

Report on the On-site Training for the Handling of Tuna on Board Handline Bancas

10 – 11 December 2008
At Philippine Fisheries Development Authority Complex,
General Santos City, the Philippines



National Marine Fisheries Development Center,
Bureau of Fisheries and Aquatic Resources (BFAR)

Southeast Asian Fisheries Development Center

TD/RP/125



Report on the On-site Training for the Handling of Tuna on Board Handline Bancas

10 – 11 December 2008

At Philippine Fisheries Development Authority Complex,
General Santos City, the Philippines

Background:

General Santos city is known as tuna capital of the Philippine. The total daily catch of tuna landed in the city is more than any other fishing port in the country. This is due to General Santos city located near the tuna-rich fishing grounds including the Moro Gulf, Sulu Sea, Mindanao Sea and adjacent Celebes sea. Local fisherman mostly uses only handline to catch adult tuna at 80-200 m deep nearby FADs on board small Bancas boat (Fig.1). Many Yellowfin and Bigeye tunas are caught and landed at the port of General Santos, however the landed tuna quality is one of the main problems. It is reported that more than 70% of tuna landed in General Santos are low quality and are able to serve as sashimi grade. This is because of tuna handling and preservation technique on board fishing vessel are insufficient.

To support tuna handliner and its industry in General Santos, Bureau of Fisheries and Aquatic Resources (BFAR) requested SEAFDEC to provide training on appropriated tuna handling and preservation technique to local fisherman, fishing boat owner and local officer concerns. Therefore SEAFDEC under Japanese trust fund (JTF208-C203, Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses) proposed to organize the On-site Training for the Tuna Handling on Board Handline Bancas in the General Santos City.



Fig. 1 Tuna handline Bancas boat

Activities brief:

The On-site Training for the handling of Tuna and preservation techniques on board fishing vessel was co-organized during 10 to 11 December 2008 at Philippine Fisheries Development Authority (PFDA) Complex, General Santos City by SEAFDEC/TD, National Marine Fisheries Development Center of BFAR led by Dr. Alma C. Dickson in cooperation with PFDA led by Mr. Paris Y. Ayon. There are 44 participants including caption of fishing boat, fisherman, fishing boat owner, buyer, university student and fisheries officer (table 1).



Fig. 2 Group photo.

Training schedule is shown in table 2. On 10 December 2008, Mr. Paris Y. Ayon representative of PFDA in General Santos city welcomed all participants following by the message from Mr. Sani A. Macabalang, Regional Director, BFAR XII and presentation of SEAFDEC staffs for the Tuna handling and preservation technique (annex I to III).



Fig. 3 In the lecture room

On 11 December 2008, all participants went on board Bancas boat to observe unloading of tuna activity at the PFDA complex. Fishing boat owner and captain was interviewed for the current fish handling and preservation method. Figure 4 shows step of unloading tuna from Bancas boat until it is ready for transportation.



1. Pull tuna from chilling hold 2. Clean tuna using sea water 3. Carry from boat to port by man power



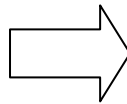
4. Weigh



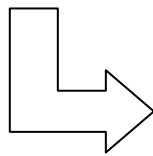
5. Grading by certifier



6. Gutting and removing intestine



To local market



To oversea market



Fig. 4 Tuna landing step

In the afternoon, there is a discussion among participant and fish handling expert for the key point of current handling and preservation technique that reduce the fish quality and constrain of tuna fisheries industry system in General Santos. Then fish handling expert from SEAFDEC and Regional Director, BFAR XII propose solution to improve the quality of Tuna. The training was then end with certificate session.

Weak point of current fish handling and preservation technique from observation and discussion

- Tuna was chilled by ice that is not well mixed. Most of the ice floats at the surface. Therefore temperature in the chilling hole may is not low enough to maintain good quality tuna meat.
- Size of ice in the chilling hole is too big. The fast reduce of tuna body is not possible.
- Fisherman use only chills for preservation. Too long time in the chilling hole, water will absorb to tuna meat.
- Pulling tuna from chilling by manpower is cause of scratch on tuna skin.
- No Bleeding, gutting and removing intestine onboard.

Recommendation for improvement

1. To improve circulation in the chilling hole, the submersible pump should be installed
2. To reduce ice size, portable crushed Ice machine should be used.

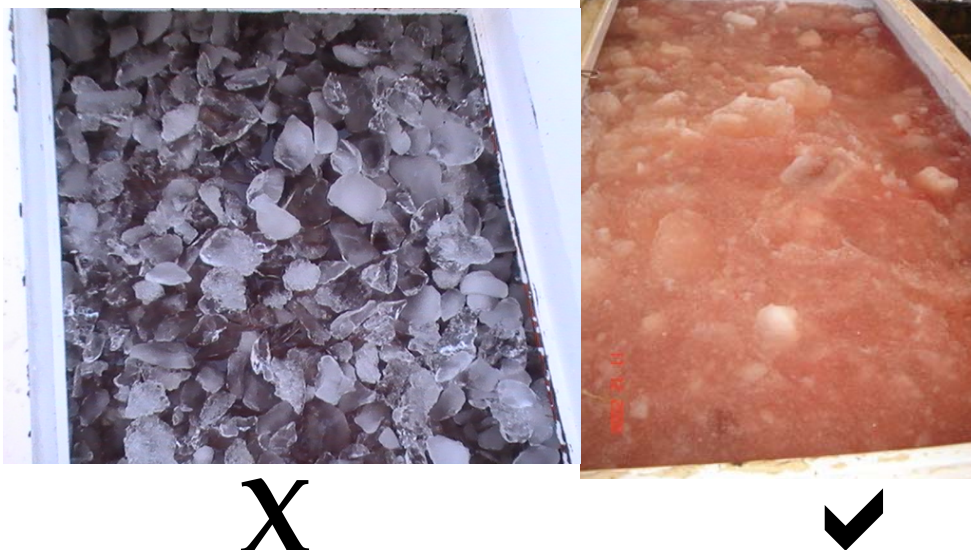


Fig. 5 The big size of ice (left picture) should be replace by crush ice (right picture)

- On board preservation technique should be a combination of chilling and storage in ice. After catch, tuna should be in the chilling tank for about 6 hrs for 30-40kg fish (depend on size) to cool down tuna meat at the core to 0 - 1°C. Then transfer the chilled tuna from sea water chilled tank to storage room using crushed ice only. Due to the limitation of space on Bancas, the available four fish holes are needed to be well managed. Example of chilling tank management plan is in figure 6.

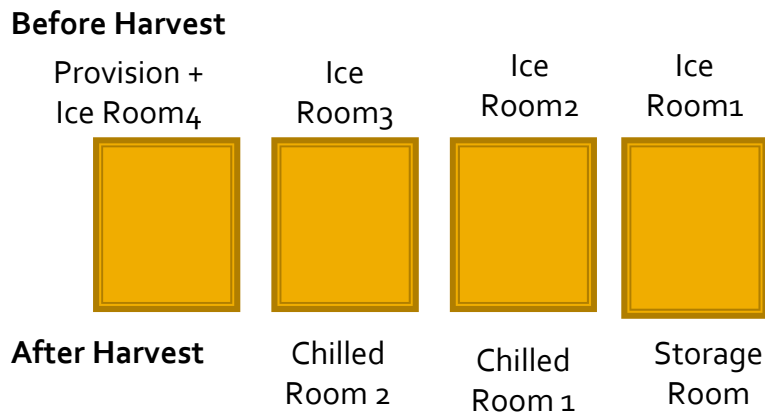


Fig. 6 Recommended schematic of preservation space on board Bancas

- To reduce scratch on tuna skin due to unloading technique, pulley should be used.

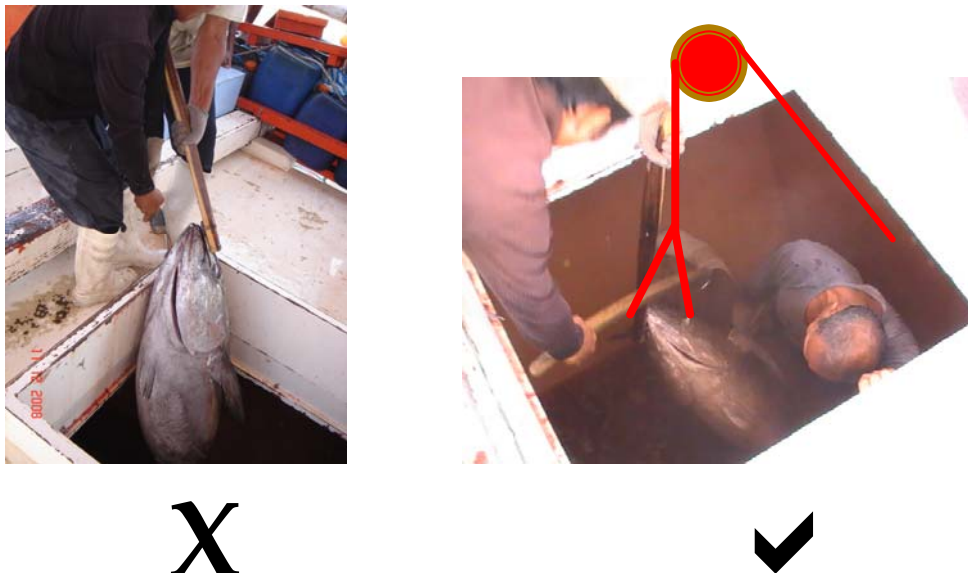


Fig. 7 Transferring of tuna from sea water chilling tank.

- Bleeding, gutting and removing intestine should be conducted before chilled tuna
- Period of fishing at sea should be reduced to be not over than 22 days,
- Generally, Tuna Bancas boat will stay at sea about one month to catch tuna. They have to keep all tuna catch until they come back. Tuna that were

caught early usually were graded as low quality. In case of tuna fishing company that have many boat, the carried boat for transportation tuna should be applied.

Future activities:

1. To support and come up with appropriated tuna handling and preservation techniques, more researches should be conducted on the fishing vessels, to ensure that quality of tuna are handled in a manner and unloading at the port. The most economic and efficiency of preservation techniques are required by tuna handliners in General Santos.
2. The tuna handline fishing technique of General Santos fisherman is unique and effective. Fisherman can catch adult that habit at deep water (80 – 200 m) by handline. This fishing technique should be documented and transfer to other fisherman such as in Thailand.

Training team members:

SEAFDEC Team

1. Ms. Suthipong Thanasansakorn Team leader
2. Dr. Somboon Siriraksophon Instructor
3. Mr. Thaweesak Thimkrap Instructor
4. Ms. Penchan Laongmanee Course coordinator

BFAR Team

1. Dr. Alma C. Dickson Course coordinator
2. Dr. Jonathan O. Dickson
3. Mr. Arsenio S. Banares

Table 1. Participants list

Name	Address	Position	Name of Fishing Boat
1. Opong Cates	Calumpang, General Santos City (Gensan)	Captain	Edelyn
2. Junel Abedijos	Calumpang, Gensan	Captain	RL-8
3. Raymundo Gimagan	Ligaya, Gensan	Captain	Groundfish
4. Merlito Sagario	Calumpang, Gensan	Captain	RL-8
5. Adil Pagalan	Malapatan, Gensan	Pasahero	RL-8
6. Joy Milgo	Calumpang, Gensan	Pasahero	RL-8
7. Pepito Felipe	Calumpang, Gensan	Pasahero	RL-8
8. Ernesto Amba	Calumpang, Gensan	Pasahero	RL-8
9. Elbert Lopez	Calumpang, Gensan	Pacora	RL-8
10. Janwel Navacilla	Calumpang, Gensan	Operator Pacora	RL-8
11. Teofredo Gealon	Spring Valley, Tambler, Gensan	Captain	F/B TS-850
12. Sammuel R. Silinaung	Spring Valley, Tambler, Gensan	Liaison	Admin
13. Jun Condiman	Calumpang, Gensan	Pacora	RL-8
14. Arnel Eslit	Calumpang, Gensan	Pasahero	Edelyn
15. Enrique Crucio	Calumpang, Gensan	Seaman	Edelyn
16. Joel Baluarte	Calumpang, Gensan	Pasahero	RL-3
17. Celso Marianito	Apopong, Gensan	Captain	Ramona-04
18. Almira Bacoy	Calumpang, Gensan	Classifier	CINMIC
19. Jenny Luzurata	Tambler, Gensan / Pagadian City	Admin/HR	Ramona Fishing Corporation
20. Diego Sagario	Zone III, Saeg, Calumpang, Gensan	Ship Cook	Rogelio-3
21. Jomar Rencio	Malecio Homes III-A, Gensan	Classifier	Pescador Sea Trading
22. Marilyn Partulan	2 nd Road, Calumpang, Gensan	Checker	EISFR
23. Cristy H. Cadorna	Fatima Shaw, Gensan	Classifier	CINMIC
24. Federita S. Donaldo	Calumpang, Gensan	Checker	EISFR
25. Euferico Milgo	Saeg, Calumpang, Gensan	Pumpboat Owner	Euniel
26. Demie Alaras	Zone 15, Blk 2, Gensan	Liaison	JCWC Fishing

Name	Address	Position	Name of Fishing Boat
27. Dario Lauron	Bula, Gensan	President	Alliance of Tuna Handliners
28. Emiliano Maya Jr.	2nd Road, Calumpang	Captain/Owner	Emiliano
29. Rolando Amay	Silway Fatima, Gensan	Head Labor	Pescador Sea Trading
30. Nilo P. Gatoc	Labangal, Gensan	Classifier	Pescador Sea Trading
31. Nelrose Jumanguin	Calumpang, Gensan	Quality Control Inspector	GS Pescador
32. Merlyn Cadiz	Lote, Calumpang, Gensan	Quality Control Inspector	Pescador
33. Dinah Songcog	Tuna Cooperative	Secretary	-
34. Johnny Ibahan	Panduma Tukuran, Zamboanga del Sur	Masterfisherman	Aramona-7
35. Omar Sabal	BFAR XII	Aquaculturist II	-
36. Redecco Pichon	Greenville, Gensan	Boat Captain	MGTR
37. Nicolas Ordaneza	Calumpang, Gensan	Boat Captain	C-604 MGTR
38. Diony Seromines	City Heights, Gensan	Secretary	Alliance of Tuna Handliners
39. Jick Pajurano	Delfin St., Purok Malakas, Gensan	Vice Chairman	Alliance of Tuna Handliners
40. Leah P. Balbes	Diamond Valley, Tumbler, Gensan	Checker	MGTR/CM SC
41. Wilma Balolong	Lote, Calumpang, Gensan	Financer	JCWC Fishing
42. Harry Arawiran	Gensan	Pasahero	RL-8
43. Darwin Repaso	Calumpang, Gensan	Operator-Pacora	RL-8
44. Faith Sharreah Lim	Villa Consuelo Subdivision, Gensan	MSU-Student	-

Table 2. Activity schedule

Date/Time	Activity	Responsible person
10 Dec 08, Wed		
09:00 – 10:00	Welcome/Opening Remarks	Mr. Paris Y. Ayon, FMO III, PFDA
	Message	Mr. Sani A. Macabalang, Regional Director, BFAR XII
10:00-10:30	Introduction to the training course (Annex I)	Ms. Penchan Laongmanee
10:30 – 12:00	Principle of fish handling and preservation technology (Annex II)	Mr. Suthipong Thanasansakorn
12:00 – 13:30	Lunch break	
13:30 – 16:30	Tuna handling on board and preservation technique (Annex III)	Dr. Somboon Siriraksophon
11 Dec 08, Thu		
07:00 – 12:00	Observation on fish handling and preservation technique at PFDA complex	All participant
13:00-13:30	Lunch break	
13:30 – 16:00	Discussion and recommendation	All participant and Mr. Sani A. Macabalang



Annex I

Introduction to the On-site Training on at Sea Fish Handling in The Philippines – Tuna and Squid

SEAFDEC/TD



Introduction to On-site Training on Fish Handling and Preservation Technique

About SEAFDEC (Southeast Asian Fisheries Development Center):

SEAFDEC is an inter-governmental body established as a regional treaty organization on 28th December 1967. SEAFDEC was mandated to develop fisheries potential of the Southeast Asian region by rational utilization of the resources to provide food security to the people through transfer of new technologies, and to conduct research and information dissemination activities.

SEAFDEC comprises 11 Member Countries: [Brunei Darussalam](#), [Cambodia](#), [Indonesia](#), [Japan](#), [Lao PDR](#), [Malaysia](#), [Myanmar](#), [the Philippines](#), [Singapore](#), [Thailand](#) and [Vietnam](#).



Introduction to On-site Training on Fish Handling and Preservation Technique

SEAFDEC Operations:

The Center operates through the Secretariat located in Thailand and has four technical Departments,

1. Training Department (TD) in Thailand,
2. Marine Fisheries Research Department (MFRD) in Singapore,
3. Aquaculture Department (AQD) in the Philippines, and
4. Marine Fishery Resources Development and Management Department (MFRDMD) in Malaysia.

Activities of SEAFDEC which are being undertaken in close cooperation among SEAFDEC Secretariat, Departments, and its Member Countries, are aimed towards sustainable fisheries development of the Southeast Asian region.



Introduction to On-site Training on Fish Handling and Preservation Technique

Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses (2006-2010)

Objective: To develop the appropriated fish handling at sea to reduce the post-harvest losses

Publication for on board fish handling and preservation technology (<http://map.seafdec.org/download>)

1. [Preliminary report : experiments on fish handling and preservation technique for squid , TD/RES/117](#)
2. [Handbook on High Value Fish Handling. TD/RES/126](#)



Introduction to On-site Training on Fish Handling and Preservation Technique

Background:

Main problem in fisheries activity in the Southeast Asian Country is fish handling and preservation technique to ensure food safety for consumer. More over the declining of fisheries resources and the rising of fuel cost are pressure fisherman to more consider in the on board fish handling and preservation technique to land **fresh and high quality** fish for earning higher price.

In the Philippine, tuna fisheries targeting for high grade quality for exporting is one of the main issues. Therefore, BFAR requested SEAFDEC to share the information of on board fish handling and preservation technique to their fisher and fishing boat owners.



Introduction to On-site Training on Fish Handling and Preservation Technique

Activity time table:

10 Dec 08

09:00 – 10:00	Registration & opening ceremony
10:00 – 10:10	Introduction to the training course
10:10 – 11:00	Principle of fish handling and preservation technology
11:00 – 12:00	High value fish handling and preservation procedure (Tuna and squid)
12:00 – 13:30	Lunch
13:30 – 15:30	Cont., High value fish handling and preservation procedure (Tuna and squid)
15:30 – 16:00	Tea break
16:00 – 17:00	Cont., High value fish handling and preservation procedure (Tuna and squid)

11 Dec 08

09:00 – 12:00	Observation for on board fish handling and preservation procedure at the fishing port.
12:00 – 16:00	Discussion, Conclusion and recommendation

Annex II

On-site Training on Preservation technique and onboard Fish handling



For General Santos city Tuna Hand liner

By

SOUTHEAST ASIAN FISHERY DEVELOPMENT CENTER
TRAINING DEPARTMENT

Preservation Technique And Onboard Fish Handling



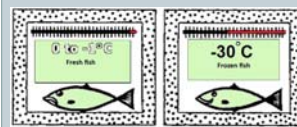
SEAFDEC/TD

Objective:

- To improve, promote fishermen fish handling and preservation technique.
- To be upgrade and increase fish value.
- To reduce Fish Quality losses onboard.
- To transfer sufficient fish preservation technique for fisherman.

SEAFDEC/TD

Method of fish storage



Left a recommended temperature of unfrozen fish hold. Right a recommended temperature of frozen fish hold

There are tways of storage method for common fish products. One is frozen with minus 20°F or -30°C. Bacterial action is completely arrested at this temperature, specially for sashimi grade is down to -60 °C.

And the storage temperature of unfrozen (fresh fish) is maintain at 0 to -1°C

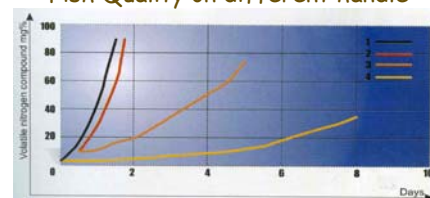
SEAFDEC/TD

Method of fish storage

1. Fresh fish (unfrozen fish)
 - 1.1 Ice boxes, crushed ice and flake ice
 - 1.2 Chilly
 - Ice seawater
 - Refrigeration seawater
 - Seawater sherbet ice
2. Frozen fish (freezing)

SEAFDEC/TD

Fish Quality on different handle



Black - without ice, 18-20°C

Red - Iced on board for ten hours, but left without ice hereafter.

Orange - without ice on board for ten hours but stored 5-0°C.

Yellow - Chilled with chilly seawater to 2°C immediately after fish arrived onboard for ten hours thenafter stored at 5-0°C.

SEAFDEC/TD

Minimised of quality losses.

Temperatures should be control and monitoring. Kept a temperature steady at low level to reduced bacterial activity rate growth. Therefore keep fish as cold as possible but without freezing, if intended to sale as fresh fish.

Preventing physical damage Gentle handle avoid bruising or cuts to the skin of fish.

Preventing contamination through good vessel design such as construction, working environment and proper handling practices.

SEAFDEC/TD

A sample of Fish quality loss



The comparison of dry squid between good handling practice and poor handle.

SEAFDEC/TD

A sample of Fish quality loss



Illustrated fishes in fish hold of a purse seine. Fish is decomposing as results of lag of Cooling medium.

SEAFDEC/TD

Method of fish storage

1. Icing system, flake ice, crush ice block ice

Ice plant



The temperature of ice preservation, fish body around 0°C
Not less than this.



SEAFDEC/TD

Handling component



Illustrated the cleanliness and fine pieces of ice chopper machine

SEAFDEC/TD

Handling component



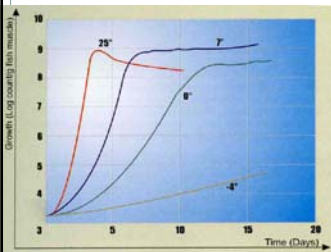
Illustrated ice making machine



Ice without contamination is use to preserved fish. Then clean water must be provided.

SEAFDEC/TD

Utilized of Ice Storage.



Ice storage is suitable for small scale fishing boats which fishing period less than 10 days and fishing ground close to fish market

Ice storage should be started as first priority when finished of fishing operation.

A table of bacteria growth rate of fish on different temperature

Ice required for cool fish to 0 °C

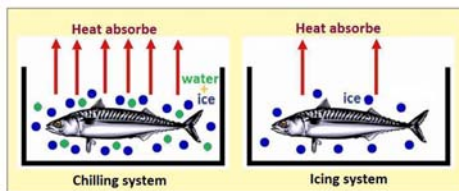
$$\begin{aligned}
 \text{Ice (Kg)} &= \frac{\text{Mass of fish(kg)} \times \text{fish temperature(}^\circ\text{C)}}{80} \\
 &= \frac{1000(\text{kg}) \times 30}{80} \\
 &= 375
 \end{aligned}$$

Ice required to preserved fish at 0°C

Table below is illustrated the weight of ice needed to cool down 10 kg of fish to 0°C at various ambient temperatures.

Ambient temp.	Weight of ice required
°C	kg
30	3.4
25	2.8
20	2.3
15	1.7
10	1.2
5	0.6

2. Chilling system



The comparison of heat removal efficiency between chilly ice seawater and icing system.

Chilly ice seawater is the mixed of ice and seawater

2.1 Chilly ice seawater (csw)



Chilling system is offer mainly for purse sein. Fish caught need to chill them fresh as quickly as possible.

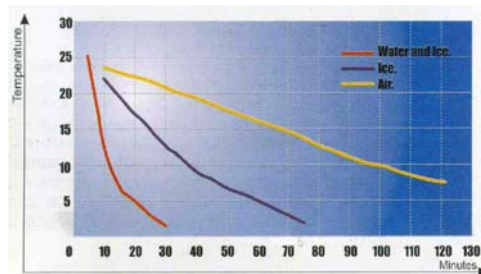
Chilly ice seawater is also easy and common performed.

Fishes will cool more rapidly than used of ice alone.

Figure of chilly ice seawater which maintain temperature -3 to -4 °C

Fish temperature about 1 to 0 °C. It can be attend the time for 3 - 5 days.

Chilly efficiency



Cooling speed of seawater, ice, and chilled air Data on small mackerel

Ice required for chill fish.

The ratios for mixing of ice, water and fish in insulated container or chill tanks vary depending on the climate temperature.

Seawater : Ice : Fish
1 : 2 : 6

SEAFDEC/TD

Ice required for chilling fish.

The amount of ice, fish and seawater necessary to chilled fish can be calculated by the following formula:

$$I_w = \frac{(S_w + F_w) S_t}{80}$$

SEAFDEC/TD

2.2 Chilly refrigeration seawater (rsw)

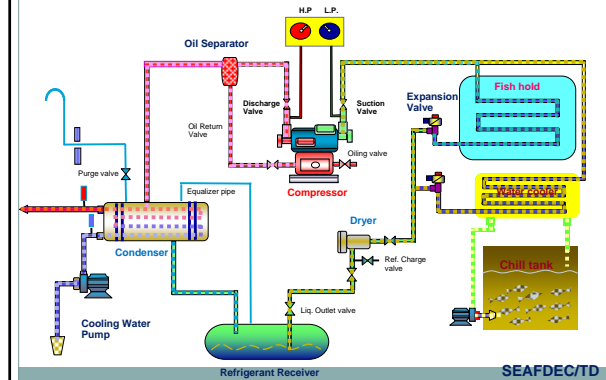
Refrigeration seawater (RSW) generally when a mechanical refrigeration system is used as cooling unit instead of ice.

Then RSW system is no used of ice added or mixed with seawater.

Water circulation system is very important which used to conveys every bit of fish freshness.

SEAFDEC/TD

Major components of chilly refrigeration seawater



SEAFDEC/TD

Major component of chilly refrigeration seawater

- Chilling unit/water cooler
- Condensing unit.(compressor + condenser)
- Circulation water pump.
- Driven components and control system (engine/motor)

SEAFDEC/TD

General information on refrigeration seawater system

Principle function of chilling process by repeated pumping up of seawater in fish hold by using circulation pump force to seawater chiller and returning chilled water back into fish hold.

This system is used for maintain fishes freshness of fishes by cooling down seawater temperature between -3 to -4°C.

Therefore, large amount of fish are maintain fleshy as quickly without delay, comfortable and less of manpower used on board.

SEAFDEC/TD

An advantage of RSW as following:

1. Greater speed of cooling
2. Reduced pressure on the fish body
3. Lower holding temperature possible
4. Quicker handling of large quantities of fish with little delay or less of labor involvement
5. Extended storage time and fishing duration.

SEAFDEC/TD

The limited of refrigeration chilly seawater

Salty taste of fish

Salty taste is probably most important factor, which limits the application of RSW systems.

The upper limit is usually equivalent to a concentration of about 0.5 percent in the raw fish.

SEAFDEC/TD

The limited of refrigeration chilly seawater

Fish weight gains in RSW.

Weight gain depends on species and a number of other factors.

That problem will retard by certain temperature control.

SEAFDEC/TD

3. Freezing of fish

Conventional freezing system.

1. Coils/tube freezer	Refrigerant is evaporated in coil/tubes to cool the fish hold down to -30°C. The tubes are arranged beside of fish hold or shelves.
2. Air blast freezer	Similar to the coils/tubes freezer but equipped with fans to circulate air at 2-5m/sec.
3. Contact freezer	Refrigerant is evaporated in flat plates which sandwiches and cools the fishes/food.
4. Immersion freezer	Fishes are placed directly in brine (usually NaCl) which is cooled by refrigeration system.

SEAFDEC/TD

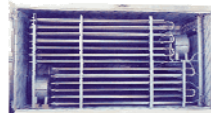
Coils/tube freezer



SEAFDEC/TD

Air blast and Se-mi Air blast freezer

Semi air blast

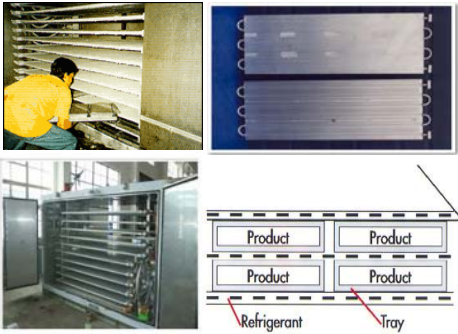


Air blast



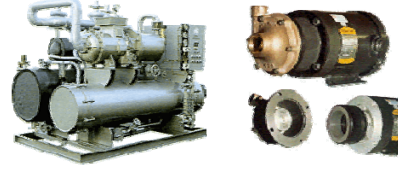
SEAFDEC/TD

Contact plates freezer



SEAFDEC/TD

Brine freezer



SEAFDEC/TD

Freezing time and temperature

Freezing time defined here as is the time of taken temperature of the warmest part of fish, usually at the center to be reduced down to certain temperature (-20° C).

The recommended storage temperature for frozen fish in general is -30 °C.

SEAFDEC/TD

Onboard Fish handling procedure

1. Preparation and handle procedure.
2. Preservation techniques
3. Chilled operation
4. Handling of fish unloading

SEAFDEC/TD

1. Preparation and handle procedure.



On board fish handling of MV. Seafdec 2 with a high personal hygiene

- a. To ensure all crew members maintain a high personal hygiene while handling of fish.

SEAFDEC/TD

1. Preparation and handle procedure.



Hands and gloves should be thoroughly washed before handling of fish or entering the fish holding.

Hands wash with clean water in some case hand detergent is used

SEAFDEC/TD

1. Preparation and handle procedure.



Prepare for On board handling of MV. Seafdec2 with deck hose to cool down working area

b. Make sure deck and fish hold is cooled and cleaned before hauling the fish.

If deck is hot before fish haul on it, cool it down with seawater to avoid raising temperature of fish as this will affect to the fish quality and reduce fish shelf life.

SEAFDEC/TD

1. Preparation and handle procedure.



c. Take care and gentle not to damage fish on deck while sorting and handling proceeds

Never walk over and throw fish or trample saleable fish. It leads to bruising or degrade and subsequent fish value. Placed basket or container near by the hander as close as possible instead of throw fish.

SEAFDEC/TD

1. Preparation and handle procedure.



d. Protect fish on deck from sunlight and wind, keep cool and wash baskets of fish with gentle deck hose.

Sorting of fish on deck should be completed as quickly as possible in order to minimize exposure to sunlight and wind.

SEAFDEC/TD



1. Preparation and handle procedure.



Overload fish boxes would be break the fish skin due to weight pressure.

e. Do not overload boxes or fish basket.

Loss of scales or breaks on the skin when fish are pressed exposes the fish to early and more attack by bacteria and temperatures up rise due to lag of cooling efficient lead to more rapid spoilage and loss of freshness and shelf life.

SEAFDEC/TD

1. Preparation and handle procedure.



MV. Seafdec 2 Clean all fish handling equipment and deck area with deck hose after each shot

f. Fish should be cleaned from deck. Wash the container box, hand gloves clean and other equipment ensure no fish are trapped.

SEAFDEC/TD

1. Preparation and handle procedure.



Scrubbed and hose down with clean seawater

Deck or working area, fish hold fish boxes, and every conner should be washed and scrubbed after each shot.

SEAFDEC/TD

2. Preservation Techniques



fish is placed into slush chilly seawater of temperature -4°C fish is immediate dead.

- a. Chilling fish is the first priority, net repairs should not be allowed. Fish should be placed into the chilly water quickly as soon as possible.

Try to place clean fish into the cold chilly water within 40 minutes of landing fish onboard.

SEAFDEC/TD

2. Preservation techniques



Clean chilly ice seawater with maintain temperature -4°C

- b. Chilly water should be prepare and kept clean with water temperature about -3 to -4°C before fish are added.



SEAFDEC/TD

2. Preservation techniques



A dirty chilly ice seawater contain with ink must be replace for the next shot

- Replace chilly water and ice if needed, after each shot or when it is discolored due to indicating contamination from earlier loads of fish.

SEAFDEC/TD

2. Preservation techniques.



Chilly fish has remove to preserve with ice and transfer in cold fish hold

- c. As soon as the fish is thoroughly chilled fish should be transferred from chilly tank.

When the temperature of fish in the centre has been lowered to about -1°C fish is removed to maintain with crushed ice in storage room or refrigerated storage

SEAFDEC/TD

2. Preservation techniques.



Temperature of fish onboard MV. SEAFDEC2 chilled for 4 and half hours in slush chilly seawater fish temperature down to 2.2°C

- d. Monitor and check of chilly water and fish temperature.

Regularly monitor and record temperatures of chilly tanks, holding room and fish. To ensure that correct temperatures and ice added is required to bring fish temperature down to -1°C within seven to eight hours.

SEAFDEC/TD

2. Preservation techniques.



Fresh handling in slush chilly seawater tank on MV. Seafdec 2

- Check and maintain chilly slush seawater in range between -3 to -4°C . A compressor is start if additional ice as required.

SEAFDEC/TD

3. Chilled operation



Squid in chill box is placed into chilly seawater tank

- a. Chilly Ice seawater should be prepared by the time before fish landing on board.

A mixture of 2 parts ice and one part of seawater will maintain a temperature six part of fish cool down 0° to -1° C. Fish will not freeze

SEAFDEC/TD

3. Chilled operation



The improvement of chilling efficiency by circulations of chilly seawater ice in combine with refrigeration system.

- B. Seawater ice should be well stirred or circulate by pumping.

Temperature on the surface may differ from that of the deeper layers due to differential of specific gravity between seawater and freshwater formed by mixture and melting of ice.

SEAFDEC/TD

3. Chilled operation



A compensates of salts is added due to ice is used in chilly water

To maintain chilly seawater salt density concentrated, salts about 2 to 3% by weight of ice need to added

SEAFDEC/TD

3. Chilled operation



Deck hose is used not only for clean, it also used to cool down fish temperature before chilling

- c. Before chilling the fish in seawater ice, fish body has to bewashed clean

When fish landed on board should be washed immediately with clean seawater to remove mud, slime and blood.

SEAFDEC/TD

3. Chilled operation

- d. Chilled tank for chilling fish should be insulate, water tight and large enough to avoid damage to fish bodies by their colliding into each other due to rolling and pitching of the boat. In large boats, several small pools are more effective.

SEAFDEC/TD

4. Handling of fish unloading

- Unload fishes quickly, avoiding the hottest period of the day.
- Check and record on consignment product temperature to the transport.
- Transportation should be insulated or used insulate container to avoided an exceed temperature and the door should be closed in between loading each pallet.
- In case of long way transportation refrigerated is used, to keep fish cool and should be started early to ensure that the truck is cold when fish are actually loaded.

SEAFDEC/TD

4. Handling of fish unloading



e. While arrange for fish loading at the harbor do not used deck hose due to water quality to prevent fish early spoils by a contamination of bacteria from water

SEAFDEC/TD

Application and implement of onboard fish handling

The simply refrigeration chilly seawater, submersible type develop by training department

SEAFDEC/TD

The multi purpose fish handling container:

- Fresh/seawater chilly
- Freezer

SEAFDEC/TD

Refrigeration chilly seawater while preserve fish

SEAFDEC/TD

Temperature and uniform of preserve fish

SEAFDEC/TD

Physical of chilled fish in refrigeration seawater, test for 20 days at -10°C



SEAFDEC/TD



SEAFDEC/TD



Quality of fish After chill in chilly refrigeration seawater for 20 days

SEAFDEC/TD

Fresh fish handling experimental

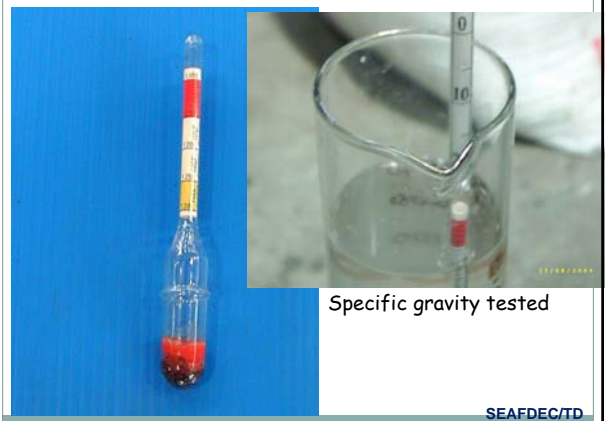


SEAFDEC/TD

Freshness check



SEAFDEC/TD



Specific gravity tested

SEAFDEC/TD



Squid Preservation Research

Squid is once of high value sea food that it's very difficult for preserve. So that we are necessary to study about it.

Method of preserve

1. Storage with ice only
2. Chill for 5-7 hrs before storage with ice
3. Chill for 5-7 hrs before freezing at -30°c

Period for squid preserve

- 1 night
- 2 night
- 3 night
- 10 night

SEAFDEC/TD

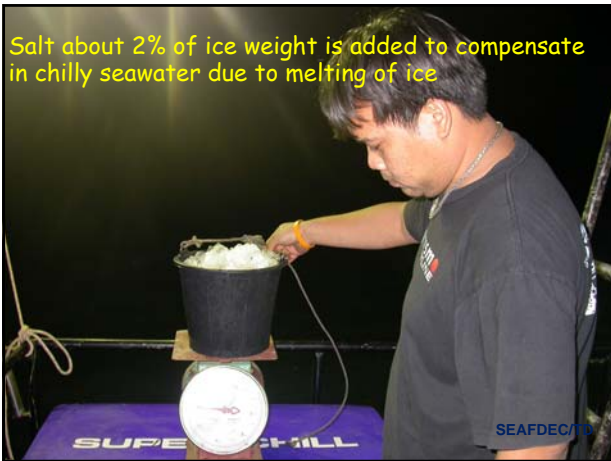
Research area at Chantaburi Province



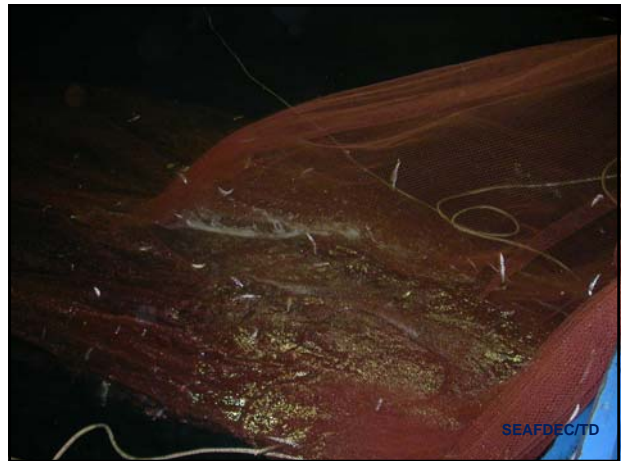
Specific gravity of chilly seawater check



Salt about 2% of ice weight is added to compensate in chilly seawater due to melting of ice



SEAFDEC/TD



SEAFDEC/TD

Squid hauled onboard



SEAFDEC/TD



SEAFDEC/TD



SEAFDEC/TD



SEAFDEC/TD



Onboard fish handling experimental on introduction of appropriate of fish handling technology.

SEAFDEC/TD



Chill boxes preparation

SEAFDEC/TD



Squid in chill boxes was chilled in chilly seawater at -4 °C for 7 hours

SEAFDEC/TD

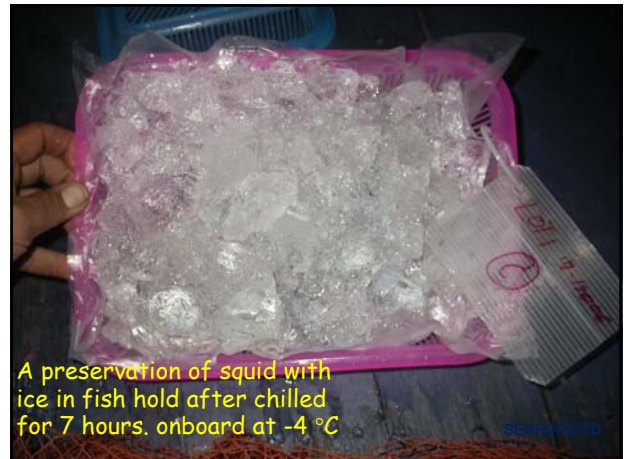


Squid has nice shape after Chilled onboard at -4 °C for 7 hours.

Handling of squid

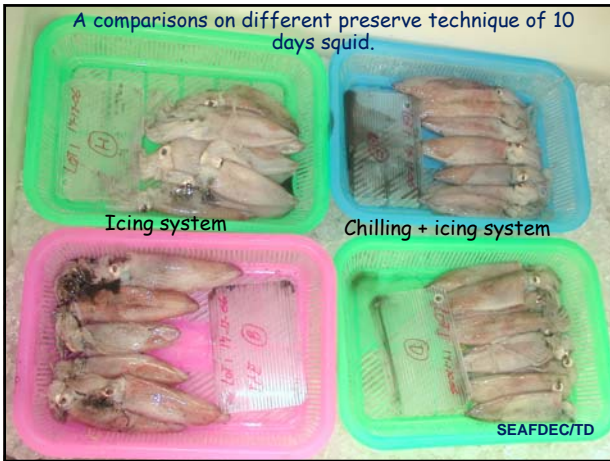
After squid was chill in chilly seawater , there are two method of handling

1. Handling as fresh squid by storage with ice
2. Handling as frozen Squid by storage by freezing



After chilled for 7 hours, remove its to freezing maintenances at -30°C





Squid Quality analysis's

1. Analysis by Chemical
2. Analysis by Sensibility

Summary squid preservation on board research

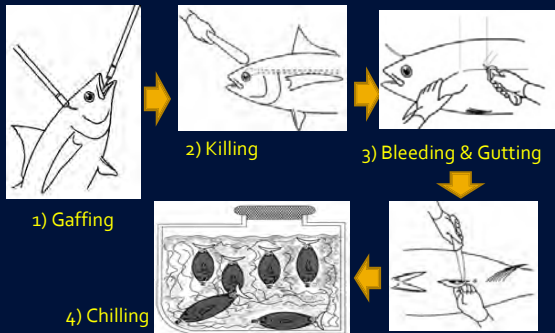
1. Freezing squid of 10 days are still fresh equal 1 night of squid
2. The chill process can be extend freshness more longer than without chill process.
3. Freezing squid still uniform of fresh both with physical property and color or taste
4. The best time for chill process before keeping around 5-7 hr

SEAFDEC/TD

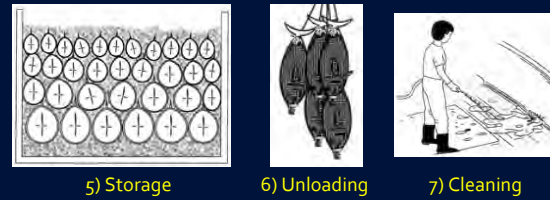


Annex III

Handling and Fish Quality Issues (1)



Handling and Fish Quality Issues (2)



Bad handling can damage a fish of naturally high quality and make it worthless at the market. Careful handling will can prevent unnecessary losses.

Gaffing



Problem Indicators	Why it occurred	Preventions
Flesh Damage	Bad handling when hauling and landing	Extra care when hauling and landing fish
	Gaffing / harpoon damage	Only gaff through the head. If the fish is large, use 2 gaffs.
	Slamming into the side or deck of vessel.	Hold fish against side of vessel before lifting
	Line damage.	Lift fish as vessel drops in rough conditions
		Use carpets or mats to land, slide and rest fish on
	Use de-hooking devices	

Killing

Killing should be carried out as soon as the fish has been hauled aboard

To 'pith' is to completely destroy the spinal cord running in the neural canal. This **stops biochemical reactions**, which contribute to flesh deterioration. (using the **Tanaguchi method**)

1. Stun the fish with a sharp blow to the top of the head **between the eyes** using a fish club or other blunt instrument.
2. Use a very sharp knife to make a 3-4cm cut over the soft spot. The incision must be deep enough to expose the brain
3. Insert a length of sterilised mono-filament nylon or stainless steel wire into the brain and push it as far as possible into the neural canal to destroy the spinal cord

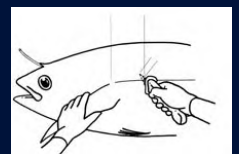


Bleeding

- Bleeding the fish immediately after killing is important to maintain quality. This is because after the brain has been destroyed, the heart continues to beat for a few minutes. These cuts should be made as quickly as possible, to allow the last heartbeats to pump the blood through the wounds.
- Bleeding will remove the wastes (lactic Acid), high temp of blood and cools the body. The fish can then be refrigerated more quickly and will have better quality flesh.

Bleeding

- *Bleed the tuna by making a cut in the fish's side with a knife, 2-3 fingers long and 2cm deep behind the base of the pectoral fin both sides of the fish*
- *Make a cut between the gill collar and the gills, and place a hose pipe carrying sea water into the mouth, or side of the gill*



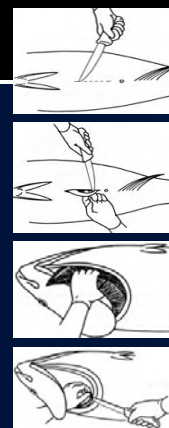
Gutting

- Cut the top edge of the gill cover
- Cut the connection between the gills and the lower jaw
- Cut the connection between the gills and the base of the skull



Removing Intestine

- Cut to 1 cm from the anus
- Cut off the end of the digestive tube and the gonads
- Remove the gills and the internal organs
- Cleaning



Chilling:

- There are two Chilling Concepts:
 - 1) **Chilling Processes:** we are trying to actively remove body heat and reduce the temperature of the flesh to the desired limit.
 - 2) **Chilling Storage:** is used to ensure that the fish is maintained at the desired temperature.

Key Points for Chilling

- In order to keep the fish in top condition, the core body temperature must be lowered to 0°C as quickly as possible, and maintained until the fish reaches the market: that is, while stored on board, while unloading and packing and during transport to market. Any temperature variation at any stage in the process runs the risk of damaging the product and reducing quality.
- Once chilled, the tuna must be kept under chilled conditions until arrival at port. Tuna can be stored in a fresh or frozen state.

Key Points for Chilling

- Never add warm fish to fish that are already chilled, or still in the process of chilling. Adding warm fish will increase the temperature of the fish already present in the chilling medium, which will cause deterioration in quality and an increase in the numbers of bacteria present.
- Always remove the chilled fish and place into the storage area prior to chilling the next catch.

The Stages of the Chilling Process

Chilling occurs in two stages:

1. **The surface of the fish will chill first**, because it is in direct contact with the chilling medium. It is important to ensure that the chilling process is monitored regularly to keep the temperature moving down as quickly as possible. Keeping the chilling process happening may involve stirring the ice slurry or adding more ice.
2. **Chilling to the core of the fish takes much longer**, because the body heat needs to be drawn outward through dense muscle tissue and skin. This happens much more slowly than at the surface of the fish. The rate of heat loss depends on the efficiency of the chilling system and how quickly the meat and skin can conduct heat.

Chilling Time

<Remember!>

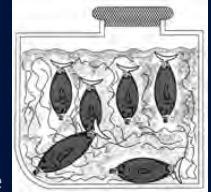
- The time taken to chill depends on the size of the fish. **6 to 12 hours is advisable for small sashimi tuna (30-40kg)**. It is preferable to **leave larger fish in longer, up to 36 hours**, to make sure they are chilled to the core.
- Although fish can be left in brine for several days, it is generally recommended that they be removed after 24-36 hours, **otherwise their colour will fade and the eyes will go white**. This will affect market price.



Rubber mats on the wall of the Chilled tank protect fish. The holes are to ensure that circulation is even.

Using Ice + Sea water to Chill

- The temperature range is usually from about -6°C (for sea water ice), to about 0°C .
- Ice is very efficient at cooling, is safe to use, and doesn't change the taste of the fish.
- An ice slurry is often used to chill fish immediately after they are caught. The ice must be melting and thoroughly mixed in water to produce a slurry with a uniform temperature of about 0°C .



Using Sea Water Ice : Good or Bad?

- The chilling capacity of sea water ice is only slightly greater than freshwater ice. This is despite the **lower temperature of seawater ice compared to freshwater ice**.
- There are risks involved in using sea water ice. **Fish stored in sea water ice may become partly frozen, and headless, gutted fish may absorb some salt**. This impacts on quality.
- Salt concentration affects the freezing temperature of sea water, so the temperature of sea water ice varies. The initial melting temperature of clean sea water ice may be as low as -6°C , but as the salt leaches away in the melting water, the melting temperature may rise again to nearly 0°C .

Chilling Storage (Icing)

- There are 3 types of ice that can be used to store fish: **fresh water** (desalinated water), **seawater ice**, or a **combination of the two**.
- Generally, it is not recommended to use pure seawater ice, this is because when seawater ice freezes can cause chill damage to the fish.
- The Icing method works best when only freshwater ice, or a mixture of freshwater and seawater ice, is used.

Unloading in Port

- **Temperature Control**
 - it is important to maintain the low temperature of the fish. Fish must be transferred as quickly as possible from the chilled storage area on the boat to the next chilled storage area, which may be a cold store or a processing facility.
- **Avoiding Damage**
 - Do not twist or bend the fish when removing them from ice, as this entails a risk of damaging the flesh and damaging the fish's external appearance.
 - Handle the fish gently. Do not throw them or drag them along the deck or the ground.
 - If a fish is dropped, clearly label it and continue unloading so that a decision can be made on its status later on.

Appropriate method for handliners





TRAINING/WORKSHOP ON

TUNA HANDLING & PRESERVATION TECHNIQUE

BUREAU OF FISHERIES AND AQUATIC RESOURCES (BFAR)
IN COLLABORATION WITH
THE SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER (SEAFDEC)

Introduction

- *Tuna Industry in General Santos*
- *Challenges*
- *How to maintain premium quality products*
- *How important of Tuna Handling*



Objectives & Goals

- To provide you with simple, easy on how to handle tuna in a manner which will allow you to deliver the best possible quality product to the port.
- To provide you a basic knowledge on tuna preservation techniques.

Goal: premium quality tuna for domestic and In't markets

Main causes induce Low quality tuna

There are three main types of causes:

- 1) Handling practices,
- 2) Biological factors, and
- 3) a combination of handling and biological factors.

The problems caused by biological factors are beyond human control.

Problems that originate through incorrect handling practices are preventable.

Handling plays an important role: good handling practices can ensure good quality and help to minimize these problems.

Contents :

- Tuna Biology
 - How Does Biology Affect Quality?
- Quality Issues Specific to the Japanese Tuna Market
 - What is Sashimi Quality Tuna?
 - What buyer look for?
- Fish Flesh Conditions
- Handling and Fish Quality Issues

Tuna Biology (1)

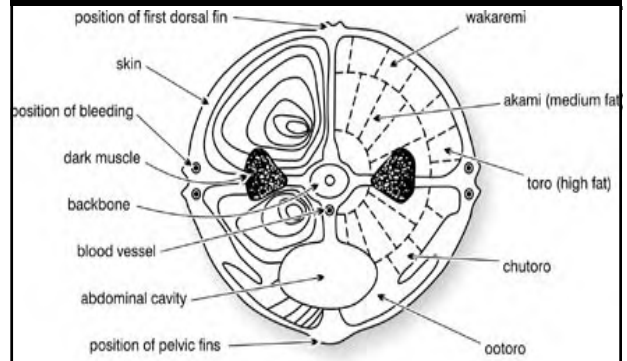
- They are warm-blooded and their internal temperature maintain at about 28°C
- during stress and struggle during capture, their body temperature may rise for short periods to 35°C to 40°C.
- After death, this high body temperature is damaging to flesh quality ...>Bacteria Growth

Tuna biology: (2)

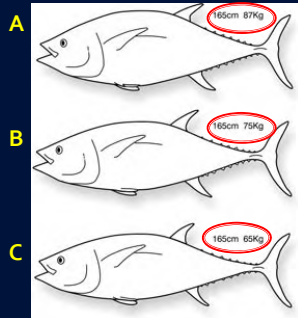
How Does Biology Affect Quality?

- Before death, tuna can suffer a build up of **lactic acid**. In addition, A fish that thrashes (beat) around will use up all the oxygen in the muscles, producing lactic acid.
- Lactic acid is a waste product of muscle exercise and needs to be removed before it causes damage to the exhausted muscle tissue.
- This damage can include a change in meat appearance from **translucent to cloudy**, **softening the texture** and giving a **bitter flavour** to the meat.
- These aspects of the fish are used by buyers grading tuna that is to be sold for sashimi.

A Cross Section of a Tuna



What Buyers Look For? (2)



Shows three tunas of the same length but different weights.

The 'A Grade' fish (top) has a deep, well rounded body. The 'C Grade' fish (bottom) is more slender than the others. Each of these tunas are likely to attract a different price on the export market.

What Buyers Look For? (1)

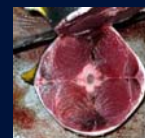
- At the market, the buyer can only inspect the **tail section** and thickness of the belly flaps of the fish and must estimate the colour and fattiness of the carcass (body) from both of tails and belly areas.



What Buyers Look For?

- Generally, tuna flesh (tissue) should be bright and clear, with a slight shine and a silky texture.
- Any signs of darkened or 'muddied' flesh can indicate a problem with flesh quality, such as 'Yake', or 'flesh burn'. The colour of the meat will **turn opaque** with varying states of colour from pale reddish pink to darkish grey and the meat texture will lose its tenderness. Caused by insufficient cooling of the fish immediately after killing. Often happens to larger fish. Can also occur when fish is extremely vigorous at capture, heating his body and building up lactic acid.

Fish Flesh Conditions



Bloody



Parasite



Torn stomach lining

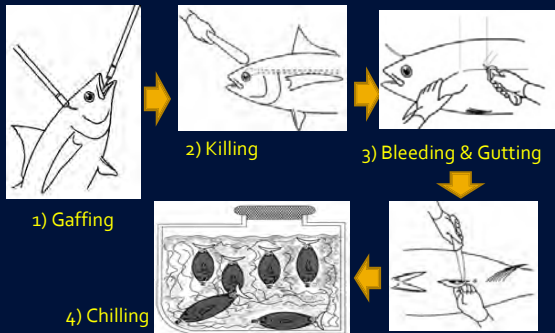


Damage flesh fin

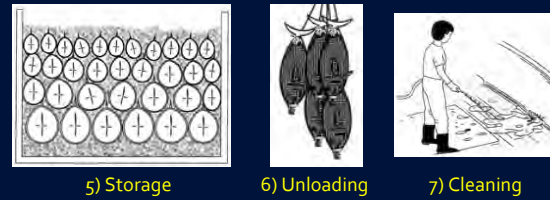


Healthy Pink Stomach, Good Lining

Handling and Fish Quality Issues (1)



Handling and Fish Quality Issues (2)



Bad handling can damage a fish of naturally high quality and make it worthless at the market. Careful handling will can prevent unnecessary losses.

Gaffing



Problem Indicators	Why it occurred	Preventions
Flesh Damage	Bad handling when hauling and landing	Extra care when hauling and landing fish
	Gaffing / harpoon damage	Only gaff through the head. If the fish is large, use 2 gaffs.
	Slamming into the side or deck of vessel.	Hold fish against side of vessel before lifting
	Line damage.	Lift fish as vessel drops in rough conditions
		Use carpets or mats to land, slide and rest fish on
	Use de-hooking devices	

Killing

Killing should be carried out as soon as the fish has been hauled aboard

To 'pith' is to completely destroy the spinal cord running in the neural canal. This **stops biochemical reactions**, which contribute to flesh deterioration. (using the **Tanaguchi method**)

1. Stun the fish with a sharp blow to the top of the head **between the eyes** using a fish club or other blunt instrument.
2. Use a very sharp knife to make a 3-4cm cut over the soft spot. The incision must be deep enough to expose the brain
3. Insert a length of sterilised mono-filament nylon or stainless steel wire into the brain and push it as far as possible into the neural canal to destroy the spinal cord

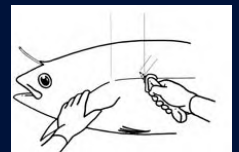


Bleeding

- Bleeding the fish immediately after killing is important to maintain quality. This is because after the brain has been destroyed, the heart continues to beat for a few minutes. These cuts should be made as quickly as possible, to allow the last heartbeats to pump the blood through the wounds.
- Bleeding will remove the wastes (lactic Acid), high temp of blood and cools the body. The fish can then be refrigerated more quickly and will have better quality flesh.

Bleeding

- *Bleed the tuna by making a cut in the fish's side with a knife, 2-3 fingers long and 2cm deep behind the base of the pectoral fin both sides of the fish*
- *Make a cut between the gill collar and the gills, and place a hose pipe carrying sea water into the mouth, or side of the gill*



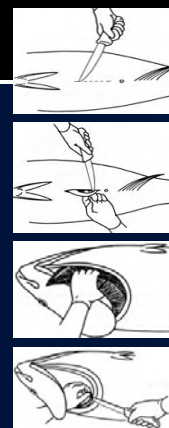
Gutting

- Cut the top edge of the gill cover
- Cut the connection between the gills and the lower jaw
- Cut the connection between the gills and the base of the skull



Removing Intestine

- Cut to 1 cm from the anus
- Cut off the end of the digestive tube and the gonads
- Remove the gills and the internal organs
- Cleaning



Chilling:

- There are two Chilling Concepts:
 - 1) **Chilling Processes:** we are trying to actively remove body heat and reduce the temperature of the flesh to the desired limit.
 - 2) **Chilling Storage:** is used to ensure that the fish is maintained at the desired temperature.

Key Points for Chilling

- In order to keep the fish in top condition, the core body temperature must be lowered to 0°C as quickly as possible, and maintained until the fish reaches the market: that is, while stored on board, while unloading and packing and during transport to market. Any temperature variation at any stage in the process runs the risk of damaging the product and reducing quality.
- Once chilled, the tuna must be kept under chilled conditions until arrival at port. Tuna can be stored in a fresh or frozen state.

Key Points for Chilling

- Never add warm fish to fish that are already chilled, or still in the process of chilling. Adding warm fish will increase the temperature of the fish already present in the chilling medium, which will cause deterioration in quality and an increase in the numbers of bacteria present.
- Always remove the chilled fish and place into the storage area prior to chilling the next catch.

The Stages of the Chilling Process

Chilling occurs in two stages:

1. **The surface of the fish will chill first**, because it is in direct contact with the chilling medium. It is important to ensure that the chilling process is monitored regularly to keep the temperature moving down as quickly as possible. Keeping the chilling process happening may involve stirring the ice slurry or adding more ice.
2. **Chilling to the core of the fish takes much longer**, because the body heat needs to be drawn outward through dense muscle tissue and skin. This happens much more slowly than at the surface of the fish. The rate of heat loss depends on the efficiency of the chilling system and how quickly the meat and skin can conduct heat.

Chilling Time

<Remember!>

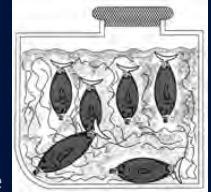
- The time taken to chill depends on the size of the fish. **6 to 12 hours is advisable for small sashimi tuna (30-40kg)**. It is preferable to **leave larger fish in longer, up to 36 hours**, to make sure they are chilled to the core.
- Although fish can be left in brine for several days, it is generally recommended that they be removed after 24-36 hours, **otherwise their colour will fade and the eyes will go white**. This will affect market price.



Rubber mats on the wall of the Chilled tank protect fish. The holes are to ensure that circulation is even.

Using Ice + Sea water to Chill

- The temperature range is usually from about -6°C (for sea water ice), to about 0°C .
- Ice is very efficient at cooling, is safe to use, and doesn't change the taste of the fish.
- An ice slurry is often used to chill fish immediately after they are caught. The ice must be melting and thoroughly mixed in water to produce a slurry with a uniform temperature of about 0°C .



Using Sea Water Ice : Good or Bad?

- The chilling capacity of sea water ice is only slightly greater than freshwater ice. This is despite the **lower temperature of seawater ice compared to freshwater ice**.
- There are risks involved in using sea water ice. **Fish stored in sea water ice may become partly frozen, and headless, gutted fish may absorb some salt**. This impacts on quality.
- Salt concentration affects the freezing temperature of sea water, so the temperature of sea water ice varies. The initial melting temperature of clean sea water ice may be as low as -6°C , but as the salt leaches away in the melting water, the melting temperature may rise again to nearly 0°C .

Chilling Storage (Icing)

- There are 3 types of ice that can be used to store fish: **fresh water** (desalinated water), **seawater ice**, or a **combination of the two**.
- Generally, it is not recommended to use pure seawater ice, this is because when seawater ice freezes can cause chill damage to the fish.
- The Icing method works best when only freshwater ice, or a mixture of freshwater and seawater ice, is used.

Unloading in Port

- **Temperature Control**
 - it is important to maintain the low temperature of the fish. Fish must be transferred as quickly as possible from the chilled storage area on the boat to the next chilled storage area, which may be a cold store or a processing facility.
- **Avoiding Damage**
 - Do not twist or bend the fish when removing them from ice, as this entails a risk of damaging the flesh and damaging the fish's external appearance.
 - Handle the fish gently. Do not throw them or drag them along the deck or the ground.
 - If a fish is dropped, clearly label it and continue unloading so that a decision can be made on its status later on.