ANALYSIS OF THE IMPACT OF FLOATING NET CAGES ON WATER QUALITY OF LAKE BULILIN, SOUTHEAST MINAHASA REGENCY NORTHSULAWESI PROVINCE

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ABSTRACT
Pollution that occurs in the waters of Lake Bulilin is thought to originate from the flow (input) of the waste load of community activities that take place in indogenously (lake water bodies) and exogenously (outside the lake). Waste originating from activities that take place in water bodies originates from KJA activities. The organic waste load sourced from KJA in the form of leftover feed and fish feces can reduce the quality of lake waters. In addition to this, the decline in water quality is also caused by waste originating from outside the lake in the form of domestic waste, waste from agricultural and livestock activities around the lake waters. Based on this, the following research problems can be formulated: (1) What is the quality of the waters and the level of water pollution in Lake Bulilin, Southeast Minahasa Regency, North Sulawesi Province. (2) What is the public's perception of the Lake Bulilin KJA, Southeast Minahasa Regency, North Sulawesi Province. The aims of the study were: (1) to analyze the water quality and contamination level of Lake Bulilin waters. (2) Analyzing the public's perception of the Lake Bulilin KJA. Based on the results of the study, it can be concluded that: (1) The water quality display for Lake Bulilin has exceeded class 1 water quality standards, based on PP. No. 82 of 2001 which is designated as a source of raw water for drinking water is BOD5, COD, fecal coliform, and total coliform. Based on the Aquatic Environmental Quality Index (IMPL), the quality of the waters of Bulilin Lake is included in the moderate or slightly polluted quality category. (2) The community's perception ofthe impact of KJA on the quality of lake waters around their residence is relatively negative, meaning that the community believes that the aquatic environment of the lake has been polluted by KJA, which is increasing in abundance in Lake Bulilin. For this reason, it is suggested that: (1) Regency governments need to improve pollution control programs, especially those concerning waste control; both domestic waste, KJA waste, livestock waste, as well as erosion control, both residential and agricultural erosion. (2) In order to maintain the preservation of Lake Bulilin, it is necessary to make policies that are not only oriented towards economic growth, but also guarantee environmental sustainability. KJA waste, livestock waste, and erosion control, both residential and agricultural erosion. (2) In order to maintain the preservation of Lake Bulilin, it is necessary to formulate policies that are not only oriented towards economic growth, but also guarantee environmental sustainability. KJA waste, livestock waste, and erosion control, both residential and agricultural erosion. (2) In order to maintain the preservation of Lake Bulilin, it is necessary to formulate policies that are not only oriented towards economic growth, but also guarantee environmental sustainability.

Keywords: Floating Net Cage, Lake Water Quality.

INTRODUCTION

Pollution that occurs in lake waters isan important issue that needs attention from various parties. This is caused by various sources of contaminants that enter and accumulate in the lake. Sources of pollutant materials, among others, come fromproductive and non-productive activities inhe *upland*, from settlements and activitiesthat take place in the water area of the lake itself, and so on. The main types of pollutant materials that enter lake waters consist of several types, including organic and non- organic waste, pesticide residues, sediment, and other materials.

Floating Net Cages (KJA)Cultivation is a fishery business that can be developed intensively, in limited waters by providing additional feed (generally artificial feed), so that it is possible to develop it on an industrial scale. Providing additional feed in aquaculture allows the accumulation of organic waste originating from wasted feed residues, in addition to fish waste. These organic materials will experience decomposition and break down into nutrients,mainly in the form of nitrogen (N) and phosphorus (P) compounds which are needed by phytoplankton. In natural waters, phytoplankton is a primary producer that influences the abundance of

organisms at the trophic level above it. Leftover feed and fish waste from the KJA will act as fertilizer in the waters concerned.

Danakusumah and Herawan (2000) stated that the reservoir is a large pool owned by the public which has a limited carrying capacity. Opportunities to gain large profits from fish farming in reservoir waters have stimulated people's desire to do marine cage business in waters with relatively limited carrying capacity. The negative impact of an aquaculture business that exceeds its capacityis the occurrence of mass mortality of cultivated fish. In Cirata the largest contributor of organic waste is from KJA cultivation activities, which reaches 80%(Garno, 2000). Also added by Garno (2000) that because of the presence of organic matter, the Cirata Reservoir is approachinghypertrophy. The results of Nastiti et.al's research. (2001) in the waters of the Saguling, Cirata, and Jatiluhur Reservoirs also found that the largest total N and total P contributors (83.63 – 99), comes from fish farming.

Furthermore, the results of research by Widyastuti (2004) in the Panglima Besar Reservoir, General Sudirman Purwokerto, and Prihadi (2005) in the Cirata Reservoir, West Java; both of them concluded that the intensive KJA cultivation in the reservoir has been faced with several serious problems, namely: decreased water quality, siltation, plankton blooms, and deposits. The resultsshowed that fish farming activities in floatingnet cages in the Cirata reservoir had far exceeded their carrying capacity. The carrying capacity of the Cirata Reservoir can accommodate 4,625 units or around 18,500 KJA with a size of 7x7x3 m3 per cage with a total production of 18,500 tons per year. Currently, the number of cages has reached 38,286 KJA, and the high number of cages has resulted in a decrease in water qualityboth during the rainy season, dry season, and transitional seasons.

The mass death of fish in KJAoccurred in Lake Maninjau, where 950 tonnesof fish died in October 1997 (Syndri, 2000).In the Juanda Reservoir, mass mortality of cultivated fish (carp and tilapia) was found which reached more than 900 tonnes in December 1999 (Danakusumah and Herawan, 2000).

Lake Bulilin in Tombatu District, Southeast Minahasa Regency is in the middle of 3 villages, namely Betelen Satu Village, Kali Village, and Touliang Oki Village.Because of the very strategic location of the 3villages, the people in the vicinity really depend on Lake Bulilin for their livelihood, namely as KJA entrepreneurs. The carrying capacity of Lake Bulilin is 2,925 units or around 11,700 KJA with a size of 7x7x7x3 m3 per cage with a total production of 11,700tonnes per year. Currently, the number of cages has reached 14,214 KJA, the high number of cages has resulted in siltation due to leftover feed, and decreased water quality for plankton blooms, so in Bulilin Lake there are often mass deaths of aquaculture (carpand tilapia) of up to hundreds of tonsresulting in losses for KJA farmers, (Tampang, et al. 2019).

When there is a reversal of the water mass (upwelling), there is infiltration of red blood cells out of the tissues, necrosis, and pigmentation of the organs of the fish's body, especially the liver, kidneys, and spleen, so that these organs do not function properly, besides that these organs are more fragile.The affinity of hemoglobin for toxic gases is much higher than that of oxygen, so aeration is less helpful and fish death cannot be avoided. This histological abnormality is also characterized by high levels of heavy metals contained (Prihadi, 2005).

Now, almost all users of the lake's aquatic ecosystem are less concerned about the aquatic ecosystem of Lake Bulilin. The ecological principles that lake waters have a carrying capacity and a limited capacity to assimilate waste are not understood by most of the people who use the lake. For example, the use of lakes for aquaculture activities withKJA techniques always increases from year to year.

The entry of feed waste (nutrients) into lake waters in excess amounts can cause the waters to become too fertile it will stimulate the blooming (explosion) of phytoplankton populations and water microbes that are pathogenic. Nutrient andorganic wastes, both in dissolved and particulate form, originate from uneaten feed and fish excretion, which are generally characterized by increases in total suspended solids (TSS), BOD5, COD, and C, N, and P content. the impact of waste disposal which isrich in nutrients and organic matter, can increase sedimentation, siltation, hypoxia,hypernutrification, and changes in productivity, as well as benthic community structure (Barg, 1992).

Pollution that occurs in the waters of Lake Bulilin is thought to originate from the flow (input) of waste loads from community activities that take place in indogenously (lake water bodies) and in exogenous (outsidethe lake). Waste originating from activities that take place in water bodies originates from KJA activities. The organic waste load sourced from KJA in the form of leftoverfeed and fish feces can reduce the quality of lake waters. In addition to this, the decline in water quality is also caused by waste originating from outside the lake in the form of domestic waste, and waste from agricultural and livestock activities around the lake waters. These phenomena reveal that thepollution that occurs in the waters of Lake Bulilin is increasingly worrying because itcan threaten the preservation of the function of the lake. This is a problem that needs to

be taken seriously immediately so that it does not spread and get worse in the future. Based on this thought, the researchers formulatedthe title: "Analysis of the Impact of Floating Net Cage on the Water Quality of Lake Bulilin, Southeast Minahasa Regency, North Sulawesi Province".

Formulation of the problem based
On the background of the problem, the research problem can be formulated as follows:
How is the quality and level of pollution of the waters of Lake Bulilin, Southeast Minahasa Regency, North Sulawesi Province.
What is the public's perception of LakeBulilin KJA, Southeast Minahasa Regency,North Sulawesi Province.

Research purposes
Based on the formulation of the problem, thisstudy aims to:
Analyzing the quality and level of contamination of the waters of Lake Bulilin, Southeast Minahasa Regency, NorthSulawesi Province.
Analyzing public perceptions of the Lake Bulilin KJA, Southeast Minahasa Regency,North Sulawesi Province.

Research Urgency
The Lake Bulilin ecosystem is the main support for life and a direct provider of livelihoods for the surrounding community. There is a link between community activities and the condition of the Bulilin Lake ecosystem. Identification of problems in the management of Lake Bulilin refers to the assessment of biodiversity in the Drivers- Pressures-States-Impacts-Responses (DPSIR)framework developed by Bin, et. al., (2009)in Sulistiawati (2011). According to Bowen and Riley (2013), the DPSIR model aims to identify key aspects or parameters in a systemand monitor the level of sustainability of management. The urgency of the research canbe described in chart form in Figure 1.
Condition Change PressureEnvironment, Environment,
Environmental Driving Factors Impact
Drivers(D) Pressures (P) *State Changes*(S) Impacts (I)

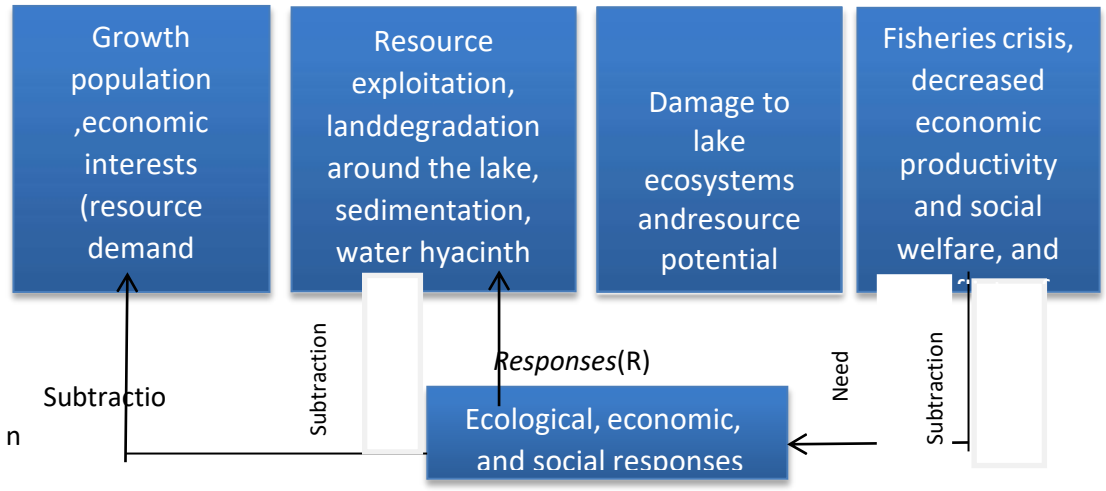

Figure 1 The Urgency of Research on the Management of Lake Bulilin withDPSIR framework.

RESEARCH METHODS
Location and Time of Research The research location is Lake Bulilin,Southeast Minahasa Regency, North
Sulawesi Province. The research period is 6months, starting from April to September 2022.

Determination of Water SamplingLocations
Determination of locations for takingsamples of physical, chemical, and microbiological parameters of lake waters isdetermined on an arbitrary basis purposive (on purpose). Water sampling is more directed at population activity centers as a source of waste flowing into lake waters, such as settlements, and KJA activity locations. Sampling was carried out 3 times,with an interval of every 2 weeks. The sampling time was carried

out around 09.00-11.00.
The water parameters studied include physical, chemical, and microbiological waters. The types of parameters and the method of measuring water quality refer to the MENLH Decree Number: KEP-58/MENLH/12/1995, concerning Liquid Waste Quality Standards for Hospital Activities and KEP-02/MENKLH/I/1998 (Table 1).
Table 1 Water quality parameters and method of analysis

Parameter	Unit	Analysis Method	Tool
PHYSICS Temperature Turbidity	□C NTU	Expansion Turbidimetric	Thermometer turbidimeter
CHEMISTRY pH BOD	unitsmg/l	PH meter Titrimetric	PH meterTitration
COD DO	mg/l mg/l	Titrimetric Titrimetric	Titration Titration
MICROBIOLOGY coliform *E. coli*	MPN/100 ml MPN/100 ml	FiltrationFiltration	MPN table, incubator tube,

Source: Saeni and Darusman (2001), Fardiaz (2002), Effendi (2003), Manik (2003). Lay (2004),
Materials and Research Tools
The research materials were water samples from each predetermined point and reagents for physical, chemical, and microbiological analysis, while the tools used included: cooling flasks, BOD bottles, spectrophotometers, pH meters, MPN tables, Sedgwick Rafler (Saeni and Darusman, 2001,Lay, 2004).
Data collection technique
Primary water quality data: physical, chemical, and microbiological obtained from the results of laboratory analysis, while data on socio-economic conditions were obtained by circulating questionnaires and interviews with 25 respondents, namely the people around Bulilin Lake. The selection of respondents as a research unit was carried outusing the Cluster Random Sampling method (Nawawi, 2005), in which the population wasdivided into groups based on area or cluster, then samples were taken randomly.
Secondary data were obtained from relatedagencies.
Data analysis technique
To analyze of the level of pollution inthe aquatic environment of Lake Bulilin is carried out based on Standard *Methods*1995 and compared with PP No. 82 of 2001 concerning Class 1 Water Quality Standards (KLH, 2004). Water quality analysis apart from being carried out directly in the field was also carried out by the Physical Chemistry Laboratory of FMIPA UNIMA. The diversity of plankton at each observationstation was calculated using the Shannon- Weaver Diversity Index method.
Furthermore, to calculate the type uniformity index (evenness) using the Shannon-Weaver function. Operations are carried out with the help of computer software.

RESULTS AND DISCUSSION

A. Physical Properties of Waters

Based on the results of the analysis inthe laboratory, the value of the physical properties of the waters (temperature) in the aquatic environment of Lake Bulilin was obtained, presented in Table 2.

Table 2 Value of the physical properties of Lake Bulilin waters

No.	**Parameter**	**Unit**	**Terms Limit**	**Time (Results**	**Measurement Analysis)**	**Average**	**Ket.**
				I	II		
A	Physique						
1	Temperature	^{0}C	300C	28,16	28,49	28,33	Ms
2	Turbidity	JTU	5 MTU	22.95	23.90	23,43	TMS

Information: MS = Qualified
TMS = Not eligible Temperature is a very important factor in the metabolic processes of organisms in the water. Water temperaturegreatly affects the solubility of oxygen in the water. Water whose temperature rises will disrupt the life of aquatic animals and other aquatic organisms because the oxygen levels dissolved in the water will decrease. Yet all life requires oxygen to breathe. The oxygen dissolved in the water comes from the airwhich slowly diffuses into the water. The higher the temperature rise of the water the less oxygen dissolved in it.

Based on the research results, the data collected results show that the temperature in the waters of Lake Bulilin ranges from 28.16-28.490C, with an average value of 28.330C. The current climatic conditions are irregular so the striking temperature differencesbetween the rainy and dry seasons are not significantly different. Likewise, the season regulations that apply have experienced a slight shift, namely, the rainy season is quite long and the dry season is relatively short. Therefore, the temperature observed duringthe study did not show a significant difference. Mahida (2003), and Darmono (2001), stated that temperature has a significant effect on most biochemicalreactions. Biological activity is enhancedwith increasing temperatures up to 600C.

Water turbidity is caused by suspendedsolids, both inorganic and organic. Inorganic substances usually come from weathered rocks and metals, while organic ones can come from weathered plants or animals. Industrial effluents can also be a source of turbidity. Organic substances can become food for bacteria, thereby supporting their proliferation. These bacteria are also suspended organic matter, so their addition will also increase the turbidity of the water. Likewise, algae reproduce due to thepresence of nutrients N, P, and K which will increase the turbidity of the water. Turbid water is difficult to disinfect because the microbes are protected by the suspended matter. This is certainly dangerous for health if the microbe is a pathogen.

Based on the results of the analysis obtained turbidity values in the waters of Lake Bulilin, ranged from 22.95-23.90 JTU with an average value of 23.43 JTU. WHO (1993) requires a maximum turbidity value for drinking water of 5 MTU, thus the waters of Bulilin Lake are unfit for use as a standard source of drinking water. Saeni (2004), states that turbid water cannot be a very productivesource of biomass, even though the watershave sufficient nutrients, optimum temperature, and other necessary conditions. **Water Chemical Properties** Based onthe results of the analysis, the value of thechemical properties of the waters (pH, BOD,COD) in the aquatic environment of LakeBulilin, is presented in Table 4.2. The acidityof water characterizes the balance betweenacids and bases in water. pH is defined as thelogarithm of the hydrogen ion (H) concentration in moles per liter. Pure water at250C contains 10-7 moles of H+ and OH-ions per liter, so the pH of neutral water is 7.If the pH value is less than 7, the water isacidic and if the pH is greater than 7, thewater is alkaline or alkaline, (Manik, 2013).Saeni (2004), stated that the pH of freshwaterranges from 5.0-9.0. In this pH range,freshwater fish can still live.

The pH values in the aquatic environment of Lake Bulilin are presented in Table 3, withpH values ranging from 7.30 to 7.45 with an average value. This means that the pHconditions in the aquatic environment around Lake Bulilin are still within the permitted quality standard range, namely between 6.0-9.0 according to Kep-58/MENLH/12/1995. Novotny and Olem (2004) argue that most aquatic biotas are sensitive to pH and prefer pH values around 7.0-8.5. The pH value greatly affects the biochemical processes of the water, for example, the nitrification process will end if the pH is low. Metal toxicity shows an increase at low pH. Effendi (2013), stated that bacteria grow well at neutral and alkaline pH, while fungi prefer low pH (acidic conditions). Therefore,

Table 3 Value of the chemical properties of Lake Bulilin waters

No.	Parameter	Unit	Terms Limit	Time (Results	Measurement Analysis)	Average	Ket.
				I	II		
	Chemistry						
1	pH		6.0-9.0	7.35	7.50	7,43	Ms
2	BOD5	mg/l	2,5	2.95	5.75	4.35	TMS
3	COD	mg/l	10	9.90	11.5	10.70	TMS

Information: MS = Qualified
TMS = Not Qualified

The degree of acidity or pH is a valuethat indicates the activity of hydrogen ions in water. The pH value of water can reflect the balance between acids and bases in the water.The pH value ranges from 1-14, pH 7 is the middle limit between acids and bases (neutral). The higher the pH of water, thegreater the alkaline nature, and vice versa, thelower the pH value, the more acidic the water. The pH value is influenced by several parameters, including biological activity, temperature, oxygen content, and ions. Biological activity produces CO2 gas whichis the result of respiration. The gas will form buffer ions or buffers to maintain the pH range in the waters to remain stable (Pescod, 2003).

BOD5 (Biochemical Oxygen Demand) is the amount of oxygen (mg) needed to decomposeorganic matter in one liter of wastewater during ripening (5 x 24 hours at 200C). Sothe BOD5 value indicates the amount of dissolved oxygen needed by microbes to break down or oxidize contaminants contained in water.

Based on the research results of the BOD value5in the waters of Lake Bulilin it ranges from 2.95-5.75 mg/l with an average value of 4.35 mg/l. Based on class 1 water quality standards, the required BOD5 value is ≤ 2 mg/l. Thus, it can be concluded that the waters of Lake Bulilin have been polluted by easily decomposed organic matter (BOD5) and are not suitable for use as a raw source ofdrinking water, but can still be used for KJA cultivation activities. The high level of BOD5is mainly due to the dense use of the area around the lake for residential areas, and the density of marine cages. This will introduce domestic waste into lake waters. The higher the activity around the waters of the lake which produces organic matter, the greaterthe pollution load borne by the aquatic environment. This condition causes highorganic matter.

COD (Chemical Oxygen Demand) describes the total amount of oxygen needed to chemically oxidize organic matter, both biodegradable and non-biodegradable to CO2and H2O. In the COD determinationprocedure, the oxygen consumed is equivalent to the amount of dichromaterequired to oxidize the sample water (Boyd, 1998). The large COD value indicates the large demand for oxygen used by the chemical oxidation process in water. Chemical oxygen demand is also widely usedas a measure of the polluting power of wastewater.

The results of measuring the value of COD in the aquatic environment of Lake Bulilin, ranged from 9.90-11.50 mg/l, with anaverage value of 10.70. Based on class 1 water quality standards which require a COD value for drinking water raw water is ≤ 10 mg/l, then the waters of Lake Bulilin have been polluted by organic matter that is difficult to decompose. Thus, the waters of Lake Bulilin in general no longer meet the requirements to be used as a source of drinking water.

When compared with the BOD value5,then the COD value is higher, thus it can be concluded that the organic matter in the waters of Bulilin Lake is organic material thatis not biodegradable or difficult to decompose (Saeni, 2004). Likewise, Metcalf and Eddy(1999) stated that differences in COD andBOD5 values usually occur in polluted waters, because the organic matter that can bechemically decomposed is more than biological decomposition.

Aquatic Biological Properties

Coliform bacteria are biological indicators in water. Coliform bacteria are generally found in the stool. Therefore, its presence in water is undesirable, both in terms of aesthetics, hygiene, sanitation, and the possibility of dangerous infection. Various diseases can be transmitted through water, especially stomach diseases such astyphoid, paratyphoid, cholera, and dysentery (Suriawiria, 2008).

Table 4. The value of the biological properties of the waters of Bulilin Lake

No.	Parameter	Unit	Limit Condition	Time I	Measurement II

Biology					
1	*Fecal coliforms*	Qty/100 ml	1000	67	77
2	Total coliforms	Qty/100 ml	1000	74	94

The results of the analysis of the content of fecal coliform bacteria in the waters of Lake Bulilin ranged from 68-78 MPN/100 ml, withan average value of 73 MPN/100 ml. This shows that the waters of Lake Bulilin contain organic matter which is quite high as a sourceof life for microorganisms.Suriawiria (2008), states that the presence of pathogenic microbes in water will increase if the organic matter content in the water is high enough, which functions as a place and source of life for microorganisms.

The habit of people throwing feces into the lake still occurs frequently, and the intensity is even higher with the increasing number of people living and using the lake for toiletneeds. This condition is very dangerous for the health of residents who use the water from the lake because they can be infected with various diseases, such as skin diseases and dysentery.

Total coliform bacteria, like fecal coliform, are also indicator bacteria in assessing thelevel of hygiene in water. The results of the analysis of the total coliform content in the waters of Lake Bulilin found that the total coliform content ranged from 75-96MPN/100 ml, with an average content of 85.5MPN/100 ml. This value generally illustrates that the total coliform bacteria content in the waters of Bulilin Lake is still below the class

1 water quality standard threshold which indicates a maximum total coliform contentof 1000 MPN/100 ml. However, this totalcoliform value already shows that the water quality of Lake Bulilin is considered polluted.

Community Perception

1 Knowledge of the impact of KJA on the quality of lake waters

Community knowledge about theimpact of KJA on the quality of lake waters is

15 respondents (60%) who answered they knew. Even though this knowledge is very ordinary in nature, like dirty water, it smells; and 10 respondents (40%) answered they did not know, presented in Table 5.

Table5 Knowledge of the impact of KJA on the quality of lake waters

Category	Absolute Frequency	Relative Frequency (%)
Yes	15	60
No	10	40
Amount	25	100

Sources of information on organicdischarge of hospital liquid waste
Sources of information fromnewspapers and magazines 2 respondents (8%), radio and TV 3 respondents (12%),
government officials, 4 respondents (16%),
neighbors and friends 6 respondents (24%), and others (don't know) 10 respondents (40%), presented in Table 6. This means that the distribution of print media is still low in Southeast Minahasa Regency, more specifically in the communities around Lake Bulilin, or it could also mean that thepopulation's interest in reading is still low. Likewise, counseling from the government is still lacking. Information from neighbors or friends is at most 24%, and others don't know(40%), this may also mean that the level of knowledge of the people around the lake is still lacking.

Table 6 Sources of information about the impact of KJA on the quality of lake waters

Category	Absolute Frequency	Relative Frequency (%)
Newspapers and Magazines Radio and TV Government officials Neighbors and Friends	2 3 4 6	8 12 16 24
Other (don't know)	10	40
Amount	25	100

About counseling on environmental pollution

Regarding the existence of counseling in the community regarding the impact of KJA on the quality of lake waters, all respondents answered that it had neverbeen held. This was also reinforced by the results of interviews with several community leaders.

Community perceptions of the increasing number of marine cages in lakes

megarding perception (understanding) the community about the KJA around the residence has polluted theenvironment as many as 3 respondents (12%), very polluting, 2 respondents (8%), no pollution, 9 respondents (36%), and 11 respondents (44%) answered that they did notknow , presented in Table 7.

Table7 Community perceptions of the increasing number of marine cages in lakes

Category	Absolute Frequency	Relative Frequency (%)
Very pollutingpollute No pollutionDon't know	2 3 9 11	8 12 36 44
Amount	25	100

Causes of water environment pollution Causes of polluted aquatic environment9 respondents (36%) answeredKJA waste, 5 respondents (20%) answered household waste, and 3 respondents (12%) answered agricultural waste, 6 respondents (24%) answered livestock waste, and 2 respondents (8%) answered no know, presented in Table 8.

Table 8 Causes of environmental pollution of lake waters

Category	Absolute Frequency	Relative Frequency (%)
KJA waste Household waste Agricultural Waste Livestock Waste Other (don't know)	9 5 3 6 2	36 20 12 24 8
ount	25	100

The Relationship between Socio-Economic Conditions and Community Perceptions

Socio-economic conditions related to people's perceptions, namely: age, education level, occupation, income, distance fromhome, and length of stay (Soerjani,*et.al.*(2007), Soedjono (2000), and Sarwono (2009). The results of statistical calculations using Chi-square StatisticalAnalysis (Siegel, 2015, Walpole, 2012) show socio-economic conditions related to people'sperceptions of natural resource ecosystems and the environment with KJA businesses and their effects on the socio-economic conditions of the community, presented in Table 9.

Table9 The relationship between socio-economic conditions and people's perceptions ofecosystem of natural resources and environment with KJA.

Socioeconom ic Conditions	Category	Community Perceptions of Natural Resources Ecosystems and Environment. with KJA				Significance	
		TT	TP	home work	PB	□2htg	P
Age	<25 25-55 >55	0 2 0	0 3 1	1 5 3	1 8 1	16,723**	0.005
Education	SD junior high school high school PT	0 0 1 0	0 0 2 0	0 3 5 1	0 4 8 1	17,750*	0.019
	Civil servants and ABRI	0 0	0 0	1 2	1 3		

Work	Private sector employee Self-employed Farmers and Laborers Retired	0 0 0	1 2 1	5 2 1	3 2 1	14,631tn	0.260
Income per Month (IDR)	< 900,000 900.000-1.800.00 > 1,800,000	0 1 0	2 2 1	3 6 1	5 2 2	16,703**	0.005
Home Distance	< 100m 100-200m > 200m	0 1 1	4 1 1	6 4 1	5 1 0	41.610**	0.000
Length of stay	< 1 year 1-5 years 6-10 years > 10 years	0 0 0 0	1 1 2 1	1 1 4 7	0 1 1 5	21.221**	0.003

Information:
TT = Don't know tn) = Not significant at the 0.05 levelTP = No Pollution * = Significant at the 0.05 level
PR = Light Pollution ** = Very significant at the 0.01 levelPB = Heavy Pollution

Table 9 shows that the results of the analysis of the relationship between age and people's perceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment have a very significant relationship (p <0.01). This shows that the difference in the age of the community causes differences in their perceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment. In this study, theages between 25-55 years and 55 years and over were more sensitive than those aged 25 and under. This is closely related to one's life experience, because the older a person is, the more experience he has, so that people's perceptions or understanding of natural resource ecosystems and the environment,with KJA businesses in the aquatic environment are based on their life experiences.

The results of the analysis of the relationship between education level andpublic perceptions of natural resource ecosystems and the environment, with KJA efforts, in the aquatic environment in Table 9 have a significant relationship (p <0.05). Thisshows that the level of formal education has asignificant relationship with people's perceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment. In other words, the level of formal education affects people's perceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment. This is closely
related to the level of knowledge possessedby the community through formal education, the higher a person's formal education, themore knowledge he has.

The results of the analysis of the relationship between the type of work andpeople's perceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment in Table 9 have no significant relationship(p>0.05). This shows that work does not havea significant relationship with people'sperceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment, meaning that the type of community work does not affect their perceptions of natural resource ecosystems and the environment, towards KJA businessesin the aquatic environment.

The results of the analysis of the relationship between income levels and people's perceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment in Table 9 have a very significant relationship (p
<0.01). This shows that income has a significant relationship with people's perceptions of natural resource ecosystems and the environment, with the KJA business in the aquatic environment, meaning that the high and low income of the community also influences their perceptions of natural resource ecosystems and the environment, towards the KJA business in the aquatic environment. . The higher the community's income, the more negative their perception ofnatural resource ecosystems and the environment, with the KJA business in the aquatic environment. This is in accordancewith the results of the study that the income levels of the respondents are quite different,

The results of the analysis of the relationship between the distance from the house and the community's perception of natural resource ecosystems and theenvironment, with the KJA business in the aquatic environment in Table 9 has a very significant relationship (p <0.01). This shows that the distance between houses has a significant relationship with people's perceptions of natural resource

ecosystemsand the environment, with KJA businesses in the aquatic environment, meaning that the distance of people's homes from the lake affects their perceptions of natural resource ecosystems and the environment, with KJA businesses in the environment. waters. In this study, people whose houses are less than 100 meters from the lake have more negative perceptions than people whose houses are more than 100 meters away. That matter,

The results of the analysis of the relationship between length of stay and people's perceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment in Table 9 have a very significant relationship (p <0.01). This shows that the length of stay has a significant relationship with people'sperceptions of natural resource ecosystems and the environment, with KJA businesses in the aquatic environment, meaning that the difference in length of stay around the lake causes differences in their perceptions of natural resource ecosystems and theenvironment, with KJA businesses. in aquaticenvironment. In this study, the length of stay between one and 10 years was more sensitive than the length of stay of less than one year and more than 10 years around the lake.

CONCLUSIONS

1. The water quality display for Lake Bulilin has exceeded class 1 water quality standards, according to PP. No. 82 of 2001 which is designated as a source of raw water for drinking water is BOD5, COD, fecal coliform, and total coliform. Based on the Aquatic Environmental Quality Index (IMPL), the quality of the waters of Bulilin Lake is included in the moderate or slightly polluted quality category.
2. The community's perception of the impactof KJA on the quality of the lake waters around their residence is relatively negative, meaning that the community believes that the lake's aquatic
3. environment has been polluted by an increasing number of KJA in Lake Bulilin.
4. Suggestion
5. District governments need to improve pollution control programs, especially those concerning waste control; both domestic waste, KJA waste, livestockwaste, as well as erosion control, both residential and agricultural erosion.
6. In order to preserve Lake Bulilin, it is necessary to make policies that are notonly oriented towards economic growth, but also to ensure environmentalsustainability.
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