

Optimizing site-based conservation approach to secure key species in Wallacea hotspot, Indonesia

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Abstract. Wallacea is a globally important biodiversity area, home to many endemic and endangered species. However, habitat loss, poaching, and unsustainable resource use continue to threaten these species, necessitating innovative conservation strategies. This paper examines the optimization of a site-based conservation approach as an effective strategy to protect key species in Wallacea. Site-based conservation focuses on protecting critical habitats and ecosystems that support species survival while addressing local threats. By combining scientific research, community engagement, and enforcement of conservation regulations, this approach aims to create a sustainable balance between human activities and biodiversity conservation. Key elements of this optimized strategy include habitat restoration, strengthening protected areas, and the use of community-based monitoring systems. The involvement of local communities ensures long-term conservation outcomes by aligning their interests with conservation goals. In addition, the use of species encounter monitoring tools can provide accurate data for adaptive management. Case studies from the *Program Kemitraan Wallacea 2* (PKW 2) demonstrate the success of this approach, highlighting how targeted, site-based efforts can stabilize populations of globally threatened species such as Banggai Cardinalfish, Dugong, Turtles, and several shark species. The paper concludes with recommendations for relevant site-level protection schemes to be replicated to preserve biodiversity.

1 Introduction, scope, and main objectives

Wallacea hotspot, which lies in the Indonesian archipelago and Timor-Leste between the Sunda and Sahul continental shelves. This region covers an area of 33.8 million hectares and comprises three biogeographic subregions: Maluku, Lesser Sundas, and Sulawesi. As a result of subduction and volcanic activity, the land area in Wallacea is fragmented into thousands of small islands and a few bigger ones (of more than a million hectares) separated by oceanic trenches [1–3]

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The marine basins between the island arcs may be as deep as 7,000 meters and are swept by powerful currents [3]. These form a barrier to the dispersal of terrestrial species and an obstacle to the dispersal of marine species [4]. As a result, the marine area of this region, together with the neighbouring area that forms the coral triangle, has the richest marine biodiversity on earth [5]. Wallacea water is exceptionally rich in coral species, with the main types of coral reefs being fringing reefs and atolls [6].

The key conservation issues facing marine ecosystems in Wallacea include: destructive fishing practices, such as the use of explosives and poison, by both local communities and outsiders traveling from distant areas; conversion of mangroves for commercial development and housing; and conversion of nearshore habitats, such as reefs and seagrass beds, due to sea farms, port development and dredging [7]. All these practices destroy coral reefs and the biota they support. When combined with pollution, sedimentation from degraded land runoff, and ocean warming, they stress the coral to the point where disease and bleaching result, followed by the physical erosion of the reef [8].

To address these issues in the Wallacea Hotspot, Burung Indonesia is implementing Program Kemitraan Wallacea 2 (PKW2). PKW 2 is a grant program managed by Burung Indonesia that aims to strengthen civil society engagement and effectiveness in the conservation and management of globally important biodiversity in Wallacea. Management of globally important biodiversity in Wallacea. Since its launch, the PKW 2 has disbursed grants to 43 civil society organizations in Indonesia. This grant program has contributed to building cross-sectoral partnerships between government, nongovernmental organizations, and local communities to develop coastal management strategies through a collaborative approach [11] From those conservation actions, some positive impact on key marine species in the Wallacea Hotspot was extracted, alongside valuable lessons learned and the identification of critical success factors

2 Method

This paper uses primary data collected from reports of activities carried out by at least 44 Civil Society Organizations (CSOs) that joined in a collective action of Program Kemitraan Wallacea 2 (PKW 2), which was led by Burung Indonesia. This program conduct varieties of conservation activities in marine corridor throughout Wallacea marine corridor which identified based on (Beyer *et al.*, 2018) that asses a set of reefs using indicators of past, recent and predicted future thermal stress, larval connectivity and vulnerability to cyclone damage. That analysis divides reefs into regions (bioclimatic units, BCUs) containing approximately 500 km² of coral, then identifies the top fifty percent of those that perform best in relation to the indicators of stress.

These conservation actions were conducted with the aim of conserving the coastal and marine biodiversity and its ecosystems through the active role of local fishermen and support from several stakeholders at the village, sub-national, and national levels.

The relevant information related to the impact of the activities on the Endangered, Threatened, and Protected marine species is thus being extracted and assessed to produce a report of the project impacts descriptively. This paper was drafted at the end of 2024, while the data itself was collected from 2020 to 2024. The research was located in the Wallacea priority marine corridor of Pangkajene Kepulauan, Alor, Seram, and Togean- Banggai. The corridor was chosen due to the occurrence of Program Kemitraan Wallacea 2 grantee projects, which were identified in the updated Wallacea profile ecosystem process in 2020 (CEPF, 2020 *Unpub*)

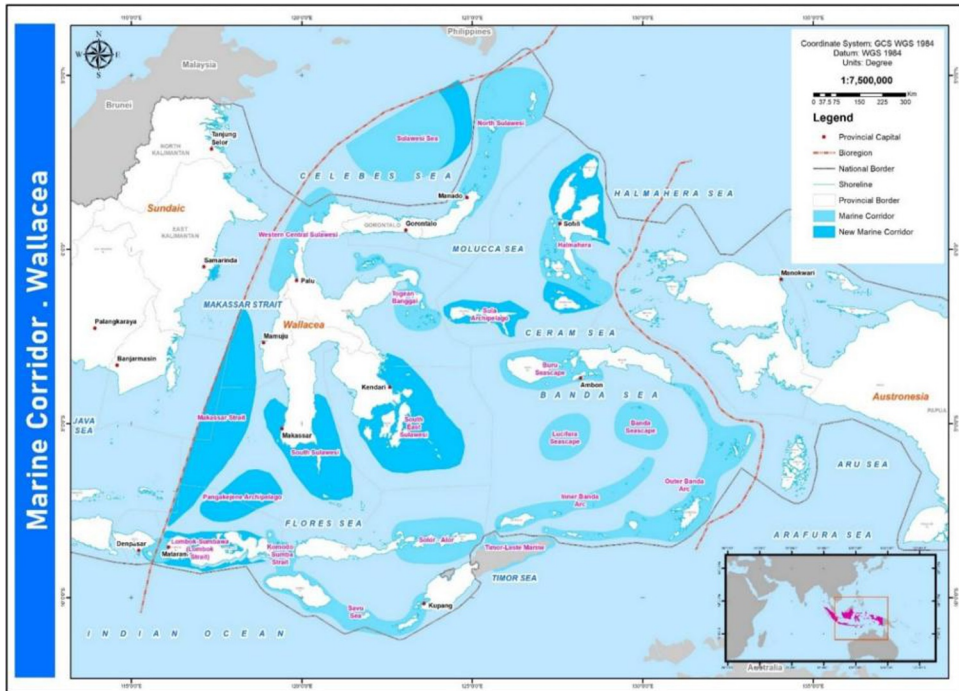


Fig. 1. Location for data collection in Wallacea Priority Marine Corridor

In this research, we created a simple tool in an Excel spreadsheet to extract the information from the CSO's report. The information collected is not just for the administrative use of the PKW 2 program management but also on the impact to biodiversity, community beneficiaries, habitat, ecosystem, policy and economic impact. For this paper, we are focus on addressing the impact of the conservation actions of the program to marine key species.

3 Results

Implementation of the conservation actions conducted throughout the Program Kemitraan Wallacea 2 by a total of 61 projects implemented by 46 different Civil Society Organizations (CSOs) has produced positive impacts, especially for the endangered, threatened, and protected marine species. From the collected data, the information shows that at a minimum, seven 7 marine key species were regularly monitored to be impacted by the conservation actions.

The information collected is not only restricted to the list of impacted species, but also the information on conservation status, approach of the project, and what the impacts of the conservation actions are in detail for those species, such as reducing the number of hunting, bycatch, and even establishing species-related policy.

In the Program Kemitraan Wallacea 2 implementation, most of the projects are addressing the gaps in sustainable small-scale fisheries governance. Only a small part of the project activities targeted certain key marine species.

Component for key marine species, usually being integrated in other components of the projects, such as coastal ecosystem assessment, participatory mapping of the coastal ecosystem, or in education and awareness activities.

Table 1. Key marine species directly impacted by community-based conservation

No	Species	Scientific Name	IUCN Status	Approach	Impact
1	Banggai Cardinal Fish	<i>Pterapogon kauderni</i>	Endangered (EN)	Community-protected area, policy advocacy	Establishing a National Species Action Plan on Banggai Cardinal Fish and improving its microhabitat in two villages in Banggai Laut.
2	Dugong	<i>Dugong dugon</i>	Vulnerable (VU)	Sea-grass habitat protection, monitoring	Increased number of community-based protected seagrass habitats at two coastal villages in Sangihe. North Sulawesi.
3	Green Turtle	<i>Chelonia mydas</i>	Endangered (EN)	Awareness and education	Increased the number of community-led semi-natural hatcheries by protecting 41 turtle nests in Langkai and Lanjukang island.
4	Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Critically endangered (CR)	Awareness and education	Reduced the number of sea turtle bycatch and released a total of 3943 sea turtle hatchlings in South Sulawesi.
5	Pelagic Thresher Shark	<i>Alopias pelagicus</i>	Endangered (EN)	Alternative livelihood	Reduced number of individual thresher sharks captured by fishermen, from 233 individuals at the start to 55 individuals by the end of the project. (Shidqi <i>et al</i> , 2025)
6	Sandfish	<i>Holothuria scabra</i>	Endangered (EN)	fisheries management	Improve Sandfish fisheries management by two communities in Togeang islands, Central Sulawesi, and Sapuka islands, South Sulawesi

The impact has resulted from various activities that involve the local community, which include education and awareness, research, livelihood, and policy advocacy. Combined with traditional knowledge of the local coastal community, it was able to successfully increase the protection of key marine species.



Fig. 2. Activities targeted at key marine species conservation



Fig. 3. Pelagic thresher shark and Dugong, which were impacted by the conservation actions in Wallacea

4 Discussion

In Alor, the area was known as one of the main migration routes of the endangered Pelagic thresher shark, *Alopias pelagicus* [9]. Unfortunately, the local fishermen were known to fish for the species and sell it to the market. The project aimed to reduce the number of captured thresher sharks through various activities. The local CSO that is supported by Burung Indonesia then designs various activities such as research, monitoring, training, education, and alternative livelihoods to achieve the goal.

Shark fishermen were chosen and facilitated to establish a fishermen's group. This group is then given education and awareness about the thresher shark and its conservation value. After that, the group was trained to fish for more valuable and sustainable yellowfin tuna. The women's group was also actively involved by training them on producing and selling tuna products, which helps increase daily income. The positive outcome of increasing household income then affected the number of captured pelagic thresher sharks, which dropped significantly, as shown by monitoring results. This project in Alor has demonstrated that a livelihood-based approach to thresher shark conservation could succeed [10]

In Sangihe, North Sulawesi, the local community was actively involved in various activities that aim to increase the protection of the Dugong and sea grass habitat. The activities include education awareness on Dugong and its importance to the ecosystem, along with educating the fishermen on the ecology to reduce the accidental killing of Dugong by hitting fishermen's boats. Other activities also include participatory coastal mapping to map the important sea-grass meadows, where the mapping results are being discussed with the community and village government to determine fishing areas and coastal ecosystem management.

The work in Sangihe, also supporting the provincial government of North Sulawesi and the Ministry of Marine and Fisheries Affairs, is encouraging in designating and establishing the Dugong habitat in Sangihe to be declared as a formal marine protected area.

Meanwhile, in the Banggai Islands. Community-based conservation actions are working to conserve the Banggai Cardinal Fish. Banggai Cardinal Fish *Pterapogon kauderni* is a unique, reef-associated fish species that has limited distribution to the Banggai island and its few nearby islands (Bernardi & Vagelli, 2004). Several to secure the habitat and its reef association through education and awareness, especially to reduce the consumption of

anemone and sea urchin, which both are closely associated with the life cycle of Banggai Cardinalfish. The community-based protected Banggai Cardinalfish habitat is formed through participatory mapping and agreement with the local community.

Aside from site-based protection of Banggai Cardinalfish habitat, other effort on policy at the national level was also conducted by supporting the process of drafting of strategy and public consultation of the ministerial decree on the national species action plan for Banggai Cardinalfish. This document will be the guideline for stakeholders who work on Banggai Cardinalfish conservation.

From these several cases, we find that several factors was supporting the successful impact of the conservation actions to the key marine species; such as a) key issue, conservation model and priority settings, which helps projects to more strategically address the suitable issue on the targeted area; b) Strategic policy mapping, which helps to determine what strategic policy needs to be intervened or even to be encourage; c) Strategic engagement with key stakeholder; which is the most important factor in determining the success of a conservation actions, especially on gathering additional supports outside of the available resources; d) Local knowledge & community rights acknowledgement; e) Capacity building and knowledge sharing; f) Active role of local community and CSO network.

5 Conclusion

Based on our findings, a different approach to conserve marine biodiversity and sustainable natural resources management could be implemented based on the local context. Different sites may need a different approach and model.

For areas that have not been covered by a formal MPA network, the community-based conservation approach may become the most suitable approach in conserving biodiversity. Thus, the government should identify and give support to the existing community-based conservation actions. CSO also played an important role in the success of such an approach. CSO strategically supports the community through capacity building and facilitating the local community in conserving marine biodiversity and managing the coastal habitat.

Therefore, relevant site-level key marine protection schemes need to be replicated to secure biodiversity across the region, ensuring the survival of Wallacea's hotspot unique species. Thus, a simple monitoring tool has been proven to be useful in monitoring the impact of a project on the conservation of key marine species.

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