Loktak

NEWSLETTER

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IN THIS ISSUE

Caring for wetlands : an answer to climate change

Athaphums fishing in Loktak Lake : evolving a management strategy

Management Plan for Loktak Lake : review of implementation

LDA

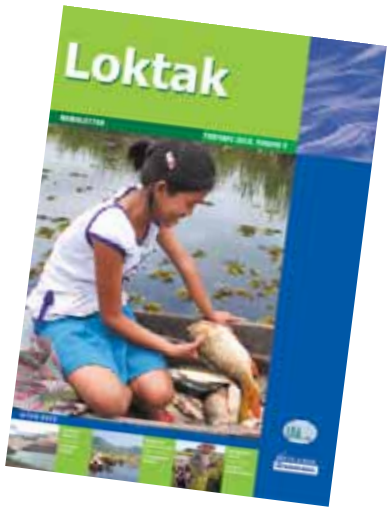
WETLANDS INTERNATIONAL

Loktak Development Authority

LDA is the nodal organization entrusted with management of Loktak Lake. It functions under the aegis of the Department of Forests and Environment, Government of Manipur. The authority draws its powers and functions from the Manipur Loktak Lake (Protection) Act, 2006. The Chief Minister is the Chairman of the Authority and Project Director its Member Secretary. The members of the authority include state ministers, members of legislative assembly, secretaries / heads of concerned state government departments and experts.

Wetlands International – South Asia

WISA is the South Asia Programme of Wetlands International, a global organization dedicated to conservation and wise use of wetlands. Its mission is to sustain and restore wetlands, their resources and biodiversity for future generations. WISA provides scientific and technical support to national governments, wetland authorities, non government organizations, and the private sector for wetland management planning and implementation in South Asia region. It is registered as a non government organization under the Societies Registration Act and steered by eminent conservation planners and wetland experts.



"LOKTAK" is the jointly published newsletter of the Loktak Development Authority and Wetland International - South Asia

CONTENTS

EDITORIAL PANEL

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The views and opinions expressed in "LOKTAK" are not necessarily those of Loktak Development Authority, Wetlands International - South Asia or its members.

The editorial panel welcomes contributions of articles and information

Cover Photograph : A girl rejoicing over bumper fish catch from Loktak Lake (Ng. Sanajaoba Meitei)

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Caring for wetlands : an answer to climate change

Chandratal, a high alititude wetland in Himachal Pradesh

Ritesh Kumar

Wetlands International - South Asia

Second February of each year is World Wetlands Day. It marks the date of signing of the Convention on Wetlands on 2 February 1971 in the Iranian City of Ramsar. This day is an opportunity to undertake actions aimed at enhancing awareness of the values and benefits of wetlands in general and Ramsar Convention in particular. Each year, the World Wetland Day is attached to a theme and a slogan bringing attention to a specific issue pertaining to wetlands. The World Wetland Day slogan for 2010 is: Caring for wetlands – an answer to climate change.

This article highlights the importance of wetlands in addressing climate change and outlines specific measures that could be undertaken to enhance their conservation and wise use in this context.

Source of River Chandra, Himachal Pradesh

Climate change and its impacts

Climate change is unarguably the most intriguing management challenges of our century. Its manifestations range manifolds from decreased food and water security, vulnerability to extreme weather events to unstable economic development. Globally, the assessment reports of Intergovernmental Panel on Climate Change indicate warming of the climate system evidenced from increases in global average air and ocean temperature, widespread melting of snow and ice and rising global average sea levels. There is also increasing evidence that natural systems are being affected by regional climate changes.

Climate change is a matter of concern for India in several ways. Agriculture, which is one of the core sectors of the economy and base for the other development sectors is highly climate sensitive. Various models have been developed and are under further refinement to understand the current implications and future trends in climate change for our country. Increase in annual mean surface temperatures, increase in summer monsoon intensity and changes in frequency and magnitude of extreme temperature and precipitation events have been projected. Some of the key expected impacts include changes in water resources. River systems of the Brahmaputra, Ganges and the Indus, which are fed by snow melt are likely to be affected by decrease in snow cover. A decline in total runoff for all river basins except Narmada and Tapi has been projected by research of Central Water Commission. Crop production is also likely to be affected. Studies by Indian Agricultural Research Institute have indicated decline in rabi crop production. Impacts on human health by altered distribution of major vector species is also projected. Assessments on forests indicate shifts in forest types, with consequent changes in forest produce. Changes in frequency of extreme events as cyclones, floods and droughts will enhance vulnerability of large populations. Sea level rise an increase in intensity of tropical cyclones would enhance the vulnerability of our heavily populated coastline. In terms of stakeholders, the impacts would be far stronger on the poor and marginalized with weak coping and adapting mechanisms.

Wetlands and Climate Change

Wetlands are ecosystems that connect land and water. The ways wetlands are linked to climate change can be understood in two dimensions – firstly, the impact of climate change on wetlands and secondly, the capacity wetlands have to influence climate change.

Direct impacts on wetlands include changes in area and extent & ecological character. Pressures on wetlands are expected to be mediated through changes in hydrology, direct and indirect effects of changes in temperature, as well as land use changes. A review carried by the Scientific and Technical Review Panel of the Ramsar Convention identified impacts on wetlands to include changes in base flows; altered hydrology; extended range and activity of some pests and disease vectors; increased flooding, landslide, avalanche, and mudslide damage; increased soil erosion; decrease in recharge of aquifers resulting from increased runoff; decreased water resources quality and quantity; and increased coastal erosion. Climate change is often expected to act in conjunction with other pressures which would exacerbate impacts on wetlands. For example, increased demand for water can lead to its reduced availability for natural ecosystems as wetlands.

The way wetlands can influence climate change is through their role in adaptation and mitigation. Climate change mitigation actions comprise measures to reduce the emissions of greenhouse gases that cause climate change in the first place. Adaptation refers to measures taken to minimize the adverse impacts of climate change.

One of the major roles of wetlands in adapting to climate change emanates from their hydrological regime regulation service. The principal supply of renewable fresh water for human use comes from an array of inland wetlands. As integral components of hydrological cycle, wetlands are critically important in regulating the quantity, quality and reliability of water as it moves through in its various forms. Their intrinsic hydrological processes buffer against extremes as droughts and floods. Wetlands located at head waters of basins often act as sponges, storing the glacial melt and rainfall and gradually releasing them in the lean seasons. This

contribution is often important in maintaining base flow of the river systems. The downstream wetlands support food security by provision of water for various human uses as agriculture, domestic use and hydropower. The coastal wetlands prevent salinity ingress from the sea. An example of the significance of wetlands in hydrological regulation is demonstrated in the high altitude wetlands of the Himalayan region. The Himalayas, with an ice reserve of 3,735 cu km are the largest body of ice outside the polar caps. The high altitude wetlands, by capturing this glacial melt form the source of 10 large rivers of Asia, basins of which support more than 1.3 billion people, roughly equivalent to one-fifth of global population. Thus, conserving wetlands and their ecosystem services is an important strategy to reduce water stress emanating from changing regimes and extremities.

The ability of wetlands to buffer against extreme events is another important way wetlands contribute to climate change adaptation strategies. Coastal ecosystems as mangroves and coral reefs play an important role in stabilizing coastlines through accretion as well as buffering against cyclones and other natural hazards. An assessment based on analysis of hurricanes in the United States over a period of 20 years indicated the annual value of coastal wetlands for hurricane protection to be US$ 23.2 billion. Similarly, studies along the Orissa coastline have validated that villages with wider mangroves between them and the coast experienced significantly fewer deaths than ones with narrower or no mangroves. The opportunity cost of saving a life by retaining mangroves was assessed to be Rs. 11.7 million per life saved.

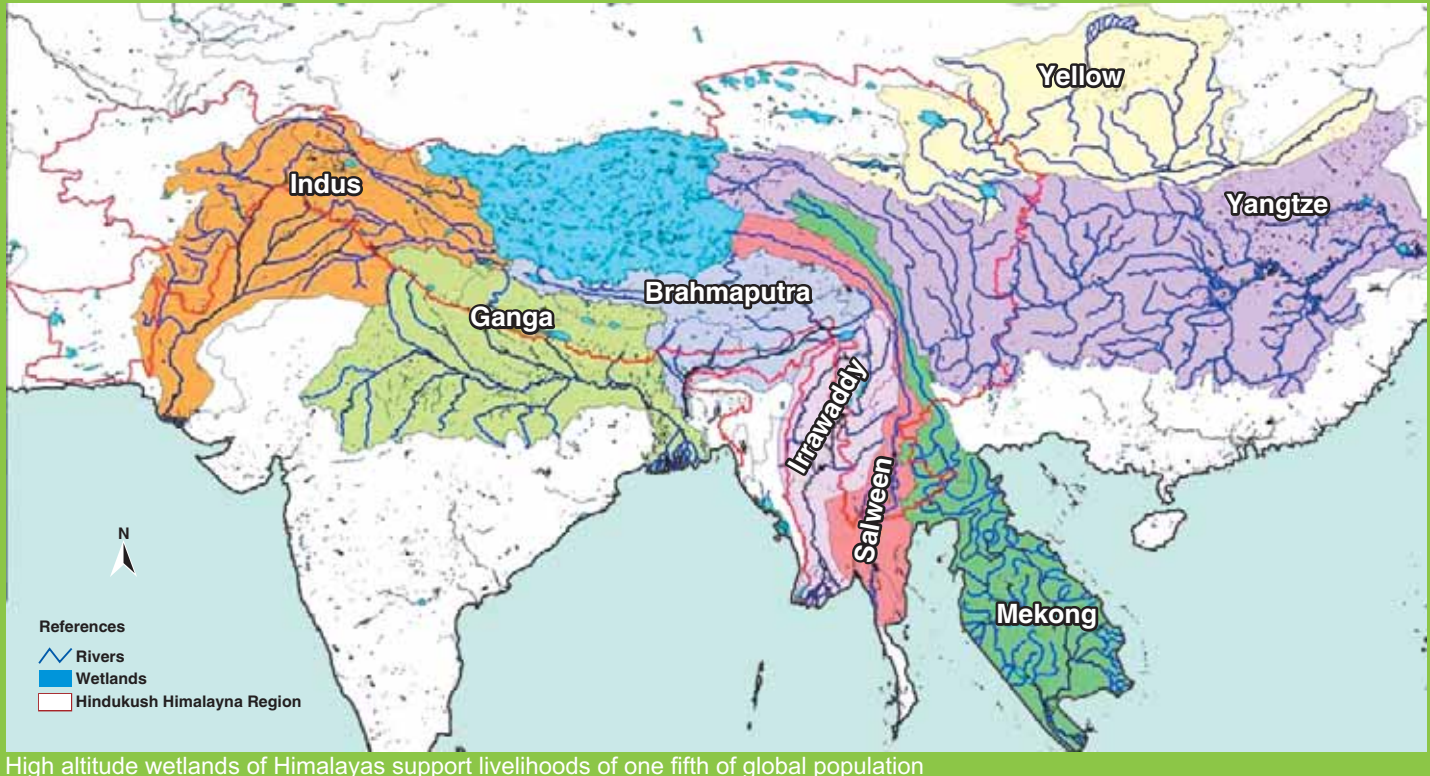
The role of wetlands in provision of products as water, fish, fiber, medicines etc. make them important components in ensuring food and water security. The fact that in several circumstances, the poor communities derive their sustenance from wetland resources, make these ecosystems vital component of enhancing resilience of these communities.

The role of wetlands in climate change mitigation stems from their role on global carbon cycle, especially in sequestering and releasing fixed carbon in the biosphere. Anaerobic conditions in inundated wetland soils and slow decomposition rates contribute to long term soil carbon storage and formation of carbon rich peatlands. Though covering only an estimated 3-4% of the world's land area, peatlands hold 540 giga-tones of carbon equivalent to 1.5% of the total estimated global carbon storage and about 25 – 30% of that contained in terrestrial vegetation and soils. Their drainage and degradation results in substantial emission of carbon di oxide. A global assessment carried by Wetlands International on the peatland status and drainage related emissions indicate an over 20% increase (in carbon-di-oxide emissions) during 1990 – 2008.

The other range of impacts on wetlands can emerge from ill-informed adaptation and mitigation strategies. For example, efforts to provide sustained water supplies through creation of additional engineering infrastructure could negatively impact wetlands which depend on connectivity with riverine systems. Conversion of wetlands to bring in more areas under food production is another example, as wetlands are often considered to be marginal lands.

Status and trends of wetland ecosystem services

Despite playing an immense role in sustaining human well-being, wetlands and their ecosystem



High altitude wetlands of Himalayas support livelihoods of one fifth of global population

Mangroves, as in Peechavaram (Tamil Nadu), are our natural coastal defence

services are in decline globally. The Millennium Ecosystem Assessment published a special synthesis on water and wetlands providing conclusive evidence of wetlands being one of the most rapidly degrading ecosystems of the earth. While highlighting that data on all wetland types were still not available, their global extent was assessed to be 1.28 million hectares (as an underestimate). The report suggested that more than 50% of the specific types of wetlands in parts of North America, Europe, Australia and New Zealand were converted for alternate uses in the twentieth century. Similarly, about 35% of the mangroves representing 54% of the total mangrove area were lost in the last two decades. One fifth of coral reefs were lost and further 20% degraded in the last several decades. Equally significant is the stress on wetland species. The list of threatened wetland species, based on data from compiled by the Ramsar Convention (using the IUCN Red List and databases of Wetlands International and Birdlife International) include 17% of known species of waterbirds, 38% of wetland dependant mammals, 33% of freshwater fish, 26% of freshwater amphibians, 72% of (90 species of) freshwater turtles and 27% of coral building species.

The overall extent of wetlands in India, based on assessment by Space Application Center in 1992-93, is indicated to be 7.58 million hectare of which freshwater wetlands account for 3.56 million hectare. The mapping however excludes wetlands below 56 ha. Though specific details are not available on change in area and extent, there are several site level evidences that indicate wetlands are under tremendous stress. For example, 70% of area under marshes associated with Wular Lake was converted for agriculture and settlements between 1911 – 2007. Till the seventies, more than one third of wetlands on the periphery of East Kolkata Wetlands were converted for settlements. Within Manipur River Basin, Lamphelpat and Porompat, once large wetlands, have been reduced to remnants Imphal city.

Drivers and Pressures

Globally, the primary direct drivers of wetland loss include infrastructure development, land conversion, water withdrawals, pollution, over harvesting and overexploitation, and introduction of invasive alien species. The primary indirect drivers have been identified as population growth and increasing economic development.

Within the country, the major direct drivers of wetland degradation include changes in hydrological regimes, conversions and encroachments primarily for agriculture and settlements, pollution, over exploitation, and introduction of invasive species. Water management has conventionally been driven by structural approaches without considering the impacts on natural ecosystems as wetlands. Construction of hydraulic structures as dams, reservoirs and embankments have led to fragmentation of wetland regimes and altered their hydrology. Invasive species as water hyacinth and salvinia have profusely spread and are choking several wetlands. Sedimentation resulting from degradation of catchments has affected water holding capacity of wetlands. Wetlands are also often used to discharge untreated sewage and sewerage from adjoining settlements and industrial units. Absence of concrete data on wetland extent, processes and functions and ecosystem services prevent informed decision making. This is further complicated by multiplicity of institutional regimes managing wetlands or components thereof.

Integrating wetlands into climate change policies and strategies

Our national climate change policies and strategies have increasingly focused on reducing emission of greenhouse gases, mainly through cleaner energy strategies, and accompanying investment into infrastructure development to create water and energy security. While these measures are necessary, there is also an opportunity to complement these processes by enhancing emphasis on our natural capital and investment into ecosystem based approaches to mitigation and adaptation, through improved conservation and sustainable management of natural habitats and resources, including wetlands. In terms of adaptation, these include a range of local and landscape scale strategies for managing ecosystems to increase resilience and maintaining essential ecosystem services and reduce vulnerability of people, their livelihoods and nature in the face of climate change.

Floodplain wetlands, as of River Yamuna, recharge ground water and support biodiversity

A key direction in supporting integration of wetlands and climate change is provided in the Resolution X.24 on Climate Change and Wetlands adopted at the 10th meeting of the Contracting Parties to the Ramsar Convention held in 2008 at Changwon, South Korea. Specific recommendations to the Contracting Parties, including the Government of India, include the following:

- Wise management of wetlands to reduce multiple pressures they face and thereby increase their resilience to climate change , and to take advantage of significant opportunities to use wetlands wisely as a response option to reduce the impacts of climate change
- Ensure that necessary safeguards and mechanisms are in place to maintain ecological character of wetlands, particularly with respect to water allocation for wetland ecosystems
- Promote restoration of wetlands as an important aspect of policy related to climate change.
- Promote integrated coordination in developing and implementing national policies related to water management, agriculture, energy production, and human health in order to ensure that sectoral objectives are mutually supportive in addressing the likely negative impacts of climate change.
- Pay attention to the potential of incentive measures and funding mechanisms under climate change adaptation and mitigation activities to support sustainable use and restoration of wetlands as well as to support local livelihoods and contribute to poverty eradication

A key response strategy would, therefore, be to promote implementation of these recommendations.

Integrated management of wetlands is one of crucial steps towards their conservation and wise use. The Ministry of Environment and Forest (MoEF) has identified conservation and sustainable use of wetlands as one of the key areas under natural resources management. Under the National Wetland Programme of the MoEF, 115 wetlands (including 25 Wetlands of International Importance under Ramsar Convention) have been identified for priority management actions. Similarly 40 lakes and 38

Fish storage tanks on the periphery of Wular Lake

Wetlands, as Chilika harbour rich biodiversity.

mangroves and coral reefs areas have been identified for priority conservation under the National Lakes Conservation Plan and National Programme on Mangroves and Coral Reefs. Emphasis is given on development and implementation of coordinated action plans which integrate hydrological, ecological, socioeconomic and institutional aspects. Needless to say, the ambit of the national programmes should be widened to cover more wetlands, including financial support implementation of management plans. Consideration to climate impacts would need to be integrated into prioritization of wetlands. It is equally important to create indicators for successful wetland management and link them to other indicators currently being used to target climate change related actions.

There is also an urgent need to promote integration of wetlands within water resources management. With increasing water stress due to climate change, an enhanced emphasis is expected on regulating natural regimes to ensure its sustained provision for human uses. It is important that the needs of wetlands are integrated and effectively addressed in design and implementation of allocation strategies. The integration of wetlands into water management should also not be limited merely to ensuring water allocation, but should also consider the contributions these ecosystem services to different water management objectives. For example, flood management could also be addressed by restoration of floodplain wetlands. Such complementarities would promote use of wetlands as natural infrastructure in water resources planning and management.

A critical component of wetland management entails addressing inter as well intra generational tradeoffs. Private benefits from wetland conversion are often encouraged by subsidies or under accounting of environmental damages. In several situations, benefits from wetland conversion are private in nature, whereas the damages in terms of regulating or cultural services are societal. Thus, individuals do not have incentives to maintain the services

in the interest of the wider society. There is a need to promote incentives for local stewardship of wetlands, as much of the potential for achieving their conservation and wise use lies with the local stakeholders, particularly communities. This could in the form of community based ecotourism, payment for environmental services by downstream communities etc.

Increasing the coverage and scope of wetland conservation would also need to be supported by commensurate number of trained wetland managers to effectively implement the integrated programmes. Review of the management plans submitted by various state government agencies indicate that the requisite integration and professionalism is yet to be achieved. The main reason for this is the lack of capacity within the agencies involved in wetland management to design and deliver cross sectoral and multi-scalar programme for conservation and wise use of these ecosystems. This not only weakens the efforts made by the national government, but poses serious limitation to address wetland conservation in the face of increasing anthropogenic and non-anthropogenic pressures as climate change.

Strengthening institutional regimes is equally important for achieving wetland conservation and wise use. The current institutional arrangements for wetland management in the county include committees within the Ministry of Environment and Forests to guide national policy and state level steering committees to guide state level actions. For several wetlands, dedicated management authorities have also been constituted. However, not all wetland management authorities have been effective, and for several states, steering committees are yet to play a proactive role. Similarly, the policy and regulatory framework for wetlands also need to be augmented. A draft regulatory framework for wetlands is presently under consideration, which aims to provide a distinct categorization to wetlands based on area and usage of resources and recommends appropriate regulations thereof.

The role of interdisciplinary research is critical in supporting integration of wetlands in climate change policies and strategies. Much of the research on wetlands within the country is focused on biological and physic-chemical aspects, with little attention being paid to ecosystem services. The linkages between wetland conditions, provision of ecosystem services and consequences for human well being needs to be better elucidated and communicated through policy oriented assessments. Similarly, wetlands have received almost no emphasis in climate related modelling. Research that can establish the costs and benefits of nature based adaptation as compared to hard engineering options could be important in getting the buy-in of decision makers in enhancing investment into wetlands.

A panoramic view of Loktak Lake

Athaphum fishing in Loktak Lake: evolving a management strategy

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Rampant *athaphum* fishing in Loktak has contributed to increase in provisioning services from the lake whereas undermining its regulating, cultural and supporting services. The ecological and socioeconomic assessments clearly indicate that continuing this practice in its current state and form is highly unsustainable, and would need to be completely abolished from the lake. However, the challenge lies in the manner this shift is enabled by the lake management as well the communities.

Fish from *athaphum* being collected by women traders *(unjha)*

Introduction

The first sight that strikes to an onlooker in Loktak is that of circles of vegetation which dot entire water spread. This fishing technique, locally called *athaphum,* has evolved over ages, but in its current form and state presents a great challenge to lake management, particularly due to its role in promoting *phumdi* proliferation. Addressing the issue of *athaphum,* however, needs an understanding of the nestedness of the ecological and social aspects of genesis, transformations and factors contributing to its rapid spread.

Considering the centrality of *athaphum* management in lake conservation and wise use, the current article attempts to provide an insight into the overall issue outlining its current status, trends and transformations over a period of time, lessons learnt from previous management and management strategy. The article is based on field assessments, sample surveys, consultations and interpretation of remote sensing data.

Athaphum fishing in Loktak Lake

Athaphum is formed of two words from Manipuri language – *'thaba'* meaning laying out and *'phum'* referring to composite mass of floating vegetation, soil and debri found in Loktak and associated wetlands. *Athaphum* is a fishing technique using enclosures of strips of *phumdi* arranged in a circular formation. The preparation phase, called *phum thaba,* involves creation of a circular enclosure (with a circumference of 200-250 m) using long strips of cut *phumdi* (2 – 3 m wide and 0.5 – 1.0 m thick). Usually *phumdi* of higher buoyancy (thickness less than 1meter having lesser soil and plant debris but richer vegetation) are preferred. These strips, if short, are pinned together using bamboo pegs and anchored to the lake bed. Thin *phumdi* (known as *haarei* in Manipuri) and other plants (as *Echinochloa stagnina, Capillipedium sp., P. Hydropiper, Eichhornia sp., Salvinia sp.* etc.) are put within the enclosure to attract fish.

The harvest phase is called *phum namba* and involves a team of about 10-15 fishers working for 1-2 days. The enclosure is surrounded by nets of fine mesh sizes locally called *hapa*, which touches the lake bed and does not allow fish to escape. The floating and as well as submerged vegetation from the enclosure are cleared and thrown out. The fishes are caught using dragnets. Harvest is done in any time of the year and is mainly based on availability of fish inside the enclosure. The frequency ranges from once every fortnight to even three months. Stock assessments carried during 1999 – 2003 indicated the annual fish production from *athaphum* to be nearly 40% (~ 560 MT) of the total lake fish yield. As per surveys conducted during 2007-08, more than 5,000 fisher households base their livelihoods on this form of fishing.

Status and trends

Fishing using *phumdi* is an age old practice in Loktak Lake. Though written accounts are sparse, Dr. S.L. Hora, a renowned zoologist presents a vivid description of this technique in an article published in 1921 in the Records of Indian Museum. He highlighted that fishing using *phumdi* enclosures was limited to winter months with only certain parts of the lake being brought to use for this purpose. The harvest was done by muddling the enclosure using bamboos or even buffaloes which deoxygenated the water

Women returns home with a boatful of fish after *athaphum* harvest

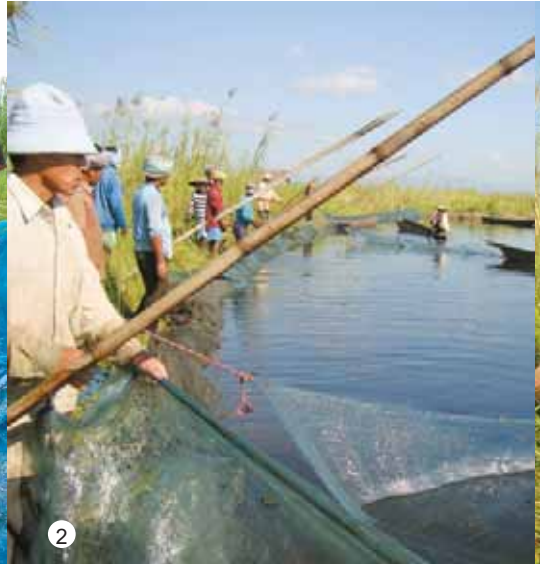
due to high suspended silt and organic matter. Fishes therefore came to the surface and could be easily caught using dip and scoop nets. The practice has undergone several transformations since then, most noticeably during the last two decades.

Assessment of extent and number of *athaphum* is quite challenging as during any given year, it changes on account of several factors, most importantly movement of large masses of *phumdi* due to wind action and voluntary shifting in search of better fish catch. An analysis of remote sensing data for various years, however, clearly indicates an increasing trend both in their number as well as area (Fig.1). However it is stressed that the images can at best represent the minimum numbers only.

Though *athaphum* presently dot the entire open water surface, community consultations reveal a distinct spatial trend. With operationalization of Ithai Barrage in 1984, the natural regimes of Loktak were regulated and large areas were brought under permanent inundation. This facilitated spread of *athaphum* to the entire central part of the lake. Changes in seasonal variations of water levels have also impacted seasonality of this practice. With barrage in place, the lake levels remained relatively stable and thereby *athaphum* fishing could be practised throughout the year. The only major risk posed now is destruction or damage to the enclosure by large moving chunks of *phumdi.*

Changes have also emerged in group dynamics related to *athaphum* fishing. Till the sixties, *athaphum* fishing was a group phenomenon. *Phumlups* comprising 10-12 persons were formed which would annually construct about 6-12 *athaphum*. Harvesting was done sequentially till the entire set was exhausted. The investments as well as earnings were distributed evenly within the entire group. However, there is only individual ownership these days. Labour is still shared under an informal mutual agreement, wherein a person receiving labour for operation under his *athaphum* returns the favour by providing free labour on equal terms. The owner of the *athaphum* retains the proceeds. An informal jurisdiction over the lake area has also emerged. Individuals exercise rights over areas which have been continuously used for laying the enclosures, and others are allowed only after mutual consent. Theft of fish is unheard-off, however instances of removing ropes do happen at times, mostly during laying of nets by other fishers.

Several technological changes have also taken place in the way *athaphum* are constructed and fished. Conventionally, till the sixties, at the time of fishing, a ring of bamboo supported vegetation was created around the enclosure. Construction of this ring *(phumchak hanba*) was very tedious and required high manual effort. Later, thick clothes *(damboor)* were introduced to hold this ring, and subsequently improvised in the 60-70s to thick loin clothes dipped in a


Harvesting fish in *athaphums*

mixture of kerosene and coal tar. As nets became available after the eighties, they became the main material for constructing enclosures, and remain so even today. Anchoring of cut strip of *phumdi* was initially done using bamboos. Thereafter, stones tied to jute ropes were introduced, and were subsequently replaced by nylon ropes and wooden pegs driven deep into the lake bed using galvanized iron pipes. In the late eighties, fishers resorted to use of chemical pesticides within the enclosures for fishing, leading to rapid degradation of water quality and impacting overall ecosystem processes and functions. It is interesting to note that this practise was abandoned soon after due to community driven initiatives and a self-imposed ban on use of chemical pesticides. The sizes of the *athaphum* have also increased dramatically with advancement in technology. The circumference which used to average 100 m in the 60s has more than doubled to 200 – 250 m in the present times.

Communities also indicate changes in fish catches from *athaphum* which is linked to changes in fish diversity that has taken place in the entire ecosystem. Minor carps like *Labeo angara, L.bata, L.dero* and *Oestobrama belangiri* which used to migrate from Chindwin-Irrawaddy River system to upstream of Manipur River for breeding purposes are no longer caught as their migration has been disrupted by hydraulic structures. Additionally, while the frequency of harvest from a single *athaphum* has increased nearly 10 times since 60s, the overall income sufficiency has declined. A typical single harvest in the fifties fetched Rs. 300 (which translates to nearly Rs. 1.5 lakh at present at an average discount rate of 14% based on price of fish) received in 10 instalments over the entire year as the group shared its revenue. This earning alone was sufficient to meet the livelihood expenses. Presently, the earnings average Rs. 4,900 per harvest and at 10 harvests in a year is insufficient to meet the full range of household needs. A section of fishers have resorted to owning multiple *athaphums* so that a regular and sufficient incomes can be sourced from this practice alone.

Implications for Lake Management

The current spread of *athaphum* within the lake poses several management issues from ecological, hydrological, socioeconomic and institutional perspectives. First and foremost concern is its contribution to proliferation of *phumdi.* The enclosure construction process involves fragmentation of *phumdi* masses and spread in all parts of the lake. Within the enclosures, fishers generally use fast growing aquatic plant species to attract fish. These plant species are subsequently thrown out into open spaces, providing a means for further proliferation of *phumdi.* The process also involves clearing of submerged vegetation from the enclosure, which is left to rot and decay within the lake waters. Assessments carried based on analysis of satellite imageries indicate strong positive correlation between increase in number of *athaphum* and area under *phumdi* in central sector (Fig 2). However, it is also understood that the causality between the two

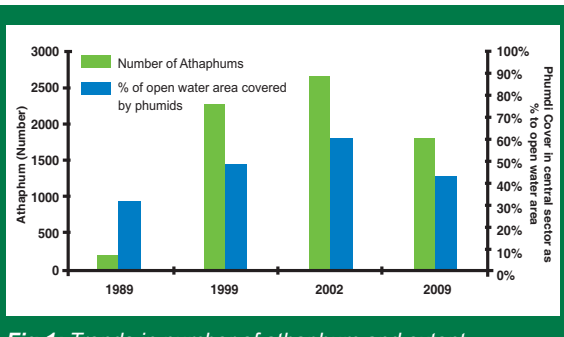


Fig 1: *Trends in number of athaphum and extent of phumdi proliferation*

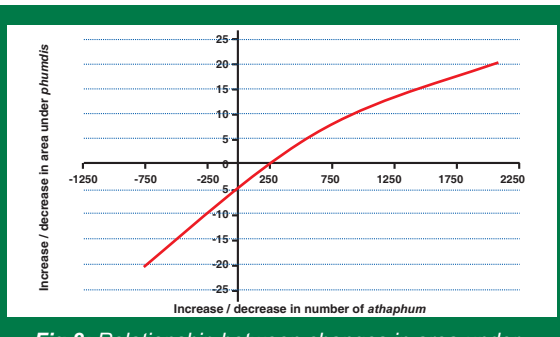
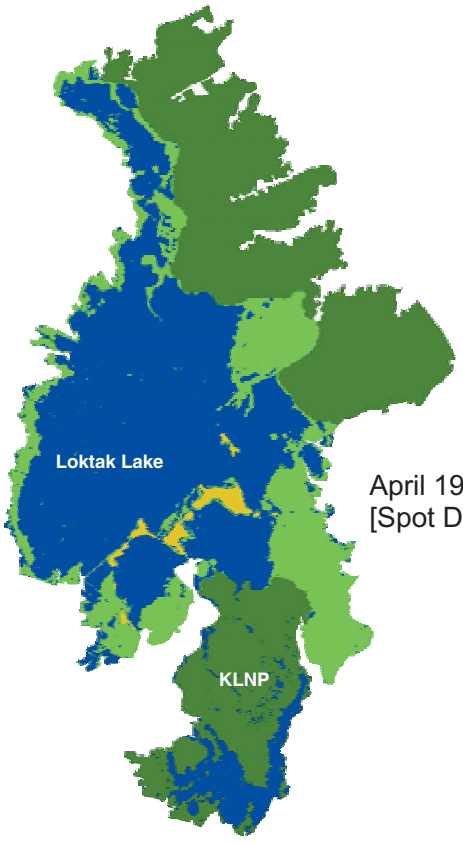


Fig 2: *Relationship between changes in area under phumdi and number of athaphum*



April 1989
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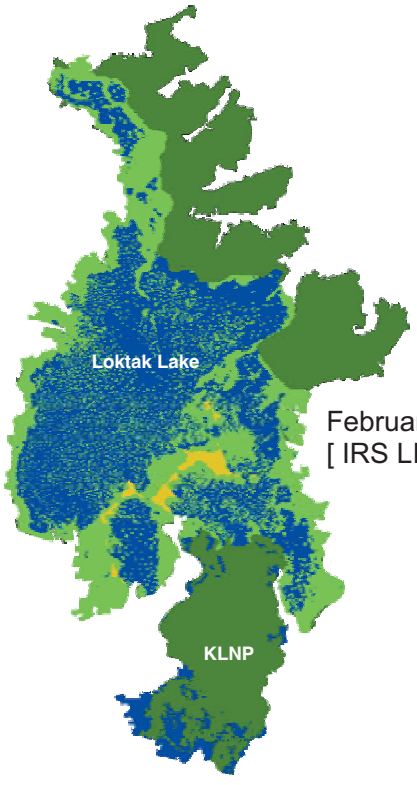

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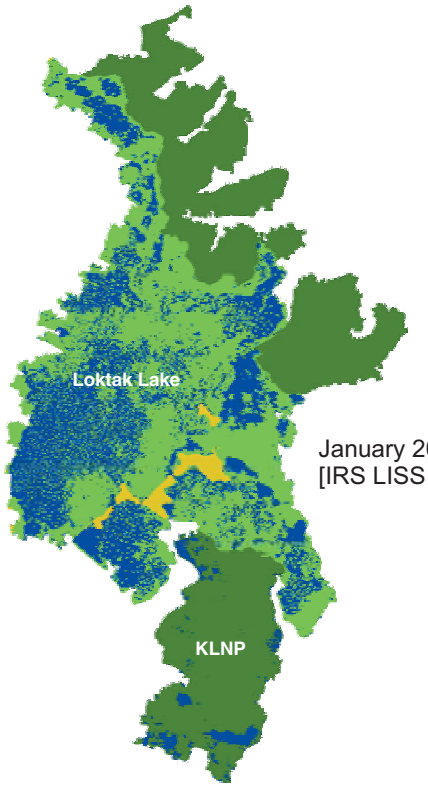

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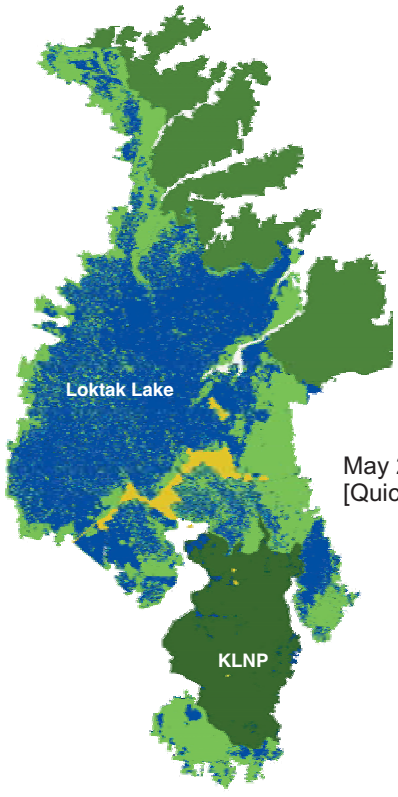


May 2009
[Quick bird]

Classified satellite imageries of Loktak Lake. In 1989, the central portion of lake is almost clear, but by 2002 is choked with *phum* enclosures. The status has improved somewhat in May 2009 due to *phumdi* removal interventions

phenomena is influenced by several other factors, most importantly being changes in hydrological regimes and nutrient enrichment through the peripheral settlements.

	Before harvesting (31 October 2009)	After harvesting (1 November 2009)
Dissolved Oxygen (mg/l)	10.06	6.04
pH	6.5	5.2
Free CO2 (mg/l)	22	26.4
Transparency (m)	2.42	1 27

Spread of *phumdi* on lake surface creates anoxic conditions which impacts habitat, particularly of fish (Table 1). Frequent interference in their breeding and spawning grounds due to *athaphum* operation is also a major concern, and would need to be addressed for rejuvenation of lake fisheries. The impact on fisheries created due to *athaphum* proliferation itself poses questions on overall sustainability and economic viability of this practice.

From a hydrological perspective, *athaphum* proliferation leads to fragmentation of water regimes and creates stagnant conditions in an otherwise dynamic system. Spread of *phumdi* in the central sector is also likely to exert stress on circulation and mixing patterns, and associated ecological processes.

Socially, expansion of area under *athaphum* is impinging on the open water surface available for other forms of capture fishing techniques. Movement within the lake is also hampered, which affects large number of households living in and around the lake. Decline in water quality induced due to *phumdi* proliferation have also impacted its availability for domestic use. The opportunities for improvement in water transport have also been severely constrained. Decline in overall aesthetics of the lake also impact development of wetland based ecotourism, which could be an important livelihood and economic development alternative balancing conservation values. Creation of new informal rights and jurisdictions within lake waters, and vested interests are institutional challenges that have emerged due to this practice.

Assessment of costs and benefits marks a further question on the efficiency of this practise. The private benefits from *athaphum* fishing at the current market rates are estimated to be Rs. 4.6 crore per annum. However, the cost of restoring *phumdi* proliferation even to 1989 levels using the current estimates are nearly Rs. 65 crores per annum (based on the assumption that it would take three years to remove *phumdi*). This does not include other forms of ecological and socioeconomic impacts. The fact that the benefits are accrued privately and the costs socially question the equity and distributional aspects of cost-benefit sharing.

Factors contributing to rapid increase in *athaphum* fishing

The overall dependence on Loktak Lake resources for livelihoods has increased over a period of time. This can be attributed both to natural reasons as population increase as well as to induced shifts generated due to hydropower project. Naturally, livelihood strategies have also evolved to seek regular and higher incomes in the face of increased competition over limited resources, limited options for diversification and poverty. This is perhaps the most significant factor that has promoted increased adoption of *athaphum* fishing as a means of livelihoods, particularly since the 90s.

Athaphum fishing provides a high probability of having a regular income stream, with added benefit of bumper harvests. This difference becomes very significant when compared to other forms of fishing which often have lower returns. The second factor lies in its ease of specialization. Most of the forms of fishing practised in the lake require a degree of specialized skills for operation of the crafts and gears, for example use of multipronged spears, nets or traps. *Athaphum* fishing on the other hand does not demand high levels of specialized skills but is albeit more labour intensive. Technological changes, like introduction of nylon nets and ropes have made *athaphum* construction more durable and less input intensive. From an institutional perspective, proliferation of *athaphum* can be attributed to decline in collective ownership, absence of knowledgebase on impacts, and need for stronger lake regulatory regimes.

A scene from Manungpat area of Loktak which has densely laid *athaphum.*

Lesson learnt from past efforts

Athaphum management as an issue is reflective of dynamism and complexities related with wetland management. As a matter of fact, the rationale developed for formulation of *phumdi* management components within the management plans formulated by Water and Power Consultancy Services (WAPCOS) in 1993 and Loktak Development Authority in 1996 hardly referred to *athaphum* as a significant causative factor. The India –Canada Environment Facility (ICEF) and Ministry of Environment and Forests (MoEF) supported Sustainable Development and Water Resources Management of Loktak (SDWRML) Project implemented during 1997-2003 for the first time identified the role of *athaphum* in proliferating *phumdi*, and thereby focused on creating a baseline on the status of this fishing technique. Extensive community consultations carried out within the lake villages, which culminated into a stakeholder workshop held in Imphal in 2002 provided a specific recommendation for removal of *athaphum* while providing suitable livelihood alternatives. The Management Action Plan for Loktak and associated wetlands formulated in 2005 for the first time outlined an investment strategy for managing *athaphum.*

During 2006-08, Loktak Development Authority (LDA) attempted to address the issue of *athaphum* proliferation by seeking their complete removal from the lake and in return compensating the owners through an economic package in the form of funds to purchase boats and nets. This was based on the presumption that an increased awareness of negative consequences of *athaphum* proliferation would induce the owners to abandon this practice and shift to other forms of fishing. A full-fledged livelihood programme, as envisaged in the action plan was also intended to be implemented as a follow up measure. However, the effort was challenged by the issues related to activity sequencing, complete readiness to immediately forego the practice, and a clear vision of alternative livelihood options. In certain circumstances, compensation also acted as perverse incentives triggering proliferation rather than acting as a deterrent. Concerns were also raised on the amount of the compensation provided.

The Government of Manipur notified the Manipur Loktak Lake (Protection) Act, 2006 paving way for reorganization of LDA and bringing in legislative basis for lake management. The Act defines the boundaries of the lake delineating a core and buffer zone. The core zone includes the central part the lake wherein the Act prohibits any discharge of any sewage or domestic waste, *athaphum* fishing, building huts and use of fish feed or pesticide. Thus, by sheer notification of the act, all *athaphum* fishing is illegal and prohibited. However, specific disincentives and penal actions to deter future spread of detrimental activities, including *athaphum* need to be strengthened.

Based on these experiences, key lessons that emerge are the urgent need to dovetail need and capability based livelihood interventions and enhancing community stewardship in lake management. Management plan implementation is rendered vulnerable and susceptible to recurrence of *athaphum* fishing in case the livelihood interventions are not appropriately targeted, and behavioural and attitudinal changes do not take place within various stakeholders, particularly *athaphum* fishers.

Management strategy

The transformation in resource use to gain more sustained livelihoods security is common to human evolution. In fact, such transitions have been noticed in several wetlands around the world, wherein traditional and sustainable techniques undergo gradual change into extensive and then intensive forms, both due to natural as well as induced factors. However, such changes often undermine the full range of ecosystem services, and might enhance certain provisioning services at the cost of other regulating, cultural and supporting services. The management challenge therefore lies in rebalancing these services while creating

Fisher removes submerged vegetation from *athaphum*

sustained livelihood opportunities for dependent communities. There are ample evidences within the country which demonstrate the consequences of lack of timely action in addressing such changes, which not only impinge on overall ecosystem health but also create social conflicts.

The ecological and socioeconomic assessments clearly indicate that continuing *athaphum* fishing in its current state and form is highly unsustainable, and therefore would need to be completely abolished from the lake. However, the challenge lies in the manner this shift is enabled by the lake management as well the communities.

The management plan for Loktak and associated wetlands envisages to address *athaphum* management using an adaptive strategy which operates at three levels. First and foremost, the implications of *athaphum* proliferation for the lake ecosystem in general and livelihoods in particular is being communicated strongly. This is important to bring in attitudinal and behavioural change, and is supported by communication, education, participation and awareness programmes. Secondly, need and capability based alternate livelihood options are being identified. Attempts are being made that the support process does not involve merely doling out grants but ensuring proper handholding in the form of training, financial support and creating market linkages. Fisher societies, *marups*, self help groups, youth clubs and other community based organizations are being integrated in design and implementation of livelihood programmes. Convergence is also being maximized between various developmental schemes of the state and central government to ensure maximum leverage towards supporting livelihood transition for *athaphum* fishers. Effective enforcement of the regulatory regimes is also being ensured to deter communities from creating *athaphum* in the lake. In the long run, stewardship of the stakeholders in lake management is critical to achieving conservation and wise use of Loktak Lake and its resources.

Management Plan for Loktak Lake

Progress of Short Term Action Plan Implementation 2009

Restoration of Loktak Lake is guided by a Management Action Plan (MAP) which aims at conservation and sustainable utilization of Loktak and associated wetlands integrating Manipur River Basin for ecological security and livelihood improvement of local communities. The plan, approved in 2007, envisages investment into five year action plans for catchment conservation, water management, biodiversity conservation, sustainable resource development and livelihood improvement and institutional development. Plan implementation was initiated in 2007 through financial support of Planning Commission, Government of India. Subsequently, based on a review in 2008, the overall action plan was prioritized into a Short Term and a Long Term Action Plan. The Short Term Action Plan (STAP) includes priority actions for lake restoration of Loktak Lake, whereas the long term plan addresses the entire wetland regime. The present section provides a brief overview of activities implemented during 2009.

Project Inception Workshop

A project inception workshop was organized on July 2-3, 2009 at Imphal, Manipur with an objective of introducing the project to implementing line departments of the state government. The workshop was attended by 43 participants from Loktak Development Authority; National Hydroelectric Power Corporation (NHPC); and state government departments of forests, fisheries, rural development agriculture, horticulture, veterinary and animal husbandry

Chief Secretary, Mr. D. S. Poonia, speaking at the inception workshop

and public health engineering. The workshop entailed detailed discussions on various work components and strategies for synergizing implementation in order to achieve integrated management of Loktak Lake.

Phumdi Management

STAP has placed highest priority on *phumdi* management to achieve ecological restoration of Loktak Lake. A target of addressing 39.7 sq km *phumdi* within central sector of the lake has been identified through removal and restoration. K Pro Infra Works Pvt. Limited, a New Delhi based firm has been selected through competitive bidding to undertake the task of removal of *phumdis* and transportation to

Senior Adviser (Planning Commission), Mrs. Jayati Chandra reviewing project implementation at Loktak

Machinery at work for improvement of drainage system

Kokadan Khullen villagers engage in plantation works

identified locations. The work was formally launched by the Chief Minister of Manipur, Shri O.Ibobi Singh at a public function held on 6 January 2010 at Sendra. The work is expected to be completed within a time frame of two years and three months, and will be closely supervised and monitored by LDA.

Water Management

Improvement of drainage system

Siltation and drainage congestion of the inlet and outlet channels interferes with the natural hydrological regime of the lake and also creates extensive waterlogging conditions in lake periphery and upstream areas resulting in damages to houses and agricultural fields. LDA undertook improvement of 10 inlet streams in the western and northern periphery of the lake. This has resulted in significant reduction in waterlogging in these areas.

Total Sanitation Campaign

Loktak waters contain very high level of fecal coliforms which are a hazard to human as well as ecosystem health. This is primarily attributed to lack of adequate sanitation facilities in the peripheral and island villages of the lake. The STAP aims to achieve 100% sanitation coverage within these villages by dovetailing plan implementation with the Total Sanitation Campaign being implemented by the Public Health Engineering Department of the state government. Identification of 3,380 beneficiary households within the first phase has been completed. The programme is also focusing on building local capacities and awareness for safe sanitation by partnering with local organizations through the Community Capacity Development Unit (CCDU) of the Campaign.

Water allocation

Balancing allocation of water for human purposes with ecological needs of Loktak is critical to lake restoration. Wetlands International – South Asia has initiated formulation of a water allocation plan to minimize tradeoffs and maximizing ecological and socioeconomic benefits. An initial assessment of basin level water availability based on rainfall-runoff modelling has been undertaken along with projecting upstream water requirements. Based on the models, various allocation scenarios would be generated, which would be evaluated based on stakeholders and particular community consultations and ecological and socioeconomic assessments.

Catchment Conservation

Reducing silt load from degraded catchments is

Chief Minister Mr. O. Ibobi Singh inaugurating *phumdi* removal programme in Loktak

Release of fish seed in Loktak Lake

A fish seed releasing programme

one of the major programmes of action under the STAP. During 2009, the state forest department undertook afforestation in 3,565 ha. and maintenance of 2,984 ha. of 1 year old plantations within the direct catchments of Loktak Lake. Aided regeneration in 3,947 ha. was also carried in degraded forest lands. LDA has also initiated planning for convergence of activities within the ongoing programmes of Forest Department and Horticulture and Soil Conservation Department for management of shifting cultivation within Manipur River Basin.

Sustainable Resource Development and Livelihood Improvement

Operationalization of fish hatcheries
State Fisheries Department has taken up operationalization of 8 community-owned hatcheries in the lakeshore areas to enhance availability of fish seeds for supporting culture and capture fisheries. The department is reorganizing the Hatchery Management Committees to ensure efficient operations and equitable sharing of usufruct.

Lake restocking
The State Department of Fisheries released 6 lakh fingerlings within the Loktak Lake to replenish fish stocks.

Communication, Education, Participation and Awareness

LDA continued its efforts towards raising awareness amongst communities on values and functions of Loktak Lake and its interrelationship with overall environment. World Environment Day was celebrated around several parts of the lake on 5 June 2009 during which activities highlighting the need for conserving environment were undertaken. Boat rallies, workshops, boat races (hiyang tannaba) and other cultural events were organized to mark the occasion.

Loktak Day was celebrated on 4 October 2009 to promote conservation and wise use of the lake. Community events were organized at Thanga and Komlakhong on this eve.

LDA also organized a three day nature camp at Thanga Khunjem involving school children to create awareness of the general environment. Students were exposed to basic scientific experiments and means of exploring nature by local experts.

Monitoring and Evaluation

Monitoring and Evaluation Plan
Central to success of STAP is an integrated

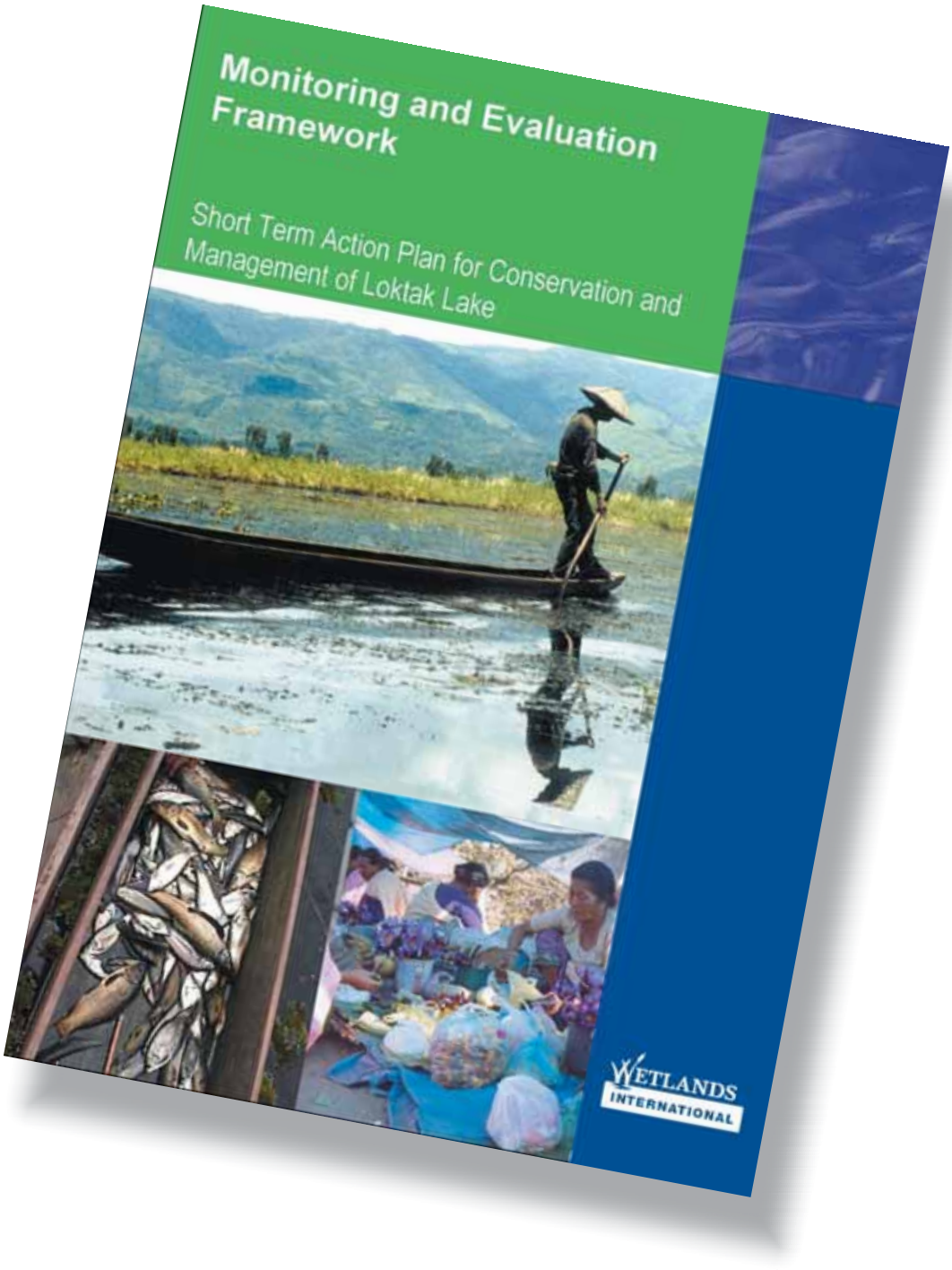
A boat rally celebrating World Environment Day 2009

A nature camp involving school children of an island village

monitoring and evaluation system that is able to inform project management of the status of implementation and provide evidence of why certain objectives were achieved or not / under achieved. Wetlands International – South Asia has developed a comprehensive monitoring and evaluation framework for STAP implementation based on results oriented Logical Framework Analysis (LFA) which is widely accepted by developmental agencies as a key tool for project planning and monitoring. The plan was formulated involving all the implementing departments through two workshops held on July 3 and September 7-8 at Imphal. The plan developed elaborates a results based project management framework including identification of performance indicators at various levels. A three tier monitoring and evaluation mechanism has been proposed, at the base of which is an activity based physical and financial monitoring and evaluation by heads of line departments responsible for implementation of various action plans. The next level is based on performance indicators at output, outcome and impact levels to be co-ordinated by LDA Monitoring and Evaluation Division. At the apex is the independent evaluation engaging external experts. As per the plan, necessary infrastructure is being put in place within LDA and concerned line departments.

Lake Monitoring

LDA has continued lake monitoring to assess effectiveness of various restoration measures being undertaken. High resolution Quickbird imagery has been procured from NRSA to determine changes in phumdi area and overall lake morphology. Water quality is also being regularly monitored. Specific studies on invasive plant species have been initiated to develop management strategies based on vegetation dynamics.



Payments for Ecosystem Services for Sustainable Water Management in Loktak Lake

Loktak and associated lakes are multifunctional systems providing the base of ecological and economic security to the entire northeastern region of India. These floodplain wetlands provide fish and vegetables, moderate floods, support rich biodiversity and are inextricably linked to the Manipuri culture. Southern portion of Loktak Lake forms the Keibul Lamjao National Park (KLNP), which is the habitat of globally threatened ungulate species *Cervus eldi eldi*. Based on its high ecological and socioeconomic importance, Loktak was designated by Government of India as a Wetland of International Importance under the Ramsar Convention in 1990. Despite providing a range of ecosystem services, these wetlands continue to be stressed by several factors most significant being water management focused on human uses with inadequate emphasis on impacts on ecological processes and functions. At the core of lake degradation is lack of integration of ecosystem services into developmental planning processes leading to over provisioning of tangible ecosystem services while severely undermining relatively intangible regulating, cultural and supporting services of the wetland ecosystem.

Loktak Development Authority has initiated implementation of an integrated management plan for conservation and wise use of Loktak and its resources through implementation of action plans on catchment conservation, water management, biodiversity conservation, sustainable resource development and livelihoods, and institutional development. While the current investment portfolio would address the major factors leading to lake degradation, sustainable lake management would require realigning and rationalizing of the incentive systems related with the lake resources. A unique opportunity therefore exists for internalizing the environmental externalities generated by unsustainable water management through implementation of a payment scheme transforming environmental damages into conservation revenue flows for lake management and incentivizing resource stewardship. This would greatly complement the ongoing conservation efforts and rationalize water use for various developmental purposes.

The linkage between ecosystem services and human well being forms the basis of an economic perspective to environmental policy. Based on the values people hold for their environment, important repercussions for ecosystem services could result just by making the link between the economy and environment more explicit. Experience has shown that well designed market based instruments can achieve environmental goals at less cost than conventional “command and control” approaches, while creating positive incentives for continual innovation and improvement. Payments for Ecosystem Services (PES) is one such mechanism for translating external, non market values of the environment into real financial incentives for local actors for services provision.

Application of PES has been carried out in a wide range of circumstances. Rvonborg et al. (2007) identify 167 PES cases based on hydrological services, biodiversity conservation, carbon sequestration and landscape beauty. Landel-Mills & Porras (2002) in their global review mention 287 cases of application of PES. The range of ecosystem services vary from specific services to bundled up situations, wherein a particular service renders more than one ecosystem service. The Los Negros scheme in Bolivia focuses on watershed and biodiversity protection wherein the Pampagranade Municipality pays Santa Rosa farmers for forest and páramo conservation. Vittel, a France-based water company pays the dairy farmers in a spring catchment to maintain

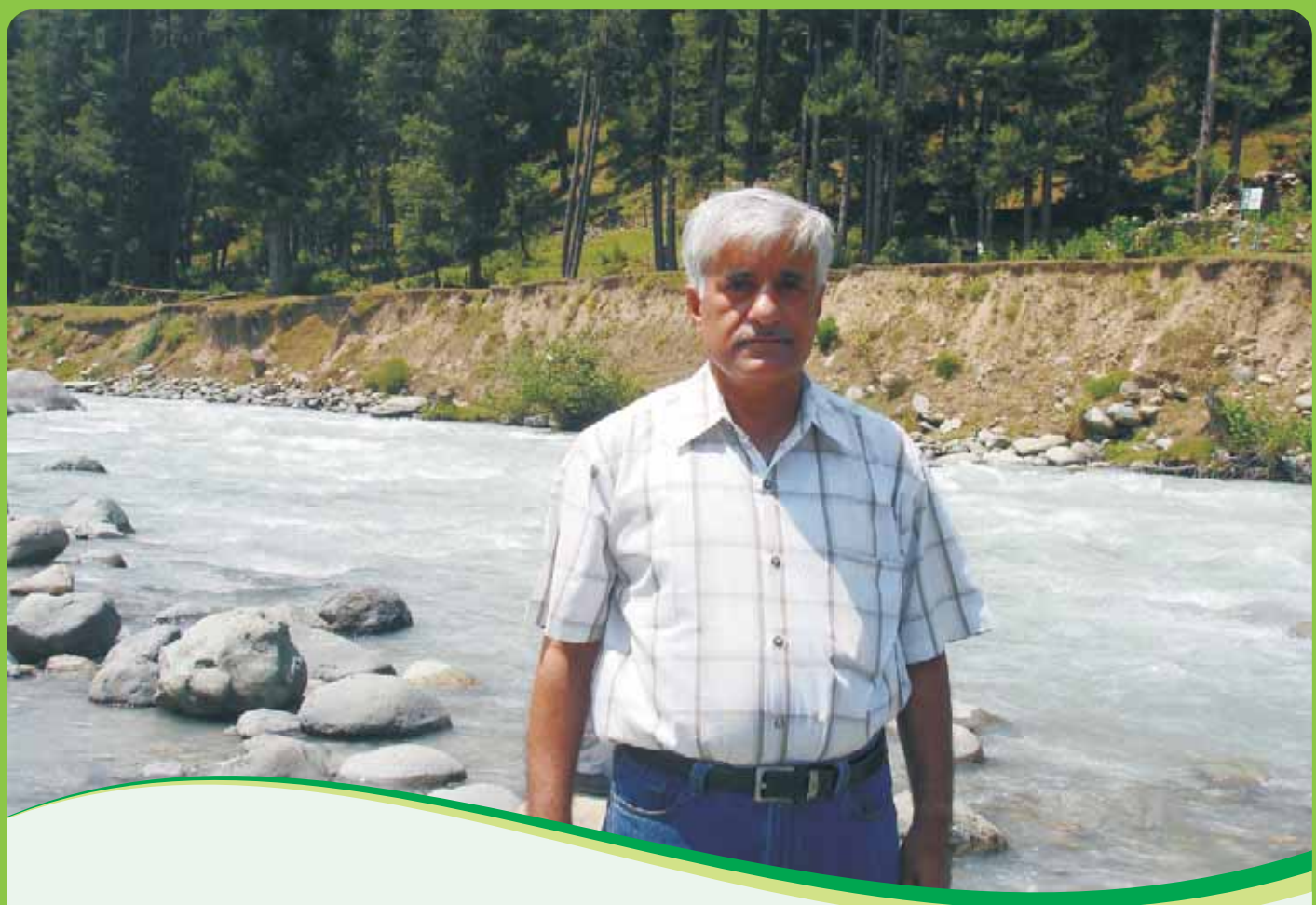
A *phum* hut in Loktak Lake

a form of land use that enables sustained supply of mineral water with exceptional quality. The central government of China initiated the Sloping Land Conversion Program focussing on watershed protection wherein the central government pays rural households for cropland retirement and afforestation.

In this context Loktak Lake has been identified as one of the demonstration sites in South and Southeast Asia under the Rewarding Upland Poor for Environmental Services (RUPES) Programme Phase II of the World Agroforestry Center. The primary objective of the Loktak initiative, launched in 2009, is rationalizing incentive systems within Loktak Lake to promote sustainable water management for ecological restoration and poverty alleviation. This is expected to be achieved through four interrelated components: a) Economic Valuation of Ecosystem Services; b) PES Instrument Design and Implementation; c) Institutional Development and Capacity Building; and, d) Policy and advocacy. Implementation of this project is led by Wetlands International – South Asia.

An economic valuation of the various ecosystem services of Loktak Lake was undertaken to demonstrate and quantify the “hidden economy”. Application of market and non-market tools to assess the economic contribution of various ecosystem services of the wetland. Assessments on economic valuation of ecosystem services revealed that the annual benefits from Loktak Lake at 2006-2007 prices stood at Rs. 600 millions, which is equivalent to nearly 2% of the state's gross domestic product. Direct benefits through provisioning of fisheries, water for hydropower generation and vegetation for use as fuel, food, fodder and raw material for handicrafts account for 48% of the overall benefits. Water use for hydropower generates 74% of the direct benefits accrued. Fisheries and vegetation account for 18% and 8% of the benefits respectively. Indirect benefits based on regulating, supporting and cultural features account for 52% of the overall benefits derived from the lake. Nutrient retention functions of *phumdis* forms the basis of 12% of non-use benefits. The assessment clearly indicated that more than half of the total benefits derived from Loktak Lake do not have marked based prices. This led to significant underestimation of the overall contribution of Loktak Lake to the regional economy, and dominance of the more tangible use of lake resources, i.e. for hydropower generation.

Project implementation within the current phase is aimed at establishing the tradeoffs and designing of PES instruments. A workshop is planned in April 2010 at Imphal to present the various project outcomes and seek inputs of stakeholders to implementation.



Remembering Dr.Chaman Trisal
The visionary of Loktak Lake management

The untimely demise of Dr. Chaman Trisal, Founder Director of Wetlands International – South Asia comes as a major shock to his friends and admirers.

Dr. Chaman Trisal laid the foundation of integrated management of Loktak as early as 1993 during his tenure with the Ministry of Environment and Forests, Government of India. He guided formulation of a Comprehensive Management Plan of Loktak Lake in 1996. Immediately in 1997, he launched the first major lake management initiative in Loktak with the support of India Canada Environment Facility. The project, implementation of which lasted for more than 7 years, was an ambitious programme for lake conservation, with focus on collection of scientific data on various wetland functions and ecological processes and building capacity at multiple levels for lake management. He travelled far and wide into the state despite civil unrest, worked extensively with communities and became the voice of the numerous villages which had faced the implication of lake degradation. He always challenged established scientific knowledge and urged scientists to test and enrich their understanding by dealing with real world situations, in particular by internalizing traditional knowledge and natural resource management practices. Of particular mention is one workshop on management of lake vegetation organized in 2002 in Imphal which was attended by several senior scientists from entire country. To their surprise, he asked all community leaders to take the centre-stage and express their opinions on lake management. The attending scientists were given the task of decoding the community anecdotal knowledge into management practices. No wonder, the recommendations set a new direction to the perspective of management of Loktak Lake vegetation. It is to his credit that Loktak Development Authority transformed from an engineering organization to an organization capable of implementing integrated wetland management initiatives. The Atlas on Loktak Lake is a compelling evidence of his deep understanding of its ecological and social aspects.

The management plan on Loktak and associated wetlands integrating Manipur River Basin remains one of his most cherished assignments, which he successfully argued for financial support within the various labyrinths of government. The immaculate design of the plan was recognized world-wide, most noticeably by the Ramsar Convention, who invited Dr. Trisal to present the New Guidelines for Management Planning in Conference of Parties Meeting held in Valencia, Spain. Though, he did not live long enough to see the progress of plan implementation, he already laid the foundation of mainstreaming conservation and wise use of Loktak Lake within developmental planning.

Dr. Chaman Trisal breathed his last on September 10, 2009 after brief illness. He will be missed sorely by all of us, and will be ever remembered as a visionary who demonstrated practical wetland management balancing conservation and livelihoods.

Mission :

Restore and develop Loktak Lake resources and biodiversity for present and future generations through participatory processes, research and conservation activities

WETLANDS INTERNATIONAL

To sustain and restore wetlands, their resources and biodiversity for future generations

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