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Preliminary Study, Risk Analysis and HACCP in Cold Chain System, Frozen Yellow Fin Tuna in Moluccas

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Abstract

The differences In cold chain system, Risk analysis and Hazard Analysis and Critical Crisis Point(HACCP) is a procedure for the identification, assessment and control of hazards in, and indirectly risks from, food. HACCP procedures focus on chemical, physical and microbiological hazards, Yellow Fin Tuna is the one of the most superior export fishery product of Moluccas, based on paper review and field observation in Molucass, this paper is a preliminary study to development HACCP framework of frozen Yellow Fin Tuna in Moluccas.

Keywords: Cold Chain System; Risk analysis and HACCP; Yellow Fin Tuna

1. Introduction

There are five main species of tuna; skipjack, yellowfin, bigeye, albacore and bluefin, global trade in all tuna materials and products has increased in the last 30 years. In 1976 just over 425,000 tonnes of tuna, with a value of US$391 million, was imported globally. By 2006 these figures had grown to over 1.8 million tonnes of tuna with a value in excess of US$3.6 billion.*(seafish.org,2009)*

Tuna production growth in Indonesia in the period 1989 - 2006 reached 4.74% per year with the export volume of 5.21% per year. Tuna export value in 2008 ranks second after the shrimp. Total production of the national tuna until October 2008 reached 130,056 tons with a value of 347.189 million USD, *(ministry of maritime affairs and fisheries RI, 2007).*

The potential of fish resources in Maluku is large enough that distributed in the Arafura Sea (792 100) tons with sustainable potential 633,600 tons / year), the Banda Sea (248 400 tons with sustainable potential 198,700 tons / year), and the Maluku Sea and surrounding areas (587 000 with the potential for sustainable 469,500 tons / year), while exports of frozen fish from Maluku for 2003 to 2007, only recently ranged from 220 570 tons - 321,885 tons *(Moluccas in number 2008)*, this means that export opportunities are great potential in the era of globalization and free trade now. If this sector is driven optimally, will greatly encourage local revenue.

This globalization of fish trade, coupled with technological developments in food production, handling, processing and distribution, and the increasing awareness and demand of consumers for safe and high quality food have put food safety and quality assurance high in public awareness and a priority for many governments*(Lahsen ababouch,2006)*

There are many factors that influence, but fundamental factor are: fulfillment quality standard and safety to consumed of international requirements and regional from importer countries. To guarantee this fulfillments requirement are needed adequate cold chain system.These issues make the development of cold chain system model for the prospects of development fishery and marine product exports of Indonesia especially frozen fish become important and strategic*(grasiano.W.L,et al,2010).*

In cold chain system ,Risk analysis and Hazard Analysis and Critical Crisis Point(HACCP) is a procedure for the identification, assessment and control of hazards in, and indirectly risks from food. HACCP procedures focus on chemical, physical and microbiological hazards. The number of cases of detention of tuna products in overseas markets between 2004-2006 can be seen in Table bellow**.**from the table, majority of turned out to reject cases, caused by histamine and heavy metal

Table 1. Detention cases of indonesian tuna products in international the market

Parameters	Year			Fisheries Commodity	Specific Compound
	2004	2005	2006		
Vetenary drugs	10	5	9	Shrimps,	Nitrofuran, Chloramphenicol
				Catfish	Malachite green
				Chanus Chanos	Malachite green
				Eel	Malachite green + Cristal Violet
				Milkfish	Malachite green
				Tilapia	Malachite green
Histamine	21	3	5	Tuna	-
Heavy metal	20	4	17	Swordfish, Tuna, Cuttlefish, Lobster, Shark, Butterfish, Marlin	Cover by develop knowledge through monitoring
CO2	4	21	3	Tuna	-
				Tuna	TPC
				Goatfish	Salmonella

(source: *Notification of RASFF of Indonesian Fishery roducts by EU Commission 2004 – 2006)*

In cold chain system, Risk analysis and Hazard Analysis and Critical Crisis Point(HACCP) is a procedure for the identification, assessment and control of hazards in, and indirectly risks from, food. HACCP procedures focus on chemical, physical and microbiological hazards.This problem triggers a manufacturer of fishery products including frozen yellow fin tuna exporter continue trying to fulfill the standards required both regional standards of export destinations and international standards (FAO, WHO.WTO).

Habitat biochemical products will also affect the hazard / risk aspect (biological aspect, the chemical aspect, physical aspect) so that the stages in the cycle that are considered critical cold chain will also vary depending on the product, resulting in a model approach to Risk Analysis and Hazard Analysis Critical Crisis will also be different. This paper is a preliminary study for the development of HACCP Yellow fin tuna in the Moluccas

2. Methods

This paper based on research literature,paper review and Field observations in Molucass

3. Result and Discussion

3.1 Concept of Risk Analysis

In general terms, risk is the potential occurrence of unwanted, adverse consequences associated with some action over a specified time period**.** Risk is the possibility that a negative impact will result from an action or decision and the magnitude of that impact. Workshop on Understanding and Applying Risk Analysis in Aquaculture, held in Rayong, Thailand from 8–11 June 2007, were find Seven “risk categories” have been identified in previous expert discussions, specifically at the FAO/Network of Aquaculture Centres in Asia-Pacific (NACA) :

- Pathogen risks
- Food safety and public health risks
- Ecological (pests and invasives) risks
- Genetic risks
- Environmental risks
- Financial risks
- Social risks

To more clearly,See table 2 and figure.1.bellow,

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Table 2. Relationship between the seven risk categories and relevant frameworks

Framework	Pathogens	Food safety and public health	Ecological (pests and invasive species)	Genetic	Environmental	Financial	Social
FAO/WHO *Codex Alimentarius*		X					
Convention on Biodiversity (CBD)	X		X	X	X		X
International Plant Protection Convention (IPPC)	X		X	X	X		
World Health Organization (WHO)	X	X	X				
OIE *Aquatic Animal Health Code*	X		X				
WTO *Agreement on Sanitary and Phytosanitary Measures*	X	X	X	X	X		
FAO *Code of Conduct for Responsible Fisheries* (CCRF)	X	X	X	X	X		
ICES *Code of Practice on the Introductions and Transfers of Marine Organisms*	X	X	X	X	X		

Risk category	Hazard to aquaculture	Hazard from aquaculture
Pathogen risks	Disease outbreak causing loss of stock OIE-listed disease Food safety and public health concern Loss of consumer confidence	Disease outbreak in wild populations OIE -listed disease Food safety and public health concern
Food safety and public health risks	Bacteria Viruses Parasites Residual therapeutants Biotoxins (HABs)	Transfer of pathogen from aquaculture facility to wild Residual therapeutants
Ecological (pests and invasives) risks	Pest outbreak causing fouling Pest outbreak competing for space Pest outbreak predating on adult or juvenile stock	Escape of adult or juvenile stock into wild Release of non-target hitch-hiker into wild Release of species as /or associated with feed stock (e.g. microalgae, pathogens)
Genetic risks	Not applicable	Genetic introgression Loss of local adaptation Loss of locally adapted populations
Environmental risks	storm activity (including flooding) Predation Competition for food	Organic loading Inorganic loading Residual heavy metals Residual therapeutants Physical interaction with marine life Physical impact on marine habitat
Financial risks	Changing production costs Reduced production Equipment failure Poor quality broodstock Market demand fluctuations Increased regulatory costs	Volatility in the aquaculture industry affecting economy Global market instability Changes in transport costs due to "carbon-miles"
Social risks	Industrial action Skill shortage Civil unrest Excessive regulation	Poor workplace conditions Use of technology that replaces labour Pollution from farm Poor quality product Loss of resource access due to farm site

Figure 1. List of aquatic animal diseases notifiable to the World Organisation for Animal Health, 2009

To guarantee this fulfillments requirement are needed adequate cold chain system.These issues make the development of cold chain system model for the prospects of development fishery and marine product exports of Indonesia especially frozen fish become important and strategic*(grasiano.W.L,et al,2010)*

3.2 The Risk Analysis Process

Risk analysis is frequently used by decision-makers and management to direct actions that potentially have large consequences but also have a large uncertainty. Risk analysis is a structured process for determining what events can occur (identifying hazards), analyzing the probability that the event will occur (determining likelihood), assessing the potential impact once it occurs (determining consequence), identifying the potential management options and communicating the elements and magnitude of identified risks.

In simple terms, risk analysis is used to determine the likelihood that an undesired event will occur and the consequences of such an event. This is generally developed in a repeatable and iterative process (MacDiarmid, 1997; Rodgers, 2004;OIE, 2009) where we seek answers to the following questions:

• What can occur? (*Hazard identification*)

• How likely is it to occur? (*Risk assessment*: likelihood assessment through release assessment and exposure assessment)

• What would be the consequences of it occurring? (*Risk assessment* :consequence assessment and risk estimation; risk management: risk evaluation); and

• What can be done to reduce either the likelihood or the consequences of it occurring? (*Risk management*: option evaluation, Implementation,Monitoring and review).

3.3 Hazard Analysis Crisis Control Point (HACCP)

In the UK, the Food Safety (General Food Hygiene) Regulations 1995 implemented the European Union Directive 93/43/EEC relating to food hygiene. This places the emphasis for food safety activities on the identification of the critical operational steps and findingways of controlling them.The approach is defined in terms of five principles, developed according to HACCP:

1. Hazard analysis of given foodstuff,
2. Identification of all points or operation steps at which hazards may occur,
3. Identification of points critical to food safety (i.e.,CCPs),
4. Implementation of control and monitoring procedures at CCPs, and
5. Periodic review of food hazards, CCPs, control and monitoring to ensure continued effectiveness.*(Karl Ropkins)*

From the review that there are some thoughts on paper so important about haccp among them : As an approved valid food safety management system for lowering microorganism, Hazard Analysis and Critical Crisis Point (HACCP) system has been spread by FAO and WHO to help consumers obtain safety food

We have made good progress on our food safety strategy, which is based on the principles of preventing food safety problems, ensuring that industry and government are carrying out appropriate roles and responsibilities, and ensuring that we focus our regulatory activities on the most critical food safety risks*(Thomas J. Billy,2002)*

Well designed and structured premises with well designed and reliable equipment, will help in protecting ingredients and food products, maintaining hygienic conditions, improving cleanliness and cleaning efectiveness and controlling pest infestations. The design and layout of factories and equipment, is also important to eliminate, prevent or control hazards (e.g. temperature- or pressure-controlled areas) and reduce the amount of CCPs by efective control of the plant environment. However, food premises with congested and unhygienically designed food preparation rooms are frequently found *(Has ҫi ҫek et al., 2004).*
Conducted a national study and found three types of barriers: resource management, employee motivation, and employee confidence. Employees are nervous about taking food safety certiWcation examinations and often are not comfortable with the change needed for implementation of a program like HACCP *(Giampaoli et al.2002)*
Found that Indiana school foodservice managers identified time to establish a HACCP program, time to run the program, and labor costs as being the three biggest obstacles. In addition, "lack of training funds, time to get used to running the HACCP program, and union problems" were other identified obstacles *(Hwang, Almanza, and Nelson ,2001)*
During the last three decades, HACCP has been progressively introduced and applied for the benefit of food industry Panisello & Quantick, 2001). The system can be considered as an efficient tool for both industry and health authorities to prevent foodborne diseases if it is based on understanding and proper implementation, because it is not HACCP system itself which makes food safe, but its correct application *(Motarjemi & K äferstein, 1999).*
In generally Process flow Diagram of Frozen Yellow Fin Tuna in Molucass can be see from figure 2 bellow:

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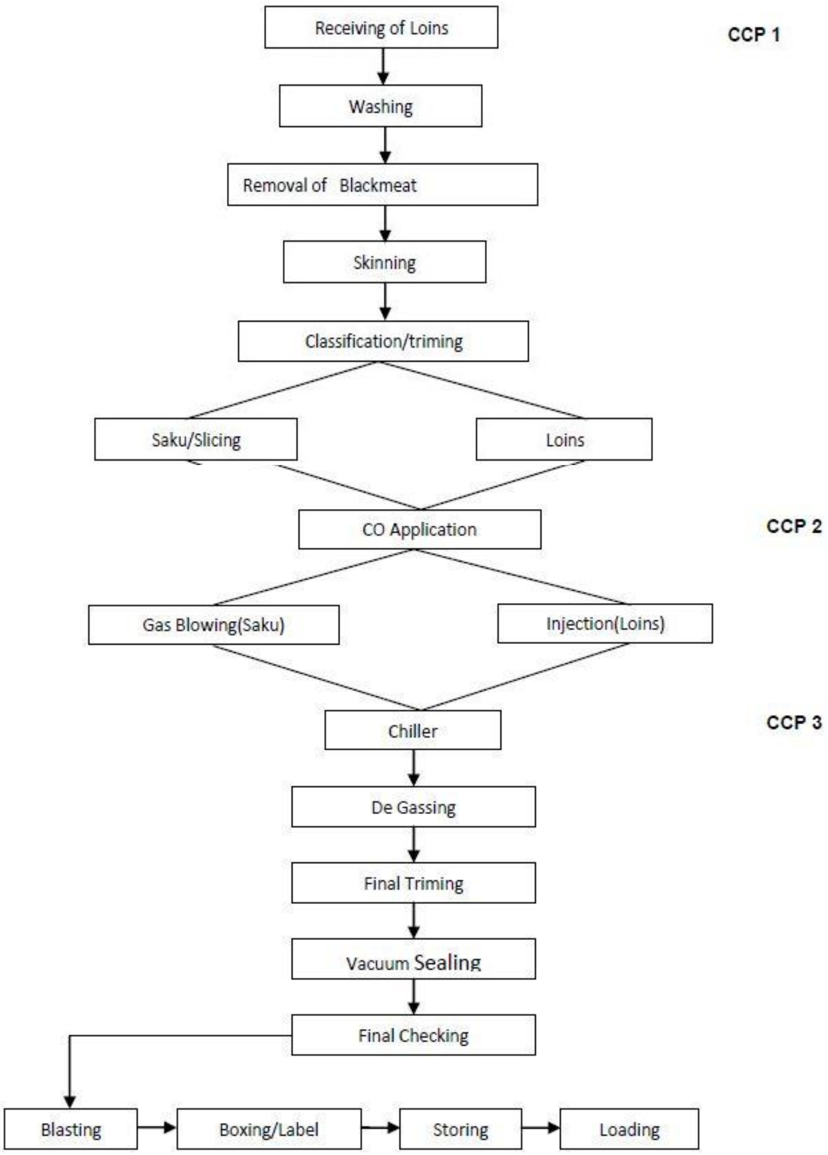

Figure 2. Process Flow Diagram Fresh-Frozen CO treated Yellow Fin Tuna n it's CCP
(source : result of field studi)

Based on figure 2, we can find three Crisis Control Point(CCP):

CCP 1, quality of loins wich received very influential in the next process, a failure at this stage can cause to fish will be reject (suppliers delivered quarter loins with plastic in the plant by placing it in astyro box with adequate supply of ice ,Temprature is maintained $0^0 – 4{,}4^0$ C as required.

CCP 2, in CO Application process(these product are then segregated and arranged per item/line before placing inside the chiller.their are blown with CO only so as not to disintegrated the meat).

CCP 3, in chiller process(All product are then arranged inside the chiller and placed with production dates for traceability after curing,chilled/cured, the product for a maximum 48 hours to allow the carbon monoxide penetration.

Another hand,from field observations on fishing vessels, general process of Tuna fish handling on the ship,can be seen on figure.3 bellow,

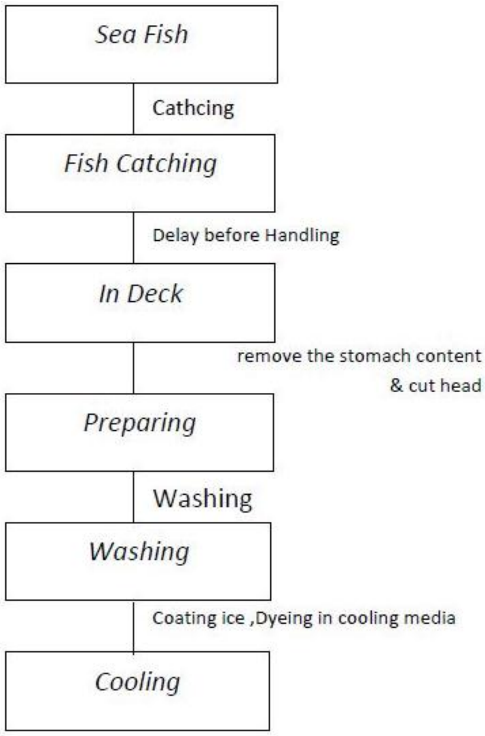

Figure 3. Handling Process in Fishery Ship (source: result of field study)

Figure 3 show, handling process on the ship, greatly effect to the quality of fish, especially in Crisis Control Point(CCP) 1(figure 2), to minimize the hazards ,table 3 below can see some point in the main hazards and actions that must be taken. Minimize the hazards will be improve the quality of tuna to be received

Table 3. Some point in the main hazards and action that must be taken to minimize CCP 1

MAIN HAZARDS	ACTIONS MUST BE TAKEN
• Long time in nets • Physical damage	• Improve fishing practices
• Direct sunlight,wind,heat • Fish Drying • The pressure in the heap of fish a lot	• Keep the fish stay cool and protected • Avoid a lot heap
• Spending the stomach contents and cutting fish head are bad	• improvement by training
• Heating • Delay • disturbances in machine	• fix the washing technique • Enchance training
• incorrect handling of cooling	• Add more ice • Perfected equipment • Enchance training

Besides the first critical control point CCP1 have explained above, there are still some of the following points in the process flow diagrams that are considered critical are:

From the results of studies litaratur and process flow diagrams, there are some important things to note in developing HACCP frame work of the Yellow Fin Tuna in Maluku:

1. HAACP Team Composition, Product Description,Description of utility usage, Development of production process diagram /Flowchart,Confirm the location of the job. }
2. Good Manufacturing Practices(GMP) : Building and Facilities,Grounds,Plant construction and Design,General Maintenance,Pest Control,Sanitation and Food Contact Surface,Toilet facilities, handwashing, waste disposal)
3. Equipment and Utensils
4. Production and Process Control : Raw Material and Other Indigreients,Manufacturing Operations,Cold Stored,Warehousing and Container Shipping
5. Sanitation Standart Operating Procedure

Relevant institutions and laboratories were identified regarding four main responsibilities for which the commitment of government is vital (food policy, risk assessment, legislation, public authorities),recommended that industry stakeholders: review the above developments and identify key risk areas and identify opportunities to influence and so mitigate risk areas

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Reference

Ayçiçek, H., Sarimehmetoglu, B., & Çakiroglu, S. (2004). Assessment of the microbiological quality of meals sampled are the meal serving units of a military hospital in Ankara, Turkey. *Food Control*, *15,* 379-384. http://dx.doi.org/10.1016/S0956-7135(03)00101-4

Fazil, M. A. (2005). A primer on risk assessment modelling: focus on seafood products, fisheries technical paper 462, FAO, Rome.

Giampaoli, J., Sneed, J., Cluskey, M., & Koenig, H. F. (2002). School foodservice directors' attitudes and perceived challenges to implementing food safety and HACCP programs. The *Journal of Child Nutrition & Management*, *26*(1). http://docs.schoolnutrition.org/newsroom/jcnm/02spring/giampaoli1

Hwang, J. H., Almanza, B. A., & Nelson, D. C. (2001). Factors influencing Indiana school foodservice directors/managers' plans to implement a hazard analysis critical control point (HACCP) program. *The Journal of Child Nutrition & Management*, *25*(1), 24-29

Lahsen Ababouch, (2006). Assuring fish safety and quality in international fish trade, *International Journal Marine pollution Bulletin*, *53***,** 561-568. http://dx.doi.org/10.1016/j.marpolbul.2006.08.011

Lailossa,G. W., Artana, K. B., & Dinariyana, A. A. B.(2010).Cold Chain System (future research prespective), 2nd International Seminar on Applied Technology Science and Arts-APTECS ITS,pp.23 ,Surabaya,ITS. available at, http://aptecs.its.ac.id/2010/paper/Proceeding%20APTECS%202rd%202010.pdf

Melba. G. B. R., Arthur, J. R., & Subasinghe, R. P. (2008). Understanding and applying Risk Analysis in Aquaculture, Fisheries and Aquaculture Technical Paper 519, FAO,Rome

Motarjemi, Y., & Käferstein, F. (1999). Food safety, HACCP and the increase in foodborne diseases: A paradox? , *Food Control Journal, 10,* 325-333. http://dx.doi.org/10.1016/S0956-7135(99)00008-0

Murat, B., Mariye, Y., & Tufba, Ç. (2007). Dificulties and barriers for the implementing of HACCP and food safety systems in food businesses in Turkey, *Food Control Journal, 18,*124–130. http://dx.doi.org/10.1016/j.foodcont.2005.09.002

Panisello, P. J., & Quantick, P. C. (2001). Technical barriers to hazard analysis critical control point (HACCP). *Food Control Journal, 12*(3), 165-173. http://dx.doi.org/10.1016/S0956-7135(00)00035-9

Samira, S., Gilles, S., & Patrick, G. (2010). A Swot analysis of HACCP implementation in Madagascar, *Food Control Journal, 21*, 253-259. http://dx.doi.org/10.1016/j.foodcont.2009.05.015

Thomas, J. B. (2002). HACCP–a work in progress, *Food Control Journal, 13*(6-7) 359-362. http://dx.doi.org/10.1016/S0956-7135(01)00026-3

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