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Report on stakeholder evaluation of highland aquatic resources

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Introduction and purpose

This report gives an overview of completed research activities on the value ascribed by users, local communities and stakeholders to functions, goods and services (including non-use values) derived from the aquatic resources in the study areas. The perceived impact of factors such as environmental degradation, changing demand for goods and services and modified highland aquatic resources management practices on these values has also been assessed. To help structure this analysis stakeholder Delphi studies have been undertaken in each country involving representatives from all stakeholder groups to better characterise constraints and conflicts, and build consensus concerning opportunities for better conservation and management of highland aquatic resources, opportunities for livelihoods enhancement and sustaining ecosystem services.

The purpose of these research activities has been to provide a basis for negotiation and to ascertain the perceptions of different people concerning highland aquatic resources. The assumption of the HighARCS project is that such research steps are necessary in order to facilitate the emergence of a common understanding of the needs for joint integrated action plans for more sustainable, wise use practices of aquatic resources amongst stakeholders in the study areas and concerned national and local authorities.

Methodology and data sources

In order to obtain stakeholder perceptions and evaluation of the aquatic resources, an ecosystem service evaluation approach was developed for HighARCS during the March methodology workshops in 2010. This approach is based on multiple sources of information. The ecosystem service evaluation activities have been integrated within the overall activities of work packages 3, 4, and 5.

- Focus group interviews with men, women and children from the HighARCS study site communities have been facilitated and recorded (WP 3 and 4). During this process, researchers have been recording species names where relevant, conducting mapping exercises, identifying value chains related to specific services, considering different community groups and recording seasonality in dependence. This has been supported by a PRA ranking approach used to identify the value that different groups of stakeholders (in particular different wealth groups) attribute to different ecosystem services, and how these values alter seasonally.
- The views of other stakeholders and concerned authorities have been recorded from state-of-the-system and stakeholder workshops (WP 1, and WP 3, 4 & 5 integrated).
- As an additional step, stakeholder Delphi studies designed to shed light on stakeholder assessment of the state and value of the wetlands ecosystem services as well as ideas for improved resource management practices and local livelihood options have been conducted in all the five project sites (WP 5). This report includes a presentation of the Stakeholder Delphi method and a discussion of the outcomes for each of the sites.

There are other multiple ecosystem service evaluation methods, which could have been applied by HighARCS, such as the market value method, replacement cost method, and the shadow price method. One of the teams (China) has included evaluations based on available official statistics of production or consumption according to such methods. This was reported in the China in-country report D5.1 on institutions, policy and conflict (June 2011).

The stakeholder Delphi Method

The stakeholder Delphi Method is a technique to facilitate the interactive participation of varied and conceivably hierarchical and antagonistic stakeholder groups and in capitalising on their knowledge and opinions as valid input to research in an inexact research area (Bunting, 2010). The stakeholder Delphi technique is particularly appropriate when decision-making is required in a political or emotional environment, or when the decisions affect strong factions with opposing references. It is also considered good for giving equal attention to minority view points. We distinguish between the "classical Delphi", where only subject-matter experts are involved as panel members, and the "stakeholder Delphi", where experts as well as local authorities and important concerned stakeholders are included.

As shown in **Figure 1**, the stakeholder Delphi process can be divided into a sequence of activities and Rounds. It can be resumed in 12 steps (Adapted from Bunting, HighARCS concept note 2010).

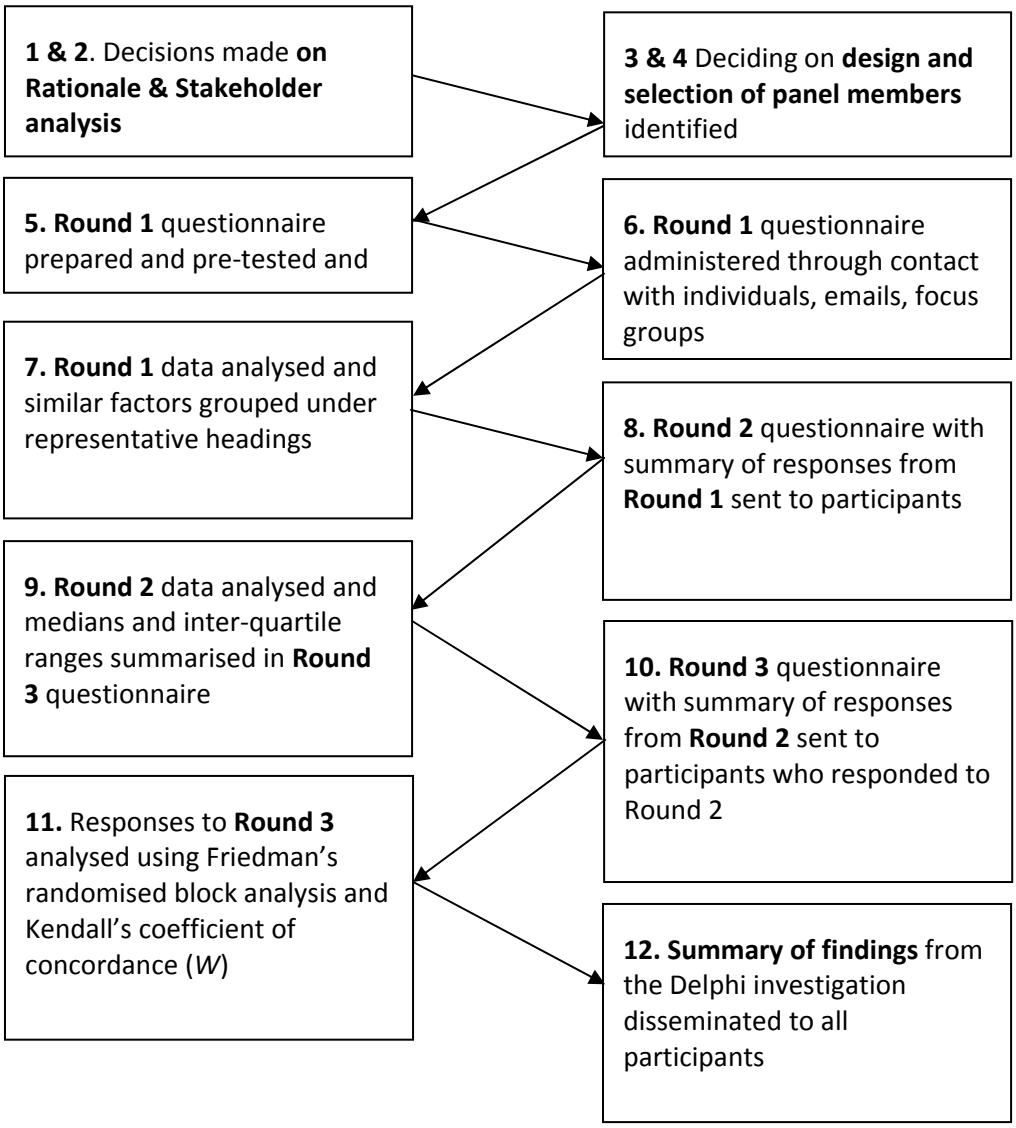

Fig. 1. Flow-chart for the stakeholder Delphi process

Once the rationale and main questions have been decided, designing a stakeholder Delphi study implies undertaking a stakeholder mapping to identify relevant stakeholder groups to be included. It also implies assessing which kind of statistical tests are appropriate to run in order to characterize the responses. In our case, as stipulated in the Project Document, we have applied Friedman's two-way analysis of variance and Kendall's W coefficient of concordance, except in the case of the Chinese team (see below).

Once these technical issues have been decided on, the actual stakeholder Delphi runs in 2 to 3 rounds. In the first round, a series of open questions pertinent to the issue to be reflected on are formulated and sent to the panel members to answer.

The responses from the panel-members of the first round are grouped into a (reduced) number of main statements about the issue, its importance, causes, and solutions. These statements are then sent out to the panel members without mentioning who suggested what, but only how many panel members "are behind" each statement. The panel members are now asked to rank their agreement or disagreement with each statement on a scale from 1 (total disagreement) to 10 (total agreement).

The results from Round 2 are now analyzed. The mean score is calculated for each statement (or question), and the distribution of the individual rankings within or outside inter-quartile ranges are indicated. Panel-members having given rankings outside the inter-quartile ranges are asked for further explanation of their rankings.

Two preliminary statistical analyses of the data from Round 2 are now made.

Friedman's test can be used to focus on the difference of scores (ranking or agreement with) given by the panel members as a whole between the different questions or propositions asked.

Confidence in the degree of agreement can be assessed with Kendall's coefficient of concordance (W). This measure of rank convergence, ranging 0 – 1 (Table 1), is recommended for interpreting data from Delphi investigations, providing a measure concerning the degree of consensus achieved and level of confidence in mean ordinal ranks (Schmidt, 1997).

Table 2. Interpreting agreement and confidence associated with Kendall's coefficient of concordance (W)

(Schmidt, 1997)

Kendall's W	*Agreement*	*Confidence in ranks*
0.0 - 0.1	Very weak	None
< 0.1 - 0.3	Weak	Low
< 0.3 - 0.5	Moderate	Fair
< 0.5 - 0.7	Strong	High
< 0.7 – 1.0	Unusually strong	Very high

If results of the preliminary tests show that there is a strong or unusually strong agreement amongst panel members, the process is stopped and there is no 3. Round. Otherwise, questions are sent out again including information on the mean score from round 2. Panel members are now asked if they can agree with the mean score or give a new individual score.

Results from Round 3 are submitted the same statistical tests as in round 2. The results are discussed with panel members at a meeting in the end.

The application of the stakeholder Delphi in HighARCS

Rationale

The rationale for undertaking the stakeholder Delphi in the HighARCS project followed from the situational analyses made during the first year of the project (D1.1). Here the assumption stated in the Project Document was confirmed, according to which stakeholders groups (including men, women and children) and various government officers are expected to be having different or competing interests, understandings, and resource management goals with regards to the conservation of highland aquatic resources and their ecosystems.

Main questions

It followed from the objectives of the HighARCS project that the main questions we were interested in answering concerned the present state of the aquatic resources and how it has changed over time, the identification of the factors responsible for this state and the changes, an evaluation of the available resources and the link between conservation actions and local livelihoods, and finally, the identification of needs and priorities with regards to resource conservation and livelihood options in the future.

The responsible in-country teams have structured their questions differently according to the specific situation of the given site, the action planning approach followed, and the experience and research profile of the team. As a common framework, the teams have been invited to consider structuring their questions according either to:

- a *factorial framework* built around the *STEPS* (social, technical, environmental, political and sustainability) issues;
- a *problem-cause-impact-solutions* type of framework organized around a process analysis of "Drivers-Pressures-State-Impact-Response *(DPSIR model*);
- or a combination of both.

This logic was most clearly used in the China site (with a focus on important legal and policy measures (responses) related to environmental protection and to the livelihoods of local fishers), and in the two Vietnam sites (factorial listing of problems, constraints and threats facing highland aquatic resources; factorial listing of causes or pressures on the aquatic resources; and suggestions for responses).

The two Indian teams (Buxa, West Bengal, and Nainital, Uttarakhand) opted for a more direct problem identification and response seeking logic for the main (open) questions of the first round of the stakeholder Delphi. *The Nainital team* asked about (1) how the local environment has changed over time, (2) how the llivelihoods depend on Biodiversity, (3) stakeholder understanding of the interaction between people and the biodiversity of the Lakes, (4) local perceptions about aquatic biodiversity of the Lake, (5) awareness of conservation measures to protect the biodiversity of the lake, (6) suggestions of the local people on how the biodiversity of the lakes could be properly managed without affecting negatively the situation of people depending on the lakes for their livelihoods.

The Buxa team divided its questions into four sections. The *first section* was on the general conditions: they asked about (1) the general state of highland rivers and lakes and their living organisms in the Buxa reserve, (2) the sustainability of the pressure exerted by local people on these resources in their own opinion, (3) the need to take remedial action, (4) the effectiveness of current regulations, and the economic, social or environmental benefits to be gained from better conserving aquatic resources in the Buxa reserve. In the *second section*, the team asked about problems, constraints and threats facing highland aquatic resources

in the Buxa reserve. This section was structured according to a modified STEPS approach, including managerial and cultural issues, but excluding technical issues. In a *third section*, they explored other issues (not mentioned in section 2) which could be said to relate to highland aquatic resources, using the same "modified STEPS" logic as in section 2. In the *fourth (last) section*, they asked for potential measures, actions or institution change that could help improve highland aquatic resources conservation and wise-use in Buxa reserve. This section is structured according the "modified STEPS" in conformity with the preceding sections.

It should be noted that we ran into a special methodological issue concerning the open-ended questions for Round 1. As the stakeholder Delphi exercise was launched after the project had been conduction surveys, stakeholder meetings, focused group meetings, and household interviews touching upon many of the issues which would otherwise have been left open for the stakeholder Delphi panel members to formulate/articulate in Round 1. Some of the teams therefore already had stakeholder-driven claims and statements ready for the scoring procedure included in their Round 1, although the method normally expects such statements to emerge as a result of Round 1.

Stakeholder mapping and data collection approach

The stakeholder mapping used to identify the relevant stakeholder groups to be included in the panel was based on the contacts made and the data collected for D5.1 on the institutions and governance systems, as well as the general information presented in the Situational Analysis reports from Phase I (D1.1). Wherever feasible, a number of 3-4 respondents were included from each stakeholder category. As to the choice of specific government officers to be invited on the panel, the Indian and Chinese teams approached the officers as they deemed appropriate (or who was available). The Vietnamese team approached the leading officers at the respective provincial and local levels and invited them to either participate themselves or to assign other staff members as appropriate. In all sites, the number of panel members from various branches and levels of the local / provincial authorities turned out to be making up more than half the number of panel members.

The briefing of the panel members is a very important aspect of the data collection approach in a stakeholder Delphi. All teams have used the opportunity of the stakeholder meetings planned for the project to present findings and discuss the state of the aquatic resources as a briefing method. Panel members were identified amongst the participants, and the stakeholder Delphi questions immediately explained after the end of the meetings. In some cases responses were collected at the meeting venue on the same day. In other cases, the HighARCS team went to collect the responses directly from the panel members at their work place after some time.

The non-professional panel members (village people, fishers, students) were contacted differently. In China, they were assisted by SCAU staff or master students in a form resembling personal interviews. In Vietnam, a mixture of focus group discussions and personal interviews was used. The personal interview style was also used in Nainital (India) and the two Vietnamese sites, whereas in the Buxa site, focus group discussion methods were used.

In the case of Nainital, the team was challenged by the fact that the respondents from the students and tourist stakeholder groups were not local residents and therefore did not remain on location to answer during all three rounds. We have included these groups in the statistical tests run on the data for the present report (see section below), but we will discuss the implications of this in a scientific paper on the Stakeholder Delphi experience of HighARCS later.

Choice of statistical tests to be used.

A central element of the stakeholder Delphi method is the statistical description of the distribution and degree of concordance of the scores given by each of the panel members to each question or statement in Round 2 and Round 3. For this purpose, as prescribed in the Project Document and explained in the above

section, two interlinked non-parametric statistical tests were run, namely Kendall's W (test of concordance) and Friedman's Chi-Square tests. In the case of the Chinese site, however, the team decided to use a more sophisticated set of tests, namely the analysis of variance (ANOVA). These tests have allowed not only to describe the overall degree of concordance, but also to describe response patterns in relation to other variables, such as gender, stakeholder group or the number of rounds (by using Duncan's multi-range test method). The Buxa team has run a T-test in addition to the Kendall's W and the Friedman's tests in order to test the evolution of the scores from Round 2 to Round 3. These aspects will also be more systematically discussed in the forthcoming article on the Stakeholder Delphi.

FINDINGS

Stakeholder valuation of aquatic resources across sites

Findings per site

Beijiang River Watershed, China

The *stakeholder's evaluation of the ecosystem services* at the 3 project localities at the Beijiang River Watershed were identified as part of WP3 and assessed jointly under WP 3 and WP5. The outcomes have thus been reported in more detail in D3.1 and D5.1 Shaoguan).

(1) Identified ecosystem services (WP3 China)

The aquatic ecosystem ***provisional*** services and biodiversity values of the Beijiang River, China are found to be wood (adjacent forests), fish & shellfish, shrimps and crabs, water for productive use (agriculture and industries), domestic water supply, sand supply for construction, hydropower supply , transportation through the river, and food products (irrigation crops).

The aquatic ecosystem ***regulating services*** include flooding control, soil, sand and nutrient transfers, water resource storage, soil conservation, Environmental purification (air, water and local climate), nutrient cycling, providing wildlife habitat, and biodiversity protection.

The ***supporting services*** include soil development, circulation of materials etc.

The ***cultural services*** (spiritual enjoyment, encouragement, entertainment, sports, aesthetics, education etc.) mainly concern sightseeing, fishing, boating and swimming.

(2) *Participatory evaluation of Beijiang River ecosystem services (WP3 China)*

The above mentioned total list of ecosystem services (irrigation, daily water use, etc.) and ecosystem costs (flooding, draught, dike building, etc.) were presented to different groups of stakeholders and authorities (108 people in total), who were then asked to rank their importance on a scale from 5 (very important) to 1 (not important). Reponses were analysed with SPSS software, using Univariate Analysis of Variance for ecosystem services (test of between-subject effects), and Duncan's multi-range analysis for gender group effects.

It was found that the most important ecosystem services recognized by stakeholders were aquatic products, daily water supply, reduced flooding, hydro-power supply and as a mechanism to "delete" and evacuate pollutants. Secondary importance was assigned to services such as spiritual functions, provision of a clean environment, reduction of diseases etc. Third level of importance was assigned to services such as biodiversity, scientific research, beautiful environment etc. And the least important services included tourism, fishing sport, boating sport and swimming sport.

The most important ecosystem costs considered by stakeholders include the damage cause by flooding and pollution, the expenditure used in waste water treatment, dike building and drugging of the river bed for transportation). Second most important costs were expenditures used for fishing management, picking up river garbage, and tree planting. Third level of importance was costs such as expenditure induced by

diseases spreading along the river, and clearing waters from water hyacinth. The evaluation exercise also mentions draught as an ecosystem cost (4th level of importance).

(3) Analysis of difference amongst different stakeholder groups

The Chinese team has looked at four main groups of stakeholders: Government officers, company leaders, Fishers, and Farmers. The analysis of statistically significant differences in the evaluation amongst these four groups shows that many of the views held by the four groups are quite similar, for example on ecosystems services such as: daily water use, transportation, clean environment, flooding reduction, biodiversity and many others.

As for ecosystem services where the four groups have statistically significant different views, it could be mentioned that the fishers valued the ecosystem services of the river lower than other stakeholder groups, and government officers valued them higher than other stakeholder groups. However, this result may partially be explained by the fact that fishers seemed to have a harder time relating to the abstract notions of ecosystem services than others. In support of this is the observation that fishers gave high importance to getting a clean environment, reducing water pollution, maintained aquatic production, and avoiding a drought disaster (D5.1). In other cases, it is quite obvious that fishers or farmers give lower values than authorities and company leaders. Three ecosystem services should be particularly noticed: irrigation; industrial water supply; and sand for construction. Government officers, company leaders and farmers considered irrigation as one of the top 4 ecosystem services, fishers ranged it as one of the 4 least important eco system services. While government officers and company leaders considered industrial water supply as one of the top 10 ecosystem services, fishers and farmers considered it as one of the 4 least important services. Fishers also value "hydro-electricity" lower than the three other groups, as they are the only group who is experiencing the negative effects of the hydro-power stations directly. On the other hand, they attribute higher values to "aquatic products" than the other groups.

There was no significant gender difference in the value of the ecosystem services.

(4) Stakeholder Delphi

The assessment of ecosystem services was followed by a *stakeholder Delphi study* on policy responses to the environmental situation of the aquatic ecosystems in the area (restrictions and incentives), which was equally reported in the previous deliverable D 5.1 Shaoguan.

The first round of Delphi interviews was conducted from 20th to 22nd of May, 2010, the second round from 2nd to 3rd of July, 2010, and the third round from 1st to 2nd of October, 2010. A total of 47 panel members were selected from the four above-mentioned major stakeholder groups: Government officers (17), company leaders (12), and individual fishers and farmers (34).

The initial open questions for Round 1 were extracted from the results produced by the ecosystem services exercise and the stakeholder meetings held. They were structured into two main sections:

A. The importance of legal measures and policies related to environmental protection,

B. The importance of legal measures and policies related to fishermen's livelihoods to be considered in the near future.

Thus, the Chinese team's approach to the stakeholder Delphi exercise went straight for the opinions on the policy and governance responses to the conservation and livelihood issues identified. The DPSIR analysis was made by the team itself subsequently.

The statistical analysis applied on the responses was also different from the tests used at the other HighARCS sites. An analysis of variance of multiple factors was selected, making it possible to go beyond the mere overall description of consensus, adding analyses on the differences between stakeholder

groups/occupational groups, gender groups, specific policy measures ranked, and the difference between the two Rounds of the Delphi.

It was found that stakeholders prioritize measures of industrial pollution control, sand mining control, medical care for fishers, provision of maintenance grant for the poorest, oil (fuel) subsidies for fishing boats, solving the housing problems of the fishers' families, and getting compensation from the hydropower stations for the reduction of the fish resources.

The Chinese team went through 3 rounds of the stakeholder Delphi. According to the Duncan's Multi-range test method, there was no significant difference in the overall scores of the stakeholders between the 3 rounds. The Kendall's W and Friedman's tests were not performed, but the result of the Duncan's Multi-range test point to a conclusion that the expected consensus-making effect of the Stakeholder Delphi analysis in this case cannot be documented. In a subsequent article on the stakeholder Delphi experience of the HighARCS project, we will run the Kendall's W and Friedman's tests on the data from the Chinese site in order to make cross site comparisons.

Buxa site, West Bengal, India

(1) Ecosystem services in Buxa

In Buxa, ecosystem services are listed in WP3 Buxa as follows:

Provisioning services: Buxa community members depend on aquatic ecosystem provisioning services such as food, fresh drinking water (humans and animals), washing, wood and fibres, fuel wood, fodder, boulders and stones from the river bed. These services can be valued through market prices (WP 3 Buxa, WP 5.1 Buxa).

Supporting services: The local rivers offer the natural habitation for fishes, collection of crabs and molluscs and aquatic plants. It also provides the basis for attracting tourism. Such services may be valued through production function and cost based approaches (WP 3 Buxa), but the team has not undertaken this analysis so far.

Regulating services: In this category are counted services such as food regulation, diseases prevention, and water purification. The WP 3 Buxa report mention specifically that the Buxa area suffers from serious soil erosion related to heavy rains and flooding. Uses of the riverbeds and land uses (agricultural systems, forestry systems, infrastructure construction) influence the magnitude of the flooding and soil erosion problems. Similarly to the previous category, the economic value of such services can be assessed through production function and cost based approaches.

Cultural services: Aesthetic, spiritual education and recreational services. Such eco-system services include availability of recreational services -picnic spot on the bank of the river and streams in Jayanti. The roots of certain plants are used to make toys for the children. They serve multiple purposes –education and recreation.

(2) Access to ecosystem services

Access to ecosystem services for people in Buxa is regulated under the Reserve Forest Act (1972), as Buxa has been declared a Tiger Reserve. However, the communities are allowed free access to eco-system services as per their consumption needs. More info on this in the Buxa "Institutions, Policies and Conflicts" report (D5.1).

(3) Outcome of stakeholder evaluation of eco-system services in Buxa

Stakeholders, in case of evaluating the ecosystem services, include local communities, local village Panchayat **(village assemblies),** Government officials-forest, fishery and agriculture departments and civil

society institutions. The team also tried to have the views of women on the eco-system services to have a gender perspective.

The stakeholders' evaluation suggests that there are divergent views on eco-system services of Buxa influenced by their social location, institutional commitment and proximity and relationship with the community. Use of participative methods has brought finer differentiations in their locations which, in turn, have helped evolve respective priorities. A special feature of the evaluation exercise is near agreement among stakeholders on the priorities and concern. Water, flood and soil erosion, fish, plants, fuel wood and tourism have emerged as priorities. There is a visible concern toward the issues of soil –erosion, water and aquatic products. Water scarcity is a great issue and the community has to access water from far off places. Women and adolescent girls toil harder to bring water leaving a larger gender gap. The officials from the forest department seem more cautious to maintain norms even at the cost of ignoring urgent needs of the community. The local Panchayats and the civil society are located in close proximity whose views are quite similar to those of the community. Cultural tourism emerging as a livelihoods opportunity has to be seen with caution. While there is economic opportunity in it, it may spell cultural doom for the simple community members. In a recent case rich businessmen are promoting local tourist dwellings keeping the local community as subservient. While this may set a process of exploitation and pauperization this may also bring urban elite in contact with the local communities leading further to human exploitation and moral degradation. The Integrated Action Plan (IAP) would keep this in mind.

(4) Stakeholder Delphi

The stakeholders participating in the stakeholder Delphi panel in Buxa included community members, members of the Panchayat, local (including district) and state level government officers, members of civil society and self-help groups. In all 14 stakeholders, from among the above, were identified.

The items of the research questionnaire for Round 1 pertained to general environmental conditions, extent of use, factors contributing to degradation, policy adequacy/inadequacy, and effectiveness of current environmental policy, economic, social and environmental benefits, threats and potential measures. As some of these questions pertaining to the state of the resources and the need for action had already been analysed with the stakeholders earlier, the Round 1 Questionnaire a section with ranking questions (Section 1: General information), whereas the following sections on Potential problems and threats (section 2) and Other issues related to highland aquatic resources (Section 3) were kept as open questions.

All the respondents have found the Buxa aquatic resources as satisfactory –ranging from acceptable to quite plentiful. Also extent of pressure on the aquatic resources has been considered to be less. About the need to take policy correctives for conserving the aquatic bio-diversity the respondent do not feel strong need-the current provisions are adequate. There is, however, missing awareness due to non-availability of relevant information. People feel that present policy regime is not quite effective to ensure conservation and better conserving the aquatic resources could ensure economic, social and environmental benefits.

Considering potential problems and threats on the aquatic resources, such as natural calamities (floods), soil erosion, deforestation, pollution through sewerage and poisoning of the river for fishing were mentioned, as well as "governance inadequacy" and lack of infrastructural support (Section 3: Other issues). On these issues, the statistical tests showed a significant but only moderate concordance of scores (section 2), and moderate concordance of scores (section 3) respectively in Round 2. In Round 3, contrary to expectations, the level of concordance had diminished to the level of "weak" (section 2) and to "very low" (section 3). However, as the p-value for section 3, Round 3, had risen to 0.181 assuming a chi-square distribution with 29df, it was concluded that there was no statistical difference in the scores on the statements in this section.

Stakeholders views to mitigation/solutions (section IV) include **c**apacity building and reorientation of the local officials and other partners in governance, introduction of new technologies, building and

strengthening financial support system, checking of stone and sand mining, trying and testing of new income generation activities including appropriate cropping system, and awareness building for the protection, nurturance and promotion of high aquatic resources. For this section, Round 2 responses showed a moderate degree of concordance, and – contrary to expectations – having consensus dropping to "very weak" in Round 3.

Reasons why opinions grew further apart as stakeholders were exposed to the opinions of the others may partly be explained by the fact that the local environment and the livelihood situation of the communities living in the Tiger Reserve is considered a sensitive issue and that respondents in the first round may not have given quite honest answers.

Uttarakhand Site, India

(1) Ecosystem services in Nainital lake system

Regarding provisional services, the lakes in our field sites offer food, fresh water, drinking water, irrigation water and drainage system. At the Bhimtal and Naukuchiatal Lakes, fishing is also provided. Climate regulation, water regulation and water purification are the key regulatory services provided by the Lake System. In terms of supporting services, the lakes provide nutrient cycling and sediment retention. Finally, the lakes provide cultural services of spiritual activities related to various places of worship, recreational activities, educational activities and tourism.

(2) Access to ecosystem services

Access to the ecosystem services of the Lakes show a mixed picture. The provisional and some of the cultural services (boating) services are regulated by the local authorities. The regulatory and supporting services are to the benefits of all.

(3) Outcome of stakeholder evaluation of ecosystem services in the Nainital Lake System.

Data was gathered through focus group discussions. Discussions were held for groups of men, women, boys and girls separately and subsequent ranking exercises by stakeholder group. The Nainital D5.2 report contains sections where the ecosystem services are presented as they are perceived by each of the four mentioned groups of men, women, boy, and girls.

On the overall, it was found that tourism, drinking and irrigation water, fishing, and water regulation (against flooding; to provide stable drinking and irrigation water supplies) are the most valued ecosystem services. The current version of the country report also contains the category of "climate change" as an important ecosystem service appreciated by the respondents. What seems to be meant here is that the lakes can provide some "mitigating" qualities if there is climate change (stable water supply, prevent floods, breeding place for cold temperature fish species, etc.).

The Uttarakhand report explains how different stakeholders have different/ conflicting uses of the ecosystem services provided by the Lakes. It also mentions that most of the stakeholders are not informed and therefore not concerned about the regulatory and supporting services provided to them by the lakes.

(4) Stakeholder Delphi

The team identified 13 relevant stakeholder groups to include in the exercise: boatmen, fishermen, hotel/resort owners and restaurant owners, The Irrigational Department, the cold Water Fisheries Department, the National Lake Region Special Area Development Authority, the Jal Sansthan (water provision department), Tourists, small shops around the lake, schools- and college teachers, students, farmers and the Nainital Nagar Palika Parishad – the local municipality.

Initial open questions were about (1) how the environment of the lakes has changed over time, (2) how the livelihoods of people depend on biodiversity, (3) how they see the relation / interaction of human activities

with the biodiversity of the lake, (4) their perception of the state of the biodiversity of the lake; (5) if they are aware of the existence of any conservation measure to protect biodiversity of the lakes; (6) their opinion about how biodiversity can be properly managed without affecting the livelihoods of the people, and (7) How the inflow of tourists has changed over time.

The standard procedure of the Stakeholder Delphi as described above was then followed, using Kendall's W and Friedman's Chi-Square tests to analyse the results. A methodological difficulty met was the fact that tourists and students do not necessarily stay around for long enough to participate in all three phases. We have therefore accepted to run the Delphi with some of the respondents from these two groups being replaced by new ones from one round to another, seeing them as randomly selected representatives of the particular stakeholder group. Interpretations of the effectiveness of the stakeholder Delphi Method in terms of facilitating a consensus-building process amongst the same group of stakeholders there must be done with some precaution.

The results of the Stakeholder Delphi has shown a moderate to fair degree of consensus amongst the panel members in the matter of perceptions about the aquatic biodiversity of the lake, the existing conservation plans to protect the biodiversity, and the change of inflow of tourists over time. If we take all 7 issues and all stakeholders as a whole, there is a moderate degree of consensus. There is an unusually strong consensus of the dependence of the livelihoods of people on biodiversity. But there is a very weak consensus concerning the change in the local environment over time, the adverse effects of interactions of the people with the lake biodiversity, and the appropriate ways to manage biodiversity without negatively affecting of the livelihoods of the people depending on the lake system.

The impact of the use of the Stakeholder Delphi methodology in order to facilitate the establishment of consensus amongst stakeholder groups shows no effect in this case, as responses in Round 2 and Round 3 were almost identical for all stakeholders. But as some of the panel members were replaced from Round 2 to Round 3, the outcome may have been influenced by this.

VIETNAM SITES

At the Vietnam sites, field work on stakeholder evaluations was done in 2011. The stakeholder Delphi survey preceded the ecosystems services assessments. Although the final reporting of this has been delayed until 2013, the substantive results from the stakeholder evaluations were fully integrated in the elaboration of the action plans in Vietnam and caused no delays in the planning process in 2011-2012. The account of the results of the stakeholder evaluation of ecosystem services has been reported in D3.2 under WP 3. Therefore, it is only briefly summarized in the present country report from Vietnam.

The stakeholder Delphi was used by the team as a tool for identifying most important problems, pressures (causes) and solutions (remedial measures to be taken) and prioritizing them by using the "mean rank".

The selection of panel members from local and provincial government offices was made through the respective Heads of Department. The selection of panel members amongst local community groups was done according to the team's own knowledge of local people in the villages.

The initial open questions for Round 1 were elaborated according to a combination of the DPSIR and the STEPS models. The respondents were asked to list (1) potential problems, constraints or threats facing highland aquatic resources, (2) factors (pressures/drivers) relevant to aquatic resources in the area, (3) suggestions for implementation, activities, policy or institutional measures to better manage and suitably utilise aquatic resources.

The standard analysis of Kendall's W and Friedman's two way analysis has been made for the results of Rounds 2 and 3 at each site looking at the degree of concordance of responses concerning "problems", "factors" (drivers/pressures), and "suggestions" (responses) respectively. At this level of analysis, the DPSIR methodology was used as the structuring principle. In addition, an analysis of concordance was made of

responses at the sub-level of dimensions inspired by the STEPS framework, distinguishing between physical, environmental, managerial, social, economic, and livelihoods related aspects.

Son La site, Northern Vietnam

The major aquatic ecosystems services identified at the Song La are domestic water, fishing, aquaculture, and irrigated agriculture. However, the field work also showed that different stakeholder groups value the services differently. The regulating services were valued the highest by the Provincial and District level of governance and the Commune level of governance, in particular wetland water storage during dry season, habitat provision for economic species, flood control and the maintenance of genetic diversity of valuable fish species. Whereas the villagers also value the provisioning services, especially fishes for commercial and subsistence use as highly as the regulating services. Many of the highly prioritized ecosystem services are depending upon the reservoir (an artificial environment) and the dam management providing suitable levels of water for harvesting of fish and water etc.

44 letters for possible panel members for the *stakeholder Delphi* were sent out, representing local and provincial authorities and various local stakeholder groups, men and women. 39 panel members remained in round 3. The stakeholder Delphi explored which problems or threats for maintaining these services; the reasons behind these problems, and the solutions to take to address them.

Concerning the *problems and threats,* the muddy conditions of the water in the river and the lake behind the dam ranked highest amongst with a median score of 9.0 in Round 3, a score which links well with the identified opinions on the most valuable ecosystem services provided being water for human consumption and use (drinking, washing, fishing). But important managerial issues were also identified, such as the lack of effective policy measures and locally specified rules and regulations; as well as lack of coordination and unclear division of responsibilities amongst governance institutions concerning the conservation of aquatic resources. Lack of knowledge and awareness of the need to conserve aquatic resources was also mentioned as an important issue.

Concerning the *factors (drivers, pressures)* accounting for these problems, the most important ones were seen to originate from the steep slopes of the landscape and the lack of available land suitable for farming. On the managerial side, stakeholders pointed towards inadequate infrastructures and planning as factors leading to the problems, threats and issues experienced.

The most important *suggestions* for action emerging from the stakeholder Delphi were the provision of training on aquaculture, financial subsidies for people in the fishing areas, and the making of detailed action plans for conservation of aquatic resources (median scores of 10). The establishment of user groups and organisational units within the government structures to be responsible for the management of aquatic resources also received a very high score (9).

The statistical test of concordance showed weak or very weak levels of agreement in Round 2 moving to moderate strong levels of agreement in Round 3 for each of the 3 categories of problems, factors, and solutions. Broken down into “SMART-inspired” dimensions (environmental/physical, managerial, institutional, economic, social and livelihoods-related) the picture in Round 3 becomes a bit more nuanced. Thus, for example, there was unusually strong agreement on institutional and economic problems identified, whereas agreement was weak/moderate on the mentioned managerial problems. It is also interesting to note that there is strong agreement on the suggestions for institutional and management-related actions and the suggestions for economic development, whereas there is only weak-moderate agreement on the suggestions for “more regulation”.

Quang Tri site, Central Vietnam

The major aquatic ecosystems services identified at the Quang Tri study site are fish, domestic water supply, hydro-power energy and water transportation. Similarly to the situation in the Phu Yen District sites, the report pointed out that there are some differences between the different governance stakeholder

groups (Provincial and District; Commune; and village). The villagers scored the fishes/shrimps for commercial use higher than the other groups in Quang Tri, and the Provincial and District level governance group prioritized flood control and tourism and aesthetic value higher than the other groups. The Commune governance group scored only recreation higher than the others. The upper forested catchment of the Dakrong River is essential for the provision of all the ecosystem services, and in the case of migratory species that are utilised in fisheries, the lower catchment is also critical.

Stakeholder Delphi results

As in Son La, the Stakeholder Delhi survey explored problems and threats to the aquatic resources in Quang Tri (Dakrong River), the factors causing the problems, and the actions to take to solve them. In Quang Tri, the team sent out 33 letters for selected panel members with the same open ended questions as the letters sent out in Son La. 30 members responded in Round 1, 27 responded in Round 2, and 21 Responded in Round 3.

The most important *threats and problems* on aquatic resources in Quang Tri according to panel members were seen to be lack of local awareness on aquatic resource conservation and unstable destructive fishing methods (score: 10), followed by the two environmental problems of “climate change” and “pollution from industry and agriculture”.

The most important *factors (drivers and pressures)* behind the problems were found to be the lack of environmental protection and waste water treatment, shortage of water, and the on-going deforestation of the surrounding hills and mountain slopes.

To solve the problems or diminish the threats against the aquatic resources, the *suggestions* given most importance by the panel members were the need to develop programs, documents and regulation for fisheries; clear policy programmes; better management procedures/capacity; and stricter implementation of measures against destructive fishing and environmental pollution or in giving permission for mineral exploitation or gold mining (scores: 10). It was also seen as very important to give more “propaganda to local people” in aquatic resources conservation and training of local staffs in aquatic resources conservation (score:10).

At the Quang Tri site, the statistical tests of concordance showed the same pattern of moving from weak or very weak agreement in Round 2 towards strong or unusually strong agreement in Round 3. Broken down into specific sub-categories, stakeholder panel members were agreeing strongly on the way to assess *threats and problems* of the aquatic resources in Quang Tri, although the environmental threats seem to present an issue where opinions remained divided also in Round 3.

Concerning the *factors of relevance to aquatic resources* in at the Quang Tri Site, panel members agree strongly on an (only) moderate support to the proposed factors (drivers & pressures), which points to the need to working more with local stakeholders in understanding the dynamics of the local ecosystems and aquatic resources conservation.

The panel members also agreed strongly or unusually strongly within each proposed area of intervention. However, although it was noted above that there was a very high support to more regulation, this support was not statistically confirmed, as the test of concordance turns out to yield the result of a “very weak” agreement on this particular set of suggestions.

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HighARCS
Highland Aquatic Resources Conservation and Sustainable Development
www.higharcs.org

D5.2

Report on stakeholder evaluation of highland aquatic resources in China site

by

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Oct. 25, 2011

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Executive Summary

The cooperation and participation with key stakeholders to solve the complex problem of managing highland ecosystem is one of the characteristic of this HighARCS project. After we identified the key stakeholders in 2009, three types of stakeholder evaluation of highland aquatic resources in China site were conducted in 2010. The first was the System Of State (SOS) workshop where we discussed with stakeholders about the general situation of Beijiang River Watershed. The second was the priority order of ecosystem services given by stakeholders. The third one was the stakeholder Delphi investigation on the importance of the management and policy related to ecosystem conservation and livelihood improvement for fishers. The result of SOS workshop shows that our understanding on Beijiang River Watershed was basically supported by the key stakeholders (73.4%). However, different opinion between government officers and other stakeholders was quite clear. Different interests and understandings of the situation among stakeholders were also found. The need for communication among stakeholders and coordination among government departments was also identified. The results of priority order given by stakeholder clearly show that there is a common understanding of the ecosystem functions on its provisioning and cultural services. However it is relative weak in understanding supporting and regulating functions. It also shows that government officers and company leaders understand ecosystem service better than farmers and fishers. The bias caused by occupation was statistically significant. However, there was no significant difference between sex groups in ranking the priority of ecosystem services. The result shows that pollution control and sand mining activity management are highly valued by stakeholders for improving resources and environment, and housing issue and financial supports in forms of medical care, grant to the poor, oil subsidy, and compensation from industry sector were recognized as the important measures for improving the livelihood of fishers. The result of stakeholder Delphi investigation on the policy and management issue also indicates that the influence of the occupation of stakeholders was a significant factor to cause different understanding about the importance of a management or policy measure. There is no significant effect caused by sex group, or by different round of the stakeholder Delphi investigation reply. In general, the information gathered from this three participatory appraisals are quite consistent. It will help us to identify those important ecosystem services, key measures in management and policy. It also will help us to recognize the importance about communication and coordination among stakeholders. These results will help us in the coming action plan stage of this project. In our bioeconomic modelling stage, the information collected from these evaluations will help us to choose the right parameters, the right direction and the magnitude of the change. Hence the model will likely provide more realistic pictures in respond to our action plan.

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1. Introduction

1.1 Introduction and purpose

As they are stated in the "Annex 1-Descriptioon of Work" about HighARCS, "the first project objective is to provide a detailed Situation Analysis of highland aquatic resources and associated biodiversity and ecosystems services at five sites in Asia (Guangdong, China; Uttrakhand and West Bengal, India and northern and central Vietnam). This will be followed participatory action planning focused on conservation, livelihoods and policy, in collaboration with stakeholders, especially primary and key stakeholders, including resource users, poor and vulnerable groups, CBOs, NGOs, civil society, and local, state and national government institutions. These will be designed to reconcile multiple demands, including those associated with livelihoods (including men, women and children) dependent of highland aquatic resources and associated biodiversity and ecosystem services, whilst monitoring and evaluating impacts on the highland aquatic ecosystems (biodiversity and services), dependent livelihoods, especially those of poor and food-insecure households, stakeholders and institutions involved." So, it is important to know different views, demands and judgements from different stakeholders, before we can take better steps in our action plan to balance different ecosystem services to meet the different, and some times conflicting needs of the society.

China site is located in the upper part of Beijiang River, the major branch of Pearl River in southern China. Shaoguan municipal region covers the majority part of Beijiang River Watershed (Research Team of South China Agricultural University, 2010). This region is not only ecologically sensitive to Guangdong Province because of its forest cover and water resources, but also a very typical area in China for solving the conflicts between rapid social economic changes and sustainable development We have conducted general situation analysis (China WP1 Report, 2010), field investigation on fish, mollusc, dragonfly and aquatic plant species and investigation on ecosystem structure and functions (China WP3 Report, 2010), livelihood investigation for fishers (China WP4 Report, 2010), and the related policy and management analysis (China WP5 Report, 2010) The participatory approach is one of the basic methodologies adopted in this project. In this report we will summarise our research results of the stakeholder evaluation of highland aquatic resources. This will provide a solid base for balancing different demands and needs among different stakeholders in our action plan for protection and sustainable use of aquatic resources in Beijiang River watershed.

1.2 General Methodology and data sources

The physical structure and function of Beijiang River Watershed was explored through site visits and literature review in 2009. The field investigation was conducted in different parts of the watershed including forest, farm field, fishing village, iron ore mining site, sand mining site, hydropower station, reservoir, fish pond, wood processing factory, fish market, supper market ect. Literatures used included different annual reports and statistics from Shaoguan municipal government and Guangdong provincial government, and scientific reports, papers and books. GIS method was adopted to identify the land use pattern and area under research. In order to calculate

the economic value of the ecosystem services provided by Beijiang River Watershed, the IUCN proposed method was used to categorized ecosystem services (Olive Springate-Baninski, David Allen, William Darwall, 2009), and economic evaluation methods including market value method, replacement cost method, and the opportunity price method were used to calculate the benefit and cost generated by Beijiang River Watershed (Xie GD, Lu CCX, Leng YF et al., 2003）.

After the general survey of the watershed, we identified the key stakeholders related to the protection and sustainable use of aquatic resources in Beijiang River Watershed and chose three typical fishing villages, namely Kengkou, Zhoutian and Lishi as our detail livelihood investigation sites. We conducted focus group discussion in 2009 to get their idea about the ecosystem services and to understand the general situation. One discussion was conducted among officers from different government departments. The second discussion was conducted among company leaders from industrial, agriculture and services sectors. The third discussion was conducted among fishers from different fishing groups. The 18 research team members from South China Agricultural University are from different disciplines including ecology, geology, forestry, fishery, entomology, plant science, agronomy, economy, law and management (see the Annexes in page 36). After we got the idea about the general situation of the watershed, we held a State of System Workshop with key stakeholders and asked them to confirm or reject our understanding (WP1 Report, 2009. Report on the State of System (SOS) Workshop in China Site, 2011)

In order to get the prioritisation of ecosystem services and costs from the key stakeholders, we conducted an evaluation meeting in May, 2010 in Shaoguan. After an introduction about the concept of ecosystem services, stakeholders gave their judgement on the importance of each ecosystem service by filling the form we provided. Fishers and farmers could not attend the meeting because of the long distant and separation. We conducted a household investigation for them instead. We explained the concept of ecosystem services in a household base and help them to fill the form (China WP3 Report, 2010).

Delphi investigation method on the policy and management related to the improvement of the ecosystem services was conducted through May to October, 2010. We carefully formulated the table of questionnaires and chose the key stakeholders. After the stakeholders filled the table for the first time, we calculated the average and standard deviation. We gave them this result and asked them to fill the table again as the second round. The same procedure was used for the third round. After the third round of Delphi investigation, statistic analysis of the data collected was conducted by using SPSS software (China WP5 Report, 2010).

The results of ecosystem evaluation from stakeholder by different methods were compared and the future usage for action plan and bioeconomic modelling is discussed below.

2. Stakeholder valuation of aquatic resources at China site

Ecosystem services are the conditions and processes through which natural ecosystems and the species that make them sustain and fulfil human life (Daily 1997). They maintain biodiversity and the production of ecosystem goods, such as food, timber, fuel, natural fibber, and many pharmaceuticals, industrial products, and their precursors. The American ecologists (Costanza et al. 1997) called the products and services provided by ecosystems as “ecosystem services” and divided it into 17 different types. According to the mechanisms, types and efficiency of the

ecosystem services and we sorted ecosystem services into 4 types in this study. They are product supply, ecological maintenance, culture functions and support functions according to IUCN "An Integrated Wetland Assessment Toolkit" (Fig. 1) (Springate-Bafinski, Allen and Darwall 2009).

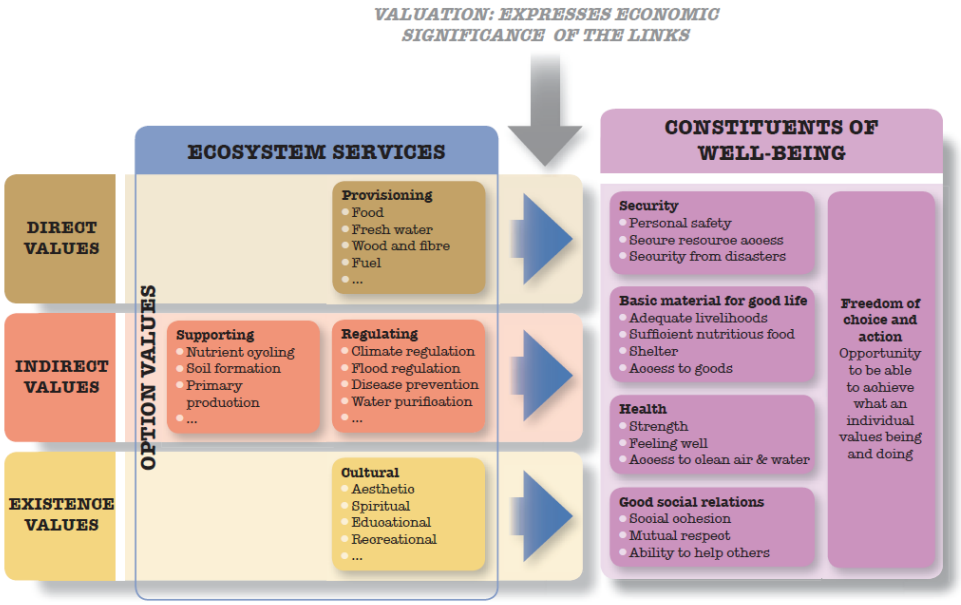

Fig.1 Ecosystem services, human well-being and the total economic value of wetlands (IUCN, 2009)

2.1 Identified ecosystem services at Beijiang River Watershed

The ecosystem services provided by Beijiang River Watershed can be indentified as follows (WP 3 Report of HighARCS 2010).

2.1.1 Provisional Services

Provisioning services includes food, water, fuel, fibre, biochemical composition, and genetic resources. In the upper Beijiang River, the ecosystem products mainly include wood from the forest ecosystem, fish, industrial water supply, domestic water supply, sand supply, hydropower supply, and transportation across the river, reservoirs and lakes; and grain products from the farmland ecosystem.

（1） Wood

In recent years, lots of trees have been planted within the Beijiang catchment and the area of forest is increasing. In the year 2008, the land area which can be used for forestry was 1.433 million ha with 1.162 million ha covered by forest. The standing forest stock was 65.235 million m3, with the biomass of forest being 73.666 million tons, including 46.91 million tons of commercial forest biomass and 26.755 million tons of non-commercial forest biomass.

（2） Aquatic products

In 2007, the aquaculture output of Shaoguan City was 60,395 t, including 59,612 t fish, 393 t shellfish, and 202 t shrimps and crabs (Table 1). In 2007, the aquaculture output value was 431.87 million Yuan. It was 3.93% of the total agricultural output value.

Table 1 The aquiculture output of Shaoguan City in 2007

（Statistical Bureau of Shaoguan, 2008）

	Yield(t)
Total aquiculture output	**60395**
1.fish	**59612**
(1)high valued fish	**18420**
Channa argus	166
Siniperca chuatsi (provisionally assessed as Data Deficient)	130
Micropterus salmoides (provisionally assessed as Data Deficient)	526
Piaractus brachypomus (introduced to China, native to South America)	2009
Oreochromis niloticu	5118
Carassius auratus (provisionally assessed as Least Concern)	3809
(2) other fish	**41192**
*Ctenopharyngodon idell*a	14781
Hypophthalmichthys nobilis	9194
Hypophthalmichthys molitrix (provisionally assessed as Data Deficient)	10126
Cyprinus carpio (Introduced to China, native to western Europe)	4853
2.shellfish	**393**
3. shrimps and crabs	**202**

According to the survey, the main fish types caught in the three sampling fishing village are carp, crucian carp, yellow horn fish, shrimp, a small amount of blue knife fish, catfish, perch, turtles, mud carp etc. In Spring, a typical amount of catch per day by a small fishing boat operated by two persons is 15 kg carp fish, with a price of 5 Yuan/kg, or 5 kg crucian fish with a price of 6 Yuan/kg, or 0.25 kg yellow horn fish with a price of 18 Yuan/kg. In April to September, 2 kg of shrimp with a price of 14 Yuan/kg can be captured per day.

According to the results of the three sampling villages, 1/3 of the fishermen's families are completely living on fishing. About 1/5 fishing families are live partly on fishing and partly on income from working outside or from children working outside. In Lishi Fishing Village for example, there are 11 families totally rely on fishing, and 3 families totally rely on income from working outside the village, 2 families totally rely on the support from their children working outside, and the income of the remaining 7 households are 50-90% from fishing, 10-50% from other resources.

（3） Water for productive use

Water for productive use includes agricultural water supply and industrial water supply. For agricultural irrigation, there are 1,567,200 hectares of cultivated land and 1,433,000 hectares of forest land in Shaoguan City in 2008. Most of the agricultural irrigation was provided by the water stored in dams or reservoirs while some were provided directly by the springs from the forest (Fig. 39). Industrial water supply is very important for many companies in Shaoguan City for example Shaoguan Iron Steel Group Limited Company of Guangdong Province, Shaoguan Smelter,

Dabaoshan Mining Limited Company of Guangdong, etc. The industrial water consumption was 5.49x106 tons in 2008.

（4） Domestic Water Supply

The urban and rural domestic water is mostly supplied by the large reservoirs such as the Nanshui reservoir in Ru Yuan County. Part of the rural domestic water is gained from the river and underground water. According to the statistic provided by the Shaoguan Bureau of Water Management, average domestic water use for each person was 181 liter per day in urban area and was 118 liter per day in rural area (Shaoguan Bureao of Water Management, 2008)

（5） Sand Supply for Construction

The main sand digging activity is in the river bed of the major streams. Sand digging mainly provides urban construction sand. For example, the Water Management Bureau of Shaoguan allowed 5.3 km section of the river near Zhoutian Village for sand mining and the quota was 0.35 million cubic metres per year. It also permitted a 4.6 km river section near Lishi village for sand mining and the quota was 25 million cubic meters per year. The depth for sand mining is usually reaching 1-1.3 m on average.

（6） Hydropower Supply

Beijiang River is abundant in its hydropower resources. Its theoretical potential reaches 1,744,900 kW. The actual utilizable hydropower reaches 1,474,000 kW. The annual hydropower generated electricity can reach 55.8 billion kWh. By the end of 2008, there were 485 reservoirs in Shaoguan. They include 4 large scale reservoirs, 29 medium scale reservoirs and 454 small scale reservoirs. There are 1989 small scale hydropower stations. Total installed capacity of power generator reaches 1,519,200 kW and the actual power generated a year reached 45.56 billion kWh in year 2008 (Annual Report of Shaoguan, 2009). All the hydropower supplies are incorporated into the national electricity network and supply to domestic, commercial and industrial usage.

（7） River Transportation

Shaoguan water transportation channels include rivers such as Beijiang, Wujiang, Zhenjiang, Wengjiang, Xinfengjiang, and the Longguihe. Beijiang River can be accessed by hundred tonnage big ships between Shaoguan and Guangzhou. In 2008, there were 698 km water transportation channels in Shaoguan and the shipping capacity reached 15 million tons with the actual port throughput reached 200 million tons. The 184 km long Shaoguan-Qingyuan river channel is wide enough for cargo ship transportation. (Guangdong Shaoguan city ecological civilization construction planning, 2008) (Fig.44). On October 14, 2008, the container shipping voyage from Beijiang Xingang Port, Shaoguan to Hong Kong was officially opened. It diversified the channels for importation and exportation from the mountainous area of north Guangdong (http://www.yicang.com/html/news/view/awv).

（8） Food products

Shaoguan is suited to agricultural production in owing to its warm and humid subtropical climate resources. The arable land area per capita in Shaoguan is the largest in Guangdong Province. In recent years, the infrastructure in agricultural and rural areas has been improved. Agricultural output value has increased. The seven major agricultural products in the region are vegetable, rice, livestock, fish, fruit, bamboo, and tobacco. Many rice, livestock and fish are well known for their quality and have high market values. In 2009, the grain growing area was 1,567,266 ha with a total production of 9,010,000 t. The growing area of high-quality rice was 564,933 ha with a total production of 3,894,000 t. The production of meat was 148,000 t which included 117,000 t pork and 66,000 t fish.

2.1.2 Regulating services

Regulating services include climate regulation, water regulation, water purification, soil conservancy, natural disaster control, etc. This study would introduce ecosystem regulation in both forest ecosystem and river ecosystem.

Table 2 Regulation services provided by river ecosystem

Flooding control	Vegetation along the river ecosystem, floodplains and downstream wetlands, swamps, etc. with the water storage capacity, can reduce flood peaks, delay flood flows and reduce the economic losses caused by floods.
Regulation of the amount of soil, sand and nutrient transferred through river ecosystem	River transportation of sediment allows nutrients to be passed downstream, including carbon, nitrogen, phosphorus and others, and is one of the world's most important biogeochemical cycles.
Water resource storage	Floodplains, wetlands, marshes of the river ecosystem accumulate and store lots of water resources. In the dry season they supplement the supply of water and can improve regional stability of water supply.
Soil conservancy	Sediment of soil particle and sand transported to wetland, swamp area and river mouth helps to create new land.
Environmental purification	Including air purification, water purification and local climate regulation, etc.
Nutrient cycling	The organisms within freshwater systems supply store and absorb nutrients. They promote the element exchange between living organisms and their environment. It keeps the ecological processes through a series of cyclic processes including nutrient storage and transformation within the river ecosystem.
Providing wildlife habitat	The river ecosystem provides important breeding, migration and nursery habitats for birds, mammals, fish, invertebrates, amphibians, plankton and other aquatic plants.

Regulation services usually can not be valued directly by market price. It is the same for cultural services and supporting services. In this case, other methods must be adopted for evaluation. The following methods can be used for the evaluation of ecosystem services:

Market value method: It is used for those services which can produce products, or have impact on the products which can be sold in the market.

Replacement cost method: If one ecosystem service is not provided by nature, the cost which must be used to generate this service artificially is called replacement cost. For example, the value of water storage capacity of forest can be estimated by the cost of building a reservoir with similar capacity.

Shadow price method: Values of some services can be estimated by the value change if ecosystem changes its services in certain level. The value changed can be estimated indirectly by the price which visitor agree to pay, the pollution treatment cost which society has to pay, or the price increase of land property etc.

（1）Forest ecosystem's regulating services

In the year 2008, the land area used for forestry was 1.433 million ha. This are provided annual carbon dioxide absorption of 106 million tons, released 78 million tons of oxygen, stored 56 million tons of carbon and provided 2.16 billion tons of fresh water downstream (Shaoguan Bureau of Forest, 2009).

According to the ecological service assessment methods which include the market value method, replacement cost method, and shadow price method, the value of forest ecosystem service was 8.4737 billion RMB Yuan, including 2.3675 billion Yuan of forestry carbon assimilation, 2.5528 billion Yuan of forestry oxygen releasing, 1.998 billion Yuan of forest water saving and flood control, 300 million Yuan for cleaning atmosphere, 0.3855 billion Yuan of forest soil erosion control, and 0.1375 billion Yuan for wildlife protection benefit (Shaoguan Bureau of Forest, 2009).

（2）River ecosystem's regulating services

The Shaoguan City includes Wujiang catchment, Jinjiang catchment, Nanshui catchment, Zhenjiang catchment, Mojiang catchment, Beijiang trunk river catchment and Xinfenjiang catchment. Rivers with catchments over 1,000 km2 are Mojiang, Jinjiang, Wujiang, Nanshui, and Wenjiang. The river ecosystem regulating services, as shown in Table 2, mainly includes: flooding control; soil, sand and nutrient transfer; water resource storage; soil conservancy; environmental purification; nutrient cycling; providing wildlife habitat; and CO2 fixation (Xiao et al., 2006, 2008；Wang, 2006).

2.1.3 Supporting Services

The supporting service includes soil development, circulation of materials, etc. Soil is formed through a slow process for thousands of years. It is an important part of national wealth (Ou Yang Zhi Yun，2000). The total land cover in Shaoguan is 17,100 km2 (Statistical Bureau of Shaoguan, 2008). Soil not only plays an important role in water cycle, but also provides habitat and nutrients for plant growth and development. It also plays a key role in nutrient storage, soil organic matter balance, and N, P, K, C, S cycling. It is estimated that soil carbon storage is 118 times larger than all plant carbon storage while soil nitrogen storage is 19 times larger than plants nitrogen storage (Schlesinger， 1991).

2.1.4 Cultural Services

Cultural services typically include the spiritual enjoyment, inspiration, entertainment, sports, aesthetic, education etc. In Beijiang basin, it's mainly sightseeing, fishing, boating and swimming. The natural tourism resources of Shaoguan City are mainly geological features, forest waterfalls, rivers and valleys, lakes and hot springs. There are 10 forest park, including 3 state forest parks, 2 provincial forest parks, 5 county forest parks. There are 22 nature reserves, including 3 state nature reserves, 12 provincial nature reserves, and 2 county nature reserves. Meanwhile, Shaoguan City is rich in cultural tourism resources, such as religious sites Nan Hua Temple, Yun Men Temple. Historical sites are also plenty in Shaoguan, such as Maba Site, Zhuji Lane, Mei Guan Road, Hakka buildings, folk customs from Hakka folk and Bibei Yao minority culture.

2.1.5 Vlue of ecosystem services based on land use

The value of all ecosystem services can also be divided into direct use values, indirect use values, optional values and existence values according to IUCN (2009). Different types of system function call for different assessment method (Fig.2).

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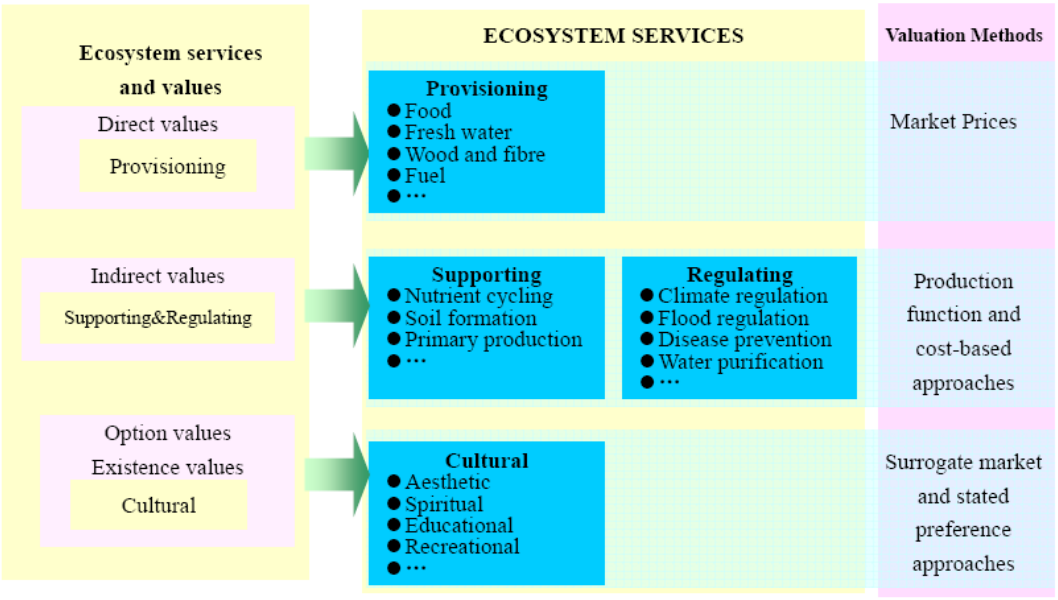

Fig. 2 Ecosystem values, services and evaluation methods

According to Xie Gaodi's improvement on Costanza's ecosystem valuation study (Xie et al., 2003); there is an equation which is more suitable for the calculation of China's ecosystem service value:

$$ESV = \sum_{i=1}^{n} VC_i \times A_i \qquad (1)$$

Where, ESV is the total ecosystem service value (Yuan) in the research area. VC_i is the unit value of ecosystem service provided by the ith type of land use pattern (yuan/hm^2). A_i is the total area of the ith type of land use pattern. n is the number of land use patterns.

For example, woodland can provide 3097 Yuan service each hm^2 for gas regulation, and then 1.3879 million hm^2 woodland can provide 4298.4 million Yuan of gas regulation service. Here

$VC_i = VC_{(woodland\ gas\ regulation)}$ =3097 Yuan, and Ai=$A_{(woodland)}$= 1.3879 million hm^2,

henc VC_i X A_i=3096.8 (Yuan/hm^2) X 1.3879 (million hm^2) =4298.4 (million Yuan)

Table 3 The land use and land cover in Shaoguan City in 2007(unit: hm^2)

Type of land use	cropland	Woodland	Grassland	Water surface	Land for construction	Unused land
Area	242986.67	1387926.67	2460.00	35813.33	70440.00	89413.33

Value of ecosystem services provided by Beijiang River watershed in Shaoguan City is calculated according to Shaoguan land use data in 2007 (Table 3). The value of VC_i adopted from Xie Gaodi's research for China land ecosystem service (Xie et al., 2003). We calculated the values of ecosystem service provided by Beijiang Wateshed. The results are in Table 4.

Table 4 The ecosystem service values of 2007 in Shaoguan City (unit: million Yuan)

	Cropland	*Woodland*	*Grassland*	*Water body*	*Unused land*	**Total**
Gas regulation	107.50	**4298.41***	1.74	0.00	0.00	4407.65
Climate regulation	1913.52	3315.90	19.59	145.76	0.00	3523.78
Water conservation	129.00	3929.91	1.74	645.83	2.37	4708.86
Soil formation	313.91	4789.60	4.24	0.32	1.58	5109.65
Water treatment	352.62	1608.88	2.85	576.11	0.79	2541.26
Biodiversity conservation	152.64	4003.61	2.37	78.91	2.75	4240.29
Food production	215.02	122.83	0.65	3.17	0.79	342.46
Raw materials	21.50	3193.06	0.11	0.32	0.00	3214.99
Recreation	2.14	1571.97	0.09	137.53	0.79	1712.51
Total	**1517.75**	**27385.23**	**16.09**	**1471.26**	**9.15**	**29801.45**

* Demonstration for calculation can be seen in text in page11.

2.2 Participatory evaluation of Beijiang River Watershed ecosystem services according to focus group discussions and field surveys

After the field surveys and focus group discussion conducted in 2009, we held a State of System Workshop in May, 2010 to evaluate our understanding of the situation by key stakeholders (Fig. 3). This was reported in the WP1 Situation Report (2010). The stakeholders who joined the SOS workshop are listed in Table 5. We introduced our understanding of the system by the help of Fig. 4 first. We separated our understanding of the watershed situation into seven sections which included forestry management, reservoir management, pollution management, hydropower station and dam management, sand mining management, aquatic resources management, and livelihood of fishers. Then we had a discussion and filling a form (Table 6) to express their opinion about our understanding of the system.

The general feedback from the stakeholders for our understanding of the system was positive. They agreed most of our judgment on the strong points and weak points of the watershed management which were represented in our draft of HighARCS WP1 background report. However, some new information also came out from the discussion and the returned forms. The detail information is provided below.

Table 5. Stakeholders in State of System Workshop on Beijiang River Watershed

(number indicates the number of person from the same source)

12 stakeholders from government departments	17 stakeholders from different companies
Bureau of Agriculture (1) Bureau of Water Management (2) Bureau of Forestry (1) Bureau of Environmental Protection (1) Bureau of Industry and Commerce (2) Bureau of Aquatic Product (1) Monitory Team for Fishery (1) Department of Development and Reform (1) Secretary of city government (1) City Court (1)	sand mining company (2) river transportation company (1) agricultural company (6) steel and iron company (2) mining company (2) hydropower station (1) hotel and food company (1) Research Institute of Aquatic Products (1) Tangwan Village leader of Xihe Township (1)

Fig. 3 One section of the State of System Workshop held in Shaoguan, May, 2010

Table 6. The Investigation Form for Stakeholders to express their idea about the understanding of HighARCS research team on Beijiang Watershed situation

The understanding from HighARCS on:	agree	disagree	Other comments
1. forestry management			
2. reservoir management			
3. pollution management			
4. hydropower station and dam management			
5. sand mining management,			
6. aquatic resources management,			
7. livelihood of fishers			

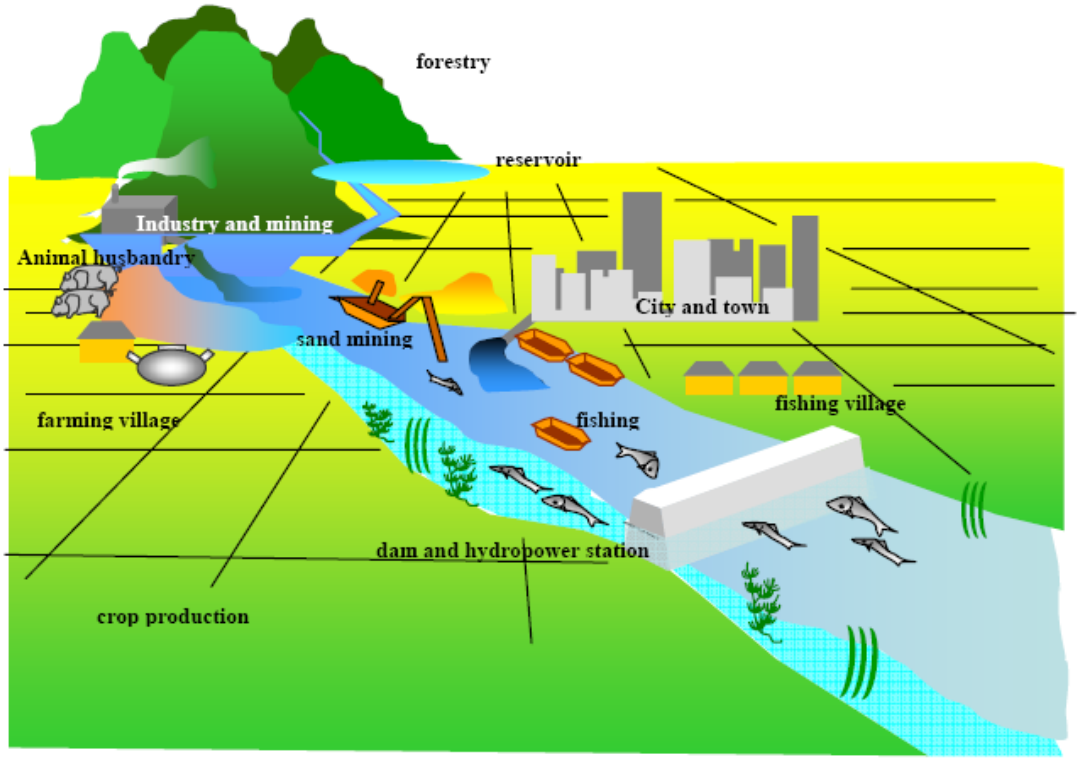

Fig.4 The major components of Beijiang Watershed system used in SOS workshop

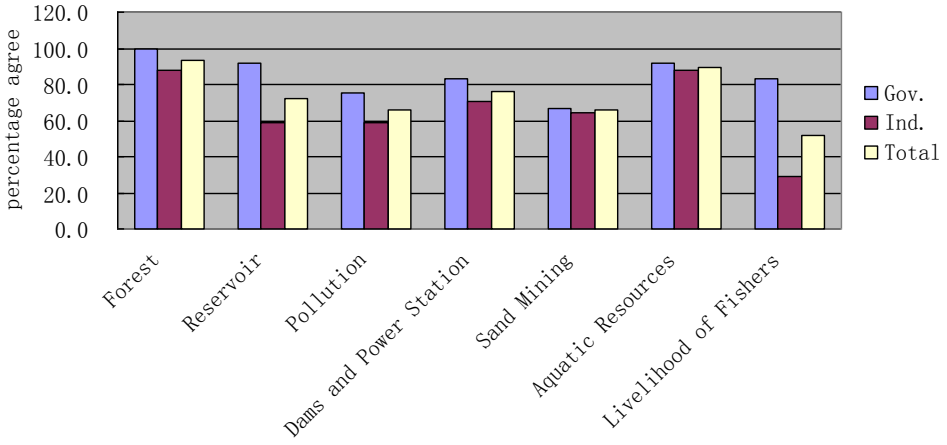

Fig.5 The percentage of stakeholders who agreed with the understanding of HighARCS China team on the situation of Beijiang River Watershed

The result in Fig. 5 shows that the high satisfaction with our understanding from government officers was in forestry management (100%), reservoir management (91.7%) and aquatic resources management (91.7%). The high satisfaction with our understanding from company leaders were about forestry (93.1%) and aquatic resources management (89.7%). Different understanding were existed between government officers and company leaders in reservoir management (91.7%: 58.8%) and livelihood of fishers (83.3%: 29.4%). The average percentage was higher from government officers (84.5%) than from company leaders (65.5%). It could be explained that government departments were in charge of the watershed management which they

had a closer understanding of the whole watershed as we did. However, leaders from company emphasized more on their own standpoints which were quite different from the whole pictures of the system. However the majority of the stakeholders agreed with most of our understanding. The total average percentage agreed with our understanding of watershed situation reached 73.4%.

Table 7 Comments from the SOS Workshop

Stakeholder from	**Comments**
Bureau of Industry and Commerce of Shaoguan City Government	● The species in artificial forestry is too simple in some place. Eucalyptus tree are the dominant tree species.
Department of Development and Reform of Shaoguan City Government	● The aquatic food chains did not loose their balance
Zhoutian Sand mining Company	● Punishment should be given to those using electric method to kill fish
Zehngjiang Sand mining Company	● Fast growth commercial forest (Eucalyptus) should not be expanded so quickly.
Qingyuan Transportation Company	● Pollution problem from boat restaurant and industry parks is still serious. ● Fishers should be arranged to live on land and have job on land.
Tangwan Village, Xihe Township	● Reduce Eucalyptus. Enforce environmental protection. Better flooding discharge control. Fishers are moved on land.
Shaoguan Pin Raising Association	● Eucalyptus has negative impact on environment. River channel should be maintained to reduce its ecological cost. ● Fishers should be arranged to live and work on land.
Environmental Protection Department of Shaoguan Iron and Steel Factory	● Reservoir should not be overuse by travel and bathing activities. ● Energy saving and pollution reduction have been improved a lot.
Environmental Protection Department of Shaoguan Iron and Steel Factory	● Considering the environmental effects, similar economic forestry such as eucalyptus should be changed. ● Reservoir as drinking water resource has not been recognized by government departments and protected properly.
Mengzhou Dam Hydropower Station	● Sand mining management should be strengthened. ● Fishers also used electric method to kill fish.
Fantai Agricultural Company	● It should be strengthened such as reforestation, storage of water in reservoir, control of hydropower station, and control sand mining activity.
Research Institute of Aquatic Resources	● Some economic activities are too much like dam building.
Golden Land Agricultural Company	● To control eucalyptus plantation. To control the sand mining pints. To set a side for fishers on land.
Da Baoshan Mining Company	● Too much eucalyptus. Overuse reservoir for tourist and fish raising

There was a space in the form for them to fill in their understanding of the situation which was different from ours or should be emphasized. There were only two feedbacks from the government officers (the first two rows in Table 7) and none of them could be considered new and correct idea. However, there were 12 feedbacks from the company leaders. Many of the views such as the complaint about eucalyptus forest, using electrical method to kill fish by fishers themselves and the reservoir management problems were quite valuable (from the third row in Table 7).

During the discussion, we found that the views from different stakeholders were quite different. Most of the stakeholders were lack system's view and lack of communication among them. For example, officers from the department of forestry supported the development of eucalyptus forest which was quite different from other stakeholders in Shaoguan. There was big difference on the management of Nanshui Reservoir. Officers from Environmental Protection Bureau strongly supported to protect the water quality in this reservoir as it was a source for drinking water. However, some other government departments and local township government did not know this information and still supported to use if for fishery and tourist activity.

During the discussion, we also found that government departments had done a lot of work to control pollution which included more green technique and more biogas generation tanks in agriculture, more sewage treatment centers in cities and towns, more strict pollution control for major industrial companies. However, serious problems still existed in pollution control for medium and small size industries.

2.3 Participatory evaluation of Beijiang River Watershed ecosystem services according to stakeholder meeting

A participatory assessment of the ecosystem service provided and ecosystem cost charged by Beijiang River, China has been undertaken. It takes into consideration the views of different stakeholders, and will be helpful to understand conflicts and identify potential solutions.

2.3.1 Methods

According to the ecosystem service described in "An Integrated Wetland Assessment Toolkit" of IUCN (Olive Springate-Baninski, David Allen, William Darwall, 2009), Table 8 was designed using common terms for participatory evaluation.

On May 21, 2010, an evaluation meeting was held in the meeting room of Shaoguan City Government. Government officers participated the morning meeting, and leaders from enterprises participated the afternoon meeting. The evaluation table was introduced by a slide show. After a short discussion, each individual filled his/her own form with or without their name on it according to their own will. On May 22, and July 2, 2010, three teams were sent to different fishing villages and farming villages to conduct the same surveys with fishmen and farmers.

One hundred and eight people participated in the investigation. Among them 15 from government offices including the Bureau of Agriculture, the Bureau of Water Management, the Bureau of Forestry, the Bureau of Environmental Protection, the Bureau of Industry and Commerce, the Bureau of Aquatic Product, the Department of Development and Reform, the Department of Security, Research Institute of Aquatic Products, Secretary of city government, City Hospital, and Xihe township government. Fourteen came from enterprises including sand mining company, river transportation company, agricultural company, steel and iron company, mining company,

Table 8 Evaluation Sheet for Ecosystem Service and Cost of Beijiang River

Affiliation_____Location_____Date_____No._____

Please draw a circle ○ in the cell where you think the level of importance is right. The bigger the number, the more important it is. You can add some other items at the end of the table if you think it is missing.

Ecosystem services		5	4	3	2	1
Provisioning	1 irrigation					
	2 daily water use					
	3 industrial water supply					
	4 aquatic products					
	5 sand for construction					
	6 transportation					
	7 hydro-electricity					
	8 game fishing					
	9 boating					
	10 tourism					
	11 swimming					
Regulating and supporting	12 air humidity					
	13 stable air temperature					
	14 clean environment					
	15 reduce flooding					
	16 delete pollution					
	17 reduce diseases					
	18 biodiversity					
	19 residential value					
Cultural	20 beautiful environment					
	21 spiritual home					
	22 education					
	23 research					
	24					
Ecosystem Cost		5	4	3	2	1
Cost for other reasons	-1flooding	○				
	-2 Drought					○
	-3 transmit diseases					
	-4 carrying pollutants					
Management cost	-5 dike building					
	-6 river bed clearance					
	-7 fishing management					
	-8 planting tree					
	-9 river pollution control					
	-10 water hyacinth					
	-11 picking up river garbage					
	-12					

hydropower station, hotel and food company. There were 62 fishers who came from the three sampling villages of this project, Kengkou, Lishi, Zhoutian fishing village, and Shangping fishing village and 17 farmers from near by villages such as Kengkou village in Kengkou, Qunlai village in Lishi, and Pingfu village in Zhoutian. In total, there were 29 women, 71 men and another 8 people without sex record. Except one lady, all 28 women were from fishing or farming villages. Software SPSS was used for data statistic analysis.

2.3.2 Result and Analysis

2.3.2.1 The general result of variation analysis

In order to understand the true differences exited within the data we collected, statistic method for ANalysis Of VAriation (ANOVA) by software SPSS was adopted. The results of an ANOVA (Table 9) show that there are significant differences existing among different ecosystem services or costs, among different types of stakeholder, and among different sex groups. However, further analysis shows that there are no significant different between men and women because the significant difference was caused by the group without sex record (Table 10). The significant difference that existed in the sex group is caused by the unidentified 8 people with out a recorded sex record. So, further analysis was focused on different stakeholder and different ecosystem service/cost items.

Table 9 Result of Univariate Analysis of Variance for Ecosystem service provided by Beijiang River, China

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Model	37739.983(a)	204	185.000	88.334	.000
ecosystem services	727.631	33	22.049	10.528	.000
types of stakeholder	481.071	3	160.357	76.567	.000
Sex group	251.110	2	125.555	59.950	.000
ecosystem services X types of stakeholder	552.443	99	5.580	2.664	.000
ecosystem services X sex group	172.562	66	2.615	1.248	.086
Error	7261.017	3467	2.094		
Total	45001.000	3671			

a R Squared = .839 (Adjusted R Squared = .829)

Table 10 Duncan's multi-range analysis result for sex group effects

Sex group	Average score	Duncan's Multi-range test result
men	3.126	b
women	3.144	b
no sex record	2.669	a

2.3.2.2 The assessment result of ecosystem services (Table 11, Table 12)

(1) The most important ecosystem services recognized by stakeholders

The most important ecosystem services ranked by the stakeholders include aquatic products; daily water supply, reducing flooding, hydro-power supply and deletion of pollutants by Beijiang River (see the red part in ecosystem service of Table 11). The average importance achieved from stakeholders is all more than 3.61 in the maximum 5 point system. These services can touch

Table 11 Evaluation Result for Ecosystem Services

	Service Item	Average	SD	Duncan's multi-range test*								
Ecosystem Service provided by Beijiang River	11 swimming	1.71	1.22	a								
	9 boating	2.06	1.36	a								
	8 game fishing	2.07	1.37	a								
	10 tourism	2.08	1.28	a								
	6 transportation	2.56	1.38		b							
	23 research	2.58	1.55		b	c						
	1 irrigation	2.87	1.77		b	c	d					
	12 air humidity	2.94	1.56		b	c	d	e				
	20 beautiful environment	2.98	1.54		b	c	d	e				
	3 industrial water supply	2.99	1.63		b	c	d	e				
	13 stable air temperature	3.00	1.5		b	c	d	e				
	19 residential value	3.03	1.63		b	c	d	e				
	18 biodiversity	3.04	1.48			c	d	e				
	5 sand for construction	3.16	1.57				d	e	f	g		
	22 education	3.32	1.58					e	f	g	h	
	17 reduce diseases	3.34	1.58					e	f	g	h	
	14 clean environment	3.53	1.54						f	g	h	i
	21 spiritual home	3.55	1.34						f	g	h	i
	16 delete pollution	3.61	1.55							g	h	i
	7 hydro-electricity	3.62	1.48							g	h	i
	15 reduce flooding	3.71	1.58								h	i
	2 daily water use	3.77	1.74								h	i
	4 aquatic products	3.98	1.34									i

Ecosystem cost caused by Beijiang River	-2 drought	2.15	1.55	a								
	-3 transmit diseases	2.75	1.61		b	c	d					
	-10 water hyacinth	2.88	1.66		b	c	d	e				
	-8 planting tree	3.09	1.63				d	e	f			
	-11 picking up river garbage	3.21	1.67				d	e	f	g		
	-7 fishing management	3.24	1.56					e	f	g		
	-4 pollutant diffusion	3.52	1.49						f	g	h	i
	-6 river bed clearance	3.6	1.49							g	h	i
	-5 dike building	3.62	1.52							g	h	i
	-9 river pollution control	3.83	1.57									i
	-1flooding	3.86	1.73									i

* Factors with the same character did not significantly different within 5% significant level; they can be assigned to the same group. The numbers in front of the service items are the same as in table 15. Negative number indicates ecosystem cost.

everyone living in the Beijiang River area. However, fishermen pay more attention to aquatic products (Table 12, item 4), and pay less attention to the flooding caused by river (Table 12, item 15). Government officers and leaders of enterprises give more attention to daily water supply than farmers and fishermen. It may be the reason that many farmers and fishermen rely on well water rather than tap water (Table 12, item 2).

(2) The second most important ecosystem services considered by the stakeholders

The second most important ecosystem services considered by the stakeholders (an average score of 3.16-3.55 points) include the spiritual function, clean environment provided, reduction of diseases; educational function, and sand production for construction (see the orange part of ecosystem service in Table 11). It is beyond our expectation that spiritual function was so heavily weighted by stakeholders, because they are not so popularly involved in religious, neither in intellectual activities. The function for clean environment was considered less important by farmers than by the other stakeholders, possibly a result of farmers' activity being confined on land (Table 12, item 14).

(3) The third most important category of ecosystem services recognized by stakeholders

The third most important category of ecosystem services (2.56-3.04 points) ranked by the stakeholders include biodiversity, scientific research, stable air temperature and humidity, industrial and agricultural water supply, beautiful environment, residential value, and river transportation (see the yellow part of ecosystem service in Table 11). In general, the values given by fishmen were lower than from other stakeholders, except for scientific research (Table 12).

(4) The least important category for ecosystem services for stakeholders

The least important category for ecosystem services (1.71-2.08 points) ranked by the stakeholders includes tourism, fishing for sport, boating for sport and swimming. Although tourism is developing very quickly, the number of people benefiting from these services is still very limited. However, the value given from government officers and leaders of enterprises is significantly higher than from fishers and farmers, possibly as these groups may have more opportunity to enjoy these services due to their better financial situation.

2.3.2.3 The assessment result of ecosystem costs (Table 11, Table 12)

(1) The most important ecosystem costs

The most important ecosystem costs ranked by the stakeholders include the damage caused by flooding and pollution, the expenditure used in waste water treatment; dike building and dredging of river bed for transportation (see red part in ecosystem costs of Table 11). They are very relevant to the most important category of ecosystem service (Table 11, red part in ecosystem services). It is reasonable because the costs reflect the money used for strengthening the services, or the damage caused by stopping that service. For example, the stakeholder considers reduce of flooding and delete pollution are very important ecosystem services. Hence they also considered that the money spends in waste water treatment, dike building and dredging is also very important. The leaders from enterprises group gave significantly lower values than the other stakeholders on

pollutant diffusion by the river (Table 12, item －4), possibly as many companies are releasing pollutants to the river and they are not directly affected by the polluted river.

Ecosystem services	Gover. Officers	Comp. leaders	Fishers	Farmers

Table 12 The order of importance for each ecosystem service provided by different stakeholders

* The ** indicates that there is statistically significant difference in the evaluation result among different stakeholders for this ecosystem service.

1 irrigation**	**4**	**2**	**19**	**4**
2 daily water use	**1**	**1**	**4**	**3**
3 industrial water supply**	**9**	**4**	**23**	**19**
4 aquatic products**	**10**	**16**	**1**	**7**
5 sand for construction**	**15**	**10**	**22**	**11**
6 transportation	**18**	**12**	**18**	**18**
7 hydro-electricity**	**8**	**5**	**15**	**6**
8 game fishing	**21**	**21**	**16**	**21**
9 boating	**20**	**20**	**17**	**22**
10 tourism	**16**	**19**	**21**	**20**
11 swimming	**22**	**22**	**20**	**23**
12 air humidity	**15**	**15**	**14**	**8**
13 stable air temperature	**14**	**8**	**10**	**13**
14 clean environment	**5**	**5**	**8**	**1**
15 reduce flooding	**3**	**3**	**5**	**2**
16 delete pollution	**2**	**6**	**3**	**5**
17 reduce diseases	**6**	**14**	**5**	**9**
18 biodiversity	**7**	**11**	**13**	**15**
19 residential value**	**17**	**17**	**7**	**16**
20 beautiful environment**	**11**	**20**	**11**	**12**
21 spiritual home	**12**	**7**	**9**	**14**
22 education	**13**	**9**	**6**	**10**
23 research	**19**	**18**	**12**	**17**

(2) The second most important ecosystem costs

The second most important ecosystem costs ranked by stakeholders include expenditure used for fishing management, picking up river garbage, and tree planting (Table 11, orange part of ecosystem costs). Fishers gave a significant lower value to tree planting than other group of people. This may be due to the fact that only a very few activities of fishers link directly to the forest up in the hill and mountain, like firewood collecting if flooding did not carry enough wood for them.

(3) The third most important category of ecosystem costs

The third most important category of ecosystem costs ranked by stakeholders include the expenditure induced by diseases spreading along rivers and the picking of water hyacinth, an invasive species that grows very quickly in rivers and lakes (Table 11, yellow part in ecosystem cost).

(4) The least important group of ecosystem costs

The least important group of ecosystem costs include the lost caused by drought such as field crop failure and lack of drinking water supply. Many people recognize that river itself is not the reason of draught (Table 11, white part of ecosystem costs).

Table 13 the influence of Stakeholder on the evaluation of ecosystem services

	Average score for the evaluation of the importance				Result of Duncan's multi-range test*			
Stakeholders	**Gov.officer**	**Leaders of enterprise**	**Farmer**	**Fisher**	**Gov. officer**	**Leaders of enterprise**	**Farmer**	**Fisher**
Average	**3.54**	**3.42**	**3.28**	**2.87**	**c**	**cb**	**b**	**a**
10 tourism	2.80	2.64	2.29	1.73	b	b	ab	a
6 transportation	2.87	3.50	2.59	2.27	ab	b	a	a
20 beautiful environment	3.80	3.71	3.41	2.50	b	b	ab	a
3 industrial water supply	4.00	4.14	2.35	2.66	b	b	a	a
-11 picking up river garbage	3.47	4.07	3.47	2.89	ab	b	ab	a
1 irrigation	4.40	4.71	3.70	1.85	bc	c	b	a
12 air humidity	3.60	3.42	3.53	2.50	b	ab	b	a
13 stable air temperature	3.53	3.71	3.35	2.61	ab	b	ab	a
18 biodiversity	4.13	3.57	3.17	2.61	c	bc	ab	a
-1 flooding	5.00	5.00	4.47	3.16	b	b	b	a
15 flooding control	4.60	4.21	4.21	3.24	b	ab	b	a
2 daily water supply	4.93	5.00	4.05	3.13	b	b	ab	a
-8 tree planting	4.06	3.78	4.12	2.42	b	b	b	a
14 clean environment	4.40	4.07	2.95	4.41	b	b	a	b
-4 pollutant diffusion	3.80	2.35	3.41	3.74	b	a	b	bc
4 aquatic products	3.80	3.21	3.53	4.32	b	a	ab	b
-2 draught	1.53	1.00	2.65	2.41	ab	a	c	bc

* Factors with the same character did not significantly different within 5% significant level; they can be assigned to the same group. The numbers in front of the service items are the same as in table 11. Negative number indicates ecosystem cost.

2.3.2.4 The analysis of differences among different stakeholders (Table 12, Table 13)

(1) General analysis

The order of evaluation from different groups of stakeholder is presented in Table 12. The evaluation result shows that many views of all the four groups were quite similar. For example, they all agreed that daily water supply, clean environment, reducing flooding, and deleting pollutants were within the top 10 ecosystem services. The function for swimming is not important. However, the fishermen paid more attention to ecosystem services related to their life such as provision of aquatic resources (4.32 points), provision of living environment (4.41 points), and

fishing or angling (2.88 points) than other three groups (Table 13). However, the fishers paid less attention to irrigation, and sand mining than the other three groups. Marks given by government officers and enterprise representatives on ecosystem services do not have significant difference.

(2) Men and women

Although statistic result in Table 9 shows that there is significant difference in sex. However, further analysis in Table 10 shows that the different was caused by some uncompleted records which the sex section was missing. There is actually no significant difference in the ranking made by men and women. This is likely due to the equal statue of men and women in their daily life in this region. They often work together and share their life together without significant sexual work separation.

(3) Government officers, company leaders, farmers and fishers

The higher the average ranking given by a stakeholder group, the more important they considered the ecosystem services provided by Beijiang River Watershed. The average ranking value for ecosystem services is in this order: government officers (3.54) > leaders of enterprises (3.42)> farmers (3.28) > fishers (2.87) (Table 13, line 1). Surprisingly the fishers have the lowest average, even though they are probably the most heavily reliant upon the services provided by the river. This may be due to the concept of ecosystem services being quite abstract and that some groups of fishers and farmers needed more explanation, whereas the government officers and leaders of enterprises are usually more educated. The slide explanation for government officers and leaders of enterprises in a meeting room was more easily understood than oral explanation by different researchers for farmers and fishers in their houses.

(4) The fishers perception about ecosystem services

Although fishers gave lower value to many ecosystem services and costs, they did score the clean environment (Table 13, 14) , water pollution (Table 13, －4) , aquatic production (Table 13, 4) , and drought disaster (Table 13, －2) very highly. Although leaders of enterprises gave high scores for many ecosystem services and costs, they did score pollutant diffusion, aquatic products and drought relatively low. These may be the reason of conflict of interest among different stakeholders. Hence, the difference between fishers and enterprise leaders should be solved by education about ecosystem service, communication among stake holders and policy regulation. Leaders of enterprises need a greater understanding of the importance of the river to the livelihoods of fishers and the serious impacts of water pollution. Government policy should help fishers to overcome the loss caused by pollution and other economic activities. For example, ecological compensation fund should be set up and collected from industrial companies which damaged ecosystem services. More financial support should be channelled to help the conservation and proliferation of aquatic species, to improve the housing and employment opportunity of fishermen, and to recover ecosystem structure such as reforestation, soil erosion control, pollution treatment etc.

2.4 Participatory evaluation of Beijiang River Watershed ecosystem services according to a stakeholder Delphi

A three round stakeholder Delphi method was used for the evaluation of Beijiang River Watershed ecosystem services in order to understand the view and attitude of different stakeholders.

2.4.1 Presentation of the methodology and design

The procedure of the stakeholder Delphi method is described in Fig. 6.

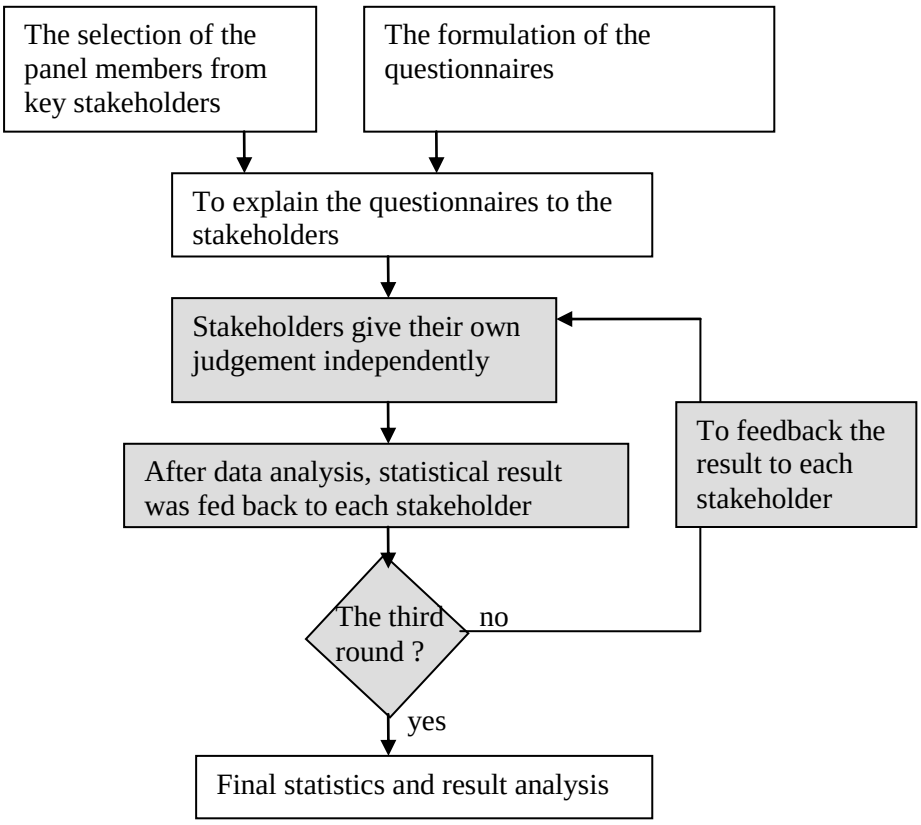

Fig. 6 The procedure for stakeholder Delphi investigation
(Adapted from Luo Shiming, 1996)

2.4.2 Account of the steps followed

2.4.2.1 The selection of key stakeholders

The key stakeholders who are closely related to the protection and sustainable use of aquatic resources in Beijiang River Watershed were identified during the first period of this program. The benefices from water, hydro-power, sand and fish supply from the river include almost every one in the watershed. Fishers heavily rely on fish resources in the river. Farmers not only rely on water supply but also would cause water pollution by applying excessive fertilizer and pesticides, and by raising livestock. If they plant trees, it would be good for the river system. Major industrial companies not only consume large amount of water, but also generate large quantity of waste water. Hydropower Stations are built to reduce flooding and draught, and to generate electricity. However the cutting off natural flow of river stream also caused a lot of negative side effects on aquatic resources. Sand mining companies produce sand from river sediment for construction needs, but also damage the habitat of many aquatic species. Government officers in different departments of Shaoguan municipal government such as agricultural bureau, fishery bureau, fishing monitoring team, environmental protection bureau, forestry bureau, water management bureau, etc. are actually in charge of major regulation and management of the key activities in the watershed area. We decided the list of the key stakeholders. The specific person to join the activity

was decided by the specific government bureau, or by the specific company leader, or by random sampling in the fishing village and farming village. The fishers were mainly from the three sampling fishing villages, e.g. Kengkou, Lishi and Zhoutian fishing villages. There were totally 63 stakeholders joined the Delphi investigation. Among them 17 were government officers, 12 were company leaders. Other 34 were fishers and farmers.

The stakeholders involved in this Delphi evaluation included: (1) Government officers from Mayor's office, courts, Development and Reform Bureau, Tax Bureau, Agriculture Bureau, Forestry Bureau, Aquatic Products Bureau, Environment Bureau, and Industry and Commerce Bureau; (2) Representatives of related enterprises from the Da-Baoshan Mining Company, the Shaoguan Steel Co., the Pig Association of Shaoguan, the director of Wujiang Villagers' committee (fish culture), the Golden Earth Company (also fish culture), Wujiang Rhizoma Dioscoreae Association, Shaoguan Institute of Fisheries Research, Fish Culture Association, Mining Companies, cotton companies, hydropower stations, Farmers Development Company, restaurants; (3) Fishermen from Lishi, Kengkou and Zhoutian fishing villages; (4) Farmers from Pingfu, Fengcun, Maowu, and Yangshapo villages. In the first round of Delphi method, the person participated the evaluation of ecosystem services also joined the Delphi investigation. The later feedbacks for the second and third round of Delphi investigation were through direct interview for fishers and farmers and through telephone and mailing for government officers and company leaders.

2.4.2.2 The formulation of questionnaires

According to the background investigation in 2009 which including literature review, site visit, interview with fishers and farmers, and workshop with stakeholders for the discussion about the situation of Beijiang Watershed, we got a clearer picture about the situation of the system and the idea from different stakeholders. The Driver-Pressure-State- Impact-Respond (DPSIR) analysis was also helpful for us to understand the conflicts and possible solutions of the system, and hence helpful for formulating the questionnaires (see WP5 Report). The questionnaires formulated mainly included two parts. One part is related to the management of environment protection, and the other part to the improvement of the livelihood of fishers. Each contains fourteen specific legal measures and policies (Table 14).

2.4.2.3 The collection of idea from stakeholders and data processing

The first round of Delphi interviews was conducted from 20th to 22nd of May, 2010, the second round from 2nd to 3rd of July, 2010, and the third round from 1st to 2nd of October, 2010. All three rounds of interviews took place in the project site of Shaoguan.

The first round of Delphi investigation for government officers and company leaders was conducted in a meeting room in the government building. Government officers and companies leaders came for the meeting separately in the morning or in the afternoon. After we explained the table of questions, they filled the form independently. For fishers and farmers, we visited their homes one by one and adopted an interview method to record their answers.

Table 14. Questionnaire used in all three rounds of Delphi method for policy and management issues for different stakeholders in Shaoguan City

A. How do you think the importance of the legal measures and policies related to environment protection? Please mark each choice from extreme important (5), very important (4), important (3), less important (2), or not important (1).

(1) Industrial Pollution Control
(2) Sand Mining Control
(3) Dams Control
(4) Ban of direct dumping of garbage
(5) Control of fertilizer and pesticide
(6) Ban of direct discharge of sewage by boat restaurants
(7) Forestation
(8) Mandatory requirements for the building of passages for fish and boats
(9) Artificial discharge of fish fries
(10) Limitation on fishing tools
(11) Monitoring and publicizing water quality
(12) Control of water reservation of dams
(13) Ban of caged culture in reservoirs
(14) Limitation of poultry farming

B. How do you think the importance of the legal measures and policies related to fishermen livelihoods should be considered in the near future? Please mark each choice from extreme important (5), very important (4), important (3), less important (2), or not important (1).

(15) Oil subsidy
(16) Medical care
(17) Reduction of Tax and fees
(18) Reduction of administrative procedures
(19) Renovation and building of cheap low-rent houses
(20) Professional training
(21) Improvement of roads to fishing villages
(22) Building of tap water facilities
(23) Maintenance grant to the poorest
(24) Providing job information
(25) Compensation for the damages to fishermen by hydropower stations
(26) Centralized processing of garbage
(27) Compensation for the damages to fishermen by sand mining companies
(28) Fishermen organization

We used surface mail to feedback the result of the first round to each government officer and company leader and asked them to fill the table after reading the result and mail it back to us. For some situation of delay, we reminded stakeholder through telephone and e-mail. We went to fishers and farmers houses for the second round of interview. Almost the same procedure was used in the third round of Delphi investigation.

After we gather all forms filled by stakeholders, statistic was conducted by using SPSS 13.0. Further analysis was based on the statistical result.

2.4.3 Results of the stakeholder Delphi

In general, our stakeholders gave very different important scores to different management and policy measures (Table 15 C). The average scores given from different stakeholders were also

different very significantly (Table 15, A). Different stakeholders gave significantly different importance values to different policy and management measures (Table 15 cross effect of A×C). Their changes in different rounds were significant (Table 15 A×D). Although there were no significant differences among the average scores of each round in the three rounds of the stakeholder Delphi method (Table 15 D), there were significant changes happening in different rounds of the stakeholder Delphi investigation for different management policy (Table 15 C×D). There was no significant difference existing between the average scores of men and women (Table 15 B), however there were significant differences in some specific policy and management measures between sex groups (Table 15 B×C). More detail explanation will be presented in the following sections.

Table 15 The Statistic result of variance analysis on the important value given by different stakeholders for different policy and management measures*

Dependent Variable: importance value

Source	Sum of Squares of the differences	Degree of Freedom	Mean Square*	F**	Significance***
Difference among occupation of stakeholders (A)	98.452	3	32.817	25.302	.000
Difference between sex group (B)	2.281	1	2.281	1.758	.185
Difference among different management and policy measures (C)	326.225	27	12.082	9.315	.000
Difference among different rounds of Delphi method (D)	.333	2	.167	.129	.879
cross effect of two factors(A×C)	443.124	81	5.471	4.218	.000
cross effect of two factors(B×C)	60.089	27	2.226	1.716	.012
cross effect of two factors(C×D)	97.313	53	1.836	1.416	.026
cross effect of two factors(A×D)	41.838	5	8.368	6.451	.000
Error	7525.377	5802	1.297		
Total	103101.000	6002			
Corrected Total	9761.853	6001			

* Mean Square= (Sum of Squares of the differences)/ (Degree of freedom). It measures the difference affected by the specific factor indicated in the left of this row.

** F value= Mean Square/ (the mean square of the random error, or 1.303 here). It indicates the significance of the difference. The larger the number, the more significant the difference is.

*** The number indicates statistically significant impact of the factor if it is less than 0.05 or very significant if it is less than 0.01. Otherwise it indicates the influence of the factor is insignificant.

Table 16. The importance of each policy and management measures evaluated by different stakeholders

*The red parts indicate the important management measures which are highly evaluated by stakeholders. The green parts are considered unimportant by stakeholders. The importance of the black parts is ranged in between red and green parts.

policy and management measures	Average Scores	Subsets with different number have significant difference by Duncan's Multi-range test											
Part 1 improvement of resources and environment													
(1) Industrial Pollution Control	4.42										11	12	13
(2) Sand Mining Control	4.32								9	10	11	12	13
(9) Artificial discharge of fish fries	4.14						8	9	10				
(4) Ban of direct dumping of garbage	4.07					7	8	9					
(5) Control of fertilizer and pesticide	4.07					7	8	9					
(3) Dams Control	4.04				6	7	8						
(11) Monitoring and publicizing water quality	4.04				6	7	8						
(6) regulation on sewage from boat restaurants	3.97			5	6	7	8						
(8) Building of dam passages for fish and boats	3.84		4	5	6	7							
(7) Forestation	3.71		4										
(12) Control of water reservation of dams	3.68		4										
(10) Limitation on fishing tools	3.25	3											
(14) Limitation of poultry farming	2.74	2											
(13) Ban of caged culture in reservoirs	2.46	1											
Part 2. improvement of the livelihood of fishers													
(16) Medical care	4.54												13
(23) Maintenance grant to the poorest	4.43											12	13
(15) Oil subsidy	4.42										11	12	13
(19) solve housing issue	4.34									10	11	12	13
(25) Compensation form hydropower stations	4.32								9	10	11	12	13
(22) Building of tap water facilities	4.19						8	9	10	11	12		
(27) Compensation form sand mining companies	4.18						8	9	10	11	12		
(26) Centralized processing of garbage	4.17						8	9	10	11			
(21) Improvement of roads to fishing villages	4.05					7	8						
(20) Professional training	4.01				6	7	8						
(17) Reduction of Tax and fees	3.81		4	5	6								
(28) Fishermen organization	3.79		4	5	6								
(24) Providing job information	3.73		4	5									
(18) Reduction of administrative procedures	3.61		4										

The importance range of policy and management measures in Table 16 shows that our stakeholders gave their most attention to the measures (in red colour in Table 16) which included (1) industrial pollution control, (2) sand mining control, (16) medical care for fishers, (23) maintenance grant to the poorest, (15) oil subsidy for fishing boat, (19) solve housing issue for fishers' family, and (25) getting compensation form hydropower stations for the reduction of fish resources. Some measures which stakeholders considered unimportant (green colour in Table 16), include (13) Ban of caged culture in reservoirs, (14) limitation of poultry farming, (10) limitation on fishing tools, (12) control of water reservation of dams, (7) forestation at this stage, (18) reduction of administrative procedures, (24) providing job information for fishers,

(28) strengthening of fishermen organization, (17) reduction of tax and fees which have already reached zero for some years for farming and fishing, and (8) building of dam passages for fish and boats. The important scores of other measures (in black colour in Table 16) were considered in the middle range.

2.4.4 Discussion of the Results

More interesting results and phenomenon can be seen from the result of Delphi investigation.

2.4.4.1 The influence of stakeholders' occupation on their views of related measures

Stakeholders' occupation and social status have significant influence on their evaluation of the related measures. Four groups of people with different background which included leaders from enterprises, officers from government, farmers and fishermen, took part in our Delphi research. Table 17 shows their average important scores given for the 28 proposed measures. It can be seen that fishers are more eager for the change than other three groups. The representatives from enterprises are paid much less attention to the issue of environment, resources and the livelihood of fishers.

Table 17 The impact of occupation groups of the stakeholders by using Duncan's multi-range test method.

Stakeholder groups	Sampling size*	Average scores **		
		3	2	1
Company Leaders	518	3.67		
Government officers	799		3.81	
Farmers	1006		3.81	
Fishers	3679			4.05

* Sampling size= number of person * number of evaluation values given by each person

** The difference between average evaluation values appeared in different column is statistically significant.

The number denoted in the horizontal axis is the same number of policy or measure indicated in table 14.

From Fig. 7, it can be seen quite clear on how the occupation affected the attitude of stakeholder for their evaluation of different management and policy measures. For example, fishers gave much higher important value than government officers, farmers and industrial leaders on the subsidy for fuel (17), reduction of industrial pollution (1), fishers' housing issue (21), improvement of infrastructure of fishing villages (23), continue the poor relief policy (25), compensation from dam building (27) and sand mining (29), regulation on sand mining activities (2), control the increase of hydropower station (3), control the increasing use of chemical fertilizer (5), improving the dam operation for the crossing of fish and fish boat (8), and the increase of fish releasing activity (9). However fishers paid much less important value to the abandon of net-box fish raising method (13) and the reduction of fishery along the river (14). However, leaders from industrial companies gave much lower level of importance to the medical care system reform for fishers (18), the reduction of government fee collection (19) and reduction of government permission affairs (20), improvement of infrastructure for fishing villages (23), and more information about employment for fishers (26). Farmers gave much lower important scores on the reduction of chemical fertilizer (5). The average scores from government officers were quite close to the

average in general and only gave slightly higher important score in limitation on fishing tools (10) and improving tap water facility (22).

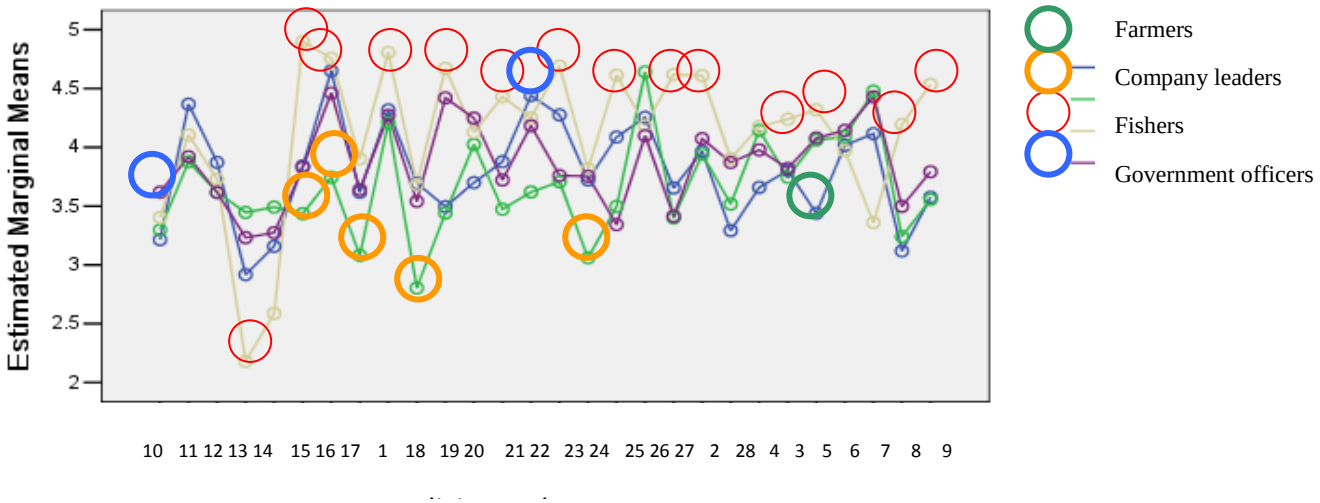

Fig.7 The different attitude of different types of stakeholders towards different management and policy and measures

These differences indicate the need for information exchange, education and coordination for different stakeholders.

2.4.4.2 The impact of different rounds of the Delphi exercise

Table 18 The impact by different rounds during Delphi interview by Duncan's Multi-range test method

Round number in Delphi method	Sampling size 1	Average scores * 1
1	1162	3.89
3	1455	3.94
2	3385	3.96

- The difference between average evaluation values appeared in the same column is statistically insignificant.

The Delphi investigation results of each round was given back to the stakeholders to help them get some ideas of what others think and thus try to find some common ground. The three rounds of interviews are quite similar in average scores without significant difference (Table 18). However, there were some changes for different measures in different rounds of Delphi investigation (Fig. 8). The important scores gradually decreased from the first round to the third round for the measures such as reducing government permission affairs (18), improving the organization level of fishers (28), and employment training for fishers (20). On the other hand, the important scores were gradually increased for the following measures such as continue the fuel subsidy for fishers (15), construction of drinking water supply system (22) and increase the fish fly releasing activity (9).

This shows that the communication among stakeholder did make more people understand the situation of fishing population and fish resources.

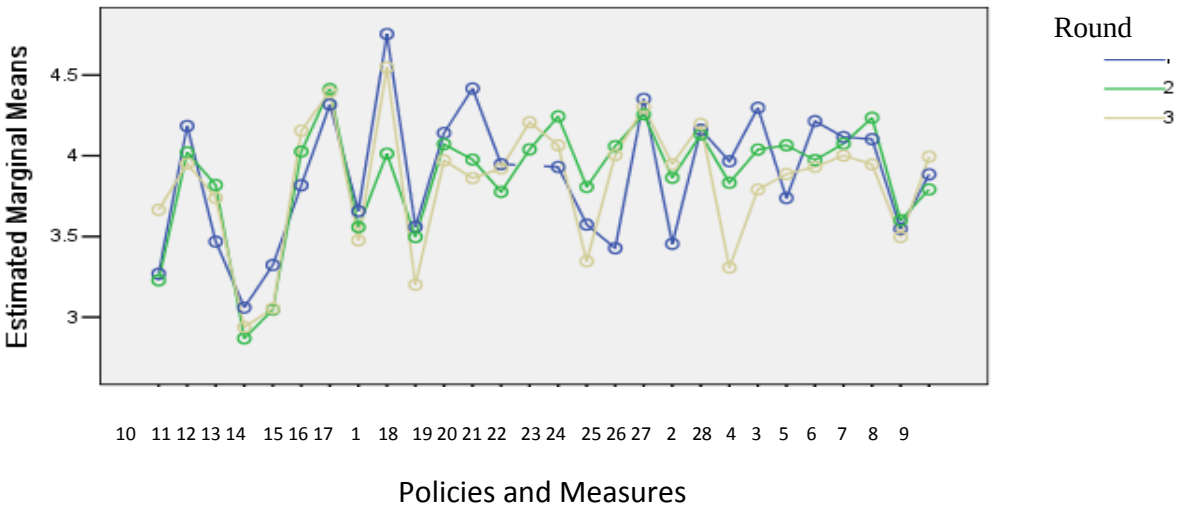

Fig. 8 The average important scores in the three round of Delphi investigation.

The number in the horizontal axis is the same number of policy or measure indicated in Table 14 above.

Fig.9: Impact of Sex group on the average score of each measure

The number in the horizontal axis is the same number of policy or measure indicated in table 2 above.

The number in the vertical axis is the average important values given by men (blue) or women (green)

2.4.4.3 The impact from sex groups

Generally males and females have quite similar views on most of the proposed measures (as what is showed in Fig.9 below). There is no significant difference between the average important scores from men (3.833) and women (3.787). However, they do have distinctions in some of the measures. For example, males tend to be more sensitive on management issues. They gave higher marks to measures such as "reduction of tax and fees (17)", "reduction of administrative procedures (18)", and "improvement of fishermen organization (28)" then females. Females tended to care more about daily life, so they gave higher scores on item such as "building of tap water facilities (22)".

3. Conclusion

3.1 Summary of stakeholder valuations of aquatic resources in Beijiang River Watershed

After the three types of stakeholder valuation on ecosystem services related to Beijiang River Watershed, we found that there are no substantial conflicts among the results and actually they are complementary. Hence the following conclusions can be made.

3.1.1 The common understandings of the situation

（1） The stakeholders have a high percentage of agreement with the general understanding of the watershed situation which we concluded from the first stage of this research (Fig.5). Our understanding of the situation can be used as the basis for future action plan.

（2） They all recognized that the water supply, fish supply, sand supply and electricity supply were very important. Most of them understood that the pollution problem was serious and should be tackled as soon as possible. They highly appreciated the spiritual value, educational function and cleaning function of the river system (Table 11).

（3） They all agreed that creational activities such as swimming, boating, and game fishing should not be put into the priority list (Table 11).

（4） Men and women from the fishing village and from the society in general shared very similar understanding of the situation due to their close cooperation in their job and daily life (Fig. 9).

3.1.2 The different understandings of the situation

（1） The government officers in general were more satisfied with the present situation then the company leaders, fishers and farmers (Table 13). The government officers might understand more about what they have done for improving the situation and other stakeholders might understand more about the existing problems which they were facing every day.

（2） During the SOS workshop, officers from different government departments had different views on the management of the system. For example, the purpose on the use of Nanshui Reservoir, the permission procedure for forest along the high voltage power line and in the area which will be submerged by small hydropower station. It seems that strengthening communication and coordination among different government departments is needed for the complex ecosystem management.

（3） In general, farmers and fishers gave less value to ecosystem services then the government officers and company leaders (Table 13). So, it is needed to have more educational

program in the future to tell the public in the rural and remote area about the concept of ecosystem services.

（4） Government leaders and industrial leaders in general didn't pay enough attention to the fish resources and poor situation of the fishers in the watershed (Fig 7, Table 5). The communication about the livelihood of fishers and the education about the importance of aquatic species are needed.

（5） Industrial leaders in general were more satisfied with their pollution control efforts and pay much less attention to the result of pollution then fishers who are in the situation of vulnerable and weak. We should give more voice to those could not speak (fish species) and those with very weak bargaining power in policy making.

（6） Government officers and industrial leaders paid significantly more attention to the tourist function of the system than other stakeholders although the scores given to it was also not very high (Table 13). However, the tourist activity will be a good direction for future development in the area under the regulation for ecological development and environmental protection. Actually tourism is developing very quickly in the area. Education for the significance of eco-tourist development should be strengthened in the future.

（7） Fishers highly valued the policy of fuel subsidy for fishing, the poverty relief policy and the fish fry releasing activity, and strongly called for better policy related to the water pollution control, the housing issue for fishers, sand mining management, and dam management (Fig.7). However the evaluations from other stakeholders were much lower on these matters. This further confirms that their situation should be understood by more people in our society.

We can understand the reason behind caused these differences and try our best to reduce the gaps among stakeholders by having more education activities and setting up proper communication and coordination mechanisms. However, it is not that easy to eliminate all the differences in the future because the conflict between the economic development and the protection of aquatic resources. One example is the sand mining activity. There is a big demand for sand because of large scale infrastructure development such as highway, bridge, housing and factories. The price for sand keeps increasing in the market. However, the sand supply relies heavily on the sand mining activity along rivers with sand in river bed. The similar situation exists in the construction of hydropower stations along the river. The solution in the future will be a careful balance with the conflict needs and a better eco-compensation system.

3.2 Integrating stakeholder values to enhance bioeconomic modelling

The results from the evaluation of ecosystem services from the key stakeholders have given us a much clearer picture on the whole system no only in terms of physical structure and function, but also in terms of people's relationship related to their interests and responsibilities. The gaps in mutual understanding will be able to reduce by strengthening communication and education. According to the evaluation results provided by the stakeholders, we can choose a suitable scenario and manipulate the related parameters to predict the possible change of the system by a specific action plan. The common understanding can be used as one scenario in the bioeconomic

model. The conflict views can be used as separated scenarios to operate the bioeconomic model. Through the operation results of the model, we can predict the result of different action plan. By this way, the sensitive balance of the interests among different stakeholders could be achieved.

Based on our understanding so far on the Beijiang River, we need to take some actions to protect the ecosystem and the aquatic resources. To estimate the impacts of these actions on the ecosystem and the aquatic resources as well as the livelihoods of local fishers, bioeconomic model will be used. So, we need to select different scenarios first, and then try to determine the parameters in the model to simulate those scenarios. To select the scenarios, stakeholder values can provide useful guidelines. According to the focus group interviews and Delphi studies we have taken in Beijiang River, the following scenarios will be used for further study in our later stage in the project:

Scenario 1: To increase financial resources for protection and conservation of aquatic resources.

Scenario 2: To try the recovery of aquatic plants and the habitat of aquatic species.

Scenario 3: To implement the no fishing season from 2011

Scenario 4: To reduce water pollution from iron ore mining.

Scenario 5: To reduce water pollution from rural area.

Scenario 6: To adjust the policy for eucalyptus forest development.

Scenario 7: To have more public educational activities

Scenario 8: To notice the fishers about the water gate operation by hydropower stations on time

Scenario 9: To develop fishing as a recreation activity.

Scenario 10: To give reward policy to volunteers who monitor illegal fishing

Scenario 11: To strengthen government management organization for fishing communities

Some of the parameters will be assumed according to the stakeholder values, such as the change of the fish stocks, fish species, harvest and price of fish. According to the interview of the fishers, the model will be used to estimate the change of the benefit and costs of each scenario. The results of each scenario will be compared to select the available scenarios to improve the aquatic resources and the livelihoods of local fishers.

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Annexes

List of China team members for HighARCS projects

from South China Agricultural University

	Name in English	Name in Chinese	Specialty
1	Luo Shiming	骆世明	Agro-ecology
2	Cai Kunzheng	蔡昆争	Agro-ecology, Crop
3	Zhang Jia'en	章家恩	Agro-ecology, Geology
4	Li Huashou	黎华寿	Agro-ecology, Pollution
5	He Hongzhi	贺鸿志	Phytoplankton
6	Ye Yanqiong	叶延琼	GIS，Geology
7	Cui Ke	崔科	FW fish
8	Zhao Zhuihong	赵会宏	FW fish
9	Fu Jinghua	付京花	mollusc
10	Gan Lian	甘炼	FW crab and shrimp
11	Tong Xiaoli	童晓立	Aquatic Insect, odonata
12	Zhuang Xueying	庄雪影	Plant Taxonomy
13	Wang Quandian	王权典	Environmental law
14	Jiang Baoguo	江保国	International law
15	Gao Min	高敏	Environmental law
16	Liu Yiming	刘一明	Resources Economic
17	Chen Fengbo	陈风波	Agricultural Economic
18	Wang Wenzhong	王文中	Agricultural Economic
19	Shang Chunrong	商春荣	Agricultural Economic

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D5.2

Report on stakeholders' evaluation of

Highland aquatic resources in Buxa (West Bengal-India) site

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Executive Summary

The link between environmental degradation and increased vulnerability of poor communities is well known, particularly in the context of climate change and economic globalisation. In this context however, only limited information is available concerning communities in highland areas, and even less regarding those dependent on aquatic resources and associated ecosystem services. Highland Aquatic Resources Conservation and Sustainable Development (High ARCS) is a project which seeks to better understand the patterns of resource use and livelihoods of communities who utilize highland natural resources in five sites across Vietnam, China and India, with a focus on aquatic resources. The interdisciplinary approach, employed by this project, seeks to encourage sustainable and wise-use of aquatic and other natural resources while safeguarding ecosystem services, biodiversity and livelihoods of poor and vulnerable groups.

One of the project sites is located in Buxa - the extreme north east of Kalchini block under Jalpaiguri district of West Bengal (India). It lies 26 degree C 37'N, 91 Degree 53'E. The area has rich natural resources with hilly terrain. The population is a mix of Neplali and Dhukpa origin. The 11 picturesque villages offer diversity of terrain and remoteness-with Adama being the farthest from the centre of the hills –Buxa and most difficult of all to traverse. Buxa is the centre of the 11 villages with a rich historical legacy. All the villages fall under Rajabhatkhaba Gram Panchayat. Earlier the project carried out situation analysis, bio-diversity assessment, livelihoods assessment and institutional analysis outcome of which offer important opportunity to develop the interfaces among the bio-diversity, livelihoods and institutions and suggest wise use of the bio-diversity and at the same time ensure sustainable livelihoods of the marginal communities.

Based on the above assessment and analysis an Integrated Action Plan (IAP) has evolved. Beforehand stakeholders' evaluation has been carried out to ascertain and identify their preference and priorities in order to firm up an effective action plan. The stakeholders' assessment has been carried out following participative methods and tools including PRA, Focused Group Discussion (FGD) and observation. Delphi has been used to authenticate perspectives among the stakeholders and have their views on important aspects of eco-system services and High ARCS.

The stakeholders' evaluation suggests rich to moderate availability of aquatic resources –flora and fauna. State regulations mediate stakeholder's access and control over aquatic resources. The Delphi analysis suggests that the stakeholders consider Buxa aquatic resources as satisfactory –ranging from acceptable to quite plentiful. In general the present status does not show much concern. So far as the use of aquatic resources is concerned it is not quite a lot –usually it has been described as being less. Also extent of use of the aquatic resources has been considered to be moderate. About the need to take policy correctives for conserving the aquatic bio-diversity the respondents do not feel strong need-the current provisions are adequate. There is, however, missing awareness due to non-availability of relevant information. People feel that present

policy regime is not quite effective to ensure conservation- better conserving the aquatic resources could ensure economic, social and environmental benefits.

The stakeholders have indicated flood and soil erosion as the possible threat to the aquatic resources in Buxa. Lack of awareness, on the part of the officials about the existing provisions and capacity to deal with the complex situation are important management and institutional threats. People's institutions are not fully geared to take on the challenges. Inadequate financial allocations are major constraints for infrastructure development and stepped up conservation measures.

The stakeholders felt that mining and soil erosion are the important factors contributing to the degradation of stock of fish and molluscs. Some of them have also felt that illegal fishing is another factor although this is not substantiated by others. Over all **Delphi** result based on stakeholders views, suggest that aquatic stock in Buxa are rich and well below threatened level. The policy perspective is adequate but awareness about the same is needed. The community have been living in perfect harmony with the nature including aquatic resources and there is no much threat from them. A very docile community is conformist and amenable to the existing regulations. Integrated Action Planning (IAP) would use the analysis to evolve sustainable livelihoods strategies.

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1.0 Introduction

1.1 Introduction and purpose

The link between environmental degradation and increased vulnerability of poor communities is well known, particularly in the context of climate change and economic globalisation. In this context however, only limited information is available concerning communities in highland areas, and even less regarding those dependent on aquatic resources and associated ecosystem services. Highland Aquatic Resources Conservation and Sustainable Development (High ARCS) is a project which seeks to better understand the patterns of resource use and livelihoods of communities who utilise highland natural resources in five sites across Vietnam, China and India, with a focus on aquatic resources. The interdisciplinary approach employed by this project seeks to encourage sustainable and wise-use of aquatic and other natural resources while safeguarding ecosystem services, biodiversity and livelihoods of poor and vulnerable groups.

The project is divided into three interrelated phases. The first phase is related to assessment of the bio-diversity, livelihoods, institutions and policies, second phase, based on the understanding of the above, is research and the third action planning and implementation of selected components of bio-diversity and livelihoods as interplay of institutions and policies.

1.2 Research Questions

Considering the objective of the project the overall research question, to assess the biodiversity and livelihoods, therefore, is *how can highland aquatic resources be sustain ably managed and conserved while accommodating for the livelihoods of poor and food insecure communities?*

This is approached through considering a set of research questions which fall under four broad themes:

1) Biodiversity

i) What is the existing aquatic biodiversity in the selected field sites?

ii) How can these aquatic ecosystems be managed to secure the sustainable provision of ecosystem services and the conservation of biodiversity?

2) Livelihoods

i) What are the dynamics of the multiple livelihood strategies in the selected field sites, how do these strategies utilise resources derived from aquatic ecosystems and what are the differences according to gender, age, ethnicity and class?

ii) How can resource dependent livelihoods be ecologically sustainable and at the same time permit equitable local development opportunities?

3) Policies and Institutions

i) In each selected field site, what are the existing institutions and legislations which mediate access to aquatic resources at multiple scales and levels of government?

ii) What policies and institutional frameworks are needed to resolve conflicts between multiple stakeholders and ensure sustainable resource management whilst maximising local income generating activities?

4) Planning

i) What is the best approach to facilitating interactive participation in assessment, decision-making and planning with respect to aquatic biodiversity conservation and wise-use and promotion of sustainable livelihoods? How do we ensure participation which includes individuals stratified by relations of gender, age, ethnicity and class?

ii) What interventions both in the realms of policy and livelihoods, can be promoted to both protect aquatic biodiversity while offering sustainable livelihood opportunities and enhanced wellbeing for poor and vulnerable groups. How can these be sensitive to gender, age, ethnicity and class?

ii) Can indicators be identified that are appropriate for local communities to assess change?

iii) How can monitoring of aquatic ecosystems, livelihoods, and institutions be established and sustained locally? Who should be responsible? What to do if something changes?

1.3 Project site -Buxa

For the purpose of High ARCS research, five sites in total, across three countries were selected for an in-depth case study. Each site shares something in common, enhancing the potential for comparative analysis, while also having unique characteristics, providing valuable 'case studies'. The Buxa Tiger Reserve (henceforth interchangeably used as BUXA) in the foothills of the Bhutan Himalaya in Jalpaiguri District, West Bengal, offered a number of interesting case studies to enrich the overall High ARCS research agenda. It is today a protected area and is a region of rich forest and aquatic biodiversity, with many seasonal and perennial rivers flowing down from the hills. It is home to marginalised communities, many of whom are from minority ethnic groups, together representing a cross section of the eastern Himalayan population. These communities have used aquatic resources for multiple purposes over the generations, and their presence within a National Park adds a new angle to explore. It is also a region of growing tourism development, while having a climate and topography which makes it vulnerable to natural disasters such as flooding and soil erosion.

Having selected the primary site, three communities were selected for in-depth analysis. The criterion for community selection was that they were dependent on the same aquatic ecosystem (i.e. river basin) and that they were close enough together to be of comparative value, while still being in different parts of the watershed to demonstrate

the influence of particular geological-ecological and socio-cultural settings on livelihoods and biodiversity. Each community consists of a cluster of small number of settlements or villages. The first cluster, referred to here as the Buxa Fort cluster, consists of a series of small settlements in the hills around the ruined Buxa Fort. The second cluster, Adma, is a remote set of hamlets in the valleys to the west of the Buxa Fort cluster. The third, Jayanti, lies on the gentle alluvial slope right at the foot of the hills downstream of Buxa fort, where the Jayanti river spills out onto the plains (see Figure 1).

1.

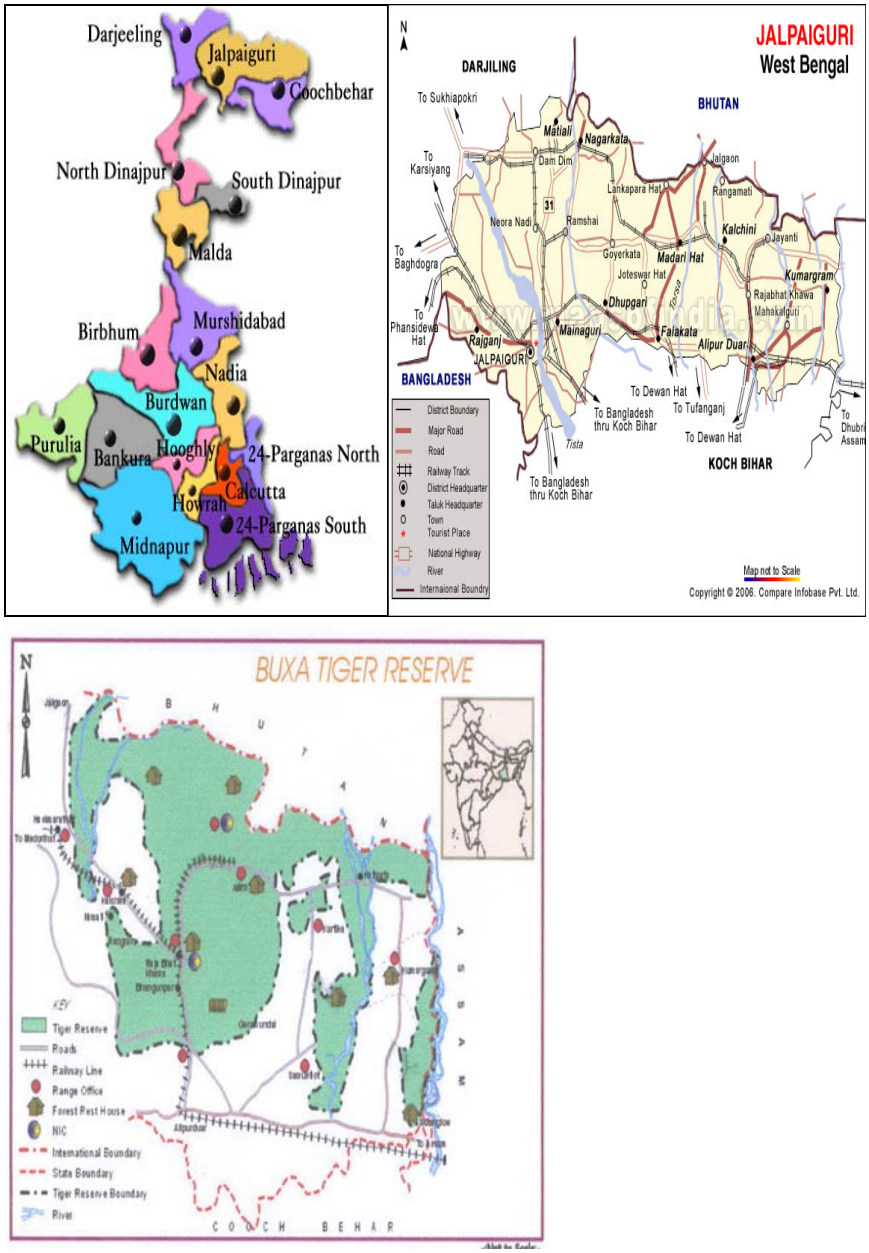


Figure 1: Map of Buxa field site, west bengal, india (clockwise- map of West Bengal, Jalpaiguri district and Buxa reserve forest)

1.4 Methods and data sources

The first stage of the research involved a situational analysis. This involved a biodiversity assessment across the major river basin where the project intended to work. This was

followed by exploratory site visits, review of secondary data, and discussions with local stakeholders. This formed the basis for the selection of communities and offered initial insights into livelihood and conservation issues of the region. The second stage involved three integrated research trajectories, one examining biodiversity the other examining livelihoods, and one focussing on policies and institutions. Although these three themes are being assessed in an integrated manner, this report is based upon the second trajectory, focussing on livelihoods. A separate High ARCS biodiversity and policies and institutions reports focus on data derived from the first and third programmes.

For the HighArcs livelihoods research, combinations of qualitative and quantitative techniques were used in a process of 'triangulation', in line with the projects interdisciplinary agenda. In this context, a detailed interview schedule was prepared. This began with a quantitative section which investigated, aside from basic household information, levels of aquatic resource use such as fishing or fish culture yields and income and data on water use. Further data was collected on livelihood activities such as agricultural and livestock production and income, labouring and migration. To gain an understanding of household budgets, the survey also reviewed household expenditure for both productive and non-productive purposes, while collecting data on asset ownership and employment of labourers to better understand relative wealth. This was followed by a qualitative section, which was designed around a series of open ended questions organised into themes, which could be asked with some flexibility. Topics included overall livelihood strategy, environmental change, gender and age relations, understandings of relative wealth and poverty, market relations and environmental knowledge. Further sections dealt with policies for the management of aquatic resources and respondents visions and aspirations for the future.

Based on the High ARCS sampling framework, from the three selected communities in each field site, 30 surveys/interviews were carried out. A random sample was drawn from the village households considering the fact that most of households in the three clusters belonged to below poverty line (BPL) category. In order to gain deeper insights into the issues raised in the quantitative section of the interviews, a series of qualitative focus groups were carried out. A specific objective of the focus groups was to understand the gender and age dynamics of aquatic resource use. In total the research team completed approximately 40 focus groups. Out of this, an equal number (10) were carried out with women, men, girls and boys respectively. For the focus group with women and men, open ended evolving themes were used. The themes included livelihood change, the use of rivers and lakes, rules and access regimes for natural resources, market relations, understandings of wellbeing, and ecological knowledge. Gender specific questions related to the intra-household division of labour, distribution of household resources, participation of women in local governance and their decision making and changing status of women. Participatory techniques were used, including community resource mapping, production of historical and annual timelines, ven-diagram and ranking activities, whereby respondents were asked to rank livelihood activities and problems in order of importance, often using cards. The mapping tools was also repeated for the focus groups with young people, along with the compilation of

a daily time chart of activities and ranking focussing on different types of work. We asked questions relating to how young people use aquatic resources, their relations with siblings, the benefits they get from their contribution to family labour, education and leisure. During this report, when referring to data collected from focus groups, the acronym FG is used, with HH interview being used for data from household interviews.

1.5 General Methodology and data sources for stakeholders' evaluation

Multi-method was used for data collection and stakeholders' evaluation. To begin with a series of stakeholders' consultations were organized to understand their perspectives on High ARCS and develop a common perspective and language. Subsequently, situation analysis was carried out using participatory methods and tools including focused group discussion (FGDs). Assessment of the bio-diversity was undertaken using IUCN framework and tool which included two sessions with them on methods. Livelihoods assessment was completed using the questionnaire developed jointly by all the project partners. All these helped in completing various reports including livelihoods, biodiversity and livelihoods. In aggregate they provided inputs for preparing Integrated Action Planning (IAP). Stakeholders' consultations were organized to triangulate the findings.

2.0 Stakeholders' evaluation of aquatic resources at Buxa Site

2.1 Identification of eco-system services in Buxa

Colloquially, ecosystem services are "the benefits of nature to households, communities, and economies." The term has gained currency because it conveys an important idea: that ecosystems are socially valuable and in ways that may not be immediately intuited (Daily 1997). Beyond that, however, ecology and economics have failed to standardize the definition and measurement of ecosystem services. According to Vinish Kathuria (Vinish 2009) *Ecosystem Services* (ES) are the processes by which the environment produces resources that we often take for granted such as clean water, timber, habitat for fisheries, pollination of native and agricultural plants etc. These services are extensive and diverse and affect the quality of our land, water, food, and health (Kathuria, 2009)

They maintain biodiversity and the production of ecosystem goods, such as food, timber, fuel, natural fibber, and many pharmaceuticals, industrial products, and their precursors. The American ecologists (Costanza et al. 1997) called the products and services provided by ecosystems as "ecosystem services" and divided it into 17 different types. We have identified four types of eco-system services as per the definition of the IUCN "An Integrated Wetland Assessment Toolkit" (Fig. 1) (Springate-Bafinski, Allen and Darwall 2009). They are:

2.1.1 Provisioning services

2.1.2 Regulating services

2,1.3 Cultural and

2.1.4 Supporting services

Our analysis follows IUCN framework as presented below:

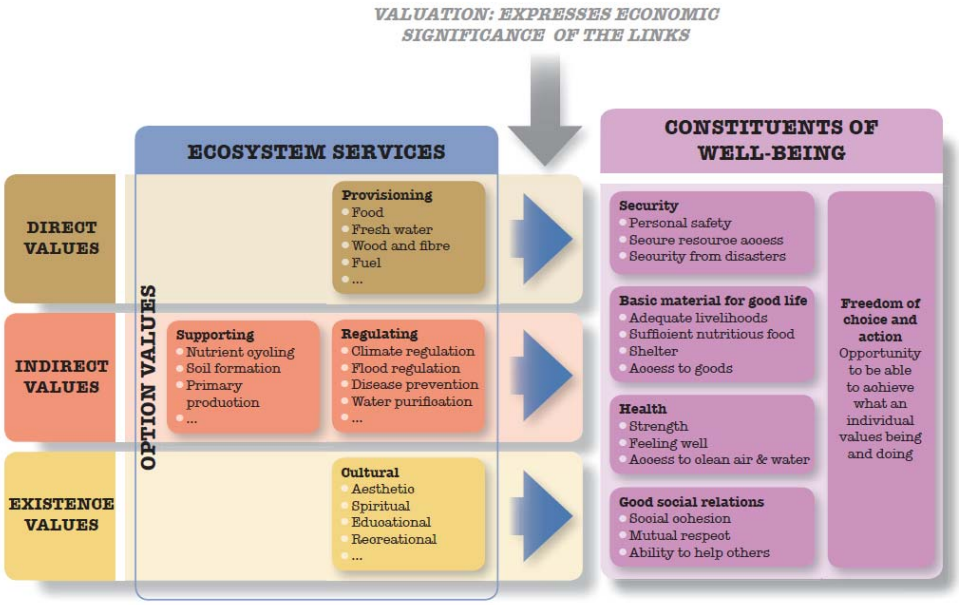


Fig.1 Ecosystem services, human well-being and the total economic value of wetlands (IUCN, 2009)

The eco-system services as identified in Buxa include the followings:

Provisioning services: Buxa community members depend on aquatic ecosystem provisioning services such as food, fresh drinking water (humans and animals), washing, wood and fibres, fuel wood, fodder, boulders and stones from the riverbed. These services can be valued through market prices (WP 3 Buxa, WP 5.1 Buxa).

Supporting services: The local rivers/wetlands offer the natural habitation for fishes, collection of crabs and molluscs and aquatic plants. It also provides the basis for attracting tourism. Such services may be valued through production function and cost based approaches (WP 3 Buxa).

Regulating services: In this category are counted services such as food regulation, diseases prevention, and water purification. The WP 3 Buxa report mention specifically that the Buxa area suffers from serious soil erosion related to heavy rains and flooding. Uses of the riverbeds and land uses (agricultural systems, forestry systems, infrastructure construction) influence the magnitude of the flooding and soil erosion problems. Similarly to the previous category, the economic value of such services can be assessed through production function and cost based approaches.

Cultural services: Aesthetic, spiritual education and recreational services. These types of services although not mentioned in WP3 Buxa they have emerged during the FGDs and stakeholders consultation. Such eco-system services include availability of recreational

services -picnic spot on the bank of the river and streams in Jayanti. The roots of certain plants are used to make toys for the children. They serve multiple purposes –education and recreation. In fact during one of the FGDs we came across several games prepared indigenously by the community and being used by the children.

2.1.5 **Access to ecosystem services**

Access to ecosystem services for people in Buxa is regulated under the Reserve Forest Act (1972), as Buxa has been declared a Tiger Reserve. More info on this is available in the Buxa "Institutions, Policies and Conflicts" report . However, the communities are allowed free access to eco-system services as per their consumption needs.

2.2 Stakeholder's evaluation of eco-system services in Buxa

Stakeholders, in case of evaluating the ecosystem services, include local communities, local village Panchayat **(village assemblies),** Government officials-forest, fishery and agriculture departments and civil society institutions. We also tried to have the views of women on the eco-system services to have a gender perspective. The men women responses have been collected only for the communities and not for the government officials. There has also been site specific variations but not significant.

Stakeholders' evaluation has been carried out and is based on the information collected using FGDs, stakeholders' consultation, personal interactions and observations of their regular activities like fuel wood collection and meeting of the village assemblies of the Panchayats and joint forest management meetings. Outcome of some of the FGDs conducted during the livelihoods study has also been referred to.

According to the exercises made, priorities at the non-aggregate level are provision of fishes for business (78%), maintaining a "stable environment" (72%), "**research** of renewable energy" (67%), "basic health services" (63%) and "biodiversity" (51%). These different single services were subsequently grouped into categories, and total scores counted.

The most valued ecosystem services at the grouped category level were aquatic products, such as (1) daily use of water for human consumption, (2) daily use of water for animals, (3) flood to be reduced, (4) water pollution (to be stopped), and (5) "rainfall" (sustained and sufficient).

Second most important category was health and education, such as (1) skill based training for livelihood using provisioning and supporting services, (2) education for children use of provisioning and support services, and (3) Basic health services using local roots and herbs.

Third most important category concerned further research covering eco-system services: (1) Research on aquatic resources and services, (2) Biodiversity, (3) renewable energy, and (4) a stable environment.

In the following section we present the evaluation in terms of priority and quality of eco-system services in Buxa sites. The figures in the parenthesis indicate quality of services. The two figures, in combination, offer a balanced understanding of the priority of the given service and the existing quality suggesting need for intervention toward improving the quality.

2.2.1 Community evaluation of the ecosystem services *

Eco-system services rankings /concerns	Male	Female
Water	1(-)	1(-)
Fish	1(-)	2(Neutral)
Flood and Soil erosion	2 (-)	2 (-)
Fuel wood	3(-)	2(-)
Medicinal/horticultural plants/flowers/roots and herbs	2(-)	1 (Neutral)
Eco-tourism	2(+)	Neutral and unaware

- **(-) indicates deficient quality whereas (+) indicates encouraging quality. Number indicates the ranking of priority**

The figures in the above table are interesting. Water is top priority for both the male and female community members who consider both their availability and quality as something requiring interventions for improvement. As the rivers are shallow and seasonal water do not stay for long, they have to make do with the streams. Water is required for bathing and drinking the animals, household consumptions and bathing. A deficient and low quality water adversely influence their life –health and hygiene and also fish and other aquatic animals. Women and girl children have to traverse long distances to fetch water. Water is great concern in Buxa and less in Jayanti and Adama. However, jayanti river, getting dry, results into poor harvest of fish which uses fish for domestic consumption and also for the market. Over fish women seem to maintain a more neutral position.

Flood and soil erosion are concerns of both male and female farmers both of whom consider it as adversely impacting their life in equal vein. There is very little being done to check soil erosion which also effects their agriculture whatever they have. Fuel wood is greater concern of the women than men. There are hardships in the collection and stocking of fuel wood expressed by the women although men are equally involved in the management of fuel wood.

For women medicinal plants/horticultural plants, flowers and roots are greater priority than men but are neutral about the quality and availability. These services are important in the life of the people from all the three sites as they offer significant livelihoods

opportunity for them. Adma and Buxa have greater value for them than Jayanti which has wider livelihoods options and also which differ significantly in the topography. Jayanti's agricultural and livelihoods pattern are different from that of the two other sites.

Over the last couple of years there has been systematic efforts at establishing tourist stay houses by some of the articulate members of the community and the civil society who have gradually been earning considerably good income. Beginning with one in Sadarbazar, establishment of tourist lodges have grown significantly even at the remote locations. These have attracted good number of local as well as tourists from outside. Needless to say the community has started seeing this as a livelihood and entrepreneurial opportunity. Women, though involved in the management of the same, have not been able to articulate the position of the sector. They seem to be playing second fiddle as of now.

2.2.2 Evaluation by the government officials

Eco-system services rankings /concerns	**Forest Department**	**Other Departments**
Water	1(Neutral)	Neutral
Fish	3 (Neutral)	2(-)
Flood and Soil erosion	1 (-)	1 (-)
Fuel wood	1(+)	1(Neutral)
Medicinal/horticultural plants/flowers/roots and herbs	1 (+)	2(+)

We tried to have evaluation of the government officials based on their perceived involvement in the affairs of Buxa. Forest department is the key department whose perceptions are important. We also had an opportunity to present Buxa scenario to some 72 young forest officers from all over India and requested them to evaluate the eco-system services and suggest interventions. Interestingly, their response matched quite closely to the West Bengal /Buxa forest officials (Mishra, Ray and Stuart,2011). While presenting the views of the forest officials we also considered and combined their perspective.

The pattern, as it emerged from the above figures, is interesting. The forest department officials agree that water is a great concern but do not see the situation alarming both in terms of availability and quality. The abundance of water coming from the mountain streams, for them is fine. They also did not mind the drudgery of women and girl children while fetching water from far off sources. Other department's officials do not seem to be quite aware of the situation so far water is concerned. Fish as a priority, for

the forest officials do not seem to be of much significance. Perhaps, being with the community, for long, they have realized that fish is not a livelihoods opportunity for them. They also did not differentiate between the three sub-research sites. For the officials from other departments fishery is a modest priority and they feel that availability of water and food habit of the local community may be limiting factors for them not going for fishery. The officials from all the departments consider flood and soil erosion as priority to tackle the problem. Interestingly, the forest department and other officials consider fuel wood as a priority for the area. The forest department officials do not feel there is any shortage as the same is available in abundance and they have easy access to them. Officials from other departments do not seem to have any clue of the access and availability. Officials from both the categories consider medicinal/horticultural plants and flowers and roots as great priority and potentials and consider positive opportunity to turn the opportunity into livelihoods realities-both as a means for household domestic use and for the market. One can read from the figures that the government officials are slightly farther from the needs and priorities of the local communities and although they seem to empathise with them they have nothing concrete to suggest/offer.

This is interesting if one can examine the ven-diagram plotted by the community. They very clearly underline their importance but find them as remotely located not to available in times of needs and emergencies. The interface between the community and the officials seems to be freshly looked at and articulated.

2.2.3 Evaluation by the Panchayt representatives and members of the civil society

Eco-system services rankings /concerns	**Panchayat**	**Civil society**
Water	1(-l)	1 (-)
Fish	2 (Neutral)	3(-)
Flood and Soil erosion	1 (-)	1 (-)
Fuel wood	1(+)	1(-l)
Medicinal/horticultural plants/flowers/roots and herbs	1 (-)	1(-)
Eco-tourism	2(Neutral)	1(+)

The above figures on the evaluation of the ecosystem services are quite significant from several points of view. First, there is agreement on the priorities between the Panchayat and the civil society. On water both agree that water is the top priority and there is serious concern in terms of availability and quality of water. Fish is priority two for the Panchayat but have neutral stance over fish being an opportunity. Civil society considers fish as low priority and has negative factors against it-water is not available, food pattern and market are not compatible. Flood and soil erosion is a serious concern for both category of agencies and they consider negative factors –no initiative by the government

either at the state or local levels –to be responsible for the same. Panchayat sees fuel wood as an issue but has no problem with the availability and quality. But for the civil society quality and availability of the service is a concern. Coming from the similar socio-cultural and environmental milieu both the civil society and panchayats consider medicinal plants, horticulture, flowers, roots and herbs as great potentials and hold similar views on their quality and availability. The topography, scarcity of water and government regulations come in the way of their optimum utilization as sustainable livelihoods opportunity. Interestingly, both the Panchayat and civil society consider great opportunity for eco-tourism considering the local ecology and other services-water, birds, mountains and forest. It offers tranquillity and pollution free environment. Eco-tourism has not figured in the priority of the government officials.

Again, if one could analyse the outcome of ven-diagram(s) one can clearly see that people place so much emphasis over the Panchayats and civil society institutions-they consider them as important institutions to interface constructively with them. At the same time these institutions have been shown to be available at close proximity. Logically, their views on priority and concern match quite well with the community.

2.2.4 Summary of the stakeholder's evaluation

A quick summary of the stakeholders' evaluation suggest that there is divergent views on eco-system services of Buxa influenced by their social location, institutional commitment and proximity and relationship with the community. Use of participative methods has brought finer differentiations in their locations which, in turn, have helped evolve respective priorities. A special feature of the evaluation exercise is near agreement among stakeholders on the priorities and concern. Water, flood and soil erosion, fish, plants, fuel wood and tourism have emerged as priorities. There is a visible concern toward the issues of soil –erosion, water and aquatic products. Water scarcity is a great issue and the community has to access water from far off places. Women and adolescent girls toil harder to bring water leaving a larger gender gap. The officials from the forest department seem more cautious to maintain norms even at the cost of ignoring urgent needs of the community. The local Pacnahayts and the civil society are located in close proximity whose views are quite similar to those of the community. Cultural tourism emerging as a livelihoods opportunity has to be seen with caution. While there is economic opportunity in it, it may spell cultural doom for the simple community members. In a recent case rich businessmen are promoting local tourist dwellings keeping the local community as subservient. While this may set a process of exploitation and pauperization this may also bring urban elite in contact with the local communities leading further to human exploitation and moral degradation. The Integrated Action Plan (IAP) would keep this in mind.

3.0 Stakeholder Delphi –Buxa Delphi

The Delphi technique has been described as 'a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem' (Linstone &Turoff, 1975). High ARCS being a

multidisciplinary research enterprise has involvement of different stakeholders. The research, under High ARCS, has the involvement of several actors with divergent views and perspectives. Delphi has been specifically used to not only understand their perspectives but to also help each other reorient their perspectives picking up the cues/ experiences of the others. Delphi involved the following steps:

3.1 The selection of key stakeholders

The key stakeholders include those who are closely related to the protection and sustainable use of aquatic resources in Buxa. The stakeholders in Buxa included community members, members of Panchayat, local (including district) and state level bureaucracy, members of civil society and self-help group. In all 14 stakeholders, from among the above, were identified. Identification and final selection of stakeholders was made with the discussion among the research team including international team. Stakeholders' consultation also helped in identifying stakeholders. In the beginning 20 stakeholders were identified to participate in the Delphi analysis but six them could not make it because of several factors-apprehensions of adverse consequences if they expressed openly and also the rigour that was involved in the process.

3.2 Development of questionnaires

The research questionnaire, to be used for Delphi, evolved gradually and systematically in a participatory way. During the early phase of the project the concept was discussed at several forums including the ones at the country level workshops in Kolkata and Jalpaiguri. The work package leader (WP 5) and coordinator came out with the draft questionnaire and shared with the teams. Through an iterative process the questionnaire was finalized. *The items of the questionnaire pertained to general environmental conditions, extent of use, factors contributing to degradation, policy adequacy/inadequacy, and effectiveness of current environmental policy, economic, social and environmental benefits, threats and potential measures.*

3.3 Collection of idea from stakeholders and data processing

Questionnaires were administered in three rounds. During the first round the respondents offered their views on different issues as given in the five sections of the questionnaire. The views were analysed which offered further insights. Based on the first round of responses further issues and feedback were identified and presented in four sections. They were presented before the same set of stakeholders (round II). The interview / has been take from panel members individually like round I. Most of the cases CDHI team fixed the date and time with panel members over phone according to their convenience then met with each individual at their office / work place. There was one to one interview in friendly environment. (please see the annexure II of a sample sheet). As mention above, four sections are included in the round II and section one related general information is not included. The emerging issues from different section of round I are included in round II for the panel members' view in giving score / marks varies zero to ten. The responses of the round II were analysed and the result was

shared with the same set of stakeholders. They were requested to consider/ consult the result of the second round and further articulate their views on the same set of issues in round III. In round III same process has been adopted for fixing the date and time for individual interview. The objective for round III was to get more authentic response from the panel members. In the round III questionnaire, scores of each respondents (without mentioning their name)were highlighted in the table includes range of median score.(Please see the annexure for Delphi round III)

In case of Buxa (India), initially, the stakeholders were little suspicious and avoided giving any opinion on the subject which they considered sensitive. Buxa has two sensitive issues-(1) the area is under reserve forest which has its own security sensitivity and (2) the international boarder which makes the government officials sceptical about research. It is often considered as something interfering with the state subjects and security. Gradually, the issues were discussed and the stakeholders were convinced of the scientific credentials and temper of the project and came forward to give their views. Collection of views from the stakeholders was carried out on three occasions- the views obtained at the first occasion was analysed and fed back to the same set of stakeholders. The process continued to further two occasions. The idea was to let the stakeholders reflect upon in the light of the aggregate feedback presented to them. This helped them review their own views which were not necessarily complete reversal/denial of the earlier views. This helped learning from their fellow stakeholders and revising their stand. The process took longer time but elicited important views from the stakeholders. It is presumed that the stakeholders, following this iterative and mutually learning process, gained better ground –understanding/sensitivity to deal with different problems related to High ARCS.

Following section presents the outcome of the first round of views expressed by the stakeholders. This is followed by analysis of the response on round II and III.

3.4 Analysis of the round I responses

Section1: **General Information**

3.4.1 In general, Status or condition highland rivers and lakes and the aquatic plants, fish, molluscs and other organisms living in them in the Buxa reserve.

Sl	Status	Percentage
A	Very degraded and totally insufficient	00.00%
B	Somewhat degraded and scarce	21.42%
C	Acceptable	28.57%
D	***Quite plentiful and diverse***	***14.30%***
E	***Very plentiful and diverse***	***35.71%***

F	Cannot answer due to insufficient information available to me on this issue	00.00
G	Others	Nil

The responses suggest, by and large, a rich environment with 50% of the respondents considering the situation as rich and diverse. The perception of degradation is acceptable to the stakeholders by and large.

Extent of use of highland aquatic resources in the Buxa reserve

Sl	Use of high land aquatic resources	Percentage
A	Very excessive	7.15
B	Excessive	50.00
C	Correct	21.45
D	Less	21.45
E	Very less	00.00
F	Cannot answer due to insufficient information available to me on this issue.	00.00
G	Others	Nil

Rich and diverse bio-diversity apart, use of the aquatic resources is seen as being excessively used which is considered correct by some 22% of them.

3.4.1.1 *There is a need to take action or implement a new policy to improve aquatic biodiversity conservation in Buxa reserve, particularly in the highland sections.*

Sl	**Need to take action**	**Percentage**
A	Agree strongly	42.85
B	Agree	50.00
C	Neither agree nor disagree	00.00
D	Disagree	00.00
E	Disagree strongly	7.15

F	Can not answer due to insufficient information available	00.00
G	Others	Nil

The stakeholders feel the need to implement new policy to improve aquatic bio-diversity. This shows the concern as well as proactive urgency to preserve the richness.

3.4.1.2 *Effectiveness of current regulations related to the conservation of aquatic resources in Buxa reserve.*

Sl	**Effectiveness of current regulations**	**Percentage**
A	Very ineffective	00.00
B	Ineffective	7.15
C	Appropriate	35.70
D	Effective	14.30
E	Very effective	00.00
F	Can not answer due to insufficient information available	42.85
G	Others	Nil

An interesting aspect of the adequacy of current regulation is reflected through missing awareness for stakeholders 43% of whom reported to suffer insufficiency of information.

3.4.1.3 *Economic, social or environmental benefits could be gained from better conserving aquatic resources in Buxa reserve.*

Sl	**Benefits**	**Percentage**
A	Yes	92.85
B	Unsure	7.15
C	No	00.00

There is over all agreement about the need for conserving bio-diversity in Buxa to optimize the socio economic and environmental benefits. This points to the possibility of conservation initiative.

3.4.2 Section 2: Potential *problem constraints or threats facing highland aquatic resources in Buxa reserve?*

Factors	Problems, threats	Frequency of responses
Physical	1. Poor maintenance of physical infrastructure	1
	2. Illegal fishing	1
	3. Communication Network	1
	4. Need modern infrastructure	1
	5. Natural calamities	1
	6. Regular occurrence of flood and shifting of river source	2
Environnemental	1. Soil Erosion	5
	2. Pollution	3
	3. Déforestation	1
	4. Lack of awareness	1
	5. Rapid deforestation, urbanization and pollution created by tourism.	1
	6. No serious threat.	1
Managerial	1. Poor management	1
	2. Shortage of infrastructure and staffs	1
	3. Officials are not down to earth	1
	4. Limited mainstreaming approaches of all concerned govt. And other agencies.	1
	5. Lack of proper awareness campaigning	1

Institutional	1. Poor Education 2. Weak local level committee 3. Lack of Knowledge 4. Traditional practices 5. Lack of net working 6. Infrastructure needs to be strengthened. 7. Economically backward area and livelihood mainly depends on natural resources	2 1 2 1 1 1 1
Economic	1. Weak and poor income 2. Less Finance 3. Poverty due to unemployment and non availability of attractive scope including employment opportunities 4. Lack of livelihood among the poor people 5. No alternative sustainable livelihood plan. 6. Resources include natural, finance, social etc. 7. Poverty and dependency on forest.	2 2 3 3 3 1 1
Culture/social	1. Missing vibrancy of cultural inputs to create awareness and sensitivity about High ARCS	1
Other	2. Proper regulation and collaboration needed within two departments (	1

	Forest and Fishery) for development of Buxa area.	

The above response is interesting and quite in conformity with the stakeholders evaluation. The issues are of erosions and other forms of degradation. The factors include lack of awareness, exposure and education about the existing conservation provisions.

3.4.3 Section 3: *Other issues related to highland aquatic resources*

Factors	**Issues**	**Frequency of responses**
Physical	1. Need to do regular maintenance	1
	2. Permanent embankment.	1
	3. Pollution by illegal fishing	4
	4. Pollution	1
Environmental	1. Awareness is needed.	1
	2. Conservation of ponds, lakes etc.	1
	3. To arrest soil erosion	1
	4. To stop unscientific cultivation.	1
	5. Food chain / Food cycle	4
	6. Less rainfall	3
Managerial	1. Officials to be knowledgeable person on highland aquatic resources.	1
	2. Forest Protection	2
	3. Environment protection	2
	4. Protection of wild life	1
		1

	5. Avoid deforestation 6. Strengthening supervision.	1
Institutional	1. Need to organize training for the member of local level institutions 2. Attractive source of drinking water. 3. Qualified person 4. Civilized persons 5. Learning institute	2 1 2 1 1
Economic	1. Need positive development 2. Most of the people are living below poverty line. They are largely dependent on forest vegetarian and aquatic resources. 3. Source of income 4. High level economic condition 5. Good service	1 1 1 1 3
Culture/social	1. Need to develop cultural society 2. Need good market for local cultural groups.	1 1
Other	1. Mind set of people to interpret the problems as well as to address the problems. 2. Major approaches are basically project made, not in program made.	1 1

Other issues overlap with the issues mentioned above.

3.4.4 Section 4: *Potential measures, action or institutional change that could help improve highland aquatic resources conservation and wise-use in Buxa reserve*

	Measures, actions or institutional change	**Frequency of responses**
Institutional	1. Training 2. Education and health support system should be provided. 3. Net working and advocacy.	3 1 1
Management	1. Strong committee 2. Infrastructure, road and building. 3. Trained staff. 4. Construction for trekking. 5. Need strategic planning.	2 1 1 1 1
Financial	1. Funding for Construction of reserve tank / water tank 2. Finance for New construction related to aquatic resources and protection of biodiversity 3. Service to be explored for financial development or aids. 4. Need to invest more money for research on aquatic resources.	1 1 1 1
Culture/social	1. Developmental changes of both culture and social for strong social bonding towards aquatic resources.	1 1

	2. Govt. should take action plan to revive the village cultural groups.	
Researches	1. New organization building. 2. Innovation and selection of local endeavors. 3. Need to do advocacy on the basis of research findings.	1 1 1
Technology	1. Mini-hydro power 2. Soil utilization, embankment protection, cultivation methodologies, cash crop production and food processing. 3. New technologies to be adopted.	2 1 1
Other		

The potential measures indicated by the stakeholders include changes, reorientation and revamping of institutional, managerial, financial and cultural practices backed by adequate research and appropriate technology.

3.5 Analysis of round II and III

In the following section the scores of the stakeholders have been analyzed and explained across four sections of the questions as used in the Delphi questionnaire.

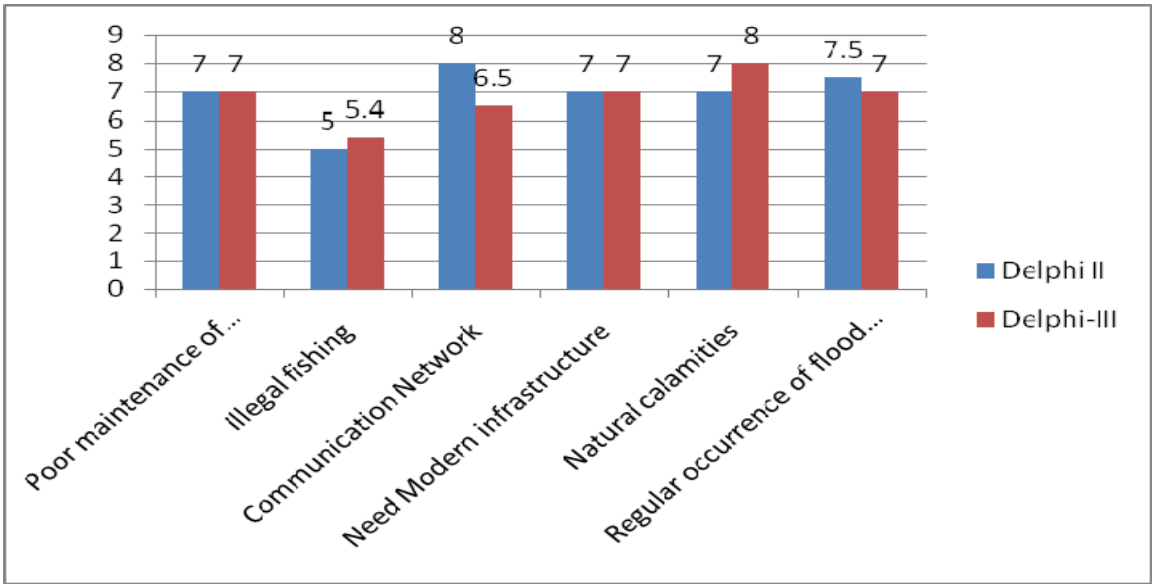
Section-I

Potential problem constraints or threats facing highland aquatic resources in Buxa reserve?

This section examines how different factors contribute to the potential problems, constraints or threats facing highland aquatic resources in Buxa reserve. The factors have been subdivided based on the response of the first round and include:

3.5.1 Physical factors

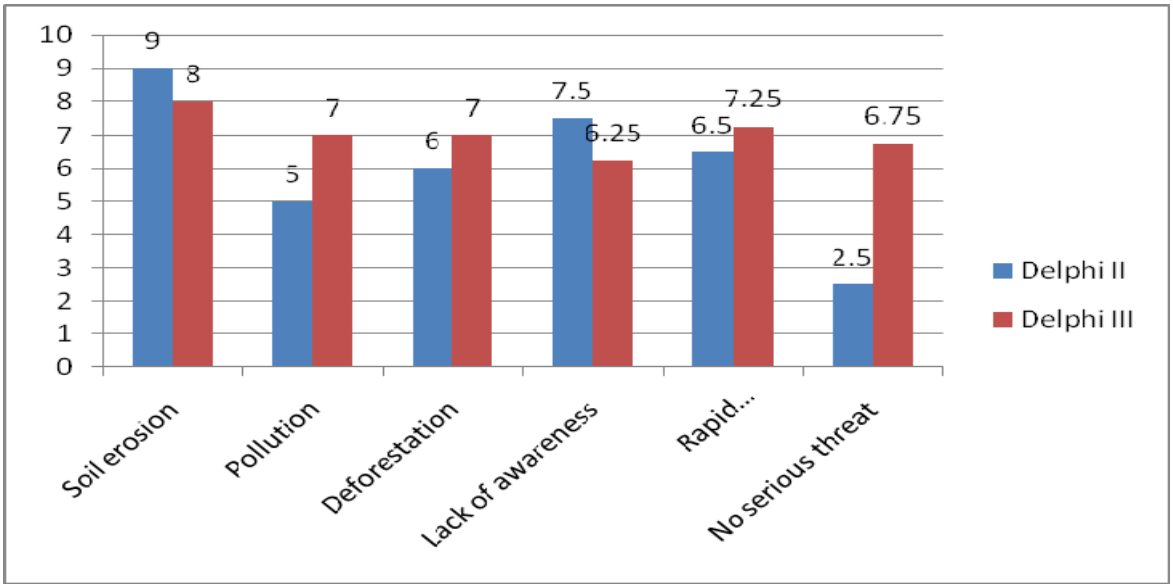
Factors	Problems & threats	Delphi-II														Median	Delphi-III														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	10	11	12	13	14	Median
Physical	Poor maintenance of physical infrastructure	8	3	7	6	8	7	7	5	7	5	6	7	5	8	7	6	7	7	8	6	5	5	9	9	7	9	9	7	7	7
	Illegal fishing	3	3	8	6	8	2	3	5	6	5	4	5	5	10	5	7	3	7	4	6	8	8	5	8	5	5	8	5	5	5.4
	Communication Network	9	6	7	7	8	5	6	10	8	10	9	8	7	9	8	9	9	6	9	9	7	7	4	5	2	4	5	2	8	6.5
	Need Modern infrastructure	5	5	6	7	7	6	7	7	9	6	9	5	7	8	7	7	7	8	5	8	5	5	9	9	4	9	9	4	7	7
	Natural calamities	7	6	6	8	9	8	5	7	4	7	8	6	8	5	7	8	7	10	4	5	2	8	8	8	8	8	8	8	5	8
	Regular occurrence of flood and shifting of river course	9	6	5	6	8	9	7	7	8	7	9	8	8	2	7.5	7	8	10	9	9	4	7	7	10	4	7	10	4	5	7



The results show some changes in the ratings given with an increased median rating for some questions and a decreased rating for others though there is no change of views on poor maintenance of physical infrastructure and need of modern infrastructure. The second round Delphi confirms the growing network of communication-road and transport as one of the major threats followed by regular occurrence of flood as well as shifting of river course. Natural calamity including flood is considered a major threat during the third round. Poor maintenance of physical infrastructure emerged equally important problem. The panel members in both rounds have not prioritized illegal fishing as a major concern. The analysis underlines the need for enhancing preparedness to respond to the calamities, building and maintenance of infrastructure and creating policy sensitivities among the stakeholders more so among the government functionaries. Creating awareness among the local communities to maintain the physical infrastructure is yet another priority emerging out of the stakeholders' views on possible interventions.

3.5.2 Environmental factor

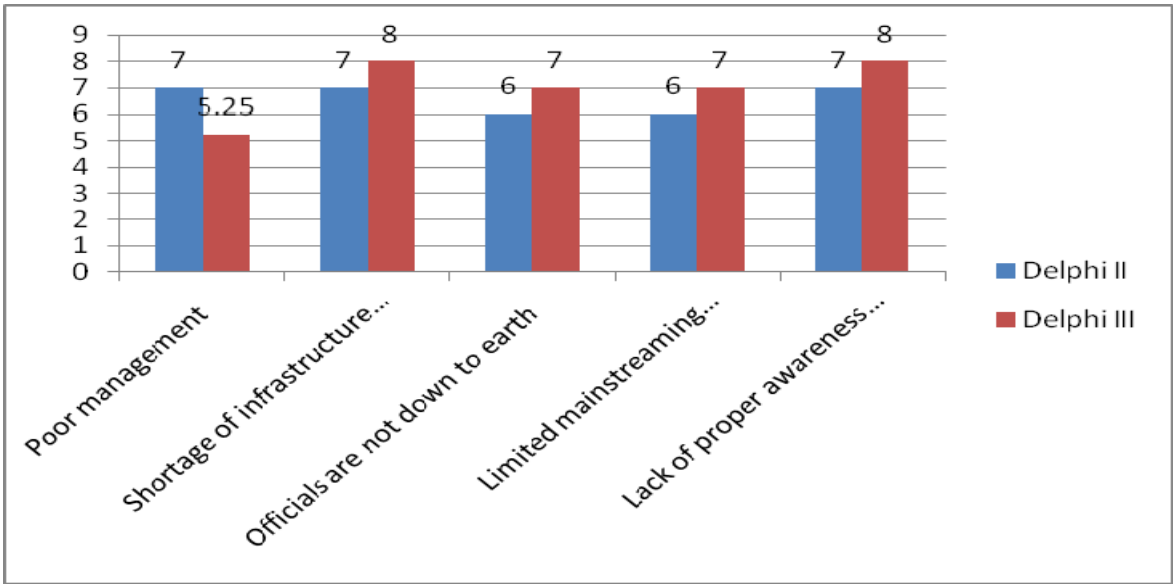
Factors	Problems & threats	Delphi-II														Median	Delphi-III														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	10	11	12	13	14	Median
Environmental	Soil erosion	9	8	9	9	9	10	6	8	10	8	9	8	9	3	9	10	9	9	8	8	8	5	8	7	7	8	7	7	8	8
	Pollution	2	3	5	8	8	8	2	5	6	6	4	5	6	1	5	7	6	4	7	10	4	5	9	8	6	9	9	7	7	7
	Deforestation	3	6	6	6	6	6	5	6	8	5	5	8	8	8	6	7	7	7	8	7	7	8	5	8	7	5	8	5	5	7
	Lack of awareness	7	7	7	6	7	6	7	9	10	10	10	9	8	8	7.5	7	7	3	9	8	6	7	4	7	4	4	5	2	8	6.25
	Rapid deforestation, urbanisation and pollution created by tourism	5	5	8	7	7	5	4	7	7	6	6	7	8	2	6.5	6	7	8	5	8	7	5	9	9	9	9	9	4	7	7.25
	No serious threat	5	0	6	2	2	2	6	4	6	2	3	2	1	8	2.5	8	7	7	4	7	4	5	5	8	5	8	8	8	5	6.75



Almost all stakeholders have confirmed soil erosion as a serious problem in Buxa which has scored 9 and 8 respectively (median) out of 10. Some of the Government officials have given 100% score in considering soil erosion as a threat to environment. Rapid deforestation and urbanization marked by gradually increasing construction of building and entry of markets is considered as a major threat. During the first Delhi round stakeholders did not consider threat to environment but in the subsequent rounds this emerged as a major threat.

3.5.3 Managerial factors

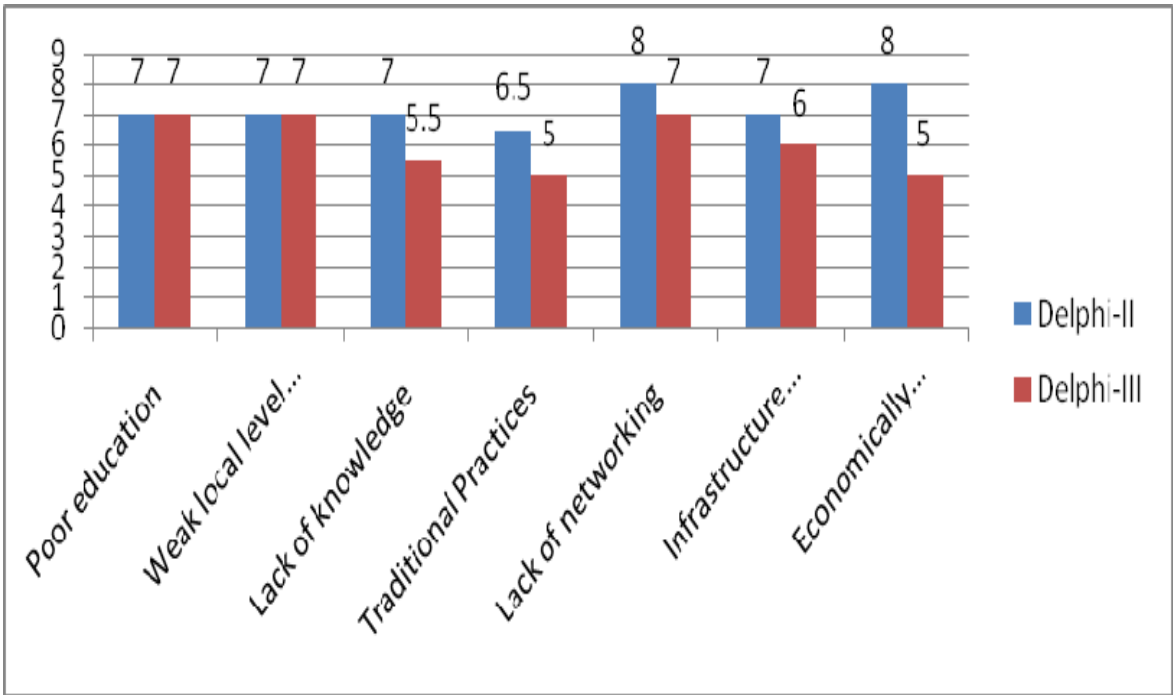
Factors	Problems & threats	Delphi-II														Median	Delphi-III														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	10	11	12	13	14	Median
Managerial	Poor management	8	6	5	6	9	8	7	7	8	4	5	8	5	9	7	6	6	8	5	6	5	8	4	5	4	7	10	4	5	5.25
	Shortage of infrastructure and staffs	8	5	6	7	8	7	6	7	7	9	7	9	7	9	7	8	6	8	8	9	8	7	9	9	9	8	7	7	8	8
	Officials are not down to earth	8	3	7	4	7	5	6	7	6	3	4	10	6	3	6	5	7	8	5	7	5	5	8	8	8	9	8	6	7	7
	Limited mainstreaming approaches of all concerned govt. and other agencies	9	4	8	5	7	6	6	6	8	4	5	8	6	9	6	7	7	9	4	8	4	5	7	10	7	5	7.5	7	5	7
	Lack of proper awareness campaigning	7	6	6	6	7	7	5	6	5	9	9	9	8	8	7	8	8	7	8	9	8	8	8	7	8	4	6.5	4	5	8



Managerial factors include lack of infrastructure, status consciousness among the government officials and missing strategies to involve people in the management. The concerns, as underlined in round one, is confirmed by the stakeholders in other two rounds with different levels. Buxa is managed by the government departments and it is important that the government departments improve and reorient their management strategies and procedures, encourage participation of the local communities, evolve relevant strategies and tools to create awareness among them and seek support from different agencies where ever they miss their in-house capacities.

3.5.4 Institutional factors

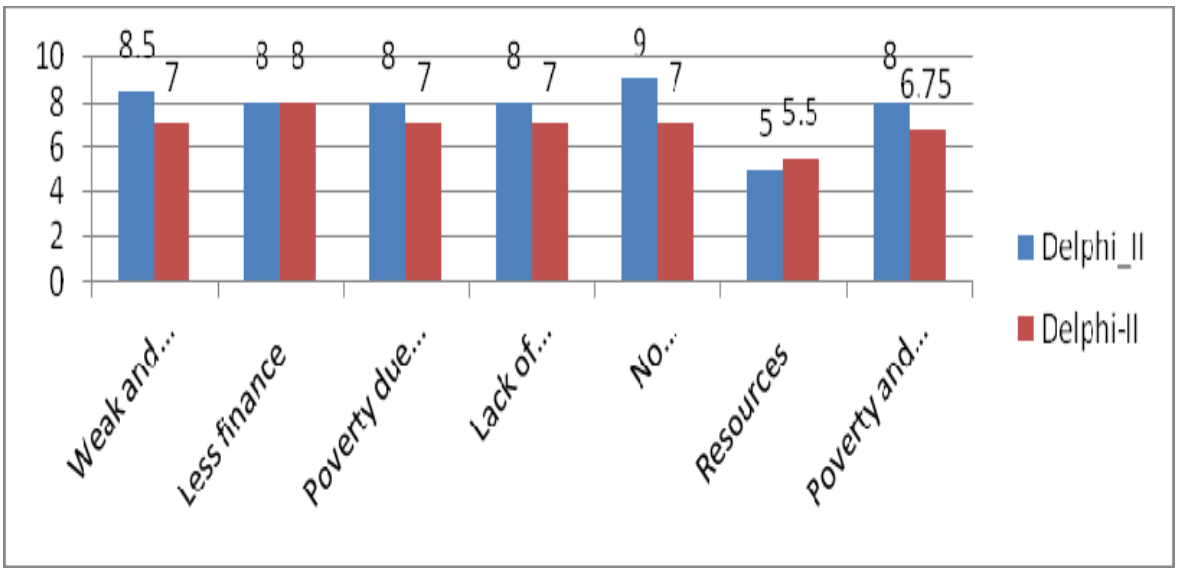
Factors	Problems & threats	Delphi-II														Median	Delphi-III														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	10	11	12	13	14	Median
Institutional	Poor education	9	5	7	7	9	8	7	7	6	7	8	9	7	9	7	9	7	10	5	6	3	7	9	8	9	5	5.5	5	8	7
	Weak local level committee	8	7	5	8	7	6	7	6	8	6	9	10	7	9	7	9	9	3	6	5	8	5	5	8	5	9	9	7	7	7
	Lack of knowledge	6	4	6	10	9	7	7	7	7	8	10	8	8	2	7	8	7	3	8	8	6	2	4	7	4	5	8	5	5	5.5
	Traditional Practices	8	3	7	3	7	3	6	6	9	3	7	9	6	9	6.5	5	7	6	5	9	7	4	5	6	5	4	5	2	8	5
	Lack of networking	5	5	8	8	8	5	6	8	8	9	9	6	8	7	8	8	7	7	9	7	6	8	9	9	7	7	9	4	7	7
	Infrastructure needs to be strengthened	5	5	9	7	7	7	7	6	6	7	8	5	5	10	7	8	7	8	5	5	7	4	5	8	5	5	8	8	5	6
	Economically backward area and livelihood mainly depends on natural resources	8	6	8	6	6	8	8	7	5	8	10	8	5	10	8	10	7	8	4	5	4	5	4	5	2	8	10	4	5	5



Stakeholders on round II and III confirm weak local institutional presence which they attribute to poor education, weak knowledge and economic condition. There is also perceived missing network of institutions. All these are considered as threats. There is need to have a deeper analysis of these issues and threats. For example traditional practices of using local leaves and herbs for treating various diseases results into illegal collection and sale of these resources but the compelling economic conditions force them to resort to such practices. There is no way that their traditional knowledge is scientifically authenticated.

3.5.5 Economic factors

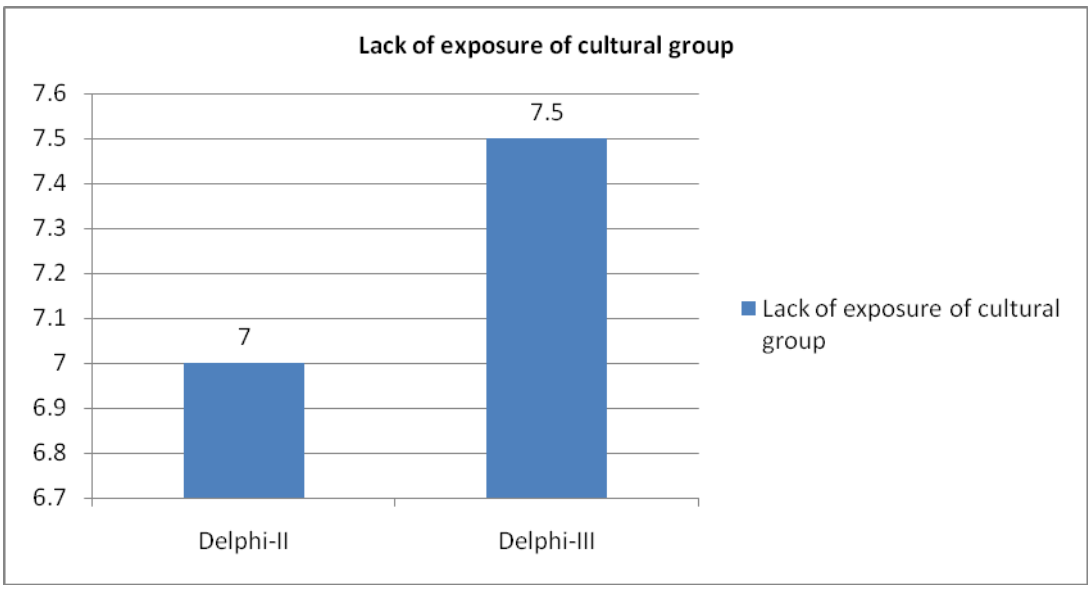
Factors	Problems & threats	Delphi-II														Median	Delphi-II														Median
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Economic	Weak and poor income	9	7	8	7	7	9	8	9	6	9	9	9	6	10	8.5	10	10	7	5	7	5	8	9	9	4	7	7	7	8	7
	Less finance	9	7	8	6	5	9	8	7	7	9	9	9	6	10	8	10	7	8	8	5	8	7	8	8	8	5	8	6	7	8
	Poverty due to unempoyment and non availability of attractive scope	8	8	9	5	6	9	7	8	8	9	10	8	8	10	8	9	9	7	5	7	7	5	7	10	4	5	7.5	7	5	7
	Lack of livelihood among th epoor people	6	9	8	6	8	7	8	9	9	7	9	8	8	10	8	9	7	7	5	5	6	2	8	7	7	9	9	7	7	7
	No alternative sustainable livelihood plan	8	9	9	7	9	8	8	9	6	8	10	9	9	10	9	9	8	7	4	8	7	4	9	8	6	5	8	5	5	7
	Resources	8	3	6	6	3	5	8	3	5	4	3	7	6	2	5	6	5	7	5	7	4	8	5	8	7	4	5	2	8	5.5
	Poverty and dependency on forest	9	8	8	6	10	8	7	7	9	8	7	10	7	10	8	7	7	7	8	6	5	5	4	7	4	9	9	4	7	6.75



The problems/threat related to economic factors include weak and lower income, poverty due to unemployment, no alternate sustainable livelihood opportunities. Sustainable livelihood has evolved as serious issue in Buxa. Limited opportunities for livelihoods for the community force them over exploitation of the natural resources. Creation of alternative sources of livelihoods seems to be an important component of the IAP.

3.5.6 Cultural and Social factors

Factors	Problems & threats	Delphi-II														Median	Delphi-III														Median
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Culture/social	Lack of exposure of cultural group	8	5	7	5	7	7	8	6	6	9	8	7	5	9	7	8	7	8	5	5	8	8	5	6	5	8	8	8	5	7.5



Culturally, the communities have affinity with the nature which would mean that the culture encourages preservation and protection. Over the period the people are losing touch with the cultural practices which the stakeholders feel as responsible for undermining the preservation and protection. An important aspect of the IAP could be efforts at restoring their cultural vibrancy and linking the same with the preservation and protection of local eco-system on which their survival depends to a large extent.

3.5.7 Overall consensus on "Problems and Threats" (Section 1)

Concerning the level of concordance amongst panel-members, there is a significant, but only moderate concordance of scores (Kendall W = 0,3170; p-value = 0.0000; chi-squre with 32df) amongst the panel members in Round 2 It was therefore decided to pursue the inquiry by engaging a 3rd Round. However, in Round 3, the level concordance diminished to the level of "weak" (Kendall W = 0,120, with a p-value = 0,010 assuming qui-square with 32df), contrary to what was expected. This phenomenon might be explained as following from the issue of political sensitivity making respondents hesitant in giving their honest responses in the first rounds, but gaining more confidence and thus changing their views on this ground. It might also be due to hastiness of the responses given, thus adding some degree of randomness in answers.

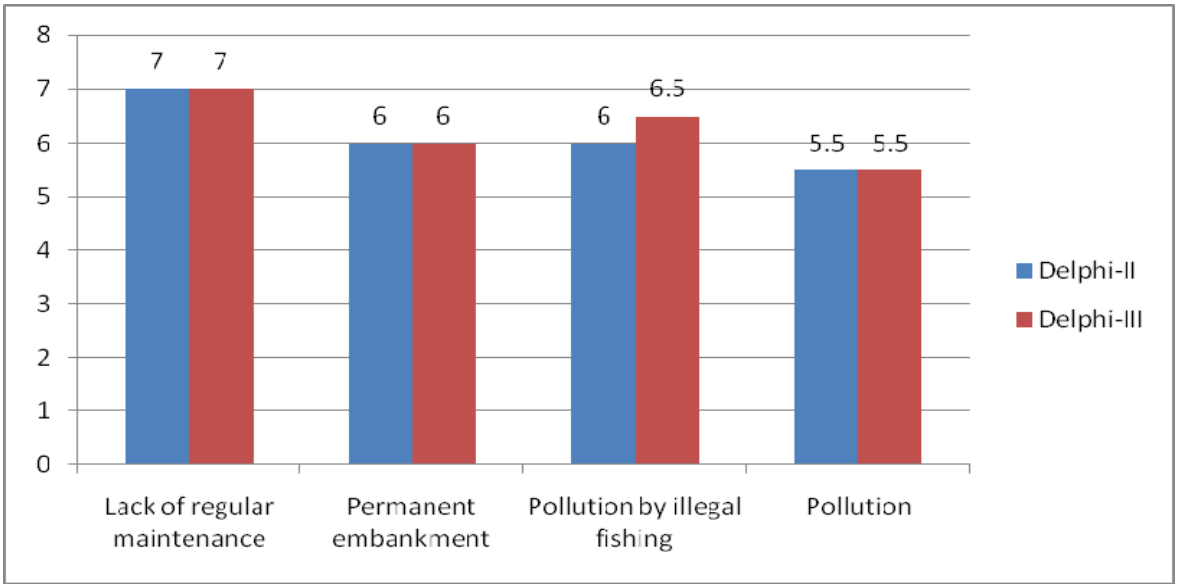
Section-III

Other issues related to highland aquatic resources.

This section tries to take the stakeholders around other issues related to Highland Aquatic resources. This helps the stakeholders reflect around the issues and see if they deviate/differ from their earlier position.

3.5.2.1 Physical issues

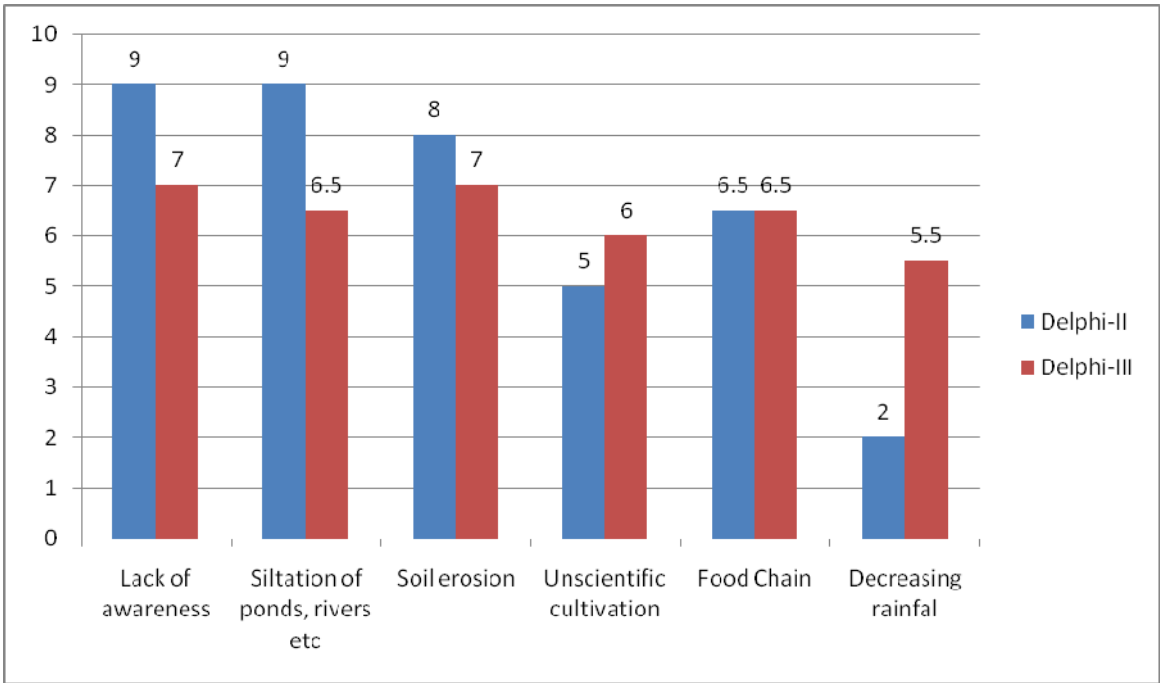
Factors	Other Isues	Delphi-II														Median	Delphi-III													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	#	11	12	13	14	Median
Physical	Lack of regular maintenance	9	7	7	6	7	7	7	6	8	6	7	7	6	9	7	8	7	6	5	4	8	8	9	5	7	8	5	4	7	7
	Permanent embankment	9	6	8	6	6	8	5	6	9	5	6	7	6	5	6	7	7	5	9	7	6	5	6	9	4	6	4	7	6	6
	Pollution by illegal fishing	5	5	9	8	8	9	4	8	7	5	4	9	5	3	6	7	6	7	5	6	7	9	7	4	5	7	8	6	5	6.5
	Pollution	2	6	8	6	7	6	4	7	6	5	5	5	5	2	5.5	6	8	6	4	4	8	4	4	7	4	6	5	7	4	5.5



The issues relate to lack of maintenance of infrastructure including lack of embankment on the river which causes soil erosion. Another issue relate to pollution by sewage from the household and poisoning of the river for fishing.

3.5.2.2 Environmental issues

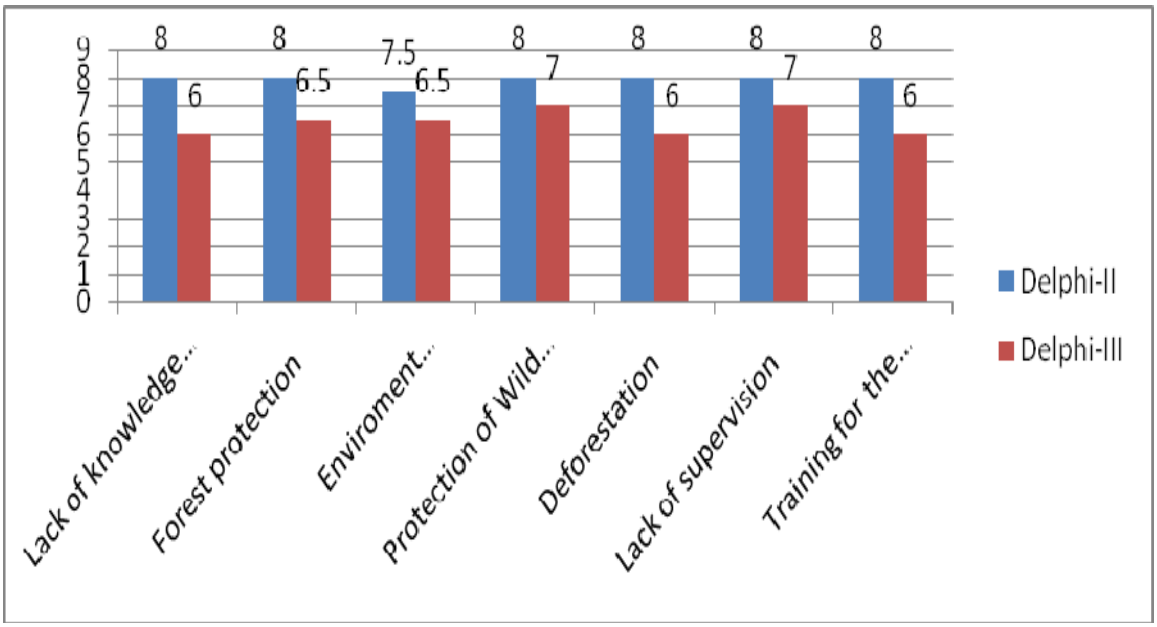
Factors	Other Issues	Delphi-II														Median	Delphi-III													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	#	11	12	13	14	Median
Environmental	Lack of awareness.	10	7	10	6	5	10	7	9	7	9	9	9	9	8	9	8	10	7	5	7	6	7	7	6	5	7	9	7	5	7
	Siltation of ponds, rivers etc	9	4	10	5	6	8	7	9	8	9	10	9	9	10	9	9	10	7	8	6	7	6	6	5	5	8	4	9	5	6.5
	Soil erosion	10	3	8	6	7	7	7	8	9	8	9	6	9	10	8	7	9	9	5	7	8	5	7	4	9	6	7	9	9	7
	Unscientific cultivation	9	3	6	5	3	6	7	8	10	5	2	5	3	2	5	6	4	6	9	4	6	4	7	5	5	7	6	7	5	6
	Food Chain	6	3	7	7	9	8	2	9	5	5	2	7	7	1	6.5	7	7	7	4	5	7	8	9	5	5	6	5	4	7	6.5
	Decreasing rainfall	3	2	2	4	2	2	1	2	6	4	1	7	1	1	2	3	3	4	7	4	6	5	9	9	4	8	4	7	6	5.5



Delphi II and III round views of the stakeholders on other issues related to environment including lack of awareness, depletion and siltation of wetlands including ponds, soil erosion and decreasing rain fall which is becoming erratic and shrinking. The opinion seems to have been revised during Delphi III as there is substantial change in the reported incidence which can be seen above.

3.5.2.3 Managerial aspects

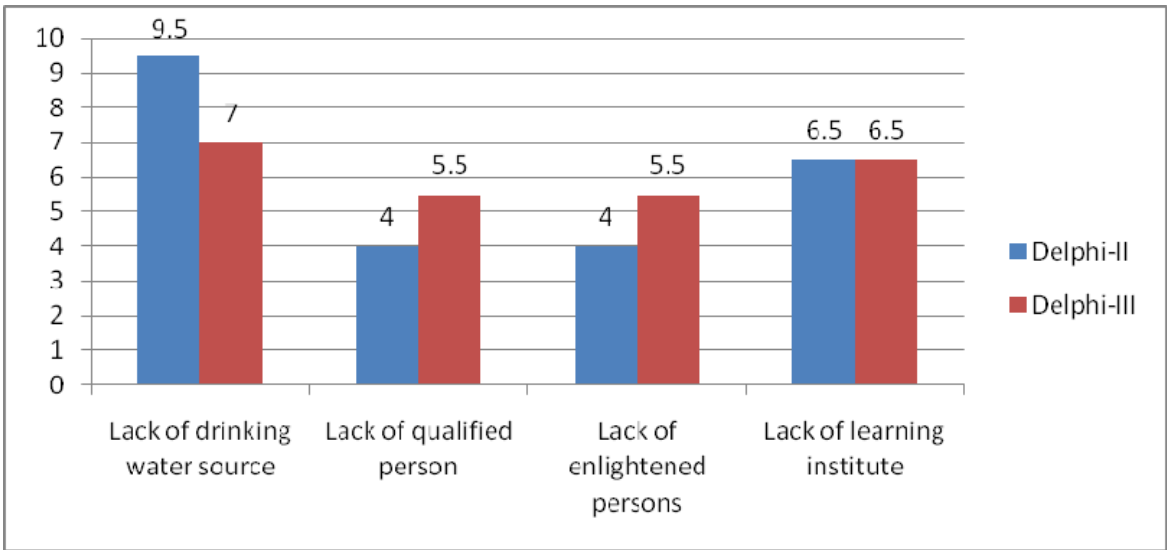
Factors	Other Isues	Delphi-II														Median	Delphi-III													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	#	11	12	13	14	Median
Managerial	Lack of knowledge on aquatic resources	10	5	8	6	9	9	7	7	7	8	8	8	8	10	8	4	8	7	6	5	7	9	7	5	5	6	8	6	5	6
	Forest protection	9	6	8	7	8	8	6	8	8	8	8	5	8	10	8	7	7	6	5	5	8	4	9	5	7	8	5	7	4	6.5
	Environment protection	10	6	8	8	7	7	6	8	5	9	7	8	8	2	7.5	7	8	7	4	9	6	7	6	9	4	6	4	7	5	6.5
	Protection of Wild life	10	6	7	8	8	6	7	8	9	7	8	9	8	10	8	7	8	7	5	5	7	6	7	4	5	7	8	9	5	7
	Deforestation	9	7	8	8	8	5	8	8	9	8	5	10	8	10	8	8	8	9	5	5	6	5	4	7	4	6	5	9	9	6
	Lack of supervision	9	6	7	7	9	7	8	9	10	8	8	8	7	10	8	7	9	9	9	4	8	4	7	6	5	7	9	7	5	7
	Training for the local level institutions	10	8	6	9	7	9	8	7	7	10	9	8	8	2	8	6	7	7	5	5	6	8	6	5	5	8	4	4	7	6



The above table and diagram shows the significant change if we compare the data of two round stakeholders Delphi survey. The stakeholders consider limited knowledge of the managerial cadre on the issues followed by issues related to the protection of the forest and wild life and weak local institutions.

3.5.2.4 Institutional issues

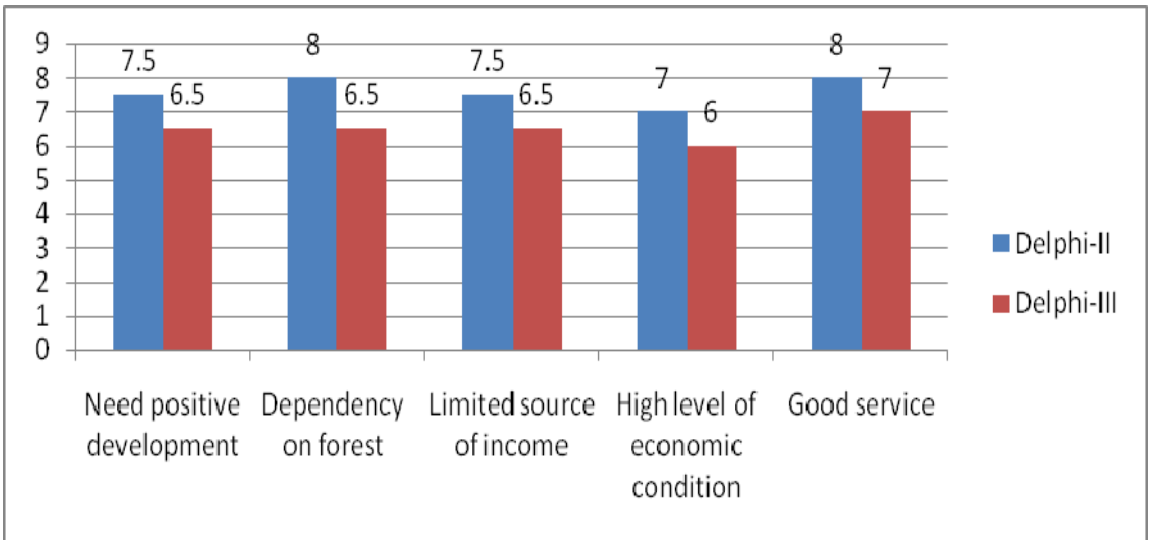
Factors	Others Issue	Delphi-II														Median	Delphi-III													Median
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Institutional	Lack of appropriate source of drinking water	10	8	9	9	10	7	8	10	6	10	10	9	10	10	9.5	9	10	8	4	4	7	5	7	4	9	6	7	7	6	7
	Lack of qualified person	10	2	4	6	3	4	7	3	5	4	6	6	3	3	4	6	3	5	5	5	6	9	9	5	7	8	5	6	5	5.5
	Lack of enlightened persons	5	3	5	4	3	7	4	7	6	2	3	4	7	2	4	5	3	6	6	5	8	4	6	9	4	6	4	7	4	5.5
	Lack of learning institute	8	5	7	6	10	8	6	6	7	5	4	7	7	2	6.5	7	6	7	5	4	6	7	7	4	5	7	8	7	5	6.5



One of the pressing needs of the people is expressed by the non-availability of potable drinking water even under the institutional issues. The stakeholders emphasized that talking of institutions would be futile if we don't consider the survival needs of the people. An effective institutional fit alone can ensure this. The institutional development is faced by the issues of absence of qualified and enlightened people. There is visible cynicism.They observed that most of the contemporary institutions are focused over tangible and physical issues. An institution with learning focus is missing which is a serious issue.

3.5.2.5 Economic issue

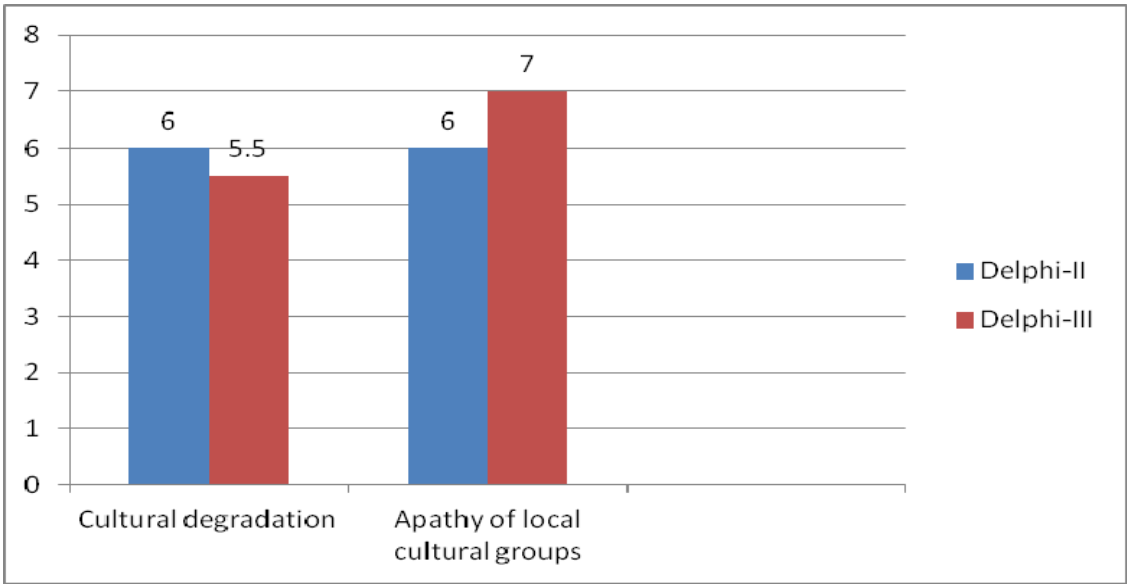
Factors	Other Isues	Delphi-II														Median	Delphi-III													
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**#**	**11**	**12**	**13**	**14**	Median
Economic	Need positive development	8	6	8	7	10	6	7	8	8	6	6	9	7	10	7.5	9	7	8	4	7	7	6	4	7	4	6	5	9	5	6.5
	Dependency on forest	10	6	9	8	9	5	8	8	5	6	9	9	8	9	8	10	8	7	5	6	6	5	7	6	5	7	9	4	7	6.5
	Limited Ssource of income	9	6	8	6	8	6	7	7	7	6	8	8	8	8	7.5	8	8	8	6	7	7	4	6	5	5	8	4	7	6	6.5
	High level of economic condition	7	6	7	6	7	7	6	6	8	5	7	6	7	9	7	6	7	6	5	4	8	5	7	4	9	6	7	6	5	6
	Good service	8	7	6	8	7	8	7	9	9	7	9	8	9	10	8	8	8	7	4	7	6	8	7	5	5	7	6	7	4	7



Economic issues gloss over all issues of local eco-system. The limited sources of income and employment opportunities are issues which everybody considers as prime. The stakeholders are consistent in their position to assert that high economic condition using multiple endowments and sources can address the issues otherwise they remain serious issues.

3.5 .2.6 Cultural and Social issues

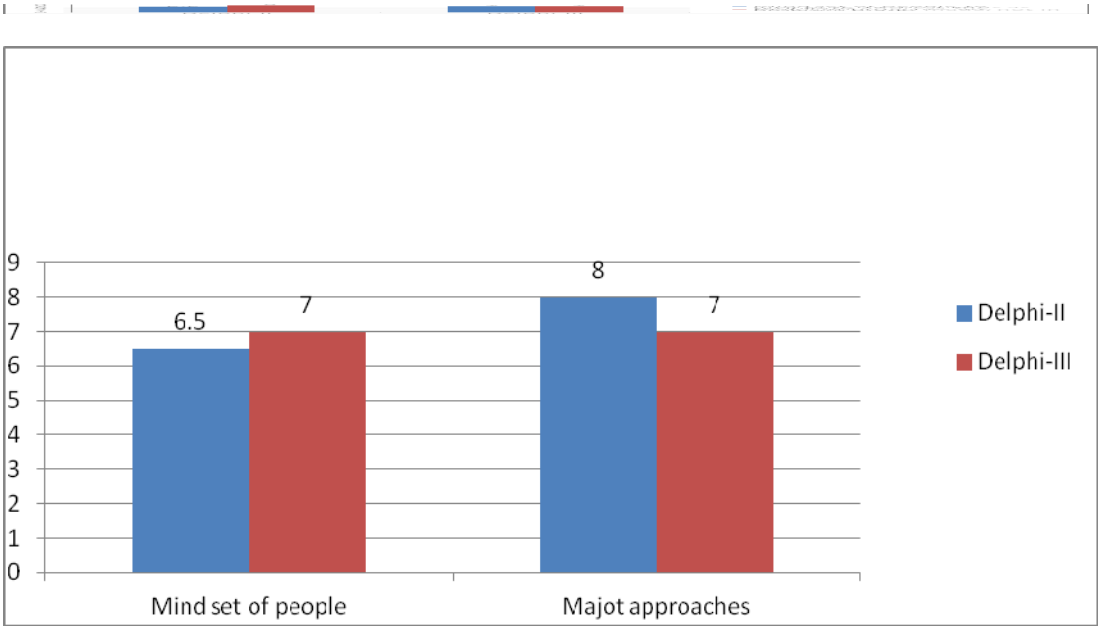
Factors	Other Isues	Delphi-II														Median	Delphi-III													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	#	11	12	13	14	Median
Culture/ social	Cultural degradation	8	6	7	7	6	8	6	6	5	8	4	7	6	1	6	8	7	5	5	6	7	5	9	5	5	6	5	7	5	5.5
	Apathy of local cultural groups	7	7	9	6	6	6	5	7	6	6	3	9	6	1	6	10	7	5	6	7	6	9	9	9	4	8	4	9	5	7



The local Dhukpa and Nepali community has rich cultural heritage which is gradually losing its presence as agent of change. The people are becoming indifferent to the cultural richness which are embedded into local natural environment and need for their protection and preservation.

3.5.2.7 Other aspects

Aspects	Other Issues	Delphi-II														Median	Delphi-III														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14		1	2	3	4	5	6	7	8	9	#	11	12	13	14	Median
Other	Mind set of people to interpret the problems as well as to address the problems	9	6	8	7	6	7	6	7	3	7	6	7	6	3	6.5	7	7	5	5	7	7	4	7	5	5	6	8	9	9	7
	Major approaches are basically project made, not in program made	8	7	9	7	7	8	5	9	4	8	9	8	9	10	8	7	7	7	4	9	4	7	8	4	4	7	5	7	5	7



It is interesting that the stakeholders have considered other issues which have struck them spontaneously. The two important issues, under this category, are what they colloquially call 'mindset'-meaning attitude. A discussion with them reveals their frustration with the people for their dependence proneness and lack of action. At another level they are concerned with the interventions in project mode and not as mainstream interventions to be institutionalized. Examples are the World Bank supported Eco-development Project which made positive headways in involving people in preservation and protection. Completion of the project has left a vacuum. They ask a question –what is completion based on –expiration of time as proposed or completion of certain bench marks?

3.5.2.8 Consensus on "Other issues relating to highland aquatic resources in Buxa" (Section III)

For this section as a whole, the level of concordance for Round two was found to be moderate (Kendall W = 0,4013; p-value = 0,0000 assuming chi-square distribution with 29 df). For Round 3, the Kendall's Coefficient of concordance dropped to 0,088, which is considered very weak. Adding to this that the p-value had risen to 0,181 assuming a chi-square distribution with 29df, it must be concluded that there is NOT a statistically significant difference in the way the respondents score on the 30 statements in this section.

Views on sensitive issues like the environment is shaped by perceived social desirability and need for conformity with the norms as prescribed by the government. Although stakeholders may have different opinion they may not express them objectively. The stakeholders, in our culture and not quite familiar with such exercise and participate rather routinely which is based on personal consideration (because Joy has requested or because CDHI has been working on important issues-let us oblige them). This results into missing seriousness. This results into concoction and misrepresentation.

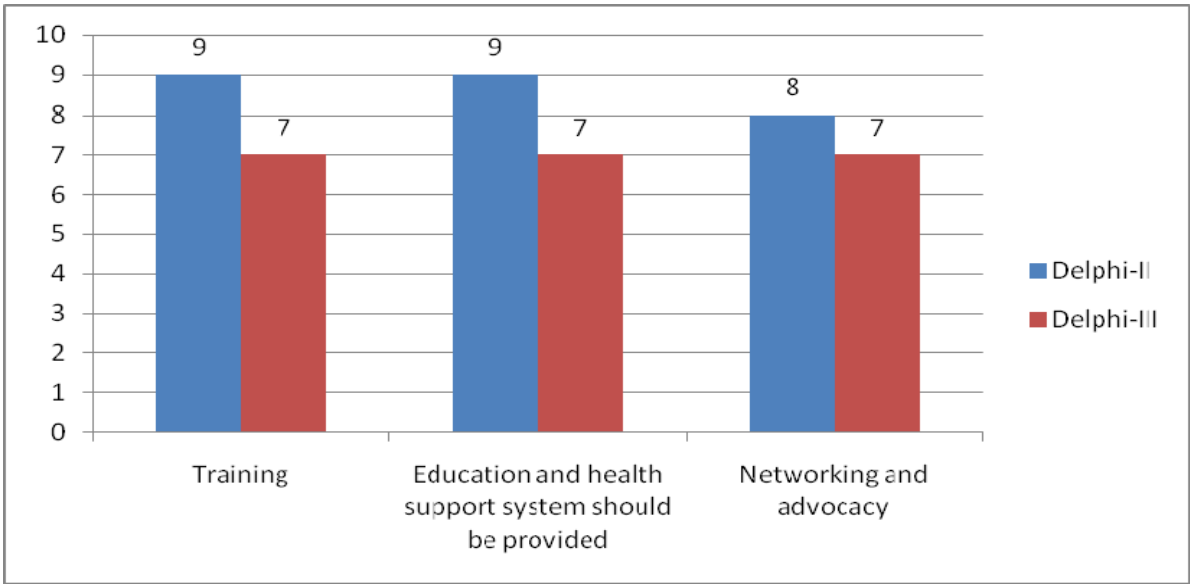
Section-IV

Potential measures, action or institutional change that could help improve highland aquatic resources conservation and wise-use in Buxa reserve.

The stakeholders seriously considered various options for measures, actions and institutional change that can possibly help improve conservation and wise use of highland aquatic resources in Buxa. They propose the measures with their own perspective. They are presented under various categories as are given below:

3.5.3.1 Institutional aspects

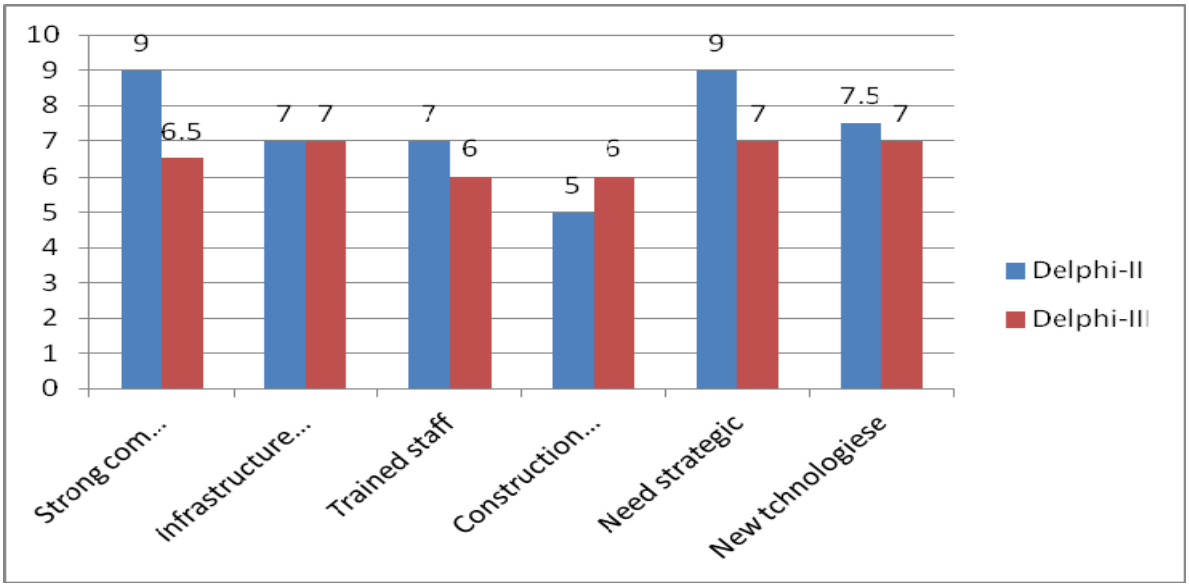
Factors	Potential measures	Delphi-II														Median	Delphi-III														Median
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Institutional	Training	10	10	9	8	10	9	7	9	8	10	9	8	10	5	9	8	3	4	7	6	7	7	4	6	5	7	9	6	9	7
	Education and health support system should be provided	10	9	7	6	8	9	7	9	9	10	7	9	10	10	9	9	8	7	6	7	7	6	5	7	9	7	5	7	5	7
	Networking and advocacy	9	10	8	6	10	8	7	10	7	10	8	8	10	3	8	9	7	6	7	7	4	7	5	8	4	9	5	7	9	7



Three important potential measures -training, education-health support and networking-advocacy, evolved from first round Delphi, are considered as basic need for community development which has direct and indirect impact on highland aquatic resources and sustainable livelihood development. In second and third round Delphi the stakeholders have also recognized their importance by assigning high score. These issues, especially networking and advocacy can be included in IAPs.

3.5.3.2 Management aspects

Factors	Potential measures	Delphi-II														Median	Delphi-III														Median
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Management	Strong Committee	10	10	9	5	10	7	7	10	8	9	10	9	10	5	9	7	8	7	7	4	6	7	9	6	7	9	5	8	4	7
	Infrastructure, road and building	5	8	8	4	7	6	8	6	5	7	9	8	6	10	7	7	8	7	4	7	7	4	5	7	6	7	9	6	7	6
	Trained staff	9	6	7	4	7	5	7	6	6	8	7	9	7	5	7	4	8	4	7	6	7	7	5	6	5	4	5	7	6	6
	construction for trekking	5	2	1	4	4	7	6	7	3	5	8	8	5	10	5	10	9	7	6	7	4	6	4	8	4	7	5	6	5	7
	Need strategic planning	9	10	9	10	9	6	7	10	4	6	9	7	10	10	9	7	7	6	7	7	7	7	5	6	8	6	4	8	4	7
	New technologies to be adapted	10	3	6	7	8	5	8	8	7	4	8	8	4	10	7.5	3	10	7	8	6	4	7	5	6	8	6	4	8	4	7

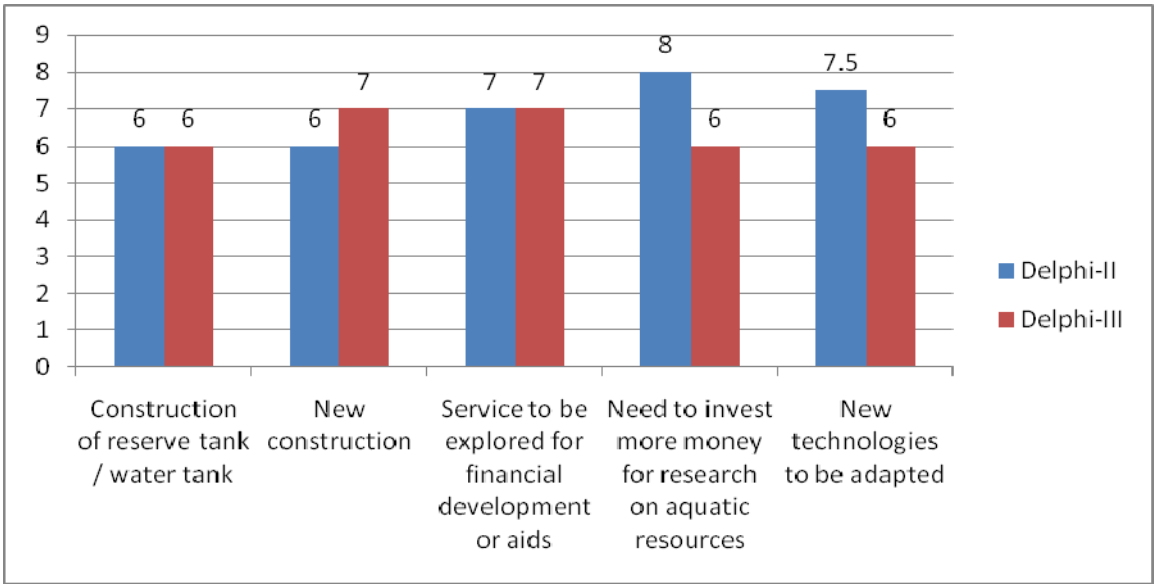


The potential measures as expressed by the stakeholders include strong local level committee, infrastructure development, and training to the staff, strategic planning process and adoption of new technologies. It is emphasized by the all panel members that need to strengthen and empower the local level committees include SHGs, Forest Right Committee (FRCs), Forest Protection Committee (FPC), Gram Unnayan Samity (GUS) / Village Development committees etc formed by line departments, NGOs and community. In conclusion the project needs to strengthen the local level institutions that could help improve the highland aquatic resources conservation in Buxa.

3.5.3.3 Financial aspects

The stakeholders felt that financial infusion/provision was required to develop infrastructure including construction of ponds and reservoirs, conduct research and innovations and develop new technologies.

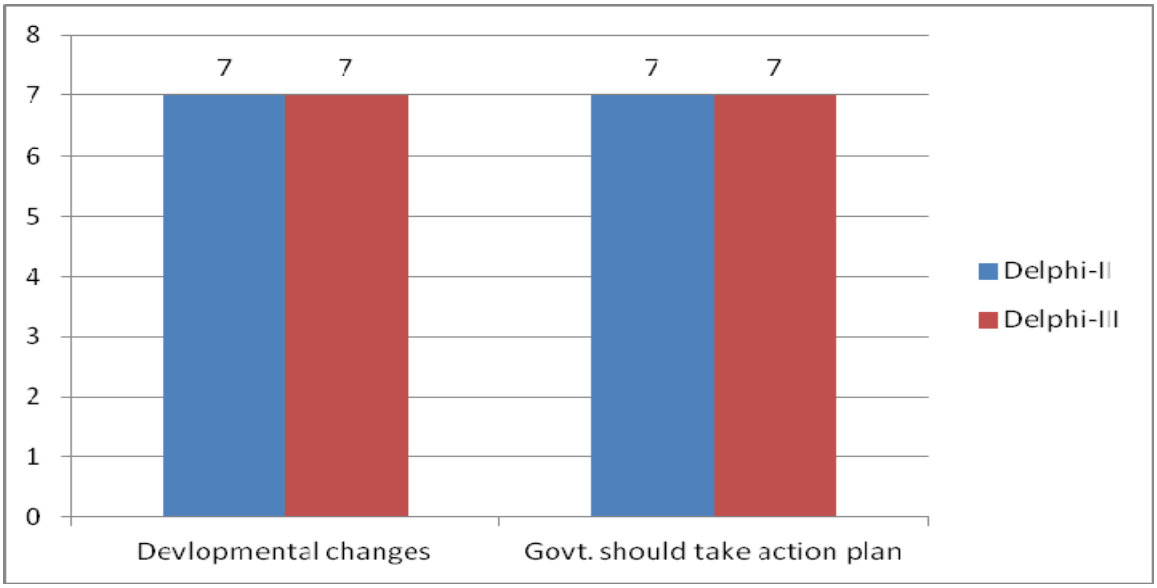
Factors	Potential measures	Delphi-II														Median	Delphi-III														Median
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Financial	Construction of reserve tank / water tank	10	3	6	6	7	7	3	6	5	6	7	8	5	10	6	5	10	7	7	7	6	4	7	8	5	7	5	7	9	6
	New construction	5	3	7	6	8	6	7	6	6	5	6	7	5	5	6	7	3	7	4	6	7	7	4	6	4	7	5	8	4	7
	Service to be explored for financial development or aids	10	6	8	7	9	7	7	7	9	8	5	7	5	9	7	7	3	9	4	7	7	6	5	7	8	9	9	6	7	7
	Need to invest more money for research on aquatic resources	10	7	8	8	7	8	7	8	8	9	3	6	7	10	8	9	6	9	7	7	4	7	5	7	8	6	5	7	6	6
	New technologies to be adapted	10	3	6	7	8	5	8	8	7	4	8	8	4	10	7.5	3	10	7	8	6	4	7	5	6	8	6	4	8	4	6



The potential measures related to financial inputs for construction of water tank, adoption of innovative technologies and investment in research on aquatic resources as an outcome of first round Delphi. In second round and third round Delphi, panel members have similar views. They have recommended that there is need to do more work including research on aquatic resources by the central government or any other interested and experienced agency. It indicates the research under High ARCS supported by EC is quite relevant according to the stakeholders.

3.5.3.4 Cultural and Social aspects

Factors	Potential measures	Delphi-II														Median	Delphi-III														Median
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Culture / Social	Developmental changes of both culture and social	9	5	7	9	6	6	5	7	7	9	7	5	10	5	7	8	7	7	6	4	6	7	4	6	5	7	5	6	5	7
	Govt. should take action plan to revive village cultural groups	10	5	6	7	5	5	7	7	6	8	8	7	8	1	7	8	8	4	7	7	7	4	5	7	9	7	4	8	4	7

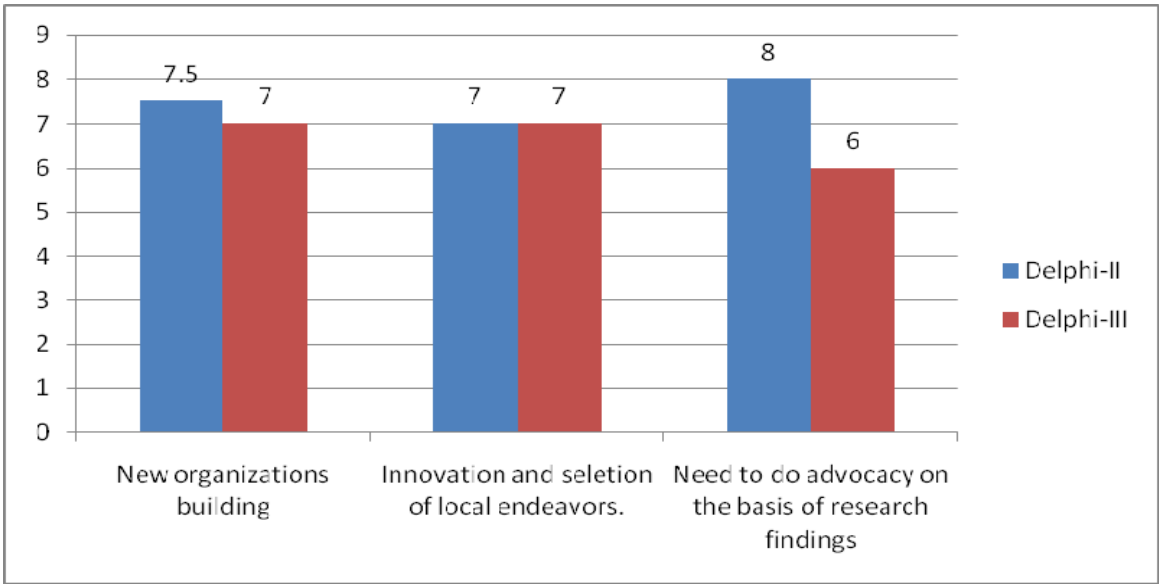


Incidentally two potential measures of social and cultural aspects evolving out of Delphi-I also emerged as issue from community members of three clusters in Buxa in the next two Delphi rounds. As discussed earlier community members and other stakeholders believed that revival of cultural groups could solve many problems as it could create very strong social bonding to address several issues. In both the rounds the panel members gave equal importance to both the issues. It is to be noticed that developmental challenge of both cultural and social nature can be achieved by reviving the village cultural practices.

3.5.3.5 Research and innovation

The stakeholders felt strongly in favour of research and innovation as integral component of impacting local eco-system in general and high aquatic ecosystem services in particular. As priority they consider developing infrastructure, encouragement to local initiatives and advocacy for spreading the research findings and also influencing policy sensitivities.

Factors	**Potential measures**	**Delphi-II**														**Median**	**Delphi-III**														Median
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Researches	New organizations building	9	3	5	8	7	4	6	8	10	6	4	8	8	10	7.5	8	8	7	7	6	7	7	5	8	4	9	5	7	9	7
	Innovation and selection of local endeavors.	7	8	7	6	8	7	7	6	7	7	9	8	8	10	7	9	8	7	4	7	4	6	9	6	7	9	5	8	4	7
	Need to do advocacy on the basis of research findings	9	8	9	5	7	10	7	10	8	8	7	7	9	10	8	4	8	4	7	7	6	7	5	7	6	7	9	6	7	6



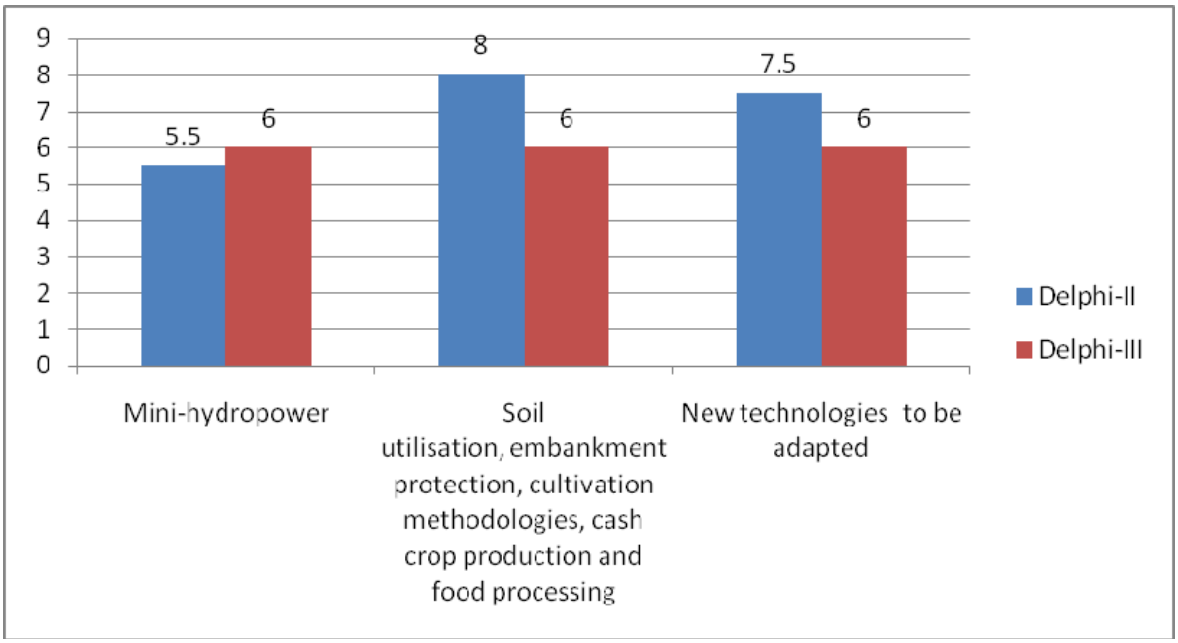
Research is considered as an important component by considering three potential measurable issues including formation of new organizations / institutions, innovation and selection of local initiatives and advocacy as afollow-up to the research findings. The panel members have authenticated that there is no significant change of their perception in round two and three. In other section of Delphi questionnaire it is also discussed that formation of community based new institutions and strengthening the new and existing institutions can play vital role for conserving the aquatic resources.

3.5.3.6 Technology

Technology has important components as felt necessary by the stakeholders. Technology has been considered in generic terms to be adopted at different levels. The stakeholders feel that such a combination can deal with the issues pertaining to the conservation of the eco-system services including aquatic resources.

In the following section we compare the Delphi scores at round II and III.

Factors	**Potential measures**	**Delphi-II**														**Median**	Delphi-III														Median
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Technology	Mini-hydropower	8	2	6	4	8	5	3	8	9	2	3	9	5	9	5.5	10	9	7	3	4	7	7	5	6	5	4	5	7	6	6
	Soil utilization, embankment protection, cultivation methodologies, cash crop production and food processing	10	7	7	7	7	8	8	8	10	9	9	9	7	9	8	7	7	6	3	7	7	4	4	8	4	7	5	6	5	6
	New technologies to be adopted	10	3	6	7	8	5	8	8	7	4	8	8	4	10	7.5	3	10	7	8	6	4	7	5	6	8	6	4	8	4	6



In the context of technology , three potential measures figured out of the first round Delphi, are further supported by the panel members in the second and third round. They felt the need to develop and adopt technology based activities. However, past experience of CDHI and other agencies including line departments argue that certain provisions of the reserve forest restricts adoption of any technologies which are considered as interfering with the local eco-system. It implies that careful selection of technology has to be made. Establishment of mini-hydro power stations might not stand to the tests of conditions imposed by the Government. However, activities like soil utilization, embankment protection, cultivation methodologies, cash crop production and food processing can be included in the action plan.

3.5.3.7 Consensus concerning potential measures, action or institutional change that could help improving highland aquatic resources conservation and wise-use in Buxa reserve (section III)

As for the previous sections, the Round 2 responses showed only a moderate degree of concordance (Kendall's W = 0,2805; p-value = 0,0000 assuming chi-square distribution with 19 df). In Round 3, the concordance dropped to become very weak (Kendall W = 0, 091). However, as the p-value had risen considerably (p-value = 0,187 assuming chi-square with 19df), it is concluded that there is NOT a statistically significant difference in the way panel members have rated the 20 statements of this section.

3.6 Summary of the Delphi

3.6.1 General Information

All the respondents have found the Buxa aquatic resources as satisfactory –ranging from acceptable to quite plentiful. The present status does not show much concern. So far use of aquatic resources is concerned it is not quite a lot –usually it has been described as being less. Also extent of use of the aquatic resources has been considered to be less. About the need to take policy correctives for conserving the aquatic bio-diversity the respondent do not feel strong need-the current provisions are adequate. There is, however, missing awareness due to non-availability of relevant information. People feel that present policy regime is not quite effective to ensure conservation and better conserving the aquatic resources could ensure economic, social and environmental benefits.

3.6.2Potential problems and threats

The result of Delphi based on the three rounds bring to the fore the following issues and threats:

- Natural calamities –flood
- Soil erosion
- Deforestation
- Pollution through sewerage
- Poisoning of the river for fishing
- Governance inadequacy
- Lack of infrastructural support
- Lack of strategic planning
- Weak local institutions and network
- Erosion in the traditional institutions and practices
- Limited livelihoods opportunity for the local communities
- Decline in the cultural practices
- Deepening dependency among the people
- Short terms measures through project mode interventions

Stakeholders views to mitigation/solution include:

- Strengthening of the local institutions including institution of governance
- Capacity building and reorientation of the local officials and other partners in governance

- Introduction of new technologies
- Building and strengthening financial support system
- Checking of stone and sand mining
- Trying and testing of new income generation activities including appropriate cropping system
- Awareness building for the protection, nurturance and promotion of high aquatic resources

3.6.3 Attribution to causality

The respondents felt that mining and soil erosion are the important factors contributing to the degradation of stock of fish and molluscs. Some of them have also felt that illegal fishing is another factor although this is not substantiated by others.

3.6.4 Over all

The responses suggest that aquatic stock in Buxa are rich and well below threatened level. The policy perspective is adequate but awareness about the same is needed. The community have been living in perfect harmony with the nature including aquatic resources and there is no much threat from them. A very docile community is conformist and amenable to the existing regulations.

Delphi as a tool to set a communication process in allowing a group of individuals, as a whole, to deal with complex problem does seem to miss this goal which are because of a number of factors. In contrast to expectations, we often observed a lowering of consensus when going from round II to round III indicating that opinions among stakeholders in fact got further apart after being informed with what others thought...

The stake holders, in case of Buxa, differ in their background and authority. A forest officer and villagers may hold conflicting views because of their different interest domain and different perception of the issue. And therefore they may not come together to deal with the issues of conservation although overtly they may vouch for the same.

This does not, however, imply that Delphi has not been relevant. Through iteratively being exposed to different scenario, the stakeholders must have got opportunity to reflect around the issues as brought before them for their consideration which in turn might set a process of seeking solution. Statistically, the result may not be consistent and in accordance with the expected outcome but in practical terms the process might work to trigger a collective action.

Also the stakeholders participating in the Delphi are quite small in number. The use of other methods and tools, for example FGDs and other participatory tools, have witnessed the involvement of larger number of stakeholders. As the tools are

empowering in nature they combined with Delphi may help galvanizing the community to deal with the complex problems of conservation and eco-system management. The insights gained through the combined process may be useful to evolve and articulate future plan of action.

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Annexure-I

Buxa Delphi Questionnaire (Round I)

Information about panel members**:**

Full name……

Phone number.....E-mail:……

Job:……..

Address:……..

Section1: General Information

With each question, would you please circle answer that you suggest the most appropriate

1.1 In general, how would you describe the status or condition *highland* rivers and lakes and the aquatic plants, fish, molluscs and other organisms living in them in the Buxa reserve?

a. Very degraded and totally insufficient

b. somewhat degraded and scarce

c. acceptable

d. Quite plentiful and diverse

e. very plentiful and diverse

f. Cannot answer due to insufficient information available to me on this issue

others:

1.2 How would you describe the extent of use of *highland* aquatic resources in the Buxa reserve

a. very excessive

b. excessive

c. correct

d. less

e. very less

f. Cannot answer due to insufficient information available to me on this issue.

1.3 There is a need to take action or implement a new policy to improve aquatic biodiversity conservation in Buxa reserve, particularly in the highland sections?

a. agree strongly

b. agree

c. neither agree nor disagree

d. disagree

e. disagree strongly

f. cannot answer due to insufficient information available

Other:

1.4 how would you evaluate effectiveness of current regulations related to the conservation of aquatic resources in Buxa reserve?

a. Very ineffective

b. Ineffective

c. appropriate

d. effective

e. very effective

f. cannot answer due to insufficient information available

Other:

1.5 Do you believe that any economic, social or environmental benefits could be gained from better conserving aquatic resources in Buxa reserve?

a. yes

b. Unsure

c. no

Section 2 :Please list potential problem constraints or threats facing highland aquatic resources in Buxa reserve?

Factors	**Problems, threats**
Physical	
Environmental	
Managerial	
Institutional	
Economic	
Culture/social	
Other	

Section 3: please list any other issues related to highland aquatic resources?

Factors	**Issues**
Physical	
environmental	
Managerial	
institutional	

economic	
Culture/social	
Other	

Which factors contribute to the degradation of stocks of fish and mollusks in the lake and the rivers of Buxa:

Illegal fishing □yes □ no

Gold mining in the riverbed □yes □no

Inadequate rules of access and management □yes □no

Deforestation on the slopes □yes □no

Pollution of the river from households □yes □no

Pollution of the river from agriculture □yes □no

Pollution of the river from soil erosion and landslides □yes □no

Current forest regulation impede the sustainable access for local people to aquatic resources □yes □no

What are your overall impressions of this research tool?

Section 4: **Please list any potential measures, action or institutional change that could help improve highland aquatic resources conservation and wise-use in *Buxa reserve?***

	Measures, actions or institutional change
Institutional	
Management	
financial	
Culture/social	
Researches	
Technology	

other	

Annexure-II

Delphi Questionnaire (2nd round interview) / High ARCS / EC- CDHI

General Information of Panel member

Name:

Address:

Job/Designation:

Phone: Email:

Section 1 :Potential problem constraints or threats facing highland aquatic resources in Buxa reserve.

Factors	Problems, threats	Number of response	Marks out of 10
Physical	Poor maintenance of physical infrastructure	**1**	
	Illegal fishing	**1**	
	Communication Network	**1**	

	Need modern infrastructure	**1**	
	Natural calamities	**1**	
	Regular occurance of flood and shifting of river cource	**2**	
Environmental	Soil Erosion	**5**	
	Pollution	**3**	
	Déforestation	**1**	
	Lack of awareness	**1**	
	Rapid deforestation, urbanization and pollution created by tourism.	**1**	
	No serious threat.	**1**	
Managérial	Poor management	**1**	
	Shortage of infrastructure and staffs	**1**	
	Officials are not down to earth	**1**	
	Limited mainstreaming approaches of all concerned govt. And other agencies.	**1**	
	Lack of proper awareness campaigning	**1**	
Institutional	Poor Education	**2**	
	Weak local level committee	**1**	
	Lack of Knowledge	**2**	
	Traditional practices	**1**	
	Lack of net working	**1**	
	Infrastructure needs to be strengthened.	**1**	
	Economically backward area and livelihood mainly depends on natural resources	**1**	

Economic	Weak and poor income	**2**	
	Less Finance	**2**	
	Poverty due to unemployment and non availability of attractive scope	**1**	
	Lack of livelihood among the poor people	**1**	
	No alternative sustainable livelihood plan.	**1**	
	Resources	**1**	
	Poverty and dependency on forest.	**1**	
Culture/social	Lack of exposure of cultural group	1	
Other	Proper regulation and collaboration needed within two departments (Forest and Fishery) for development of Buxa area.	1	

Section 2: Other issues related to highland aquatic resources

Factors	Issues	Number of response	Marks out of 10
Physical	Need to do regular maintenance	**1**	
	Permanent embankment.	**1**	
	Pollution by illegal fishing	**4**	

	Pollution	**1**	
Environmental	Awareness is needed.	**1**	
	Conservation of ponds, lakes etc.	**1**	
	To arrest soil erosion	**1**	
	To stop unscientific cultivation.	**1**	
	Food chain	**4**	
	Less rainfall	**3**	
Managerial	Officials to be knowledgeable person on highland aquatic resources.	**1**	
	Forest Protection	**2**	
	Environment protection	**2**	
	Protection of wild life	**1**	
	Avoid deforestation	**1**	
	Strengthening supervision.	**1**	
	Need to organize training for the member of local level institutions	**2**	
Institutional	Attractive source of drinking water.	**1**	
	Qualified person	**2**	
	Civilized persons	**1**	
	Learning institute	**1**	
Economic	Need positive development	**1**	
	Most of the people are living below poverty line. They are largely dependent on forest vegetarian and aquatic resources.	**1**	
	Source of income	**1**	
	High level economic condition	**1**	

	Good service	**3**	
Culture/social	Need to develop cultural society	**1**	
	Need good market for local cultural groups.	**1**	
Other	Mind set of people to interpret the problems as well as to address the problems.	**1**	
	Major approaches are basically project made, not in program made.	**1**	

Section 3: Potential measures, action or institutional change that could help improve highland aquatic resources conservation and wise-use in Buxa reserve.

	Measures, actions or institutional change	Number of response	Marks out of 10
Institutional	Training	**3**	
	Education and health support system should be provided.	**1**	
	Net working and advocacy.	**1**	
Management	Strong committee	**2**	
	Infrastructure, road and building.	**1**	
	Trained staff.	**1**	
	Construction for trekking.	**1**	
	Need strategic planning.	**1**	
Financial	Construction of reserve tank / water tank	**1**	
	New construction	**1**	
	Service to be explored for financial development or aids.	**1**	
	Need to invest more money for research on aquatic resources.	**1**	
Culture/social	Developmental changes of both culture	**1**	

	and social.		
	Govt. should take action plan to revive the village cultural groups.	**1**	
Researches	New organization building.	**1**	
	Innovation and selection of local endeavors.	**1**	
	Need to do advocacy on the basis of research findings.	**1**	
Technology	Mini-hydro power	**2**	
	Soil utilization, embankment protection, cultivation methodologies, cash crop production and food processing.	**1**	
	New technologies to be adopted.	**1**	

Section-4: Factors contribute to the degradation of stocks of fish and mollusks in the lake and the rivers of Buxa(Optional):

5.1 Illegal fishing

Benefits	Number of response	Marks out of 10
Yes	7	
No	7	

5.2 Sand and Stone mining in the riverbed

Benefits	Number of response	Marks out of 10

Yes	6	
No	8	

5.3 Inadequate rules of access and management

Benefits	Number of response	Marks out of 10
Yes	9	
No	5	

5.4 Deforestation on the slopes

Benefits	Number of response	Marks out of 10
Yes	10	
No	4	

5.5 Pollution of the river from households

Benefits	Number of response	Marks out of 10
Yes	5	
No	9	

5.6 Pollution of the river from agriculture

Benefits	Number of response	Marks out of 10
Yes	6	
No	8	

5.7 Pollution of the river from soil erosion and landslides

Benefits	Number of response	Marks out of 10
Yes	13	
No	1	

5.8 Current forest regulation impede the sustainable access for local people to aquatic resources

Benefits	Number of response	Marks out of 10
Yes	10	
No	4	

Section 5: Overall impressions of this research tool

Comment	Marks out of 10
1. It is a good participatory tool.	
2. The bio-sphere of Buxa is rich and extra ordinary. The	

native residents live in complete harmony with nature. This tool will modify the practices and help to keep natural balance of this region.	
3. This research tool would be helpful to assess existing potentiality and its protection through awareness generation among the local communities.	

Observation / Suggestion:

Annexure III

Stakeholders Delphi Questionnaire (Third Round)

General Information of Panel member

Name:

Address:

Job/Designation:

Phone: Email:

Section-I

Potential problem constraints or threats facing highland aquatic resources in Buxa reserve.

Factors	Problems & threats	No. of responses Round	Stakeholder panel members	Medi	Response (score

		1																an	out of 10)
			1	2	3	4	5	6	7	8	9	10	11	12	13	14			
Physical	Poor maintenance of physical infrastructure	1	8	3	7	6	8	7	7	5	7	5	6	7	5	8	7		
	Illegal fishing	1	3	3	8	6	8	2	3	5	6	5	4	5	5	10	5		
	Communication Network	1	9	6	7	7	8	5	6	10	8	10	9	8	7	9	8		
	Need Modern infrastructure	1	5	5	6	7	7	6	7	7	9	6	9	5	7	8	7		
	Natural calamities	1	7	6	6	8	9	8	5	7	4	7	8	6	8	5	7		
	Regular occurance of flood and shifting of river course	2	9	6	5	6	8	9	7	7	8	7	9	8	8	2	7.5		
Environmental	Soil erosion	5	9	8	9	9	9	10	6	8	10	8	9	8	9	3	9		
	Pollution	3	2	3	5	8	8	8	2	5	6	6	4	5	6	1	5		
	Deforestation	1	3	6	6	6	6	6	5	6	8	5	5	8	8	8	6		
	Lack of awareness	1	7	7	7	6	7	6	7	9	10	10	10	9	8	8	7.5		
	Rapid deforestation, urbanisation and pollution created by tourism	1	5	5	8	7	7	5	4	7	7	6	6	7	8	2	6.5		
	No serious threat	1	5	0	6	2	2	2	6	4	6	2	3	2	1	8	2.5		
Managerial	Poor management	1	8	6	5	6	9	8	7	7	8	4	5	8	5	9	7		
	Shortage of infrastructure and staffs	1	8	5	6	7	8	7	6	7	7	9	7	9	7	9	7		
	Officials are not down to earth	1	8	3	7	4	7	5	6	7	6	3	4	10	6	3	6		
	Limited mainstreaming approaches of all concerned govt. and other agencies	1	9	4	8	5	7	6	6	6	8	4	5	8	6	9	6		
	Lack of proper awareness campaigning	1	7	6	6	6	7	7	5	6	5	9	9	9	8	8	7		
Institutional	Poor education	2	9	5	7	7	9	8	7	7	6	7	8	9	7	9	7		
	Weak local level committee	1	8	7	5	8	7	6	7	6	8	6	9	10	7	9	7		
	Lack of knowledge	2	6	4	6	10	9	7	7	7	7	8	10	8	8	2	7		
	Traditional Practices	1	8	3	7	3	7	3	6	6	9	3	7	9	6	9	6.5		
	Lack of networking	1	5	5	8	8	8	5	6	8	8	9	9	6	8	7	8		
	Infrastructure needs to be	1	5	5	9	7	7	7	7	6	6	7	8	5	5	10	7		

	strengthened																	
	Economically backward area and livelihood mainly depends on natural resources	1	8	6	8	6	6	8	8	7	5	8	10	8	5	10	8	
Economic	Weak and poor income	2	9	7	8	7	7	9	8	9	6	9	9	9	6	10	8.5	
	Less finance	2	9	7	8	6	5	9	8	7	7	9	9	9	6	10	8	
	Poverty due to unempoyment and non availability of attractive scope	1	8	8	9	5	6	9	7	8	8	9	10	8	8	10	8	
	Lack of livelihood among th epoor peeople	1	6	9	8	6	8	7	8	9	9	7	9	8	8	10	8	
	No alternative sustainable livelihood plan	1	8	9	9	7	9	8	8	9	6	8	10	9	9	10	9	
	Resources	1	8	3	6	6	3	5	8	3	5	4	3	7	6	2	5	
	Poverty and dependency on forest	1	9	8	8	6	10	8	7	7	9	8	7	10	7	10	8	
Culture/social	Lack of exposure of cultural group	1	8	5	7	5	7	7	8	6	6	9	8	7	5	9	7	
Other	Proper regulation and collaboration needed with two departments (Forest and Fishery) for development of Buxa area	1	9	5	7	7	7	6	8	6	7	10	9	9	5	10	7	

Section II

Other issues related to highland aquatic resources

Factors	**Other Isues**	**No. of responses Round 1**	**Stakeholder panel members**														**Median**	
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**		
Physical	Need to do regular maintenance	1	9	7	7	6	7	7	7	6	8	6	7	7	6	9	7	
	Permanent embankment	1	9	6	8	6	6	8	5	6	9	5	6	7	6	5	6	
	Pollution by illegal fishing	4	5	5	9	8	8	9	4	8	7	5	4	9	5	3	6	
	Pollution	1	2	6	8	6	7	6	4	7	6	5	5	5	5	2	5.5	
Environmental	Awareness is needed	1	10	7	10	6	5	10	7	9	7	9	9	9	9	8	9	
	Conservatin of ponds, lakes etc.	1	9	4	10	5	6	8	7	9	8	9	10	9	9	10	9	

	To arrest soil erosion	1	10	3	8	6	7	7	7	8	9	8	9	6	9	10	8	
	To stop unscientific cultivation	1	9	3	6	5	3	6	7	8	10	5	2	5	3	2	5	
	Food Chain	4	6	3	7	7	9	8	2	9	5	5	2	7	7	1	6.5	
	Less rainfal	3	3	2	2	4	2	2	1	2	6	4	1	7	1	1	2	
Managerial	Officials to be knowledgeable person on aquati resoures	1	10	5	8	6	9	9	7	7	7	8	8	8	8	10	8	
	Forest protection	2	9	6	8	7	8	8	6	8	8	8	8	5	8	10	8	
	Enviroment protection	2	10	6	8	8	7	7	6	8	5	9	7	8	8	2	7.5	
	Protection of Wild life	1	10	6	7	8	8	6	7	8	9	7	8	9	8	10	8	
	Avoid deforestation	1	9	7	8	8	8	5	8	8	9	8	5	10	8	10	8	
	Strengthen supervision	1	9	6	7	7	9	7	8	9	10	8	8	8	7	10	8	
	Need to organize training for the ember of local level institutions	2	10	8	6	9	7	9	8	7	7	10	9	8	8	2	8	
Institutional	Attractive soure of drinking water	1	10	8	9	9	10	7	8	10	6	10	10	9	10	10	9.5	
	Qualified person	2	10	2	4	6	3	4	7	3	5	4	6	6	3	3	4	
	Civilized persons	1	5	3	5	4	3	7	4	7	6	2	3	4	7	2	4	
	Learning institute	1	8	5	7	6	10	8	6	6	7	5	4	7	7	2	6.5	
Economic	Need positive development	1	8	6	8	7	10	6	7	8	8	6	6	9	7	10	7.5	
	Most of the people are living belw poverty line. They are largely dependent on forest	1	10	6	9	8	9	5	8	8	5	6	9	9	8	9	8	
	Source of income	1	9	6	8	6	8	6	7	7	7	6	8	8	8	8	7.5	
	High level of economic condition	1	7	6	7	6	7	7	6	6	8	5	7	6	7	9	7	
	Good service	3	8	7	6	8	7	8	7	9	9	7	9	8	9	10	8	
Culture/social	Need to develop cultural society	1	8	6	7	7	6	8	6	6	5	8	4	7	6	1	6	
	Need good market for local cultural groups	1	7	7	9	6	6	6	5	7	6	6	3	9	6	1	6	
Other	Mind set of people to interpret the problems as well as to address the problems	1	9	6	8	7	6	7	6	7	3	7	6	7	6	3	6.5	
	Major approaches are basically projet made, not in program made	1	8	7	9	7	7	8	5	9	4	8	9	8	9	10	8	

Section III

Potential measures, action or institutional change that could help improve highland aquatic resources conservation and wise-use in Buxa reserve.

Factors	Potential measures	No. of responses Round 1	Stakeholder panel members														Median	Response (Score out of 10)
			1	2	3	4	5	6	7	8	9	10	11	12	13	14		
Institutional	Training	3	10	10	9	8	10	9	7	9	8	10	9	8	10	5	9	
	Education and health support system should be provided	1	10	9	7	6	8	9	7	9	9	10	7	9	10	10	9	
	Networking and advocacy	1	9	10	8	6	10	8	7	10	7	10	8	8	10	3	8	
Management	Strong committee	2	10	10	9	5	10	7	7	10	8	9	10	9	10	5	9	
	Infrastructure, road and building	1	5	8	8	4	7	6	8	6	5	7	9	8	6	10	7	
	Trained staff	1	9	6	7	4	7	5	7	6	6	8	7	9	7	5	7	
	construction for trekking	1	5	2	1	4	4	7	6	7	3	5	8	8	5	10	5	
	Need strategic planning	1	9	10	9	10	9	6	7	10	4	6	9	7	10	10	9	
Financial	Construction of reserve tank / water tank	1	10	3	6	6	7	7	3	6	5	6	7	8	5	10	6	
	New construction	1	5	3	7	6	8	6	7	6	6	5	6	7	5	5	6	
	Service to be explored for financial development or aids	1	10	6	8	7	9	7	7	7	9	8	5	7	5	9	7	
	Need to invest more money for research on aquatic resources	1	10	7	8	8	7	8	7	8	8	9	3	6	7	10	8	
Culture / Social	Developmental changes of both culture and social	1	9	5	7	9	6	6	5	7	7	9	7	5	10	5	7	
	Govt. should take action plan to revive village cultural groups	1	10	5	6	7	5	5	7	7	6	8	8	7	8	1	7	
Researches	New organizations building	1	9	3	5	8	7	4	6	8	10	6	4	8	8	10	7.5	
	Innovation and seletion of local endeavors.	1	7	8	7	6	8	7	7	6	7	7	9	8	8	10	7	
	Need to do advocacy on the basis of research findings	1	9	8	9	5	7	10	7	10	8	8	7	7	9	10	8	
Technology	Mini-hydropower	2	8	2	6	4	8	5	3	8	9	2	3	9	5	9	5.5	

	Soil utilisation, embankment protection, cultivation methodologies, cash crop production and food processing	1	10	7	7	7	7	8	8	8	10	9	9	9	7	9	8	
	New technologies to be adapted	1	10	3	6	7	8	5	8	8	7	4	8	8	4	10	7.5	

Section IV

Factors contribute to the degradation of stocks of fish and mollusks in the lake and the rivers of Buxa(Optional):

Factors	Degradation	No of response	Stakeholder panel members								Median							Response
			1	2	3	4	5	6	7	8	9	10	#	#	#	14		
Illegal Fishing	Yes	7	3	3	2	8	3	8	7	5	4	4	3	0	5	3	3.5	
	No	7	8	8	9	6	3	7	3	6	8	8	8	7	6	0	7	
Sand and stone mining	Yes	6	8	3	5	5	5	5	6	5	9	10	9	8	5	10	5.5	
	No	8	3	6	6	5	5	5	4	6	3	3	0	0	5	0	4.5	
Inadequate rules	Yes	9	4	6	5	7	8	8	8	6	8	5	8	9	5	0	6.5	
	No	5	7	2	5	4	4	4	2	4	5	6	0	0	5	8	4	
Deforestation on the slopes	Yes	10	3	8	8	8	9	9	7	9	7	9	7	9	8	9	8	
	No	4	9	3	3	4	2	6	3	3	3	3	0	0	3	0	3	
Pollution on the river from household	Yes	5	2	5	5	5	5	5	4	5	5	7	8	5	4	0	5	
	No	9	8	7	7	6	7	5	6	7	5	2	0	0	7	1	6	
Pollution on the river from agriculture	Yes	6	2	3	4	7	5	7	2	5	6	2	2	0	3	0	3	
	No	8	8	8	3	8	5	8	8	7	7	9	7	9	8	5	8	
Pollution on the river from soil erosion and landslides	Yes	13	2	10	9	6	10	10	7	10	10	10	5	9	9	0	9	
	No	1	10	2	5	5	2	2	3	1	8	2	4	0	2	0	2	
Current forest regulation	Yes	10	8	8	5	9	8	7	7	5	6	6	7	8	8	0	7	
	No	4	2	3	5	4	3	3	3	6	5	5	6	0	5	0	3.5	

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STIRLING

D5.2: REPORT ON STAKEHOLDER EVALUATION OF HIGHLAND AQUATIC RESOURCES

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EXECUTIVE SUMMARY

Highland Aquatic Resources Conservation and Sustainable Development or HighARCS aims to develop an understanding of the importance of aquatic resources in highland areas of Asia. It is mainly focused on the highland aquatic resources and their functionality, management, exploitation, in particular aquatic biodiversity and their conservation issues at five sites in Asia, that is, Guangdong, China; Uttarakhand and West Bengal, India; and Northern and Central Vietnam. This study intends to have an insight in the present situation of the biodiversity of the aquatic resources as well as livelihood of those who are dependent on these ecosystem services offered by the lakes. Following this, HighARCS also plan to formulate conservation and livelihood policy action plans with the support and co-operation of the local communities. This report on stakeholders' evaluation of highland aquatic resources report aims to evaluate the congruency of the different stakeholders with the lakes, their biodiversity and ecosystem services followed by the appropriate actions needed for the economic development of the selected sites around the Nainital Lake Area in Uttaranchal Himalaya.

The report gives an overview of the local stakeholders, their relation to the aquatic resources and the ranking given by respective stakeholders to all the different ecosystem services offered at the field site. The key stakeholders are boatmen, fishermen, hotel owners, small shop owners, students, teachers, farmers, tourists, and local authorities such as NLRSADA, DCF, Jal Sansthan, Irrigation Department and NNPP.

The methodological approach followed has consisted in three steps. A focus group discussion method and field survey was employed as a part of an integrated effort looking into the state of the aquatic resources, resource users and users, livelihoods and policies for the identification of Nainital, Bhimtal and Naukuchiatal ecosystem services. Secondly, the ecosystem services identified have been ranked by different local stakeholder groups like boatmen, fishermen, hotel owner, Irrigation Dept etc. during a stakeholder meeting. Finally, a stakeholder Delphi methodology was adopted for extracting the discernment of stakeholders and supporting the establishment of a shared understanding amongst the local authorities and stakeholder groups concerning the current and past state of the Nainital Lake Area ecosystems and biodiversity, how their livelihoods depend on the services provided by these ecosystems and what management actions need to be undertaken to preserve them. The results arrived at after using these methodologies have been discussed in details in the given report. These discussions help us to determine which are the most important ecosystem services followed by its reasons have been valued by the stakeholders for considering it important. It was found that there is a strong local awareness of the importance of the existence of the lakes for tourism, but also for the supply of

water for drinking and agricultural irrigation and to some extent access to fishing resources. Regarding the cultural services including tourism, spiritual sites, recreation and education most of the stakeholders shared the same view according to the benefit accrued by them. But there are some stakeholders who shared some conflicting views. Boatmen, fishers and farmers have encouraged most of the ecosystem services by ranking them high except the regulating and supporting services as these services are not well known by any of the stakeholders. The local authorities all recognize the importance of conserving the water resources but have varying degrees of concern for the state of the biodiversity of the lakes, reflecting their respective mandates. Different ecosystem services are prior to different stakeholder groups. The ecosystem services that are valued highest by the various stakeholders are tourism, water purification, recreation and water for drinking, whereas nutrient cycling, climate regulation and water regulation are the services which are being valued the least. Tourism is valued highest by the stakeholder groups of boatmen, fishermen, hotel owners, National Lake Region Special Area Development Authority, tourists, small shop owners and Nainital Nagar Palika, water for agricultural use is valued highest by the Irrigation department and farmers, water for drinking and fish harvesting are given highest value by the teachers, the Cold Water Fisheries Department and National Lake Region Special Area Development Authority valued water purification the most and the educational services provided by the lakes is given the highest value by the students.

ABBREVIATIONS AND ACRONYMS

DCFR	Directorate of Cold Water Fisheries
DO	Dissolved Oxygen
HIGHARCS	Highland Aquatic Resource Conservation and Sustainable Development
NGO	Non-Governmental Organization
NLRSADA	National Lake Region Special Area Development Authority
NNPP	Nainital Nagar Palika Parishad

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INTRODUCTION

Introduction and purpose

The report on stakeholders' evaluation of highland aquatic resources gives an overview of the completed research activities on the weightage/ranking given by the local communities and stakeholders to functions, goods and services (including non-use values) derived from the aquatic resources in the study areas. The field site areas are the lake district of Uttarakhand i.e. Nainital District. Our study concentrates on three of the most famous lakes of Nainital which are Nainital, Bhimtal and Naukuchiatal. The district boasts of some of the most scenic lakes in India. It is one of the important Districts of Uttarakhand with high altitude. The City of Nainital is the headquarters of Nainital Lake District and Kumaon region. The selected three lakes of our study play important role in hydrological cycle and regulation of water regimes and livelihood of the local hill communities as well as those living in the plains. The lakes of Nainital, Bhimtal and Naukuchiatal are not only enriched with immense biodiversity but it also provide a number of eco-system services to the stakeholders who are directly or indirectly associated with the lakes. These aquatic resources and associated ecosystem services provide great benefits to people living there and encourage the livelihood and the personal life of the stakeholders to a great extent. Out of all the services available there are some which are most important for the stakeholders as they derive their livelihood from them (like tourism, recreation spiritual sites and areas, etc.) and there are some services which are least important like nutrient cycling, climate regulation, etc.

A stakeholder Delphi technique has been employed as a means of eliciting the perceptions of stakeholders with diverse background, opinions and knowledge. This technique allows the interactive participation of varied and conceivably hierarchical and antagonistic stakeholder groups and in capitalising on their knowledge and opinions as valid input to research in an inexact research area. It also gives equal attention to minority view points as stakeholders from diverse background and cultures get an equal opportunity to express their point of view concerning their constraints and conflicts, and to organize opportunities for better conservation and management of highland aquatic resources, opportunities for livelihoods enhancement and sustaining ecosystem services. Also the impact of different factors like lake and aquatic biodiversity, climate change, environmental degradation, livelihood of the local people, etc. has also been assessed regarding our field site.

The main purpose of this research activity is to ascertain the perceptions of different people concerning highland aquatic resources. The views, thoughts and perceptions of the users, local communities and the stakeholders form an important part of the research so as to achieve a broader and a better perspective and assessment of the field site areas. It also helps to develop a common understanding of the needs for joint integrated action plans for more sustainable, wise use practices of aquatic resources amongst stakeholders in the study areas and concerned national and local authorities.

Methodology and data sources

The methodological approach followed has consisted in three steps. A focus group discussion method and field survey was employed as a part of an integrated effort looking into the state of the aquatic resources (WP3), resource users and users, livelihoods and policies (WP 4 and 5) for the identification of Nainital, Bhimtal and Naukuchiatal ecosystem services. Secondly, the ecosystem services identified have been ranked during a number of stakeholder meetings held with different local stakeholder groups who were identified during the first phase of the project (WP1 – Situational Report), such as boatmen, fishermen, hotel owner, Irrigation Dept etc. The methods used and results obtained have been reported in the Work Package 3 report on Biodiversity and ecosystem service values of Nainital, Uttrakhand (HighARCS, Oct. 2011). Finally, a Stakeholder Delphi methodology was adopted to explore and facilitate consensus amongst stakeholders and local authorities. Further descriptions of each of the methods used can be found below.

STAKEHOLDER VALUATION OF AQUATIC RESOURCES AT THE HIGHARCS UTTARAKHAND FIELD SITE

Identified ecosystem services of Nainital, Bhimtal and Naukuchiatal.

An ecosystem is a community of animals and plants interacting with one another and with their physical environment. Ecosystems include physical and chemical components, such as soils, water, and nutrients that support the organisms living within them. The benefits people obtain from ecosystem are named as ecosystem services.

In the fold of ecosystem services, the main services includes provisioning services such as food and water, regulatory services such as climate regulation, disease control, cultural services such as spiritual, recreational and cultural benefits and supporting services such as nutrient cycling that maintains the condition for life on Earth.

In our field site, the food resources, (mainly fish) and water resources available from the three lakes provide the local people their main source of livelihood and their daily source of water use, respectively. As general regulating services of other wetlands, the lakes also contribute the same way as by climate and water regulation and also water purification. The cultural services provided by these three lakes, also serve as a source of livelihood as recreational services

significantly contribute to the tourism. The lakes maintain the regular supporting services as sediment retention and nutrient cycling as well.

Provisioning Services: In general, provisioning means "providing" or making something available. The ecosystem provides various goods for example, genetic resources, food and fiber, fresh water, drainage system and etc. Regarding provisional services, the lakes in our field sites offer food, fresh water, drinking water and drainage system.

2.1.2. Regulating Services: The benefits obtained from the regulation of ecosystem processes, include for example, the regulation of climate, water, some human diseases and etc. Climate regulation, water regulation and water purification are the key hand outs under the regulatory services provided by these lakes.

2.1.3. Supporting Services: Ecosystem services that are necessary for the production of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat. The lakes in our field site Nainital, Bhimtal and Naukuchiatal offer nutrient cycling and sediment retention as the key supporting services.

2.1.4.Cultural Services: The non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience, including, for e.g. knowledge systems, social relations, and aesthetic values. Spiritual activities, recreational activities, educational activities and tourism are the cultural services provided by the lakes in our field sites.

Participatory evaluation of Nainital, Bhimtal and Naukuchiatal ecosystem services according to focus group discussions and field surveys

The focus group discussion (FGD) is a rapid assessment, semi-structured data gathering method in which a purposively selected set of participants gather to discuss issues and concerns based on a list of key themes drawn up by the researcher/facilitator. This qualitative research technique is a cost-effective technique for eliciting views and opinions of prospective members, groups, researchers and end-users.

Focus groups are rarely used in isolation. Researchers employ a variety of tools, including one-on-one interviews, written surveys and polling to track participant's opinion. Used with all of the above, a focus group is an integral part of gauging public perceptions. However, they do have some obvious benefits:

The researcher can interact with the participants, pose follow-up questions or ask questions that probe more deeply.

Results can be easier to understand than complicated statistical data.

The researcher can get information from non-verbal responses, such as facial expressions or body language.

Information is provided more quickly than if people were interviewed separately.

Focus group discussion in our field site endows the same conception. These types of group discussions are held with same procedure, motives with different objectives. In our field site i.e. the three important lakes of Nainital, Bhimtal and Naukuchiatal the main objective is to study the perceptions and conceptions of the focus group regarding the lakes, its biodiversity, the ecosystem services offered by the lakes and the surrounding. This focus group discussion leads to a two way interaction which helps the researchers to understand that whether the focus groups other than their personal life are concerned about the surrounding or not and it will help the focus group also to understand the importance of the surroundings in their life. Through this discussion the researchers are assured that either the concepts, importance, threats and solutions regarding the lakes, biodiversity, ecosystem services are known to the focus groups or the information are not available to them or they are reluctant towards their surroundings.

Sampling for focus group needed minimum of 40 focus groups in each site. The format should be as follows: 10 with men, 10 with women, 10 with boys and 10 with girls across the three villages in our field site such as Bilaspur of Bhimtal, Chanoti of Naukuchiatal and the surrounding of Nainital. Within these subgroups the discussions are held with different livelihood groups, or in the case of boys/girls, with younger children and teenagers. The same essential questions are asked to both men and women, but flexibility is maintained so that new questions can be added when interesting issues aroused in the process of field work. To keep the session on track while allowing respondents to talk freely and spontaneously, the facilitator uses a discussion guide that lists the main topics or themes to be covered in the session. The objectives and information needed for the focus group discussion were specified. The major topics were splitted into discussion points or themes. Probable questions were prepared. The quality of questions asked in the focus group makes a large difference in the kind of information obtained. Open-ended questions are most appropriate at the start of the discussion because they allow participants to answer from different angles. As the possible responses are not preconceived, open-ended questions give the participants opportunities to express their thoughts and feelings based on their specific situations. After a brief introduction, the purpose and scope of the discussion are explained. Participants are asked to give their names and short background information about themselves. The discussion is structured around the key themes using the

probable questions prepared in advance. During the discussion, all participants are given the opportunity to participate. Varieties of moderating tactics to facilitate the group were used.

The FGD is an opportunity for the research team to listen and learn, and not to lecture or provide team members' interpretation of the local biophysical and social system. The discussions about the ecosystem services offered by the three lakes of our field site by the focus groups are stated below.

MEN: This focus group is the main earning member of a household. They earn their livelihood mainly by boating, fishing, and small business and also by farming. So they have a concept regarding these services offered by the lakes. Thus tourism is the main and the most important livelihood for them. They are quite aware of the tourism service offered by the lakes and they have the opinion that measures were taken to improve and to conserve the lakes but more measures are needed to maintain the lakes on which their whole livelihood is dependent. According to this group in the peak season through tourism via boating, selling fishes etc they can earn a handsome amount to run their households. Small business also received profit during the peak season through tourists. But in off season they have to switch to other alternatives for their earning. Many men work in hotels, resorts and guest houses which is also dependent on tourism. But they are also aware of the pollution of the lakes and its surrounding due to wastes, garbages, plastic packets by tourists and the sewage coming from different households and hotels. Not only water but soil, air is also hampered due to rampant cutting of trees, forest fire, use of pesticides etc. This causes various types of diseases occurred in their family and these also hampers the load of tourists as they prefer this place for its beautiful environment, climate, scenic beauty and its biodiversity. Due to this pollution aquatic animals are also threatened. But steps taken for the conservation of the lakes are also admitted by this focus group. Spiritual sites and areas are linked with tourism and the local residents are the followers of many Dev and Devi so they have some knowledge regarding this service. Recreation like boating in these lakes, angling, yatching, horse riding etc facilitated this group also in some source of earning so they are informed regarding these service. Now regarding educational services offered by lakes, the focus group does not show so much concern as they are not linked with any research or educational services offered by the lakes. Water use for both human and agriculture is a common topic for them. They have related information regarding water of the lakes and its related workings by the organizations as they need water for the both purposes. For daily household use they need water. Drinking water holds a prime importance and they are aware that Jal Sansthan provides them the drinking water but rather than that they don't have any specific idea. Problems regarding drinking water or water for household purposes are also mentioned by them. System or channels are there through which water can be received but due to electricity problems, pumping system doesn't work there. Loads of water is less and the amount received is not sufficient for drinking or household purpose. They have complained that government any other organizations are not aware of these problems. Similarly for agricultural purpose also irrigational water does

not reach every place. Areas in the lower side of the villages only receive water for agricultural purpose. So rate of agriculture also have decreased. Fishes for own consumption is required by all the locals over there. Fishing is done by men from Kichha dam. In Bhimtal and Naukuchiatal fishing can be done with restrictions by taking permission from Fisheries Department. Fishing is strictly restricted in Nainital. So they face problems and they have to depend on the Fisheries Department for the fishes. In Naukuchiatal, due to bad quality of water fishes are found in the bottom of the lake. Fishing requires big net which is only available to Fisheries Department. This causes problem to them. Other ecosystem services offered such as the regulating and supporting services by the lakes are not related to our concerned focus groups. Interacting with them we have come to know that no information is available to them and they are also reluctant to these services as these services are not linked with their daily life.

WOMEN: Women are the supporting system of every household. Most of them are not involved in earning livelihood. They mainly handle all the household activities. During the focus group discussion the researchers establish the fact that they are limited within their household boundary. This group is not concerned with the outer knowledge regarding the lakes, its surrounding, its biodiversity and the services offered by the lakes. In relation to cultural services, their opinion is encircled to the benefits needed for their household and most importantly their family. According to them tourists are attracted towards the lake because of its scenic beauty and lots of tourists visit these lakes every year. Tourism is the main livelihood for their family as their husband's source of revenue are boating, fishing, angling, managing hotels, restaurants, driving trekkers and private cars depends upon the tourism. They have also shared with the researchers that due to climatic change and pollution in the lakes and its surroundings number of tourists are less now a days and it affects their earning also. So measures should be there to conserve the lakes. Women are quite conscious about the divine power and the divine places in Nainital. They have a strong believe in the Dev and Devi of Nainital such as Nanda Devi of Nanda Devi Mandir, Lord Shiva of Bhimeshwar Mandir. According to them they are always protected by the blessings of these Dev and Devi. Other than these they are not concerned by other beneficial service offered by these spiritual sites. In case of recreation, the women are not concerned personally; they are only linked with it as a source of livelihood for their husbands. Educational services related to the three lakes are not connected with the daily lives of the women. They are only concerned about the education of their children. Now in regards to the provisioning services, water needed for daily household use is related to the homemaker of every family. For drinking purpose, daily activities they are obviously linked with these immense service of the lakes. But it is also admitted by them that due to various problems, amount of water received is less than they needed. Water is not available all the time in their houses mainly in villages due to the lack of electricity. Either they have to wait for that time when water will be available in taps or they have to fetch water from other places like the spring water from mountains. But then also there are communication and transport problems and in winter and summer the spring water also dried up. Especially Naukuchiatal is not maintained properly and

the water quality has also degraded so the water is not suitable for drinking purpose also. Agriculture is one of the alternatives for earning livelihood where women also sometime participate. Agriculture is done mainly to fulfill self demand as very less amount remains to sell in market. But irrigational water doesn't reach everywhere. Water from Naukuchiatal Lake is not supplied to the agricultural land in Chanoti village. Though water is needed for agricultural use but the amount of water supplied by the lakes is not satisfactory. Women also admitted that though fishing is banned in Nainital and restricted in Bhimtal and Naukuchiatal is not preferable for fishing but for non-vegetarian households fishing are beneficial as a source of food as well as an alternative income opportunity. It is also true from their side they cannot solely depend on fishing also. Regulating and supporting services are not well known to the women of Nainital.

Boys: This particular focus group agrees that the cultural services provided (tourism, education, spiritual sites and areas and recreation) is an important ecosystem service which is offered. Most of these services are interlinked and the most important is tourism which is also a major industry here and a large percentage of the local people earn their livelihood from there. Since Nainital is a tourist spot, it gives young boys a chance to engage in various activities like boating, fishing, horse riding, driving trekkers, working in hotels, restaurants through which they can earn additional income. Recreations like boating, angling, yatching, horses riding enliven these teenagers mostly. Apart from that education is also a very important service for them since most of the boys are students. Most important activity pursue by them is studying at school, college and institutions. For research work these lakes provide immense knowledge and information. Many projects include the rich biodiversity and livelihood of these high altitudinal lakes as it has a treasure of immense aquatic resources. Under the provisioning services, this focus group does make use of some of the ecosystem services like water for human consumption and fish for own consumption as most of these are common services pertaining to every household. Young generation is not interested in agriculture. So, this livelihood does not excite them enough to continue through generations. Thus water for agricultural use does not possess prime importance for them. However, as far as the other two services are concerned- regulating and supporting service this focus group has very little knowledge about it. The ecosystem services falling under it are very complicated and require in depth knowledge which the young boys who are mostly students do not have power over.

Girls: The focus group consisting of girls do not have much opinion about the ecosystem services being offered. Similar to the focus group consisting of boys they also agree that the cultural services offered are the most important. They also consider tourism as the most important service even though they are mostly engaged in household work and assisting their mothers and other female members of their family. For those who attend schools and colleges to them education is the most important service as it a prominent research topic also. Like boys, girls are also attracted by some of the recreational activities like boating, horse riding etc.

Among the provisioning services offered, they are also familiar with services like water for human use and fish as a staple meal for own consumption but they are not very much aware of the other services offered and so they hardly have any opinion on that.

Participatory evaluation of Nainital, Bhimtal and Naukuchiatal ecosystem services according to stakeholder meetings

Table A: Ranking of the ecosystem services offered by the lakes according to the stakeholders

Types of Services	Ecosystem Service	Different Stakeholders- (10= most imp, 1 = least imp)												
		Boat man	Fisherman	Hotel owner	Irrigation Dept	DCFR	NLRSADA	Jal Sansthan	Tourists	Small Shop Owner	Teacher	Student	Farmer	NNPP
Cultural	Tourism	10	10	10	9	4	9	9	10	10	3	6	7	10
	Spiritual sites and areas	9	5	8	7	2	4	4	8	8	5	5	5	7
	Recreation	8	7	8	7	2	7	7	9	9	3	7	7	8
	Education	7	3	8	1	7	1	1	2	8	6	9	1	3
Provisioning services	Water use for human	6	5	6	7	3	7	10	6	5	7	6	7	7
	Water use for agriculture water	7	7	6	10	2	3	3	3	3	5	5	10	3
	Fishes for own consumption	6	7	5	3	3	2	2	8	7	7	8	8	6
Regulating Services	Climate regulation	2	2	4	3	6	4	4	4	2	2	1	2	3
	Water regulation	2	3	2	5	7	3	3	3	2	2	2	2	5
	Water purification	7	8	7	8	8	9	9	9	7	5	6	7	9
Supporting services	Nutrient cycling	1	1	1	1	3	2	1	1	1	2	1	1	1

In the table given above we have prioritized the most significant activities as these are the key ecosystem services that the three lakes offer. To categorize the importance of the ecosystem services in the field sites, the services are ranked by the stakeholders according to the benefits accrued by them from the services. Here rank 10 is the most important service and rank 1 is the least important service according to the stakeholders.

Tourism is the major industry for earning livelihood for the people and so it has been ranked 10 by most of the stakeholders (boatmen, fishermen, hotel owners, small shop owners). It was observed that although tourists are not dependant on the lakes to earn their living yet they have ranked it high because of the recreational facilities that it provides. Also NNPP has ranked it as 10 because of the high revenue that tourism can generate. Further, because of the positive relation between the Irrigation Dept. and tourism they have ranked it 9/10 since this department issues boating licenses and during tourist season so during tourist season they can earn a lot of revenue. NLRSADA and Jal Sansthan play an equally important role in the maintenance and conservation of these lakes. DCFR is not directly linked with tourism but as they are linked with conservation of the biodiversity of the lakes which is again linked with tourism so they have ranked it moderately. For students and farmers tourist season is only important as an alternative source of income but for teachers it is not so important.

Uttarakhand also known as the 'DevBhoomi' has several masjids, majhars and churches in the surrounding region of these three lakes. Boatmen are highly benefitted by these spiritual sites because the tourists and locals who visit these divine places also like to enjoy the serene beauty of lakes by indulging in boating (ranked 9). Also hotel owners and small shop owners (ranked 8) are benefitted by the rush of these devotees who stay in the local hotels and buy their daily necessary things from these shops. Similarly there are many tourists who like to visit places that are famous for holy shrines. Again for the Irrigation Dept. and NNPP presence of spiritual places has the same advantage of earning more revenues. However, fishermen, teachers, students and farmers are not directly benefitted by it so they ranked it 5 while NLRSADA and Jal Sansthan have ranked it as 4 because their only role is to keep the surroundings of the temple and the lake area clean which is often made dirty by the visitors.

Nainital, Bhimtal and Naukuchiatal are one of the most beautiful sources of recreations. They are especially important for tourists, small shop owners, boatmen, hotel owners and NNPP (ranked 9 and 8). Where shop owners, boatmen and hotel owners are benefitted by the rush of tourists who visit the hill station to enjoy some leisure time, for the tourists on the other hand the lake view is an admirable experience which is not compromised by anyone and also with the permission of Fisheries Department, the tourists can also get permission of fishing over here. For fishermen, Irrigation Dept, NLRSADA, Jal Sansthan, students and farmers (ranked 7) the benefit derived is almost the same as in case of tourism and recreation. Teachers and DCFR (ranked 3 and 2 respectively) don't have any direct relation to the services offered so they have not ranked it high.

Nainital now has become an important research area for many organizations, institutions; NGO's all over India and abroad too as the lakes offers a great educational service related to the lakes. It is most important for students (ranked 9) who get more opportunities for research as well as hotel owners (ranked 8) who earn through various study tours and trips conducted on a regular basis. Similarly for DCFR and teachers (ranked 7) it is also important because since DCFR is the research institute these lakes offer them immense resources for their studies and experiments and also for teachers whose main profession is the betterment of the educational standard of the region even though no benefit is accrued by them from this service. The remaining stakeholders have ranked it pretty low as they do not derive any benefit out of educational services offered (fishermen, NNPP, tourists, Irrigation Dept, NLRSADA, Jal Sansthan and farmers)

The lake and its **water** is the root of the livelihood of the people of Nainital. The lake is immensely needed by the people not only for livelihood but also for personal use of the water.

Jal Sansthan ranks it as 10 because it is directly related with this service as they are the provider of this service i.e. they supply **water for drinking purpose** to the households. Irrigation Dept, NLRSADA and NNPP ranked it 7 because the activities of Irrigation Dept, NLRSADA and NNPP are closely associated with regulate the quantity of water supplied for both agricultural and drinking purpose to Bilaspur and Haldwani. The needs of teachers and farmers (who ranked 7) is similar to those of boatmen, fishermen, tourists, students, (ranked 6) farmers and small shop owners (ranked 5) as they all need water of the lake for their personal and household use rather than livelihood purpose. Water of these lakes is an important part of their daily routine work while DCFR rank water use for human as 3 because they are not directly linked with any of these services.

Agriculture is another lucrative alternative for the people residing in the villages of Nainital, Bhimtal and Naukuchiatal. Villagers of Chanoti and Pandeygaon village directly depend on the **water for agricultural use** therefore farmers and Irrigation Dept ranked it as 10 because where farmers residing in the villages of Chanoti and Pandeygaon as unswervingly depend upon agriculture for their livelihood so they incessantly need water for agricultural purpose i.e. irrigation use. Irrigation Dept they also play a key role in providing water for agricultural use to Bilaspur and Haldwani. Water of Bhimtal lake is under their control i.e. they decides the amount of water to be drawn from the lake for the irrigation purpose and they also earn revenue from it by imposing tax on irrigation water. Hotel owners, (ranked 6) teachers and students (ranked 5) although not benefitted by this service do agree that water is important for agricultural purposes so they have ranked it moderately. NLRSADA, Jal Sansthan, tourists, small shop owners, NNPP and DCFR (ranked 3 and 2) share the same opinion even though they are not involved in any work which has relation to this service provided by the lakes.

Fish is an important food for the human being and the people of Nainital, Bhimtal and Naukuchiatal are not the exception to this verity. But due to the religious belief some people of the area are vegetarians. Tourists, students, farmers, (ranked 8) shop owners, teachers and

fishermen (ranked 7) rank them as an important service because they accrue benefit from this service as they need fishes for their own consumption use. Boatmen (ranked 6) and Hotel owners (ranked 5) value this service with equal importance as they also need fish for their own consumption purpose. Hotel owners not only for their own consumption but also need this service for their guests as well. NNPP ranked it as 6 because it issues licenses for fishing and angling in Nainital so they are involved in this service. DCFR, NLRSADA, Irrigation Department and Jal Sansthan rank it as 3. These organizations are into work of the betterment of the lake its aquatic resources and its surrounding region but fishes for own consumption use does not provide any benefits to these organizations.

Climate change has been a major issue in the field of environment. Since changes in the climate can cause environmental threats efforts are being made constantly to regulate such changes in the climate and to avoid the dangers of climate regulation as far as possible. DCFR has ranked it at 6 because climate regulations help DCFR in carrying on their research on cold water fishes. Hotel owners and tourists (ranked 4) are not much affected by climate regulation as they are mostly concerned with tourism related activities. The situation is same with NLRSADA and Jal Sansthan (ranked 4) who are more involved with the water regulation activities rather than climate regulation activities. Climate regulation does not have an important effect on the regulatory activities of Irrigation Dept and NNPP (ranked 3). Boatmen, fishermen and farmers (ranked 2) do benefit a little from climate regulation as a good climate can yield good quality fishes and also help in agricultural activities. Teachers and students are not much affected by climate regulation activities but they do support it for environmental concerns (ranked 2 and 1 respectively).

Water regulation is most important for the DCFR and NNPP (ranked 7 and 5 respectively) because where it assists DCFR in carrying on their research activities the main role of NNPP is to maintain the quality of water. Water regulation is also important for Irrigation Dept (ranked 5) as they play a key role in providing water for irrigation purposes. The main activity of NLRSADA and Jal Sansthan who ranked it 3 is management and conservation of lakes, regulation of water and proper maintenance of water quality and purity. Tourists are also attracted by beautiful lakes which are clean and pure (tourist also ranked it as 3). Fishermen ranked it as 3 because water regulation can yield better quality fishes. If the water is polluted then the aquatic life is also disturbed. Boatmen, hotel owners, small shop owners, teachers, students and farmers ranked it 2 as they are not much affected by water regulation activities.

The water of the lake and the different stakeholders are interrelated. So, improved and purified water is the necessity of every one. Regarding to this service is most important for almost every stakeholder because it facilitate them in carrying their daily activities. NLRSADA, Jal Sansthan and NNPP (ranked 9) have given it similar ranking because their main activities are related to water purification. NNPP, NLRSADA and Jal Sansthan are concerned with is management and conservation of lakes, regulation and maintenance of water quality. Tourists have also ranked it as 9 because proper maintenance of water quality and purity can magnetize tourists because this

hill station is the attraction centre for all stressed out tourists. Water purification is important activity for DCFR and Irrigation Dept (ranked 8) because where pure water is required for irrigation purposes it is also necessary for research purposes. Boatmen, hotel owners, small shop owners, farmers, students and teachers (ranked 7, 6 and 5) all agree that purified water is important for their daily use but they are not concerned as they know always they will be the recipient of the purified water supplied by the different organizations.

The lakes of Uttarakhand field site can efficiently offer cycling of different enriched nutrients within its fold and the benefits are ensued by the different stakeholders. But this service is not known and controlled by any of the stakeholders as the role is only entrusted to the lakes. So, in the above feedback table it can be noticed that every stakeholder have ranked it low.

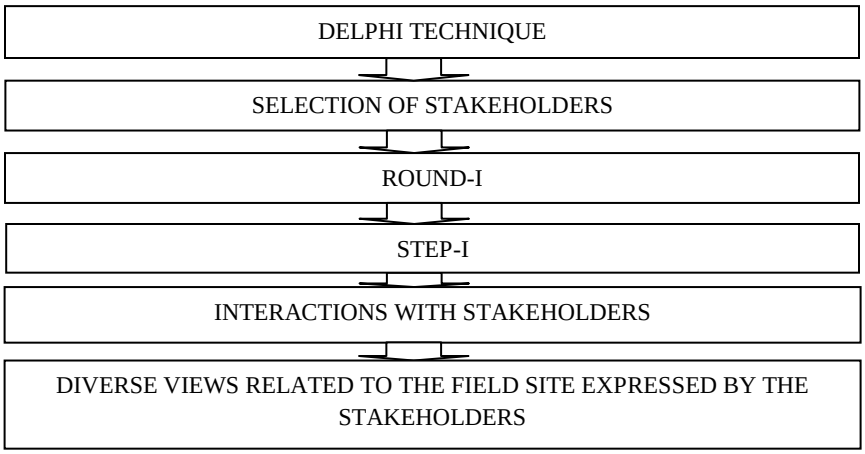
The above stated discussions lead us towards the conclusion that the stakeholders shared some conflicting views among themselves regarding the perceptions towards the ecosystem services. Most of the stakeholders are not informed as well as concerned regarding the regulatory and supporting services provided to them by the economically and culturally enriched lakes.

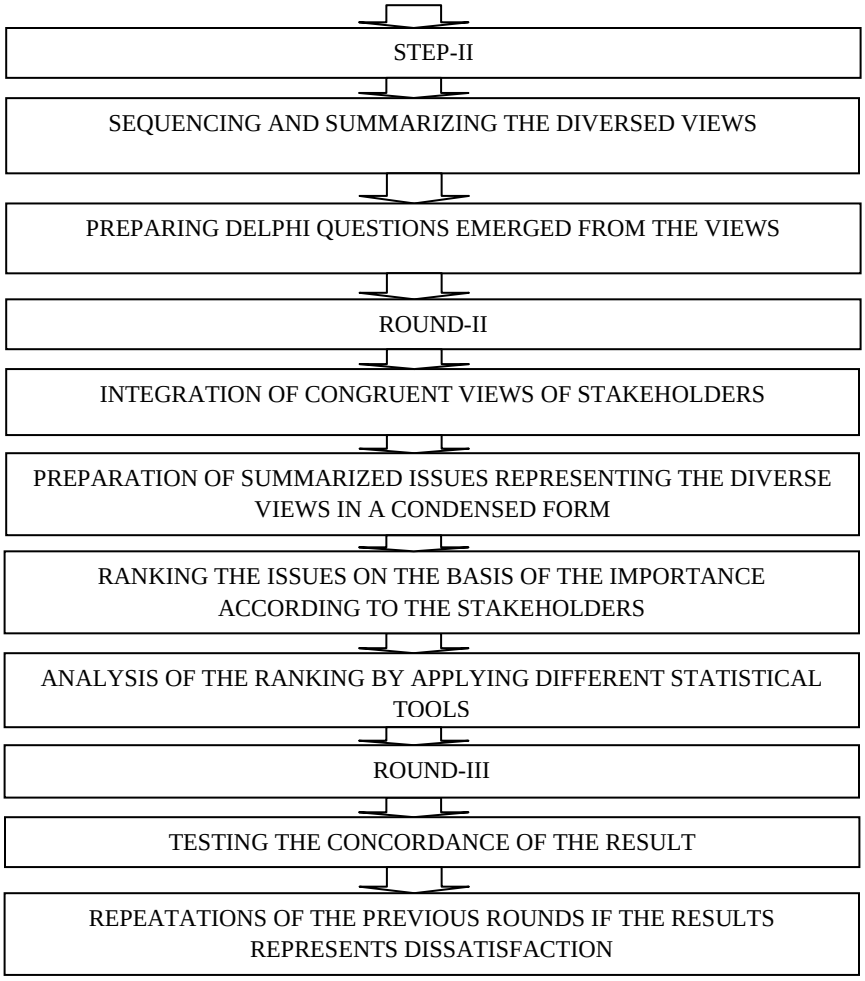
The value added services eventually benefits some stakeholders at the extreme most level whereas some stakeholders are least concerned regarding those services like the cultural services and provisioning services are highly ranked by boatmen, fishermen, farmers, hotel owners etc but most of the services are ignored by teachers, DCFR, and other organizations. The other two services like supporting services and regulatory services have not been recognized and welcomed by the most of the stakeholders.

Thus to assess critically the concordance between the stakeholders on the subject of the services and the biodiversity of the lakes which is lacking in this part, we have to depend on some other way out whose destination will be the final picture of concordance. The renowned Delphi technique is the appropriate carrier towards the destination we want to arrive at.

Participatory evaluation of Nainital, Bhimtal and Naukuchiatal ecosystem services according to a stakeholder Delphi

Presentation of the methodology and design





Account of the steps followed

Delphi methodology is preferred mainly for extracting the discernment of stakeholders associated with assorted surroundings, estimations and acquaintance. Instead of collecting expert opinions, the views and thoughts of stakeholders were captured. The stakeholder's Delphi Technique acknowledges that some stakeholders though not classified as experts can be highly influential or possess knowledge that may better inform the process. Contrary to group discussion methods e.g. meetings, workshops or committees, the quasi anonymity assured in Delphi avoids th

INTEGRATION OF CONGRUENT VIEWS OF STAKEHOLDERS

The selected thr osystem services but these aquatic bodies are under th due to degradation of catchments and water diversion leading to changes in water regime ociated biodiversity and overall ecosystem services. In addition, impact of climate change, which has severe implications on regional water resources, is also there.

The field site areas being the lakes and the immediate surroundings, the stakeholders are chosen in accordance to the site, being directly or indirectly associated with the lakes. Here association means any kind of interaction with the chosen lakes. Delphi report here covers a diverse range of stakeholders, to achieve a broader and a better perspective and assessment of the lakes and the surrounding regions. The stakeholders may be broadly categorized as:

1. Boatmen
2. Fishermen
3. Hotel/Resort owners, Restaurant owners
4. Irrigational Department
5. Cold Water Fisheries Department
6. National Lake Region Special Area Development Authority (NLRSADA)
7. Jal Sansthan
8. Tourists
9. Small shops around the lake
10. School/college teacher
11. Student
12. Farmer
13. Nainital Nagar Palika Parishad
The inclusion of the stakeholders needs a justification for choosing the different categories of stakeholders.

Boatmen
Boatmen are directly linked with the lakes through tourism. Lakes are the main attraction for the tourists. And the pleasant environment of this area pulls the tourists from diverse parts of India. Boating is the key service that can be provided to the tourists from the lake region. The local people do not boat for recreation but tourists do. So, boating is directly linked with the cultural ecosystem services which have a very much significant relation with tourism.

Fishermen
Fishermen are also directly connected with the lakes. Fishing in the lake complex region is one of the foremost livelihood strategies of the local people. Though there are restrictions in fishing but still it is one of the services which link the fishermen with the lakes for their daily basis.

Hotel/ Resort Owner or Restaurant Owner
It can be said blindly that Hotel/ Resort owner or Restaurant owner directly deals with tourism. This kind of stakeholder is immensely dependent on tourism. Rather it can be said that if tourism is not developed in this region the hotel business may not come into the scene. Just because of tourism ecosystem service, the hotel and restaurant owner exists significantly and are directly linked with the lakes.

Irrigation Department

Irrigation Department is also attached with the lakes. Though they do not derive any services from the lake, but they are the protector of the lakes. Irrigation Department has the responsibility to take care of the amount of water of the Bhimtal Lake. They control the level of water and according to their permission; water is supplied for irrigation and drinking purpose to Bilaspur and Haldwani from Bhimtal Lake. Boating licenses are also issued by them. So in these respects they are one of the stakeholders of the lakes.

Cold Water Fisheries Department

Cold Water Fisheries Department has the accountability to maintain the biodiversity of the Bhimtal Lake. This department have experimented different kinds of mutation of different species in the Bhimtal lake water with the aim to maintain the biodiversity. So, it can be said that this department becomes the direct stakeholder of the lakes.

National Lake Region Special Area Development Authority (NLRSADA)

National Lake Region Special Area Development Authority (NLRSADA) is in charge for maintaining and monitoring of all the lakes and their surrounding in this Kumaon Region. Three lakes Nainital, Bhimtal and Naukuchiatal, taken for HighARCS research also falls under the maintenance of NLRSADA. So, among the direct stakeholders NLRSADA is one of the significant stakeholders.

Jal Sansthan

Jal Sansthan is the drinking water supply department of Nainital. They supply drinking water all over the Nainital town. The drinking water is drawn from the Nainital Lake. In this way they are also related with the lake and is taken as its important stakeholder.

Tourists

Tourists are the biggest stakeholders of the lakes in this lake region. As the key concern for selection of Uttarakhand site is tourism.

Small Shop Owner

Small Shop Owners are also related with the lakes. As these lake areas are famous for its tourism so, the small shops are emerged in the lake side chiefly for serving the tourists. That is why small shop owner are also incorporated in the lake's stakeholders list.

School / College Teacher

In case of school or college teacher, it can be said that as they are the residents of the field sites of Uttarakhand are emotionally attached with the lakes. They have fascination towards the climate, scenic beauty of the lakes and they are aware of the ecosystem services offered by the

lakes though it doesn't affect their livelihood. So they are taken as the stakeholder who is indirectly linked with the lakes

Students

Students are not indirectly related with the lakes like teachers. The students at some time choose boating, fishing, horse riding, driving trekkers and private cars as their part time earning. Many work in the guest house, restaurant and hotels as their side job. Again most of them have taken these lakes as their part of research work. As a resident also they are sentimentally attached to the lakes. Thus for these reasons they are one of the chosen stakeholders.

Farmer

It can be said that farmers are also related with the lakes in case of Bhimtal and Naukuchiatal lakes. From Bhimtal Lake water is released to Bilaspur Village through canal for agriculture and water is released to Chanoti Village from Naukuchiatal Lake for same purpose. So, farmers are too associated with the lakes.

Nainital Nagar Palika Parishad(NNPP)

Nainital Nagar Palika Parishad is the Municipality of Nainital town. NNPP is chiefly liable for the maintenance of the roads and lakeside surroundings. NNPP in Nainital issue licenses for boating, impose toll tax, collect tax for keeping clean the nearby areas of lake and they are also in the duty of maintenance of Nainital Lake. So though indirectly but this department is linked with the lakes as well.

These stakeholders were assigned for the purpose of Delphi technique as the prime factors. The procedure through which individual respondents were selected during the field visits can be explained with the help of following few examples – i) at the time of boatmen (one of the individual respondents) selection, researchers firstly observe the boating system for some time, what was observed is that some boatmen were busy in boating, some were queuing at the front of ticket counter, while some were trying to convince the field visitors as well as other people to have a ride on their boats but apart from them some boatmen were sitting ideal, i.e., they were free at that time and were waiting for their turn to come, the field visitors choose few boatmen among them as respondents. ii) in case of tourists, researchers tried to include different types of tourists, i.e., regular tourist, first time tourist etc but were able to involve only those who were willing to talk and give their views during the field visits. iii) in case of government officials, there is no option of selecting, the researchers contacted the concerned department officials and also them whom those officials recommended to serve the researchers' purpose. But there may exist divergent views among each stakeholder groups because of the following factors, one of the depending factor of boatmen's view is that who were selected as respondents, they belong which lake; tourists' view depend on the factor that whether they are first time tourist, second time tourist or regular tourist, i.e., frequency of their visits. Tourists are prominent stakeholders in the

study but naturally same tourists were not found in every field visits, only government officials were same all the time but their view might change after the March2012 election. In real fact, at the time of interactions with these stakeholders it is observed that many of them were not available for the interactions and meetings regarding the Delphi procedure. As the interaction depends on the field visit and the visit again is constrained by time boundary, we have to arrange the meetings with all the stakeholders within the time slot. This creates a lot of hassles. Rather than this most of the stakeholders were not interested to interact with us. The questions and the options should be précised and understandable so that they do not face any problem to answer it. They always attempted to give an overall view rather than answering each option. But to extract the juice from the stem we have to force them to answer each question so that we can get the appropriate result out of the meeting and so that the statistical results prepared are accurate. For example, during field visit it is observed that the communication with boatmen creates a lot of problems. First of all they are very busy with their work and convincing the passengers to boat in their lake. Secondly if we are not ready to ply on their boat they will not give us time and if we manage to talk with them they will misguide us by giving wrong answers. So we are forced to take a boat over there to have our answers. Mainly this problem arises in the Nainital Lake.
The entire Delphi process has been broken into three broad rounds.

ROUND-I

It is the initial round of the Delphi process including the following points
Collect written responses from panel members
Code responses: categories, themes, stances/viewpoints
Synthesise the collected responses and submit to second round the new question emerged from the collected responses from the panel-members who answered that in round 1
To develop, confirm or comment on propositions, hypothesis, explanations, problem causes etc. emerging from round 1

This round I can be classified into two steps and was taken posteriori and separately to the previous mentioned FGD but anterior to stakeholder meeting ranking sessions. These are as following:

STEP-I

To avoid any form of biasness, interactions were done with the stakeholders personally. One common thing which may be marked here is that even within the same stakeholder group, individual mentalities; their opinions about various aspects differ. The diverse views covering the field site hence expressed were jotted down in step-I without any form of modification.

STEP-II

In step-II the diverse and haphazard views expressed in step-I were given shape and expressed in sequential and summarized form. There were seven Delphi questions emerged common for all the stakeholders after discussing their view regarding the field site. These questions are prepared

by keeping in mind that these questions will cover up all the key aspects of the stakeholders. Attempts have been made to capture the diverse views of all the stakeholders with respect to these questions. During the preparation of the questions we have kept in mind the following points

Brainstorm with the stakeholders

Maintaining present action-research issue/problem already identified in preliminary research

Having the form of an semi-structured open-ended questionnaire

Written responses were collected from panel-members. The views of different stakeholders about a particular question were studied together. The views which were nearly congruent were merged and instead a broad representative was placed. Hence under each question we have a few summarized options which are the representative of the diverse views of the different stakeholders in a condensed form.

In case of our study, the common questions along with the summarized options according to the view of the stakeholders regarding the questions are given below with their frequency mentioned in brackets. Here frequency means numbers of stakeholders having same view.

Question no 1: How has the local environment changed over the time?

(a) Local Environment has degraded; construction work and resale of land in the mountains, along with rapid urbanization has resulted in congestion and pollution. *(14)*

(b) It has changed but a lot of effort has been put in by the government to combat the degradation to some extent. *(5)*

(c) The environment has deteriorated and further negligence on the government's part has made matters worse. *(4)*

(d) The local environment has not changed at all. *(1)*

(e) The climate has become warmer. *(3)*

(f) The lake water has become more polluted. *(5)*

(g) The aquatic life is under threat due to increasing pollution. *(2)*

Question no 2: How the livelihoods of people depend on Biodiversity?

(a) Lakes are the main attraction for the tourists, and tourists are the only source of income in these areas and therefore the livelihood of the people completely depend on the lakes and the Biodiversity of the lakes. (6)

(b) The livelihood of the people indirectly depends on the Biodiversity of the lakes. *(6)*

(c) The livelihood of people does not depend on the Biodiversity in any way. *(4)*

Question no 3: Do you think these interactions of the people with Lake Biodiversity have any adverse effect on it? If yes, what are the reasons behind your thinking?

(a) Interaction of people with the Lake Biodiversity has no adverse effect on it. *(2)*

(b) Interaction of people with Lake Biodiversity may have adverse impact on it. *(12)*

(c) Over fishing and illegal fishing lead to exhaustion of lakes. *(5)*

(d) Shops around the lakes are polluting the lakes by throwing the wastes into them. *(3)*

(e) The discharge of sewage water and dirty water from the adjoining areas has adversely affected the Lake Biodiversity. *(3)*

(f) There is a regular check on the activities which have adverse impact on the Biodiversity of the lake and as such there is no such noticeable adverse impact on the lakes due human interaction. *(3)*

Question no 4: What is your perception about the aquatic Biodiversity of the lake?

(a) There is a wide range of fishes and aquatic plants which are found in these lakes. The fishes which are found are Mahseer, Silver Carp, Scale Carp, Common Carp, Punti, Gambusia, Rohu, Katla etc. *(11)*

(b) The Aquatic plants mainly comprise weeds, grasses, Algae etc. A grass called as Haleong is used as a vegetable by local people here. (10)

(c) The relationship between the aquatic plants and aquatic animals are symbiotic. *(2)*

(d) Due to prevailing low temperature scarce aquatic flora and least organic constituents, the fish production in upland waters is registered to be very low. *(1)*

(e) The change in climatic conditions resulted in a drop in the number of fishes found in these lakes, because the fishes found it difficult to adapt themselves to the changing climate. *(1)*

(f) Do not have proper idea about Biodiversity of the lakes; they are acquainted with few local fishes like Mahseer and Carps etc. *(1)*

Question no 5: Is there any conservation plan to protect these Biodiversity? If yes, what?

(a) Fisheries department keeps a check on the amount of fishes that can be withdrawn from the lakes to maintain the Biodiversity of the lakes. The fishermen in Bhimtal, Naukuchiyatal Lake can draw up to 4 kg of fish per person per day. *(7)*

(b) Fishing is banned in Nainital, Almost 1.5 lakh fish has been fed in the lake. Pantnagar University collects the fishes from the lake when they grow large in number and instead plant fish seeds for culture. *(5)*

(c) Lake Development Authority looks after and monitors the lakes. Mission Butterfly was undertaken for solid waste management. *(5)*

(d) Lake Wardon Scheme was undertaken to combat the pollution problem. *(5)*

(e) Lot of aeration work has been done by the NLRSADA which has increased the DO (dissolved oxygen) level in the lakes thereby increasing the visibility of the lakes. *(6)*

(f) Indian Fisheries act for declaration of sanctuaries means to protect the endangered germ plan. This should be effectively used to conserve Mahseer and other fish species. *(1)*

(g) The pathway around the Nainital Lake has been tiled so as to prevent the washing of dirty water in to the lakes, from the nearby areas after rainfall. *(1)*

(h) Polythene has been banned in Nainital and it will be very soon banned in Bhimtal as well as Naukuchiyatal regions. *(2)*

(i) The NGOs and the local organizations are putting in a lot of effort to conserve the lakes and the adjoining areas. *(2)*

(j) Most of the conservation plans are Nainital oriented. *(4)*

(k) Have no idea about any conservation plans. *(2)*

Question no 6: In your opinion, how can be these biodiversity properly managed without affecting the livelihood of depended people?

(a) Better and equitable assistance required from the government. *(5)*

(b) NLRSADA and fisheries Department should be more active. *(2)*

(c) Greater assistance along with proper training should be provided to the fishermen so that harmful fishing practices may come to a standstill. Illegal fishing practices should come to a standstill. *(5)*

(d) Awareness and co-operation of common people is required for effective implementation of the conservation schemes and programs. *(8)*

(e) Common people should be included in rule making body so that rules and regulations may be formulated in accordance to their well being. *(1)*

(f) Town area should arrange for management of dirty rainwater, plantations should be done around the lake. *(1)*

(g) Polythene must be strictly prohibited in Bhimtal and Naukuchiyatal regions. People who throw plastics, wrappers in the lakes should be punished. *(6)*

(h) Tourism should be in harmony with the lakes instead of destroying it.*(2)*

(i) The construction works for the resort and hotel must be prohibited. *(2)*

(j) No idea of any conservation plans. *(1)*

Question no 7: How has the inflow of tourists changed over the time?

(a) Number of tourists has dipped over the time due to environmental change. *(3)*

(b) The inflow of tourists has not changed at all. *(6)*

(c) The inflow of tourists have increased over the time, the weekend crowd from the neighboring regions have provided the further impetus. *(7)*

(d) The quantity of tourists has increased but number of quality tourists has gone down. *(1)*

(e) Number of tourists now resides more in adjoining areas like Almora, Ranikhet to avoid congestion in Nainital and the adjoining areas. *(2)*

ROUND-II

The questions along with the summarized views to those questions will be placed before the same stakeholders and they will have to rate the options according to the preference.

They will rank 10 where there strong agreement with the view and rate 1 poor agreement with the summarized view.

Applications of statistical tools to the data representing the rates given by the stakeholders and analysis of the results.

Synthesise and code responses again – this time propositions for solutions / actions should be emerging

ROUND-III

Gradually we need to reach a general consensus, and mark out those people who differ from the generality and identify the reasons for the same.

Comparing the result of the Delphi and testing the concordance using the statistical tools and if there is a disagreement of the concordance with the proposed view then round1 and round 2 should be then repeated.

Results of the stakeholder Delphi

In our calculation of Delphi technique we have taken views of 4 boatmen, 3 fishermen, 4 tourists, 4 small shop owners, 2 school/college teachers, 5 students, 3 farmers along with hotel owners, Irrigation department, DCF, NLRSADA, Jal Sansthan, NNPP as stakeholders ,i.e., there are in total 31 respondents.

The Table Rating of each Stakeholders (Annexure 1) shows the rates given by each stakeholders for each questions containing different reasons (for example, Question 1: How has the local environment changed over time?, under this question there are 7 reasons and each stakeholders have given rating on these reasons, they have rated them according to their priority, i.e., the reason which is most prior to them, they have rated it 10 and which is most inferior to them they have rated it 1).

ROUND-II

Following table shows mean, median, quartiles values taking into consideration ratings **of all stakeholders for each questions containing different reasons as well as for all the questions as a whole**

Descriptive Statistics for questions

Table B. Descriptive Statistics for question number 1

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 1a	31	8.6774	1.16582	6.00	10.00	8.0000	9.0000	10.0000
Number 1b	31	6.2258	2.40430	2.00	10.00	4.0000	6.0000	8.0000
Number 1c	31	6.3871	1.54224	3.00	9.00	5.0000	7.0000	8.0000
Number 1d	31	4.7419	2.43540	1.00	8.00	2.0000	6.0000	7.0000
Number 1e	31	6.2258	2.18647	2.00	10.00	4.0000	6.0000	8.0000
Number 1f	31	5.9677	1.92326	2.00	9.00	5.0000	6.0000	7.0000

Number 1g	31	5.9355	1.86074	3.00	10.00	4.0000	6.0000	7.0000

Table C. Descriptive Statistics for question number 2

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 2a	31	9.3226	.90874	7.00	10.00	9.0000	10.0000	10.0000
Number 2b	31	6.6452	1.22606	3.00	9.00	6.0000	7.0000	8.0000
Number 2c	31	1.9032	.90755	1.00	4.00	1.0000	2.0000	2.0000

Table D. Descriptive Statistics for question number 3

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 3a	31	4.0968	2.63761	1.00	9.00	2.0000	3.0000	7.0000
Number 3b	31	6.4839	2.99857	1.00	10.00	3.0000	7.0000	9.0000
Number 3c	31	6.1290	3.33409	1.00	10.00	2.0000	7.0000	9.0000
Number 3d	31	4.8065	1.79665	1.00	9.00	3.0000	5.0000	6.0000
Number 3e	31	5.5484	1.94660	1.00	9.00	5.0000	6.0000	6.0000
Number 3f	31	5.3226	2.54803	1.00	9.00	3.0000	5.0000	8.0000

Table E. Descriptive Statistics for question number 4

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 4a	31	7.9032	2.03887	4.00	10.00	6.0000	9.0000	9.0000
Number 4b	31	7.3226	1.44654	5.00	9.00	6.0000	7.0000	9.0000
Number 4c	31	5.7742	2.24662	2.00	10.00	4.0000	6.0000	7.0000

Number 4d	31	5.6774	2.78552	1.00	10.00	4.0000	6.0000	8.0000
Number 4e	31	4.0323	2.50977	1.00	8.00	2.0000	4.0000	6.0000
Number 4f	31	4.6774	2.86807	1.00	8.00	1.0000	6.0000	7.0000

Table F. Descriptive Statistics for question number 5

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 5a	31	5.8710	2.78977	1.00	10.00	3.0000	7.0000	8.0000
Number 5b	31	7.1290	1.97892	2.00	10.00	6.0000	8.0000	9.0000
Number 5c	31	6.2903	2.00322	3.00	10.00	5.0000	6.0000	8.0000
Number 5d	31	5.3548	2.18401	1.00	9.00	4.0000	6.0000	7.0000
Number 5e	31	6.1290	2.33441	2.00	10.00	4.0000	6.0000	8.0000
Number 5f	31	4.6774	2.84473	1.00	10.00	2.0000	5.0000	7.0000
Number 5g	31	4.1935	2.91455	1.00	10.00	2.0000	3.0000	7.0000
Number 5h	31	8.1613	1.55127	5.00	10.00	7.0000	8.0000	9.0000
Number 5i	31	2.9355	2.03200	1.00	7.00	1.0000	2.0000	5.0000
Number 5j	31	6.9032	1.86824	3.00	9.00	5.0000	8.0000	8.0000
Number 5k	31	2.5484	2.12664	1.00	8.00	1.0000	1.0000	4.0000

Table G. Descriptive Statistics for question number 6

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 6a	31	7.7097	1.44207	5.00	10.00	7.0000	8.0000	9.0000
Number 6b	31	7.3548	1.58216	3.00	9.00	6.0000	8.0000	9.0000
Number 6c	31	6.6774	2.30054	3.00	10.00	4.0000	7.0000	9.0000
Number 6d	31	7.8710	2.12512	4.00	10.00	7.0000	8.0000	10.0000
Number 6e	31	6.5161	2.09557	3.00	10.00	4.0000	7.0000	8.0000
Number 6f	31	5.7419	1.89680	2.00	10.00	4.0000	6.0000	7.0000
Number 6g	31	6.6129	2.91750	1.00	10.00	3.0000	8.0000	9.0000
Number 6h	31	6.5806	2.59196	2.00	10.00	5.0000	7.0000	8.0000
Number 6i	31	7.0968	2.61221	1.00	10.00	6.0000	8.0000	9.0000
Number 6j	31	2.8065	2.41412	1.00	9.00	1.0000	2.0000	4.0000

Table H. Descriptive Statistics for question number 7

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 7a	31	4.6452	2.57615	1.00	8.00	2.0000	6.0000	7.0000
Number 7b	31	4.1613	2.80591	1.00	10.00	2.0000	4.0000	6.0000
Number 7c	31	7.2258	1.70704	3.00	10.00	6.0000	8.0000	8.0000
Number 7d	31	6.7097	2.19383	3.00	10.00	5.0000	8.0000	8.0000
Number 7e	31	6.8387	2.20751	1.00	10.00	6.0000	7.0000	8.0000

Table I. Descriptive Statistics for all questions

Questions	N	Mean	Std. Deviation	Minimum	Maximum	Percentiles		
						25th	50th (Median)	75th
Number 1	31	8.6774	1.16582	6.00	10.00	8.0000	9.0000	10.0000

Number 2	31	6.2258	2.40430	2.00	10.00	4.0000	6.0000	8.0000
Number 3	31	6.3871	1.54224	3.00	9.00	5.0000	7.0000	8.0000
Number 4	31	4.7419	2.43540	1.00	8.00	2.0000	6.0000	7.0000
Number 5	31	6.2258	2.18647	2.00	10.00	4.0000	6.0000	8.0000
Number 6	31	5.9677	1.92326	2.00	9.00	5.0000	6.0000	7.0000
Number 7	31	5.9355	1.86074	3.00	10.00	4.0000	6.0000	7.0000
Number 8	31	9.3226	.90874	7.00	10.00	9.0000	10.0000	10.0000
Number 9	31	6.6452	1.22606	3.00	9.00	6.0000	7.0000	8.0000
Number 10	31	1.9032	.90755	1.00	4.00	1.0000	2.0000	2.0000
Number 11	31	4.0968	2.63761	1.00	9.00	2.0000	3.0000	7.0000
Number 12	31	6.4839	2.99857	1.00	10.00	3.0000	7.0000	9.0000
Number 13	31	6.1290	3.33409	1.00	10.00	2.0000	7.0000	9.0000
Number 14	31	4.8065	1.79665	1.00	9.00	3.0000	5.0000	6.0000
Number 15	31	5.5484	1.94660	1.00	9.00	5.0000	6.0000	6.0000
Number 16	31	5.3226	2.54803	1.00	9.00	3.0000	5.0000	8.0000
Number 17	31	7.9032	2.03887	4.00	10.00	6.0000	9.0000	9.0000
Number 18	31	7.3226	1.44654	5.00	9.00	6.0000	7.0000	9.0000
Number 19	31	5.7742	2.24662	2.00	10.00	4.0000	6.0000	7.0000
Number 20	31	5.6774	2.78552	1.00	10.00	4.0000	6.0000	8.0000
Number 21	31	4.0323	2.50977	1.00	8.00	2.0000	4.0000	6.0000
Number 22	31	4.6774	2.86807	1.00	8.00	1.0000	6.0000	7.0000
Number 23	31	5.8710	2.78977	1.00	10.00	3.0000	7.0000	8.0000
Number 24	31	7.1290	1.97892	2.00	10.00	6.0000	8.0000	9.0000
Number 25	31	6.2903	2.00322	3.00	10.00	5.0000	6.0000	8.0000
Number 26	31	5.3548	2.18401	1.00	9.00	4.0000	6.0000	7.0000
Number 27	31	6.1290	2.33441	2.00	10.00	4.0000	6.0000	8.0000
Number 28	31	4.6774	2.84473	1.00	10.00	2.0000	5.0000	7.0000
Number 29	31	4.1935	2.91455	1.00	10.00	2.0000	3.0000	7.0000
Number 30	31	8.1613	1.55127	5.00	10.00	7.0000	8.0000	9.0000

Number 31	31	2.9355	2.03200	1.00	7.00	1.0000	2.0000	5.0000
Number 32	31	6.9032	1.86824	3.00	9.00	5.0000	8.0000	8.0000
Number 33	31	2.5484	2.12664	1.00	8.00	1.0000	1.0000	4.0000
Number 34	31	7.7097	1.44207	5.00	10.00	7.0000	8.0000	9.0000
Number 35	31	7.3548	1.58216	3.00	9.00	6.0000	8.0000	9.0000
Number 36	31	6.6774	2.30054	3.00	10.00	4.0000	7.0000	9.0000
Number 37	31	7.8710	2.12512	4.00	10.00	7.0000	8.0000	10.0000
Number 38	31	6.5161	2.09557	3.00	10.00	4.0000	7.0000	8.0000
Number 39	31	5.7419	1.89680	2.00	10.00	4.0000	6.0000	7.0000
Number 40	31	6.6129	2.91750	1.00	10.00	3.0000	8.0000	9.0000
Number 41	31	6.5806	2.59196	2.00	10.00	5.0000	7.0000	8.0000
Number 42	31	7.0968	2.61221	1.00	10.00	6.0000	8.0000	9.0000
Number 43	31	2.8065	2.41412	1.00	9.00	1.0000	2.0000	4.0000
Number 44	31	4.6452	2.57615	1.00	8.00	2.0000	6.0000	7.0000
Number 45	31	4.1613	2.80591	1.00	10.00	2.0000	4.0000	6.0000
Number 46	31	7.2258	1.70704	3.00	10.00	6.0000	8.0000	8.0000
Number 47	31	6.7097	2.19383	3.00	10.00	5.0000	8.0000	8.0000
Number 48	31	6.8387	2.20751	1.00	10.00	6.0000	7.0000	8.0000

ROUND-III

The following table shows **Friedman's (X^2_r), Kendall's (W) and p value**, taking into consideration **ratings** of all stakeholders for each questions containing different reasons as well as all the questions as a whole.

Table J. Friedman's (X^2_r), Kendall's (W) and p value table for each and all questions containing different reasons

Questions	Respondents	Friedman's (X^2_r)	Kendall's (W)	df	p value
1	31	46.358	.249	6	.000
2	31	61.512	.992	2	.000
3	31	20.850	.135	5	.001

4	31	52.153	.336	5	.000
5	31	131.703	.425	10	.000
6	31	71.562	.256	9	.000
7	31	50.986	.411	4	.000
All	31	514.462	.353	47	.000

DISCUSSION OF THE RESULTS

Using the Delphi technique which is explained above and applying different statistical tools mainly SPSS we have computed required imperative statistical results which will enlighten the different views and opinions of the stakeholders of our field site i.e. Nainital, Bhimtal and Naukuchiatal. Here we have calculated the median values, quartile values, mean values, maximum values, minimum values, std. deviation, Kendall's coefficient of concordance and Friedman's **(X^2_r)** at probability levels (**p**) to infer whether the differences of responses is random or not and the degree of concordance of the ranks assigned by the stakeholders on the basis of their perceptions regarding the lakes, its biodiversity, environment, livelihood, threats to the biodiversity and lastly the conservation plans to protect the lake biodiversity.

Table B, C, D, E, F, G, H and I show calculated **median values, quartile values, mean values, maximum values, minimum values, std. deviation** of all stakeholders for each questions containing different reasons (for example, Question 1: How has the local environment changed over time?, under this question there are 7 reasons and each stakeholders have given rating on these reasons, they have rated them according to their priority) as well as for all the questions as a whole. The mean values help to find the one score that is most correct expression of the total rating value expressed; however, it may be that more than half the respondents would prefer a higher or lower value. On the other hand, the median value presents the "democratic" compromise, i.e., emphasis on finding the middle between equally respectable opinions/positions on the rating/value. In case of median, extreme points do not pull the result as strongly in their direction as with the mean.

Table J shows calculated **Kendall's (W),** Friedman's **($X^2_{r)}$ and p value**, taking into consideration **rating/scoring** of all stakeholders for each questions containing different reasons (for example, Question 1: How has the local environment changed over time?, under this

question there are 7 reasons and each stakeholders have given rating on these reasons, they have rated them according to their priority) as well as for all the questions as a whole.

Kendall's W (also known as **Kendall's coefficient of concordance**) is a non-parametric statistic. It is normalization of the statistic of the **Friedman test**, and can be used for assessing agreement among raters. In other words, Kendall's W provides information on the degree of consensus and the associated level of confidence in the expressed rates by the respondents. Kendall's W ranges from 0 (no agreement) to 1 (complete agreement). It is used for evaluating the degree rank convergence in Delphi surveys.

Friedman's ($X^2_{r)}$ at probability levels (p) can be utilized with Delphi survey data to determine the presence of similar/dissimilar score patterns for responses from the respondents/stakeholders in the concerned issues. Friedman's null hypothesis indicates that the differences of responses is random, or in other words that all the responses were given by the same person. The alternative hypothesis indicates that that there is a next to nothing chance of the null hypothesis being correct. This means that at least one of the responses is significant.

Using SPSS, we have computed **Kendall's W, Friedman's ($X^2_{r)}$** at probability levels (**p**) for each question containing different reasons as well as for all the questions as a whole with respect to **rating/scoring** given by all the stakeholders and the results are given in Table I. By looking at the upshot in case of questions no 4, 5, 7 and taking all 7 questions together, the value of Kendall's W being .336, .425, .411 and .353 respectively (with reference to Table 2 in the Annexure 2), we can infer the degree of consensus/ agreement among respondents/ stakeholders is moderate and the associated level of confidence is fair. In other words, in the matter of **perceptions about the aquatic Biodiversity of the lake, conservation plan to protect these Biodiversity**, **change of inflow of tourists over the time** and **all the 7 issues together** respectively**,** the respondents/ stakeholders have moderate consensus/ agreement with fair associated level of confidence while rating the reasons behind the issues. In case of question no 2, the value of Kendall's W being .992 (with reference to table2 in the Annexure), we can infer the degree of consensus/ agreement among respondents/ stakeholders is unusually strong and the associated level of confidence is very high. In other words, in the matter of **dependence of livelihoods of people on Biodiversity**, the respondents/ stakeholders have unusually strong consensus/ agreement with very high associated level of confidence while rating the reasons behind the issues. For question no 1, 3 and 6 the value of Kendall's W being .249, .135 and .256 respectively (with reference to table2 in the Annexure), we can infer the degree of consensus/ agreement among respondents/ stakeholders is very weak and the associated level of confidence is none. In other words, in the matter of **change in local environment over the time**, adverse effects of **interactions of the people with Lake Biodiversity** and **proper management of biodiversity without affecting the livelihood of depended people** respectively, the respondents/ stakeholders have very weak consensus/ agreement with no associated level of confidence while rating the reasons behind the issues.

The Table J also shows that the p-values in all cases are well below the 0.05 level, meaning that there is a next to nothing chance of the null hypothesis, i.e., the differences of responses is random, being correct. This means that at least one of the responses is significant.

CONCLUSION

Summary of stakeholder valuations of aquatic resources in Nainital, Bhimtal and Naukuchiatal

The Nainital district is situated in the Central Himalaya, where the climate is subtropical. This district is blessed with a number of God gifted lakes among which for our field site we have chosen Nainital, Bhimtal and Naukuchiatal as the subject matter of research. The lakes play an important role in socio-economic development of hill people. They are used for drinking water supply, boating, recreation and various other core activities. The three lakes also maintain the local climate as a large amount of heat is absorbed during summer and the same is released during winters by it. The climate thus maintained by the lakes boost tourism in this area, which is the backbone of the economy of the hill people. They are also a good repository of biodiversity. However, due to human's activities in last several years the lakes become eutrophic. For eutrophication reversal and to conserving it for future, the central as well as the state governments are making efforts.

The persons associated with these lakes i.e. the stakeholders are the key factors for evolving the purpose of this report. Lakes and these stakeholders are unswervingly or circuitously correlated with each other. Most of them are naturally coupled with these lakes as to castle out their family; the lakes are the only starting place. The other stakeholders are influenced by the lakes to perform those activities which ultimately end its destination in the lap of the lakes. The key stakeholders are boatmen, fishermen, hotel owners, small shop owners, students, teachers, farmers, tourists, NLRSADA, DCF, Jal Sansthan, Irrigation Department and NNPP.

Here in this report the evaluation of the ecosystem services by the different stakeholders has been executed. The lakes of Nainital, Bhimtal and Naukuchiatal have crafted a fully fledged ecosystem followed by some indefinable services. Regarding the cultural services including tourism, spiritual sites, recreation and education most of the stakeholders shared the same view according to the benefit accrued by them. But there are some stakeholders who shared some conflicting views. Boatmen have encouraged most of the ecosystem services by ranking them

high except the regulating and supporting services as these services are not well known by any of the stakeholders. Similar views are shared by fishermen and farmers regarding the cultural and provisioning services as they mount up same sort of benefits or facilities from these services. DCFR, NLRSADA, Jal Sansthan have possessed conflicting views with each other in relation to cultural and provisioning services while Irrigation department and NNPP, who have more or less same duties and responsibilities, possess same views. The tourists and shop owners also possess similar views , i.e., they more or less rank same values to the services. Teachers throughout have performed reluctantly towards the services in comparison to the students. Education in cultural services, water for agriculture use and the technical services like the entire regulating and supporting services are valued less by most of the stakeholders. There is conflict between Jal Sansthan and NNPP regarding the supply of drinking water. According to Jal Sansthan, source of water for drinking purpose in Nainital is deep bore tube well but NNPP denied it by concluding it that they haul out water from the lake itself. In Bhimtal drinking water is supplied from Bhimtal Lake but Jal Sansthan disagree to pay tax for it whereas Irrigation Department charges them to pay tax as they are exploiting the lake for it. NLRSADA who is the nodal agency for monitoring and maintaining the lakes imposed complaint against NNPP, that though they are lacking in their management but all sort of revenue generated by not only collecting toll tax but also revenue generated by other tax related to lake, lake ownership, boating license goes to NNPP. No resource has been provided to NLRSADA though the management of NNPP in not up to the mark.

Boatmen, fishermen, shop owners, tourists hold the view that though there has been a lot of change due to rapid urbanization but efforts have been put by the government to combat the problems associated with it. The local environment has changed a lot; construction work and incessant resale of land in mountains, along with rapid urbanization has resulted in congestion and pollution which have had a derogatory impact on these areas. One common complaint that we got from both Naukuchiyatal as well as Bhimtal was that the Lake Development authority mainly concentrates on Nainital and the remaining lakes are neglected by them as a result the condition around them has been degrading past few years. According to some hotel owners the climate has become warmer, people used to flock to these hill stations to escape the scorching heat of the plains. However Nainital did not receive any snowfall past few years. However some resorts and the restaurant owner have admitted that not much has changed for them, the number of tourist during the peak season remains close to 70 for a restaurant owner and which drops to 30 during the off season. DCFR has the view that the aquatic resources are under influence of habitat destruction, lesser flow in the rivers, increasing silt load and the fishery is facing the menace of wanton destruction. Most of the fish species have narrow thermal tolerance and as such the increase in temperature is imperative for their survival. The environment in these areas have changed a lot and the local people specially the farmers are blamed by NLRSADA for that, the farmers use fertilizers in their field for better yield, which is washed in to the lakes during rainy season and thereby polluting them. According to NLRSADA Polythene bags are prohibited in Nainital and proposition to ban them in Bhimtal is also cropping up. In spite of all the odds

the plans and programs formulated by the government has improved the environmental conditions over the time. Along with the steady decline in the environmental condition of these areas with erratic rainfall, the problem of drinking water for Jal Sansthan has also intensified. The pollution in the lake has resulted in illness of local people as well as aquatic animals and trees are also being cut for land; necessary to fulfill the need of ever growing population which is the views of teachers and students. The agricultural productivity has stooped to a negligible level, mostly due to the erratic climatic conditions, to be specific due to the shift in the rainfall. The farmers nowadays are finding it difficult to meet their family consumption needs and actually have to buy food grains and vegetables from the market.

Biodiversity aspect is well known and admired by most of the stakeholders as their source of revenue is nothing but the lakes. The Cold water Fisheries Department deal with the piscine species of the cold water, their main concern is maintaining the Biodiversity of the lakes and as such their livelihood depends partially on the lakes. The Biodiversity of the lakes attract people from all over the country and the inflow of tourists and the income of these petty shopkeepers around the lakes are directly related. So, we may say that the livelihoods of these people are related to the lakes. The government institutions which deal with the maintenance of the Biodiversity of the lakes employ a large number of people and hence it might be inferred that their livelihood partially depends on the lakes. Again students prefer only studying and later they move out of the town due to lack of job opportunities rather than part time works in these regions and therefore will never depend on the lakes for their livelihood. The interactions with the stakeholders related to the adverse effect of biodiversity in the lakes inferred that mostly all of the stakeholders relish the biodiversity impact and admits that Lake Biodiversity has no adverse impact on the lake. But there is some dreadful facts also such as the tourists rowed by the boatmen have a tendency of throwing litter in the lakes and thereby polluting them, the problem of illegal fishing persists and it is leading to over exhaustion of the lakes. The untrained fishermen adopt harmful fishing practices which greatly affect the Biodiversity of these lakes. Again a lot of fishing is done on the behalf of the fisheries department, which sometimes results in drop of fish population in the lakes. Local people cut trees for wood and in process loosen the soil causing landslide. Soil from the hills as well as pesticides from agricultural field is washed into the lakes resulting in decrease of depth of lake along with death of aquatic organisms. On the other hand, regular monitoring is done by the government institutions so according to them interaction of people with Biodiversity of the lakes do not have any effect on it and even if there is an adverse effect, it is checked by the monitoring authority.

The stakeholders also have some sound perceptions about the aquatic biodiversity of the lakes. Every stakeholders associated with the lakes have a clear idea regarding the species which augment the biodiversity of the lakes. There is a wide range of fishes and aquatic plants which are found in these lakes. The fishes which are commonly found are Mahseers, Silver Carp, Common Carp, Rohu, Katla, Punti, Gambusia etc. The Aquatic plants mainly comprise weeds, grasses, Algae etc. A grass called as Haleong is used as a vegetable by local people here. The

relationship between these plants and animals are very much symbiotic, the fishes eat the plants and on the other hand the carbon dioxide given out by the fishes and the other aquatic animals are utilized by the aquatic plants to make their food by the process of photosynthesis. Apart from the aquatic life several kinds of plants are also found in the adjoining areas. Mango, Lime, Guava, Avocado, Chestnut, Rose, Lantana, Timur, Turmeric, Ginger, Coriander, Garlic etc are common here. The water snakes, ducks, fishes, crabs, earthworms etc comprise the aquatic life of the lakes. But the change in climatic conditions, over harvesting and pollution resulted in a drop in the number of fishes found in these lakes, because the fishes found it difficult to adapt themselves to the changing climate.

The stakeholders are aware that some conservation plan is duly needed to protect the biodiversity of the lakes so that it can provide its ecosystem services without any restraint. According to them, fisheries department keeps a check on the amount of fishes that can be withdrawn from the lakes to maintain the Biodiversity of the lakes. The fishermen in Bhimtal can draw up to 4 kg of fish per person per day. Fishing is strictly prohibited in Nainital Lake. Fishing is not a common scenario in Naukuchiatal due to bad water quality. Lake Development Authority looks after and monitors the lakes. Mission Butterfly was undertaken for solid waste management. Lake Wardon Scheme was undertaken to combat the pollution problem. Oxygen supply to lake water through aeration plants has been established specially in Nainital. De-siltation of the lakes are supposed to be done once a year, however there are complaints that the NLRSADA focuses mainly on Nainital and the other lakes are neglected. The Nagar Palika, Fisheries department, and the NLRSADA have undertaken several plans and programs to maintain the Biodiversity of these lakes. The pathway around the Nainital Lake has been tiled by NLRSADA so as to prevent the washing of dirty water in to the lakes, from the nearby areas after rainfall. According to DCFR, Indian Fisheries act for declaration of sanctuaries means to protect the endangered germplan. This should be effectively used to conserve Mahseers and other fish species. Non governmental institutions like Chiraag and Gawal Sena are putting in lot of effort to protect the lake and the Biodiversity of the Lakes.

The actions proposed by the stakeholders which should be implemented to improve the biodiversity of the lakes are crystal clear to them. They are not only economically but also emotionally attached to the lakes and they urged for the conservation and monitoring of the lakes.

Better and equitable assistance required from the government.
Organizations that have the stake of maintaining, monitoring and conserving the lakes should be more active.
The government should formulate few other plans and make sure that they are implemented with full vigor.
Awareness and co-operation of common people is required.

People themselves who seem to be the basic cause of the problems can be made part of solutions in the Lake management through a system of awareness and participatory project implementation.

Polythene must be strictly prohibited in Bhimtal and Naukuchiatal regions.

Greater assistance along with proper training should be provided to the fishermen so that harmful fishing practices may come to a standstill. Illegal fishing should be prohibited. Over fishing should be prohibited

A national policy on fisheries should be formulated which can take care of all the conflicting interests.

There can be fish release programmes in the lakes; those may engage local people as laborers. Directorate of coldwater fisheries is already working on the germplasm conservation of the endemic fish species. They are also working on the gene sequence of the fishes for temperature tolerance

Efforts should be made to consult the relevant research and development agencies before abstracting water from natural eco-system.

Proper maintenance of the pathways around the lakes required.

The construction around the lakes should be stopped.

The people mainly the unaware tourists who throw litter and polythene in the lake should be punished.

Town area should arrange for management of dirty rainwater, plantations should be done around the lake. The sewage management should be properly handled. Systems of garbage disposal around the lakes should be fined. There can be a strict regular monitoring around the lake to look out and prevent the disposal of garbage in the lakes of Bhimtal and Naukuchiatal. Local people can be employed for the look after of the lakes and can be paid on daily basis. This may contribute to conservation and maintenance of the water quality and employment opportunities for the local people.

The boatmen and the fishermen are directly dependent on the lakes. Since this is their main livelihood source, adequate number of trips per day must be likely. This should be done to enable generation of adequate income to the boatmen and fishermen. In Nainital, numbers of tourists are quite high owing to its natural beauty. Hence with an increase in the number of boats the livelihood of the people could be developed. Timescale could be the period of license issuing that is for 1 year. If more licenses are issued in that time and if the boatmen have adequate trips per day then they will renew their boating licenses.

Promotion of tourism should be done satisfactorily and facilities are satisfactory for the tourists then that can attract good number of tourists to visit the place. The tourists come here mainly attracted by the beauty of the lakes and the hills, so to have more number of tourists the natural resources must be conserved.

Transport and communication facilities should be well developed so that there is easy movement from one tourist spot to another. In Naukuchiatal, people said that they have transport problem as

the numbers of trekkers are less. Tourists usually come in their own cars to visit the place. Young boys and girls also find it difficult to reach colleges and schools.

In Bhimtal and Naukuchiatal people have some amount of agricultural land. These agricultural lands are mainly for producing vegetables, fruits and other crops by the families for self consumption. So there is little or no marketing of the agricultural goods. Thus, if agriculture could be enhanced by producing more output then the surplus beyond the consumption could be marketed. Moreover, vegetables mainly come from Haldwani and the local markets are expensive. So if vegetables are produced locally and marketed then that problem could be solved by Department of Agriculture, Government of Uttarakhand.

3.2 Integrating stakeholder values to enhance Bio-economic modeling

This section will be completed in a revised version after the completion of the on-going work with setting up the bio-economic modeling.

References

<pending; will be supplied in revised version>

Table 1 : Table Rating of each Stakeholders (Annexure 1)

Qs	B1	B2	B3	B4	F1	F2	F3	Ho	Irr.D	DCF	LDA	J.S	NNPP	T1	T2	T3	T4	SS.O1	SS.O2	SS.O3	SS.O4	S/CT1	S/CT2	S1	S2	S3	S4	S5	F1	F2	F3
1.a	8	9	6	8	7	7	8	7	7	9	7	8	8	9	9	8	9	9	10	10	9	10	10	10	9	10	9	10	10	0	9
1.b	10	10	5	7	3	3	2	10	8	9	10	8	8	6	5	4	4	2	5	4	4	9	8	6	7	8	5	6	5	6	6
1.c	7	7	7	7	8	6	6	9	8	7	4	8	8	7	4	5	4	8	7	8	7	3	5	6	5	8	5	6	5	5	8
1.d	1	1	8	1	2	1	1	2	6	5	8	7	7	6	7	6	6	8	5	6	5	7	6	2	2	7	6	5	6	5	2
1.e	8	9	9	8	8	6	5	7	8	10	2	9	8	7	6	5	5	8	6	4	5	7	4	3	4	9	4	4	3	4	8
1.f	7	7	8	7	6	5	5	6	7	2	2	7	6	3	4	3	4	9	8	9	8	7	5	5	5	9	6	7	5	6	7
1.g	7	7	7	7	7	6	6	7	6	8	5	8	4	4	4	3	3	9	9	8	10	6	4	4	6	6	5	4	4	4	6
2.a	10	10	9	10	10	9	9	10	9	8	9	8	8	8	7	8	8	10	10	9	10	10	10	10	10	10	10	10	10	10	10
2.b	6	6	6	6	7	5	6	6	6	7	3	7	7	8	6	6	5	5	8	6	7	7	8	7	8	7	8	7	8	9	8
2.c	2	2	1	1	1	1	1	2	1	4	2	2	2	1	2	2	1	2	3	4	3	3	2	1	2	1	1	2	3	1	3
3.a	2	2	2	2	2	1	2	8	7	9	2	8	2	2	1	1	1	6	7	8	9	7	3	4	5	6	4	3	4	3	4
3.b	3	2	3	1	8	7	7	2	2	4	5	10	7	7	6	7	7	10	9	8	10	10	10	9	9	9	8	9	10	8	3
3.c	2	2	2	2	7	2	1	9	9	7	1	10	9	4	3	2	1	10	8	7	8	5	8	8	10	10	9	10	8	9	7
3.d	5	4	7	6	5	5	6	3	2	6	5	6	7	6	3	2	3	9	2	3	1	5	4	5	4	7	5	5	6	6	6
3.e	4	4	5	5	6	6	5	2	8	1	7	8	9	7	6	5	6	9	6	5	6	3	5	6	5	9	6	6	5	5	2
3.f	7	8	8	8	2	2	1	9	8	6	9	9	9	6	5	5	5	3	5	6	7	4	2	11	3	5	4	3	3	4	8
4.a	8	8	6	8	9	8	4	4	9	10	9	9	9	5	5	6	5	9	10	9	8	9	10	10	0	6	9	10	0	9	4
4.b	7	7	5	6	7	7	6	5	5	9	7	7	7	6	6	5	5	9	9	8	9	9	9	9	9	8	8	9	8	8	8
4.c	4	4	6	4	8	6	5	7	8	10	7	9	10	7	2	2	2	5	5	4	3	9	4	5	6	8	4	5	6	7	7
4.d	1	1	2	1	4	3	2	9	8	10	9	9	9	4	4	3	4	5	4	5	4	8	8	7	8	7	7	8	9	6	7
4.e	2	2	4	1	8	5	4	8	4	8	1	8	6	8	3	4	3	4	6	6	6	5	1	1	1	3	2	1	2	1	7
4.f	3	4	4	3	1	1	1	7	7	1	8	7	6	8	1	1	1	8	1	2	1	8	6	8	7	8	6	7	6	5	8

5.a	2	3	2	2	1	2	2	4	7	10	9	7		8	7	4	3	4	6	10	9	10	7	9	8	7	4	7	7	8	7	6
5.b	7	8	7	7	8	4	5	9	9	10	8	9		9	9	5	3	2	5	9	8	9	4	8	7	8	8	7	8	7	8	6
5.c	8	7	5	4	6	5	4	8	7	9	10	9		9	5	9	8	9	4	8	4	3	7	5	6	5	7	5	6	5	5	3
5.d	4	4	6	1	7	2	2	7	7	5	9	7		8	6	8	9	8	4	7	5	6	7	7	4	4	6	3	4	3	3	3
5.e	8	8	2	2	9	6	5	10	9	5	10	9		8	7	6	4	6	9	8	6	7	7	6	3	3	6	4	3	4	6	4
5.f	7	6	7	5	5	5	4	3	7	10	9	8		9	8	7	8	7	5	1	2	1	4	2	1	2	4	2	1	2	1	2
5.g	3	2	4	1	3	3	2	8	7	10	7	9		10	9	4	5	4	5	2	2	2	4	1	2	1	7	1	2	1	2	7
5.h	8	8	8	6	7	8	7	9	8	7	9	9		10	9	10	10	10	5	6	5	6	10	10	9	8	9	8	9	10	9	6
5.i	6	5	1	4	2	3	2	6	6	5	5	5		6	7	1	2	1	2	1	2	1	5	1	2	1	3	1	2	1	1	1
5.j	7	6	5	5	4	8	7	5	8	9	9	8		3	9	4	5	3	5	7	8	8	9	8	7	9	8	8	9	7	8	8
5.k	7	6	5	4	5	1	1	2	2	1	1	3		2	2	1	10	1	8	1	1	4	2	1	1	1	6	1	1	1	10	5
6.a	7	8	8	8	9	8	7	6	7	9	9	9		9	9	8	10	9	8	5	8	7	6	9	5	5	7	6	6	9	10	8
6.b	7	6	8	5	9	9	9	5	7	9	10	10		8	8	7	7	8	9	7	8	9	7	8	6	6	8	5	5	8	9	9
6.c	9	8	8	7	3	4	3	7	8	10	10	10		10	8	6	6	4	9	3	9	9	6	6	5	5	8	4	4	7	7	4
6.d	7	8	7	7	9	8	7	10	9	10	10	10		9	10	10	9	10	9	10	10	10	8	5	4	4	8	4	4	5	6	7
6.e	5	4	4	3	7	6	7	8	8	10	9	10		9	8	4	4	3	9	4	8	7	5	7	8	8	4	8	8	6	5	6
6.f	4	3	3	2	7	6	7	6	6	10	6	10		8	7	5	5	5	7	2	7	7	5	4	7	7	5	7	7	4	4	6
6.g	8	7	9	8	9	8	9	4	7	10	9	10		10	9	3	3	6	8	8	9	10	8	3	3	3	8	2	1	2	3	8
6.h	8	8	7	8	7	7	8	10	8	10	9	10		10	8	9	8	7	5	6	6	6	7	2	10	2	8	10	3	10	2	7
6.i	7	8	6	7	8	8	9	7	6	6	4	7		10	7	2	1	1	7	9	8	7	8	10	10	9	9	10	9	10	8	2
6.j	7	6	7	4	4	3	2	3	2	2	1	4		2	1	1	2	2	6	1	1	1	1	1	1	1	9	1	1	1	1	8
7.a	7	8	6	5	7	8	8	2	1	6	1	7		7	6	5	6	5	6	7	6	7	7	2	1	1	4	1	1	2	2	2
7.b	5	4	6	4	1	1	1	9	2	10	9	5		7	8	2	3	4	8	5	4	4	6	1	2	2	8	2	1	2	1	2
7.c	7	8	8	7	8	8	7	8	9	10	8	8		9	9	8	7	6	9	8	7	8	8	5	6	5	8	4	5	3	4	9
7.d	8	7	9	8	9	8	7	8	8	8	8	9		8	9	6	5	5	9	9	8	10	5	3	4	3	6	3	4	4	3	7

7.e	8	7	8	7	3	3	4	6	8	9	8	7		8	7	9	8	7	9	10	9	9	6	7	8	7	8	2	1	5	6	8

B-Boatman, F- Fisherman, Ho- hotel Owner, Irr. D- Irrigation Department, DCF- Directorate of Coldwater Fisheries, LDA- Lake Development Authority, JS-Jal Sansthatn,NNPP- Nainitla Nagar Palika Parishad, T1 to T4- tourist 1 ,2, ,3,4, SS01 – SS04- Small Shop Owner 1 ,2,3,4, S/C T 1 S/C T2- School/College Teacher 1 ,2, S1 to 5- Student 1,2,3,4,5, F1-3- Fisherman 1,2,3,

Table 2. Interpreting agreement and confidence associated with Kendall's coefficient of concordance (W)

(Schmidt, 1997) (Annexure 2)

Kendall's W	Agreement	Confidence in ranks
0.1	Very weak	None
0.3	Weak	Low
0.3-0.5	Moderate	Fair
0.5-0.7	Strong	High
0.7-1.0	Unusually strong	Very high

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Deliverable 5.2

Report on stakeholder evaluation of highland aquatic resources Study sites: Northern and Central of Vietnam

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1 Introduction

1.1 Introduction and purpose

The present report on stakeholder evaluation of highland aquatic resources provides an overview of completed research activities undertaken within the HighARCS project on the value ascribed by users, local communities and stakeholders to functions, goods and services (including non-use values) derived from the aquatic resources in the Northern and Central of Vietnam. The perceived impact of factors such as environmental degradation, changing demand for goods and services and modified highland aquatic resources management practices on these values has also been assessed.

The purpose of the stakeholder evaluation research activities must be seen in an action planning perspective as intending to create a social space for communicative interaction, learning, and negotiation and to ascertain the perceptions of different people concerning highland aquatic resources.

The assumption of the HighARCS project was that such participatory and stakeholder-oriented research activities are necessary in order to facilitate the emergence of a common understanding of the needs for joint integrated action plans for more sustainable, wise use practices of aquatic resources amongst stakeholders in the study areas and concerned national and local authorities.

The results from the stakeholder evaluations of the aquatic resources at the sites were subsequently used by the HighARCS team for supporting local stakeholders and authorities in reaching consensus and common understanding of the needs for developing specific integrated action plans for improved management of the aquatic resources, reported in HighARCS D.1 report on the Integrated Action Plans (September 2012).

1.2 Methodology and data sources

There are 2 study sites in Vietnam. Communes Tuong Tien and Tuong Ha of Phu Yen district of Son La province is representative for study site in Northern Vietnam. Dakrong commune of Dakrong district of Quang Tri province is representative for study site in central Vietnam (Figure 2).

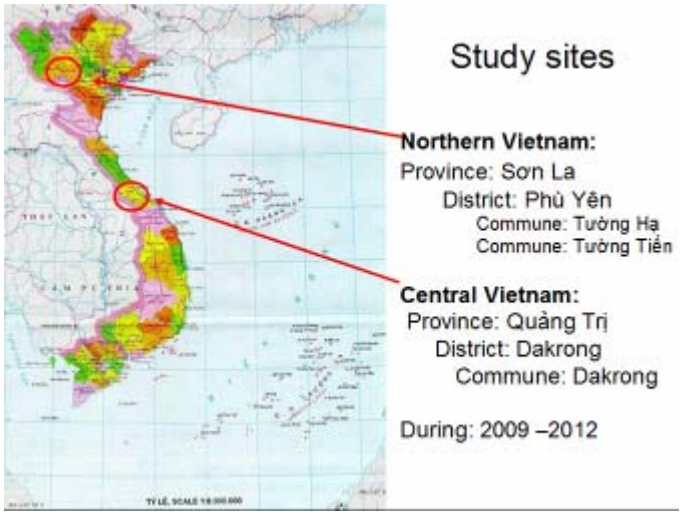

Figure 1. Study sites in Son La (Northern Vietnam) and Quang Tri (Central Vietnam)

In order to obtain stakeholder perceptions and evaluation of the aquatic resources, an ecosystem service evaluation approach was developed for HighARCS during the March methodology workshops in 2010. This approach is based on multiple sources of information. The ecosystem service evaluation activities have been integrated within the overall activities of work packages 3, 4, and 5.

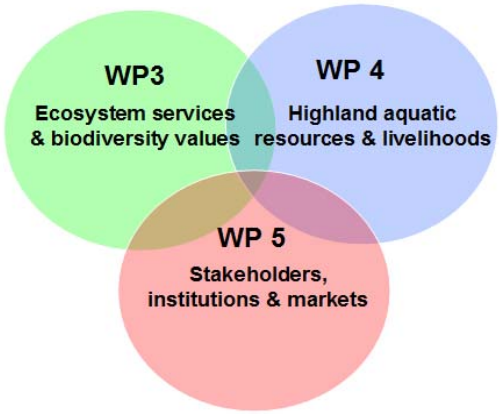

Figure 2. Methodology and approach: integrated activities of WP3, WP4 and WP5

The views of stakeholders and concerned authorities have been recorded from state-of-the-system (SOS) and stakeholder workshops (WP 1, and WP 3, 4 & 5 integrated).

At the end of the first phase of the HighARCS project (WP1), SOS workshops were organised to include local people in the HighARCS research process in Son La and Quang Tri provinces. The purpose of the SOS workshops were to present the outputs of WP1, to check data, gather feedback understanding from broad stakeholders and agreement coming activities of WP3, WP4 and WP5 of HighARCS project.

During the following months, a number of activities were undertaken with the purpose of better understand the uses and users of the aquatic resources at the project sites. The topic of this report is the stakeholder evaluations of the aquatic resources which resulted from these activities. A brief overview of all the activities is given below, but as many of the findings have been reported in other HighARCS reports under work packages 3 and 4, the focus of this report is on the account of the Stakeholder Delphi surveys.

1.1.1 Household interviews

In order to identify type of ecosystem service, questionnaires were carried out integrated with WP4 through household interviews, focus groups at study sites during the second phase of the project in 2010. Then, the list of ecosystem services were listed and presented in the survey sheet. The survey sheet was sent to 26 people belonging to different groups including groups (1) at province and district level (people living outside study site, policy making & management), group (2) at commune level (people live in study site, party involve in fishing, making plan for commune & management) and group (3) at village level (fishermen and people living in HighARCS village). Respondent were ask to mark on the list of ecosystem service according to their importance. Smaller number means less important (1 means less important and 5 means more important). The result are analysed based on Excel.

1.1.2 Focus group discussions

Stakeholder views were also explored through 36 focus groups in Son La study site and 34 focus groups in Quang Tri study site formed in relation to gender and age with men, women and children from groups 9-13 and 14-20 years old at the HighARCS study site communities have been facilitated and recorded. During this process, researchers have been recording species names where relevant, conducting mapping exercises, identifying value chains related to specific services, considering different community groups and recording seasonality in dependence. This has been supported by a PRA ranking approach used to identify the value that different groups of stakeholders (in particular different wealth groups) attribute to different ecosystem services, and how these values alter seasonally.

1.1.3 Stakeholder workshops

At the end of the second phase of the HighARCS project, stakeholder workshops were carried out in Son La and Quang Tri provinces. The purpose of the Stakeholder workshops were to present outputs of WP 3, 4 & 5, to gather feedback from broad stakeholders and to inform the participants of a tentative proposal for an Integrated Action Plan to be implemented during the third phase of HighARCS of WP6, WP7 and WP8.

Figure 3. SOS and Stakeholder Workshops in Son La and Quang Tri provinces

The results of the stakeholder identification and evaluation of ecosystem services done through SOS stakeholder workshops and the integrated conservation-livelihoods-policy and household surveys undertaken have been reported in the two earlier reports 'Biodiversity and Ecosystem Service Values of the Dakrong River, Quang Tri, Vietnam' and 'Biodiversity and ecosystem service values of Phu Yen District, Son La, Vietnam' (October 2011) and further discussed in the D3.1 Deliverable report (December 2011).

According to the D3.1 report, the key threats to biodiversity and ecosystem services at the *Phu Yen District site* were identified to being overfishing and the use of destructive fishing methods, agricultural pollution, deforestation, and the changing water levels caused by hydropower dam operation. All the threats apart from over harvesting are driven by factors outside of the communities' control, with the land use changes upstream and dam control impacting the biodiversity and ecosystem services at the site.

The ecosystem service prioritization work done at the Phu Yen District site showed that different stakeholder groups value the services differently. The regulating services were valued the highest by the Provincial and District level governance (group 1) and the Commune level governance (Group 2), in particular wetland water storage during dry season, habitat provision for economic species, flood control and the maintenance of genetic diversity of valuable fish species. Whereas the villagers (group 3) also value the provisioning services, especially fishes for commercial and subsistence use as highly as the regulating services. Many of the highly prioritized ecosystem services are depending upon the reservoir (an artificial environment) and the dam management providing suitable levels of water for harvesting of fish and water etc.

At the *Dakrong River Site (Quang Tri Province),* the key threats at the site include the hydropower stations upstream of the site that hold back water during the dry season and discharge high sediment loaded water creating flood surges which damages the villagers micro-hydropower generators, disrupts river transportation and reduces water quality.

There are also a number of new dams under construction, including Dakrong II which is situated at the site. While this dam is a run of the river dam (there will be no blocking of the river or creation of a reservoir) its construction will destroy species habitats at the site which is likely to impact aquatic resources, and the running of the dam (the diversion of water) will have unknown implications to the rivers biodiversity. Water pollution from gold mining, agricultural chemicals and domestic waste are also reducing the quality of water at the site.

The stakeholder assessment of ecosystems services done by the HighARCS team during the focus group discussions and the stakeholder meetings concluded that eco-system system services provided by the Dakrong River are highly valued by all stakeholder groups questioned and water provision for human use and water filtration are considered the most important services.

Similarly to the situation in the Phu Yen District sites, the report pointed out that there are some differences between the different governance stakeholder groups (Provincial and District; Commune; and village). The villagers scored the fishes/shrimps for commercial use higher than the other groups in Quang Tri, and the Provincial and District level governance group prioritized flood control and tourism and aesthetic value higher than the other groups. The Commune governance group scored only recreation higher than the

others. The upper forested catchment of the Dakrong River is essential for the provision of all the ecosystem services, and in the case of migratory species that are utilised in fisheries, the lower catchment is also critical.

Figure 4. Some images of ecosystem services in Da River at study sites in Son La

1.1.4 Stakeholder Delphi

Already prior to the findings of the differences of opinion amongst stakeholders appearing from the assessments of ecosystem services made under work package 3, the existence of a certain disagreement amongst stakeholders about the use and value of aquatic resources and their ecosystem services was anticipated by the project. Therefore, in parallel to activities of work package 3, stakeholder Delphi studies were undertaken in Son La province Quang Tri province involving representatives from all stakeholder groups. The purpose of adding this study was to facilitate the targeted action planning. The stakeholder Delphi is assumed helpful to better characterise constraints and conflicts, and build consensus concerning opportunities for better conservation and management of highland aquatic resources, opportunities for livelihoods enhancement and sustaining ecosystem services. The question now was whether opinions were in fact diverging, and whether the

application of the Stakeholder Delphi technique would lead to a reconciliation of any such divergent opinions and facilitate the creation of some degree of consensus as to which action plans to undertake at the sites.

2 Presentation of the stakeholder Delphi methodology

The Delphi method was developed in the late 1960s as a forecasting methodology using expert panels and works formally or informally, in large or small contexts (Hishamunda et al., 2009). The stakeholder Delphi methodology evolved from the original method as a means of eliciting the perceptions of stakeholders with diverse backgrounds and to explore consensus concerning the relative importance of constraints and opportunities (Bunting, 2008). The stakeholder Delphi acknowledges some stakeholders although not classified as experts can highly influential knowledge that may better inform the process. By inviting the diversity of stakeholders to participate a broader perspective and wider sense of ownership can be achieved (Bunting, 2008). The results provided by a Delphi survey represent the synthesis of the opinion of a particular group of experts (Hishamunda et al., 2009) or -in the case of the stakeholder Delphi - a particular set of stakeholder groups.

The Stakeholder Delphi is based on an interactive survey methodology, including 2-4 rounds of statements which the selected panel members identify (round 1) and subsequently express their degree of agreement or disagreement (rounds 2 and 3) towards. The procedure can be visualized as in Figure 5:

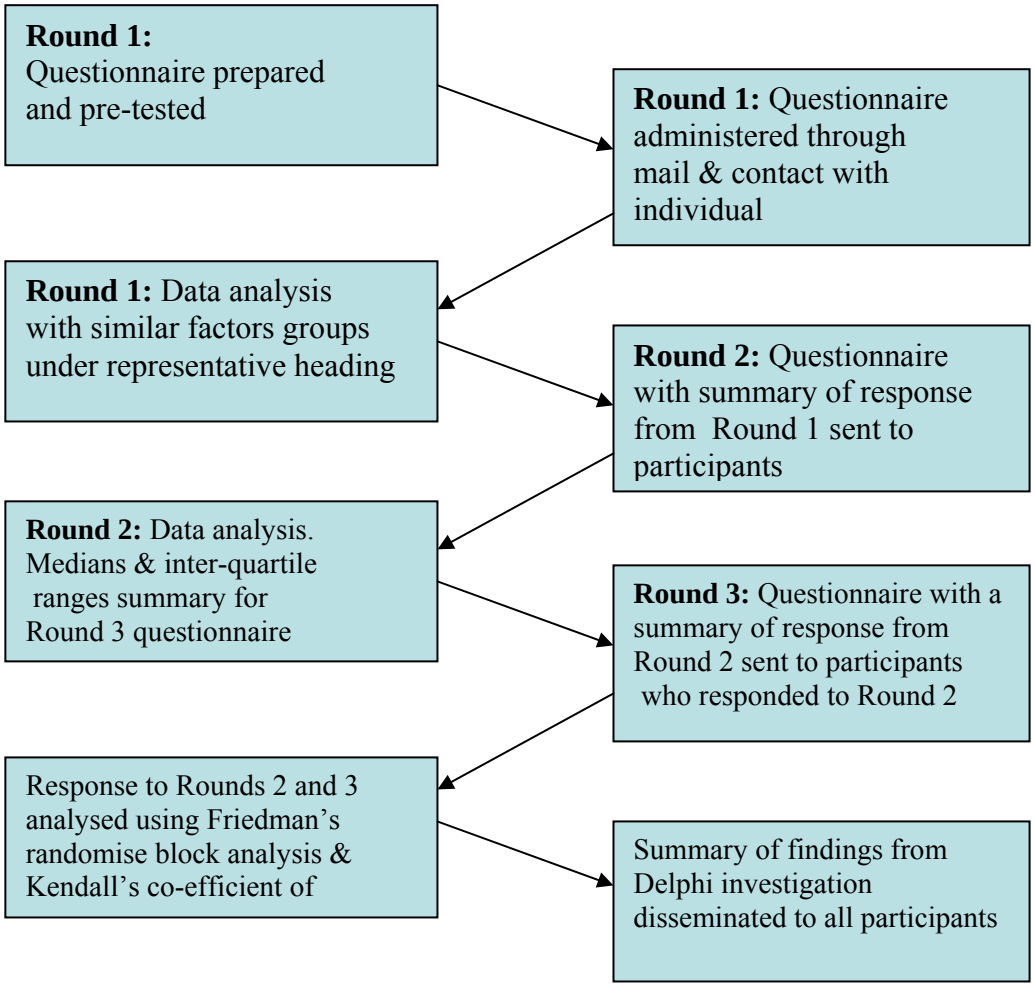

Figure 5. Flow chart for data collection and feedback to participants during three rounds of Delphi (Adapted from Bunting, 2008)

2.1 The application of the stakeholder Delphi in Vietnam

Taking inspiration from this model, the Stakeholder Delphi in the HighARCS project has been used to gather and share information, ideas, and viewpoints of all stakeholders who relate to aquatic resources conservation and development in order to facilitate a joint identification of the need for conservation, livelihoods and policy measures to be introduced.

Issues on which stakeholder opinions were sought from the stakeholder Delphi were selected in view of creating a shared understanding amongst stakeholders and local authorities which could be used to inform subsequent action planning for wise use of the aquatic resources. For this purpose, the DPSIR (Drivers, Pressures, State, Impact and Responses) framework was chosen as an appropriate framework to guide the formulation of questions for the stakeholder panel members. The issues thus selected included:

(1) Evaluation, remarks of stakeholders about the status of aquatic resources in study site (exploitation; use; biological diversity; problems and threats), policy, regulation (government and village), organization and implementation in aquatic resource conservation as well as

(2) Pressures and factors on the aquatic resources, and

(3) Suggestions of policy, implementation measures, organization.

2.2 Procedure

Stakeholder Delphi HighARCS in Vietnam were carried in 2 study sites of Son La and Quang Tri. The procedure consisted of 3 rounds as prescribed.

- *Round 1:* questionnaires with open thematic questions, structured according to a mixed combination of the DPSIR framework and a factorial framework distinguishing physical, environmental, managerial, institutional, economic, social and local livelihood-related factors were sent out and replies received. Responses were grouped into statements with similar contents (i.e. group different stakeholders' responses together if they have similar viewpoint). The team carefully checked statements given by the respondents to ensure correct interpretation of views.

- *Round 2:* The results of Round 1 were summarized into statements (ideas) and sent back to the panel members without mentioning who replied what, but only indicating number of panel members having expressed these ideas for each topic. Round 2 was explained as serving the purpose of continuing the collection of ideas in order to build a suitable policy on conservation and develop aquatic resources in the study sites and make agreement between all respondents. The participants were requested to read the result outputs (problems, factors and solutions) of Round 1 and ranking their level of importance on a scale of mark from 1-10 (1 is not important, 10 is the most important issues) on "Mark" column. The result of Responses were collected and summary output analyses made, calculating the median scores and the inter quartile range. This output was then used for the preparation of Round 3.

- Round 3 – The results of Round 2 were sent out again to exactly the same panel members who had responded in Round 2. In Round 3 participants were requested to read the result outputs Round 1 (viewpoint which were the summarizing ideas and number of people had answered for each topic) again, and see outputs from Round 2 (median scores and the inter

quartile range of responses from participants), still without revealing the identities of the panel members behind each score. As in Round 2, panel members were requested again to indicate his/her idea about level of important issues for Round 3 on a scale of mark 1-10 (1 is not important, 10 is the most important issues).

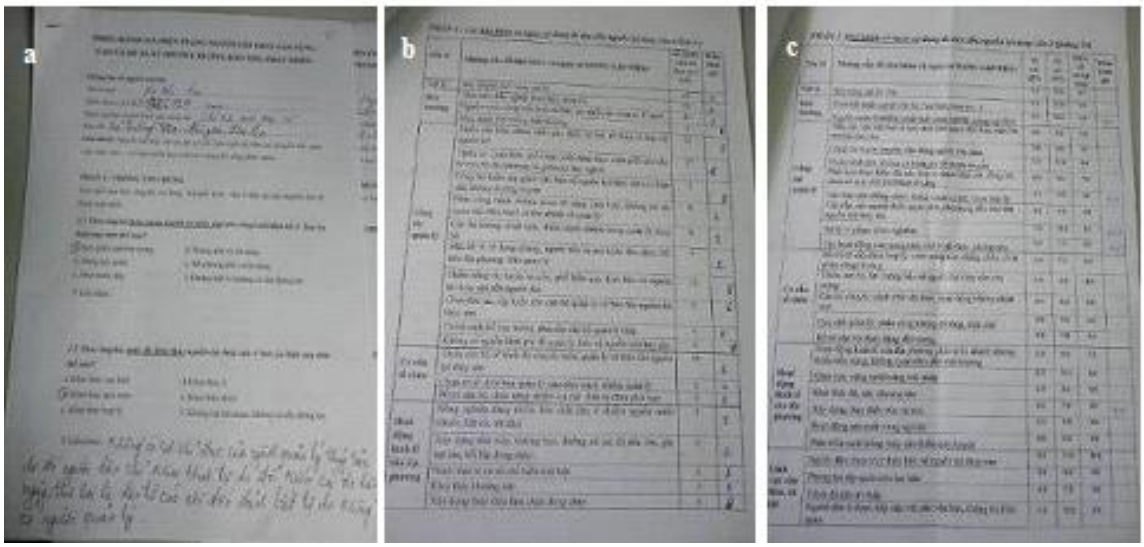

Figure 6. Three rounds of Delphi questionnaire: a. Round 1; b. Round 2; c. Round 3

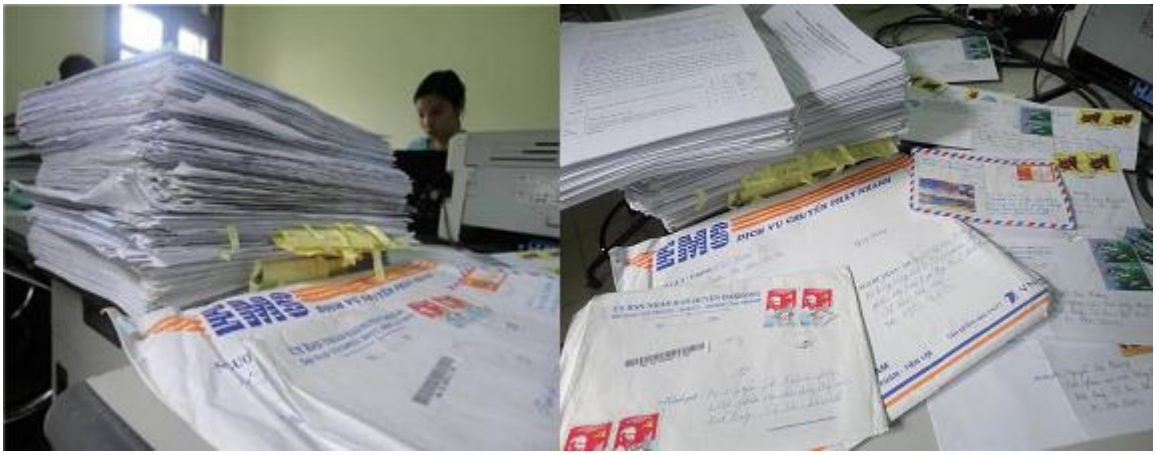

Figure 7. Data collection by mail

Data analysis: Summary statistics and tests, Friedman's Test and Kendall's W, were done using SPSS software with the formulae for these tests used for Delphi study. Outcomes were then analysed and discussed in order to identify concordance of stakeholder opinions on the importance of various resource management issues and corresponding response measures to be undertaken at the level of conservation, livelihoods and policies.

Table 1. Interpreting agreement and confidence associated with Kendall's coefficient of concordance (W)

Kendall's *W*	Agreement	Confidence in ranks
0.1	Very weak	None
0.3	Weak	Low
0.5	Moderate	Fair
0.7	Strong	High
0.9	Unusually strong	Very high

Source: Bunting, 2008. Aquacult Int. 16:153-169

2.3 Stakeholders at the HighARCS study sites in Vietnam

In order to conduct the stakeholder Delphi survey, relevant stakeholder groups dependent on or influencing the state of highland aquatic resources need to be identified and specific panel members from each group selected. In the case of the HighARCS project, it was decided that a panel of 40 to 50 members was needed and to be identified by the HighARCS project team amongst members from local communities, local administrations and the provincial administration. The selection of stakeholders was done through the following stakeholder mapping.

2.3.1 Stakeholders managing or regulating highland aquatic resources (government authorities)

In Vietnam, all of laws such as the fisheries law, the biodiversity law, the environment law and the decrees were drafted by the Ministries then Congress supplemented and modified and public. The Ministry gives guide document and transfer to the provinces level. The law and policies were concretized by province manager to suit with their province. District coordinated with community to implement the policy and monitor.

2.3.1.1 Province level

1 / Department of Agriculture and Rural Development: performing the function and the tasks of managing and protecting and developing forest, fisheries, water resources etc.; directing the implementation of policies related to the exploitation and protection of fisheries resources of the Ministry of Agriculture and Rural Development in the province level.

2/ Sub- Department of Agriculture and Rural Development: to guide the implementation of regulations to protect aquatic species such as time, method, minimum size, restricted areas
Aquaculture office of Department of agriculture and rural development: to guild the implementation of policies, plans, projects of aquaculture
3/. Department of resource and environment: to manage land, water, mineral resource, environment …this department responses in implementation of biodiversity policies.

2.3.1.2 District level

1/ Vice district chairmen is the manager of agriculture, forest, fish. He directs the professional agencies belong people's committees of district and commune level implementing legal documents, the development plan as well as controlling, supervising this implementing process
2/ Agriculture office: guild and organizing implementation of legal documents, planning in field of agriculture - forestry – fishery what relates to the aquatic resources as well as communicates.
3/ resource and environment office: organizing Implementation of the provisions of law in the protection of land resources, water resources, mineral resources and under the direction of people's committees

2.3.1.3 Commune level

Chairman of commune is head of the administrative organization in commune level, is responsible for management of economical-cultural-social in commune level and communicates legal matters and policies to local people. A Staff is responsible for agriculture, forestry and fishery field in local which he guilds directly local people planting, culture and protect aquatic resource. A staff is responsible for environment in local. Commune police is responsible for managing security in local and cooperate with the young team to patrol, arrest and sanction fishing people who use mines, explosives to fishing. All of the leader of each village have role and prestige in the village. They communicate and mobilize local people implementing right regular of State.

2.3.2 Non-government institutions, schools, unions and associations

Other stakeholders such as nature reservation, association, union, schools: There are many associations and union in community, this association can participate in communication policies and legal to the members. The natural environment protecting Education is the task of the schools.

2.3.3 Selection

A list of specific names and candidates was elaborated by the HighARCS team for each stakeholder group. In some cases, the candidates were approached directly by the HighARCS team. In other cases, for example with many of the government officers, the head of the office was approached and asked for advice on which staff member to include.

At the Son La Site 51 letters were sent out to the identified panel members. 44 panel members accepted to respond. At the Quang Tri Site 33 letters were sent out. 30 members accepted to respond.

3 Results of the stakeholder Delphi at the Vietnam sites

3.1 Results of the stakeholder Delphi Son La

At the Son La Site, 51 letters to panel members were sent out. 44 members responded in Round 1. Responses were grouped into three major categories: potential problems facing local aquatic resources; factors (drivers/pressures) influencing aquatic resources; and suggested actions for improved conservation of aquatic resources and improved livelihoods. The results were as follows.

3.1.1 Potential problems, constraints or threats facing aquatic resources in Son La

Potential problems, constraint or threats facing highland aquatic resources in Son La were grouped into categories of Physical, Environmental, Managerial, Institutional, Economic, Social as well as Livelihood of local people.

The *result of Round 1*was the identification/recording of the panel-member's perceptions concerning the physical, environmental, managerial, institutional, economic, social, and livelihood-related problems, constraints or threats to the ecosystem services provided from the local aquatic resources in Son La (cf. **Table 2.a.** on the next page).

Table 2.a. **List potential problems, constraints or threats facing highland aquatic resources in *Son La.* Rounds 1 & 2. The value (f) for Round 1 gives how many stakeholders mentioned this as an issue in the open questions (frequency of response) while the data in the following columns summarizes the importance of issues given by the panel members in Round 2 of each problem, constraint or threat (1=not important to 10 = the most important)**

Dimen-sion	Problems, constraints or threats	f (R1)	min	Q1 (25%)	Median (50%) (R2)	Q3 (75%)	max	N
Physical	Erosion. muddy	40	3.0	8.0	9.0	10.0	10.0	39
Environ mental	Hard climate condition	29	2.0	5.0	7.0	8.5	10.0	39
	Water pollution because of flooding	19	1.0	5.0	6.0	8.0	10.0	39
	Unregular water level changing	23	1.0	6.0	7.0	8.0	10.0	38
Manager ial	Not enough documents. policy and regulation in aquatic conservation	16	2.0	5.0	8.0	10.0	10.0	39
	Not well collaboration between stakeholders. don't have clear collaboration regulation from province to commune and between organization	12	2.0	5.0	8.0	9.0	10.0	38
	Examination. control and protection in aquatic resources is limited and irregular	23	2.0	3.5	7.0	8.0	10.0	39
	Not clear in responsible and unsuitable. don't have organization responsible in management	17	2.0	5.0	6.0	8.0	10.0	39
	Staffs are not enthusiastic and not responsible in lake management	13	1.0	2.0	4.0	6.0	10.0	39
	Water surface can use by all people. people from other province come for fishing so that cannot manage	5	1.0	5.0	7.0	9.5	10.0	39
	Don't have information transfer in aquatic resources conservation regulation	29	3.0	5.0	7.0	8.0	10.0	39
	Don't have training for local staff on aquatic conservation regulate	9	1.0	3.0	6.0	9.5	10.0	39

Dimen-sion	Problems, constraints or threats	f (R1)	min	Q1 (25%)	Median (50%) (R2)	Q3 (75%)	max	N
Managerial cont.	Support policy. salary for staff are low	4	1.0	3.0	6.0	10.0	10.0	38
	No budget for aquatic conservation	8	2.0	5.0	8.0	10.0	10.0	35
Institutional	Don't have staff have background in aquatic conservation	7	1.0	5.3	8.0	10.0	10.0	38
	Don't have organization/department are responsible for conservation	14	1.0	4.0	6.0	9.0	10.0	39
	Staff setting is not suitable	3	2.0	3.0	5.0	8.0	10.0	37
Economic	Agriculture use a lot of chemical that make water pollution (pesticide. herbicide)	23	2.0	5.0	6.0	8.0	10.0	39
	Build factory. School. road (high slope. soil erosion. current covered)	9	1.0	2.5	5.0	6.0	9.0	39
	Wastewater from factory	5	1.0	2.0	3.0	5.0	8.0	38
	Mineral mining	3	1.0	2.0	2.5	5.0	9.0	38
	Hydropower dam that prevent the current	5	1.0	1.3	3.0	7.0	10.0	38
Social	Old custom that affect to environment (natural exploiting habit. don't have environmental treatment systems systems)	5	1.0	5.3	7.0	8.8	10.0	38
	Local people not understanding about the useful of aquatic resources conservation	4	2.0	6.0	7.5	9.0	10.0	38
Livelihood of local people	Unsustainable fishing method: electric. chemical	4	3.0	6.0	8.0	10.0	10.0	38
	Not organize fishing	11	1.0	5.0	7.5	9.8	10.0	38
	Domestic waste	3	1.0	3.0	6.0	8.0	10.0	38
	Deforestation	4	2.0	5.0	7.5	9.0	10.0	38
	Boat discharge petrol that make water pollution	3	1.0	2.0	5.0	6.0	10.0	38

The first column of results in the table (frequency of responses Round 1) reads as follows:

Physical constraints: It comes out very clearly that almost everybody (40 out of 44) has observed the muddy quality of the water which used to be clear before the dam was built and sees this as a problem or constraint for various reasons which could be traced by referring to the ecosystem services assessment reported in D3.1 (water for drinking, washing, fishing…). 29 panel members have referred to "hard climate conditions" as an *environmental constraint*, Related to this, a few panel members (7) have observed "unregular water level changing", which is likely to be a reflection on the unpredictable levels of water retained in the reservoir behind the new dam. More than half the panel members (23) have noted "water pollution because of flooding" as a problem, referring to pesticides and various items of solid waste ending up in the river during flooding events.

Turning now to the *managerial problems and constraints*, categories of ideas and issues raised by the panel members were more plentiful. Ten (10) different issues were raised (compared to one (1) in the physical dimension and three (3) in the environmental dimension). The most frequently raised issue was related to "don't have information transfer in aquatic resources conservation regulation" (29). In other words, local authorities and local community members felt that they were unaware of which legal rules and decrees were in vigour with regards to the management and regulation of access to aquatic resources. Almost as many (23) pointed towards "Examination, control and protection in aquatic resources is limited and irregular". The unclear division of responsibilities and the lack of resource management capacity ("Not clear in responsible and unsuitable. Don't have organization responsible in management") were also mentioned quite a bit (17). This problem is presented almost identically under the *Institutional* dimension, where 14 panel members stated that they "don't have organization/department <that> are responsible for conservation".

Under the *economic problems* it is interesting to note that the most frequent issue raised was that "agriculture use a lot of chemical that make water pollution (pesticide; herbicide)" (23 panel members), but only a few (5) mentioned "hydropower dam that prevent the current". *Social constraints* were not referred to by many (4 or 5), and those who did only mentioned "old customs" or "local people not understanding about the useful of aquatic resources conservation". The local *livelihoods issues* also were not mentioned by many (3-

4) except the issue of fisheries not being well organised (11), already mentioned earlier under the institutional and managerial categories.

This result was shown to the panel members in *Round 2.* 39 panel members responded in this Round. The results from this Round can be seen in the remaining columns of **Table 2.a. above.** Looking at each of the problems or issues mentioned, they are all characterized by their notable lack of consensus amongst the panel members in the sense that opinions in many cases spread from 1 to 10. This will be further discussed below in section 3.1.4 (**Table 5)**. It can also be noted, however, that statements with high frequencies of mention in Round 1 also tend to have relatively high or medium high median scores in Round 2 (between 9 and 6).

Round 3

The result of Round 2 was now presented to the stakeholder panel members for a third Round.

Table 2.b – Problems and constraints at the Son La Site - Round 3. **The value (f) for Round 1 gives how many stakeholders mentioned this as an issue in the open questions (frequency of response) while the data in the following columns summarizes the importance of issues given by the panel members in Round 3 of each problem, constraint or threat (1=not important to 10 = the most important)**

	Problems. constraints or threats	**f (R1)**	**min**	**Q1 (25%)**	**Median (50%) (R3)**	**Q3 (75%)**	**max**	**N**
Phys-ical	Erosion. muddy	40	7.0	9.0	9.0	9.0	10.0	39
Envi-ron-ment-al	Hard clime condition	29	7.0	7.0	7.0	8.0	10.0	39
	Water pollution because of flooding	23	5.0	6.0	6.0	7.0	10.0	39
	Unregular water level changing	7	4.0	6.0	6.0	8.0	10.0	39

	Problems. constraints or threats	f (R1)	min	Q1 (25%)	Median (50%) (R3)	Q3 (75%)	max	N
Man-age-rial	Not enough documents. policy and regulation in aquatic conservation	16	6.0	8.0	8.0	8.0	10.0	39
	Not well collaboration between stakeholders. don't have clear collaboration regulation from province to commune and between organization	12	5.5	8.0	8.0	8.0	10.0	39
	Examination. control and protection in aquatic resources is limited and irregular	23	5.0	6.0	7.0	8.0	9.0	39
	Not clear in responsible and unsuitable. don't have organization responsible in management	17	5.0	7.0	7.0	8.0	10.0	39
	Staffs are not enthusiastic and not responsible in lake management	13	3.0	4.0	4.0	5.0	10.0	39
	Water surface can use by all people. people from other province come for fishing so that cannot manage	5	6.0	7.0	7.0	9.0	10.0	39
	Don't have information transfer in aquatic resources conservation regulation	29	7.0	8.0	8.0	8.0	10.0	39
	Don't have training for local staff on aquatic conservation regulate	9	4.0	5.0	6.5	8.0	10.0	39
	Support policy. salary for staff are low	4	2.5	5.0	5.0	8.0	10.0	39
	No budget for aquatic conservation	8	6.0	7.0	7.0	8.0	10.0	39

	Problems. constraints or threats	f (R1)	min	Q1 (25%)	Median (50%) (R3)	Q3 (75%)	max	N
Insti-tutional	Don't have staff have background in aquatic conservation	7	7.0	8.0	8.0	9.0	10.0	39
	Don't have organization/ department are responsible for conservation	14	5.0	5.0	5.0	8.0	10.0	39
	Staff setting is not suitable	3	5.0	5.0	5.0	7.0	9.0	39
Econo mic	Agriculture use a lot of chemical that make water pollution (pesticide. herbicide)	23	5.0	6.0	6.0	7.0	10.0	39
	Build factory. School. road (high slope. soil erosion. current covered)	9	3.0	5.0	5.0	5.0	9.0	39
	Wastewater from factory	5	2.0	3.0	3.0	3.0	8.0	39
	Mineral mining	3	2.0	3.0	3.0	3.0	7.0	39
	Hydropower dam that prevent the current	5	1.0	3.0	3.0	3.0	9.0	39
So-cial	Old custom that affect to environment (natural exploiting habit. don't have environmental treatment systems systems)	5	5.0	7.0	7.0	8.0	10.0	39
	Local people not understanding about the useful of aquatic resources conservation	4	7.0	8.0	8.0	9.0	10.0	39
Liveli-hood of local people	Unsustainable fishing method: electric. chemical	4	5.0	8.0	8.0	8.0	10.0	39
	Not organize fishing	11	5.0	6.0	7.0	8.0	9.0	39
	Domestic waste	3	5.0	8.0	8.0	8.0	8.0	39
	Deforestation	4	1.0	4.0	4.0	4.0	8.0	39
	Boat discharge petrol that make water pollution	3	5.0	8.0	9.0	9.0	10.0	39

Table 2.b above shows the results of Round 3.

In *Round 3*, the 39 panel members remained and answered. As it will appear from the Friedman's X^2_F and the Kendall's W tests presented in **Table 4** shown in section 3.1.4 further below, the stakeholder agreement increased considerably. In most cases, consensus narrowed in around the announced median value from Round 2 (16 statements out of 29). In most of the remaining responses (10 out of 13), the median value either rose or decreased by one score. But in the case of three livelihood factors, there was a major change in median agreement value: Domestic waste (from 6.0 to 8.0), Boat discharge (water pollution) rose from 5.0 to 9.0; whereas Deforestation as a factor fell from 7.5 to 4.0.

3.1.2 Stakeholder views on relevant factors (drivers and pressures) impacting on aquatic resources in Son La

This section explores what the stakeholder panel members see as the main drivers and pressures causing the problems mentioned above. In principle, the research team applied the same categories as before, except that there were no "physical" drivers or pressures identified.

It is noteworthy that there are not as many statements, suggestions or opinions expressed by the stakeholder panel members at this level of analysis (13) as at the problems level (29). This observation may point to a need for working more with the stakeholders on joint analysis of the situation.

This observation having been made, it is also striking that half the panel members, under the *management drivers,* pointed to "economic activities is selves develop, small and don't have the management" (15), meaning that local people try to adapt to the new conditions given by the dam (and the rapid economic development of Vietnam) the best they can at their household level and have not yet developed, received support for or acquired the appropriate management skills and knowledge.

Table 3.a: Factors (drivers) of relevance to aquatic resources in river/stream/ in Sơn La – Rounds 1 & 2. **Data as in Table 2a.**

Relevant drivers	f (R1)	Min	Q1	Median (R2)	Q3	Max	n
Environmental							
Climate change	3	1	3	5	7	10	38
Management							
Plan/policy of party and government	7	1	5	6.5	8	10	38
Not well management	3	2	3	5	8	10	38
Staffs are responsible for many things	1	1	1	5	7.75	10	38
Bad infrastructure and not well	10	1	5.75	8	9	10	36
Economic activities are selves develop. small and don't have the management	15	2	5	7.5	9	10	38
Lack of investment	2	1	4	7	9	10	37
Social and economic							
Social organization activities and	4	2	4	5	7	10	38
Education/culture	14	2	6	7	9.75	10	38
Bad in information transfer	1	1	3	6	6.5	10	35
Social culture in environment and fishing is not built	1	1	3.25	5	8	10	38
Livelihood of local people							
Less productive. don't have techniques	5	1	5	6.5	8	10	38
High slope. lack of land for farming	7	3	6	8	8.75	10	38

The claim corresponds quite well with the second most stated factor: "education/culture", mentioned under the category *Social and economic"* by 14 panel members. Two other *management drivers* also merit to be mentioned: "Bad infrastructure and not well plan" (10) and "planning policy of Party and the Government" (7). In other words, the stakeholder panel members point towards weak management capacities, both at the local and the national level.

Lack of capacity also appears amongst the drivers mentioned under *"Livelihood of local people"*, where a driver was identified to being "less productive, don't have techniques" (5). But differently, "high slope, lack of land for farming" was also mentioned under the livelihoods-related pressures (7). This partially is a reflection of the changed conditions for practising agricultural activities at the site, with large areas of the river valley having disappeared into the lake behind the dam, or are being frequently flooded.

The remaining seven propositions were mentioned by less than 5 panel members. "Climate change" was the only *Environmental* driver mentioned here (3).

Round 2 responses for the relevant factors/drivers behind the problems of the aquatic resources in Son La show the same pattern of great diversity of opinions amongst the panel members with minimum scores all ranging from 0 to 3 and maximum scores for all being 10! This applies even for the most commonly proposed statements. Median scores ranged between 5 and 8, which is less diverse than median opinions on the problems and threats. The most commonly proposed statements also tend to be the higher median scores (between 6.5 and 8).

Round 3 responses repeated the pattern from the section on problems. Consensus increased substantially, centring on the median values, which remained constant from Round 2 to Round 3 in 8 out of 13 statements. The median score increased or decreased by 0.5 to 1.0 points in the remaining 5 statements. Most consensus and highest median score (8.0) was given to the statements "high slope; lack of land for farming" and "bad infrastructure and not well plan".

Table 3.b Factors (drivers) of relevance to aquatic resources in river/stream/ in Sơn La – Round 3. Data as in Table 2.b.

	Round 1	Round 3					
Relevance issues	**f**	**Min**	**Q1**	**Median (R3)**	**Q3**	**Max**	**n**
Environmental							
Climate change	3	5	6	6	6.5	9	39
Management							
Plan/policy of party and government	7	6	6.5	6.5	7.75	9	39
Not well management	3	4	5	5	8	10	39
Staffs are responsible for many things	1	3	5.5	5.5	6.5	8	39
Bad infrastructure and not well	10	7	8	8	8	9	39
Economic activities are selves develop. small and don't have the management	15	6	7	7	8	9	39
Lack of investment	2	6	7	7	9	10	39
Social and economic							
Social organization activities	4	4	5	5	6	9	39
Education/culture	14	5	7	7	7	10	39
Bad in information transfer	1	5	6	6	6	8	39
Social culture in environment and fishing is not built	1	5	6	6	7	10	39
Livelihood of local people							
Less productive. don't have techniques	5	6	7	7	8	10	39
High slope. lack of land for farming	7	7	8	8	8.5	10	39

3.1.3 Stakeholder suggestions for responses in Son La

The last part of the stakeholder Delphi explored the suggestions from the panel members on the responses to be given to the observed problems, threats, and issues. The research team grouped the suggestions into six major categories: institutional and management, training and education, more regulation, policy and action plan, local activities, and economic development.

Table 4.a.1: Suggestion for implementation, activities, policy, institutional to better management and suitable utilization of aquatic resources – institutional & management Rounds 1 & 2. Data as in table 2.a.

Suggestion	f (R1)	Min	Q1	Median (R2)	Q3	Max	n (R2)
1. Suggestion for institutional and management							
Distribution of areas and responsible of river for commune manage	4	1	5	8	10	10	38
Establish groups/ department to protect aquatic resources. and environment in each commune	13	2	8	9	10	10	38
Clear given the responsible and function on protect aquatic resource	1	1	3	7	10	10	37
Setting staff to manage fishing on the river	7	1	5	8	10	10	38
Responsible staff need regularly report to people committee	1	1	4	5.5	10	10	38
Need staff to protect aquatic resource from district to commune	8	1	6	8	10	10	38
Need collaboration from district to village	3	1	4	7.5	10	10	36
All level need to implement the protection rules	1	1	5	7	10	10	38
Government need to notice the changing of water level for local people	1	1	4	8	10	10	38
Environmental impact assessment and natural recover after finishing hydropower project	1	1	5	7	9	10	37

Table 4.a.1 is the first sub-table out of six sub-tables on *suggestions.* In contrast with the relative few ideas on the pressures and drivers behind the problems, a richness of ideas and *suggestions (*55) were recorded in *Round 1.* However, most of the ideas and suggestions had only been given by a single or a few panel members. In each major category, only two to four suggestions were given with frequencies higher than 7, and in some of the

categories none of the suggestions were given with a frequency higher than 4. The first category was "institutional and management."

10 different suggestions were given in relation to *Institutional and Management responses.* The most frequently suggested response was to "establish groups/ department to protect aquatic resources and environment in each commune" (13). Second most frequently suggested response was to accommodate the "need <for> staff to protect aquatic resource from district and commune" (8), and thirdly "setting staff to manage fishing on the river" (7). Reponses like "Government need to notice the change of water level for local people" or "Environmental impact assessment and natural recover after finishing hydropower project" were only suggested by one single panel member each.

Moving now to **Table 4.a.2.**, clearly the mostly suggested response direction was *Training and Education.* Here 25 panel members suggested "Training on fish culture", the highest frequency of all the 55 suggested responses. A response phrased as "propaganda local people in aquatic resources conservation" came in second (16).

Table 4.a.2.: Suggestion for implementation, activities, policy, institutional to better management and suitable utilization of aquatic resources – training, education. Data as in table 2.b.

2. Suggestion for training and education	f (R1)	Min	Q1	Median (R2)	Q3	Max	n (R2)
Propaganda local people in aquatic resources conservation	16	2	8	9	10	10	38
Training for local staffs and awareness raising in aquatic	4	1	4.25	8	10	10	38
Training on fish culture	25	2	8	10	10	10	38
Training on suitable fishing	5	3	5	8	10	10	37
Training on husbandry and	5	1	5	8	10	10	38
Setting some model in aquaculture	1	1	5.25	8	10	10	38
Transferring technique on reproduction of fish	1	1	4.25	8	10	10	38

The third category has grouped responses under the common designation: *More Regulation* (**Table 4.a.3)**. It contains five (5) suggestions, none of which are stated with a frequency above 5 ("Regulation which species and tools and not allowed for fishing").

Table 4.a.3.: Suggestion for implementation, activities, policy, institutional to better management and suitable utilize aquatic resources – "Regulation" – Rounds 1 & 2

3. Suggestion to have more regulation	**F (R1)**	**Min**	**Q1**	**Median (R2)**	**Q3**	**Max**	**n (R2)**
Should have rule for punishment and encouragement	2	1	5	6.5	9.75	10	38
Manage people from other areas come for fishing	1	1	5	8	10	10	38
Setting rule to punish people using light net for fishing	1	1	5	6	10	10	37
Regulation which species or tools are not allow for fishing	5	1	5.25	7.5	10	10	38
Don't not allow to discharge house waste over 100 m	1	1	4	6.5	9.75	10	38

Section 4 is related to *policy and action plan* (**Table 3.a.4.)**. In this category, eleven responses were suggested, of which two responses should be noticed: "Making detailed plan and policy for implementation" (19), and "supporting money for people in the fishing areas" (17).

Table 4.a.4: Suggestion for better management and suitable utilize aquatic resources – "Policy and Action Plan" Rounds 1 & 2

4. Suggestion on policy and action plan *(continued next page)*	**f (R1)**	**Min**	**Q1**	**Median (R2)**	**Q3**	**Max**	**n (R2)**
Making detail plan and policy for implementation	19	5	8	10	10	10	37
Master plan for breeding areas. fishing areas to protect resources and landscape of the river	2	1	5	7	10	10	37
Government should keep stable water level in the river	3	1	4	7.5	10	10	36
Plant and protecting forest	3	1	6	8	10	10	37
Budget for aquatic resource conservation	3	1	7	8	10	10	36
Investment for aquaculture and fishing	5	1	7	8	10	10	36
Policy supporting for management staffs	5	2	5.75	8	10	10	36
Support tools for farming	1	1	5	8	10	10	36
Supporting on seed and animal	3	2	5.75	8.5	10	10	36

4.Policy & Action plan - continued	**f (R1)**	**Min**	**Q1**	**Median (R2)**	**Q3**	**Max**	**n (R2)**
Supporting in techniques	1	1	5.75	8	10	10	36
Supporting money for people in the fishing areas	17	1	8	10	10	10	35

The fifth category is termed *Local Activities* (**Table 4.a.5.)**. It contains a number of suggestions (8) concerning local infrastructure (market facilities, "infrastructure", setting market chain) and economic development as below.

Table 4.a.5.: Suggestion for implementation, activities, policy, institutional to better management and suitable utilize aquatic resources – "Local Activities" – Round 1 & 2

1. **Suggestion local activities**	**f (R1)**	**Min**	**Q1**	**Median (R2)**	**Q3**	**Max**	**n (R2)**
Building market to exchange between	1	1	3.75	6	10	10	36
Improving infrastructure	2	1	5	8	10	10	36
Project on aquaculture and fishing for	4	3	5.75	7.5	10	10	36
Setting market chain	2	1	6	7.5	10	10	36
Aquaculture on the river. Cage culture	2	1	5.75	8	10	10	36
Setting model on economic-culture	2	1	4.75	8	10	10	36
Develop husbandry. aquaculture	1	1	5	8	10	10	36
Develop economic link with protect environment and aquatic resources	2	1	6	8	10	10	35

Finally, the panel members have suggested a number of responses concerning *Economic Development* (see **Table 4.a.6** below/next page). The suggestions appear quite diversified, although "research on aquaculture: which species are suitable" came out with the highest frequency (7).

Table 4.a.6: Suggestion for implementation, activities, policy, institutional to better management and suitable utilize aquatic resources – "Economic Development" – Round 1 & 2

2. **Suggestion on economic development**	**f (R1)**	**Min**	**Q1**	**Median (R2)**	**Q3**	**Max**	**n (R2)**
Setting village regulation on aquatic resources	4	3	5	9	10	10	36
Setting culture on fishing for local people awareness raising	1	1	5	8	10	10	36
Communities need to sign on the agreement on aquatic resources	1	1	4.75	7	10	10	36
Research on suitable fishing tool and cheap methods	4	1	5	7	10	10	36
Research water level to make plan for farming	1	1	5.75	8	10	10	36
Develop tourism and market on the river	2	1	5	7.5	10	10	36
Organizing communities activities	1	1	3.5	7	9	10	35
Setting up 1 culture room in each village	2	1	6	8	10	10	37
Setting up football. singing and transfer information in each commune	1	1	5	8	10	10	37
Improving education	2	1	6	10	10	10	37
Research on aquaculture: which species is suitable	7	5	7	9	10	10	37
Monitoring on aquatic resources	3	2	5	8	10	10	37
Restocking	4	1	6	8	10	10	37
Setting project on develop aquatic resource	1	1	7	9	10	10	37

When the results of Round 1 were presented with the frequency statements, *Round 2* produced responses characterized by general disagreement on most of the proposals, scores for each proposal ranging from 1-2 to 9-10. A few proposals showed more consensus from the start: "making detailed plan and policy for implementation" (min score: 5; max score 10) and "research on aquaculture: which species are suitable" (min score: 5; max score:

10). However, looking at the interquartile distribution, obviously the proposals which had received a high frequency of response in Round 1 tended to have high median scores in Round 2, with the interquartile range lying between the scores of 8 to 10.

In *Round 3,* 39 panel members responded. The minimum scores rose considerably (from 0-3 to 5-8). Most median scores remained stable from Round 2 to Round 3 (33 out of 55), and the others showed a slight decline by 0.5 to 1.0 points (a single decline was 1.5).

Table 4.b (1-6). Suggestions Son La, Round 3. Data as previous.

Suggestion	f (R1)	Min	Q1	Median (R3)	Q3	Max	n (R3)
1. Suggestion for institutional and management							
Distribution of areas and responsible of river for commune manage	4	8	8	8	9	10	39
Establish groups/ department to protect aquatic resources. and environment in each commune	13	5	9	9	9	10	39
Clear given the responsible and function on protect aquatic resource	1	5	5.5	6	9	10	39
Setting staff to manage fishing on the river	7	7	8	8	8	10	39
Responsible staff need regularly report to people committee	1	5	5.5	5.5	6.5	9	39
Need staff to protect aquatic resource from district to commune	8	6	8	8	8	10	39
Need collaboration from district to village	3	6	7	7	7	10	39
All level need to implement the protection rules	1	5	6	6	6	9	39
Government need to notice the changing of water level for local people	1	8	8	8	8.5	10	39
Environmental impact assessment and natural recover after finishing hydropower project	1	6	6.5	6.5	7	9.8	39

Suggestion	f (R1)	Min	Q1	Median (R3)	Q3	Max	n (R3)
2. **Suggestion for training and education**							
Propaganda local people in aquatic resources conservation	16	8	9	9	9	10	39
Training for local staffs and awareness raising in aquatic resources conservation	4	6	8	8	8	10	39
Training on fish culture	25	8	10	10	10	10	39
Training on suitable fishing	5	5	7.5	7.5	8.5	10	39
Training on husbandry and farming	5	6	8	8	8.5	10	39
Setting some model in aquaculture	1	4	8	8	9	10	39
Transferring technique on reproduction of fish	1	5	7	7	8	10	39
3. **Suggestion to have more regulation**							
Should have rule for punishment and encouragement	2	5	6	6	8	10	39
Manage people from other areas come for fishing	1	2	6.5	6.5	8	10	39
Setting rule to punish people using light net for fishing	1	5	5.5	5.5	7	10	39
Regulation which species or tools are not allow for fishing	5	5	7	7	8.25	10	39
Don’t not allow to discharge house waste over 100 m	1	5	6.5	6.5	7.25	10	39

Suggestion	F (R1)	Min	Q1	Median (R3)	Q3	Max	n (R3)
4. Suggestion on policy and action plan							
Making detail plan and policy for implementation	19	7	10	10	10	10	39
Master plan for breeding areas. fishing areas to protect resources and landscape of the river	2	5	6	6	7	10	39
Government should keep stable water level in the river	3	8	8	8	9	10	39
Plant and protecting forest	3	7	8	8	9.25	10	39
Budget for aquatic resource conservation	3	6	8	8	9	10	39
Investment for aquaculture and fishing	5	7	8	8	9	10	39
Policy supporting for management staffs	5	6	8	8	9	10	39
Support tools for farming	1	6	8	8	9	10	39
Supporting on seed and animal	3	7	8.5	8.5	9	10	39
Supporting in techniques	1	7	7.5	7.5	8.5	10	39
Supporting money for people in the fishing areas	17	8	10	10	10	10	39

Suggestion	F (R1)	Min	Q1	Median (R3)	Q3	Max	n (R3)
5. Suggestion local activities							
Building market to exchange between villages	1	5	6	6	7	10	39
Improving infrastructure	2	6	8	8	8	10	39
Project on aquaculture and fishing for each areas	4	6	7	7	9	10	39
Setting market chain	2	6	7	7	7	10	39
Aquaculture on the river. Cage culture	2	8	8	8	8	10	39
Setting model on economic-culture and social	2	7	8	8	8	10	39
Develop husbandry. aquaculture	1	8	8	8	8	10	39
Develop economic link with protect environment and aquatic resources	2	8	8.5	8.5	8.5	10	39
6. Suggestion on economic development							
Setting village regulation on aquatic resources	4	7	8.5	8.5	8.5	10	39
Setting culture on fishing for local people awareness raising	1	7	8	8	8	10	39
Communities need to sign on the agreement on aquatic resources	1	7	7	7	8	10	39
Research on suitable fishing tool and cheap methods	4	6	6.5	6.5	7.5	10	39
Research water level to make plan for farming	1	6	8.5	8.5	9.25	10	39
Develop tourism and market on the river	2	7	7.5	7.5	7.75	10	39
Organizing communities activities	1	6	6	6	6	9.5	39
Setting up 1 culture room in each village	2	8	8	8	9	10	39
Setting up football. singing and transfer information in each commune	1	7	8	8	8	10	39
Improving education	2	8	9	9	9	10	39
Research on aquaculture: which species is suitable	7	8	9	9	9	10	39

Suggestion	f (R1)	Min	Q1	Median (R3)	Q3	Max	n (R3)
Monitoring on aquatic resources	3	7	7.5	7.5	7.75	10	39
Restocking	4	8	8	8	8	10	39
Setting project on develop aquatic resource	1	8	9	9	9	10	39

3.1.4 Tests of concordance for the Son La site

The impression of a very weak level of concordance in Round 2 at all three main levels of analysis (problems, drivers, and responses) is confirmed by the Friedman's X2F and Kendall's W tests as shown in **Table 5.a.** below. It also comes out clearly, that the application of the stakeholder Delphi Technique has had quite a strong impact on efforts to reach consensus, as the Agreement rose to moderate-strong levels with a fair-high level of confidence.

Table 5.a.: Value for Friedman's X^2_F and the probability levels P (versus the null hypothesis of no concordance) indicated and Kendall's W for round 2 and 3 – The level of agreement and confidence levels

Research area	Friedman's X^2_F	P	Kendall's W	Agreement	Confidence
Round 2					
Potential problems, constraints or threats facing highland aquatic resources	210.473	0.000	0.259	Weak	Low
Factors relevance to aquatic resources in river	27.983	0.000	0.073	Very weak	Non
Suggestion for implementation, activities, policy, institutional to better management and suitable utilize aquatic resources	211.537	0.000	0.140	Very weak	Non
Round 3					
Potential problems, constraints or threats facing highland aquatic resources	710.033	0.000	0.650	Moderate-Strong	Fair-High
Factors relevance to aquatic resources in river	283.194	0.000	0.605	Moderate-Strong	Fair-High
Suggestion for implementation, activities, policy, institutional to better management and suitable utilize aquatic resources	1272.931	0.000	0.604	Moderate-Strong	Fair-High

For Round 3, it is also interesting to note, that the overall moderately-strong consensus achieved covers some variation at the sub-category level (**Table 5.b. below/next page)**. There is a strong or unusually Strong *agreement on the institutional and economic problems experienced* with regards to aquatic resources in Son La, whereas there is only *a weak-moderate consensus concerning the importance of managerial problems* or threats.

There was *strong consensus on the mentioned livelihood problems, as well as livelihood-issues as drivers* of the degradation of aquatic resources in the area. Panel members agreed less on the threats originating from *social conditions* (such as old customs or lack of awareness).

Concerning the *drivers*, agreement was moderate to moderately strong at the level of environmental and institutional factors, but agreement was strong to unusually Strong at the level of the *livelihood factors.*

Table 5.b.: Friedman's X^2_F at the probability levels P indicated and Kendall's W for rank pattern for Round 3 - Agreement and confidence levels

Research area	Friedman's X^2_F	P	Kendall's W	Agreement	Confidence
Part 1. Potential problems, constraints or threats facing highland aquatic resources					
Environmental and Physical	62.409	0.000	0.533	Moderate	Fair
Managerial	147.327	0.000	0.420	Weak-Moderate	Low-Fair
Institutional	62.826	0.000	0.805	Strong-Unusually strong	High-very high
Economic	138.111	0.000	0.885	Unusually Strong	Very high
Social	20.829	0.000	0.534	Moderate	Fair
Livelihood of local people	106.003	0.000	0.680	Strong	High
Part 2. Factors relevance to aquatic resources in river					
Environmental	104.593	0.000	0.536	Moderate	Fair
Institutional, management	65.127	0.000	0.557	Moderate-Strong	Fare-High
Livelihood	30.118	0.000	0.772	Strong-Unusually Strong	High-Very high

Continued next page

Part 3: Suggestion for implementation, activities, policy, institutional to better management and suitable utilize aquatic resources					
Suggestion for institutional and management	233.381	0.000	0.665	Strong	High
Suggestion for training and education	130.288	0.000	0.557	Moderate-Strong	Fair-High
Suggestion to have more regulation	63.741	0.000	0.409	Weak-Moderate	Low-Fair
Suggestion on policy and action plan	228.574	0.000	0.586	Moderate-Strong	Fair-High
Suggestion local activities	158.727	0.000	0.581	Moderate-Strong	Fair-High
Suggestion on economic development	346.379	0.000	0.683	Strong	High

At the level of *responses (suggested actions),* levels of agreement did not differ quite as much as on the 'problems' and 'drivers' levels. Agreement was strong concerning suggestions for institutional and management responses and the suggestions for economic development. Agreement was moderately-strong with regards to suggestions for training and education; policy and action plan; and for local activities. And – reflecting the weak agreement at the 'problems level', there was a similar weak-to-moderate agreement on the suggestions to have more regulation.

3.2 Results of the stakeholder Delphi in Quang Tri

3.2.1 Potential problems, constraints or threats facing aquatic resources in Quang Tri

At the site around the Dakrong River in Quang Tri, the same procedure as described for the Son La site was followed. The team sent out 33 letters for selected panel members with open ended questions structured around seven main categories (physical, environmental, managerial, etc.). 30 members responded in Round 1.

Results of Round 1

On the *physical dimension,* according to the panel members in Quang Tri, the soil erosion and consequent muddy quality of the river was observed by 22 panel members. There were no other suggestions. For the *environmental dimension* of the problems and threats, there

were two suggestions.22 panel members suggested the hard climate conditions in the sense of extreme weather events such as flooding, heavy rain etc. 14 panel members suggested also "water polluted" from industry and agricultural waste (see **Table 6.1.a.** below).

Moving to the *managerial dimension,* expressed problems and threats were more diverse (8). Most of the panel members (17) have pointed to "not well collaboration between stakeholders, don't have clear collaboration regulation", whereas the other managerial issues such as "information transfer to local people not good" (4) or "not enough finance, no budget for information transfer" (2) are mentioned by only a few panel members.

The panel members have mentioned 5 *institutional issues*, amongst which the "lack of staffs and human resources for aquatic resources conservation" is the most frequently mentioned (11).

The awareness of *economic problems and threats* on the aquatic resources seems high, judging from the frequency of responses given on this dimension. Most frequently is mentioned the construction of medium and small hydropower dams (23), illegal gold mining (19), and "exploiting stone, sand, mineral" (16).

Table 6.1.a. **List potential problems, constraints or threats facing highland aquatic resources in *Quảng Trị. Rounds 1 & 2.* The value (f) for Round 1 gives how many stakeholders mentioned this as an issue in the open questions (frequency of response) while the data in the following columns summarizes the importance of issues given by the panel members in Round 2 of each problem, constraint or threat (1=not important to 10 = the most important)**

Dimension	Problems, constraints or threats	f (R1)	min	Q1 (25%)	Median (50%) (R2)	Q3 (75%)	max	n
Physical	Erosion, muddy	22	5.0	7.0	8.0	10	10	25
Environmental	Hard clime condition (flood, drought, heavy rain...)	22	1.0	6.5	8.0	10	10	27
	Water polluted (industry/agriculture waste)	14	1.0	5.0	8.0	10	10	25

Managerial	Staffs less access on document and policy in aquatic resources	1	1.0	5.0	6.0	7.5	10	27
	Information transfer to local people not good	4	3.0	5.0	7.0	9.0	10	26
	Not enough finance, no budget for information transfer	2	1.0	5.0	8.0	10	10	27
	Not well collaboration between stakeholders, don't have clear collaboration regulation	17	2.0	5.0	7.0	8.0	10	27
	Less, not suitable, too general and overlap regulation	7	1.0	4.0	5.0	6.0	10	27
	Stakeholders are not concentrate on aquatic conservation	3	2.0	3.5	5.0	7.0	10	27
	Not good in punishment	1	1.0	6.5	8.0	10	10	27
	Formalist in style of activities	2	1.0	4.0	6.0	7.0	10	26
	Problems, constraints or threats	**f (R1)**	**min**	**Q1 (25%)**	**Median (50%) (R2)**	**Q3 (75%)**	**max**	**n**
Institutional	Not well structure, overlap and not clear in function	7	2.0	4.0	5.0	7.0	10	27
	Lack of staffs and human resources for aquatic resources conservation	11	3.0	3.5	8.0	9.0	10	27
	Responsible staffs are low education and not enthusialism	5	1.0	3.5	5.0	6.0	10	27
	Management regulation not clear and detail	4	1.0	4.5	6.0	7.0	10	27
	Staff setting is not suitable	1	1.0	4.0	5.0	6.0	10	26
Economic	Quick local economic develop but not sustainable and not concentrate on environmental	2	1.0	5.0	6.0	8.0	10	27

	protection							
	Illegal gold mining	19	1.0	6.5	9.0	10	10	27
	Exploiting stone, sand, mineral	16	1.0	5.0	5.0	8.0	10	27
	Construction of medium and small hydropower dam	23	1.0	3.0	5.0	6.75	10	26
	Agriculture activities	1	1.0	2.0	5.0	6.5	10	27
	Aquaculture development without master plan	1	1.0	4.0	6.0	8.0	10	27
Social	Local people are not aware in aquatic resources conservation	9	1.0	6.0	9.0	10	10	27
	Backward custom	9	1.0	3.0	5.0	7.0	10	27
	Low education	1	1.0	4.0	5.0	7.5	10	27
	Local people are less approaching to documents and relevant information	2	1.0	5.0	8.0	9.0	10	27

	Problems, constraints or threats	f (R1)	min	Q1 (25%)	Median (50%) (R2)	Q3 (75%)	max	n
Liveli-hood of local people	Livelihood of local people are unprompted and not be managed	1	1.0	4.0	6.0	8.0	10	27
	Unsustainable and destructive fishing methods	19	1.0	7.25	9.5	10	10	26
	Fishing is the main income of local people (for family consumption)	4	1.0	4.5	5.0	7.0	10	27
	Livelihood of local people have many difficulties	3	2.0	7.0	8.0	9.5	10	27

When asked about *social* threats and problems, the panel members have evoked "backward customs" (9) and lack of awareness of aquatic resources conservation (9) as the two most frequently mentioned issues out of a total of 4.

Finally, amongst the *livelihoods issues* mentioned, the "unsustainable and destructive fishing methods" was an issue mentioned by 19 panel members, the three other issues were only mentioned by very few panel members, such as "livelihood of local people are unprompted and not be managed" (1) or "livelihood of local people have many difficulties" (3).

This result was now presented to the 30 panel members having responded in Round 1 for *Round 2* (also presented in **Table 6.1.a** above). 27 panel members responded this time. However, a few of the respondents had omitted or forgotten to give scores to one or two questions, which is why **n=** varies between 27 and 25 in Table 6.1.

As it will be shown in 3.1.4 (**Table 7)**, the test of concordance of Round two showed quite some disagreement. All statements had maximum scores of 10 and all but one minimum scores of 1-3. The statement that "Erosion and Muddy" is a problem had a minimum score of 5. Median scores for those statements having high frequencies of response in Round 1 tended to be higher (between 9.5 and 7.0) than the statements with low frequencies of response in Round 1 (most of them between 5.0 and 6.0), although not for all. Thus the median score for high frequency responses such as "exploiting stone, sand and mineral"

(frequency: 16) and "Construction of medium and small hydropower dam (frequency: 23) were quite low (5.0 respectively). In the same manner, reversely, even though only 1 panel member pointed to the managerial problem of "no good in punishment" in Round 1, this statement still recorded an 8.0 median score in Round 2.

This picture changed dramatically for *Round 3* where much more agreement had emerged (**Table 6.1.b;** see also section 3.1.4 below). 21 panel members responded in Round 3. Agreement narrowed in around the same median scores as in Round 2 for half the statements (15), around a slightly increased median score from 0.5 to 1.5 in a little less than half (12), and around a slightly lower median score (0.5-1.0) in three statements.

Table 6.1.b. **List potential problems, constraints or threats facing highland aquatic resources in *Quảng Trị. Round 3.* The value (f) for Round 1 gives how many stakeholders mentioned this as an issue in the open questions (frequency of response) while the data in the following columns summarizes the importance of issues given by the panel members in Round 2 of each problem, constraint or threat (1=not important to 10 = the most important)**

Factor	Problems, constraints or threats	n (R1)	min	Q1 (25 %)	Median (50%)	Q3 (75 %)	max
		(R1)					
Physical	Erosion, muddy	22	4.0	8.5	8.5	9.0	10
Environmental	Hard clime condition (flood, drought, heavy rain...)	22	8.0	9.0	9.5	9.5	10
	Water polluted (industry/agriculture waste)	14	4.0	8.5	9.0	9.0	10
Managerial	Staffs less access on document and policy in aquatic resources	1	5.0	6.0	6.0	6.5	8.0
	Information transfer to local people not good	4	5.0	7.5	7.5	8.0	10
	Not enough finance, no budget for information transfer	2	6.0	8.0	8.0	8.0	10
	Not well collaboration between stakeholders, don't have clear collaboration regulation	17	6.0	7.0	7.0	7.0	10
	Less, not suitable, too general and overlap regulation	7	4.0	4.0	4.0	4.0	7.0
	Stakeholders are not concentrate on aquatic conservation	3	4.0	6.0	6.0	7.0	9.0
	Not good in punishment	1	7.5	8.5	8.5	8.5	10
	Formalist in style of activities	2	5.0	6.0	6.0	6.0	8.0

Factor	Problems, constraints or threats	n (R1)	min	Q1 (25 %)	Median (50%)	Q3 (75 %)	max
Institutional	Not well structure, overlap and not clear in function	7	5.0	5.0	5.0	5.0	7.0
	Lack of staffs and human resources for aquatic resources conservation	11	7.0	8.0	8.0	8.0	9.0
	Responsible staffs are low education and not enthusialism	5	4.0	5.0	5.0	5.0	8.0
	Management regulation not clear and detail	4	5.5	6.0	6.0	6.0	6.0
	Staff setting is not suitable	1	4.0	5.0	5.0	5.0	8.0
Economic	Quick local economic develop but not sustainable and not concentrate on environmental protection	2	6.0	7.0	7.0	7.0	9.0
	Illegal gold mining	19	7.5	8.5	8.5	9.0	10
	Exploiting stone, sand, mineral	16	4.0	5.5	5.5	8.0	10
	Construction of medium and small hydropower dam	23	5.0	5.5	5.5	6.0	10
	Agriculture activities	1	5.0	5.0	5.0	5.0	9.0
	Aquaculture development without master plan	1	5.0	5.5	5.5	5.5	9.5
Social	Local people are not aware in aquatic resources conservation	9	7.0	10	10	10	10
	Backward custom	9	4.0	5.0	5.0	5.0	8.0
	Low education	1	4.5	5.0	5.0	5.0	10
	Local people are less approaching to documents and relevant information	2	7.0	8.0	8.0	8.0	10
Livelihood of local people	Livelihood of local people are unprompted and not be managed	1	5.0	6.5	6.5	7.0	9.5
	Unsustainable and destructive fishing methods	19	5.5	10.0	10	10	10
	Fishing is the main income of local people (for family consumption)	4	5.0	5.0	5.0	5.0	7.0
	Livelihood of local people have many difficulties	3	7.0	8.0	8.0	8.0	10

As it can be seen, lack of local awareness on aquatic resource conservation and unstable and destructive fishing methods are seen as the most important issues, followed by the two environmental problems of climate change and pollution from industry and agriculture.

The next section now turns towards the factors behind this – the drivers and pressures.

3.2.2 Stakeholder views on relevant factors (drivers and pressures) impacting on aquatic resources in Quang Tri

The drivers and pressures identified by the panel members in *Round 1* have been organized into three major categories: environmental, institutional/management, and livelihoods. For all three categories it can be observed that there were only a modest number of suggestions made, and many panel members simply have left the boxes in this category empty. As in the case of Son La, this may be interpreted as a lack of awareness of the existence of such causal links amongst the responding panel members. But this question has not been explored by the team.

Five (5) *environmental factors* were identified. The statement "topography, short river, high slope" is mentioned by 5 panel members, "climate change" by 2. "Environmental protection", "Low forest cover" and "Forest Fire" is mentioned by 1 panel member each.

Ideas are more numerous with regards to *institutional and managerial factors* (9 factors). "Infrastructure is damaging (transportation infrastructure)" is mentioned by 6 panel members, "low education, information, technical" and "large areas, bad road between villages" mentioned by 2 each. The remaining six factors were mentioned with a frequency of 1 each.

Table 6.2.a.: Factors relevance to aquatic resources in river/stream/ in Quang Tri (Rounds 1 & 2). Data as in previous tables.

Dimen-sion	Relevance factors	f (R1)	min	Q1	median (R2)	Q3	Max	n (R2)
Environ-mental	Topography. short river. high slope	5	4	6	7	8.5	10	27
	Climate change	2	1	4.5	5	7	10	27
	Environmental protection. waste water treatment	1	1	5	8	9.5	10	27
	Low forest cover	1	1	2.5	4	7	10	27
	Forest fire	1	1	2	5	5.5	8	27

Dimen-sion	Relevance factors	f (R1)	min	Q1	median (R2)	Q3	Max	n (R2)
Institutional. management	Forest management	1	1	4	5	7	10	27
	Staffs and institution organization is changing frequently	1	1	2	4	6	10	27
	Staff at low level are responsible for many fields	1	1	2	5	6	10	27
	Not well in master plan for social economic development	1	1	2	5	7	10	27
	Village regulation have not been built	1	1	2	5	7	10	27
	Low education. Information. technical	2	1	3.5	6	7	10	27
	Not well organize development in some fields	1	1	3	4	6.5	10	27
	Infrastructure is damaging (transportation infrastructure)	6	1	4	5	6.5	10	27
	Large areas. bad road between villages	2	1	3.5	5	10	10	27
Livelihood	Lack of water	1	1	5	8	10	10	27
	Deforestation. wood exploitation	2	2	6.5	8	8.5	10	27
	Simple fishing method	1	1	4	6	7.5	10	27
	Forest cutting for planting is cuscom of local people	3	1	5	7	9	10	27
	Market	1	1	2.5	4	5	10	27
	Disease	2	1	5.5	7	8	10	27

The panel members identified six different *livelihood factors.* “Forest cutting for planting is custom of local people” (3), “deforestation, wood exploitation” (2), and “disease” (2) are the most mentioned factors.

In *Round 2,* there was a wide distance between minimum scores (all =1, except topographical factors (min. score = 4) and deforestation (min. score = 2)) and the maximum scores (all =10 except “forest fire” which only had a maximum score = 8).

In *Round 3* (**Table 6.2.b below/next page)**, 21 panel members replied. The concordance of scores amongst the remaining respondents had largely improved. Agreement centered on the exact same median scores as were given in Round 2.

The level of concordance will be further discussed below in section 3.2.4.

Table 6.2.b.: Factors relevance to aquatic resources in river/stream/ in Quang Tri (Round 3). Data as in previous tables.

Dimen-sion	Relevancee factors	f (R1)	min	Q1	median (R3)	Q3	Max	n (R3)
Environmental	Topography. Short river. high slope	5	6	7	7	7	10	21
	Climate change	2	5	5	5	5	9	21
	Environmental protection. waste water treatment	1	7	8	8	8	10	21
	Low forest cover	1	3	4	4	4	9	21
	Forest fire	1	3	5	5	5	6	21
Institutional. management	Forest management	1	4	5	5	5	8	21
	Staffs and institution organization is changing frequently	1	3.5	4	4	4	5	21
	Staff at low level are responsible for many fields	1	5	5	5	5	8	21
	Not well in master plan for social economic development	1	5	5	5	5	7	21
	Village regulation have not been built	1	2	5	5	6	8	21
	Low education. Information. technical	2	5	6	6	6	7	21
	Not well organize development in some fields	1	3.5	4	4	4	7	21
	Infrastructure is damaging (transportation infrastructure)	6	4.5	5	5	5	10	21
	Large areas. bad road between villages	2	5	5	5	7	10	21

	Relevancee factors	f (R1)	min	Q1	median (R3)	Q3	Max	n (R3)
Liveli-hood	Lack of water	1	6	8	8	8	10	21
	Deforestation. wood exploitation	2	5.5	8	8	8	9	21
	Simple fishing method	1	5	6	6	6	8	21
	Forest cutting for planting is cuscom of local people	3	3	7	7	7	9	21
	Market	1	4	4	4	4	6	21
	Disease	2	5	7	7	7	8	21

3.2.3 Stakeholder suggestions for responses in Quang Tri

Suggestions for action identified by the 30 panel members responding in Round 1 were grouped into seven categories in a similar manner as it had been done at the Son La Site: institutional/management; more regulation; policy and action plan; training and education; economic development; and research and additional activities. In total, 44 different suggestions were made.

Table 6.3.a.: Suggestion for implementation, activities, policy, institutional to better management and suitable utilization of aquatic resources (Rounds 1 & 2)

Suggestions	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
1. Suggestion for institutional and management							
Develop program. documents and regulation for fisheries	3	2	7	9.5	10	10	26
Need to have collaboration between different stakeholders (policy. army)	5	2	7	8	8.75	10	26
Establish groups/ department to protect aquatic resources. and environment	3	1	5.25	8	9	10	26
Stable institution structure. increase staffs and function at different level (fishing protectors)	4	1	3.5	5	7	10	27
Better management. more strict in destructive fishing	2	2	8	10	10	10	27

(1. Suggestions for institutional and management, continued)	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
Need to have staffs responsible for fishing at commune and district level	5	1	2	5.5	8.75	10	26
Give management responsible for one organization	2	1	5.5	8	9	10	27
District manager need to manage in aquatic resources conservation	1	1	6	7	9	10	27
Staffs position setting suitable with background	2	2	7	8	9	10	26
Need to have environmental impact assessment when develop economic activities (coffee factory. hydropower)	2	4	6.5	8	9.5	10	27
Strict punishment for environment pollution activities	1	1	9	10	10	10	27
More strict in giving permission for mineral exploiting and forbidden in gold mining	1	4	8	10	10	10	27

The most frequently suggested *institutional and managerial* actions in Round 1 were the need to have collaboration between different (governmental) stakeholders (policy-makers and the army, suggested 5 times); and the need to have staff responsible for fishing at the commune and district levels. The need to have environmental impact assessments made when economic activities were developed for the area (coffee factory, hydropower station) was mentioned by 4 panel members initially.

Concerning institutional matters, there were two suggestions for *more regulation* (clearer punishment, and detailed and suitable regulation).

2. Suggestion to have more regulation	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
Clear regulation for punishment. administration punishment to whom using bomb and electricity for fishing	3	2	8.5	10	10	10	27
Have clear. detail and suitable regulation in aquatic resources conservation	3	2	7	9	10	10	27

The proposal for detailed and suitable regulation can also be seen from the suggestions given under the following category of policy and action.

3. Suggestion on policy and action plan	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
To have policy supporting people in agriculture. aquaculture (plan and animal)	8	7	8	9	10	10	27
To have policy for environment protection and wastewater treatment	2	3	7	9	10	10	27
To have policy for each areas and regions	1	2	6	7	8.75	10	26
Policy for manager staffs	1	1	6	7	8	10	27
Finance support for social organization for information transferring and campaign	2	1	7	8	8.5	10	27

The most frequently proposed action in this category was to have a policy supporting people in agriculture and animal husbandry activities.

Moving now to suggestions for training and education, actions of “propaganda local people” including booklets and poster competitions on the theme of conservation of aquatic resources were suggested by 14 of the 30 panel members responding in Round 1. Training on husbandry and freshwater fish culture was second most frequently mentioned suggestion for training and education.

4. Suggestion for training and education	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
Propaganda local people (booklets. posters. competition) in aquatic resources conservation	14	4	8	10	10	10	27
Training on husbandry. and freshwater fish culture	4	4	7	8	10	10	27
Training on culture and social	2	2	5.25	7	7.75	10	26
Training on suitable fishing	1	2	7	8.5	10	10	26
Training for local staffs in aquatic resources conservation	1	2	7	10	10	10	26

5. Suggestion on economic development	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
Diversity livelihood	6	5	8	9	9.5	10	27
Develop economic with farm and aquaculture	1	3	7	9	9	10	26
Growing bamboo and cassava	1	1	6	7	8	10	27
Building sustainable aquaculture	2	4	7	9	10	10	27
Building infrastructure (pond. irrigation systems)	1	1	7	8	9	10	26

Suggestions for *economic development* identified by the panel members suggested diversification of local livelihoods (6 panel members) without mentioning any specific ideas. Two panel members suggested "building sustainable aquaculture", a suggestion which links well with the suggestion above on training for fresh water fish culture as well as the expertise of the host institution of the HighARCS national team in Vietnam.

The same level of generalization applies to the most frequently proposed suggestion for *culture and social activities* being articulated as a general wish for "improving education" (4 panel members).

6. Suggestion on culture and social activities	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
Building village regulation in aquatic resources conservation	2	2	6.5	10	10	10	27
Undertake environmental protection regulation	1	5	7.25	10	10	10	26
Improving education	4	2	7	8	8	10	27
Elimination old and not suitable customs	1	1	5	7	10	10	27
Hunger and poor elimination	1	1	8	9	10	10	27
Drinking water support	1	1	7	10	10	10	27
Supporting in electricity	1	1	5	6	9.5	10	26

Finally, the local panel members' ideas for further *research and other additional activities* pointed to forest planting and protection (3 panel members). A total of 8 research topics or other additional activities were suggested.

7. Suggestion on research and supplementation activities	f (R1)	Min	Q1	median (R2)	Q3	max	n (R2)
Research custom of local ethnic people	1	2	4	7	8	10	27
Research on distribution. Species diversity depending on elevation. water flow	2	2	4.5	6	7.5	10	27
Research to protect endangered species	2	1	5	6	10	10	27
Research in Mat fish	1	1	5	7	8	10	25
Making plan for areas which is suitable for aquaculture development	1	3	7	8	8.5	10	27
Forest planting and protection	3	2	6.5	8	8.5	10	27
Support instrument. tools to examining and control	1	1	5	8	9	10	27
Making water flow	1	1	2.5	7	8	10	27

When all these 44 different suggestions for action were presented for the 30 stakeholders having responded in Round 1, 27 of them responded.

It is interesting to note that whereas the views on the problems or the drivers in *Round 2* were quite different amongst the panel members, there was a more heterogeneous picture of accordance of the scores given to the various suggestions for action. Minimal scores ranged from 1 ("strict punishment for environmental pollution activities", or "finance support for social organization for information transferring and campaign" and many others) to a minimal score of 7 given to the suggestion of having "policy supporting people in agriculture/aquaculture (plants and animals)".

Nevertheless, the concordance increased in *Round 3.* 21 panel members out of the 27 responding in Round 2 responded in Round 3. Minimum scores increased.

Table 6.3.b.: Suggestion for implementation, activities, policy, institutional to better management and suitable utilization of aquatic resources (Round 3). Data as in previous tables.

Suggestions	f (R1)	Min	Q1	median (R3)	Q3	max	n (R3)
1. Suggestion for institutional and management							
Develop program. documents and regulation for fisheries	3	8	10	10	10	10	21
Need to have collaboration between different stakeholders (policy. army)	5	8	8	8	8	10	21
Establish groups/ department to protect aquatic resources. and environment	3	8	8.5	8.5	8.5	10	21
Stable institution structure. increase staffs and function at different level (fishing protectors)	4	5	5	5	5	9	21
Better management. more strict in destructive fishing	2	9	10	10	10	10	21
Need to have staffs responsible for fishing at commune and district level	5	4.5	4.5	4.5	8	9	21
Give management responsible for one organization	2	7	7.5	7.5	7.5	9	21
District manager need to manage in aquatic resources conservation	1	7	7	7	7	8.5	21
Staffs position setting suitable with background	2	7	8	8	8	9	21
Need to have environmental impact assessment when develop economic activities (coffee factory. hydropower)	2	8	8	8	9	9.5	21
Strict punishment for environment pollution activities	1	10	10	10	10	10	21
More strict in giving permission for mineral exploiting and forbidden in gold mining	1	8	10	10	10	10	21

It can be noted that there is very strong agreement with the proposal to develop program, documents and regulation for fisheries, as well as to improve management and introduce more strict measures against destructive fishing. Equally there is a very strong agreement with the view that actions of strict punishment for environment pollution activities should

be undertaken (although initially this was only suggested by one single panel member). Finally, there is also very strong support to becoming stricter in giving permission for mineral exploiting and prohibiting gold mining.

These views are mirrored in the following suggestions to have more regulation: introduction of clear sanctions through administrative action concerning destructive fishing methods, and to elaborate clearly detailed and "suitable" regulation for aquatic resources conservation in general.

2. Suggestion to have more regulation	f (R1)	Min	Q1	median (R3)	Q3	max	n (R3)
Clear regulation for punishment. administration punishment to whom using bomb and electricity for fishing	3	9	10	10	10	10	21
Have clear. detail and suitable regulation in aquatic resources conservation	3	8	10	10	10	10	21

On the *policy action* level, strong support was established in Round 3 for having a policy for environment protection and wastewater treatment, combined with a policy supporting people in agriculture and aquaculture.

3. Suggestion on policy and action plan	f (R1)	Min	Q1	median (R3)	Q3	max	n (R3)
To have policy supporting people in agriculture. aquaculture (plan and animal)	8	9	9.5	9.5	9.5	10	21
To have policy for environment protection and wastewater treatment	2	9	10	10	10	10	21
To have policy for each areas and regions	1	6	8	8	8	10	21
Policy for manager staffs	1	7	7	7	7	10	21
Finance support for social organization for information transferring and campaign	2	8	8	8	9	10	21

Concerning *training and education*, strong agreement was achieved on "propaganda local people" in aquatic resources conservation; training on suitable fishing; and training for local staffs in aquatic resources conservation.

4. Suggestion for training and education	**f (R1)**	**Min**	**Q1**	**median (R3)**	**Q3**	**max**	**n (R3)**
Propaganda local people (booklets. posters. competition) in aquatic resources conservation	14	7	10	10	10	10	21
Training on husbandry. and freshwater fish culture	4	8	9	9	9	10	21
Training on culture and social	2	7	7	7	7	9	21
Training on suitable fishing	1	7	9.5	9.5	9.5	10	21
Training for local staffs in aquatic resources conservation	1	8	10	10	10	10	21

Median scores on *measures for economic development* were not quite as high as those highlighted within the previous categories of action above, but still it can be seen that there is a strong positive consensus in favour of actions targeting the diversification of local livelihoods, and developing a mixed farming and aquaculture system.

5. Suggestion on economic development	**f (R1)**	**Min**	**Q1**	**median (R3)**	**Q3**	**max**	**n (R3)**
Diversity livelihood	6	9	9	9	9	10	21
Develop economic with farm and aquaculture	1	8	9	9	9	10	21
Growing bamboo and casavan	1	7	7	7	7	9	21
Building sustainable aquaculture	2	7.5	9	9	9	10	21
Building infrastructure (pond. irrigation systems)	1	8.5	8.5	8.5	8.5	9	21

Under the category of *culture and social activities* (table below), it is interesting to note a very strong agreement on the wish to meet and jointly develop local village regulation in the domain of aquatic resources conservation and measures of protection. On the

livelihood side (considered here as a social activity), there is very strong consensus for seeking drinking water support.

6. Suggestion on culture and social activities	f (R1)	Min	Q1	median (R3)	Q3	max	n (R3)
Building village regulation in aquatic resources conservation	2	7	10	10	10	10	21
Undertake environmental protection regulation	1	9	10	10	10	10	21
Improving education	4	8	8	8	8	9	21
Elimination old and not suitable customs	1	5	7	7	7	10	21
Hunger and poor elimination	1	7	9	9	9	10	21
Drinking water support	1	8	10	10	10	10	21
Supporting in electricity	1	6	6	6	9	10	21

The final category of *suggestions on research and other additional activities* produced less strong support than the highlighted ones from the previous areas of intervention.

7. Suggestion on research and supplementation activities	f (R1)	Min	Q1	median (R3)	Q3	max	n (R3)
Research custom of local ethnic people	1	6	7	7	7	9	21
Research on distribution. species diversity depending on elevation. water flow	2	6	6	6	6	7	21
Research to protect endangered species	2	5.5	6	6	6	8	21
Research in Mat fish	1	7	7	7	7	10	21
Making plan for areas which is suitable for aquaculture development	1	8	8	8	8	9	21
Forest planting and protection	3	8	8	8	8	10	21
Support instrument. tools to examining and control	1	7.5	7.5	7.5	8	10	21
Making water flow	1	6	7	7	7	9	21

This result pointed towards giving these latter suggestions less attention in the following action planning activities.

3.2.4 Tests of concordance for the Quang Tri Site

The concordance of the results from the 2nd and 3rd Rounds of the Stakeholder Delphi at the Quang Tri Site survey reported above were tested using the Friedman's X^2_F and Kendall's W tests at the level of the three major analytic dimensions (problems, pressures/drivers and suggested actions).

The outcome shows moderate-weak, weak or very weak agreement in Round 2, changing into a strong or unsually strong agreement in round 3.

Table 7. Value for Friedman's X^2_F at the probability levels P indicated (versus the null hypothesis of no concordance) and Kendall's W for each topic for round 2 and 3 – The level of agreement and confidence levels.

Research area	Friedman's X^2_F	P	Kendall's W	Agreement	Confidence
Round 2					
Potential problems, constraints or threats facing highland aquatic resources	159.071	0.000	0.274	Weak	Low
Factors relevance to aquatic resources in river	108.539	0.000	0.212	Very weak-weak	Non-Low
Suggestion for implementation, activities, policy, institutional to better management and suitable usetilise aquatic resources	293.614	0.000	0.341	Weak-Moderate	Low-Fair
Round 3					
Potential problems, constraints or threats facing highland aquatic resources	485.364	0.000	0.797	Strong-Ussually strong	High-Very high
Factors relevance to aquatic resources in river	306.293	0.000	0.768	Strong-Ussually strong	High-Very high
Suggestion for implementation, activities, policy, institutional to better management and suitable usetilise aquatic resources	722.257	0.000	0.800	Strong-Ussually strong	High-Very high

In addition to this, the two tests were run at the factorial level, where agreement within statements for each factor (category) used was tested (Round 3 only).

Table 8: Friedman's X^2_F at the probability levels P indicated and Kendall's W for rank pattern of the factorial level for round 3 - Agreement and confidence levels. Data as in Table 7.

Research area	Friedman's X^2_F	P	Kendall's W	Agreement	Confidence
Part 1. Potential problems, constraints or threats facing highland aquatic resources					
Environmental and Physical	20.817	0.000	0.496	Moderate	Fair
Managerial	113.474	0.000	0.772	Strong-Unusually Strong	High-very high
Institutional	73.811	0.000	0.879	Unusually Strong	Very high
Economic	69.237	0.000	0.659	Moderate-Strong	Fare-High
Social	53.871	0.000	0.855	Unusually Strong	Very high
Livelihood of local people	55.966	0.000	0.888	Unusually Strong	Very high
Part 2. Factors relevance to aquatic resources in river					
Envirormental	73.289	0.000	0.872	Unusually Strong	Very high
Institutional, management	110.962	0.000	0.660	Moderate-Strong	Fare-High
Livelihood	86.169	0.000	0.821	Strong-Unusually Strong	High-Very high

The tests tell us that the members of the stakeholder panel are agreeing strongly on the way the assess threats and problems of the aquatic resources in Quang Tri, although the environmental threats seem to present an issue where opinions are still rather divided.

Concerning the factors of relevance to aquatic resources in the Dakrong River, the tests imply that stakeholders agree strongly on a moderate support to the suggested factors (drivers, pressures). This outcome seems compatible with the conclusion made earlier,

suggesting a need for working more with local stakeholders in understanding the dynamics of the local ecosystems and aquatic resources conservation.

With regards to Part 3, the suggestions for actions to be taken, it can be noted from the tests that there is a strong or unusually strong agreement amongst stakeholders within each of the major domains of intervention. However, although it was noted above that there was a very high support to more regulation, this support was not statistically confirmed, as the test turns out to yield the result of a "very weak" agreement on this particular group of suggestions.

Part 3: Suggestion for implementation, activities, policy, institutional to better management and suitable usetilise aquatic resources					
Suggestion for institutional and management	188.884	0.000	0.818	Strong-Unusually Strong	High-Very high
Suggestion to have more regulation	2.000	0.157	0.095	Very weak	Non
Suggestion on policy and action plan	69.372	0.000	0.826	Strong-Unusually Strong	High-Very high
Susgestion for training and education	70.297	0.000	0.837	Strong-Unusually Strong	High-Very high
Suggestion on economic development	65.006	0.000	0.774	Strong-Unusually Strong	High-Very high
Suggestion on culture and social activities	88.372	0.000	0.701	Strong	High
Suggestion on research and supplementation activities	119.764	0.000	0.815	Strong-Unusually Strong	High-Very high

4 Conclusion

The Stakeholder Delphi method was employed at the two Vietnamese HighARCS sites as a one of the tools to facilitate the action planning process. The Vietnamese team employed

this methodology for the first time. The team found the Stakeholder Delphi to be a very useful tool to support their interaction with local stakeholders. The use of the stakeholder Delphi facilitated good progress of local stakeholder participation in aquatic resources management and integrated them well into all the steps of the planning process. The Delphi process allowed not only to incorporate local knowledge of the stakeholders into the assessment of the status of aquatic resources, but in return it also helped stakeholders better understand the way aquatic ecosystems work and the role played by aquatic resources. Further, it helped stakeholders at different levels to be more knowledgeable and concerned about management issues and about the constraints and opportunities for more sustainable management of aquatic resources.

Outputs of the Stakeholder Delphi method after the analysis of 3 rounds showed the emergence of consensus of stakeholders on which factors are most important in affecting the state of highland aquatic resources; similarly, it showed emerging consensus on ranking the importance of potential problems and constraints and threats highland aquatic resource are facing.

Outputs of Delphi especially helped the HighARCS project in providing direction for building specific action plans in the Son La and Quang Tri study sites in close concordance with the recommendations given by the stakeholders. This was done through including suggestions for needed actions on conservation, livelihoods or policy & institutional levels as a topic in the stakeholder Delphi. The team received a richness of suggestions of goals for implementation, activities, policy, institutional for better management and suitable uses of the aquatic resources at the two study sites.

The HighARCS project assumed at the outset the existence of some extent of disagreement on the nature of issues related to aquatic resources at the study sites, and the measures needed to conserve them. The Project also has assumed that such differences can (at least partially) be overcome and consensus be developed through the application of the stakeholder Delphi technique. Here we observed a remarkable increase in agreement as a result of the Delphi, multiple round process.

The two stakeholder Delphi surveys conducted at the Vietnamese sites of Son La and Quang Tri have confirmed the existence of such disagreement. It has also given support to the methodological thinking that more consensus can be facilitated through the application of a stakeholder Delphi methodology.

5 List of References

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Annexes

ANNEX 1a
Panel Members – Stakeholder Delphi in SON LA (English)

Full name	*Position and address*	*Telephone*
	Province level	
Nguyen Van Ngoc	Vice-director of department of Agriculture and Rural Development	0912324657
Duong Van Bieng	Vice-leader of sub- department of Agriculture and Rural Development	0904852246
Tran Huy Chan	Leader of sub-department of Agriculture and Rural Development	0912742909
Vu Van Thien	Leader of sub- Department of Natural Resources and Environment	
	District level	
Cam Van Tan	Chairman of People's Committee	
Vi Duy Tinh	Leader of Agriculture and Rural Development office	0904653679
Le Duc Thien	Staff is responsible for fisheries of Agriculture and Rural Development office	0976426379
Do Thi Ly	Staff of environment department	0989799708
Hoang Xuan Ha	Leader of environment office	0903494245
	Commune level: Tuong Ha commune	
Dinh Thanh Su	Leader of Tuong ha commune	0977427074
Dinh Tien Loc	Vice - leader of Tuong ha commune	01669573454
Dinh Trong Nghia	Secretary of Tuong Ha commune	01678008952
Cam Minh Chan	Leader of police at Tuong Ha commune	
Ha Van Be	Staff responsibility for manage Forest-Agriculture-Fisheries in Tuong Ha commune	
Dinh Duc Que	Staff responsibility for manage land and environment in Tuong Ha commune	0975271735
Luu Minh Loi	Leader of Youth Union in Tuong Ha commune	01686785896

	Organisations in Tuong Ha commune	
Dinh Van Yeng	Leader of Veterans Association in Tuong Ha commune	
Ha Duc Am	Chairman of Commune Fatherland Front Tuong Ha commune	01657385727
Ha Xuan Chien	Leader of elder union in Tuong Ha commune	01698316140
Dinh Van Ang	Leader of Farmer union in Tuong Ha commune	
Dinh Thi Duong	Leader of women association in Tuong Ha commune	0985483306
	Villages level in Tuong Ha commune	
Dinh Van Tuan	Leader of Dan 2 village	
Luong Van Ham	Leader of Tam Oc 2 village	0223660632
Dinh Thanh En	Secretary of Tam Oc 2 village	01294739156
Dinh Van Phu	Leader of Dan 1 village	01686320242
Ha Van Uoi	Leader of Tam Oc 1 village	0226505477
	Schools in Tuong Ha commune	
Cam Ngoc Dinh	Leader of prymary school in Tuong Ha commune	0988406278
Chu Van Đai	Leader of secondary school in Tuong Ha commune	
	People involved in Exploit aquatic resources	
Dinh Van Thien	Fishmen in Dăn 2 village, Tuong Ha	01656458150
Dinh Van Un	Fishmen in Tam Oc 2 village, Tuong Ha	0223660056
Lo Van Vinh	Fishmen in Tam Oc 2 village, Tuong Ha	
	People involved in marketing aquatic resources	
Nguyen Thi Hue	Fishmen in Tam Oc 2 village, Tuong Ha (out site came to exploiting fish)	01665115651 (call her sister)
Nguyen Thi Lan	Fishmen, saler fish in Tam Oc 2 village, Tuong Ha (From Vinh Phuc province came to exploiting fish)	
	Commune level in Tuong Tien commune	
Luong Manh Cuong	leader of Youth Union in Tuong ha commune	
Luong Tien Muon	staff is responsible for land – environment Tuong Tien commune	
Ha Van Chung	staff is responsible for forest-Agriculture-fisheries in Tuong Tien commune	
Luong Van Chung	Police in Tuong Tien commune	
Cam Chien	Leader of Tuong Tien commune	01235741818

	Organisations	
Dinh Hang	Leader of elder union in Tuong Tien commune	
Cam Ngoc	Chairman of Commune Fatherland Front Tuong Tien commune	
Dinh Van Khec	Leader of Veterans Association in Tuong Tien commune	
Dinh Xuan Co	Leader of Farmer union in Tuong Tien commune	
Dinh Thi Tan	Leader of women association in Tuong Tien commune	
	Other	
Hoang Van Thang	Head of Tat village, Tuong Tien	
Nguyen Van Vui	Head of Primary and secondary school of Tuong Tien	
Cam Ngoc An	Fishmen	
Lo Thi Loan	Fish men, saler trap in Tuong Tien commune	01676113195

Annex 1 b
Panel Members – Stakeholder Delphi in Quang Tri (English)

Full name	*Position and address*	*Telephone*
	Province level	
Le Thanh Chung	Power Management-Department of Industry and Trade	0906456645
Nguyen Hoai Nam	Deputy Director Department of exploitation and protection of fisheries resources	0913515005
Nguyen Huu Ninh	Office management-chi cuc mining exploitation and resource conservation	0915315366
Nguyen Van Huan	leader of aquaculture office of department of Agriculture and rural environment	0982037123
Nguyen Thanh Tung	Quang Tri extension centers	0533550445
Tran Duc Tam	Dakrong Nature Reserve	0532243718
	District level	
Le Van Chi	Staff of trade department	
Trang Quyen	Staff of trade department	0915717045
Ho Tat Huan	Staff of district	0915010053
Tran Thi Hai Thuy	Staff of Natural Resources and Environment	0985066026
Ho Tat Hien	Dakrong Station Extension, extension	0914164670
Ho Thi Thu Huong	Agricultural and rural development department	0935961646
Pham Van Hung	Leader of Administration in Dakrong District	
Nguyen Ba Hung	The military area No3	0982037225
Le Phuoc Chuong	Deputy Natural Resources and Environment	
Ho Pan	Culture and Information department	0978626883
Truong Van Hoai	Youth Union	0915719293
Ho Thi Cam	Women association	0987148243
Le Dac Quy	Vice district chairmen	
Nguyen Thi Ha	Farmer union	09839020131
Nguyen Van Loi	Farmer union	
	Commune level	
Ho Van Linh	Leader of school in commune	
Ho Van Dum	Staff of commune	01655373150
Ho Thanh	Vice -leader of school in commune	01669086622
Ho Thi Dieu Linh	Health care center	0983608444
Pham Thi Hue	Women association	0974414602
Ho Van Tan	Farmer union	
Ho Sy Tan	Veterans Association	3886746
Ho Van Len	Veterans Association	
Ho Van Hieu	Staff is responsible for forest-Agriculture-fisheries	
	Village level	
Ho Van Thoan	Leader of Klu village	01655394326

Ho E Not	Leader of Kupua village	0977422502
Ho Van Cai	Vice -leader of Chan Ro village	
	Other	
Pham Thi Minh	Fish Saler, Krong Klang town, Dakrong	
Le Thi Hoa	Fish Saler, Market in Dakrong center	
Nguyen Ngoc Vinh	Teacher in Dakrong primary school No 2	0979873199
Hoang Van Quynh	Teacher in Dakrong primary school No 1	0913886579

ANNEX 1c: Stakeholder Panel members (in Vietnamese)

PANNEL MEMBERS FOR DELPHI IN SON LA

Code	HỌ VÀ TÊN	ĐỊA CHỈ	SDT
	Cấp tỉnh		
	Nguyễn Văn Ngọc	phó giám đốc sở Nông nghiệp và PTNT Sơn La	0912324657
1	Dương Văn Biểng	Chi cục phó Chi cục Thủy sản tỉnh Sơn La	0904852246
	Trần Huy Chấn	Chi cục trưởng Chi cục thủy sản tỉnh Sơn La	0912742909
	Vũ Văn Thiên	Chi cục trưởng Chi cục tài nguyên môi trường tỉnh Sơn La	
	UBND Huyện		
	Cầm Văn Tân	Phó chủ tịch huyện Phù yên	
2	Vì Duy Tính	trưởng phòng Nông nghiệp, huyện Phù Yên - Sơn La	0904653679
3	Lê Đức Thiện	Cán bộ phòng Nông nghiệp, huyện Phù Yên - Sơn La	0976426379
4	Đỗ Thị Lý	cán bộ phòng TN MT huyện Phù Yên - Sơn La	0989799708
5	Hoàng Xuân Hà	Trưởng phòng TNMT huyện Phù Yên- Sơn LA	0903494245
	Cán bộ xã		
6	Đinh Thanh Sư	Chủ tịch xã Tường Hạ	0977427074
7	Đinh Tiến Lộc	Phó Chủ tịch UBND xã Tường Hạ	01669573454
8	Đinh Trọng Nghĩa	Bí Thư đảng Ủy xã Tường Hạ	01678008952
9	Cầm Minh Chấn	trưởng Công an xã Tường Hạ	
10	Hà Văn Bé	Cán bộ nông -lâm thủy xã Tường Hạ	
11	Đinh Đức Quế	cán bộ địa chính xã Tường Hạ, Phù Yên, son La	0975271735
12	Lưu Minh Lợi	Bí thư đoàn xã Tường Hạ	01686785896
	Các hội, đoàn thể		
13	Đinh Văn Yếng	Chủ tịch Hội Cựu chiến binh xã Tường Hạ	
14	Hà Đức Âm	Chủ tịch mặt trận tổ quốc xã Tường Hạ	01657385727
15	Hà Xuân Chiến	Chủ tịch hội người cao tuổi xã Tường Hạ	01698316140
16	Đinh Văn Ắng	Chủ tịch hội nông dân xã tường hạ	
17	Đinh Thị Dương	Chủ tịch hội phụ nữ xã Tường Hạ	0985483306
	cán bộ thôn/bản		
18	Đinh Văn Tuấn	trưởng bản Dằn 2, xã Tường Hạ	
19	Lường Văn Hấm	trưởng bản Tầm ốc 2, Tường Hạ	0223660632
20	Đinh Thanh En	Bí thư chi bộ bản Tầm ốc 2, xã Tường Hạ	01294739156
21	Đinh Văn Phú	Trưởng bản Dằn 1, xã Tường Hạ	01686320242
22	Hà Văn Uổi	Trưởng bản Tầm ốc 1	0226505477
	trường học		
23	Cầm Ngọc Dinh	Hiệu trưởng trường cấp 1 Tường Hạ	0988406278
24	Chu Văn Đại	Hiệu trưởng trường cấp 2, tường hạ	
	Người khai thác tôm,cá		
25	Đinh Văn Thiên	Người khai thác cá bản Dằn 2, xã Tường Hạ	01656458150
26	Đinh Văn Un	Khai thác thủy sản bản Tầm ốc 2- Tường Hạ	0223660056
27	Lò Văn Vĩnh	Khai thác thủy sản Tầm ố 2-Tường Hạ	

	người bán tôm cá		
	Nguyễn thị Huế	Đánh bắt-bán cá tại Tầm ốc 2 (Vĩnh Phúc)	01665115651 (chị gái: Quế)
	Nguyễn Thị Lan	dánh bắt tôm, cá, bán cábản Khảo- Tường Hạ (Vĩnh Phúc)	
	Cán bộ xã Tường tiến		
28	Lường Mạnh Cường	Bí thư xã tường Tiến	
29	Lường Tiến Muôn	Cán bộ phụ trách địa chính - môi trường xã Tường Tiến	
30	Hà Văn Chung	Cán bộ phụ trách nông-lâm thủy xã Tường Tiến	
31	Lường Văn Chung	Công An xã Tường Tiến	
32	Cầm Chiên	Chủ tịch xã Tường Tiến	01235741818
	Hội, đoàn thể		
33	Đinh Hâng	Hội người cao tuổi xã Tường Tiến	
34	Cầm ngọc	Chủ tịch UNMT tổ quốc xã Tường Tiến	
35	Đinh VĂn Khẹc	Hội cựu chiến binh xã Tường Tiến	
36	Đinh Xuân Cọ	Hội Nông dân xã tường Tiến	
37	Đinh Thị Tán	Chủ tịch hội phụ nữ xã tường tiến	
	Cán bộ bản		
38	Hoàng Văn Thăng	Trưởng Bản Tặt, Tường Tiến	
	trường học	Hiệu trưởng trường cấp 1,2 Tường Tiến	
39	Nguyễn Văn Vui		
	Người khai thác tôm,cá		
40	Cầm Ngọc Ân	Khai thác thủy sản Tường Tiến	
44	Lò Thị Loan	Người khai thác, buôn bán tôm, rọ tôm tại Tường Tiến	01676113195

PANEL MEMBERS FOR STAKEHOLDER DELPHI IN QUANG TRI

Full name	*Position and address*	*Telephone*
Cấp tỉnh		
lê Thành Chung	Quản lý điện năng- Sở công thương	0906456645
Nguyễn Hoài Nam	Chi cục phó CC khai thác và bảo vệ nguồn lợi thủy sản QT	0913515005
Nguyễn Hữu Ninh	Phòng quản lý khai thác-CC KTBVNL	0915315366
Nguyễn văn Huân	Phòng NTTS, sở NN PTNT	0982037123
Nguyễn Thanh Tùng	TT khuyến nông QT	0533550445
Trần Đức Tâm	Khu bảo tồn thiên nhiên Dakrong	0532243718
cán bộ UBND Huyện, Hội, đoàn thể cấp huyện		
Lê văn Chỉ	Cán bộ phòng Công thương DR	
Trang Quyền	Cán bộ phòng Công thương DR	0915717045
Hồ Tất Huấn	Văn phòng UBND huyện	0915010053
Traần Thị hải Thùy	CV lĩnh vực môi trường phòng TNMT	0985066026
Hồ Tất Hiến	Trạm Khuyến ngư, khuyến nông DR	0914164670
Hồ Thị Thu Hương	Phòng NN PTNT DK	0935961646
Phạm Văn Hùng	Chánh Văn Phòng Huyện	
Nguyễn Bá Hùng	Bộ đội, ban chỉ huy quân khu 3	0982037225
Lê Phước Chưởng	Phó trưởng phòng TNMT	
Hồ Pần	phòng VHTT huyện	0978626883

Trương văn hoài	huyện đoàn DR	0915719293
Hồ Thị Cam	Hội LH phụ nữ huyện	0987148243
Lê Đắc Quỳ	Phó chủ tịch UBND huyện Đakrông	
Nguyễn Thị Hà	Hội Nông dân	09839020131
Nguyễn Văn Lợi	Hội Nông dân	
Cán bộ xã, Các hội, đoàn thể xã		
Hồ Văn Linh	Chủ tịch UBND xã	
Hồ văn Dưm	cán bộ xã Dr	01655373150
Hồ Thanh	Phó Chủ tịch UBND xã	01669086622
Hồ Thị Diệu Linh	trạm y tế xã	0983608444
Phạm Thị Huệ	Chủ tịch hội LHPN xã DR	0974414602
Hồ Văn Tân	Hội nông dân xã DR	
Hồ Sỹ Tân	Hội CCB	3886746
Hồ văn Lên	Hội CCB	
Hồ Văn Hiếu	Công chức xã Đakrông	
cán bộ thôn/bản		
Hồ Văn Thoan	cán bộ thôn Klu	01655394326
Hồ Ê Nót	cán bộ thôn Cu Pua	0977422502
Hồ Văn Cài	phó bản thôn Chân To	
người bán tôm cá		
Phạm Thị Minh	Khóm I TT Krong Klang, DR, QT	
Lê Thị Hoa	bán cá chợ trung tâm thị trấn DR	
trường học		
Nguyễn Ngọc Vinh	Giáo viên trường Tiểu học số 2 DR	979873199
Hoàng văn Quỳnh	giáo viên trường tiểu học số 1, DR	0913886579

ANNEX 2: official letter and Vietnamese Questionnaire through 3 rounds

BỘ NÔNG NGHIỆP
VÀ PHÁT TRIỂN NÔNG THÔN
VIỆN NGHIÊN CỨU
NUÔI TRỒNG THỦY SẢN I

Số: /VTS1
V/v Đánh giá hiện trạng và đề xuất phương hướng Bảo tồn phát triển nguồn lợi thủy sản vùng cao

CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM
Độc lập – Tự do – Hạnh phúc

Bắc Ninh, ngày tháng năm 2010

Kính gửi: .....

Viện Nghiên cứu Nuôi trồng Thủy sản 1 hiện đang triển khai nghiên cứu 'Bảo tồn và phát triển bền vững nguồn lợi thủy sản vùng cao'. Các tỉnh Sơn La và Quảng Trị đã được chọn là địa điểm nghiên cứu đại diện ở miền núi phía Bắc và miền Trung của nước ta. Ở các khu vực này, một bộ phận người dân sống phụ thuộc chặt chẽ vào nguồn lợi thủy sản trên hồ chứa thủy điện và ở các sông suối. Tuy nhiên, nguồn lợi thủy sản đang ngày càng suy giảm và đã ảnh hưởng không nhỏ tới đa dạng sinh học và kinh tế xã hội của khu vực.

Để có những chính sách phù hợp cho việc quản lý bền vững nguồn lợi thủy sản vùng cao, chúng tôi thành lập Hội đồng đánh giá và tư vấn. Hội đồng này bao gồm các tổ chức, cá nhân đại diện cho các nhà quản lý, cán bộ lập chính sách và nhà nghiên cứu về môi trường, nguồn lợi thủy sản; người trực tiếp khai thác, kinh doanh và sử dụng nguồn lợi thủy sản ở vùng cao. Những người được lựa chọn tham gia đánh giá và đóng góp ý kiến cho nghiên cứu là người có hiểu biết sâu sắc về hiện trạng, có vai trò quan trọng đối với sự phát triển bền vững nguồn lợi thủy sản vùng cao và ở các tỉnh Sơn La, Quảng Trị.

Chúng tôi dự kiến gửi đến ông/bà ba bộ câu hỏi vào các lần khác nhau. Đề nghị ông/bà trả lời, đóng góp ý kiến và gửi lại sớm nhất cho chúng tôi qua đường bưu điện theo địa chỉ và phong bì có sẵn. Sau mỗi lần nhận được ý kiến đóng góp, chúng tôi sẽ tổng hợp, phân tích các ý kiến và gửi phản hồi kết quả tới ông/bà cùng bộ câu hỏi lần tiếp theo. Mọi ý kiến đề xuất đều được trân trọng và các thông tin cá nhân của ông/bà được đảm bảo sẽ giữ kín.

Viện Nghiên cứu nuôi trồng thủy sản 1 xin trân trọng cảm ơn và mong nhận được sự hợp tác của ông/bà.

VIỆN TRƯỞNG

PHIẾU ĐÁNH GIÁ HIỆN TRẠNG NGUỒN LỢI THỦY SẢN VÙNG CAO VÀ ĐỀ XUẤT PHƯƠNG HƯỚNG BẢO TỒN, PHÁT TRIỂN

Thông tin về người trả lời:

Họ và tên: .....

Điện thoại: .....*Email:* .....

Nghề nghiệp chính/Đơn vị công tác: .....

Địa chỉ: .....

Chú thích: Nguồn lợi thủy sản là tất cả các loài sinh vật như cá, nhuyễn thể, giáp xác, thực vật.... có một phần hay toàn bộ vòng đời sống dưới nước.

PHẦN 1: THÔNG TIN CHUNG

Với mỗi câu hỏi, ông/bà vui lòng khoanh tròn vào ô đặt ở đầu mà ông/bà cho là thích hợp nhất.

1.1 Theo ông/bà hiện trạng nguồn lợi thủy sản trên sông/suối/đầm hồ ở Sơn La hiện nay như thế nào?

a. Suy giảm nghiêm trọng
b. Đang suy giảm
c. Như trước đây
d. Phong phú và đa dạng
e. Rất phong phú và đa dạng
f. Không biết/ trả lời được, không có sẵn thông tin

Ý kiến khác:

1.2 Theo ông/bà, mức độ khai thác nguồn lợi thủy sản ở Sơn La hiện nay như thế nào?

a. Khai thác quá kiệt
b. Khai thác quá mức
c. Khai thác hợp lý
d. Khai thác ít
e. Khai thác rất ít
f. Không trả lời được, không có sẵn thông tin.

Ý kiến khác:

1.3 Mức độ tiếp cận các văn bản luật hay các quy định có liên quan đến bảo tồn nguồn lợi thủy sản của ông/bà như thế nào? (qua đọc văn bản, tuyên truyền, tập huấn, xem TV, nghe đài báo....)

a. Rất ít
b. Ít
c. Bình thường
d. Nhiều
e. Rất nhiều
f. Không trả lời được, không có sẵn thông tin

Ý kiến khác:

1.4 Theo ông/bà sự tương các hoạt động, các biện pháp triển khai thực hiện để bảo tồn nguồn lợi thủy sản trên sông/suối/ao hồ như thế nào?

a. Rất ít
b. Ít
c. Bình thường
d. Nhiều
e. Rất nhiều
f. Không trả lời được, không có sẵn thông tin

Ý kiến khác:

1.5. Ông/bà đánh giá như thế nào về công tác triển khai thực hiện các văn bản luật và các quy định liên quan đến bảo tồn nguồn lợi thủy sản hiện nay?

a. Rất kém hiệu quả
b. Kém hiệu quả
c. Hiệu quả
d. Hiệu quả tốt
e. Hiệu quả rất tốt
f. Không trả lời được, không có sẵn thông tin

Ý kiến khác:

1.6 Theo ông/bà có cần thiết phải đưa ra các hướng dẫn, chính sách, kế hoạch cụ thể hơn để bảo tồn nguồn lợi thủy sản không ?

a. Rất cần thiết
b. Cần thiết
c. Không hoàn toàn cần thiết
d. Không cần thiết
e. Phản đối
f. Không trả lời được, thiếu thông tin

Ý kiến khác:

1.7 Ông/bà đánh giá như thế nào về hiệu quả của các quy định hay hương ước của làng/bản liên quan đến bảo tồn nguồn lợi thủy sản?

a. Rất kém hiệu quả
b. Kém hiệu quả
c. Bình thường
d. Hiệu quả tốt
e. Hiệu quả rất tốt
f. Không trả lời được, không có sẵn thông tin

Ý kiến khác:

1.8 Ông/bà có cho rằng nguồn lợi thủy sản ở Sơn La có thể được cải thiện hơn để người dân được sử dụng hợp lý và bền vững không?

a. Có thể cải thiện được
b. Không chắc chắn
c. Không thể cải thiện

Ý kiến khác:

1.9 Ông/bà có cho rằng lợi ích về kinh tế, xã hội và môi trường ở Sơn La sẽ được cải thiện hơn nếu nguồn lợi thủy sản được bảo vệ tốt hơn?

a. Đồng ý
b. Không chắc chắn
c. Không đồng ý

Ý kiến khác:

PHẦN 2: Xin ông/bà vui lòng nêu ra các khó khăn và nguy cơ đang đe dọa đến nguồn lợi thủy sản ở Sơn La

Yếu tố	Những vấn đề khó khăn và nguy cơ ĐANG GẶP PHẢI
Các nguy cơ thuộc yếu tố vật lý	Ví dụ: lũ lụt, thiên tai,... cải tạo... sạt lở, bồi...
Các nguy cơ do yếu tố môi trường	Ví dụ: thời tiết, nguồn nước ô nhiễm...
Các khó khăn thuộc về công tác quản lý	Ví dụ: văn bản, chính sách, cán bộ...
Các khó khăn thuộc về cơ cấu tổ chức	Ví dụ: bộ tổ chức không phù hợp với thực tế, phân hoạch thực hiện của các đơn vị...
Các hoạt động kinh tế của địa phương	Ví dụ: xây dựng cơ sở hạ tầng, khai thác khoáng sản, thủy điện...
Các yếu tố thuộc lĩnh vực văn hóa, xã hội	Ví dụ: các phong tục tập quán, hoạt động cộng đồng...
Hoạt động của người dân	Ví dụ: khai thác hủy diệt, nước thải sinh hoạt, khai thác vàng tràn lan
Các yếu tố khác	

PHẦN 3: Ông/bà vui lòng cho biết những vấn đề nào có liên quan đến nguồn lợi thủy sản ở sông/suối/ao hồ của Sơn La?

Yếu tố	Những vấn đề có liên quan
Yếu tố vật lý	
Yếu tố môi trường	
Về công tác quản lý	
Về cơ cấu tổ chức	
Các hoạt động kinh tế của địa phương	
Các yếu tố thuộc lĩnh vực văn hóa, xã hội	
Hoạt động của người dân	
Các yếu tố khác	

PHẦN 4: Ông/bà vui lòng đề xuất ý kiến về phương pháp thực hiện, các hoạt động, chính sách, cơ cấu tổ chức nhằm quản lý tốt hơn và sử dụng hợp lý nguồn lợi thủy sản?

Yếu tố	Đề xuất phương pháp thực hiện, hoạt động và cơ cấu tổ chức
Đề xuất bố trí về cơ cấu tổ chức, công tác quản lý	
Đề xuất chính sách, kế hoạch hành động, quy định bổ sung	
Đề xuất trong hoạt động kinh tế địa phương	
Đề xuất vấn đề văn hóa/Xã hội	
Đề xuất những nghiên cứu, hoạt động bổ sung	
Đề xuất về kỹ thuật	
Các đề xuất khác	

Viện Nghiên cứu Nuôi trồng Thủy sản 1 trân trọng cảm ơn ông/bà đã hợp tác và dành thời gian trả lời bộ câu hỏi này. Các kết quả sẽ được tổng hợp và gửi đến ông/bà trong thời gian tới.

Nếu ông/bà có bất cứ thắc mắc gì hoặc cần thảo luận thêm xin vui lòng liên hệ theo địa chỉ sau:

ThS. Nguyễn Thị Hiệu Hương
Phó trưởng phòng Sinh học thực nghiệm
Viện Nghiên cứu Nuôi trồng Thủy sản 1,
Đình Bảng – Từ Sơn – Bắc Ninh
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Fax: 04-38273070
Email: nthieuhuong@ria1.org
Website :http://www.ria1.org/ ; http://www.biqhaves.org/

ANNEX 2b TRANSLATED QUESTIONNAIRE ROUND 1

PHIẾU ĐÁNH GIÁ HIỆN TRẠNG NGUỒN LỢI THỦY SẢN VÙNG CAO VÀ ĐỀ XUẤT PHƯƠNG HƯỚNG BẢO TỒN, PHÁT TRIỂN

Information about panel members:

Full name.……

Phone number.....E-mail:……

Job:……

Address:……

Section1: General Information
With each question, would you please circle answer that you suggest the most appropriate

1.1 In general, how would you describe the status or condition rivers and lakes and the aquatic plants, fish, molluscs and other organisms living in them in Sơn la/Quang tri?

a. Very degraded and totally insufficient
b. somewhat degraded and scarce
c. acceptable
d. Quite plentiful and divers
e. very plentiful and diverse
f. Cannot answer due to insufficient information available to me on this issue

other opinion:

1.2 How would you describe the extent of use of highland aquatic resources in ***Sơn La/Quảng Trị hiện nay như thế nào?***

a. very excessive
b. excessive
c. correct
d. less
e. very less
f. Cannot answer due to insufficient information available to me on this issue.

other opinion:

1.3 There is a need to take action, policy to improve aquatic biodiversity conservation in the highlands in Son la/quang trị?

a. agree strongly
b. agree
c. neither agree nor disagree
d. disagree
e. disagree strongly
f. cannot answer due to insufficient information available

other opinion:

1.4 in general, how would you describe the number of legal and policy documents in Son la/Quang trị?

***1.5 How would you** evaluatethe implementation of legal documents and regulations related to conservation of aquatic resources in Son La / Quang Tri?*

a. very bad
b. bad
c. nomally
d. good
e. very good
f. cannot answer due to insufficient information available

other opinion:

1.6 how would you evaluate effectiveness of current regulations related to conservation of fisheries resources in Son La /Quang tri ? (conventions of the village the provisions of the commune / village, the licensing / permit)

a. Very ineffective
b. Ineffective
c. appropriate
d. effective
e. very effective
f. cannot answer due to insufficient information available

other opinion:

1.7 do you believe wise-use of highland aquatich resources is possible in Son La/Quang Trị?

a. yes
b. unsure
c. No

Other opinion:

1.8 Do you believe that any economic, social or environmental benefits could be gained from better conserving highland aquatic resources in Sơn la/Quang Trị?

a. yes
b. unsure
c. No

Other opinion:

Part 2 : please list potential problem constraints or threats facing highland aquatic resource in Son La/Quang tri?

factors	**Problems, threats**
physical	
environmental	
managerial	
institutional	
economic	
Culture/social	
other	

Section 3: please list issues related to highland aquatic resources?

Factors	issues
Physical	
environmental	
managerial	
institutional	
economic	
Culture/social	
other	

Section 4: **Please list any potential measures, action or institutional change that could help improve highland aquatic resources conservation and wise-use in*Sơn La/Quảng Trị?***

	Measures, actions or institutional change
institutional	
management	
financial	
Culture/social	
Researches	
Technology	
other	

QUESTIONNAIRE FOR ROUND 2 IN STUDY SITE QUANG TRI

PHIẾU LẤY Ý KIẾN CHUYÊN GIA
VỀ THỐNG NHẤT ĐỀ XUẤT PHƯƠNG HƯỚNG BẢO TỒN, PHÁT TRIỂN NGUỒN LỢI THỦY SẢN Ở QUẢNG TRỊ

Thông tin về người trả lời:

Họ và tên: .....

Nghề nghiệp chính/Đơn vị công tác: .....

Địa chỉ: .....

Trong thời gian qua Viện Nghiên cứu Nuôi trồng thủy sản 1 đã làm việc với các ban liên quan từ cấp tỉnh đến địa phương về "Đánh giá hiện trạng và đề xuất biện pháp bảo tồn và phát triển nguồn lợi thủy sản". Ở Quảng Trị đã có 30 người đại diện cho nhà quản lý, nhà chuyên môn và những người sống phụ thuộc vào nguồn lợi thủy sản tham gia trả lời bộ câu hỏi này. Chúng tôi gửi tới ông/bà tổng hợp ý kiến đóng và số lượng thành viên đã đưa ra ý kiến ở từng vấn đề.

Nhằm đề xuất xây dựng chính sách Bảo tồn và phát triển nguồn lợi thủy sản ở vùng cao và phù hợp, đề thống nhất các ý kiến của tất cả các thành viên đã trả lời, chúng tôi tiếp tục lấy ý kiến đánh giá. Đề nghị ông/bà đọc kỹ bảng kết quả và tiếp tục cho điểm vào cột "Điểm đánh giá" về tầm quan trọng của từng vấn đề đã được nêu ra. Trong điểm đánh giá từ 1 đến 10 (điểm 1 là vấn đề không quan trọng, điểm 10 là vấn đề rất quan trọng)

Ví dụ:

Yếu tố	Những vấn đề khó khăn và nguy cơ ĐANG GẶP PHẢI	Số thành viên đã đưa ra ý kiến	Điểm đánh giá
Vật lý	Xói mòn, rửa lở bờ,	22	10
Môi trường	Thời tiết khắc nghiệt (Bất thường, mưa to,...)	22	5
	Nguồn nước ô nhiễm (chất thải công nghiệp, nông nghiệp)	14	3

PHẦN 1. Khó khăn và nguy cơ đang đe dọa đến nguồn lợi thủy sản ở Quảng Trị

Yếu tố	Những vấn đề khó khăn và nguy cơ ĐANG GẶP PHẢI	Số thành viên đã đưa ra ý kiến	Điểm đánh giá
Vật lý	Xói mòn, rửa lở bờ,	22	
Môi trường	Thời tiết khắc nghiệt (Bất thường, mưa to,...)	22	
	Nguồn nước ô nhiễm (chất thải công nghiệp, nông nghiệp)	14	
Công tác quản lý	Thiếu các văn bản, chính sách hiện hành quản lý thủy sản của bộ ngành	1	
	Công tác tuyên truyền, vận động người dân kém	4	
	Hiểu hình pháp luật của người dân còn hạn chế	2	
	Phải lấy ý kiến của các đơn vị chủ chốt, đông bộ, chưa có quy chế phối hợp rõ ràng	17	
	Văn bản còn chồng chéo, thiếu chưa cụ thể, chưa hợp lý	7	
	Các cấp, các ngành thiếu sự quan tâm, chỉ đạo trong điều tra nguồn lợi thủy sản	3	
	Xử lý vi phạm chưa nghiêm	1	
	Các hoạt động còn mang tính chất hình thức, phong trào	2	
Cơ cấu tổ chức	Bộ máy cán bộ chưa hợp lý, chức năng còn chồng chéo, chưa phân công rõ ràng	7	
	Thiếu cán bộ, kinh phí cho công tác điều tra, đánh giá nguồn lợi thủy sản	11	
	Cán bộ chuyên trách tính thời kém, hoạt động hiệu quả thấp	2	
	Quy chế quản lý, phân công không rõ ràng, chặt chẽ	4	
	Bộ máy cán bộ chưa đồng bộ từ trung	1	
Hoạt động kinh tế của địa phương	Hoạt động kinh tế của địa phương phát triển nhanh nhưng thiếu bền vững, khó ngăn chặn tác động tiêu cực	2	
	Khai thác quá mức, không hợp pháp	19	
	Khai thác đã cạn kiệt nguồn lợi	14	
	Xây dựng tràn lan ven bờ, ven sông	22	
	Hoạt động sản xuất không hợp pháp	1	
	Phát triển nuôi trồng thủy sản thiếu quy hoạch	1	
Lĩnh vực văn Hóa, xã hội	Người dân hiểu có ý thức bảo vệ nguồn lợi thủy sản	9	
	Phong tục tập quán còn lạc hậu	9	
	Trình độ dân trí thấp	1	
Hoạt động của người dân	Người dân được tiếp cận với các văn bản, thông tin hiện nay	2	
	Các hoạt động sinh kế của người dân còn tự phát chưa kiểm soát được	1	
	Đánh bắt chưa hợp lý, hợp pháp	19	
	Khai thác thủy sản là nguồn thu nhập của người dân (đóng góp lớn nhất cho gia đình)	4	
	Đời sống người dân còn nhiều khó khăn	3	

PHẦN 2: Những vấn đề cần quan tâm về nguồn lợi thủy sản ở Quảng Trị

Yếu tố	Những vấn đề cần quan tâm	Số thành viên đã đưa ra ý kiến	Điểm đánh giá
Môi trường	Đa dạng sinh học, nguồn gen, cần đặc biệt	5	
	Biến đổi khí hậu	2	
	Bảo vệ môi trường, xử lý nguồn nước thải	1	
	Thảm thực vật kém	1	
	Cháy rừng	1	
Về cơ cấu tổ chức, quản lý	Quản lý khai thác, ranh giới	1	
	Tổ chức, cán bộ, đường truyền thay đổi	1	
	Cán bộ, cấp cơ sở kiêm nhiệm nhiều việc	1	
	Quy hoạch, kinh tế-xã hội vùng nuôi, chưa đồng nhất	1	
	Chưa xây dựng được hương ước bản làng	1	
	Trình độ còn rất thấp, thông tin, công nghệ	2	
	Phát triển không đồng bộ, mất cân bằng sinh thái	1	
	Cơ sở hạ tầng, trang cấp (hạ tầng giao thông)	4	
	Đa dạng, giao thông, đi ra các đảm bảo lắc lắm	2	
Tình hình của người dân	Nước chảy xiết, lũ lớn	1	
	Chết phá rừng, đánh bắt, khai thác gỗ	2	
	Khai thác thủy sản bằng công cụ thô sơ, đơn giản	1	
	Phát triển không hợp lý, phá rừng của người dân	3	
	Tài trường, tiêu thụ sản phẩm	1	
	Dịch bệnh	2	

PHẦN 3: Đề xuất, bổ sung về phương pháp thực hiện, các hoạt động, chính sách, cơ cấu tổ chức nhằm quản lý, khai thác và sử dụng hợp lý nguồn lợi thủy sản

Ý kiến đề xuất	Số thành viên đã đưa ra ý kiến	Điểm đánh giá
Đề xuất bổ trí về cơ cấu tổ chức, công tác quản lý:		
Xây dựng chương trình, kế hoạch của hàng năm phù hợp với thực tiễn	3	
Cần có cơ chế phối hợp chặt chẽ giữa các đơn vị (Công an, quân đội,...)	5	
Thành lập nhóm bảo vệ nguồn lợi thủy sản bảo vệ môi trường tại địa phương	3	

Chi đình tổ chức, tăng cường hiện có, chức năng quản lý ở các cấp (cán bộ kiêm nghề)	4	
Quản lý chặt chẽ, nghiêm cấm việc đánh bắt thủy sản bất hợp	2	
Cấp huyện nên có cán bộ chuyên trách về thủy sản	5	
Phân công trách nhiệm quản lý cụ thể cho 1 cơ quan	2	
Phân công của lãnh đạo huyện quản lý vấn đề bảo vệ nguồn lợi thủy sản	1	
Bố trí cán bộ đủ trình độ chuyên môn	2	
Các hoạt động kinh tế phải đánh giá đúng và đầy đủ tác động môi trường (xây dựng nhà máy, cảng, thủy điện)	2	
Xử lý nghiêm minh hành vi gây ô nhiễm môi trường	1	
Quản lý chặt chẽ việc cấp phép, khai thác khoáng sản ở địa phương nghiêm cấm đào đãi vàng	1	
Đề xuất bổ sung quy định:		
Chế tài xử phạt từ nặng xử phạt hành chính với đối tượng dùng chất nổ, xa điện	3	
Có quy định cụ thể, xử nặng hợp lý về bảo vệ nguồn lợi thủy sản	3	
Đề xuất chính sách, kế hoạch hành động:		
Có chính sách hỗ trợ cho người dân sản xuất giống nghiệp, nuôi trồng thủy sản (cây trồng vật nuôi	8	
Có chính sách bảo vệ môi trường xử lý tốt nguồn nước thải	2	
Có chính sách cho trồng rừng ngập mặn chống lấn đất phát triển	1	
Chính sách cho người làm công tác quản lý	1	
Hỗ trợ kinh phí hoạt động cho các ban ngành đoàn thể trong tuyên truyền, vận động...	2	
Đề xuất đào tạo, tập huấn:		
Tuyên truyền, vận động người dân (cung cấp tờ rơi, pano, lời đi...) về bảo vệ nguồn lợi thủy sản	14	
Tập huấn kỹ thuật chăm nuôi chăm sóc ca nước ngọt	4	
Tập huấn về văn hóa, xã hội	2	
Tập huấn, hướng dẫn kỹ thuật đánh bắt hợp lý	1	
Tập huấn đào tạo cán bộ cơ sở, cán bộ xã thôn về bảo vệ nguồn lợi thủy sản	1	
Đề xuất hoạt động kinh tế của địa phương:		
Phát triển các ngành nghề thay thế tạo thu nhập cho người dân	4	
Phát triển kinh tế vườn đồi kết hợp nuôi trồng thủy sản	1	
Trồng rừng, sản cao sản	1	
Xây dựng mô hình nuôi trồng thủy sản bền vững tại địa phương	2	

Xây dựng cơ sở hạ tầng (cải tạo, khai hoang làm ao, trồng thủy lợi tạo điều kiện cho người dân phát triển kinh tế	1	
Đề xuất vấn đề văn hóa, xã hội		
Xây dựng hương ước bảo vệ nguồn lợi thủy sản	2	
Lập cam kết bảo vệ môi trường	1	
Nâng cao trình độ dân trí	4	
Xóa bỏ một số lợi tục lạc hậu	1	
Xóa đói, giảm nghèo	1	
Hỗ trợ kể thế hệ trẻ cấp nước sông	1	
Hỗ trợ về điện thắp sáng	1	
Đề xuất những nghiên cứu, hoạt động bổ sung:		
Nghiên cứu lý các phương tiện, tập quán của đồng bào dân tộc thiểu số trên địa bàn	1	
Nghiên cứu phân bố, đa dạng loài theo độ cao, tốc độ dòng chảy	2	
Nghiên cứu các loài có nguy cơ tuyệt chủng để bảo vệ	2	
Nghiên cứu môi loài cá mát	1	
Quy hoạch chi tiết các vùng có tiềm năng phát triển môi trường thủy sản	1	
Tăng cường khả năng bảo vệ rừng tại rừng	3	
Tăng cường phương tiện công cụ để kiểm tra, giám sát	1	
Tạo động lực để một số công nhân	1	

Viện Nghiên cứu Nuôi trồng Thủy sản 1 trân trọng cảm ơn ông/bà đã hợp tác và dành thời gian trả lời bộ câu hỏi này. Các kết quả sẽ được tổng hợp và gửi đến ông/bà trong thời gian tới.

Kính mong ông/bà gửi lại bộ câu hỏi hoặc có bất cứ thắc mắc gì xin vui lòng liên hệ theo địa chỉ sau:

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