Darwin Initiative: Final Report

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 4 grant £67,958)
Start/end dates of project	Start date: 01 April 2017 End date: 31 March 2021
Project leader's name	Annabelle Bladon
Project website/blog/social media	https://www.iied.org/carrots-sticks-incentives-conserve-hilsa-fish-myanmar
Report author(s) and date	Annabelle Bladon (IIED) and Michael Akester (WorldFish Myanmar), 30 April 2021

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 [redacted] MT in 2018/2019, with a value of US$[redacted]

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 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 aimed to design a cost-effective, scientifically researched and participatory 'incentive-based' hilsa fishery management mechanism for Myanmar. We used the following methodological building blocks to achieve this:

1. **Understand the biology and ecology of the hilsa fishery**. 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**. Conduct a socioeconomic assessment of hilsa fishing households in the region to understand their challenges and opportunities for socioeconomics improvement. Use a choice experiment to assess preferences for incentive packages and the level of incentive packages required to offset the short-term economic cost of abiding by fishing regulations.
3. **Make a business case for investment in hilsa management**. 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**. Explore and promote 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 focused 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.

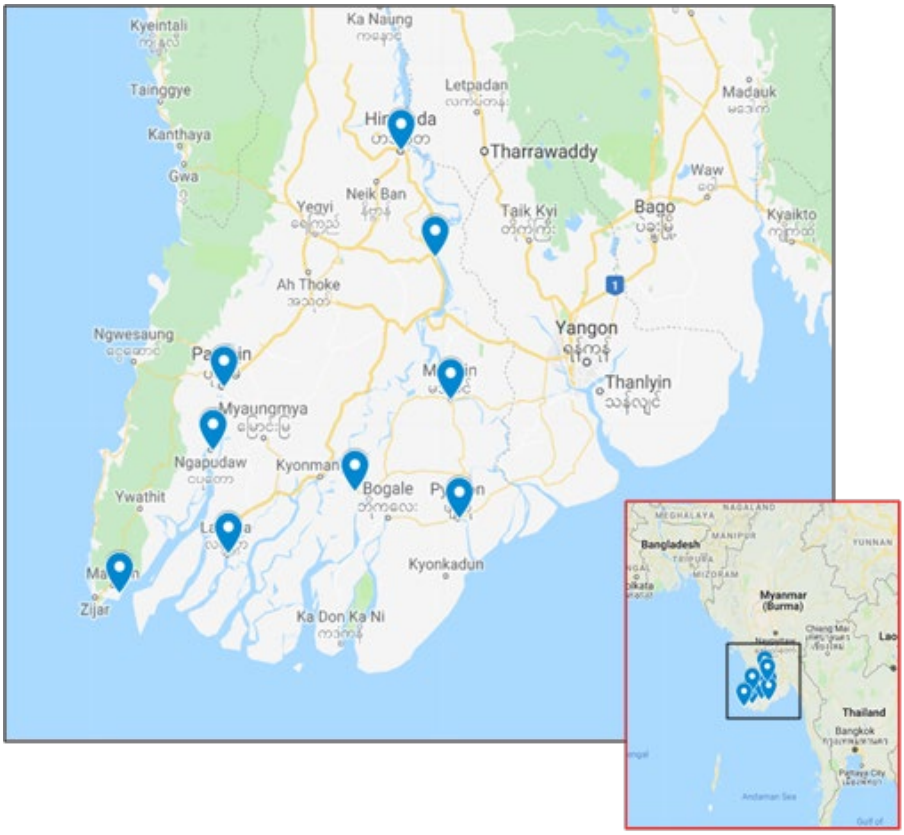

Figure 1. Map of the Ayeyarwady Delta Region and nine study sites within it.

2 Project Partnerships

Since inception of the project, IIED has maintained strong 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. The partnerships arose from demand within the host country, when scientists and officials from Myanmar learnt about IIED's previous project in Bangladesh at a regional seminar in Dhaka, 2016. Overall, the partnership between the lead institution and host-country partners can be rated as outstanding, although political developments led to reduced involvement of the DoF in the final year of the project. IIED and WorldFish Myanmar will maintain a relationship after project completion, and follow-up projects are already being discussed. IIED and WorldFish Myanmar jointly prepared this report. Other partners would have been given the opportunity to review and contribute, but this was not deemed appropriate in the context of current challenges in Myanmar.

As lead institution, IIED has drawn 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. Each year, IIED took responsibility for specific components of the project and provided support to partners for their delivery of other components.

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. Michael Akester, Country Director, has been deeply engaged in all project planning, monitoring and evaluation throughout the project. WorldFish staff were instrumental in providing in-country perspective to project reports and in liaising with government and other key stakeholders. Michael Akester and Khin Maung Soe, a consultant for WorldFish and the project's DoF liaison / inland fisheries governance expert, both put in substantial time and effort to ensure that all research was of a good quality, delivered on time, and relevant to policymakers. Even though circumstances in Myanmar have been particularly challenging this year, Khin Maung Soe continued to interact with his DoF contacts

and to promote our recommendations in every way possible (see email exchange, Annex 7.1). Each year, IIED has worked closely with WorldFish on all monitoring, evaluation and decision making.

The DoF's role in the project was to ensure that the Myanmar government is fully engaged and aware of research findings, as well as coordinating hilsa data collection from landing sites for Output 1. In October 2018, the Director General of DoF Myanmar wrote and signed a written statement which read: "The Darwin initiative project is providing valuable up to date research into the current status of the hilsa fishery in the Ayeyarwady Delta" (see Annex 7.2). 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 Annex 7.3). 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 a meeting to discuss findings with the Ayeyarwady Region parliamentarians (Hluttaw) and DoF officials from each district in the region (see Fig. 2 and Annexes 7.4 and 7.5). This meeting was an initial recognition by the Ayeyarwady Region parliament and DoF of the Darwin project's findings. However, engagement became more difficult in the final year of the project due to the national elections in November 2020 and subsequent military coup (see Section 3). Although current military leaders want DoF activities to resume, WorldFish policy is to maintain an apolitical stance, while the main donors in the country (multilateral and bilateral) demand no collaboration with the military.

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 Agriculture, Livestock, and Irrigation (MoALI), 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. The WorldFish operating license with the Ministry of Home Affairs is being renewed 2021-2026. Some international organisations have been requested by the military government to close field offices and operations – to date this is not the case with WorldFish or other CGIAR entities with offices in country.

The University of Yangon led the biological and ecological research elements of the project (Output 1). A team of their fisheries scientists designed the research methodology, collected data with assistance from the DoF (body length and weight, gonad weight, and sex ratio) and analysed this data with support from WorldFish and IIED. The results were published in two reports during Year 3 (Indicator 1.2). 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: "*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 was to work directly with fishing communities and to help to strengthen capacities for better fishery management. With support from partners, the NAG team designed and conducted a socio-economic survey and drafted a report to inform the design of an effective incentive-based mechanism (Indicator 2.1). The NAG team were also instrumental in supporting

a choice experiment led by consultants from Scotland's Rural College (SRUC) (Indicator 2.2). A socio-economist from NAG attended a workshop organised by IIED and SRUC in Edinburgh (Scotland) to help design the choice experiment. 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. NAG also provided SRUC with logistical support, helping them to travel between survey sites and providing interpretation services.

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 also catalysed new partnership opportunities and synergistic projects. During 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. During Year 4, IIED hired an alumnus of SRUC to provide expertise in economic valuation and conduct the analyses supporting delivery of Output 3. She has since been hired by WorldFish as Research Fellow.

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. During Year 4, it provided a channel for various stakeholders (including Norad, Danida, Helvetas, Flora and Fauna International, Wildlife Conservation Society, Instituto Oikos, World Wildlife Fund, and Macalister Elliott & Partners Ltd) to review our whitepaper (see Annex 7.6). This led to discussions with Norad on their interest in working with the DoF to modify closed seasons for the offshore hilsa fishery and set up a new Marine Protected Area (MPA) in the Ayeyarwady Region.

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. 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. Initial results show that all the fish sampled were born in freshwater and subsequently migrate to the sea as bands of both Strontium and Barium have been detected in the otolith samples. However not all the samples have been analysed. A PhD student is currently working on this in Australia.

3 Project Achievements

While this project achieved a great deal in its first three years, successfully delivering high quality research and creating an enabling environment for implementation of project recommendations, a series of events beyond our control interrupted in-country activities planned for Year 4. Following the delays and challenges imposed by COVID-19 (see Section 8), concerns about the potential disruptions around Myanmar's upcoming national elections (8th November 2020) led us predict that we would not be able to engage with government in any meaningful way until early 2021. For this reason, we requested a six-month project extension on submission of our last half-year report. But on 1st February 2021, towards the end of this extension period, the military seized control of Myanmar leading to mass protests, civil disobedience, and general strikes. The military has declared a one-year state of emergency. Escalation of violence against civilians led us to take the decision in March to draw the project to early close (ie to reverse the six month extension and return to the original end date of 31st March 2021). The main reasons for this were as follows:

- Although WorldFish continued to try to engage with individuals in regional and central DoF with whom it already had relationships (while avoiding engagement with the military government), many of these people are no longer contactable. The Ayeyarwady Region parliamentarians were very supportive of the project's hilsa fishery reform proposals. However, most of this group, as seen in Fig. 2 above, are currently removed from office and some are in hiding.
- The civil disobedience movement encourages people not to pay taxes, and this has halted fiscal flows. The main recommended pathway to incentive-based fisheries management in Myanmar is through fiscal reform, which would be very difficult to promote in this context.
- IIED has a safeguarding duty to its in-country partners, and asking them to continue trying to engage with civilian government would be unethical. For example, the main contact of WorldFish in the DoF is thought to be a leader of the civil disobedience movement, and so the risk of interacting with them may be high for Myanmar nationals.

3.1 Outputs

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

Indicator 1.1 and 1.2

In Year 2 of the project, an ecological survey was completed and the data were used to assess hilsa spawning seasonality and migratory routes in the Ayeyarwady Delta. Two working papers were published in Year 3:

- 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/

The findings challenge previous understanding (that there is one spawning peak from May to July) by providing evidence of major hilsa spawning activity between July and September in fresh water, with a peak in September. Among other findings, the research demonstrates that current fishing restrictions do not coincide with the main spawning season. Various recommendations were made for improved hilsa fisheries management on the basis of this enhanced understanding. WorldFish shared these findings and recommendations with Ayeyarwady Region DoF officials and parliamentarians during Year 3, initiating a dialogue about which management options would be most feasible (see Annex 7.5).

Enhanced understanding of hilsa productivity and biomass yields has been published in a peer-reviewed paper:

- Akester, M.J. (2019) Productivity and coastal fisheries biomass yields of the northeast coastal waters of the Bay of Bengal Large Marine Ecosystem. Deep Sea Research Part II: Topical Studies in Oceanography. Available at: https://www.sciencedirect.com/science/article/pii/S0967064518301115

Output 2. Enhanced understanding of the complex socioeconomics of hilsa fishery in the Ayeyarwady Delta.

Indicator 2.1

A large-scale socio-economic survey was completed in Year 2 to enhance understanding of the socioeconomics of the hilsa fishery. IIED published a country report based on this survey:

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

The research highlights the dependence of fishing households on hilsa for their income, and provides evidence of the need for incentives to improve compliance with closed seasons, including a potential second closed season. They also highlight the need for improved financial inclusion, alternative livelihood support, and awareness campaigns – policy measures which should be included in an incentive-based management regime.

Indicator 2.2

An assessment of preferences using the choice experiment method was completed in 2019, following a slight delay (see Section 6.1 for details). Participants were offered the choice of six levels of compensation for hypothetical management options including new seasonal closures, seasonal net mesh size restrictions, and establishing new sanctuary spaces. The research provides important insights for the development of incentive-based hilsa fisheries management in Myanmar, including on the types of management options that would be most acceptable, and the types and amounts of compensation that would be most acceptable.

Findings are published in a working paper:

- 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

Using data collected through the choice experiment (Activity 2.2), the short-term economic cost of hilsa conservation was estimated using willingness-to-accept values (see Indicator 3.2). The analysis provides critical information for the development of effective and equitable incentive-based fisheries management, in particular demonstrating the need for incentives. Scaling average individual willingness-to-accept values up to the level of the Ayeyarwady Region's artisanal fisher population allowed estimation of the total amount of money that would be required to provide fishers with an incentive to comply with management changes. Based on these amounts, it was estimated that between [redacted] would be required annually to compensate all licensed artisanal fishers in the Ayeyarwady Region for hilsa conservation.

The findings are published as part of the following working paper:

- Burcham, L, Glenk, K, Akester, M, Bladon, A and Mohammed, EY (2020) Myanmar's artisanal hilsa fisheries: how much are they really worth? IIED, London. Available at: https://pubs.iied.org/16675iied

Indicator 2.4

This workshop was initially scheduled to be held in Yangon, 23-24 March 2020, as part of a two-day agenda (see Annex 7.7), but it was postponed due to COVID-19. When it became clear later in the year that restrictions on movement and gathering would continue, partners decided to organize a virtual meeting on the design of incentive-based management, expected

to be mostly attended by civil society members of the new national hilsa expert group (see Indicator 5.2), with some DoF counterparts. Unfortunately, this virtual meeting could not be held due to the disruption around the national elections in Myanmar and the military coup that followed.

Instead, partners used the development of a whitepaper (Activity 2.4) to share understanding with stakeholders and invite discussion by email. This whitepaper is a collaborative document which summarises the understanding developed through Output 2 (among others) and provides associated recommendations for designing incentive-based hilsa fisheries management in the Ayeyarwady Region (see Annex 7.6).

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

Indicator 3.1

The economic value of the hilsa fishery was estimated in Year 4. Artisanal income data from the socioeconomic survey (Indicator 2.1) was used to estimate use value and a benefit transfer was used to estimate non-use value. For the Ayeyarwady Region's artisanal fisher population, aggregating use and non-use value took the total estimated annual value to US$[redacted] We also estimated annual value across all coastal states and regions of Myanmar, which came to US$[redacted]. Finally, we extrapolated a national annual value of US$[redacted], which included the cultural significance of catching and eating fish.

The use and non-use value has been estimated and published in the following working paper:

- Burcham, L, Glenk, K, Akester, M, Bladon, A and Mohammed, EY (2020) Myanmar's artisanal hilsa fisheries: how much are they really worth? IIED, London. Available at: https://pubs.iied.org/16675iied

Indicator 3.2

Willingness to accept hilsa conservation was estimated as described under Indicator 2.3, using data collected through the choice experiment. Overall, results indicated a willingness to participate in and accept an incentive scheme, but this varied by township, as well as by social class and gender of the respondents. Willingness to accept also varied between types of management options (eg sanctuary, closed season, and net restriction), with some being more acceptable than others. These preliminary findings demonstrate the need for more detailed assessments and pilots, to ensure that socioeconomic benefits of the scheme are distributed equitably between and within households. Findings were initially published in the first of the two following working papers, and the data formed a key part of the analysis published in the second:

- 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/
- Burcham, L, Glenk, K, Akester, M, Bladon, A and Mohammed, EY (2020) Myanmar's artisanal hilsa fisheries: how much are they really worth? IIED, London. Available at: https://pubs.iied.org/16675iied

Indicator 3.3

The figures produced from the analyses described under Indicators 3.1 and 3.2 were used to estimate the total cost of implementing an incentive scheme for licensed fishers in the Ayeyarwady Region (between [redacted] per year). The benefits of an increase in hilsa production over a ten-year period (in terms of expected impact on economic value) were also estimated based on changes in production seen in neighbouring Bangladesh since implementation of an incentive scheme. Our cost–benefit analysis indicated that implementation of an incentive scheme for hilsa fishers would produce a high net present value (between [redacted] and a benefit–cost ratio of between 5.7 and 9.3, meaning that an incentive scheme could generate benefits up to around nine times the cost of the scheme. This analysis clearly demonstrates the business case for investment in incentive-based hilsa fishery management and indicates the optimal level of investment. The

findings are published within a working paper as well as a more focused policy briefing, both published during Year 4:

- Burcham, L, Glenk, K, Akester, M, Bladon, A and Mohammed, EY (2020) Myanmar's artisanal hilsa fisheries: how much are they really worth? IIED, London. Available at: https://pubs.iied.org/16675iied
- Bladon, A, Akester, M, and Burcham, L (2020) The business case for investing in Myanmar's artisanal hilsa fishery. IIED, London. Available at: https://pubs.iied.org/17765iied

Output 4. Sustainable financial mechanism developed.

Indicator 4.1

A diagnostic analysis of fiscal reforms to finance incentive-based hilsa fisheries management in Myanmar was completed in Year 3. The analysis highlighted two main potential sets of reforms. First, the analysis indicated that increasing current revenue-collection efficiency could generate annual revenues in the region of [redacted] for the DoF and government of Myanmar more broadly (more than twice the current annual revenues). Combining this increase in revenue-collection efficiency with proposed revisions to fee and tax rates could generate revenues nearer [redacted] per year (more than three and a half times current annual revenues), by better targeting actors nearer the top of the hilsa value chain.

The findings are 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

These indicators have been through a few iterations, as explained in detail in Section 6.1. On submission of our last annual report, we shifted our plans for engagement with government on fiscal reforms away from large multi-stakeholder workshops towards small, focused government meetings (see Section 8 for details on why virtual meetings were difficult). We planned for these small meetings to take place in early 2021, once any disruption around the national elections had died down. Unfortunately, due to the military coup, these meetings could not take place during Year 4. Furthermore, discussing fiscal reform as a financial mechanism seems inappropriate at a time when civil disobedience has halted fiscal flows.

One of the means of verification (4.2) for these Indicators are no longer valid since the multi-stakeholder workshop was cancelled (this was an omission when we submitted our last logframe revision). However, we were able to make our preliminary recommendations to regional and central government in the meetings held in February and March 2020 (see Annex 7.3 and 7.4 for details). Recommendations for fiscal reform at the regional and central level are also clearly outlined in the whitepaper (Indicator 4.3, see Annex 7.6). Unfortunately, due to the political situation in Myanmar, we were unable to share the whitepaper with central government officials for endorsement as intended, but we are hopeful that it lays the groundwork for implementation and will be made available through the channels we have established when the time is right. We also had our key policy pointers translated into Burmese to maximise opportunity for our message to reach them (see Annex 7.8 for example).

Output 5. A national hilsa fishery management expert group in place [revised during the project from 'A transboundary hilsa fishery management system in place'].

Political tensions between Bangladesh and Myanmar escalated at times during the project, often in relation to the Rohingya crisis, undermining our assumption that the status quo would be maintained. This led us to decide to focus efforts on establishing national expert group (to ensure national ownership of project recommendations) while continuing to encourage a transboundary dialogue as and when possible. The evolution of this Output throughout the lifetime of the project is described in more detail in Section 6.1.

Indicator 5.1

Although it had not been possible for delegates from Bangladesh to attend the inception workshop, the transboundary workshop was successfully held in March 2019 with hilsa experts from Bangladesh and Myanmar. This was the first step towards the formation of a transboundary hilsa expert group, which was hoped to pave the way for further cooperation between Myanmar and Bangladesh. A workshop report was published, which summarises all presentations, discussions, and recommendations:

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

IIED published a blog which highlighted the role of the workshop in initiating a dialogue on hilsa between the two countries and describes how the formation of a transboundary hilsa expert group could provide the basis for the development of transboundary fisheries management plan further down the line:

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

The WorldFish Center also published a blog on hilsa fisheries in Bangladesh, which acknowledged the transboundary nature of hilsa and the work of Darwin-Hilsa[MM], stating: '*As hilsa is a resource shared with neighbouring Myanmar, transboundary learning and cooperation are crucial*'.

After the workshop, WorldFish Myanmar wrote a letter of consent for cooperation with a professor from Bangladesh Agricultural University (BAU) for the collection of hilsa samples from Myanmar (see Annex 7.9). The expectation was that BAU will also share samples from Bangladesh. This letter provides evidence of the impact that the workshop and planned expert group have already had in terms of catalysing cooperative research. Building on this dialogue, 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 and eventually cancelled due to an escalation of tensions between Bangladesh and Myanmar related to the Rohingya humanitarian crisis. Scientists from all three nations are keen to renew collaboration and this may be further catalysed when the Bay of Bengal Large Marine Ecosystem (BoBLME) Strategic Action Programme (SAP[1]) is implemented by the eight partner countries: Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand.

Indicator 5.2

After being granted a project extension in November 2020, we planned for this workshop to take place at the end of the project in September 2021. Unfortunately, the early closure of the project means that this workshop did not take place. However, during the first half of Year 4 we did establish a national hilsa management expert group with key stakeholders, and began arranging an initial virtual meeting to develop principles and ambitions (see Annex 7.10). The group sits within the Myanmar Fisheries Partnership (which is led by the DoF and has WorldFish as a Secretariat role), and it is championed by Khin Maung Soe, Senior Consultant for WorldFish. It brings together stakeholders from national and international NGOs and research entities. We also established a Facebook group in tandem with this, which has 104 members at the time of writing. Facebook is a platform that WorldFish Myanmar has experience using to engage local fishers and fisher leaders, who may find it difficult to otherwise engage with the expert group while meetings continue to be held virtually.

The disruption caused by the national elections, followed by the military coup, meant that the group was not able to meet even virtually to develop principles and ambitions before the project's early closure, and so we have been unable to officially launch the group, publish a

[1] See webpage (https://www.boblme.org/BOBLME_SAP_2.html) and Strategic Action Programme document (http://www.boblme.org/documentRepository/BOBLME%20SAP%20Report%20low%20res.pdf).

blog, or release any statements in the media. However, we have laid the groundwork for this group to reconnect and take ownership of next steps as soon as it is possible. We have also succeeded in starting conversations to initiate a transboundary working group involving researchers and other stakeholders from Bangladesh, India and Myanmar, despite the deterioration of diplomatic relations (see Annex 7.12 for email exchanges with Dr Amiya Sahoo, based at ICAR-Central Inland Fisheries Research Institute (India). This collaboration will now be promoted by the BoBLME SAP implementation as described above. During the design of the SAP a series of Transboundary Diagnostic Analyses (TDA) were undertaken. The initial TDA from Myanmar was very data poor, hence the outputs from this project and the previous in Bangladesh provide a significant addition to the TDA analysis which is of importance for the SAP implementation. WorldFish has agreed to co-supervise a PhD project on transboundary hilsa fisheries management involving collaborators in India, Myanmar, and Bangladesh (see Annex 7.11).

3.2 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 to demonstrate that the project has achieved this Outcome, despite multiple setbacks which limited our ability to engage with policymakers as intended.

Indicator 0.1

During Year 4, IIED and partners finished developing a document (whitepaper) on the design essentials of incentive-based hilsa management in the Ayeyarwady Delta. The whitepaper summarises evidence produced by the project and provides policy recommendations (see Annex 7.6). We circulated the document for feedback from key stakeholders and incorporated their inputs, but due to unforeseen political circumstances we were unable to submit it to the DoF for endorsement within the lifetime of the project. The global pandemic and then the military coup in Myanmar undermined our assumption that the DoF would be highly engaged with the research throughout the project, and these events were completely out of our control.

In the last revision of our logframe (November 2020) we also committed to producing and circulating an animation, as an alternative means of dissemination and a way to redirect workshop funds, but this has not been possible within Year 4 due to the disruption caused by the military coup in Myanmar.

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 (available here: https://pubs.iied.org/16669IIED/). 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, which provided the willingness-to-accept data that allowed us to estimate the short-term economic cost of sustainable hilsa fisheries management for these fishers. During Year 4, we published these findings in a working paper (available here: https://pubs.iied.org/16675iied) and policy briefing (available here: https://pubs.iied.org/17765iied) which go a step further than required by Indicator 0.2, using the cost in an analysis which makes the business case to government for investing in incentive-based hilsa fisheries management. They also clearly demonstrate how the investment required could be mobilised by adapting current fiscal tools.

3.3 Monitoring of assumptions

Assumptions were monitored throughout the course of the project and changes are outlined below. More detail on actions taken to manage these challenges is provided in Section 6.1.

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:

In October 2018, government buy-in to the project was demonstrated by Director General of DoF Myanmar, U Khin Maung Maw, who stated the following: 'The Darwin Initiative project is providing valuable up-to-date research into the current status of the hilsa fishery in the Ayeyarwady Delta and will soon be able to put a total economic value on this important fishery' (see Annex 7.13 and quoted in a CGIAR article). Throughout Years 2 and 3, officials continued to respond positively to project recommendations at regional and central levels, advising that reform should start at the regional level because Regional Ministers control inland fisheries (see Annex 7.5). Dr Htun Thein, our DoF focal point, has remained committed to engaging with and supporting the project throughout Year 4, and has maintained that reforms would need to start at a decentralised level (see Annex 7.1). Although we were confident in our potential to advance recommendations during Year 4 at this level, and that this would pave the way to advance them at central level, COVID-19 proved to be a huge distraction for government, and hilsa fisheries were understandably deprioritised (see Section 8). The national election result would have paved the way to greater democratic reforms, however the military coup that followed then undermined this assumption completely, because of changes in leadership and the current inability to work with military leaders due to a consensus from international donors to work exclusively with the private sector – at least those not on sanction links due to their military ties. Furthermore, acts of civil disobedience mean that some fiscal flows have stopped, and so our recommended financing mechanism is not currently practical. We are still hopeful that should the political situation stabilize, that the government will act on our recommendations, but now is not the time.

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 the 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. 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 continue research on 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. However, a recent publication from Bangladesh concluded that *"Fish (hilsa) from haors and small coastal rivers were not unique and no genetic differences between migratory cohorts. The hilsa shad fishery should be managed considering it as a single panmictic population in Bangladesh with low genetic diversity".*

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’.

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 have been no foreign vessels registered to fish in Myanmar in recent years, but there are known to be Chinese vessels fishing. All Myanmar national industrial vessels registered as such are now fitted with Vessel Monitoring Systems (VMS) and a satellite linked GPS. These 3,000+ offshore vessels can be tracked real-time (see Annex 7.14). However, there is an intermediary size vessel which should be classified as industrial, due to their >25hp engines and size, operating illegally within the 10 nautical mile inshore fishing area.

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 deteriorated throughout the project as a result of 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. As a result of these tensions, we have focused efforts primarily on establishing a national hilsa expert group to support the project Outcome, but continued to facilitate a transboundary virtual dialogue between scientists and researchers as a secondary goal (see Section 3.1 for details).

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

The Impact in our original proposal was as follows: ‘Threats to hilsa and marine biodiversity are avoided in line with CBD targets (Aichi Biodiversity Target 6) and food security and employment opportunities of millions of poor people are maintained’.

When the political climate is right for implementation of the recommended incentive-based fisheries management system, it should have long-term impacts on marine and coastal biodiversity. Output 1 provides clear evidence for the expected impacts of new and improved hilsa fisheries regulations – including closed seasons, net restrictions, and sanctuaries – on

successful migration and reproduction of hilsa (see Section 3.1 for reports). By changing perceptions of sustainable hilsa fisheries management and conservation, and strengthening incentives for sustainable fishing, these regulations should be more effective than they otherwise would be. Although this project focuses on hilsa, effective implementation of management should have impacts on wider coastal and marine biodiversity, particularly if a no-take zone is established as recommended in the following report: https://pubs.iied.org/16661IIED/. The contribution of this project to biodiversity conservation is described in more detail in Section 4.2.

Effective implementation of incentive-based hilsa fisheries management should help to alleviate poverty in the following ways (over the short- and long-term):

1) **Through direct assistance that ensures the poorest fishers are not made worse off by fishing regulations**. Our research indicates that at least 63,000 households (the number of fishers currently licensed) in the Ayeyarwady Region could be compensated for the short-term economic cost of fishing regulations (see: https://pubs.iied.org/17765iied).
2) **By enabling continued employment in artisanal fisheries**. According to estimates from 2008–2014, Myanmar's inland fisheries sector employs 1.6 million people among the country's most impoverished communities, of which an estimated 30% (400,000) are held by women. Sustainable hilsa fishery management should help to maintain this employment into this future.
3) **By maintaining a food source that is important for the poor**. Although our research indicates that hilsa are generally considered to be too valuable for consumption by fishing households, smaller sized fish are consumed locally, and hilsa are widely consumed nationally and throughout Bangladesh and India (see: https://pubs.iied.org/16675iied). Rebuilding hilsa stocks will also have indirect benefits for the food security of the poorest by maintaining or improving income in the long term.

Furthermore, we anticipate that the shift towards co-management (see Section 4.2) will empower local communities to become more active players in sustainable resource management, strengthening the impact of incentives. The contribution of this project to poverty alleviation is described in more detail in Section 4.3.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Contribution to Global Goals for Sustainable Development (SDGs)

Currently, Myanmar ranks 104 out of 157 countries globally in SDG performance. By promoting and facilitating sustainable incentive-based management of the hilsa fishery, which would enhance the resilience of fishing communities to shocks, the project has provided a means for Myanmar to make progress towards SDG 1: 'End poverty in all its forms everywhere' and, less directly, to SDG 2: 'Zero hunger'. The evidence and guidance produced through Outputs 1-4 provide the basis for government to pilot incentive-based hilsa fisheries management. Not only should compensation ensure that fisheries regulations do not send households further into poverty, but it is also likely to improve the supply of fish (and therefore food security) in the long term by enabling and incentivizing compliance with sustainable fishing regulations.

Ultimately, the incentive scheme should therefore contribute to progress towards SDG 14: 'Conserve and sustainably use the oceans, seas and marine resources for sustainable development'. Since hilsa are caught inland, 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.

4.2 Project support to the Conventions or Treaties (e.g. CBD, Nagoya Protocol, ITPGRFA, CITES, Ramsar, CMS, UNFCCC)

The project has contributed to progress towards the CBD and several Aichi Biodiversity targets, as identified in Annex 4. More specifically, the project has contributed to the following national targets for Myanmar.

Target 3.2: 'By 2020, positive incentives are established for the sustainable use of nature'. Drawing on Outputs 1-4, we have produced a whitepaper which provides a comprehensive set of recommendations to government for designing incentive-based fisheries management (see Indicator 0.1), as well as two policy briefings that go into more detail on the business case and the financing (Indicators 3.3 and 4.1).

Target 6.1: '…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 Year 3, 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 7.15). The association leader, U Nyunt Win, travelled with the project team to Bangladesh for the transboundary workshop in 2019 (Indicator 5.1) and has been working closely with WorldFish since. On March 13 2020, fiscal reform recommendations were presented to the Ayeyarwady Regional Government Cabinet with Speaker and Deputy Speaker, Parliamentarians and Department of Fisheries District Officers all in attendance (Figure 2 above). The recommendations were well received. However, the COVID-19 crisis then unfolded, followed less than a year later by the military takeover.

Target 6.2: '…total commercial marine catch reduced to more sustainable levels'. Under Output 1, this project made recommendations for improved management of hilsa in inshore marine areas (which are managed together with inland fisheries), as well as offshore marine areas. These recommendations are published in two working papers (Indicator 1.2) and included in the whitepaper (Indicator 0.1) which provides the tools for government to improve and strengthen fisheries management regulations.

We planned for project outputs to inform national processes to meet these 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 numerous times throughout the project lifetime, with limited response. Most recently, Dr Naing Zaw Htun, Director, Nature and Wildlife Conservation Division responded that fisheries are 'beyond our mandate'. In-person follow-up work was scheduled following the presentation to the Ayeyarwady Regional Government in March 2020. This was not possible due to travel restrictions.

4.3 Project support to poverty alleviation

This project has contributed to poverty alleviation in Myanmar by producing the evidence and creating an enabling environment for:

- Direct assistance to ensure that poor and vulnerable fishers are not made worse off by fisheries regulations
- Indirect benefits in terms of maintenance of employment and food security in Myanmar's artisanal fisheries

In Year 2 of the project, we furthered understanding of the socioeconomic status of artisanal fishing communities in the Ayeyarwady Region (Indicator 2.1). The research showed that hilsa fishing households tend to be poor and extremely vulnerable to shock, highlighting the coping strategies that are most used in times of shock. This understanding allowed us to design a choice experiment testing the needs and preferences of hilsa fishing households in those same communities (Indicator 2.2). 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 helping the DoF to deliver an incentive 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.

In Year 4 of the project, we estimated willingness to accept hilsa conservation and thus the short-term economic cost of hilsa conservation (Indicators 2.3/3.2). Building on the study of fiscal reforms completed during Year 3 (Indicator 4.1) the report provides evidence for the direct poverty impacts expected from this project (report available here: https://pubs.iied.org/16675iied). It demonstrates how fiscal reform could generate enough revenue to provide incentives to all artisanal fishers across the Ayeyarwady Region (around 63,000 registered and another 63,000 currently unregistered), as well as the net economic benefit of doing so.

Given the focus of this project 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. The benefit estimate used in our cost-benefit analysis of incentive-based management in Myanmar was in fact based on the increase in hilsa production reported in Bangladesh (report available here: https://pubs.iied.org/16675iied). This stock rebuilding is expected to have indirect benefits in terms of employment (for an estimated 1.6 million people involved in artisanal hilsa fisheries alone) and national food security.

4.4 Gender equality

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 socioeconomic survey (Indicator 2.1; report available here: https://pubs.iied.org/16656IIED/) 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. Furthermore, the publication enhanced understanding of women's roles in the hilsa fishery and therefore their visibility in a sector that is so often associated with men.

During Year 3 of the project we completed a choice experiment which built on these findings (Indicator 2.2) and produced the data for analysis conducted during Year 4 (Indicators 2.3, 3.1, 3.2, and 3.3; report available here: https://pubs.iied.org/16675iied). The experiment followed a gender disaggregated data collection approach which differentiated between male and female respondents (see Fig. 4). We also 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 options, women were only willing to accept compensation for net use restrictions and were on average willing to accept less than men were.

During Year 3 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 4. A woman from a fishing household in Lay Ein Su village, Maubin township, being interviewed in June 2019. Credit: Lauren Burcham.

Our Outputs demonstrate the necessity for an incentive scheme to be gender responsive if it is to be effective and have a direct impact on gender equality. This will require further investigation of the differences between men and women in needs and preferences for compensation, as recommended to the DoF in our whitepaper (see Annex 7.6).

4.5 Programme indicators

- **Did the project lead to greater representation of local poor people in management structures of biodiversity?**
  Yes, the project promoted and supported the development of co-management institutions in the Ayeyarwady Region, as a means to increase the potential for compensation to incentivise long-term behaviour change. During 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. WorldFish also helped to stabilise artisanal fisher organisations like the 'Helmsman' group in the Pyapon area of the Ayeyarwady Region, now legally constituted under the new Ayeyarwady Region decentralised inland Fisheries Law 2019 (see description in Annex 7.15). The association leader, U Nyunt Win, worked closely with the Darwin project since travelling with the team to Bangladesh for the transboundary workshop in 2019.

- **Were any management plans for biodiversity developed and were these formally accepted?**
  Yes, a preliminary incentive-based fisheries management plan was developed (see Whitepaper in Annex 7.6), but it was not formally accepted due to the challenges imposed by the military coup.

- **Were they participatory in nature or were they 'top-down'? How well represented are the local poor including women, in any proposed management structures?**
  The project recommended a system of management which combined 'top-down' fisheries regulations with incentives. Design of the incentives was participatory, based on a socioeconomic survey and choice experiment (see Section 3.1). The choice experiment assessed men and women's preferences for management. The project recommended further participatory community needs assessments to ensure that incentives are acceptable and equitable.

- **How did the project positively influence household (HH) income and how many HHs saw an increase?**
  The project did not influence household income within its lifetime, but the recommended management system has the potential to directly increase the income of at least 63,000 fishing households (the number of fishers that are currently licensed in the Ayeyarwady

Region), and to indirectly increase the income of at least double that number via positive impacts on fish stocks (see Indicator 4.1).

- **How much did their HH income increase (e.g. x% above baseline, x% above national average)? How was this measured?**
  N/A

4.6 Transfer of knowledge

A large component of this project involved the transfer of new knowledge about Myanmar's hilsa fisheries (and how best to manage them) to policymakers. This knowledge was passed over in the form of policy briefings (Indicators 4.1 and 3.3), a whitepaper (Indicators 0.1 and 4.3), national-level workshops (Indicator 4.1), and one-on-one discussions via telephone or email (Indicators 4.2 and 4.3). Due to the challenges presented by the global pandemic and subsequent military coup in Myanmar, opportunities to transfer knowledge to policymakers were greatly reduced (see Section 3 for details). One international multi-stakeholder workshop facilitated knowledge transfer between Myanmar and Bangladesh (Indicator 5.1).

4.7 Capacity building

Wae Win Khaing (female, Burmese) was a Research Officer at NAG when the project began. She was heavily involved in Output 2 and benefit from the capacity building provided by WorldFish, IIED, and SRUC to NAG. She has since gone on to work for WorldFish as a Social Awareness Officer and Consultant and has recently been accepted onto a PhD programme at the University of Manitoba Canada to study social aspects of Myanmar's fisheries sector.

5 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, particularly in Bangladesh and India. For example, the transboundary hilsa fishery workshop held in Bangladesh in Year 2 raised the profile of the project in Bangladesh, building on the legacy of the previous Darwin-Hilsa^{BD} and the ECOFISH^{BD} project that it inspired. An IIED blog published about the workshop has been widely circulated on twitter.

WorldFish Myanmar has presented and referred to the project wherever possible at national and international events, including the 3rd World Small-Scale Fisheries Congress in Chiang Mai, Thailand, 22-26 October 2018; WorldFish science week activities; co-management group work with other agencies (Flora and Fauna International, Wildlife Conservation Society, World Wildlife Fund, Danida and Oikos); the FISH meeting, 'Towards resilient and equitable small-scale fisheries', in partnership with the Oak Foundation, September 3 2019; and the annual World Fish Migration Day.

Our planned exit strategy was based on collaborating with government authorities to gain endorsement of our recommendations and change perceptions around small-scale fisheries, creating an enabling environment for the scheme's implementation. WorldFish regularly presented our 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 an incentive scheme for hilsa fishers, and potential mechanisms for finance, to the DoF Director General and Director of Research and Development (see Annex 7.16). 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 Annexes 7.3 and 7.4). This recommendation, which challenges the conventional dependence on external funding for biodiversity conservation and poverty alleviation, is the one which received the most positive feedback and has potential to be the most enduring. A great deal of progress was made during Years 2 and 3 in terms of using evidence to build support at the decentralised level with Ayeyarwady Regional parliamentarians and DoF in Pathein (see Annex 7.5). However, first COVID-19 and then the political challenges have limited these kinds of engagement efforts and prevented WorldFish from seeking endorsement at Union level during

Year 4. WorldFish nevertheless has done what it can to lay the groundwork for government to take ownership when the political climate is right. Michael Akester sent a letter to the Director General of the DoF in the run-up to the national elections (24th October 2020), updating him on our findings and requesting feedback (see Annex 7.17). Project communications between WorldFish and our DoF hilsa focal point continued into Year 4, with positive feedback (see Annex 7.1).

The project team has worked collaboratively on publications with the goal of transferring skills and knowledge between people and institutions. The newly established national hilsa expert group provides a channel for the project to build capacity in Myanmar for the design and implementation of an incentive scheme. By sharing our knowledge and recommendations with the group, the goal is for those hilsa experts to take ownership of the scheme and support the DoF through the design and implementation process. WorldFish has worked 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 project recommendations at the local level (see Annex 7.15 for his account of progress).

One policy change was achieved during the project. WorldFish worked with the DoF to amend the *Ayeyarwady Freshwater Fisheries Law (2018)*, which now acknowledges co-management. As highlighted in the whitepaper, the development of co-management institutions should increase the potential for compensation to incentivise long-term behaviour change (see Annex 7.6). WorldFish is also developing co-management guidelines in coordination with an expert group in Myanmar and abroad. WorldFish will pilot the final version before delivery to the Myanmar Fisheries Federation (MFF), a private sector apex group, who in turn will approach the DoF for their comments and endorsement.

This Darwin project has also garnered interest from other stakeholders in the country (particularly within the Myanmar Fisheries Partnership) and catalysed the development of other projects which have synergies with our project Outcome.

- 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 its current research sites were chosen to study leasable fisheries in the areas where this Darwin Initiative Project operated. Subsequently this was reduced to 10 as data collection was difficult at two sites.

- WorldFish has recently agreed to co-supervise a research project on transboundary hilsa fisheries management and governance, which should help to galvanize the transboundary collaboration and dialogue which this project has promoted. The project is a collaboration between WorldFish, Bangladesh's Sylhet Agricultural University, India's Central Inland Fisheries Research Institute, and Myanmar's the University of Yangon, as well as the Natural Resources Institute of Finland (see Annex 7.11).

- Jens-Otto Krakstad, a Senior Scientist at the Institute of Marine Research Norway involved in the collaboration on fisheries between Norway and Myanmar (MYANOR-FISH) said that they '*strongly support this initiative and will be able to stand behind the recommendations*'.

- Norad have voiced interest in funding work to modify closed seasons for the offshore hilsa fishery and set up a new Marine Protected Area (MPA) in the Ayeyarwady Region to protect hilsa – possibilities that were being discussed within the DoF and would help to protect hilsa. However, at present Norad and other donors have withdrawn their support to Myanmar leaving only USAID with a development program.

- There has been interest from various members of the MFP in establishing a national Conservation Trust Fund or fisheries research and management fund using revenues from licence fees as taxes, as recommended by the project.

- Before the military coup, USAID raised the possibility of establishing a pilot of the incentive scheme, similar to the ECOFISH project in Bangladesh. We hope this will still be of interest later on when the political climate is right.

6 Lessons learned

In response to the impacts of COVID-19 and concerns about the implications of the upcoming national elections in Myanmar, we requested a six-month project extension in October 2020. We were hopeful that, even if the election results were disputed, that the situation would normalize by early 2021, allowing us to resume project activities. Given the military coup that followed, and subsequent need to close the project (see Section 11), in hindsight it may have been wise to adjust our indicators more radically and redirect budget towards more realistically achievable activities, instead of pausing activities and losing the funds. However, the situation was very difficult to predict.

Despite the challenges faced and activities that could not be completed, IIED and partners are proud of achievements in the face of these challenges, and of the reach that our research has had (see Section 5). We are also intent on keeping the project's recommendations alive despite funding coming to an end.

6.1 Monitoring and evaluation

IIED staff have held regular (monthly/quarterly) calls with WorldFish staff to monitor project progress. In addition, we aimed to hold two monitoring and evaluation meetings per year with all partners, in person if possible (usually either side of a workshop or other event already requiring travel). In each of these meetings, we reviewed the project logframe, checking that indicators of achievements could be verified, and identifying changes to be made. We also shared thoughts on how we have been working as a team and discussed lessons learnt. Partners met once in-person during Year 1 (Yangon, August 2017) and twice in person during twice in person in Year 2 (in Yangon, July 2018; and in Dhaka, Bangladesh, March 2019 following the transboundary hilsa fishery workshop). During Years 3 and 4, these meetings were held virtually due to the global pandemic.

Approved changes made to the logframe over the course of the project are as follows:

Indicator 2.2: In Year 2 NAG raised the issue that some study villages would be inaccessible during the planned period of fieldwork because it fell during monsoon season. The decision was made to push back 2.2 to Q3 Year 3, to allow time for those villages to be surveyed after monsoon season.

Indicators 2.4, 4.2 and 4.3: Originally, these three multi-stakeholder workshops were planned as individual workshops, two held in Q3 Year 4 and one in Q4 Year 4. Following discussions with the host country team, we feared that there could be fatigue effect by participants, and consequently limited attendance by key government stakeholders. Therefore, we decided to combine the three workshops into one (multiday) workshop with three parts, culminating in a session to which government officials will be invited. We decided to hold the series of workshops in Q4 Y3 so that they could be informed by findings from 2.2, 2.3, 3.1, 3.2, 3.3, and 4.1. They were 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 7.7 for draft agenda). The workshop was then postponed due to COVID-19, but when it became clear that restrictions on movement and gathering would continue, we decided in October 2020 to organize a virtual meeting (Indicator 2.4), expected to be mostly attended by civil society members of the new national hilsa expert group, with some DoF counterparts expected. This would be complemented by small meetings with regional and central government (Indicators 4.2 and 4.3). We planned for these to take place in early 2021, once any disruption around the national elections had died down. Accordingly, we changed means of verification 4.3 to a whitepaper on the design of incentive-based hilsa fisheries management, including a sustainable financial mechanism.

Indicator 4.3: We decided in Year 3 to refocus Output 4 on fiscal reform as a sustainable finance mechanism, since we had already completed significant work identifying this as a clear pathway

to incentive-based management. The original aim of looking at a Conservation Trust Fund would have relied on discussions held at the postponed national multi-stakeholder workshop, and we were concerned that the workshop would not take place early enough in Year 4 to leave time for preparation of a memorandum and articles of association. Instead, we planned to produce a roadmap (ie strategic plan) for the Myanmar government to implement our proposed fiscal reforms, co-developed with the fisheries management working group under the Agriculture Development Strategy (Danida, WCS, FFI, IUCN, WorldFish, OIKOS, NAG). This would initially target reforms at the decentralised Ayeyarwady Region level, followed by the Union (central) level. It was hoped that if the workshop were delayed by many months, we would still be able to initiate and even complete this co-development process through virtual means. The roadmap development process was going to be summarised in the workshop report (means of verification 4.2) and other meeting minutes, and the final roadmap would be included in the whitepaper on design of incentive-based hilsa fisheries management (means of verification 4.3), for which we hope to obtain government endorsement by the end of the project. However, as explained above, no workshops or small government meetings could take place during Year 4.

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 during Year 3 were 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 had time to deliver a quality report. As a result, we also pushed back delivery of the policy briefing to Q2 Year 4, as this was based on that report.

Indicator 3.2: We realized that this indicator had been incorrectly worded. The data we collected were not appropriate for the analysis of income elasticity, nor was it relevant to our question.

Output 5: The project initially set out to establish a transboundary initiative for regional hilsa fishery management. An increase in diplomatic tensions between Myanmar and Bangladesh during the first half of the project (related to the Rohingya crisis) led us to refocus Output 5 on establishing a national hilsa fishery expert group, as a priority. We therefore changed Indicator 5.2 from an MoU on transboundary hilsa management to an MoU on national hilsa management.

Means of verification 0.5: When we took the decision to cancel the postponed multi-stakeholder workshop, we added the animation as a way for WorldFish to redirect budget towards an alternative means of communicating with stakeholders. They have previously produced animations of this nature which have been very effective for communicating with local communities.

Indicators 0.1, 2.4, 4.2, 4.3, and 5.2: We requested a six-month project extension due to COVID-19, taking our project end-date from March 31st 2021 to September 30th 2021. This meant that the delivery date of these indicators were shifted. Following these revisions and acceptance of a project extension, IIED and WorldFish continued to monitor the political situation and its implications for the project. In March 2021 it became clear that there would be little more we could achieve in the current context (see Section 11 for details) and we took the decision to end the project – ultimately bringing the closure back its original date of March 31st 2021.

6.2 Actions taken in response to annual report reviews

Comment: WorldFish have another project that is undertaking a survey of stakeholders in the fish value chain to assess the impacts of COVID-19. The Darwin project will use this data to help its incentive-based hilsa fisheries management strategy. It would be helpful to provide an update in the next half yearly report.

We responded in our half year report, and provide a brief update here. WorldFish conducted a telephone survey to assess the evolving impacts of COVID-19 on the availability and price of aquatic foods and production inputs across Myanmar's fish value chain, including hilsa (see publication). Surveys were conducted weekly from May 2020 to July 2020, when they were reduced to monthly, with 143 respondents, 29% of which are in the Ayeyarwady Region. The findings highlighted the extent to which artisanal fishers are affected by limited access to fishing and emphasised the need for regulations to be accompanied by incentives. It was intended that

this would strengthen the relevance of our recommendations when we engaged with government.

7 Darwin identity

This project has acknowledged Darwin Initiative funding and the UK Government's contribution to the project whenever possible. We have displayed the Darwin logo prominently on IIED's project web page, in all our project publications (available here on aforementioned webpage), as well as in IIED's annual review video which features the project. The Darwin Initiative have also been acknowledged at all workshops and in 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 Annex 7.3 and 7.4 and Fig. 5).

Figure 5. 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. When our final project publication was released, Michael Akester circulated by email the full list of publications to WorldFish colleagues. Philippa Cohen, Program Leader of Resilient Small-Scale Fisheries at WorldFish, responded as follows: '*The body of work you and the team have developed is incredibly impressive – and the pathways to impact are strong and clear*.'

All project publications are 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. 6)

Figure 6. Screenshot of tweets publicising outputs of this Darwin project by project lead, Annabelle Bladon, posted during Year 4 of the project.

8 Impact of COVID-19 on project delivery

We are fortunate that by the time COVID-19 started impacting travel and movement, we had already completed our research activities. Strong relationships between partners also meant that we were able to continue working well virtually. However, the pandemic has impacted the dissemination and policy engagement activities we had planned for the final year of the project. In March 2020 we were due to hold a multi-stakeholder workshop in Myanmar (Indicator 2.4), but this was postponed and eventually cancelled due to COVID-19 restrictions. We considered holding it virtually, but WorldFish has experienced resistance from Myanmar nationals and particularly from government staff to participating in such events and meetings virtually – an issue which has been linked to the concept *aarr nar tel*, a social regulator that is used universally in Myanmar to show consideration for other people (see Annex 7.18). It dictates that being polite requires an individual to not risk embarrassing others, and that people of a lower social status, such as youth and work subordinates, must express *aarr nar tel* to those with a higher social status, such as elders and workplace superiors, through respectful speech and behaviour. This makes it difficult for people to participate in large virtual meetings via their own computers outside of the office, where they risk speaking out of turn. When WorldFish has held virtual meetings with government participants, they have gathered to participate in one room and speak through masks into one microphone, making audio very difficult. For these reasons, the team decided instead to organize a virtual meeting that was expected to be mostly attended by civil society members of the new national hilsa expert group, with some DoF counterparts expected. This unfortunately could not take place either, due to the political situation in Myanmar (see Section 3).

The challenges described above have also interfered with our strategy for policy influence, which relied on holding in-person meetings with regional and central government officials. The incidence of COVID-19 in Myanmar increased throughout Year 4 and both regional and central governments become very busy with their response, making it very difficult to engage with them in the time before the national elections and subsequent military coup. Furthermore, restrictions made it impossible for WorldFish staff to travel to for meetings, as planned. The WorldFish team aimed as a minimum to seek endorsement of our design via virtual meetings with the relevant government officials before the end of the project (Indicators 4.2 and 4.3), but political developments prevented this from happening.

These impacts of COVID-19 have contributed to a significant underspend by WorldFish. When exploring alternative and additional means of disseminating project findings and

recommendations, we planned for WorldFish to use some of these funds to produce an animation during the last six months of the project, but this was thwarted by the early closure of the project.

Finally, our project Outcome (ie the design of a financially sustainable system of incentive-based hilsa fisheries management) has some relevance to the COVID-19 response in Myanmar. Our estimation of the short-term economic cost of not fishing demonstrates the necessity to compensate and assist artisanal fishers when they lack access to fishing grounds and markets, as has occurred during the pandemic in Myanmar, and as will happen again in the context of climate-related and other shocks. Without a systems of social protection or compensation in place, it is likely that vulnerable fishing households will suffer, and do what they can to continue fishing at times when this may not be safe. There is an opportunity to ensure that incentive systems which are being designed to support sustainable fisheries and other natural resource management also provide the social protection needed to support the poor and vulnerable during times of shock.

9 Finance and administration

9.1 Project expenditure

Project spend (indicative) since last annual report	2020/21 Grant (£)	2020/21 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Others (see below)				
Audit costs				
TOTAL				

Staff employed (Name and position)	Cost (£)
Geraldine Galvaing	[redacted]
Annabelle Bladon	
Kate Green	
Jodie Frosdick	
Michael Akester	
TOTAL	

Capital items – description	Capital items – cost (£)

TOTAL	

Other items – description	Other items – cost (£)
Consultancy costs	[redacted]
Overheads costs	
Travel & subsistence	
Operating costs	
Audit costs	
Editorial/publications	
TOTAL	

9.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
IIED own funds	[redacted]
WorldFish own funds	
TOTAL	

Source of funding for additional work after project lifetime	Total (£)
TOTAL	

9.3 Value for Money

The project was very good value for money, first and foremost because it used a methodology and approach that had already been tested in Bangladesh. Costs were also kept low by in-country partners conducting field work, minimizing travel. Staff funded days were also kept to a minimum, but when challenges arose IIED and WorldFish both contributed extra staff time to the project. IIED fulfilled its commitment to co-finance [redacted] of the total project budget. The bulk

of this was spent in Year 1 (£[redacted] Year 2 (£[redacted] and Year 3 (£[redacted] Due to cancellation of the closing workshop, £[redacted] was outstanding for Year 4, which has been used to fund additional staff costs. WorldFish fulfilled their commitment to co-finance 11% of their budget and contributed significant additional staff time above and beyond that. On the WorldFish side there was an underspend of £[redacted] which is [redacted] of their total contracted budget (£[redacted] They planned to use the underspend for the proposed six-month extension which was eventually not possible due to the uncertainties of the political situation.

10 OPTIONAL: Outstanding achievements of your project during the (300-400 words maximum). This section may be used for publicity purposes

I agree for the Darwin Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here)

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: (Max 30 words) Threats to hilsa and marine biodiversity are avoided in line with CBD targets (Aichi Biodiversity Targets 6) and food security and employment opportunities of millions of poor people are maintained.			
Outcome 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 Q2~~3~~ of Y5~~4~~. 0.2 Number of fishing communities and households affected by regulatory regimes (by Q2 Y2) and their short-term cost identified (by Q1 Y4).	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 socio-economic assessment (due by Q2 of Y2) and another on opportunity cost (due Q1 Y4). 4.5. One animation on design of incentive-based scheme is produced and circulated online and in the national media (Q4 Y4)	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. 1.2 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 1.2 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 socio-economics of hilsa fishery in the Ayeyarwady Delta.	2.1 Large scale survey covering 833 households by Q2 of Y2.	2.1. One report on socio-economic assessment of hilsa fishers and copy of questionnaire survey by Q2 of Y2.	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

	2.2 Assessment of preferences using the choice experiment method by Q3 of Y3. 2.3 Short-term economic cost (opportunity cost) estimated by Q1 of Y4. 2.4 One national multi-stakeholder virtual workshop: incentive-based hilsa management (Part 1): Design essentials by Q4 of Y43.	2.2. One report on assessment of preferences for compensation packages by Q3 Y3. 2.3 One report estimating the economic value of hilsa fishery, short-term economic cost (opportunity cost) ~~and income elasticity of willingness to accept~~ Q1 Y4. 2.4. workshop report Q4 Y43	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	3.1 Monetary estimation of non-use value of hilsa fishery estimated by Q1 of Y4. 3.2 Estimating ~~income elasticity of~~ willingness to accept hilsa conservation (Q1 Y4) 3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery by Q2 of Y4.	3.1. See 2.3 3.2 See 2.3 3.3. One Policy Briefing paper on optimal level of investment to conserve hilsa Q2 Y4	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	4.1 Fiscal reforms to finance incentive-based management (diagnostic analysis) Q4 of Y3. 4.2 ~~Multi-stakeholder workshop (Part 2):~~ Meetings with regional government on f~~F~~iscal reforms to ~~increase revenue across the value chain (*increase revenue collection efficiency by 30%)*~~finance incentive-based management *by Q4 of Y43* 4.3 ~~Multi-stakeholder workshop (Part 3): Development of a roadmap (strategic plan) to guide government through implementation of fiscal reform Q4 Y3~~ Meetings with central government on fiscal reforms to	4.1. Policy briefing paper: fiscal reforms diagnostic analysis Q4 Y3 4.2. Workshop report: See deliverable for 2.4 4.3 Whitepaper on the design of incentive-based hilsa management in the AD (see means of verification for Outcome) and endorsed by government Q23 ~~Y4~~ Y5	Myanmar commerce law allows the establishment of a legally independent fund management system.

	finance incentive-based management by Q1 of Y5		
Output 5 A national 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 national MoU on hilsa management (and end of project) Q24 Y54 [participants from Bangladesh will still be invited to attend.]	5.1 Workshop report and IIED blog (Q24 Y52) 5.2 Launch of expert group with set of principles and ambitions, Blog or press release (Q4 Y4)	Diplomatic relationship between Myanmar and Bangladesh is not severed (at least status quo is maintained). There has been tensions between Muslim Rohingya and Buddhist Residents in Rakhine State in Myanmar. Occasionally, this has led to strained relationships between the two countries. We believe that cooperation between scientific communities in both countries has not been affected.

Activities

Output 1. Enhanced understanding of the biology and ecology of the hilsa fishery
0.0 Inception workshop
1.1 Spawning seasonality of hilsa using gonadosomatic index
1.2 Assessment of migratory routes of hilsa

Output 2. Enhanced understanding of the complex socio-economics of hilsa fishery in the Ayeyarwady Delta.
2.1 Socio-economic assessment of hilsa fishing communities in the delta (survey design, execution and reporting)
2.2 Assessment of preferences using the choice experiment method
2.3 Estimation of short-terms economic cost (opportunity cost)
2.4 Whitepaper: the design of incentive-based hilsa management in the AD
2.5 National multi-stakeholder workshop (~~Part 1~~virtual): incentive-based hilsa management: Design essentials

Output 3. Use and non-use values of hilsa fishery estimated and business case developed
3.1 Estimating economic value of hilsa fishery in AD (using revealed and stated-preference techniques)
3.2 Estimating ~~income elasticity of~~ willingness to accept hilsa conservation (distributional study)
3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery

Output 4. Sustainable financial mechanism developed
4.1 ~~Multi-stakeholder workshop (Part 2)~~Regional government meetings: ~~Diagnostic analysis of fiscal~~Fiscal reforms for sustainable fisheries management
4.2 Policy briefing paper on fiscal reforms
4.3 ~~Multi-stakeholder workshop (Part 3)~~Central government meetings: Fiscal reforms for sustainable fisheries management~~Assessment of the plausibility of establishing a national hilsa fishery management trust fund~~
~~4.4 Development of roadmap for fiscal reform~~

Output 5. A transboundary hilsa fishery management expert group is in place
5.1 Participation of delegates from Bangladesh in project inception workshop
5.2 Workshop: transboundary hilsa management – experts from Bangladesh and Myanmar
5.3 Workshop: signing MoU ~~(Myanmar and Bangladesh)~~ on national hilsa management expert group (and end of project)

Annex 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
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 and understanding of its economic value have created the enabling conditions for more sustainable hilsa fisheries management, which would indirectly impact the food security and livelihoods of millions. Tools and guidance have also been provided for the development of an effective incentive scheme that aligns with the needs and preferences of the communities which directly depend on the hilsa fishery.
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 Q2 of Y5. 0.2. Number of fishing communities and households affected by regulatory regimes (Q2 Y2) and their short- term cost identified (Q1 Y4).	Based on enhanced understanding of the ecology and biology of hilsa and the socioeconomics of the fishery, an incentive-based fisheries management system has been designed, which would compensate at least all licensed fishers in the Ayeyarwady Region (63,000 of an estimated 126,000 households) for the short-term economic costs of new and improved fisheries management. A financial mechanism was proposed and the business case developed for this approach. Following initial support and positive feedback on the recommendations from DoF and central and regional government, the assumption that government would accept and act on project findings presented in the document on design essentials was undermined in Year 4 due to political events. Plans to redirect workshop funds towards the production of an animation were also thwarted by early project closure. Nevertheless, the groundwork has been laid for implementation of project recommendations when the time is right.
Output 1. Enhanced understanding of the biology and ecology of hilsa fishery	1.1 Ecological survey on migratory and spawning seasonality studies in the 3 intervention sites by Q1 of Y3. 1.2 Two 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.	Ecological survey was completed in Y2 and data analysed to provide evidence for improved hilsa fisheries management. Two working papers were published in Y3, one focused on the spawning seasonality of hilsa (https://pubs.iied.org/16661IIED/) and the other on migratory routes of hilsa in the Ayeyarwady Delta (https://pubs.iied.org/16665IIED/). Key findings and recommendations also summarized in the whitepaper (see Annex 7.6).
Activity 1.1 Spawning seasonality of hilsa using gonadosomatic index		Analysis completed and report published (https://pubs.iied.org/16661IIED/)
Activity 1.3 Assessment of migratory routes of hilsa		Analysis completed and report published (https://pubs.iied.org/16665IIED/)

Project summary	Measurable Indicators	Progress and Achievements
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 Q1 of Y4. 2.4 One national multi-stakeholder workshop: incentive-based hilsa management (Virtual): Design essentials by Q4 of Y4.	A great more is now understood about the socioeconomics of hilsa fishing communities in the Ayeyarwady Region as a result of this project. The large-scale survey took place in Y2 and a report highlighting the opportunities and challenges faced by hilsa fisher households in Myanmar, is available (https://pubs.iied.org/16656IIED/). A choice experiment was completed in Y3 and the assessment of preferences for compensation was published online (https://pubs.iied.org/16668IIED/). Based on the choice experiment results, the short-term economic cost of hilsa fisheries management has been estimated and published as part of a report (https://pubs.iied.org/16675iied) as well as feeding into analysis supporting Output 3. All key learnings and subsequent recommendations are summarised in the whitepaper (see Annex 7.6). It was not possible to hold the multi-stakeholder workshop on design essentials even virtually due to COVID-19 and the military coup in Myanmar, so the means of verification for this indicator is no longer appropriate. Instead, we focused on gathering stakeholder feedback on the design essentials document (whitepaper) in writing (see Annex 7.6).
Activity 2.1 Socioeconomic assessment of hilsa fishing communities in the delta		Survey has been completed and report has been published (https://pubs.iied.org/16656IIED/).
Activity 2.2 Assessment of preferences using the choice experiment method		Survey has been completed and report has been published (https://pubs.iied.org/16668IIED/).
Activity 2.3 Estimation of short-terms economic cost (opportunity cost)		Analysis completed and estimate presented in published report (https://pubs.iied.org/16675iied)
Activity 2.4 Whitepaper: the design of incentive-based hilsa management in the AD		Document drafted and stakeholder feedback sought and incorporated (see Annex 7.6).
Activity 2.5 National multi-stakeholder workshop (virtual): incentive-based hilsa management: Design essentials		Workshop cancelled due to factors out of our control.
Output 3. Use and non-use values of hilsa fishery estimated and business case developed	3.1 Monetary estimation of non-use value of hilsa fishery estimated by Q1 of Y4. 3.2 Estimating willingness to accept hilsa conservation (Q1 Y4) 3.3 Cost-benefit analysis of investment in sustainable management of hilsa fishery by Q2 of Y4.	The economic value (use and non-use value) of Myanmar's hilsa fishery has been estimated using data from Output 2 and published in a working paper (https://pubs.iied.org/16675iied). This report also features estimates of willingness to accept hilsa conservation and a cost-benefit analysis of investment in hilsa fisheries management. The cost-benefit analysis forms the bulk of the business case presented in this policy briefing: https://pubs.iied.org/17765iied. Again, all key learnings and subsequent recommendations are summarised in the whitepaper (see Annex 7.6).

Project summary	Measurable Indicators	Progress and Achievements
Activity 3.1 Estimating economic value of hilsa fishery in AD (using revealed and stated-preference techniques)		This analysis was completed and presented in a published report
Activity 3.2 Estimating willingness to accept hilsa conservation (distributional study)		This analysis was completed and presented in a published report
Activity 3.3 Cost benefit analysis of investment in sustainable management of hilsa fishery		This analysis was completed and used to produce a policy briefing
Output 4. Sustainable financial mechanism developed	4.1 Fiscal reforms to finance incentive-based management (diagnostic analysis) Q4 of Y3. 4.2 Meetings with regional government on fiscal reforms to finance incentive-based management by Q4 of Y4 4.3 Meetings with central government on fiscal reforms to finance incentive-based management by Q1 of Y5	Challenges related to COVID and the political situation in Myanmar meant that this Output became more strongly focused on fiscal reforms than originally planned. This aside, good progress was made in a developing a sustainable finance mechanism based on fiscal reforms. The diagnostic analysis was completed in Y3 and published as a working paper. A policy briefing was also produced to make the case for this financial mechanism directly to policymakers, which was also translated into Burmese (Annex 7.8). Although preliminary meetings were held to discuss this financial mechanism with regional and central government in 2020, further meetings could not be held before the project was closed. See Section 3.1 for more details.
Activity 4.1 Policy briefing paper on fiscal reforms		Analysis completed and policy briefing published (https://pubs.iied.org/17751IIED/)
Activity 4.2 Regional government meetings: Fiscal reforms for sustainable fisheries management		Meetings cancelled due to factors out of our control.
Activity 4.3 Central government meetings: Fiscal reforms for sustainable fisheries management		Meetings cancelled due to factors out of our control.
Output 5. A national 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 national MoU on hilsa management (and end of project) Q2 Y5 [participants from Bangladesh will still be invited to attend.]	A transboundary workshop was held and dialogues initiated between stakeholders from Bangladesh and Myanmar (see workshop report and blog). The focus of this Output subsequently shifted away from transboundary hilsa fisheries management group towards a national expert group due to escalation of the Rohingya crisis and associated diplomatic tensions. A national expert group has been established within the Myanmar Fisheries Partnership, and there has also been interest from Bangladesh and India in such a group (see Section 3.1 for evidence and details). However, due to the military coup and COVID a closing workshop could not be held and the expert group has not yet developed and signed an MoU on hilsa management. We are nevertheless confident that there is enough in-country ownership of the group and project outcomes to ensure that the group convenes when the time is right.
Activity 5.1 Participation of delegates from Bangladesh in project inception workshop		The inception workshop took place August 2017 in Yangon, but delegates from Bangladesh could not participate due to political instability between Myanmar and Bangladesh.

Project summary	Measurable Indicators	Progress and Achievements
Activity 5.2 Workshop: transboundary hilsa management – experts from Bangladesh and Myanmar		This workshop took place and was summarised in a workshop report. It also inspired a blog on transboundary hilsa fisheries management.
Activity 5.3 Workshop: signing MoU on national hilsa management expert group (and end of project)		The closing workshop was cancelled due to the military coup and subsequent early closure of the project. No MoU has yet been developed, as explained in Section 3.1.

Annex 3 Standard Measures

Code	Description	Total	Nationality	Gender	Title or Focus	Language	Comments
Training Measures							
1a	Number of people to submit PhD thesis						
1b	Number of PhD qualifications obtained						
2	Number of Masters qualifications obtained	1	American	Female	Compensation for hilsa fisheries management in Myanmar	English	
3	Number of other qualifications obtained						
4a	Number of undergraduate students receiving training						
4b	Number of training weeks provided to undergraduate students						
4c	Number of postgraduate students receiving training (not 1-3 above)						
4d	Number of training weeks for postgraduate students						
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification (e.g., not categories 1-4 above)						
6a	Number of people receiving other forms of short-term education/training (e.g., not categories 1-5 above)	46	Burmese	Female and male			
6b	Number of training weeks not leading to formal qualification						
7	Number of types of training materials produced for use by host country(s) (describe training materials)						

Research Measures		Total	Nationality	Gender	Title	Language	Comments/ Weblink if available
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (ies)						
10	Number of formal documents produced to assist work related to species identification, classification and recording.						
11a	Number of papers published or accepted for publication in peer reviewed journals	1	UK	Male	Productivity and coastal fisheries biomass yields of the northeast coastal waters of the Bay of Bengal Large Marine Ecosystem	English	Link
11b	Number of papers published or accepted for publication elsewhere						
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country						
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country						
13a	Number of species reference collections established and handed over to host country(s)						
13b	Number of species reference collections enhanced and handed over to host country(s)						

Dissemination Measures		Total	Nationality	Gender	Theme	Language	Comments
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	5					
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	2					

Physical Measures		Total	Comments
20	Estimated value (£s) of physical assets handed over to host country(s)		
21	Number of permanent educational, training, research facilities or organisation established		
22	Number of permanent field plots established		Please describe

Financial Measures		Total	Nationality	Gender	Theme	Language	Comments
23	Value of additional resources raised from other sources (e.g., in addition to Darwin funding) for project work *(please note that the figure provided here should align with financial information provided in section 9.2)*	£[redacted]					

Annex 4 Aichi Targets

	Aichi Target	Tick if applicable to your project
1	People are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	x
2	Biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	
3	Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	x
4	Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	x
5	The rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	
6	All fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	x
7	Areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	
8	Pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	
9	Invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	
10	The multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	
11	At least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	x
12	The extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	
13	The genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	

14	Ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	
15	Ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	
16	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	
17	Each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	
18	The traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	
19	Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	
20	The mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	

Annex 5 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. web link, contact address etc)
Paper at 3rd World small-scale fisheries congress	Carrots and sticks: incentives to conserve Hilsa fish in Myanmar. Kyi Thar Myint, Khin Maung Soe, Bobby Maung, Essam Mohammed, Mike Akester, 2018	Burmese	Burmese	Female	TBTI	Link
Workshop report	Regional hilsa knowledge-sharing workshop (Bangladesh - Myanmar): lessons for incentive-based hilsa management. Eugenia Merayo, 2019	Spanish	British	Female	IIED, London	https://pubs.iied.org/G04407/
Country report	Socioeconomic characteristics of hilsa fishers in Ayeyarwady Delta, Myanmar: Opportunities and Challenges. Wae Win Khaing, Michael Akester, Eugenia Merayo, Annabelle Bladon, Essam Y. Mohammed, 2018	Burmese	Burmese	Female	IIED, London	https://pubs.iied.org/16656IIED/

Blog	Cooperation vs. competition over shared fish stocks. Annabelle Bladon, 2018.	British	British	Female	IIED, London	https://www.iied.org/cooperation-vs-competition-over-shared-fish-stocks
Journal article	Productivity and coastal fisheries biomass yields of the northeast coastal waters of the Bay of Bengal Large Marine Ecosystem. Michael Akester 2019	British	Malaysian	Male	Elsevier's journal Deep Sea Research Part II: Topical Studies in Oceanography.	Link
Blog	Seasonal ban on brood hilsa helps to protect stocks in Bangladesh. Cecily Layzell, 2019.		Malaysian	Female	CGIAR	Link
Policy briefing	Financing Myanmar's fisheries through fiscal reform. Bladon, A, Akester, M and Mohammed EY, 2020.	British	British	Female	IIED, London	https://pubs.iied.org/17751IIED/
Working paper	Financing incentive-based hilsa fisheries management in Myanmar through fiscal reform. Silvester, P, Bladon, A, Akester, M, Maung Soe, K and Mohammed, EY, 2020.	Australian	British	Male	IIED, London	https://pubs.iied.org/16669IIED/
Working paper	Informing incentive-based management of hilsa fish in	Scottish	British	Male	IIED, London	https://pubs.iied.org/16668IIED/

	Myanmar – results of a choice experiment. Glenk, K, Novo, P, Khaing, WW, Lwin, WW, Burcham, L, Mohammed, EY, Soe, KM, Akester, M, Bladon, A, Merayo, E, 2020.					
Working paper	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.	Spanish	British	Female	IIED, London	https://pubs.iied.org/16665IIED/
Working paper	Spawning seasonality of hilsa (Tenualosa ilisha) in Myanmar's Ayeyarwady Delta	British	British	Female	IIED, London	https://pubs.iied.org/16661IIED/
Working paper	Myanmar's artisanal hilsa fisheries: how much are they really worth? Burcham, L, Glenk, K, Akester, M, Bladon, A and Mohammed, EY, 2020	American	Scottish	Female	IIED, London	https://pubs.iied.org/16675iied
Policy briefing	The business case for investing in	British	British	Female	IIED, London	https://pubs.iied.org/17765iied

	Myanmar's artisanal hilsa fishery. Bladon, A, Akester, M, and Burcham, L, 2020.					
Online video	Annual review video: Sustainable fisheries in Myanmar. IIED, 2021.		British		IIED, London	Link
Whitepaper*	Whitepaper on the design of incentive-based hilsa management in the Ayeyarwady Delta. Bladon, A and Akester, M. 2020.	British	British	Female	IIED, London	Available on request from IIED, [redacted]

Annex 6 Darwin Contacts

Please note that we are unable to provide contacts for the Department of Fisheries (due to the military takeover), the University of Yangon or NAG (our colleagues have had their contracts cancelled by the current government as they were deemed to be part of the resistance movement against the military takeover).

Ref No	24-014 ref 3739
Project Title	Carrots and sticks: incentives to conserve hilsa fish in Myanmar
Project Leader Details	
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Role within Darwin Project	
Address	
Fax/Skype	
Email	
Partner 4	
Name	

Organisation	
Role within Darwin Project	
Address	
Fax/Skype	
Email	

Checklist for submission

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