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Evaluating and Monitoring of National Post-Harvest Fish Loss in Indonesia

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ABSTRACT

The demand of fish supply as food increases significantly as the population grows. One of the crucial aspects related to the production of fish is post-harvest fish loss which will substantially reduce the fish supply. Due to the perishable characteristics of fish, especially in tropical climate areas as Indonesia with high daily temperature and humidity, the situation will be more crucial and the reduction in quantity and/or quality could be considerably high. In the other side, the figure of fish stock potency does not indicate the available fish for further processing yet. Therefore, the figure will be more meaningful when it is corrected by the loss. Until recently, post-harvest fish loss in Indonesia is estimated as high as 30%; this figure has been used as reference for decades eventhough many effort has been done to reduce the fish loss. This situation indicates very serious problem since no further information how the data or the figure had been quantified. This figure needs to be evaluated and monitored periodically in order to provide more reliable number resulted by appropriate method of quantification. Questionnaire Loss Assessment Method (QLAM) developed by Ward and Jeffries in 2000 is recommended for fish loss calculation employing physical, quality and financial data as quantification bases. The quantification of national total post-harvest fish loss should be started from the fish is caughtuntil ready to be consumed. It is recommended that a system for evaluating and monitoring of national post-harvest fish loss is designed. The Ministry of Marine Affairs and Fisheries needs to assign a team consisted of Directorate General of Capture Fisheries, Agency of Research and Development for Marine and Fisheries to initiate and establish a system for evaluating and monitoring of national post-harvest fish loss comprehensively. Local Government should also be involved in the system, especially in coordination and providing enumerators. Agency for Marine and Fisheries Human Resources Development and Agency of Research and Development for Marine and Fisheries are responsible for providing capacity building and training of the enumerators systematically and periodically.

Keywords: *Post-harvest fish loss, Questionnaire Loss Assessment Method (QLAM), evaluation and monitoring*

INTRODUCTION

Exploitation of marine fish in most of Indonesia waters has been overfishing or over the maximum sustainable yield (MSY), a maximum fish catch (yield) that is allowed to maintain sustainable fish stock. Meanwhile, the fish demand tends to increase as world demand of fish increased in accordance with the increasingof world population. In other side, the capability of nature on recovering its resource is limited and takes very long time. Consequently, there will be imbalance in supply-demand of fish. This situation is worsening by insufficient implementation of good handling practices (GHP). This condition results in high post-harvest losses of fish.

The post-harvest fish loss is estimated as high as 30-40%. Unfortunately, this figure so far do not show a significant change regardless many efforts have been performed to improve fish handling practices.Updating post-harvest fish loss has not been performed so it could be one of the reasons why post-harvest fish loss is still high. Ineffective improvement on fish handling could also be other reason. Exploiting fish resources to increase fish catch production when post-harvest fish loss is till high seems to be inadvisable.

Regardless the problem above, the post-harvest fish loss should be evaluated and updated since the figures are an estimation that has been used since 1970s. The evaluation is not only able to update

post-harvest fish loss number but also enable on obtaining information for evaluating the causes of the fish loss and coping strategies as well. The update fish loss is also important for estimating an effective fish catch that can be landed based on its sustainable potency. Fish loss is also important for fish processors for coping strategies in order to reduce the potential loss in their production line. Appropriate method and approach are required for accurate assessment. Method developed by Ward andJeffries (2000) which was applied in many countries by the guidance of FAO (Akande, 2001; Akande and Odogbo, 2001; Akande et. al, 2001a; Akande et.al, 2001b; Diei-Ouadi and Mgawe, 2011; Eyo and Mdaihli, 2001; Ward and Jeffries, 2000) can be employed for the purpose.

The objective of this study is to create a concept for evaluating and monitoring post-harvest fish losses in Indonesia. The concept will include the appropriate methodology and system for evaluating and monitoring post-harvest fish losses in Indonesia. The study will also cover the understanding of post-harvest fish losses and current information on post-harvest losses in Indonesia.

METHODS

As mentioned above, this study aims to produce a system that can be used for evaluating and monitoring post-harvest fish losses in Indonesia as well as its appropriate methodology. For the purpose, two focus group discussions (FGDs) were carried out.

FirstFGD was done involvingresource persons as key speakers, resource persons involved in the discussion and participants as well. Resource persons invited in the FGD as key speakers consisted of (1) resource person who has expertise on post-harvest fish losses assessment in Indonesia, (2) resource person who has an expertise on the understanding on the terminology and methodology for post-harvest fish losses assessmentas well as experience on performing fish losses assessment in Indonesia, (3) resource person who has experience on managing post-harvest fish losses assessment in Indonesia, and (4) resource person who has expertise in biometric and data base construction.Resource persons who did not speak as key speakers were the persons who knowledgeable about fisheries in Indonesia, especially in capture fisheries and aquaculture fisheries. Researcher participants whohave a background in post-harvest fisheries were also invited to FGD to enrichthe discussion.

Second FGD was carried out involving small group of competent researchers to perform synthesis for solution findings. The second FGD is used to develop a concept of post-harvest fish losses assessment based on the previous methods. The findings will cover in four substances namely (1) understanding post-harvest fish losses, (2) appropriate methodology for monitoring post-harvest fish loss, (3) information on current post-harvest fish losses in Indonesia, and (4) system for evaluating and monitoring post-harvest fish losses in Indonesia.

RESULTS AND DISCUSSIONS

Understanding post-harvest fish losses. In order to calculate post-harvest fish losses requires the same understanding. Interpretation of post-harvest fish losses can be expressed in different ways. However, basically post-harvest fish losses can be defined as overall loss occurred started from when a fish is taken from its environment until consumed by consumers because of physical damage, quality deterioration or others.Based on this understanding, types of losses can be classified as physical loss, quality loss, financial loss, market force loss, nutritional loss and functional loss (Ward andJeffries, 2000). Any of the losses can occur at any steps in the supply chain, from capture or harvesting to consumers (Wibowo, 2013).

The figure of losses required is a figure that can be monitored at any time which is in turn require suitable and accurate method with reasonable cost. Among the above types of losses, nutritional loss and functional loss are not the types of losses that can be simply calculated and cost as well as time consuming. Market force loss is also not easy to be measured unless market force loss is defined as supply-demand effect. For monitoring purpose, the suitable types of losses are physical loss, quality loss and financial loss.

Methodology for evaluating and monitoring post-harvest fish losses. Ward and Jeffries (2000) had developed three methods for assessing post-harvest fish losses, i.e. Informal Fish Loss Assessment Method(IFLAM) which is now called Exploratory Fish Loss Assessment Method (EFLAM), Load Tracking Method (LTM) and Questionnaire Loss Assessment Method(QLAM). These methods have been developed and adopted in many countries especially in Africa (Akande, 2001; Akande and Odogbo, 2001; Akande et. al, 2001a; Akande et.al, 2001b; Diei-Ouadi and Mgawe, 2011; Eyo and Mdaihli, 2001; Ward and Jeffries, 2000).

Based on rapid and/or participatory rural appraisal (RRA and/or PRA), EFLAM is planned and performed to generatequalitative and indicative quantitative data (Conroy, 2002; Ward and Jeffries, 2000).The method is combined with simple interview and discussion as well as on location observation to provide information related to losses and the cause of losses, and an indication of losses figures. However, to obtain more accurate and precise losses data, LTM is the method. This method requires appropriate experimental design, sampling, replication and biometric design to measure the losses. This method is also used to testing and measure interventions as well as efforts to reduce losses.

For assessing key aspects of post-harvest fish losses quantitatively, QLAM is used, especially to generate valid data on many question related to losses. This method is also powerful to validate EFLAM and LTM findings, useful to cover in a wide geographical area (many locations) or communities. The results are useful for decision making and providing more comprehensive information about losses. For monitoring in many location (national monitoring), QLAM is prevailing. Survey with formal questioner is used to generate data for QLAM which is performed by enumerators who interview selected respondents in selected location. By simplifying the questioners to enable enumerators fill the questioners easily; QLAM is more suitable for monitoring purposes.EFLAM is essential for providing key point losses which are then validated by QLAM. LTM is also necessary to find level of losses accurately. Success key for applying QLAM will depend on biomatrix support, experience in planning and implementing survey using a questioner as a tool for collecting the data, database design, and qualified enumerators. The strength of this method is the ability in providing representative data for policy making. Meanwhile, the weakness of this method is data finding which is very much affected by the diversity of fish species, variety of fishing vessel, fishing gear, fishing trip, price and quality different, quality, and others. Focusing on specific species of fish might be able to eliminate the weakness.

Current post-harvest fish losses in Indonesia. Fish losses assessment should be evaluated over the supply chain started from just after the fish is harvested or caught up to consumer. Therefore, ideally the assessment should follow the fish over its supply chain started from fish capture activity (since fish caught until fish ready for unloading in fish landing port), fish landing (started from the fishing vessel harbors in fishing port, the fish unloaded and fish auction completed), fish processing activity, transportation and distribution, fish storage, and fish marketing (Ward, 2014; Ward and Jeffries, 2000;

Wibowo, 2013). So far, the number of post-harvest fish losses used in Indonesia is 30% which has been uses for decades. No more information explains the number.

Information on current post-harvest fish losses in Indonesia is very limited. Evaluating and monitoring post-harvest fish losses had been carried out by the Ministry of Marine Affairs and Fisheries since 2010 to 2012 which were focused in one point of supply chain of fish landing and auction activities (Table 1). National evaluation and monitoring were performed periodically in 33 cities/regencies in 33 provinces (Koeshendrajana, 2013; Wibowo 2013) every two weeks.In this evaluation and monitoring, physical, quality and financial loss were assessed. The results revealed that fish losses in landing port tended to decrease during 2010-2012 from 7.11% in 2010, 6.26 in 2011 and 5.85% in 2012.This could be an indication that improvement on fish handling in the fish landing and auction area was able to reduce fish physical and quality loss (Koeshendrajana, 2013). Unfortunately, this task was discontinued due to some administrative issues.

In addition, fish loss assessments had also been carried out in 2013 to evaluate fish loss in fish processing, especially filleting and boiled salted fish processing in Tegal and Pati, West Java. In this assessment, EFLAM and QLAM were employed to evaluate fish loss. The EFLAM was used to produce qualitative information related to fish loss occurred in the fish landing and processing. Based on this finding, QLAM was planned to generate data for quantitative analysis and calculation (Utomo et al., 2013; 2014) as shown in Table 2 and 3. In this study, post-harvest fish losses were calculated based on physical, quality and financial loss.

In fish landing in Tegal, Central Java, that can be assumed represent fish landing for fish caught and landed in north shoreline of Java Sea, showed a fish loss of 4.05% in 2012. Fish species used for calculation were manyung or giant cat fish (*Netuma thalassina*), squid/common cuttlefish(*Loligo pealii/Sepia oficinalis*),snapper (*Lutjanus altifrontalis*), kurisi or doublewhip threadfin bream (*Nemipterus nematoporus*), kuniran or yellow goat fish (*Upenephelus sephureus),* and stingray fish (*Trygon* sp.). Among the species, kurisi and kuniran were the dominant fishes commonly processed for fillet. Other fishes commonly processed for fillet were demang or purplespotted bigeye (*Priacanthus tayenus*) and coklatan or lattice monocle bream (*Scholopsis taeniopterus*). Table 3 revealed that fish loss in fillet processing was relatively high. This indicated of inappropriate handling and processing resulting in quality loss. Other factor affected the loss were physical as high as 2-3% and quality loss were estimated around 2 – 4% (Utomo et al., 2013).

In processing area in Tegal, Central Java, evaluation on post-harvest fish losses focused on fish fillet processing using kurisi, kuniran, demang and coklatan fish showed average of the post-harvest fish losses of 6.62%. However, this number cannot be used to represent national post-harvest fish losses in the processing area.

Considering the results above, post-harvest fish losses in the two supply chain points of fish landing and fillet processing were 4.05% and 6.62% respectively resulting in total post-harvest fish losses of 10.67%. Post-harvest losses of kuniranfish at fish landing and fillet processing (Table 2, 3) were 5.80% and 5.31% respectively resulting in total post-harvest fish losses of 11.11% in just two points of supply chain. Based on these examplesshowing total post-harvest fish losses from two points of supply chain in between 10-11%, therefore it seems that the 30% of post-harvest fish losses is over estimate. Post-harvest

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fish lossbelow 30% is more reasonable. However, assessing real and current post-harvest fish losses in the supply chain is necessary.

System for evaluating and monitoring post-harvest fish losses in Indonesia. A system for evaluation and monitoring is required to produce comprehensive post-harvest fish losses. The system should meet with the condition of Indonesia fisheries which is very divers at any point of supply chain from capture to utilization.Every location may show variety and diversity. The diversity can be type of fish, type of vessel, type of fishing gears, duration of fishing trip, type of processing and product, and others. Consequently, a suitable system should be developed to explain the situation accured in the fish supply chain fish from capture to consumer.

Table 1. Post-harvest fish lossatfish landing area in Indonesia during 2010 – 2012

No	Provinces	Post-harvest Fish Losses(%)		
		2010	2011	2012
1	NAceh Darussalam	6.20	1.27	10.03
2	North Sumatera	6.65	13.89	10.88
3	West Sumatera	5.26	8.27	9.94
4	Jambi	7.77	10.61	4.70
5	Bengkulu	7.23	9.01	5.94
6	Riau	11.43	7.34	6.92
7	Riau Islands	5.58	5.,41	5.91
8	Bangka Belitung	6.54	3.91	7.68
9	South Sumatera	2.26	1.17	-
10	Lampung	4.27	4.62	5.08
11	Banten	4.35	4.35	8.30
12	DKI Jakarta	-	11.40	9.54
13	West Java (south shoreline)	7.99	7.75	7.75
14	Central Java (north shoreline)	5.94	4.05	4.05
15	DIYogyakarta (south shoreline)	-	1.57	2.38
16	East Java	14.92	13.28	2.11
17	Bali	5.28	-	-
18	NTB	-	5.61	-
19	NTT	3.51	11.07	1.68
20	Central Kalimantan	6.88	3.32	-
21	West Kalimantan	6.96	5.38	6.09
22	East Kalimantan	8.03	5.80	3.83
23	South Kalimantan	5.17	3.97	2.11
24	North Sulawesi	-	-	2.56
25	Gorontalo	8.66	6.77	1.69
26	West Sulawesi	4.01	1.03	10.44
27	Central Sulawesi	4.51	3.55	5.32

28	South Sulawesi	8.39	5.17	7.30
29	South East Sulawesi	-	12.99	9.85
30	Maluku	19.43	9.74	-
31	North Maluku	7.58	4.76	3.74
32	Papua	-	0.81	2.00
Average (National)		**7.11**	**6.26**	**5.85**

Source: Koeshendrajana, 2013

Establishment of methodology. For evaluating and monitoring post-harvest fish losses in Indonesia nationally, QLAM is a suitable. This method should be initiated by EFLAM to evaluate the key point losses, the cause of fish losses, etc. LTM is also needed to measure the level of fish loss accurately. QLAM is then required to cover wider location. The assessment can be focused on physical, quality and financial loss, and market force loss as well if possible. Respondents and enumerators play important role in evaluation and monitoring of post-harvest fish losses. Respondents and number of respondents interviewed should represent the population and be selected carefully. Criteria should be defined; competent enumerators used for interview the respondents should be prepared.

Table 2. Post-harvest fish loss atfish landing port in Tegal, Central Java, 2013

No	Fish Species			Fish Loss Average (%)
	Indonesian Name	Scientific Name	English Name	
1	Manyung	*Netuma thalassina*	Giant cat fish	3,25
2	Cumi/sotong	*Loligo pealii/Sepia oficinalis*	Squid/common cuttlefish	3,69
3	Kakap	*Latjanus altifrontalis*	Snapper	2,28
4	Kurisi	*Nemipterus nematoporus*	Doublewhip threadfin bream	4,16
5	Kuniran	*Upenephelus sephureus*	Yellow goat fish	5,80
6	Pari	*Trygon* sp.	Stingray fish	5,13
Average of Fish Loss				4,05

Source: Utomo et al. (2013 and 2014)

Table 3. Post-harvest fish loss atfillet processing in Tegal, Central Java, 2013

No	Fish Species			Fish Loss Average (%)
	Indonesian Name	Scientific Name	English Name	
1	Kuniran	*Upenephelus sephureus*	Yellow goat fish	5,31
2	Demang	*Priacanthus tayenus*	Purplespotted bigeye	9,53
3	Kurisi	*Nemipterus nematoporus*	Doublewhip threadfin bream	6,73
4	Coklatan	*Scholopsis taeniopterus*	Lattice monocle bream	4,90
Average of Fish Loss				6,62

Source: Utomo et al. (2013 and 2014)

Criteria on location, season, type of fish. In addition to assessment focused on physical, quality and financial losses, criteria should be defined related to location, season and fish type which will be evaluated and monitored. Locations that will be evaluated and monitored are selected to represent other similar location. Overall locations should represent national condition. Besides, it is necessary to do periodical monitoring to show the typical seasonal characteristics of Indonesia fishery. For example, monitoring for every two weeks may be able to show the characteristic high and low season of fish.

Justification on type fish selection is also very important. The fish should not be necessarily one species, but could be two or more than two species. Types of fish which plays important role in national fish consumption can be the one that will be considered. Types of fish can also be selected based on their volume and value. Due to variety in the capture supply chain point, it is also necessary to consider selecting type and size of fishing vessel, fishing gear used, fishing trip, and others.

Respondent. Representative respondents are required to figure the population in each area. The respondent should be well informed about their taskand role in supply chain of fish. For example, respondents for supply chain point of fish capture and landing should be the one who are still active in the activity at least in the last 2 weeks to make sure that they are still remember about their activities.

Enumerator. Enumerators should be prepared to enable them of collecting data. Capacity building through training and supervising can be taken to improve enumerator competency on data collection, executing interview, and others related to post-harvest fish losses assessment. The training and supervision should be given to enumeratorcontinuously and periodically. The number of enumerator should also be considered, for example at least 2 (two) enumerators per location.

Organization. Team in charge and responsible in post-harvest fish losses evaluation and monitoring should be established. A direction from the Minister of Ministry of Marine Affairs and Fisheries may be necessary to regulate and empower the team. In this case, Directorate Generals (DGs) in the Ministry such as DG Fish Capture and DG Fish Processing and Marketing are required to collaborate with Marine and Fisheries Research and Development Agency and Human Resources Agency to develop technical system and provide training, coaching, and supervising to enumerators. In the implementation level, the ministry should involve and relay on Local Government, especially the related agency. Online system should also be considered for data entry and processing.

CONCLUSIONS

Post-harvest fish losses should be evaluated to produce current and representative data. Methodology used for evaluation and monitoring can be EFLAM, LTM or QLAM applied accordingly. Calculation for post-harvest fish losses in the national level may apply QLAM employing physical, quality and financial loss as calculation bases. However, market force loss may be included if possible. The figure of post-harvest fish losses 2010 – 2012 in fish landing supply chain point tend to decrease from 7.11% in 2010, to 6.26% in 2011 and finally 5.85% in 2013. Post-harvest fish losses 2013 in supply chain point of fish fillet processing in Central Java (Tegal) was 6.62%. The figure of post-harvest fish losses of 30% used as reference for decades is over estimated and need to be evaluated. System for evaluation and monitoring post-harvest fish lossesshould be planned soon by accommodating the diversity of Indonesian fisheries characteristic from capture to consumer.

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