AFFECTING NON-POPULARITY OF GREEN BUILDINGS IN INDIA

Sharma and Kamlambika (2006) have studied the scenario in India and given the following reasons for non-popularity of green buildings:

i)Lack of knowledge of the concept and LEED rating system.

ii) Sustainable architecture not having more emphasis

iii) Lack of availability of Green materials in Indian market

iv) Lack of availability of professionals who can work for green building construction.

Lack of awareness over long term benefits of Green Buildings like energy and water saving, less operating cost etc. has become the overall constraints.

CONCLUSION

Green buildings are the need of the hour which may cost 3-8% more than that of conventional buildings. But the total financial benefits of green buildings are manifold in the long run the average initial investment required to design and construct might be more but finally. Energy savings alone exceed the average increased cost associated with building green. However overtime, building performance should be assured through measurement, adjustment, and upgrading. Proper maintenance should also be done so that a building continues to perform as designed and commissioned. Awareness should be created among the people regarding the benefits of Green Buildings, the services of more green building professionals should be made available, Research and Development should be encouraged for finding new green building materials for popularization of green buildings in India. With the increasing threaten on our planet earth caused by depleting resources and increasing emission it is absolutely pertinent that all our future buildings should be designed to function as green buildings.

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MANAGEMENT OF MUNICIPAL SOLID WASTES – A CASE STUDY

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INTRODUCTION

Municipal solid waste (MSW) is defined as the solid wastes generated in a community except industrial and agricultural waste. Though waste from hospitals and nursing homes are required to be collected and treated separately, in most cities and towns, such waste continue to form a part of MSW. Generation of these waste is directly related to variation in per capita income and the size of the population. Improper management of solid waste has serious environmental and health consequences. Such practices contribute to widespread environmental pollution as well as the spread of diseases. Health deterioration, accidents, flood occurrences, and environmental pressures are just a few of the negative effects. Other environmental effects include pollution of surface and subsurface waters, unpleasant odours, and gas explosions. The hazards associated with inappropriate solid waste disposal and the associated environmental health impacts should therefore be of utmost concern to waste management experts. However environmentally acceptable management of MSW has become a global challenge due to limited resources, an exponentially increasing population, rapid urbanization and worldwide industrialization. In developing Asian countries, these factors are further exacerbated by inadequate financial resources, and inadequate management and technical skills within municipalities and government authorities(Hazra *et al*. 2008).

Improper management of solid waste has been reported by several researchers in different cities of developing countries (Turan *et al*.2008, Chung *et al*., 2008; Agdag 2008).

Bhubaneswar is the capital city of Orissa .It is located in the eastern part of India. Bhubaneswar Municipal Corporation (BMC) is responsible for the management of the solid wastes generated in the city. Bhubaneswar Municipal Corporation spreads over 135 sq.Km of area with approximately 2400 Kms of roads. During the last 55 years, the population of the city has increased from 16,521 in 1951 to approximately 8.0 lakh population in 2006,(6.48 lakh vide census-2001) with a floating population of more than 1 lakh.

This paper presents an overview of current municipal solid waste (MSW) management practices in Bhubaneswar city, and provides several recommendations for system improvement. This study may be beneficial for authorities and researchers to work towards improving their present municipal solid waste management system

COLLECTION OF DATA ON WASTE MANAGEMENT PRACTICES

To investigate the present situation of solid waste management of BMC, several questionnaires were prepared and distributed among various people of the city from different walks of life. The collected data for different MSW functional elements were based on the data collected from the above-mentioned questionnaires, available records from government and non-government organizations. Data was also collected from several persons, including engineers and scientists working in the Bhubaneswar Municipal Corporation and the Orissa State Pollution Control Board.

CURRENT STATE OF SOLID WASTE MANAGEMENT PRACTICES IN BHUBANESWAR MUNICIPAL CORPORATION

Solid waste management has several functional elements, including waste generation, waste handling and separation, storage and processing, collection, transfer and transport, and final disposal (Tchobanoglous et al., 1993). For Bhubaneswar Municipal Corporation the existing solid waste management system is being managed by the health officer, who is assisted by several sanitary inspectors and zamadars, who look after the work of collection, transportation and disposal of solid wastes by the field staff and transport operators. There are 47no of wards out of which 14 no of wards have been privatized. In this section, the current state of municipal solid waste management in Bhubaneswar Municipal Corporation has been discussed.

Solid waste generation and characteristics

Waste production and composition depend on many

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factors, such as the stage of development, socio-economic, climatic and geographical conditions, and collection frequency (Collivignarelli et al., 2004; Tchobanoglous et al., 1993). Data on quantity variation and generation are useful in planning for a collection and disposal system. According to data collected by the local authorities, the waste generation rate is estimated to be 330 gms per capita for Bhubaneswar city. Therefore, the total amount of municipal solid waste was about320 MT/day on 2006. The physical and chemical characteristics of solid wastes have been shown in the tables given below (Talble-1 & 2). As evident from the table the wastes have high organic content.

Table-1 : Physical characteristics

Sl	Ingredients	Percentage(%)
1	Green leaves,Organic waste	56.14
2	Textile	4.38
3	Paper	4.06
4	Wooden Material	1.41
5	Rubber Leather	0.52
6	Soil and inert materials	24.88
7	Stone	5.92
8	Glasses and Metals	1.82

Table-2 : Chemical characteristics

Sl	Ingredients	Percentage(%)
1	Moisture	35
2	Volatile matter	20
3	Fixed carbon	1.5
4	Ash	42.5
5	calorific Value	940 Cal/gm

* Source:-Mishra etal.(2006)

Waste handling and separation/processing at source

The method of handling, storage and processing of solid wastes at the source plays an important role in public health, aesthetics and the efficiency of the MSW system (Abdoli, 1995). Source separation of wastes (especially organic wastes) will not only bring economic benefit, but will also make the recycling of other components more efficient (Aydin and Kocasoy, 2004). The separation of MSW components is one of the most effective ways to achieve the recovery/reuse of materials. The corporation has provided dustbins in different locations of the city but at present, most of the households, shops, and establishments throw their wastes on the streets, footpaths, lanes, drains and open spaces. At present the households, shops, institutions and establishments do not segregate the wastes at source. But in some cases, sellable plastic, glass, metal and news paper etc. are separated and sold to waste purchasers / kabadiwalas by rag pickers for recycling purposes at industry. These rag pickers work at both primary and final disposal sites in the city

Waste collection and transportation

BMC has engaged private agencies for providing hired vehicles along with loaders for lifting, transportation and disposal of solid waste from different areas in the city. They collect waste and transport to different dumping yards. Besides these 200 nos wheelbarrows are there for primary colletion of wastes. The hospitals, clinics, nurshing homes wastes are removed through the express clearing service are taken to an incineration plant managed by private agency at Khurda about 30 km away from the city of Bhubaneswar.The collection of waste is 200 mt/day with collection efficiency of around 60 -65%.

Street sweeping

It is done through the sanitation workers. No sweeping is done on Sundays and public holidays resulting in 100% backlog on the days following a holiday .Short handled brooms, and traditional inefficient wheel barrows are utilized as tools for street cleaning operation.

Waste storage depots

The city does not have waste storage depots. How ever, the corporation has provided some cement concrete bins at some places, which are very badly managed. Mostly the wastes are deposited open as waste storage.

Disposal of waste

BMC has been using 8 no of waste dumping yards where the wastes are being dumped/disposed unscientifically in the areas. These dumping yards are located at the spots like Salia sahi, Baragarah, Jharapada, Bhimatangi, Dumduma, and Malisahi, near Nico Park, near Rajadhani College. In such dumping yards the wastes are neither spread nor compacted nor it is covered by earth. As a result such waste disposal sites pose a serious threat to human health and the over all environment.

DRAWBACKS IN PRESENT MSW MANAGEMENT SERVICES

Analysis of present solid waste management practices by BMC shows that there are many gaps that need to be addressed. Drawbacks in the present system are summarized below.

No Storage of waste at source

There is no practice of storing the waste at source in a scientifically segregated manner. Citizens have not been educated to keep domestic, trade and institutional bins for storage of waste at source and stop littering on the streets.

No system of primary collection from the doorstep

There is no system of primary collection from the source of waste generation. The waste discharged here and there is later collected by municipal sanitation workers through street sweeping, drain cleaning, etc. Street sweeping has, thus become the principal method of primary collection.

Irregular street sweeping

Even street sweeping is not carried out on day-to-day basis; generally commercial roads and important streets are prioritized and rest of the streets are swept occasionally or not swept at all. Generally, no sweeping is done on Sundays and public holidays and a back log is created on the next working day. The tools used for street sweeping are generally inefficient and out-dated. For instance, the broom with a short handle is still in use forcing sweepers to bend for hours resulting in fatigue and loss of productivity. Traditional hand carts and tricycles are used for collection, which do not synchronize with the secondary storage systems. Waste is deposited on the ground necessitating multiple handling. There are no uniform yardsticks adopted for street sweeping. Though, there are some work-norms, these are not very scientific. Most of the cities allocate work to sanitation workers on ad hoc basis. The work distribution ranges between 200 metres to 1000 metres of street sweeping each day. Some sanitation workers are found under worked while some over burdened.

Waste storage depots

Generally, open sites or round cement concrete bins, masonry bins or concrete structures are used for temporary bulk storage, which necessitates multiple handling of waste. Waste often spills over which does not carry a good look as well as it is very unhygienic.

Transportation of waste

Transportation of waste from the waste storage depots to the disposal site is done through a variety of vehicles Most of the transport vehicles are old and open. They are usually loaded manually. The fleet is generally inadequate and utilization is optimal. Inefficient workshop facilities do not do much to support this old and rumbling squad of squalid vehicles. The traditional transportation system does not synchronize with the system of primary collection and secondary waste storage facilities and multiple manual handling of waste results. Open transportation of the waste also pollutes the air and present a bad scenario.

Processing of Waste

As per the informations available, no processing of municipal solid waste is carried out by Bhubaneswar Municipal Corporation.

Disposal of waste

Disposal of waste is the most neglected area of solid waste management services and the current practices are grossly unscientific. Municipal authorities deposit solid waste at a dump-yard situated within or outside the city haphazardly and do not bother to spread and cover the waste with inert material. These sites emanate foul smell and become breeding grounds for flies, rodent, and pests. Liquid seeping through the rotting organic waste called leachate pollutes underground water and poses a serious threat to health and environment.Landfill sites also release landfill gas with 50 to 60 % per cent methane by volume. Methane is 21 times more potent than carbon dioxide aggravating problems related to global warming. No efforts are made to reduce the emission through composting, recycling, etc.

Low collection efficiency

The collection efficiency is only 60%-65%, which is very low.

EXPLORING METHODS TO IMPROVE THE SYSTEMS

In order to improve the current solid waste management services it is essential to explore the various constraints or issues and to arrive at a suitable solution, some of the issues which needs attention are as follows

Community participation

Community participation is of paramount importance for a successful waste management system. It should develop certain strategies to build capacity for community participation like identification of people to be addressed, identification of the areas where community participation is essential and methods to reach the commuity. A series of measures can be taken to bring about a change in public behaviour through public awareness programmes like promotion of reduce, reuse,and recycle (RRR) among manufacturers and buyers, public education through group meetings, workshops, panel discussions, mass education through print media, electronic media, radio, websites etc.

Human resource development

Human resource development is very essential for internal capacity building for any organization. Training

motivation, incentives for outstanding services, disincentives for those who fail to perform are essential. Application of new technology and methods coupled with training at different level is highly necessary. The corporators should be given appropriate know how towards modernization of solid waste management system. Rag pickers around he city should be identified and encouraged to participate in waste collection at different points. They should also be given some designation badges and uniform so as to give some dignity to this much neglected class. They should be given some training by non governmental organizations for door to door collection and segregation of waste. By imposing some monthly fee on local residents, there might be some income generation. They should be promoted to generate income by selling the recyclable wastes separated from garbage.

Promoting GIS-GPS system to obtain reliable data on waste

A management information system is required to manage large amount of spatial attribute data required to the 47 wards and generate reports (daily, weekly etc.)at various levels with details of the waste, types of vehicle etc.Training should be imparted to personnel in handling and updating the data.

Legal Mandate

Solid waste management practices can never reach the desire level of efficiency until the Municipal Solid waste (Management and Handling) Rules, 2005 is implemented properly.

Planning an Intregrated Solid Waste Management Systems for BMC

The objectives of this Municipal Solid Waste Management Plan are: (i) Providing directions for carrying out the waste management activities (collection, transportation, treatment and disposal) in a manner, which is not just environmentally, socially and financially sustainable but is also economically viable. (ii) Establishing an integrated and self-contained operating framework for MSW,which would include the development of appropriate means and technologies to handle various waste management activities. (iii) Enhancing the ability of BMC to provide effective waste management services to their citizens.

RECOMMENDATIONS

After careful analysis following recommendations have been drawn for Bhubaneswar Municipal Corporation.

Encourage source reduction

A reduction in the amount of wastes could be achieved by change of consumption pattern and lifestyle, use of more recyclable materials, practice of waste segregation, change of manufacturing, design packaging, simple house keeping measures etc.

Storage of waste at source

It is essential that the wastes should be segregated at household level into recyclable/reusable and non recyclables. Source stored at source of generation can be put to two types bins/bags; one for bio-degradable waste and the other one for recyclable waste such as plastics, metals, glass, rags, etc. No wastes should be thrown on streets, footpaths, open spaces, drains or water bodies, nallahs etc. However, toxic wastes should be separated from the above two types of waste.Rag pickers may be organized through NGOs to collect recyclable materials from door steps. Community bins may be provided in slum areas.

Maximize waste collection

Utilize the service of rag-pickers and use more vehicles including collection from congested areas and make optimum utilization of available vehicles.

Maximize waste recycling and reuse

source separation and recycling of waste reduces the volume of waste to be disposed. The authority may gain net cost savings biodegradable part should go to the municipal system and recyclable part should be handed over to waste collectors (rag pickers). At the door steps, door to door collection should be encouraged.

Encourage waste processing

Encourage the people to go for vermi composting in their houses and the compost found there may be utilized in their gardens for soil conditioning. Aerobic microbial composting is suggested for processing of bio-degradable part of MSW. Care should be taken to keep the level of mechanization and the production cost to the minimum and to produce a good quality of compost free from heavy metals, sharp object, glass etc. so that it finds a good market. Considering 50% of the total quantity of MSW generated daily to be bio-degradable, a 160 MT per/ day compost plant may be set up and subsequently it may be upgraded.

Promote safe disposal of soild waste

For eliminating the negative aspect of open dumping and to facilitate the city with an effective solid waste disposal system a proper scientific sanitary landfill is proposed and designed .The primary objective of designing a sanitary landfill is to dispose of the discarded materials in a manner

that is environmentally acceptable. The non-biodegradable municipal solid waste and the inert rejects of the compost facility may go for landfilling.

A CASE STUDY OF DESIGN OF SANITARY LANDFILL

Site selected by BMC at Tulasideipur, 25 kms from Bhubaneswar for construction of sanitary landfill was inspected by the authors and found that the site confirms the Municipal Solid Wastes (Management and Handling) Rules,2000. Geo-technical properties of soil were found out for design of sanitary landfill.The area is 26 Acres. Considering a design period of 10 years from 2006 to 2016, a collection efficiency of 75%, a 4% annual increase in generation of solid wastes and assuming 40% of collected waste will be dumped in sanitary landfill, a sanitary landfill has been designed . Limiting the thickness of waste to a maximum of 15m in landfill , waste generation rate 330gm/c/day ,a plan dimension of 120mX50m was found out. Additional area of 10-15% is required for infrastructure development and green belt. This is a below ground landfill and hence a side slope of 3:1was taken with volume of clay required as 819.528m^3(layer thickness in liner as 0.9m and layer thickness cover as 0.60m) .Approximate quantity of geombrane required for MSW has been found to be 5463 m^2 of 1.5 mm thick HDPE geombrane having density of 9.4 KN/M^3 and Tensile strength at yield 18 KN/m. The stability analysis for sliding of geombrane under self weight over clay in linear system was checked, and also stability analysis for sliding of soil over geomembrane was performed and found that geomembrane will fail in tension if its tensile strength will be less than 57.14 KN/m(Detail design available with the authors).

Land fill Gas

Landfills produce gas that can be tapped to generate electricity. This produces landfill gas, typically comprised of roughly 60 % methane and 40 % carbon dioxide. Landfills to install collection systems at landfill sites to minimize the release of methane, a major contributor to global climate change. Landfill gas is collected from landfills by drilling “wells” into the landfills, and collecting the gases through pipes. Once the landfill gas is processed, it can be combined with natural gas to fuel conventional combustion turbines or used to fuel small combustion or combined cycle turbines. Landfill gas may also be used in fuel cell technologies, which use chemical reactions to create electricity, and are much more efficient than combustion turbines.

CONCLUSION

Solid waste management has been gaining much importance from last few years, not only to create sustainable environment to inhabitants but also to keep the city neat and clean. For a fastest growing city like Bhubaneswar it is high time to give proper attention to solid waste management. In this paper the current solid waste management practices in Bhubaneswar Municipal Corporation (BMC) has been discussed .Drawbacks in the current system has been analysed and an integrated solid waste management system for BMC has been recommended. However implementation of these recommendations is not an easy task for BMC.In addition to technical and financial requirements ,it is necessary to enhance public awareness and participation to promote these activities.

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GOLA- THE SEMI NOMADIC BIOCONSERVATIONIST OF ORISSA

B. Sahu

INTRODUCTION

Gola, the nomadic pastoralists of Orissa, is one of the ancient nomadic pastoralists of southeastern part of India. In the state of Orissa, Gola are found in districts of Ganjam, Gajapati and to some extent in Nayagrah district. In Ganjam and Gajapati, the Gola are mostly present in different villages, locally called as "Gola Gaon" means Gola village.

The Gola rears goats and sheep by practicing migration through natural grass and pasturelands. The people of Gola community are generally illiterate, hard working, enduring, brave and efficient traditional healers of small ruminants. The practice of migration, not only help in biodiversity conservation of local sheep and goat breeds but also help in propagation of seeds, grains, herbs and significantly contribute to social unity and land fertility.

GOLA HABITAT

Most of the Gola people live in Gola villages called 'Gola Gaon'. Each Gola Gaon is situated near a forest and/or near a hill (Fig.1).

Fig. 1 : A birds eye view of a Gola Gaon

Each Gola male starting from the young age of 16 to 70 years old, remain outside the village with the flock of sheep and goats locally called "Mandaa". They go on migrating from place to place through the traditional pasturelands in valleys and mountains. Golas move near about 20-30km a day while grazing the animals. A'Mandaa' of goats and sheep may contain 3000-5000goats and sheep. Generally a number of 7-8 Gola pastoralists move with one Mandaa of livestock along with 4-5 pet dogs.

GOLAS' DAY TO DAY ACTIVITIES

In the evening, before the dark falls, the animals are grouped on lands on the invitation of the landowners. The landowner in turn gives Rs200-250 per 'Mandaa' per night stay and offers rice to the Gola pastoralists for food in the night. Near the flock; the Gola people cook their 'Rice' and ' Dal' for supper. There are three to four watchdogs accompanying the flock stay in position near the flock. Gola pastorlists cook food, sing songs and mostly discuss the health problems of any of the animals and eat food by 12 in the mid night. They go to sleep in batches while others watch the animals in rotation.

(i) By early in the morning one of the Gola checks the animals and kids, if there are any sick annimal (Fig.2).

Fig. 2 : Gola pastoralist migrating for grazing the animals

(ii) Landowners come and examine, his/her land for droppings/urine; (iii) There is exchange of better seed stocks of animals between the near by villagers and Gola; (iv) There is also exchange of best local agricultural commodities, seeds with those brought by the Gola.

THE MOVE

When the herd moves sheep and goats are separated (fig.3)

Fig. 3 : Before the herd moves sheep and goat separate

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(i) Before the flocks move, the sheep and goats are separated. This facilitates sheep in practicing grazing and goats in browsing the fodder; (ii) Kids and new born are kept together. The Gola physically carries the most sick and newborn kids. One of the Gola moves in advance and cooks food for the lunch for other Gola. While Gola takes the lunch, the animals group together and take rest. Before eveining sets, the mandaa returns to the temporary hulting place (Fig.4). The night stay is repeated on the same way described earlier.

Fig.4 ; Mandaa returns at day break.

GOLA SOCIETY

The food habites, ecomnomy, behaviour, helth management and the overall social intercourse of Golas' are described inthe following;

(i) Gola tribes are mostly illiterate, simple, honest, brave, hard working, God fearing but eccentric people (Fig.6).

(ii) They are very much friendly to their animals. Even, they share the rice with their loved animals from a same bowl.

(iii) They never take goat or sheep meat except on the occasion of the death of a family member.

(iv) Brides often bring goats and sheep as gifts for the groom from her mother's house.

(v) Gola women, old and young remain in village, while the men migrate for 6-7 months in a year (Fig. 5).

Fig. 5 : Gola women remain inthe village.

Fig.6 : Gola tribes, the most illiterate, simple, honest, brave, hardwoking and excentric people.

(vi) The evening starts with prayer to Lord Krishna, the Hindu God for inviting welfare of their animals.

(vii) Mother goats (Daalua or Ganjam breeds) even feed the Gola children by putting own teat into the mouth of the baby.

(viii) No woman is allowed to visit a 'Mandaa' of goats when she is under menstruation cycle. With smell of the menstruated lady, the Gola believes, there will be no crossing between Buck and Doe.

(ix) Whistling is an important art of the Gola tribe. The adult Gola whistles in different way than a young Gola.The whistling is used to send message to other Gola.Even the animals are commanded through whistling. The intensity of whistling sound varies as per the context of the message. Whistling to send sad news is different from that for happy news.

(x) Polygamy and homosexuality is absent in Gola community.

TRADITIONAL KNOWLEDGE AND BELIEF OF GOLA

(i) Dropping of goat is mixed with goat milk and warmed a little. Then a paste is prepared and smeared on the site of a bone fracture and immobilized the bone with a bamboo splint. This heals the fracture wonderfully within 20 days

Fig. 7 : Herbs collection by Golas on migration.

(ii) Heating an iron rod in the fire and cauterizing the head and neck treats paralysis. The fire is prepared from the dry goat dropping. This method of activating nervous system is very effective.
(iii) While migrating, sick animals (Daalua breed of goats) identify the herbs in their own and eat them as auto treatment and also for autodeworming.
(iv) In rains, animals move to graze on mountains.
(v) The young kids are not allowed to drink water from outside. Only milks are fed to kids up to 3 months age.
(vi) They allow eating of Neem (Azadyrachta indica) leave to young kids for deworming. It tremendously works as deworming agent and also as prevention against goat and sheep pox. Many other herbal preparations are preferred fo rthe animals during the move (Fig. 7).
(vii) In the night, the teats of the mother does are sealed by locally prepared caps to prevent over eating by kids.
(viii) There is better conception rate in Does, after crossing, if the head Gola will not leave the 'Mandaa'' and return to his home.
(ix) For better conception, the head Gola do not wash his head for 10 days.

'GOLA' - THE BIODIVERSITY CONSERVER

The Gola community while practicing migratory pastoralism contributes immensely to biodiversity conservation.
(i) Gola are the best traditional animal breeders. People in villages, wait for the Gola to come to their village. People get best breeding stocks of sheep and goat from Gola and in turn they exchange their best animal breeding stock. This is like an informal animal fair on move
(ii) The night stays are sometimes longer, that lasts 2-3days in one village, by which the land on which they keep their flock get fertilized.
(iii) The Gola brings seeds, grains from their own village and take back seeds from the farmer's enroute, there by conserving biodiversity.
(iv) The Gola plants herbs, grass enroute to ensure fodder availability during future migration.
(v) The Golas are traditional animal healers who utilize local plants and herbs during treatment. There by they train localites how to utilize the local biodiversity products and best nurture the biodiversity.

GOLA AND THE LIVESTOCK ECONOMICS

Gola are the traditional small animal rearers who breed, rear and market goats and sheep. Although middlemen control the bulk of mutton and chevon trade in Orissa, Gola contributes significantly to the fair-trading and ensures availability of ruminants during high demand time of Durga Puja, Eid, New Year parties and marriage celebrations. The dynamics of the small animal trading is still in fluid state, causing loss against the Gola.

No doubt, the Gola system of rearing and trading the livestock is a perfect example of low external input based sustainable livestock rearing system. The migration and sustenance of life together makes the system a perfect endogenous development.

THREATS AND CHALLENGES

(i) The young generation is unwilling to live the life of traditional Gola.They prefer to go to urban ares and earn livelihood as laboures/taxi drivers.
(ii) While migrating with livestock, they are often robbed by thieves, thugs. These cases are increasing day by day.
(iii)People of forest dept are restricting their entry to certain areas of fodder and forests.
(iv)Large-scale plantation of cashew nut causes no growth of fodder grass in plain as well as in hills.
(v)Traditional grasslands and pasturelands are decreasing day by day.

BREEDING BEHAVIOUR OF A WILD TUSKER

R. K. Samantaray

It was a 2007 winter at northern part of the country. The wintery cold was at its low. The Olympic circus was conducting show at Raniganj then. The show continued from 12 th August to 9th September 2007.On 28th August every other members of the circus party were retiring after a strainous work out. On 28.8.07 a male wild tusker entered the campus. All the 4 female captive elephants out of fear trumpeted. Four elephants went in 4 different directions. Then male pushed one female elephant named Sabitri from the camp almost 100 meters away. Later the female one started walking behind the tusker. It was a kind of situation where the male elephant from wild entering into the circus forcibly took away the female one in front of all other elephants and the staffs of the circus in the wee hours. Then staff of the circus, Divisional Forest Officer and the media of the region followed both the elephants. Both the elephants crossed Gangajal ghati of Bankura district. En-route both of them came accross a jungle named Radhur Bainth. Both engaged in caressing and communicating better which later culminated into mating. Mating continued besides a pond over there. Within the said week 3-4 times mating were observed. On 4th September night both were separated. By then both the elephants had already come 70-80 kms. Later the Forest Range Officer of the locality intimated the circus staff regarding the whereabouts of the missing elephant. Thereafter, the mahout, ring master and 8-10 people from the concerned circus reached the spot and tried to give command but the female one did not respond to command. Finally when the female one was one km. away from the male, it slowly responded to the command specifically of the mahout after she was fed with banana plant and ripe banana. Then in presence of Divisional Forest Officer, Superintendent of Police and Forest Range Officer the pachyderm was loaded into a truck and drove back to Raniganj circus campus. Then time rolled on. The female elephant Sabitri got conceived.When the circus was playing at Baripada urine of the said female elephant was examined and revealed to + ve for pregnancy. Thereafter,during October 2008 when the circus was conducting show at Bhubaneswar, development of tits and other symptoms of pregnancy were marked.The press fondly gave the name of the tusker to be Satyaban since the female's name was Sabitri. After taking pleasure of the bride the groom vanished and mingled into the jungle. There are some more happenings like this in other parts of the country without much documentation. This type of breeding behaviour is a rarer thing in elephant fraternity.

WILD ANIMAL ENRICHMENT (Letter from a nature lover)

By Mr Sheru, Bhubaneswar

Sir, you are most aquainted with the animals or our wild lives. As they are not as intelligent as us or as they are not having a great evolve brain, we are here to protect them, preserve them and to enrich them. What does an animal want in its habitat ? (It does not matter for it that the habit is in a national park or in a zoo). Animals choose their territory in such a way that it can provide the requirements like ; (i) Protection from adverse conditions, (ii) Protection from predators, (iii) Availability of food, (iv) Non-interference by other animals (v) To satisfy the instinctive needs. Undoubtedly, as animals are being inside a zoological park, they are getting all of their basic requirements except territory problem and their instinctive needs. As each animals(either loner or gregarious) has got their own limit of territory, they should be provided with that amount of area for their natural growth. But sir; I am feeling very much sorry to say that our park is not providing all the animals with their required territory. So, my hearty request to you sir, please put a hearty concern upon this matter. The pertinent thing is that most of the animals are unsatisfied with their instinctive needs i.e. what they need habitually. Imagine sir, if you are provided with sufficient amount of food, clothings, money but not allowed to go outside a slum area and are bound to live there always, then sir, can you develop ! Exactly sir, our animals are provided with food, shelter, protection etc. but not with that habitat, which they need instinctively. Their habitat should almost be a replica of their natural one. For example sir, barking deer prefers dense forest and closed canopy but their instinctive needs become unfulfilled when their habitats become forest with open canopy and they run away from that habitat. But here they can not run away; thus we have to create a condition so that their development will increase naturally. Sir, put a view upon the bears under captivity. How they are looking like? Like a disease animal, not getting food from some days ago, not in a playful mood, not interested in human. Why sir ? They are simply animals as we. We all have to live together in this planet. Thus we have to change the conditions, we have to make them as our friend. So sir, please find out a good way to make them happy and I expect you to be in happiness always.

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RESCUE AND REHABILITATION OF A CINEREOUS VULTURE (*Aegypius monachus*) IN ORISSA

A.K.Mishra[1], R.K. Samantaray[2], P. K. Roy[3], A.K. Pattnaik[4] and P. Ray[5]

One strange looking large bird was rescued by forest staff of Bonai Range of Bonai Forest Division, Orissa from Bhalupani village area on 12.12.2008. Initially staff of banai forest division every body thought it to be some kind of eagle. Since it was unable to fly, it was brought to Nandankanan Zoo on 13.12.2008 for necessary treatment and rehabilitation. Since the bird was dull, immidiately anti-stress drug restobal and zetress were given followed by antibiotic coverage in drinking water for five days. From phenotypically characterizationit resmbled to vulture on stand by the vets of the park. subsiquently for species identification. Subsequently some ornithologist and nature lovers viz. Dr. P. Ray, Director, Regional Museum of Natural History, Bhubaneswar, Dr. Siba Prasad Parida, Sri Ramesh Chandra Jhankar, Ornithologist were invited and the bird was identified to be Cinereous Vulture (Aegypius monachus). This is also commonly known as Black Vulture.

This is a massive black to blackish brown vulture with light pinkish naked neck with black ruff. The head is

Fig. : First sighting record of Cinereous vulture (*Aegypius monachus*) at Bonai Forest Division, Sundargarh, Orissa

partially naked with medium crown, occiput, check and lores covered with fur like feathers. The rescued black vulture which is now housed in Encl. No. 18 of Nandankanan Zoo is a sub-adult one. This is being kept under quarantine at

Fig. : The said vulture successfully rehabilitated at Nandankanan Zoological Park, Orissa

present. The fecal sample tested in zoo laboratory showed no worms. On the first day it was given a dressed chicken which it dewormed immediately by tearing apart. On the next day it was given a live chicken which it immediately attacked and devoured immediately. The wing span when spread apart seems to be over 1.5 mtr.

This type of vulture are actually found in Himalayas wandering in winter down to south and west to lower latitudes. Occasional vagrant to the peninsular and recorded in Maharastra (Satara) and Kerala. This is the first sighting record in the State of Orissa. Cinereous Vulture prefers habitats of open savannah and semi-desert habitat. Mostly they are seen sighly perched on the ground and rarely in a group of 15 to 20 nos. They are also found in Pakistan. They feed on carrion and also on tortoises. The nesting season is from March to April. The nest happens to be an enormous platform of sticks added annvestly built on a tall tree.Cinereous vulture is usually solitary but has been seen in small groups. This vulture soars as the morning sun warms the air using its long broad wings to catch these thermals to get lift as it soars. This is a quiet bird. Sexes are alike in appearance with no seasonal variations.

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INAUGURATION OF E-PLANET IN INTERNATIONAL CONGRESS AT JAMMU ON 26.04.2008

Reitz, S. Padhi and T. Samantaray

Inset (L to R) : [Prof. Dr. Ngendra Sharma, Vice Chanceller, Sher- e- Kashmir University of Agricultural Sciences & Technology; Dr. R. K. Samantaray, Editor- in Chief, e-planet; Prof. Dr. A. K. Srivastava, Organizing Secretary and Dean Faculty of Veterinary Sciences and Animal Husbandry, SKUAST-Jammu, jenab qazi Mohammad Afzal, Hon'ble Minister for Forest, Environment, Ecology, Housing and Urban, Jammu and Kashmir Government; Dr. Michele Miller, Disney's Animal Programmer, Orlando, Florida, United States of America; Dr. Mads F.Bertelsen, Center for Zoo and Wild Animal Health, Copenhagen Zoo, Denmark; Prof. Dr.B. M. Arora; President, Association of Indian Zoo and Wildlife Veterinarians, Dr. Leela Singh, Faculty of Veterinary Sciences and Animal husbandry, SKUAST-Jammu]

An international congress on 'Advances in zoo and wild animals health and management" and symposium on "Impact of diseases on conservation of wild animals' has been successfully organized in Jamu, the city of temples on April 26-27 2007 by Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology; R.S.Pura, Jamu under the auspices of the Association of Indian Zoo and Wildlife Veterinarians . The deliberations of the symposium focused on various aspects of wild animal treatment and management of diseases of zoo and free ranging animals , drug action in wild and zoo animals and impact of diseases on conservation of wild animals. The congress provided an opportunity to teachers, researchers, biologists, wildlife conservators, policy makers, administrators and veterinarians for interaction and to discuss latest methods for control of these diseases.

Plenary lectures included management of zoo animals, conservation of wild animals and diagnostic techniques for zoo and wild animal diseases. Technical sessions included breeding and management approaches for wild life, wildlife conservation and rehabilitation, diseases of zoo animals and their treatment, public health importance of zoo and wild animal and judicious use of drugs in wild and zoo animals. A number of veterinarians and researchers gave oral and poster presentations in the said congress upon which general recommendations were drawn. In the said congress the journal "***e-planet***" (Vol. 5/ issue no.1) was inaugurated in the inaugural function on 26.4.2008 by Jenab Qazi Mohammad Afzal, Hon'ble Minister for Forest, Environment and Ecology, Housing and Urban, Jammu and Kashmir Government in presence of Jenab Ajaz Ahmad Khan, Minister of State Agriculture, Horticulture, Higher and Technical Education, Prof. Nagendra Sharma, Vice Chancellor and Chief Patron, Organizing Committee, Michele Miller, Disney's Animal Programmer, Orlando, Florida,USA and Mads F. Bertelsen, Center for Zoo and Wild animal Health, Copenhagen Zoo, Denmark. The president of Association of Indian Zoo and wildlife Veterinarians and the chairman of the congress, Dr. B. M. Arora and the Dean, Faculty of Veterinary sciences and Animal Husbandary and the organising secretary, Prof. A. K. Srivastava successfully conducted the program.

ENVIRONMENTAL BALANCE AND ITS SUSTAINABILITY

R. S. Rohella[1] and P. Biswal[2]

INTRODUCTION

Global warming, ozone depletion, biodiversity, waste management and human population are the five major factors which really go in for the environmental balance and its sustainability of the planet earth.

Global warming

Global warming on the increase and species and their habitats on the decrease, chances for ecosystems to adapt naturally are diminishing. Many are agreed that climate change may be one of the greatest threats facing the planet. Recent years show increasing temperatures in various regions, and/or increasing extremities in weather patterns. Global warming and climate change refer to an increase in average global temperatures. Natural events and human activities are believed to be contributing to an increase in average global temperatures. This is caused primarily by increases in "greenhouse" gases such as carbon dioxide (CO2).

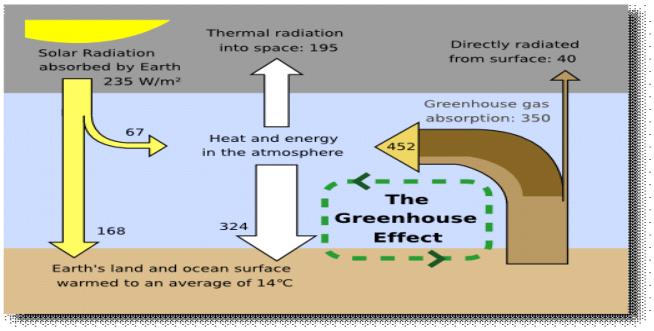

Fig. 1 : Diagram showing the green house iffect.

Six main greenhouse gases are carbon dioxide (CO2), methane (CH4) (which is 20 times as potent a greenhouse gas as carbon dioxide) and nitrous oxide (N2O), plus three fluorinated industrial gases: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6). Water vapour is also considered a greenhouse gas. Although many of these greenhouse gases are actually life enabling, for without them, heat would escape back into space and the earth's average temperature would be a lot colder. However, if the greenhouse effect becomes stronger, then more heat gets trapped than needed, and the earth might be less habitable for humans, plants and animals.

Carbon dioxide, though not the most potent of greenhouse gases, is the most significant one. Human activity has caused an imbalance in the natural cycle of the greenhouse effect and related processes.

Ozone depletion

Ozone depletion is also a major factor in the environmental balance. The two distinct, but related observations: a slow, steady decline of about 4 percent per decade in the total volume of ozone earth's stratosphere (ozone layer) since the late 1970s, and a much larger, but seasonal, decrease in stratospheric ozone over Earth's polar regions during the same period. The latter phenomenon is commonly referred to as the ozone hole. In addition to this well-known stratosphere ozone depletion, there are also trophospheric ozone depletion events, which occur near the surface in polar- regions during spring.

Biodiversity

Biodiversity actually boosts ecosystem productivity where each species, no matter how small, all have an important role to play and that it is this combination that enables the ecosystem to possess the ability to prevent and recover from a variety of disasters. This is obviously useful for mankind as a larger number of species of plants means more variety of crops and a larger number of species of animals ensure that the ecosystem is naturally sustained.

The variety of life on earth, its biological diversity is commonly referred to as biodiversity. The number of species of plants, animals and microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all part of a biologically diverse earth. Appropriate conservation and sustainable development strategies attempt to recognize this as being integral to any approach. Almost all cultures have in some way or form recognized the importance that nature, and its biological diversity has had upon them and the need to maintain it. Yet, power, greed and politics have affected the precarious balance.

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Waste management

Waste Management is the human control of the collection, treatment and disposal of different wastes. Waste is an unwanted or undesired material or substance. It is also referred to as rubbish, trash, garbage, or junk depending upon the type of material and the regional terminology. In living organisms, waste relates to unwanted substances or toxins that are expelled from them.

This is in order to reduce the negative impacts waste has on environment and society. Waste is directly linked to the human development, both technologically and socially. The composition of different wastes have varied over time and location, with industrial development and innovation being directly linked to waste materials. Examples of this include plastics and nuclear technology. Some components of waste have economical value and can be recycledonce correctly recovered.

Biodegradable waste such as food waste or sewage, is broken down naturally by microorganisms either aerobically or anaerobically. If the disposal of biodegradable waste is not controlled it can cause a number of wider problems including contributing to the release of greenhouse gases and can impact upon human health via encouragement of pathogens.

Human population growth

5. Human population growth is the number one threat to the world's environment. Each person requires energy, space and resources to survive, which results in environmental losses. If the human population were maintained at sustainable levels, it would be possible to balance these environmental losses with renewable resources and regeneration. But our population is rapidly rising beyond the earth's ability to regenerate and sustain us with a reasonable quality of life. We are exceeding the carrying capacity of our planet.

We need to limit our growth voluntarily, and promote contraceptive use, before nature controls our population for us with famines, drought and plagues. Our children's future depends on us. The population reached 6.1 billion in 2000. The United Nation projects that world population for the year 2050 could range from 7.9 billion to 10.9 billion, depending on the actions we take today.

India as a country of vast resources and varied biodiversity is on rapid economic growth and certainly has to face the threat of climate change. The utilization of the unique natural resources depends on the judicious and its food and energy needs vis-à-vis social development and obligations are the overriding priorities before India and these have to be met without compromising and sacrificing the global environmental balance and sustainability. Further maintaining high growth rate is also a necessity for India. So it is the responsibility of every citizen of country to contribute to minimize and control environmental degradation any further by adopting the energy efficient means and devices in their daily routine.

ROLE OF NM GROUP OF INSTITUTIONS

NM Group while spreading the message on use of renewable energy through its Renewable Energy Club (REC) set up at NMIET Bhubaneswar in Oct. 2006 under aegis of Ministry of New and Renewable Energy (MNRE), Government of India is doing a very good job and is also playing a critical role in disseminating information regarding the renewable energy generation, efficient energy devices, optimum utilization and energy conservation in our day to day life there by contributing in global environmental balance and ssustainability