Department for Environment Food & Rural Affairs

DARWIN INITIATIVE

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Darwin Initiative Main and Post Project Annual Report

To be completed with reference to the "Writing a Darwin Report" guidance: (http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms). It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)

Submission Deadline: 30th April 2020

Darwin Project Information

Project reference	24-014 ref 3739
Project title	Carrots and sticks: incentives to conserve hilsa fish in Myanmar
Country/ies	Country 1: Republic of the Union of Myanmar (also known as Burma); Country 2: Bangladesh (collaborating country)
Lead organisation	International Institute for Environment and Development (IIED)
Partner institution(s)	Department of Fisheries; WorldFish; Network Activities Group (NAG); and University of Yangon Zoology Department
Darwin grant value	£301,895 (Year 3 grant £64,077)
Start/end dates of project	Start date: 01 April 2017 End date: 31 March 2021
Reporting period (e.g. Apr 2019 – Mar 2020) and number (e.g. Annual Report 1, 2, 3)	April 2019 – March 2020; Annual report 3
Project Leader name	Annabelle Bladon
Project website/blog/social media	https://www.iied.org/carrots-sticks-incentives-conserve-hilsa-fish-myanmar
Report author(s) and date	Michael Akester (WorldFish Myanmar) and Annabelle Bladon (IIED), 7 May 2020

1. Project summary

The hilsa shad (*Tenualosa ilisha*; known locally as *nga-tha-lauk*) forms one of Myanmar's most economically important fisheries. Although it appears to constitute only a small portion of official fish production, it has a high commercial value due to strong and steady demand from export markets. Officially reported hilsa exports amounted to 11,400 MT in 2017/2018, with a value of US$32 million. While provisional 2018/2019 figures are lower (a possible reflection of declining stocks) hilsa is still one of the most valuable export species in Myanmar.

As a migratory species, the hilsa is caught in both marine (inshore and offshore) and inland areas – particularly in the Ayeyarwady Region, adjacent Rakhine State, and potentially Mon State. These fish are caught both by offshore vessels and by artisanal fishers using boats and fixed traps. They are thought to support the livelihoods of at least 1.6 million people in some of Myanmar's most impoverished areas.

But hilsa are 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, 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 fishing regulations. The impacts of fishing activities are also 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 socioeconomics of hilsa fishing**. We will conduct a socioeconomic assessment of hilsa fishing households in the region to understand their challenges and opportunities for socioeconomics 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 and transboundary learning, to catalyse the development of a transboundary hilsa fisheries management plan between Myanmar and Bangladesh.

The project focuses on the Ayeyarwady Delta Region, where the majority of Myanmar's hilsa fishing is thought to take place (Fig. 1). Within this area, up to nine study sites (townships) were selected for the ecological, biological, and socioeconomic components of the project.

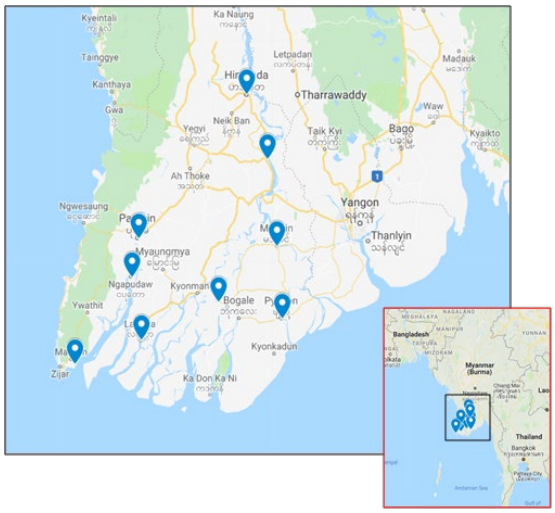

Figure 1. Map of the Ayeyarwady Delta Region and nine study sites within it.

2. Project partnerships

Since inception of the project, IIED has maintained partnerships with WorldFish Myanmar, University of Yangon, 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 dialogues. We also took responsibility for specific components of the project which, in Year 3 (FY 2019-2020), have included the design and implementation of a study exploring the potential for fiscal reform to provide financing for incentive-based management, and analysis of a choice experiment to assess preferences for compensation, estimate the economic value of hilsa, and build the business case for investment.

The IIED team has consistently supported partners through project coordination and quality control. For example, we supported the University of Yangon to analyse ecological data and draft two published reports; together with NAG, we supported external technical specialists to complete a choice experiment and draft a published report; and together with WorldFish, we supported a external technical specialist to conduct and draft a published diagnostic study on fiscal reform, producing a policy briefing in partnership with WorldFish based on the results (see Section 3.1). IIED also committed to co-finance the project budget. In Year 3, we fulfilled this commitment by funding a consultant to visit Myanmar and train NAG staff for the second phase of the choice experiment survey (Indicator 2.2).

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. Michael Akester, Country Director, has been deeply engaged in all project planning, monitoring and evaluation during Year 3, spending an extra six days on the project. WorldFish staff have been instrumental in liaising with and identifying new partners, providing in-country insights, and arranging logistics. They were able to suggest a trusted independent consultant to help design and lead our fiscal reform research (see Section 3.1); organised the logistics of, and funded, their in-country activities; and provided technical inputs to the analysis and final report. Michael Akester and Khin Maung Soe, a consultant for WorldFish and our project's DoF liaison / inland

fisheries governance expert, both put in substantial time and effort to ensure that the research was of a good quality, delivered on time, and relevant to policymakers. Khin Maung Soe arranged and facilitated the stakeholder interviews on which this research was based, as well as two meetings for researchers to discuss and validate findings with key stakeholders (see agenda and presentations in Annex 4). WorldFish covered the cost of these two meetings. Going forward, the WorldFish team have committed to leading the development of a whitepaper over the course of the next year, targeted to both central and regional government.

The DoF's role is to ensure that the Myanmar government is fully engaged and aware of this project's research findings. During Year 3, key officials from the DoF attended a meeting organised by WorldFish, which focused on validation of results from the fiscal reform study (see agenda in Annex 4). Participants included the Deputy Director General, the Director of Research and Development, and the Director of Fisheries Management and Revenue. Their attendance reinforced the commitment of the DoF to the ambition and goals of this project.

WorldFish also held an additional meeting to discuss findings with the Ayeyarwady Region parliamentarians (Hluttaw) and DoF officials from each district in the region (see Fig. 2). This meeting was an initial recognition by the Ayeyarwady Region parliament and DoF of the Darwin project's findings. A summary of key points agreed at the meeting can be found in Annex 4, and WorldFish is waiting to receive a translation of minutes from the Ayeyarwady Region parliament's subsequent cabinet meeting, which apparently mention the meeting's presentation and discussions. The response was very positive (see Section 3.4).

Figure 2. Ayeyarwady Region parliamentarians and DoF officials at validation meeting, 13th March 2020. Credit: Michael Akester.

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 the reporting period, a book was published on Myanmar's inland capture fisheries and aquaculture, based on data and knowledge acquired through this agreement.

The Fisheries Research Development network (FRDN), established by WorldFish and led by the DoF in collaboration with universities and Myanmar Fisheries Federation, carries out research to study biological and social aspects of improved fisheries management. Twelve of the current research sites were chosen to study leasable fisheries in the areas where this Darwin Initiative Project is operating.

The University of Yangon has led the biological and ecological research elements of the project. During Year 3, a team of fisheries scientists worked collaboratively with WorldFish and IIED to complete two reports based on data collected during Year 2 (see Section 3.1). Through working collaboratively on Output 1, IIED and WorldFish Myanmar have built capacity among University of Yangon's researchers in data analysis, report writing and general quality assurance. Dave Shearer, Director of Partnerships at WorldFish made the following comment about one of the reports on October 4th: "*Congratulations! I really want to recognize the level of involvement of Myanmar partners in this publication – well done, this is the type of thing that really builds capacity and partnerships*".

NAG's role in the project is to work directly with fishing communities and to help to strengthen capacities for better fishery management. The NAG team were instrumental in supporting a choice experiment started during in Year 2 by consultants from Scotland's Rural College (SRUC) (see Section 3.1). NAG staff initially assisted with data collection and management, until they had received enough training to complete surveys without assistance. SRUC conducted two training courses and a pilot survey with NAG (see Fig. 3). The first training took place in July 2019 over two days (20 people), and a one-day refresher was also provided in October 2019, following the break in data collection during monsoon season. NAG staff were trained in how to collect data for a choice experiment, data entry and how to design a database for ease of data manipulation. Day-to-day remote support was also provided by SRUC to NAG during data collection and entry, which helped to build local capacity. Throughout this process, NAG provided valuable input in terms of monitoring the process and making decisions in response to data challenges encountered, such as achieving the targeted gender balance (see Section 8). NAG also provided SRUC with logistical support, helping them to travel between survey sites and providing interpretation services.

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

Figure 3. Data collection training session held by SRUC for NAG in Yangon (left) and pilot data collection in Maubin, June 2019 (right). Credit: Paula Nuovo.

New partnerships

The project has catalysed new partnership opportunities and synergistic projects during Year 3. In Year 2, IIED contracted Scotland's Rural College (SRUC) to design and implement the choice experiment, which brought additional research capacity into the Darwin project for Year 3. Building on this successful collaboration, SRUC have agreed to provide their expertise to assist the project team with activities 3.1, 3.2 and 3.3 during Year 4.

The DoF-led Myanmar Fisheries Partnership (MFP), for which WorldFish holds a Secretariat role, has also provided a platform through which the Darwin project has linked to other partners and projects. For example, Dr John Conallin from Charles Sturt University Australia has been conducting hilsa otolith chemical analysis to test for Barium (rich in freshwater) and Strontium (rich in saltwater) to determine fish migrations and whether there may be a landlocked hilsa stock as seen in Bangladesh (see Fig. 4). The Darwin project has provided otolith samples from across the Ayeyarwady Delta and the Charles Sturt University team has further samples from higher up in the Ayeyarwady River system attained though collection under a project funded by the Australian Centre for International Agricultural Research (ACIAR) and Flora and Fauna International (FFI). The samples will be tested at the University of Adelaide, Australia (results should be available by the end of 2020).

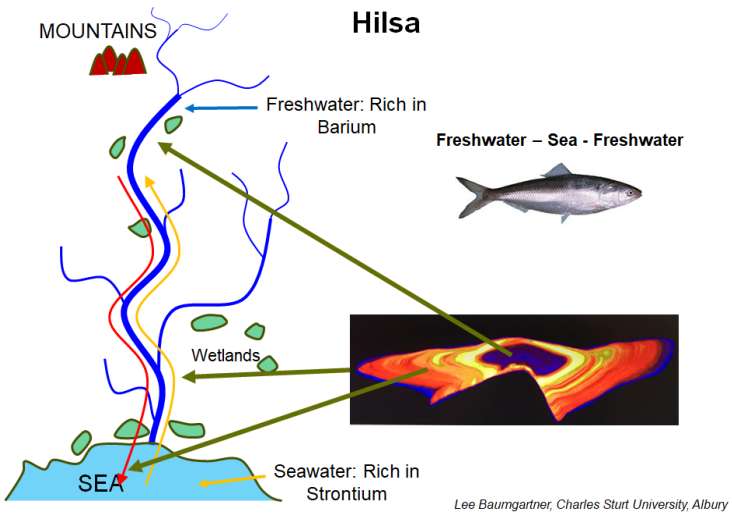

Figure 4. Slide describing research led by Charles Sturt University using chemical analysis of hilsa otoliths to determine time spent in both freshwater and marine environments. The absence of Strontium in a 1+ year old fish would indicate a landlocked stock (See Annex 4 for complete slides).

3. Project progress

Year 3 Activities are on track based on the logical framework revised in March 2020. Some further revisions have been made to activities 2.3, 2.5, 3.1, 3.2, 3.3, 4.2, and 4.3, following our end of year monitoring and evaluation exercise, as explained in Section 9 and below (please see attached change request form).

3.1 Progress in carrying out project Activities

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 complete. During Year 2, data collection was completed and a team of fisheries scientists from the University of Yangon conducted preliminary analysis and shared zero drafts of reports with the rest of the team. During Year 3, IIED worked with the team to conduct further data analysis and supported them to produce two reports.

The assessment of spawning seasonality has been published as a working paper (available here: https://pubs.iied.org/16661IIED/). The aim of this study was to interrogate the existing understanding of hilsa's spawning seasonality in Myanmar, in order to determine the optimum timing for fishing restrictions. Using the data described in our last annual report, we assessed spawning behaviour through seasonal and spatial patterns in four key parameters: the length–weight relationship, gonadosomatic index (GSI), maturity, and sex ratio of sampled hilsa.

The length–weight relationship for the hilsa in this study was established using a logarithmic form of the equation W=aLb, where W is the body weight of the fish (g), L is the total length of the fish (cm), 'a' is the coefficient describing rate of change of weight as the fish grows in length, and 'b' is the exponent describing change in form or shape of the fish as it grows. We found that the hilsa specimens caught in fresh water were significantly smaller and lighter than those caught in brackish and saline water. This indicates that hilsa spawn mostly in the freshwater zone, which also provides a nursery area for juveniles before they migrate towards the coast, where they reach maturity. We also observed negative allometric growth (exponent parameter b < 3) in September, indicating that fish had released their gonad products at this time (see Fig. 5).

To examine seasonal variation in spawning activity and reproductive readiness, we plotted GSI values by month, focusing on the pattern in females since their gonads are larger and vary more in size with maturity. The GSI represents the relative weight of the gonad to body. A high GSI value indicates a greater gonad weight relative to body weight, and a major drop from high to low GSI is an indication of spawning activity. Peaks and troughs were visible throughout the year, indicating that there could be more than one spawning season, but the largest drop was seen from July to September, with the lowest mean GSI values in September, coinciding with a parallel drop in b values (see Fig. 6). When divided by ecological zone, we found that mean female GSI values varied most in the freshwater zone, indicating that more brood fish congregate in fresh water than in other zones and release their eggs in this zone.

An assessment of when mature and immature hilsa tend to be caught, and in which ecological zones, provided further evidence to describe when and where hilsa spawn. We used hierarchical agglomerative clustering on GSI and fish length to roughly divide specimens according to whether they were mature or immature. In the saline zone, mature fish (80%) were much more abundant than immature fish, whereas in fresh water, immature fish (77%) were much more abundant (Fig. 7).

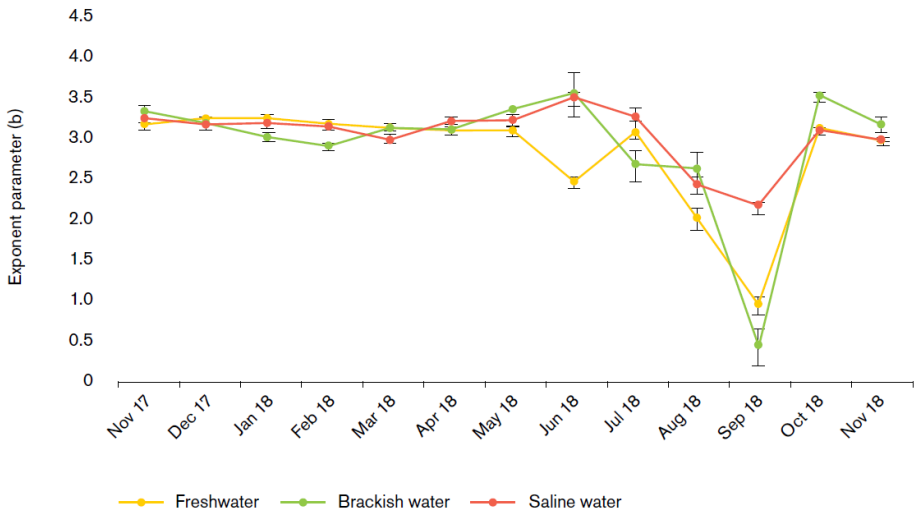

Figure 5. Monthly variation in mean values of exponent parameter (b) (ie change in shape of a fish as it grows) for length-weight relationship of hilsa collected from freshwater (n = 1499), brackish water (n = 2791) and saline water (n = 3724). Error bars represent standard error.

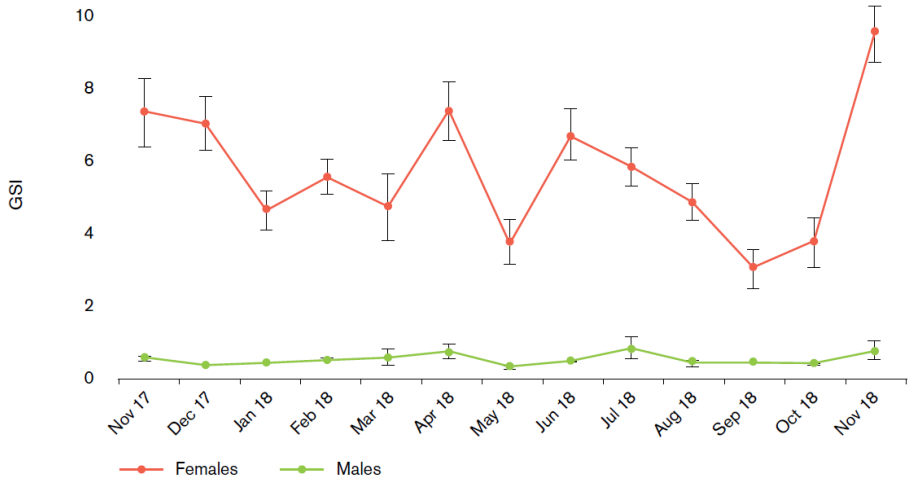

Figure 6. Mean monthly gonadosomatic index (GSI) values for male hilsa (n = 448) and female hilsa (n = 534) collected from Myanmar's Ayeyarwady Delta from November 2017 through November 2018. Error bars represent standard error.

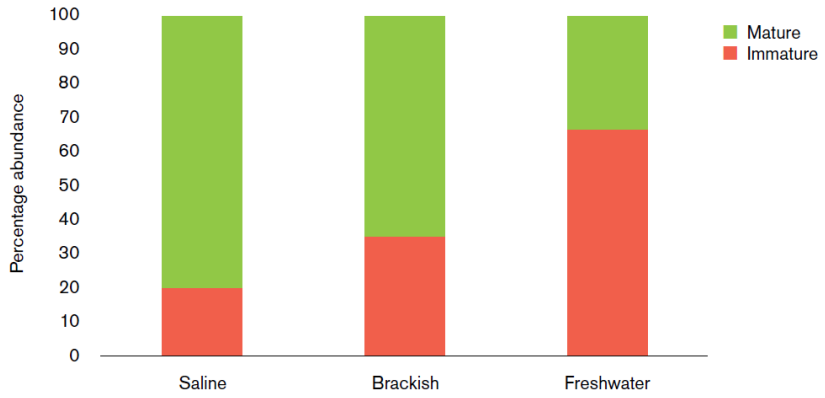

Figure 7. Percentage abundance of immature (n = 310) and mature hilsa (n = 547) by ecological zone.

Finally, we calculated sex ratios (total number of males/total number of females), assessed their divergence from the expected value of 1:1, and compared this across space and time to understand where and when male and female hilsa congregate for spawning. Overall, females predominated. Fluctuations in sex ratio by month indicate that males and females congregate for spawning in July, September, and from March to April, but larger sample sizes would be required to draw robust conclusions (see Fig. 8).

Figure 8. Monthly sex ratio (number of males/number of females) observed for hilsa (n = 982) and expected sex ratio (1:1). The scale of the y axis represents the number of males for every one female. Ratios significantly diverged from 1:1 (P < 0.05) in all months apart from March, April, July and September.

Preliminary results from the University of Yangon indicated that the main spawning seasons are March-April and October-November. The final results described above instead showed a major spawning season in August-September, peaking in September, and indicated potential additional seasons in April-May and January-February. These findings demonstrate that current fishing restrictions between May and August do not coincide with main hilsa spawning season. We made the following recommendations:

- Close freshwater areas to fishing during the month of September
- Protect nursery grounds all year round through mesh size regulations and sanctuaries
- Establish no-take marine protected areas to protect mature hilsa
- Maintain upstream and downstream migratory routes
- Ensure management measures are flexible and adaptable enough to keep pace with environmental change

The assessment of hilsa migratory routes has also been published as a working paper (available here: https://pubs.iied.org/16665IIED/). Using the same dataset described above, and some of the same parameters (GSI, maturity, length-weight relationship, as well as length-frequency), IIED worked with the team from University of Yangon to build a more detailed picture of hilsa's seasonal migratory patterns in the Ayeyarwady Delta. Two main migratory routes have already been established for hilsa in the Ayeyarwady Region: the Ayeyarwady route and the Pathein route. We analysed patterns in key parameters at township level, with fish samples disaggregated according to these two routes and by ecological zone.

Our analyses indicated that, on the Ayeyarwady route, the main season of hilsa migration is in July and August, when mature hilsa start migrating upstream from saline areas (see Table 1). Shortly afterwards, they reach brackish and freshwater areas, where they spawn mainly in August and September. Once they release their eggs and become spent, they start downstream migration, crossing brackish areas on their way to the sea in September, and finally reaching marine areas in October. Juvenile hilsa produced in fresh water in September stay in fresh water and brackish nursery grounds during the next few months for further maturation and growth, before starting their journey to the sea.

Table 1. Summary of main findings for hilsa on the Ayeyarwady route.

	SALINE AREAS			BRACKISH AREAS	FRESHWATER AREAS	
TOWNSHIP	LABUTTA	MAWLAMYINEGYUN	PYAPON	MAUBIN	DANUPHYU	HINTHADA
Abundance of mature hilsa (>55%)	May–Aug Oct–Dec	Mar–Nov	All year	Jan–Feb Jun–Sep	June	Jun–July September
Abundance of largest hilsa (>40cm)	Jun–Aug Oct–Dec	Mar–Jun Aug–Nov	Apr–Jul Oct–Nov	Jan–Feb Aug–Sep	–	–
Drop in GSI	Jun–Sep	Aug–Oct	Sep–Oct	Sep–Oct	May–Jun Aug–Oct	May Aug–Sep
Abundance of immature hilsa (>55%)	Jan March September	January	–	Oct–Nov Mar–May	Aug–Dec Mar–May	Oct–May
Abundance of smallest hilsa (<20cm)	–	Dec–Jan	–	Mar–Apr October	March May October	March May October

On the Pathein route, the main season of hilsa migration appears to take place in July, when mature hilsa start migrating upstream from marine waters (Table 2). Shortly afterwards, they reach brackish and freshwater areas, where they spawn mainly in August and September. Once they release their eggs and become spent they start downstream migration, reaching marine areas as spent fish in September. Juvenile hilsa produced in fresh water in September stay in freshwater and brackish nursery grounds until December–January, before crossing brackish areas in January on their way down to the sea, where they arrive during the same period.

Table 2. Summary of main findings for hilsa on the Pathein route.

	SALINE AREAS	BRACKISH AREAS		FRESHWATER AREAS
TOWNSHIP	HAINGGYI	NGAPUDAW	PATHEIN	HINTHADA
Abundance of mature hilsa (>55%)	Feb–July September November	May–July	Feb–Nov	Jun–July September
Abundance of largest hilsa (>40cm)	July September	Dec–March Jun–July	Jul–Aug	–
Drop in GSI	March–June Oct–Jan	July October	July–Sep January	May Aug–Sep
Abundance of immature hilsa (>55%)	Dec–Jan August October	–	January	Oct–May
Abundance of smallest hilsa (<20cm)	–	–	–	March May October

Based on the observed seasonal patterns along the two routes (see Fig. 9), we recommended the following additional policy interventions:

- Protect hilsa in the marine environment during July and August, when the largest mature females are found, on both migratory routes – a total ban on fishing may be difficult, but restrictions on fishing access or limits on total catch may be feasible
- Prohibit fishing during March-April and October in Maubin's brackish waters, which provide an important nursery ground for hilsa
- Combine regulations with compensation for artisanal fishers

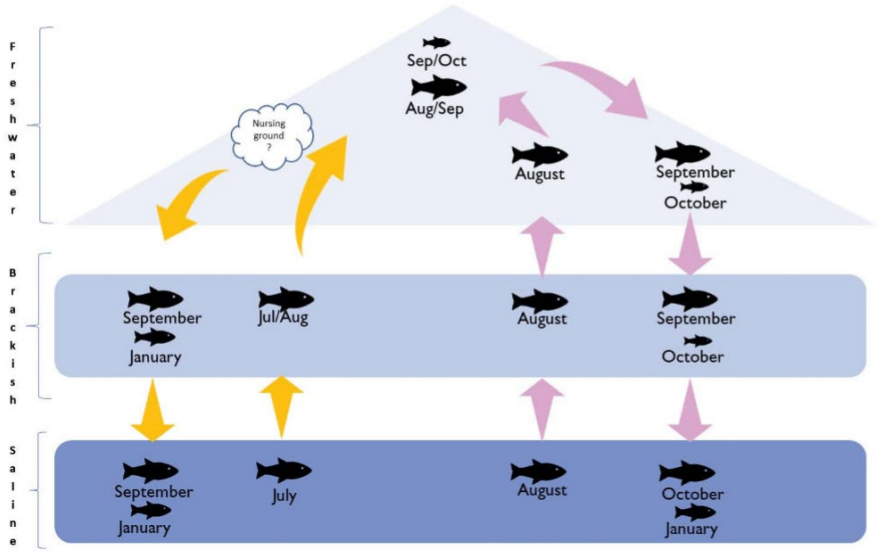

Figure 9. Main seasonal hilsa migration in Myanmar by ecological area through Pathein route (orange) and Ayeyarwady route (lilac).

The Darwin project team were due to present these findings at the national multi-stakeholder workshop scheduled for 23 March 2020 (see draft agenda in Annex 4), but this has been postponed until further notice due to COVID-19. This is the main forum through which we were planning to share recommendations with government during the reporting period. However, before restrictions on movement were put in place, WorldFish did manage to successfully share findings with the Ayeyarwady Region parliamentarians and DoF officials (see Annex 4 for meeting presentation and summary of key points that were agreed).

Assessment of preferences using the choice experiment method (2.2)

This activity has been completed and published as a working paper (available here: https://pubs.iied.org/16668IIED/). With support from NAG and IIED, Scotland's Rural College (SRUC) used a choice experiment to assess fishers' attitudes towards and preferences for different packages of incentive-based management. A total of 381 respondents were surveyed during July, October and November 2019 in four townships of the Ayeyerwady Region: Maubin (where the survey was piloted), Ngapudaw, Mawlamyinegyun and Labutta. Where possible, respondents were chosen to overlap with households that had participated in the previous socioeconomic survey (Activity 2.1).

The hypothetical options offered to respondents in the choice experiment included three attributes related to hilsa management and two aspects that characterised monetary and in-kind compensation (see Table 3). These were developed based on the expert opinion of local partners and the experience of previous incentive-based schemes for hilsa conservation in Bangladesh. Each choice shown to respondents contained two alternatives representing incentive-based management options, and a 'No agreement' alternative (see Fig. 10). Respondents were asked to choose between two incentive-based management options with varying attributes and levels, or non-participation ('No agreement'). Survey respondents were informed that the DoF would

hand out compensation once a year at the nearest township, and that monetary payments could also be administered by a mobile phone service such as Wave. An experimental design was used to create the combinations of attributes and levels in each of the conservation agreements in the choice tasks to be shown to respondents.

The results of this choice experiment provide some important insights for the development of incentive-based hilsa fisheries management in Myanmar. On average, respondents showed a tendency to choose an incentive-based management option, rather than the 'No agreement' alternative. This indicates a general willingness to participate in this type of conservation scheme; however, such an interpretation should be carefully assessed against the presence of cultural norms.

The results also showed that both additional closed periods to facilitate spawning and the creation of new sanctuaries are the most widely accepted management changes. Restrictions on net type requiring a larger mesh size (to allow more juveniles to mature) were perceived as the most controversial. Monetary compensation was typically preferred over the option of rice compensation, and fishers typically cared about greater amounts of monetary compensation. However, fishers in some townships perceived the amounts on offer to be too low to offset the income they would forego by complying with the conditions of the incentive. There was limited interest from our respondents in compensation in the form of rice, which could be due to abundance of rice in the region. But further exploration is needed to understand whether other forms of in-kind compensation would be more appropriate, including food items that are perceived to be nutritious and difficult to obtain in local markets.

These findings reveal some promising management options. We recommended further research to refine these using new ecological understanding (Output 1), to identify appropriate in-kind and monetary compensation amounts, and to explore how and with what regularity this compensation would be best delivered.

Table 3. Final list of attributes and attribute levels used in the choice experiment

Attribute	Label	Level 1	Level 2	Level 3	Level 4
Additional periods of closure	CLOSE	No change	No fishing during *Thadingyut*[1] for 3 days before and 3 days after the full moon, for a total closure of 7 days	No fishing during *Thadingyut* and *Tazaungmon* for 3 days before and 3 days after the full moon in each month, for a total closure of 14 days	No fishing during *Thadingyut*, *Tazaungmon*, and *Natdaw* for 3 days before and 3 days after the full moon in each month, for a total closure of 21 days
Creation of sanctuaries	SANCT	No change	New sanctuary every 9 miles, maximum length 1 mile of river, up to half the width of river	New sanctuary every 6 miles, maximum length 1 mile of river, up to half the width of river	New sanctuary every 3 miles, maximum length 1 mile of river, up to half the width of river

[1] *Thadingyut* is the seventh month of the Burmese lunisolar calendar, approximately coinciding with October in the Gregorian calendar. *Tazaungmon* is the eight month, approximately coinciding with November. *Natdaw* is the ninth month, approximately coinciding with December.

Nets with 4.5-inch mesh required between *Thadingyut* and *Natdaw* (October to December)	NETS	No change	Ban on all other nets, only use nets distributed by DoF with 4.5-inch mesh during *Thadingyut*, *Tazaungmon* and *Natdaw*		
In-kind payment (rice)	RICE	No rice payment	1 *tinn**	2 *tinn*	3 *tinn*
Cash payment (MMK)**	CASH				

Note: The levels of the 'No agreement' alternative were 'No change' in management attributes, and no rice and cash payments. **Tinn* is a Myanmar measure of volume commonly used for rice. The standard weight equivalent of 1 *tinn* ranges from 46 pounds (20.9kg) to 56 pounds (25.4kg). **MMK – Myanmar kyat, MMK 1,000 = US$ 0.7 in June 2019

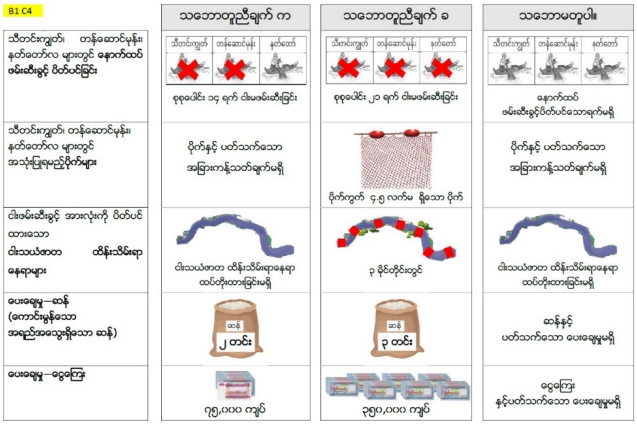

Figure 10. Example of choice shown to respondents.

Estimation of short-term economic cost (2.3), economic value of hilsa fishery in AD (3.1), income elasticity of willingness to accept hilsa conservation (3.2)

These activities are based on analysis of data already collected through Activity 2.2, and following revisions to the logframe, will not be completed until Q1 Year 4. IIED is currently working with SRUC and an independent consultant to complete these analyses and draft a working paper.

Cost-benefit analysis of investment in sustainable management of hilsa fishery (3.3)

This Activity will make the business case for investment in the hilsa fishery and identify the optimum level of that investment. As it depends on the estimation of economic value (Activity 3.1), which will be delivered in Q1 Year 4, this Activity cannot be delivered until Q2 Year 4 (see Section 9 and attached request for logframe revisions).

Policy briefing paper on fiscal reforms (4.1)

This activity has been completed and we have published the policy briefing (available here: https://pubs.iied.org/17751IIED/). We have also published the results of the diagnostic analysis underpinning this policy briefing as a working paper (available here: https://pubs.iied.org/16669IIED/). The design of any incentive-based management requires a mechanism for sustainable finance. This activity explored the potential for the Myanmar government to finance incentive-based management through fiscal reforms. IIED hired an

independent consultant to work closely with WorldFish in Myanmar to characterise the key actors involved in Myanmar's hilsa value chain and assess information on how (and how effectively) the government currently uses fiscal tools to raise revenue from these actors. We used a mixed-methods value chain approach, where information was collected through a literature review, focus group discussions and key information interviews (see Table 4), and analysed it using qualitative and quantitative methods. Through this analysis we identified opportunities to generate additional finance by improving collection efficiency and better targeting those who profit most from hilsa (see Fig. 11).

Table 4. Hilsa value chain actors interviewed through focus group discussions or key informant interviews.

Actor	Number of individuals interviewed and profile
Fishers	13 (5 female and 8 male) from villages across the Ayeyarwady Region
Village traders	1 male from a village in Mawlamyinegyun township (Bamar ethnicity)
Township traders	3 males from Pyapon, Hinthada and Maubin townships (Bamar ethnicity)
Wholesale traders	2 traders at San Pya Fish Wholesale Market, Yangon (male, Bamar ethnicity)
Export-oriented processors	2 managing directors of processing factories for the export market on the outskirts of Yangon (male, Chinese and Bangladeshi)
Actors adjacent to value chain	1 village processer (female) 1 general manager of a marine jetty (male) 1 DoF deputy fisheries officer in charge of marine jetty (male) 1 trawl fishing net manufacturer (male) 1 NGO staff member with relevant expertise (male) 1 Chairman of a fisher association from Mawlamyinegyun township (male)

The reforms set out in this paper for increasing current revenue-collection efficiency could generate annual revenues in the region of US$56.9 million for the DoF and government of Myanmar more broadly (more than twice the current annual revenues). Combining this increase in revenue-collection efficiency with the proposed revisions to fee and tax rates could generate revenues nearer US$91 million per year (more than three and a half times current annual revenues), by better targeting actors nearer the top of the hilsa value chain.

While our figures are based on numerous assumptions and should be interpreted with caution, this study clearly demonstrates how fiscal reform could be used to finance a system of incentives for hilsa fisheries management, simply by adapting tools that are already used. Although we do not yet have accurate estimates of what type and level of incentives fishing households in the Ayeyarwady Region would be willing to accept for compliance with specific fishing regulations, based on an incentive scheme for hilsa fishing households in nearby Bangladesh, these additional revenues would be enough to provide incentives to all artisanal fishers across the Ayeyarwady Region, including those who are currently not registered (around 126,000 people).

To maximise the success of fiscal reform — both in terms of raising additional revenues and ensuring that those revenues support the incentive scheme — we also recommended that policymakers consider the following factors:

- Policymakers should consider the full range of potential impacts (social, political, economic and environmental) to understand how fiscal reforms may affect different groups and explore how they can reduce negative and unintended consequences.
- Creating new opportunities to collect, manage and distribute funds can also create new opportunities for misuse of funds. Policymakers should ensure that at least a portion of revenues raised through fiscal reform are used to support a system of incentive-based fisheries management, which may require stronger fiscal administration. Options include streamlining the bureaucratic approval process for channelling funds to the DoF's

research and development fund; establishing a regional hilsa conservation fund within the scope of the 2018 Ayeyarwady Region Freshwater Fisheries Law (updated in 2019), and/or establishing a national Conservation Trust Fund for hilsa.

- Weak offshore governance limits efficient collection of revenues from the offshore fleet, and unsustainable marine activities may undermine the impacts of improved hilsa management inland. Offshore governance needs to be strengthened.

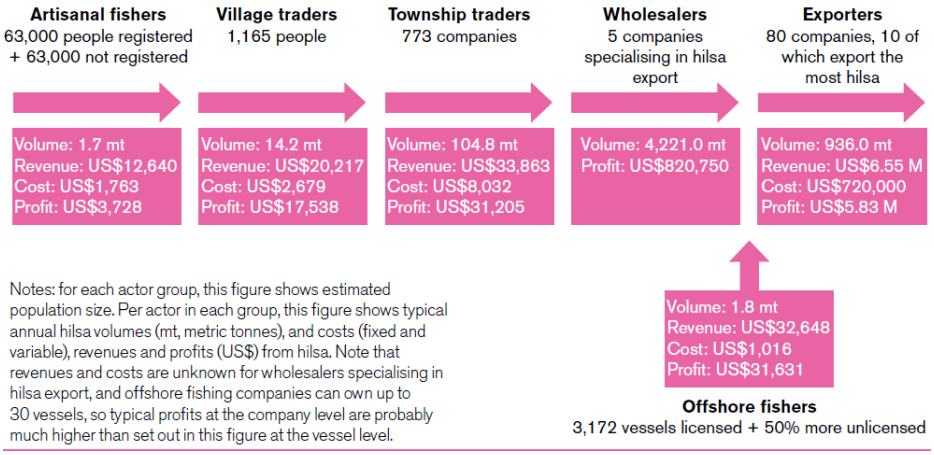

Figure 11. Summary of key actors in Myanmar's hilsa value chain.

National multi-stakeholder workshop on the design essentials of incentive-based management (2.5), diagnostic analysis of fiscal reforms for sustainable fisheries management (4.2) and assessment of the plausibility of establishing a national hilsa fishery management trust fund (4.3).

This workshop was scheduled to be held in Yangon, 23-24 March 2020. The agenda was designed to cover each of these three themes over the course of two days (see Annex 4 for draft agenda). Unfortunately, this workshop has been postponed until further notice, owing to COVID-19, resulting in an underspend by WorldFish during the reporting period (see Section 9).

3.2 Progress towards project Outputs

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

Indicator 1.2

Two working papers have been published on the ecology and biology of hilsa in the Ayeyarwady Delta, the findings of which are summarised in Section 3.1:

- Bladon, A, Myint, KT, Ei, T, Khine, M, Aye, PT, Thwe, TL, Leemans, K, Soe, KM, Akester, M, Merayo, E and Mohammed, EY (2019) Spawning seasonality of hilsa (Tenualosa ilisha) in Myanmar's Ayeyarwady Delta. IIIED, London. Available at: https://pubs.iied.org/16661IIED/
- Merayo, E, Myint, KT, Ei, T, Khine, M, Aye, PT, Thwe, TL, Leemans, K, Soe, KM, Akester, M, Bladon, A and Mohammed EY (2020) Migratory patterns of Hilsa shad in the Myanmar Ayeyarwady delta: lessons for fisheries management. IIED, London. Available at: https://pubs.iied.org/16665IIED/

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

Indicator 2.2

An assessment of preferences using the choice experiment method has been completed. This was based on a survey of 381 respondents which took place during July, October and November 2019 in four townships of the Ayeyerwady Delta. We have produced a working paper based on this survey:

- Glenk, K, Novo, P, Khaing, WW, Lwin, WW, Burcham, L, Mohammed, EY, Soe, KM, Akester, M, Bladon, A, Merayo, E (2020) Informing incentive-based management of hilsa fish in Myanmar – results of a choice experiment. IIED, London. Available at: https://pubs.iied.org/16668IIED/

Indicator 2.3

In the last revision of the logframe, the short-term economic cost (opportunity cost) was due to be estimated by Q3 of Year 3. However, IIED activities since this time have been slightly disrupted due to the departure of the project leader and impacts of COVID-19 on operations, and so we have pushed back the deadline to Q1 Year 4 to ensure that we have time to deliver a quality report.

Indicator 2.4

A national multi-stakeholder workshop was scheduled to be held in Yangon, 23rd-24th March 2020. A significant portion of the draft agenda was dedicated to the design essentials of incentive-based fisheries management (see Annex 4). However, the workshop has been postponed until further notice, owing to COVID-19.

Output 3. Use and non-use values of hilsa fishery estimated and business case developed. [On track].

Indicators 3.1, 3.2 and 3.3

In the latest revision of the logframe, Indicators 3.1 (monetary estimation of non-use value of hilsa fishery estimated) and 3.2 (estimation of income elasticity of willingness to accept hilsa conservation) were combined with Indicator 2.3 (estimation of short-term economic cost), since each of these Indicators will be based on analysis of the same data. As explained under Indicator 2.3, we have also pushed back the deadline for this report to Q1 Year 4.

Since the policy briefing on the optimal level of investment to conserve hilsa depends on these estimations, we have requested to push delivery of Indicator 3.3 back to Q2 Year 4 (please see attached change request form).

Output 4. Sustainable financial mechanism developed. [On track].

Indicator 4.1

We have completed a diagnostic analysis of fiscal reforms to finance incentive-based hilsa fisheries management in Myanmar. The findings are summarised in Section 3.1, and published in the form of a working paper and a policy briefing:

- Silvester, P, Bladon, A, Akester, M, Maung Soe, K and Mohammed, EY (2020) Financing incentive-based hilsa fisheries management in Myanmar through fiscal reform. IIED, London. Available at: https://pubs.iied.org/16669IIED/
- Bladon, A, Akester, M and Mohammed EY (2020) Financing Myanmar's fisheries through fiscal reform. IIED, London. Available at: https://pubs.iied.org/17751IIED/.

Indicators 4.2 and 4.3

A national multi-stakeholder workshop was scheduled to be held in Yangon, 23rd-24th March 2020. A large portion of the draft agenda was dedicated to fiscal reforms and the plausibility of establishing a national hilsa fishery management trust fund (see Annex 4). However, the workshop has been postponed until further notice, owing to COVID-19.

As a result, we have removed the memorandum and articles of association for a Conservation Trust Fund from the logframe. This is because it would depend on discussions at the postponed

national multi-stakeholder workshop. Since we do not anticipate that travel restrictions will be lifted soon enough for this workshop to inform such a product, we have decided to focus Output 4 on fiscal reform. Instead of developing a memorandum and articles of association, we will produce a roadmap for the Myanmar government to implement our proposed fiscal reforms (please see attached change request form).

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 and 3, and progress towards the Indicator for Year 4.

Indicator 0.2

The socioeconomic assessment of hilsa fishing households was completed during Year 2 (available here: https://pubs.iied.org/16656IIED/). This assessment shows the level and seasonality of dependence on hilsa fishing in the Ayeyarwady Region. During Year 3, we conducted a diagnostic analysis of fiscal reform as a sustainable finance mechanism. This analysis relied on the collection of information on key actors in the hilsa value chain. We learnt through literature review and interviews with experts that about 63,000 artisanal fishers were registered in the Ayeyarwady Region in 2017/2018, and that the same number again were probably operating without registering as fishers. We therefore estimated that a total of 126,000 fishers are likely to be affected by potential regulatory measures, although many of these people are primarily farmers who do not rely on fishing as their main source of income.

We also completed a choice experiment during Year 3. This survey generated the data on which our estimation of these fishers' short-term (opportunity) cost will be based. Preliminary findings were published this year as part of the assessment of preferences (Indicator 2.2) and will be elaborated in a report due to be delivered in Q1 Year 4 (Indicator 2.3).

Indicator 0.1

During Year 3, IIED started drafting a whitepaper on the design essentials of incentive-based hilsa management in the Ayeyarwady Delta, based on evidence produced by the project so far (see Annex 4 for draft). WorldFish are now providing their inputs to the document, which will include recommendations based on preliminary results of a telephone survey looking at the impacts of COVID-19 on the hilsa supply chain (see Annex 4 for questionnaire templates and description of survey). We will share the whitepaper with DoF officials for their inputs and endorsement by Q3 of Year 4.

3.4 Monitoring of assumptions

Assumption 1: 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.

Comments:

Three key officials from the DoF attended our validation meeting for the fiscal reform study in Naypyitaw on 28 February 2020: U Myint Zin Htoo, Deputy Director General; U Htun Win Myint, Director Research and Development; and U Aung Nyi Toe, Director Fisheries Management and Revenue. They were very engaged in the workshop and a key outcome was agreement that one key focal point should be appointed for hilsa at DoF. Dr Htun Thein was confirmed in this role (see Annex 4 for WorldFish business trip report). This should make the process of engaging with the right DoF officials during Year 4 more efficient and demonstrates their commitment to making change.

DoF officials also suggested during this meeting that any fiscal reforms would need to start at a decentralised level in Ayeyarwady, Yangon and Mon States/Regions. While DoF at Union (central) level manage marine fisheries, Regional Ministers in the States and Regions control

inland fisheries. As a result, WorldFish quickly organised a second meeting in Pathein (13 March 2020) with Ayeyarwady Region parliamentarians and DoF officials, to discuss fiscal reforms and incentive-based management options. This meeting went very well, and we are confident that we can advance recommendations well at the decentralised level (see Annex 4 for summary of agreed points). The Ayeyarwady government is willing to use the project's research findings to instigate a closed season extension in April (a potentially important month for spawning) and hilsa sanctuaries. Participants were concerned that fishing bans in September (the major spawning month) would be difficult to impose as the project's research has shown this to coincide with the annual peak fishing period. However, they said that if fisher associations can determine the exact days that spawning runs occur, a fishing ban on specific days at specific locations during September might be possible under flexible fisheries management plans enforced by fisher associations. We are confident that successful introduction of our recommendations at the regional level should pave the way to advance them at Union (central) level.

Assumption 2: 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.

Comments:

Our research on spawning seasonality of hilsa in Myanmar indicates one main spawning peak in August-September (particularly September), with potential smaller peaks in January-February and April-May (please note that these findings are slightly different to preliminary findings described in the last annual report). In Bangladesh, the peak spawning season is thought to be September-October (but particularly October), with some evidence of a distinct smaller winter spawning stock with a peak spawning season in January. Although spawning seasonality appears to be very similar in the two countries, the slight variation could indeed be explained by inter-annual variability. Joint transboundary management of the shared stock would clearly be positive. However, there is a need to carry out further studies as to the nature of the shared stock, since migratory and landlocked populations are likely to have different spawning seasons and will therefore require different management approaches (see Section 13).

Assumption 3: 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.

Comments:

This assumption holds. The choice experiment survey did not have a 'don't know' response option, but if respondents felt unsure about their answer we would expect them to have chosen the 'no agreement' option frequently. Instead, 89% of respondents selected a management and compensation package, rather than choosing 'no agreement' (see Section 3.1).

Assumption 4: 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.

Comments:

While this is still true, investment in the sector remains low due to clear evidence of IUU fishing and overfishing. There were no foreign vessels registered to fish in Myanmar in 2018/2019, but there are known to be Chinese vessels fishing. The central fish market in Yangon has closed due to COVID-19, so any fish caught now will be transhipped at sea as IUU.

Assumption 5: Myanmar commerce law allows the establishment of a legally independent fund management system.

Comments:

This assumption is still valid.

Assumption 6: 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.

Comments:

Diplomatic relations have deteriorated due to the Rohingya crisis. The Bangladesh authorities have closed fishing in and around the Naf River area (frontier with Myanmar). While fishing is not closed on the Myanmar side the presence of the Army has reduced fishing in Myanmar since 2017 as evidenced by the large size of fish caught by the few fishers operating in the area and sold in the Sittwe fish market. The tensions have led us to further revise Output 5 and its activities (see attached change request form). While we hope that a transboundary dialogue between scientists and researchers, and even DoF officials, is still possible, this may need to be a virtual dialogue while tensions remain high. As a result, we will focus primarily on establishing a national hilsa expert group, to support the Outcome of the project, but continue to facilitate a transboundary dialogue where possible and as a secondary goal.

4. Impact: achievement of positive impact on biodiversity and poverty alleviation

Please see sections 5, 6 and 7 below.

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

Currently, Myanmar ranks 110 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'. During Year 3 of the project, we produced a report describing the preferences of Ayeyarwady Region fishing households for different kinds of compensation (available here: https://pubs.iied.org/16668IIED/). The report indicates that monetary compensation is typically preferred by fishing households over the option of rice compensation, and provides evidence that preferences vary between township and gender. These insights can be used to support next steps in the design of incentive-based hilsa fisheries management, which has huge potential to reduce poverty in the region. Not only will they help policymakers design compensation packages that effectively incentivise compliance with regulations, they can also be used to ensure that the compensation contributes to poverty alleviation, by highlighting what households really need.

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'; and, less directly, to SDG 2: 'Zero hunger'. During Year 3 we have published five reports which improve ecological and socioeconomic understanding of hilsa fisheries in the Ayeyarwady Region (see Section 3.1). In Year 4, we intend to use the evidence in these reports to engage with and guide the DoF in updating fisheries legislation, including designation of sanctuary areas for hilsa and adapting the closed season, and designing incentives to improve compliance with regulations. We will optimise the impact of this incentive-based management system on these SDGs 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 is being used in Myanmar (alongside the twelve Ecosystem Based-Management Principles and the FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication) by the Multi-Stakeholder Information and Communication

(MuSIC) initiative, started in 2019 (see: https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/4088/c1b7f991e31efaf78cacb07b0edc4d89.pdf). MuSIC is a platform to support small-scale fisheries in Asia, designed to increase collaboration and communication between WorldFish, FAO/UN and national research organisations, and to link to global policy processes.

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.

6. Project support to the Conventions, Treaties or Agreements

With active involvement of the Myanmar DoF, this project has already contributed 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 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. For example, during the current reporting year, WorldFish helped to stabilise artisanal fisher organisations like the 'Helmsman' group in the Pyapon area of the Ayeyarwady Delta, now legally constituted under the new Ayeyarwady Region decentralised inland Fisheries Law 2019 (see description in Annex 4). The association leader, U Nyunt Win, has been working closely with the Darwin project since travelling with the team to Bangladesh for the transboundary workshop in 2019.

Progress has also been made during Year 3 towards contributing to national CBD **Targets 3.2** ('positive incentives are established for the sustainable use of nature') **and 6.2** ('total commercial marine catch reduced to more sustainable levels'). We have published five communication products this year which should contribute to these targets (Indicators 1.3, 2.2, and 4.1):

- Bladon, A et al. (2019) Spawning seasonality of hilsa (Tenualosa ilisha) in Myanmar's Ayeyarwady Delta. IIED, London. Available at: https://pubs.iied.org/16661IIED/
- Merayo Garcia, E et al. (2020) Migratory patterns of hilsa shad in the Myanmar Ayeyarwady delta: lessons for fisheries management. IIED, London. Available at: https://pubs.iied.org/16665IIED/
- Glenk, K et al. (2020) Informing incentive-based management of hilsa fish in Myanmar – results of a choice experiment: How do you like your fish? IIED, London. Available at: https://pubs.iied.org/16668IIED/
- Silvester, P et al. (2020) Financing incentive-based hilsa fisheries management in Myanmar through fiscal reform. IIED, London. Available at: https://pubs.iied.org/16669IIED/
- Bladon, A et al. (2020) Financing Myanmar's fisheries through fiscal reform. IIED, London. Available at: https://pubs.iied.org/17751IIED/

In particular, the latter two products clearly demonstrate how fiscal reform could be used to finance incentive-based fisheries management in Myanmar. DoF officials participated in a meeting held by WorldFish in March 2020 to discuss findings (see Annex 4 for powerpoint presentations), and during Year 4 we intend to develop a roadmap to guide the government of Myanmar through implementation of the proposed fiscal reforms (see Section 9). We have also started drafting a whitepaper which will provide a comprehensive set of recommendations to government for designing the incentive scheme (see draft in Annex 4). We planned for these project outputs to inform national processes to meet these CBD targets via structured engagements with national CBD focal points. However, Michael Akester from WorldFish has contacted Myanmar's CBD primary national focal point, Dr Nyi Nyi Kyaw, and other colleagues at the Forest Department a number of times during and previous to the reporting period, with limited response. Most recently, Dr Naing Zaw Htun, Director, Nature and Wildlife Conservation Division responded that fisheries are 'beyond our mandate'.

7. Project support to poverty alleviation

This project is designed to alleviate poverty in Myanmar by providing assistance to ensure that the poorest fishers are not made worse off by fisheries regulations, by maintaining a source of food that is important for the poor, and by maintaining employment in Myanmar's small-scale fisheries. In Year 2 of the project, we furthered our understanding of the socioeconomic characteristics of small-scale fishing communities in the Ayeyarwady Region (Indicator 2.1).

This allowed us to design a choice experiment testing the needs and preferences of hilsa fishing households in those same communities. We completed this choice experiment during Year 3 (Indicator 2.2; report available here: https://pubs.iied.org/16668IIED/). This choice experiment provided preliminary information on local acceptance of different types of management options, and what types of compensation packages are preferred. This information will play a pivotal role in enabling this project to contribute to poverty alleviation.

Of particular relevance is the finding that preferences vary significantly between social class. For instance, while fishers typically preferred the option of monetary compensation over food compensation, less wealthy fishers showed a greater willingness to accept food compensation. They also found the prospect of a change in net mesh size to be much less acceptable than the introduction of hilsa sanctuaries or closed seasons – potentially due to the impact this reduction might have on the time spent to catch fish. This information will help the DoF to deliver a scheme that is well-aligned with the realities of the communities involved so that it enhances their resilience to environmental and economic shocks and reduces their vulnerability to poverty.

The study of fiscal reforms completed during Year 3 (Indicator 4.1; report available here: https://pubs.iied.org/16669IIED/) also provides evidence for the direct poverty impacts expected from this project. It demonstrates how fiscal reform could generate enough revenue to provide incentives to all registered and unregistered artisanal fishers across the Ayeyarwady Region (around 126,000 people).

Since we have thus far been focusing on incentive scheme design rather than implementation, another 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 socioeconomic 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.

8. Consideration of gender equality issues

This project has aimed from the outset to ensure that systemic constraints faced by women along the hilsa value chain are at the core of the incentive-based scheme's design. The socioeconomics survey (Indicator 2.1; report available here: https://pubs.iied.org/16656IIED/) completed during Year 2 demonstrated that both men and women generate income from hilsa through fishing, but that women tend to be more involved in other activities such as net repair and selling hilsa, as well as domestic activities and education. Access to and preferences for hilsa markets and loans can also differ significantly by gender, as can access to alternative sources of income. These findings confirmed 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 of the project we completed a choice experiment which built on these findings (Indicator 2.2; report available here: https://pubs.iied.org/16668IIED/). The experiment followed a gender and generation (GnG) disaggregated data collection approach which differentiated between male and female respondents (see Fig. 12). We aimed for a gender balance in our sampling, but found participation of women in the pilot survey to be low, presumably because they tend to be less directly involved in fishing activity than men and so perhaps did not feel confident to answer the preliminary questions focused on fishing. For the remainder of the survey, enumerators responded to this challenge by encouraging women to continue their participation even if they felt unable to answer these initial questions. This allowed us to assess the needs

and preferences of both women and men for compensation. While men's willingness to accept compensation varied significantly between management option, women were only willing to accept compensation for net use restrictions, and on average they were willing to accept less than men were. While these results will inform our design of a gender-aware incentive scheme, our recommendations to the DoF will include further investigation of the different needs and preferences of men and women for compensation.

This year we also completed a diagnostic study of fiscal reform as a mechanism to finance the incentive scheme (indicator 4.1; report available here: https://pubs.iied.org/16669IIED/). This used information collected through a small number of interviews with key actors from the hilsa value chain. We aimed for the gender balance of respondents to be broadly consistent with the relative role women or men play in each part of the value chain, and therefore included five women in our sample of 13 artisanal fishers.

Figure 12. A woman from a fishing household in Lay Ein Su village, Maubin township, being interviewed in June 2019. Credit: Lauren Burcham.

9. Monitoring and evaluation

IIED team members have regular (quarterly or more) calls with WorldFish, who lead in-country activities, to monitor project progress. IIED had also planned to hold an in-person annual M&E meeting with project partners in Yangon, March 2020, following on from the national multi-stakeholder workshop that was scheduled for this time, but this was postponed due to COVID-19 travel restrictions. Instead, IIED and WorldFish staff held a virtual M&E meeting on 9th April, 2020. We discussed lessons learnt from Year 3 (see Section 10) and reviewed the project logframe, checking that indicators of achievements could be verified. In particular, we discussed the impacts of COVID-19 on the project so far and the potential implications for Year 4. Changes made to the logframe following this meeting are as follows (see attached change request form and revised logframe):

- **Indicators 2.4, 4.2 and 4.3:** A national multi-stakeholder workshop was scheduled to be held in Yangon, 23rd-24th March 2020. The agenda covered a) design essentials of incentive-based fisheries management, b) fiscal reforms to finance incentive-based management and c) assessing the plausibility of establishing a national hilsa Conservation Trust Fund (see Annex 4 for draft agenda). This has been postponed until further notice, as a result of COVID-19. We hope to reschedule the workshop to take place before we submit the next half year report, so if travel restrictions do not allow travel between the UK and Myanmar within the next six months, then it is likely that the workshop will have to go ahead without in-person attendance from IIED.
- **Indicators 2.3, 3.2 and 3.3:** Since these indicators depend on data collected through the choice experiment, the report estimating the economic value of the hilsa fishery, short-term economic cost, and income elasticity of willingness to accept was planned to be completed

by Q3 Year 3, together with assessment of preferences (Indicator 2.2). However, IIED activities since this time have been slightly disrupted due to the departure of the project leader and impacts of COVID-19 on operations, and so we pushed back the deadline to Q1 Year 4, to ensure that we have time to deliver a quality report. As a result, we have also pushed back delivery of the policy briefing on optimal level of investment to conserve hilsa to Q2 Year 4, as this will be based on that report (please see attached change request form).

- **Indicator 3.3:** We have removed the memorandum and articles of association for a Conservation Trust Fund from the logframe. This is because it would need to be based on discussions at the postponed national multi-stakeholder workshop. We do not anticipate that the workshop can be rescheduled to take place early enough in Year 4 to leave time for preparation of such a document. Therefore, we have decided to focus Output 4 on fiscal reform and build on the work already started. Instead of developing a memorandum and articles of association, we will produce a roadmap for the Myanmar government to implement our proposed fiscal reforms. This will initially target reforms at the decentralised Ayeyarwady Region level, followed by the Union (central) level.
- **Output 5:** The project initially set out to establish a transboundary initiative for regional hilsa fishery management. Building on the dialogue started at the transboundary knowledge-sharing workshop held during Year 2, the WorldFish ECOFISH project in Bangladesh organised a meeting for June 2019 with Fishery Association/Federation leaders from India, Bangladesh and Myanmar to discuss transboundary hilsa management. Unfortunately, it was postponed due to the current complex political relationship between Bangladesh and Myanmar, and we have doubts that it will be rearranged, or that establishing a transboundary expert group within the project period is still achievable. We have therefore decided to refocus Output 5 on establishing a national hilsa fishery expert group, as a priority (please see attached change request form). This requires that Indicator 5.2 be changed from an MoU on transboundary hilsa management to an MoU on national hilsa management. As a first step during Year 4, we will set up a virtual platform for the expert group (which should enable progress regardless of any COVID-19 restrictions).

We will nevertheless continue facilitating a transboundary dialogue between Myanmar and Bangladesh – and, if possible, India. We will do so by engaging with the FAO's Bay of Bengal Large Marine Ecosystem (BOBLME) Strategic Action Programme on the prospect of connecting the national expert group in Myanmar with experts in the region. WorldFish has also contacted a representative in Odisha State, India (Arun Padiyar) regarding initiating dialogues with experts in India, who introduced the team to Dr. Amiya Kumar Sahoo, Senior Scientist in ICAR Central Inland Fisheries Research Institute, Kolkota (West Bengal). Dr Sahoo responded very positively and said that they have long discussed working on hilsa under a common platform as it is a transboundary fish species. Michael Akester will set up a virtual meeting including the Darwin project team, Dr Sahoo and his colleagues, and scientists from the Bangladesh Fisheries Research Institute to develop a plan of action.

WorldFish staff have observed dramatic changes to fish supply and demand in Myanmar with the arrival of COVID-19. Under the current lock-down situation in Myanmar, offshore boats are not allowed to fish, many markets are closed, and road networks are badly disrupted. Due to closure of export markets, unusually large hilsa have been available in local markets, where most people cannot afford to purchase them. The closure of the export markets is also likely causing a huge reduction in fishers' income streams, with potentially negative implications for the prospect of establishing new fishing regulations. WorldFish have designed and started a telephone survey with all stakeholders in the fish value chain including traders at San Pya Fish Wholesale market in Yangon, as part of another project, to assess the impacts of COVID-19 on the supply of fish, including hilsa from both marine and freshwater (see Annex 4 for description of survey and questionnaire templates). We have taken the decision to use these data to inform our work during Year 4. They will complement the fiscal reform study in recording the reaction of the fish supply chain at times of system shocks. We expect to have a good enough understanding of the new dynamics by June, and we will incorporate this understanding into our communication with policymakers regarding the design essentials of incentive-based hilsa fisheries management (Indicator 1), highlighting the importance of building strategies into fisheries management schemes to mitigate the impacts of unprecedented events like this.

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

10. Lessons learnt

The main lessons learnt during Year 3 of this project can be summarised as follows:

- **Government engagement and capacity**: It has become clear that the interest of Union (central) level DoF, and their capacity to implement changes, is lower than that at the decentralised level. The DoF at Union level claim that while they manage marine fisheries (inshore and offshore), the control of inland fisheries management is 100% with the Regional Ministers in the States and Regions. Union-level DoF therefore perceive fisheries regulations designed to protect hilsa in their nursery and spawning grounds, such as modified closed seasons, establishment of sanctuaries, and formation of fisher associations to co-manage the new fisheries management plans, to be functions under the State/Region Fisheries Laws (2018 – amended 2019 for Ayeyarwady Region). On the basis of this new understanding, we will prioritise engaging with the Ayeyarwady Region government and work our way up to central Union level. Some of our proposed reforms will need to be implemented at Union level, but DoF at this level are waiting to see if the decentralised governments are capable of instigating the suggested reforms.

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

Comment 2: The project has provided evidence to support the modification of fisheries legislation at Union and State/Regional levels; and it has highlighted the importance of improved monitoring and surveillance. How confident are the project team that this information will be used to guide decisions on setting up the first hilsa sanctuaries? Under the new Ayeyarwady Regional Fisheries Law (2019 with associated Regulation of the same date), fisher associations can be legally constituted, and they can set up sanctuaries under management plans as year-round no-take zones. District officials can also demarcate conservation areas under this law. The scientific results delivered to date by the project have convinced local decentralised government, Ayeyarwady Regional Minister for Agriculture, Livestock, Natural Resources and Environmental Conservation, U Tin Win Aung, and Parliament Speaker, Aung Kyaw Khaing, that there are more efficient ways of managing the hilsa fishery in the Ayeyarwady Region. The first hilsa sanctuary has already been set up in the Pyapon area by the 'Helmsman' association, whose leader U Nyunt Win accompanied the Darwin project team to our workshop Bangladesh in 2019 (see Annex 4 for U Nyunt Win's account of progress).

Comment 3: The Report indicates that preliminary discussions were held in Dhaka on the formation of transboundary hilsa expert group; given the fact that the project has already reached the mid-point, how soon does the project team think that this expert group might be agreed and set up? We responded to this comment in our half-year report, but please note that continued heightened political tensions have led us to adapt our plans again (see Section 9).

Comment 4: IIED is reported to have used additional funds to publish a toolkit to evaluate the contribution of the Darwin project to SDG 14, and to guide engagements with the national SDG focal point. It would be useful to include a link to this in the next Annual Report. We have provided the correct link in Section 5 of this report.

Comment 5: The Report raises the very important issue of offshore fisheries, which was somewhat overlooked when the current project was designed. The Report indicates that the majority of hilsa caught in Myanmar is actually caught in the marine sector. It seems important therefore, that this sector is given serious attention in the remaining years of the project. Throughout the course of this project, the DoF have been working to improve data collection systems (see FAO-funded project), which has improved our understanding of the relative impacts of artisanal and offshore hilsa fisheries in Myanmar, and their interactions. There is also a vessel monitoring system (VMS) being piloted under a DoF project, funded by the Danish Government. Currently over 2,800 offshore fishing vessels are fitted with VMS transponders. Real time vessel navigating tracks show extensive intrusion of offshore vessels in inshore waters (see: https://www.mmtimes.com/news/myanmar-cracks-down-illegal-fishing-myeik.html). While this Darwin project remains focused on introducing incentive-based fisheries

management to Myanmar's artisanal fisheries, in Year 3 we incorporated this understanding into our design of the diagnostic analysis of fiscal reform as a financing solution for incentive-based management (see Section 3.1). We used a value chain analysis to explore which actors throughout the hilsa value chain profit most from hilsa, including offshore fishers. We demonstrated that, since a typical offshore fisher profits much more from hilsa than a typical artisanal fisher, they should be paying relatively higher tax rates and license fees – the revenue from which could in turn contribute to financing incentives for artisanal fishers. We used these findings to develop recommendations communicated to the government in the form of a policy briefing (see here: https://pubs.iied.org/17751IIED/). We also plan to invite industry representatives to our postponed national multi-stakeholder workshop (2.4, 4.2, and 4.3).

12. Other comments on progress not covered elsewhere

13. 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, including their science week activities; co-management group work with other agencies (Flora and Fauna International, Wildlife Conservation Society, World Wildlife Fund, Danida and Oikos); and the FISH meeting, 'Towards resilient and equitable small-scale fisheries', in partnership with the Oak Foundation, September 3 2019.

IIED, WorldFish, and external consultants SRUC have been building capacity at NAG through this project. Wae Win Khaing was heavily involved in the socioeconomic component as a Research Officer at NAG, and benefited from this capacity building. She has recently been employed by WorldFish Myanmar as Social Awareness Officer and accepted for a PhD programme at the University of Manitoba Canada to study social aspects of Myanmar's fisheries sector.

Our exit strategy is based on collaborating with government authorities to create an enabling environment for the scheme's ongoing operation, and this is still valid. WorldFish regularly presents research to the DoF, to encourage their commitment to the ambition and goals of the project. For example, on 2nd September 2019, Michael Akester presented the concept of a compensation scheme for hilsa fishers, and potential mechanisms for finance, to the DoF Director General and Director of Research and Development (see Annex 4 for project information shared). In March 2020, WorldFish held two meetings with DoF – one in Yangon and one for Ayeyarwady Regional parliamentarians and DoF in Pathein – to disseminate and discuss research on fiscal reform as a financing tool (see Annex 4 for agenda and presentations). The research has been well received (as demonstrated by the summary of agreed points in Annex 4), and we are confident that during Year 4 the DoF can begin to take ownership of the incentive scheme – first at decentralised level, and later at Union level. WorldFish is also working with representatives of fisher associations to encourage community acceptance and longevity of the scheme. For example, chairman of the 'Helmsman' fisher association, U Nyunt Win, travelled with the Darwin project team to Bangladesh for the transboundary workshop in 2019, and his association has already implemented some of our recommendations at the local level (see Annex 4 for his account of progress).

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

- Flora and Fauna International and Charles Sturt University (Australia) have been collecting otoliths from hilsa in the Ayeyarwady Delta for chemical analysis to determine whether, or not, Myanmar has any landlocked freshwater populations – as scientists suspect that there are in Bangladesh. The study has found large numbers of hilsa juveniles at the confluence of the Chindwin and Ayeyarwady Rivers, and otolith analysis will confirm whether this is a migratory or landlocked population (see Annex 4 for powerpoint presentation). This is important because migratory and landlocked populations are likely to have different spawning seasons and will therefore require

different management approaches. It is planned that the results from this project will be used to justify a further project to the north of the Ayeyarwady Delta to study the migration of hilsa in the mid-section of the Ayeyarwady River.

- Charles Sturt University has also agreed to analyse otoliths collected by the University of Yangon for this Darwin project, and has organised a sampling trip to collect water from the different Ayeyarwady areas, which can be used to further distinguish the different areas where hilsa are. The results of this collaboration are expected to further illuminate the findings published in our working paper on spawning seasonality of hilsa, and will therefore influence the Darwin project's fisheries management recommendations.
- WorldFish, Charles Sturt University, IIED and University of Yangon have also discussed the prospect of developing a follow-on transboundary project around these preliminary results. Further chemical analysis of hilsa otoliths and possible environmental DNA work could be used to determine the extent to which fish migrate within the north-eastern sector of the Bay of Bengal. A logical way to start this work would be through the new Global Environment Facility funded FAO implemented Strategic Action Programme (SAP) for the Bay of Bengal Large Marine Ecosystem (BoBLME), which aims to address overexploitation of marine living resources (see here), and the Darwin project team have started pursuing this.

14. 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, at both fiscal reform validation meetings in Naypyitaw and Pathein, the title slides of powerpoint presentations displayed the Darwin Initiative logo (as well as partner logos) and a line recognizing that the project is funded by the Darwin Initiative (see powerpoint presentations in Annex 4 and Fig. 13).

Figure 13. Validation meeting for fiscal reform study, 28 February 2020, Naypyitaw. *Credit: May Thu Oo.*

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. Dave Shearer, Director of Partnerships at WorldFish Director, described it of as a classic example of a well-designed research project 'punching above its weight' in terms of publication delivery and impact on policy reform.

All project publications have been made available for free download from IIED's website. IIED's communications team, as well as project team members themselves, have used social media

sites such as Twitter and LinkedIn to disseminate these publications, tagging the Darwin Initiative where possible (see Fig. 14)

Safeguarding

Respect for colleagues, partners and the communities with which we work has always been a key element of IIED's culture, and the ethics policy ensures this is upheld in our research. As of this year, IIED's new safeguarding policy makes this explicit and sets out our intent to do no harm personally or through our work (see Annex 4). As of the end of March 2020, all IIED staff have been trained in and are expected to adhere to this policy. All IIED staff have also signed a code of conduct (see Annex 4), which brings together in one policy, IIED's policies and practices around ethical research, health & safety, data protection, anti-fraud and bribery, confidentiality, whistleblowing and the complaints process.

Going forward, IIED also expects all partner organisations to have a safeguarding policy and code of conduct in place, or to implement one as part of the contracting process. We will provide a draft safeguarding policy and code of conduct for organisations which do not already have one, as well as online training to help them explain safeguarding within their own organisations. All contractors and consultants will be issued with a copy of IIED's safeguarding policy and code of conduct, and will be required to acknowledge receipt and to agree to abide by the policy. IIED has also received assurance from WorldFish that appropriate procedures and policies have been shared with in-country partners – particularly NAG, who have been heavily involved in our socioeconomic research.

15. Project expenditure

Table 1: Project expenditure during the reporting period (1 April 2019 – 31 March 2020)

Project spend (indicative) since last annual report	2019/20 Grant (£)	2019/20 Total Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Monitoring & Evaluation (M&E)				
Others (see below)				
TOTAL				

Postponing the March workshop ''Financing Myanmar's fisheries through fiscal reform' due to COVID-19 and the inability to travel led to an underspend of more than 10% on the budget lines relating to staff and overhead costs, travel and subsistence and operating costs.

The production of publications at IIED led to higher costs than expected, primarily due to higher than forecasted editing costs.

Annex 1: Report of progress and achievements against Logical Framework for Financial Year 2019-2020

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 socioeconomic knowledge of the hilsa fishery in Myanmar (studies completed in Y3) contribute towards improved sustainability of hilsa and communities that depend on it for a living, as well as the development of an effective incentive scheme that aligns with the needs of preferences of these communities.	[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.	Socioeconomic studies have demonstrated the dependence of poor fishers on year-round hilsa fishing (not respecting the May-July closed season) and their preferences for incentive-based management options. They also indicate that around 126,000 fishers could be affected by regulatory regimes, and at least half of these require compensation.	The estimation of opportunity costs will help to justify and inform the design of an incentive-based hilsa management scheme, and final project findings will feed into the design essentials document to be discussed with and endorsed by government.
Output 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.	The biology and ecology of hilsa fishery, including spawning seasonality and migratory routes, is now better understood; reports have been published (see Section 3.1); and findings are being shared with national and local government.	
1.1 Spawning seasonality of hilsa using gonadosomatic index		Completed (see Section 3.1)	Findings and recommendations will feed into the whitepaper on design essentials.

1.3 Assessment of migratory routes of hilsa		Completed (see Section 3.1)	Findings and recommendations will feed into the whitepaper on design essentials.
Output 2. Enhanced understanding of the complex socioeconomics 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). A second survey was completed in Y3 and the assessment of preferences is now published online (see Section 3.1). Based on the same dataset, the short-term economic cost is being estimated and will be shared in a report now due Q1 Y4. The multi-stakeholder workshop has been postponed until further notice due to COVID-19.	
2.1 Socioeconomic 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		Survey has been completed and report has been published.	
2.3 Estimation of short-terms economic cost (opportunity cost)		Data analysis has been started	The opportunity cost will be estimated in Q1 Y4
2.4 Whitepaper: the design of incentive-based hilsa management in the AD		Drafted	This will be completed and shared with government for inputs and endorsement by Q3 Y4.
2.5 National multi-stakeholder workshop (Part 1): incentive-based hilsa management: Design essentials		Postponed until further notice	
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)	The choice experiment survey on which this analysis is based has been completed. One report will be produced in Q1 Y4 which will combine the estimation of non-use value, income elasticity, and cost-benefit analysis. A policy briefing is planned for Q2 Y4 which will present the optimal level of investment in the hilsa fishery.	

	3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery by Q4 of Y3.		
3.1 Estimating economic value of hilsa fishery in AD (using revealed and stated-preference techniques)		Analysis started based on results from CE method (activity 2.2)	Report due for publication Q1 Y4
3.2 Estimating income elasticity of willingness to pay for hilsa conservation (distributional study)		Analysis started based on results from CE method (activity 2.2)	Report due for publication Q1 Y4
3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery		Analysis started based on results from CE method (activity 2.2)	Report due for publication Q1 Y4 and policy briefing due Q2 Y4
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 (*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	The diagnostic analysis of fiscal reforms to finance incentive-based management is complete and findings have been published in two forms (see Section 3.1). The multi-stakeholder workshop (activities 4.2 and 4.3) has been postponed until further notice due to COVID-19.	
4.1 Multi-stakeholder workshop (Part 2): Diagnostic analysis of fiscal reforms for sustainable fisheries management		Postponed until further notice	
4.2 Policy briefing paper on capacity gaps/needs for fiscal reforms		Completed in Y3	
4.3 Multi-stakeholder workshop (Part 3): Assessment of the plausibility of establishing a national hilsa fishery management trust fund		Postponed until further notice	

4.4 Development memorandum and articles of association of the fund		The workshop (activity 4.3) on which this would have been based has been postponed until further notice.	Instead, we will produce a roadmap in Y4 for implementation of fiscal reforms
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 on transboundary hilsa management (and end of project) Q4 Y4	The March 2019 workshop in Bangladesh (see Section 3.1) was an important step towards establishing a transboundary hilsa management expert group that includes participants from both Bangladesh and Myanmar. We hope for the closing workshop to involve at least one or both of India and Bangladesh, and to demonstrate scientific collaboration and an agreement to pursue future funding together. Given the COVID-19 outbreak, we are cognisant of the possibility that the closing workshop may need to be virtual, or held without IIED attendance.	
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 and has already been reported	
5.3 Workshop: signing MoU on transboundary hilsa management expert group (and end of project)			Scheduled for Y4. In the lead up, we plan to establish a virtual hilsa expert group, involving scientists from at least one additional country, but preferably both India and Bangladesh.

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: 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: 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.	1. One document on design essentials of the incentive-based scheme submitted to and endorsed by the Department of Fisheries by Q3 of Y4. 2. Number of fishing communities and households affected by regulatory regimes (by Q2 Y2) and their short-term cost identified (by Q3 Y3).	1. One [signed] copy of design essentials document 2. One news article that includes a testimony from the Director General of DoF due Q2 of Y2 (end of September 2018). 3. Whitepaper: the design of incentive-based hilsa management in the AD (Q3 Y4) 4. One report on socioeconomic 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.
Output 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.

Output 2 Enhanced understanding of the complex socioeconomics of hilsa fishery in the Ayeyarwady Delta	1 Large scale survey covering 833 households by Q2 of 2. Assessment of preferences using the choice experiment method by Q3 of Y3. 3. Short-term economic cost (opportunity cost) estimated by Q3 of Y3. One national multi-stakeholder workshop: incentive-based hilsa management (Part 1): Design essentials by Q4 of Y3.	2.1. One report on socioeconomic assessment of hilsa fishers and copy of questionnaire survey by Q2 of Y2. 2.2. One report on assessment of preferences for compensation packages 2.3 One report on estimation of economic value of hilsa fishery, and estimation of income elasticity of willingness to accept 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.
Output 3 Use and non-use values of hilsa fishery estimated and business case developed	1. Monetary estimation of non-use value of hilsa fishery estimated by Q3 of Y3. 2. Estimating income elasticity of willingness to accept hilsa conservation (Q3 Y3) Cost benefit analysis of investment in sustainable management of hilsa fishery by Q4 of 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.
Output 4 Sustainable financial mechanism developed	1. Fiscal reforms to finance incentive-based management (diagnostic analysis) Q4 of Y3. 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* 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. Workshop report: See deliverable for 2.4 4.3. Whitepaper: memorandum and articles of association (MAA) of trust fund Q2 Y4	Myanmar commerce law allows the establishment of a legally independent fund management system.
Output 5	1. Workshop in February or March 2019 (Q4 of Y2) with experts from Bangladesh and Myanmar.	5.1 Workshop report and IIED blog (Q4 Y2)	Diplomatic relationship between Myanmar and Bangladesh is not

A transboundary hilsa fishery management expert group in place	Closing workshop: signing MoU (Myanmar and Bangladesh) on transboundary hilsa management (and end of project) Q4 Y4	5.2 Launch of expert group with set of principles and ambitions, Blog or press release (Q4 Y4)	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 (each activity is numbered according to the output that it will contribute towards, for example 1.1, 1.2 and 1.3 are contributing to Output 1)

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

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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
Established codes								
6A	On the job training for research workers from Yangon University and the Networks Activity Group (NAG) and fisherfolk from Papin village Maubin	14 women and 32 men	Burmese	11	20	15		
2	Student received MSc	Female	American			1		
11A	Papers published in peer-reviewed journal				1			
14B	Conferences/seminars/workshops attended at which Darwin work was shared				1			
14A	Conferences/seminars/ workshops organised to present/disseminate Darwin project work			1	1	3		6

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)
Financing Myanmar's fisheries through fiscal reform*	Policy briefing	Bladon, A, Akester, M and Mohammed EY (2020)	Female	British	IIED, London	https://pubs.iied.org/17751IIED/
Financing incentive-based hilsa fisheries management in Myanmar through fiscal reform*	Working paper	Silvester, P, Bladon, A, Akester, M, Maung Soe, K and Mohammed, EY (2020)	Male	Australian	IIED, London	https://pubs.iied.org/16669IIED/

Informing incentive-based management of hilsa fish in Myanmar – results of a choice experiment*	Working paper	Glenk, K, Novo, P, Khaing, WW, Lwin, WW, Burcham, L, Mohammed, EY, Soe, KM, Akester, M, Bladon, A, Merayo, E (2020)	Male		IIED, London	https://pubs.iied.org/16668IIED/
Migratory patterns of Hilsa shad in the Myanmar Ayeyarwady delta: lessons for fisheries management*		Merayo, E, Myint, KT, Ei, T, Khine, M, Aye, PT, Thwe, TL, Leemans, K, Soe, KM, Akester, M, Bladon, A and Mohammed EY (2020)	Female		IIED, London	https://pubs.iied.org/16665IIED/
Spawning seasonality of hilsa (Tenualosa ilisha) in Myanmar's Ayeyarwady Delta*		Bladon, A, Myint, KT, Ei, T, Khine, M, Aye, PT, Thwe, TL, Leemans, K, Soe, KM, Akester, M, Merayo, E and Mohammed, EY (2019)	Female			https://pubs.iied.org/16661IIED/

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

Checklist for submission

	Check
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Have you completed the Project Expenditure table fully?	x
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