

Briefing

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Myanmar would benefit from greater investment in the sustainable management of artisanal hilsa fisheries. These are worth US\$731.4 million to US\$867 million annually, but receive limited attention from policymakers.

A government-led compensation scheme for licensed artisanal fishers would alleviate the short-term impacts of new regulations. The potential economic benefits of such a scheme could outweigh estimated costs by up to nine times.

Through implementing an incentive scheme in the Ayeyarwady Region, the Department of Fisheries could reduce the burden of enforcement, since fishers should be more able and willing to comply with regulations.

The government could fund this incentive scheme by adapting fiscal tools to better target actors nearer the top of the hilsa value chain and by collecting revenues more efficiently.

The business case for investing in Myanmar's artisanal hilsa fishery

Tens of thousands of fishing families in Myanmar rely on the hilsa shad for their incomes, yet much of their catch goes unreported. As a result, current national statistics do not capture the true value of Myanmar's artisanal hilsa fisheries and investment in their sustainable management is limited. Yet we estimate this sector is worth between US\$731.4 million and US\$867 million a year. To protect it, the government should consider compensating artisanal fishers for complying with new fishing regulations. Over ten years, such an incentive scheme could yield a net benefit of between US\$790.4 million and \$1.1 billion, with economic benefits outweighing costs by up to nine times. In addition, incentive-based management could allow the recovery of hilsa populations and their coastal and inland habitats, as well as immediately reducing the vulnerability of fishing communities.

The hilsa shad (*Tenualosa ilisha*) is one of Myanmar's most commercially valuable fish species, supporting small-scale artisanal fisheries in its coastal and delta regions, as well as offshore industrial fisheries in the Bay of Bengal.¹ The Department of Fisheries has attributed nearly half of Myanmar's hilsa catch since 2015 to offshore vessels.² Yet research indicates that Myanmar's inland artisanal fisheries, which include hilsa, produce 50% more fish than official figures capture — often referred to as the 'hidden harvest'.³

In the Ayeyarwady Region's coastal and delta communities, fishing contributes an average of 63% of household income.⁴ However, with limited access to formal credit or livelihood diversification opportunities, the seasonal and unpredictable nature of fishing means that households tend to be extremely vulnerable. Hilsa form a much more substantial portion of household income than national statistics would

indicate — more than 75% in some areas.⁵ Their high value means that many people who do not depend on fishing for their livelihood will still catch hilsa when they are abundant in rivers.⁴ And while hilsa fishing is a male-dominated activity, women also generate income through post-harvest activities such as selling hilsa.⁶

While the importance of hilsa to the national economy is recognised, particularly in terms of export revenues (US\$32 million in 2018), the value of Myanmar's artisanal fishery is much less visible to policymakers.⁷ This has led to limited investment in its sustainable management. As a result, catch rates are too high, with too many juveniles and egg-laden females caught.⁸ Although hilsa also face the threat of overexploitation by offshore vessels, ecological research indicates that protection of hilsa should be prioritised in key spawning and nursery grounds, many of which are in coastal and delta areas where artisanal fishers operate.^{9,10}

Rewards of investing in artisanal hilsa fisheries

This briefing sets out the business case for the Myanmar government to invest in an incentive scheme for more sustainable and inclusive management of artisanal hilsa fisheries (see Box 1 for background on this approach). Building on a previous briefing which outlined **how** such a scheme could be financed through fiscal reform,¹¹ this one focuses

on **why**. Both briefings have been based on studies conducted as part of a wider IIED-led research project, Darwin-Hilsa^{MM}.¹²

This study used a combination of primary and secondary data to estimate the economic value of Myanmar's artisanal hilsa fisheries, with a focus on the Ayeyarwady Region.¹³ We supplemented this information with data from a Darwin-Hilsa^{MM} survey, and secondary data from Bangladesh, to calculate the approximate costs and benefits of implementing an incentive scheme for artisanal fishers in the region.

Our analysis demonstrates a clear economic rationale for the government to invest in incentive-based management, with every dollar invested generating a benefit worth at least six times that. However, the incentive schemes used in the analysis are hypothetical, and so our estimates of costs and benefits should not be considered definitive.

Every US\$1 invested in incentive-based management could generate a benefit worth at least US\$6

Box. 1 Incentivising a more sustainable artisanal hilsa fishery

New regulations tend to impose a short-term economic cost on fishers, for instance by restricting fishing or requiring investment in specific gear. Ayeyarwady Region fishing households already struggle to make ends meet and rely on informal loans to survive during low-catch periods.⁴ Locked into cycles of debt, fishers have limited ability to shoulder the additional cost of compliance with regulations. Furthermore, the Myanmar government has limited capacity to enforce regulations.

One promising solution to these kinds of challenges is incentive-based management, wherein governments provide monetary or in-kind compensation to fishers to reduce or offset the short-term costs of fishing more sustainably.¹⁴ Compensating artisanal fishers affected by new regulations should encourage greater compliance and reduce the need for top-down enforcement.

These incentives should: 1) help to reduce artisanal fishing pressure on hilsa stocks, 2) reduce the vulnerability of fishers who depend on those stocks, and 3) ultimately yield long-term positive economic benefits through maintaining or increasing healthy populations of hilsa in Myanmar and beyond.

Calculating the economic value of Myanmar's artisanal hilsa fisheries

We estimate the economic value of Myanmar's artisanal hilsa fisheries to be between US\$731.4 million and US\$867 million per year.

The lower end of the range is based on a conservative estimate of the income derived from hilsa by artisanal fishers in the Ayeyarwady Region, (the '**use value**'). This was calculated by taking the average monthly household income from hilsa reported by 833 artisanal fishers, surveyed in 2018, and using it to arrive at an annual total for the region.

The upper end of the range is based on our estimate of the income derived from hilsa by artisanal fishers in the Ayeyarwady Region **plus** the value of the fisheries to a country in which catching and consuming fish is a significant part of the culture. For example, 60% of animal protein consumed in Myanmar comes from fish, and hilsa specifically forms the traditional basis of its national dish, mohinga rice noodles.

To calculate the value that the hilsa fisheries hold for Myanmar's national population, (the '**non-use value**'), we used secondary data from a survey asking 1,006 households in neighbouring Bangladesh what they would be willing to pay annually for a hypothetical programme to restore hilsa populations. The survey took place in Bangladesh's Barisal Division, which shares many characteristics with Myanmar's Ayeyarwady Region, including an abundance of hilsa.¹⁵ We converted the average figure given by respondents in Bangladesh into a percentage of their average annual income and applied the same percentage to estimate the annual non-use value of hilsa in Myanmar.

Adding **use** and **non-use** values together, we calculated that the economic value of artisanal hilsa fisheries for Myanmar's national population is US\$867 million a year.

These estimates demonstrate the tremendous value that artisanal hilsa fisheries hold in Myanmar, without including the income that is generated through secondary markets (national and export) or by artisanal fishers outside of the Ayeyarwady Region. This value indicates the scale of socioeconomic return that could be generated by incentivising a more sustainable artisanal hilsa fishery.

To approximate the size of this return, we conducted a cost-benefit analysis of two hypothetical incentive schemes for two different sets of new fishing regulations: one requiring

smaller amounts of compensation and the other requiring larger amounts of compensation.

Analysing the costs and benefits of an incentive scheme

Over ten years, investing between US\$132.7 million and \$167.2 million in an incentive scheme for artisanal fishers could generate a net benefit of between US\$790.4 million and \$1.1 billion (see Table 1). Our analysis shows high rates of return on investment across a wide range of compensation levels and regardless of whether non-use value is included in the economic value of artisanal hilsa fisheries. The expected economic benefits outweigh estimated costs by between six and nine times; ie every US\$1 invested in incentive-based hilsa fisheries management generates a benefit estimated at US\$6–9.

How much compensation is required? We estimated how much monetary compensation might be required by artisanal fishers for compliance with various potential new fishing regulations in three categories: new closed seasons, new minimum net mesh size restrictions, and new permanent hilsa sanctuary areas. We based these estimates on data collected through an experiment conducted in fishing communities across the Ayeyarwady Region in 2019, whereby participants were offered the hypothetical choice of six levels of compensation for each regulation, ranging from US\$30 up to US\$300.

The amount of compensation required per individual was calculated by adding together the average amounts that participants demanded for one regulation in each of the three categories: first using the regulations perceived to be most costly,¹⁶ and second using those perceived to be least costly.¹⁷

Under the incentive scheme with lower compensation, each fisher would require an annual total of US\$278 in compensation, which would equate to US\$17.5 million per year if all 63,000 licenced artisanal fishers in the Ayeyarwady Region were compensated. Under the incentive scheme with higher compensation, each fisher would require an annual total of US\$351 in compensation, translating to a regional total of US\$22.1 million per year.

What are the costs of running an incentive scheme? In addition to the compensation itself, an incentive scheme would incur various transaction and administration costs, including the costs of selecting beneficiaries, distributing the compensation, and staff wages. We estimated these costs based on those

Table 1. Costs and benefits of two hypothetical incentive schemes over ten years

Total discounted cost (US\$)	Total discounted benefit (US\$)	Net present value (US\$) [†]	Benefit-cost ratio
Incentive scheme one (lower compensation)			
132.7 million	957.6 million (use value*)	824.9 million	7:1
	1.2 billion (use and non-use value**)	1.1 billion	9:1
Incentive scheme two (higher compensation)			
167.2 million	957.6 million (use value*)	790.4 million	6:1
	1.2 billion (use and non-use value**)	1.1 billion	7:1

*Benefits were estimated in terms of potential impacts on income derived from hilsa by artisanal fishers licensed in the Ayeyarwady Region (use value).

**Benefits were estimated in terms of potential impacts on Ayeyarwady Region artisanal fisher income combined with the existence value placed on hilsa by the wider national population (use value and non-use value).

[†]'Net present value' is a calculation used to estimate the value — or net benefit — over the lifetime of a project compared to initial capital investment. To account for the time value of money we used a discount rate of 7%, which is the interest rate charged to commercial banks and other financial institutions for the loans they take from the Central Bank of Myanmar.

reportedly incurred by a food compensation scheme for hilsa fishers in Bangladesh.¹⁸ The processes and costs of distributing compensation in Myanmar are expected to be quite similar to those in Bangladesh, where fishers collect rice from local distribution points. Since access to bank accounts is not common among artisanal fishing communities in Myanmar, fishers would probably receive electronic transfers via a mobile app that would still require them to collect the cash from the office of a mobile financial services provider (for example, Wave) or via the General Administration Department at Township level.

On average, it cost the government of Bangladesh US\$2.23 (adjusted for inflation to 2018) per person compensated to operate their incentive scheme in 2014. Based on this figure, it would cost an estimated US\$140,602 per year to operate an incentive scheme for licenced artisanal fishers in the Ayeyarwady Region of Myanmar.

What is the total cost of an incentive scheme? The total cost of an incentive scheme — monetary compensation plus running costs — comes to between US\$17.7 million and US\$22.3 million a year, depending on the regulations imposed. Over the course of ten years, this would come to a total discounted cost of between US\$132.7 million and US\$167.2 million.

These estimates are merely indicative; in reality, costs would vary according to the design of the scheme. Previous research^{6,11} clearly demonstrates how the government of Myanmar

could generate more than enough funds to cover even the higher estimated costs by increasing the efficiency of revenue collection from the hilsa value chain and adapting current fiscal tools to better target actors nearer the top of the chain.

What are the expected benefits? Our analysis indicates that an incentive scheme for licensed artisanal fishers in the Ayeyarwady Region could yield economic benefits of between US\$957.6 million and US\$1.2 billion over ten years (see Table 1), before taking into account the potential impacts on secondary sales, size of hilsa fish or catch in other regions.

The expected increase in artisanal income could improve resilience to food insecurity and other shocks like COVID-19 by better enabling families to cover daily expenses, save money towards setting up other livelihoods or migrate in search of employment.⁴ In the longer term, these families should not require compensation for fishing regulations, having acquired the tools they need to support themselves during this time.

Following implementation of the incentive scheme for artisanal fishers in Bangladesh, hilsa production reportedly increased by 5% per year

for the ten years that followed.¹⁹ While this increase cannot be solely attributed to incentive-based management, research indicates that it is a strong contributor.¹⁸ Assuming that more effective management of inland and coastal hilsa stocks would benefit artisanal fishers, we translated this annual 5% increase in hilsa production into a 5% annual increase in their income from hilsa.

In summary

Understanding the true economic value of Myanmar's artisanal hilsa fishery highlights the economic imperative to manage it sustainably. It also illuminates the potential net benefit of investing in incentive-based management. Compensating artisanal fishers for compliance with new fisheries regulations grounded in robust science makes business sense for the Department of Fisheries.

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Knowledge Products

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WorldFish is an international, non-profit research organisation that harnesses the potential of fisheries and aquaculture to strengthen livelihoods and improve food and nutrition security. Globally, more than one billion people obtain most of their animal protein from fish and 800 million depend on fisheries and aquaculture for their livelihoods. WorldFish is a member of CGIAR, a global research partnership for a food-secure future.

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Notes

¹ Bay of Bengal Large Marine Ecosystem Project (2015) Distribution, migration and breeding of Hilsa (*Tenualosa ilisha*) in the Ayeyarwady system in Myanmar. / ² DoF (2019) Unpublished fishery statistics 2019. Ministry of Agriculture, Livestock and Irrigation, Republic of the Union of Myanmar, Naypyidaw. / ³ Kelleher, K, Westlund, L, Hoshino, E, Mills, D, Willmann, R, de Graaf, G and Brummett, R (2012) Hidden harvest: the global contribution of capture fisheries. World Bank and WorldFish. / ⁴ Khaing, WW, Akester, M, Merayo Garcia, E, Bladon, A and Mohammed, EY (2018) Socioeconomic characteristics of hilsa fishers in the Ayeyarwady Delta, Myanmar. IIED, London. pubs.iied.org/16656IIED / ⁵ Myanmar Marketing Research and Development (2015) Livelihood assessment on the Hilsa fisher families in the Ayeyarwady Delta. / ⁶ 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. pubs.iied.org/16669IIED / ⁷ DoF (2018) Fishery statistics 2018. Republic of the Union of Myanmar, MoALI. Naypyidaw, Myanmar. / ⁸ Bay of Bengal Large Marine Ecosystem Project (2015) Stock assessment of hilsa shad (*Tenualosa ilisha*) in Myanmar. / ⁹ Merayo Garcia, 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. pubs.iied.org/16665IIED / ¹⁰ Bladon, A, Myint, KT, Ei, T, Khine, M, Aye, PT, Thwe, TL, Leemans, K, Soe, KM, Akester, M, Merayo Garcia, E and Mohammed, EY (2019) Spawning seasonality of hilsa (*Tenualosa ilisha*) in Myanmar's Ayeyarwady Delta. IIED, London. pubs.iied.org/16661IIED / ¹¹ Bladon, A, Akester, M and Mohammed, EY (2020) Financing Myanmar's fisheries through fiscal reform. IIED, London. pubs.iied.org/17751IIED / ¹² For more information on the project, please visit: www.iied.org/carrots-sticks-incentives-convert-hilsa-fish-myanmar / ¹³ Burcham, L, Glenk, K, Akester, M, Bladon, A and Mohammed, EY (forthcoming) Myanmar's artisanal hilsa fisheries: how much are they really worth? IIED, London. / ¹⁴ Mohammed, EY and Wahab, MA (2013) Direct economic incentives for sustainable fisheries management: the case of Hilsa conservation in Bangladesh. IIED, London. pubs.iied.org/16527IIED / ¹⁵ Mohammed, EY, Ali, L, Ali, S, Hussein, B, Wahab, MA and Sage, N (2016) Hilsa's non-consumptive value in Bangladesh: Estimating the non-consumptive value of the hilsa fishery in Bangladesh using the contingent valuation method. IIED, London. pubs.iied.org/16626IIED / ¹⁶ The three regulations requiring the most compensation were: 1) introduce a closed season for 21 days of fishing during peak fishing season; 2) increase fishing net mesh size requirements to 4.5 inches during peak fishing season; and 3) permanently close sanctuary areas to fishing every 3 miles along the river. / ¹⁷ The three regulations requiring the least compensation were: 1) introduce a closed season for 14 days of fishing during peak season; 2) increase fishing net mesh size requirements to 4.5 inches during peak fishing season; and 3) permanently close sanctuary areas to fishing every 9 miles along the river. / ¹⁸ Haldar, GC and Ali, L (2014) The cost of compensation: Transaction and administration costs of hilsa fish management in Bangladesh. IIED, London. pubs.iied.org/15522IIED / ¹⁹ Rahman, MJ, Wahab, MA, Nahiduzzaman, M, Haque, ABMM and Cohen, P (2020) Hilsa fishery management in Bangladesh. *IOP Conference Series: Earth and Environmental Science* 414 1-10.