

Coral reef biodiversity conservation and connectivity in the southern Gulf of Thailand to support reef resilience and sustainable use



PSU-TUYF five years summary report

1 Oct 2021 – 31 Aug 2026



**ENVIRONMENTAL
MANAGEMENT**

PSU-TUYF
Charitable Trust Fund



Coastal Oceanography
and
Climate Change
Research Center



Executive summary

Over five years (2021–2026), this project transformed coral reef research in the southern Gulf of Thailand from fragmented, data-poor monitoring into an integrated, scalable model for science-based reef management. Working across seven reef sites and multiple coastal communities, the project combined ecological surveys, experimental biology, molecular analysis, social science, and economic valuation to generate knowledge that could directly inform management and policy.

The work began by listening – to reefs and to the people who depend on them. Baseline ecological surveys were paired with community engagement to understand how reefs function as ecosystems, livelihoods, and cultural assets. This foundation enabled the development of a locally relevant reef resilience index, translating complex ecological and social data into clear, decision-ready insights. The index revealed strong spatial variation in resilience and identified priority areas for intervention, particularly in Songkhla Province.

Kham Island emerged as a focal site where integrated science could be applied in depth. Controlled experiments revealed coral vulnerability to low-oxygen stress and disease, while tourism carrying capacity assessments linked human use directly to ecological thresholds. Social research documented governance gaps and community practices, enabling science to be translated into realistic management pathways. Over time, Kham Island evolved into a living laboratory and regional reference site for coral reef research and training.

Executive summary

(Continued)

By the final year, the project had expanded to emerging stressors such as microplastics, and documented coral spawning in Songkhla Province for the first time. Crucially, local fishing communities transitioned from consultation to independent stewardship, actively monitoring and protecting reefs. **A Social Return on Investment (SROI) analysis demonstrated a 1:4.51 return**, quantifying the significant socio-economic and ecological value generated relative to the initial investment.

The project's evidence base supported direct engagement with national agencies, resulting in seed funding and international support to scale coral connectivity science across the Gulf of Thailand. Delivered within budget and leveraged into additional funding, the project demonstrates how integrated, place-based science can move from local reefs to national policy — leaving a lasting legacy of knowledge, capacity, and collaboration.





From listening to leadership: scaling coral reef science from local reefs to national policy

Over five years, this project transformed coral reef science in the southern Gulf of Thailand.

By combining rigorous research with community knowledge and policy engagement, it shows how local reefs can become anchors for national decision-making.

What began with listening evolved into leadership, stewardship, and scalable solutions for reef resilience in a changing climate.



Coral reef management needed a new approach

- Southern Gulf reefs were data-poor but socially critical
- Management decisions lacked integrated ecological + social evidence
- Climate stress demanded place-based, scalable science

Coral reefs in the southern Gulf of Thailand support fisheries, tourism, and coastal identity, yet remained under-studied and under-protected. Management decisions were often made without integrated ecological or social evidence. At the same time, climate change intensified local pressures. This project addressed a critical gap: how to generate science that is credible, locally grounded, and usable for real-world reef management.



Science works best when it starts by listening

- This project embedded rigorous science in local realities
- Combined ecology, physiology, molecular biology, and social science
- Designed from day one to translate into action

This project was built on a simple principle: science is most powerful when it starts by listening. Listening to reefs, through careful observation and experimentation. Listening to people, through dialogue with those who depend on reef ecosystems. By integrating ecological surveys, experimental biology, and social science, the project was designed not just to generate data, but to translate knowledge into action.



Year 1: Listening to reefs & people

- Baseline surveys across 7 reef sites
- Community dialogues in 5 coastal villages
- Multidisciplinary research team established

The first year focused on understanding before intervening. A multidisciplinary team conducted baseline ecological surveys across seven reef sites in Songkhla, Pattani, and Narathiwat Provinces.

At the same time, researchers met with coastal communities to document reef use, livelihoods, and change over time. This dual listening process grounded the project in both ecological reality and social context.

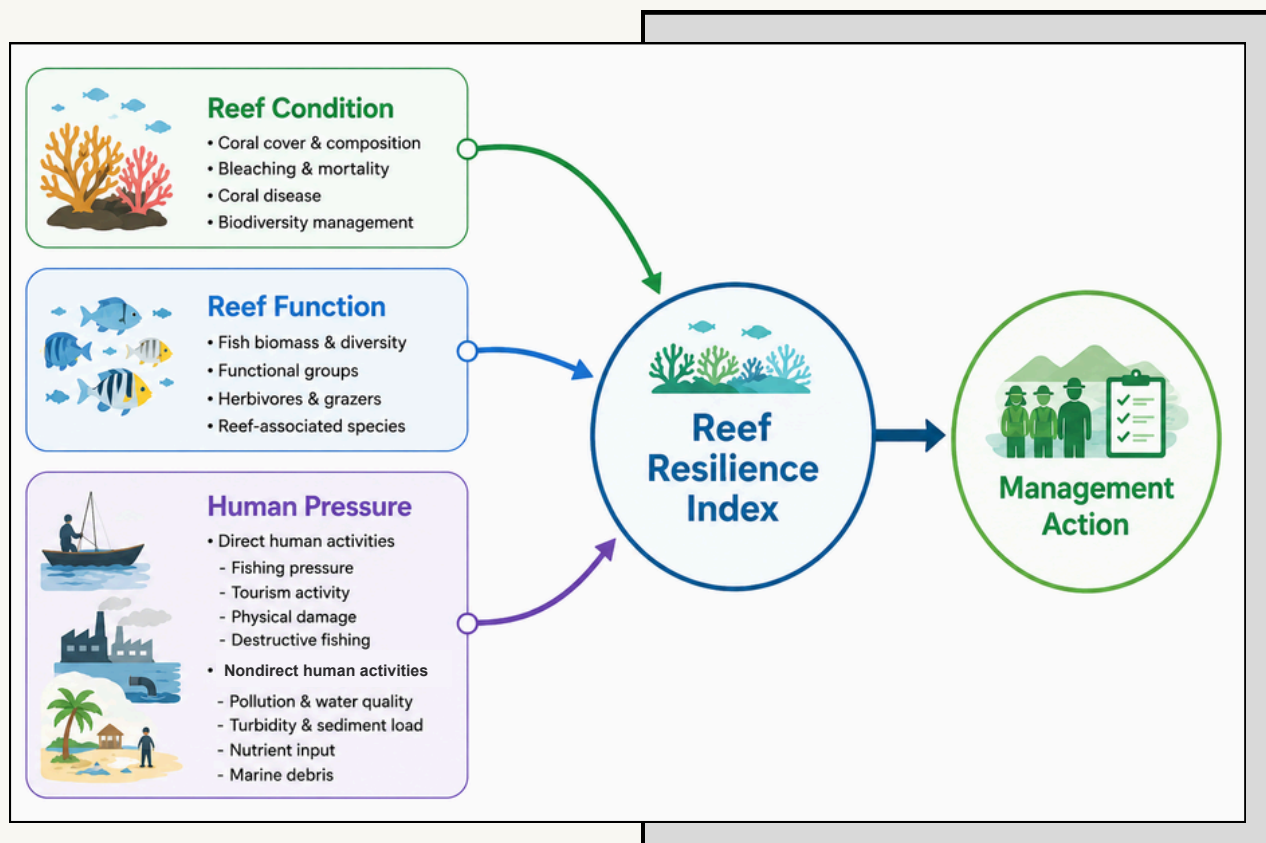


What Changed (Year 1)

Reefs became visible — socially and scientifically

- First integrated ecological & social baseline for the region
- Reefs recognised as living infrastructure, not abstract sites
- Trust established with local communities

Previously fragmented knowledge became visible and connected. For the first time, reefs in the southern Gulf were documented not only as ecosystems, but as social-ecological systems. Baseline data established reference points for future change, while community engagement built trust and shared ownership. Reefs shifted from being overlooked spaces to recognised foundations of local economies and identities.

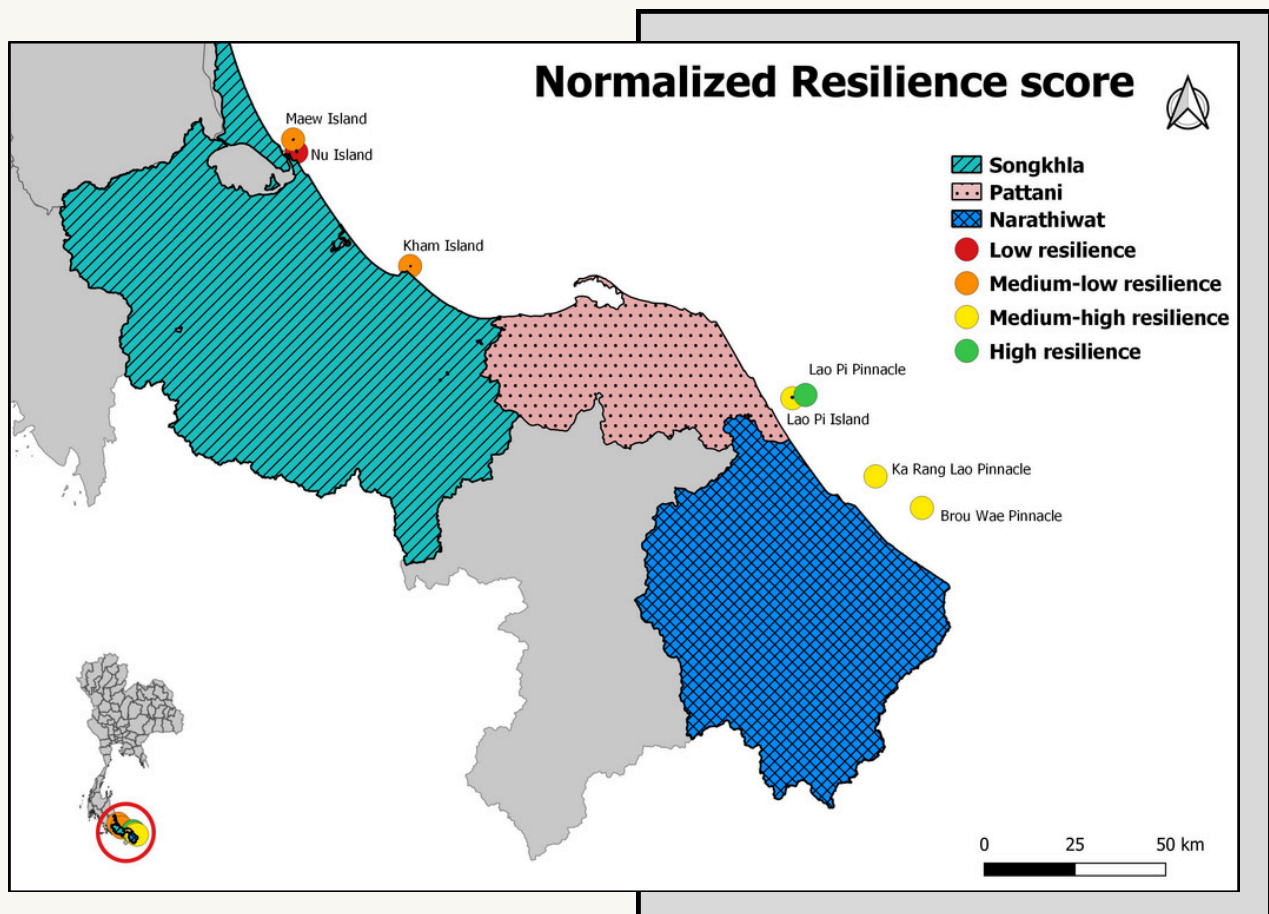


Year 2: Turning data into meaning

From raw data to decision-ready insight

- Locally relevant reef resilience index
- Integrated human pressure + ecological indicators
- Wet lab established for experimental science

With baseline data in place, the project moved from observation to interpretation. Ecological indicators such as coral health and fish communities were integrated with human pressures including fishing, tourism, and pollution. This led to the development of a locally relevant reef resilience index, translating complex data into clear, comparable scores that could inform prioritisation and management.

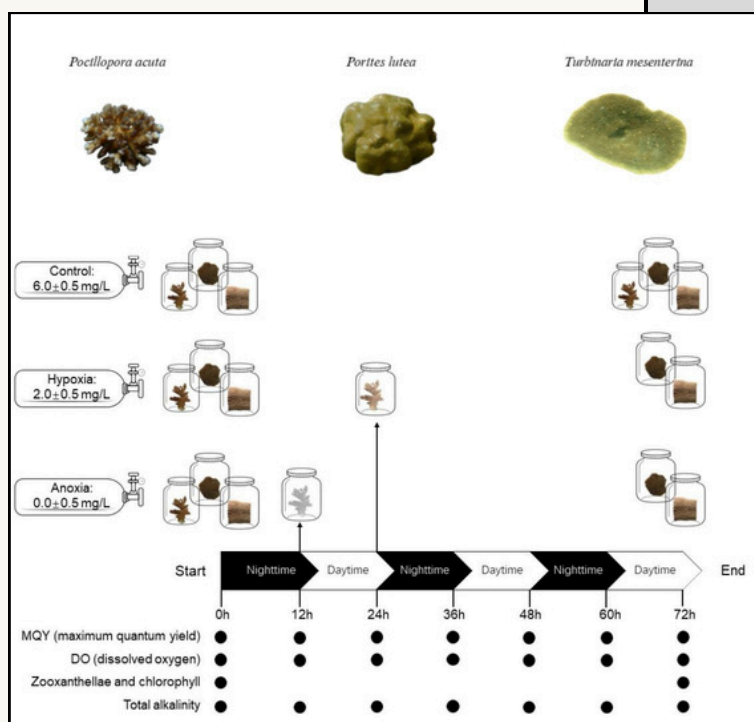


What changed (Year 2)

Managers could finally see where to act

- Clear identification of high vs low resilience reefs
- Songkhla reefs flagged as priority intervention zones
- Science translated into interpretable scores

Resilience mapping revealed where intervention mattered most. Reefs in Pattani and Narathiwat showed medium to high resilience, while reefs in Songkhla emerged as more vulnerable due to tourism and local stressors. For the first time, managers could see spatial patterns of risk and resilience, enabling evidence-based decisions rather than uniform or reactive approaches.



Year 3: From knowledge to stewardship

Science gains power when communities engage

- Priority site identified: Kham Island
- Controlled hypoxia experiments
- Deep community governance research

Building on two years of integrated data, the project identified Kham Island as a priority site. Scientific work deepened through controlled experiments examining coral responses to low oxygen stress. In parallel, social research explored governance, reef use, and community-led conservation. Kham Island became a focal point where science, society and management could meaningfully intersect.



What changed (Year 3)

Kham Island became a living laboratory

- Mechanistic understanding of coral vulnerability
- Community engagement shifted

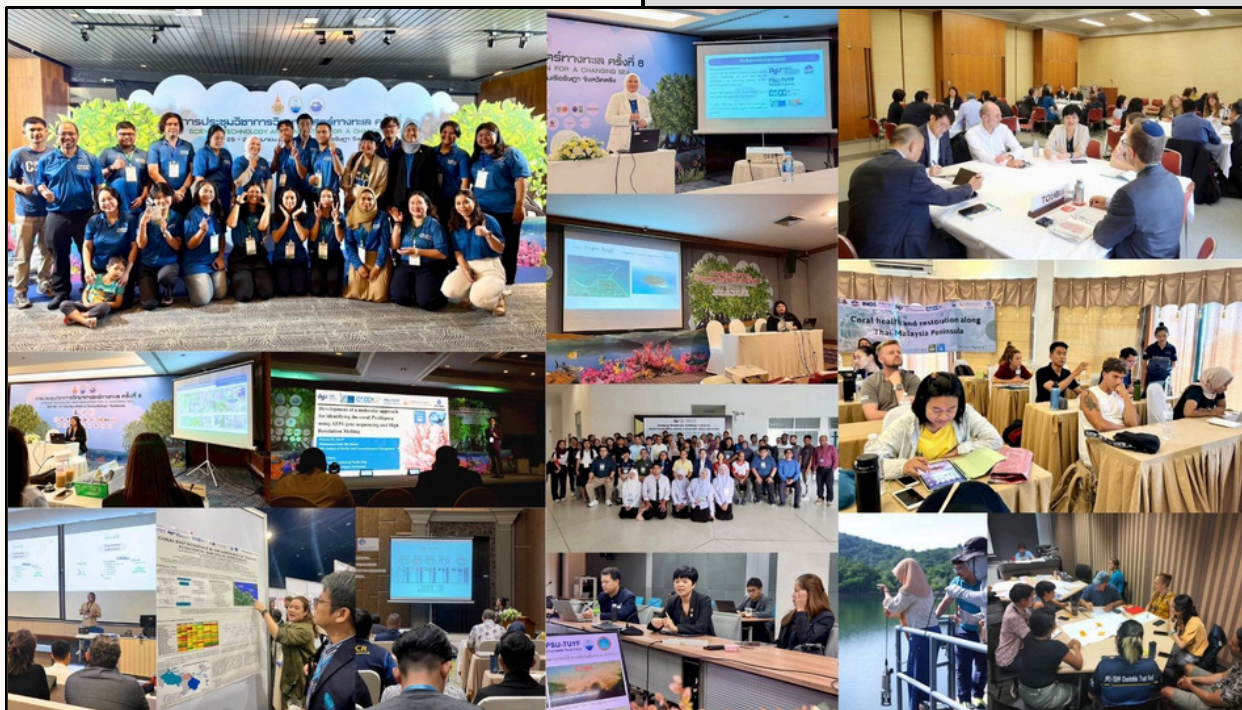
Experimental results revealed the biological limits of corals under local stressors, while social research clarified where community action was effective and where policy support was needed. Science became directly relevant to management, and communities were no longer passive stakeholders. This shift also translated into tangible livelihood opportunities: community members gained occupations as tourism practitioners, acted as knowledge communicators for visitors, and contributed to the development of a more informed and responsible ecotourism model.



Year 4: Deep science, broader Reach From physiology to policy relevance

- Gene expression & disease experiments
- Tourism carrying capacity assessment
- Strong international exposure & training

In Year 4, research expanded from physiological responses to molecular mechanisms. Gene expression and coral disease experiments deepened understanding of vulnerability under environmental stress. At the same time, tourism carrying capacity assessments linked reef condition to human use. The project also strengthened regional and international collaboration, positioning Kham Island as a reference site for reef science.



What changed (Year 4)

Local science entered regional conversations

- Kham Island recognised as a reference site
- Evidence linked tourism pressure directly to reef stress
- Young scientists trained in advanced methods and communication

Local research gained regional relevance. Scientific evidence connected tourism intensity directly to ecological thresholds, supporting practical management guidance. Young scientists trained through the project developed advanced technical and communication skills, presenting findings internationally. What began as a local study increasingly contributed to regional conversations on coral resilience, conservation, and sustainable reef use.

Coral spawning record at Songkhla (Maew Island Apr 2025 and Kham Islands Apr 2026)



Year 5: Returning knowledge to society Science comes full circle

- Ongoing assessment of emerging stressors on coral health
- First coral spawning records in Songkhla
- Economic valuation of reef ecosystems

The final year focused on completing the science loop. Research expanded to emerging stressors, including microplastics, sedimentation, coral disease caused by pathogenic bacteria and documented coral spawning in Songkhla Province for the first time. Economic valuation translated reef condition into societal and livelihood value. At the same time, findings were shared through exhibitions, schools and public dialogue, ensuring accessibility beyond academia.

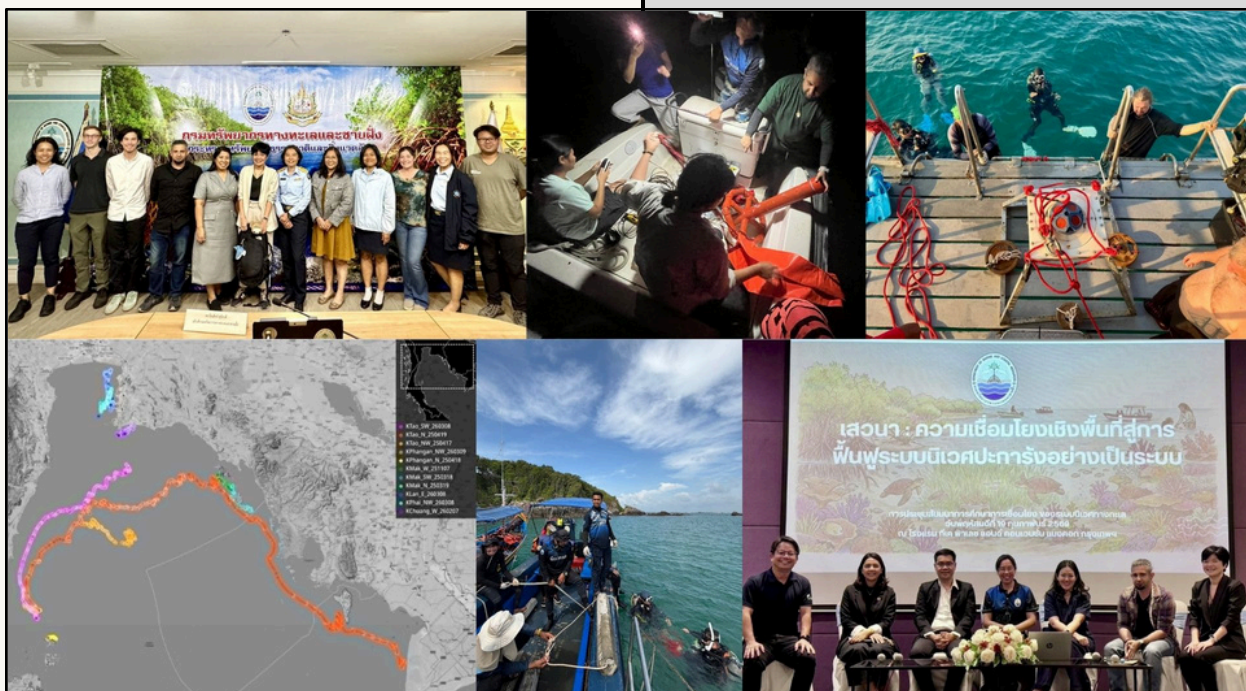


What changed (Year 5)

Communities became stewards

- Conservation shifted from project-led to community-led
- Trust became long-term governance capacity

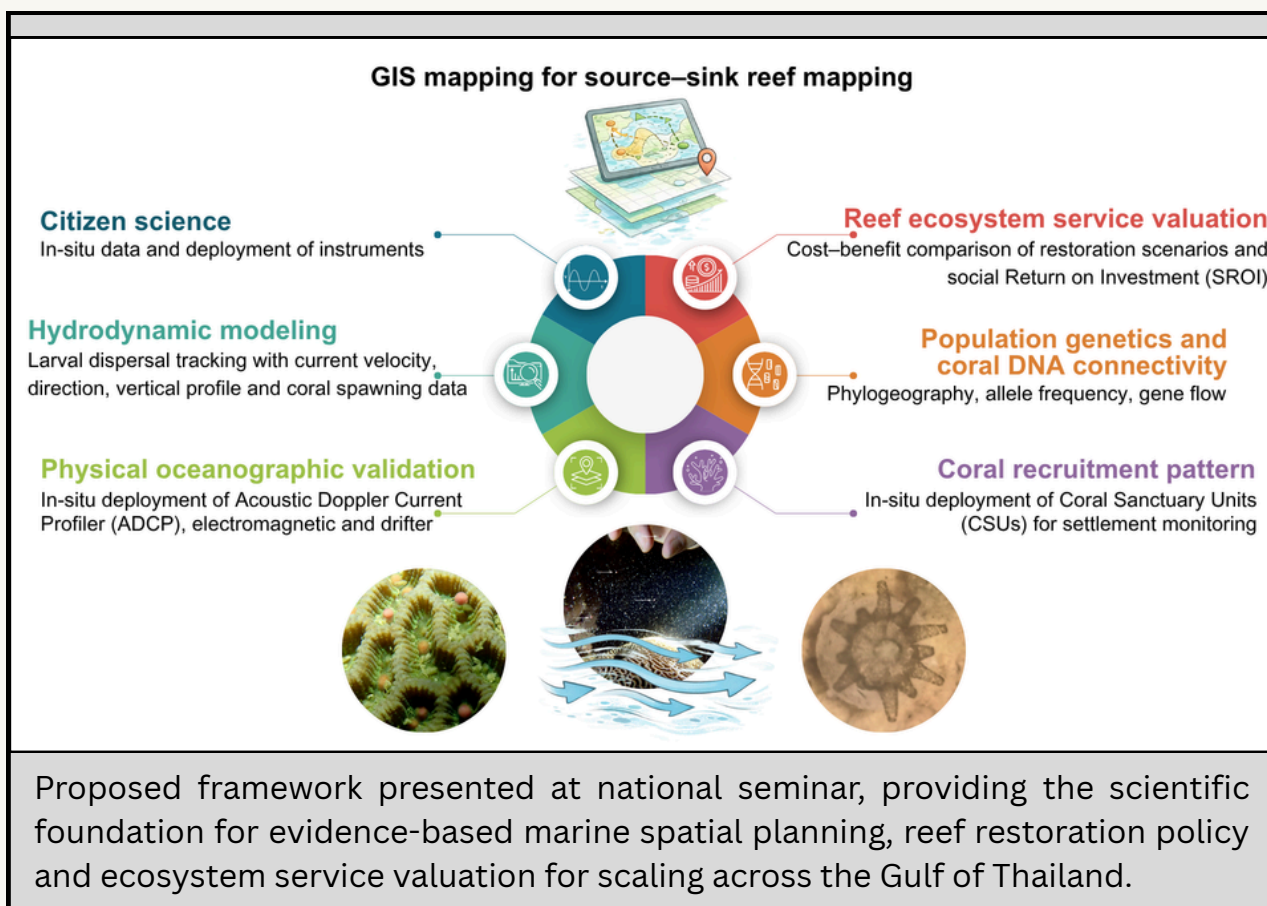
Communities became stewards. Fisher groups around Kham Island now monitor reefs, support conservation, and collaborate closely with authorities as co-stewards of the ecosystem. The relationship has shifted from project-led engagement to community-led action, with our university team providing occasional support when needed, particularly in the form of education and training. This transition represents one of the project's most significant legacies: long-term stewardship capacity that continues beyond funding cycles or research timelines.



Scaling Beyond One Reef From one island to Thai Waters

- Engagement with DMCR
- Seed funding for national connectivity pilot
- International support via CORDAP

With strong local evidence, the project expanded its horizon. Engagement with the Department of Marine and Coastal Resources demonstrated how integrated science could support national reef management. Seed funding and international support enabled the next phase: scaling coral connectivity science beyond a single site to inform restoration, planning, and resilience across Thai waters.



Policy Pathways

How science entered decision-making

- Evidence informs restoration, zoning, and spatial planning
- Connectivity science supports national reef resilience
- Economics translates ecology into policy language

This project created clear pathways from science to policy. Integrated ecological, social, and economic evidence now supports reef prioritization, spatial planning, and restoration strategies. Connectivity science links local reefs into national systems, while economic valuation translates ecological outcomes into policy-relevant terms. Together, these tools enable informed, forward-looking marine governance.

KEY OUTPUTS

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- 1** Resilience mapping (7 reefs)
 - 2** Experimental coral stress science
 - 3** Tourism carrying capacity tools
 - 4** Economic valuation
 - 5** Coral spawning documentation
 - 6** Publications & datasets

Over five years, the project delivered integrated reef resilience assessments, experimental evidence on coral stress and disease, tourism carrying capacity tools, economic valuation of reef ecosystems, and the first coral spawning records for Songkhla Province.

These outputs are supported by peer-reviewed publications, datasets, trained scientists, and communication materials designed for use beyond academia.

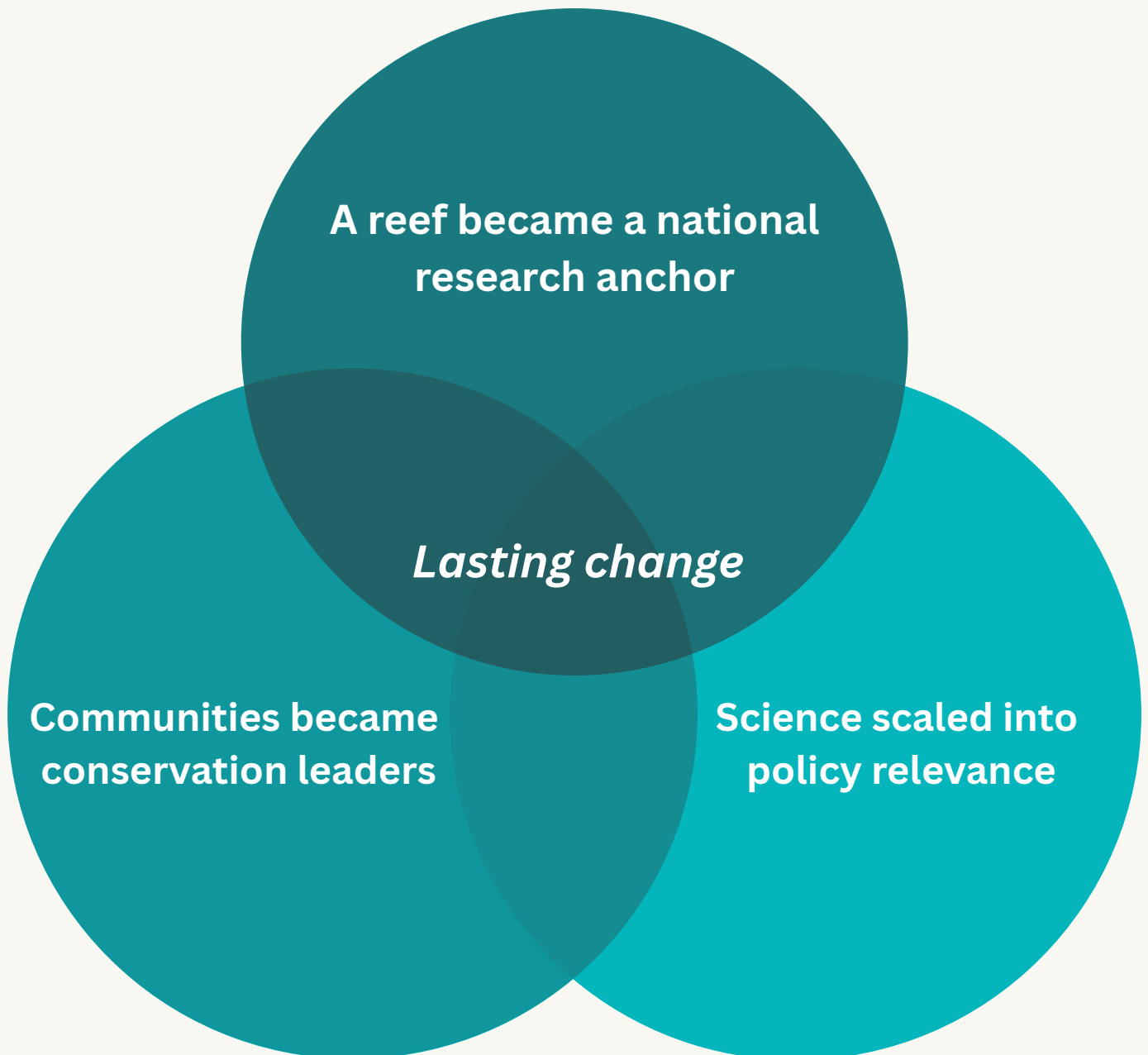
IMPACT



The project strengthened science, communities, and institutions simultaneously. Scientific knowledge became integrated and place-based. Communities gained confidence, skills, and stewardship roles. Government agencies gained actionable evidence and trusted partnerships.

Rather than isolated outputs, the project produced a connected system capable of supporting long-term reef management and adaptation.

OUTCOMES



A single reef became a platform for national relevance. Community consultation evolved into independent stewardship. Scientific evidence informed funded pilot studies and future policy directions.

The project demonstrated that when science is embedded locally and designed to scale, it can move from observation to transformation—benefiting ecosystems, livelihoods, and governance structures alike.



The PSU–TUYF Charitable Trust Fund supported this project with a five-year investment of THB 4.78 million. Funds were used as approved, with transparent tracking across research, training, fieldwork, and outreach. Importantly, this investment leveraged additional national and international funding, extending impact well beyond the original grant period.

This project leaves behind more than data. It leaves a model for integrating science, society, and policy. A model for scaling from local reefs to national relevance. And a model for empowering communities as long-term stewards of marine ecosystems.

The work continues, but the foundation for resilient, evidence-based reef management is firmly in place.

OUR TEAM



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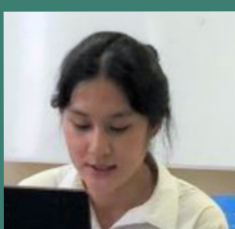
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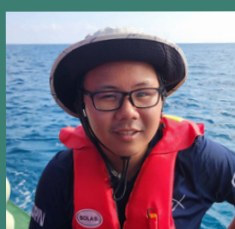
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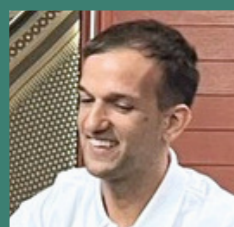
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