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A Convergence for the Future

The collaboration of the Forest Department with the Ela Foundation for the publication of the *'Ela Journal of Forestry and Wildlife'* brings together, on one platform, two groups that are closely associated with the Conservation of Natural Habitats and the life forms that are a part of it. The Forest Department is mandated from the Government with managing the natural resources. In order to take this mandate forward the Forest Department has developed close linkages with Civil Society in this momentous scientific endeavor for Conservation of Nature through Research and Education.

The Forest Department along with the Ela Foundation (*'Ela'* means Earth) has joined hands through a MOU for the publication of research papers and pertinent information on Nature Conservation, including Wild Life in the *'Ela Journal of Forestry and Wildlife'*. This is flagged as a unique opportunity for sharing research findings and a service to the public on information for the scientific, forestry, civil society and other interested citizens for whom conservation and education is a means for ensuring whole hearted public participation for inter-generic equity. As we enter the new vistas of technology oriented management of natural eco-systems, there is a need for coming together of like minds and allow convergence of intellectual inputs from different spheres. The new way for conserving ecology is a challenge which can be made only by such a synergetic relationship of forestry officials with civil society. This endeavour also opens up an opportunity for Government officials to come out and showcase their professional work from the field which otherwise had remained mostly hidden.

In tune with the present trends the *EJFW* is in the electronic form. This will not only save on costs and paper, but shall allow unlimited access as well as tremendous outreach to people, thus facilitating the much needed 360 degree support from different sections of society for the cause of Ecology and the Environment.

I therefore make a clarion call for Government officers and civil society to utilize this platform for sharing research and information. Please come forward!!!

Mafiul Hussain

The academic collaboration between Ela Foundation and the Maharashtra State Forest Department for jointly publishing the scientific electronic quarterly *'Ela Journal of Foresty and Wildlife*' is an inspiring step of long lasting significance. It will bring researchers from the civil society and the Forest Department to achieve the conservation of habitats for the benefit of the voiceless inhabitants. More than ever before, the delicately balanced and complexly linked flora and fauna need our undivided attention for their survival. Research is the best tool to truly appreciate and preserve the sublime design knit by the unseen Hand, and improved over millions of years of evolution. Modern scientific tools give us a glimpse of the astounding nano-technology that has gone in perfectly designing the diverse life forms. I am full of hope and look forward to see the *Journal* establish itself on solid foundations of respect, research and solidarity towards Ela – Mother Earth. Research is the soul of conservation.

Dr. Satish Pande

Ecological Study of Intertidal Marine Algae of Konkan: Vertical Distribution

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ABSTRACT

Algae, the primitive group of plants and the benthic marine algae are the biological components of the rocky shores. The vast coastal area of India offers scope for research in the field of marine algae. A dynamic and cyclic habit and the diverse distribution, abundance and reproductive features of the algal species offer an opportunity for developing adaptations to combat the extreme environmental conditions. About 159 algal species are recorded along the coast of Maharashtra and there is a need of extensive study of the biodiversity of the seaweeds along the coast. We conducted a study of vertical distribution of the marine algae at Hedavi and Kolthare, along the North Ratnagiri district, Maharashtra. The zonation pattern of the marine algae at Hedavi and Kolthare shows close conformity with the universal scheme of zonation pattern for rocky coasts as suggested by Stephenson and Stephenson (1949). However we observed that, most of the algal species were found in the infralittoral region.

KEY WORDS

Vertical Distribution, Marine Algae, Coasts, Konkan.

INTRODUCTION

Algae are a primitive group of plants, which residesin the fresh water and marine water, as well as wet surfaces of the soil. Algae show wide variations in their habit such as: macro algae, green algae (Chlorophyta), brown algae (Phaeophyta), red algae (Rhodophyta), and microalgae such as blue – green algae (Cyanophyta).

Every coast shows diversity of seashore habitats like, rocky, sandy, reefs, etc., which harbour various life forms including algae. Earlier researchers have restricted their work to describing the distribution of marine algae along the seashores. Eventually studies of a small portion of seashore or a rock pool were undertaken to study the distribution of marine algae along rocky seashores.

Though in recent years, research has been undertaken in marine ecology, mainly focused on the East coast of India, some of researchers have undrtaken investigations

on the West Coast of India, specifically in Maharashtra. Those investigations were restricted to the study of diversity or on a particular species of marine algae.

Stephenson and Stephenson (1949), with distinctive studies on the rocky shore of Britain, North America, South America, Indian Ocean and Australia have published the 'Universal Features of Zonation' of Organisms between tidemarks on Rocky Coasts. They suggested the following five zones viz.

1. Supralittoral zone.
2. Supralittoral fringe.
3. Midlittoral zone.
4. Infralittoral fringe.
5. Infralittoral zone.

Very little work has been done on ecology of intertidal marine algae along the west coast of Maharashtra. In Konkan region, especially in north Ratnagiri district, only taxonomy of marine algae has been studied by Phanse (2000) and marine macroalgal diversity along Maharashtra coast by Dhargalkar, Untwale and Jagtap (2001).

However, the distribution and zonation pattern of the marine algae has not been studied along the entire west coast of Maharashtra except for Mumbai, the latter by Deodhar (1987). At present, the North Ratnagiri district has very few industries that can influence the marine flora and fauna. These include the Ratnagiri Gas and Power Pvt. Ltd. located near Dabhol, and another JSW Power project at Jaigad near Hedavi. Many more industries, particularly in the power sector are likely to be established along the coast of Ratnagiri district. These industries may have an impact on the algal flora of this coast and shall justify further studies.

MATERIALS AND METHODS:

The detailed ecological study of marine algae has been carried out at one station in each taluka. Two sites were selected for the above investigation, of which Hedavi is the first site and will be considered as Site – 1, and Kolthare is the second site and will be considered as Site – 2. Both sites are situated on the west coast of Maharashtra state on the North Ratnagiri district. The Site – 1 is situated at the longitude of 17^{o} 21' 30.53 N and latitude of 73^{o}12'57.77 E, and Site – 2 is situated at the longitude of 17^{o} 39'36.43 N and latitude of 73^{o}07'35.38 E. Both sites show high rocky shore and are easily approachable for the research work.

A line transect was placed perpendicular to the shoreline. Starting from the boulders, a line transect was fixed for monthly observations.

Monthly observations were carried out at the suitable low tides, consulting the tide time tables published by the Government Port Authority at Ratnagiri. The occurrence of algae, along the line transect, were recorded for 18 months from June 2009 to November 2010. Both sites of Hedavi and Kolthare, were studied using line transect of 50 and 52 meters respectively, extending from the shoreline to low water level. During each visit, depending upon the height of water, readings were taken from 1 meter up to the distance that was exposed during the low tide. The algal species occurring along the line were noted down.

The profile of the shore along the line transect was charted by using "The Emery Profile Method" as described by Dawes (1981).

RESULTS AND DISCUSSION:

Both sites, on the west coast of Ratnagiri district exhibit good diversity in the macro algal species. The shore type at both sites is rocky and is similar to that of other Indian rocky shores. The rocky shore at Site – 1 and Site – 2, shows gradual slope towards the sea.

The list of identified algal species is given in Table No. 1 and Table No. 2. The observations at Site – 1 and Site – 2 are listed in Table No. 3 and Table No. 4 respectively.

The vertical emersion was 5.4 meters at Site – 1 above the Chart Datum (CD) and was 3.2 meters above the Chart Datum (CD) at Site – 2. Figure No. E, F, G and H illustrate the meter-wise distribution of marine algae at Hedavi. Figure No. I, J, K and L illustrate the meter-wise distribution of marine algae at Kolthare.

Supralittoral zone at Site – 1 was found near the shore line at the height of 4.9 to 5.4 meters from CD, while at Site – 2 it was found at the height of 2.4 to 3.2 meters from CD.

Supralittoral fringe at Site – 1 was found at the height of 3.1 to 4.9 meters from the CD, whereas the Site – 2 showed the height of this belt at 1.5 to 2.4 meters from CD.

Midlittoral zone found at Site – 1 was at the height of 3.1 to 3.9 meters from CD and at Site – 2 it was at the height of 1.5 to 2.3 meters from CD.

Infralittoral fringe was observed at Site – 1 was at height of 0.9 to 3.1 meters above CD, while the Site – 2 showed the height of this belt at 0.3 to 1.7 meters above CD.

Infralittoral zone was found bellow the 0.9 meters from CD at Site – 1, and at Site – 2 it was observed the height bellow 0.3 meters from CD.

The present study indicates that, majority of algal species occur in the intertidal region. During late monsoon time *Enteromorpha flexuosa* is the only member that can be collected in the supralittoral zone, the region above high water mark, which is a spray zone.

On the rocky surface in the supralittoral fringe zone we recorded various algal members like *Porphyra vietnamensis, Chaetomorpha linum* and *Ulva lactuca*.

At both Sites – 1 and 2, in the supra-littoral fringe and mid-littoral region, we recorded algal species like *Gelidium pusillum, Spongomorpha indica, Cladophora* and *Padina tetrastromatica*. Whereas, *Sargassum cinereum, Dictyota* sp, *Stoechospermum marginatum, Gracilaria corticata, Hypnea valentiae*, *Jania rubens* growing in the rock pools. These rock pools are never exposed to air.

At Site – 1 and Site – 2, large number of algal species grownear the extreme low water spring zone or in the infralittoral fringe. Most of the species in this region are either exposed for very short period or always submerged. This area is characterized by *Padina tetrastromatica*, *Sargassum cinereum, Spatoglossum asperum, Stoechospermum marginatum, Gracilaria corticata, Champia compressa, Laurencia obtusa, Dasya sp., Catenella rapens,* etc.

All these species also extend down in the infralittoral zone, which is always covered with seawater and are never exposed. Along with algae, Littorinoids, Belenoids, and Barnacles are some of the animals that characteristically appear in various zones.

Thus, our study shows that it is possible to recognize a pattern of zonation of the algal species at Site – 1 and Site – 2 as postulated by Stephenson T.A. and Stephenson A. (1949).

At Hedavi and Kolthare, comparable type of 'mosaic zone' was seen in the infralittoral fringe, particularly below the level of mean low water of spring tides (MLWS). The entire vertical range of the intertidal algal zone was 2.61 meters at Site – 1 and with a gentle slope extending to a horizontal distance of 50 meters. While at Site – 2 vertical range of the intertidal algal zone was 2.26 meters with a gentle slope extending to a horizontal distance of 52 meters. The mosaic zone at both sites was a narrow zone, as both sites are attributed by the wide range of vertical emergence and tides.

CONCLUSION:

The zonation pattern of the marine algae at Hedavi and Kolthare shows close conformity with the universal scheme of zonation pattern for rocky coasts as suggested by Stephenson and Stephenson (1949). The five different zones at Hedavi and Kolthare are been recognized as follows,

1. Supralittoral Zone: This zone existed in the monsoon period i.e. from July to August. *Enteromorpha flexuosa* was the only alga found in this zone throughout the study period.
2. Supralittoral fringe: This zone was characterized by *Chaetomorpha linum, Spongomorpha indica*, and *Ulva lactuca* and some red algae like *Gelidium pusillum* and J*ania rubens* (in rock pool).The upper limit of this zone at both sites coincided with the lower limit of the supralittoral zone. The alga *Ulva lactuca* sometimes was seen migrating to upper zone.
3. Midlittoral zone: The algal species of this zone were *Padina tetrastromatica, Porphyra vietnamensis and Gelidium pusillum*. Whereas *Chaetomorpha linum and Ulva lactuca* extended from supralittoral fringe down to the lower limit of this zone. *Sargassum cinereum, Dictyota, Stoechospermum marginatum, Gracilaria corticata, Hypnea valentiae*, etc. were seen growing in the rock pools of this region.
4. Infralittoral fringe: In this zone brown algae like *Padina tetrastromatica, Stoechospermum marginatum, Sargassum cinereum, Sphacelaria furcigera, Spatoglossum asperum, and red algae like Gracilaria corticata, Centroceras clavulatum, Hypnea valentiae*, and *Gelidium pusillum* were present. While some algal species like *Sargassum cinereum, Spatoglossum asperum, Gracilaria corticata, Gelidium pusillum, Laurencia obtusa, Champia compressa*, and *Catenella rapens* occupied the lower part of this zone and, also extend into the infralittoral zone.
5. Infralittoral zone: This zone was characterized by the growth of S*argassum cinereum, Laurencia obtusa, Champia compressa,* and *Catenella rapens*, which were restricted only to this zone and were seen in the infralittoral zone as well as in the infralittoral fringe.

Thus five characteristic zones existed along the coast of Hedavi and Kolthare, but it was observed that, most of the algal species were found in the infralittoral region and infralittoral zone.

At Hedavi and Kolthare, mixed type of algal populations was observed and termed as 'algal mosaics'. This mosaic zone showed vertical migration of algal species in different months of the year.

The seasonal variation has shown relation with the zonation pattern of algal community, as during the monsoon period the algal flora was very poor. The algal community has exhibited a higher density during the post monsoon period from November to January. The density agradually reduced from the summer season till the monsoon period and during the monsoon season majority of the algal members disappeared.

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Table No. 1
List of algae encountered along the line transect at Hedavi

Sr. No.	Name of Algae
01	***Chaetomorpha linum*** (Muell.) Kuetz.
02	***Enteromorpha flexuosa*** (Wulf.) J. Ag.
03	***Spongomorpha indica*** Thivy et Visalakshmi.
04	***Ulva lactuca*** Linn.
05	***Cladophora fasicularis*** (Mert.) Kuetz.
06	***Dictyota divaricata*** Lamouroux
07	***Dictyota dichotoma*** (Hudson) Lamouroux.
08	***Padina tetrastromatica*** Hauck.
09	***Stoechospermum marginatum*** (C. Ag.) Kuetz.
10	***Sargassum cinereum*** J. Ag.
11	***Sphacelaria furcigera*** Kuetz.
12	***Spatoglossum asperum***
13	***Catenella rapens*** (Lightf.) Batters.
14	***Champia compressa*** Harvey.
15	***Centroceros clavulatum*** (C. Ag.) Mont.
16	***Gelidium pusillum*** (Stackhouse) Le Jolis.
17	***Gracilaria corticata*** J. Ag.
18	***Grateloupia filicina*** (Wulf) G. Ag.
19	***Hypnea valentiae*** (Turn.) Mont.
20	***Jania rubens*** Lamour.
21	***Laurencia obtusa*** (Hudson) Lamouroux.
22	***Porphyra vietnamensis*** Tanaka et Ho.

Table No. 2
List of algae encountered along the line transect at Kolthare

Sr. No.	Name of Algae
01	***Chaetomorpha linum*** (Muell.) Kuetz.
02	***Enteromorpha flexuosa*** (Wulf.) J. Ag.
03	***Spongomorpha indica*** Thivy et Visalakshmi.
04	***Ulva lactuca*** Linn.
05	***Cladophora fasicularis*** (Mert.) Kuetz.
06	***Dictyota divaricata*** Lamouroux
07	***Dictyota dichotoma*** (Hudson) Lamouroux.
08	***Padina tetrastromatica*** Hauck.
09	***Stoechospermum marginatum*** (C. Ag.) Kuetz.
10	***Sargassum cinereum*** J. Ag.
11	***Sphacelaria furcigera*** Kuetz.
12	***Catenella rapens*** (Lightf.) Batters.
13	***Champia compressa*** Harvey.
14	***Centroceros clavulatum*** (C. Ag.) Mont.
15	***Dasaya spp.***
16	***Gelidium pusillum*** (Stackhouse) Le Jolis.
17	***Gracilaria corticata*** J. Ag.
18	***Grateloupia filicina*** (Wulf) G. Ag.
19	***Hypnea valentiae*** (Turn.) Mont.
20	***Jania rubens*** Lamour
21	***Laurencia obtusa*** (Hudson) Lamour.
22	***Porphyra vietnamensis*** Tanaka et Ho.

Table No. 3 Observations of algae encountered along the line transect at Hedavi

Name of Algae	Months								
	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10
Chaetomorpha linum	+	+	+	-	-	+	-	+	+
Enteromorpha flexuosa	-	+	+	-	-	-	-	-	-
Spongomorpha indica	-	-	-	-	-	-	-	-	-
Ulva lactuca	-	-	-	+	-	+	+	+	+
Cladophora fasicularis	-	-	-	-	-	-	+	-	-
Dictyota divaricata	-	-	-	-	-	-	-	-	-
Dictyota dichotoma	-	-	-	+	-	-	-	-	-
Padina tetrastromatica	-	-	-	+	+	+	+	+	+
Stoechospermum marginatum	-	-	+	-	-	+	-	+	-
Sargassum cinereum	-	-	+	+	+	+	+	+	+
Sphacelaria furcigera	-	-	+	-	+	-	+	-	-
Catenella rapens	-	-	+	-	-	-	-	-	+
Champia compressa	-	-	-	-	-	-	-	-	+
Centroceros clavulatum	-	-	-	-	-	-	-	-	-
Dasaya spp.	-	-	-	-	-	-	-	-	-
Gelidium pusillum	+	+	+	+	+	+	+	+	+
Gracilaria corticata	-	-	+	+	+	-	+	-	-
Grateloupia filicina	-	-	-	-	+	-	-	-	-
Hypnea valentiae	-	-	-	-	-	-	-	-	-
Jania rubens	-	-	-	-	-	-	-	-	-
Laurencia obtusa	-	-	-	-	+	-	-	-	-
Porphyra vietnamensis	-	+	+	-	-	-	-	-	-

Name of Algae	Months								
	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10	Oct 10	Nov 10	Dec 10
Chaetomorpha linum	+	+	+	-	+	+	-	+	+
Enteromorpha flexuosa	-	-	-	-	-	-	-	-	-
Spongomorpha indica	-	-	-	-	-	-	-	-	-
Ulva lactuca	+	+	-	-	-	-	+	+	+
Cladophora fasicularis	-	-	-	-	-	-	-	-	-
Dictyota divaricata	-	-	-	-	-	-	+	-	-
Dictyota dichotoma	-	-	-	-	-	-	-	-	-
Padina tetrastromatica	-	-	-	-	-	-	+	+	+
Stoechospermum marginatum	-	-	-	-	-	+	-	-	-
Sargassum cinereum	-	-	-	-	-	+	+	+	+
Sphacelaria furcigera	-	-	-	-	-	+	+	+	+
Catenella rapens	-	-	-	-	-	-	-	+	+
Champia compressa	-	-	-	-	-	-	-	-	+
Centroceros clavulatum	-	-	-	-	-	-	-	-	+
Dasaya spp.	+	-	-	-	-	-	-	+	+
Gelidium pusillum	+	+	+	+	+	+	+	+	+
Gracilaria corticata	+	+	+	+	+	+	+	+	-
Grateloupia filicina	-	-	-	-	-	-	-	-	-
Hypnea valentiae	-	-	-	-	-	-	-	-	-
Jania rubens	-	-	-	-	-	-	-	-	-
Laurencia obtusa	-	-	-	-	-	-	-	-	-
Porphyra vietnamensis	-	-	-	-	+	+	-	-	-

Table No. 4 Observations of algae encountered along the line transect at Kolthare

Name of Algae	Months								
	Jul 09	Aug 09	Sep 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10
Chaetomorpha linum	+	-	-	+	+	+	+	-	-
Enteromorpha flexuosa	-	+	+	+	-	+	-	-	-
Spongomorpha indica	-	-	-	-	-	-	-	-	-
Ulva lactuca	-	-	-	-	+	+	-	+	+
Cladophora fasicularis	-	-	-	-	-	-	-	+	+
Dictyota divaricata	-	-	-	+	-	-	-	-	-
Dictyota dichotoma	-	-	-	-	+	-	+	-	-
Padina tetrastromatica	-	-	-	-	+	+	+	+	+
Stoechospermum marginatum	-	-	-	+	+	+	+	+	+
Sargassum cinereum	-	-	-	-	+	+	+	+	+
Sphacelaria furcigera	-	+	+	-	-	+	+	-	-
Spatoglossum asperum	-	-	-	-	-	-	+	+	+
Catenella rapens	-	-	-	-	-	+	-	-	-
Champia compressa	-	-	-	+	-	+	-	+	-
Centroceros clavulatum	-	-	-	-	+	+	-	-	-
Gelidium pusillum	+	+	+	+	+	+	+	+	+
Gracilaria corticata	-	+	-	+	+	-	+	-	+
Grateloupia filicina	-	-	-	+	+	-	-	-	-
Hypnea valentiae	-	-	-	-	+	-	-	-	-
Jania rubens	-	-	-	-	-	-	-	-	-
Laurencia obtusa	-	-	-	-	-	+	-	-	-
Porphyra vietnamensis	-	+	+	-	-	-	-	-	-

Name of Algae	Months								
	Apr 10	May 10	Jun 10	Jul 10	Aug 10	Sep 10	Oct 10	Nov 10	Dec 10
Chaetomorpha linum	-	+	+	+	-	+	+	+	+
Enteromorpha flexuosa	-	-	-	-	+	+	+	-	-
Spongomorpha indica	-	-	-	-	-	-	+	-	-
Ulva lactuca	+	+	+	-	-	-	-	+	+
Cladophora fasicularis	-	-	+	-	-	-	+	-	-
Dictyota divaricata	-	-	-	-	-	-	+	-	-
Dictyota dichotoma	+	-	-	-	-	-	-	+	-
Padina tetrastromatica	+	+	-	-	-	-	-	+	+
Stoechospermum marginatum	-	+	-	-	-	-	+	+	+
Sargassum cinereum	+	+	-	-	-	-	+	+	+
Sphacelaria furcigera	-	-	-	-	-	+	+	+	+
Spatoglossum asperum	-	-	-	-	-	-	-	+	+
Catenella rapens	-	-	-	-	-	-	+	+	-
Champia compressa	-	-	+	-	-	-	+	+	+
Centroceros clavulatum	-	-	-	-	-	-	-	-	+
Gelidium pusillum	+	+	+	+	+	+	+	+	+
Gracilaria corticata	+	-	-	-	+	-	-	-	-
Grateloupia filicina	-	-	-	-	-	-	+	-	-
Hypnea valentiae	-	-	-	-	-	-	-	-	-
Jania rubens	-	-	-	-	-	-	-	-	-
Laurencia obtusa	-	-	-	-	-	-	-	-	+
Porphyra vietnamensis	-	-	-	+	+	+	-	-	-

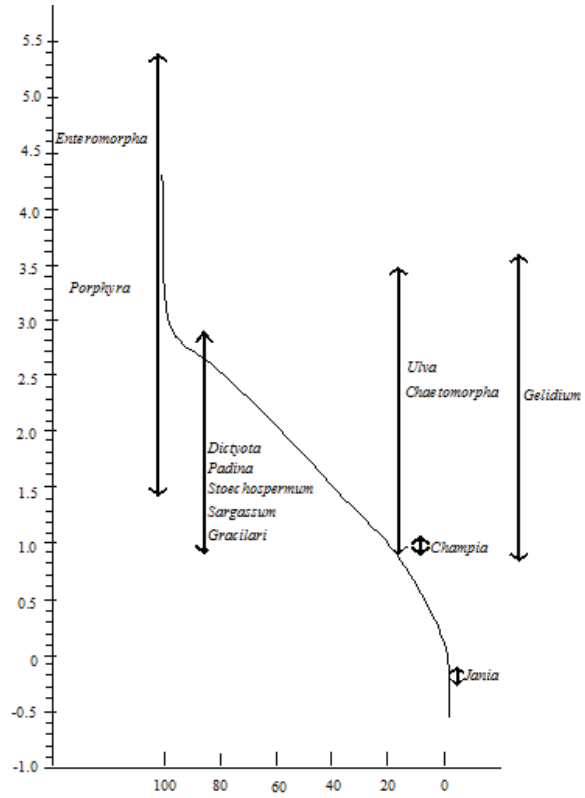
Table No. 5
Distribution of algal species with percent exposure to air at Site – 1

Name of Algae	Percentage Exposure
Enteromorpha flexuosa	100 %
Chaetomorpha linum, *Ulva lactuca*	18 – 100 %
Porphyra vietnamensis	35 – 100 %
Gelidium pusillum	18 – 100 %
Dictyota dichotoma	18 – 85 %
Padina tetrastromatica, *Stoechospermum marginatum*, *Sargassum cinereum*	18 - 100 %
Sphacelaria furcigera	18 – 100 %
Gracilaria corticata	18 – 100 %
Champia compressa	18 – 28 %
Jania rubens	0 %

Table No. 6
Distribution of algal species with percent exposure to air at Site – 2

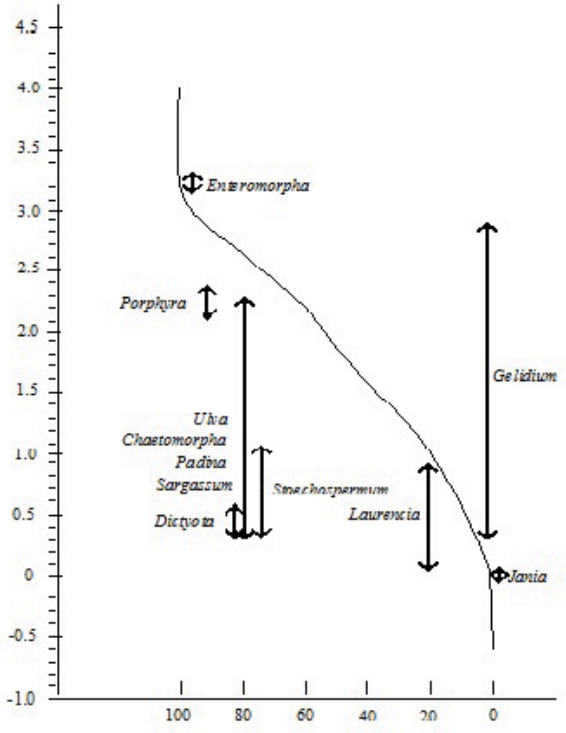
Name of Organisms	Percentage Exposure
Enteromorpha flexuosa	100 %
Chaetomorpha linum, *Ulva lactuca*	5 – 62 %
Porphyra vietnamensis	55 – 70 %
Gelidium pusillum	5 – 95 %
Dictyota dichotoma	5 – 10 %
Padina tetrastromatica	5 – 65 %
Stoechospermum marginatum	5 – 22 %
Sphacelaria furcigera	5 – 58 %
Sargassum cinereum	5 – 50 %
Gracilaria corticata	5 – 38 %
Laurencia obtusa	0 – 18 %
Jania rubens	0 %

Figures A
Vertical distribution of algae in terms of exposure to air at Site-1



All Figures and Images by Rajendra Shevde

Figures B
Vertical distribution of algae in terms of exposure to air at Site-2



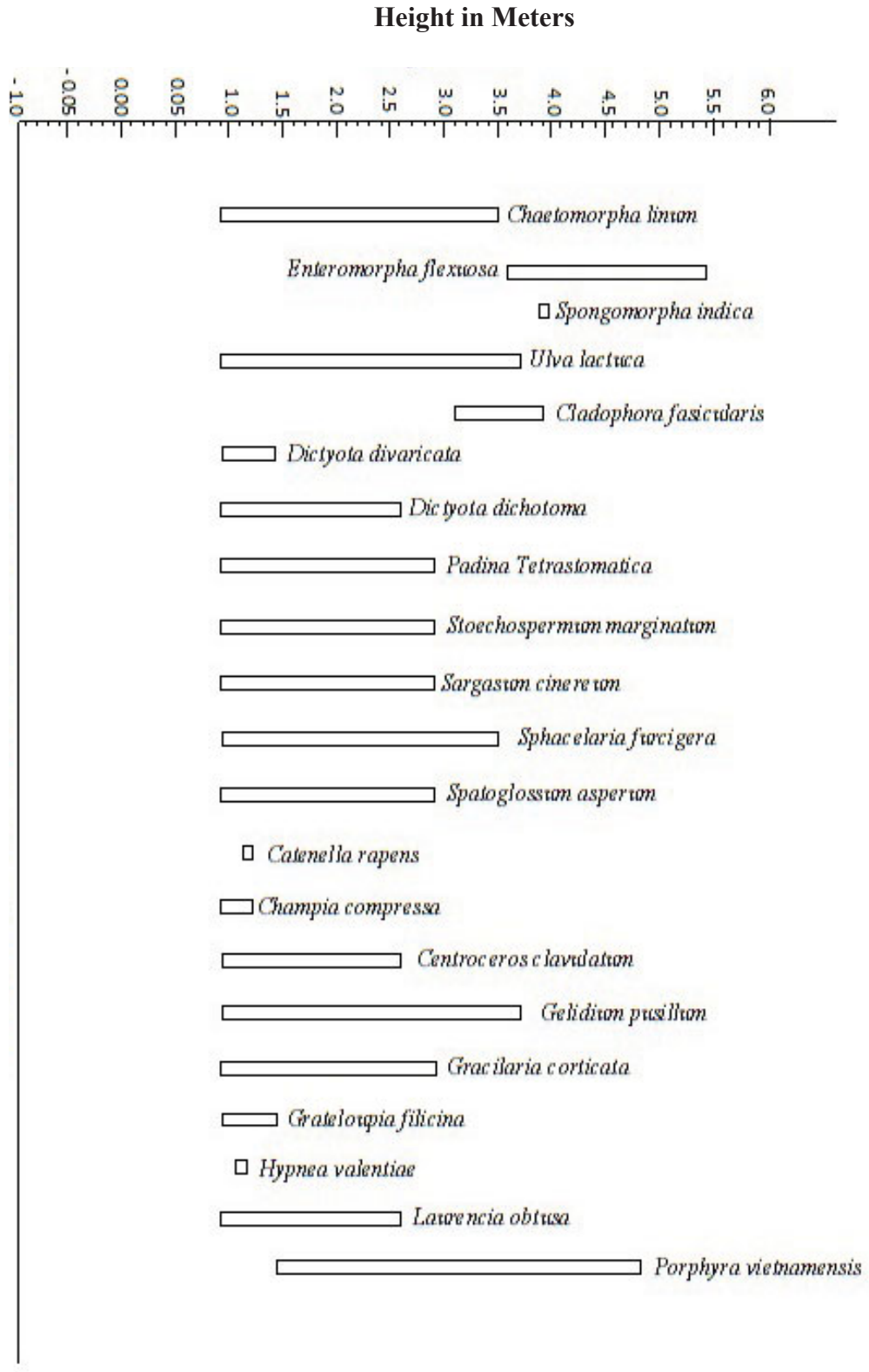


Figure C: Vertical Distribution of Algae at Site-1 for 18 Months

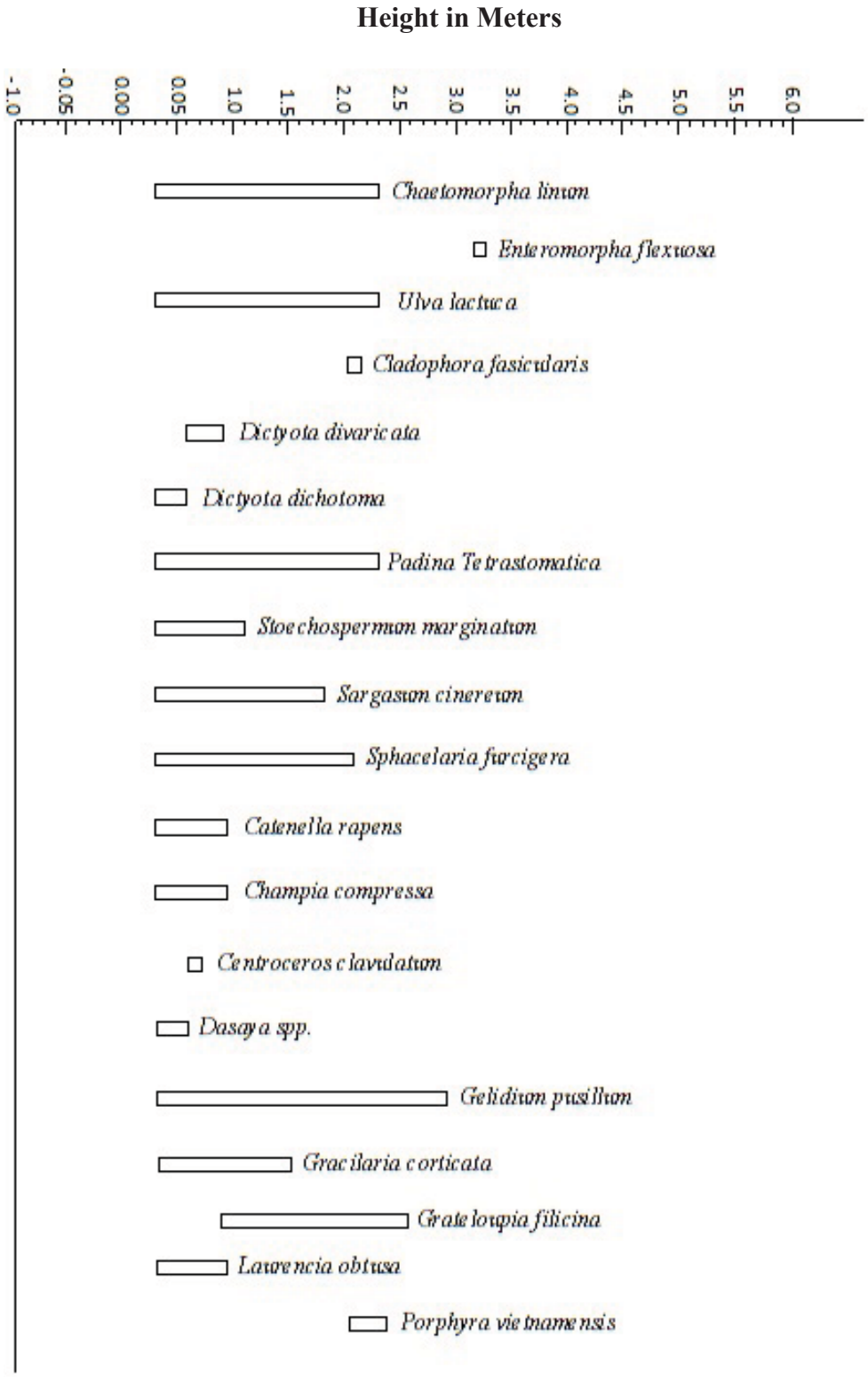


Figure D: Vertical Distribution of Algae at Site-2 for 18 Months

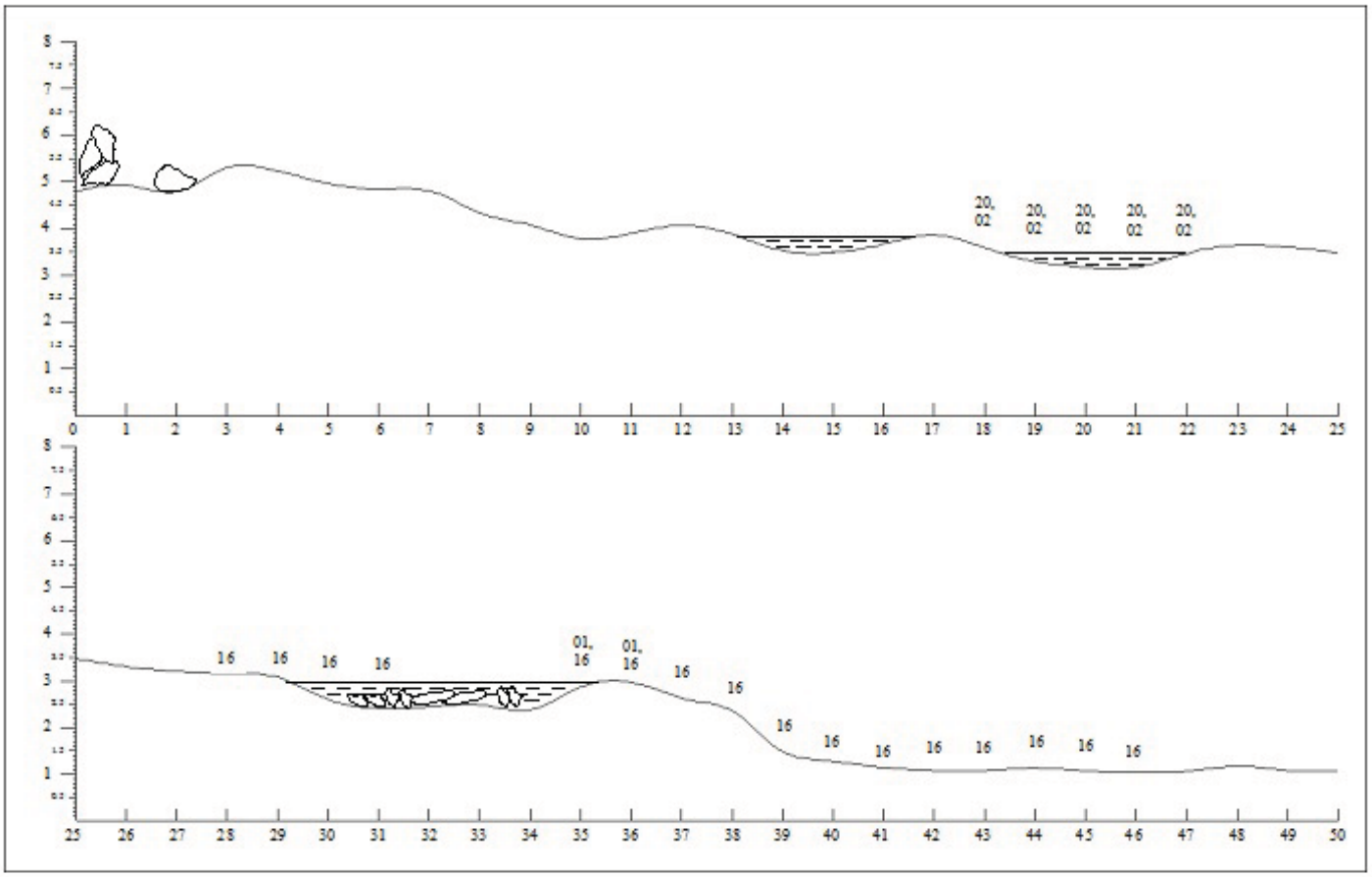


Figure No. E: Profile of the Shore of Hedavi indicating meter wise distribution of algal species – Month: July 2009

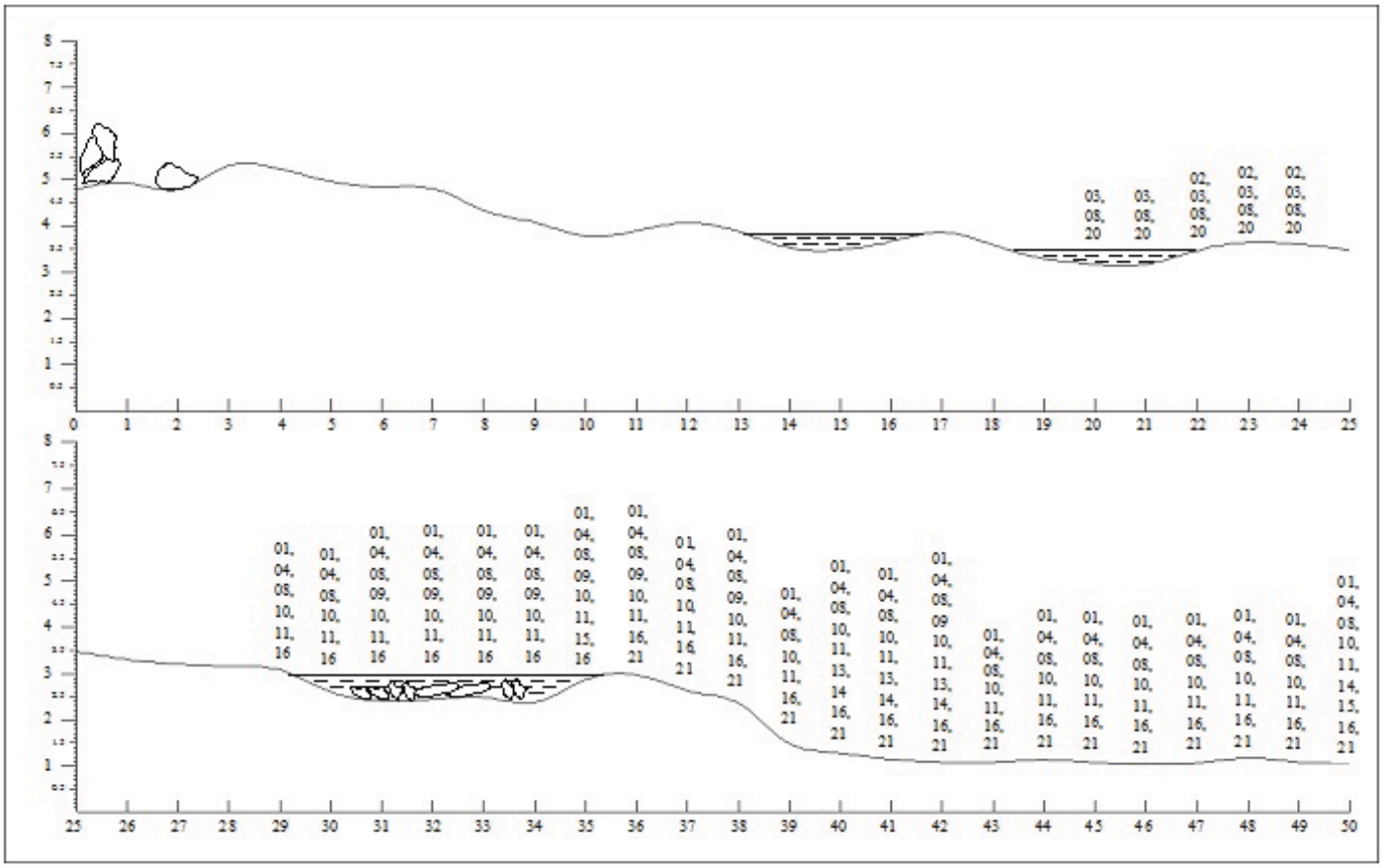


Figure No. F: Profile of the Shore of Hedavi indicating meter wise distribution of algal species – Month: December 2009

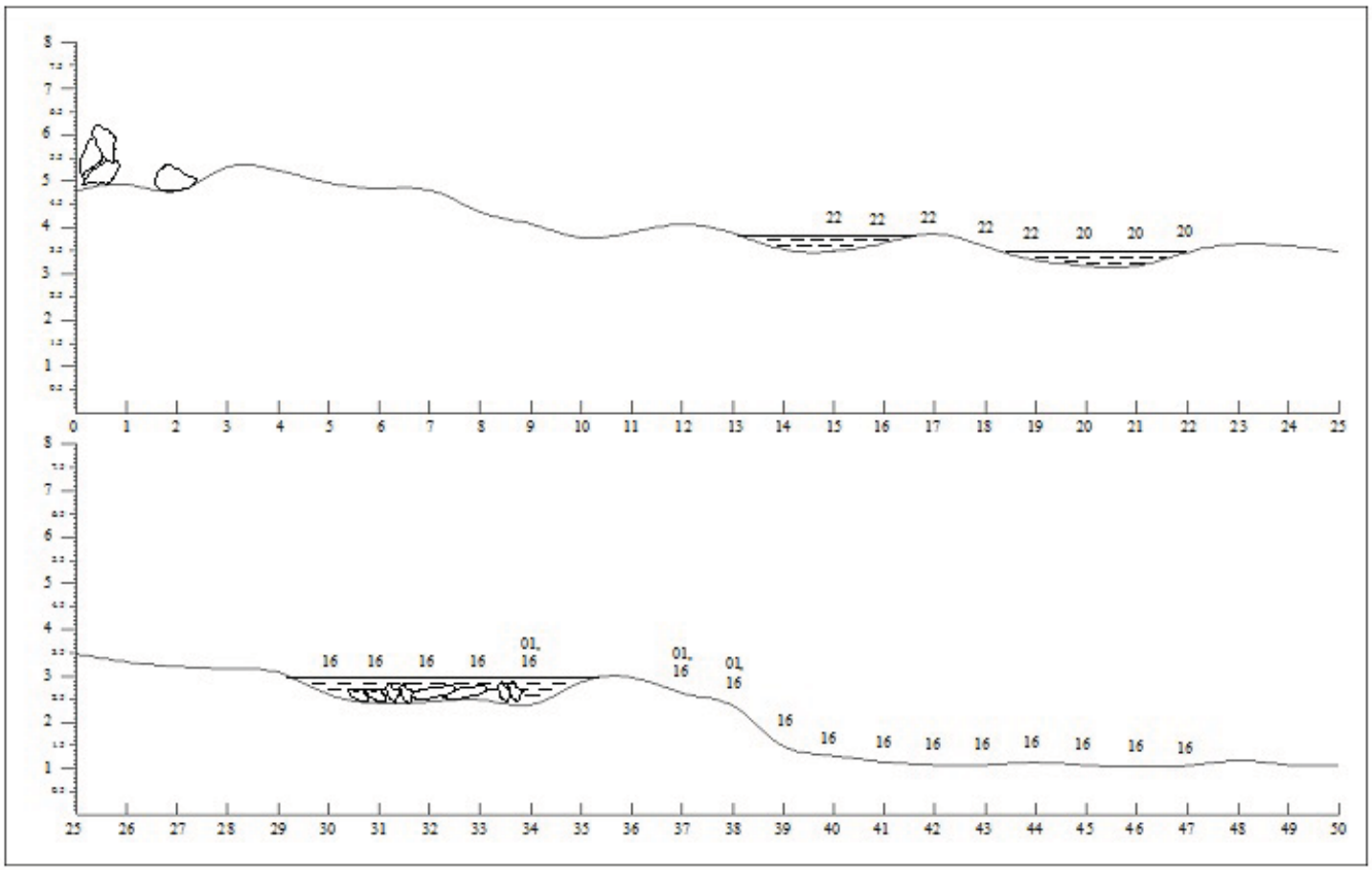


Figure No. G: Profile of the Shore of Hedavi indicating meter wise distribution of algal species – Month: July 2010

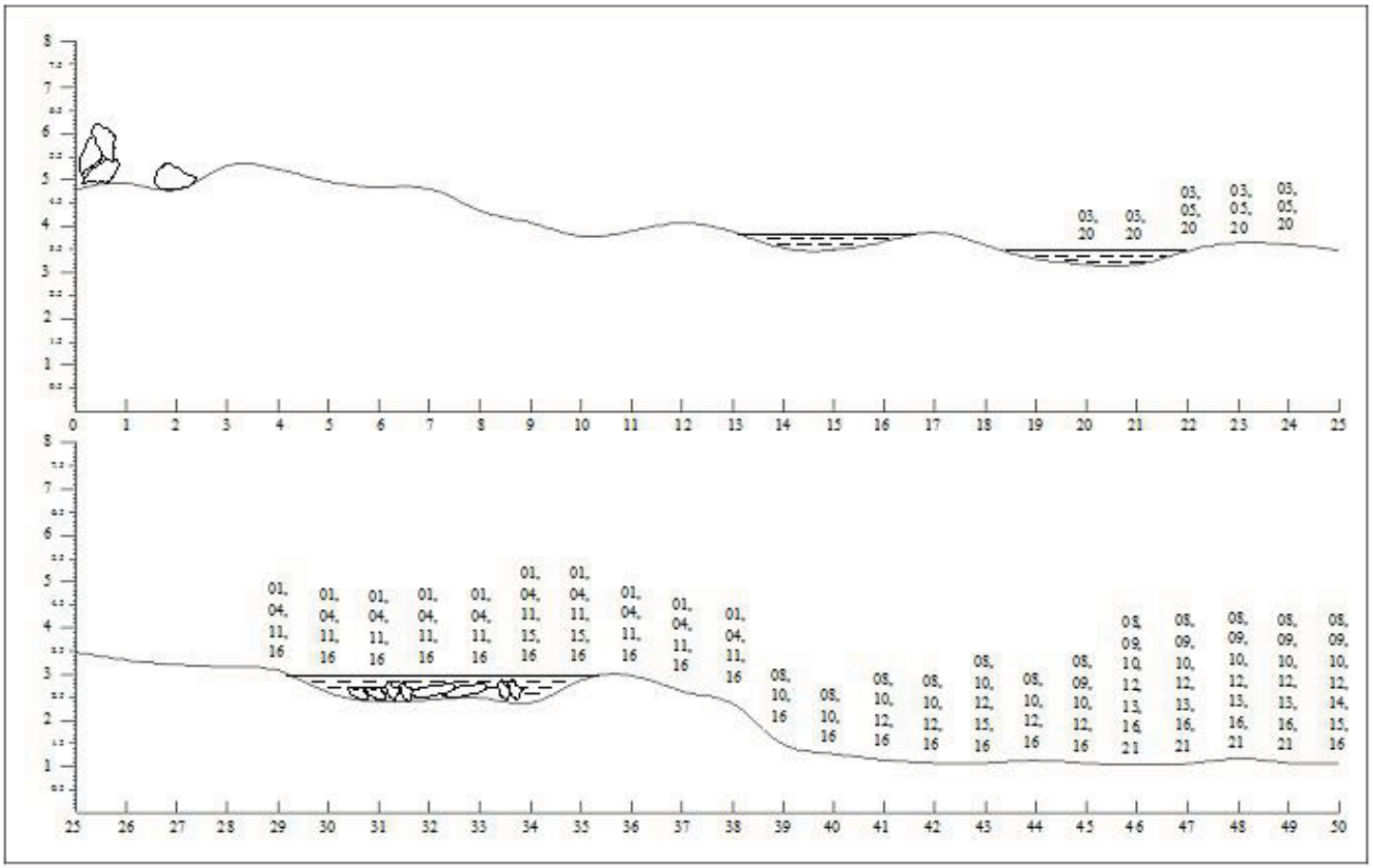


Figure No. H: Profile of the Shore of Hedavi indicating meter wise distribution of algal species – Month: December 2010

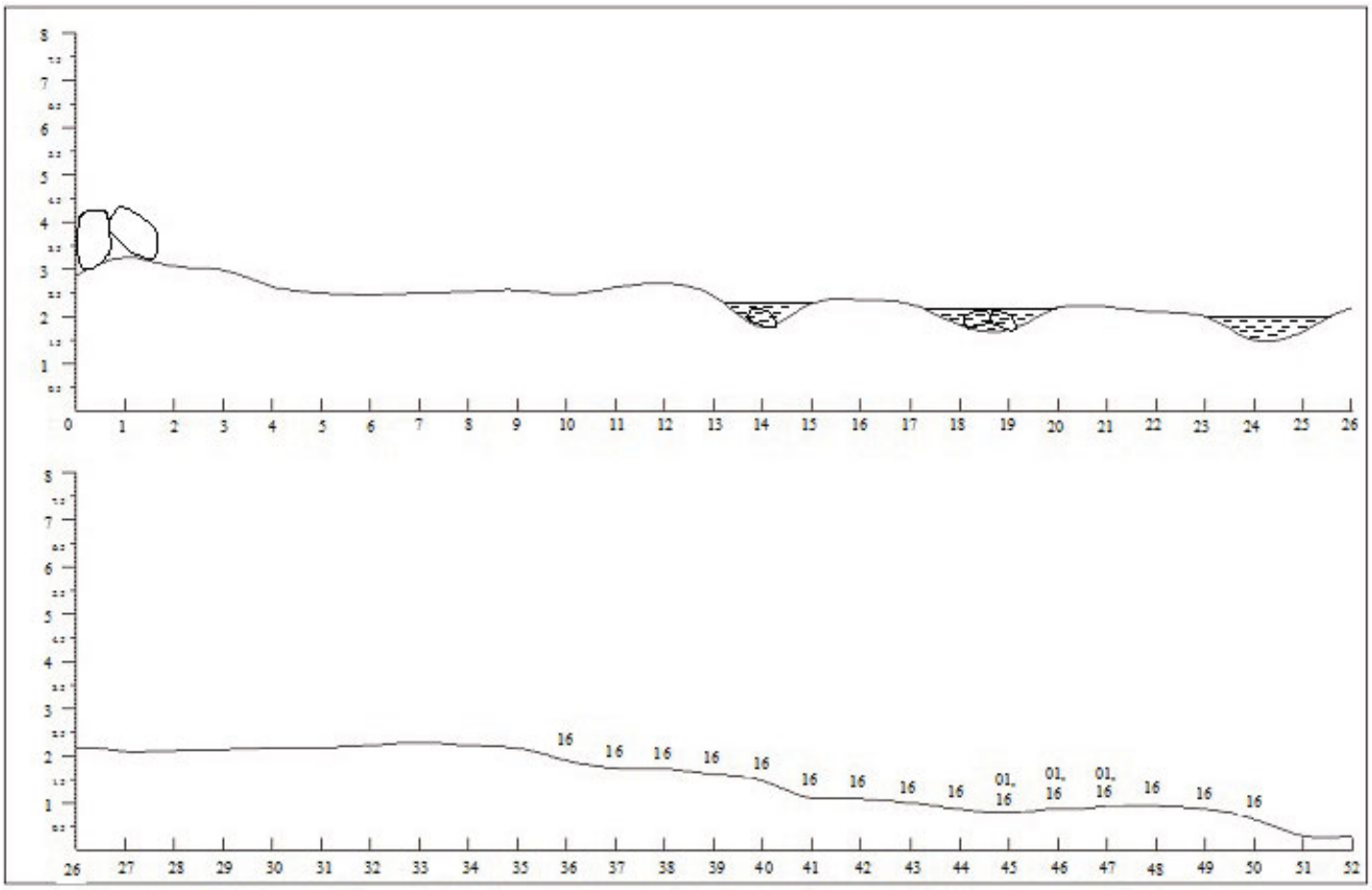


Figure No. I: Profile of the Shore of Kolthare indicating meter wise distribution of algal species – Month: July 2009

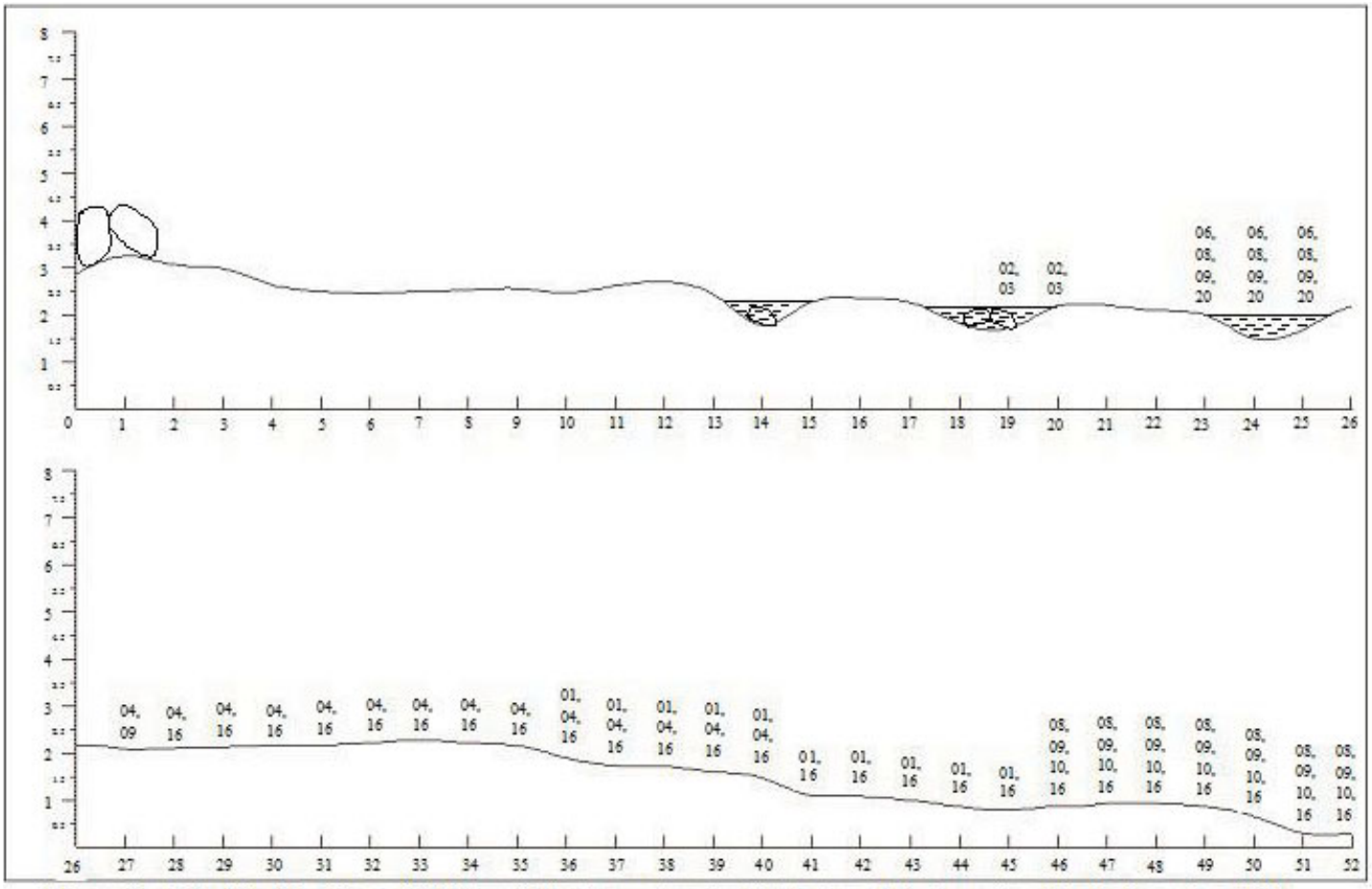


Figure No. J: Profile of the Shore of Kolthare indicating meter wise distribution of algal species – Month: December 2009

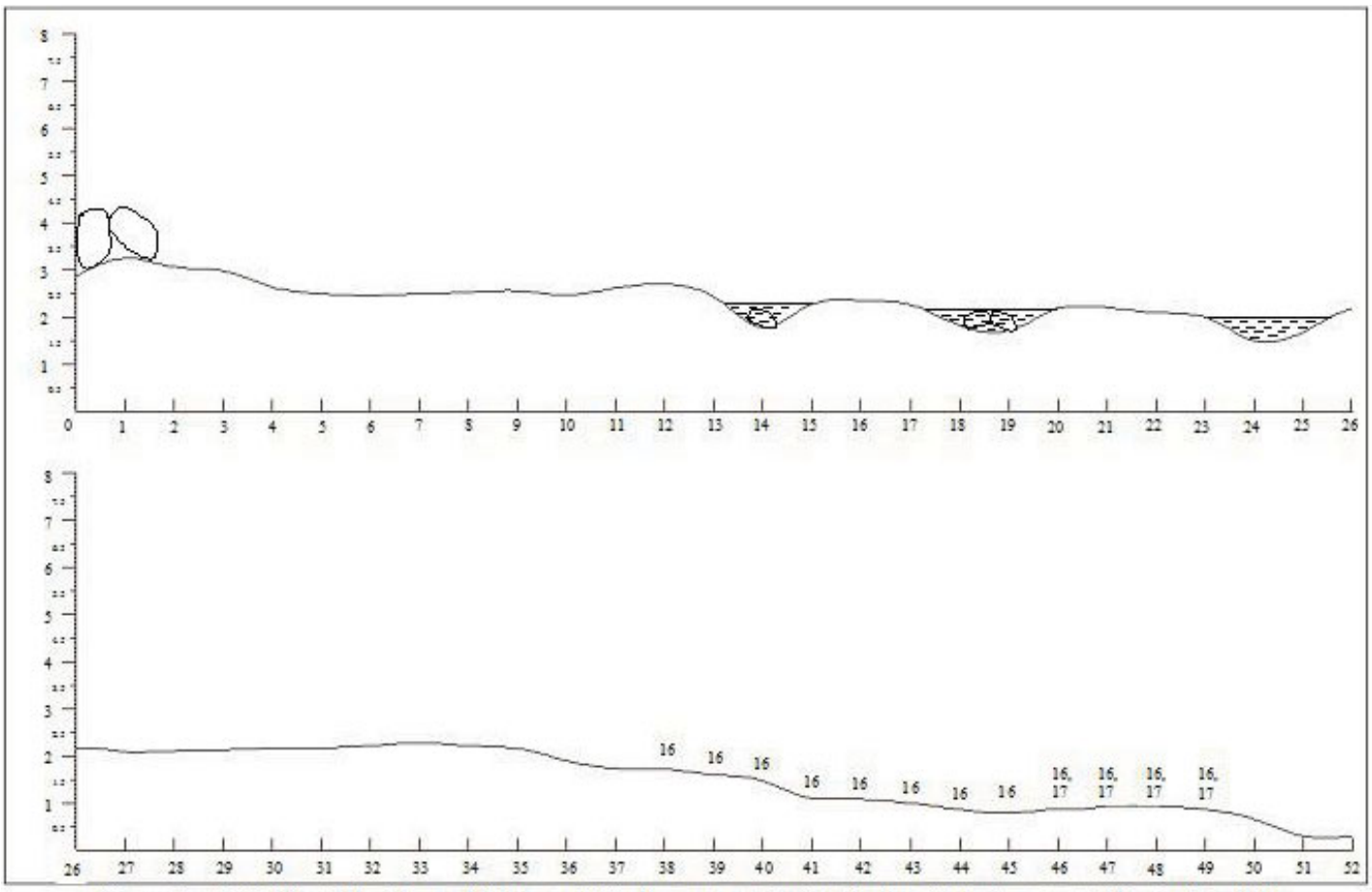


Figure No. K: Profile of the Shore of Kolthare indicating meter wise distribution of algal species – Month: July 2010

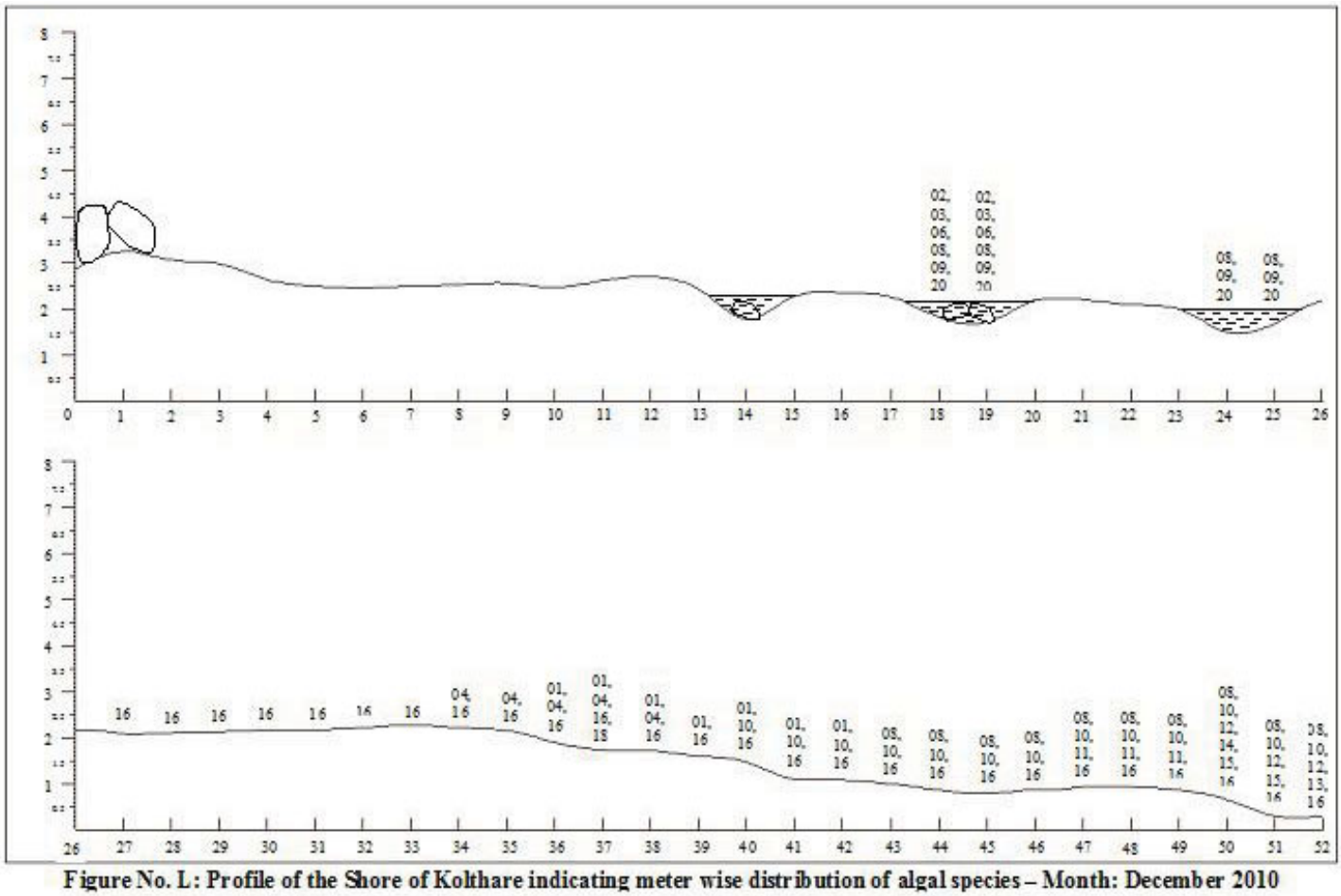


Figure No. L: Profile of the Shore of Kolthare indicating meter wise distribution of algal species – Month: December 2010

All Photographs Taken by Rajendra Shevde

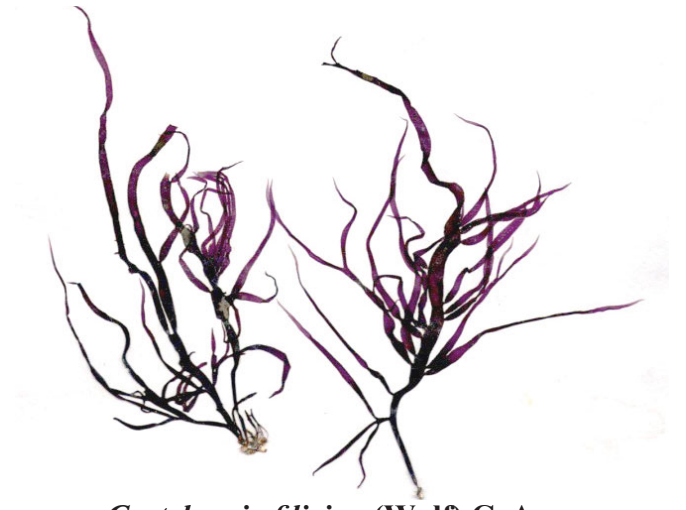
Photo Plates

Chaetomorpha linum **(Muell.) Kuetz**

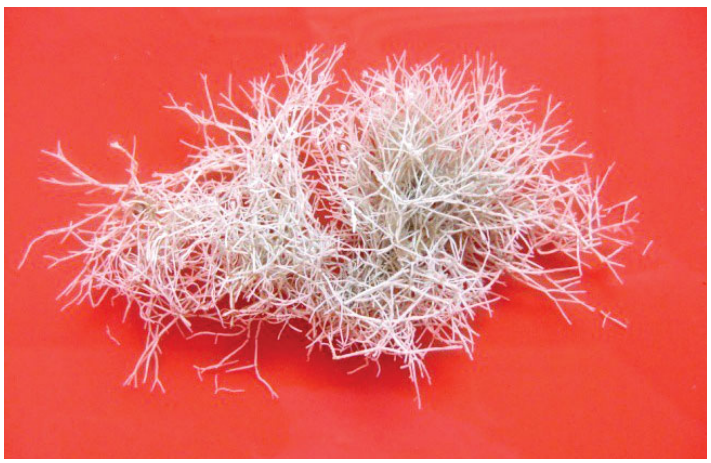
Champia compressa **Harvey**

Dictyota divaricata **Lamouroux**

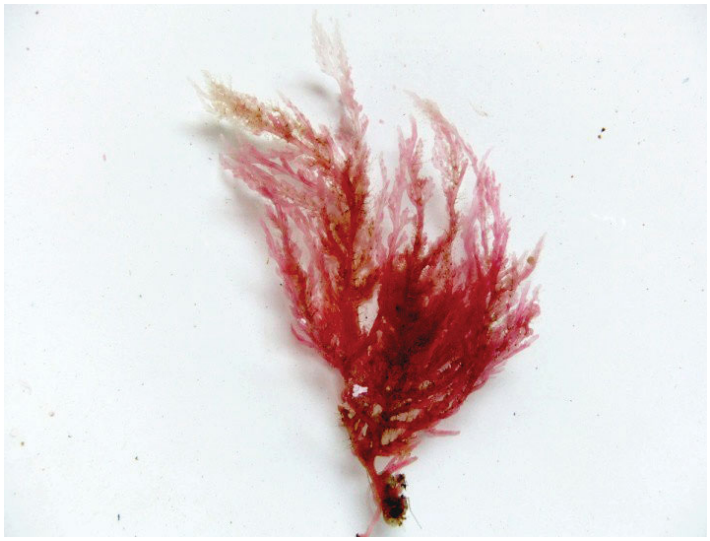
Gracilaria corticata **J. Ag.**



Grateloupia filicina **(Wulf) G. Ag.**



Jania rubens **Lamour**



Laurencia obtusa (Hudson) Lamouroux

Padina tetrastromatica Hauck

Porphyra vietnamensis Tanaka et Ho.

Spatoglossum asperum J. Agardh

Sargassum cinereum J. Ag.

Stoechospermum marginatum (C.Ag.) Kuetz

Ulva lactuca Linn.

Exposed rocky surface at the Site - 1, Hedavi showing rock pool

Rock pool with algal growth

Front view of the Site - 2, Kolthare

Author measuring shore profile

Industrial development near the Site - 1, Hedavi

Exposed rocky shore showing growth of algae, barnacles, etc.

Alternate methodology for eco-restoration of limestone quarries- Giving back to nature and community

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ABSTRACT

Today almost all our development needs centre around cement and concrete – whether buildings, bridges or roads. Production of large quantity of cement requires equally large quantity of limestone. The limestone when extracted in the form of open cast mining creates big quarries which are stripped of all integral living material. What remains after the extraction is a sterile landmass incapable of supporting life. The loss of agricultural and grazing lands to mining, have always given rise to local antagonism towards the cement companies. The mining norms of the Ministry of Environment and Forests, Government of India, require the mining company's quarried areas to be restored to a form that may resemble its original ecosystem. However, because of the sterile soil strata, flora and fauna natural restoration is almost impossible.

Restoration in most cases has meant just taking up of monoculture plantations of exotic species of trees. Such plantations have never formed ecosystems and the study of insects and birds in these "so called" restored areas shows a poor biological diversity. The objective of replicating nature is thus never achieved. This had called for "an alternative approach" towards restoration based on the principle of restoring the excavation completed mines - to recreate lands that

Figure 1

a. Surface mining excavator in a limestone quarry

b. Large tracts of sterile landscapes due to quarrying

c. Old plantation with wide spaced exotic trees.

could not only resemble local ecosystems but also be useful to the community.

We converted the excavation completed mines into following useful areas: a) Sustainable ecosystems and habitats that replicate the local environment in the floral content. b) Fodder plots for the local cattle, where the fodder cropping, irrigation, protection, harvesting and distribution were taken up by the neighbouring community. c) Agriculture and horticulture plots of fruiting trees. Fruiting trees provided sustained regular income with supportive agriculture as an intercrop. Many of the old mined areas started bearing fruits of restoration. d) Water from living water bodies was utilised extensively by the neighbouring villagers – who almost tripled their farm productivity. e) a large numbers of resident and migratory water birds have accepted these water bodies, confirming the new life sustaining ecosystem that was re-established in the once sterile and alkaline water-bodies.

1. INTRODUCTION

Large scale open cast limestone mining has left denuded landscapes, devoid of plants and soil that are of little use to the surrounding agricultural communities. The natural restoration of flora and fauna in such sterile soil strata is almost impossible. These factors result in a strong antagonism against the cement companies.

All mining completed areas are required to be restored according to the norms of Ministry of Environment & Forests – Government of India. However, the involved parties only undertake typical plantations of exotic trees (trees typically planted include *Glyricidia sapium, Cassia siamea, Peltophorum ferrugineum, Acacia auriculiformis, Leucaena leucocephala, Eucalyptus sp.* etc.) in straight rows and columns. Such a plantation neither creates natural habitats nor restores biodiversity and the outcome is of little use to the local communities.

A new restoration approach was developed by Pugmarks Ecologix. The long term goal was set to return the mining completed lands– back to nature and to the community.

2. RESTORATION PATH

The restoration of the limestone quarries of Gujarat Ambuja Cement Ltd. started in April 2002. The approach used the large voids formed by open cast mining to create bird friendly habitats, areas suitable for cultivating fodder for cattle, reviving agriculture in some areas, storing rain water for agriculture and taking up fruiting tree plantations.

3. PROJECT DETAILS

Project site location

Ambuja Cement Ltd. and Ambuja Cement Foundation, Public Charitable Trust, Kodinar, Gujarat, India. (Coordinates: 20.46 N and 70.46 E).

Type of ecosystem being restored

The area is comprised mainly of agricultural lands with interspersed scrub *Acacia* woodlands.

3.4 PROJECT SITE SIZE

At Ambuja, there were 4 mining areas.

Table 1: Villages surrounding the lease area

Village	Area	Population
Vadnagar	366 ha	16,439
Solaj	200 ha	7,628
Rampara	131 ha	9.927
Sugala	417 ha	5,611
TOTAL	**1,114 ha**	**39,605**

3.5 PROJECT DESCRIPTION

The Gujarat Ambuja Cement Ltd. limestone quarry restoration project exemplifies an integrated approach to landscape regeneration that uses the new post-mining landscape as a resource to improve local

a.

b.

Figure 2.

a. Students take up plantation of local species. The cement company is in the background.
b. Demoiselle cranes at a restored mine. This project has used birds as indicators.

biodiversity, provide local communities with enhanced and sustainable livelihoods and offers the extraction company a viable exit strategy.

Rainfall here is reasonably good (average 900 mm). However, the area suffers from prolonged summer droughts owing to the highly seasonal nature of the rainfall. A high proportion of the population is farmers and the crop yield is constrained by the harsh climate. Farmers are also adversely affected by the loss of their farming land due to limestone extraction.

Voids left by limestone extraction, underlain by the impermeable marl bed enables the development of significant water storage areas. These capture water during the intense rainy seasons, ensuring on-going supply for ecological and economic activities during the prolonged drought periods of the Indian summer. Today this water is used to irrigate agricultural land up to a distance of one kilometre from the quarries.

Figure 3.

a.

b.

a. The excavation completed mines become large storages of water. These water-bodies are restored into living ones as a part of the project.

b. The neighbouring farmers use water from this "restored" water-body for irrigating their fields.

4. THE RESTORATION PROCESS

An alternative approach to restoration was developed, using the opportunities existing in the post-mining landscape, while recognising the limitations posed by such sites. In particular, the restoration aim was changed to creating sustainable habitats in closed extraction areas that could resemble local ecosystems, but also be of value to the local communities.

The first step in the restoration process was determining the base-line data; this included studies of:

- Local flora surrounding the mines – i.e. the vegetation best suited to the local environmental conditions;
- Local fauna – in particular, their relation to food plants;
- Local land-use patterns – typical crops, fodder requirements, availability of water for irrigation;
- Substrate conditions in the excavated areas – pH, substrate hardness etc., to determine the thickness of soil to be re-spread (the top soil that was earlier removed before the mining began) to ensure sufficient planting material;
- Detailed land use patterns - Most of the population in this area is dependent on agriculture. Requirements mainly cantered on water requirement post monsoon and fodder for their cattle.

The initial plan for restoration took very long – 9 months to formulate. There were no guidelines or examples to follow. Many had to do with what was possible in that area and what was of interest to the cement company and the neighbouring community.

The result was a restoration plan for each area of excavation. During the development of the plans, considerations were taken into account, in particular, the proximity of the local community, agricultural land and scrub forest. In areas where excavation was still underway, the restoration plan for that area influenced the extraction work – to decide the final landscape with respect to side wall slopes and creation of low-lying areas for water bodies.

4.1 THE PROCESS OF RESTORING OF A MINE

- Creation of an eco-friendly habitat – replicating the nearby natural woodlands.
- Creation of "living" water-bodies – for supporting local agriculture.
- Creation of fodder plot for providing for the numerous cattle.
- Creation of plots for revival of agricultural practices.
- Taking up horticultural and medicinal plantations as model for replication by the community.

4.1.1 CREATION OF ECOSYSTEMS AND HABITATS.

In the absence of any guidelines, the restoration process till we intervened mainly comprised of taking up monoculture plantations of exotic species in straight rows and columns, separated by a distance of 8 meters. This had to be changed to augment biodiversity and establish food chains. Thus all the new plantations were based on the following principles.

- Saplings were planted randomly - instead of straight row and column pits.
- In 2003-2004, 30,000 plants belonging to 96 species of native species were selected and monoculture plantations were avoided.
- Bird attracting trees were preferred to attract more birds – and helped dispersal of seeds. *Ficus* trees (*Ficus benghalensis*, *Ficus religiosa*, *Ficus racemosa*) being keystone species were planted in significant numbers.
- The inter plant distance was reduced to 2 ½ meters. From the earlier 8 meters.
- Fifteen centimetres of the original soil was spread between the saplings to enable the development of local herbaceous vegetation from the seed bank, and the local insect fauna from the "egg bank". This was necessary to form the food chain in the restored area.
- People from the local community were given the plantation plots for care and maintenance on a monthly retainer ship basis. This provided them incentive for participation.

Table 2: Areas under 'ecosystem & habitat' plantation

Village	Area under plantation
Vadnagar	89 ha (includes Pasture land)
Solaj	2 ha
Rampara	2ha
Sugala	1ha
Eco-park	22.5 ha

(The plantation at Rampara, Sugala, Ecopark are totally as per new design, while some areas of Vadnagar are as per new design)

4.1.2 CREATION OF 'LIVING' WATER BODIES

Although average rainfall is high, it is not evenly spread throughout the year leading to long droughts in the hot Indian summer. This has affected the agriculture, as it is mainly rain fed. The fodder available for the cattle was always in short supply. One of the key aspects of the mine restoration scheme was the creation of rain water holding reservoirs. Low-lying areas were converted into water bodies. The impermeable marl layer beneath extracted limestone ensured that water retained for long periods – extending over 12 months. Only evaporation losses reduced the water levels but helped cooling the surrounding areas.

Figure 4.

a.

b.

c.

a. Extensive Ficus stumps plantation has been undertaken. Ficus is a keystone species.
b. Ficus saplings prepared in the nursery
c. New plantation design: mixed plantation of local tree species.

Table 3: Areas under water-bodies & their capacities

Mining area	Present area (ha)	Present capacity (m3)	Future area (ha)	Futurecapacity (m3)
Vadnagar	22	700000	88.2	4300976
Solaj	28	791810	58.7	3271043
Rampara	15	368410	33.0	1159093
Sugala	Active Mining area			

- This water was used extensively by local villagers who almost tripled their agricultural production. Earlier their agriculture was purely rain-fed.
- The water bodies acted as focal points of the re-establishment of biodiversity. Life was introduced from nearby water bodies. Introduction of organic matter like cow dung helped jumpstart life in these restored water bodies. Aquatic and semi-aquatic local plants species were planted. Today, as a result of life formation and decomposition of organic matter, there was significant lowering of pH. The sterile water bodies reported pH around 10.5. After two years of restoration, we achieved a pH of 8.5, total hardness of 80, alkalinity of 60 and normal permissible levels of calcium, magnesium, chlorides, sulphates, fluorides and nitrates. (As per the government laboratory of restored mine at Solaz the water was potable).
- These new lakes become heavens for resident and migratory water birds– key indicators of the health of the ecosystem. (Detailed bird list in annex. 1)

4.1.3 CREATION OF FODDER PLOTS

The long hot and dry summers have always made the availability of sufficient fodder for cattle a problem for local communities. The cattle invariably ended up in the plantation areas. Thus a solution was designed to involve these cattle owners to grow fodder on a restored mine – by providing them with black soil re-spread on the floor of the mine and also providing them water for irrigating their crop.

This enabled significant increase in the availability of wet and dry fodder grown on restored mine area. The new system of fodder cropping, irrigation and protection, harvesting and distribution was adopted by the community on 8 restored mines. Today, there are far fewer stray cattle– ensuring better results in the plantation areas.

Table 4: Areas under fodder and agriculture

The areas under fodder and agriculture	12Ha (mainly jowar, bajara, maize & lucerne grass)

Figure 5.

a.

b.

a. Fodder crop taken up on a restored mine. Cultivation, protection and harvesting was undertaken by the community.
b. Fodder areas protected by a local.

4.1.4 CREATION OF AGRICULTURAL PLOTS

A soil layer almost 2 feet thick was spread over the excavated layer. Waste rock was removed and the floor of the pit was levelled to create areas for growing crops. Initially, the area was used to grow crops only for fodder. However, sound agricultural practices like crop rotation and nitrogen fixing legumes improved soil conditions. Mainly jowar, bajara and maize were initially taken up and eventually land improved to suit wheat, groundnuts and barley. The initial moderate results inspired more farmers to participate.

4.1.5 CREATION OF HORTICULTURE PLOTS

Apart form fodder and agriculture crops; many restored areas were brought under fruiting orchards. The success of these plantations served an important role in convincing the local community to undertake plantations on their lands. In suitable areas, inter-cropped fruit trees were planted, providing regular income for local farmers. Most of these plantations were taken up prior to year 2002.

Table 5: Areas under fruit trees plantation:

Vadnagar:	10 Hectares	(Mango, coconut, sapota, guava)
Solaj:	3.00 Hectares	(Coconut, guava)
Rampara:	0.50	(Mango, coconut, chiku)
Sugala:	2.00	(Guava, mango)

Areas under medicinal plants at Vadnagar Mines: 1.4 ha

5.0 LESSONS LEARNT

- Simply planting trees does not restore sustainable landscapes. The prerequisite is to establish ecosystems with living water-bodies and food chains.
- Any restoration programme, will succeed only if the organisation concerned follows a good neighbour policy – involving the local community in the process - they need to be incentivised to motivate their long-term involvement.
- The host organisation must be committed to the process - as the restoration process is slow and involves on-going financial inputs.

6.0 LEGISLATIVE / POLICY FRAMEWORK

The Government of India's Ministry of Environment and Forests has a policy for the restoration of mined areas, which requires the mined landscape to be restored to a form resembling the pre-existing ecosystem. However, the post-mining edaphic conditions precluded this, so a system of monocultural exotic tree plantations has been practiced to bring areas under "quick" green tree cover. We have presented a successful restoration model that has re-created biodiversity in the mined areas.

7.0 RESULTS

- Creation of bird friendly habitat: Construction of shallow water baths & containers for grain to attract birds made Ambujanagar a bird habitat. Several species of birds had accepted the nest boxes that were installed for nesting. Spreading of grain near large water-bodies had augmented bird populations.
- Better understanding of birds: Sign boards displaying images of birds had become popular amongst the residents of Ambujanagar. Painting of buses with images of birds and butterflies ensured a better understanding amongst the local communities - as the buses traveled through the neighboring villages and towns.
- Planting pattern has become more "natural": Random plantation of local trees were replaced with straight line plantations of multi-species and bird attracting trees.
- Plantation of *ficus* species: Since epic times, the importance of *ficus* trees has been stressed by our culture. *Ficus* trees by themselves form an ecosystem by creating habitats for insects, animals and birds and hence are called keystone species.
- Water-body restoration: Introduction of life & aquatic plants brought life in the otherwise sterile water-bodies. We used birds as indicators to determine the health of the water-body. The presence of the birds like kingfisher and osprey indicated its good health.
- Planting babool (*Acacia nilotica*) trees in the water-bodies for bird roosting.
- Preparation of pasture lands for local cattle: In order to prevent the entry of local cattle into our plantation areas, some of the restored mines were converted into pasture lands. Today, the local community grows, protects, harvests and distributes the fodder grown on the restored mines. (However, this program has been a partial failure - because all the pasture lands on restored mines are used by the *Grampanchayat*. Individual grazers have no grazing areas; hence their cattle still damage our plantations. Some areas need to be reserved for them.)
- Reducing the alkaline pH: The water was certified as potable. It is being extensively used for agriculture by the local communities- who almost tripled their crop yield.
- Plantation of trees in the Eco-Park by school students: Students were involved in plantations in the Eco-Park and in areas surrounding the school premise. This became a popular activity because the student's name was displayed on a board next to the plant that he had planted.
- Study of Flora & Fauna. The study of the local flora and fauna created a base data of the biodiversity of the area.

ACKNOWLEDGEMENTS

The restoration of the excavation completed mines at Ambujanagar was possible mainly due to

the wholehearted support and a sincere desire of the erstwhile management under Mr. Narottam Sekhsaria. Mr. Narottam Sekhsaria, Managing Director, whose personal involvement drove this process; Mr. Pulkit Sekhsaria, Director; Mr. Patel, Jt. President; Mr. Jalpota, Sr. Vice President – Commercial; Mr. Parik, General Manager – Mines; Mr. Rajashekhar. General Manager – Geology; Mr. Pawar, Sr. Manager, Horticulture; Mr. Mori, Sr. Manager, Ambuja Cement Foundation. Staff of Ambuja Cement Ltd. Horticulture, Environment and Mines departments. Mr. Rahul Marathe, Lecturer in Zoology, Sinhagad College of Science. Mr. Vivek Gaur Broome, Botanist.

ANNEX 1.

BIRDS of AMBUJANAGAR

This restoration process involving taking up of "ecosystem" plantations and creating "living" water-bodies cannot be gauged by any mechanical device. However, using birds as indicators gives fairly good idea of an established eco-system. For example, an Osprey on a water-body is likened to the tiger indicating a healthy forest. (Res. – Restoration area).

Sr.	Area	English Name	Scientific name
1.	Mines	Little Grebe	*Podiceps ruficollis*
2.	Mines	Little Cormorant	*Phalacrocorax niger*
3.	Mines	Little Egret	*Egretta garzetta*
4.	Mines	Grey Heron	*Ardea cinerea*
5.	Mines	Purple Heron	*Ardea purpurea*
6.	Mines	Great Egret	*Ardea insignis*
7.	Mines	Intermediate Egret	*Egretta intermedia*
8.	Mines	Cattle Egret	*Bulbulcus ibis*
9.	Mines	Indian Pond Heron	*Ardeola grayii*
10.	Mines	Black-crowned Night Heron	*Nycticorax nicticorax*
11.	Mines	Painted Stork	*Mycteria leucocephala*
12.	Mines	Asian Openbill Stork	*Anastomus oscitans*
13.	Mines	Woolly-necked Stork	*Ciconia ciconia*
14.	Mines	White Ibis	*Threskiornis aethiopica*
15.	Mines	Black Ibis	*Pseudibis papillosa*

a.

b.

Figure 6:

Birds habitat:
a. Comb Ducks
b. Little Cormorants feeding gregariously.

16.	Mines	Eurasian Spoonbill	*Platalea leucorodia*
17.	Mines	Lesser Flamingo	*Phoeniconaias minor*
18.	Mines	Lesser Whistling Duck	*Dendrocygna javanica*
19.	Mines	Comb Duck	*Sarkidiornis melanotos*
20.	Mines	Eurasian Wigeon	*Anas Penelope*
21.	Mines	Gadwall	*Anas strepera*
22.	Mines	Common Teal	*Anas crecca*
23.	Mines	Spot-billed Duck	*Anas poecilorhyncha*
24.	Mines	Northern Pintail	*Anas acuta*
25.	Mines	Garganey Teal	*Anas querquedula*
26.	Mines	Northern Shoveler	*Anas clypeate*

27.	Mines	Common Pochard	*Aythya farina*
28.	Mines	Indian White-backed Vulture	*Gyps bengalensis*
29.	Mines	Long-billed Vulture	*Gyps indicus*
30.	Mines	Eurasian Marsh Harrier	*Circus aeruginosus*
31.	Mines	Common Moorhen	*Gallinula chloropus*
32.	Mines	Eurasian Coot	*Fulica atra*
33.	Mines	Demoiselle Crane	*Anthropoides virgo*
34.	Mines	Common Crane	*Grus grus*
35.	Mines	Black-winged Stilt	*Himantopus himantopus*
36.	Mines	Little Ringed Plover	*Charadrius dubius*
37.	Mines	Kentish Plover	*Charadrius alexandrinus*
38.	Mines	Common Snipe	*Gallinago stenura*
39.	Mines	Black-tailed Godwit	*Limosa limosa*
40.	Mines	Eurasian Curlew	*Numenius arquata*
41.	Mines	Common Redshank	*Tringa tetanus*
42.	Mines	Marsh Sandpiper	*Tringa stagnatilis*
43.	Mines	Common Greenshank	*Tringa nebularia*
44.	Mines	Green Sandpiper	*Tringa ochropus*
45.	Mines	Common Sandpiper	*Tringa hypoleucos*
46.	Mines	Brown-headed Gull	*Larus brunnicephalus*
47.	Mines	Gull-billed Tern	*Gelochelidon nilotica*
48.	Mines	Indian River Tern	*Strena aurantia*
49.	Mines	White-throated Kingfisher	*Halcyon smyrnensis*

a.

b.

Figure 7:

a. Artificial bird boxes
b. Nesting population of Peafowl

50.	Mines	Baya Weaver bird	*Ploceus manyar*
51.	Mines	Wire-tailed Swallow	*Hirundo smithii*
52.	Mines	White Wagtail	*Motacilla alba*
53.	Mines	Large Pied Wagtail	*Motacilla maderaspatensis*
54.	Mines	Grey Wagtail	*Motacilla cinerea*
55.	Mines	Yellow Wagtail	*Motacilla flava*
56.	Mines	Pied Bush Chat	*Saxicola ferrea*
57.	Mines	Desert Wheatear	*Oenanthe deserti*
58.	Mines	Bay-backed Shrike	*Lanius vittatus*
59.	Mines	Indian Silverbill	*Lonchura malabarica*
60.	Res	Green Bee-eater	*Merops orientalis*
61.	Res	Indian Roller	*Coracias benghalensis*
62.	Res	Eurasian Hoopoe	*Upupa epops*
63.	Res	Coppersmith Barbet	*Megalaima haemacephala*
64.	Res	Blue Rock Pigeon	*Columba livia*
65.	Res	Shikra	*Accipiter badius*

66.	Res	Oriental Honey Buzzard	*Pernis ptilorhyncus*
67.	Mines	Osprey	Pandion haliaetus
68.	Res	Common Peafowl	*Pavo cristatus*
69.	Res	White-breasted Waterhen	*Amaurornis phoenicurus*
70.	Res	Spotted Dove	*Streptopelia chinensis*
71.	Res	Little Brown Dove	*Streptopelia senegalensis*
72.	Res	Indian Ring Dove	*Streptopelia decaocto*
73.	Res	Rose-ringed Parakeet	*Psittacula alexandri*
74.	Res	Asian Koel	*Eudynamys scolopacea*
75.	Res	Greater Coucal	*Centropus sinensis*
76.	Res	Spotted Owlet	*Athene brama*
77.	Res	House Swift	*Apus affinis*
78.	Res	Red-vented Bulbul	*Pycnonotus cafer*
79.	Res	Common Iora	*Aegithina tiphia*
80.	Res	Magpie-Robin	*Copsychs saularis*
81.	Res	Indian Robin	*Saxicoloides fulicata*
82.	Res	Black Redstart	*Phoenicurus ochruros*
83.	Res	Ashy Wren Warbler	*Prinia socialis*
84.	Res	Common Tailorbird	*Orthotomus sutorius*
85.	Res	Tickell's Blue Flycatcher	*Muscicapa tickelliae*
86.	Res	White-browed Fantail	*Rhipidura aureola*
87.	Res	Large Grey Babbler	*Turdoides malcomi*
88.	Res	Grey Tit	*Parus major*
89.	Res	Purple Sunbird	*Nectarinia asiatica*
90.	Res	Purple-rumped Sunbird	*Nectarinia zeylonica*
91.	Res	Oriental White-eye	*Zosterops palpebrosa*
92.	Res	Black Drongo	*Dicrurus adsimilis*
93.	Res	Indian Treepie	*Dendrocitta vagabunda*
94.	Res	House Crow	*Corvus splendens*
95.	Res	Jungle Crow	*Corvus macrorhynchos*
96.	Res	Brahminy Myna	*Sturnus pagodarum*
97.	Res	Common Myna	*Acridotheres tristis*
98.	Res	Tickell's Flowerpecker	*Dicaeum erythrorhynchos*
99.	Res	House Sparrow	*Passer domesticus*
100.	Res	White-backed Munia	*Lonchura striata*
101.	Neigh	Indian Sandgrouse	*Pterocles exustus*
102.	Neigh	Palm Swift	*Cypsiurus parvus*
103.	Neigh	Tawny Eagle	*Aquila rapax*
104.	Neigh	Black-shouldered Kite	*Elanus caeruleus*
105.	Neigh	Pariah Kite	*Milvus migrans*
106.	Neigh	Pied Kingfisher	*Ceryle rudis*
107.	Neigh	Egyptian Vulture	*Neophron percnopterus*
108.	Neigh	Yellow-wattled Lapwing	*Vanellus malbaricus*
109.	Neigh	Red-wattled Lapwing	*Vanellus indicus*
110.	Neigh	Alexandrine Parakeet	*Psittacula eupatria*
111.	Neigh	Indian Nightjar	*Caprimulgus indicus*
112.	Neigh	Ashy-crowned Sparrow-lark	*Eremoprerix grisea*
113.	Neigh	Rufous-tailed Finch Lark	*Ammomanes phoenicurus*
114.	Neigh	Crested Lark	*Galerida cristata*
115.	Neigh	Dusky Crag Martin	*Hirundo concolor*
116.	Neigh	Rufous-backed Shrike	*Lanius schach*
117.	Neigh	Bank Myna	*Acridotheres ginginianus*
118.	Res	Grey Partridge	*Francolinus pondicerianus*

First Report of Kollegal Ground Gecko *Geckoella* cf. *collegalensis* (Beddome) 1870), (Squamata, Sauria, Gekkonidae), From Akola, Maharashtra, India.

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ABSTRACT

Geckoella cf. *collegalensis* (Beddome, 1870) was observed near Gadanki Police Training Center (Akola , Maharashtra) on 6 June 2013. Our record of *Geckoella* cf. *collegalensis* from Akola, Maharashtra, is the first report from this region of Maharashtra. Review of published literature and some photographic records have revealed the distribution of this species from six states of India.

KEY WORD

Gekkonidae, *Geckoella* cf. *collegalensis*, Akola, Maharashtra. Distribution

INTRODUCTION

Genus *Geckoella* is endemic to India and Sri Lanka, Five species of the genus *Geckoella* specifically *G. deccanensis, G. albofasciata, G. nebulosus, G. jeyporensis and G. collegalensis* are reported from India. *Geckoella collegalensis* was described in 1870 by Beddome, based on specimens collected from Biligiriranga Hills in Yelandur and Kollegal Taluks of Chamarajanagar District, Karnataka (Beddome 1870).

Geckoella collegalensis was reported from Sri Lanka and India (Smith 1935, Taylor 1953, Tikader and Sharma 1992), however, according to Wickramasinghe and Somaweera (2002), Das and De Silva (2005), Bauer and De Silva (2007) Ziesmann et al. (2007), the status of this species in Sri Lanka is uncertain. Until 2000, this gecko had been considered a rare species and restricted to areas of low elevations and known to occur south of 13ºN (Smith 1935, Tikader and Sharma 1992). According to Smith (1935), the species occurred in the hills of South India and Sri Lanka (Ceylon). However, the species is now known to occur in Madhya Pradesh, Maharashtra, Gujarat, Karnataka, Kerala and Tamil Nadu (Mirza et al. 2010). This species is not only widely distributed, but is also abundant from the sites where it has been reported (Mirza et al. 2010).

Prasanna (1993) reported this species from Madhya Pradesh. Sekar (1994) reported this species from the Sanjay Gandhi National park, Mumbai, Maharashtra. Vyas (1998) reported it from Gir forest, Gujarat.

According to Vyas (2000), the species is distributed over a large area with reports from Gir, Vansada, (Gujarat); Sanjay Gandhi National Park, Borivali (Mumbai, Maharashtra); Balarangam (Karnataka), Nilambur (Kerala) and Manar, Anaikatty, and Madurai (Tamil Nadu). Chandra and Gajbe (2005) again reported this species from Madhya Pradesh. Mirza *et al.*, (2010) reported it from Aarey Milk Colony, Goregaon, Mumbai, Maharashtra and Vivek Gour Broome photographically documented it from Toranmal, Dhule district and Chandrapur, Chandrapur district (Mirza *et al.*, 2010). Prasad Shinde recorded it from Nanded (Photo posted on facebook). Recently this species has been reported from Little Rann of Kutch, Gujarat, India (Walmiki *et al*., 2013). It occurs at elevations between 50 to 1,400 m ASL and according to Srinivasulu & Srinivasulu (2013), the extent of occurrence is unclear, however, as the majority of records are recent, it is likely that this species is more widespread than is currently known. Our record of *Geckoella* cf. *collegalensis* from Akola, Maharashtra, is the first report from this region.

STUDY SITE

Gadanki Police training center (20.7227°N 76.9809°E) (Map.1), Akola, Akola District, Maharashtra State (Map.3). Morna River is on the east of the police training center, north and west of the center is agricultural and scrubland with some rocky scrap. The altitude of Akola is 282 m ASL. Average annual rainfall of the district is 846.5 mm. The maximum temperature in summer is 47.4° C and the minimum temperature in winter can be as low as 2.5° C. The summer months are the driest when the relative humidity is less than 20%. (Pathak, 2006).

MATERIAL AND METHODS

Five live specimens of *Geckoella* cf. *collegalensis* were collected by hand near Gadanki Police training center. The specimens were examined under a dissecting Microscope and measurements were taken with a Yamayo digimatic caliper (least count 0.1 mm). (Table 1). Photographic data were collected with digital camera.

OBSERVATION AND DISCUSSION

Geckoella cf. *collegalensis* (Fig.1) was sited under a rock at night. During the field work five specimens were observed in two days. Two of these were full grown males (evident from presence of hemipenial bulge) and three were females. Specimens were examined and after identification were released at the same site. *Geckoella collegalensis* is reported from a few parts of Maharashtra, Madhya Pradesh to Tamil Nadu. The habitat in the study area was agricultural and scrubland. *Geckoella* cf. *collegalensis* prefers open dry deciduous patches and scrubland. I would like to consider this specimen to be *Geckoella* cf. *collegalensis* following Mirza *et al.*, (2010).

Two color morphs of *Geckoella collegalensis* are considered by Smith, 1935. No further work on the color morphs has been done. Moreover, when specimens in this study were compared with the photographs of specimen from type locality taken by Mr. N. S. Achyuthani and Ms. Keerthi Krutha (personal communication), it was evident that the dorsal pattern of specimen from the type locality is rather different than that in the specimen from the current locality. Thus, extensive surveys and taxonomic studies with the help of recent molecular techniques are needed, since this beautiful species is likely to be more widely distributed. Further, habitat

Map 1: Study Aria near Gadanki Police training center Akola Dist.

Map 2: Akola District, Maharashtra, India.

destruction in its distribution range, due to farming, industrial as well as residential development could be a major threat to the species.

Table 1: Morphometry of observed *Geckoella* cf. *collegalensis* is given in this table.

Parameter	Measurement
Snout-vent length	45.8 mm
Tail length	3.4 mm
Body width	8.3 mm
Head length	15.5 mm
Head width	8.6 mm
Eye to nostril distance	3.3 mm
Eye to ear distance	3.3 mm
Eye to snout distance	5 mm
Eye diameter	3.3 mm
Supralabials left / right	10/10 mm
Infralabials left / right	7/8 mm
Length of forelimb	6.5 mm
Length of hindlimb	9.3 mm

Fig.1: Adult Geckoella cf. collegalensis from Gadanki police training center, Akola, Maharashtra.

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A report of hyperkeratosis in wild Paddyfield Pipit *Anthus rufulus* from Pune

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Hyperkeratosis in the avian context indicates an abnormal excess keratin in the outer layers of epidermal structures such as skin (leg and foot scales), beak, feathers and talons. This condition is generally caused due to deficiency of Vitamin A in diet. The condition is commonly recorded in pet birds like starlings, parakeets and other species. This can cause discomfort in birds during walking, flying or feeding depending on the site of involvement. It can be corrected by appropriate dietary supplements and trimming of the excess growth.

However, in wild birds, this condition is poorly reported. We report the presence of hyperkeratosis in Paddyfield Pipit *Anthus rufulus*. The abnormal growth was in the form of large horny and rather ugly excrescences on the tibio-tarsus of the wild birds. The projections were related to the leg scales. The movements of the birds were hampered to some extent.

The Paddyfield Pipits (n=2) were recorded at Kavadi Pat, Pune on 26 January 2014. The locality is a shallow river bed upstream and downstream of a bund on the Mula-Mutha river. The area has significant organic and inorganic pollution in the form of chemicals and garbage including plastic. There were several other birds such as wagtails, other pipit species, ibises, plovers, herons, storks, ducks, etc. and none of these birds showed such deformities.

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Wind-Solar Hybrid Power Generation System at Forest Training Institute, Pal (Maharashtra) - A Model of Green Initiative

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BACKGROUND

The Dadasaheb Chaudhari Forest Training Institute of the Forest Department of Maharashtra lies deep inside the Satpuda mountain ranges of Central India. It is located near the tribal village Pal, Taluka Raver, District Jalgaon and was established in 1966 in the reserve forest area of Yawal Forest division sprawling over an area of 13.350 ha. This came to be declared as a Sanctuary in 1969. Its geographic location is: Latitude 21^{o} 21'15" N and Longitude 75^{o} 53' 48" E. In this remote and inaccessible part of the Jalgaon district and surrounded by forests and mountains, the Pal village is located on the banks of river Suki.

The surrounding forest made Pal an ideal place of learning and training for the forest personnel. The institute has trained gardeners, forest labourers, forest guards, foresters, administrative personnel and Joint Forest Management Committee members for the past 46 years. Very preliminary facilities like public transport, communication and electricity supply are present. The power supply to the institute comes from the State but due to various factors like lack of industries, poverty, remoteness and lesser demand for the power supply, the service sector has not developed to the desired levels.. Prolonged and frequent power cuts and load shedding up to 48 hours are common making regular office work and training difficult. The institute being located in forest area also requires night illumination in view of wild animals.

To address this issue the institute had installed solar street lighting system during the year 2008. Stand alone poles with a solar panel and the battery were scattered over the 13 ha campus making maintenance and protection difficult. Thefts of batteries and solar panels were common compelling night patrolling and demand on additional personnel and trainees. Rhesus Monkeys also damaged the solar panels. The battery boxes rusted due to heavy rains.

Another measure that was taken to manage the shortage and unreliability of power supply was the installation of diesel run power generator. Rising cost of diesel made it unaffordable, apart from problems of procurement, transport, storage and environmental

pollution. Operating the diesel generator for 6 hours required 24 lit of diesel at Rs.1000 per day amounting to Rs.1.5 Lac per annum.

THE SOLUTION

For the smooth running of the institute it was decided to install a reliable, affordable and maintenance free energy supply source using non-conventional energy from wind and solar radiation, which were plentiful in this area.

OBJECTIVES OF THE RENEWABLE ENERGY PROJECT

1) The primary objective was to provide technically feasible and financial viable assured power supply to the Institute under expert guidance.
2) The functioning model could demonstrate to the forest department trainees and visitors to our institute, the successful use of non-conventional and renewable energy system using hybrid solar-wind energy.
3) The model could promote and generate awareness on a wider scale about eco-friendly adoption of non-conventional, environmentally safe and clean energy sources using new technology.

SCOPE OF WORK

1) The renewable energy installation project would conform to the specifications and technical norms of the State and Central government for technical feasibility and financial viability.
2) This project aimed at providing requisite renewable energy to the Pal Institute.
3) The load was calculated for the use of the various electrical appliances linked to the existing conventional power source, based on their day to day usage / requirements for training classrooms, computer lab, accounts office, administrative office, faculty chambers, library, conference hall and exteriors.
4) The revised load calculations were calculated for energy saving devices such as LED and CFL lighting and electronic controller devices. The electrical requirements dropped down drastically.
5) These revised load calculations were considered for the hybrid Wind-Solar power system.

MEASURES

1) Utilize Hybrid Power Generation technology based on renewable energy resources (Solar Photo Voltaic Panels - SPV and Wind Turbine Generators - WTG) instead of conventional power.
2) Achieve reduction in power consumption using power saving devises like LED tube lights, CFL bulbs, high speed low power consuming fans, automation and devices with 3/5 star power rating.
3) Alter existing infrastructure for provisioning of natural light.
4) Create awareness among the staff about saving electricity.

SPECIFICATIONS, RATES, LOCATION AND INSTALLATION

1) A consultant was appointed to study the power requirement. The work was carried out as per standard Specifications and Guidelines of M.E.D.A (Maharashtra Energy Development Agency), a State Nodal Agency under M.N.R.E (Govt. of India, Ministry of New and Renewable Energy). The Detailed Project Report – DPR, was prepared to indicate the probable expenditure. The Hybrid power generation system was designed for 8.5 KW output at the existing cost of Rs.26.5 lac. The DPR was submitted to MEDA, Pune and technical approval was obtained.
2) The rates were as per the prevailing market situation and MEDA guidelines.
3) The solar power generation system including battery bank, charge controller and inverter were installed near the academic cum administrative complex to avoid power transmission losses and safety.
4) All routine tests certificates were supplied by the manufacturer along with the equipment. After physical completion of installation, the entire system was tested by the institute jointly with the vendor in accordance with the functional requirements.
5) By the time DPR was sanctioned, but before the installation of the Hybrid Solar-Wind Power Generation Project, the cost came down due to advancement in technology. At the tendering stage we noticed that we could install 10 Kw capacity systems instead of 8.5 Kw system in the same project cost.
6) The system installation was completed in February 2014 and power generation commenced from 26 February 2014. By the end of February 2015, 1950 units of power was generated and used.

THE GREEN INITIATIVE

1) Low maintenance LED lighting was installed in all buildings to reduce power consumption. LED's sustain voltage fluctuations over a wider range of 180 – 280 V. CFL lights were used where use of LED was not practical. High speed low power consumption fans were fitted.

2) Modifications in window designs allowed more natural light inside the buildings.
3) To avoid thefts, the old solar PV panels available with the institute were used with power-pack system for street lights and ladies hostel.
4) Solar water heating system was installed for two blocks of ladies hostel.
5) The maximum energy generated from the system was used for the academic-cum-administrative building and when ever available, the State grid power was used only when there was very low power generation during cloudy weather and lack of wind.
6) The trainees passing out from the Institute and the visitors are now sensitized towards the unique and successful green initiative adopted by the Pal Institute.
7) It is hoped that our model inspires others and similar Hybrid Power Models are replicated widely in appropriate places by other institutes to address the nationwide problem of power shortage and lead the users to an eco-friendly way of life.

NOTE

During the monsoon months, because the wind speed is often sub- optimal and the sky is cloudy, the power generation is not adequate. In spite of these limitations, as compared to the bill for January to December 2013 (pre-installation year), there was reduction in electricity bill for January – December 2014 (year when the hybrid system came into operation) by 44%.

The project was designed for total power needs of Academic building, Hostels and other places, but to begin with, power was supplied to academic building only as other building were renovated at a later period. The power will soon be distributed to other sites.

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The details of number of gadgets wired for hybrid power consumption points are:

Gadgets wired to Solar-Wind System						
Name of Room	**LED lights**	**Fans**	**Computers**	**Printers**	**Photo Copiers**	**Bulk head**
Class Room No.1	4	4	0	0	0	0
Class Room No.2	4	4	0	0	0	0
Computer Lab	4	4	27	0	0	0
Office	4	4	3	3	2	0
Conference Hall	18	10	0	0	0	4
Administrative Office	9	5	1	1	1	1
Library	6	6	0	0	0	0
Meeting Hall	2	2	0	0	0	0
Total	51	39	31	4	3	5
Use pattern	Daily	Daily	Lab/Office*	Daily	Daily	Daily

* Laboratory use for one month when training; for office use daily.

Peafowl and Deities: Conservation Thought in Indian Cuture

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INTRODUCTION

Mayura (Indian Peafowl) is the national bird of India since 1962. In several rural regions the peafowl is accorded protection by local people for various reasons. These are the people's sanctuaries. Peafowl is one of our most beautiful and elegant birds and it can be easily tamed. The bird is known since the Vedic times*. The peafowl has adorned flags, thrones, coins and crowns. According to the *Ayurveda* (Indian system of medicine) (*Charaka Samhita* 27.55 and *Sushruta Samhita* 16.19; 2nd c. AD) the peafowl is classified under the group named '*vishikira*' (bird that eats food by scattering which suggests their habit of frequenting the ground for partaking food) and peafowl is seen taking its food by scratching the leaf litter using strong feet. Another famous example is of the 'Peacock Throne' having figures of two peacocks standing behind it, their tails

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being expanded and inlaid with sapphires, rubies, emeralds, pearls and many other colourful precious stones to represent life. The throne was created in India in the 17th century for the Mughal King *Shah Jahan*. *Shah Jahan* had the well known *koh-i-noor* diamond inlaid in this throne. (In 1849 the British confiscated the *koh-i-noor* diamond as a compensation for the *Sikh* wars). The *Gurugranthasahiba* (the central text of *Sikhism*- a religion that emerged in Punjab region of India during 15th century) speaks reverently about lord *Krishna*: 'after seeing lord *Krishna*, the peafowl thought that Him to be a black cloud and started dancing.' (*Gurugranthasahib*a *Sainchi* i.e. a part 2.1669).

The peafowl also has a great symbolic meaning in other Asian cultures. In the Buddhist *Jataka* literature the *Mora Jataka* (159) (Cowell, Vol.II-1990, P. 23), *Baveru Jataka* (339) (Cowell, Vol. III-1990, P. 83) and *Mahamora Jataka* (491) (Cowell, Vol.IV-1990, P. 210), the *Bodhisattva* is born as the beautiful golden peafowl. In Buddhism, the great deity *Mahamayuri* has a peafowl for her vehicle. As the peafowl, though presenting a fine blend of all the colours of the spectrum of light has a special display of green. The Tibetan culture views green as the mixture of all aspects of creation.

SANSKRIT SYNONYMS FOR THE MAYURA

1. *Mayura* The grammatical explanation of the word *Mayura* is traditionally derived from the root √ *may* (1A) 'to go'. Alternatively the word is explained as 'one who cries aloud on the earth' (*mahi*+√ *ru*). The word is included in the *prushodaradi gana* (P.6.3.109), i.e. among the words that are accepted as the appropriate words (i.e. the *sadhu* words), on account of their usage or pronunciation in that manner by the learned (*shishta*). According to the Monier Williams Sanskrit-English dictionary, the word derived probably from the root √ *ma* (3U) 'to sound, bellow, roar, bleat'.
2. *Barhin*- One with a plumage. The word is derived from the word *barha* 'plumage' with the possessive termination '*in*' (*barha* + *in*).
3. *Nilakantha* is 'one having a blue throat'. (*nila* means a blue colour + *kantha* means a neck).
4. *Bhujangabhuka* is 'one who devours the snake' (*bhujanga* means a snake + the root word *bhuj* means to eat).
5. *Shikhavala* is 'one who is crested' (*shikha* means a crest + the word *valacha* is a possession termination).
6. *Shikhin* has the same meaning as that of *shikhavala*. Here the possessive termination 'in' is added to the word *shikha*.
7. *Keki* is one whose calls are known as '*keka*'. It is further said that the calls i.e. *vanee* of the peafowl are called as '*keka*'.
8. *Meghanadanulasin* is one who dances to the thunder of the clouds (*meghanada* means the thunderous sound of the clouds+ *anulasin*). The root √ *las* (1P) has several meanings, out of which, one is 'to dance'. ('*lasya* 'means dancing).
9. *Candraka* allude to the glossy and bright feathers of the peafowl, i.e. 'one having a moonlike design of

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feathers' and

10. *Mechaka* means 'dark blue colour or the eye of a peacock's tail'.
11. *Chuda* means a crest.
12. *Picchabarha* refers to the plumage of the peafowl.
13. *Napunsaka* means one who is impotent. In the regional language of Maharashtra State of India such a peafowl is called '*mukana mora*'.

MAYURA IN MYTHOLOGY

In the *Puranic* times (particularly before 1000 AD) god *Kartikeya* or *Skanda* was associated with the peafowl. There are many references to *Kartikeya* or *Skanda* sitting on the peafowl. The *Jaina* community respects the peafowl because they believe that the peafowl is the carrier of goddess Sarasvati- the goddess of intellect. *Kartikeya* is believed to be the youthful, courageous chief of the army of gods; he is the protector and his vehicle is the peafowl. The bird is the representative of beauty and bravery. Our ancestors believed that from the peafowl, one should learn habits like fearlessness in battle, getting up early in the morning, taking food and roaming along with the members of the flock and protecting the peahens.

Mayureshwara is one of the names of *Ganapati*, the god of intellect, and the destroyer of ignorance. The peafowl is believed to be the vehicle of *Ganapati* in the *Treta yuga* (the second of the four *yuga* i.e. an era in the world envisioned by the Hindus). As the peafowl has the capacity to digest poisonous snakes, he is the symbol of the one who can conquer the *kala-sarpa* i.e. death in the form of a snake. The peafowl has a deep blue colour which is the symbol of evolved higher state of mind. Poets have composed *Sanskrit* verses like the '*mayuresh stotra*' singing the glory of the *Mayureshwara* i.e. *Ganapati*.

Sarasvati is the personification of all knowledge-arts, science, crafts and skills. Literally '*Sarasvati*' means 'the flowing one' which suggests that our knowledge should always be on the path of development. Symbolically, the peafowl stands for this world in all its glory and if we want *moksha* i.e. beatitude, we have to transcend the worldly attractions to achieve spiritual knowledge. Her vehicle is believed to be a white swan and the popular mythological literature and pictures depict the peafowl as her carrier vehicle. Even today a symbolic expression of *Sarasvati* and her peafowl is drawn on stone slates or papers and worshipped by students on the day of Hindu festival called as the "*Dasara*" (according to the Hindu calendar it is the day of *Ashvin Shuddha Navami*). This symbolic depiction of *Sarasvati* suggests a plumage of the peafowl and the triangles suggest the *shakti* i.e. the divine motherly power behind all our activities. (The triangles have a specific meaning in the *Tantra* cult. Etymologically there are two constituents in the word '*tantra*'; '*tan*' to spread and '*trai*', to protect).

Lord *Krishna* is depicted as wearing an ornamental feather of the peafowl on his head. Here, the feather is a symbol of *prakriti* i.e. Nature. Lord *Krishna* has played a great role in Indian history, mythology and poetry. He stayed in the city *Vrindavan* (a place in Uttarapradesh State) a place with abundant peafowl and *Krishna* is believed to be a great lover and protector of nature's beauty.

NOTE

*According to "*An Encyclopaedia of Sanskrit on Historical Principles*" the date of the Vedas is 1400 BC. On the other hand, the dates of the *Veda* literature assigned by various Eastern and Western scholars vary as widely as 25000 B.C. to 1000 B.C. But most of the Indian scholars agree that the Harappan-Mohenjodaro culture (c. 4000 B.C.) was a later phase of the Vedic culture.

Chironji Tree: A neglected and useful tree *Buchanania cochinchinensis (lanzan)* (Lour.) Almeida

Vivek Vishwasrao
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- Common Marathi Name: **Charoli**
- Family: *Anacardiaceae* (Cashew family)
- Flowering season: January – February
- Fruiting season – March to April

This tree was first described by Francis Hamilton in 1798. The tree is naturally found in the wild in the tropical dry and moist deciduous forests of Northern, Western and Central India. Traditional indigenous knowledge regarding this tree reveals the immense value of almost all parts of the tree including roots, leaves, fruits, seeds and gum for various medicinal purposes. Tropical countries like India are blessed with a variety of fruits that they naturally grow and produce.

Charoli Tree is a medium-sized deciduous tree, growing to a height of about 35 to 40 ft. It bears fruits, each containing a single edible seed with high nutritive value. It is commonly found in forest on eroded landscapes where rainfall is medium.

This medicinal plant is presently categorized as Vulnerable, and is included in the IUCN Red Data Book.

- **Leaves -** Leathery leaves, broadly oblong, with blunt tip and rounded base. Leaves have 10-20 pairs of straight, parallel veins.
- **Flowers** - Pyramidal panicles of greenish white flowers emerge in early spring. Fruits ripen from April to May and remain on the tree for a long time thereafter. Flowering is during January to March.
- **Bark** - The bark of the tree is greyish in colour.
- **Soil requirements** - It does not withstand waterlogged areas and requires well drained soils.
- **Medicinal uses**- The roots: acrid, astringent, depurative and constipating, traditionally be used in the treatment of diarrhoea. Leaves useful in the treatment of skin diseases; fruits in treating cough and asthma. Seeds are added for flavour and nutritive value in sweet recipes.
- **Afforestation -** A good economically viable species for afforesting bare hill slopes in suitable habitats. This species has high socio-economic value with a potential of providing livelihood to regional tribal population and has a high potential as commercial horticulture tree. Unfortunately, due to over-exploitation and indiscriminate harvesting (lopping and cutting), the tree presently experiences severe threat. This calls for an urgent conservation efforts at all levels.

Recovery of two ringed and wing-tagged Black-headed Ibises *Threskiornis melanocephalus* at Bhigwan, district Pune, Maharashtra

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Introduction:

During the collaborative study by Forest Department, Maharashtra, National Institute of Virology, Pune and Ela Foundation, Pune under the Bird Flu Monitoring Project, ringing and wing tagging of several avian species was undertaken to understand their movement, longevity and site fidelity. We present the interesting records of resighting of the ringed and wing tagged Near Threatened Black-headed Ibis *Threskiornis melanocephalus*.

Site of ringing/wing-tagging:

Bhadalwadi Irrigation Tank, Tal. Indapur, Pune, Maharashtra.

The juvenile Black-headed Ibises were rescued following nest damage due to a hail storm a few days ago. The nests were broken and after repairing the nests the juveniles were kept in the nests after examination, ringing and wing-tagging.

Black-headed Ibis No. 1:

Age:16 Days
Physical examination: Healthy, no disease or deformity.
Date of ringing: 01 May 2014. (Only ringing was done and wing tagging was not done).
Left Leg Ring No.: 101
Wing chord 9 cm, Body Mass 425 g.

Black-headed Ibis No. 1 (Ringed nestling & 8 months old juvenile)

Black-headed Ibis No. 2 (Wing-tagged & ringed nestling & 10 months old juvenile)

Black-headed Ibis No. 2:
Age: 23 Days
Physical examination: Healthy, no disease or deformity.
Date of ringing & wing-tagging: 01 May 2014
Left Leg Ring No.: 127
Wing chord 18 cm, Body Mass 975 g.
Wing tag No.: A27

DETAILS OF RE-SIGHTING

Ibis No. 1:
Photographed by: Harshal Kulkarni
Place: Kumbhargaon, near Bhigwan, tal. Indapur, Pune, Maharashtra
- Time: 15:07 hr
- Date: Wednesday 10/12/2014.
- Distance: Within 10 km from the ringing site.
- Age at recovery: 08 months 28 days.
- 08 months 12 days since ringing.
- Feeding with other con-specifics and Ruddy Shelduck.

Ibis No. 2:
Photographed by Sucheta Dange, Participant of 'Certificate Course in Basic Ornithology'
Place: Kumbhargaon, near Bhigwan, tal. Indapur, Pune, Maharashtra
- Time: 15-06 hr
- Date: Sunday 05/04/2015
- Distance: Within 10 km from the ringing site.
- Age at recovery: 11 months 3 days.
- 10 months 5 days since ringing.
- Feeding with other con-specifics, Asian Openbill and Black-winged Stilt.

Importance of the study and future implications:

Since a long time the migratory birds have been suspected carrier/resorvoirs of many arboviral infections either directly or indirectly by carrying ticks and mites harboring such infections. In recent years, the emergence of avian influenza in various parts of the world again drew the attentions of ornithologists, biologists, virologist and other public health professionals on determining the role of the migratory birds in spreading avian influenza to different parts. Indeed, studies done by ornithologists on migratory birds gave bases to virologists in finding out the possible hot spots for origin and pathway of migratory birds helped in understanding possible spread from such hotspots thus formulating better strategy for preparedness, control and prevention of this deadly infection.

These two birds were tested for the presence of avian influenza viruses by virus isolation using embryonated chicken eggs and were found negative. Their serum samples were also negative for the presence of antibodies against Highly Pathogenic Avian Influenza HPAI H5N1 virus.

These are the first records of the re-sighting of ringed and wing-tagged Black-headed Ibis from Bhigwan, Pune, Maharashtra. However, due to the limitations of the ringing and wing-tagging method, we do not have any information about the movement of the birds between the time of ringing and re-sighting. This lacuna can be addressed by putting data-loggers or other kind of electronic data transmitting devices on the backs of birds. Such devices can throw light on the vital aspects of avian ecology such as feeding territories, dispersal range and habitat utilization of the young after fledging. They would also be useful to elucidate the role of wild and migratory birds in transmission of viral diseases such as avian influenza. Such studies are urgently required in the scenario of emerging viral diseases and need to be undertaken on a wider scale for effective implementation of conservation strategies based on sound scientific data.

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