

EFFECTS OF INCENTIVE BASED HILSA SHAD (*Tenualosa ilisha*) MANAGEMENT AND CONSERVATION STRATEGIES IN BANGLADESH

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Abstract

Hilsa (*Tenualosa ilisha*) is an important diadromus fish species in the South and Southeast Asia, especially in Bangladesh. The fish has its unique nature gained international demand for its nutritional value, taste, special aroma and delicacy. It is considered as the national fish of Bangladesh and contributes significantly to the national economy. The hilsa fish is available almost throughout the year in the major rivers and their tributaries, as well as in the Bay of Bengal. During last two decades, the feeding, spawning, nursery and migratory areas of hilsa have been reduced in the up streams. Hilsa fishery is also suffering seriously from recruitment overfishing (catching *jatka*) and growth overfishing (catching brood hilsa). To optimise these situations, an incentive based hilsa management and conservation programme had implemented during the period of five years from July 2008 to June 2013. The on-going hilsa management activities have been designed to enhance the implementation of hilsa conservation measures during seasonal ban period, as well as to improve livelihood of *jatka* fishers by creating alternative income generation options. Hilsa catch data and socioeconomic information were collected from fishers through interview using prescribed format by Upazila Fisheries Officer and Field Assistant. Due to introduction of some socio-friendly management regimes, abundance of *jatka* was also found 195% higher and hilsa production was increased gradually year after year. Finally, the total hilsa production has increased 26.74% in the year 2012-13 in comparison to the base year (2005-06) production 2,77,123 tonnes (traditional management period).

Keywords: Incentive, hilsa management, overfishing, conservation

Introduction

Hilsa (*Tenualosa ilisha* Hamilton, 1822) is the national fish of Bangladesh because of its importance. Hilsa is a major food fish in Bangladesh and is sacred according to Hindu mythology. This fish is important socially, culturally and religiously to Bengali people living in Bangladesh, West Bengal and many other states like Orrissa, Bihar and Assam of India (Sharma *et al.* 2012). Hilsa is hailed in Bengali as *Macher raja ilish*, meaning “hilsa—the king of fish”. The popular and tasty fish hilsa plays an important role to contribute national economy, employment opportunity, export earnings and protein food supply in Bangladesh. At the moment, 50-60% of the global hilsa catch is reported from Bangladesh waters, 20-25% from Myanmar, 15-20% from India and rest 5-10% from other countries (Alam, 2012; Rahman *et al.* 2012). It has the highest contribution in country's fish production as a single fish species, which is about 11% and contributes 1.0% to the GDP (DoF, 2014). The fish has already gained international fame for its high nutritional value, taste and delicacy. The species is an extremely popular food fish for the people of Bangladesh and India and exploited from rivers, estuaries and the sea. It is popular because of its high palatability, special flavour, moderate size, attractive body shape and lucrative shiny appearance. As a result, the market demand for the species is increasing and it is becoming an export item to other countries (Haldar *et al.* 2004; Rahman, 2006). In 2012-13, hilsa production was about 0.351 million tonnes and it is expected that the production would be increased sustainable up to 0.50 million tonnes through rational management (JCP, 2013; DoF, 2014). An estimated 0.50 million people are engaged in hilsa fishing directly and 2.0-2.5 million people are directly or indirectly involved in hilsa fishery for their livelihoods (Roy and Habib, 2013).

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In Bangladesh, hilsa fish is found almost throughout the year in the major rivers, viz. the Padma, Meghna, Jamuna, Rupsa, Shibsa, Bishkhali, Pyra and their tributaries as well as in the Bay of Bengal. In addition to these rivers, hilsa were also abundant in Karnafuly, Feni and Muhuri rivers and most of the tributaries of the Padma (Ganges) and the Brahmaputra (Quereshi, 1968; Haldar *et al.* 1992). During last two decades, hilsa fishery has been suffered and the production was declining due to indiscriminate catch of brood hilsa, over exploitation of *jatka* (juvenile hilsa up to 23cm), siltation in the river basin, upstream diversion of river water and water pollution by industrial waste and manmade causes (Rahman *et al.* 2012). To minimize these adverse impacts, Government has been trying to establish adequate number of bio-reserves and sanctuaries to protect and conserve these ecosystems and the living resources (Haldar *et al.* 2004; Rahman, 2006). To sustain as well as to increase its production, several management measures have been undertaken. Among the different attempts, conservation of *jatka* through declaring fish sanctuaries in the major nursery and spawning grounds, seasonal ban on *jatka* catch, conducting massive awareness campaign, implementation of legal instruments and protection of brood hilsa catches for 11 days during the peak breeding season are most important (Roy and Habib, 2013).

Hilsa catch remained at similarly low levels from the year 1991-1992 to 2001-2002. Catch levels further declined during 2002-03, which marked the implementation of incentive-based mechanisms to halt further decline, and to focus on efforts to increase hilsa production (Haldar, 2004). Regulations on the catching of small hilsa, a ban on fishing of *jatka* (juvenile hilsa, less than 23 cm in size) and restrictions on the catching of brood (mature and about to spawn) hilsa during the breeding season was adopted in 2007. The government mobilized its resources to build awareness, and introduced monitoring and law-enforcement involving by the local administration, Coastguard, Navy, law-enforcement agencies and DoF officers. To compensate for the loss of earnings, the government started providing 'affected' fisher communities (60-70% fishers household) with 30 kg m⁻¹h h⁻¹ (earlier it was 10 kg m⁻¹h h⁻¹) and providing training and AIG inputs. To ensure maximum sustainable yield of *T. ilisha*, it is a prerequisite to ensure safe and successful breeding of brood hilsa and also to conserve *jatka*. Thus, harvesting of *jatka* is prohibited by law throughout the country. However, incentive based hilsa management and conservation study was carried out with focusing on the two following objectives: 1) to increase the hilsa production; and 2) to improve the livelihood status of *jatka* fishers.

Materials and Methods

Study area and duration

This study was conducted by the Jatka Conservation, Alternate Income Generation for the Jatka Fishers and Research Project (JCP) team for a period of five years from July 2008 to June 2013. Jatka prone major districts Bhola, Patuakhali, Chandpur, Laxmipur, Barguna, Barisal, Pirojpur, Shariatpur, Jhalkathi, Munshigonj, Noakhali, Bagerhat, Manikgonj, Satkhira and Chitagong were included for this study, where VGF (Vulnerable Group Feeding) and AIGA (Alternative Income Generating Activities) inputs were distributed among the fishers household.

Fishers' selection and VGF distribution

The preliminary list of *jatka* fishers' household was prepared and updated in every year by the UPMC (Upazila Project Management Committee) that was further approved by DPMC (Districts Project Management Committee) with necessary verification. The Upazila Nirbahi Officer (UNO) and Upazila Fisheries Officer (UFO) are the Chairman and Member Secretary, respectively of the UPMC, where Union Parishad Chairman (the lowest tier of the administrative hierarchy) and Fishermen Representative (FR) with related others official are the member of this committee. Similarly, Deputy Commissioner (DC) and District Fisheries Officer (DFO) are the Chairman and Member Secretary, respectively of the DPMC. After that, the list was sent to JCP & DoF headquarter for final approval. Before final approval, the list was checked and verified properly by the project authority. A demand letter for VGF inputs was prepared by JCP office according to the final list of *jatka* fishers' and the letter forwarded to the Ministry of Disaster management and Relief through Ministry of Fisheries and Livestock. The respective higher authority has considered 60-70% numbers of fishers as VGF beneficiaries from the total number of fishers and accordingly they allotted VGF inputs (rice) to the Deputy Commissioner (DC). Then the DC arranges a meeting of concern committee and distributes the allotted VGF beneficiaries' number to the Upazila. After this, UNO the Chairman of Upazila committee issued a DO (Demand order) letter to the concern Union Parishad Chairman to collect his allotted rice from the government local depot and distribute it to his enlisted *jatka* fishers. According to

the allotted number, concern union committee selects the beneficiaries on the basis of their income and other socio-economic conditions. It is noted that, not all the *jatka* fishers but 60-70% of the fishers from a union were provided VGF facilities in every year.

Beneficiaries' selection and AIG inputs distribution

According to the availability of fund of JCP, the AIGAs target benefit was list down every year for each district with necessary verification and a letter issued to the DFO from JCP Headquarter. Then the DPMC divided the beneficiaries' number to the concern upazila of the district. The UPMC than divided these to the concern Union Parishad. According to the demand of those beneficiaries, the UPMC select the AIGA packages from different choice. A budget was allotted to the Upazila according to their demand depending on the number of beneficiaries. Then the UPMC purchase those inputs according to the PPR (Public Procurement Rules). Then the inputs were distributed to the beneficiaries arranging a huge gathering with presence of the local representatives and local administration.

Hilsa sanctuaries conservation

Five sites in the Meghna and Padma rivers, and some inshore marine areas, have been declared hilsa sanctuaries under the Protection and Conservation of Fish Act, 1950, intended for the conservation of juvenile hilsa (*jatka*) in the major nursery areas, and maintenance of fish biodiversity. After declaration of five hilsa sanctuaries the JCP with DoF personnel including all concern have been protected hilsa sanctuaries and to conserve *jatka* in the major nursery and spawning grounds of river systems through implementation of fish act.

Special operations for jatka protection

The JCP introduced special measures for the protection of *jatka*, formulating a specific act. The act states that 'all activities related to juvenile hilsa (*jatka*) catching, transportation, marketing, selling and possession is banned from 1 November to 31 May every year in Bangladesh'. A comprehensive programme (mobile court, awareness campaign, *jatka* week observation, incentives etc.) has been implemented by the leadership of DoF with direct coordination of JCP.

Jatka abundance

Monofilament special gill nets which are locally called *current jal* were used to catch *jatka* for the measurement of *jatka* abundance. The *jatka* availability was measured by the trends of catch per unit effort (CPUE) of gill nets from different sampling sites. Mechanized boat and speed boat were used for sampling, information and data collection. Major nursery grounds of *jatka* and related areas *viz*, Ramgoti, Kamalnagar, Haimchar, Hatia, Monpura, Dhalchar, Moulivirchar, Kalirchar, Daulatkhan, Tetulia, Patharghata, Kuakata, Mohipur, Galachipa, Rangabali were selected for sampling and the sites were visited frequently for comprehensive study. The CPUE was measured through the total catch of a gear divided by the fishing effort in a given period. A standard 100 metre fishing net (*current jal*) were used for *jatka* fishing in each sampling site. The following formula was used for calculation:

$$\text{CPUE} = \frac{\text{Total catch of a fishing net (kg)}}{\text{Fishing time (h)}}$$

Conservation of brood hilsa

The JCP introduced a special measure to prevent the catch of brood hilsa during spawning season. Government has been implemented 11 days ban period (earlier it was 10 days), 5 days before and 5 days after the full moon including the day of the full moon (*Bara purnima*) in the Bengali month of *Ashwin* (October). According to the rules 'hilsa catching, transportation, marketing, selling and possession are banned for 11 days throughout the country'. A massive programme (mobile court, special operation in the fish market and river site, awareness campaign and

public meeting) has been done by the leadership of DoF with direct coordination of JCP, local administration, Navy, Coastguard and law enforcement agencies.

Hilsa catch data collection

Hilsa catch data were collected from fish landing centre by Upazila Fisheries Officer and Field Assistant through a prescribed format. Survey Officer in each District Fisheries Office was accommodated all these things. Moreover the secondary data were used from Fisheries Resource Survey System, Department of Fisheries (DoF) for cross-checking and authenticity of catch data. After cross-checking the data were computed and analyzed properly.

Data analysis

Collected data were analyzed by computer programme, Microsoft Excel 2007.

Results and Discussion

Hilsa sanctuaries conservation

The location of the hilsa sanctuaries and ban period for *jatka* conservation are presented in the Table 1. Five sanctuaries covers a total area of 350 km for nursery ground have been banned for catching juvenile hilsa (*jatka*) including all fishes during ban period. The ban period of four sanctuaries was observed in the month of March–April. Only one sanctuary which is situated in Patuakhali district, the ban period was observed in November–January. The Protection and Conservation of Fish Act, 1950 have been followed for the conservation of hilsa sanctuaries. The law enforcement agencies were played a vital role to implement fish act and mobile court against the corrupted fishermen those who caught or attempted to catch *jatka* during ban period.

Table 1. Location of sanctuary sites and ban period implemented for *jatka* conservation

Sl no.	Hilsa sanctuary areas	Ban period
1	From Shatnol of Chandpur district to Char Alexander of Laxmipur (100 km of lower Meghna estuary)	March–April
2	Madanpur/Char Ilisha to Char Pail in Bhola district (90 km area of Shahbajpur river, a tributary of the Meghna)	March–April
3	Bheduria of Bhola district to Char Rustam of Patuakhali district (nearly 100 km area of Tetulia river)	March–April
4	Whole 40 km stretch of Andharmanik river in Kalapara Upazila of Patuakhali district	November–January
5	Lower Padma river at Shariotpur district, 20 km stretch of the Padma river	March–April

There are two major nursery grounds, one in riverine, and another in the coastal area has been identified (Mazid, 1998; Haldar, 2004). The largest riverine nursery ground is situated in the Meghna river, in and around Chandpur, from Shatnol to Char Alexander of Laxmipur. In these areas *jatka* are found during January to May with the peak in March–April. The juveniles (2–10 cm) appear in large numbers in this nursery ground in November and remain there up to June, but the peak period is March to April. Another large nursery ground is situated in the coastal belt of Andharmanik river in Kalapara upazila of Patuakhali district (Haldar, 2004). Within this area comparatively large (11 to 15 cm) *jatka* are caught during November to January. Apart from the above areas, significant amount of *jatka* are caught in the different rivers such as the Ilisha, Karkhana, Pyra, Kirtonkhola, Tetulia, Bishkhali of Barisal and Bhola districts. The result was reflected due to inclusion of some more areas as nursery grounds of hilsa like Tetulia, Shabazpur channel, Arial kha, Dharmagonj and Andarmanik river (Rahman *et al.* 2012).

Special operation for jatka protection

The JCP introduced special measures for the protection of *jatka*, formulating a specific act. Under the protection act, *jatka* catching, transportation, marketing, selling and possession are banned from 1 November to 31 May in every year throughout the country and special operation was done by the JCP and DoF officials. During the study period, 1992 nos. of mobile court and 13304 nos. of special operations were done for *jatka* protection in different districts. The JCP was targeted to hilsa conservation law that should be strictly enforced in order to stop capture of *jatka*. *Jatka* are heavily caught during the period of November- December in estuaries and during the period from January–May in all rivers. Halder *et al.* (2012) also reported that *jatka* are found almost in 100 rivers during November to April-May in Bangladesh and about 60% are caught during March to April. So, it is necessary to stop capture of *jatka* during this ban period. Studies revealed that nearly 60% *jatka* graze within the declared hilsa sanctuary areas (Halder, 2004). He also reported that production of hilsa shad is tremendously declining due to indiscriminate killing of *jatka*.

Conservation of brood hilsa

The highest numbers of brood and ripe hilsa are caught in every year during the breeding season. At that time brood hilsa are migrated from sea water to riverine water for spawning. During 11 days ban period, catching of brood hilsa has therefore been banned each year in the major spawning grounds during this peak breeding season. The ban covers four major spawning grounds with an estimated area of about 7000 sq km and other major rivers during the highest breeding time (Table 2). During the study period, 2600 nos. of mobile court and 11482 nos. of special operations were done for brood hilsa conservation during 11 days ban period of peak spawning in different districts.

Table 2. Location and areas of hilsa spawning ground and ban period

Location	Area	Ban period
North-East	Mayani point, Mirersharai	Five days before and five days after of the full moon including the day of the full moon. The moon is first sighted in the Bengali month of <i>Ashwin</i> each year (Earlier it was fixed between 15 and 24 October in each year)
North-West	West Syed Awlia point, Tajumuddin	
South-East	Gandamara point, Kutubdia	
South-West	Lata Chapali point, Kalapara	

Incentive provides to jatka fishers

The incentives were provided to protect *jatka* and ensure its growth and production of hilsa through reduction of both growth and recruitment overfishing of hilsa population. During *jatka* conservation ban period, the *jatka* fishers are provided with VGF (food-grain, rice) at the rate of 30 kg m⁻¹ h h⁻¹ for 4 months since February to May each year for social safety and food security. Earlier the amount of VGF was 10 kg m⁻¹ h h⁻¹ for 3 months and the beneficiaries was about 50% less. The details of food grain (rice) distribution under VGF programme from 2007-08 to 2012-13 are presented in the Table 3.

Table 3. Distribution of food grain (rice) under Vulnerable Group Feeding (VGF) programme from 2007-08 to 2012-13

Financial year (FY)	No. of Upazila (no of Districts)	Food grain (rice) distribution			
		Allocated amount (tonnes)	No. of households	No. of household increased in compare to previous year (%)	Food grain distributed (kg month ⁻¹ family ⁻¹)
2007–08	59 (10)	4360	145,335	-	10
2008-09	59 (10)	5730	143,252	-	10
2009-10	59 (10)	19,770	164,740	21488 (15%)	30
2010-11	85 (15)	14,470	186,264	21524 (13%)	20
2011-12	85 (15)	22,352	186,264	0 (0%)	30
2012-13	85 (15)	24,747	206,229	19965 (10.7%)	30

The JCP has taken another effective initiative for *jatka* fishers with providing AIG inputs for alternative livelihood during *jatka* conservation ban period. The AIGA was considered for only the poorest fishers. JCP has been implemented need based different alternative income generating (AIG) activities such as cow fattening, goat rearing, van/rickshaw pulling, small scale business, duck/chicken rearing, sewing machine operation, home gardening, net making, cage culture, etc. Mostly the hardcore poor *jatka* fishers are selected as beneficiaries for AIGAs activities. About 2-3% of the total fishers are included under AIGAs programme in each year. The details of AIGAs inputs distribution under AIGA programme from 2007–08 to 2012-13 are shown in the Table 4.

The incentive-based hilsa conservation programme has four main activities: awareness-raising, providing food to fisher's household, strictly follow ban period and support for alternative income generating activities. In 2007-08 and 2008-09 about 145335 and 143252 fishers household were selected as VGF beneficiaries. The number of household increased every year and the incremental rate was about 10 to 15%. The lowest amount of VGF (4360 tonnes) was distributed in 2007-08 while the highest amount of VGF (22352 tonnes) was distributed in 2012-13 and the beneficiaries were 145335 and 186264, respectively. The JCP identified a total of approximately 287000 *jatka* fisher household from 20 coastal districts covering 91 upazila, who were directly affected for ban period and establishment of sanctuaries (JCP, 2014). DoF (2013) also reported that the aim was the *jatka* fishers' household to expand the coverage of the incentive scheme up to 287000 fisher households. Out of these, 60-72% of vulnerable households were selected in every year for providing VGF food supply (Roy and Habib, 2013).

Table 4. Distribution of Alternate Income Generation Activities (AIGAs) inputs under AIGA programme from 2007-08 to 2012-13

Financial year (FY)	No. of Upazila (no of Districts)	AIGAs programme		
		Allocated money (million BDT)	No. of households	Average allocated money (BDT) per fisher household
2007–08	59 (10)	20.00	16,990*	1177
2008-09	59 (10)	20.00	18,350*	1090
2009-10	59 (10)	50.00 (20.00+30.00)	14,750 (10450*+4300)	1913/7000
2010-11	21 (4)	51.70	6,869	7526
2011-12	21 (4)	58.00	7,785	7450
2012-13	21 (4)	13.05	1,743	7874

* Small amount of money was provided for AIGAs in 2007-08 to 2008-09.

The support for AIGAs is aimed to improve the livelihoods of the affected households. The programme provides need-based training/refresher courses and to enable the fishers for improving their livelihood through different alternative income generating activities. JCP was distributed need based AIGA inputs for hardcore poor *jatka* fishers. In 2007-08 and 2008-09, the small amount of money was provided in the name of AIGA, which was about 1177 BDT and 1090 BDT per household, respectively. From 2009-10 to 2012-13, JCP was provided need based AIGAs inputs to the fishers which was about 7000-7874 BDT per household (Table 4). It is widely recognized that the fisher communities in Bangladesh are among the most impoverished people in society. During the study it was found that most of the fishers were stopped *jatka* catching willingly during ban period after providing their daily requirement of food and other economic compensation (Roy and Habib, 2013). As a result, hilsa production was increased 26.74%. Mohammed and Wahab (2013) reported that these management plans involved some level of fishing restriction either through the imposition of the no-take zones or the off season. Such fishing bans deprive fishers of their fishing activities, and this will certainly have some short-term negative implications for their livelihoods. As a result, fishers have found it difficult to comply with the regulations regarding bans on fishing. Consequently any conservation efforts that limited their fishing catches would have a disproportionately negative impact on their income and livelihoods, even the fishers would ultimately benefit from these measures. Therefore, it was recognized that economic incentives should be provided to fisher households and communities to compensate for their loss in earnings and give them an incentive to abide by the imposed regulations. This is a good example of how direct economic incentive mechanisms can complement regulatory or command-and-control approaches. These findings encouraged the government of Bangladesh to further strengthen its ongoing hilsa management through the provision of incentives.

Jatka abundance

During the study period the *jatka* abundance was measured in different sampling sites. The overviews of the *jatka* abundance during different management regime are presented in Table 5. It was found that *jatka* abundance was lowest (0.61) when only sanctuary management was done. On the other hand, it was highest (2.72) where three management strategies (sanctuary management, ban period observation and provide incentive) were done. It was also found that the catch per unit effort (CPUE) of *jatka* in different rivers in different year was varied from 0.64 to 2.77. In 2012-13, abundance of *jatka* was found 195% higher than the base year 2004-05 (CPUE 0.94).

Table 5. Overviews of the *jatka* abundance under different management regimes

Year	Caught <i>jatka</i> (kg) 100 metre net h ⁻¹	Decrease (%)	Increase (%)	Management strategies
2004-05	0.94	-	-	Sanctuary management
2005-06	0.61	35.10	-	Do
2006-07	0.72	23.4	-	Do
2007-08	1.89	-	101.1	Sanctuary management + small incentive (VGF 10 kg m ⁻¹ h h ⁻¹)
2008-09	2.31	-	145.7	Sanctuary management + small incentive (VGF 10 kg m ⁻¹ h h ⁻¹) +10 days ban for brood hilsa catching in peak spawning season;
2009-10	2.44	-	160.0	Sanctuary management +10 days ban for brood hilsa catching in peak spawning season + full incentive (VGF 30 kg m ⁻¹ h h ⁻¹ + need based AIGAs distribution)
2010-11	2.72	-	189.0	Do
2011-12	2.74	-	191.0	Sanctuary management +11 days ban for brood hilsa catching in peak spawning season + full incentive (VGF 30 kg m ⁻¹ h h ⁻¹ and need based AIGAs distribution)
2012-13	2.77		195.0	do

The *jatka* abundance was recorded comparatively higher than the previous year due to management regime was increased. The more or less similar and lowest abundance was found in the year of 2005, 2006 and 2007, where only sanctuary management was occurred. In 2008, the *jatka* abundance was showed medium when sanctuary management and small scale VGF was distributed. In 2011 to 2013 *jatka* abundance was showed higher (189% to 195%) when all management measures were done. It was indicating the complete fishing ban had a strong positive impact comparing to the year of 2005 to 2007. Similarly, complete fishing ban for 11 days in the spawning grounds showed that availability of plenty of spent fish and huge number of fries and juveniles of hilsa in and around spawning grounds also indicating a positive impact on successful reproduction of hilsa. It was noted that increased *jatka* abundance could be achieved by increasing the management efforts. The similar finding has been reported by Haldar *et al.* (2012). As a result the total hilsa production has increased 26.74% in the year 2012-13 in comparison to the base year 2005-06 due to intervention of several management measures.

Hilsa production trends

The hilsa production trends are increased gradually year after year, which are shown in the Table 6. The highest production was obtained 351223 tonnes in 2012-13 which was 26.74% increased from the base year (2005-06) production. During the study period, it was revealed that hilsa production was increased after increasing the management efforts. The production was comparatively lower from 2005-06 to 2006-07 due to only sanctuary management was done. After that the production was increased for new management approach like ban period and small amount of incentive was imposed. As a result, the production was increased 4.65% and 7.87% in 2007-08 and 2008-09, respectively. In 2009-10, this was first year for strictly followed ban period and introducing full incentive package like 30 kg m⁻¹h h⁻¹ VGF (rice) distributed for 4 months with need based AIGAs inputs distribution to the

fishers where the production was increased 13% more. The hilsa production was 339845, 346512 and 351223 tonnes in 2010-11, 2011-12 and 2012-13, respectively, where the production trend was comparatively higher year after year (DoF, 2014; FRSS, 2014).

Table 6. Production of hilsa with increased % in different years under different management activities

Year	Hilsa production		Management strategies
	Total catch (tonnes)	% Increased catch	
2005-06	277123	Base Year	Sanctuary management
2006-07	279189	0.74	do
2007-08	290000	4.65	Sanctuary management + small incentive (VGF 10 kg m ⁻¹ h h ⁻¹)
2008-09	298921	7.87	Sanctuary management + small incentive (VGF 10 m ⁻¹ h h ⁻¹) + 10 days ban for brood hilsa catching in peak spawning season;
2009-10	313342	13.07	Sanctuary management +10 days ban for brood hilsa catching in peak spawning season + full incentive (VGF 30 kg m ⁻¹ h h ⁻¹ + need based AIGAs distribution)
2010-11	339845	22.63	Do
2011-12	346512	25.04	Sanctuary management +11 days ban for brood hilsa catching in peak spawning season + full incentive (VGF 30 kg m ⁻¹ h h ⁻¹ and need based AIGAs distribution)
2012-13	351223	26.74	do

During last 10 years, different management strategies were adopted by the government for sustainable hilsa production in Bangladesh. Firstly, sanctuary declaration and management was done for confined areas. Secondly, sanctuary management, ban period observation and conservation of *jatka* and brood hilsa with VGF facilities (small amount) were provided to the fishers. Finally, sanctuary management, awareness-raising, effective enforcement for conservation of *jatka* and brood hilsa during ban period and full incentive package of VGF and AIGAs were provided to the fishers. It was found that after introduction of incentive-based management with considered other management implications, the hilsa production was increased year after year and improving the livelihood status of *jatka*/hilsa fishers. The similar opinion has been reported by the researchers (Hadar *et al.* 2012; Rahman *et al.* 2012; Roy and Habib, 2013). If we consider last 8 years (2005 to 2013) hilsa production, it was observed that the production was increased gradually year after year. DoF (2013) reported that hilsa production increased from 0.277 million tonnes (2005-06) to 0.351 million tonnes in 2012-13. Halder *et al.* (2004) suggested that effective enforcement measures in critical sites and during the critical breeding period could contribute significantly to increase hilsa production and maintenance of biodiversity. The total hilsa landings from Bangladesh waters have not decreased over this period; moreover the production has been increased substantially in the recent past years due to the adoption of different management interventions for this fishery since 2005 (Rahman *et al.* 2012). For getting sustainable production it is imperative to protect *jatka* along with saving berried hilsa during at its peak spawning period for unabated release of matured egg (DoF, 2013; Habib and Roy, 2011). JCP has been adopted such type coordinated programme to conserve and protect *jatka* and brood hilsa in definitive time of the year for the betterment of fishers livelihood as well as sustainable hilsa production for the national interest. As a result, *jatka* and brood hilsa are saving remarkably with focus more abundance of *jatka* in the nursery ground that's why the production of hilsa is gradually increased due to adoption of incentive based new management strategies.

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