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EFFECT OF SIZE ON THE FRESHNESS OF CARP (*CYPRINUS CARPIO*) IN LOW TEMPERATURE STORAGE

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ABSTRACT:

This study aims to determine the effect of size on the freshness of carp in low temperature storage. This research has been carried out in the Laboratory of Fisheries Product Processing in Faculty of Fisheries and Marine Science, Universitas Padjadjaran that has been starting in November 2019. The research method carried out experimentally consisted of 3 types of fish sizes, that was fish size of 100-200 grams, 200-300 grams and >300 grams with 15 semi-trained panelists as replication. The observation parameters in this study were weight loss, degree of acidity (pH), water content and organoleptic tests that were tested Every day the 1st, 3rd, 5th, 6th and 7th storage. Organoleptic test analysis using the *Friedman Test*. The weight loss, water content, and pH were analyzed descriptively. Fish of size 100-200 grams have been rejected on the 5th storage day and sizes >300 gram are still fresh until the seventh day.

Key words: C*arp, Fish size, Weight loss, Water Content, Low temperature, pH and Organoleptic test.*

1. INTRODUCTION

Carp is a consumption fish that is consumed by many people andis a type of freshwater fish cultivated in West Java (KKP, 2010). Potencythe carp market in Indonesia is quite high, carp are one of Indonesia's leading fish commodities with an average increase of in 2010 to 2013 7.09% [13]. Quality degradation in fish is very easyoccur. This is because the fish's body has a high water content (80%) and pHthe body approaches neutral so it makes the fish a good medium forthe growth of decaying bacteria and other microorganisms [1].Handling fish is an important part because it can influencefish quality. Handling commonly used is low temperature storage.Low temperature storage can inhibit fish quality degradation [8].

In the same type of fish, smaller fish will be fasterrot because it has a higher water content in the tissue [10]. Large fish have more glycogen reserves compared to small fish so that the tendency for the process of glycolysisslower [19]. The freshness of fish can be determined by organoleptic quality testing [15].Organoleptic quality testing is done to determine the condition of fishso that it does not endanger health when consumed.

2. MATERIALS AND METHODS

The tools used for fish storage are styrofoam plates, papertissue, plastic warp , sonde skewer and basin. The tool used in testingorganoleptic, namely a plate as a place to present samples, assessment sheets and toolswrite it. Tools for pH testing, namely measuring cups, scales, pestle and mortar, spatula, and pHmeters.

The raw material used is carp which is still fresh obtained fromCianjur The fish used are 100-200 grams, 200-300 grams and> 300 grams. Arriving at Jatinangor, carp are put in a reservoir foradaptation process. During the adaptation process that lasts for one day, the water iscontained in the reservoir is given aeration. The purpose of adaptation iseliminate stress that might be experienced by fish during transportation, becausefilet made from stressed fish will decrease its freshness fasterso that the shelf life is shorter [3].

The best way to kill fish is by being stabbed [16]. After that the fish is placed on a styrofoam plate that has been coatedtissue paper then warped so that no contamination occurs. Fish that have beenin warping , immediately put in the refrigerator at a temperature of 5-10^{o} C.

This research was conducted in November 2019 at the Laboratory Fishery Product Processing Faculty of Fisheries and Marine Sciences UniversityPadjadjaran with experimental methods consisted of 3 sizes of fish with 15 people semi-trained panelists as a test. The preference test results were statistically analyzedusing the Friedman Test as well as the pH test, weight loss, water content and organolepticsanalyzed descriptively.

2.1 pH Test

Samples of 10 grams of carp meat crushed and added 10mldistilled water. The pH measurement is done using a pH meter that has been previouslycalibrated buffer solution [14].

2.2 Weight loss

Fish weight loss measurements at the beginning and end of observationsdone by calculating the weight difference. Weight lossin percent is calculated according to the formula as follows [14]:

$$Weight\ loss\ (\%) = \frac{Initial\ weight - Final\ Weight}{Initial\ Weight} \times 100\%$$

2.3 Water Content

The method of determining water content by drying is carried out at Ruminant and Food Lab, Faculty of Animal Husbandry, Padjdjaran University. Water content can be calculated using the following formula [6]:

$$Wet\ base\ water\ content\ = \frac{w - (w1 - w2)}{w} \times 100$$

Information:
W : sample weight before drying (g)
W1 : sample weight and dry cup (g)
W2 : empty cup weight (g)

2.4 Data

Data obtained from organoleptic observations were analyzed usinganalysis of the two-way variant of the Friendman test with the Chi-square test. The test was carried out forknow the effect of size on the freshness of carp (*Cyprinus carpio*) on low temperature storage. If the value of H c <x 2 α (K-1), then accept H 0 and reject H 1 , and if the value of H c > x 2 α (K-1), then H 0 is rejected and H 1 is accepted. If H 1 is accepted, then the treatment makes a noticeable difference and testing continues to find out the median values are not the same and to know the differences between treatmentsby multiple comparison tests [22].

3. RESULTS AND DISCUSSION

3.1 Weight loss

Weight loss (Figure 1) measuring 100-200g and 200-300g occursas much as 4% while fish> 300g have a weight loss of 3%. Fish species,handling, season and size of the fish will affect the weight loss. Duringstorage, weight loss occurs due to denaturation and autolysis processes[3].

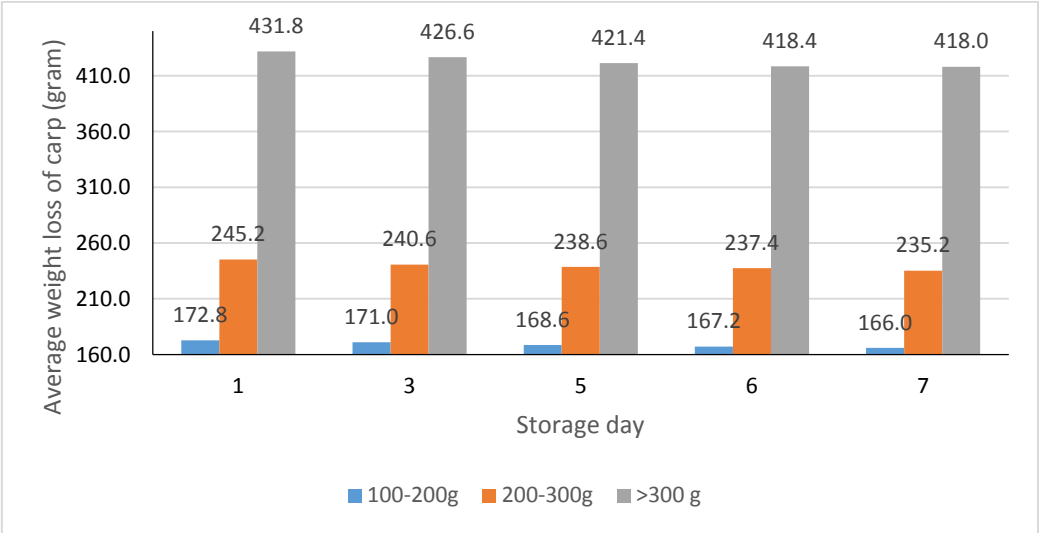


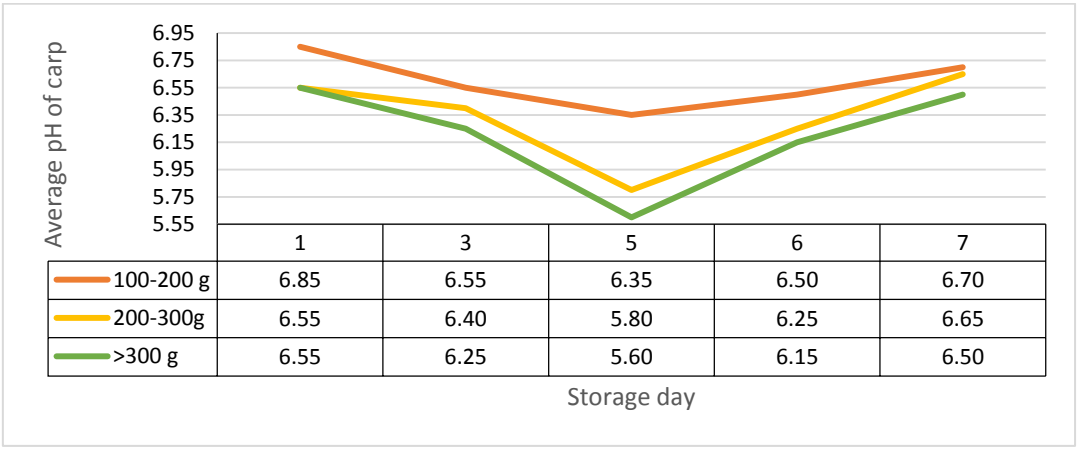
Figure 1. Weight Loss of Carp during Storage

Autolysis is an overhaul of fish meat by enzymes that come from the bodyown fish. Katepsin enzyme, which is a proteolytic enzyme whose function is to break downprotein into simple compounds. In the enzymatic process, proteins are broken downinto peptons, polypeptides, and amino acids. Denatured protein willlost the ability to hold bodily fluids so that the outside is drip. Drip isfish body fluids that trickle out and settle to the bottom of the plate [2]. The autolysis process causes a decrease in ability protein to bind body fluids, so that body fluids that are rich in nutrients willout as a drip [3].

Weight loss is also caused by microbes especially bacteria[17]. Bacteria cause the product to break down macro compoundsso the strength of fish tissue decreases due to protein overhaul. Change it upprotein will result in reduced strength of the constituent fibersmeat in holding water. Larger fish have more weight lossless than small fish.

3.2 Value of pH

The pH value of carp in figure 2, the pH of carp initially experiencedthen the next decline will go up. The states that the pH of fish after death will decrease toreach a value of 6[15]. The change in pH value decreases proportional to the formationlactic acid produced from the glycolysis process.



	1	3	5	6	7
100-200 g	6.85	6.55	6.35	6.50	6.70
200-300g	6.55	6.40	5.80	6.25	6.65
>300 g	6.55	6.25	5.60	6.15	6.50

Figure 2. pH Value of Carp

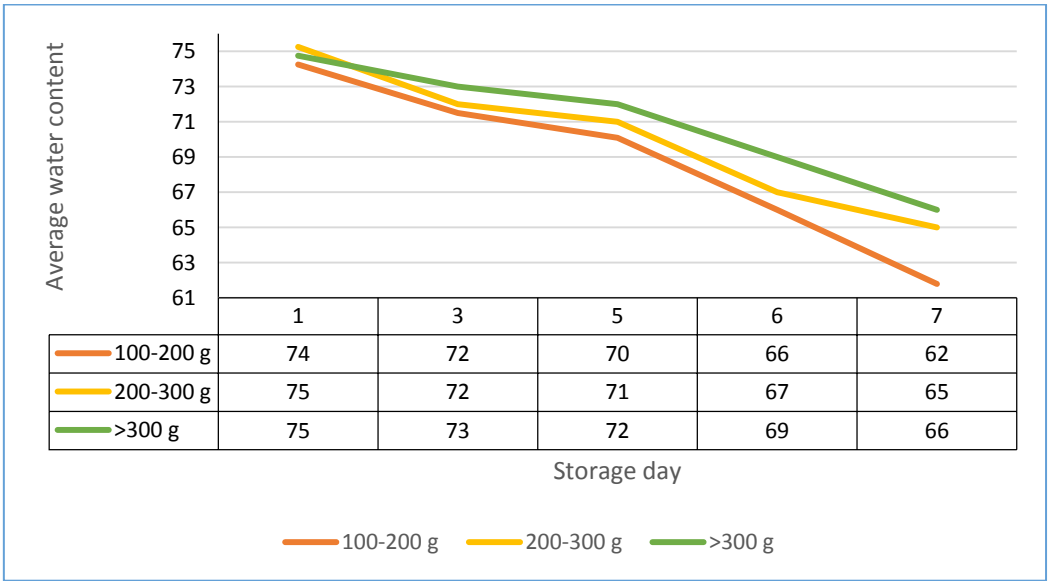
The decrease and increase in pH is a result of the compounding processfish meat macro into simpler compounds. The decrease in pH beginsfrom the pre-rigor mortis pHase , where fish muscles experience relaxation and contraction due Actin and myosin bonds are broken in the fish's body. The breakdown of glycogen to become acidiclactate will make the pH of meat around 6.4 to 6.8[2].This reshuffle happened because of the cessation of oxygen supply. PHase pre rigor mortis this only occurs for 11 hours after fish death. After the fish die, a process occursanaerobic glycolysis, which is a glycogen compound that breaks down continuouslyto lactic acid, causing a decrease in pH.

At the next storage will increase the pH value. Accumulationammonia and hydrogen sulfide compounds will slowly increase the pH to approach neutral. Increased pH due to accumulation of lactic acid due to Glycogen compounds have been depleted while macro decomposition by Enxim continuestook place [18]. Decomposition of protein causes uterus Non-protein nitrogen in fish increases. Nitrogen base accumulation causes fish meat becomes more alkaline thereby increasing the pH value [10].

Differences in age of fish harvestcause differences in glycogen content in fish size [19]. Sized fish large have more glycogen reserves than small fish so that the tendency for glycolysis to be slower.

3.3 Water Content

Water content of carp (*Cyprinus carpio*) is generally ata range of 74.55%-76.31% [4]. Water content in ingredientsfood shows the total amount of water contained in either material free water, water dispersed on the surface of macromolecules or bound water physically and chemically. The water content of carp can be seen in Figure 3



	1	3	5	6	7
100-200 g	74	72	70	66	62
200-300 g	75	72	71	67	65
>300 g	75	73	72	69	66

Figure 3. Water Content of Carp

The carp studied had a 74% -75% Water content on the first storage day.The longer storage results in a decrease in freshness. This is becausedenaturation in fish. Fish proteins are experiencing denaturation will lose the ability to hold bodily fluids, so this fluid will come out of the body in the form of drip [2]. Drip liquid is a nutrient used by microbesas food so that microbial growth is increasingly rapid. In picture 5 seen the most drastic reduction in water content on storage days 6 and 7 on fish size 100-200 g, but fish measuring 200-300g and >300g do not see a decrease in excessive water content.

Freshness and durability of food are influenced by water content in organismswaters for biological or chemical reactions. The higher the water content in an ingredientfood, the higher the growth of microorganisms so that it will acceleratethe process of decay, considering that water is a growing medium for microorganisms [23].The high content of free water can have implications for the low ability of the muscles inbinding water (water holding capacity), causing a decrease in water content.

The decrease in water content is caused by an increase in fish pH. According to Herawati et al(2014), WHC was still relatively high in the pre rigor phase but gradually declinedalong with the decrease in pH value and the amount of muscle tissue ATP (pre rigor mortis condition),after that the water binding capacity will increase again due to the activity of the cathepsin enzyme infish meat that is active when the pH drops or is low.

3.4 Scoring Test

3.4.1 Apperance

Based on panelist's assessment of the appearance of carp, it is known that the fishmeasuring 100-200g have been rejected on the fifth storage day and fish measuring 200-300g was rejected on the seventh storage day (Table 1).

Table 1. Value of Organoleptic Appearance of Carp

Size of Fish	Storage Day				
	1	**3**	**5**	**6**	**7**
100-200 g	9	7	3	3	3
200-300 g	9	7	7	5	3
>300 g	9	9	7	5	5

Changes in appearance and body color occur even if stored at low temperatures.In the last period of rigor mortis seen more real changes. After a dead fish hyperaemia will occur , i.e. releasemucus from the mucous glands in fish body. Mucus is often benefited by microbes asgrowth media[2]. On the fifth day of storage, the pH of fish measuring 100-200 grams rises close toneutral. Neutral pH makes fish a good medium for bacterial growthspoilage and other microorganisms[1].

Friedman statistical test results showed that the size of the fish 100-200 grams are differentreal size of fish with 200-300 grams and >300 grams. That smaller fish will rot more fast because of its lower water binding ability[10]. Large fish have more glycogen reservescompared to small fish so that the tendency for the process of glycolysis to beslower [19].

Fish will appear to be lackingbrilliant because of the onset of mucus [18]. Mucus is a clear and slippery liquid that comes out offish body due to damage to fish meat protein components. Protein damagecausing the release of water bonds so that more free water comes out of the tissuemeat. The liquid carries protein albumin, mineral salts and vitaminsis a good substrate for bacterial growth [18].Bacterial activityis also a cause of mucus. The outside of the bacterial cell is surrounded by layersthe mucus produced by the bacteria itself. Excessive mucus production by bacteria willresulting in ropiness ie thick mucus in the form of a rope in food spoilage.

3.4.2 Aroma

Based on panelist's assessment of the Aroma of carp, it is known that fishmeasuring 100-200g and 200-300 g have been rejected on the seventh storage day (Table 2).

Table 2. Value of Organoleptic Aromas of Carp

Size of FIsh	Storage Day				
	1	**3**	**5**	**6**	**7**
100-200 g	9	7	5	5	3
200-300 g	9	9	7	7	3
>300 g	9	9	7	7	5

Friedman statistical test results show that among the three measures, nothere is a real difference. The stench of fish that has passed the rejection limitorganoleptic caused by the process of decomposition of proteins and fats. Spoilage in fish is more oxidative rancidity [11]. This change occurred as a resultoxidation of fats causing an unwanted rancid odor. Change of protein by enzymes being peptides and free amino acids that cause odor in fish. Onfirst day storage of specific types and fresh smelling fish after that change intoneutral then comes the fishy odor formed from trimethyl amine and histamine. Solutionfat in the body of the fish will produce fatty acids and glycerol. Free fatty acids willformed and will affect the fresh aroma of fish [1].

3.4.3 Texture

Based on the panelist's assessment of the texture of carp it is known that, that of fish 100-200g in size have been rejected on the fifth storage day (Table 3).

Table 3. The Organoleptic Texture Value of Carp

Size of FIsh	Storage Day				
	1	3	5	6	7
100-200 g	9	9	3	3	3
200-300 g	9	9	7	5	5
>300 g	9	9	7	5	5

Friedman statistical test results showed that the size of the fish 100-200 grams are differentreal size of fish with 200-300 grams and >300 grams. Texture changes where the meat becomes softer occurs when the fish have starteddeteriorates due to bacterial and enzyme action. This is due toby the beginning of an alteration in the muscle tissue of the meat by an enzymatic process. At the stageearly fish are still elastic and springy, then become hard and stiff. Next is fish meatbecome soft and inelastic[1]. Bacterial activity on the insidefish meat accelerates the deterioration of fish quality [7].

Quality deterioration is influenced by denaturation and autolysis. Protein denaturation willresulting in reduced strength of the constituent fibers in the flesh to hold water.The lower muscle connective tissue of the fish and the physical properties of this tissue are differentresulting in a more tender meat texture[17].

3.4.4 Eye

Based on a panelist assessment of carp eye sightings, it is known that fish100-200g in size have been rejected on the fifth storage day (Table 4).

Table 4. The Organoleptic Eye Value of Carp

Size of FIsh	Storage Day				
	1	3	5	6	7
100-200 g	9	7	5	3	3
200-300 g	7	7	5	5	5
>300 g	9	7	7	5	5

Friedman statistical test results show that among the three measures, nothere is a real difference. Fish eye that was originally convex with white pupilstransparent and brilliant to sink or concave and tend to shrink. Pupilseyes look dull while black corneas tend to be opaque white. Microorganismsattacking the body of the fish not only from the surface, but also from the eyeball, gills, and contentsstomach so that the eyes are easier to rot (Irianto and Giyatmi 2014).

Fresh fish have characteristics that are eye sightingconvex, transparent corene and shiny black pupils while the fish are alreadyrot has a characteristic appearance of a concave eye, cornea milky white,murky white pupils, dull, shrink and sink [15]. Eye changes become concave to rot fish caused by the release of water bonds so that the surface straincorneas decrease due to water loss[21].

3.4.5 Gills

Based on a panelist assessment of carp eye sightings, it is known that fish 100-200g in size were rejected on the seventh day of storage (Table 5).

Table 5. Value of Organoleptic Gills of Carp

Size of FIsh	Storage Day				
	1	3	5	6	7
100-200 g	7	7	7	5	3
200-300 g	7	7	7	5	5
>300 g	9	7	7	7	5

Friedman statistical test results show that among the three measures, nothere is a real difference. The gills of fresh fish were originallybrilliant orange red begins to turn faded red then redbrownish or greenish red and slimy[1]. That discoloration in fish indicates that the fish has deteriorated or qualityspoilage seen from changes in brownish gills, foul odor and texturebroken [5].

The red color of the gills is relatedwith the physiological function of the gills [24]. Blood vessels are found in the gill filaments andis where oxygen and carbon dioxide are exchanged, then oxygen willdiffuse into the blood vessels in the gills joined with hemoglobin for use bycell. Exchange of oxygen and carbon dioxide does not occur in fish that die, so the colorthe gills will turn pale as the time goes by after the fish die

CONCLUTION

Based on the results of the study, carp sizes of 100-200 grams and 200-300 grams have been rejected at low temperature storage on the seventh day. While fish >300 grams in storage on the seventh day are still accepted.

REFERENCE

[1] Afrianto, E dan Evi Liviawaty. 1989. Pengawetan dan Pengolahan Ikan. Kanisius, Jakarta.
[2] Afrianto, Eddy dan Evi Liviawaty. 2010. Proses Penurunan dan Cara Mempertahankan Kesegaran Ikan. Widya Padjadjaran. Bandung.
[3] Afrianto, Eddy, Evi Liviawaty, Otong Suhara, dan Herman Hamdani. 2014. Pengaruh Suhu dan Lama Blansing Terhadap Penurunan Kesegaran Filet Tagih Selama Penyimpanan Pada Suhu Rendah Temperature and Blanching Time Effect on Declining Tagih Fillet Freshness during Storage at Low Temperature. *Akuatika* 5(1): 45–54.
[4] Afkhami, F, Javidi M, Zarei M. 2011, Antibacterial Effect of Calcium Hydroxide on Intraluminal and Intratubular Enterococcus faecalis, Iranian Endod J., 6 (3) : 103-106.
[5] Annas, Fatimah Zahra. 2017. Assesmen Kesegaran Ikan Nila Berdasarkan Perubahan Warna Mata dan Insang Berbasis Pengolahan Citra. *Skripsi*. Institut Pertanian Bogor. Bogor.
[6] AOAC. 1995. *Official Methods of Analysis. Association of Official Analytical Chemists*. Washington.
[7] Bawinto, Adelia Since, Eunike Louisje Mongi, dan Bertie Elias Kaseger. 2015. Analisa Kadar Air, PH, Organoleptik, Dan Kapang Pada Produk Ikan Tuna (*Thunnus sp*) Asap, Di Kelurahan Girian Bawah, Kota Bitung, Sulawesi Utara. *Media Teknologi Hasil Perikanan* 3(2): 55–65.
[8] Handayani, Anna, Alimin, Wa O De Rustiah. 2010. (Freezer - 3^{o}C) Terhadap Kandungan Air Dan Kandungan Lemak Pada Ikan Lemuru. *Al-Kimia* (3): 64–75.
[9] Herawati, Diah Putri, YS Darmanto dan Romadhon. 2014. Pengaruh Cara Kematian dan Tahapan Penurunan Kesegaran Ikan Terhadap Kualitas Pasta Ikan Mas (*Cyprinus carpio*). *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan*. Volume 3, Nomer 3, hal 23-31.
[10] Irianto, HE, dan S Giyatmi. 2014. Teknologi Pengolahan Hasil Perikanan. : 1–53. http://repository.ut.ac.id/4554/1/LUHT4443-M1.pdf.
[11] Ilyas, S. 1993. Teknologi Refrigenerasi Hasil Perikanan. Jilid II: Teknik Pembekuan Ikan. CV Paripurna. Jakarta.
[12] KKP. Kementerian Kelautan dan Perikanan. 2010. Statistik Kelautan dan Perikanan 2016. Pusat Data Statistik dan Informasi Kementerian Kelautan dan Perikanan. Jakarta.
[13] KKP. Kementerian Kelautan dan Perikanan. 2014. Statistik Kelautan dan Perikanan 2008. Pusat Data Statistik dan Informasi Kementerian Kelautan dan Perikanan. Jakarta.
[14] Liviawaty, Evi. 1999. Pengaruh Waktu Pembuatan Filet Ikan Nila Merah (Oreochromis niloticus). *Tesis*. Universitas Padjadjaran. Bandung.
[15] Liviawaty, Evi. 2005. Petunjuk Praktikum Penilaian Organoleptik Ikan. Buku *Petunjuk Praktikum*. Univesitas Padjadjaran. Bandung.
[16] Munandar, Aris, Nurjanah, dan Mala Nurilmala. 2009. Kemunduran Mutu Ikan Nila (*Oreochormis niloticus*) pada Penyimpanan Suhu Rendah dengan Perlakuan Cara Kematian dan Penyiangan. *Jurnal Teknologi Pengolahan Hasil Perikanan Indonesia* 10(2): 88–101.

[17] Manalu, Merlin. 2010. Penggunaan Ekstrak Bagian Tanaman *Sargassum sp*. untuk Meningkatkan Masa Simpan Bandeng Segar (*Chanos chanos*) pada Penyimpanan Suhu Rendah (5^{o} – 10^{o} C). *Skripsi*. Fakultas Perikanan dan Ilmu Kelautan. Unpad.

[18] Manurung, Samuel Galaxy. 2010. Pengaruh Ekstrak Lidah Buaya (*Aloe vera*) terhadap Masa Simpan Bandeng (*Chanos chanos*) pada Penyimpanan Suhu Rendah. *Skripsi*. Fakultas Perikanan dan Ilmu Kelautan. Unpad.

[19] Nurjanah, Tati Nurhayati, dan Rijan Zakaria. 2011. Kemunduran Mutu Ikan Gurami (*OspHronemus gouramy*) Pasca Kematian pada Penyimpanan Suhu *Chilling*. *Sumberdaya Perairan* 5(2): 11–18.

[20] Oyelese, O. A. 2007. *Drip* loss measurements, organoleptic assessment and filleting characteristics of the silver catfish Chrysichthys Nigrodigitatus under low storage temperature conditions. *Journal of Food Processing and Preservation* 31(4): 469–79.

[21] Rahayu, Roni. 2002. Pengaruh Cara Pemasaran Ikan terhadap Kemunduran Mutu Ikan Bandeng yang Berasal dari Pasar Caringin, Bandung. *Skripsi*. Fakultas Pertanian. Unpad.

[22] Sudrajat, M. 1999. Statistik Non Parametrik. Fakultas Pertanian, Universitas Padjadjaran. Jatinangor

[23] Winarno FG. 2002. Kimia Pangan dan Gizi. Gramedia Pustaka Utama. Jakarta.

[24] Wilson JM, Laurent P. 2002. Fish gill morpHology: inside out. *Journal of Experimental Zoology*. 293: 192-213.