Darwin Initiative Main & Extra: Final Report

To be completed with reference to the "Project Reporting Information Note": (https://www.darwininitiative.org.uk/resources/information-notes/).

It is expected that this report will be a **maximum of 20 pages** in length, excluding annexes.

Submission Deadline: no later than 3 months after agreed end date.

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Darwin Initiative Project Information

Scheme (Main or Extra)	Main
Project reference	29-029
Project title	Nature Climate Solution to Protect Mangrove Biodiversity and Improve Livelihood
Country(ies)	Indonesia
Lead Organisation	Yayasan Konservasi Alam Nusantara (YKAN)
Project partner(s)	• Faculty of Biological Sciences, University of Leeds • Faculty of Fisheries and Marine Science, Mulawarman University
Darwin Initiative grant value	GBP 599,365
Start/end dates of project	1 July 2022 – 31 March 2025
Project Leader name	Mariski Nirwan
Project website/blog/social media	https://www.ykan.or.id/en/program/oceans-program/blue-economy/secure/
Report author(s) and date	Mariski Nirwan, Basir, Aji Anggoro, Andi Trisnawati, Topik Hidayat

1 Project Summary

Indonesia has the largest mangrove ecosystem in the world with an area of 3.9 million hectares (23% of the world's mangroves), which can store up to 1/3 of all carbon stored in the world's coastal ecosystems. Unfortunately, Indonesia's mangrove forests are disappearing faster than tropical rainforests and coral reefs with rates of approximately 5,000-10,000 ha per year. The major cause of mangrove loss in Indonesia is conversion for shrimp ponds. Berau Regency in East Kalimantan has 86,043 ha of mangrove ecosystem, the biggest in East Kalimantan Province. However, in 2019 alone 13% or 11,237 ha mangroves were converted to shrimp ponds which can lead to adverse impact not only to the ecosystem but also for the coastal communities.

Unsustainable aquaculture practices (converting mangroves into shrimp ponds to increase productivity) support 30% of the population but threaten 54,000 ha of mangrove ecosystems in Berau Regency. Through community engagement, capacity building and establishment of land-use plans, the project aims to protect 15,000 ha of mangroves and provide a novel community-based model to increase shrimp productivity while restoring up to 80% of shrimp ponds back to mangroves. Healthier mangrove ecosystems and comparable, and preferably higher, harvest of

shrimps, and biodiversity in the coasts of Berau Regency can enjoy increased resilience, higher income, and better living conditions.

The expected outcomes are increased biodiversity and governance of vulnerable mangroves, and improved livelihoods in 3 villages namely Pegat Batumbuk, Suaran, and Tabalar Muara.

2 Project Partnerships

YKAN's longstanding collaboration with the Government of East Kalimantan Province and Berau District enabled not only strategic oversight but also technical contributions. Government agencies actively supported data collection, policy development, and field activities, appointing focal points for continuous coordination. Their engagement resulted in the issuance of key policies, including village regulations and a district decree on the EAA (Ecological Approach to Aquaculture) working group.

Academic partners—University of Mulawarman and University of Leeds—played a central role in biodiversity monitoring and spatial planning. Their research helped shape pond restoration design and validate ecological impacts, with regular coordination alongside YKAN's teams. Jointly, a manuscript has been submitted to Aquaculture Journal for wider knowledge generation.

At the community level, participatory planning, field schools, and local facilitator's support ensured active involvement of pond owners, village institutions, and women's groups in conservation-linked livelihoods. Partnerships were further enriched through internship, product certification support, and market access facilitation.

While the final report was authored by YKAN, key partners contributed inputs and validations, particularly on data, technical achievements, and lessons learned. Many of these relationships will continue post-project through local mandates, village regulations, and institutional uptake such as the EAA working group. These embedded networks ensure continuity, foster ownership, and enhance the durability of project outcomes.

Table 1. Government Stakeholders and Their Roles

Government Partner	Role in Project
Ministry of Marine Affairs and Fisheries	Mentor and resource person of Secure and Ecosystem Approach of Aquaculture (EAA) development
National Research and Innovation Agency	Research, collecting data, resource person for SECURE and EAA development
Marine and Fisheries Agency of East Kalimantan	Mentor and resource person of SECURE and EAA
Research, planning and development Agency of East Kalimantan	Update database from SDG's activities in SECURE project
Environmental Agency of East Kalimantan	Resource person of SECURE and part of EAA working group
Fisheries Agency of Berau District	Mentor and SECURE field supervisor, and EAA working group
Community and Village Empowerment Agency of Berau District	Mentor and resource person of Village Government capacity building, BUMKamp (village-owned enterprises) improvement, and EAA working group
Environment and sanitary agency of Berau District	Mentor and resource person of SECURE, and EAA working group

3 Project Achievements

The report is written in narrative to describe the project context, achievements, and the dynamics occurred. Summarized report against indicators is presented in Annex 1.

3.1 Outputs

Output 1: Management plans for the protection of 15,000ha of mangrove ecosystems and their biodiversity are developed, approved, and implemented through strengthened village governance capacity

Management authority in the program expanded to five villages: Pegat Batumbuk, Teluk Semanting, Suaran, Tabalar Muara, and Karangan. The project made significant achievement in strengthening village-based governance through regulations, and community-based mangrove management through participatory and collaboration processes with village stakeholders. A total of 30,660 ha mangrove covered under village regulations in three villages while 748.89 ha strengthened through community-based mangrove management Governor Decree No. 483/2022 designated for sustainable use through ecotourism (MOV1).

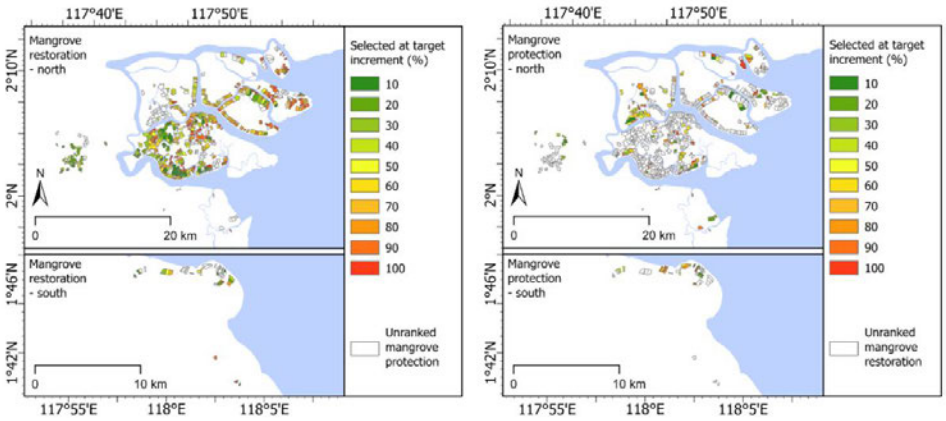
Prior to the project, Pegat Batumbuk had an 11,000 ha Village Forest designated by the Ministry of Environment and Forestry (MoEF) out of the 22,153.82 ha proposed. However, management had been ineffective. To enhance the governance of both approved and unapproved forest areas, a Village Regulation No. 5/2023 was enacted covering 25,000 ha, establishing legal frameworks for mangrove protection, restoration, and sustainable use (MOV2).

The project also partnered with local institutions—LPHD Samaturu in Pegat Batumbuk and TPM Semanting in Teluk Semanting—to strengthen governance. This included integrating mangrove management plans into the villages' Mid-Term Development Plans (RPJMK), forming inter-institutional networks, and building multi-stakeholder support. In Suaran, Tabalar Muara, and Karangan, community mangrove management plans were developed. Tabalar Muara formalized its 2,760 ha mangrove area through village spatial plan (MOV3), while Karangan secured legal recognition of 2,900 ha under Village Regulation No. 3/2024 (MOV4). Suaran proposed 3,800 ha, including 250 ha for strict protection, pending final regulation (MOV5).

Challenges arose due to overlapping jurisdiction across forest (provincial forestry agency), coastal conservation (marine affairs agency), and Other Land Use zones (district government). The project addressed these through multi-level consultations to delineate non-overlapping areas Strategic plans for mangrove groups were developed in all target villages to guide long-term management, and village regulations were enacted to provide legal backing.

To inform spatial planning and restoration prioritization, University of Leeds produced a prioritization framework based on mangrove restoration/protection potential, shrimp productivity, and SECURE pond development cost. Of 718 ponds assessed, 551 were identified for restoration and 167 for protection based on mangrove cover and proximity to villages (MOV6). These insights were disseminated during village spatial planning workshops.

Picture 1. Spatial Prioritization for Mangrove Restoration (left) and Mangrove Protection (right)



University of Mulawarman supported monitoring using traditional and molecular tools (MOV7). Environmental monitoring using eDNA revealed marked biodiversity improvements in SECURE ponds. Year 1 data showed low biodiversity and dominance of decomposers; by Year 3, analysis showed a marked increase in species richness (over 12,000 OTUs), a significant rise in Shannon (>4.5) and Simpson (>0.90) indices, and a functional shift toward photosynthetic autotrophs (Picochlorum, Chaetoceros). These changes were supported by PCoA and PERMANOVA

results ($p < 0.001$) and a positive correlation between biodiversity and water quality indicators (temperature, pH, DO). Conventional plankton data reinforced these findings, confirming the SECURE system's positive impact on ecosystem structure and function.

Despite these successes, mangrove-based systems showed slower recovery due to complex ecological conditions, including unstable substrates and variable hydrology. While change was evident, biodiversity gains were more modest. Limitations in genetic libraries constrained taxonomic resolution, prompting the adoption of new bioinformatics tools to improve analysis. These challenges were addressed through adaptive recommendation, such as improving mangrove substrate management, and by reinforcing the need for long-term monitoring. Nonetheless, stable environmental parameters and increased Bacillariophyta presence indicated improved ecosystem health. Bacterial diversity, particularly in secondary mangroves, suggested enhanced nutrient cycling (MOV8).

To support long-term governance, a capacity needs assessment revealed strong local commitment to mangrove conservation, but gaps remained in legal frameworks, budgeting, coordination, and livelihood support. YKAN responded with on-the-job training to develop village regulations, involving diverse participants including women and youth. From Nov–Dec 2023, workshops in Pegat Batumbuk, Suaran, and Tabalar Muara helped village management to draft management plans covering 27,500 ha (MOV9-MOV12). However, sustainable financing and private sector engagement remain challenges. Recommendations included routine coordination with authorities, institutional strengthening, income diversification, and improved advocacy.

Mangrove surveillance capacity was improved for five village community mangrove groups, namely LPHD Samaturu, Tabalar Muara Lestari, TPM Semanting, and 2 newly formed community mangrove groups in Suaran and Karangan (MOV13). The groups received trainings that resulted in SOPs for patrol and ecosystem monitoring (MOV14-MOV15). The first year of training focused on field methods and SOP development; advanced training in Year 3 covered equipment handling, data processing, visualization, and evaluation (MOV16). Patrol scheduling had to be adapted to accommodate fisher group availability, and equipment grants were provided to sustain group motivation and support village budget advocacy for surveillance activities.

Output 2: 10-year mangrove restoration and biodiversity improvement plan developed and approved for 5,000 ha of shrimp ponds and, a 100 ha SECURE model demonstration site (within the 5,000ha area) is established by the end of the project

YKAN completed the Ecological Approach to Aquaculture (EAA) assessment and consulted findings with relevant agencies in Berau Regency in the first year of the project. The study identified Pegat Batumbuk and Suaran Villages—totaling 12,054.93 hectares—as the most suitable for EAA, while Tabalar Muara was deemed less viable due to its inclusion in a coastal conservation zone (MOV17).

While technocratic process took longer through series of consultations, workshops, and advocacy, by the end of the project, we successfully supported Pegat Batumbuk to formally designated 7,611 hectares that covers aquaculture area as EAA through Village Regulation No. 2/2025 (MOV18), and 600 hectares were included in Tabalar Muara's village spatial plan (MOV3). Suaran has earmarked 718 hectares for EAA management based on a carrying capacity study, pending formal regulation. In support of EAA planning, Berau Regent issued Decree No. 200/2025, establishing a multi-stakeholder EAA Working Group to sustain and operationalize EAA through government programs beyond the project (MOV19).

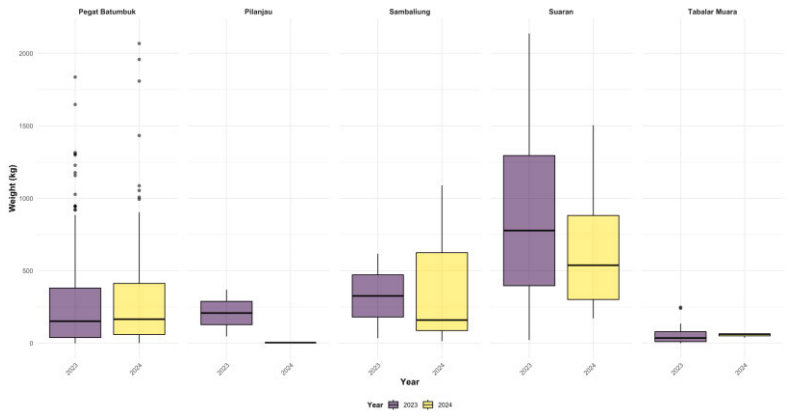
The SECURE pond initiative reached a total of 10 demonstration ponds across Pegat Batumbuk (6 ponds), Suaran (2 ponds), and Tabalar Muara (2 ponds), covering a combined area of 120 hectares. Pond zoning was allocated to 19.07 ha for cultivation, 52.76 ha for mangrove restoration, and 50.56 ha for protection. Nine ponds are operational, with the tenth currently undergoing embankment repair. YKAN provided seeds (shrimp, milkfish, mangrove crab), organic fertilizers, and cultivation equipment, with technical support from stationed facilitators

and aquaculture experts. Additionally, BBPAP Jepara partnered to co-develop a SECURE Pond Cultivation Guide based on field learning (MOV20).

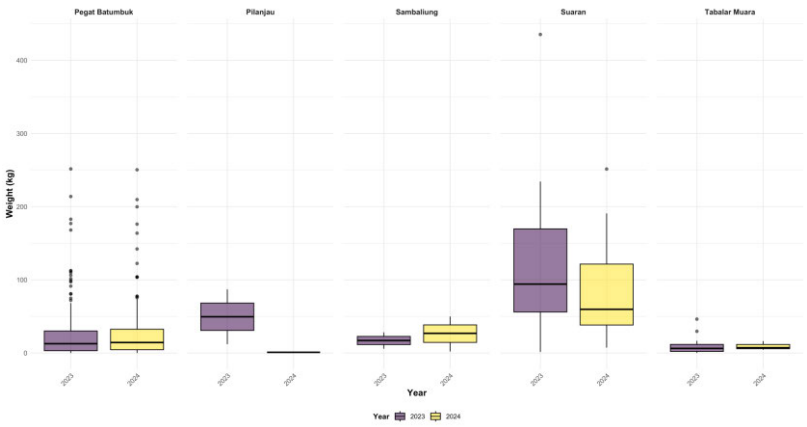
To build local capacity, in partnership with Blue Forest, YKAN launched a Field School in all three villages, enrolling 48 participants in Pegat Batumbuk, 55 in Tabalar Muara, and 69 in Suaran. The school's 15-module syllabus ranged from ecosystem mapping to aquaculture business planning. A Training-of-Trainers (TOT) course followed, with a recorded 18.7% increase in knowledge (MOV21).

The average annual harvest is comparable between conventional practices and the SECURE model. Although the conventional model achieves a larger average annual harvest (~296 kg), it operates over a larger area (~12 ha), often at the expense of mangrove forests converted into ponds. In contrast, the SECURE model yields about half the annual harvest (~142 kg) on average but uses significantly smaller pond areas (~2.3 ha), thereby allowing space for mangrove restoration. Interestingly, the per-hectare harvests are also comparable between the two models, suggesting that efforts to increase productivity per unit area under the SECURE model are on track. The conventional model yields an average of 29 kg/ha, while the SECURE model averages 28 kg/ha (Picture 2).

Picture 2. Productivity of SECURE Ponds



Box Plot of Harvest from around 700 pond owners using data 2024 and 2025. Average mean harvest for five villages in Berau is ~. 296 kg.



Box Plot of Harvest data from around 700 pond owners using 2024 and 2025 survey. Average mean harvest/hectare for five villages is ~29 kg.

Mangrove restoration in the SECURE demonstration site employed Community-Based Ecological Mangrove Restoration (CBEMR) and structural innovations, including double-fence bamboo barriers to address abrasion and hydrological paths. Vegetation analyses in 2023, 2024, and 2025 documented 20 mangrove species, with dominant species including Nypa fruticans. By February 2025, average stem diameter increased by 0.53 cm, biomass by 3.59 tons/ha, and

carbon stock by 1.69 tons/ha. Carbon storage across the site was estimated at 32.04 tons/ha (MOV22).

Picture 3. Designs of mangrove restoration to allow for natural mangrove regeneration

Satellite imagery and drone-based monitoring validated restoration gains by showing increased canopy cover and ecosystem structure. However, water flow between cultivation and restoration plots remains suboptimal. YKAN redesigned the plots and constructed dedicated water gates is recommended to improve hydrology (MOV23).

A pre-feasibility study estimated that 2,327 ha of restoration and 6,934 ha of protection could yield 13,000 tCO_2e/year (2,757 from restoration; 10,244 from protection). At 2022 prices—US\$11.79/tCO_2e (restoration) and US\$10.60/tCO_2e (protection)—annual revenue could reach US\$137,000 to US\$150,000, potentially rising to >US\$170,000 with future VCM projections. While initial capital costs are high, a blended model of aquaculture and carbon financing presents strong sustainability prospects (MOV24). A workshop with East Kalimantan stakeholders on sustainable financing was held in March 2024 to discuss potential application in the region (MOV25). However, implementation of carbon project is constrained by East Kalimantan's ongoing Result-Based Payment agreement with FCPF, which prohibits overlapping carbon projects until 2027. The study and feasibility analysis nonetheless serve as a key knowledge base for future carbon-finance initiatives.

A carbon finance training workshop was held in January 2025 with 23 participants from government agencies and five villages. Pre-tests revealed limited prior knowledge, but post-tests showed a 46% improvement (MOV26). A key challenge encountered was the very low starting point of technical knowledge, to which the facilitators adjusted by using a simplified delivery format, interactive sessions, and recommendations for a phased, multi-session training approach.

Output 3: At the completion of the project (2025) the income of people working in shrimp aquaculture, mangrove ecotourism, and mangrove-based household industries in the 3 target villages is increased by 15% (compared to baseline)

Recognizing that successful conservation is inseparable from community wellbeing, Output 3 of the SECURE project focused on improving the incomes of communities dependent on mangrove-based livelihoods in the three demonstration villages—Suaran, Pegat Batumbuk, and Tabalar Muara. Over the three-year project period, socio-economic surveys show average household income in these villages increased by 48.7%, rising from IDR 2,908,500/month in 2022 to IDR 4,325,000/month in 2025. This notable increase was partly attributed to previously inactive aquaculture farmers reactivating idle ponds due to the SECURE program's positive influence, diversified income (ecotourism and aquaculture-based products) as well as the entry of new members in women's groups who previously had no income stream. In parallel, the percentage

of poor households (as defined by Indonesia's national poverty line using BPS thresholds) decreased from 54.2% to 31.6%—a 41.7% reduction—based on official BPS Kabupaten Berau data and participatory household surveys (MOV26).

The project's training program reached 100 households (around 400 individuals) in environmentally friendly shrimp aquaculture, community-based mangrove ecotourism, and non-timber mangrove-based household industries. Training participants were gender-balanced, with 54% women, exceeding the project's target of 50% female participation (MOV27). Training modules were delivered through a blend of on-site workshops, live demonstration ponds, mentoring, and active participation of local facilitators and technical experts. Specific sessions for women's groups focused on food safety and innovation, branding and certification (Halal and Home Industry/GMP), and financial literacy. These targeted trainings contributed to the diversification and strengthening of women-led microenterprises.

YKAN supported women's groups in developing 13 mangrove-based products, of which twelve received Home Industry Food Production Permits (PIRT) and ten obtained Halal certification by the end of the project (MOV28). Flagship products such as amplang (traditional fish crackers) and spicy shrimp sambal have gained popularity due to their strong market appeal. The project started with 10 products and in the final year, 3 additional products—Spicy Shrimp Sambal (canned), Bandeng Mercon (canned spicy milkfish), and Crispy Shrimp Heads—were added, with two already certified with PIRT and the Halal certifications. These achievements reflect improved product quality and market readiness and align with the project's goal of promoting compliance with food safety and manufacturing standards.

Table 2. List of Micro Business Certifications

No	Product	Group Name	Home Industry License	HALAL
1	Cracker (brand: Ceria)	Ceria	V	V
2	*Amplang* (brand: Ceria)	Ceria	V	V
3	Crackers (brand: ASA)	Tenggiri 2	V	V
4	*Amplang* (brand: ASA)	Tenggiri 2	V	V
5	Cracker (brand: Heeem)	Tenggiri 1	V	V
6	Cracker (brand: Bandeng Laut 1)	Bandeng Laut 1	V	V
7	Cracker (brand: Puri)	Bandeng Laut 1	V	V
8	Fish floss	Kerjasama Jaya	V	V
9	Fish crackers	kerjasama Jaya	V	
10	Shrimp head broth	Kerjasama Jaya	V	
11	Spicy shrimp sambal	Kerjasama Jaya	V	V
12	Bandeng Mercon	Kerjasama Jaya	V	V
13	Crispy shrimp head	Kerjasama Jaya		

To expand market access, YKAN facilitated these groups in several events, including the launch of Teluk Semanting Eco Tourism on May 1, 2023, a Product Expo in Medan on May 16, 2023, the Berau Village-Owned Enterprise Expo on June 16, 2023, Expos in Jakarta and Surabaya on June 23 and September 1, 2023, respectively, a YKAN event on September 6, 2023, and the Sabah International Convention from September 22-24, 2023 (MOV30). Groups such as Kelompok Kerjasama Jaya, Kelompok Tenggiri, and Kelompok Ceria participated in these events. YKAN also supported groups in improving marketing and financial management, establishing digital transactions via bank accounts, and initiating a partnership with RUMAH BUMN Pertamina in Berau to integrate women's groups into the digital economy ecosystem.

To reinforce learning and innovation, the project facilitated a study visit to Clungup Mangrove Conservation in East Java, exposing Teluk Semanting's ecotourism team to good practices in tourism, conservation, and financial management. Additionally, an internship program was organized for members of women's groups to gain hands-on training in business management.

In addition, YKAN supported the Village-Owned Enterprises (BUMK) in Teluk Semanting and Tabalar Muara, which are key to sustaining women-led businesses. Following a gap analysis and

visioning workshops, support was provided to help BUMKs revise their statutes and governance frameworks, establish long-term business plans, and improve financial systems. Although progress is slow due to institutional issues, this support lays the groundwork for stronger local enterprise development.

Lastly, despite difficulties to obtain eco-certifications due to land tenure status and required improvement in the overall value chain (not only on the cultivation side), but the project has also made strong early progress toward eco-certification of SECURE aquaculture ponds, particularly aligning with the principles of the Aquaculture Stewardship Council (ASC). Key foundations have been laid through training on sustainable aquaculture practices, redesign of ponds to integrate mangrove restoration, and traceability improvements via certified value-added products. Collaborations with BBPAP Jepara and local authorities further support alignment with national standards. However, formal ASC compliance has not yet been audited; further steps such as establishing full documentation systems, environmental monitoring protocols, and third-party verification to transition from foundational readiness to full certification is planned to be continued under YKAN's new project funded by the GFCR.

3.2 Outcome

Outcome: Biodiversity threats prevented from protection of 15,000ha intact mangrove forests and improved biodiversity and community income from management plans for 5,000ha of shrimp ponds in Berau Regency, East Kalimantan.

Indicator 1: By 2025, community based mangrove management plan for conservation (15,000ha) developed and implemented by village communities and Regency government, and endorsed by national Ministry of Environment & Forestry

The project successfully supported the development and local adoption of village-level mangrove management plans and regulations covering 31,490 ha ha across five villages. Specifically, Pegat Batumbuk's mangrove regulation (25,000 ha), Teluk Semanting ecotourism designation (749 ha), Tabalar Muara (2,760 ha) integration into village spatial planning, Karangan Village Regulation No. 3/2024 (2,900 ha), while Suaran proposed 3,800 ha pending final endorsement (MOV1-MOV5). The overlapping jurisdictions of forest area (provincial forestry agency), coastal conservation (marine affairs agency), and Other Land Use zones (district government) does not hinder project's progress and the project sites are mainly falls under district and village authorities; thus, did not require MoEF's endorsement. The plans are operationalized by the community mangrove groups in the five villages that has been trained by the project.

Indicator 2: By 2025, The Regency Government Approved the Village Governments Plan to implement an Ecosystems Approach to Aquaculture (EAA) improvement plan covering 5,000 ha of shrimp ponds (including a 100ha SECURE model demonstration site) to increase overall shrimp yield whilst reducing total pond size area.

7,611 ha in Pegat Batumbuk (MOV18) and 600 ha in Tabalar Muara (MOV3) were designated for EAA through village regulations and spatial plans, with 718 ha in Suaran planned for future designation based on the project's assessment (MOV17). The handover to the government is through the establishment of a multi-stakeholders EAA Working Group (MOV19). 10 SECURE ponds covering 120 ha were redesigned and operated using EAA approach that integrates aquaculture with mangrove restoration, supported by scientific analysis and ground biodiversity surveys (MOV21-MOV23)

Indicator 3: Mangrove flora and fauna (e.g. mammals, water birds, aquatic biota) are stabilized in the 15,000ha protected areas and increased by at least 10% in the mosaic of restored mangroves in the 5,000ha shrimp pond/mangrove area compared to baseline study of 2022.

Biodiversity monitoring using vegetation analysis documented stabilized populations, with no significant decline in species richness or abundance. In restored areas, the February 2025 vegetation analysis (MOV22) recorded a 10–15% increase in species richness, with 20 mangrove-associated species identified (12 true mangroves, 3 associates, 5 understory plants),

compared to the 17 species recorded in 2022. Biomass increased by 3.59 tons/ha and carbon stock by 1.69 tons/ha, verified through both field-based and drone-assisted analysis, reinforcing the success of restoration efforts. Environmental monitoring using eDNA revealed biodiversity improvements in SECURE ponds with stable environmental parameters and increased Bacillariophyta presence indicated improved ecosystem health (MOV7-MOV8).

Indicator 4: By 2025, the average household income of people dependent on mangrove-related livelihoods across the 3 target villages will have been increased by 15% compared to baseline study of 2022.

Socio-economic surveys in 2025 show that average monthly household income rose from IDR 2,908,500 in 2022 to IDR 4,325,000, an increase of 48.7% across the three villages. The most significant improvements were seen among women's groups engaged in mangrove-based microenterprises and shrimp farmers adopting improved SECURE aquaculture practices (MOV27). Poverty rates declined from 54.2% to 31.6% during the project period, representing a 41.7% reduction in poor households, validated through BPS thresholds and participatory household interviews (MOV27). These figures exceed the original 15% target and highlight the project's role in strengthening economic resilience in mangrove communities.

Challenges and limitations

While the project met most of its Outcome indicators, some elements remain in progress or slightly under the original target scope. For instance, carbon financing potential was assessed, but implementation is deferred due to East Kalimantan's existing Result-Based Payment (RBP) agreement with FCPF, which restricts carbon projects until at least 2027. Another challenge is on the obtainment of pond eco-certification. Upon assessing the process and procedures for ponds certification, the project encountered difficulties in obtaining aquaculture certifications, as certification requires improvements in the whole value chain. For example, the project is not involved in the shrimp seed hatcheries that are sourced from other provinces, and therefore, has little control over the upstream sustainability, making certification difficult. The project is collaborating with another organization to conduct gap analysis and recommendation toward pond certification requirements. However, early indication suggests this may take years to fulfil.

These limitations were largely external to the project's control and had been partially identified in the original assumptions. To mitigate these risks, the project adopted several adaptive strategies: focusing on village-level regulation while awaiting higher level endorsement, conducting carbon readiness training to ensure future scalability post-2027, and continuing the good aquaculture practices within its project scope. These actions reflect a proactive approach in responding to structural limitations.

3.3 Monitoring of assumptions

Assumption 1: No negative effects from forest fires or natural disasters including pandemic in site locations / There is no drastic change of the ecosystems due to man-made or natural disasters such as forest fire, storm, or tsunami that affect wide scale habitat the aquatic biota and key species.

Comments: No natural or pandemic events occurred except for occasional bad weather and high tides that hamper in-field work. We constantly monitor the weather and adapt a flexible working approach on site where the tide and weather can change by the hour.

Assumption 2: Continued support of Government policies for mangrove conservation following Provincial government elections scheduled during this project's timeframe. An active communication with the government in charge is needed to ensure the new government will have a consistent policy with the previous administration

Comments: Governments at regency and village levels continue to support the project as evident from the successful enactment of regulations as explained in Section 3. YKAN has a cooperation agreement with the regency government requiring a formal periodic reporting to the regency

government as well as regular coordination, including providing inputs to formal regulations such as Mid-Term Regional Planning document.

Assumption 3: Continued community commitment and engagement

Comments: YKAN has a long standing and presence in East Kalimantan and have gained the trust from both the government and communities. In this project, we also engage facilitators from the local communities that support building strong relationships and engagement with the community. These facilitators became local champions that promote and advocate our cause as evident from expansion of SECURE ponds and strong livelihood programs.

Assumption 4: The government successfully provided a clear regulation and mechanisms on carbon financing for both domestic and international markets. To anticipate the slow legislation process, this project will also seek potential of voluntary carbon market.

Comment: Albeit regulations on carbon trading has been established, implementation guidelines remain unclear and mangrove carbon projects is still absent. In East Kalimantan, current Result-Based Payment (RBP) program from the World Bank under the FCPF is still in effect and halting new carbon projects until at least 2027.

Assumption 5: At least 70% of community members reliant on shrimp aquaculture and mangrove-based industries for income are able to attend training courses.

Comment: Total participants attended Field School is 172 people from three villages with varying attendance on each of the session, depending on farmer's activity.

Assumption 6: The economic situation, especially shrimp global demand, not disrupted by disasters such as pandemic or regional conflicts. To anticipate and minimise the impact on community's income, the project should invest also on market and product diversification.

Comment: The project is also developing alternative livelihoods through value added products such as milkfish crackers, milkfish floss, and ecotourism to diversify income sources. Capacities of microenterprise groups are increased through various methods of capacity buildings and the project also linked them with potential market.

3.4 Impact

Impact: Biodiversity threats halted, poverty reduced and long-term climate change impacts mitigated in mangrove ecosystems in Berau Regency, East Kalimantan, Indonesia

The project reduced key threats such as illegal logging, unregulated aquaculture expansion, and land conversion by reinforcing tenure clarity, community capacity, and ecological monitoring—all of which directly contribute to halting biodiversity loss in Berau's critical mangrove habitats. Through partnerships with communities and local governments, the project supported the development of regulations covering 28,649 hectares of mangroves and 17,560 hectares of community-based mangrove management as detailed in Output 1. Annual biodiversity monitoring using eDNA and traditional methods as also described in Output 1 confirmed increased species richness, improved water quality, and regenerating mangrove biomass. These ecological outcomes strengthen the resilience of mangrove ecosystems against further degradation.

Mangrove restoration and protection under the project were estimated to generate 13,000 tCO_2e/year in potential Verified Carbon Units (VCUs). Although monetization is pending due to East Kalimantan's FCPF agreement, the project laid the groundwork for future carbon financing pathways, aligning with Indonesia's climate targets and NDC contributions (see Output 2).

As detailed in Output 3 and Section 4.2, the project strengthened coastal community livelihoods by improving aquaculture productivity, supporting women's microenterprises, and building governance capacity for sustainable mangrove-based economic activities. These outcomes collectively enhance economic resilience and wellbeing, especially in marginalized communities dependent on natural resources. While the broader systemic issue of poverty reduction extends beyond the scope of this project, the interventions created replicable models of sustainable livelihood development, particularly for marginalized coastal households. This includes pathways

for gender-inclusive economic participation and potential long-term income from carbon financing once the current Result-Based Payment (RBP) period concludes.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Project support to the Conventions, Treaties or Agreements

Ecosystem-based approaches utilized in this project have resulted in mangrove protection, management, and restoration plans as well as actions as detailed in Section 3. These climate mitigation and adaptation actions through improved mangrove management can support global and national obligations such as sustainable use of natural resources & halting & reversing decline of nature by 2030 as laid out in the Post-2020 Global Biodiversity Framework; Indonesia's NDC; Paris Agreement; and the SDG 13, 14 and 15 targets. Specifically, the project directly tackles SDG14 targets through mangrove restoration and improved aquaculture practices (Target 14.2), assisting communities to sustainably manage and conserve coastal areas (Target 14.5), and increases economic benefits through capacity building of environmentally friendly aquaculture, mangrove ecotourism and non-timber household industries (Target 14.7).

Improvement in mangrove habitat links to the protection of migratory water birds under the Convention of the Conservation of Migratory Species of Wild Animals as result of the project works can support Ramsar targets 3,9,12 and 13 as well as Indonesia's commitment to the Convention on Biological Diversity (CBD) presented in the Indonesian Biodiversity Strategy and Action Plan (IBSAP).

Economic and social incentives for local communities to support conservation agenda is embedded in the project through community engagement and awareness, including women and women groups of whom are very active in shrimp aquaculture post-harvest activities, to empower them to protect and restore mangroves and to develop alternative sustainable livelihoods. Our works with village women groups and community-led ecotourism explained in Section 3 above supports SDG 1 and 5. SDG Targets 1.4, 1.5 and 5a are also supported by promoting equitable businesses and integrating women's involvement in mangrove management decisions.

4.2 Project support for multidimensional poverty reduction

Although Indonesia is an Upper Middle Income Country, the project targeted marginalized coastal communities in Berau Regency with limited income opportunities and high dependence on mangrove ecosystems. The project contributed to poverty reduction through both direct livelihood improvements and indirect systemic changes, aligning with Darwin's multidimensional poverty framework.

The project supported 400 individuals, including 54% women, through targeted training in SECURE aquaculture, ecotourism, and mangrove-based household industries (see Section 3). These interventions directly addressed income poverty and built long-term capacity for self-reliant livelihood growth. As a result, some idle ponds are reactivated and women-led microenterprises developed diversified sustainable products which collectively increased income by 48.7% and overall poverty rate declined by 41.7% across three villages (see Output 3).

A groundwork for future potential income generation of revenue of USD 137,000–170,000/year from carbon project was supported through strengthened local governance and planning, integrated mangrove restoration into village development plans, and enhanced community institutions (based on carbon pre-feasibility study as described in Section 3).

For knowledge contribution, the project generated new evidence on integrated biodiversity-livelihood models and blue carbon potential in tropical mangroves. It piloted SECURE ponds, contributed to peer-reviewed studies, and demonstrated a scalable model for community-led conservation finance—relevant well beyond Indonesia.

4.3 Gender Equality and Social Inclusion (GESI)

GESI Scale	Description	Put X where you think your project is on the scale
Not yet sensitive	The GESI context may have been considered but the project isn't quite meeting the requirements of a 'sensitive' approach	
Sensitive	The GESI context has been considered and project activities take this into account in their design and implementation. The project addresses basic needs and vulnerabilities of women and marginalised groups and the project will not contribute to or create further inequalities.	
Empowering	The project has all the characteristics of a 'sensitive' approach whilst also increasing equal access to assets, resources and capabilities for women and marginalised groups	X
Transformative	The project has all the characteristics of an 'empowering' approach whilst also addressing unequal power relationships and seeking institutional and societal change	

While we're working with the men on their SECURE ponds, on another hand, we are focusing on empowering women by training them to produce and market non-timber mangrove-based products, such as crackers, milkfish floss and *amplang*. These initiatives not only open new income stream for them and their family, but also foster a sense of independence among the women.

Women are particularly active in the post-harvest activities including shrimp fry and feed collection, and storage and processing. Despite women's significant contribution to shrimp farming, Indonesian gender norms view women's primary role as domestic caregivers, so are typically only hired as casual workers creating barriers to their engagement to decision making in this industry.

Our gender responsive alternative livelihood programme exclusively targets women groups in the three villages through provision of development of 10 non-timber mangrove-based products. To date, the programme has been well received by the women groups, and we hope to see more good news throughout the project especially with the increased additional income and stronger association created from the business (evidence provided in MOV and details explained in Section 3).

4.4 Transfer of knowledge

SECURE has begun influencing regional and national discourse. The Ministry of Marine Affairs and Fisheries has recognized its potential, inviting YKAN to help shape national Ecological Aquaculture training materials. The model has sparked interest from private and philanthropic actors, from Global Mangrove Alliance to the Asia Community Foundation, to support similar program in other provinces starting in 2024.

Research and publication from SECURE generated attention during the First International Mangrove Conference in Abu Dhabi held in December 2024 where YKAN presented learnings from Berau on conservation for production and the potential contribution of scaled SECURE to Indonesia's Nationally Determined Contribution.

A 20-page spread exclusive report on SECURE program in Berau was published in National Geographic Indonesia's August 2024 edition, synthesizing both environmental and community benefits the program brings about. Additionally, under university internship program, a total of 52 students have interned in conducting research and studies on mangrove and environmentally friendly aquaculture in SECURE pond locations.

4.5 Capacity building

Collaborations with experts and other NGO partner such Blue Forest not only supported project targets but enable a cross-learning and exchanges to project staff. A collaborative work on developing the Aquaculture Best Management Practice incorporated expertise and experience of various stakeholders (from farmers, experts, to peer organization) beneficial to enhance staff capacities. Additionally, cooperation with University of Leeds and Mulawarman University increases scientific research capabilities that resulted in manuscript submitted for publication. A number of YKAN staff had been invited to speak at international forum such as the Abu Dhabi Mangrove Conference, Global Mangrove Alliance knowledge sharing sessions, and The Nature Conservancy's Decision Science workshop.

5 Monitoring and evaluation

YKAN has an overall dashboard that keeps track of each indicator and the overall project progress. This dashboard is linked to staff KPI and performance. Additionally, we have set up communication and reporting lines to allow timely and more accurate updates from the pond level to project outcomes. These came in the form of: (1) Monthly monitoring for internal purpose; (2) Adaptive management, regular meetings and additional when needed to respond dynamics in the field, including evaluating and capturing project successes and learnings; (3) Data collection and on-site monitoring; (4) Project dashboard updating; and (5) YKAN's Senior Management Team (SMT) and Indonesia Leadership Team (ILT) reviews and reports. With our university partners, we organized briefing sessions both on programmatic and admin-finance aspects. Both partners are monitoring progress within their scope of work and submit progress reports to YKAN accordingly to the timetable that has been set and jointly agreed. We also have a WhatsApp Group dedicated for fluid communication (WhatsApp is a big communication tool in Indonesia, used even as formal platform by government). Part of the adaptive programming and ensuring relevance, the project has updated its Theory of Change in late 2024 and monthly progress calls.

6 Lessons learnt

The Darwin project in Berau offered valuable lessons that can inform similar biodiversity conservation and livelihood-improvement efforts, particularly those implemented in remote coastal settings with complex socio-ecological systems:

1. Embedding Local Facilitators Builds Trust and Improves Delivery

Having dedicated village-based facilitators proved to be one of the most effective strategies for fostering trust, community engagement, and consistent project communication. In the absence of centralized shrimp farmer associations, relationship-building with each pond owner was essential.

2. Adaptive Design and Technical Adjustments are Crucial for Success

Initial designs for mangrove restoration ponds required improvement to prevent hydrological conflicts with adjacent aquaculture plots. Through aerial and ground surveys, the project identified the need for customized water gates and improved channel configurations to support mangrove regeneration without affecting shrimp yields. This underlines the importance of site-specific design, iterative field validation, and flexible restoration methods that can evolve based on real-time learning.

3. Restoration and Aquaculture Infrastructure Need Long-Term Support

Common physical challenges—such as leaking embankments, broken sluice gates, and invasive weeds like devil grass—frequently disrupted SECURE pond operations. While mobile teams conducted maintenance visits and solar panels were installed for limited power supply, the remote nature of pond locations made continuous support difficult. Future projects should consider budgeting for basic infrastructure upgrades, investing in low-maintenance technologies, and exploring local stewardship arrangements for long-term maintenance.

4. Technical and Academic Collaboration Must Anticipate Delays

Delays in staff recruitment and alignment of research timelines between University of Leeds and YKAN affected activity delivery in Year 1. However, close coordination and shared vision helped overcome these hurdles. Similarly, University of Mulawarman faced lab-based and bioinformatics challenges in early eDNA analyses. This highlights the importance of realistic timelines for academic partnerships, built-in flexibility for technical troubleshooting, and early-stage testing of sampling and lab protocols.

5. Capacity Building in Emerging Topics Like Carbon Requires Iterative Learning

The initial baseline assessment showed limited understanding of carbon finance among stakeholders. However, through simplified content, phased delivery, and participatory methods, the project achieved a 46% increase in carbon knowledge. This demonstrates that complex technical topics can be effectively localized, but require repetition, local context, and accessible formats. Similar projects should allocate sufficient time and resources for iterative capacity building, especially in under-explored areas like blue carbon.

7 Actions taken in response to Annual Report reviews

Feedback from Annual Reports have been addressed in the subsequent reports, as directed by the reviewer.

8 Risk Management

We are monitoring risks with most updated risk mitigations compiled as below table:

Risk	Likelihood	Impact	Mitigation
Pond owners reluctant to join the program	Medium	High	▪ YKAN Berau team has close ties with communities including having village facilitators for close communications with pond owners ▪ Tailored agreements with each pond owners based on mutual interests ▪ Continue looking and assessing potential ponds and strengthen relationships with villagers ▪ Invite pond owners to participate in the field school
Natural hazards such as high tides, unfavorable weather, or government restrictions	Medium	High	▪ Implement agile and adaptive management approaches ▪ Monitor weather and schedule activities accordingly to minimize effects
Production failures due to various reasons	Medium	High	▪ YKAN's research on productivity function remains strong ▪ Engage experts such as from BBPBAP Jepara in brackish aquaculture ▪ Develop guidelines on the management and implementation of SECURE ▪ Conduct research on seeds, fertilizers, water quality and other environmental factors contributing to harvests (incl. treatments)
Changes in Berau/East Kalimantan development priorities	Low	High	▪ Involve local governments closely ▪ Assist local government in developing policies/regulations on mangrove-aquaculture
Uncertainty of government regulations on carbon	High	Low	▪ Keep project updated with regulations, methodologies, and verification methods adopted by GoI ▪ As the project is only building its carbon case/proof and not aiming for carbon trading, this has less impact politically or reputationally with MoEF

In 2025, no new risks arisen. Updated risk framework attached.

9 Scalability and Durability

The SECURE model's integrated approach to aquaculture, mangrove restoration, and community livelihoods has gained traction among diverse stakeholders, demonstrating potential for replication and long-term sustainability. Stakeholders—including local communities, district government, NGOs, and private sector actors—have been actively engaged through field demonstrations, technical workshops, and dialogues. This also leads to additional 2 villages involved in the project (Teluk Semanting and Karangan).

The project's alignment with district development plans and the issuance of village regulations (e.g. Perkam No. 2/2025 on EAA) have anchored its outputs within formal governance structures. The inclusion of YKAN in the national working group to develop Ecological Aquaculture Approaches (EAA) training modules further institutionalizes the model. Farmer interest is

evidenced by reactivation of idle ponds, and women's groups continue to expand micro-businesses post-project, demonstrating perceived value.

YKAN's role in national dialogues—such as with the Ministry of Marine Affairs and Fisheries—and partnerships with entities like HSBC, UBS Climate Collective, Global Fund for Coral Reef, and Temasek Foundation, also reflect growing interest in scaling SECURE and CBEMR approaches. These engagements pave the way for wider adoption through CSR, philanthropy, policy integration, and potential investment model.

Key legacy mechanisms include: a multistakeholder working group on EAA led by the Berau Regency; certified community microenterprises; and knowledge products co-developed with universities. Though Darwin funding has ceased, having new funding from different projects, staff are retained by YKAN to continue technical support and coordination, ensuring momentum toward durable impact and future investment opportunities.

10 Darwin Initiative identity

Our project transparently communicates Darwin's support to our government counterparts (Berau Regency Office, Berau Fisheries Agency, East Kalimantan Marine and Fisheries Agency, and East Kalimantan Environmental Agency) and stakeholders we work with. We include partners' logos (such as government bodies and the Darwin Initiative) in our backdrops during events, mention partners' support in our remarks to allow our stakeholders to identify Darwin and other donors we work with, press releases, and other communication activities/materials. SECURE page under YKAN's website has also mentioned Darwin as one of its partners.

Additionally, the project facilitated courtesy meeting of DEFRA's International Biodiversity and Climate Director with Head of Berau Regency on 22 July 2023. Some coverage of the meeting is listed below:

- https://suaraberau.com/kerja-sama-bupati-berau-dan-pemerintah-inggris-upaya-menjaga-hutan-dan-melestarikan-mangrove-kabupaten-berau/?amp=1
- https://busam.id/bupati-berau-dapat-kunjungan-tim-defra-dan-ykan-jakarta-dan-berau/
- https://mediakaltim.com/komitmen-lindungi-ekosistem-mangrove-di-pesisir-berau/
- https://lensaku.id/2023/07/23/kementrian-lingkungan-hidup-inggris-apresiasi-pemkab-berau-dalam-menjaga-lingkungan-hidup/
- https://nomorsatuutara.com/apresiasi-komitmen-pemkab-berau/
- https://benuanta.co.id/index.php/2023/07/24/bupati-berau-terima-kunjungan-tamu-tim-defra-uk-dan-ykan/117356/17/04/14/
- https://www.instagram.com/p/Cu_5BCdrSuW/?igshid=MzRlODBiNWFlZA==
- https://www.instagram.com/p/Cu_IxNGJott/

11 Safeguarding

[redacted]

12 Finance and administration

12.1 Project expenditure

Project spend (indicative) since last Annual Report	2024/25 Grant (£)	2024/25 Total actual Darwin Initiative Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)	[redacted]			

	[redacted]			
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Others (see below)				
Audit costs	£3,000.00	£3,000.00	0%	
TOTAL				

Staff employed (Name and position)	Cost (£)
Dr Dewi Embong Bulan, Research lead PI, University of Mulawarman	[redacted]
Dr. Rahardian Pratama, Data Analyst, University of Mulawarman	
Dr. dr. Yadi Yasir, Laboratory Assistant, University of Mulawarman	
Dr. Maria Berger, Research lead PI, Leeds University	
Dr Dominic Muenzel, Spatial Planning Analyst, Leeds University	
Aji Anggoro, Blue Carbon Programme Manager, YKAN	
Basir, Field Manager, YKAN	
Dhika Pratama, GIS Officer, YKAN	
Dzimar Prakoso, Remote Sensing Officer, YKAN	
Kiki Anggraini, Sustainable Practice Sr. Manager, YKAN	
Mariski, Project Director, YKAN	
Muhammad Ilman, Project Director, YKAN	
Topik Hidayat, Mangrove Science Coordinator, YKAN	
Yitno Suprapto, Aquaculture Coordinator, YKAN	
Yusuf Fajariyanto, Oceans Protection Manager, YKAN	
TOTAL	£83,159.34

Capital items – description	Capital items – cost (£)
TOTAL	

Other items – description	Other items – cost (£)
University of Mulawarman, Gloves dan Masks	[redacted]
University of Mulawarman, coolbox	

University of Mulawarman, markers	[redacted]
University of Mulawarman, bottles for samples	
University of Mulawarman, pH solution	
University of Mulawarman, water quality analysis	
University of Mulawarman, plankton analysis cost	
University of Mulawarman, DNeasy PowerSoil Pro Kit (50) Qiagen Cat#47014	
University of Mulawarman, DNeasy PowerWater Kit (50) 1 Qiagen Cat#14900-50-NF	
University of Mulawarman, BLUNT/TA LIGASE MASTER MIX	
University of Mulawarman, Pipette filter	
University of Mulawarman, Gloves	
University of Mulawarman, mineral water and ice	
University of Mulawarman, cork	
University of Mulawarman, ice	
University of Mulawarman, Amplate Low Pro 96 Wells Flex. Non Skirted plates natural	
University of Mulawarman, water quality and plankton suaran and tabalar analysis	
University of Mulawarman, VAHTS DNA Clean Beads	
YKAN, Y-24/1173/THidayat/EER E 0076448 Restoration Preparation LEMSA SECURE	
YKAN, Y-24/1173/THidayat/EER E 0076448 Restoration Preparation LEMSA SECURE	
YKAN, Y-24/1754/AWAnggoro/EER E 0078564 Restoration Fieldwork Bengkalis & Berau	
YKAN, Y-24/1754/AWAnggoro/EER E 0078564 Restoration Fieldwork Bengkalis & Berau	
YKAN, Y-24/2218/THidayat/EER E 0076448 Restoration Fieldwork Berau	
YKAN, Y-24/2218/THidayat/EER E 0076448 Restoration Fieldwork Berau	
YKAN, R-24/0796/Nana Benur/PO No.24 - Shrimp seeds for Abd. Rahman and Asnawi	
YKAN, R-24/0784/Basir/Secure Ponds Operations period Apr - June 2024	
YKAN, Y-24/2620/THidayat/EER E 0076448 Berau 071824-072624 Fieldwork	
YKAN, R-24/0890/Hallo Tour/ SYIDIK FAHMI - Ticket for Vegetation Analysis and Pond Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ MUHAMMAD MIFTAHUL BAYYAN Ticket for Vegetation Analysis and Pond Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ PRIMA ANGGORO Ticket for Vegetation Analysis and Pon Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ MUHAMMAD MIFTAHUL BAYYAN Baggage for tools-Vegetation Analysis and Pond Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ SYIDIK FAHMI Ticket for Vegetation Analysis and Pond Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ RIFFAN RIYADI Ticket for Vegetation Analysis and Pond Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ PRIMA ANGGORO Ticket for Vegetation Analysis and Pon Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ MUHAMMAD MIFTAHUL BAYYAN Ticket for Vegetation Analysis and Pond Restoration Visit	
YKAN, R-24/0890/Hallo Tour/ RIFFAN RIYADI Vegetation Analysis and Pond Restoration Visit BATIK AIR & LION AIR CGK - BEJ 05-08-24	
YKAN, R-24/0901/Basir/Settlement refer R-24/0532 - Ponds material	

YKAN, R-24/0914/Bumi Segah/(Bayaan, Prima, Rifan) accomodation for Vegetation Analysis and pond restoration visit	[redacted]
YKAN, R-24/0918/Palmy /M. M. Bayyan accomodation for Vegetation Analysis and pon restoration visit	
YKAN, R-24/0918/Palmy /Syidik Fahmi accomodation for Vegetation Analysis and pond restoration visit	
YKAN, R-24/0930/Ikbal Transport/(Aji, Topik, Syidik, Bayyan, Prima, Riffan) transport rental for vegetation analysis	
YKAN, R-24/0930/Ikbal Transport/(Bayyan, Prima, Riffan) transport rental for vegetatio analysis	
YKAN, R-24/0930/Ikbal Transport/ Support Aji, Topik, Syidik to Pond Restoration Visit local transport Tanjung Redeb 06-08-24	
YKAN, R-24/0955/Mutiara Jaya/PO No.008-Berau/Plastic Sheeting for SECURE Ponds i Batumbuk	
YKAN, R-24/0955/Correction wrong Project ID ref. R-24/0234 - Mutiara Jaya/PO No.008 Berau/Plastic Sheeting for SECURE Ponds in Batumbuk	
YKAN, Y-24/3138/AWAnggoro/EER E 0078564 Fieldwork Vegetation Analysis, SECURE Pond Restoration Visit	
YKAN, Y-24/3138/AWAnggoro/EER E 0078564 Fieldwork Vegetation Analysis, SECURE Pond Restoration Visit	
YKAN, Y-24/3247/RRiyadi/Survey Changes Mangrove Vegetation Berau	
YKAN, Y-24/3715/Imecon/ATrisnawati - Women groups livelihood activity and support	
YKAN, Y-24/3715/Imecon/ATrisnawati - Women groups livelihood activity and support	
YKAN, Y-24/4090/Imecon/AHusnanda - Materials and supplies for fieldwork	
YKAN, Y-24/4090/Imecon/AHusnanda - Materials and supplies for fieldwork	
YKAN, R-25/0114/NANA BENUR/PO Berau No. 005/SHRIMP SEED FOR SECURE SUPRIYANTO	
YKAN, R-25/0135/M Zakiy Rabbanii/Analyzer and Surveyor mangrove vegetation analysis	
YKAN, R-25/0134/Andani Mahardika/Analyzer and Surveyor mangrove vegetation analysis	
YKAN, R-25/0153/DFitrianingsih/Socio economic survey analysis Suaran	
YKAN, R-25/0196/Marina/Mid-Term Development Plan review	
YKAN, R-25/0243/Top Setup/Freight cost for Binocular, Apexcel, GPS, Samsung A06	
YKAN, R-25/0245/Basir qq AHusnanda/Supplies for Mangrove team on Pegat Batumbuk, Suaran and Tabalar Muara	
YKAN, R-25/0248/DFitrianingsih/Socio economic survey analysis Suaran	
YKAN, R-25/0246/Maxmedia-RitaYulisa/Postage fee Mangrove Team in Pegat (Gloves, Evogrip, Life Jacket and Drybag)	
YKAN, R-25/0246/Maxmedia-RitaYulisa/Supplies for Mangrove Team in Pegat (Gloves, Evogrip, Life Jacket and Drybag)	
YKAN, R-25/0272/M Zakiy Rabbanii/Analyzer and Surveyor mangrove vegetation analysis	
YKAN, R-25/0265/Andani Mahardika/Analyzer and Surveyor mangrove vegetation analysis	
YKAN, R-25/0264/Magenta Computer/Binocular Telescope 1080P for mangrove team	
YKAN, R-25/0284/Basir/SECURE Bingkar Pond Cultivation Cycle period Sept - Dec 202	
YKAN, R-25/0326/Top Setup/supplies for mangrove team	
YKAN, Y-25/1392/AWAnggoro/EER E 0078564 Fieldwork Vegetation Analysis	

TOTAL	[redacted]

12.2 Additional funds or in-kind contributions secured

Matched funding leveraged by the partners to deliver the project	Total (£)
FY1	[redacted]
FY2	
FY3	
TOTAL	

Total additional finance mobilised for new activities occurring outside of the project, building on evidence, best practices and the project	Total (£)
TOTAL	

12.3 Value for Money

The project delivered value for money by leveraging the 4E framework—economy, efficiency, effectiveness, and equity. Through YKAN's long-standing partnerships and field presence, the project reduced coordination and implementation costs, using embedded facilitators, local procurement, and in-kind support from stakeholders e.g. official man-time, community venue, and *gotong royong* (a mutual cooperation spirit). Outputs were delivered cost-effectively: over 30,000 ha of mangroves were brought under local regulation, household incomes increased by nearly 49%, and multiple certified mangrove-based products entered the market, all within the project's budget envelope.

Efficiency was further achieved through adaptive, field-based training models, use of efficient monitoring technology like drones, and iterative coordination with village and district-level authorities. Effectiveness was demonstrated by exceeding outcome indicators, while equity was central, with women comprising over 50% of participants and playing a key role in business development.

Project expenditures were regularly monitored through internal controls and reporting mechanisms. Procurement processes followed YKAN's standard operating procedures, which include transparent bidding, vendor assessments, and compliance with Darwin financial rules. These governance mechanisms ensured that funds were used efficiently and with accountability.

The project has laid a foundation for scaling through new partnerships and future innovative financing mechanisms to sustain benefits beyond the funding period.

13 Other comments on progress not covered elsewhere

YKAN remains alert that we need still need to validate the SECURE approach and ensure that this prototyping approach can be successful. The match funding sources supports continuous learning and research on cultivation methods and addressing field challenges, improving pond digital database, as well as measuring GHG emissions using Lidar, high resolution drone and camera. This will feed into the feedback loop to check our assumptions, improve the SECURE model where necessary, and build evidence on project achievements and lessons learned. Community and field dynamics often time deviates from initial project aspirations, it would be very useful for Darwin Initiative to allow calculated flexibility as we find that rigidness in the reporting format and requirements can be quite overwhelming for field team.

14 OPTIONAL: Outstanding achievements of your project (300-400 words maximum). This section may be used for publicity purposes.

I agree for the Biodiversity Challenge Funds to edit and use the following for various promotional purposes (please leave this line in to indicate your agreement to use any material you provide here).

Reclaiming Balance: How the SECURE Model is Restoring Mangroves and Transforming Lives in Coastal East Kalimantan

In the remote coastal villages of East Kalimantan, a quiet revolution is unfolding. Once-degraded shrimp ponds, long symbols of ecological loss, are now at the heart of a pioneering effort to harmonize biodiversity conservation, climate action, and coastal livelihoods. At the center of this transformation is the SECURE (Shrimp-Carbon Aquaculture) model, an innovative approach developed under a Darwin Initiative-supported project led by Yayasan Konservasi Alam Nusantara (YKAN).

Over three years, the project has turned 120 hectares of traditional aquaculture ponds into living laboratories where mangrove restoration thrives alongside sustainable shrimp farming. These redesigned ponds include zones for cultivation, natural regeneration of mangroves, and permanent protection of intact ecosystems. By pairing ecological enhancement with community-driven management, SECURE has become a model of resilience in action.

The results speak volumes. Vegetation surveys and eDNA analysis have shown a measurable recovery in biodiversity and a 1.69 tons/ha increase in carbon stock, translating to real contributions to climate mitigation. At the same time, aquaculture yields improved and farmers saw a 12% average income increase. Women's groups, empowered through tailored training and support, experienced an even greater economic boost—with incomes rising by 40% and 12 products gaining formal certification, including halal and IRT licenses.

SECURE has begun influencing regional and national discourse. The Ministry of Marine Affairs and Fisheries has recognized its potential, inviting YKAN to help shape national Ecological Aquaculture training materials. The model has sparked interest from private and philanthropic actors, from Global Mangrove Alliance to the Asia Community Foundation, eager to support scalable nature-based solutions in other provinces.

Importantly, the project embedded its achievements within village governance frameworks. Village regulations and the establishment of a district-level multi-stakeholder task force on sustainable aquaculture ensure that these gains endure beyond project closure. Community ownership and formal policy backing have turned SECURE from an experimental model into a replicable success story.

In a time when climate and biodiversity goals can seem at odds with economic realities, the SECURE approach offers a rare win-win. It's a blueprint for how evidence-based conservation can uplift communities while restoring nature—proof that with the right mix of innovation, inclusion, and local leadership, lasting change is not only possible, it's already underway.

File Type (Image / Video / Graphic)	File Name or File Location	Caption, country and credit	Online accounts to be tagged (leave blank if none)	Consent of subjects received (delete as necessary)
				Yes / No
				Yes / No
				Yes / No
				Yes / No

Annex 1 Report of progress and achievements against logframe for the life of the project

Project summary	Progress and achievements
Impact Biodiversity threats halted, poverty reduced and long-term climate change impacts mitigated in mangrove ecosystems in Berau Regency, East Kalimantan, Indonesia	The project successfully mitigated biodiversity threats and reduced poverty by protecting and restoring mangrove ecosystems and its mangrove-based livelihood. Key achievements include reinforcing regulatory basis, community capacity, and ecological monitoring, which halted biodiversity loss and strengthened ecosystem resilience. The project also generated potential carbon credits, improved livelihoods through sustainable aquaculture and women's microenterprises, and enhanced economic resilience in marginalized coastal communities. Details can be found in Section 3.
Outcome Biodiversity threats prevented from protection of 15,000ha intact mangrove forests and improved biodiversity and community income from management plans for 5,000ha of shrimp ponds in Berau Regency, East Kalimantan	The project successfully enabled regulations and management plans covering 31,490 ha of mangroves and community income through improved aquaculture practices and development of women groups' value-added aquaculture products. Key achievements include developing village-level mangrove management plans, restoring mangrove ecosystems and promoting sustainable aquaculture practices using SECURE approach, thereby resulting in increased species richness, biomass, and carbon stock. The project also led to a 48.7% increase in average monthly household income.
Outcome indicator 0.1. By 2025, community based mangrove management plan for conservation (15,000ha) developed and implemented by village communities and Regency government, and endorsed by national Ministry of Environment & Forestry	The project successfully supported the development and local adoption of village-level mangrove management plans and regulations covering 31,490 ha ha across five villages (MOV1-MOV5). Overlapping jurisdictions of forest area (provincial forestry agency), coastal conservation (marine affairs agency), and Other Land Use zones (district government) within the project sites are mainly falls under district and village authorities; thus, did not require MoEF's endorsement.
Outcome indicator 0.2. By 2025, The Regency Government Approved the Village Governments Plan to implement an Ecosystems Approach to Aquaculture (EAA) improvement plan covering 5,000 ha of shrimp ponds (including a 100ha SECURE model demonstration site) to increase overall shrimp yield whilst reducing total pond size area.	7,611 ha in Pegat Batumbuk (MOV18) and 600 ha in Tabalar Muara (MOV3) were designated for EAA through village regulations and spatial plans. 10 SECURE ponds covering 120 ha were redesigned and operated using EAA approach that integrates aquaculture with mangrove restoration, supported by scientific analysis, spatial prioritization, and ground biodiversity surveys (MOV21-MOV23)
Outcome indicator 0.3. mangrove flora and fauna (e.g. mammals, water birds, aquatic biota) are stabilized in the 15,000ha protected areas and increased by at least 10% in the mosaic of restored mangroves in the 5,000ha shrimp pond/mangrove area compared to baseline study of 2022.	Last vegetation analysis in 2025 (MOV22) recorded a 10–15% increase in species richness, with 20 mangrove-associated species identified (12 true mangroves, 3 associates, 5 understory plants), compared to the 17 species recorded in 2022. While eDNA analysis revealed biodiversity improvements in SECURE ponds with stable environmental parameters and increased Bacillariophyta presence indicated improved ecosystem health (MOV7-MOV8).

Outcome indicator 0.4. By 2025, the average household income of people dependent on mangrove-related livelihoods across the 3 target villages will have been increased by 15% compared to baseline study of 2022.	Socio-economic surveys in 2025 show that average monthly household income rose from IDR 2,908,500 in 2022 to IDR 4,325,000, an increase of 48.7% across the three villages. Poverty rates declined from 54.2% to 31.6% during the project period, representing a 41.7% reduction in poor households, validated through BPS thresholds and participatory household interviews (MOV27).
Output 1 Management plans for the protection of 15,000ha of mangrove ecosystems and their biodiversity are developed, approved, and implemented through strengthened village governance capacity	
Output indicator 1.1 By the end of the project's first year consultations with local communities in the 3 target villages attended by 60 village leaders and community representatives are completed, and management plans for the protected mangroves are submitted by the heads of the villages to the Regency Government for Approval and to the MOEF for an endorsement.	YKAN had exceeded the consultation and planning targets and extending village engagement from the original three to five communities. Across Pegat Batumbuk, Suaran, Tabalar Muara, Karangan, and Teluk Semanting, village representatives participated in consultation processes that resulted in the submission and formalization of village-level mangrove management plans, including the enactment of Village Regulations (e.g. Pegat Batumbuk's No. 5/2023), incorporation into spatial plans (e.g. Tabalar Muara's spatial plan), and village mangrove community groups' strategic plans (MOV1-MOV5).
Output indicator 1.2 By the end of the project, the richness of mangrove tree species, mangrove-associated aquatic species, and key threatened species (e.g. Proboscis monkeys-EN, Chinese egrets-VU, Lesser adjutant stork-VU) for this target mangrove area in Berau are stabilized compared to validated baseline study.	The project achieved stabilization and modest improvement in mangrove biodiversity in protected areas, while demonstrating significant gains in restored shrimp pond zones. Using both molecular and conventional monitoring tools, the University of Mulawarman documented an increase in aquatic biodiversity, with SECURE ponds showing a shift from decomposer-dominated systems to productive, photosynthetic communities (MOV7-MOV8). Although gains in mangrove-based systems were slower due to ecological constraints, indicators such as increased Bacillariophyta and stable environmental parameters signified healthier ecosystem functions.
Output indicator 1.3 By the end of the project, the village governments have capacity to develop policies, standards, and have a management team in place to succesfully implement the management plan for 15,000 ha of village protected mangrove forest.	Village governments in five villages successfully developed and implemented mangrove management policies and community groups. Strategic plans for community groups, village regulations, and institutional strengthening supported governance of over 30,000 ha of mangroves. Capacity-building initiatives such multi-stage training improved legal and surveillance capabilities (MOV9-MOV16). Surveillance SOP was developed and supported by equipment grants, with community patrols operating under adapted scheduling to maintain participation.
Output 2. 10-year mangrove restoration and biodiversity improvement plan developed and approved for 5,000 ha of shrimp ponds and, a 100 ha SECURE model demonstration site (within the 5,000ha area) is established by the end of the project.	

Output indicator 2.1. By the end of the project's second year, village authorities have developed and approved spatial and management plans for the 5,000 ha shrimp ponds using FAO's Ecosystems Approach to Aquaculture (EAA) that takes into consideration the 15,000 ha protected mangroves and village area.	Ecosystem Approach to Aquaculture (EAA) has been adopted by village authorities where Pegat Batumbuk formally designated 7,611 ha EAA area under Village Regulation No. 2/2025, and Tabalar Muara incorporated 600 ha into its spatial plan. Suaran proposed 718 ha but pending formal adoption (MOV17, MOV18, MOV3). These efforts were supported by Berau Regent Decree No. 200/2025 establishing a multi-stakeholder EAA Working Group to ensure long-term adoption and integration into government programs (MOV19).
Output indicator 2.2. By the end of the project, ~80% of the 100ha SECURE model demonstration site is restored back to mangroves using hydrological or hybrid engineering restoration approaches.	The SECURE model successfully allocated 52.76 ha (44%) for active restoration and 50.56 ha (42%) for mangrove protection—together meeting and exceeding the 80% target. Restoration used CBEMR approaches, hydrological design improvements, and innovations such as double-fence bamboo barriers to support sedimentation and regeneration (MOV22, MOV23). Vegetation monitoring confirmed improvements in canopy cover and ecological recovery, as validated by satellite imagery and drone-based observation.
Output indicator 2.3 By the end of the project, ~20% of the 100ha SECURE model demonstration site is being managed as shrimp ponds with improved aquaculture practices, which will increase overall shrimp yield by 30%	The remaining 19.07 ha (16%) of SECURE ponds were allocated for sustainable shrimp cultivation. Since the conventional ponds have significantly larger pond cultivation sizes, the total annual harvest is below the conventional ponds. However, on a per hectare basis, SECURE model is compatible with per hectare productivity of 28 kg/ha compared to conventional ponds at 29 kh/ha. This suggests that efforts to increase productivity per unit area under the SECURE model are on track.
Output indicator 2.4 By the end of the project, a business case for carbon finance for mangrove restoration and protection is developed and used as business proposal for carbon finance project.	A pre-feasibility study for carbon finance proposed a blended model with 2,327 ha for restoration and 6,934 ha for protection, generating an estimated 13,000 tCO_2e/year. Based on conservative 2022 prices, this could yield US\$137,000–150,000 annually (MOV24). Although implementation is currently constrained by East Kalimantan's Result-Based Payment (RBP) agreement with FCPF until 2027, the study provides a robust foundation for future carbon-based financing.
Output indicator 2.5 By the end of the project, village authorities have the knowledge to co-manage carbon financing for the project area.	In March 2024 and January 2025, a carbon finance workshop and training were held for participants from village and government institutions (MOV26. Resulting in 46% knowledge increase, the training built early-stage capacity for co-managing blue carbon opportunities and sparked local engagement with the concept, though further multi-session capacity development is needed to reach full readiness.
Output 3. At the completion of the project (2025) the income of people working in shrimp aquaculture, mangrove ecotourism, and mangrove-based household industries in the 3 target villages is increased by 15% (compared to baseline)	
Output indicator 3.1	The project successfully trained 105 selected households (around 400 individuals), with 54% female participation, in sustainable shrimp aquaculture, community-

By the end of the project's first year, 100 selected households (400 persons, with at least 50% women) are trained in new practices in environmentally-friendly shrimp aquaculture, mangrove ecotourism, and non-timber mangrove-based household industry development.	based ecotourism, and non-timber mangrove-based microenterprises (MOV27). Training methods included demonstration ponds, local mentorship, and targeted women-focused modules on food safety, certification, and financial literacy. This met the gender equity targets and directly contributed to diversified livelihoods, particularly for previously income-less women, resulting in a 48.7% increase in average household income (MOV26).
Output indicator 3.2 By the end of the project, products produced by workers with mangrove-based livelihoods in at least two aquaculture ponds will meet the requirements for national and globally recognized certifications, (.e., Aquaculture Stewardship Council (ASC), Halal, and Indonesia Good Manufacturing Practices (GMP) improving the product value and quantity, with a broader access to markets.	By project end, 13 mangrove-based products were developed of which 12 received PIRT permits, and 10 achieved Halal certification (MOV28). Flagship items like shrimp sambal and amplang reached wider markets through regional expos and strategic marketing support (MOV30). Two new canned products (Bandeng Mercon and Spicy Shrimp Sambal) received dual Halal and PIRT certification, with a third product in the certification pipeline. While full ASC certification for aquaculture ponds was not achieved due to land tenure and value chain improvement beyond the project's scope, foundational steps—including pond redesign, traceability protocols, and training—position SECURE ponds for future eco-certification in line with ASC principles.

Project Summary	Measurable Indicators	Means of Verification	Important Assumptions
Impact: Biodiversity threats halted, poverty reduced and long-term climate changed impacts mitigated in mangrove ecosystems in Berau Regency, East Kalimantan, Indonesia			
Outcome: Biodiversity threats prevented from protection of 15,000ha intact mangrove forests and improved biodiversity and community income from management plans for 5,000ha of shrimp ponds in Berau Regency, East Kalimantan	0.1 By 2025, community based mangrove management plan for conservation (15,000ha) developed and implemented by village communities and Regency government, and endorsed by national Ministry of Environment & Forestry	0.1.1 Spatial plan agreement signed by Berau Regency Government. 0.1.2 Endorsement letter from Ministry of Environment & Forestry received. 0.1.3 Village government decision letter delivered on the establishment of Community Surveillance unit and certificate of training completion of by the Government Fisheries Agency.	1. No negative effects from forest fires or natural disasters including pandemic in site locations. 2. Continued support of Government policies for mangrove conservation following Provincial government elections scheduled during this project's timeframe. An active comunication with the government in charge is needed to ensure the new government will have a consistent policy with the previous administration. 3. Continued community commitment and engagement.
	0.2 By 2025, The Regency Government Approved the Village Governments Plan to implement an Ecosystems Approach to Aquaculture (EAA) improvement plan covering 5,000 ha of shrimp ponds (including a 100ha SECURE model demonstration site) to increase overall shrimp yield whilst reducing total pond size area.	0.2.1 Management Plan for Ecosystem Aproach to Aquaculture (EAA) signed by Berau Regency Government. 0.2.2 Report on the SECURE Model Pond comprised of information on each shrimp pond characteristics, land ownership status, aquaculture improvement plans, and conservation agreement with the community group to manage the SECURE Model Pond	
	0.3 By 2025, the richness of mangrove flora and fauna (e.g. mammals, water birds, aquatic biota) are stabilized in the 15,000ha protected areas and increased by at least 10% in the mosaic of restored mangroves in the 5,000ha shrimp pond/mangrove area compared to baseline study of 2022.	0.3 Annual biodiversity status reports comprise of species count, population, distribution, threats, and recommendation, shared to Indonesia's Biodiversity Strategy and Action Plan (IBSAP) team to be included in the IBSAP development process.	

	0.4 By 2025, the average household income of people dependent on mangrove-related livelihoods across the 3 target villages will have been increased by 15% compared to baseline study of 2022.	0.4 Number of poor households from Indonesia's Statistical Agency (BPS) data combined with household interviews (collected before and after project intervention).	
Outputs: **1**. Management plans for the protection of 15,000ha of mangrove ecosystems and their biodiversity are developed, approved, and implemented through strengthened village governance capacity	1.1 By the end of the project's first year consultations with local communities in the 3 target villages attended by 60 village leaders and community representatives are completed, and management plans for the protected mangroves are submitted by the heads of the villages to the Regency Government for Approval and to the MOEF for an endorsement. *Interim target: not relevant.*	1.1.1 Workshop Report comprise of minutes of consultation workshops conducted within the 3 target villages, list of attendees, are documented and include boundary map of the 15,000 ha protected area which available for public view in the village offices. 1.1.2 Villages management plans for the protection of 15,000 ha of mangroves, proposed by village government, approved by Regency Government with The MOEF's endorsement.	1. Consistent government policy to protect the mangroves following Provincial government elections scheduled during this project's timeframe. An active comunication with the government in charge is needed to ensure the consistent policy to support better protection of mangrove through aquaculture improvement. 2. There is no drastic change of the ecosystems due to man-made or natural disasters such as forest fire, storm, or tsunami that affect wide scale habitat the aquatic biota and key species.
	1.2 By the end of the project, the richness of mangrove tree species, mangrove-associated aquatic species, and key threatened species (e.g. Proboscis monkeys-EN, Chinese egrets-VU, Lesser adjutant stork-VU) for this target mangrove area in Berau are stabilized compared to validated baseline study. *Interim target: By the end of Project's first year, baseline study is available*.	1.2 Mangrove species biodiversity project report including the use of environmental DNA to check aquatic and associated terrestrial biodiversity, and validation of baseline measures from existing studies for threatened and indicator mangrove species is produced and submitted for peer-reviewed journal for publication by the end of the project.	

	1.3 By the end of the project, the village governments have capacity to develop policies, standards, and have a management team in place to succesfully implement the management plan for 15,000 ha of village protected mangrove forest. *Interim target, by the end of Project's second year, the Community Surveillanve Unit is established.*	1.3 The village government issued mangrove protection standard operating procedures, and established Community Surveillance Unit for mangroves for protection comprised of 30 mangrove rangers.	
2. 10-year mangrove restoration and biodiversity improvement plan developed and approved for 5,000 ha of shrimp ponds and, a 100 ha SECURE model demonstration site (within the 5,000ha area) is established by the end of the project.	2.1 By the end of the project's second year, village authorities have developed and approved spatial and management plans for the 5,000 ha shrimp ponds using FAO's Ecosystems Approach to Aquaculture (EAA) that takes into consideration the 15,000 ha protected mangroves and village area *Interim target: not relevant.*	2.1.1 The Village Government's Spatial and Management plans using Ecosystem Aproach to Aquaculture approved and signed by Berau Regency Government 2.1.2 Scientific project report of potential CO2e emissions reduction/increase after the modification of shrimp ponds by the Project. The results submitted for peer-reviewed journal publication.	1. Consistent government policy to protect mangroves following Provincial government elections scheduled during this project's timeframe. 2. No natural disasters (e.g. forest fires, floods, storms, coastal erosion) that damage the aquaculture ponds. 3. The government succesfully provided a clear regulation and mechanisms on carbon financing for both domestic and international markets. To anticipate the slow legislation process, this project will also seek potential of voluntary carbon market.
	2.2 By the end of the project, ~80% of the 100ha SECURE model demonstration site is restored back to mangroves using hydrological or hybrid engineering restoration approaches Interim target: by the end of the Project's first year, the pond redesign and restoration plan for the 100 ha ponds are available.	2.2. Satellite imagery analysis of 100ha SECURE model demonstration site combined with ground mangrove biodiversity and population survey, to measure the success of mangrove restoration.	
	2.3 By the end of the project, ~20% of the 100ha SECURE model demonstration site is being managed as shrimp ponds with improved aquaculture practices, which will increase overall shrimp yield by 30%	2.3.1 SECURE model ponds Performance Report comprised of annual shrimp yield and production costs, submitted for peer-reviewed journal publication. 2.3.2 Training Report comprised of attendance reports, before and after knowledge test of the training	

	Interim target: by the end of Project's second year, all 100 SECURE ponds have been operating with harvest equal to business as usual productivity.	sessions at the Aquaculture Field School (Sekolah Lapang Perikanan) at the 100ha SECURE demonstration site.	
	2.4 By the end of the project, a business case for carbon finance for mangrove restoration and protection is developed and used as business proposal for carbon finance project. *Interim target: by the end of Project's second year the business case team has finalised the first draft of the business case.*	2.4 Analysis report of the viability of carbon financing through the projection of carbon emission reduction potential, carbon price, shrimp production increased, and project costs to establish the SECURE ponds	
	2.5 By the end of the project, village authorities have the knowledge to co-manage carbon financing for the project area. *Interim target: By the end of Project's second year, village authority has finalised carbon financing training.*	2.5Training report with before and after knowledge test for local authorities attendees for capacity building sessions for the available carbon financing mechanisms	
3. At the completion of the project (2025) the income of people working in shrimp aquaculture, mangrove ecotourism, and mangrove-based household industries in the 3 target villages is increased by 15% (compared to baseline).	3.1 By the end of the project's first year, 100 selected households (400 persons, with at least 50% women) are trained in new practices in environmentally-friendly shrimp aquaculture, mangrove ecotourism, and non-timber mangrove-based household industry development. *Interim target: By the end of Project's first year, the team has identified households/ candidates for training activties.*	3.1 .1 List of training attendees and their knowledge surveys performed at commencement and end of training sessions (gender dissagregated) on shrimp aquaculture, mangrove ecotourism, and mangrove-based household industry development. 3.1.2 Household income monitoring survey report completed and combined with Indonesia's Statistical Agency (BPS) data.	1. At least 70% of community members reliant on shrimp aquaculture and mangrove-based industries for income are able to attend training courses. 2. The environmental quality is not drastically changed due to the occurrence of man-made or natural disasters such as an oil spills, floods, and tsunami that make aquaculture not feasible in Berau. 3. The economic situation, especially shrimp global demand, not disrupted by disasters such as pandemic or regional conflicts. To anticipate and minimise the impact

	3.2 By the end of the project, products produced by workers with mangrove-based livelihoods in at least two aquaculture ponds will meet the requirements for national and globally recognized certifications, (.e., Aquaculture Stewardship Council (ASC), Halal, and Indonesia Good Manufacturing Practices (GMP) improving the product value and quantity, with a broader access to markets. *Interim target: by the end of Project's second year, Aquaculture Improvement Plan to meet the certification requirement for the two ponds has been available and implemented.*	3.2 Two model aquaculture ponds receive eco-certification (anticipated to be ASC) and at least 10 products halal and GMP certified.	on community's income, the project should invest also on market and product diversification

Activities

Output 1. Management plans for the protection of 15,000ha of mangrove ecosystem and their biodiversity are developed, approved, and implemented through strengthened village governance capacity.

Indicator 1.1 By the end of the project's second year consultations with local communities in the 3 target villages attended by 60 village leaders and community representatives are completed, and management plans for the protected mangroves are submitted by the Village Heads to the Regency Government for an approval through a Regent Decree and to the MOEF for an endorsement.

1.1.1 YKAN's Field Coordinators implement SIGAP (Communities Inspiring Actions for Change) approach through a live-in community facilitation to develop management plans for the protection of 15,000-ha intact mangroves. The coordinators will convene monthly community meetings in each village, facilitate discussion and provide technical advice based on YKAN's past experience (e.g. in the Bird's Head Seascape) regarding the demarcation, zoning, and management plan of a protected area. The meetings will be attended by min. 20 community representatives in each village, total 60 people for 3 villages.

1.1.2 YKAN with technical support from collaborating partners (University of Leeds and Mulawarman University) will assist the SIGAP process with GIS spatial analysis for demarcation, zoning, and produce preliminary management plans comprised of biodiversity status and conservation actions, sustainable harvest of the non-timber products of the protected mangroves, and communication and monitoring.

1.1.3 YKAN will facilitate final workshops in each village where the Village Government formally adopt the mangrove protection management plans and submit the documents to the Regency Government and the MOEF.

1.1.4 YKAN will facilitate consultation workshops at regency and provincial levels to assist the Village Governments to secure the Regency Government approval Decree for the management plan of the Protected Mangroves and the official endorsement from the MOEF.

Indicator 1.2 By the end of the project, the richness of mangrove tree species, mangrove-associated aquatic species, and key threatened species (e.g. proboscis monkeys-EN, chinese egrets-VU, adjutant stork-VU) for this target mangrove area in Berau are stabilized compared to validated baseline study.

1.2.1 Conduct biodiversity status reports (baseline and annually) that will include biodiversity survey and analyses by the collaborating university partners (University of Leeds and Mulawarman University). We will employ the use of environmental DNA sampling methods to monitor aquatic and associated terrestrial biodiversity, and field survey methods to monitor mammal and avifauna dependent on the mangroves in this region.

1.2.2 Conduct three-monthly physical-chemical characteristics of the water measurements (by collaborating university partners) in protected 15,000 ha mangrove area, and mangrove restoration, and daily measurement for the aquaculture shrimp ponds area of the 100ha SECURE site to understand their changes from the protection and restoration of the mangroves.

1.2.3 Using the biodiversity and water quality status information, develop biodiversity spatial prioritisation and protection recommendation which will inform the development of mangrove protection management plans across the three villages.

1.2.4 Provide biodiversity status data and information to Indonesia's Ministry of National Development Planning for the development of Indonesia's Biodiversity Strategy and Action Plan.

Indicator 1.3 By the end of the project, the village governments have capacity to develop policies, standards, and a management team to implement the management plan for 15,000 ha of village protected mangrove forest.

1.3.1 Undertake capacity needs assessment in terms of both human resources and equipment, and based on the findings, develop a strategy including a training plan, curriculum, and inventory of tools to improve the capacity of the government officials and community leaders.

1.3.2 Implement training plans; this will involve 3-5 workshop sessions where YKAN will assisted the village government and community leaders to develop mangrove protection policies and standard operating procedures for mangrove management.

1.3.3 YKAN supports village governments to establish community surveillance group and conduct community outreach protection and enforcement training sessions for 15 community surveillance group members.

1.3.4 Purchasing surveillance equipment, based on capacity needs assessment, anticipated to include: radio communication, drone, GPS, binoculars.

1.3.5 Conduct pre- and post-capacity building surveys to evaluate impact of both training and improved access to equipment

1.3.6 Disseminate lessons learned and best practices for community-based mangrove protection and restoration to the wider audiences through seminars at the regency, provincial, and national level, and other types of media such as poster, leaflets, and books.

Output 2. 10-year mangrove restoration and biodiversity improvement plan developed and approved for 5,000 ha of shrimp ponds and, a SECURE model 100 ha demonstration site (within the 5,000ha area) is established.

Indicator 2.1 By the end of the project's second year, village authorities have developed and approved spatial and management plans for the 5,000 ha shrimp ponds using FAO's Ecosystems Approach to Aquaculture (EAA) that takes into consideration the 15,000 ha protected mangroves and village areas.

2.1.1 YKAN will conduct carrying capacity analysis for shrimp aquaculture in the three villages using biodiversity and water quality information from 1.2 and develop preliminary plans for EAA development in the three villages.

2.1.2 Parallel with the 1.1 activities, Field Coordinators, with YKAN technical experts support, will facilitate the process to develop EAA using SIGAP approach in the three villages by convening monthly meetings for community leaders to review and finalize EAA management plans (zoning plan, communication and monitoring, and mangrove restoration plan).

2.1.3 Once finalized, YKAN will facilitate follow-up public consultations at the Regency level to obtain approval (Regent Decree) from Berau Regency Government for the implementation of EAA in the three villages.

Indicator 2.2 By the end of the project, ~80% of the 100ha SECURE model demonstration site is restored back to mangroves using hydrological or hybrid engineering restoration approaches.

2.2.1 YKAN will redesign the existing shrimp ponds for SECURE model by splitting the shrimp pond into two parts:(1) Aquaculture area (20%), mangrove restoration areas (80%). The community group will carry out the construction works: developing new pond dikes, creating water gate, shrimp pond canals, and supporting facilities including farmer hut and storage, and harvest platform.

2.2.2 Conduct mangrove restoration with the community, covering ~80% of the 100ha SECURE shrimp pond demonstration site. Restoration will be achieved by one of two possible approaches: hydrological improvement approach or hybrid engineering approach, depending on local situation

2.2.3 YKAN will undertake six-monthly vegetation analyses to monitor the restoration progress and identify actions necessary to ensure the success of restoration.

Indicator 2.3 By the end of the project, ~20% of the 100ha SECURE model demonstration site is being managed as shrimp ponds with improved aquaculture practices, which will increase overall shrimp yield by 30%.

2.3.1 YKAN will provide materials and technical expertise for community group to operate the SECURE ponds.

2.3.2 Community groups operating the total 20 ha shrimp ponds using YKAN's Better Management Practices for SECURE ponds.

2.3.3 Improve the community capacity (100 households) on implementing mangrove protection, restoration, and aquaculture improvement through the establishment of a community Aquaculture Field School (Sekolah Lapang Perikanan).

Indicator 2.4 By the end of the project, a business case for carbon finance for mangrove restoration and protection is developed and used as business proposal for carbon finance project.

2.4.1 YKAN will measure the carbon soil content, biomass (data from the six-monthly vegetation analysis), and analyse land cover change (via satellite imagery analysis and ground surveys) to provide accurate information about potential carbon emission reduction from the SECURE pond restoration at commencement and end of project.

2.4.2 A consultant will analyse the Berau mangrove carbon information, national regulation, and market opportunity to evaluate of the viability of carbon financing through the projection of carbon emission reduction potential, carbon price, shrimp production increased, and project costs to establish the SECURE ponds.

Indicator 2.5 By the end of the project, village authorities have the knowledge and capacity to manage carbon financing for the project area.

2.5.1 YKAN facilitates carbon project training for village government and BUMDES staff regarding carbon measurement, monitoring, and carbon accounting 101

2.5.2 YKAN will facilitate the Village Government and BUMDES staff to attend an apprenticeship week in a mangrove carbon project in Indonesia (eg. in North Sumatra).

Output 3. At the completion of the project (2025) the income of people working in shrimp aquaculture, mangrove ecotourism, and mangrove-based household industries in the 3 target villages is increased by 15% (compared to baseline in 2022).

Indicator 3.1 By the end of the project's first year, 100 selected households (400 persons, with at least 50% women) are trained in new practices in environmentally-friendly shrimp aquaculture, mangrove ecotourism, and non-timber mangrove-based household industry development.

3.1.1 Gather and analyse data on the natural resource conservation, poverty and livelihood (community benefits, social impacts), aquaculture practices and productivity, and village governance and social inclusiveness to improve the understanding on key socio-economic condition and changes (baseline and end of project).

3.1.2 YKAN to conduct training sessions and knowledge surveys to develop and strengthen Village Business Units by coaching BUMDES staff on the community's mangrove-based products business models.

3.1.3 YKAN will facilitate apprenticeship of community group members in a successful mangrove-based products business in other regency or province (e.g. South Sulawesi Province or East Java).

Indicator 3.2 By the end of the project, products produced by workers with mangrove-based livelihoods in at least two aquaculture ponds will meet the requirements for national and globally recognized certifications, (i.e., Aquaculture Stewardship Council (ASC), Halal, and Indonesia Good Manufacturing Practices (GMP) improving the product value and quantity, with a broader access to markets

3.2.1 YKAN will provide equipment needed by the Village Business Units for improving the quality of their products, including: refrigerator, water pump, solar panel.

3.2.2 YKAN will assist the communities in obtaining eco-certification (anticipated to be ASC) certification for two SECURE ponds and 10 halal and Indo GMP certificate for their mangrove-based products

3.2.3 YKAN will strengthen the community's small-scale enterprises by: (1) facilitating access to market through exhibitions and meetings with product off-takers, (2) linking the community enterprises with financial institutions, and (3) help connecting the community with relevant experts in livelihoods development.

Annex 3 Standard Indicators

Table 1 Project Standard Indicators

DI Indicator number	Name of indicator using original wording	Name of Indicator after adjusting wording to align with DI Standard Indicators	Units	Disaggregation	Year 1 Total	Year 2 Total	Year 3 Total	Total to date	Total planned during the project
DI-B03	Community based mangrove management plan for conservation developed and implemented	Number of new/improved community management plans available and endorsed	Number	N/A	1	1	2	4	3
DI-A01	Ecosystems Approach to Aquaculture (EAA) improvement plan in shrimp ponds (including SECURE model demonstration site)	Number of people from key national and local stakeholders completing structured and relevant training	People Proportion (Households)	Gender	F: 8 M: 24	F: 11 M: 35	F:15 M:40	F: 34 M: 99	100 households
DI-D01		Hectares of habitat under sustainable management practices	Area (hectares)	N/A	749 ha	120 ha	7,760 ha	7,880 ha	5,000 ha
DI-D07		Carbon Sequestered/Removed	Tonnes of CO2	N/A	2,376 tonnes	3,221 tonnes	3,984 tonnes	9,581 tonnes	4,950 – 7,920 tonnes
DI-D03	Richness of mangrove flora and fauna (e.g. mammals, water birds, aquatic biota) are stabilized in the 15,000ha protected areas and increased by at least 10% in the mosaic of restored mangroves compared to baseline study of 2022	Number of policies with biodiversity provisions that have been enacted or amended	Number of instruments	Policy typology (Local, National Policy)	0	1 (local)	4 (local)	5 (local)	1 national and 1 local
DI-D04		Stabilised/ improved species population (relative abundance/ distribution) within the project area	% Increase	Flora/Fauna/Fungi	0	33% (true mangrove species found)	58% (average of sapling and tree abundance)	0	10% increase
DI-D11	Average household income of people dependent on mangrove-related livelihoods across the 3 target villages will have been increased by 15% compared to baseline study of 2022	Number of people benefitting from improved sustainable agriculture practices and are more resilient to weather shocks and climate trends	People/ household	Gender	F: 0 M: 0	F: 106 M: 32	F: 228 M: 272	F: 334 M: 304	400 persons, with at least 50% women

DI-D16		Number of households reporting improved livelihoods	Households	N/A	0	86 (48.8% women)	105 (41,90% women)	105	100 Household

Table 2 Publications

Title	Type	Detail (authors, year)	Gender of Lead Author	Nationality of Lead Author	Publishers	Available from
Microplastics Leaving a Trace in Mangrove Sediments (Study in Indonesia)	Journal: Marine Pollution Bulletin Volume 195, October 2023, 115517	Muhammad Reza Cordovaa, Yaya Ihya Ulumuddina, Ali Arman Lubisb, Muhammad Taufik Kaisupya, Singgih Prasetyo Adi Wibowoa, Riyana Subandia, Deny Yogaswaraa, Triyoni Purbonegoroa, Jeverson Renyaana, Doni Nurdiansaha, Untung Sugihartob, Dienda Shintianatab, Sonia Saraswati Meiliastrib, Faza Putri Andinib, Suratnoc, Muhammad Ilmand, Aji Wahyu Anggorod, Basird, Simon M. Craggef (2023) a. Research Center for Oceanography, The Indonesian National Research and Innovation Agency, BRIN Kawasan Ancol Jl Pasir Putih 1, Jakarta 14430, Indonesia b. Research Center for Radiation Process Technology, The Indonesian National Research and Innovation Agency, Jl. Lebak Bulus Raya No.49, Jakarta 12630, Indonesia c. Research Center for Food Technology and Processing, The Indonesian National Research and Innovation Agency, Gading IV Playen Gunung Kidul, Yogyakarta 55861, Indonesia d. Yayasan Konservasi Alam Nusantara, Jl. Iskandarsyah Raya No.66C, Jakarta 12160, Indonesia e. Institute of Marine Sciences, University of Portsmouth, Portsmouth, United Kingdom f. Centre for Blue Governance, University of Portsmouth, Portsmouth, United Kingdom	Male	Indonesia	ELSEVIER	Link 1 Link 2
Conservation for production? The benefits of mangroves for sustainable shrimp aquaculture	Aquaculture International, Volume 33, article number 377, (2025)	Aji W. Anggoro, Miguel Castro, Muhammad Ilman, Sara Leavitt, Basir, Mariski Nirwan, Vabian Adriano, Andi Trisnawati, Topik Hidayat, Rahmadi Muis, Dzimar A. R. Prakoso, Yusuf Fajariyanto, Peter Benham,Yustina Octifanny, Muhammad M. Bayyan, Aldo R. A. Prananda, Arsy Husnanda	Male	Indonesia	Springer Nature	Link
How much carbon loss from mangrove conversion to aquaculture? A case study from East Kalimantan, Indonesia	Journal: Frontiers in Ecology and Evolution, section Biogeography and Macroecology	Nisa Novita, Adibtya Asyhari, Adi Gangga, Rasis Putra Ritonga, Chandra Agung Putra, Aji Anggoro, Yiwei Wang, Virni Budi Arifanti, Joni Jupesta and Muhammad Ilman (submitted on 26 April 2024)	30% F 70% M	Indonesia, Singapore	Frontiers	Link will be provided upon published

Implementing ecosystem approaches to aquaculture for shrimp farming ponds in Kalimantan, Indonesia	Aquaculture: Manuscript Submitted	Dominic Muenzel, Aji W. Anggoro, Dewi Embong Bulan, Yadi, Nurfadilah, Rahardian Pratama, Muhammad Ilman, Basir, Mariski Nirwan, Vabian Adriano, Muhammad M. Bayyan, Topik Hidayat, Andi Trisnawati, Maria Beger 1. School of Biology, Faculty of Biological Sciences, University of Leeds, Leeds, LS2 9JT, UK 2. Yayasan Konservasi Alam Nusantara, Graha Iskandarsyah Bld, 3rd floor, Jl. Iskandarsyah Raya No.66C, Jakarta 12160, Indonesia 3. Department of Aquatic Resource Management, Faculty of Fisheries and Marine Sciences, Mulawarman University, Samarinda, East Kalimantan, Indonesia 4. Faculty of Medicine, Mulawarman University, Samarinda, 75119, Indonesia 5. Faculty of Biochemistry, IPB University, Bogor, Indonesia	Male	UK	Science Direct	**Link**

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