Jurnal Perikanan

Fisheries Journal, 15 (3), 1665-1676 (2025)
http://doi.org/10.29303/jp.v15i3.1535

COMPARISON OF FLOATING NET CAGES CULTIVATION TECHNIQUES IN JATIGEDE RESERVOIR AND JATILUHUR RESERVOIR: REGULATION, MANAGEMENT, CULTIVATION SYSTEM, AND ENVIRONMENTAL IMPACT

Komparasi Teknik Budidaya Karamba Jaring Apung di Waduk Jatigede dan Waduk Jatiluhur: Regulasi, Pengelolaan, Sistem Budidaya, dan Dampak Lingkungan

Yuli Andriani*, Vira Lestari

Fisheries Study Program, Faculty of Fisheries, Padjadjaran University

Ir. Soekarno Street, KM. 21 Jatinangor, Sumedang District, West Jawa Province

*Corresponding author: yuli.andriani@unpad.ac.id

(Received May 2nd 2025; Accepted June 22th 2025)

ABSTRACT

Aquaculture using the Floating Net Cage (FNCs) system has rapidly developed and become an important economic source, but it also poses environmental pressures such as pollution and eutrophication. Jatigede and Jatiluhur Reservoirs serve as examples of water bodies affected by the accumulation of aquaculture waste, despite having different legal statuses and management approaches. This study aims to evaluate the environmental impacts of FNCs aquaculture in both reservoirs and to formulate sustainable management strategies that balance economic and ecological aspects. The findings indicate that FNCs activities are prohibited in Jatigede through local regulations; however, illegal practices persist due to economic reasons, with simple farming systems centered on Nile tilapia. In contrast, Jatiluhur allows FNCs operations under a permit system, but the number of cages has exceeded the environmental carrying capacity, with more intensive farming practices using high levels of supplementary feed. Ecological impacts such as eutrophication occur in both reservoirs, with a more severe scale in Jatiluhur. Sustainable management efforts are urgently needed, including alternative livelihoods, regulation of FNCs numbers, and education on environmentally friendly aquaculture practices.

Keywords: Carrying Capacity, FNCs, Jatigede, Jatiluhur, Management

ABSTRAK

Perikanan budidaya dengan sistem Karamba Jaring Apung (KJA) berkembang pesat dan menjadi sumber ekonomi penting, namun menimbulkan tekanan lingkungan seperti pencemaran dan eutrofikasi. Waduk Jatigede dan Waduk Jatiluhur menjadi contoh waduk yang terdampak akibat akumulasi limbah budidaya, meskipun memiliki perbedaan dalam aspek legalitas dan pengelolaan. Penelitian ini bertujuan untuk mengevaluasi dampak lingkungan budidaya KJA di kedua waduk serta menyusun strategi pengelolaan berkelanjutan yang seimbang antara aspek ekonomi dan ekologi. Hasil kajian menunjukkan bahwa Waduk Jatigede melarang aktivitas KJA melalui peraturan daerah, namun praktik ilegal masih terjadi karena alasan ekonomi, dengan sistem budidaya sederhana berbasis komoditas utama ikan nila. Di Waduk Jatiluhur, KJA diizinkan dengan adanya pembatasan jumlah, namun jumlahnya telah melebihi daya dukung lingkungan, dengan sistem budidaya yang lebih intensif menggunakan pakan tambahan tinggi. Dampak ekologis berupa eutrofikasi terjadi di kedua waduk, dengan skala lebih berat di Jatiluhur. Upaya pengelolaan berkelanjutan sangat diperlukan, termasuk alternatif mata pencaharian, pengendalian jumlah KJA, serta edukasi budidaya ramah lingkungan.

Kata Kunci: KJA, Jatigede, Jatiluhur, Daya Dukung, Pengelolaan

INTRODUCTION

Aquaculture is one of the strategic sub-sectors in national fisheries development that plays an important role in meeting food needs, increasing community income, and creating jobs. One of the aquaculture technologies that has developed rapidly in the last two decades is the Floating Net Cage (KJA) system. Floating Net Cage is a cultivation system that utilizes inland public waters such as lakes and reservoirs as a cultivation medium using floating nets as a container for fish maintenance because the implementation of this KJA system does not require land, is efficient, and relatively easy to implement by communities around the waters and is adaptive to the geographical conditions of Indonesia which has many inland public waters. However, the growth of this system also presents serious challenges in the context of environmental sustainability and water carrying capacity (Abidin et al., 2023; Rustadi, 2008; Sulaiman et al., 2020).

Along with the increasing intensity of aquaculture activities using the floating net cage system, there has been an increase in the burden of organic pollution, especially from leftover feed that is thrown into the water body and the results of fish metabolism containing nitrogen and phosphorus compounds. This waste accumulation has the potential to reduce water quality and accelerate the eutrophication process which can ultimately cause long-term degradation of aquatic ecosystems and mass fish mortality (Melani et al., 2022; Price, 2013). This phenomenon has occurred in many reservoirs in Indonesia, including the Jatiluhur Reservoir and the Jatigede Reservoir.

The Jatigede Reservoir is located in the Cimanuk-Cisanggarung River basin and is surrounded by five sub-districts and 26 villages in the surrounding area (Susanto, 2016). The construction of this reservoir was initially intended to meet various vital needs, such as irrigation of agricultural land or irrigation land covering an area of 90,000 hectares, provision of raw water of 3,500 liters per second for Cirebon and Indramayu Regencies, generation of 110 MW of electricity, and as a means of flood control (Pradwipa, 2019). In addition to its main function as a water resource utilization, communities affected by the construction of the reservoir also utilize it for fisheries activities, both capture fisheries and aquaculture, including the Floating Net Cage (KJA) system. Although until now KJA activities have not received legal recognition from the local government, this activity continues because it is an important source of income for local communities. However, this cultivation practice also puts pressure on the reservoir ecosystem, especially through the accumulation of nitrogen waste from leftover feed and fish excretion, which can worsen water quality (Price, 2013). In addition, changes in the morphology of the waters from a flowing river system to a stagnant reservoir have changed the pattern of water circulation and have an impact on the physical condition and ecological balance of aquatic organisms (Andani et al., 2017).

On the other hand, the Jatiluhur Reservoir, also known as the Ir. H. Djuanda Reservoir, is located in Purwakarta Regency, West Java, and is part of the Citarum River Basin (DAS). This reservoir has an area of approximately 8,300 hectares with a water capacity of approximately 3 billion cubic meters, and a maximum water level estimated at 107 meters above sea level. Jatiluhur Reservoir is managed by Perum Jasa Tirta II, this reservoir functions as a multipurpose infrastructure that supports various sectors. In addition to being a Hydroelectric Power Plant (PLTA) with a capacity of 187.5 MW, this reservoir also plays a role in providing raw water for drinking water and industrial needs, irrigation of rice fields in the northern region of West Java covering an area of 242,000 hectares, and flood control. In addition, this reservoir is also used for freshwater fisheries cultivation, tourism sector development, and water sports activities (PJT II, 2015 in Hamzah et al., 2016).

Jatiluhur Reservoir is also one of the main centers for freshwater fish farming through a floating net cage system. Unlike Jatigede Reservoir which is still facing legal issues, KJA management in Jatiluhur Reservoir is more structured with the existence of a designated cultivation zone. Although it has been regulated, the number of KJA in this reservoir exceeds the environmental carrying capacity. Based on ecological carrying capacity research using the Beveridge method, the maximum KJA capacity that can be accepted by Jatiluhur Reservoir sustainably is 6,838 units (Simangunsong & Hidayat, 2017). However, data in 2014 showed that there were around 23,000 KJA units operating, or more than three times the ideal capacity. Another study by (Susanto, 2016) stated that the optimal number of KJA that can be accommodated sustainably is 19,401 plots, which means that excess capacity remains an important issue even in a looser management formulation.

The high number of KJA in Jatiluhur Reservoir has a major economic impact, including increasing community income and contributing to the fisheries production of Purwakarta Regency which reaches 94.5 thousand tons per year. However, from an environmental perspective, the uncontrolled increase in the number of KJA causes a decrease in water quality due to the high phosphorus and nitrate content of fish feed residue. This waste settles at the bottom of the reservoir and can cause eutrophication, which can ultimately damage the aquatic ecosystem (Deswati & Adrison, 2019). Based on the differences in the regulation and implementation of the Floating Net Cage system in the two reservoirs, further studies are needed regarding sustainable management strategies. The policies that have been implemented must consider the balance between economic aspects and ecosystem sustainability, so that the utilization of the reservoir can be carried out optimally without damaging the carrying capacity of its environment. In addition, it is important to understand that the cultivation system applied in each reservoir has different characteristics. Variations in feeding techniques, stocking densities, net types, and cultivation waste management methods will affect the level of pollution and environmental sustainability of the reservoir.

METHODS

This research was conducted from March to May 2025 using a literature study method, namely by collecting, reviewing, and analyzing various library sources or literature relevant to the research topic sourced from various scientific articles, scientific references, books related to aquatic resources, and research reports that discuss aquatic resources and related to cultivation in floating net cages. Literature data was obtained through searches on the Google Scholar portal, Garuda Ristekdikti, ResearchGate, and Campus Repositories using keywords such as "Floating Net Cages in Jatigede Reservoir", "Fish cultivation in Jatiluhur Reservoir", "Environmental carrying capacity of KJA", and "Environmental impact of fish cultivation in reservoirs". The articles used were selected from peer-reviewed journals, official government documents, and trusted research reports to ensure the validity of the data and the suitability of the data to the topics discussed.

RESULTS

Fish farming with the Floating Net Cage (KJA) system in Jatigede Reservoir and Jatiluhur Reservoir has fundamental differences in technical aspects and cultivation intensity.

A comparison of the cultivation systems in the two reservoirs is listed in Table 1.

Table 1. Comparison of Floating Net Cage Cultivation Systems

Aspect	Jatigede Reservoir	Jatiluhur Reservoir
KJA Type	Layered net (7x7m), dolos net (7x14m), drawstring net (14x14m)	Layered nets, dolos nets, drawstring nets
Fish Type	Tilapia	Tilapia, Pangasius, Carp, Catfish
Cultivation System	Semi-Intensive, manual feeding, low stocking density (1,000-1,500 fish/plot)	Intensive, floating commercial feed, high stocking density (2,000-3,500 fish/plot)
Supporting Technology	No additional aeration, open culture system	Some use aeration and feed management
Waste Management	No special management	Efforts are beginning to be made on feeding trays and waste control
Environmental Impact	Medium, increased N and P load	Heavy, eutrophication, upwelling cause mass fish deaths

(Sources: Anas et al., 2017; Deswati and Adrison, 2019; Marsela et al., 2023; Pradwipa, 2019; Price, 2013)

Based on the factors influencing the existence of KJA in the Jatigede Reservoir and Jatiluhur Reservoir that have been discussed, the following is a journal synthesis table from several literatures that have been studied (Table 2).

Table 2. Journal Synthesis of Literature Study Results

No	Source	Location	Research Focus	Result
1	(Marsela *et al.*, 2023)	Jatigede	Production and environmental carrying capacity of KJA	816 KJA units, production 14,932 tons/year, moderate eutrophication status
2	(Pradwipa, 2019)	Jatigede	Analysis of reservoir water quality	KJA is illegal and increases N and P levels in the waters
3	(Herawati *et al.*, 2018)	Jatigede	Status of reservoir water quality	Decreased water quality detected
4	(Susanto, 2016)	Jatigede	Ecological impacts after filling the reservoir	Cimanuk River ecosystem significantly affected
5	(Haifa *et al.*, 2020)	Jatigede	Phytoplankton distribution	Phytoplankton dominance indicates the onset of eutrophication symptoms
6	(Arief *et al.*, 2023)	Jatigede	Local technology for reservoir management	Implementation of effective community-based local technology
7	(Deswati dan Adrison, 2019)	Jatiluhur	Externalities of KJA production	The number of KJA exceeds the carrying capacity and causes water degradation
8	(Anas *et al.*, 2017)	Jatiluhur	Waste and water quality in KJA	KJA causes an increase in nitrate and phosphate levels
9	(Sulaiman *et al.*, 2020)	Jatiluhur	Mitigation of mass fish mortality	Umbalan is worsened by KJA activities

No	Source	Location	Research Focus	Result
10	(Rustadi, 2008)	Jatiluhur	Impact of feed waste	Increased sedimentation of the reservoir bottoms due to leftover feed

DISCUSSION

Floating Net Cage System

The Floating Net Cage (KJA) system has developed rapidly as a fish farming method in various reservoirs in Indonesia, including the Jatigede Reservoir and Jatiluhur Reservoir. The increase in the number of KJA in these two reservoirs has contributed significantly to freshwater fisheries production. However, poorly controlled cultivation practices also pose serious challenges to aquatic ecosystems, especially in terms of decreasing water quality, changing ecosystems, and social and economic impacts on local communities (Deswati & Adrison, 2019). An overview of KJA activities in inland public waters can be seen in (Figure 1).

Figure 1. Floating Net Cage in Inland Public Waters (Source: Tempo.co)

According to research by Marsela et al., (2023) there are around 816 KJA units in the Jatigede Reservoir consisting of several size variations. Each unit consists of four 7×7 meter plots called layered nets, while the other units have two 7×14 meter plots called dolos nets. In addition, there is also a unit without partitions measuring 14×14 meters known as a drawstring net. Based on production data, the total fish harvest from KJA in Jatigede Reservoir reaches around 14,932.8 tons per year, with tilapia (Oreochromis niloticus) as the main commodity. However, KJA cultivation in Jatigede Reservoir is still a controversial issue because it does not have clear regulations and is considered illegal by the local government. However, high market demand and economic needs encourage people to continue this cultivation business (Figure 2). The ecological impacts caused by this system include an increase in the burden of pollution due to organic waste from leftover feed and fish metabolism, which leads to a decrease in water quality and the risk of eutrophication (Price, 2013).

Figure 2. KJA in Jatigede Reservoir (Source: Jabarnews.com)

The floating net cage cultivation pattern in Jatiluhur Reservoir (Figure 3) has a similar configuration to Jatigede, consisting of layered nets (4 plots, measuring 7×7 m), dolos nets (2 plots, measuring 7×14 m), and drawstring nets that do not have partitions measuring 14×14 m (Marsela et al., 2023). Although the management of KJA in Jatiluhur Reservoir is more organized with zoning, the number of KJA operating still exceeds the environmental carrying capacity. The increase in fisheries production reaching 94.5 thousand tons per year contributes to the community's economy, but on the other hand, the increase in organic waste also risks accelerating the eutrophication process and water quality degradation (Deswati & Adrison, 2019).

Figure 3. KJA in Jatiluhur Reservoir (Source: Jabaprov.go.id)

Regulation or Permit for Floating Net Cages Management

The Jatigede Reservoir has a prohibition on establishing KJA, so that fishing activities in this reservoir are limited, but there are still some parties who establish KJA on a small scale (Herawati et al., 2018). The reservoir manager has issued a ban on the use of floating net cages in the Jatigede Reservoir. This prohibition is enforced based on Sumedang Regency Regional Regulation Number 4 of 2018, specifically in Article 54 paragraph 5 point b which states "prohibition of inland fisheries cultivation activities with floating nets and the like" and Article 59 paragraph 10 point e which reads "prohibition of floating net activities and the like in the water body of the Jatigede Reservoir". However, in reality, some fish farmers still run KJA cultivation businesses illegally. As a result, waste produced from leftover feed and fish waste increases nitrogen and phosphorus levels in the water. This causes eutrophication, namely excessive algae growth that can reduce water quality and damage aquatic ecosystems.

The increasing number of floating net cages in the Jatigede Reservoir has prompted the government to take action on several KJAs there. As a follow-up to handling the impact of floating net cages on the waters of the Jatigede Reservoir, several parties have taken action to destroy KJAs, resulting in hundreds of KJAs being destroyed. This was done by the government to maintain the quantity and quality of water in the Jatigede Reservoir and to maintain the stability of the Jatigede dam embankment so as not to cause leaks or damage to parts of the dam. In addition, this action was also carried out to prevent the acceleration of the age of the Jatigede Reservoir due to sedimentation entering the waters of the Jatigede Reservoir (BBWS Cimanuk Cisanggarung 2020). The following is evidence of the action to destroy KJAs in the Jatigede Reservoir (Figure 4).

Figure 4. Regulation of KJA in Jatigede Reservoir (Source: Sumedang.radarbandung.id)

Meanwhile, in Jatiluhur Reservoir, KJA growth is more intensive with the number of units exceeding the recommended optimal capacity. As a result, organic waste from fish farming is increasing and causing sedimentation which reduces the condition of the aquatic ecosystem (Deswati and Adrison, 2019). A study also shows that the concentration of phosphate and nitrate in water increases due to uneaten feed residue, thus contributing to the decline in water quality and the balance of the reservoir ecosystem (Anas et al., 2017). To overcome this problem, the West Java Provincial Government issued Governor Regulation Number 660.31/2019 concerning KJA Management, which sets the ideal number of KJA in Jatiluhur Reservoir at 11,306 plots.

The KJA cleanup is focused on three zones, namely Sukatani, Sukasari, and Jatiluhur Districts, where there are 46,270 KJA plots, far exceeding the set capacity. Jasa Tirta II, in collaboration with the Citarum Harum Task Force and the Purwakarta Regency Government, is carrying out KJA cleanup in stages and continuously. This cleanup will take place from November to December 2022, with a total of 1,722 KJA plots successfully cleaned up. The cleanup is carried out in stages by considering the economic factors of the community, where the dismantling is carried out on 10 percent of the total KJA ownership. The following is evidence of KJA cleanup in the Jatiluhur Reservoir (Figure 5).

Figure 5. Regulation of Floating Net Cages in Jatiluhur Reservoir (Source: Citarumharum.jabarprov.go.id)

The regulations or rules related to floating net cages in Jatigede Reservoir are more of a total prohibition on the establishment of floating net cages, while in Jatiluhur Reservoir they are more of a control on the number and location of their operations. However, both face serious challenges in implementation in the field due to socio-economic pressures on the community. In addition, the floating net cage cultivation system must pay attention to the suitability of the floating net cage location with several oceanographic parameters and water quality, in order to minimize the risk of pollution and failure of the cultivation process (Affan, 2012).

Socio-Economic Impacts

The social impacts of the construction of the Jatigede Reservoir on the surrounding community are marked by unresolved problems, such as compensation not yet received by some people affected by the construction of the reservoir, relocation has not been optimal, and social change from a farming community to a fishing and fish farming community has not been prepared. Relocation is the relocation of residents or citizens who have to move because of an activity that is considered more important for the interests of the nation and state. In this case, the responsibility for implementing the relocation lies entirely with the government to pay attention to its citizens who are the objects of development, especially the construction of the Jatigede Reservoir in Sumedang Regency, West Java Province. Changes in the natural environment from agricultural land to a reservoir inundation area on a large scale cause changes in the socio-economic activities of the community, especially in terms of livelihoods. This change in profession must be prepared comprehensively because it will have an impact on the socio-cultural structure of the local community. Psychologically, the community must also be prepared so that they do not experience stress due to drastic social changes (Nurhayati et al., 2020).

In terms of social aspects, the prohibition on the establishment of Floating Net Cages in the Jatigede Reservoir has caused unrest among the surrounding community. The ban on fish farming activities using the Floating Net Cage (KJA) system in the Jatigede Reservoir has had a significant social impact on the surrounding community. Based on Regional Regulation No. 4 of 2018, fish farming activities using KJA are prohibited because they are considered to be able to damage the quality of the reservoir waters. However, this cultivation practice is still ongoing in the field with a total of 139 KJA blocks, each consisting of 10 ponds measuring 64 m². This reflects the community's dependence on KJA as their main source of livelihood, especially after the change in profession from farmers to fishermen and cultivators after the construction of the Jatigede Reservoir. The lack of alternative livelihoods worsens the socio-economic conditions of the community affected by the prohibition policy (Melani et al., 2022).

Meanwhile, in the Jatiluhur Reservoir, fish farming using the KJA system is still the main activity that provides a significant economic contribution to the local community. This reservoir is an important location for the development of freshwater fisheries through the KJA system which is capital-intensive and labor-intensive. KJA cultivation is considered capable of increasing community income and meeting fish consumption needs in the surrounding area. However, this activity also has quite serious ecological impacts. Research by Anas et al., (2017) shows that KJA in Jatiluhur Reservoir contributes a fairly high load of organic and inorganic waste, especially from leftover feed and fish feces. This waste contributes to a decrease in water quality, an increase in nitrogen and phosphorus concentrations, and triggers the eutrophication process. If not managed properly, the accumulation of this waste can cause ecosystem degradation and a decrease in fisheries productivity in the long term. To minimize these negative impacts, an integrated approach is needed in the form of increasing community capacity in creating new jobs, providing social consultation facilities, and socializing clear and inclusive policies. In addition, improvements to KJA control policies must consider historical aspects, the socio-economic conditions of the community, and business relations that have been formed so that the transition process can run fairly and not cause wider horizontal conflicts (Kurniasari et al., 2020).

This is supported by the statement of Deswati & Adrison (2019) that the existence of KJA provides prospects for increasing other supporting economic activities such as culinary businesses, fisheries production facilities, transportation services and so on. This is proof that the KJA business does have a positive influence in terms of alternative livelihoods, but in reality on the other hand it can have a negative impact in the form of decreased water quality if its existence is not controlled such as decreased dissolved oxygen levels, increased ammonia, increased turbidity, increased pollution of undigested organic matter, fish feces and urine (Astuti et al., 2018).

Management Efforts

Management efforts to reduce the negative impacts caused by KJA in both reservoirs need to be carried out in order to support better management. In Jatigede Reservoir, the government needs to provide economic alternatives for the community so that they no longer depend on illegal KJA. Training programs and business diversification, such as fish farming in inland ponds or other fisheries sectors, can be effective solutions (Rustadi, 2008). Meanwhile, in Jatiluhur Reservoir, adjusting the number of KJA units according to environmental carrying capacity needs to be done to reduce the burden of water pollution. The use of environmentally friendly feed, water recirculation systems, and stricter supervision can help maintain a balance between economic needs and the sustainability of aquatic resources. In addition, strengthening regulations and increasing public awareness of the importance of sustainable fisheries management are also important steps in maintaining the sustainability of the KJA system in this reservoir (Deswati & Adrison, 2019). The application of the Integrated Aquaculture Management (IAM) approach which discusses technical aspects of cultivation, waste management, community education, and regulations based on environmental carrying capacity needs to be implemented for both reservoirs so that cultivation can take place sustainably.

Case Study

Mass fish deaths in Jatiluhur Reservoir have become a serious concern in recent years. According to Kartamihardja & Krismono (2016) in (Sulaiman et al., 2020) the main cause of fish deaths in Jatiluhur Reservoir and other reservoirs is the upwelling phenomenon, which is the process of rising water mass from the bottom of the reservoir to the surface carrying toxic compounds such as ammonia (NH_3) and hydrogen sulfide (H_2S). This phenomenon is often triggered by a decrease in surface water temperature due to continuous rain and lack of sunlight, which causes differences in water density so that the upper layer of water becomes heavier and sinks, pushing the bottom water to rise to the surface. This upwelling process is very dangerous for fish because it drastically reduces the level of dissolved oxygen in the water, causing fish to become stressed and die en masse. In addition, intensive fish farming activities in Floating Net Cages (KJA) also worsen water conditions, through increasing the nutrient load from leftover feed and fish waste which triggers eutrophication, increasing the possibility of upwelling.

In the research results of Sulaiman et al., (2020) presented various mitigation strategies to overcome the risk of mass fish mortality in lakes and reservoirs, including in the Jatiluhur Reservoir. Several important efforts that are recommended include limiting the number of Floating Net Cages (KJA) according to the carrying capacity of the waters to reduce the accumulation of organic waste, as well as regulating the cultivation system such as rotating locations or production periods to prevent the accumulation of residues at the bottom of the reservoir. In addition, reducing fish stocking density is also recommended so as not to overload the ecosystem.

Routine monitoring of water quality parameters such as dissolved oxygen (DO) levels, water temperature, and ammonia concentrations is essential to detect the potential for agglomeration early. Information from this monitoring should be conveyed quickly to farmers so that they can take preventive measures such as harvesting earlier or reducing stocking density. As a form of mitigation technology, the installation of the Early Warning System (EWS) has also been tested in the Jatiluhur Reservoir, Cirata, and Lake Maninjau to record environmental parameters in real time and provide warnings if there are changes in conditions that pose a high risk of mass fish mortality (Sulaiman et al., 2020).

The latest incident in February 2025 reported mass mortality (Figure 6) of around 100 tons of fish in the Jatiluhur Reservoir and the main cause identified was the upwelling phenomenon which caused a decrease in dissolved oxygen levels, exacerbated by extreme weather. The Ministry of Marine Affairs and Fisheries (KKP) has issued an appeal to farmers to harvest earlier to reduce the risk of losses due to mass fish mortality. The upwelling phenomenon in the Jatiluhur Reservoir is clear evidence that KJA management that does not consider environmental aspects and carrying capacity can cause natural disasters that lead to economic losses for the community.

Figure 6. Mass Mortality in the Jatiluhur Reservoir (Source: kkp.go.id)

CONCLUSION

This study shows that there are differences in the cultivation techniques, regulations, management, and environmental impacts of floating net cages in the Jatigede and Jatiluhur

Reservoirs. The Jatigede Reservoir applies a semi-intensive cultivation system without official permits, while the Jatiluhur Reservoir adopts an intensive system with a number of KJA far exceeding the carrying capacity. This difference results in different levels of pollution and ecosystem degradation. Strategic efforts are needed, including limiting the number of KJA, using environmentally friendly feed, providing economic alternatives, and socializing sustainable cultivation techniques.

ACKNOWLEDGEMENT

On this occasion, the author would like to thank all parties who have helped the author, so that the author can complete this paper well and on time.

REFERENCES

Abidin, Z., Affandi, R. I., Scarba, A. R., Cokrowati, N., Aulia, J., Rahman, A., Diniariwisan, D., Sumsanto, M., Rahmadani, T. B. C., & Diamahesa, W. A. (2023). Penyuluhan Teknik Budidaya Ikan Menggunakan Keramba Jaring Apung di Danau Lebo Kabupaten Sumbawa Barat. *Jurnal Pengabdian Magister Pendidikan IPA*, *6*(4), 940–944. https://doi.org/10.29303/jpmpi.v6i4.5713

Affan, J. M. (2012). Identifikasi Lokasi untuk Pengembangan Budidaya Keramba Jaring Apung (KJA) berdasarkan Faktor Lingkungan dan Kualitas Air di Perairan Pantai Timur Bangka Tengah. *Depik*, *1*(1), 78–85.

Anas, P., Jubaedah, I., & Sudino, D. (2017). Kualitas Air dan Beban Limbah Karamba Jaring Apung di Waduk Jatiluhur Jawa Barat. *Jurnal Penyuluhan Perikanan dan Kelautan*, *11*(1), 35–47.

Andani, A., Herawati, T., Zahidah, & Hamdani, H. (2017). Identifikasi dan Inventarisasi Ikan yang Dapat Beradaptasi di Waduk Jatigede pada Tahan Inundasi Awal. *Jurnal Perikanan Dan Kelautan*, *8*, 28–35.

Arief, M. C. W., Hasan, Z., Andriani, Y., Iskandar, I., Maulina, I., Herawati, H., & Awaliyah, F. (2023). Studi Penerapan Teknologi Berbasis Potensi Sumberdaya Lokal Mendukung Pengelolaan Waduk Berbasis Masyarakat. *Farmers : Journal of Community Services*, *4*(1), 38. https://doi.org/10.24198/fjcs.v4i1.43684

Astuti, L. P., Hendrawan, A. L. S., & Krismono. (2018). Pengelolaan Kualitas Perairan Melalui Penerapan Budidaya Ikan dalam Keramba Jaring Apung "SMART." *Jurnal Kebijakan Perikanan Indonesia*, *10*, 87–97. http://ejournal-balitbang.kkp.go.id/index.php/jkpi

Deswati, R. H., & Adrison, V. (2019). Eksternalitas Produksi Keramba Jaring Apung Waduk Jatiluhur. *Jurnal Ilmu Ekonomi Dan Pembangunan*, *19*(1), 47–60.

Haifa, R. N., Hasan, Z., Herawati, H., Nurruhwati, I., & Sahidin, A. (2020). Spatial Distribution of Phytoplankton in Jatigede Reservoir, West Java, Indonesia. *Asian Journal of Fisheries and Aquatic Research*, *6*(1), 39–48. https://doi.org/10.9734/ajfar/2020/v6i130090

Hamzah, Maarif, M. S., Marimin, & Riani, E. (2016). Status Mutu Air Waduk Jatiluhur dan Ancaman terhadap Proses Bisnis Vital. *Jurnal Sumber Daya Air*, *12*(1), 47–60.

Herawati, H., Kurniawati, N., Maulina, I., Zahidah, & Sahidin, A. (2018). Water Quality Status of Jatigede Reservoirs in Sumedang. *Global Scientific Journals*, *6*(12), 181–188. www.globalscientificjournal.com

Kurniasari, N., Apriliani, T., Koeshendrajana, S., & Wijaya, R. A. (2020). Risiko Sosial Penertiban Keramba Jaring Apung di Waduk Jatiluhur. *Jurnal Sosial Ekonomi Kelautan Dan Perikanan*, *15*(1), 107–119. https://doi.org/10.15578/jsekp.v15i1.8363

Marsela, K., Sumiarsa, D., & Kurniadie, D. (2023). Penentuan Status Trofik dan Daya Dukung Keramba Jaring Apung di Waduk Jatigede. *Jurnal Akuakultur Indonesia*, *22*(2), 147–155. https://doi.org/10.19027/jai.22.2.147-155

Melani, A., Iswantari, A., Wulandari, D. Y., & Pratiwi, N. T. M. (2022). Kualitas Air dan Beban Nitrogen di Waduk Jatigede. *Habitus Aquatica*, *3*(1). https://doi.org/10.29244/HAJ.3.1.22

Nurhayati, A., Herawati, T., Lili, W., Yustiati, A., & Nurruhwati, I. (2020). Kajian Nilai Sosial Ekonomi dan Lingkungan Sumberdaya Perikanan Tangkap di Waduk Jatigede Kabupaten Sumedang Provinsi Jawa Barat. *Jurnal Penyuluhan*, *16*(1), 122–133. https://doi.org/10.25015/16202025262

Pradwipa, I., Kurniawan, A., & Handayani, P. (2019). Analisis Kualitas Air Waduk Jatigede Berdasarkan Parameter Fisika dan Kimia. *Jurnal Manajemen Lingkungan*, *25*(3), 85–97.

Price, C. & Jones, M. (2013). *Water Quality and Nutrient Dynamics in Aquaculture Systems*. *8*(1), 23–37.

Rustadi. (2008). Penampungan Limbah dan Pengaruhnya terhadap Laju Sintasan dan Pertumbuhan Nila Merahdalam Keramba Jaring Apung di Waduk Sermo, Yogyakarta. *Journal of Fisheries Sciences*, *X*, 30–36.

Simangunsong, N. F., & Hidayat, A. (2017). Carrying Capacity and Institutional Analysis of Floating Net Cages in Jatiluhur Reservoir. *Journal of Environment and Sustainability*, *1*(1), 37–47. https://doi.org/10.22515/sustinere.jes.v1i1.6

Sulaiman, P. S., Rachmawati, P. F., Puspasari, R., & Wiadnyana, N. N. (2020). Upaya Pencegahan dan Penanggulangan Kematian Massal Ikan di Danau dan Waduk. *Jurnal Kebijakan Perikanan Indonesia*, *12*(2), 59–73. https://doi.org/10.15578/jkpi.12.1.2020.59-73

Susanto, B. (2016). Pengaruh Waduk Jatigede terhadap Ekosistem Perairan Sungai Cimanuk. *Jurnal Akuakultur Indonesia*, *15*(2), 32–48.