


**MIID/Cornell University LIFT Project**

***Securing Positive Nutritional Outcomes through Agriculture Extension and Institution Building in Rural Chin State (NOAC)***

# Report on

# *Assessment of Access to Fish and Current Capacities of Aquaculture in selected NOAC target villages*

by
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## Abbreviations

| | |
|---|---|
| **DoF** | Department of Fisheries |
| **EPI** | Local (village based) Environment Protection Initiatives |
| **FFFS** | Fish Farmer Field School |
| **FFS** | Farmer Field School |
| **GAqPs** | Good Aquaculture Practices |
| **IPPM** | Integrated Production and Pest Management |
| **MFF** | Myanmar Fisheries Federation |
| **MIID** | Myanmar Institute for Integrated Development |
| **NOAC** | Securing Positive Nutritional Outcomes through Agriculture Extension and Institution Building in Rural Chin State - Project |
| **NSA** | Nutrition-sensitive Agriculture |
| **SAI** | State Agricultural Institute, Lungpi, Falam, Chin State |
| **WF** | World Fish (Center) – international fisheries specialized NGO operating under the Consultative Group for International Agricultural Research (cigar) consortium |

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## 1. Introduction

Fish, next to rice, is one of the two main sources of Myanmar's food security. (Belton et al. 2015) Availability and access to fish is considered very important especially for poorer segments of the population.

The NOAC project document acknowledges "Livestock and fish can play an essential role in the subsistence economy of rural households in Chin State." (MIID & Cornell University 2016: 7) Furthermore, it proposes fishponds to be linked into integrated small-scale farming approaches that aim at linking fish and crop farming with livestock raising in a mutually beneficial manner. While the initial project proposal focused exclusively on aquaculture and its potential linkages into integrate farming practices, the Inception Mission found that most fish consumed comes from natural water bodies that are coming increasingly under threat as they are largely unmanaged. The Chin State Department of Fisheries highlighted "environmental protection" of fisheries habitats as its highest priority for future actions. Thus, it was also recommended to take stock of the natural wild fisheries, its ecological context, fishing practices focusing mainly on its selected target villages. (NOAC 2016: 38)

This report presents the findings from a field assessment of the aquaculture practices and how community members access wild fish in NOAC target villages. Recommendations are formulated for NOAC to implement during the project period in the next 30 months.

## 2. Purpose and Structure of this report

The stated purposes of this assessment are to:

- Assess and document current capacities of fishponds aquaculture in selected villages (fingerlings), feed, water management and profitability;
- Develop a plan on how to optimize fishponds and their integration in other farming practices, including how fishponds will be used to educate farmers about aquaculture potential and cost/benefit to farmers;
- Present findings about backyard aquaculture to MIID NOAC team and finalize plan on how to optimize fishponds within project timeframe & budget.

As indicated above, this report also presents observations on the overall fisheries context in Hakha Township since Good Aquaculture Practices[1] also require paying due attention to site specific and environmental sustainability considerations. (Schwartz et al. 2010) Moreover, it was found that wild fish from nearby rivers is the major source of fish for local communities. Recommendations for project support initiatives/interventions, thus, include initiatives for both aquaculture as well as fisheries management.

## 3. Methodology

The assessment methodology made use of a series of information gathering strategies including literature review, interviews with high ranking representatives of fisheries authority at different levels (DoF), specialized organizations (WF), as well as, and most of all, primary data collection through field visits to fish ponds, interviews with fish farmers and community meetings in NOAC target villages.

It is noted that there is, at best, very sparse information on upland fisheries and aquaculture available in academic literature or official statistics. Thus this report relies mainly on primary data generation in target villages.

The field data collection was conducted as part of the project introduction to target villages and parallel to training, coaching, and reflection sessions with Community Facilitators in classroom and

[1] Myanmar, through its Department of Fisheries, Aquaculture Division, is committed to implement GAqPs in accordance with the guidelines agreed under the ASEAN umbrella. (ASEAN 2015)

field exposure sessions. Considerable time had to be spent introducing the overall approach and objectives of the NOAC project to village authorities and farmers and women groups. At the same time the project field team undertook wealth ranking, collected responses for "Concept Mapping" and conducted initial Farming Systems Analysis in form of crop and land use mapping.

Overall, the project field team visited fourteen project target villages, namely Chuncung, Thipul, Hniarlawn, Aive, Nabual, Cinkhua, Nipi, Bualtak, Loklung, Zathal, Zokhua, Surkhua, Leium B and Bunzung. Information was gathered from Village Tract Administration members, village elders, and farmer groups including women as well as through direct observations of fishponds and interviews with fish farmers, women and fishers individually.

# 4. Current Aquaculture Practices in NOAC target villages

## 4.1 The nature of "backyard aquaculture" in Chin Mountains

The NOAC project proposal document refers to *backyard aquaculture* in the context of an integrated farming system that is characterized by the "…. ability to use animal waste from the livestock for fish food and dual use of land (with animal pens above fish ponds)." (MIID and Cornell University 2016:30) In the literature on integrated fish-livestock farming systems in Myanmar examples generally describe backyard aquaculture in lowland areas where indeed animal pens are constructed above fishponds in the immediate proximity of farm dwellings.

In the geographical conditions of Hakha Township with steep slopes, limited availability of flat land and settlements along roads the nature of backyard aquaculture is different. Fishponds are mostly further away from homesteads while domestic animals like e.g. chicken, pigs and cows are held nearby the farmhouse, which also facilitates the more frequent feeding (as compared to fish feeding). While it would be desirable to combine aquaculture with livestock rearing in an integrated manner the opportunities to do so in the steep mountains in Hakha Township are rather limited. In villages at lower elevations, such as Bunzug, Keizuan, Chawncum, Leium A, and Surkhua where landscape is less hilly and more smooth fishpond aquaculture is not practiced as rivers and creeks are easily accessible to catch fish in an effective and efficient manner.

## 4.2 Pond Aquaculture

The Department of Fisheries introduced fishpond aquaculture to the project target area during the first half of 1970s. Following experimentation with Common Carp, Grass Carp and Tilapia the most common fish found in pond aquaculture is Common Carp. Tilapia did not adapt to the cold environment of the Chin Mountains and Grass Carp was not able to breed without induced spawning. Common Carp is currently by far the most frequently used species as it is well adapted to the colder environment and breeds naturally.

| *Village name* | *Number of HH** | *HH with fish ponds* | *Total No of fishponds* | *No of fish hatcheries** | *Fish species cultured* | *Remark* |
|---|---|---|---|---|---|---|
| Chuncung | | | | | | |
| Tiphul | | 8 | 18 | 0 | Common Carp | Ponds are small <40x40 feet; buy fingerlings from Hniarlawn; stocking of rice paddies – soil keeps water |
| Hniarlawn | | | | | | |
| Nabual | | 6 | 12 | 0 | Common Carp | Pond size between 0.06 and 0.4 acres; by fingerlings in Hniarlawn; only for HH consumption; |
| Zokhua | | | | | | |
| Bualtak | | 0 | 0 | 0 | - | No stocking in rice paddies because lack of water |
| Nipi | | 5 | 5 | 0 | Common Carp; | 3 fishponds damaged by landslide; 2 operating very extensively without |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | Grass Carp | maintenance or feeding only for household consumption; fish farmers also go fishing to the river |
| Aive | | 6 | 10 | 0 | Common Carp | 4 fishponds damaged by landslides; 3 ponds cannot operate in dry season due to water scarcity. |
| Cinkhua | | | | | | |
| Loklung | | | | | | |
| Zathal | | | | | | |
| Surkhua | | | | | | |
| Leium B | | 2 | 4 | 0 | Grass Carp, “sala via” | Only 2 ponds operating; can only operate during rainy season; ponds <40x40 feet; 2 ponds not operating because of water issues |
| Bunzung | | | | | | |

* Hatchery practicing brood stock management

* HH = Household

### Fish species

### Pond construction

### Breeding – access to fish seed/fingerlings

Access to quality fish seed seems to be a major issue. There is no indication that any fish farmer maintains and breeds pure strains of Common Carp (or other species) by certified breeders in licensed fish hatcheries.

While there are only few, yet well known fish farmers who focus mainly on Common Carp fingerling production and who know how to separate male and female breeders. The majority fish farmers who produce fingerlings in their ponds do this in a rather unmanaged manner. Mostly they keep female and male fish in one pond letting brood stock reproduce without any technical intervention; this results in very low reproduction rates as their parents prey on the spawn and hatchlings before they make it to juvenile and post juvenile stage.

### Stocking of ponds

#### Fish feeding

#### Fish health care

#### Harvesting

#### Cost-benefit considerations

### 4.3 Integration of rice paddy and fish farming

#### Fish stocking of rice paddy land

#### Integrated production and pest management (IPPM)

## 5. Capture Fisheries

The most important source of fish in NOAC project target villages visited in the context of this assessment is by far wild fish from the nearby rivers. While pond aquaculture and rice paddy stocking is used in target villages in higher elevations (about 3,500-6,000 feet asl) in villages at lower elevations located in the South of Hakha Township aquaculture and stocking of rice fields is not practiced at all as villagers have more direct access to larger rivers, such as the Ri Va, Phawk Va and Boinu rivers and tributaries.

| *Village name* | *Number of Households* | *Involvement in capture fisheries in rivers & creeks* |
|---|---|---|

| | | |
|---|---|---|
| 1. Chuncung | | |
| 2. Tiphul | | Fishing in Phau river; nearly all households go fishing in winter and summer; gender specific fishing methods; fishing for households consumption |
| 3. Hniarlawn | | |
| 4. Nabual | | Main source of fish from rivers; |
| 5. Zokhua | | |
| 6. Bualtak | | Due to landslides in 2015 fishing activities in rivers is limited now; before landslide everybody used to fish in rivers and fish was sold in Hakha fresh (6,000 K/. per viss). Main fishing grounds: Tirwan Va, Khua Va, Pangrawn Tiva, Cawsih Tiva, Tihna Va, Donpi Va |
| 7. Nipi | | |
| 8. Aive | | |
| 9. Cinkhua | | |
| 10. Loklung | | |
| 11. Zathal | | |
| 12. Surkhua | | |
| 13. Leium B | | All households fish in Ri Va and Ciai Va rivers as main source of fish; fishing throughout the year; surplus fish is dried & smoked and sold to Hakha traders for K./20,000/viss |
| 14. Bunzung | | |

Surveys – fish consumption by origin of fish

Fish from river is more appreciated, i.e. considered more delicious than fish from ponds.

Fish species and ecology/seasonality, Spawning migrations

Fish species

The main fishing season is during the dry period from November/December to May with a peak in fishing activity towards the end of the dry season when water levels are very low. Fishing activities are often undertaken concomitantly with lowland paddy rice harvesting activities in November and December as rice paddy field are located in relative proximity to rivers and streams. Gill nets, hook and line and cast net are the main fishing gears used by men.

Access and use of wild fish -Fishing grounds

Fishing practices

Young women, often accompanied by children, are also strongly involved in fishing activities, they frequently gather in small groups of two to five women who fish with baskets from January to April. One woman levers a bigger stone with a wooden pole while the remaining group members chase the escaping fishes with their baskets.

### *Issues of capture fisheries*

Loss of forest cover, depletion of valuable forest products, increased water scarcity including drying out of small creeks in summer time, and increased threats from landslides, among others, have sensitized higher environmental awareness among rural communities in Hakha Township during the past several years. VTAs and local youth organizations, often in close collaboration, have developed rules and regulations for access and use of natural resources including rivers and fish.

In recent years, in several communities landslides altered fish refuge and spawning habitats and, thus, impacted access to and temporary availability of fish in rivers. Likewise, uncontrolled use of unsafe fishing methods such as electro fishing, use of explosives and agro chemicals are reported as major reasons for decline in fish stocks. Control of fishing grounds is difficult as they are located far away from upland villages and frequent intrusion of fishers from outside is reported.

Rules & regulations

- Fish protection initiatives - Fishing regulations

Examples:

**Loklung** (Youth Fellowship in agreement with VTA)

VTA meeting minutes from 1 August 2016

Agree not to catch or kill beaver

Agree not to catch fish during the spawning season

Agree not to go to the river during spawning season for fishing

Agree not to use fish catching methods such as:

- "Chang Kham" [weir across river with opening(s) for attached basket(s) to catch up-migrating fish; weir can also be used in combination with electrofishing gear and poisons]
- "Fuan bawn" [same as Chang Kham to catch down-migrating fish]
- Electrofishing
- Poisoning with agro chemicals
- Poisoning with natural plant substances from roots, barks, branches and leaves
- Mosquito net

## 6. Conclusion

Fish does play an important role in the diet of upland villages in Hakha Township. Wild fish from the rivers and creeks still remains the main source of fish even in villages where aquaculture is practiced. Since the introduction of aquaculture in the first half of 1970s extensive fishpond aquaculture has been established mostly in villages at higher elevations. There is no commercial fishpond aquaculture, i.e. semi-intensive or intensive fish farming that would constitute the main income of a farmer household. Common Carp is by far the main cultured fish with Grass Carp only cultured occasionally. Fish seed production is limited while demand for fish fingerlings appears to be high, especially for stocking in paddy rice fields.

Concerns are identified in many areas of Good Aquaculture Practice, including the lack of clarity on the strain of fish, inadequate brood stock management, and the use potentially pest threatening exotic fish species in aquaculture; limited attention to integrated production and pest management; and the need for strengthening community-based fisheries management initiatives and linking them into up-scaled fisheries co-management structures.

Comparable to agriculture, the options for promoting nutrition-sensitive food production in the fisheries sub-sectors aquaculture and fisheries depends strongly on the elevation of the target villages, which in turn conditions the landscape feature of gradient, temperature, and consistency of water availability. Consequently, the rational choices for food production of farmers, women and fishers/fish farmers is framed by the physiographic conditions that are linked to the level of elevation.

## 7. Recommendations

The following five NOAC project initiatives are proposed to address the current identified issues concerning limited capacity, lack of technical knowledge and low institutional and organizational capacity in the area of aquaculture and wild fisheries management. These recommendations are further outlined in LogFrame format in Section 8 where preliminary Outputs and corresponding Activities are set out for each initiative as further guidance. Once agreed on specific proposed initiatives this initial framework will need to be detailed for actual implementation.

The implementation of the NOAC project initiatives will take place in Farmer Field School[2] format that will be adjusted to the particular needs of each initiative. Due to the idiosyncrasy of the "backyard" fishponds in the target villages of Hakha Township rendered the potential for designing an integrated model with livestock-fish-crops for piloting in five villages impractical. The recommendations put forward here aim at

> (1) Improving the current aquaculture practices including fish seed production, availability and accessibility;
>
> (2) Testing the efficiency of Integrated Production and Pest Management combining rice pest management with fish production; and
>
> (3) Supporting the development of river fisheries co-management based on existing community-based initiatives for environmental protection and good governance.

### 7.1 Good Aquaculture Practice

> "Good aquaculture practices (GAqPs)[3] are a series of considerations, procedures, and protocols designed to foster efficient and responsible aquaculture production and expansion and to help ensure final product quality, safety, and environmental sustainability." (Schwarz et al. 2010:1)

This initiative is designed to ensure that fish farmers in the project target villages strengthen their knowledge and experience in Good Aquaculture Practices so as to enhance fish yields in their ponds by using technically sound and environmentally safe practices. The initiative would include all interested fish farmers from villages where there are fishponds in operation. Focus of this initiative will be on Common Carp aquaculture as it is the most farmed species and, since non-native, with high need for promoting farming procedures intended to protect local fish stocks and ensure biodiversity in the long term.

It would take the form of a cycle of awareness and hands-on practical training at selected, well-operated fishponds (of model "fish farmers") where interested fish farmers would convene at

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[2] The term Farmer Field School is used here to maintain consistency with the project proposal document and the terminology of mainstream discussion on this topic. However, in Chin language and during actual field implementation the term "school" is avoided so as to avoid the association with top-down teaching and learning by heart as the facilitation approach used aims at proactive engagement in and development of ownership of experimental farming activities in the so-called Farmer Field School.

[3] The concept GAqPs was developed for commercial aquaculture that aims at the export of fish originating from aquaculture so as to ensure environmental and biosafety in the country of origin and food safety in the destination country. The main GAqPs items though are also applicable for small-scale aquaculture. (Schwarz et al. 2010; APEC-FSCF 2013)

certain moments during the yearly aquaculture production cycle, e.g. at the time of pond preparation, fish stocking, and feeding & harvesting. To this end, the hired aquaculture specialist would prepare a syllabus; prepare visuals and training materials in Chin language (with the assistance of the NOAC project staff, if and as necessary).

Also, there is a need to gage the willingness of "model fish farmers" to participate as resource persons and make available their fishponds throughout the training and awareness building cycle. Pu Phirmawng and Pu Thla Ceu, from Hniralawn and Chuncung, respectively, have signalled their predisposition to participate in this initiative as "model farmers". Both have 6-7 fishponds and are known in Hakha Township and beyond as "model fish farmers". In Hniarlawn and in Chuncung there are also relatively high numbers of fishponds, many of them operating in low-yield mode. Chuncung is located close to the border of Falam Township and would be easily accessible by students from State Agricultural Institute, Lungpi.

Extension officers from the Fisheries Department at State and District levels would also participate and, depending on their particular expertise, would prepare for and train certain topics. Likewise, students from the State Agricultural Institute, Lungpi, and Yezin Agricultural University could as it may fit into their academic curriculum.

The main training/awareness topics would include: site location; production system design; source of fry and fingerlings; water quality for growing fish; facility biosecurity; feeding management, procurement, and storage; production techniques for disease prevention and control to maximize fish health; veterinary drugs; harvesting procedures; and cleaning and sanitation basics to ensure final product quality and food safety.

This initiative will be implemented during the timespan of one year (2017) in two "model fish farms" starting with the fishpond preparation and related training topics. During the fish production year three 2-3 awareness and hands-on training sessions would be provided. A similar training cycle will be implemented in the following year (2018) with training fish farms and syllabus adjustments as deemed necessary.

Complementary, the fish farmer resource persons, i.e. the "model fish farmers" will be engaged for short (3-4 days) periods by the project to conduct FishFarmer-to-FishFarmer extension activities in the 2$^{nd}$ cycle 2018 project target villages of project implementation. It is expected that as a result of this GAqPs training and awareness initiative dormant fishponds will be increasingly rehabilitated and better practices applied.

Finally, the implementation of this initiative will be monitored and lessons learnt documented. They will be the main ingredients for a final workshop with DoF extensionists and professors from SAI and Yezin University (and other knowledgeable stakeholders) to explore the elements that will need consideration in the formulation of a NSA curriculum in the area of fisheries extension.

## 7.2 Support to brood stock management and fish seed production

This initiative is designed to improve the knowledge and skills of quality fish seed production so as to enhance availability and accessibility of fish fingerlings in project target villages and rural communities in Hakha Township.

The initiative will target current fish fingerling producers. It will review in a participatory manner the details of current fish seed/fingerling production in project target villages and facilitate a learning process that encourages local fish farmers to improve breeding technology. Technical training topics include brood stock identification, brood stock management including renewal of brood stock, fish ecology and spawning behaviour, fish breeding, and management of fish spawn, larvae, juveniles and fingerlings, as well as good fish seed nursing and feeding practices.

The "model fish farmers" mentioned as resource persons for the GAqPs awareness training also practice high standards of fish seed production and their fish farms are considered as main sources of fingerlings for local fish farmers. Complementary to formal training and practice sessions at model farms, the resource persons could also engage as Fish Farmer-to-Fish Farmer extension work whereby a model fish farmer could visit fish farms in one village and discuss and share his

knowledge on both general fish farming practice and more specifically on seed production so as to encourage village-based seed production.

In close collaboration with DoF, Aquaculture Division and the MFF this initiative will also promote the networking, communication and association of local Common Carp (or other species) breeders to maintain and breed pure strains of Common Carp (and other stocked fish) by certified breeders in licensed fish hatcheries.

The benefits will be measured in terms of increased dedication of fishpond owners to cleaning their ponds and installing separate small ponds for better brood stock management.

The implementation of this initiative will be monitored and lessons learnt documented. They will be the main ingredients for a final workshop with DoF extension officers, professors from SAI and Yezin University (and other knowledgeable stakeholders) and resource fish farmers to explore the elements that will need consideration in the formulation of a NSA curriculum in the area of fisheries extension.

## 7.3 Paddy field Integrated Production and Pest Management (IPPM)

This initiative is designed as an experimental platform that integrates paddy field rice production and pest management with stocking of Common Carp in paddy fields, and thus, leads to reduced week occurrence and increased fish production. The initiative is based on the feeding behaviour of adult Common Carp stirring up the bottom surface of a water body, i.e. in this case a paddy field in its search for feed. In this way the omnivorous fish softens the soil while feeding on herbs, weed, weed seed, as well as on worms, insects, and all kind of organic matter. This in turn reduces the need for weeding requirements during the rice growing period by more than 33% (….) on the one hand and on the other, the fish grows much faster than in a pond due to highly nutritious feed available and readily accessible in the paddy land ahead of the rice farming season.

It will only be conducted where similar initial initiatives exist and soil conditions promise some level of success, i.e. the soil in a paddy plot should keep the water. Different trial plots will be installed to observe and measure differences in weed regrowth and fish growth. Three to four plots will be prepared with different stocking rates and with and without ploughing before transplanting rice seedlings.

This initiative could be conducted in form of a Farmer Field School in Tiphul village where one farmer, Pu Thong Kam, is practicing a similar IPPM technique. The willingness of Pu Thong Kam still needs to be gaged for participation in this initiative. Exposure field visits will be organized from other villages where farmers express high interest in learning about these trials and where this technology could be potentially applied. Importantly, the Farmer Field School will record all activities, inputs (time, fish size and numbers, type of work, land preparation expenditures, labour expenses, etc.) and outputs (fish, amount of weed, rice yield, etc.) for each trial plot so as to compare and explore the most efficient and/or high yielding practice. The most successful IPPM technology will then be propagated through Farmer-to-Farmer extension work in villages with suitable soil conditions.

The implementation of each of the steps of this initiative will be monitored and issues encountered and lessons learnt documented. They will be important ingredients for a final workshop with DoF extension officers and professors from SAI and Yezin University (and other knowledgeable stakeholders) where the elements that will need consideration in the formulation of a NSA curriculum in the area of IPPM extension will be explored.

## 7.4 Exploration of indigenous fish species for upland aquaculture (with DoF)

This initiative is designed to start exploring possibilities to farm indigenous fish species in upland communities so as to phase out and replace in the medium term the non-native Common Carp in aquaculture.

While wild stocks of Common Carp (*Cyprinus carpio*) are listed by IUCN-CITES as vulnerable, the domesticated Common Carp is often considered a destructive invasive species (Fishbase.org) and is included in the List of the world's 100 worst invasive species. (IUCN 2014)[4] Given its use in stocking practices of leasable fisheries in Myanmar it can be safely assumed that this species is established in the wild. Yet it is not known under what kind of environmental triggers (e.g. water quality, water condition, and combination of water and/or ambient factors, etc.) the Common Carp would become invasive. Fishbase.org, consequently, is listing Common Carp as a "potential pest", thus, demanding a precautionary approach to its management. (http://www.fishbase.org/)

NOAC will explore, in close collaboration with the Aquaculture Section of DoF, the use of indigenous fish species in upland areas with colder environmental conditions than the lowland. Potential native species to try out could be Rohu (*Labeo rohita*), Mrigal (*Cirrhinus mrigala*), Catla (*Catla catla*). Also, this initiative will be implemented in close collaboration with SAI and Yezin University so as to incorporate the lessons learnt from different farming trials into their NSA-fisheries curricula.

## 7.5 Engaging with existing local "environment initiatives" for fisheries co-management

This initiative is designed to strengthen existing environmental conservation initiatives with particular attention to local rivers and their fisheries. The ultimate goal is to ensure sustainable management and use of fisheries resources and river habitats as an important source of quality food and nutrition.

Given the importance of access to and source of animal protein of wild fish local communities have started to realize the urgency of taking measures to conserve the fisheries. Under different organizational forms some of the communities, mostly villages of lower elevations such as Bunzung, Leium A, Chawncum and Keizuan, have started to develop initial rules and regulations. The general gist of these rules is that of repression and policing with little considerations of fisheries ecological aspects that ideally would inform fisheries management measures. Nevertheless, these local initiatives indicate a high level of urgency and commitment to address the issue of fisheries habitat conservation and management.

This NOAC project initiative takes stock of all rules and regulations that communities have developed through their Village Tract Administration or by Youth Fellowship, Minnow group, Ecology Committee, etc. so as to fully understand the current set of regulations and identify gaps and/or contradictions among them. Likewise, the project will explore with the local groups their institutional set-up of the development and enforcement of their current rules. The relationship between these groups and NOAC project will need to be formalized, to some extent, by developing a common work plan. The main outputs of this work plan will focus on documenting Local Ecological Knowledge (LEK) about fish and fisheries through action research approach, developing and use of a basic fisheries identification and monitoring tool to describe the local fisheries in terms of species; migrations; seasonal availability; spawning, nursing and feeding behaviour; history & trends; use of fishing gears, gender participation, fish processing and marketing. Grounded on the insights gained from this action research by local groups the existing local regulatory stipulations will be assessed, reviewed and, if required, adjusted for fisheries management that would allow regulated access to fish resources based on sustainability considerations.

Furthermore, the NOAC project initiative will promote networking among neighbouring communities within a water catchment for harmonization of regulations and enforcement. Dissemination materials for improved fisheries management will be developed and awareness events for the conservation and management of natural fish stocks in the rivers will be conducted.

[4] This list is maintained by IUCN. It acknowledges "It is very difficult to identify 100 invasive species from around the world that really are 'worse' than any others."

Throughout the implementation of this initiative local administrative authorities and fisheries authorities will be informed and engaged. Authorities at the various levels will be part of the broader support network and integral part of a fisheries co-management governance framework. The Fisheries Department will be well positioned to replicate the fisheries co-management facilitation approach in other river basins or catchment areas.

The immediate benefits of this NOAC project initiative will be measured in terms of positive impacts on youth groups' and villagers' participation in action research activities. Also, broad consultation and support by villagers to fisheries management regulations will be an important measurement of success.

This NOAC project is a low input initiative as it depends on proactive engagement of local groups; it mainly requires some basic facilitation materials (flip charts, markers, etc.), notebooks, and fish identification sheets and measurement instruments as well as recording forms.

## 8. Draft plan for project initiatives in support of enhancing fish availability and accessibility for improved nutrition

Preliminary plan for discussion considering budget availability and allocations

| Proposed Initiative | Time Line / LogFrame | 2017 | | | | | | | | | | | | 2018 | | | | | | | | | | | | 2019 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J |
| **1. Promotion of Good Aquaculture Practice** | **Objective**<br>**Strengthen fish farmers' knowledge and experience in Good Aquaculture Practices (GAqPs)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 1*: GAqPs training/awareness initiative well managed** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.1*: Support logistics, communication, transport, field stays, | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity *1.2*: Monitor implementation plan, expenditures within budget, and quality reporting | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.3*: Support production of facilitation materials, staff management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 2*: Training/awareness session plans and materials are prepared and documented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 2.1: Prepare training session plan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 2.2: Prepare training materials | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 2.3: Document training procedures | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 3*: Willingness of participants is gaged & training schedule agreed** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.1*: Agree roles & responsibilities and conditions with resource persons at demonstration fish farm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.2*: Gage willingness of fish farmers to participate in GAqPs training | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.2*: Agree training schedule and implementation plan with participants | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 4*: GAqPs training/awareness initiative implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | Activity 4.1: Field Session 1: Site location; pond preparation; production design; (species specific) fish ecology & environmental considerations; source & handling of fish seed/fingerling; seed/fingerling nursing | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.2: Field Session 2: Fish feeding management, procurement, and storage; water quality for good growth; production techniques for disease identification, prevention and control to maximize fish health; veterinary drugs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.3: Field Session 3: Fish harvesting procedures; post-harvest considerations; Graduation of participants (linked to fish food preparation and nutritious food awareness event) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 5*: Lessons Learnt from GAqPs training/awareness initiative monitored and documented for feedback into NSA curriculum development at SAI and Yezin** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.1: Record regularly performance of GAqPs training/awareness and issues encountered | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.2: Conduct Lessons Learnt workshop on GAqPs training/awareness with resource FishFarmers, DoF extension officers, SAI and Yezin professors for fish farming. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.3: Formulate approach and activities for SAI and Yezin NSA curriculum for fisheries | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **2. Support to brood stock management and fish seed production** | **Objective**<br>**Improve knowledge and skills of quality fish seed production and availability of and accessibility to fish seed in target villages** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 1*: Fish breeding and seed production training initiative is well managed and implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Proposed Initiative | Time Line | 2017 | | | | | | | | | | | | 2018 | | | | | | | | | | | | 2019 | | | | | |
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| | *Activity 1.1*: Support logistics, communication, transport, field stays, | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.2*: Monitor implementation plan, expenditures within budget, and quality reporting | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.3*: Support production of facilitation materials, staff management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 2*: Current fish seed producers, their seed production practices and access to seed are identified** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 2.1*: Conduct participatory SWOT analysis of fish breeding and seed production with fish farmers in selected villages | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 2.2*: Explore sources and quality of fish fingerings that are stocked in the village | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 2.3*: Explore solutions to produce and access better and more abundant fish seed with fish farmers in selected villages and establish training needs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 3*: Training session plans, materials and field demonstration pond facilities are prepared** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.1*: Prepare training session plan and corresponding training materials (visuals) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.2*: Ensure adequate timing, conditions and facilities for training in field demonstration ponds | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 4*: Fish breeding and seed production training implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.1: Conduct training in fish breeding and seed production at fingerling production farm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.2: Conduct participatory evaluation of the training and define follow-up FishFarmer-to-FishFarmer extension needs and modalities | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 5*: FishFarmer-to-FishFarmer extension plan** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | **developed and implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.1: Prepare FishFarmer-to-FishFarmer extension work plan in close collaboration with resource FishFarmers | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.2: Implement extension work plan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 6*: Lessons Learnt from FishFarmer-to-FishFarmer extension work is monitored and documented for feedback into NSA curriculum development at SAI and Yezin** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 6.1: Record regularly extension work performance and issues encountered | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 6.2: Conduct Lessons Learnt workshop on extension work for improvement of production, availability and accessibility of fish seed with resource FishFarmers, DoF extension officers, SAI and Yezin professors for fish farming. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 6.3: Formulate approach and activities for SAI and Yezin NSA curriculum for fisheries | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **3. Paddy field Integrated Production and Pest Management (IPPM)** | **Objective**<br>**Explore efficient paddy field rice production & pest management (IPPM) by stocking Common Carp in an environmentally safe manner** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 1*: IPPM initiative is well managed and implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.1*: Support logistics, communication, transport, field stays, etc. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.2*: Monitor implementation plan, expenditures within budget, and quality reporting | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.3*: Support production of facilitation materials, staff management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 2*: On-farm trial demonstration plan prepared and** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | **documented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 2.1: Prepare plan, in consultation with resource farmer, for on-farm trials of different plots (different stocking densities, with or without ploughing, etc.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 2.2: Document on-farm demonstration procedures and record and measure all inputs, important events and outputs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 3*: Willingness of participants and resource farmers is gaged & training schedule agreed** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.1*: Agree roles & responsibilities and conditions with resource farmer(s) at field demonstration plot | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.2*: Gage willingness of fish farmers to participate in IPPM on-farm experimental trials | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 4*: IPPM initiative is implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.1: Select on-farm demonstration plots | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.2: Stock Common Carp at different densities in different plots according to plan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.3: Plough and till demonstration plot according to plan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 4.3: Plough and till demonstration plot according to plan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 5*: Lessons Learnt field exchange visit(s) and workshop implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.1: Analyse on-farm trial data and prepare presentation materials about results of analysis for field exchange visits | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.2: Prepare demonstration materials for field exchange visits to the demonstration plots by interested farmers | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.3: Conduct field exchange visit(s) to the on-farm | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | IPPM demonstration plots by interested farmers and DoF, SAI and Yezin University | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 5.4: Conduct IPPM lessons learnt workshop with SAI and Yezin University to explore usefulness for and integration into NSA curriculum | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **4. Promote indigenous fish species for upland aquaculture** | **Objective**<br>**Test potentially suitable indigenous fish species for upland aquaculture technology** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 1*: Potentially suitable indigenous fish species selected in close collaboration with DoF** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 1.1: Explore options with DoF and fisheries stations for promising fish species for upland aquaculture | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 1.2: Gage interest with fish farmers in project target villages and SAI and Yezin to engage in farming trials with indigenous fish species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 1.3: Convene decision-making platform to decide on which species to test | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 2*: On-farm trials for testing suitability of indigenous fish species for upland aquaculture designed** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Activity 2.1: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 3*: On-farm trials for testing suitability of indigenous fish species for upland aquaculture implemented and documented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 4*: On-farm trial data and prepare presentation materials for indigenous fish upland aquaculture analysed** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | ***Output 5*: Lessons Learnt workshop for designing further approach to promoting uplands indigenous fish aquaculture convened** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **5. Engaging with local environment conservation initiatives for Fisheries Co-Management** | **Objective**<br>**Strengthen existing environment conservation initiatives with particular attention to the management of local rivers and their fisheries** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 1*: NOAC Fisheries Co-Management initiative is well managed and implemented** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.1*: Support logistics; communication; transport; field stays; networking meetings. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.2*: Monitor implementation plan, expenditures within budget, and quality reporting | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 1.3*: Support production of facilitation materials, staff management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 2*: Baseline survey on local environmental protection initiatives (EPI) with special focus in fisheries conducted** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 2.1*: Design and test survey approach | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 2.2*: Conduct survey | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 2.3*: Compile and analyse survey results | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 2.4*: Design preliminary approach to and action plan for engaging with EPI and authorities at the various levels for fisheries co-mangement | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 3*: Action plan with EPI and authorities for strengthening and developing fisheries co-management consulted and prepared** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.1*: Consult with EPI and authorities on preliminary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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| | action plan and adjust plan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.2*: Define NOAC support and facilitation activities for EPIs' action research, networking, and institutional strengthening | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 3.3*: Prepare budget for approval | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 4*: Facilitation support to EPIs' plan of action provided** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 4.1*: Prepare facilitation materials as required | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 4.2*: Facilitate EPIs' action research on LEK, fish identification & ecology, and fishing practices | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 4.3*: Facilitate EPIs' institution building for fisheries co-management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 4.4*: Facilitate EPIs' networking initiatives with neighbouring villages and within the catchment and authorities at the various levels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ***Output 5*: Lessons Learnt documented and fisheries co-management meeting with DoF convened** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 5.1*: Document Lessons Learnt from this NOAC initiative | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 5.2*: Prepare communication and dissemination materials on Lessons Learnt on upland fisheries co-management | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | *Activity 5.3*: Convene a meeting with DoF to present and discuss approach to and results of NOAC fisheries co-management initiative | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

## ANNEXES

**Annex 1: List of References**


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**Annex 2: Target villages visited and persons met**

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