Department for Environment Food & Rural Affairs

DARWIN INITIATIVE

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Darwin Initiative Main and Post Project Annual Report

Submission Deadline: 30th April 2019

Darwin Project Information

Project reference	24-014
Project title	Carrots and sticks: Incentives to conserve hilsa fish in Myanmar
Host country/ies	Country 1: Republic of the Union of Myanmar (also known as Myanmar/Burma); Country 2: Bangladesh (collaborating country)
Lead organisation	International Institute for Environment and Development (IIED)
Partner institution(s)	Department of Fisheries Myanmar; WorldFish Myanmar; Network Activities Group (NAG); Zoology Department Yangon University (YU).
Darwin grant value	£301,895 (Year 2 grant £80,534)
Start/end dates of project	Start date: 01 April 2017 End date: 31 March 2021
Reporting period	April 2018 – March 2019; Annual report 2
Project Leader name	Dr Essam Yassin Mohammed
Project website/blog/Twitter	https://www.iied.org/carrots-sticks-incentives-conserve-hilsa-fish-myanmar
Report author(s) and date	Michael Akester (WorldFish Myanmar), Eugenia Merayo Garcia (IIED), Annabelle Bladon (IIED) and Essam Yassin Mohammed (IIED). 30 April 2019

1. Project rationale

The hilsa shad, *Tenualosa ilisha* (locally called *Nga Tha Lauk*), forms one of Myanmar's most important fisheries. Although it only makes up a small portion of official fish production (1-5%; see Box 1), it has a high value. In 2018, hilsa exports amounted to 11,400 MT with a value of USD32 million, making it the fourth most valuable export species in Myanmar. As a migratory species, hilsa is caught in both marine (inshore and offshore) and inland areas, and it supports the livelihoods of at least 1.6 million people.

But hilsa is under severe threat from overfishing, habitat destruction, and climate change. Myanmar's marine and freshwater fisheries legislation is archaic and monitoring, control, and surveillance is limited. This has led to widespread Illegal, Unreported, and Unregulated (IUU) fishing, inaccurate fisheries statistics (see Box 1), and exploitation rates that are estimated to be beyond sustainable levels. These issues are further complicated by the high levels of poverty in small-scale fisher communities, which make it difficult for many households to comply with closed fishing seasons. The impacts of their fishing activities are compounded by other anthropogenic threats to hilsa migration and spawning grounds – particularly flood control (river diversion and

damming), irrigation, and drainage infrastructure, which blocks the migration of hilsa to and from the sea.

With Darwin Initiative support, IIED previously worked with host-country partners on a project in Bangladesh (known as Darwin-Hilsa[BD]) that aimed to improve incentive-based hilsa fishery management in the country. It is reported that the project succeeded in enhancing the impacts of this management, both in terms of biodiversity conservation and livelihood protection. At a regional seminar sharing project achievements (Dhaka, May 2016), scientists and officials from Myanmar called for the development and implementation of a similar approach in Myanmar. Therefore, this project aims to design a cost-effective, scientifically-researched, and participatory 'incentive-based' hilsa fishery management mechanism for Myanmar. We are using the following methodological building blocks to achieve this:

1. **Understand the biology and ecology of the hilsa fishery**. We will assess spawning seasonality and migratory routes of hilsa in order to demonstrate when closed seasons should be imposed and where hilsa sanctuaries should be placed.
2. **Understand the complex socio-economics of hilsa fishing**. We will conduct a socio-economic assessment of hilsa fishing households in the region to understand their challenges and opportunities for socio-economics improvement. We will use a choice experiment to assess preferences for incentive packages and the level of incentive packages required to offset the short-term cost (opportunity cost) of abiding by fishing regulations.
3. **Make a business case for investment in hilsa management**. We will estimate the economic value of the hilsa fishery and use cost-benefit analysis to make a compelling business case as to why the government and the private sector should make sufficient investments to restore the fishery.
4. **Develop a sustainable financing mechanism**. Through multi-stakeholder workshops, we will explore and establish innovative financing mechanisms using fiscal reforms, independent fund management, and private sector investment.
5. **Lay the foundation for the development of transboundary hilsa fisheries management**. Migrating between marine and freshwater, the hilsa presents a transboundary fisheries management challenge for Myanmar and Bangladesh, which together account for up to 85% of hilsa production. An important component of this project is therefore to establish a platform for dialogue to catalyse the development of a transboundary hilsa fisheries management plan between Myanmar and Bangladesh.

The project focuses on the Ayeyarwady Delta Region, where most of Myanmar's hilsa fishing takes place (Fig.1). Within this area, up to nine study sites (townships) were selected for the ecological, biological, and socio-economic components of the project.

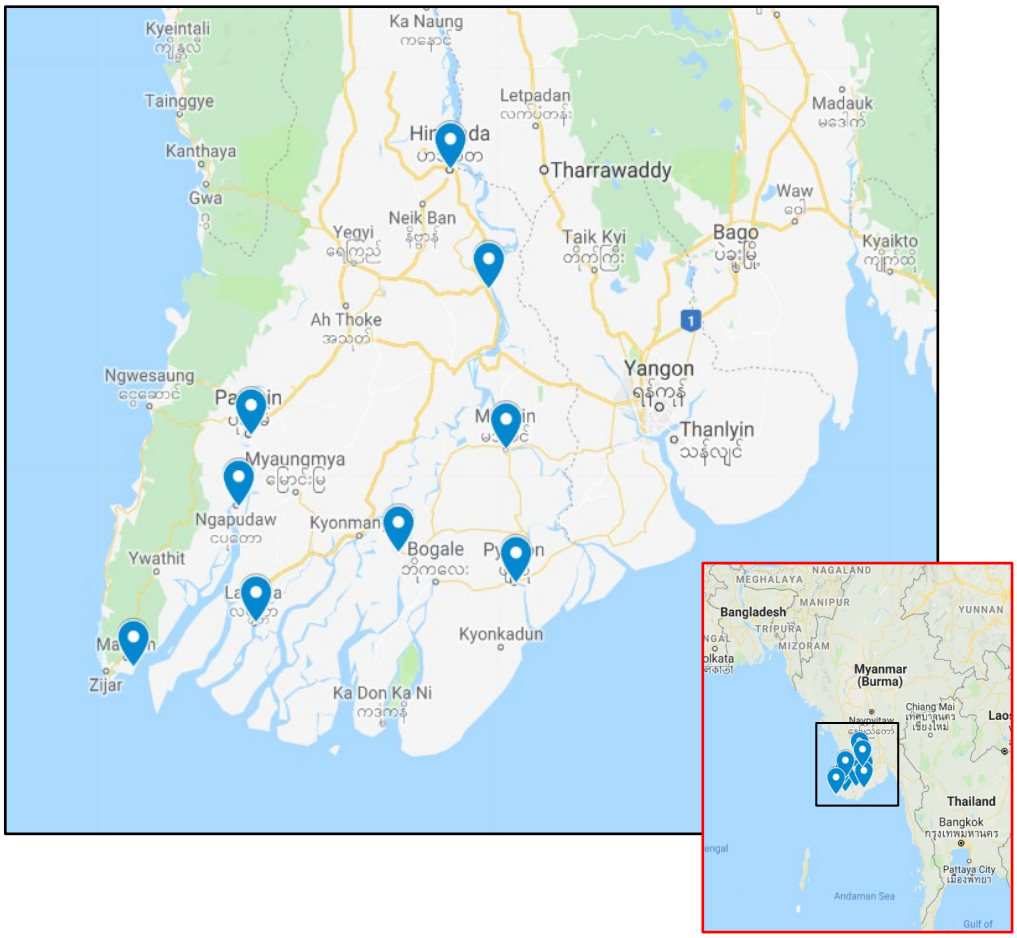


***Figure 1**. Map of the Ayeyarwady Delta Region and nine study sites within it.*

2. Project partnerships

Since inception of the project, IIED has maintained partnerships with WorldFish Myanmar, Yangon University (YU), the Network Activities Group (NAG) and the Department of Fisheries (DoF) of the Ministry of Agriculture, Livestock and Irrigation of Myanmar.

As lead institution, IIED committed to draw on its international experiences in incentive-based fisheries management to ensure best practice in relation to effectiveness, equity, and financial sustainability, and to facilitate transboundary dialogues between Myanmar and Bangladesh. We also took responsibility for the design of the socio-economic studies, including choice experiment. Over the course of Year 2 (FY 2018-2019), the IIED team has consistently supported partners through project coordination and quality control. For example, we supported NAG to analyse socio-economic data and produce a report; we initiated the design of a choice experiment with support from NAG and external consultants; and we coordinated a transboundary workshop in Bangladesh, along with two related communication products (see Section 3.2). IIED committed to co-finance 13% of the total project budget. In Year 2, we fulfilled this commitment by covering travel and subsistence for two IIED staff trips to Myanmar (five people in total) and one NAG staff member to attend a workshop in Scotland on the choice experiment design.

WorldFish Myanmar is the lead host-country partner organisation – supporting documentation and reporting, data collection, liaising with DoF and other local stakeholders, and presenting research findings to government and fisher organisations. WorldFish also committed to co-finance 11% of the total project budget, which covers their overheads and extra staff costs. During Year 2, Michael Akester, Country Director, spent an extra 17 days on the project. WorldFish Myanmar has been instrumental in liaising with partners and providing IIED with logistical assistance and in-country insights. They supported NAG on the socio-economic survey, and partnered with WorldFish Bangladesh to organise the transboundary workshop held in

Bangladesh (see Section 3.1). The team have also committed to support Yangon University to produce first drafts of two reports on the ecology and biology of the hilsa fishery.

The WorldFish-led project ECOFISH[BD also] provided in-kind and financial support towards the transboundary hilsa fisheries management workshop held in Bangladesh, which they were happy to provide due to a long-standing partnership between WorldFish Bangladesh and IIED.

The DoF's role is to ensure that the Myanmar government is fully engaged and aware of this project's research findings. During Year 2, the Ayeyarwady Regional Fishery Officer (supported by district DoF officers) coordinated the collection and transportation of hilsa specimens from landing sites. These data are now being used by Yangon University to produce two reports: one on the spawning seasonality of hilsa fish and another on their migratory routes. Furthermore, in October 2018, the Director General of DoF Myanmar wrote and signed a written statement in support of an incentive-based hilsa fishery management mechanism for Myanmar, stating that: *"The Darwin initiative project is providing valuable up to date research into the current status of the hilsa fishery in the Ayeyarwady Delta"* (see Annex 4). This reinforces the commitment of the DoF to the ambition and goals of this project.

WorldFish has a 10-year country agreement with the Ministry of Livestock, Fisheries and Rural Development, which commits to building research and development capacity in the DoF and providing technical inputs to undertake surveys and research with DoF and the fishery sector partners. During Year 2, WorldFish has been collating and analysing catch data from a survey conducted by associate U Kyaw Min from the DoF. These data, not yet published, are already helping the project team to further understand the socio-economics of the hilsa fishery, with significant relevance for the design of the incentive mechanism.

Yangon University has been leading the biological and ecological research elements of the project. During Year 2, a team of fisheries scientists designed the research methodology, collected data with assistance from the DoF (body length and weight, gonad weight, and sex ratio) and analysed this data with support from WorldFish (see Section 3.1). They are currently drafting two reports based on this analysis which will be available in Year 3 of the project period.

NAG's role in the project is to work directly with fishing communities and help to strengthen capacities in better fishery management. The NAG team has designed and conducted a socio-economic survey and produced a report that will inform the design of an effective incentive-based mechanism. A socio-economist from NAG also attended a workshop organised by IIED and Scotland's Rural College (SRUC) in Edinburgh (Scotland) to design the choice experiment (see Section 3.1).

Overall, the partnership between the lead institution and host-country partners, including the DoF, can be rated as outstanding.

New partnerships

The project has catalysed new partnership opportunities and synergistic projects during Year 2. IIED has contracted Scotland's Rural College (SRUC) to design the choice experiment, bringing additional research capacity into the Darwin project. The DoF-led Myanmar Fisheries Partnership (MFP), for which WorldFish also holds a Secretariat role, has also provided a platform through which the Darwin project has linked to other partners and projects. For example:

- The Yangon University team has formed a collaboration with Dr John Conallin from Charles Sturt University Australia and the IHE Delft Institute for Water Education (the Netherlands) who are providing financial support for hilsa otolith analysis. This will provide a useful comparison to our research on spawning seasonality.
- The DoF has partnered with researchers on a project funded by the Australian Centre for International Agricultural Research (ACIAR) that is looking at the cost effectiveness of installing fish passes on the river systems in Myanmar (see: https://reachout.aciar.gov.au/ladders-of-success). One of the key aims is to ensure that hilsa are able to migrate to their spawning grounds upstream and that juveniles can return to the sea. This research will complement the management strategy being promoted by the Darwin project.

3. Project progress

3.1 Progress in carrying out project Activities

Year 2 Activities are on track based on the revised logical framework (please see half year report). Some further revisions have been made to activities 2.3 and 5.1, following Year 2 monitoring and evaluation exercise, as explained in Section 8 and below (please see attached change request form).

Spawning seasonality of hilsa using gonadosomatic index (1.1) and assessment of migratory routes of hilsa (1.3)

Activities under the biological and ecological component of the project are on track. Yangon University identified nine sample sites from three different ecological zones (coastal, brackish, and freshwater) in the study area (Fig.2).

***Figure 2**. Map of study sites in different ecological zones in the Ayeyarwady Delta Region: coastal locations shown in red (Hainggyi, Labutta, Mawlamyinegyun and Pyapon Townships); brackish locations shown in blue (Maubin, Ngapudaw, and Pathein Townships); and freshwater locations in orange (Danuphyu and Hinthada Townships).*

Monthly sampling was conducted at these study sites during the last week of the month (Fig.3), over the period from November 2017 to November 2018. A total of 971 mature hilsa were collected during the study period (530 females and 441 males). After measuring total length, standard length, and body weight of each specimen, the team dissected them to identify the sex and removed and weighed the gonads. Some dissections were performed on site and some were performed at Yangon University Zoology Department's laboratory, where specimens were transported on ice within 36 hours. Measurement of these parameters allowed the team to calculate sex ratio (number of females / number of males), and Gonadosomatic Index (GSI), a tool for measuring sexual maturity using the following formula: [gonad weight/body weight] * 100.

The team has analysed the data and shared preliminary results at the transboundary hilsa management workshop in March 2019 (see Annex 4 for slides). Monthly variation in the parameters assessed provides an indication of spawning seasonality, and when analysed in the

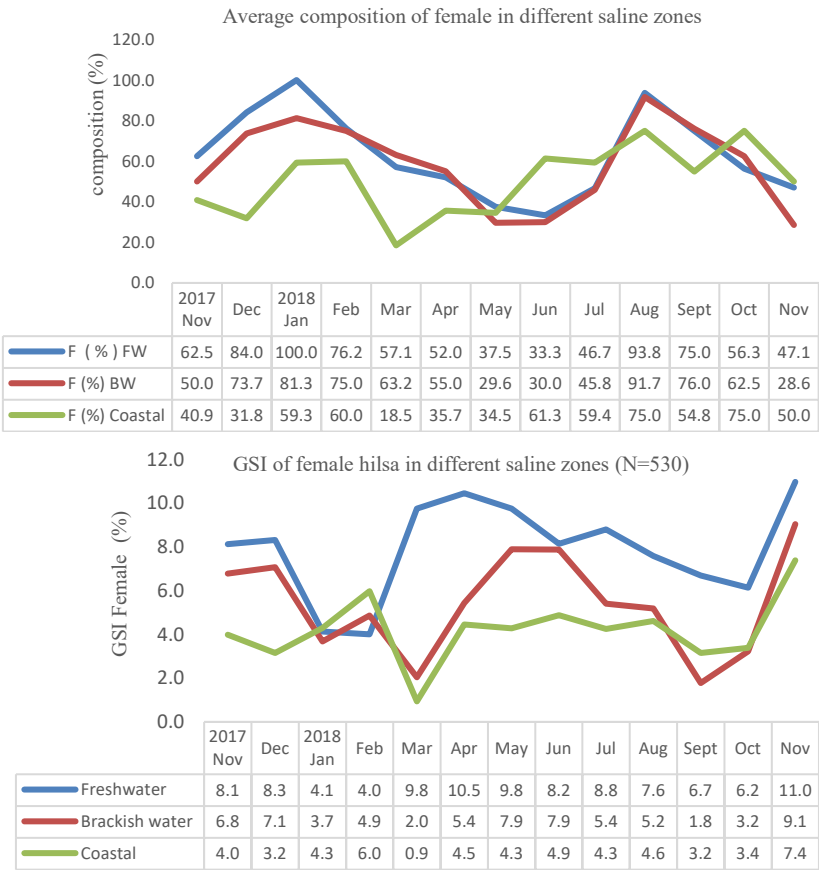
context of differences between ecological zones, this will contribute to understanding the migratory routes of hilsa. Two written reports have been drafted – one on spawning seasonality and another one on migratory routes. These are on track to be finalised by Q1 of Year 3 (June 2019).

***Figure 3**. The project team sampling, measuring, and dissecting hilsa fish at study sites.*

Results indicate that spawning takes place across each of the ecological zones. In the freshwater and brackish zones, findings indicate two similar spawning periods: October to December (in freshwater this period was shorter – October to November) and March to July. In the coastal zone, data show two much shorter periods of spawning in February and November (Fig.4).

In the freshwater zone, the reduced proportion of males sampled during December, January, and February could have a negative impact on success of fertilisation or recruitment. In the brackish zone there were proportionately more female fish from January to March, but GSI was low, indicating that these fish were spent (gonads have released gametes) and on their way back to

marine feeding grounds after spawning in December. In the coastal areas there were proportionally less fully mature females, but from November to February their GSI levels increased, indicating that mature female fish were starting to move upstream to spawning grounds over this period.



	2017 Nov	Dec	2018 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
F (%) FW	62.5	84.0	100.0	76.2	57.1	52.0	37.5	33.3	46.7	93.8	75.0	56.3	47.1
F (%) BW	50.0	73.7	81.3	75.0	63.2	55.0	29.6	30.0	45.8	91.7	76.0	62.5	28.6
F (%) Coastal	40.9	31.8	59.3	60.0	18.5	35.7	34.5	61.3	59.4	75.0	54.8	75.0	50.0

	2017 Nov	Dec	2018 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov
Freshwater	8.1	8.3	4.1	4.0	9.8	10.5	9.8	8.2	8.8	7.6	6.7	6.2	11.0
Brackish water	6.8	7.1	3.7	4.9	2.0	5.4	7.9	7.9	5.4	5.2	1.8	3.2	9.1
Coastal	4.0	3.2	4.3	6.0	0.9	4.5	4.3	4.9	4.3	4.6	3.2	3.4	7.4

***Figure 4**. Monthly percentage of females and gonadosomatic index of females in freshwater, brackish water and coastal zones.*

These initial results provide evidence that the DoF should modify fisheries legislation at Union and State/Regional levels. The existing May-July closed season may need extension to include the months of March and April (at least in freshwater/riverine ecosystems), and a second closed season should be implemented in October-November to protect spawning hilsa. The results also highlight the importance of improved monitoring, control, and surveillance during these times, and the value of an incentive-based approach that should improve compliance.

Furthermore, we expect the data on location of spawning and migratory routes to help guide decisions on setting up hilsa sanctuaries – which currently do not exist.

Hilsa otoliths were also collected during this survey but are yet to be analysed (as mentioned in Section 2, this is dependent on extra financial support from Charles Sturt University Australia). By comparing barium and strontium concentrations, we can estimate when the fish moved from salt to freshwater and back again (Fig.5). These results should help to corroborate findings from the GSI analysis.

***Figure 5**. Hilsa otoliths from specimens collected during this survey.*

Socio-economic assessment of hilsa fishing communities in the delta (2.1)

A socio-economic assessment of the hilsa fishery has been completed and published as an IIED country report (available here: https://pubs.iied.org/16656IIED/). The goal of this assessment was to develop a baseline understanding of the socio-economic characteristics of hilsa fishing households and the challenges and opportunities which they face. NAG collected data during the period of 6 April to 13 May 2018 from four study sites: Ngapudaw, Maubin, Mawlamyinegyun, and Labutta Townships (Fig.6). Townships were selected in consultation with the DoF for their importance as habitats for hilsa, the concentration of hilsa fishers, and accessibility of landing sites. The initial selection included Hinthada instead of Labutta, but when very few hilsa fishers were found in Hinthada, it was replaced with Labutta. Each of these sites were also included in the ecological and biological survey.

***Figure 6**. Google map showing the four townships surveyed (in clockwise direction: Ngapudaw, Maubin, Mawlamyinegyun, and Labutta).*

Quantitative data were collected through a household survey, and qualitative data were collected through key informant interviews, focus group discussions, and Participatory Rural Appraisal (see

Annex 4 for questions used). Data were collected from 46 villages (see Fig.7 for photo of data collection and Table 1 for sample sizes for each method and type of informant). Data were collected on demographics, housing and living conditions, assets, income, expenditure, debt, alternative livelihoods, hilsa fishing and marketing activities, local ecological knowledge, perceptions of sustainability and co-management activities, and environmental awareness and motivation for conservation.

***Table 1**. Details of sample sites and sample sizes by survey method (household survey, focus group discussions, Participatory Rural Appraisal (PRA), and key informant interviews).*

Township	Total population	Total villages	Sample villages	Household surveys	FGDs	PRA	KIIs				
							Total	DoF	Township fish collector	Village admin.	Village fish collecto
Labutta	75,583	505	15	274	15	15	45	1	3	15	27
Maubin	71,804	442	9	162	9	9	27	1	0	9	6
Mawlamyinegyun	74,886	676	13	235	13	13	39	1	3	13	19
Ngapudaw	76,652	411	9	162	9	9	27	1	2	9	10
Total	298,925	2,034	46	833	46	46	138	4	8	46	62

***Figure 7**. Collection of qualitative data by NAG.*

The initial plan was to sample 1,600 households. We later realised that the cost of the household survey had been underestimated, so the sample size was revised. NAG used the following formula (and see Table 2) to calculate an appropriate sample size (n=833), based on the total number of households in the region. This meant we could be sure that the reduction in sample size was not going to compromise results:

$$n = \frac{NZ^2_{\alpha/2}p(1-p)}{(N-1)d^2 + Z^2_{\alpha/2}p(1-p)}$$

***Table 2**. Calculation of household survey sample size.*

Design Effect	*deff*	2
Population Size	*N*	298925
Percentage of success (value of indicator)	p	50%
Significance level	Alpha	5%
Standard normal value for 5% sig. level	$z_{Alpha/2}$	1.96
Margin of error	d	0.05
Required at risk per study wave (n)	n	767
Cushion (% of non-respondents)		9%
Required at risk per study wave (n1)	n1	833
% of Population at risk		100%
Prevalence rate		100%
Final Sample Size	n2	833

Data from the household survey were analysed and triangulated using qualitative data. Results demonstrate that the majority of hilsa fishing households in the Ayeyarwady Delta live in very challenging socio-economic conditions, although there is a great deal of heterogeneity between social classes and townships. They depend mostly on fishing for income, but this income is seasonal in nature and insufficient to cover expenditure, and they lack access to formal credit and to the markets where they can sell fish for higher prices. They use a range of coping strategies to manage food insecurity and other shocks, such as taking informal loans from fish collectors and relatives, livelihood diversification, and migrating for work. However, there are limited opportunities for alternative livelihoods in the region, and many households lack the skills and/or capital required to pursue them.

A key finding for this project is that although fishing effort and hilsa catches decline during the May-June closed fishing season, hilsa fishing continues throughout this period for many households – not just the poorest households. Furthermore, catch and effort peaks during the second hilsa spawning peak in October-December (Fig.8). These findings add weight to the proposed need for incentives to improve compliance with closed seasons and provide further evidence of the need to legislate for a second closed season. For those households most dependent on fishing, alternative livelihood support and improved access to appropriate financial products may be just as important as monetary or food compensation.

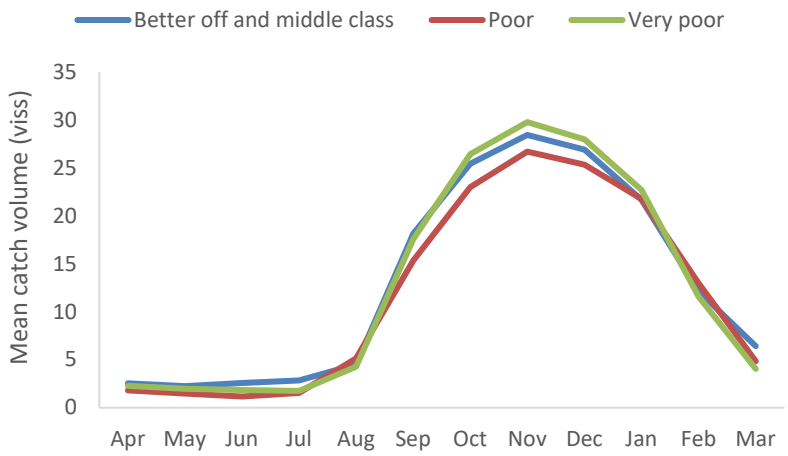


***Figure 8**. Mean monthly volume of hilsa catch by social class.*

Survey respondents also demonstrated limited knowledge of their impacts on the hilsa fishery or conservation needs, and limited motivations for conservation. This highlights the need for any incentives to be accompanied by awareness-raising activities – one of the goals of this project. Respondents' perceptions of the role of fisheries associations and the limited understanding of co-management systems reflect the slow pace at which co-management is being implemented in the region. Once the approach was explained, most respondents were supportive of co-management. Support to strengthen and multiply fisheries associations could help to build awareness about sustainable hilsa fishing practices. Similarly, increased awareness by fisher leaders will lead to hilsa fisher associations demanding improved co-management mechanisms.

Assessment of preferences using the choice experiment method (2.2), estimation of short-terms economic cost (2.3), and estimating economic value of hilsa fishery in AD (3.1)

The choice experiment method will be used assess preferences for compensation packages, estimate the economic value of the fishery, estimate the short-term opportunity cost of no-fishing, and estimate the income elasticity of willingness to accept. Following revisions to the logframe explained in attached change request form, these activities are not due to be completed until Q3 Year 3 of the project. Initial conversations on the design of the choice experiment have taken place with SRUC (the consultancy that is going to deliver on these activities with support from NAG). An initial meeting was held on 3 April 2019 in Edinburgh, UK and attended by NAG, SRUC and IIED. Local insights provided by NAG will help inform the survey design and implementation.

Workshop: transboundary hilsa management (5.2)

Due to the current political tensions between Myanmar and Bangladesh (previously mentioned in the annual and half year reports submitted in 2018), potential for joint hilsa management between the two countries in the project period has been compromised. The project team believes that a regional transboundary dialogue between scientists and researchers is still possible. We aim for this project to provide a platform for knowledge exchange between the two countries, and to lay the foundation for the formation of a transboundary hilsa fishery management system in the future – beyond the project lifespan.

With the ambition of starting this knowledge-sharing dialogue between Myanmar and Bangladesh, a workshop was held on 5-8 March 2019 in Dhaka, Bangladesh (Fig.9). It brought together 25 representatives from the two countries' Departments of Fisheries, universities, NGOs and fishing communities. All project partners (DoF Myanmar, WorldFish, NAG, Yangon University, IIED) participated in the workshop.

It was an opportunity for both countries to share their knowledge about hilsa – ecological, biological, socio-economic, and fisheries management aspects. Participants from Bangladesh shared their experiences with incentive-based hilsa management and the legacy of the Darwin-Hilsa[BD] project. Participants from Myanmar shared their perspectives on the opportunities that a similar management approach would provide, and the challenges they anticipate, in the context

of this Darwin-Hilsa[MM] project. 'Hilsa knowledge basket' USB sticks containing all knowledge products related to the Darwin-Hilsa[BD] project were distributed among Myanmar participants (Fig.10).

***Figure 9**. Participants at the Transboundary Hilsa Fisheries Management workshop, March 2019, Dhaka, Bangladesh.*

***Figure 10**. Contents of USB sticks distributed to participants at workshop.*

Participants also discussed the formation of a Bangladesh-Myanmar hilsa expert group – what form it should take, who should be involved, what the goal should be, how often it should meet

etc. The next steps are to develop a short document and MoU to take this forward and discuss with potential collaborators (see Section 12).

Following the workshop, participants went on a field trip to Chandpur, one the most important hilsa landing sites in Bangladesh. This allowed them to continue discussions in a less formal setting. Participants visited a fish landing centre, met the leaders of fish trader associations, visited an ECOFISH[BD] 'model' village where alternative income support for hilsa fishing households is ongoing, and witnessed the distribution of food compensation (Fig.11).

***Figure 11**. IIED, Yangon University, and WorldFish Myanmar representatives at a compensation distribution site in Chandpur, Bangladesh.*

A workshop report that summarizes the main discussions and outcomes of the workshop, including a participant list and workshop agenda, has been published (available here: https://pubs.iied.org/G04407/).

3.2 Progress towards project Outputs

Output 1. Enhanced understanding of the biology and ecology of hilsa fishery. [On track].

Indicators 1.1 and 1.2

An assessment of hilsa spawning seasonality and migratory routes has been conducted by Yangon University with support from the DoF and WorldFish. The Yangon University team presented their preliminary findings on spawning seasonality at a workshop in Year 2 (see Annex 4 for slides). We are currently supporting the team to write two reports which will be ready by Q1 of Year 3.

The findings challenge previous understanding (that there is one spawning peak from May to July) by demonstrating the existence of two main spawning peaks: one in March-July and another in October-November. While some of the former is included in the current multi-species closed season (May-July), a second closed season will be required to protect hilsa during the second spawning peak.

WorldFish Myanmar also has a journal article in press on productivity and coastal fisheries yields in Myanmar. This paper enhances our understanding of the causes of decline in biomass yields for hilsa:

- *Akester, M.J. (in press) Productivity and coastal fisheries biomass yields of the northeast coastal waters of the Bay of Bengal Large Marine Ecosystem. Deep Sea Research Part II: Topical Studies in Oceanography.* Available at: https://www.sciencedirect.com/science/article/pii/S0967064518301115

Output 2. Enhanced understanding of the complex socio-economics of hilsa fishery in the Ayeyarwady Delta. [On track].

Indicator 2.1

A large-scale socio-economic survey covering 833 households was completed in May 2018 (see Annex 4 for survey questionnaire). We have produced a report based on this survey:

- *Khaing, W.W., Akester, M., Merayo, E., Bladon, A. and Mohammed, E.Y. 2018. Socio-economic characteristics of hilsa fishing households in the Ayeyarwady Delta: Opportunities and challenges. IIED Country Report, London. Available at*: https://pubs.iied.org/16656IIED/

This detailed report highlights the dependence of these fishing households on hilsa for their income. Although fishing effort and hilsa catches decline during the May-June closed fishing season, hilsa fishing continues throughout this period for many households – not only the poorest ones. Furthermore, catch and effort peaks during the second spawning peak that has been observed in October-November. These findings provide evidence of the need for incentives to improve compliance with closed seasons, including a potential second closed season. They also highlight the need for improved financial inclusion, alternative livelihood support, and awareness campaigns – policy measures which could be included in the incentive-based management regime.

Indicator 2.3

In the latest revision of the logframe, the short-term economic cost (opportunity cost) was due to be estimated by Q2 of Year 2, but this has been pushed back to Q3 of Year 3 (please see attached change request form). NAG collected data on monthly income from hilsa fishing through the socio-economic survey (2.1), but this was not appropriate to use for estimation of opportunity cost. We will therefore now base this study on data from the choice experiment, which is due to be completed Q3 of Year 3. We have already begun designing the choice experiment, with advice from NAG, and do not expect to encounter any more problems (see Annex 4 for workshop notes).

Finally, progress has been made by WorldFish in improving the accuracy of catch and landings data in Myanmar (Box 1), which has huge relevance for Output 2.

Box 1. Hilsa catch and landings data in Myanmar

Fisheries statistics in Myanmar are inaccurate, typically showing year-on-year increases in landings. Official statistics for 2018 indicate capture fisheries landings from the marine and inland areas being 3.1 million and 1.6 million MT respectively. The FAO estimates these to be inflated by a factor of 2.8 for marine and 2.0 for inland, but there is also a large 'hidden harvest' factor related to IUU fishing.

Hilsa are caught inland by small-scale/artisanal fishers (21,886 registered vessels) and by the inshore marine (within 10nm) and offshore fleet, made up of around 3,200 registered vessels with an engine size above 25hp and length greater than 10m. Data for inland capture fisheries are inaccurate due to the high proportion of 'hidden harvest' fish (including juveniles) caught by unregistered boats and traps and hence not recorded at landing sites. Secondary data collected by a DoF official and analysed by WorldFish indicates that in 2017-18 the catch was 64% marine and 36% inland.

Output 5. A transboundary hilsa fishery expert group is in place. [We have revised this output since submitting the most recent logframe, due to the limitations imposed by current political tensions between Bangladesh and Myanmar (see attached change request form). We have delivered revised activities according to the original timeline.]

Indicator 5.1

A transboundary workshop was held in March 2019 with hilsa experts from Bangladesh and Myanmar. This was the first step towards the formation of a transboundary hilsa expert group, which should pave the way for further cooperation between Myanmar and Bangladesh. Details discussed during the workshop can be summarised as follows:

- The main goals of the group would be to improve hilsa fish stocks and to introduce a holistic and sustainable management approach to transboundary hilsa resources.

- Various names were suggested for the group, including the regional hilsa fishery working group, the Bay of Bengal hilsa fisheries working group, and the Bay of Bengal commission.
- Participants agreed that an annual workplan should be drafted and in-person meetings scheduled for once or twice a year, although exchange visits for specific topics could also be arranged.
- Participants were in favour of a multi-stakeholder approach with representation from international organisations, autonomous intergovernmental bodies, NGOs, the private sector and development partners, fishers' associations, academia, civil society, and local and national government.
- Myanmar, Bangladesh and, eventually, India should be represented, since the three countries account for 99% of hilsa landings.
- Some participants proposed that the group should sign a Memorandum of Understanding under the FAO's Bay of Bengal Large Marine Ecosystem (BOBLME) Strategic Action Programme, due to start in 2020.
- Participants agreed that a permanent secretariat, similar to Benguela Current Commission, will be required for coordination of the group, and should be hosted by Bangladesh.

The next steps are to develop a short document and MoU setting out the main goals, principles, and country commitments, and to have a strategic discussion with the BOBLME Chief Technical Advisor (see Section 12). We have published a workshop report, which summarises all presentations, discussions, and recommendations:

- *IIED. 2019. Regional hilsa knowledge-sharing workshop (Bangladesh-Myanmar): lessons for incentive-based hilsa management, 5-8 March 2019, Dhaka and Chandpur, Bangladesh. IIED Workshop Report, London. Available at: https://pubs.iied.org/G04407/*

A blog has also been published by IIED, inspired by this workshop, which highlights the role of the workshop in initiating a dialogue on hilsa between the two countries and describes how the formation of a transboundary hilsa expert group could provide the basis for the development of transboundary fisheries management plan further down the line:

- *Cooperation vs. competition over shared fish stocks:* https://www.iied.org/cooperation-vs-competition-over-shared-fish-stocks

Since the workshop, WorldFish Myanmar has written a letter of consent for cooperation with a professor from Bangladesh Agricultural University (BAU) for the collection of hilsa samples from Myanmar (see Annex 4 for copy of letter). The expectation is that BAU will also share samples from Bangladesh. This letter provides evidence of the impact that the workshop and planned expert group have already had in terms of catalysing cooperative research.

The WorldFish Center has published a blog on hilsa fisheries in Bangladesh, which acknowledged the transboundary nature of hilsa and the work of Darwin-Hilsa[MM], stating: '*As hilsa is a resource shared with neighboring Myanmar, transboundary learning and cooperation are crucial*' (available at: http://blog.worldfishcenter.org/2018/10/seasonal-ban-on-brood-hilsa-helps-to-protect-stocks-in-bangladesh/). This blog shows that the project is already building a profile around the goal of transboundary hilsa fisheries management.

3.3 Progress towards the project Outcome

The project Outcome is: "*Cost-effective and scientifically-researched 'incentive-based' sustainable hilsa management scheme is designed, reducing threats to biodiversity and contributing to poverty alleviation by maintaining a food source and continued employment for small-scale fishers*". In this section we provide evidence in relation to the indicator for Year 2 (0.2) as well as progress towards indicators for Year 3 (0.2 and 0.1)

Indicator 0.2

The socio-economic assessment of hilsa fishing households has been completed (available here: https://pubs.iied.org/16656IIED/). This assessment shows the level and seasonality of dependence on hilsa fishing, and provides a starting point to determine the number of fishing communities and households that would be affected by potential regulatory regimes. During Year

2, we also started designing the choice experiment through which short-term cost will be identified.

Indicator 0.1

Year 2 of the project has focused on collecting and analysing data on the biology and ecology of hilsa and the socio-economics of the communities who depend on it (outputs 1 and 2). This baseline data will provide the scientific evidence to underpin the design of the incentive-based management scheme, which is not due until Year 4. Publication of a WorldFish news article on the CGIAR website provides evidence of progress towards indicator 0.1 (available at: https://fish.cgiar.org/impact/stories-of-change/carrots-and-sticks-how-incentives-are-conserving-hilsa-fishery-myanmar.) This article quotes a statement signed by the DoF Director General, U Khin Maung Maw (see Annex 4), evidence that the project continues to gain support from the DoF, which will be crucial in achieving the project Outcome.

3.4 Monitoring of assumptions

Assumptions at project design	Comments at the end of Year 2
It is expected that the Burmese Government will accept and act on the project findings. DoF will be engaged in the research and hilsa is a high priority and high value species. Myanmar has formulated a fishery development policy that respects national and international agreements and the conditions and nature of the resources.	The statement by the Director General of DoF Myanmar (see section 3.3) supporting this project and an incentive-based management scheme for Myanmar reinforces the government's engagement and commitment to this project. Two officials from DoF Myanmar also attended the transboundary hilsa fisheries management workshop in Bangladesh, March 2019: Mr. U Win Myint Saw (Deputy Director Ayeyarwady Region) and U Aung Nyi Toe (Director Fisheries Management). They were very engaged and positive at the workshop (including the plan to create a transboundary hilsa expert group). We feel confident that this motivation will channel itself back into policy. WorldFish has successfully worked with the DoF to amend the Ayeyarwady Freshwater Fisheries Law (2018), which now acknowledges co-management. This is a prerequisite for incentive-based fisheries management.
The findings of the studies should correspond with previous studies of hilsa ecology and biology in the region. However, migratory fish can show considerable variability in the timing and duration of spawning in response to climactic factors, with the result that the limited duration of this study may prove inconclusive in its findings regarding the level of inter-annual variability in the duration and timing of spawning in hilsa under a rapidly changing climate in the Bay of Bengal region.	Research findings from Yangon University have demonstrated similarities between the ecology and biology of hilsa in Bangladesh and Myanmar. In Bangladesh, the peak spawning season is thought to be September-October (but particularly October), and some evidence of a distinct smaller winter spawning stock with a peak spawning season in January. Our findings indicate two main spawning peaks in Myanmar: March-July and October-November. Although these biannual spawning peaks are similar, the variation could indeed be explained by inter-annual variability. During the transboundary hilsa workshop in March 2019, participants from Bangladesh shared genetic research with participants from Myanmar, which confirms that hilsa in the Bay of Bengal is a single stock shared between India, Bangladesh, and Myanmar.
A high '*don't know*' rate is usually expected in survey answers due to the newness of public surveys in Myanmar, and the recent establishment of many government institutions and processes since 2011. Nevertheless, '*don't know*' responses are expected to be at a lower than average rate given the high level of local	This assumption holds. In our socio-economic assessment of hilsa fishing households, nearly all respondents answered the closed-ended questions. Some '*don't know*' responses were received for more complex open-ended questions and for specific questions about alternative livelihoods, but nothing

knowledge in the subject matter and its intrinsic importance to local livelihoods.	higher than 10%. We excluded these responses from our analysis.
Burmese government generally encourages private investment in fisheries sector with recent introduction of legal reforms and tax incentives. It generally views foreign direct investment in fisheries as a potential means to improve lack of capital and technology and poor management practices in the sector.	While this is still true, investment in the sector remains low due to clear evidence of IUU fishing and overfishing. There were only five registered foreign vessels operating in Myanmar waters in 2018.
Myanmar commerce law allows the establishment of a legally independent fund management system.	This assumption is still valid.
Diplomatic relationship between Myanmar and Bangladesh is not severed (at least status quo is maintained). There have been tensions between Muslim Rohingya and Buddhist Residents in Rakhine State in Myanmar. Occasionally, this has led to strained relationships between the two countries. We believe that cooperation between scientific communities in both countries has not been affected.	Diplomatic relations have deteriorated due to the Rohingya crisis. The tensions have led us to slightly revise Output 5 and its activities (see attached change request form). A transboundary dialogue between scientists and researchers, and even DoF officials is still possible – as demonstrated by participation in the March 2019 transboundary hilsa management workshop.

Impact of inland hilsa fishing

An implicit assumption made in the inception phase of the project was that overfishing of hilsa inland – particularly juveniles and spawning hilsa – is one of the major threats to the fishery, as it is in Bangladesh. While it remains true that inland small-scale fishers are having a negative impact on fish migration and spawning, we do not know the proportion of hilsa migration that is prevented by fishing versus that prevented by physical barriers such as tidal barrages. Whatever the respective impacts of these threats, physical barriers are not blocking migratory routes entirely. We can therefore remain confident that an effective incentive-based scheme will benefit hilsa stocks. We will continue to collaborate with researchers working on this issue.

New landings data indicates that the majority of hilsa caught in Myanmar is caught in the marine sector (over 60%; see Box 1). Since the incentive-based scheme will be designed to target small-scale fishers in the Ayeyarwady Delta, we must not leave the offshore marine sector out of this mechanism (see Box 2 for initial ideas). Awareness campaigns will be crucial. It would, for example, be valuable to convince offshore boat owners that they should compensate their crews when not working during the closed season. Although the significance of the offshore fleet was somewhat overlooked during the inception phase of the project, we plan to start dialogues with industrial fishers by involving representatives in the multi-stakeholder workshops planned for Year 3 (activities 2.5, 4.1, and 4.3).

Box 2. Potential mechanism for sustainability of incentives for inland fishers

The commercial offshore fishing fleet in Myanmar amounts to 3,170 registered vessels of which 15% will target hilsa. To obtain permission to fish a range of fees should be paid annually – the most important include a gross registered tonnage fee and a fishing gear type fee. The sum of the two amounts to the equivalent of USD2,100 per vessel per year. 3% of these fees can be used by the DoF for work to improve fisheries management. It is suggested that half of this fee (1.5% of the total i.e. USD15,000 [3170*0.15*2100*0.015]) should be used as a conservation tax as a start point for revenue collection for the incentives to the inland fishers to establish sanctuaries and a second closed season with no fishing for at least 60 days spread over the two spawning peaks. As shown by the socio-economic survey, poor fisher households have few other income generating opportunities – hence the opportunity cost of not fishing 60 days of the year would be high in the short term. Offshore fishing vessel owners would be encouraged to pay their crews the minimum daily wage [MMK4,800 = USD3.20] as a retainer during closed seasons.

3.5 Impact: achievement of positive impact on biodiversity and poverty alleviation

Please see sections 4, 5 and 6 below.

4. Contribution to the Global Goals for Sustainable Development (SDGs)

Currently, Myanmar ranks 113 out of 157 countries globally in SDG performance. By ensuring sustainable management of the hilsa fishery and enhancing the resilience of fishing communities to income shocks, the project should contribute to meeting SDG 1: 'End poverty in all its forms everywhere'.

Although it is still early in the project to assess this contribution, we have produced a report describing the socio-economic characteristics of hilsa fishing households in the Ayeyarwady region, and the challenges that they face (available here: https://pubs.iied.org/16656IIED/). It demonstrates that around 70% of these households are 'poor' or 'very poor' and extremely vulnerable to shock – information that will be used during Year 3 to design incentives that can reduce this poverty.

Combining these incentives with evidence-based regulations should also help the Myanmar government implement SDG 14: 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development'. During Year 2 we have collected and analysed baseline ecological, biological and socio-economic data (see Section 3.1). In Year 3 we intend to use these data to guide the DoF in updating fisheries legislation, including designation of sanctuary areas for hilsa and a second closed season, and designing incentives to improve compliance with regulations. We will optimise the impact of this incentive-based management system on SDG 14 through structured engagements with the SDG focal point in Myanmar.

During Year 2, IIED designated additional funds and published a monitoring, evaluation, and learning toolkit for SDG 14 (available here: https://pubs.iied.org/16644IIED/). The toolkit can now be used to assess the contribution of this project to SDG 14, and to guide engagements with the national SDG focal point.

Since hilsa are also caught inland, these same outputs should also contribute to achieving Goal 15: 'Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss'. Effective protection of hilsa habitat inland would have wider biodiversity benefits.

5. Project support to the Conventions, Treaties or Agreements

With active involvement of the Myanmar DoF, this project is already contributing to Myanmar's national **CBD Target 6.1**: 'By 2020, states/regions have approved laws allowing for community and/or co-managed fisheries'. During Year 2 of the project, WorldFish has worked with the DoF to amend the *Ayeyarwady Freshwater Fisheries Law (2018)*, which now acknowledges co-management. As a result, more fisheries management associations and co-management partnerships have emerged in the region. Our socio-economic assessment of hilsa fishers demonstrated that these associations are still quite rare and poorly understood, but that fishing households are supportive of the concept of co-management. We intend to build on this support for co-management going forward, as a first step to increasing awareness around sustainable fishing practices.

Progress has also been made towards contributing to national CBD **Targets 3.2 and 6.2** through the socio-economic, biological, and ecological assessments. In Year 1 we held a structured meeting with Myanmar's primary CBD focal point, Dr. Nyi Nyi Kyaw. Armed with new baseline data and understanding of the hilsa fishery, we intend to hold further structured engagements with national CBD focal points during Year 3. Through sharing our results with focal points, we hope to identify ways through which project outputs could inform national processes to meet these international commitments.

During Year 2, IIED published two relevant toolkits (funded externally to this project):

- Porras, I (2018) Fair fishing: supporting inclusive fiscal reform in fisheries. IIED, London. Available at: https://pubs.iied.org/16647IIED/

- Porras, I et al. (2018) No hidden catch – Mainstreaming values of small-scale fisheries in national accounts. London, IIED. Available at: https://pubs.iied.org/16646IIED/?k=fisheries

During Year 3, we intend to pilot these toolkits in Myanmar. These pilots will not only support this project, but also support national processes to meet CBD and SDG targets more broadly. Delegates from the Ministry of Agriculture, Livestock and Irrigation participated in a workshop IIED held in Costa Rica in March 2019 on mainstreaming values of small-scale fisheries in national accounts.

6. Project support to poverty alleviation

The project has completed a socio-economic survey of hilsa fishing households (report available here: https://pubs.iied.org/16656IIED/). This provides baseline information on the opportunities and challenges that hilsa fishing households experience, particularly the implications of seasonal fishery closures. This information will help the Darwin project to deliver a scheme well-aligned with reality of the communities involved so that it enhances their resilience to environmental and economic shocks and reduces their vulnerability to poverty. We also expect the choice experiment (which we have started designing) to support the effectiveness of the scheme in contributing to poverty alleviation.

At this early stage, an important source of evidence to assess potential impact of the project on poverty alleviation is our previous research in Bangladesh. Through a combination of incentives and regulations, the Bangladesh government has made real progress in rebuilding its hilsa stocks, with a 250% increase reported in inland hilsa landings during implementation of the scheme. This management has led to notable socio-economic improvements (see Bladon et al. 2016). Given the similar levels of dependence on the hilsa fishery in the project site in Myanmar now and in Bangladesh before incentives were introduced, we can be hopeful that implementation of such management will have similar impacts in Myanmar.

Since hilsa is a common resource of the Bay of Bengal, efforts by this project to start a transboundary dialogue between Myanmar and Bangladesh are expected to contribute to regional hilsa fishery management, and ultimately to regional poverty alleviation. If there is cooperation between countries over rebuilding and maintaining hilsa stocks, this is much more likely to have significant poverty alleviation impacts in each of these countries.

Indirect impacts

We are conscious of the potential for unintended consequences or negative spillover effects of the incentives (e.g. distortion of local markets or impacts on intra-households benefit distribution). In our design of the choice experiment, which we started at the end of year 2, we are considering individuals (not households) as the 'undifferentiated utility maximising unit', to ensure that overall benefits to households and communities are maximised.

7. Project support to gender equality issues

This project aims to design an incentive-based management scheme that addresses the needs of both men and women.

The socio-economics survey followed a gender and generation (GnG) disaggregated data collection approach which differentiated between male and female respondents (see survey materials in Annex 4 and Fig.12). This allowed us to assess the participation of women and men in different income generating activities, including fishing and post-harvest activities such as fish selling. We found that women play a key role in the hilsa fishery, not only in activities like selling and packaging, but also in fishing itself. Selling hilsa is an activity split almost 50:50 between men and women. On the other hand, we found significant differences between men and women in terms of access to and preferences for hilsa markets and loans.

There is a common perception that fisheries management regimes primarily impact the male population. Our findings show that any incentives for compliance with fisheries regulations in the Ayeyarwady Region should be designed to mitigate impacts on and address the needs of both men and women. During Year 3 we will use these results to inform the design of a gender-aware incentive-based scheme and ensure that women are not left behind.

***Figure 12**. Women and men participating in the socio-economic survey, April 2018.*

8. Monitoring and evaluation

IIED team members met with partners from WorldFish, NAG, and Yangon University twice in Year 2 to monitor and evaluate project progress (in Yangon, July 2018; and in Dhaka, Bangladesh, March 2019 following the transboundary hilsa fishery workshop). We shared thoughts on how we have been working as a team, discussed lessons learnt from Year 2 (see Section 9), and reviewed the project logframe. Changes made to the logframe at the meeting in July 2018 were recorded in the half year report submitted 2018. Changes made at the meeting in March 2019 are as follows (see Annex 2 and attached change request form):

- **Indicator 2.2**: NAG raised the issue during the meeting that some study villages would be inaccessible during the planned period of fieldwork because it fell during monsoon season. The decision was made to push back 2.2 to Q3 Year 3, to allow time for those villages to be surveyed after monsoon season.
- **Indicators 2.4, 4.2 and 4.3**: Originally, these three multi-stakeholder workshops were planned as individual workshops, two held in Q3 Y4 and one in Q4 Y4. Following discussions with the host country team, we feared that there could be fatigue effect by participants, and consequently limited attendance by key government stakeholders. Therefore, we decided to combine the three workshops into one (multiday) workshop with three parts, culminating in a session to which government officials will be invited. This will be more cost-effective and time-efficient. We decided to hold the series of workshops in Q4 Y4 so that they can be informed by findings from 2.2, 2.3, 3.1, 3.2, 3.3, and 4.1.

Other links between activities, outputs, and indicators have been extensively discussed in section 3.

9. Lessons learnt

The main lessons learnt during Year 2 of this project can be summarised as follows:

- **Seasonality and field logistics**: We encountered some delays this year in our planning for the choice experiment. NAG alerted IIED that some of the study villages would be inaccessible during the months planned for field work, and so some of this field work had to be pushed back (see section 8 and revised logframe in Annex 2). We have learnt from this experience that timing of field work should in future be based on a rigorous assessment of seasonality and the potential challenges associated with it (e.g. flooding, inaccessibility by road, travel time etc.)
- **Engagement with fishing association leaders**: The project relied heavily on support from village and township leaders in conducting the socio-economic survey in Year 2. These leaders helped us to identify hilsa fishing households and to categorise them by social class. Working directly with fishery association leaders would probably have enhanced the accuracy of hilsa fishing household identification, since these leaders have more focused knowledge of fishing activities in their communities. However, fishery associations are fragmented and more difficult to interact with. Moving forward, we will engage both village leaders and fishery associations to eliminate potential bias.
- **Government engagement and capacity**: WorldFish Myanmar provided new advice to the project team this year, based on their experience with government engagement. Due to the numerous events and day-to-day administrative commitments of DoF officials and the lack of continuity in their posts, WorldFish advised the project team to combine the three multi-stakeholder workshops planned for Year 3 into one (see section 8 and revised logframe in Annex 2). By holding one multi-day workshop culminating in a session designed specifically for attendance by the DoF, we can optimise government engagement with the agenda of the meetings.

10. Actions taken in response to previous reviews (if applicable)

Comment 1 We have explained the implications of the sample size reduction in Section 3.1: '*We had initially planned to sample 1,600 households, but this was based on an underestimation of costs, so we had to reduce this number. NAG used the following formula…to calculate an appropriate sample size (n=833), based on the total number of households in the region, and so we can be sure that the reduction in sample size did not compromise results…'*

Comment 2 We have taken this on board when writing the current Annual Report.

Comment 3 Initially, we had planned to set up a scientific advisory committee using a sub-group of the Fisheries Research and Development Network (FRDN). Creating a sub-group was deemed arduous to the members of FRDN. It was suggested by the steering committee members of FRDN that it would be more suitable for them to get involved in the learning and evaluation process once some of the knowledge products have been produced (from Y3 onwards). Now that we have some clear results to show to the government we can promote further research related to improved inland and coastal fisheries management. Project activities are evaluated by reports, products of monthly meetings sent in Burmese to the Director General of DoF through Ms Nyunt Win (FRDN Committee Member and WorldFish focal point in the Ministry of Fisheries and Livestock).

11. Other comments on progress not covered elsewhere

12. Sustainability and legacy

The Darwin-Hilsa^{MM} project is widely recognised in Myanmar by government and NGOs alike, and we are building its profile internationally. WorldFish Myanmar presents and refers to the project wherever possible at national and international events. For example, representatives from WorldFish, Yangon University, and NAG gave a presentation on the project at the 3rd World Small-Scale Fisheries Congress in Chiang Mai, Thailand, 22-26 October 2018, titled: '*Carrot and stick: Incentive to conserve hilsa fish in Myanmar*'. The Conference Proceedings are available here: https://docs.wixstatic.com/ugd/45cb94_3505c589af504d16921ea246deb51036.pdf).

The transboundary hilsa fishery workshop held in Bangladesh in Year 2 has also raised the profile of the project in Bangladesh, building on the legacy of the previous Darwin-Hilsa^{BD} and the

ECOFISH[BD] project that it inspired. An IIED blog published about the workshop has been widely circulated on twitter.

Evidence of successful project communication can be seen in the CGIAR article published in November 2018, '*Carrots and sticks: How incentives are conserving the hilsa fishery in Myanmar*', which describes the Darwin project's goal: '*to develop a cost-effective, scientifically researched and participatory incentive-based fisheries management mechanism that will ensure the long-term sustainability of the hilsa fishing sector*'.

One of the objectives of the project is to change the perceptions around small-scale fisheries, and the hilsa fishery specifically, in order to influence policy. Recent endorsement by the Director General of DoF Myanmar, U Khin Maung Maw, (October 2018, see Annex 4 and quoted in the CGIAR article) highlights government buy-in to the project: '*The Darwin Initiative project is providing valuable up-to-date research into the current status of the hilsa fishery in the Ayeyarwady Delta and will soon be able to put a total economic value on this important fishery*.' This support is expected to continue to build over the course of the project as outputs are produced.

With the support of Darwin-Hilsa[MM], members of the team in Myanmar attended the Multi-Stakeholder Information and Communications (MuSIC) Workshop (Penang, Malaysia, 18-23 February 2019). It was co-hosted by WorldFish and FAO and intended to facilitate greater sharing of information, research and policy work on small-scale fisheries between members, leading to a more informed sector and greater visibility of the challenges and opportunities experienced by it (more information available at: https://fish.cgiar.org/news-and-updates/news/music-workshop-sounds-positive-note-visibility-small-scale-fisheries). Journalists, representatives from civil society, and researchers from six countries (Bangladesh, Cambodia, India, Myanmar, Malaysia and the Philippines) participated in the workshop, and aim to start an informal network for cooperation. Participation of Darwin-Hilsa[MM] team members in this network should enhance the reach and legacy of this project.

The Darwin project has catalysed the development of other projects which have synergies with our project Outcome.

- One of the lead fisheries scientists at Yangon University, Dr. Kyi Thar Myint, was awarded a John Dillon Memorial Fellowship in 2018 for research on a WorldFish inland capture project linked to the Darwin project.
- Yangon University has formed a collaboration with Dr John Conallin from Charles Sturt University Australia and the IHE Delft Institute for Water Education (the Netherlands) focused on hilsa otolith collection and analysis.
- Dr. Kyi Thar Myint is discussing the continuation of genetic research in collaboration with Dr Abigail Elizur from the Sunshine Coast University Australia. The aim of this work would be to determine if there are land-locked hilsa stocks in Myanmar that may need distinct management plans.

Regarding the formation of a transboundary hilsa fishery expert group (Output 5), we are aware of the need to ensure institutional sustainability. At the transboundary hilsa management workshop in March 2019, some participants proposed that the transboundary hilsa expert group could build on or merge with institutional arrangements that were initiated but deferred by the FAO's Bay of Bengal Large Marine Ecosystem (BOBLME) Project during its first phase (2009-2015).

As explained in a recent IIED blog: '*All Large Marine Ecosystem (LME) projects aim to establish a host country-funded commission to keep LME governance active after a project is delivered (see, for example, the Benguela Current Commission and its associated convention). Assuming the BOBLME project will establish a 'Bay of Bengal Commission', this could house the transboundary hilsa working group, helping to give it permanence*.' Collaboration with the BOBLME project could therefore enhance the sustainability of the transboundary hilsa expert group, and therefore the likelihood of a long-term transboundary dialogue. The team plans to discuss this with the Chief Technical Advisor for BOBLME during Year 3.

13. Darwin identity

We have acknowledged Darwin Initiative funding and displayed the Darwin logo prominently in all our project publications, workshop/meeting banners, and presentations. For example, the transboundary hilsa fishery workshop held in Bangladesh, March 2019, displayed a banner that included the Darwin Initiative logo (as well as partner logos) and a line recognizing that the workshop was funded by the Darwin Initiative in partnership with ECOFISH[BD], which provided logistical and some financial support (see Fig.13).

***Figure 13**. Female participants at transboundary hilsa workshop in Bangladesh, with banner recognising Darwin Initiative.*

The Darwin Initiative was similarly recognised on the title slide of partner presentations (see Fig.14).

***Figure 14**. Title slide from Yangon University presentation recognising Darwin Initiative funding.*

All project publications have been made available for free download from IIED's website, and IIED's communications team has used social media sites such as Twitter and Facebook to disseminate these publications. For example, IIED published a blog in April 2019 which directly referred to the project as follows: '*At a recent knowledge-sharing workshop in Bangladesh under IIED's Darwin-Hilsa[MM] project, scientists, NGOs, and government officials from Bangladesh and Myanmar started a dialogue for cooperation over their shared stocks of hilsa shad*.' This has been circulated on social media (see Fig.15).

Figure 15*. IIED tweet about a blog published on the transboundary hilsa fisheries workshop in Bangladesh.*

WorldFish Myanmar refers to Darwin-Hilsa[MM] as a Darwin Initiative project at all meetings and has invited members of the British Embassy in Yangon to attend events and fieldtrips, in recognition of the UK government funding. The project is also globally mapped to the CGIAR Research Program on Fish Agri-Food Systems (FISH), led by WorldFish.

In a blog published on hilsa in October 2018, The WorldFish Center acknowledged the Darwin project: *'…WorldFish has been working with the International Institute for Environment and Development and other partners, as part of the UK government-funded Darwin-Hilsa-MM project, to develop a scientifically researched, cost-effective and incentive-based fisheries management mechanism that will ensure the long-term sustainability of the hilsa fishing sector*' (available at: http://blog.worldfishcenter.org/2018/10/seasonal-ban-on-brood-hilsa-helps-to-protect-stocks-in-bangladesh/).

WorldFish Myanmar Country Director, Michael Akester, has also published a journal article on fisheries in Myanmar in which he acknowledges the Darwin Initiative, as follows: '*In Myanmar, WorldFish is carrying out similar work on a Darwin Initiative-funded project designed by the International Institute for Environment and Development (IIED)…*[it goes on to describe the project].

- Akester, M.J. (in press) Productivity and coastal fisheries biomass yields of the northeast coastal waters of the Bay of Bengal Large Marine Ecosystem. Deep Sea Research Part II: Topical Studies in Oceanography. Available at: https://www.sciencedirect.com/science/article/pii/S0967064518301115

14. Project expenditure

Table 1: Project expenditure <u>during the reporting period</u> (1 April 2018 – 31 March 2019)

Project spend (indicative) since last annual report	2018/19 Grant (£)	2018/19 Total actual Darwin Costs (£)	Variance %	Comments (please explain any variance)
Staff costs				
Consultancy Costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items				
Others				
Audit costs				

			Claimed So Far	Claim for this period	Surrender Amount
TOTAL					

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2018-2019

Project summary	Measurable Indicators	Progress and Achievements April 2018 – March 2019	Actions required/planned for next period
Impact Threats to hilsa and marine biodiversity are avoided in line with CBD targets (Aichi Biodiversity Targets 6) and food security and employment opportunities of millions of poor people are maintained.		Better ecological and socio-economic knowledge of the hilsa fishery in Myanmar (studies completed in Y2) contributes towards improved sustainability of hilsa and communities that depend on it for a living. The transboundary hilsa management workshop held in March 2019 in Bangladesh allowed for collaborative dialogue and experience-sharing between both countries, which is expected to contribute towards the goals of this project.	[redacted]
Outcome Cost-effective and scientifically-researched 'incentive-based' sustainable hilsa management scheme is designed, reducing threats to biodiversity and contributing to poverty alleviation by maintaining a food source and continued employment for small-scale fishers.	0.1. One document on design essentials of the incentive-based scheme submitted to and endorsed by the Department of Fisheries by Q3 of Y4. 0.2. number of fishing communities and households affected by regulatory regimes and their short-term cost identified. Note: 1 reports due by Q2 of Y2 (September 2018) on socio-economic assessment and another one on opportunity cost Q3 Y3 (see below in outputs, 2.2 and 2.3).	Research work has confirmed two spawning seasons in Myanmar (very similar to Bangladesh). Socio-economic studies have demonstrated the dependence of poor fishers on year-round hilsa fishing (not respecting the May-July closed season).	During year three fishing community leaders will receive training courses under the Darwin and ACIAR funded projects to raise awareness regarding improved fisheries management and adherence to closed seasons. Also, the survey on preferences for compensation, opportunity costs and estimation of economic value of the fishery will help design an incentive-based hilsa management scheme
Output 1. Enhanced Understanding of the biology and ecology of hilsa fishery	1.1. Ecological survey on biophysical assessments and migratory and spawning	The biology and ecology of hilsa fishery, including migratory routes, is now better understood. The surveys have already taken place, preliminary results have been shared and reports will be published in Q1 Y3 (see Section 3.1).	

	seasonality studies in the 3 intervention sites by Q1 of Y3. 1.3 *2* scientific reports on the ecology and biology of hilsa fishery in Ayeyarwady Delta by Q1 of Y3. The results will need to be ready by February, not necessarily in writing.		
1.1 Spawning seasonality of hilsa using gonadosomatic index		Completed and preliminary results have been shared at the workshop (see Section 3.1)	A report based on the study results will be published and will become available online.
1.3 Assessment of migratory routes of hilsa		Completed and preliminary results have been shared at the workshop (see Section 3.1)	A report based on the study results will be published and will become available online.
Output 2. Enhanced understanding of the complex socio-economics of hilsa fishery in the Ayeyarwady Delta.	2.1 Large scale survey covering 833 households by Q2 of Y2. 2.2 Assessment of preferences using the choice experiment method by Q3 of Y3. 2.3 Short-term economic cost (opportunity cost) estimated by Q3 of Y3. 2.4 One national multi-stakeholder workshop: incentive-based hilsa management (Part 1): Design essentials by Q4 of Y3.	The large-scale survey took place in Y2 of the project. A report based on this study, highlighting the opportunities and challenges faced by hilsa fisher households in Myanmar, is available online (see Section 3.1).	
2.1 Socio-economic assessment of hilsa fishing communities in the delta (survey design, execution and reporting)		Survey has been completed and report has been published.	
2.2 Assessment of preferences using the choice experiment method		The design of the CE survey has started.	Survey implementation and analysis will take place in Y3. A written report will be published then.

2.3 Estimation of short-terms economic cost (opportunity cost)		Not started yet	Based on the CE survey results (in reference to WTA), the opportunity cost of no-fishing will be estimated in Y3.
2.4 Whitepaper: the design of incentive-based hilsa management in the AD		Not started yet	
2.5 National multi-stakeholder workshop (Part 1): incentive-based hilsa management: Design essentials		It hasn't taken place yet	It will be organised, together with workshops 4.1 and 4.3 in Y3.
Output 3. Use and non-use values of hilsa fishery estimated and business case developed	1.1. Monetary estimation of non-use value of hilsa fishery estimated by Q3 of Y3. 3.2 Estimating income elasticity of willingness to pay for hilsa conservation (distributional study) 3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery by Q4 of Y3.	The design of the CE survey, which will provide data to estimate the economic value of the fishery, income elasticity and will make a case for investment in sustainable hilsa fishery, has started.	
3.1 Estimating economic value of hilsa fishery in AD (using revealed and stated-preference techniques)		Not started yet	Based on results from CE method (activity 2.2)
3.2 Estimating income elasticity of willingness to pay for hilsa conservation (distributional study)		Not started yet	Based on results from CE method (activity 2.2)
3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery		Not started yet	Based on results from CE method (activity 2.2)
Output 4. Sustainable financial mechanism developed	4.1 Fiscal reforms to finance incentive-based management (diagnostic analysis) Q4 of Y3. 4.2 Multi-stakeholder workshop (Part 2): Fiscal reforms to increase revenue across the value chain	Not started yet	

	(*increase revenue collection efficiency by 30%) by Q4 of Y3* 4.3 Multi-stakeholder workshop (Part 3): Assessment of the plausibility of establishing a national hilsa fishery management trust fund Q4 Y3		
4.1 Multi-stakeholder workshop (Part 2): Diagnostic analysis of fiscal reforms for sustainable fisheries management		It hasn't taken place yet	It will be organised, together with workshops 2.5 and 4.3 in Y3.
4.2 Policy briefing paper on capacity gaps/needs for fiscal reforms		Not started yet	Scheduled for Y3
4.3 Multi-stakeholder workshop (Part 3): Assessment of the plausibility of establishing a national hilsa fishery management trust fund		It hasn't taken place yet	It will be organised, together with workshops 2.5 and 4.1 in Y3.
4.4 Development memorandum and articles of association of the fund		Not started yet	It's scheduled for Y4
Output 5 A transboundary hilsa fishery management expert group in place	5.1 Workshop in February or March 2019 (Q4 of Y2) with experts from Bangladesh and Myanmar. 5.2 Closing workshop: signing MoU (Myanmar and Bangladesh) on transboundary hilsa management (and end of project) Q4 Y4	The March 2019 workshop in Bangladesh (see Section 3.1) is an important step towards establishing a transboundary hilsa management expert group that includes participants from both Bangladesh and Myanmar.	
5.1 Participation of delegates from Bangladesh in project inception workshop		It took place in August 2017 and it has been already reported.	
5.2 Workshop: transboundary hilsa management – experts from Bangladesh and Myanmar		It took place in March 2019 (see Section 3.1 for details)	Collaboration and dialogue between Myanmar and Bangladesh experts is expected to continue, informally, during Y3
5.3 Workshop: signing MoU (Myanmar and Bangladesh) on transboundary hilsa management expert group (and end of project)		It hasn't taken place yet	Scheduled for Y4

Annex 2: Project's full current logframe as presented in the application form (unless changes have been agreed)

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: (Max 30 words) Threats to hilsa and marine biodiversity are avoided in line with CBD targets (Aichi Biodiversity Targets 6) and food security and employment opportunities of millions of poor people are maintained.			
Outcome: (Max 30 words) Cost-effective and scientifically-researched 'incentive-based' sustainable hilsa management scheme is designed, reducing threats to biodiversity and contributing to poverty alleviation by maintaining a food source and continued employment for small-scale fishers.	0.1. One document on design essentials of the incentive-based scheme submitted to and endorsed by the Department of Fisheries by Q3 of Y4. 0.2. Number of fishing communities and households affected by regulatory regimes (by Q2 Y2) and their short-term cost identified (by Q3 Y3).	0.1. One [signed] copy of design essentials document 0.2. One news article that includes a testimony from the Director General of DoF due Q2 of Y2 (end of September 2018). 0.3. Whitepaper: the design of incentive-based hilsa management in the AD. KMS and Michael to arrange a meeting with the DG Q3 Y3 0.4. One report on socio-economic assessment (due by Q2 of Y2) and another on opportunity cost (due Q3 Y3).	It is expected that the Burmese Government will accept and act on the project findings. DoF will be engaged in the research and hilsa is a high priority and high value species. Myanmar has formulated a fishery development policy that respects national and international agreements and the conditions and nature of the resources.

Outputs: 1. Enhanced Understanding of the biology and ecology of hilsa fishery	1.1 Ecological survey on biophysical assessments and migratory and spawning seasonality studies in the 3 intervention sites by Q1 of Y3. *1.3 2* scientific reports on the ecology and biology of hilsa fishery in Ayeyarwady Delta by Q1 of Y3. The results will need to be ready by February, not necessarily in writing.	1.1 One report on spawning seasonality of hilsa fish using gonadosomatic index 1.3 One report on migratory routes of hilsa.	The findings of the studies should corroborate with previous studies of the hilsa's ecology and biology in the region. However, migratory fish can show considerable variability in the timing and duration of spawning in response to climactic factors, with the result that the limited duration of this study may prove inconclusive in its findings regarding the level of inter-annual variability in the duration and timing of spawning in hilsa under a rapidly changing climate in the Bay of Bengal region.
2. Enhanced understanding of the complex socio-economics of hilsa fishery in the Ayeyarwady Delta.	2.1. Large scale survey covering 833 households by Q2 of Y2. 2.2. Assessment of preferences using the choice experiment method by Q3 of Y3. 2.3. Short-term economic cost (opportunity cost) estimated by Q3 of Y3. 2.4. One national multi-stakeholder workshop: incentive-based hilsa management (Part 1): Design essentials by Q4 of Y3.	2.1. Copy of questionnaire survey 2.2. One report on socio-economic assessment of hilsa fishers by Q2 of Y2. 2.3. One report on assessment of preferences for compensation packages and estimation of economic value of hilsa fishery, short-term economic cost (opportunity cost) and income elasticity of WTA Q3 Y3 2.4. workshop report Q4 Y3	A high '*don't know*' rate is usually expected in survey answers due to the newness of public surveys in Myanmar, and the recent establishment of many government institutions and processes since 2011. Nevertheless, 'don't know' responses are expected to be at a lower than average rate given the high level of local knowledge in the subject matter and its intrinsic importance to local livelihoods.
3. Use and non-use values of hilsa fishery estimated and business case developed	3.1. Monetary estimation of non-use value of hilsa fishery estimated by Q3 of Y3. 3.2. Estimating income elasticity of willingness to pay for hilsa conservation (Q3 Y3)	3.1. See deliverable 2.3 3.2 See deliverable 2.3 3.3. One Policy Briefing paper on optimal level of investment to conserve hilsa Q4 Y3	Burmese government generally encourages private investment in fisheries sector with recent introduction of legal reforms and tax incentives. It generally views foreign direct investment in fisheries as a potential means to improve lack of capital and technology and poor management practices in the sector.

	3.3. Cost benefit analysis of investment in sustainable management of hilsa fishery by Q4 of Y3.		
4. Sustainable financial mechanism developed	4.1. Fiscal reforms to finance incentive-based management (diagnostic analysis) Q4 of Y3. 4.2. Multi-stakeholder workshop (Part 2): Fiscal reforms to increase revenue across the value chain (*increase revenue collection efficiency by 30%) by Q4 of Y3* 4.3. Multi-stakeholder workshop (Part 3): Assessment of the plausibility of establishing a national hilsa fishery management trust fund Q4 Y3	4.1. Policy briefing paper: fiscal reforms diagnostic analysis Q4 Y3 4.2. See deliverable for 2.4 4.3. White paper: memorandum and articles of association (MAA) of trust fund Q2 Y4	Myanmar commerce law allows the establishment of a legally independent fund management system.
5. A transboundary hilsa fishery management expert group in place	5.1. Workshop in February or March 2019 (Q4 of Y2) with experts from Bangladesh and Myanmar. 5.2. Closing workshop: signing MoU (Myanmar and Bangladesh) on transboundary hilsa management (and end of project) Q4 Y4	5.1 Workshop report and IIED blog (Q4 Y2) 5.2 Launch of expert group with set of principles and ambitions, Blog or press release (Q4 Y4)	Diplomatic relationship between Myanmar and Bangladesh is not severed (at least status quo is maintained). There has been tensions between Muslim Rohingya and Buddhist Residents in Rakhine State in Myanmar. Occasionally, this has led to strained relationships between the two countries. We believe that cooperation between scientific communities in both countries has not been affected.

Activities

Output 1. Enhanced understanding of the biology and ecology of the hilsa fishery
0.0 Inception workshop
1.1 Spawning seasonality of hilsa using gonadosomatic index
1.3 Assessment of migratory routes of hilsa
Output 2 Enhanced understanding of the complex socio-economics of hilsa fishery in the Ayeyarwady Delta.
2.1 Socio-economic assessment of hilsa fishing communities in the delta (survey design, execution and reporting)
2.2 Assessment of preferences using the choice experiment method
2.3 Estimation of short-terms economic cost (opportunity cost)
2.4 Whitepaper: the design of incentive-based hilsa management in the AD
2.5 National multi-stakeholder workshop (Part 1): incentive-based hilsa management: Design essentials
Output 3 Use and non-use values of hilsa fishery estimated and business case developed
3.1 Estimating economic value of hilsa fishery in AD (using revealed and stated-preference techniques)
3.2 Estimating income elasticity of willingness to pay for hilsa conservation (distributional study)
3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery
Output 4 Sustainable financial mechanism developed
4.1 Multi-stakeholder workshop (Part 2): Diagnostic analysis of fiscal reforms for sustainable fisheries management
4.2 Policy briefing paper on capacity gaps/needs for fiscal reforms
4.3 Multi-stakeholder workshop (Part 3): Assessment of the plausibility of establishing a national hilsa fishery management trust fund
4.4 Development memorandum and articles of association of the fund
Output 5 A transboundary hilsa fishery management expert group is in place
5.1 Participation of delegates from Bangladesh in project inception workshop
5.2 Workshop: transboundary hilsa management – experts from Bangladesh and Myanmar
5.3 Workshop: signing MoU (Myanmar and Bangladesh) on transboundary hilsa management expert group (and end of project)

Annex 3: Standard Measures

Table 1 Project Standard Output Measures

Code No.	Description	Gender of people (if relevant)	Nationality of people (if relevant)	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
6A	On the job training for research workers from Yangon University and the Networks Activity Group (NAG) and fisherfolk from Papin village Maubin	7 women and 24 men	Burmese	11	20			

Table 2 Publications

Title	Type (e.g. journals, manual, CDs)	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers (name, city)	Available from (e.g. weblink or publisher if not available online)
Carrots and sticks: incentives to conserve Hilsa fish in Myanmar	Paper at 3rd World small-scale fisheries congress	Kyi Thar Myint, Khin Maung Soe, Bobby Maung, Essam Mohammed, Mike Akester 2018	Female	Burmese	TBTI	Link
Regional hilsa knowledge-sharing workshop (Bangladesh - Myanmar): lessons for incentive-based hilsa management	Workshop report	Eugenia Merayo, 2019	Female	Spanish	IIED, London	https://pubs.iied.org/G04407/
'Socioeconomic characteristics of hilsa fishers in Ayeyarwady Delta, Myanmar: Opportunities and Challenges'	IIED country report	Wae Win Khaing, Michael Akester, Eugenia Merayo, Annabelle Bladon, Essam Y. Mohammed, 2018	Female	Burmese	IIED, London	https://pubs.iied.org/16656IIED/
Cooperation vs. competition over shared fish stocks	Blog	Annabelle Bladon, 2019	Female	UK	IIED, London	https://www.iied.org/cooperation-vs-competition-over-shared-fish-stocks
Productivity and coastal fisheries biomass yields of the northeast coastal waters of the Bay of Bengal Large Marine Ecosystem.	Journal article	Michael Akester 2019	Male	UK	Deep Sea Research Part II: Topical Studies in Oceanography.	https://www.sciencedirect.com/science/article/pii/S0967064518301115

Seasonal ban on brood hilsa helps to protect stocks in Bangladesh	Blog	Cecily Layzell	Female		CGIAR	http://blog.worldfishcenter.org/2018/10/seasonal-ban-on-brood-hilsa-helps-to-protect-stocks-in-bangladesh/

Annex 4 Onwards – supplementary material (optional but encouraged as evidence of project achievement)

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to Darwin-Projects@ltsi.co.uk putting the project number in the Subject line.	
Is your report more than 10MB? If so, please discuss with Darwin-Projects@ltsi.co.uk about the best way to deliver the report, putting the project number in the Subject line.	
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number. However, we would expect that most material will now be electronic.	
Have you involved your partners in preparation of the report and named the main contributors	
Have you completed the Project Expenditure table fully?	
Do not include claim forms or other communications with this report.	