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PENERAPAN ALAT PENCARI IKAN DAN PENGUMPUL IKAN UNTUK MENINGKATKAN EFISIENSI OPERASIONAL BAGI NELAYAN TRADISIONAL DI DESA PONDOK NONGKO

IMPLEMENTING FISH FINDER AND FISH AGGREGATOR DEVICES TO ENHANCE OPERATIONAL EFFICIENCY FOR TRADITIONAL FISHERMEN IN PONDOK NONGKO VILLAGE

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Abstrak: Kegiatan pengabdian masyarakat ini dilaksanakan di Desa Pondok Nongko, Kecamatan Kabat, Kabupaten Banyuwangi, dengan tujuan meningkatkan efisiensi operasi penangkapan ikan nelayan tradisional melalui penerapan teknologi fish finder dan pemanggil ikan. Permasalahan utama nelayan di wilayah ini adalah keterbatasan dalam menemukan lokasi ikan secara cepat dan tepat, yang mengakibatkan tingginya konsumsi bahan bakar serta rendahnya produktivitas tangkapan. Metode pelaksanaan meliputi sosialisasi, pelatihan penggunaan perangkat, pendampingan operasional di lapangan, serta evaluasi kinerja teknologi. Hasil kegiatan menunjukkan bahwa penggunaan fish finder mampu mempercepat identifikasi titik kumpul ikan, sedangkan teknologi pemanggil ikan meningkatkan peluang berkumpulnya ikan di area jaring tangkap. Berdasarkan uji coba, terjadi efisiensi penggunaan bahan bakar hingga 30% dan peningkatan hasil tangkapan rata-rata 25% dibandingkan dengan metode tradisional. Selain itu, tingkat penerimaan nelayan terhadap teknologi cukup tinggi karena dinilai praktis, ekonomis, dan relevan dengan kebutuhan operasional mereka. Dengan demikian, penerapan teknologi ini berpotensi menjadi solusi berkelanjutan dalam mendukung peningkatan kesejahteraan nelayan tradisional di Desa Pondok Nongko.

Kata Kunci: Nelayan tradisional; fish finder; pemanggil ikan; efisiensi operasi; Desa Pondok Nongko

Abstract: This community service project was conducted in Pondok Nongko Village, Kabat District, Banyuwangi Regency, aimed to enhance the efficiency of traditional fishermen's fishing operations through the application of fish finder and fish-calling technology. The main challenge faced by local fishermen is the difficulty in quickly and accurately locating fish, which leads to high fuel consumption and low catch productivity. The implementation methods included socialization, training on device usage, field operational assistance, and performance evaluation of the technology. The results show that the application of

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a fish finder significantly accelerates the identification of fish aggregation points, while the fish-calling device increases the likelihood of attracting fish to the netting area. Field trials demonstrated fuel efficiency improvements of up to 30% and an average catch increase of 25% compared to traditional methods. Furthermore, fishermen's acceptance level of the technology was relatively high, as it was considered practical, economical, and relevant to their operational needs. Therefore, the implementation of these technologies has strong potential as a sustainable solution to support the welfare improvement of traditional fishermen in Pondok Nongko Village.

Keywords: Traditional fishermen; fish finder; fish-calling device; operational efficiency; Pondok Nongko Village

INTRODUCTION

Pondok Nongko Village, located in Kabat District, Banyuwangi Regency, is one of the coastal villages where most residents work as traditional fishermen. Similar conditions are commonly found among small-scale fishing communities in Indonesia, where limited capital, restricted access to technology, and a strong reliance on experience and intuition often affect fishing productivity and income levels (Kementerian Kelautan dan Perikanan Republik Indonesia [KKP], 2022; Iskandar & Lestari, 2020). In this context, appropriate technological solutions are needed to help fishermen increase productivity and reduce operational costs without disregarding the local wisdom that has long been part of their livelihood (Utami et al., 2022; Badan Riset dan Inovasi Nasional [BRIN], 2023).

Fish finder and fish caller technologies have emerged as promising solutions for improving the efficiency of small-scale fisheries operations. Fish finder systems utilize acoustic and sonar waves to detect fish schools beneath the water surface, enabling fishermen to identify potential fishing grounds more accurately and efficiently (Fernandes et al., 2002; Foote, 1987; Suryanto et al., 2021). Previous studies have shown that acoustic technologies can significantly improve fishing productivity and optimize fishing operations by reducing uncertainty in fish location detection (Susanto & Putra, 2019; Bertrand et al., 2008). Meanwhile, fish caller devices generate specific sound frequencies that attract fish and encourage aggregation around fishing areas, thereby increasing the probability of successful catches (Nugraha & Arief, 2021). The combination of

fish finder and fish caller technologies is expected to improve operational efficiency in terms of search time, energy expenditure, and fuel consumption while simultaneously increasing catch yields (Wicaksono & Setiawan, 2020; Fauzi & Primyastanto, 2019).

As a vocational higher education institution, Banyuwangi State Polytechnic (POLIWANGI) plays an important role in developing and disseminating appropriate technologies that support community empowerment and sustainable fisheries development (BRIN, 2023). Through this community service program, a team of lecturers and students implemented fish finder and fish caller technologies for traditional fishermen in Pondok Nongko Village. The program emphasizes not only technology transfer but also capacity building through training, mentoring, and continuous evaluation to ensure that the technologies are accepted and effectively utilized by the target community (Rahmawati et al., 2022; Iskandar & Lestari, 2020). Such participatory approaches have been shown to enhance technology adoption and improve long-term sustainability among fishing communities (Utami et al., 2022). Based on this background, this community service project aims to: (1) implement fish finder and fish caller technologies in traditional fishing operations, (2) analyze the efficiency of technology-assisted fishing compared with conventional methods, and (3) evaluate fishermen's acceptance of these technologies. The implementation of appropriate fishing technologies is expected to contribute to increased productivity, reduced operational costs, and improved welfare among traditional fishermen while providing a replicable model for technology-based empowerment in coastal fisheries sectors (Hilborn & Branch, 2013; KKP, 2022; BRIN, 2023).

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Figure 1. Geographical Map of Pondok Nongko Village

The left image shows the administrative boundary and geographical location of Pondok Nongko Village, Banyuwangi Regency, East Java, Indonesia. The village is located in a coastal area adjacent to the Bali Strait and is characterized by extensive fisheries and aquaculture activities, which contribute significantly to the local economy and livelihoods of coastal communities (Kementerian Kelautan dan Perikanan Republik Indonesia [KKP], 2022). The right image presents a three-dimensional satellite view of the study area, illustrating the coastal morphology, fishpond complexes, mangrove areas, river estuary, and fishing settlements surrounding Pondok Nongko Village. These geographical characteristics provide favorable conditions for fisheries-based community development and support the implementation of appropriate marine technologies to enhance fishing productivity and sustainability (Badan Riset dan Inovasi Nasional [BRIN], 2023; Utami et al., 2022). Furthermore, the availability of coastal and fisheries resources makes the area suitable for the adoption of fish detection and acoustic-based fishing technologies aimed at improving the operational efficiency and welfare of traditional fishermen (Suryanto et al., 2021; Wicaksono & Setiawan, 2020; Fauzi & Primyastanto, 2019).

METODOLOGY

The community service activity on the application of fish finder and fish attractor technology to improve the operational efficiency of traditional fishermen in Pondok Nongko Village was conducted using a participatory approach. This approach was chosen because the success of an appropriate technology program depends greatly on the involvement, acceptance, and active participation of the target community (Iskandar & Lestari, 2020; Utami et al., 2022). Fishermen were

not positioned merely as recipients of aid but as active participants involved in every stage, from planning and socialization to field implementation. This participatory model ensures that knowledge transfer occurs bidirectionally, taking into account fishermen's experiences, needs, and local conditions (Rahmawati et al., 2022).

The program was conducted in Pondok Nongko Village, Kabat District, Banyuwangi Regency—a coastal area where most residents work as traditional fishermen. The village was selected because it faces several challenges in fishing activities. Most fishermen still rely on intuition and experience to determine fishing locations, resulting in long search times, high fuel consumption, and inconsistent catch volumes (KKP, 2022; Wicaksono & Setiawan, 2020). Therefore, this village was considered suitable to test the effectiveness of fish finder and fish attractor technologies as practical solutions to these challenges (Fauzi & Primyastanto, 2019; Suryanto et al., 2021). The program lasted for three months, consisting of preparation, socialization, training, field implementation, and evaluation.

The activity design consisted of four integrated stages. The first stage, socialization, involved group meetings with fishermen at the village hall. The team from Banyuwangi State Polytechnic explained the principles and benefits of fish finder and fish attractor devices through interactive discussions, allowing fishermen to express their opinions and potential constraints. Similar approaches have been shown to improve technology adoption among traditional fishermen (Rahmawati et al., 2022; Iskandar & Lestari, 2020). The second stage, technical training, focused on hands-on practice. Fishermen were trained to operate fish finders to read sea depth, water temperature, and detect fish presence using sonar technology (Fernandes et al., 2002; Foote, 1987). They were also introduced to fish attractors that emit specific sound frequencies to gather fish in a targeted area (Nugraha & Arief, 2021). The training was conducted both indoors and at sea to ensure practical understanding.

The third stage, field implementation, involved direct trials at sea. The team and fishermen worked together using traditional boats to test the

effectiveness of the devices. Fishermen acted as the main operators, while the community service team provided guidance and technical assistance. During this phase, fishermen applied their training to locate fishing grounds with the fish finder and used the fish attractor to draw fish closer to the net area. The application of acoustic technology in fisheries has been widely recognized as an effective method for detecting fish schools and improving fishing efficiency (Fernandes et al., 2002; Bertrand et al., 2008; Susanto & Putra, 2019). All activities were documented for evaluation purposes. The fourth stage, evaluation and monitoring, compared operational data before and after the technology was introduced. Key indicators included fishing time, fuel consumption, and catch volume. Additionally, focus group discussions (FGDs) and interviews were conducted to assess fishermen's acceptance and satisfaction levels (Utami et al., 2022).

The main tools used were portable sonar-based fish finders with simple digital displays, suitable for installation on traditional boats, and acoustic fish attractors designed to emit specific sound waves (Foote, 1987; Fernandes et al., 2002). These devices were integrated with fishermen's existing tools such as wooden boats, fishing nets, and GPS for location tracking. Supporting equipment included logbooks, fuel supplies, and documentation tools. The program involved 20 fishermen from the village's Joint Business Group (KUB), selected in coordination with the village government and fishing group leaders. These participants were expected to become local change agents who would share knowledge and experiences with other fishermen, ensuring broader program impact and sustainability (Utami et al., 2022). Data collection methods included direct observation at sea to record fishing time and patterns, interviews to capture perceptions and feedback, FGDs for data validation, and quantitative data logging for fuel usage and catch volume comparison. This mixed-method approach ensured comprehensive and reliable data collection and has been widely applied in community-based fisheries development programs (Rahmawati et al., 2022; Utami et al., 2022).

Data analysis combined quantitative and qualitative approaches. Quantitative analysis measured operational efficiency, such as fuel savings and catch increases, by comparing pre- and post-intervention data. Similar indicators have been used in studies evaluating fish finder performance and acoustic-based fisheries technologies (Fauzi & Primyastanto, 2019; Wicaksono & Setiawan, 2020; Susanto & Putra, 2019). Qualitative analysis explored fishermen's perceptions regarding ease of use, relevance, and economic benefits of the technology (Iskandar & Lestari, 2020). These findings were presented descriptively to illustrate fishermen's experiences.

The program's success indicators were defined early: (1) reduced fishing time and fuel consumption, (2) increased catch volume per trip, and (3) at least 70% of participants expressing satisfaction and willingness to continue using the technology. Additional indicators included demonstrated technical skills in operating and maintaining the devices and the emergence of sustainable technology use within fishing groups (Utami et al., 2022; BRIN, 2023).

Overall, the method applied in this program was not only focused on technology transfer but also on empowering fishermen. By engaging them from the beginning, the program fostered ownership and sustainability (Iskandar & Lestari, 2020). The combination of fish finder and fish attractor technologies has been reported to improve fishing efficiency, reduce operational costs, and increase catch productivity (Fauzi & Primyastanto, 2019; Wicaksono & Setiawan, 2020; Suryanto et al., 2021). More importantly, this participatory model strengthened fishermen's capacity and confidence in adopting modern yet accessible technology (Utami et al., 2022). Therefore, this community service activity serves as a replicable model of appropriate technology implementation that is practical, inclusive, and oriented toward improving the welfare of coastal communities (BRIN, 2023; Hilborn & Branch, 2013).

Figure 2. S Introduction of the Community Service Program

RESULTS AND DISCUSSION

1. Results of Socialization and Training

The socialization activity held at the village hall received a positive response from fishermen. Most of them admitted that it was their first time learning about the working principles of the *fish finder* and *fish attractor*. Out of the 20 main participant fishermen, 85% expressed interest in trying the technology, as they considered it relevant to their needs. A simple pre-test and post-test conducted during the training demonstrated a 60% increase in fishermen's understanding of the tools' functions and operation methods.

During the technical training stage, all participants were able to operate the *fish finder* independently after three simulation sessions. The fishermen successfully interpreted the display showing sea depth, seabed contour, and the presence of fish. Meanwhile, the *fish attractor* device was considered easier to use because it only required simple settings before operation.

Figure 3. Socialization on the Use of Fish Finders and Handover Ceremony

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2. Field Implementation Results

Field implementation was conducted through four trial runs using traditional fishing boats. The data obtained demonstrated a significant difference between the conventional method and the method assisted by technology. Before implementation, the average time fishermen needed to locate fish was 2-3 hours, whereas after using the *fish finder*, the search time was reduced to 1-1.5 hours. This means there was a time efficiency of approximately 40%.

In terms of fuel consumption, the application of the *fish finder* and *fish aggregating* device managed to reduce costs by up to 30%. If previously fishermen spent an average of 15 liters of diesel for one trip, after using the technology, fuel needs dropped to around 10-11 liters. This efficiency was greatly appreciated by fishermen, given that fuel prices are one of their largest operational costs.

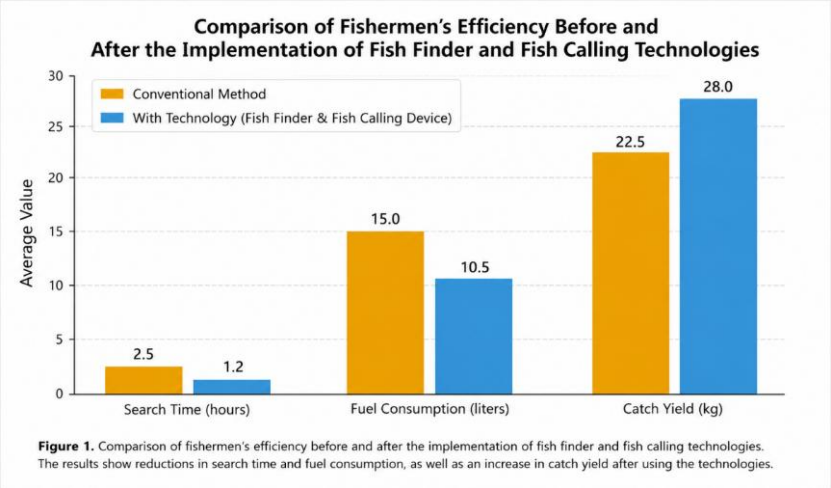

Figure 4. Comparison of Fishermen's Effeciency Before and After

Furthermore, the catch data also demonstrated an improvement. With the conventional method, fishermen's average catch was around 20-25 kg per trip. After using the *fish finder* and *fish aggregator*, the catch increased to 25-32 kg per trip, or approximately 25% higher than before. Fishermen also reported that the caught fish were more diverse, as they could reach locations that were previously difficult to predict.

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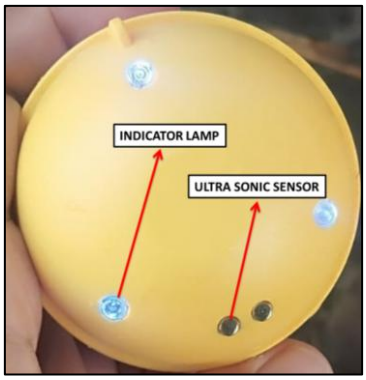

Figure 5. Ultrasonic Fishfinder

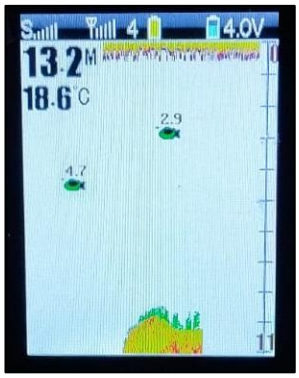

Figure 6. Monitoring Fish Finder

3. Fishermen's Acceptance

Fishermen's response to the application of this technology tends to be very positive. According to interviews, 70% of fishermen stated they were satisfied and found this technology practical and helpful for their work. A small number of fishermen (30%) still expressed hesitation due to concerns about maintenance costs or potential damage to the equipment. However, after being given an explanation about simple maintenance procedures and the relatively affordable cost estimates, these doubts were reduced.

Furthermore, fishermen assessed that the presence of the accompanying students and lecturers provided added value in the form of confidence to try new things. The presence of the academics was considered able to bridge fishermen's access to technology that they had never imagined could be used on their traditional boats before.

Figure 7. The Catch Yield of Fishermen After Using a Fish Finder

4. Discussion

The results of the activity demonstrate that the implementation of *fish finders* and *fish attractors* has had a significant impact on the operational efficiency of traditional fishermen. The reduction in fish-searching time and increased fuel efficiency are consistent with previous studies, which state that the application of acoustic technology can enhance the productivity of capture fisheries. This proves that, although fishermen's operations are still on a traditional scale, the integration of appropriate technology can be well adapted without requiring major changes to existing fishing equipment. The 25% increase in catch volume also demonstrates that this technology can provide direct economic benefits. With higher catch yields and lower operational costs, fishermen's net income has the potential to increase. Additionally, fishermen can manage their fishing time more efficiently, allowing them more time for other activities, both for family and social engagement within the village.

From a social perspective, fishermen's acceptance of the technology is an important indicator of the program's success. The key factors supporting this acceptance include ease of use, directly perceived economic benefits, and the intensive assistance provided by the community service team. This aligns with the theory of innovation diffusion, which states that technology adoption occurs more rapidly when innovations are perceived as easy to use, offer relative advantages, and fit within the users' social context. However, several important notes must be considered. First, the sustainability of technology utilization must be maintained by ensuring the availability of spare equipment and enhancing fishermen's capability to perform maintenance. Second, collaborative strategies with the village government or fishermen cooperatives are necessary to support long-term use, such as through shared ownership schemes or more affordable rental systems. Third, environmental aspects should also be taken into account to ensure that the application of *fish attractors* does not disrupt marine ecosystems if used excessively. This community service activity demonstrates that the application of *fish finders* and *fish attractors* is a strategic step toward improving operational efficiency and the welfare of traditional fishermen in Pondok Nongko Village.

The results of this activity can serve as a model for implementing appropriate technology that can be replicated in other coastal villages with similar characteristics.

CONCLUSION

The community service program conducted by Politeknik Negeri Banyuwangi through the implementation of *fish finder* and *fish attractor* technologies in Pondok Nongko Village has had a positive impact on the operational efficiency of traditional fishermen. The results show that the application of *fish finders* significantly accelerated the process of identifying fish locations, reducing search time by up to 40%. This technology also reduced average fuel consumption by 30% and increased fishermen's catch yields by approximately 25% compared to conventional methods. Additionally to providing economic benefits, this activity also improves fishermen's knowledge and skills in utilizing simple modern technology that is suitable for traditional fishing vessels. Fishermen's acceptance of the technology is relatively high, with over 70% of participants expressing satisfaction and willingness to use it sustainably. This indicates that the integration of appropriate technology with traditional methods can be effective when accompanied by intensive socialization, training, and mentoring. Thus, the implementation of *fish finder* and *fish aggregator* devices can be used as a sustainable solution model to improve the welfare of traditional fishermen in Pondok Nongko Village and has the potential to be replicated in other coastal areas facing similar problems.

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Nongko Village for their active participation in every stage of the activity — from socialization and training to field implementation. Without the involvement and cooperation of fishermen, this program would not have been successfully executed. Lastly, we would like to acknowledge the contribution of all students of Politeknik Negeri Banyuwangi who assisted in technical support, documentation, and field data collection. The support and participation of all parties have been the key factors in the successful implementation of *fish finder* and *fish attractor* technologies to enhance the operational efficiency of traditional fishermen.

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