AGHANASHINI ESTUARY IN KUMTA TALUK, UTTARA KANNADA - BIOLOGICAL HERITAGE SITE

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AGHANASHINI ESTUARY IN KUMTA TALUK, UTTARA KANNADA -

BIOLOGICAL HERITAGE SITE

DECLARATION OF BIOLOGICAL HERITAGE SITE UNDER BIOLOGICAL DIVERSITY ACT 2002

Note: The proposal made here is for Aghanashini Estuary Biological Heritage Site in Uttara Kannada district of Karnataka. Although the estuary itself is unique in biodiversity and productivity, due to the practical problems that could arise in managing the entire estuary as one unit, two separate core areas are identified within it as Location-1 and Location-2, the former of tremendous importance in Molluscan (bivalves) productivity and the latter of importance for the mangrove ecosystem, which is the core area for biodiversity and productivity. As the estuary is one biologically integrated unit the two locations within it are to be brought under a single Heritage Site Management Committee. The two locations have been described separately for convenience.

1. Identification of Property

   a. **State** **: Karnataka**

   b. **Name of the property** **:** Aghanashini Estuary Biological Heritage Site: Location I: Bivalve Mudflats

   c. **Exact location** **: Situated in Kumta taluk of Uttara Kannada district. Lat. 14.520833-14.539342 N & 74.353754-74.369593 E**

   d. **Maps/plans showing boundary of area proposed: Figures 1, 2 & 3**

   e. **Area of Location I** **: About 229 ha**

2. Justification for Declaration

   a. What is the significance of proposed site (Location-1)?

i. A highly productive estuary

Aghanashini River in central Uttara Kannada district of Karnataka originates in the Western Ghats and flows westward towards the Arabian Sea, major part of its course through forested gorges and valleys. Having no dams and no notable industrial establishments or major townships along its banks the river may be considered one of the most pristine ones along the west coast. The River meets the sea in the Aghanashini village of Kumta taluk. The tidal portion, or estuary, towards the river mouth is a flat expanse of water dotted with small islands and narrow creeks. This portion, designated as the Aghanashini estuary, is a highly productive and biologically rich waterscape of coastal Karnataka.

The high productivity of the estuary is due to the following reasons:

1. **The river water carries large quantity of organic materials from the forests in the catchment area of the Western Ghats and deposits the same in the estuary. The debris becomes important base for food chains operating in the estuary**

2. **The rich mangrove vegetation of the estuary plays significant role in nutrient supply for the diverse faunal community and provide shelter for birds and act as nurseries for many species of fishes and prawns**

3. **The rich bird community (over 120 species)associated with the estuary contributes to the nutrient cycling through their potash and nitrogen rich castings (Details in Annexure I)**

4. **The constant churning and circulation of waters due to flow of fresh water from one side and the tidal influx from the Arabian Sea oxygenates the water and circulates the nutrients**

ii. Significance of bivalve (shellfish) production

Estuaries are ranked among the highest productive ecosystems of the earth. One of the most notable economic and subsistence output of the Aghanashini estuary is the bivalves (Phylum: Mollusca). The meat of these invertebrates is used as a protein rich food by thousands people along the coastal areas of Karnataka and Goa.

*Total annual production***:** Estimated at 22,006 tons, valued at Rs.57.8 million per annum. Most of the of bivalves harvested belong to *Paphia malabarica*, although six other edible species are also gathered in lesser quantities. Bulk of the bivalve harvest is from mudflats bordering the village by name Aghanashini, close to the mouth of the river (bearing the same name). Collectively these bivalve harvesting areas measure about 229 ha. (Boominathan et al., 2008). It is significant to note that so much of food production is without any investment or supply of feeds by humans. Details are provided in Annexure II.

Constanza et al. (1997) estimated the value of an estuary as Rs.1141600/ha/year. This value is the aggregate of all goods and services such as shrimps, fish, crabs, salt, mangroves, in addition to services such as fish spawning grounds, nutrient cycling, hydrology, flood control, soil protection, sink for carbon etc. It is notable that we have provided for the proposed BHS the value of bivalves only and not the other goods and services.

Crucial role in local economy: Bivalve harvesting is the most important aspect of small scale informal fisheries of Kumta coast, an activity traditionally carried out by even persons from non-fishing communities, for family food security and for sale. Bivalve collection provided direct employment for 2,347 people according to the study referred to Boominathan et al., (2008). Of the harvesters 1,738 collectors were men and 609 were women. The collectors belonged to 19 estuarine villages and congregate in mudflats closer to Aghanashini village during the low tide time for harvesting. The bivalve-linked activities also include minor processing at the site, transportation, collection and sale of empty shells and drying of bivalve meat in small quantities for storage and future use. The calcium rich bivalve shells are used for lime making. The bivalve shell lime is of superior quality for white washing, as fertilizer, prawn feed, poultry feed, production of high grade cement etc.

Food security: Bivalves from the Aghanashini estuary provide excellent protein and mineral rich food for an estimated 198,000 people, especially along the coast. The Indian edible bivalves have protein (5-14%), fats (0.5-3%), calcium (0.04-1.84%), phosphorus (0.1-0.2%) and iron (1-29 mg/100 g of fresh weight) – CSIR (1962).

Ecosystem richness and productivity: The abundant annual production of edible bivalves reflects the rich biodiversity of the estuary in general, which also has around 150 species of fishes, 120 species of birds, 13 species of mangroves, numerous mangrove associates and many more species of lower plants. Organic debris from the bio-diverse community of the estuary itself as well as that brought into the estuary from the Western Ghat forests collectively contributes towards the high production of bivalves.

b. Why the declaration is proposed? Give justification

The proposal is put forward to declare the major bivalve gathering area of 229 ha as part of (Location-1) of Biological Heritage Site due to the following reasons.

i. The bivalve rich area mentioned is the culmination of numerous food chains in the estuary and beyond from the Western Ghats from where nutrients reach the estuary through the river

ii. The local population has strong cultural bonds with the river, which they treat as Goddess. A long history of human association with the river can be traced, as integral part of people's culture and livelihood activities such as fishing, fish

and prawn culturing, mangrove planting and utilization, transportation, estuarine rice farming, salt making etc.

iii. The edible bivalve rich mudflats of Aghanashini may be considered as unique, ecologically fragile areas, as their productivity is due to their location towards the river mouth, at appropriate flooding depth during high tides, suitable salinity ranges, and accumulation of a huge quantity organic debris.

iv. Several aquatic and terrestrial bird species, including migrant species use the bivalves and other organisms of nutrient rich bivalve beds as their food.

v. The site recommended for consideration as BHS is not covered under Protected Area network under the Wildlife Protection Act 1972 as amended

vi. No village community has exclusive jurisdiction over the proposed area, although bivalve gatherers assemble here from 19 estuarine villages.

vii. Bivalve gathering, just like fisheries, has been a subsistence and economic activity from pre-historical times. Unlike fisheries the bivalve gathering is not an activity that needs high skills. It belongs to the sector of 'informal fisheries'. The bivalve production area and activity of gathering and utilization may be considered a common heritage of the people of Aghanashini estuary.

viii. As such the bivalve collection activity is not regulated by any norms made by local communities. It is an unregulated, open to all economic activity engaged in by people, irrespective of caste and community. The activity was carried out traditionally on sustainable basis, more to cater local needs. Over the last few years large scale transportation of bivalves especially to Goa market has resulted in local famine and raises question of sustainability of the resource.

ix. As the bivalve harvesting areas are totally unprotected by any laws from any destructive type development activity or any other kind of disturbances that might happen in the future, in the very site or in any adjoining areas, that could adversely affect the food web of the estuary, it has become necessary to bring such critical areas under Location-1 of 'Aghanashini Biodviersity Heritage Site'.

x. As there is involved here an issue of common resource being used from generations by a set of villages, the proposed property is beyond the jurisdiction of any single Biodiversity Management Committee (BMC) or village panchayat. Section 6a of the Guidelines for selection and management

of Biodiversity Heritage Sites (National Biodiversity Authority, 2009) states: "Wherever the BHS extends to more than one local bodies, the management of the BHS shall be the responsibility of the Biodiversity Heritage Site Management Committee ….. approved by the SBB". Here therefore, the State Government's role will come into play in the process of declaration, management and monitoring.

c. Threat if any (give details)

For generations together the edible bivalve production areas adjoining Aghanashini village were used sustainably by the village communities as production has been abundant and the demand was mainly local. However in the recent years the demand has shot up from outside markets, especially from Goa, causing unprecedented over-harvesting. As many village communities are traditionally associated with bivalve gathering in the same production areas it is beyond the jurisdiction of any single gram panchayat or the local BMC to regulate harvests within sustainable limits. This situation could spell doom to the sustainability of the resource within few years. Further, the estuary is likely to be affected by various developmental interventions in the absence of any biodiversity centred, state sponsored governance.

3. Description

Present status of conservation

Need for conservation was not felt until recent years, when demand for bivalves as food was more local than from outside. As resource was abundant and extraction pressures limited to sustainable limits there was no need to adopt any special measures of conservation. But such need has arisen now due to over-exploitation for catering to outside markets.

4. Management

a. Ownership: The part of estuary producing huge quantity of edible bivalves is under the jurisdiction of the Government of Karnataka; no private agency or village panchayat has special rights over the 229 hectares of Location-1 of the proposed BHS.

b. Legal status: proposed area comes under the ownership of the Government of Karnataka

c. Agency to manage the site after declaration: The 'Guidelines for Selection and Management of Biodiversity Heritage Sites' (http://nbaindia.org/wb_day.htm) states under Section 6 (only relevant clauses presented here):

a. Wherever the BHS extends to more than one local bodies, the management of the BHS shall be the responsibility of the Biodiversity Heritage Site Management

Committee constituted by the BMC or other local institutions linked to the local bodies in case BMC does not exist, and approved by the SBB.

b. The committee responsible for the management of the BHS shall include representatives of all sections of local communities, and in particular those most dependent on the natural resources as also those who have been traditionally conserving the area.

c. It shall be responsibility of the BMC/BHS Management Committee to prepare and implement a management plan for the BHS which should cover a period of five to ten years

d. SBBs will then recognize and facilitate the implementation of the final management plan. Such facilitation shall include direction to all relevant government departments to assist the communities in implementation, including through appropriate changes in their plans and schemes, to eliminate biodiversity-damaging practices and to fully enable and empower the communities in conserving biodiversity. Where necessary orientation programmes shall be organized for such departments and NGOs.

g. Any project/activity to be implemented by government or any other agency, which is likely to have adverse impact on the BHS may be avoided.

i. Restriction in form of regulating the use of the resources may be warranted in some cases and such restriction shall be totally voluntary on the part of the community.

d. Name, designation and address of responsible person/institution for contact: (common for Location -1 & Location – II of proposed BHS)
e. Sources of expertise : Centre for Ecological Sciences (Indian Institute of Science),

Field Station, Viveknagar, Kumta- 581343

5. Factors Affecting the Site

   a. Pressures affecting the site (Encroachment, Agriculture etc.): nil

   b. Environmental pressures: Getting subjected to unregulated exploitation, due to non-sustainable harvests of late

   c. Visitor/tourism pressures: nil

6. Documentation

   a. Photographs : Photographs for Location-1attached

   b. Existing site management plans if any: ‘Snehakunja’, Kasarkod, an important local NGO had conducted programmes for estuarine communities on CRZ awareness, mangroves, need for sustainable harvests of bivalves etc.

7. Opinion of other concerned stakeholders: Stakeholders (local fishing communities, other bivalve gatherers and traders) would welcome introduction of sustainable management system

8. Details of disputes if any on the site: Nil

9. General remarks if any: Declaration of Location-I as part of BHS and formulation of appropriate management plans for bivalve harvests, in combination with Location- 2, mangrove area will have good positive effects on the mollusk habitat and production and thereby ensure livelihoods and food security of the local communities.

Figure 1: Uttara Kannada District Showing Location of Proposed Aghanashini Bivalve Biodiversity Heritage Site

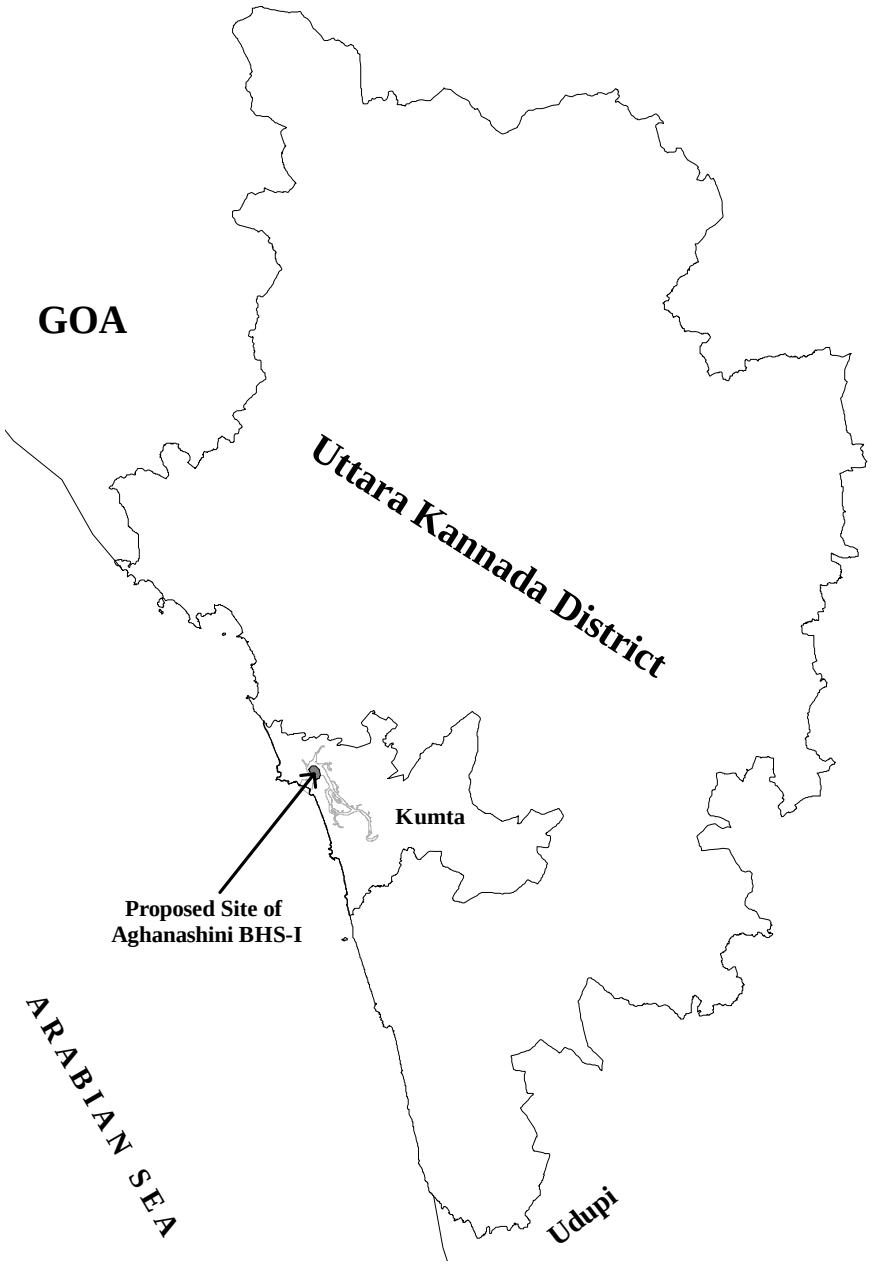
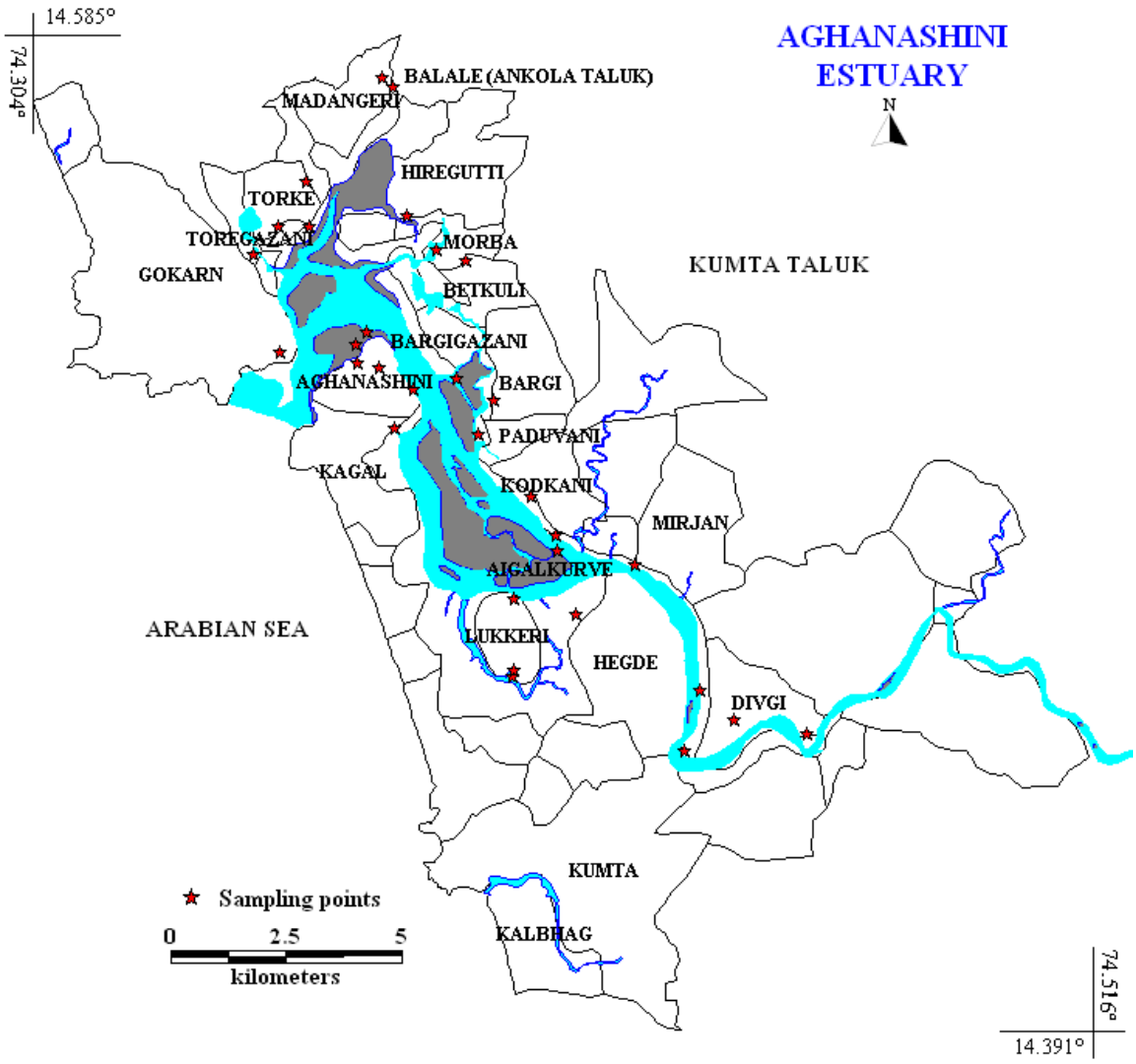


Figure 2: Proposed Aghanashini Biodiversity Heritage Site in the Estuary

Figure 3: Aghanashini River Estuary with surrounding villages



BHS Location I

1. Bivalve collection in exposed mud-flats

2: Using canoes for bivalve collection and transportation

3. Women collecting edible bivalves

4. View of edible bivalves on nutrient rich mudflats

5. Bivalve cleaning and sorting- a major activity of women

6. Bivalves packed for transportation to Goa

DESCRIPTION OF LOCATION- 2 OF AGHANASHINI ESTUARY BHS

1. Identification of Property

a. State : Karnataka

b. Name of the property : Aghanashini River Mangrove Biodiversity Heritage Site

c. Exact location : Situated in Kumta taluk of Uttara Kannada district. Lat. 14.52083-14.53934 N to 74.35375-74.36959 E

d. Maps/plans showing boundary of area proposed: Figures 1, 2 and 4

e. Area of site proposed for declaration : About 67 ha

2. Justification for Declaration

a.What is the significance of proposed site?

i. Aghanashini River in central Uttara Kannada district of Karnataka originates in the Western Ghats and flows westward towards the Arabian Sea, major part of its course through forested gorges and valleys. Having no dams and no notable industrial establishments or major townships along its banks the river may be considered one of the most pristine along the west coast. The River joins the sea in the Aghanashini village of Kumta taluk. The tidal portion, or estuary, towards the river mouth is a flat expanse of water dotted with small islands and narrow creeks.

ii. Through millennia the estuary and its environs formed the lifeline of the people and constitute a major cultural and historical heritage of the west coast. It was known as a rice bowl in the historical times and rice surplus was transported through water crafts to other regions. The Mirjan fort on the bank of the estuary built by Bijapur Sultans and the ruins of Aghanashini fort on a hill towards the river mouth giving a commanding view of the sea, the estuary and the Western Ghats are testimonials for the historical and cultural importance of the region. Spices grown in the hinterlands of Western Ghats were traded through the estuary during the European period and earlier to it. Gokarna on its shores has been, from time immemorial, a great place of pilgrimage. Before the road networks came the estuary was a major route for transportation of pilgrims. The beaches dotting the coastline of Gokarna are today well known places of tourism. The picturesque estuary with flourishing

mangrove vegetation, its rich birdlife, and traditional way of life of the people need to be protected as a cultural heritage and draw for tourism.

iii. The estuary is a highly productive and biologically rich waterscape of coastal Karnataka. Whereas hundreds of families in the shore villages have direct dependence on it for their livelihoods through activities related to fishing, agriculture, collection of edible bivalves and crabs, shrimp aquaculture, traditional fish farming in the *gazni* rice fields, bivalve shell mining, salt production, sand removal, water transportation etc. scores of consumers in the estuarine villages and in places far away are benefited by the productivity of the estuary, of which the mangroves constitute the heart. The high productivity of the estuary is due to the following reasons:

iv. The river water carries large quantity of organic materials from the forests in the catchment area of the Western Ghats and deposits the same in the estuary. The debris becomes important base for food chains operating in the estuary and beyond in the offshore waters of the sea

v. The rich mangrove vegetation has significant role in food supply for the diverse faunal community. The mangrove swamp acts as food rich and protective nurseries even for many species of marine fishes and prawns, which lay eggs in the swamp.

vi. The rich bird community (over 120 species, about half of them winter visitors)associated with the estuarine ecosystem contributes substantially to the nutrient cycling through their potash and nitrogen rich castings

vii. The constant churning and circulation of waters due to flow of fresh water from one side and the tidal influx from the Arabian Sea oxygenates the water and circulates nutrients.

b. Why the declaration is proposed? Give justification

i. Importance of mangroves: Mangroves are in the heart of estuarine ecosystem and productivity. Their influence is pronounced not only in the estuaries but also extends far into the offshore areas. Tropical estuaries are ranked among the top productive ecosystems of the world, at par with the coral reefs. The major reason for their productivity is attributed to the mangrove vegetation. There are also other reasons for ranking mangroves high in the conservation circles.

ii. Mangroves contribute nutrients to the estuarine-marine ecosystem through litter-fall that turn into nutrients eventually. These nutrients contribute significantly towards food web and productivity of the estuary and the coastal sea. The detritus and filter feeding organisms like bivalves contribute substantially to the income and food

of the local people. People engaged in bivalve trade and consumers far away are also benefited. The bivalve shell gathering is a major, estuary based enterprise providing direct employment for about 600 persons and many more in associated trade and production of goods using shells such as poultry feed, cement, shell lime, paint, fertilizers etc. The annual output of shells from Aghanashini estuary is estimated to be around 100,000 tons worth Rs.5-6 crores. Fishermen report of good catch of fish closer to mangrove patches than elsewhere. Details are provided in the Annexure II.

iii. Mangroves act as nursery for fishes and prawns. Many sea fish visit nutrient rich mangrove area for laying eggs so that the juveniles grow amidst abundance of food before they leave for the sea. Resident estuarine fishes also take benefit of the mangrove areas for their food and breeding. The mangroves with their entanglement of roots making a dense impenetrable cover provide a safe place for fishes and prawns securing them from predators. The fishermen also do not cast their nets within the mangrove areas due to the physical obstacles created by the root network.

iv. Mangroves of Aghanashini provide good roosting place for many species of birds,which find rich food supply in the estuary apart from shelter provided by the mangroves. More than 120 species of birds, half of them migrants, have been recorded (Annexure-1. for recently observed birds) Mangroves protect the islands and mainland from erosion and trap soil and debris that come along with the run-off of the rainy season.

v. Traditionally the local farmers used to plant mangroves alongside the earthen embankments of their *gazni* rice field cum fish farming areas. These mangroves helped in stabilizing the bunds from erosion due to tides and waves and torrential rains of the region. Ever-since the Government built permanent embankments in the estuaries to protect the rice fields the practice of planting mangroves by the locals almost waned out. Nevertheless the Forest Department, during the last one decade raised mangroves in large areas of the estuary. When fully grown these mangroves will make the estuary a haven for birds, increase productivity of the estuary in terms of fish, prawns, crabs, bivalves, oysters etc.

vi. In the heart of the mangrove enriched estuarine centre is a small uninhabited island which is the abode of ‘Babrudevaru’, the guardian deity of the estuary. The deity is worshipped by people from all the estuarine villages who have strong cultural bonds with the deity. A stretch of mangrove forest dominated by the several ancient trees of *Avicennia officinalis* is considered so sacred that no one should step inside it wearing footwear. Numerous birds, both migratory (during winter) and resident ones are associated with this sacred *kan* forest.

vii. The huge production of edible bivalves in the mudflats adjoining Aghanashini river mouth, although some kilometers away from the proposed mangrove heritage site, owe their productivity to the rich input of detritus from mangroves in addition to the organic matter input brought into the estuary from the Western Ghats.

viii. The site recommended for consideration as Location- II of BHS is not covered under Protected Area network under the Wildlife Protection Act 1972 as amended.

- No village community has exclusive jurisdiction over the proposed area, nor the Forest Department has any legal rights over there, in spite of the Department being responsible for enriching the estuary with mangroves for the last one decade and conserving it. The mangroves do not come under the Reserved Forest and are vulnerable to damages in the future in the absence of any formal protective measures. Their continued existence has to solely depend on the levels of awareness among the public and the constant vigil that the Department has to keep. Therefore the BHS status can be justified.

- Any decline in mangroves will have severe adverse consequences not only on mangroves but also on the estuarine ecosystem and productivity as a whole; both goods and services from the estuary, will be adversely affected by such contingencies.

- There is involved here an issue of common property resources, beyond the jurisdiction of any single Biodiversity Management Committee (BMC) or village panchayat. Section 6a of the Guidelines for selection and management of Biodiversity Heritage Sites issued by the National Biodiversity (2009) Authority states: "Wherever the BHS extends to more than one local bodies, the management of the BHS shall be the responsibility of the Biodiversity Heritage Site Management Committee ….. approved by the SBB". Here therefore, the State Government's role will come into play in the process of declaration, management and monitoring.

c. Threat if any (give details)

The estuarine farmers were aware of the importance of mangroves in protecting the earthen bunds of their estuarine rice fields locally known as *gaznis*. Their practice from time immemorial was to raise mangrove trees alongside the *gazni* bunds. When the Government constructed permanent embankments for the *gaznis* to ensure better protection from salt water inundation on a permanent basis, the awareness pertaining to the importance on the role of mangroves dwindled among the local population. The growth of shrimp farming as an enterprise resulted in the creation of numerous aqua-cultural ponds, very often destroying the mangrove vegetation in the process. Such degradation of the mangroves continued until the end of the last century, until the Forest Department came in a big way to restore mangroves, by planting over a million saplings during the last one decade. As a permanent management mechanism for the mangroves is wanting this precious ecosystem any time in future is likely to be affected, to meet demand for timber and firewood from locals as well as outside. Further, in the absence of any formal protective mechanism the mangrove ecosystem

stands to be affected by increasing developmental pressures in the densely populated coastal region.

3. Description

a. Present status of conservation

As the Forest Department is taking constant care of the mangroves and creating awareness among the local communities, the spread and growth of mangrove community, not only in the proposed BHS but also elsewhere in the estuary, presently is remarkable.

4. Management

a. Ownership: The part of estuary proposed under Mangrove Biodiversity Heritage Site is under the jurisdiction of the Government of Karnataka; no private agency or village panchayat has special rights over the mangrove areas proposed for BHS. The prawn farms or privately owned rice fields adjoining the mangrove areas have been excluded from the purview of the BHS. No gram panchayat boundary extends into those parts of the estuary proposed to be under the mangrove BHS.

b. Legal status: proposed area comes under Government of Karnataka

c. Agency to manage the site after declaration: The 'Guidelines for Selection and Management of Biodiversity Heritage Sites' (http://nbaindia.org/wb_day.htm) states under Section 6 (only relevant clauses presented here):

a. Wherever the BHS extends to more than one local bodies, the management of the BHS shall be the responsibility of the Biodiversity Heritage Site Management Committee constituted by the BMC or other local institutions linked to the local bodies in case BMC does not exist, and approved by the State Biodiversity Board.

b. The committee responsible for the management of the BHS shall include representatives of all sections of local communities, and in particular those most dependent on the natural resources as also those who have been traditionally conserving the area.

c. It shall be responsibility of the BMC/BHS Management Committee to prepare and implement a management plan for the BHS which should cover a period of five to ten years

d. SBBs will then recognize and facilitate the implementation of the final management plan. Such facilitation shall include direction to all relevant government departments to assist the communities in implementation, including through appropriate changes in their plans and schemes, to eliminate biodiversity-damaging practices and to fully enable and empower the communities in conserving biodiversity. Where necessary orientation programmes shall be organized for such departments and NGOs.

g. Any project/activity to be implemented by government or any other agency, which is likely to have adverse impact on the BHS may be avoided.

i. Restriction in form of regulating the use of the resources may be warranted in some cases and such restriction shall be totally voluntary on the part of the community.

d. Name, designation and address of responsible person/agency for contact:

1. The Western Ghats Task Force, Government of Karnataka

2. The Honavar Forest Division, Karnataka Forest Department

3. The Centre for Ecological Sciences (Indian Institute of Science), Field Station, Viveknagar, Kumta

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5. Factors Affecting the Site

a. Pressures affecting the site (Encroachment, Agriculture etc.): nil

b. Environmental pressure: Presently not significant

c. Visitor/tourism pressures: nil

6. Documentation

a. Photographs : attached

b. Existing site management plans if any: Forest Department, Honavar Division carried out many programmes among local people to develop positive attitude towards mangrove ecosystem. 'Snehakunja', Kasarkod had conducted programmes for estuarine communities on CRZ awareness, mangrove planting, need for sustainable harvests of bivalves etc. The Centre for Ecological Sciences (IISc) is conducting Carrying Capacity Studies in the estuary.

7. Opinion of other concerned stakeholders: Stakeholders (local fishing communities, and farmers) would welcome BHS status and introduction of sustainable management system

8. Details of disputes if any on the site: Nil

9. General remarks if any: Declaration of BHS and formulation of appropriate management plans will strengthen mangrove ecosystem that could benefit the goods and services from the estuary substantially which will promote goodwill of the local communities towards such a precious heritage ranked among the highest productive ecosystems of the earth.

Date:

Place: Signature of proposer

References

Boominathan, M., Chandran, MDS & Ramachandra, TV. 2008. Economic valuation of bivalves in the Aghanashini estuary, West Coast, KJarnataka. ENVIS Technical Report 3, Centre for Ecological Sciences, Indian Institute of Science, Bangalore.

Constanza, R. et al. 1997. The valuation of world's ecosystem services and natural capital. *Nature*, 387: 253-260.

CSIR 1962. *The Wealth of India*: *Raw materials* Vol. VI, National Institute of Science Communication and Information Resources, CSIR, New Delhi.

National Biodiversity Authority. 2009. Guidelines for Selection and Management of Biodiversity Heritage Sites (http://nbaindia.org/wb_day.htm)

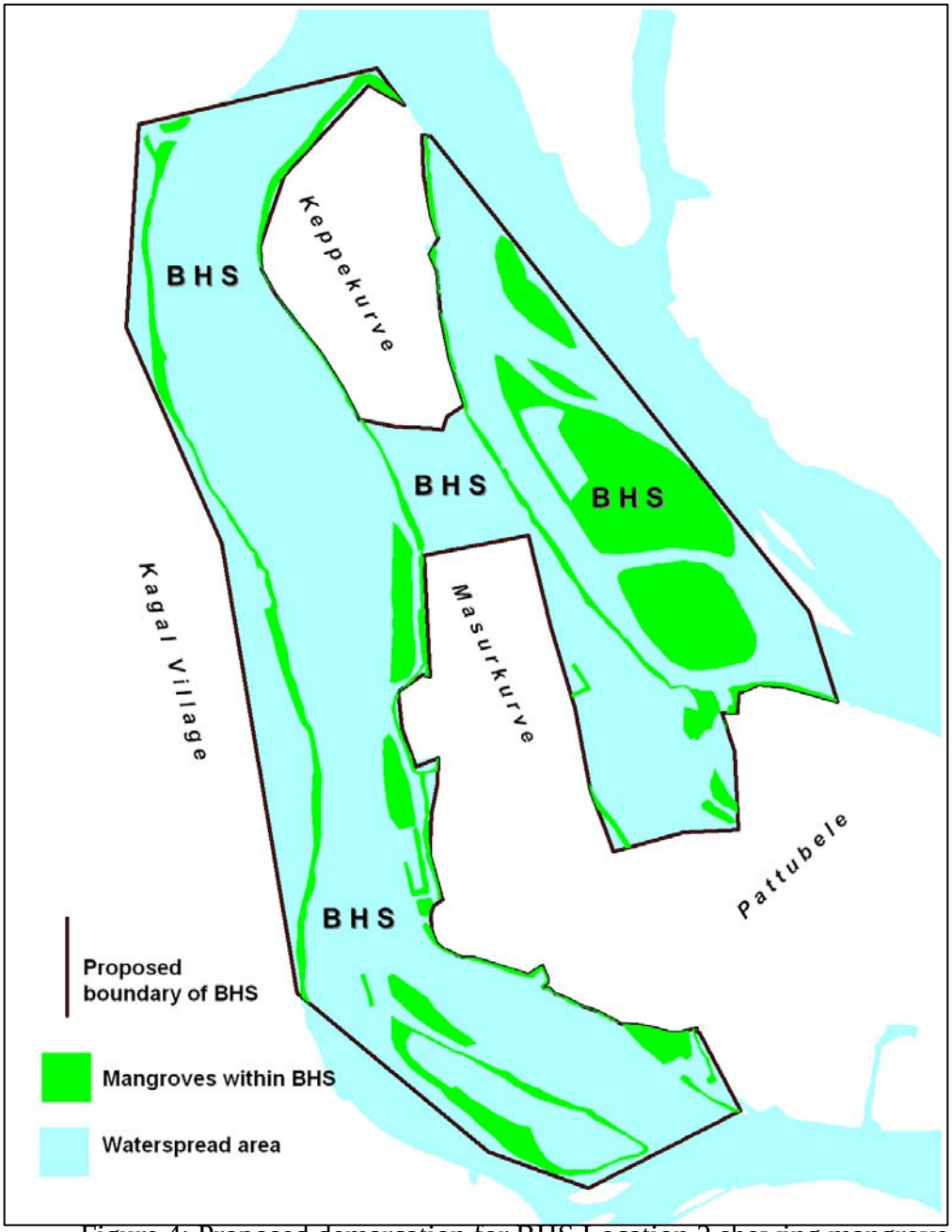

Figure 4: Proposed demarcation for BHS Location 2 showing mangrove areas in Aghanashini Estuary

Photographs of Mangroves in Location II

1. Root entanglement of *Avicennia officinalis*

2. Hanging seedlings of *Rhizophora mucronata*

3. A mangrove sacred grove in Masurkurve, Location-2

4. Transporting grass from mangrove swamp

5. A high density mangrove plantation in the estuary

Annexure-1: BIRDS OF AGHANASHINI ESTUARY IN KUMTA TALUK OF UTTARA KANNADA

SN	SCIENTIFIC NAME	COMMON NAME
1	Pavo cristatus	Indian peafowl
2	Vanellus indicus	Redwattled lapwing
3	Streptopelia chinensis	Blossomheaded parakeet
4	Psittacula cyanocephala	Indian spotted dove
5	Loriculus vernalis	Indian loriquet
6	Eudymamys scolopacea	Indian koel
7	Cetropus sinensis	Crow pheasnat
8	Cypsiurus parvus	Indian palm swift
9	Hemiprocne longipennis	Crested tree swift
10	Alcedo atthis	Small blue kingfisher
11	Pelargopsis capensis	Brownheaded storkbilled kingfisher
12	Halcyon smyrnensis	Whitebreasted kingfisher
13	Merops leschenaulti	Chestnut-headed bee-eater
14	Merops orientalis	Small green bee-eater
15	Anthracocerus coronatus	Malabar pied hornbill
16	Megalaema viridis	Small green barbet
17	Dinopaeum benghalense	Malabar goldenbacked woodpecker
18	Hirundo smithii	Indian wiretailed swallow
19	Hirundo daurica	Himalayan striated swallow
20	Lanius schach	Rufousbacked shrike
21	Oriolus xanthornus	Indian balackheaded oriole
22	Acridotheres tristis	Indian myna
23	Acridotheres fuscus	Indian jungle myna
24	Dendrocitta vagabunda	Indian treepie
25	Corvus macrorhynchos	Indain jungle crow
26	Coracina novaehollandiae	Indian large cuckoo shrike
27	Aegithina tiphia	Peninsular Indian iora
28	Pycnonotus jocosus	Redwhiskered bulbul
29	Pycnonotus cafer	Redvented bulbul
30	Muscicapa tickelliae	Tickell's blue flycatcher
31	Orthotomus sutorius	Indian tailorbird
32	Acrocephalus dumetorum	Blyth's reed warbler
33	Phylloscopus trochiloides	Greenish reed warbler
34	Phylloscopus occipitalis	Largecrowned leaf warbler
35	Copsicus saularis	Indian magpie robin
36	Motacilla maderaspatensis	Large pied wagtail

37	Indian purple sunbird	Nectarinia asiatica
38	Bulbulcus ibis	Cattle egret
39	Erymopterix grisea	Ashycrowned pinchlark
40	Galerida malabarica	Malabar crested lark
41	Alauda gulgula	Indian small skylark
42	Corvus splendens	Indian housecrow
43	Pycnonotus luteolus	Whitebrowed bulbul
44	Anthus novaeseelandiae	Richard's pipit
45	Nectarinia zeylonica	Purplerumped sunbird
46	Ploceus philippinus	Indian baya
47	Ardeola grayii	Pond heron
48	Vanellus malabaricus	Yellow-wattled lapwing
49	Turdoides affinis	Whiteheaded babbler
59	Motacilla cinerea	
51	Psittacula kramerii	Roseringed parakeet
52	Apus affinis	Indian house swift
53	Anas acuta	Pintail
54	Milvus migrans	Paraih kite
55	Haliaster indus	Brahminy kite
56	Coracias benghalensis	Indian roller
57	Hirundo rustica	Eastern swallow
58	Saxicola torquata	Indian collared bushchat
59	Accipitor badius	Indian shikra
60	Haliaeetus leucogaster	Whitebellied sea eagle
61	Columba livia	Blue rock pigeon
62	Merops phillippinensis	Small green bee-eater
63	Sturnus pagodarum	Blackheaded myna
64	Prinia socialis	Ashy wren warbler
65	Phyllacrocorax niger	Little cormorant
66	Ardea cinerea	Grey heron
67	Ardea alba	Large egret
68	Butrides stiratus	Little green heron
69	Egretta intermedia	Smaller egret
70	Anas quequdula	Bluewinged teal
71	Circus aeruginosus	Marsh harrier
72	Falco tinnunculus	European kestrel
73	Lonchura malacca	Blackheaded muniya
74	Chardarius dubius	European little ringed plover
75	Tringa glareorla	Spotted sandpiper
76	Ceryle rudis	Indian pied kingfisher
77	Hirundo daurica erythropigea	Indian redrumped swaloow
78	Arocephalus stentorius	Indian great reed warbler
79	Anthus campus	Tawny pippit
80	Motacilla flava	Greyheaded yellow wagtail
81	Motacilla alba	Grey wagtail
82	Egreta gularis	Indian reef heron
83	Nycticorax nycticorax	Night heron

84	Tadorna ferruginea	Brahminy duck
85	Anas crecca	Common teal
86	Aquila cranga	Greater spotted eagle
87	Pluvialis squatarola	Grey plover
88	Pluvialis dominica	Golden plover
90	Charadrius leschenaultii	Large sandplover
91	Charadrius alexandrianus	Kentish plover
92	Charadrius mongolus	Pamir's lesser sand plover
93	Numenius phaeopus	Whimbrel
94	Numenius arquata	Eastern curlew
95	Tringa totanus	Eastern redshank
96	Tringa stagnatalis	Marsh sandpiper
97	Tringa nebularia	Greenshank
98	Calidris minima	Little stint
99	Calidris testacea	Curlew sandpiper
100	Recurvirostrata avocetta	Avocet
101	Glaroeola lactea	Small Indian pratincole
102	Larus brunnicephalus	Brownheaded gull
103	Larus ridibundus	Blackheaded gull
104	Chlidonias hybridus	Indian whiskered tern
105	Halcyon pileata	Black-capped kingfisher
106	Sturnus roseus	Rosy pastor
107	Anhus novaeseelandiae rufulus	Indian paddyfied pippit
108	Motacilla alba	Indian white wagtail

ANNEXURE -2 : Details of data collected on bivalves and bivalve collectors

Table 1**: Village-wise estimated number of bivalve collecting (BC) households (HH) and number of individuals involved in bivalve harvesting**

Village	No. of HH**	BC HH	% of BC HH	BC men	BC women	Total BC persons
Hiregutti	596	1	0.17	1		1
Bargigazani	14	5	35.71	5		5
Aigalkurve	120	5	4.17	2	6	8
Bargi	359	7	1.95	7	4	11
Paduvani	331	13	3.93	3	11	14
Balale	213*	10	4.69	14		14
Betkuli	316	22	6.96	25		25
Lukkeri	280	32	11.43		34	34
Kodkani	407	29	7.13	25	10	35
Hegde	1311	31	2.36	29	19	48
Kagal	711	33	4.64	44	9	53

Madangeri	279	20	7.17	56		56
Morba	180	34	18.89	81	10	91
Toregazani	38	38	100	69	28	97
Mirjan	630	89	14.13	85	94	179
Torke	261	72	27.59	158	26	184
Gokarn	2,532	98	3.87	205	22	227
Divgi	524	323	61.64	237	203	440
Aghanashini	579	340	58.72	692	133	825
Total	9,681	1,202	12.42	1,738	609	2,347

****http://zpkarwar.kar.nic.in/CensusKumtaVWP.htm**
***http://zpkarwar.kar.nic.in/CensusAnkolaVWP.htm**

Table 2**: Village and season-wise average quantity (Kg. wet weight with shells) of bivalves harvested per/day**

Village	Jun-Oct	% of total harvest	Nov-May	% of total harvest
Hiregutti	105.00	0.09	105.00	0.07
Aigalkurve	300.00	0.25	300.00	0.20
Bargigazani	337.50	0.28	337.50	0.22
Bargi	412.50	0.34	412.50	0.27
Balale	420.00	0.35	420.00	0.28
Lukkeri	431.25	0.36	637.50	0.42
Paduvani	489.00	0.41	588.00	0.39
Betkuli	708.75	0.59	843.75	0.56
Hegde	851.25	0.71	2,062.50	1.37
Kodkani	1,275.00	1.06	2,175.00	1.45
Madangeri	1,680.00	1.40	1,680.00	1.12
Morba	2,497.50	2.08	3,060.00	2.04
Toregazani	2,551.50	2.13	6,014.25	4.01
Kagal	4,890.00	4.08	4,230.00	2.82
Torke	5,782.50	4.82	7,188.00	4.79
Mirjan	5,940.00	4.96	7,320.00	4.88
Gokarn	9,945.63	8.30	11,922.00	7.95
Divgi	23,565.00	19.66	30,465.00	20.31
Aghanashini	57,683.20	48.12	70,270.96	46.84
Total	119,865.58		150,031.96	

Table 3**: Village and season-wise average quantity of bivalves harvested (in kg. wet weight with shells) by men**

Village	QHD: Jun-Oct	BCD in Jun - Oct	Total harvest (kg) - Jun-Oct	QHD: Nov-May	BCD in Nov - May	Total harvest (kg) - Nov-May
Hiregutti	105	44	4,620	105	154	16,170
Bargigazani	338	32	10,800	338	64	21,600
Bargi	263	26	6,825	263	96	25,200
Aigalkurve	165	13	2,145	165	182	30,030
Paduvani	225	100	22,500	225	140	31,500
Balale	420	9	3,780	420	108	45,360
Betkuli	709	9	6,379	844	85	71,719
Hegde	638	13	8,288	1,849	120	221,850
Morba	2,475	8	19,800	3,038	78	236,925
Kodkani	1,125	10	11,250	1,875	132	247,500
Madangeri	1,680	96	161,280	1,680	168	282,240
Kagal	4,620	18	83,160	3,960	80	316,800
Toregazani	2,498	48	119,880	5,951	96	571,320
Mirjan	3,960	40	158,400	4,500	138	621,000
Torke	5,760	45	259,200	7,110	102	725,220
Gokarn	9,430	33	311,190	11,378	78	887,445
Divgi	15,960	10	159,600	21,330	90	1,919,700
Aghanashini	56,689	71	4,024,951	67,278	117	7,871,580
Total	107,058		5,374,047	132,307		14,143,159

BCD – Bivalve collecting days; QHD – Quantity harvested per day

Table 4**: Village and season-wise average quantity of bivalves harvested (in kg. wet weight with shells) by women**

Village	QHD: Jun-Oct	BCD in Jun - Oct	Total harvest (kg) - Jun-Oct	QHD: Nov-May	BCD in Nov - May	Total harvest (kg) - Nov-May
Morba	23	34	765	23	119	2,678
Toregazani	54	30	1,620	63	96	6,048
Torke	23	51	1,148	78	102	7,956
Aigalkurve	135	10	1,350	135	133	17,955
Bargi	150	36	5,400	150	126	18,900
Kagal	270	7	1,890	270	98	26,460
Paduvani	264	10	2,640	363	90	32,670
Hegde	214	12	2,565	214	168	35,910
Kodkani	150	10	1,500	300	126	37,800
Gokarn	516	75	38,672	545	105	57,173
Lukkeri	431	10	4,313	638	102	65,025
Aghanashini	994	49	48,694	2,993	114	341,145
Mirjan	1,980	48	95,040	2,820	161	454,020
Divgi	7,605	11	83,655	9,135	120	1,096,200
Total	12,807		289,251	17,725		2,199,939

BCD – Bivalve collecting days; QHD – Quantity harvested per day

Table 5**: Village, season and gender-wise income per year from bivalve collection**

Village	Men		Women		Total (Rs.)
	June - Oct	Nov - May	June - Oct	Nov - May	
Aghanashini	14,247,842	17,979,543	158,992	704,600	33,090,977
Divgi	568,830	4,428,772	291,182	2,378,217	7,667,001
Mirjan	563,418	1,422,253	328,839	967,109	3,281,619
Gokarn	969,601	1,836,715	135,472	130,651	3,072,439
Torke	795,644	1,427,533	62,813	285,116	2,571,106
Toregazani	431,482	1,333,506	86,293	201,571	2,052,852
Madangeri	588,305	672,031			1,260,336
Kagal	289,145	719,192	6,867	62,622	1,077,826
Kodkani	41,044	589,468	5,036	79,019	714,567
Hegde	29,770	515,903	9,405	86,184	**641,262**
Morba	60,376	425,015	36,535	77,000	598,926
Paduvani	75,219	65,406	9,579	77,161	227,365
Betkuli	21,459	150,423			171,882
Aigalkurve	7,714	69,957	4,950	43,092	125,713
Balale	13,589	105,607			119,196
Lukkeri			11,397	89,487	100,884
Bargi	14,748	22,534	19,365	43,839	100,486
Bargigazani	38,767	50,173			88,940
Hiregutti	16,848	38,485			55,333
Total	18,773,801	31,852,516	1,166,725	5,225,668	57,018,710

Value which is in bold is the median value

Table 6**: Village-wise income (Rs.) per year from shell sale**

Village	BHH	SHH	No. of basket (Shells) sales / family	Rs. / basket	Income (Rs.) / family	Total (Rs.) / village
Hiregutti	1	1	25	10	250	250
Aigalkurve	5	3	28	10	280	840
Kodkani	29	20	11	11	121	2,420
Balale	10	10	28	11	303	3,025
Paduvani	13	7	35	13	438	3,063
Hegde	31	19	16	11	176	3,344
Bargigazani	5	5	50	15	750	3,750
Madangeri	20	20	40	10	400	8,000
Mirjan	89	36	23	11	256	9,207
Torke	72	18	75	9	638	11,475
Gokarn	98	33	41	12	488	16,088
Toregazani	38	19	148	11	1,623	30,828
Kagal	33	26	118	12	1,416	36,816
Morba	34	26	143	12	1,710	44,460
Divgi	323	226	35	14	490	110,740
Aghanashini	340	139	118	12	1,416	196,824
Total	1,141	609			10,752	481,129

BHH – Bivalve collecting households; SHH – Shell selling households

Table 7**: Village-wise income (Rs.) per year from dried meat sale**

Village	BHH	DHH	kg sales / family	Rs. / kg	Expense (Rs.)	Income (Rs.) / family	Total (Rs.) / village
Bargigazani	5	5	2	200		300	1,500
Hiregutti	1	1	18	150		2,625	2,625
Paduvani	13	3	9	250	110	2,140	6,420
Torke	72	13	4	160	20	620	8,060
Aigalkurve	5	3	20	150	135	2,865	8,595
Kagal	33	13	6	175	200	894	11,619
Morba	34	17	8	166	88	1,159	19,709
Balale	10	5	40	100	25	3,975	19,875
Madangeri	20	20	8	175	150	1,163	23,250
Divgi	323	129	2	120	13	183	23,543
Toregazani	38	29	17	150	147	2,353	68,247
Aghanashini	340	170	8	127	175	834	141,696
Total	894	408				19,110	335,138

BHH – Bivalve collecting households; DHH –Dried meat selling households