TRANSPORTATION OF LIVE FISH (Containers, Time and Transport Technique)

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ABSTRACT

Consumer demand for fishery commodities in live form is felt to be getting bigger and growing, especially for types of fish that have high economic value such as lobster, shrimp, reef fish and several types of freshwater fish. Live fish transportation technology is increasingly popular and indeed it is time to receive special attention and need to be developed immediately. The success of live fish transportation is always influenced by the physiological characteristics of the fish, the size of the fish, the fitness/quality of the fish prior to transportation, the quality of the water during transportation (medium temperature DO, pH, CO_2 and ammonia), the density of fish in the container, mobility techniques using low temperatures or other materials. Chemical and natural metabolites and transportation time. Efforts to inhibit the rate of metabolism are carried out by keeping the water temperature low during transportation, namely by carrying out the transportation in the morning/evening or by adding ice to the transportation container. Broadly speaking, the transportation of live fish is carried out in two ways, namely the dry system and the wet system. Transportation of fish can be done with an open system and a closed system. In an open system, the water media in the container can be in direct contact with the open air outside the container, while in a closed system, contact with the outside air does not occur because the media is in a tightly closed container.

Keyword: - *Transportation, Live fish, Wet system, Dry system*

1. INTRODUCTION

Fish in general is more widely known than other fishery products, because these types are widely caught and consumed. Fish have been known for a very long time, thousands of years ago. As a food ingredient, the position of fish is very important, because it contains many components needed by the body [1].

Consumer demand for fishery commodities in live form is felt to be getting bigger and growing, especially for types of fish that have high economic value such as lobster, shrimp, reef fish and several types of freshwater fish. For this reason, appropriate and appropriate technology is needed with the demands of commodities and environmental conditions in certain areas. Unfortunately, live fish transportation technology so far still uses water transport media which is less safe, high risk, and less efficient.

Live fish transportation technology is increasingly popular and indeed it is time to receive special attention and need to be developed immediately. This type of technology is not only important for consumption fish, but also very important for the ornamental fish trade as well as the transportation of larvae, young fish and brood fish.

2. CHARACTERISTICS OF FISHERY PRODUCTS

Marketing of fish is generally done in fresh form so it is necessary to apply good handling techniques. Vigor will be achieved if the handling of fish is going well. Fish that is still fresh means that it has not undergone biochemical, microbiological, or physical changes that can cause serious damage to fish flesh [2].

Many factors affect the quality of fish after being caught, including the amount of bacteria present in the fish, presence of disease, spawning rate, satiety level, and fish fatigue level. Fish naturally contain bacteria on the skin, gills and stomach contents, but when the fish is still alive, it can resist the development and attack of these bacteria. When the fish dies, these defense mechanisms are lost, and bacteria begin to enter the muscles and grow there.

Diseased fish are often under stress and less able to withstand both internal and external bacterial attack. Fish that are undergoing spawning use a lot of energy for the reproduction process, causing the muscles to not be as elastic as usual and when frozen there will be excessive water expenditure (drip loss). Meanwhile, fish that are full when caught contain a lot of energy reserves in their muscles so that it will take a long time to enter the rigor mortis phase.

Meanwhile, fish that are exhausted (because of their flounder) use a lot of energy so that the rigor mortis process takes place quickly. If the fish is handled while the fish is still experiencing rigor mortis, muscle damage will occur, which will become more evident if the fish is filleted.

The process of decreasing the quality of fish freshness will continue if it is not inhibited. The speed of the process is very much influenced by many things, both internal factors which are more related to the nature of the fish itself and external factors related to the environment and human treatment. Decline in quality must be prevented from the start, namely from the time the fish are caught or removed from their habitat, and continue when the fish are landed, during transportation to during processing.

In inhibiting the deterioration of the quality of fresh fish, we can damage or kill the agents that cause damage, namely enzymes and bacteria. By using high temperatures, heating, cooking, and so on, so that the cause of the damage is no longer active.

However, this method not only affects the causative agents of fish quality decline, but also changes the original freshness of the fish. So as not to change the original nature of the freshness of the fish, a transportation technology is needed that can maintain the freshness of the fish so that the fish that reaches the consumer remains fresh.

Maintaining the quality of fishery products must start from harvest and continue throughout the process chain from harvest to consumers. For this reason, proper and careful handling from the time the fish are on the fishing boat to their transportation to the place of marketing or processing, is a critical stage. The physical, chemical and biological characteristics will determine how handling must be carried out to maintain the quality of fishery products.

Because fish quality deterioration is caused by physical, chemical and bacteriological processes, efforts must be directed at preventing or inhibiting these three processes. The principles that must be adhered to in the handling and transportation of fish are fast, clean and always at low temperatures. During handling and transportation, fish should not be exposed to sunlight and as much as possible avoid physical damage.

Whatever method of harvesting is done, it must be done carefully so that the fish do not flounder a lot. Fish that flounder too much besides quickly experiencing rigor mortis also secrete a lot of mucus and are likely to be injured. The presence of wounds and mucus on the surface of the skin will encourage the growth of bacteria in fish.

Fish should also be protected from sunlight and try not to dry the surface of the fish. If fish are intended to be transported live, they must be packed immediately according to the desired packaging technique (dry or wet

transport); and if it is to be transported dead, the fish must be immediately dies in accordance with the correct testing technique.

3. Live Fish Transportation

Live fish transportation is basically forcing fish to be placed in a new environment that is different from their original environment and is accompanied by very sudden changes in environmental characteristics. The success of reducing the sudden influence of change and the environment gives the possibility of reducing the death rate and achieving transportation goals [3]. Before being transported live fish will experience a physiological change from an active living state to a dormant state through an anesthetic process [4].

The success of live fish transportation is always influenced by the physiological characteristics of the fish itself, the size of the fish, the fitness/quality of the fish prior to transportation, the quality of the water during transportation (medium temperature DO, pH, CO_2 and ammonia), the density of fish in the container, mobility techniques using low temperatures or chemicals and natural metabolites and transportation time [5].

In fact, in carrying out live fish transportation activities there is always competition for the use of space and the utilization of available oxygen. Transportation with a closed system using plastic bags, the oxygen value is a determining parameter in the transportation of live fish [6]. The fish turns pale under stressful conditions, the color becomes whitish and the color pattern disappears. If fish can easily adapt to environmental conditions, the color pattern will quickly return to normal.

Temperature in the transportation of live fish plays an important role in controlling the metabolic rate of fish, at high temperatures the activity and metabolism of fish increases. Therefore low temperatures are maintained as long as possible to suppress metabolism and fish activity during transportation. So that the fish can be transported as long as possible.

According to [5] the ideal temperature for fish transportation ranges from 17-21^{o}C. According to [7] at temperatures of 21-27^{o}C there tends to be an increase in metabolism so that respiration increases the excretion of ammonia.

According to [8] the low solubility of oxygen in water will cause the color of the fish to become pale, fish activity is slow, sometimes fish rise to the surface. More on [5] in his research stated that an oxygen solubility of 3.47 mg O_2/liter causes fish to be restless, their color becomes pale, their activity is slow.

The ammonia content after transportation increases with increasing density. The ammonia content at the end of the transportation ranges from 8-11 mg/liter, but the ammonia (NH3) content is not yet toxic or lethal to fish, as can be seen from the fish survival rate which is still high. This is because the ammonia being analyzed is in the form of ammonium (NH4+), so the toxicity is not that strong. The increased ammonia content in water can be derived from the results of the metabolism of protein breakdown into ammonia by bacteria [8].

The high content of ammonia in the water causes high output of ammonia in the blood and tissues. This causes the pH in the blood to rise. This situation causes an increase in oxygen consumption by fish, while the solubility of oxygen in the media decreases, eventually causing fish death.

4. TRANSPORTATION CONTAINER

Live fish are usually transported and transported using closed or open containers. Containers that have been used traditionally are reefs, bamboo baskets, plastic cans, clay pots or wooden boxes, drums, “fiberglass” and metal barrels.

Transportation of live fish has been carried out in double plastic bags filled with water previously blown with oxygen, so that the fish can continue to breathe during transportation. This method of transportation using plastic bags turned out to be more suitable for fish species that are fragile or easily injured if they rub against the rough surface of traditional transportation containers. The tanks used for transportation generally use marine plywood, steel, aluminum, drum, plastic tanks made of glass fiber or the like.

Fish that weigh more and are transported in warmer water temperatures will require more oxygen. If the water temperature increases by 10^oC (for example from 10 to 20^oC), oxygen consumption will double, and vice versa. For every 0.5^oC increase in water temperature, the number of fish in the water must be reduced by 5.6% and vice versa [9].

If physical activity is a very important thing to pay attention to in handling live fish, of course if the fish can be anesthetized by reducing the temperature, the respiration rate will of course decrease and the respiration waste can be avoided mostly or completely.

5. TRANSPORTATION TIME

Transportation during the day can increase the temperature of the water in the fish pocket. To reduce the increase in temperature, ice cubes are used which are put in plastic and placed against the outside of the fish bag. Transportation for a distance of under 6 hours does not need to be replaced, but above that time it is necessary to make transit to replace the water in the fish bag and add oxygen.

Efforts to inhibit the rate of metabolism are carried out by keeping the water temperature low during transportation, namely by carrying out the transportation in the morning/evening or by adding ice to the transportation containers.

6. HANDLING AND TRANSPORTATION OF LIVE FISH

Live fish are usually sold at a much higher price than dead fish. However, the handling and transportation of live fish is indeed more difficult. Broadly speaking, the transportation of live fish is carried out in two ways, namely the dry system and the wet system.

a. **Dry System**

Some types of fish can survive even if they are out of water, as long as they are kept cool and wet. This system usually begins by immobilizing the fish with cold shock, chemicals (urethane, MS-22, tricaine-methane-sulphonate, etc.) or plant materials (rubber seed, cassava, clove extract, etc.) followed by packaging using media (moss, seaweed, wood shavings, sawdust, crushed ice, etc.), then transported under cool temperature conditions.

b. Wet System

This system can use containers/tanks, or bags. For tank systems, factors that need to be considered are levels of dissolved oxygen, CO_2, ammonia (NH_3), temperature, osmotic balance, and fish density. Transportation that is too crowded besides accelerating the decrease in dissolved oxygen, increasing temperature, CO_2, and ammonia, also allows the transmission of parasitic diseases from one fish to another. It is also necessary to watch out for the development of bacteria during transportation.

In the bag system, plastic bags are usually used. This bag is not completely filled with water, and the rest is filled with pure oxygen and tightly closed. In addition to supplying oxygen to fish, this method of packaging is also intended to anticipate high CO_2 released by fish (can reach more than 50 mg/l). This method is only used for small fish, bait fish, or fingerlings. The water used must be of high quality, using water where the fish originates whenever possible.

The temperature of the water for transport must be quite low and the fish must also be adapted to low temperatures and scraped (empty stomach) before being put into the bag.

Transportation of fish can be done with an open system and a closed system. In an open system, the water media in the container can be in direct contact with the open air outside the container, while in a closed system, contact with the outside air does not occur because the media is in a tightly closed container. To meet the demand for oxygen, pure oxygen gas is added to the container.

Transportation Preparation

1) Transportation activities consist of packing and transportation activities,
2) The fish to be packaged is fasted for about 24 hours first,
3) Fish to be packaged should be uniform in size to facilitate marketing,
4) The water to be used is of good quality, at least the same as the cultivation medium.

A. Open System Transportation

This system is usually used for transportation by land and the distance to be covered is relatively short. The containers used vary, ranging from simple or used chemical packaging, such as buckets, plastic jerry cans, plastic drums/barrels to those specially designed for transportation, such as fiber glass tubs. The nature of this container is generally sturdy and strong.

Open System Packaging Method
This system is usually used for transportation by land and the distance to be covered is relatively short. Closed packaging is carried out in the following way:

1. Fill the transport container in the form of a plastic or fiberglass drum with seawater up to ½ or 2/3 of the container according to the amount of fish to be transported.
2. Oxygen is flowed into the container through an oxygen hose that has been weighted and an aeration stone and is equipped with a regulator that functions to regulate the release of oxygen.
3. Enter the fish to be transported.
4. Add ice wrapped in a plastic bag to avoid decreasing salinity due to melting ice

In this transport, the source of oxygen for fish respiration is mostly oxygen dissolved in water, the rest is the result of diffusion from the air at normal air pressure. In this system the ratio of water volume to fish weight is relatively greater than in a closed system.

For transporting fish for 5 hours, at least 5 liters of water are required to transport 1 kg of fish. The longer the transportation time, the higher the ratio of water volume to fish weight. In order to reduce the volume of water or to increase the transport time, efforts are made to inhibit the metabolic rate and provide oxygen during transportation in an open system.

B. Closed System Transportation

In a closed system, pure oxygen is introduced into the transport container and the air pressure is higher than outside the container. This causes the concentration and solubility of oxygen in the water medium to be quite high, so that the ratio of the volume of water to the weight of fish in a closed system is higher than in an open system, which means it can reduce the cost of transport per kg of fish. Today almost all fish traders transport fish in a closed system, because it is considered practical but safe. Closed transport systems are generally used for the egg, larva, seed, consumptions and brood phases. As for mains size and consumption, it can also be done with an open system.

Closed System Packaging Method
This system is a packaging system that is considered the safest to use, both for short and long distance transportation. Closed packaging is carried out in the following way:

1. The materials that must be prepared are pure oxygen, plastic bags, rubber, styrofoam, ice cubes and duct tape,
2. A plastic bag with a size of 150 cm is tied in the middle so that it is divided into two parts, after that the first part is turned over so that the plastic looks doubled,
3. Sea water is put into a plastic bag as much as one-third of the volume of the plastic bag for a seed density of 110-120 heads/container,

4. The air in the plastic bag is removed and then pure oxygen is put into it through a hose connected to an oxygen cylinder,
5. Plastic bags are then tied with rubber and avoid air bubbles,
6. Put the plastic bag into the styrofoam with the plastic bag lying down,
7. To maintain the temperature, put ice cubes that have been wrapped in plastic into the styrofoam.

C. Control during Transportation

Control during transportation can be done by transporting fish in the morning or evening when the temperature is cold. Control water temperature during transport and modify packing bags during the day or hot temperatures.

7. CONCLUSION

The success of live fish transportation is always influenced by the physiological characteristics of the fish, the size of the fish, the fitness/quality of the fish prior to transportation, the quality of the water during transportation (medium temperature DO, pH, CO_2 and ammonia), the density of fish in the container, mobility techniques using low temperatures or other materials. Chemical and natural metabolites and transportation time. Efforts to inhibit the rate of metabolism are carried out by keeping the water temperature low during transportation, namely by carrying out the transportation in the morning or at night or by adding ice to the transportation container. Broadly speaking, the transportation of live fish is carried out in two ways, namely the dry system and the wet system. Transportation of fish can be done with an open system and a closed system. The water temperature must always be controlled during the process of transporting live fish.

8. REFERENCE

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