

## On Resource Exploitation and Socio-economic Status of Wular Lake and its Impact on Water birds

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### ABSTRACT

Investigations were carried out to determine socio-economic status and resource dependency of local communities on Wular lake with emphasis on impact of exploitation on water birds as well as their habitat. 31 villages were surrounding the Wular lake out of which only 6 villages located in close vicinity of Wular were surveyed extensively. During the study, questionnaires were designed and locals were interviewed in a stratified random sampling manner. Records were obtained from revenue offices and

district collectors office. Local communities were directly or indirectly dependent (43 %) on wetland for their survival. 15 consumptive and non-consumptive activities were recorded that resulted in exploitation of wetland resources. Exploitation was dominated by irrigation activities (irrigated land was result of illegally occupied and converted wetland area) comprising of 43% followed by fodder collection (29%). Negative correlation was observed between employment, education, income of households and resource dependency on wetlands. 42% of average monthly income (6000 INR) per household was generated from wetland resources. 800 households surveyed and questioned revealed positive attitude (79%) towards conservation of Wular. 61% of households were satisfied with protection and management of the Wular wetland and 12% of the locals wanted wetland to be converted into agricultural land.

**Keywords** Resource exploitation, Dependency, Socio-economics, Wular, Water birds.

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### INTRODUCTION

The thrust of India's wildlife conservation policy has been preservation, wherein emphasis has been placed on minimizing or eliminating consumptive human uses within areas designated for the protection of wildlife (Mishra, 2000). Despite such an exclusionary official policy, natural resource depen-

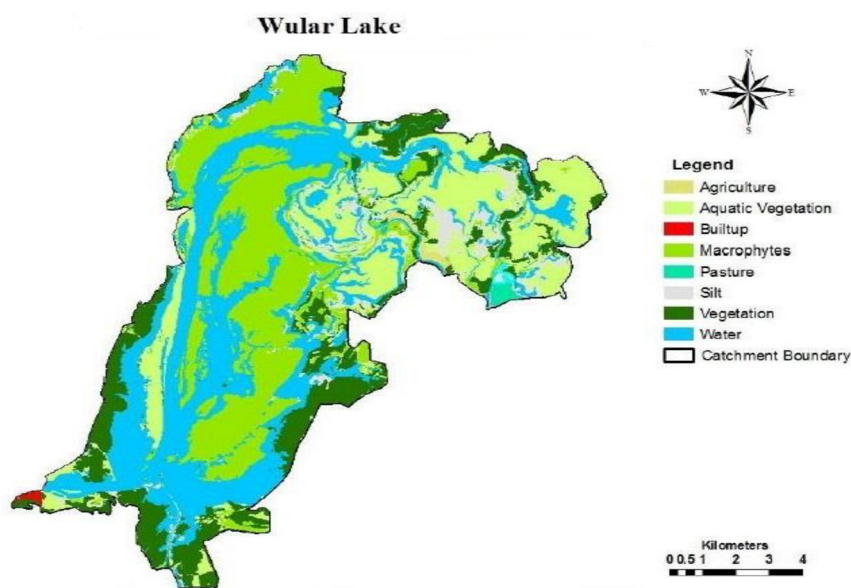


Fig. 1. Map of Wular lake (DEERS).

dependency is a common feature in India where as per the current estimates about 66% of the population is rural and more than 170 million of them are poor. More than 80% of the protected areas have human presence and some level of natural resource use, albeit within state-imposed restrictions (Kothari *et al.* 1989). Dependency on natural resource base is the result of lower socio-economic status and lack of infrastructural facilities (Badola 1997). Use of natural resources has also been the part of traditions and culture of majority of rural population (Panwar 1990). The conservationist approach demands local communities to have access to natural resource base in a sustainable way. Restrictions on traditional resource use following the creation of protected areas are responsible for local hostility and absence of local support for conservation efforts (Kothari *et al.* 1989, Saberwal 1996). In a situation where ownership and management of these wetland resources is under state controlled formal institutions, the traditional management structures have become marginalized. Existing protected area system in India allows for little involvement of local communities in resource management. The resultant conflict between different social groups and between the state and civil

society precludes setting up of sustainable resource management.

Hundreds of thousands of water birds especially waterfowl use wetlands like Wular lake every year during migration, breeding and wintering period. Adjacent to this Ramsar site are present thousands of people and small tourism industries that likely have an impact on water birds. Wular lake being exploited for food, fodder, grazing land and agricultural area results in disturbances to birds which may increase their energy expenditure or affect their ability to consume potential resources and also affecting their habitat availability, leaving those areas unsuitable for water birds (Borgmann 2000).

Community attitude and perception towards conservation influences the kinds of interactions people have with protected area (PAs) and thereby conservation effectiveness. Local communities in almost all parts of world depend on wetland for fisheries, reed harvesting, fodder and grazing (Ozesmi 2002). High habitat diversity, extent of resources, ecotones and refugia within wetlands enables them to support high species diversity compared to sur-

rounding regions (Schweigner *et al.* 2002). When decisions affecting wetlands are made with inadequate knowledge of attitudes of local people and practices of resource use, conservation programs are unlikely to be successful (Sah and Heinen 2001, Pyrovetsi and Daoutopoulos 1991).

With increased level of human disturbances in wetlands particularly Wular, need to understand impact of locals and their activities on water birds becomes mandatory. Thus, assessment of those potential impacts for recommending appropriate measures becomes essential. Here in this study, resource exploitation and attitude of local communities towards conservation of Wular and waterbirds it sustains is discussed.

## MATERIALS AND METHODS

### Study area

Wular Lake (Fig. 1) is the largest freshwater lake in India with an area of 11,277 hectares (NWA 2010) located about 34 km northwest of Srinagar at an altitude of 1580 m asl between 34°16'N and 74°40'E (NWA 2010). It provides an important habitat for migratory as well as resident water birds. It has been designated as a Wetland of International Importance under Ramsar Convention in 1990 because of its importance to the biodiversity and socio-economic values. Lake consists of open water areas with submerged and floating vegetation like *Potamogeton*, *Nymphoides peltatum*, *Nymphaea* spp. Shallow water supports emergent vegetation like *Phragmites communis*, *Scirpus palustris*, *Typha* spp. and *Carex* spp. (Hussain *et al.* 2012). Wular was divided into eight habitat types depending on the vegetation characteristics viz, open water, floating vegetation, submerged vegetation, tall emergents, marshes, plantation, paddy fields and peatlands. These habitats were scrutinized for the water bird populations and habitat utilization by them.

### METHODS

Present study was carried out through two ap-

proaches with each approach aiding the other (Foziah 2009).

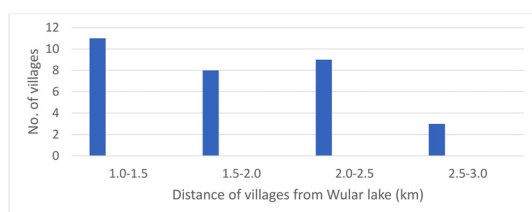
Questionnaire survey on resource exploitation by local communities and their attitude and perception towards water birds and wetland conservation.

Data collection from various government and non-government agencies.

The study was conducted from March 2017 to February 2019. First a reconnaissance survey was carried out in Wular in order to get an insight of wetland areas and collect data. Base maps and satellite maps of Wular were obtained from Department of Ecology, Environment and Remote Sensing, Bemina, Srinagar.

Socio-economic survey was conducted with the help of questionnaires and data was collected. Socio-economic profiles of the villages surrounding the wetland was obtained from existing records and documents in Tehsil and Revenue offices of district Bandipora.

Data about anthropogenic impacts and socio-economic aspects of the study wetland was collected in two stages, first stage involved collection of data from secondary sources viz., Offices of District Collector, Bandipora, Department of Revenue and Tehsil offices of the district. Information on demographics, population, income, resource use and livestock of the villages within a radius of 4 kms surrounding the wetland was collected. The radius covered 31 villages surrounding the Wular. Second stage of study involved the selection of 10% of village households for questionnaire survey (Adhikaari *et al.* 2003, Foziah 2009). Structured questionnaire was designed and interviews were conducted to obtain information on various aspects of local communities viz., family size, sex, literacy level, occupational structure, livestock holding, land holding, agriculture practices, income generating pattern, wetland resource use, income generated from wetland resources and degree of dependency (Mulatu *et al.* 2015, Bhuyan 2016). A



**Fig. 2.** Distance of villages from Wular Lake.

survey was undertaken in the sample villages using semi structured and open type questions to get an idea of resource dependence and their attitude and perception of local communities towards conservation (Foziah 2009, Roy *et al.* 2012, Jigar *et al.* 2016). Interview was conducted by visiting each household in the sample village. Questionnaires were designed and employed after following Adhikari *et al.* (2003), Foziah (2009), Roy *et al.* (2012), Mulatu *et al.* (2015), Bhuyan (2016), Jigar *et al.* (2016). Correlation was determined between variables of resource use and income; extent of resource use and the distance from the wetland. Chi square test was used to determine the relation between these variables using Minitab v19 (Zar 1974, Norusis 1994).

## RESULTS

### Village distribution around Wular

A total of 31 villages were located within the radius of 3 km of Wular lake. Distance of villages from the

**Table 1.** Demographic/Socio-economic profile of villages around Wular lake.

Socio-economic aspect	Value/Percentage
Population in villages around wetland	68, 742
Households in villages	11, 287
Sex ratio	0.8
Average literacy	41%
Male literacy	38%
Female literacy	31%
Employment	41%
Average cattle owning population	87%
Land owning population	82%
Cattle owning families per village	31.2%

**Table 2.** Land use around Wular lake.

Land use type	Area (in hectares)
Land area under villages	24, 387
Irrigated land	9510
Non-irrigated land	10,974
Barren land or uncultivated land	957
Forest area	1463

lake is given in the bar chart (Fig. 2), 11 villages were located within 1.5 km radius of the lake and rest of the villages located within 2-3 km radius.

### Socio-economic profile of villages around Wular

Human population of the villages surrounding the Wular lake is about 68, 742. Villages within radius of 1-2 km are densely populated while villages within 2-4 km radius are moderately populated according to records of revenue department of districts. Average literacy rate of villages was 41% with male literacy of 38% and female literacy of 31%. Majority of the households owned cattle and land, used for irrigation and agricultural purposes. Number of households in the villages around Wular was 11,287 that covered almost 24, 387 hectares (Table 1). Irrigated land constituted 39 % of the total area while as non-irrigated land constituted 45% (Table 2).

**Table 3.** Socio-economic profile of villages around Wular lake.

Village	Bandi-pora	Garora	Watalab	Makh-doo--myari	Bany-ari	Haijin
Distance	1-2 km	1-2 km	1km	1-2 km	1km	1km
No. of households	541	421	367	803	521	1324
Population	3787	2947	2569	6424	3647	11916
Sex ratio	0.8	0.8	0.8	0.8	0.8	0.8
Literacy	54%	47%	29%	36%	35%	37%
Land owning families	77%	86%	97%	84%	83%	91%
Cattle owning families	68%	78%	97%	93%	87%	90%

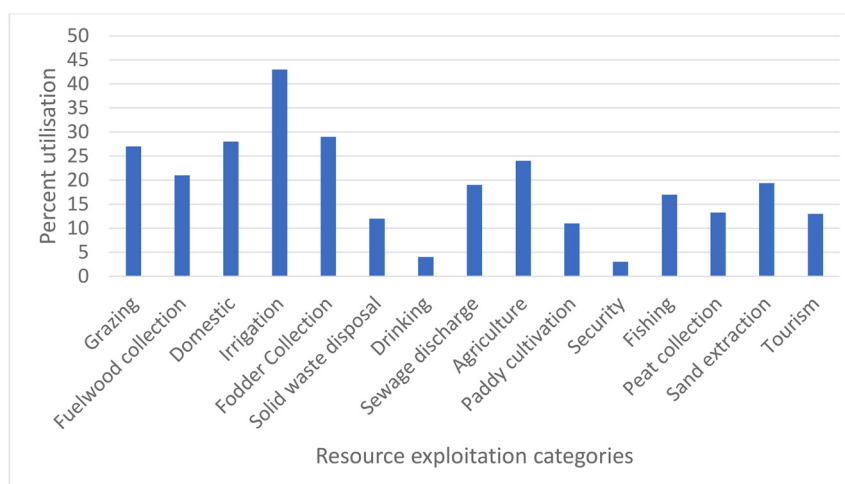


Fig. 3. Percent utilisation of resources around Wular lake.

Around Wular, Bandipora town and villages namely Watlab, Garoora, Haijin, Makhdoomyari, Saderkoot and Banyari were surveyed extensively. Among the villages Makhdoomyari and Haijin had high human population (11916) and Watlab low population (2569). Average literacy rate was high in Bandipora town (54%) and low in Watlab region (29%). Land owning percentage was high in Garoora (97%) and Watlab (86%) villages and low in Bandipora town (77%). Cattle owning community was high in Watlab (97%) and low in Bandipora town (68%). In total 85.5 % of the population owned cattle. Table 3 provides socio-economic profile of villages around Wular.

The occupational composition of people around

Table 4. Occupational composition of people around Wular.

Employment type	Proportion
Government employee	9 %
Private employee	4 %
Land laborer	11 %
Sand laborer	38.32 %
Willow worker	14.21%
Shopkeeper	7.25%
Agricultural workers	18.88
Other	12.43

Wular is provided in Table 4. Sand laborers (38.32%) dominated occupational structure in Wular region followed by agricultural workers (18.88%). It was observed that households with high education were employed in government and non-government organisations while people with lower education status were involved in services like labor, carpeting, fishing, shop keeping and other business activities. Households in villages surrounding the Wular lake were more educated.

#### Resource utilization and other anthropogenic activities in Wular

Fifteen (15) categories of both consumptive as well as non-consumptive uses of resources were recorded in Wular lake. Percentage utilization of resources is shown in Fig. 3. Out of total 11, 287 households, 43 % of households directly or indirectly exploited resources of the wetland. Resource uses like grazing by cattle, fodder collection, agricultural practices, fishing, fuelwood collection and activities like sewage discharge, solid waste disposal contributed towards the consumptive and non-consumptive resource exploitation respectively by local communities. Exploitation was dominated by irrigation activities (irrigated land was result of the illegal occupation and conversion of wetland area) comprising of 43% and fodder collection 29%.

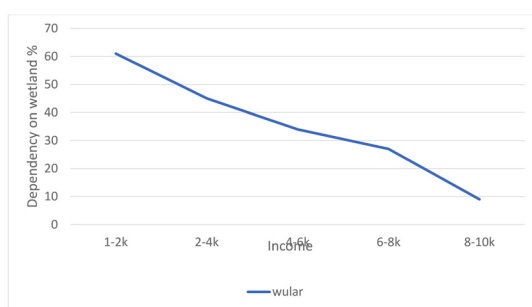


Fig. 4. Relation between income and dependence on wetlands.

### Socio-economic parameters and resource exploitation by local communities

During socio-economic survey of Wular region different household parameters like income, caste, ed-

Table 5. Attitude/Awareness of local people towards conservation and management of Wular lake (n=800).

Attitude/ Awareness questions	Positive	Negative	No. response Don't know
Do you know Wular is a Ramsar Site ?	50	116	634
Do you know Wular is protected by J & K govt ?	754	42	4
Are you part of protection in anyway ?	242	508	50
Do you think you have any responsibility towards protection of Wular ?	686	36	78
Have your rights been violated after the protection of Wular ?	58	740	2
Can you cooperate with the Department of Wildlife for protection of wetland ?	736	4	60
Do you face any problems because of wetland ?	120	658	22
Do you think wetland should be converted into agricultural land ?	96	704	0
Do you think wetland is in good condition ?	74	726	0
Is Department of Wildlife/ WUMCA managing the wetland up to the mark ?	488	312	0
Can you stop resource exploitation if asked ?	528	272	0

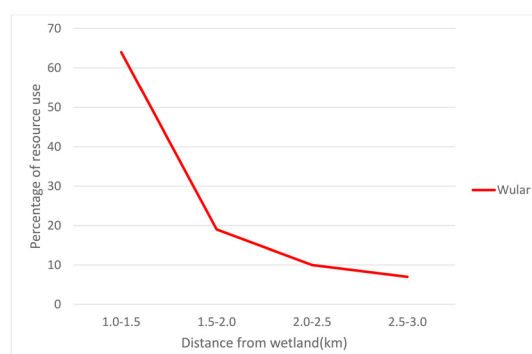


Fig. 5. Relation between resource exploitation and distance from wetland.

ucation and employment were found to have a direct effect on extent of resource use. Family size had a direct correlation with resource exploitation, more the family size more the resource exploitation. A negative correlation was found to exist between income, education and resource use, more the education and income of a family less was the resource utilization (Fig. 4). Average monthly income per household was 6000 INR in Wular region and 42% of that income was generated from the wetland resources. Positive relation existed between cattle owning families and resource exploitation. More cattle owned by family more was resource exploitation. Relation between distance of villages from wetlands and resources exploited from them was also estimated (Fig. 5).

### Attitude of people towards conservation

After performing attitudinal survey of local communities towards protection and conservation of wetlands, we observed a positive approach of people (75% of total questioned locals) towards the conservation, management and protection of wetlands. 79% People were positive in conservation of Wular. About 800 households in Wular region (10% of households) were surveyed and questioned for their attitudinal survey towards conservation of wetlands. 61% of households were satisfied with protection and management of the Wular wetland and 12% of the locals wanted the wetland to be converted into agricultural land. Majority of the population was against the conversion of wetland (88%). Local communities were highly satisfied with extent of resource use in

**Table 6.** Views of local people regarding conservation and management of Wular.

Management option	Responses (%)
There is a need for cutting peripheral vegetation	14.32
Sewage disposal in the wetland should be banned	68.21
There is need for desiltation of wetland	71.47
Sand extraction from the wetland area should be banned	74.45
Agricultural encroachment should be reclaimed for wetland use again	39.98
Human intervention in the wetland should be restricted	45.14
People should be given awareness about the benefits of wetland	32.12
Boats should be banned in the wetland	64.54
Weeds should be removed	58.02
Security should be removed from the wetland area	18.78
Department should do their job honestly	17.21
Wetland should be converted into agricultural land	3.32
Plantation of trees around wetland is necessary	19.9

the wetlands. 42% of people were satisfied with resource utilization. In terms of wetland management 57% of people were satisfied with management strategies implemented by the authorities. Attitude and perception of locals regarding conservation of Wular is provided in Table 5.

### Views regarding management

Regarding management practices of the wetlands, various questions were posed to local people to know their attitude and perception. Management strategies like dweeding and creation of bunds as carried out by wildlife department need to be strengthened according to the view of local communities. Dweeding was supported by 49% of people. Cattle grazing was opposed by 47% of people in Wular region. People who wanted to reduce the peatland area were 2%. It was 12% of people who wanted to convert the wetland for agricultural use. 71% in Wular region proposed plantation drive along the peripheral regions of wetlands. Percentage response by locals regarding conservation and management of Wular is provided in Table 6.

## DISCUSSION

Present work reveals a good knowledge about the attitude of local communities towards conservation of wetlands and water birds. It is clear to understand the factors responsible for exploitation of the wetlands and to suggest various remedial measures for their conservation and sustainable use. Human population around Wular was 68,742. No industrial or developmental settlements were observed around the wetlands. However, conversion of wetland into agricultural lands was the main threat and severe concern to the conservation. According to Williams (1990), Meyer (1995), Kabii, (1996) agricultural conversion is the main reason for destruction of wetlands. 31 villages were located around Wular lake out of which 8 villages were in the radius of 1-2 km. Number of households in the adjacent villages of Wular was 11,287 that covered almost 24,387 hectares. Irrigated land constituted 39% of the total area while as non-irrigated land constituted 45% of that area. It was observed that agricultural practices were main productive resource in the areas more land area was under agricultural practices. According to Nagarajan and Thiyageasn (1996) agricultural lands near the wetlands are important for both farmers and water birds. Socio-economic survey of the areas around wetland revealed that different parameters have a direct effect on the extent of resource use.

In Wular area, 59% of population was unemployed meaning that these people were either directly or indirectly dependent on the wetland. Because of low living status, unemployment and under developed conditions people around wetlands owned cattle either for business or for domestic purposes. 85% people around Wular owned cattle. A relation was found between the wetland dependence and cattle owning, more cattle owning people were more dependent on the wetland for grazing and fodder collection. Similar findings have been reported by Ambastha *et al.* (2007), Foziah (2009) stating that more livestock owning communities depended more on wetland resources. Irrespective of the prohibition posed by government on resource exploitation, three fourths of wetlands and in wildlife reserves are exploited through livestock grazing (Kothari *et al.* 1989).

Most of the villages in Kashmir region are underdeveloped and have same basic structural plan (Foziah 2009). Health and education facilities were available easily in villages around Wular. Literacy rate was 41% in villages around Wular. These villages had more literacy because of the developmental conditions in the area and availability of basic facilities. Negative correlation was found between the level of education and extent of resource use, more the education, less the utilization of resources. This was probably because more educated people were employed than the non-educated ones. Zidana *et al.* (2007) also reported a negative correlation between education and resource use, with less educated people having lower access to non-farming incomes.

An important relation in the form of resource dependency was found between local people and wetland ecosystems on which they were directly or indirectly dependent. Agriculture was the main activity of local communities around these areas, along with labor work, cattle owning, fishing, carpentering and wood work. A large chunk of wetland has been converted into agricultural land. Conversion of wetlands to agricultural lands has resulted in loss of 50% of peatland area, wetlands and lakes in north America, Europe and Australia (Millennium Ecosystem Assessment 2005). About 43% of local people in Wular were directly or indirectly dependent on wetlands. Ambastha *et al.* (2007) have also reported utilization of wetland resources use by local communities around Kabartal area. Resource exploitation activities like grazing, fodder collection, peat extraction, fishing and fuelwood collection pose serious threat to wetlands (Wolstencroft *et al.* 1989, Divyakaran 2000 and Foziah 2009). The pattern of resource exploitation represents a direct dependence on wetlands which reflect the role of wetlands in economy of local communities (Foziah 2009).

During present study a direct relation was observed between income of the family and dependence on wetlands. Average monthly income of 6000INR of locals around Wular was observed. More the income of family, less was the dependence and vice versa. This indicated that if the family had other sources for income generation, then direct resource utiliza-

tion was low but if the income was low, wetlands acted as source of income generated from fishing, fodder collection, cutting and selling of trees/wood and rearing and selling of cattle that depended on wetlands for fodder.

Wetlands of the world area facing continuous threats and need management for survival of flora and fauna they sustain. Many wetland sanctuaries are being auctioned for fisheries and affect negatively the sustainability of wetlands (Khurshid 1991). Processes like siltation bring about the change in the wetland ecosystems (Kulkarni 2009). Wular threatened by anthropogenic activities like agricultural conversion, fodder collection, grazing and fuel wood collection require Government intervention with knowledge of local communities to mitigate negative impacts and over exploitation of wetland resources. Present study clearly cites its importance in framing mitigational measures for conservation of wetlands and waterbirds they sustain.

### **Impact on water birds due to different factors**

#### *Conversion of wetland into Agricultural land*

The most serious threat to the Wular is the illegal encroachment of land by local communities for the agricultural purposes causing an immense decrease in the area of wetlands and reducing their use by water birds (McCartney *et al.* 2011). Of the 3619 IBA's 69% are wetlands and 42% of them are threatened by agriculture conversion (Connell 2000). Size of Wular has been reduced from 157.4 km<sup>2</sup> to 11 km<sup>2</sup> in mainly because of the agricultural conversion (SANDRP 2017). So, reclamation of illegally occupied agricultural land from local communities for wetland use should be the priority of the government. Majority of the locals were positive about reclamation of land by authorities for wetland use when questioned.

#### *Siltation*

Wular lake being connected to Jhelum basin is sus-



ceptible to silt deposition from the respective rivers. Silt from the river gets continuously deposited in the wetland causing a change in their water depth. Any change in water depth brings about change in the use of wetlands and food availability to water birds migrating to these wetlands (Khan *et al.* 2003). The siltation also increases weed invasion and decrease in fish fauna of wetlands (Judy *et al.* 1984). Desiltation process not only improves irrigation and fishing potential of wetlands but also their biodiversity (Anand 1999). This increased siltation level decreases the habitat available to water birds thus resulting in lower water bird diversity.

#### *Grazing in wetland area*

Wular is surrounded by number of villages which are directly or indirectly dependent on it. Cattle grazing and fodder collection by locals pose serious threat to Wular as these are main sources of their cattle requirements. 27% of people in Wular region were completely dependent on wetlands for their livestock grazing. Trampling of cattle also reduce aeration of soil and availability of food and increase disturbance to water birds. Thus, grazing in the wetland area must be monitored and entry of cattle in the area must be checked regularly.

#### *Fodder /firewood/food collection*

Locals communities extract firewood and fodder from Wular. 29% people in Wular utilized wetland for fodder collection. Several species of plants like *Phragmites*, *Trapa* and *Nelumbo* are being continuously harvested for either food or for selling which fetch good prices to them in town markets of the valley. However, over exploitation of these resources may change the ecology of these wetland ecosystems and thus need regular monitoring. So, educating people regarding the benefits of wetlands and their sustainable use may help to mitigate these threats.

#### *Cutting of willow plantations*

Cutting of willows in peripheries of Wular can help in restoring and managing ecosystems by increasing the

open water area of wetlands however locals cut these plantations for firewood and sell them in different markets. That process alters the nesting and breeding sites of water birds in the lake, decreasing the breeding success of the water birds.

#### *Pollution and sewage disposal*

Wetlands serve as important source of drinking water to local communities around them. However, threatened by pollution from domestic sewage and solid wastes, it may no longer be utilized as drinking sources. Lack of proper drainage leads to unwanted breach of polluted water and sewage into the Wular lake along with the addition of plastic and other non-biodegradable waste. Naval base camps in the vicinity of Wular deposit their waste in the lake. This has increased eutrophication level and weed invasion and may adversely affect waterbirds and local communities. Pollution through run off from agricultural lands containing fertilizers and pesticides needs monitoring. Thus, there is a need of proper solid waste disposal in the areas and authorities need to take action for disposing off the residues in a scientific way by creating state of art facility.

#### *Poaching of water birds*

Water birds have been continuously hunted from thousands of years either for recreation, sports, adventure or for food (Wolstencroft *et al.* 1989, Lampio 1982). During the present study it was observed that the birds particularly waterfowl are being hunted for food, sport and sale in markets. Illegal weapons and traps are being used by poachers for capturing birds. Waterfowl especially mallard, common teal, garganey, eurasian wigeon, common coot, northern shoveller and northern pintail are mostly poached. Patrolling and monitoring by wetland staff could help in reducing poaching of water birds.

#### *Fishing*

16% of resource exploitation in Wular is contributed from fishing, which is an important source of

economy for people of Kashmir and Wular lake is one of the major sources of fisheries in Kashmir valley. Nine species of fish are present in Wular lake that are being captured at large scale and sold in markets (Qureshi 2014). Increased rate of fishing has resulted in increased disturbances in the lake and more chances of water bird poaching. Fishing activities need to be monitored and illegal fishing needs to be banned.

## CONCLUSION

Survival of Wular and water birds inhabiting it, being threatened by various anthropogenic activities require immediate government intervention along with the knowledge of local communities in order to mitigate the underlying problems. Present study clearly cites its importance in utilizing these recommendations for effective conservation and management of wetlands and waterbirds they sustain.

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