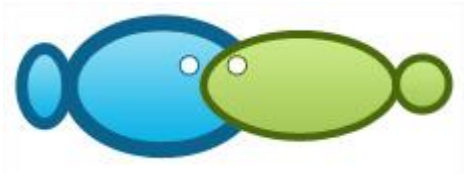

Compliance of fishermen and tour guides with zoning in the Karimunjawa Marine Protected Area

Indradi Setiyanto, Dian Wijayanto, Bambang A. Wibowo, Dian A. N. N. Dewi

Faculty of Fisheries and Marine Science, Universitas Diponegoro, Semarang, Central Java, Indonesia. Corresponding author: D. Wijayanto, dianwijayanto@gmail.com

Abstract. A potential conflict of interest arises between fishing activities by fishermen, marine tourism, and conservation in Karimunjawa Islands. Fishermen's welfare and compliance to nature conservation are factors that determine the success of conservation programs in Karimunjawa Islands. This research was performed to identify the fishing ground of fishermen and marine tourism location in Karimunjawa Islands and their support for the Karimunjawa waters conservation program. Data of this research were collected from observations, surveys, and interviews with 200 fishermen (also a provider of tourist boat rental services) from July to August 2023. The collected data were descriptively analyzed by comparing the coordinates of the fishing ground with the core zone. The research results showed that fishermen from the Karimunjawa Islands avoided fishing in the core zone of the conservation area. Furthermore, marine tourism service providers also support the conservation of coastal ecosystems, including coral reef, mangrove, and seagrass ecosystems.
Key Words: core zone, fishing ground, Karimunjawa Islands, marine protected area, marine tourism spot.

Introduction. There has been a potential conflict of interest between fishermen in fishing and the conservation programs in Karimunjawa Islands. The management of Karimunjawa Marine Protected Area, Balai Taman Nasional Karimun Jawa (BTNKJ) is responsible for balancing the protection of coastal ecosystems (coral reefs, mangroves, and seagrass) and the improvement of the welfare of local communities. Karimunjawa Islands (located at 5°40'39"-5°55'00" South Latitude and 110°05'57"-110°31'15" East Longitude) has been designated as a conservation area by the Indonesian Government since 1986 (Campbell et al 2013; BTNKJ 2019; Wibowo et al 2022; Wijayanto et al 2023a). On the other hand, local community has been living Karimunjawa Islands long before the area was designated as a conservation area. Therefore, conservation, legal, economic, and social issues need to be carefully balanced to avoid social conflicts (Suliyati et al 2017; Kennedy et al 2020; Wijayanto et al 2021; Wibowo et al 2022).

Apart from conservation and fishing, Karimunjawa Islands is thriving in terms of tourism and aquaculture (Sulardiono et al 2018; Astuti et al 2023; Puspitawati et al 2023; Wijayanto et al 2023b; Wibowo et al 2023). Fishing remains the major occupation of the Karimunjawa Islands community (Wijayanto et al 2022; BPS-Statistics of Jepara Regency 2023; Wijayanto et al 2023a). Karimunjawa Marine Conservation Area is divided into core zone, mariculture zone and traditional capture fisheries zone (BTNKJ 2019). Fishermen's compliance with the regulations is an important factor in the success of marine conservation programs in the Karimunjawa Islands. Fishermen can also act as the supervisors of the conservation program implementation in Karimunjawa Islands (Wijayanto et al 2020a, 2021, 2022). This research aims to identify the fishing ground of fishermen and marine tourism location of Karimunjawa Islands and their support for the Karimunjawa waters conservation program.

Material and Method

Research time and location. This research took place in Karimunjawa Islands (Indonesia) from July to August 2023. Researchers visited the homes of fishermen who were open to sharing the detailed information about their fishing grounds in interviews.

Data collection and analysis. The main data collection was carried out through observations and interviews with 200 respondents. Data were analyzed descriptively. The coordinates of the fishing grounds were compared with the core zone of the Karimunjawa Marine Conservation Area (BTNKJ 2019; Purnomo et al 2022; Setiyanto et al 2023; Wijayanto et al 2023b).

Results. The results of the survey showed that most of fishermen in the Karimunjawa Islands only finished primary education (60%), even 27% of them did not completed primary education. The remainder were secondary school graduates and none of them pursued higher education. The respondents had an average age of 46 years, ranging from the youngest at 21 years to the oldest at 72 years. All respondents performed the one-day fishing method using boats with an average length of 11 m and using outboard engines.

Fishing ground. The fishing ground data are presented in Figure 1.

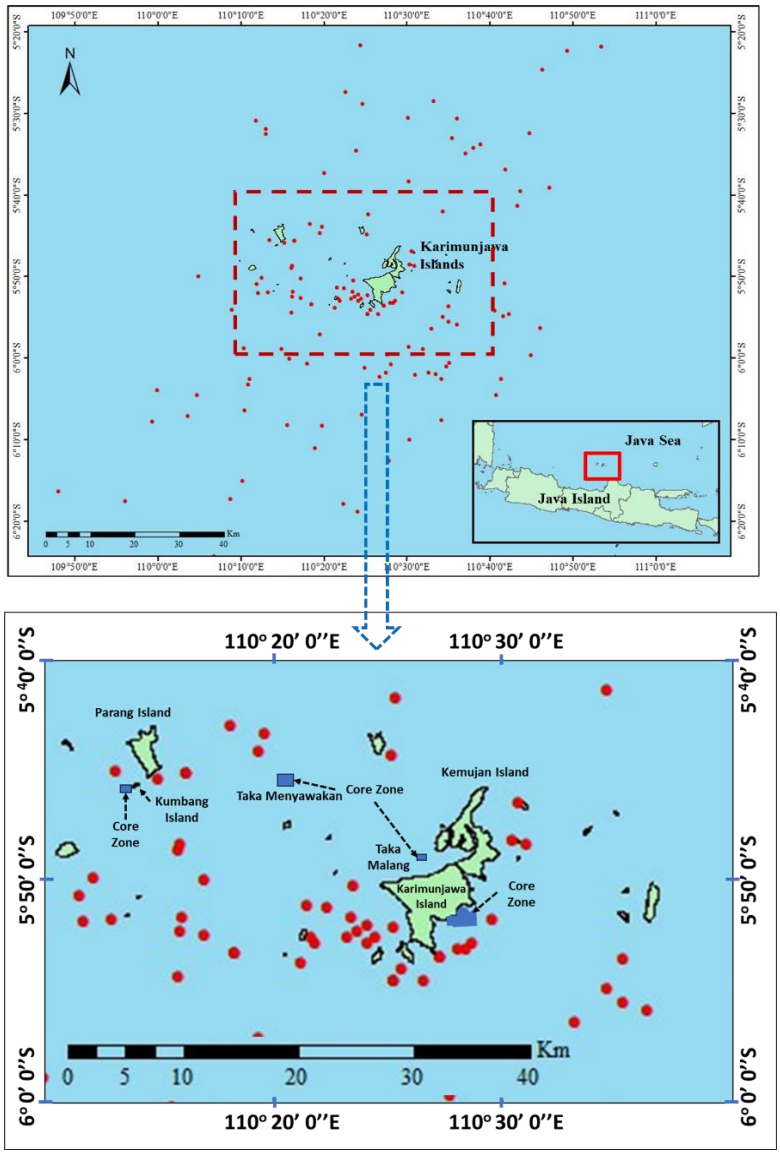

Figure 1. Fishing ground (Note: red dots are the fishing grounds).

Based on research results, fishermen of Karimunjawa Islands tended to avoid fishing in the core zone where ecosystem, unique flora, and fauna are strictly protected. The core zone serves as a reservoir for germplasm from wild plant and animal species. Permitted activities within the core zone include ensuring zone security, conducting resource inventories and monitoring, as well as facilitating education and research (BTNKJ 2019). Local fishermen in Karimunjawa Islands have adequate understanding of the zoning system in the Karimunjawa Protected Area and the awareness of fishing prohibition in the core zone. The average speed of fishermen's trip from fishing base to fishing ground is 8 knots (equivalent to 14.8 km per hour) within an average time of 2 hours, implying that the average distance between fishing base to fishing ground is around 30 km.

Based on the survey, 99% of the fishermen expressed their support to conservation programs as they also believed that preserving coastal resources is a long-term investment for the society and the future generations. Several respondents disagreed with the program as they perceived that conservation officers did not involve local communities in the program implementation which possibly triggered the conflict of interests in the exploration of coastal resources.

Marine tourism locations. The map of marine tourism locations is shown in Figure 2. Based on the results of this research, tour guides and tour services also avoided the core zone in performing their service. There are several favorite snorkeling spots in Karimunjawa Islands that include the waters around Cemara Besar Island, Cemara Kecil Island, Galean Island, Menjangan Besar Island and Menjangan Kecil Island and the waters of Kemujan Island, including Sintok Island, Tengah Island and Cilik Island.

Figure 2. Several tourist attractions (Note: red dots are tourism spots).

The primary operators of marine tourism services are based on Karimunjawa Island, where numerous tourist boat bases are also located. Hence, most marine tourism spots, particularly for snorkeling, are located around Karimunjawa Island. Most of boat owners are also fishermen who rent their boats for tourism purposes. Therefore, they understand the zoning system that applies in Karimunjawa marine protected area. Based on the

results of interviews and observations, marine tourism service providers have determined certain protocols that covered issues related to tourist safety and coral reef ecosystems preservation. Tour guides also offer guidance and supervision to ensure that tourists avoid stepping on coral reefs and refrain from taking biota from the coral reef ecosystem. Tourists are also prohibited from throwing rubbish carelessly into the sea.

Discussion. Before tourism activities developed in the Karimunjawa Islands, the majority of local community in the Karimunjawa Islands worked as fishermen and farmers. Following the transformation of the Karimunjawa Islands into a destination for both national and international tourists, the range of professions among the residents expanded, although fishing continued to be the predominant occupation. Some fishermen have also adopted dual roles, serving as both fishermen and providers of tourism services. Diversification of fishing businesses is needed to improve fishermen's welfare, which in turn is positively correlated with support for conservation efforts (Wijayanto et al 2020a; Wibowo et al 2022). Unfortunately, some fishermen found it difficult to change professions due to limited skills (Agimass & Mekonnen 2011; Wu et al 2023). Wijayanto et al (2023b) identified fishermen's reluctance to switch professions. They also expected their children to pursue career in other sectors.

The community in Karimunjawa islands consisted of Javanese, Bajo, Batak, Bugis, Buton, Mandar, Makassar, and Madurese people. The Bajo, Bugis, Bajo and Buton tribes are known to have strong maritime traditions. Despite the heterogeneity, the community in Karimunjawa Islands lives in harmony (Suliyati et al 2017; Wibowo et al 2022; Wijayanto et al 2022).

Marine tourism activities are more likely to cause damages to coastal ecosystems than fishing activities. Fishermen need to fish in fishing grounds located away from the snorkeling spots around the coral reef waters. To date, tourism business actors in the Karimunjawa Islands tend to comply with the Marine Tourism Utilization zoning system. The Marine Tourism Utilization Zone includes the waters of Menjangan Besar Island, Menjangan Kecil Island, Tengah Island, northern Cemara Besar Island, Tanjung Gelam, northern Cemara Kecil Island, and Cilik Island (BTNKJ 2019). The results of Setiyanto et al's study in 2023 showed that conservation and tourism in the Karimunjawa Islands can be synergized to gain both short term and for long term benefits related to the community welfare and protection of coastal ecosystems. Astuti et al (2023) asserted that social capital in Karimunjawa strongly influences the tourism activities in Karimunjawa. Social capital is a network of cooperation in society that can facilitate collective action in achieving goals. Social capital can also be leveraged to enhance synergy between preserving coastal ecosystems and supporting the economic activities of local communities in the Karimunjawa Islands.

Regarding mariculture activities, seaweed cultivation has been the primary focus on the northwest coast of Kemujan Island to date. This location is particularly well-suited for mariculture efforts. Entrepreneurs involved in seaweed cultivation on Kemujan Island operate on a micro and small scale. They specialize in cultivating *Eucheuma cottonii* through the longline method, with each line averaging 129 meters in length. For optimal revenue, the cultivation cycle of seaweed is maintained at 40 days per cycle, with an average cultivation effort involving 19 lines (Wijayanto et al 2020a, 2021).

Ever since its designation as a conservation area in 1986, the Indonesian Government has implemented programs to protect coastal resources in Karimujawa Islands. There are 9 zones in the Karimunjawa Protected Area; core zone, forest zone (tropical rainforest), marine protection zone, land use zone, marine tourism use zone, mariculture zone, religious-cultural-historical zone, rehabilitation zone and traditional fishing zone. BTNKJ (as manager of the Karimunjawa protected area) have implemented several programs including sea turtle conservation, monitoring of coral reefs, controlling research activities by researchers from various countries in the conservation area, empowering the community, conducting patrols, and performing law enforcement against violators in conservation areas. Violations of regulations in the area include practices such as employing potassium cyanide for fishing, utilizing mini trawls and purse seines, trading

protected species, salvaging artifacts from sunken historical ships, engaging in illegal logging, and causing damage to coral reefs through ship groundings (BTNKJ 2019).

The destruction of coral reefs is predominantly perpetrated by fishermen from outside Karimunjawa. In contrast, fishermen within Karimunjawa have developed an awareness and are actively involved in the preservation of the coral reef ecosystem. The local people of Karimunjawa realize that their livelihoods are very dependent on the nature, both as fishermen and tourism entrepreneurs. They are concerned that if coastal ecosystems are damaged, fish catches will decrease, and if the coral reef ecosystem suffers, the tourist attraction in Karimunjawa will decline. Local people protested against the existence of shrimp ponds without Wastewater Treatment Plant (WWTP) which potentially affect the coral reefs. Local fishermen take part in patrols and report to BTNKJ when they find external fishing boats that use mini trawls and purse seines. They also report to BTNKJ when they spot ships sinking on a coral reef. Such awareness and participation of the local community is a strong social capital that supports the success of conservation programs (Wijayanto et al 2020b; Purnomo et al 2021; Wijayanto et al 2021; Setiyanto et al 2023).

Strengthening fisheries institutions and tourism service providers in Karimunjawa is one of the keys to successful mobilization of business actors to support conservation. Conservation and the welfare of local people need to be properly accommodated since these two aspects are intercorrelated to the success of the conservation program (Yuliana et al 2016; Fafurida et al 2020; Kennedy et al 2020; Prihantono et al 2021; Zharif et al 2022; Wibowo et al 2022). According to Rakotonarivo et al (2017), local communities should be outreached regarding the benefits and consequences. According to Bennett et al (2020), conservation policy makers need to determine the target community groups that will be involved in managing conservation areas, and take the right approach according to the characteristics of the community groups involved in conservation programs. If the management of conservation areas proves effective in achieving social justice, local communities will lend their support. The research results of Campbell et al (2013) showed that policy and management of the Karimunjawa Protected Area can improve the welfare of fishermen if economic and legal incentives are provided. Therefore, it is important encourage empowerment programs, training, and involvement of local communities to support conservation programs in the Karimunjawa Islands. The welfare of fishermen is one of parameters of the success of conservation programs. Inadequate development of fishermen's welfare might trigger them to behave in destructive manner towards marine resources. Meanwhile, without strong compliance and support from local fishermen, the conservation program might fail due to social issues and conflicts (Yuliana et al 2016; Kennedy et al 2020; Wibowo et al 2022; Wijayanto et al 2023b).

Conclusions. The results of this research show that fishermen from the Karimunjawa Islands tend to avoid fishing in the core zone of the marine protected area. Likewise, marine tourism service providers also conduct business practices that support the preservation of coastal ecosystems, including coral reef, mangrove, and seagrass ecosystems. The local community understands the significance of the nature conservation since their livelihoods depend heavily on coastal resources. However, violations of conservation regulations still occur, especially by fishermen from outside the Karimunjawa Islands. Therefore, it is important to maintain and increase the empowerment programs, training, and engagement of local communities into the conservation programs in the Karimunjawa Islands.

Acknowledgements. Gratitude is expressed to the Faculty of Fisheries and Marine Sciences (Universitas Diponegoro) for the research grant provided to the author team (Number of Contract: 71/UN7.F10/HK/III/2023).

Conflict of interest. The authors declare that there is no conflict of interest.

References

Agimass F., Mekonnen A., 2011 Low-income fishermen's willingness-to-pay for fisheries and watershed management: an application of choice experiment to Lake Tana, Ethiopia. Ecological Economics 71:162-170.

Astuti T. M. P., Kurniawan E., Prasetyo K. B., Wijaya A., Syifauddin M., 2023 How does social capital work in developing Karimunjawa maritime tourism? Komunitas: International Journal of Indonesian Society and Culture 15(1):1-13.

Bennett N. J., Calò A., Di Franco A., Niccolini F., Marzo D., Domina I., Dimitriadis C., Sobrado F., Santoni M. C., Charbonnel E., Trujillo M., Garcia-Charton J., Seddiki L., Cappanera V., Grbin J., Kastelic L., Milazzo M., Guidetti P., 2020 Social equity and marine protected areas: perceptions of small-scale fishermen in the Mediterranean Sea. Biological Conservation 244:108531.

BPS-Statistics of Jepara Regency, 2023 [Jepara Regency in figures 2023]. BPS-Statistics of Jepara Regency, 407 pp. [in Indonesian and English]

BTNKJ, 2019 [Statistics of Karimunjawa National Park Office 2019]. Balai Taman Nasional Karimun Jawa (BTNKJ), 154 pp. [in Indonesian]

Campbell S. J., Kartawijaya T., Yulianto I., Prasetia R., Clifton J., 2013 Co-management approaches and incentives improve management effectiveness in the Karimunjawa National Park, Indonesia. Marine Policy 41:72-79.

Fafurida, Oktavilia S., Prajanti S. D. W., Maretta Y. A., 2020 Sustainable strategy: Karimunjawa National Park marine ecotourism, Jepara, Indonesia. International Journal of Scientific and Technology Research 9(3):3234-3239.

Kennedy E. V., Vercelloni J., Neal B. P., Ambariyanto, Bryant D. E. P., Ganase A., Gartrell P., Brown K., Kim C. J. S., Hudatwi M., Hadi A., Prabowo A., Prihatinningsih P., Haryanta S., Markey K., Green S., Dalton P., Lopez-Marcano S., Rodriguez-Ramirez A., Gonzalez-Rivero M., Hoegh-Guldberg O., 2020 Coral reef community changes in Karimunjawa National Park, Indonesia: assessing the efficacy of management in the face of local and global stressors. Journal of Marine Science and Engineering 8(10): 760.

Prihantono J., Yulius, Husrin S., Ramdhan M., Gemilang W. A., 2021 Assessment of underground water quality in Karimunjawa Island, Central Java – Indonesia. Jurnal Segara 17(1):23-32.

Purnomo A. R., Patria M. P., Takarina N. D., Karuniasa M., 2022 Environmental impact of the intensive system of vannamei shrimp (*Litopenaeus vannamei*) farming on the Karimunjawa-Jepara-Muria Biosphere Reserve, Indonesia. International Journal on Advanced Science, Engineering and Information Technology 12(3):873-880.

Puspitawati D., Fadli M., Lutfi M., Anggoro S., Rusli M. H. M., 2023 Conceptualizing policy on underwater cultural heritage: towards legal protection and ecotourism promotion in Karimun Jawa, Indonesia. Journal of Indonesian Legal Studies 8(2):633-662.

Rakotonarivo O. S., Jacobsen J. B., Larsen H. O., Jones J. P. G., Nielsen M. R., Ramamonjisoa B. S., Mandimbiniaina R. H., Hockley N., 2017 Qualitative and quantitative evidence on the true local welfare costs of forest conservation in Madagascar: are discrete choice experiments a valid *ex ante* tool? World Development 94:478-491.

Setiyanto I., Wijayanto D., Wibowo B. A., Dewi D. A. N. N., 2023 Important-performance analysis of marine tourism development in Karimunjawa Island. AACL Bioflux 16(6): 2912-2922.

Sulardiono B., A'in C., Muskananfola M. R., 2018 Profiles of water quality at Menjangan Besar Island, Karimunjawa, Central Java Province, Indonesia. Biodiversitas 19(6): 2308-2315.

Suliyati T., Rochwulaningsih Y., Utama M. P., 2017 Interethnic interaction pattern in Karimunjawa Island. Komunitas: International Journal of Indonesian Society and Culture 9(2):302-309.

Wibowo B. A., Wijayanto D., Setiyanto I., Dewi D. A. N. N., 2022 Important-performance analysis of capture fisheries development in Karimunjawa Islands. AACL Bioflux 15(5):2396-2404.

Wibowo B. A., Wijayanto D., Setiyanto I., Dewi D. A. N. N., 2023 Factors affecting fishermen's income on Karimunjawa Island. AACL Bioflux 16(1):457-464.
Wijayanto D., Bambang A. N., Nugroho R. A., Kurohman F., 2020a Financial analysis of seaweed cultivation in Karimunjawa Islands, Indonesia. AES Bioflux 12(1):1-10.
Wijayanto D., Bambang A. N., Nugroho R. A., Kurohman F., 2020b The impact of planting distance on productivity and profit of *Eucheuma cottonii* seaweed cultivation in Karimunjawa Islands, Indonesia. AACL Bioflux 13(4):2170-2179.
Wijayanto D., Bambang A. N., Nugroho R. A., Kurohman F., Riyadi P. H., 2021 The optimization of production and profit of *Eucheuma cottonii* cultivation in Kemojan Island, Indonesia. AACL Bioflux 14(4):1955-1964.
Wijayanto D., Kurohman F., Nugroho R. A., 2022 A study on the socio-economic characteristics of seaweed farmers on Kemojan Island to support the conservation in Karimunjawa Marine Protected Area. AACL Bioflux 15(5):2638-2650.
Wijayanto D., Kurohman F., Nugroho R. A., 2023a Characteristics of fishermen and tourist boat rental service providers in the Karimunjawa Marine Protected Area. AACL Bioflux 16(6):3357-3364.
Wijayanto D., Kurohman F., Nugroho R. A., 2023b The fishermen's socio-economic characteristics that support conservation among the community in Karimunjawa Marine Protected Area. AACL Bioflux 16(5):2517-2527.
Wu Z., Tian G., Li Y., Xia Q., 2023 Compensation mechanisms for fishermen quit fishing: a case of Jiangsu province, China. Heliyon 9(7):e17648.
Yuliana E., Fahrudin A., Boer M., Kamal M. M., Pardede S. T., 2016 The effectiveness of the zoning system in the management of reef fisheries in the marine protected area of Karimunjawa National Park, Indonesia. AACL Bioflux 9(3):483-497.
Zharif N., Rizal A., Maulina I., Mulyani Y., Suryana A. A. H., 2022 Term trade analysis of fisher in Karimunjawa Village, Jepara. Asian Journal of Fisheries and Aquatic Research 18(3):40-50.

Received: 03 April 2024. Accepted: 28 April 2024. Published online: 13 June 2024.
Authors:
Indradi Setiyanto, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Tembalang, Prof. Jacub Rais street, Semarang, Central Java, Indonesia, e-mail: indradisetiyanto@lecturer.undip.ac.id; indradifpik@gmail.com
Dian Wijayanto, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Tembalang, Prof. Jacub Rais street, Semarang, Central Java, Indonesia, e-mail: dianwijayanto@gmail.com; dianwijayanto@lecturer.undip.ac.id
Bambang Argo Wibowo, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Tembalang, Prof. Jacub Rais street, Semarang, Central Java, Indonesia, e-mail: argobambang@gmail.com; argowibowo@lecturer.undip.ac.id
Dian Ayunita Nurmala Nugraheni Dewi, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Tembalang, Prof. Jacub Rais street, Semarang, Central Java, Indonesia, e-mail: dianayunitanugraheni@lecturer.undip.ac.id
This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
How to cite this article:
Setiyanto I., Wijayanto D., Wibowo B. A., Dewi D. A. N. N., 2024 Compliance of fishermen and tour guides with zoning in the Karimunjawa Marine Protected Area. AACL Bioflux 17(3):1019-1025.