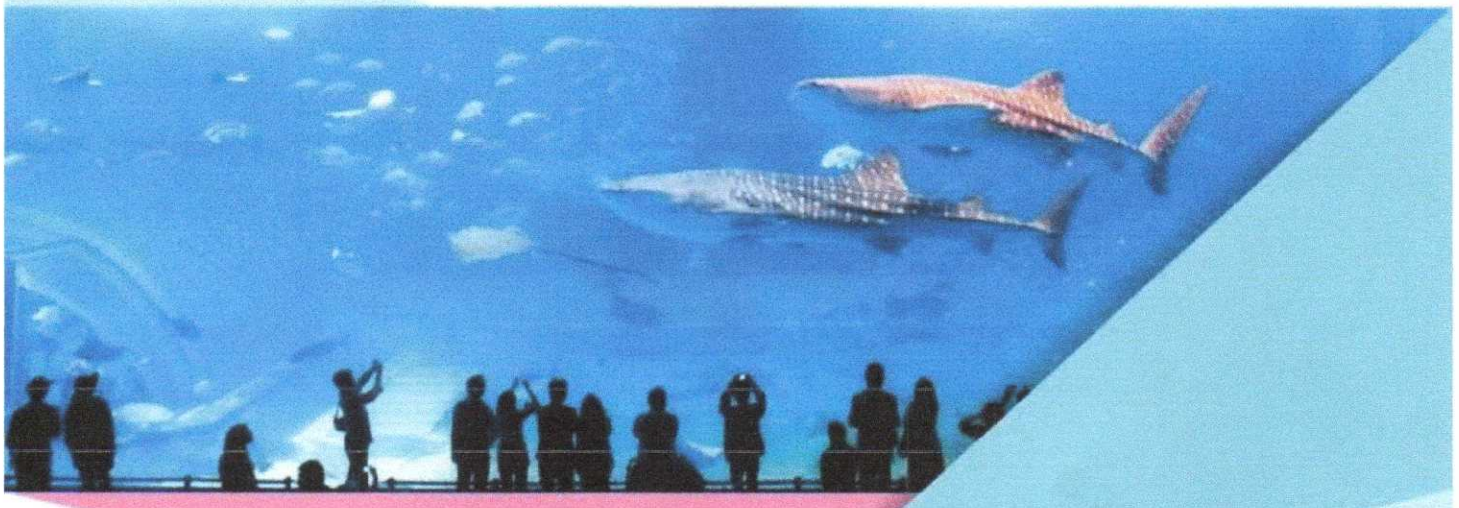
JULY 25-27,2017

OKINAWA,JAPAN



Conference Proceedings

ICSSB

International Conference on Social Science and Business

ICEPS

International Conference on Education, Psychology and Society

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July 25-27, 2017

Okinawa, Japan

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Content

Welcome Message

Local Host

Mr. Carl Bastian
The American Chamber of Commerce Okinawa Governor,
Tourism & Hospitality Committee Chairman,
CEO of The Ryukyu World Office

"HAISAI" from tropical Okinawa- the jewel of Japan.

I am pleased to extend a warm welcome on behalf of an ancient island & the awesome professionals at Higher Education Forum (HEF). For those of you who will be visiting Okinawa for the first time, please expect fantastic weather & magnificent memories. For everyone else- welcome back! Okinawa has missed you!

The past few years has seen Okinawa grow in leaps and bounds, mainly in terms of popularity, economic strength & also global recognition. Tourism leads the industrial charge with not only a constant and sustained increase in international & domestic visitors, but also for average length of stay, average tourist spending, visitor satisfaction levels & rate of return visits.

And once you get here you will understand why…
The culture & history of the ancient Ryukyu Kingdom is something we treasure dearly.
There are many World Heritage sites to visit within an hour of Naha.
The spellbinding scenery & precious nature is something we don't take for granted.
You will find views of a majestic azure sea from almost any coastal vantage point.

Our elders are respected & listened to as they speak the old tongue, endured & survived the horrific past, and also carry the secrets to longevity & happiness. I have had the pleasure of working with HEF for 5 years now & am honored to be involved in making this Okinawa Conference a regular & successful event. The diversity of topics, the passion & expertise of speakers, the hunger of delegates, the professionalism of staff, all backdropped in this tropical paradise make it an event not to be missed.

I personally look forward to welcoming you all to this island I call home.
Carl.

General Information for Participants

■ Registration

The registration desk will be situated on the **1st floor** at **Okinawa Convention Center** during the following time:

08:30-16:00, Wednesday, July 26, 2017

08:30-15:00, Thursday, July 27, 2017

■ Organizer

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■ A Polite Request to All Participants

Participants are requested to arrive in a timely fashion for all addresses. Presenters are reminded that the time slots should be divided fairly and equally by the number of presentations, and that they should not overrun. The session chair is asked to assume this timekeeping role and to summarize key issues in each topic.

■ Certificate

Certificate of Presentation or Certificate of Attendance

A certificate of attendance includes participant's name and affiliation, certifying the participation in the conference. A certificate of presentation indicates a presenter's name, affiliation and the paper title that is presented in the scheduled session.

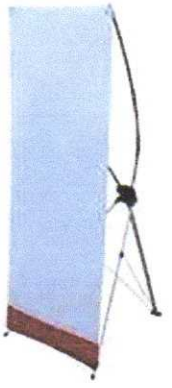
Certificate Distribution

Oral presenters will receive a certificate of presentation from the session chair after their presentations or at the end of the session. Poster presenters will receive a certificate of presentation from the conference staff at the end of their poster session.

The certificate of presentation will not be issued, either at or after the conference, to authors whose papers are registered but not presented. Instead, the certificate of attendance will be provided after the conference.

■ Preparation for Oral Presentations

All presentation rooms are equipped with a screen, an LCD projector, and a laptop computer installed with Microsoft PowerPoint. You will be able to insert your USB flash drive into the computer and double check your file in PowerPoint. We recommend you to bring two copies of the file in case that one fails. You may also connect your own laptop to the provided projector; however please ensure you have the requisite connector.



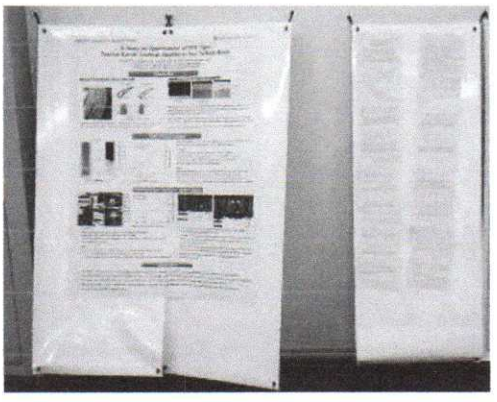
Preparation for Poster Presentation

Materials Provided by the Conference Organizer:

1. X-frame display & base fabric canvases (60cm×160cm)
2. Adhesive tapes or binder clips

Materials Prepared by the Presenters:

3. Home-made poster(s)
4. Material: not limited, can be posted on the canvases
5. Recommended poster size: 60cm*120cm

	
A 60cm*160cm poster illustrates the research findings.	1. Wider than 60cm (left) 2. Copy of PowerPoint slides in A4 papers (right)
	

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ICSSB-0030
Impact of Climate Change on Floating Net Fish Farming in Maninjau Lake, West Sumatera

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Abstract

Climate change has been well known to give impact on agricultural sector, including fresh water aquaculture sector. Floating net fish farming in Maninjau Lake, West Sumatera plays an important source of income for dwellers in the surrounding area. This study was aimed; (1) to analyze the effect of climate change on technical efficiency of floating net fish farming in Maninjau Lake; (2) to estimate the impact of climate change on the farmers' welfare, and (3) to analyze the mitigation strategies for fish farmers in Maninjau Lake to minimize loss due to massive death of fish. Methods consisted of quantitative and qualitative analyses. Quantitative analysis was conducted in two steps. First step, a non-parametric mathematical programming of Data Envelopment Analysis was employed to measure the technical efficiency of five stations of floating net fish farming data during the period of 2011 to 2016. The data included one output and six input of the farming. The second step was a critical point analysis. The technical efficiency value from the first step compared to critical point of the climate data obtained from the nearest climate stations. The results showed that the average technical efficiency of floating net fish farming in Maninjau Lake was 0.562 (constant return to scale) and 0.727 (variable return to scale).This means that by using the same input, production could still be increased by 43.8% and 21.3% by CRS and VRS respectively. The third observation station (Aweh) has the highest value of the technical efficiency. Climate parameters that affected significantly the fish farming in Maninjau Lake were surface temperature and precipitation. Purchasing power of the farmers, over the study period, ranged from 86.2 to 122.8 with an average of 101. This means that the income of farmers was only slightly above the cost of living.

Keywords: Climate change, Floating net fish farming, Maninjau Lake, Technical efficiency

Introduction

Maninjau Lake is located in the District of Tanjung Raya, Agam Regency, West Sumatra or about 105 km western part of Padang City. Position of the lake is at 100°05' to 100°16' East and 0°12"-0°25' South with total area of 150.76 Km^2 and altitude of 471 m above sea level. This lake is a volcanic lake, formed about 60,000 years ago from a caldera collapsed of an ancient Maninjau volcano. This volcano has been developed in the Great Fault zone of Sumatra that

erupts three times and eventually reaches a stable phase to form Maninjau Lake as it is today (Pribadi, et al., 2007).

The Maninjau Lake has a length of about 17 km from north to south with a width of about 8 km, covers an area of 9,950 ha (reaching 70% of the total area of Tanjung Raya District). It is surrounded by a hill line and only has one outlet, namely Batang Antokan river which flows towards the west coast of Sumatra Island.

Since the introduction of floating net fish farming in 1992, the pressure on ecological conditions has increased. The number of floating net cage continues to increase along with the increase of the farmer's welfare. Currently, total feed entering into the lake reaches 100 tons per day. The amount of feed residue and fish debris settling into the bottom of the water continues to increase. Several studies on the ecological condition of Lake Maninjau, concluded that the number of floating fish cage has extremely exceeded the carrying capacity of the environment and they recommend to reduced it. At least 23,566 units of floating net fish cage exist in the lake, whereas the carrying capacity of the waters is only able to accommodate about 6000 units of cage. The drastic increase in the number of the floating net cage occurred in 2008 to 2009, about 300%. However, the efforts of local governments to reduce the number of floating net cage did not bring satisfactory results. Floating net fish farm in the Maninjau Lake has been widespread and become an option for people around the lake to improve their welfare. The economic effects of the floating net farming include job creation, fish breeding, inter-regional fish trade and farming facilities supply.

Floating net fish farming in Maninjau Lake is quite different from elsewhere. Water temperature in the lake is relatively warmer, making fish metabolism faster, so the appetite is higher and fish growing rapidly. Fish from the Maninjau lake is marketed to the surrounding cities and is in great demand by consumers because the taste and quality is premium. Good business profits push the number of floating net cage increases every year.

The success story of fish farmers in Maninjau Lake began to change since the first occurrence of mass death fish in 1997. Initially, the incidence of mass death fish was not occurring every year, but since 2003, the incidence occurs every year, even in recent years more than once per year. The increasingly frequent of mass death fish is allegedly linked to climate change such as precipitation and surface temperature. The incidence of mass death fish always begins with high rainfall and northern wind blow from September to January.

Climate change also cause a change in hydrological conditions, which in turn leads to a reversal of the water mass (convection current) of the inner layer upward which causes a fertile of waters and trigger an explosion of phytoplankton populations. This population explosion of

phytoplankton absorbs large amounts of dissolved oxygen, especially at night, so that fish on the surface will die massively from oxygen depletion and poisoning. The mass death of fish has repeatedly occurred in Maninjau Lake causing enormous economic losses to be borne by fish farmers. Globally, the issue of climate change has been a topic of discussion for researchers over the past decade. The effects of climate change are reported to have affected primarily agriculture and fisheries. The influence in the fisheries has an impact on world food production.

Literature Review

Maninjau Lake plays an important role for the surrounding community. In the outlet of the lake, there is a 68 MW capacity of water power plant with economic value of IDR 71.8 billion/year. The lake also become a tourism destination with business value Rp IDR 2.15 billion/year, capture fisheries IDR 1.12 billion/year and aquaculture with an investment of IDR 112 billion/year (Syandri, 2004). In the last ten years the number of fish cage has grown rapidly (Syandri et al, 2014, Junaidi et al, 2014). Maninjau Lake receives ecological pressure due to the activity of floating fish cultivation in the form of waste from fish feed as much as 292,88 tons/year; Nitrogen 146.68 tons / year; And urea 310.0 ton / year (Syandri, 2000).

Globally, the aquaculture business contributes substantially to the portion of fisheries production. Percentage of cultivated fishery to the total world fish production also doubled more than 23.9% in 1990 to 54.6% in 2012 (Hamdan, et al, 2015). The contribution of the aquaculture sector to the fulfillment of world food needs is very important, reaching 16% of the total protein requirement (Tidwell and Allan, 2010).

As impact to the agricultural sector in general, aquaculture is strongly affected by climate change phenomenon that has drawn attention of many environmentalists. Therefore, farmers should prepare preventative manner to avoid the bad impact, especially the decrease of business productivity (Worldfish, 2007). Climate change parameters that have potential impacts on aquaculture include surface temperatures, seasonal monsoonal fouling and extreme weather events. Climate change gives unequal effects according to zoning on aquaculture fisheries. For example, global warming leads to an increase in water temperature and could have a significant impact on aquaculture (De Silva and Soto, 2009). The results of scientific research indicate that the impact of climate change on cultivation fishery business becomes more clear and profound, especially in fishery productivity. This should be the concern of all parties to be anticipated to reduce the social and economic impact (OECD, 2010)

Table 1. Profile of Maninjau Lake

Parameter	Unit	Value
Altitude	m	463
Surface area	km	99,5
Maximum length	k	16,7
Maximum width	k	8,5
Maximum depth	m	169
Average of depth	m	106
Volume	km	10,4
Water capture area	km	248

Figure 1. Map of the study site in Maninjau Lake
1=Muko-muko, 2=Kotogadang, 3=Aweh, 4=Linggai, 5=Bayua

The floating net fish farming in Maninjau Lake has been the concern of many researchers. Among them are Rasidi, et al (2010), examines the status of floating net fish farming. Henny and Nomosatryo (2016) examined changes in water quality and food chain in Maninjau Lake, found that the water temperature of the under layer was relatively cooler than the top layer, while the thermocline layer occurred at between 10-20 meters. Syandri et al (2015) found that poor water quality was a major constraint to fish production in the Maninjau lake. Therefore most of farmers like to grow Tilapia species of which the fingerlings derived from private-farmed hatchery. The species more survive than others in poor water quality. Nasution et al (2011) investigated socio and economic impact of mass death fish in Maninjau Lake, argued that economic loss including potential profit loss from fish farmers, traders, fish feed and fish traders. Calculated social impacts in economic terms were a loss number of livelihood and source of farmer's incomes by which lead to debt increasing.

The influence of climate on aquaculture is examined by Eissa and Zaki (2010) argued that climatic changes are the most drastic variables influence of all aspects of human life. The climate change phenomenon includes higher temperatures, melting glaciers, sea level rise, and coastal erosions, increased of inland evaporation rate, green house effects, biological invasions and deteriorated biodiversity. Asiedu et al (2017) conducted a study on the perception and mitigation of fish farmers on the impacts of climate change in Ghana. One of the farmers' efforts is to adjust the timing of seedlings to reduce the impact of climate change. While Mustafa (2013) examines the potential impacts of climate change on aquaculture in Nigeria, found that effective adaptation and mitigation strategies will depend on regional conditions that apply to human needs in the context of socio-economic needs and stakeholder pressure on fisheries. Awareness needs to be improved through awareness, enlightenment and initiative to anticipate the starting point of an adaptive strategy to reduce the impact of climate change on people's fisheries. According to Hall (2015) the impact of climate change on fishery cultivation is expected to increase. Therefore it is necessary to treat and adjust the type of feed to improve business efficiency.

Zhang et al (2011) conducted a study on climate effects using the ORI (objective risk index) method, which for the survival of each species was calculated for biodiversity, habitat quality, and socio-economy. Subsequent estimates can be a risk index (SRI), a fishery risk index (FRI), and an ecosystem risk index (ERI). Climate change primarily represented by global warming leads to changes in fish distribution patterns, growth and reproduction. Further affects the location of fish, season and maturity level of gonads.

In the Nigeria's fisheries sector, Adeleke and Omobeyeje (2016) found that the highest temperature parameters and rainfall increased as a result of climate change. He also said that the effect of climate change in the freshwater fishery sector is the change of surface temperature, the content of nutrient levels and drought in the dry season. Only about 30% of fish farmers are concerned with the importance of adaptation strategies to climate change. In the period 2002 to 2011 there was an increase in temperature by 0.9 degrees, a rise in 500 ml rainfall and a 4.4% humidity change.

Methods

This study was conducted in the period of November 2016 until March 2017 in Maninjau Lake, West Sumatera. As many as five locations of farmers group has been interviewed namely, Muko-muko, Kotogadang, Kotokaciak, Linggai and Bayua. At least 60% of farmers in each area was selected as respondent by using simple random sampling. Methods consisted of quantitative and qualitative analyses. Quantitative analysis was conducted in two steps. First step, a non-parametric mathematical programming of Data Envelopment Analysis was employed to measure the technical efficiency of five stations of floating net fish farming data during the period of 2011 to 2016. The data included one output and six input of the farming. Output is

average yield per unit floating net pond for one cycles of production. Inputs consist of floating net and facilities, feed, fish seed, labor, fuel, electric (including communication and other cost). DEA is applicable to the problems without engaging to a statistical test or to specification of production function such as cost minimization and revenue maximization (Tubene, 1997). For unconstrained optimization, the theorem states the marginal effect of a parameter (on the maximum value of the objective function), we can treat the selected variable as constant. The marginal effect of any parameter is equal to the marginal effect of that parameter on the objective function (Baldani et al., 2005).

The second step was a critical point analysis; the technical efficiency value from the first step was tabulated to the climate data (precipitation and surface temperature) obtained from the nearest climate stations or other sources. Qualitative analysis of farmers' welfare level was conducted to measure farmer's purchasing power. Mitigation strategies were described based on farmer's knowledge about the disaster prevention and the farmer's manner to find the way out in case of the disaster occurred. The data used in this study consisted of primary data and secondary data. Primary data was obtained from farmers through structured interview by using a questioner, while secondary data was obtained from government publications, and other scholars' publications.

Results

Socio Characteristic of Respondent

Floating net fish farmers from five locations have been interviewed, and the data is presented in Table 2 below. The average age of the farmers ranged from 38 years (location 2) to 50 years (location 4). Family members range from 3 to 6 people. The average number of floating net cage owned by farmer ranges from 14 to 120. The most number are found in Muko-muko (120 units) and the lowest in Kotogadang (12 units).

Table 2. Respondents characteristics of Floating Net Fish Farmers in Maninjau Lake

No	Location	Age	Number FNP	Years of Experience	Year of school	Family Member
1	Muko-muko	46	120	12	14	5
2	Kotogadang	38	14	6	10	3
3	Aweh	43	31	14	12	5
4	Linggai	50	102	18	10	6
5	Bayua	42	26	8	13	4

Source: Primary data

Note: FNP = Floating Net Pond, Year of school: elementary=6 years, junior high school= 9 years, senior high school=12 years, diploma=15 years and bachelor=16 years, the data is an average of each location

Generally fish farmers in Maninjau Lake have high school education, even some of them passed from bachelor and diploma degree. The level of education affects the ability to innovate and accept new technologies in business activities.

Table 3. Number of floating net, death fish and farmer's lost during 2010-2016

Year	Number of Floating Net Pond	Death fish (ton)	Farmer's Lost (IDR million)
2010	10420	115	1,840
2011	11050	200	3,200
2012	15200	520	8,320
2013	16120	628	10,048
2014	19250	747	14,193
2015	21651	575	10,925
2016	23566	880	16,720

Sources: Primary data (survey, 2017)

Technical Eficiency

Technical efficiency (TE) reflects on how close a firm to produce maximum output from a given level of input. It also reflects the ability of a firm to utilize the input in an optimal proportion at a given price and technology. A nonparametric Data Envelopment Analysis (DEA) model is a more popular method to investigate efficiency and productivity in many fields of economy. DEA measure TE based on constant return to scale and variable return to scale. The first one means the TE is measured by an increase of input will produce a proportional increase in output. The production function depicted by a straight line. While the variable return to scale, means an increase of input will result a not proportional output (it can be increase or decrease). The production function is showed by a non-straight line.

Result of TE measurement during the period of 2011 to 2016 of floating net fish farming in Maninjau Lake in presented in Table 4. The TE was declining with negative growth as much as minus 13.0 percent (CRS) and 11.3% (VRS). Deteriorating TE can be known by looking to the Tabel 3 above. The table shows, since 2011 farmers was facing a bigger lost from year to year.

Tabel 4. Overall technical efficiency of floating net fish farming in Maninjau Lake, 2011-2016

Year	CRTS		VRTS	
	TE	Growth (%)	TE	Growth (%)
2011	0.727	-	0.873	-
2012	0.688	-5.365	0.806	-7.675
2013	0.655	-4.797	0.815	-0.124
2014	0.578	-11.756	0.747	-7.205
2015	0.38	-34.256	0.668	-10.576
2016	0.347	-8.684	0.461	-30.988
MEAN	**0.562**	**-0.130**	**0.727**	**-0.113**

Source: Calculation by DEA method

Lower TE is associated with number massive death of fish which is occurring in rainy month (September to January). However, it was unable to measure climate change for a short period of observation. Usually climate change can be analyzed by a long period of data because the change occurs gradually. Therefore in this study, the climates change is observed at a critical data point during the period of observation.

Figure 2 presents monthly surface temperature of water in Maninjau Lake for the periode of 2014-2016. Similar pattern of surface temperature for the three years data that is a lower temperature found in August until January. This condition associate with lower TE and phenomenon of massive death of fish. In 2016, massive death of fish take place four times in the single year with total lost IDR 16.72 billion.

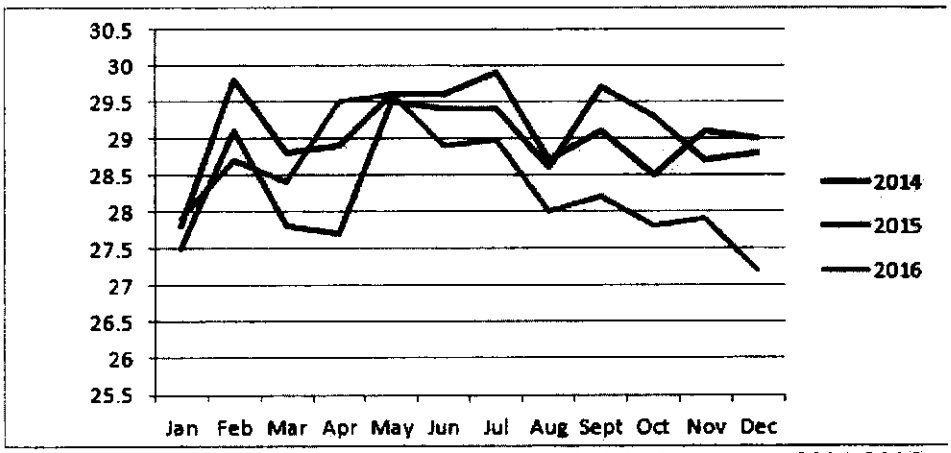

Figure 2. Trend of surface water temperature in Maninjau Lake, 2014-2016
(Data obtained from PT CPP, Maninjau representative)

Relationship between climate change and mass date of fish can be evidenced by dissolved oxygen measured by PT. CPP Maninjau representative as shown in Figure 3. Five months periods September to January in 2014-2016 observation give similar pattern, decrease DO content in the water. Since Maninjau Lake is a volcano lake, it has no enough inlets as water source to penetrate the shortage of oxygen content.

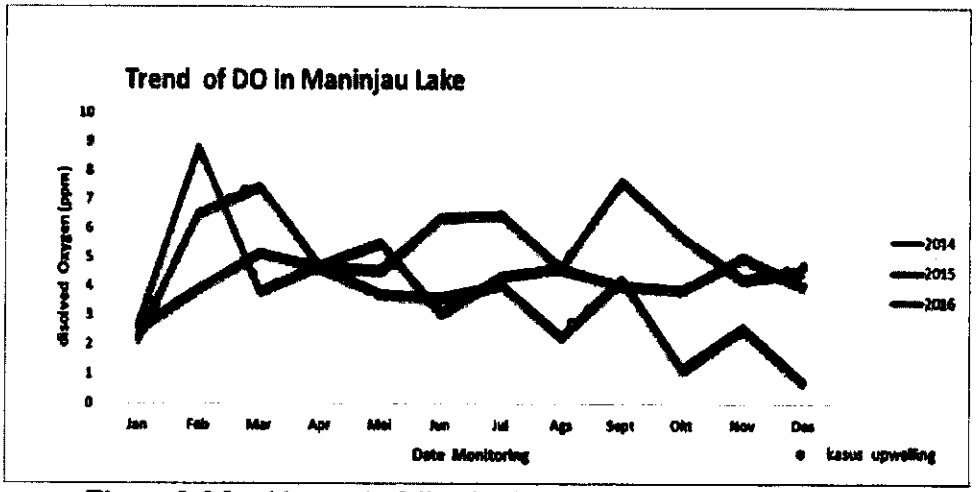

Figure 3. Monthly trend of dissolved oxygen in Maninjau Lake, 2014-2016
(Data obtained from PT CPP, Maninjau representative)

Occurrence of mass death fish has become a scourge for fish farmers in Maninjau Lake. Farmers, who are practicing business with a small capital, more suffer than one has big capital. They can continue their business only by getting debt from other party (usually from bank, feed supplier, investor or other farmers). Otherwise, the farmers will switch their livelihood, such as to be rice farmers or go to city looking for a job).

Behind surface water temperature, higher precipitation is a climate change phenomenon that precede mass death fish incidence. Data of average precipitation for nine years precipitation measurement in Maninjau Lake shows in Figure 4.

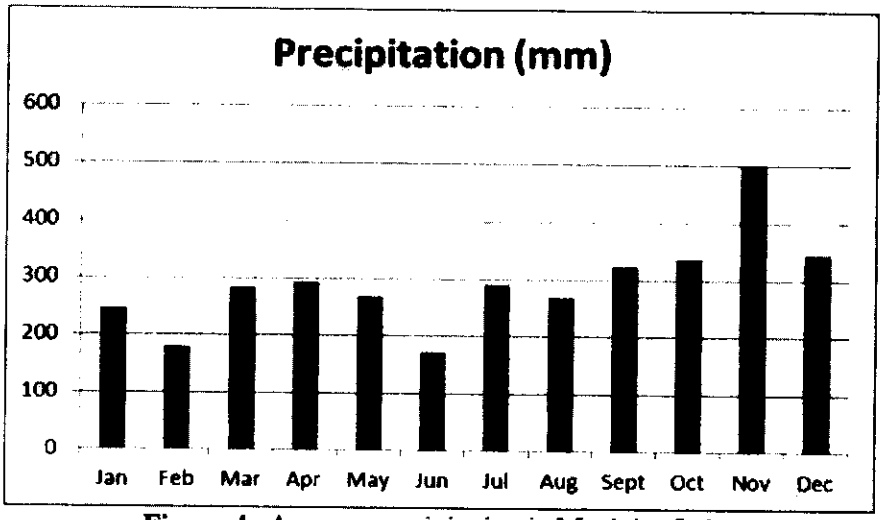

Figure 4. Average precipitation in Maninjau Lake

Precipitation is source of water in Maninjau capture area. The water enter the lake trough 13 small inlet river, the lake has no other source. Figure 4 shows that since August, rainfall increase from 288 mm to reach its peak on November about 498 mm. We have no obtain record in wind flow in the study area. However, from interview to the farmers noted that wind is stronger since November to January. This condition fuelled decrease surface temperature of waters as Figure 2 above. Cold water tend to be heavier than the under layer, so that trigger convection current. Convection current stir nutrient in the bottom which is dominated by feed residual and fertilize the water column that. Very rich nutrient in the waters sparks explosion of phytoplankton. Subsequently, abundant plankton population absorbs oxygen in the water especially during night. This bring lack of oxygen in the floating net and fatally

Impact of Climate Change to Farmer's Welfare

Farmer welfare is calculated based on Farmer's Exchange Rate (FER). Net profit of floating net farming is considering as a farmer income which proxies their purchasing power. FER defined as total income in a month is divided by total price paid by farmers in a month (percentage). A greater number than 100 means farmers get income more than their expenditure, possibly they to invest or save the money. FER of floating net farming in Maninjau Lake was quietly higher than that of rice farmer (around 101-105). However, changes in climate pattern such as wind speed, precipitation influence ecological condition of waters bring impact to massive date of fish. Tabel 5 presents average FER of five observation site. FER for year of 2011 to 2014 can be said as good value, but value in 2015 and 2016 decrease until below 100.

Table 5. Farmer's Exchange Rate of Floating net fish farming in Maninjau Lake

Location	2011	2012	2013	2014	2015	2016
1	116	123	132	105	101	83
2	114	109	112	100	98	80
3	130	135	115	102	100	95
4	123	125	110	106	103	81
5	120	122	110	104	100	92
MEANS	120.6	122.8	115.8	103.4	100.4	86.2

Sources: primary data (2017)

In 2016, all farmers suffered lost higher than previous year due to massive death fish occur 4 times in the single year. Farmers grow mainly Nile and Carp fish species. Carps is higher risk to face massive death, hence farmers prefer to grow Nile/Tilapia during the condition of water is bad. Aweh (station no 3) is the highest FER value. Result of interview record that this station always the last area exposed by mass death fish. Presumably, that condition occur because the area cored by two river, namely Bandaparik and Batang Suni.

Farmer's Mitigation of Climate Change Impacts

Mitigation to disaster (massive death of fish) investigated through two questions, those are (1) what is the farmer's strategies to anticipate mass death fish incidence and (2) if there is a mass death fish occurring, what steps are done so that the loss can be suppressed.

Fish farmers from five study sites provide almost the same answer, i.e. adjusting the time of sowing fish seed, so that during the bad season of waters, farmers do not keep many fish in the floating net cage. In case of the mass death fish occur, the step taken is to harvest the fish early. As for the cages near the mouth of the river, then they will be pulled into the front of the estuary, so that the fish get clean water supply from the river. Nevertheless, this is not easy because the case of mass death fish occurs very quickly and not all cages are located near the mouth of the river.

Conclusion

Technical efficiency of floating net fish farming in Maninjau Lake ranges from 0.562 to 0.727. This reveals that by using same amount of input, potentially farmers able to increase their output about 43 precent (operating at constant return to scale) and 21% (if they operating at variable return to scale). In observation time, the value of TE decreased by an average of 13 percent as a result of mass death fish case. Aweh observation station is the more efficient farming at average TE 0.815. Mostly, mass death fish occur in September to January, presumably related to climate change proxies by decreasing surface temperature and higher precipitation rate and lack of dissolved oxygen in the water.

The decrease in the average of surface water temperature, the changing precipitation pattern has correlation to lower dissolved oxygen concentration in the water. Maninjau Lake has no huge inlet water source to penetrate shortage of oxygen that triggers mass death of fish. Incidences of mass death fish deteriorate farmer's welfare especially since 20014 to 2016. Average of farmer's exchange rate in Maninjau Lake is more than 100 except in 2016. The farmer's welfare tends to decrease as proofed by decreasing of the farmer's exchange rate during the observation period. The fish farmers take several ways to reduce the losses as effect of mass death fish by adjusts the schedule of fish seed sowing and harvest fish earlier if the condition of the water come to bad condition.

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Certification

Author certify that the papers represent original works and are previously unpublished elsewhere. There is no simultaneous submission to any other conference, workshop or journal.

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