

## POSTHARVEST LOSSES OF FISHERIES IN VIETNAM AN OVERVIEW AND SOME SOLUTIONS

### TỠN THẤT SAU THU HOẠCH THỦY SẢN Ở VIỆT NAM – TỔNG QUAN VÀ GIẢI PHÁP

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#### ABSTRACT

*This article aims to provide some information about the current status of postharvest practices in fisheries and aquaculture sectors of Vietnam. Although there has been an improvement in post-harvest technology for the last decade, the investment for the application of the advanced technology in this area is quite limited. Most fishing vessels use mainly crushed ice or salt for fish preservation in wooden storage cellars during catching trips usually for a long time. Plastic bags or unstandardized trays are the main containers for the catch. These preservation methods cause the rate of fishery postharvest losses as high as 20% at the present. Some major reasons of this situation are pointed out, such as conservative old practices, lack of incentive policy for the postharvest investment and a shortage of technological training for the fishermen and involved people. The paper also introduces some advanced techniques, including the use of standard insulated containers, CSW system or slurry ice, that can be applied for treatment and preservation of the catch in order to minimize the postharvest losses.*

**Keywords:** fisheries; aquaculture; postharvest; loss; techniques.

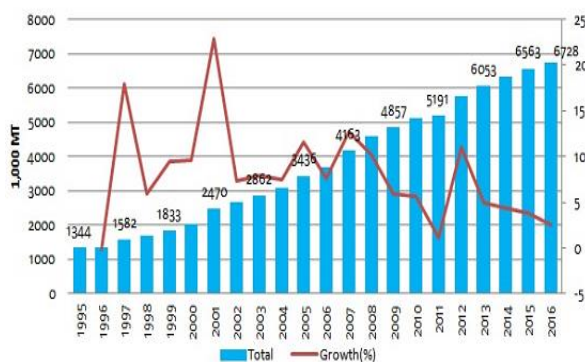
#### TÓM TẮT

*Bài báo nhằm cung cấp một số thông tin về hiện trạng bảo quản sau thu hoạch trong đánh bắt và nuôi trồng thủy sản ở Việt Nam. Mặc dù công nghệ sau thu hoạch trong một thập kỷ qua đã đạt được nhiều tiến bộ, việc đầu tư ứng dụng các công nghệ tiên tiến trong lĩnh vực này vẫn còn rất hạn chế. Hầu hết các tàu cá chủ yếu sử dụng đá xay sẵn hoặc muối để bảo quản hải sản. Cá sau đánh bắt thường được bảo quản trong túi nilon hoặc khay nhựa phi tiêu chuẩn bằng cách chất đóng trong các hầm tàu bằng gỗ trong suốt chuyến biển dài ngày. Các cách thức bảo quản này dẫn tới tỷ lệ tổn thất sau thu hoạch trong nghề cá hiện tại lên tới 20%. Những nguyên nhân chính của tình trạng này bao gồm sự bảo thủ theo tập quán, thiếu chính sách khuyến khích đầu tư phát triển công nghệ bảo quản mới và chưa chú trọng việc đào tạo về kỹ thuật bảo quản thủy sản cho ngư dân và những người liên quan. Bài báo cũng giới thiệu một số kỹ thuật tiên tiến, như sử dụng thùng chứa bảo ôn chuyên dụng, hệ thống CSW hoặc băng tuyết mà các nước phát triển đang ứng dụng nhằm giảm thiểu tổn thất sau thu hoạch.*

**Từ khóa:** khai thác; nuôi trồng thủy sản; công nghệ; tổn thất; sau thu hoạch.

## 1. INTRODUCTION

With the advantage of more than 3000 km coast-line and many large river basins Vietnam has a long fishery tradition. Nevertheless, due to historical, political, and economic situation, in the past fisheries and aquaculture were considered as a junior section in the country's economy; per capita gross domestic product earnings of the region's fishing communities were below the average for the whole country. Nowadays, however, Vietnam has emerged as one of the leading countries in aquaculture production and sea-food export, which provides livelihoods for more than 4 millions of people and significantly contributes to development of the country (4-5% GDP). As shown in figure 1, in 2016, the total Vietnam fishery production was estimated more than 6.7 million tons (nearly double compared to that of 10 years ago), in which aquaculture production was 3,65 million tons, occupied 54 % of the total. The value of fisheries export has reached 7 billion USD, equivalent 25% that of the total agricultural products.



**Figure 1.** Vietnam fisheries production  
(Courtesy of VASEP)[1]

Accompanied with the increase in production, the requirement from the markets on food safety and high standard in quality, especially for sea-food exported products, has pushed the fishery activities to keep a special attention on application of post-harvest

technology to the industry. In recent years, with the supports from international cooperation programs, fish quality from Vietnam has been significantly improved, mainly of sea-food products for exportation. However, there are many problems relating to the postharvest practices, especially for domestic fishery market, need to be solved to make the fisheries as efficient and sustainable as those in developed countries.

## 2. CURRENT STATUS OF FISH PRESERVATION PRACTICES IN VIETNAM

According to a report from the Fisheries Agency, it is estimated at present Vietnam has around 125,000 fishing vessels with the total power capacity around 10 million CVs (HP). Depending on power capacity, they can be classified into two groups: off-shore and in-shore. Around 25,000 vessels (20 % of the total) belong to the off-shore group which have engine power more than 90 CVs/each. This is a big change compared to the figure of 10 years ago when the group occupied only 10% of the total [2].

Although there are some vessels using advanced technology for fish catching and preservation, most of fishing boats in Vietnam are made of wood with poor equipment for fish preservation [3]. Only 9% of the off-shore vessels use foam P.U. for thermal insulation of storage cellars;

In the last decade there has been an improvement in post-harvest techniques introduced by institutions through different projects. However, the application of those techniques is limited. Due to conservative old practices and the lack of incentive policy for the investment in the postharvest technology, the methods and equipment used for fish preservation on both vessel groups are still quite simple. Methods to preserve fish boats

are mainly using crushed ice prepared on shore before fishing trips. Very few vessels are equipped with freezers on board. Nowadays, the facilities for fish preservation are mainly wooden storage cellars using crushed ice to keep fish in low temperature [4]. Many boats still use plastic bags during fishing trips which sometimes prolong many weeks. Only high value fishes are kept in plastic trays. Some small boats still use cure methods (salted) in fish preservation, so that the products are only sold domestically or used to produce fish-sauce. Most of the fishermen haven't been trained for the knowledge of food preservation that usually leads to incorrect fish handling and lack of control on fish quality.



**Figure 2.** Fishing boats in Phu Quoc island  
(Courtesy of Viet-travel Co.)



**Figure 3.** Fish sorting on board  
(Courtesy of MARD)

The catching method also plays an important role in the fish quality. Some methods harmfully impact on the catch. Many fishes die for a long time before getting on

board if some kinds of seine are used improperly (e.g. too slowly drawing speed), while hook and line fishing usually gives high quality caught fish.

There are also difficulties in distribution, sorting and consumption of the catch. Delays in distribution and transport lead to significant deterioration in quality prior to processing or sale at markets. A large proportion of the catch after some days being stored on those vessels has quality just only suitable for production of fish meal.



**Figure 4.** Fish packing on board for storage.  
(Courtesy of MARD)



**Figure 5.** On a fishing port [5]

In addition, the handling facilities and preservation practices do not match the seasonal capture. In the main season, fishes are caught in a large quantity. However, because of lacking good facilities for preservation and distribution, the fish price falls and a large volume of trash fish is reduced its value or even discarded as manure [6]. In the off-season, the price increases, but fishermen do not have

fish or fish products for sale. Moreover, during this period they are out of work, and their lives suffer many difficulties.

In aquaculture, the conditions for fish quality are more advantageous compared to that in capture. There are more than 1 million ha of ponds for aquaculture spreading on the whole country with various methods and species cultured. Fortunately, most fish/shrimps are usually harvested and transported to processing plants not more than 2 days, except for some farms in some remote areas. Within the period of time, fish quality may be maintained in good condition. Problems in this area are only confined in the improper handling practices of farmers during harvest, and dealers during transport and preservation. If fish is treated incorrectly it can be downgraded within a day. That causes significant losses to the farmers, even the fish/shrimp can be rejected. Among the faulty actions are as follows:

- Using improper harvesting methods that leads the fish/shrimp affected by heavy body damage, intrusion of dirt into the fish before being treated;
- Careless treatment before storage: incorrect way of killing, improper gutting and washing, packaging;

- Incorrect handling during storage and transportation (use of poor quality ice or improper icing process, Fish temperature fluctuated during preservation, or leaving the fish untreated at normal temperature for a long time after harvested).
- Use of unsuitable preservatives or additives (at present, Vietnamese authority strictly impose regulations on this matter to comply with the international requirements).

These factors lead to the fish deteriorated quickly even in a short time, or they may affect the sensory quality, such as colour, flavour or texture. As results, the value of fish and profits from aquaculture and fishing are fallen down seriously.

In Vietnam there have been very few reports on fish post-harvest losses from poor quality and discarded fish. According to an investigation conducted by RIA2 (Research Institute for Aquaculture No.2) in Kien Giang province (one of the major provinces of fisheries) on 10 fishermen and 12 farmers, the ratio of post-harvest losses is around 20 – 28 % in fisheries capture and 10 - 15 % in aquaculture. This estimation is illustrated in the following table.

**Table 1.** Post-harvest losses in different cases:

Parameters	Captured Shrimp (trawling)	Cultured giant fresh water shrimp	Anchovy (purse seine)	Mackerel (line fishing- 3 days trip)
a. Mean production (kg/trip or ha)	542	415	8560	325
b. Total sold value (VND)	48888000	48322000	39376000	30062000
c. Physical loss (rejected fish) %	6.5	1.2	2.5	0.5
d. Mean price of high quality (VND/kg)	120000	130000	8000	100000
e. Low quality loss (low price) %	55	35	70	35
f. Mean price for low quality (VND/kg)	80000	100000	5000	70000
g. Mean loss %	24.8	9.3	28.7	11.0

The mean loss is calculated as follows:

$$g = (a.d - b)/(a.d)$$

The above figures do not include losses due to processing and consumption. Duration for one fishing trip was from 5 days to 12 days, for cultured shrimp harvest within 2 days. As shown in the table, the loss is not only dependent on the length of trip but also on the captured species and the ways of preservation.

Up to now, there has been an improvement in quality control of fish production for export. However, for the local market that consume more than a half of the production, the application of post-harvest technology is still neglected that causes significant losses in the fisheries sector.

### 3. SOME ADVANCED TECHNIQUES FOR FISHERY POST-HARVEST PRESERVATION

#### 3.1 Use of new types of containers

Instead of investment on building insulated storage cellars, fishermen should preserve the catch in standard insulated containers.

As mentioned above, almost fishery extension activities in Vietnam have focused on persuade fishermen to apply foam P.U. technology for insulation of fish storage cellars. However, according to a survey of MARD, nearly 90% of the fishermen are not willing to invest in these facilities. The reasons are not only because the cost of storage cellar insulation unaffordable, but also the efficiency of the investment has not been clear enough to attract the investors.

Meanwhile in developed countries such as USA or EU, fishermen prefer to use standard insulated containers (e.g. Saeplast) for storage of the caught (**figure 6**). This method has been proved more effective, versatile and

comfortable compared to using storage cellars as fixed containers (**figure 8**). Using standard insulated containers, the fish can be continuously kept cold in the containers during the fishing trip until being processed. However, to apply the techniques, it is necessary to research for types of containers suitable for different species and different conditions in Vietnamese fish vessels.



Figure 6. Standard insulated containers (Courtesy of Seaplast Co.)



Figure 7. Containers moved to a fishing port (Courtesy of Seaplast Co.)



Figure 8. Fish bags stored in a cellar [5]



**Figure 9.** *Insulated containers in a cellar*  
*(Courtesy of Seaplast Co.)*

### 3.2 Application of chilling sea water (CSW) for fish postharvest treatment

According to different studies [7-8], using CSW as a cooling medium in certain fisheries has a number of advantages: greater speed of cooling, reduced pressure on the fish, quicker handling of large quantities of fish with little delay or labour involvement. Small fish species cooled quickly if properly handled with a CSW system. Studies have shown that the chilling rate for herring can be from 15 °C to 0 °C within two hours. Effective water circulation to ensure the uniform temperature depends on fish size and forms. Using this method, fish is undisturbed until processing and easily unloaded. In contrast, salt uptake may happen during storage. Therefore, CSW systems have been successfully used where the disadvantages of salt uptake are not important, so comparatively long periods of storage are possible. This method is suitable for pre-treatment and preservation of large fishes (e.g. tuna, swordfish,) or small pelagic fatty species (herring).

### 3.3 Use of slurry ice for fish preservation

Slurry ice (fig. 10) is created when water (with a depressant, e.g. salt, ethylene glycol, alcohols ...) is frozen and stirred

simultaneously, so that the ice is produced in the form of tiny spherical crystals (typically 0.1 to 1 mm in diameter, also called nano-ice). According to Mallikage [8] slurry ice has greater heat absorption compared to single phase refrigerants, because the melting enthalpy (latent heat) of the ice is also used. Owing to its small spherical crystals, it has greater heat transfer area than other types of ice and has good flow properties, easy to be pumped through piping systems, direct contact chilling applications, greater surface contact, flow freely around the entire product. Those properties lead to much faster cooling than other traditional forms of ice (flake, block, shell, etc.).

In addition, slurry ice provides better fish protection, because of smooth, round crystals do not damage product, unlike other forms of ice. Slurry ice has been proved as the best medium for fish cold preservation in the developed countries.

It is ideal for fish preservation when the slurry ice is used to keep the catch in standard insulated containers during the fishing trips.



**Figure 10.** *Slurry ice for fish preservation.*[8]

### 3.4 Application of advanced management:

- Provide suitable logistic services to fishermen;
- To strengthen the connection between research activities and the fisheries

industry, so that R&D projects become more effective and practical. It may create a network connecting the research institutions, fishery companies, farmers/fishermen in which the results from research will be used directly for profits of the industry and in return financial support for research will be enlarged.

- Provide training courses of postharvest technology to enhance professional skill level of Vietnamese fishermen, farmers and others involving with fishery post-harvest activities, their awareness to the importance of fishery quality control and environment protection.. A rapid biosorption occurs within the first 10 min. The biosorption equilibrium is completely obtained after 30 min. Therefore, 30 min of contact time is chosen as the optimal contact time.

#### 4. CONCLUSIONS

Vietnam fisheries and aquaculture has been rapidly developing during the last decades. The total fisheries output has increased steadily from 1500 MT in 1996 to excess 6700 MT in 2016. Meanwhile the postharvest losses is currently estimated around 20% [9], that lead to the fact that the seafood export value (around 7 billion USD) does not meet its production. In order to obtain the targets of the year 2020 when fisheries output will reach 7000 MT but the export value will have to reach 11 billion USD, fisheries sector need to improve the efficiency of its production, through application inclusive measures, including technical and management solutions in order to reduce the postharvest losses to as low as 10%, as the suggestion from the goal of the MARD pointed out in the decision 1445/QĐ-TTg of the government.

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