Seagrass meadows support biodiversity and people in Trang, Thailand

TECHNICAL REPORT
For the IKI Seagrass Ecosystem Services Project

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The IKI Project is a partnership between the CMS, Edith Cowan University, Project Seagrass, Seagrass Watch Ltd, Murdoch University, MRS, Blue Ventures, SAN, C3, ZSL, MareCet and Yapeka. The collaboration enhances understanding of seagrass ecosystem services and the capacity to develop and deliver science-based policy solutions in seagrass conservation. It brings together scientists, policy experts, business development experts and conservation NGOs to provide expert and independent advice on seagrass ecosystems services and how these might be relevant to policy and financial solutions to marine conservation issues. This report deals specifically with the assessment of seagrass blue carbon ecosystem services.

Seagrass meadows support biodiversity and people in Trang

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Summary

In our comprehensive investigation into the symbiotic relationship between seagrass meadows, biodiversity, and local communities in Trang, a dual-method approach was employed. Firstly, a historical examination grounded in social sciences provided insights into the past socio-economic dynamics of the region. This retrospective analysis by comparison, based on extensive social-economic surveys and Catch Landing Survey afforded a nuanced understanding of the historical interplay between seagrass ecosystems and local communities.

Complementing the social sciences aspect, our study incorporated rigorous scientific methodologies. Baited Remote Underwater Video (BRUV) surveys, a cutting-edge tool in marine ecology, allowed us to explore the biodiversity supported by seagrass meadows. This method provided invaluable visual data on the marine life thriving within and around seagrass habitats.

Simultaneously, meticulous collection of seagrass data, including factors such as canopy height and density, was conducted. This scientific approach, combined with the historical social sciences framework, offered a holistic perspective on the multifaceted roles played by seagrass meadows. The integration of past and present methodologies not only enhances our understanding of the intricate ecological relationships but also sheds light on the dynamic interactions between seagrass ecosystems and the communities that depend on them in Trang.

Seagrass meadows were typically characterised by 3 of species, including *Enhalus acoroides*, Halophila ovalis and *Cymodocea rotundata*. Seagrass meadows comprised of species *Enhalus acoroides* had greater canopy height. The findings unequivocally point to a crucial relationship between canopy height and the health of seagrass ecosystems. Lack of seagrass was observed at Sukorn island as we navigate the challenges and opportunities presented by Sukorn Island's unique environment, community-driven regulation emerges as a cornerstone for fostering resilience, sustainability, and the harmonious coexistence of both nature and society and it was unable to be presented vs Mook island. Whilst there were varying levels of seagrass health at Mook island it was determined that it was considerably healthier than those meadows at Sukorn. As the canopy serves as a vital component of seagrass health, understanding and managing its height is paramount for the overall well-being and sustainability of these crucial marine habitats. The decrease of seagrass area incurs additional expenses, mirroring the rising costs of fisheries, exacerbated by the scarcity of seagrass areas in close proximity.

Introduction

Seagrass ecosystems play a pivotal role in coastal environments, serving as vital habitats for numerous marine species and providing a range of ecosystem services. Their ability to sequester carbon, stabilize sediment, and support diverse communities makes them crucial components of coastal ecosystems worldwide.

Despite their recognized importance, particularly in Trang Province, seagrass ecosystems face a myriad of threats, and under threat from Enhalus dead meadow impacted by sedimentation and Global Warming, Green Turtle overpopulation to overgrazing and Illegal, unreported and unregulated (IUU) fishing, and one of the significant challenges is the impact of illegal fishing gears. Illegal fishing practices have been reported to detrimentally affect seagrass beds, leading to a decline in seagrass coverage. The deleterious consequences of such activities on seagrass health and biodiversity underscore the urgent need to investigate and understand the specific mechanisms through which illegal fishing gears contribute to the degradation of seagrass ecosystems. The need to unravel these intricacies is imperative for effective conservation and management strategies.

This preliminary research aims to question to what degree do local fishery communities depend on seagrass ecosystems for sustenance and livelihoods, and how does the degradation of seagrass beds due to illegal fishing practices impact their well-being? and What are the economic and social impacts of declining seagrass beds, specifically in terms of their importance for fishing activities on Sukorn Island? Specifically, we seek to elucidate the extent of these impacts, contributing valuable insights to the broader understanding of the ecological dynamics of seagrass ecosystems and informing targeted conservation and management strategies.

This study addresses this gap by undertaking a comprehensive investigation into the environmental conditions, species composition, and anthropogenic impacts on seagrass ecosystems of seagrass abundance and diversity and seagrass degradation. A primary objective is to compare these aspects across multiple sites, The two primary study sites were in Sukorn Island and Mook Island (Figure 1). The primary aim of this research is to compare the seagrass ecosystems on the two islands, identify key factors influencing their states, and explore the implications for local communities and fishing activities. Additionally, a key objective is to assess and document the diversity of the aquatic population associated with seagrass habitats across the studied sites. Furthermore, the research aims to compare two distinct islands to evaluate the ecosystem services provided by seagrass in terms of both economic and social dimensions. The analytical methods are from biodiversity data, social data, and seagrass data. By conducting this comparative analysis, we strive to enhance our understanding of the broader ecological dynamics of seagrass ecosystems and inform targeted conservation and management strategies.

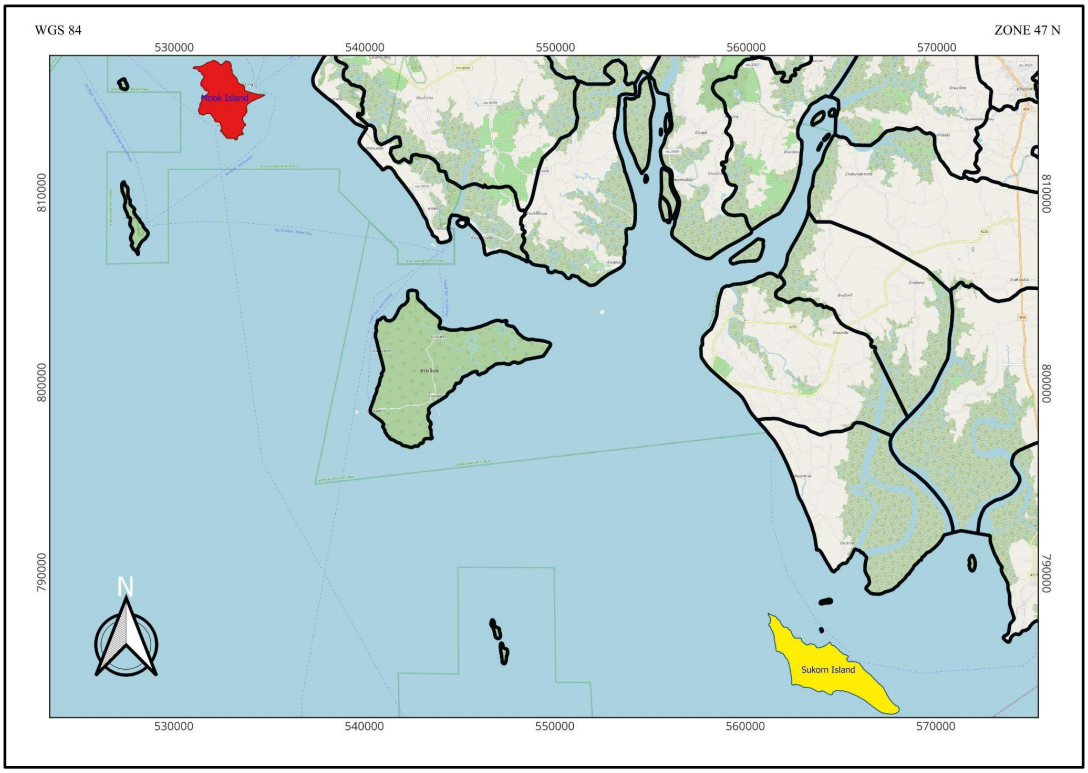


Figure 1 The two primary study sites were in the seagrass degradation on Sukorn Island represented in yellow colour and the abundance and diversity of seagrass on Mook Island represented in red colour.

Objectives and activities completed

The primary objective of this study is to conduct a comprehensive assessment of Seagrass Ecosystem Services. Through systematic research and data analysis, we aim to quantify and evaluate the various ecological, economic, and social benefits provided by seagrass ecosystems.

The disappearance of seagrass presents a pressing ecological challenge with far-reaching consequences. The situation has significantly declined, raising concerns about the overall health of the marine environment. Following a comprehensive field trip survey, it has been established that good soil quality plays a pivotal role in facilitating the successful growth of seagrass in Sukorn Island. As a critical determinant, soil quality influences the nutrient availability, substrate stability, and overall habitat suitability for seagrass but also for sustaining the biodiversity, fisheries, and ecological balance that depend on these valuable coastal habitats.

The focal point of this research is the comparative analysis of seagrass degradation and the diversity of seagrass ecosystems, with a particular emphasis on understanding their impact on natural resources and, subsequently, on fish resources and income. By delving into the historical context and comparing past and present data through a combination of secondary data analysis and social surveys, the study seeks to elucidate the evolving dynamics of seagrass ecosystems and their consequential effects on fishery resources and economic outcomes.

Through a combination of field surveys, data collection, and analysis, this study aspires to generate actionable recommendations for the preservation and management of seagrass habitats. Ultimately, the Seagrass Ecosystem Service assessment aims to foster a holistic appreciation for the ecological functions of seagrass and underscore its critical role in maintaining the health and resilience of coastal ecosystems.

The study aims to develop targeted strategies for seagrass restoration within Sukorn island. Concurrently, the research seeks to advocate for and inform the formulation of robust conservation policies that address the root causes of seagrass loss and ensure the sustained health and resilience of these vital marine habitats.

1. **Rapid Survey**

Conducting a rapid assessment survey involves a systematic process to quickly gather valuable information about a particular area. Engage with local communities to understand their perspectives on the area's conditions and any potential threats they perceive.

During interviews, cover key topics such as:

- Seagrass knowledge about the area.
- Perceived environmental changes.
- Human activities impacting the environment.
- Existing conservation or management practices.

Preliminary interviews were conducted to gather qualitative data for the draft of the review. Participants, representing diverse perspectives, shared their experiences and insights related to key topics outlined in the interview guide.

The seagrass survey successfully assessed existing seagrass and evaluated its status on Sukorn island. Fieldtrip Survey was employed to estimate seagrass cover, density, and health. The catch landing survey successfully gathered information from collectors in the study area, shedding light on the types, methods, and quantities of aquatic animals caught.

The structured questionnaire provided valuable insights into the dynamics of the local fishery trade. Preliminary analysis indicates notable trends and patterns that will inform the development of a comprehensive research outline, focusing on key aspects of aquatic resource catch and trade.

2. Literature Review

Local policy research based on interview to the stakeholder and decision maker in the province: To investigate the mechanisms and processes involved in enforcing seagrass-related policies and regulations, including the roles of various stakeholders and the effectiveness of enforcement efforts. By conducting research interviews with key Informants like decision makers and non-profit organisation environmentalists, and local community representatives.

Findings from the research interviews underscore a concerning reality: there are currently no formal seagrass policy but have the local legislations/regulations in place for the Asiatic hard Asiatic hard clam conservation area and the local ordinance of Sukorn Subdistrict Administration Organization about the conservation of dolphin in Sukorn island.

Review to the existing related policy: To identify and analyze gaps, inconsistencies, and challenges within the existing policy framework governing areas in Sukorn island, with the aim of understanding where improvements may be needed. Policymakers unanimously expressed the absence of a structured framework to protect these vital marine habitats. Sukorn island is not located in the protected areas in Trang like Mu Ko Libong non-hunting area and Hat Chao Mai National Park under the control of the Department of National Parks, Wildlife and Plant Conservation (DNP). This void raises significant environmental vulnerability concerns and represents a missed opportunity for effective conservation efforts. Recommendations include advocating for the development of tailored policies, with an emphasis on community involvement, to ensure the sustainable management of seagrass areas and the preservation of their ecological and socio-economic value.

The key interview findings underscore a critical gap in the regulatory framework of the studied area, revealing a lack of specific regulations to control the use of illegal fishing gears. Stakeholders, including local fishermen and environmental organizations, expressed shared concerns about the environmental and socio-economic consequences of unregulated practices

By aligning research objectives with specific aspects of policy and regulation related to seagrass, Participation of diverse stakeholders in the formulation and implementation of seagrass-related policies. This research aims to propose recommendations for Policy Enhancement. Based on the findings, develop informed recommendations for enhancing existing policies and regulations related to seagrass, with the goal of promoting sustainable seagrass management and conservation. To Enhance Public Awareness on Seagrass Policies to Increase public awareness and understanding of seagrass-related policies and their importance in fostering ecological resilience and sustainable use.

3. **Establish contribution of seagrass fisheries to the local people and food security**

In this research, a comprehensive approach was undertaken, encompassing a total of 365 structured surveys distributed across four coastal villages in Sukorn island. The surveys were strategically administered to capture the perspectives of fishermen, local residents, and collectors.

A. Social economic survey, marine resources and use by interviewing to the community. The survey was conducted in 4 villages/communities/sites. Ban Siam Mai Ban Laem Ban Klang Na and Ban Hadsaithong on Sukorn island.

- A total of 273 surveys were administered across 10 percent of the population from coastal communities' households. The divergence in perspectives between non-fishery local residents and fishermen underscores the multifaceted nature of coastal dynamics. Surveys were conducted using a stratified random sampling approach, ensuring representation from diverse demographic and occupational groups.
- Total of 215 survey interviewees are non - fishery local residents aimed to explore basics information of demographics, economic conditions, social and natural environment, basic knowledge of seagrass of among people in Sukorn island. In contrast, the 58 surveys for fishermen focused on gathering insights into their livelihoods, fishing practices, the challenges they face in the marine environment, and fishing areas.
- The marine resources and use encompasses data collected from 92 collectors through the structure of the catch Landing survey.

B. Database compiled and available for further analysis (and use as required)
- Department of Marine and Coastal Resources. (2007). *MARINE RESOURCE AND USE IN PALEAN DISTRICT: TRANG PROVINCE*. (Andaman Coastal Marine Resource and Use Database Research Project).

- Comparing the old data from 2007 with the present survey data in 2022, notable shifts in perceptions and attitudes among fishery local residents have emerged. These changes may be indicative of evolving environmental consciousness or responses to external factors.
- The methodological approach outlined above seeks to synergize survey and secondary data, offering a holistic perspective on the temporal dynamics of coastal ecosystems and community perceptions.
- By summarising the key steps and highlighting the significance of the consolidated data in contributing to the overall objectives of the research. Summarize the key

insights gained from comparing fishing areas data from Social Economic Survey and past 15 years of the secondary data of fishing areas in *MARINE RESOURCE AND USE IN PALEAN DISTRICT: TRANG PROVINCE (2007)*, emphasising the value of combining these sources for a comprehensive understanding of fishing areas over time.

C. Catch Landing Survey as a comprehensive approach was undertaken, encompassing a total of 92 structured surveys distributed across four coastal villages in Sukorn island to survey the statistics for the value of seagrass created.

4. **Determine species composition and seagrass habitat usage of fish assemblages**

Seagrass fish surveys using Baited Remote Underwater Video (BRUV) systems across 11 of sites. The research sites were located at Latitude 35.6895, Longitude 139.6917 for Mook island (Figure 2) and Latitude 36.7783, Longitude -119.4179 for Sukorn island (Figure 3). to compare fish abundance between abundant and degraded seagrass sites. On the abundant site, we selected Mook island as a control site. The BRUV installed a total of 9 spots, while Sukorn Island represents the degraded site on 2 spots.

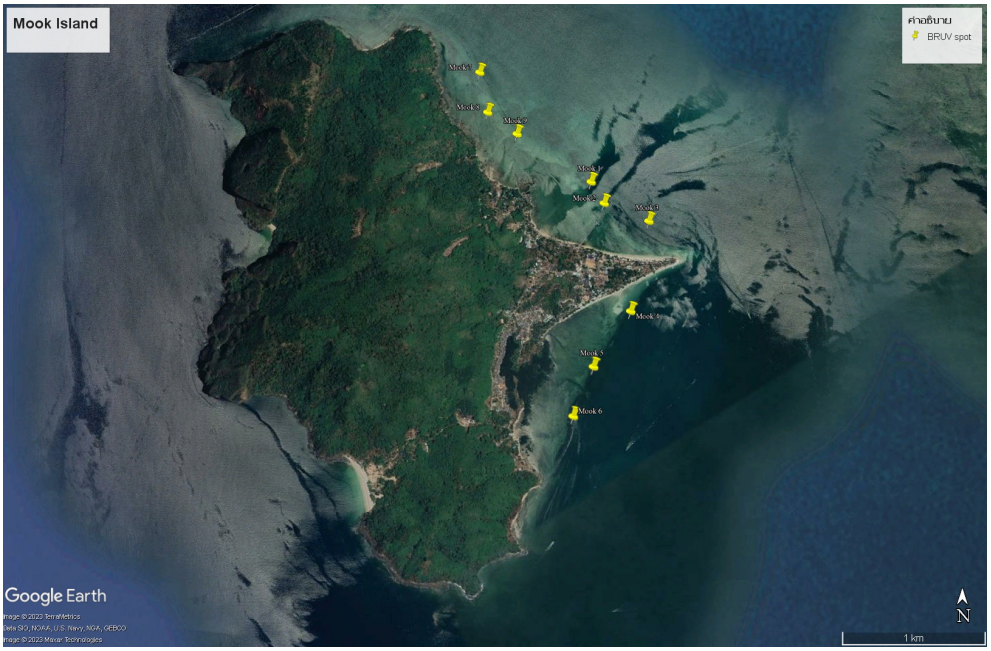


Figure 2 Nine of abundant seagrass sites on Mook island

Figure 3 Two of degraded seagrass sites on Sukorn island

GPS Coordinates of BRUV installed sites provide geographic location information for each surveyed site in the study. The table includes the latitude and longitude coordinates for 11 research sites on Mook island (the GPS coordinates in table 1) and Sukorn island (the GPS coordinates in table 2) for identifying the specific locations where data collection and analysis were conducted. These coordinates serve as essential reference points for the comparison and analysis of seagrass ecosystems across the diverse sites included in the research.

Table 1 GPS coordinates of Mook island

Site	Latitude	Longitude
1	N 07.379096	E 099.308986
2	N 07.377646	E 099.309842
3	N 07.376440	E 099.312812
4	N 07.370451	E 099.311496
5	N 07.366825	E 099.308991
6	N 07.363639	E 099.307631
7	N 07.386654	E 099.301487
8	N 07.383868	E 099.302032
9	N 07.382371	E 099.304022

Table 2 GPS coordinates of Sukorn island

Site	Latitude	Longitude
1	N 07.113164	E 099.582706
2	N 07.115166	E 099.570312

The consolidation process is a crucial step in synthesising information obtained from. Baited Remote Underwater Video records, allowing for the systematic identification and documentation of fish species inhabiting the seagrass surveyed areas. by summarising the key steps and highlighting the significance of the consolidated data in contributing to the overall objectives of the research.

- When obtaining video footage from a Baited Remote Underwater Video (BRUV) system and verifying its completeness, it's crucial to follow a systematic process to ensure the integrity of the data.
- Ensure that the video is played back at a speed no faster than 1x. Record the MaxN[1] for each identified species. MaxN refers to the maximum number of individuals of a particular species observed simultaneously during a specific time segment on the data sheet. (Figure 4)
- Analyse the characteristics of fish by referring to the book titled "Marine Fishes of South-East Asia: A Field Guide for Anglers and Divers.", the book discusses multiple fish species, considering comparing and contrasting their characteristics to gain a broader understanding of fish diversity.
- Utilize the search function on the FishBase website, Record the common name and scientific name of the fish species.

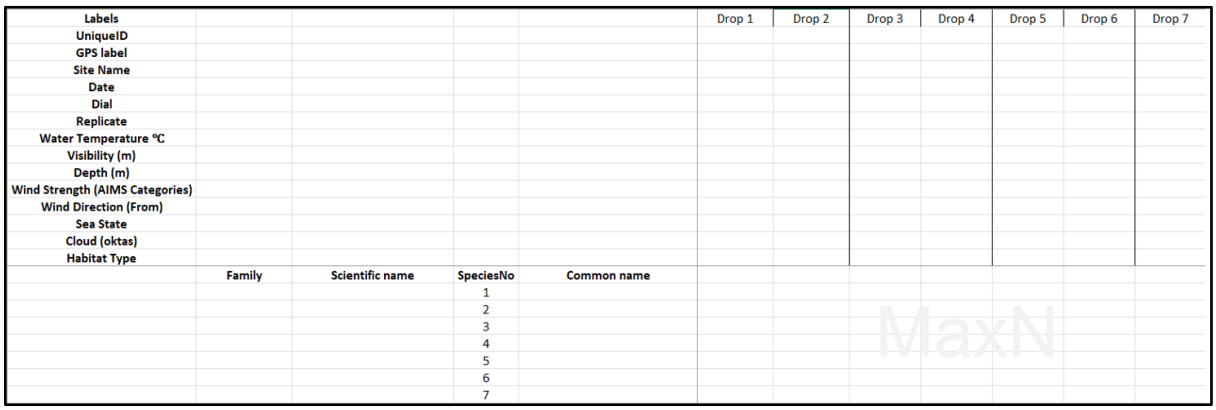


Figure 4 Data sheet

[1] The MaxN for a species is a metric for abundance – “The maximum number of fish seen at a given time/frame”.
MaxN for a species is continually checked during viewing, it only increases if more individuals of a species become visible in a single frame. The highest MaxN for each species from each video is used for analysis.

5. **Consolidate the social economic data and species composition and seagrass habitat usage in order to drive on the policy**

    1) Develop the report, establish a timeline for data collection activities, considering seasonal variations, the timing of specific events, specify the analytical techniques to be used for processing, interpreting collected data and develop strategies for adapting management approaches based on the continuous analysis of monitoring data.
    2) Participatory approach workshop with the community in Sukorn Island to understand the value of seagrass and its ecosystem services by presenting the result of the report.
    3) Continuing consultation with the community on the possibility to develop the local policy for seagrass conservation in the area.

Methods

In this section, we detail the methods employed to conduct a comprehensive assessment of Seagrass Ecosystem Services. The study utilized the analytical methods from biodiversity data, social data, and seagrass data. to explore to quantify and evaluate the various ecological, economic, and social benefits provided by seagrass ecosystems. The chosen methodology is deemed appropriate due to its ability to address the specific research questions related to what degree do local fishery communities depend on seagrass ecosystems for sustenance and livelihoods, and how does the degradation of seagrass beds due to illegal fishing practices impact their well-being? This section is organized into subsections covering participants, materials, procedures, and data analysis. Ethical considerations were carefully addressed to ensure the well-being and confidentiality of participants.

Baited Remote Underwater Video (BRUV)

We used Baited Remote Underwater Video (BRUV) systems at each site to record fish abundance and richness. 56 BRUVS were deployed across Mook island and Sukorn island, typically with 3 BRUVS per site where environment conditions such as turbidity allowed it. BRUVS were deployed for 1 hour, with the first 5 min considered a buffer time to allow fauna to respond to disturbance, this was particularly important for Sukorn island where loose sediment made it hard to implement video analysis. Videos were analysed to determine the MaxN of each fish species and fish species richness; a metric commonly used for the quantification of the relative abundance of fish observed in underwater video. MaxN is equal to the maximum number of fish recorded at any one time.

Social Economic Survey and Marine Resource and Use

A systematic sampling approach was employed, targeting 10% of the total population of Sukorn Island, which is estimated to be approximately 2,000 residents. the methodology for a Social Economic Survey using a combination of Random Sampling and Snowball Sampling, with a specific focus on fishermen.

A random sampling approach will be employed to select a baseline of participants from the general population. This will ensure that the survey provides a broad representation of Sukorn Island residents. The sample size will target 10% of the estimated overall population of 2,000 residents. From each stratum, randomly select households to participate in the survey. This will ensure a diverse and representative sample. Within the randomly selected households, identify individuals engaged in fishing or related activities. Use these initial respondents as 'seeds' for the snowball sampling technique. Ask these participants to refer other fishermen within the community who would be willing to participate in the survey.

Catch landing survey

In this section, we outline the methodology employed to conduct a comprehensive Catch Landing Survey at various collector areas. The primary objective of this survey was to assess and document the types and quantities of catches landed by local fishermen. Given the dynamic nature of fishery activities, a Catch Landing Survey is instrumental in providing real-time insights into the fishing practices within specific regions.

The rapid survey was conducted on-site at designated collector areas where fishing activities are concentrated. A total of 12 collectors actively participating in the fishing industry were identified as key informants for this survey. Within the selected collector areas, the interviews were conducted using a random sampling technique. Rather than targeting specific individuals, we employed a systematic approach to select every collector for participation in the interviews. This approach aimed to eliminate selection bias and ensure that each collector had an equal chance of being included in the study. The inclusion of these collectors aimed to capture a representative sample of the diverse fishing practices prevalent in the study area. This methodology aligns seamlessly with our research objectives of understanding the local fishing landscape and obtaining accurate data on catch diversity and quantities. Sampling was conducted at regular intervals throughout each season to account for potential temporal variations within the Dry and Monsoon periods. Multiple sampling events were carried out to capture the potential changes in aquatic resources over time.

Results & Discussion

Seagrass meadows were typically characterised by 5 of species, including *Enhalus acoroides, Halophila ovalis, Cymodocea rotundata, Thalassia hemprichii* and *Halodule uninervis*. Seagrass meadows comprised of species *Enhalus acoroides* had greater canopy height. Lack of seagrass was observed at Sukorn island, and was unable to be presented vs Mook island. Whilst there were varying levels of seagrass health at Mook island it was determined that it was considerably healthier than those meadows at Sukorn island.

Figure 5 illustrates the distribution of data collection activities, showcasing the distinct periods dedicated to the Dry and Wet seasons. The figure provides a visual representation of the seagrass cover, Canopy height, Epiphyte cover and Seagrass species richness, the targeted approach to capture seasonal differences in the aquatic environment.

- During the course of this study, seagrass cover was assessed during both the Dry and Wet seasons on Mook Island. The findings revealed substantial variations in seagrass cover, with notable differences observed between the two seasons. The Wet season exhibited a considerable increase in seagrass cover, with a range of 0.8% to 74%. This variation was notably higher than that observed during the Dry season.
- The Wet season showcased a considerable increase in canopy height, with measurements ranging from 30 cm. to 80 cm. During the Dry season in March 2023, the measured canopy height was found to be 18 cm. This relatively lower height is consistent with the expected environmental conditions characterized by Green Turtle overpopulation to overgrazing, in certain situations, an unusually high population of turtles could potentially lead to overgrazing. Overgrazing occurs when the rate of seagrass consumption by herbivores exceeds the growth rate of the seagrasses, leading to a decline in seagrass coverage. The discovery of seagrass with short leaves during your field survey suggests a potential issue with the health or condition of the seagrass beds.
- The assessment of epiphyte coverage on seagrasses during both Wet and Dry seasons on Mook Island revealed notable variations indicative of seasonal dynamics within the seagrass ecosystem. Epiphyte coverage on seagrasses was observed in the range of 0-100%. This considerable variation suggests a heightened presence of epiphytes on seagrasses during the Wet season.
- The assessment of seagrass species richness revealed notable differences in the association with fish presence between the Wet and Dry seasons on Mook Island. The Wet season displayed a considerable increase in seagrass species richness, particularly in areas where fish presence was prominent.

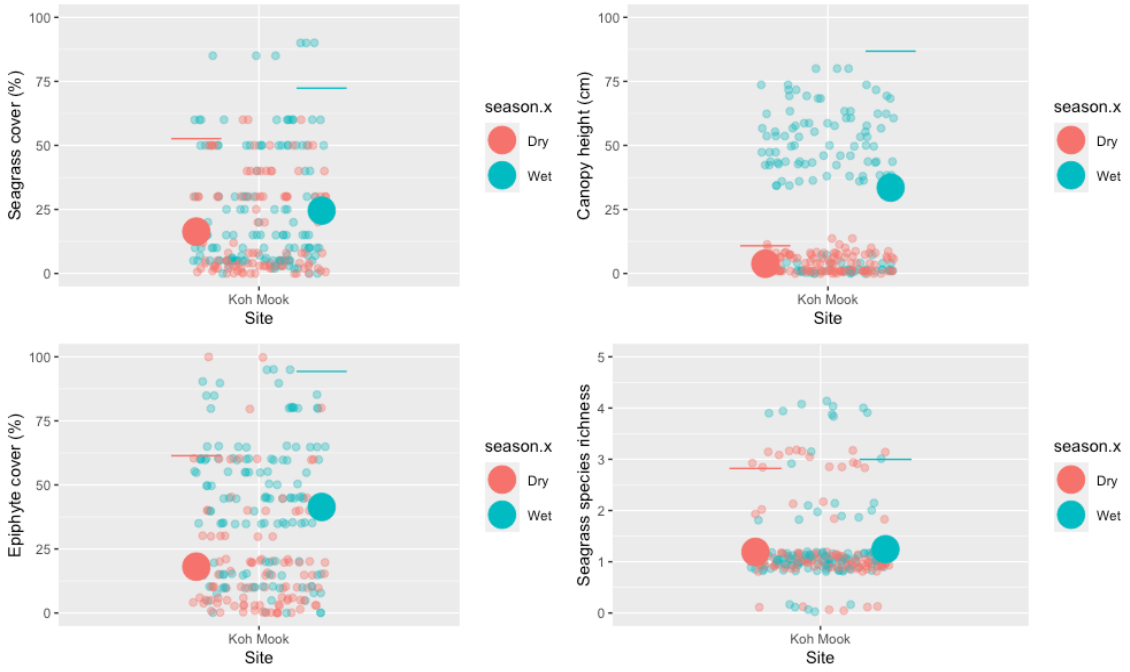


Figure 5 Average seagrass cover (%) and canopy height (cm) across sites. Solid points represent Mean + SE and smaller points represent raw quadrat values.

As part of the fish identification process, we also identified non-fish species that were either commercially or ecologically significant. These were omitted from data analysis but are mentioned here:

- Dugong as the first list of the preserved wildlife animals of wild animal reservation and protection act, B.E.2535 (1992)
- Green sea turtle on Aquatic List*
- Periscope crab
- Crab
- Shrimp
- Octopus
- Common cuttlefish
- Sea Cucumber

The presence of these non-fish species contributed to the overall biodiversity of the seagrass ecosystem.

Summary of most abundant seagrass-associated fish species

The most abundant species observed from the BRUV survey were from a diverse array of different families, with some Lethrinids, Siganids, Nemipterids and members of Gerridae being important food fish species. Namely. *Siganus canaliculatus* was observed in highest numbers, the presence of Indo-Pacific Sergeants around Mook island's pier ensured their high abundance around one specific BRUV deployment, whilst species of bream were seen in slightly lower densities. In total 40 unique fish species were observed.

Table 3 Ten most abundant (MaxN ± SE) fish species across Mook island and Sukorn island.

Species	Average ± SE
Siganus canaliculatus	5.30 ± 2.56
Abudefduf vaigiensis	2.55 ± 0.95
Ostorhinchus taeniophorus	1.91 ± 0.40
Monacanthus chinensis	1.27 ± 0.33
Lethrinus harak	1.15 ± 0.42
Gerres oyena	0.89 ± 0.19
Scolopsis ciliata	1.30 ± 0.22
Scolopsis monogramma	1.41 ± 0.33
Upeneus tragula	1.07 ± 0.73
Siganus javus	0.67 ± 0.27

We found an average relative fish abundance of 16.2 ± 30.0 per 200m^2 of seagrass (*typical area covered by a BRUV*) across Mook island in the dry season and 36.1± 28.4 respectively in the wet season. Whilst 4.11 ± 3.08 and 7.07 ± 3.11 fishes were seen across dry and wet seasons respectively. In the case of Sukorn island, relative fish abundances of 3.00 ± 1 and 4.00 ± 1 were recorded through both dry and wet seasons; only one BRUV was usable in each season due to low water visibility and high tidal range. Species richness at Sukorn island was 3.00 ± 1 and 2.00 ± 1.

The state of the overall seagrass health at Sukorn island was very poor compared to Mook island, and an observed higher percentage cover and canopy height at this site, typically correlated with higher MaxN and fish richness We noticed a large variance in fish abundance and richness between seasons, which whilst expected, was notably larger due to excessive removal of plant tissue by mega-herbivores, namely Green Sea Turtles.

The most common fish seen in Mook island and Mook island is White-spotted spinefoot as economic fish species found on the average is 4.96.

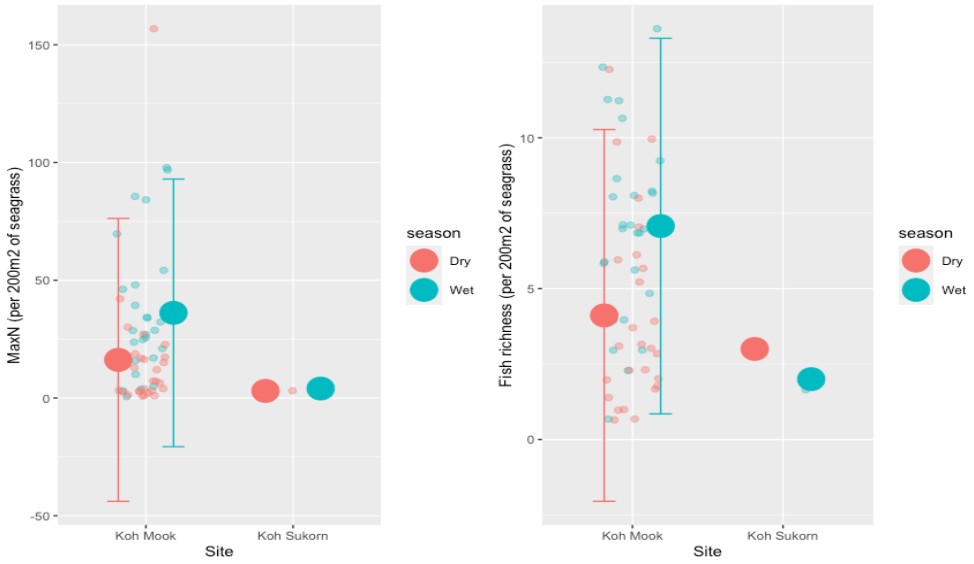


Figure 6 Boxplots representing MaxN and fish species richness across sites. Large dots represent average values and smaller dots individual data points.

Seagrass cover (%) showed a significant negative relationship to both relative abundance of fish and species richness, which, for Mook island, was an unexpected result as dense meadows seemed to have numerous fish in each clip. In light of the mega-herbivory present around Mook island the impact of canopy height against the abundances and richness of seagrass-associated fisheries was tested in order to determine the driver of fisheries in Mook island. Canopy height drives fish abundances ($R = 0.39$, $p < 0.001$) and fish richness ($R = 0.50$, $p < 0.001$) at Mook island. Analysing BRUV video files is considered easier in areas of low canopy and seagrass cover, considerations need to be made for possible unidentified fish in denser meadows compared to the sites post-grazing. (Figure 7 and Figure 8)

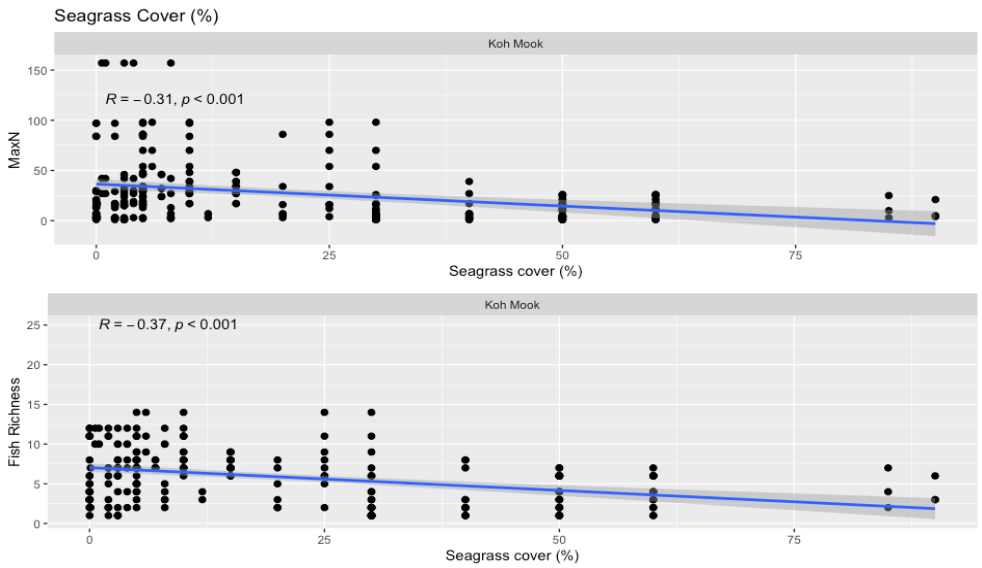


Figure 7 Scatter plots representing correlations between seagrass cover (%) and MaxN and fish species richness. R values and p values for correlations are presented.

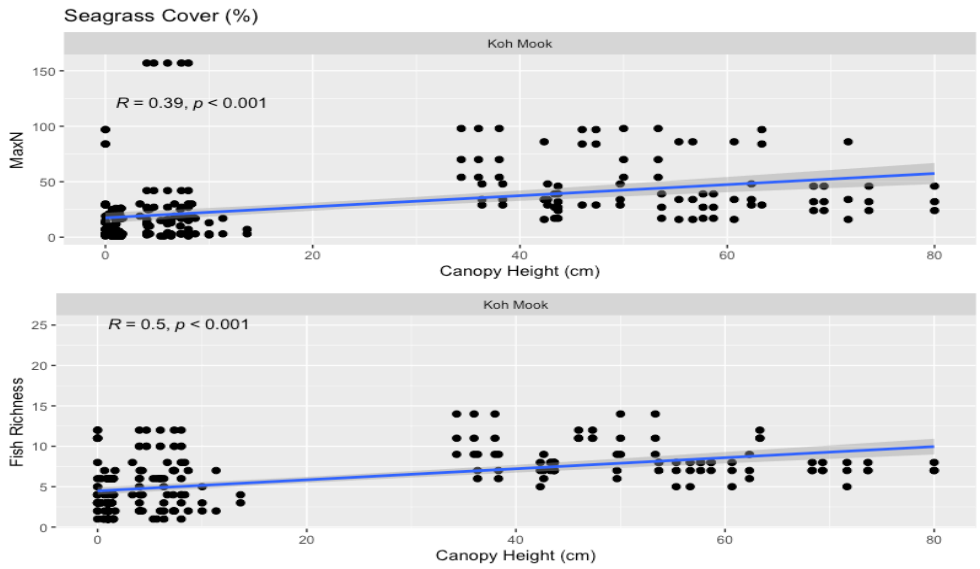


Figure 8 Scatter plots representing correlations between Canopy Height (cm) and MaxN and fish species richness. R values and p values for correlations are presented.

Summary of social data

Across 273 household interviews (the random sampling approach that your team used, targeting 10% of the total population of Sukorn Island, which is estimated to be approximately 2,000 residents. A total of 215 households unrelated to fishing were included in the survey. These households represent a diverse cross-section of the local community, contributing valuable perspectives beyond the fishing sector. The research team conducted interviews with fishermen representing a diverse range of fishing practices and backgrounds. A total of 58 households participated in the survey, providing valuable information on various aspects of their engagement with marine ecosystems.), As part of the field survey, a total of 92 households of fishermen were interviewed to gather insights into reports that they collect marine species from the environment.

Across sites, seagrass meadows were the most used habitat for fishing, with 21% of households stating that they used them for fishing. Moreover, many households preferred to fish in seagrass over other habitats.

Social economic survey

In our survey of 273 individuals, a diverse range of participants was observed, encompassing various demographic factors. The majority of respondents identified as gender, age group, education and domiciliary. Additionally, the survey reflected a balanced gender distribution, with 47.3% male and 52.4% female respondents. In terms of age demographics, our survey captured a diverse range of respondents spanning various age groups. Notably, 32.4% of participants were aged 61 years and older, reflecting a significant representation of the senior population. The majority of participants held a primary education level, constituting 56.2% of the surveyed population. Furthermore, geographical diversity was evident, with 88% participants hailing from domicile by birth. Our survey encompasses a

comprehensive representation of the local community on Sukorn Island, with respondents residing across the island's four villages. The survey successfully captured a broad spectrum of perspectives, enhancing the representativeness of our findings.

The survey delved into the financial aspects of respondents' lives, revealing a diverse range of occupations, income rates, and corresponding expenses. A notable finding from our survey is that a significant majority of respondents identified themselves as the heads of households. 41.97% of participants assumed the role of household heads, also reported family sizes within the range of 4-7 members. Approximately 52.4% of surveyed households fall within this demographic, highlighting the prevalence of moderately sized families in our study. Furthermore, our survey revealed that a significant portion of respondents reported their primary income source as occupations related to the agriculture sector. Approximately 33.8% of surveyed households derive their major income from activities such as farming or related agricultural pursuits. Notably, this income is often contributed by two members within the household, within 54.95%. Furthermore, our survey revealed a diversified occupational landscape within the community. A notable. 65.31% of participants reported occupations outside the fisheries sector. Additionally, 34.69% of respondents were engaged in occupations related to fisheries, showcasing the significance of marine-based livelihoods in the community, highlighting the diversity of economic activities in the area. This observation underscores the centrality of the fisheries sector in the livelihoods of our respondents, highlighting its 100% of fishing family presence among households in our study. Notably, the majority of respondents, particularly those involved in fishing and related activities, reported incomes not exceeding 5000 THB, with 54.07% reporting income range low. Alarmingly, 42.28% of respondents expressed that their income is not enough to cover household expenses. Further analysis revealed that within 32.5% of expense is allocated specifically to food and beverages. This finding underscores the financial challenges faced by a significant portion of the community

Some respondents may emphasize the importance of community unity for fostering a sense of belonging, support, and cooperation. Respondents might highlight the significance of a safe environment for residents, praising effective law enforcement, community policing, or neighbourhood watch programs. Many respondents may stress the importance of a clean and hygienic environment for overall well-being. They might appreciate local sanitation services, waste management, and community efforts to maintain cleanliness.

The public awareness of seagrass (Figure 9). The majority of respondents in your investigation have a basic understanding of seagrass and recognize its importance to aquatic ecosystems and fishermen. The majority of the public is supportive of seagrass conservation, especially given the significance of seagrass beds as both a food source and a habitat. but the public lacks knowledge about the specific species of seagrass. The perceived decline in seagrass area highlights the urgency of implementing conservation measures. This may include stricter enforcement against illegal fishing practices, human activities may be less resilient to natural disturbances.

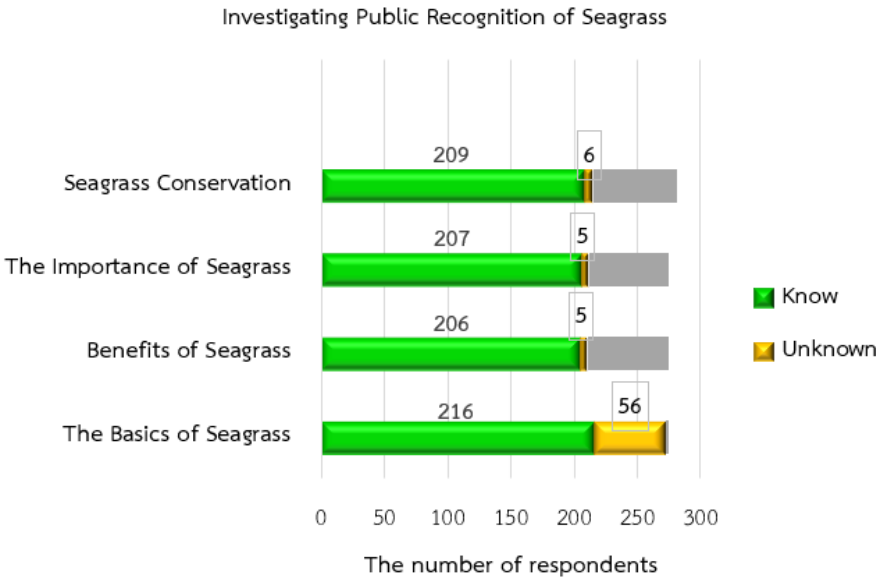


Figure 9 The comprehensive Seagrass understanding of respondents' awareness.

Marine Resource and Use

The social-economic survey found on Sukorn Island, where fishermen from every village are engaged in 100% small-scale fishing. The fact that 55.2% of households have two members engaged in fishery highlights the family-based nature of small-scale fishing in the community. With 31% of households indicating a direct relationship between fisheries and spouses. By use of a single vessel for fisheries in the household. The perception of an increased quantity of vessels may indicate a growing fishing industry within 79.3%. The information that 58.6% of respondents indicated that most fishermen can catch at least two species provides additional insights into the diversity of fishing activities on Sukorn Island. The high percentage of respondents (82.8%) expressing concern about the decreasing quantity of aquatic animals indicates a significant perception within the community on Sukorn Island.

Table 4 appears that there has been a shift in fishing patterns over the past 15 years, as indicated by a decrease in fishing area and a move to new fishing areas. The details provided suggest that some historical fishing areas are still being utilized alongside the exploration of new fishing grounds. The inclusion of a map in Figure 10 illustrates the geographical distribution of these new fishing areas.

Table 4 Comparative Analysis of Historical and New Fishing Spaces

Historical Fishing Areas (15 Years Ago)	**Historical fishing areas that are no longer utilized for fisheries activities**	**Historical fishing areas that continue to have fisheries activities**	**Newly Designated Fishing Areas**
Sukorn Island	Ta Bai Island	Sukorn Island	Jumpee Island
Phetra Island	Ta Kiang Island	Phetra Island	Laem Chin Port
Daeng Island	Ban Laem	Daeng Island	Laem Chin Beach
Ta Bai Island	Jung Kab Island	Kluay Island	Ban Tung
Kluay Island	Siam Mai Bridge	Hua Hin Tai	Jumpee Lek Island
Hua Hin Tai	Khao Lak	Lao Liang Island	Mangrove forest
Lao Liang Island	Ho Yai	Artificial coral reef	Sai Khaw Beach
Artificial coral reef	Nok Island		Khu Loan Island
Ta Kiang Island	Hua Khao Tok Num		
Ban Laem	rock shore under the bridge		
Jung Kab Island			
Siam Mai Bridge			
Khao Lak			
Ho Yai			
Nok Island			
Hua Khao Tok Num			
rock shore under the bridge			

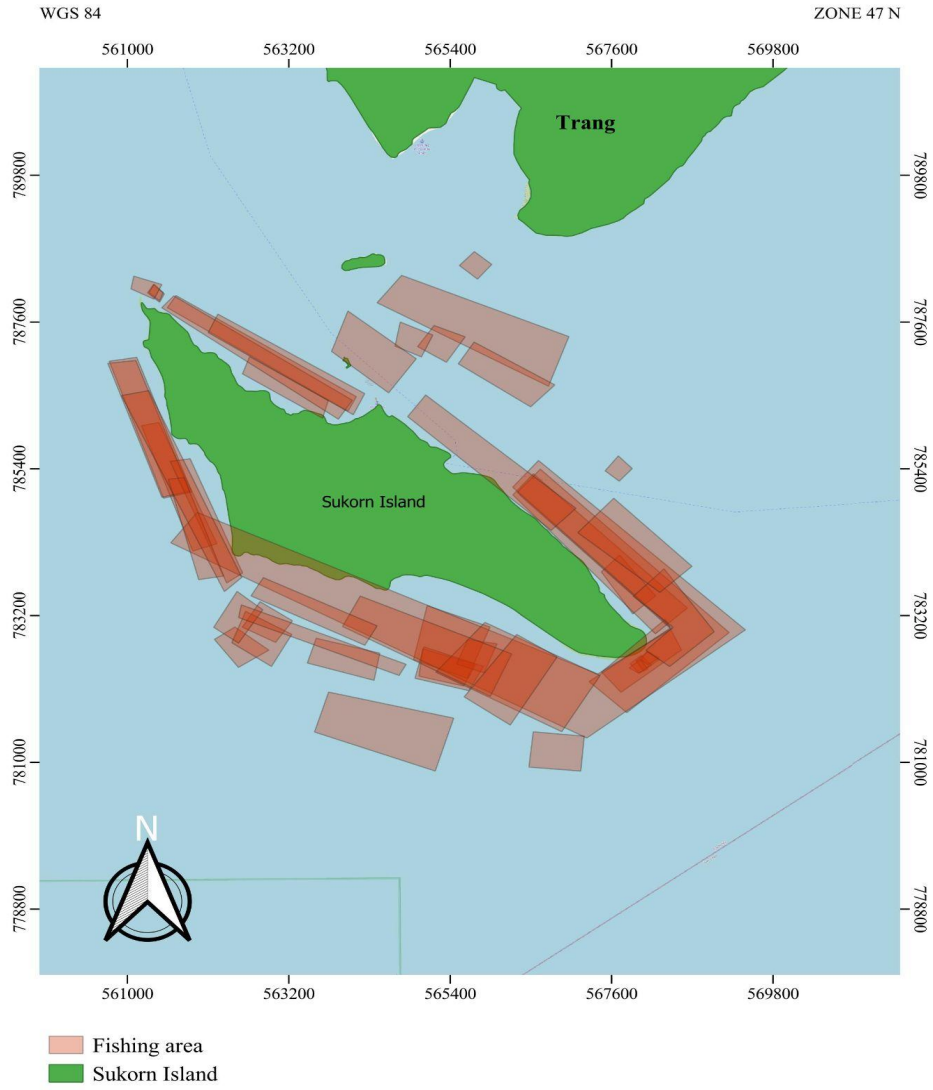


Figure 10 Current Fishing Areas Map

Comparative Analysis of Historical and New Fishing Areas, The dominance of blue swimming crab as the majority of aquatic animals in both historical and new fishing areas, despite the decreased overall fishing ground. The information shows that the quantity of catches remains similar between the past and present, while the selling price has increased. The significant increase in the average selling price from 61.67 THB per kilogram in the past to 159 THB per kilogram in the present suggests notable changes in the economic dynamics of the fishing industry on Sukorn Island. The diversity of aquatic animals caught by fishermen on Sukorn Island, including crab, fish, shrimp, and squid. by highlight the similarities and differences between the key findings from the comparison of Table 5 and Table 6

Table 5 Aquatic Animals caught from fishing activity past 15 years (2007)

Species	Fishing Areas	Fishing period / Fishing time	Transport	Fishing Gears	Quantities of Aquatic animals caught (kg. / time)			Price (THB / kg.)			Number of Fisher (vessel)		
					Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
Blue swimming crab	- Ta Kiang Island - Ta Bai Island - Phetra Island - Sukorn Island - Hua Hin Tai - Hua Khao Tok Num - Lao Liang Island - Daeng Island - Kluay Island	All the year	Local fishing boat	- Crab gillnets - crab traps	15	3	7.67	75	50	61.67	80	3	32
Short mackerel	- Ta Kiang Island - Phetra Island - Sukorn Island - Ban Laem - Lao Liang Island - Daeng Island - Kluay Island	July – November	Local fishing boat	- Indo Pacific mackerel gillnets	N/A	N/A	50	15	10	12.5	12	4	8
Mullet	- Sukorn Island - Ho Yai - Nok Island	All the year 15 days/month	Local fishing boat	- Mullet gillnets	5	2	3.33	70	40	53.33	30	3	13
Seabass	- Siam Mai Bridge - Jung Kab Island - Ta Kiang Island - Phetra Island - Sukorn Island - Lao Liang Island	December – April	- Walk - Local fishing boat	- Hook and lines	N/A	N/A	3	N/A	N/A	80	N/A	N/A	30

Species	Fishing Areas	Fishing period / Fishing time	Transport	Fishing Gears	Quantities of Aquatic animals caught (kg. / time)			Price (THB / kg.)			Number of Fisher (vessel)		
					Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
Areolate grouper	- rock shore under the bridge - Artificial coral reef - Siam Mai Bridge - Jung Kab Island - Ta Kiang Island - Phetra Island - Sukorn Island - Lao Liang Island	December – April	- Walk - Local fishing boat	- Hook and lines	3	1	2	120	100	110	30	3	14.33
Banana prawn	- Siam Mai Bridge - Ban Laem - Ta Bai Island - Phetra Island - Sukorn Island - Lao Liang Island - Daeng Island - Kluay Island	All the year	- Walk - Local fishing boat	- Cast Nets - Shimp trammel nets	3	1	2	200	80	153.33	150	4	77
Squid	- Ta Kiang Island - Ta Bai Island - Phetra Island - Sukorn Island - Hua Hin Tai - Lao Liang Island - Khao Lak	October – April 25 days/month	- Local fishing boat	- Squid traps	N/A	N/A	5	N/A	N/A	50	N/A	N/A	60
Silver pomfret	- Ho Yai - Kluay Island - Sukorn Island - Bam Laem	June – January	- Local fishing boat	- Pomfret gillnets	N/A	N/A	2	250	150	200	N/A	N/A	40
Silver sillago	- Ta Kiang Island - Ta Bai Island - Phetra Island	All the year 10 days/month	- Local fishing boat	- Sand whiting gillnets	15	5	10	N/A	N/A	60	10	2	6.33

Species	Fishing Areas	Fishing period / Fishing time	Transport	Fishing Gears	Quantities of Aquatic animals caught (kg. / time)			Price (THB / kg.)			Number of Fisher (vessel)		
					Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
	- Sukorn Island - Hua Khao Tok Num - Lao Liang Island - Daeng Island												
Donkey croaker	- rock shore under the bridge - Artificial coral reef	All the year	- Local fishing boat	- Hook and lines	N/A	N/A	2	N/A	N/A	70	N/A	N/A	10
Granular ark	- Beach around Sukorn Island	All the year	- Walk	N/A	N/A	N/A	3	N/A	N/A	20	N/A	N/A	15
Dog conch	- Beach around Sukorn Island	All the year	- Walk	N/A	N/A	N/A	3	N/A	N/A	20	N/A	N/A	15
Maculated ivory whelk	- Beach around Sukorn Island	All the year	- Walk	N/A	N/A	N/A	3	N/A	N/A	20	N/A	N/A	15
Oyster	- Beach around Sukorn Island	All the year	- Walk	N/A	N/A	N/A	3	N/A	N/A	20	N/A	N/A	

Table 6 Aquatic Animals caught from fishing activity (2022)

Species	Fishing Areas	Fishing period / Fishing time	Transport	Fishing Gears	quantities of aquatic animals caught (kg. / time)			Price (THB / kg.)			Number of Fisher (vessel)		
					Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
Blue swimming crab	- Phetra Island - Laem Chin Port - Sukorn Island - Daeng Island - Kluay Island - Ban Tung - Jumpee Lek Island	All the year 5 AM – 12 AM	- Local fishing boat	- Crab gillnets mesh size 4”	15	1	6	310	10	159	60	2	26
Gladiator swimming crab	- Phetra Island	All the year 5 AM – 10 AM	- Local fishing boat	- Crab gillnets mesh size 4”	4	2	3	75	25	50	30	10	20
Indo-Pacific swamp crab	- Mangrove forest	All the year	- Walk - Local fishing boat	- Crab Traps	20	3	12	70	15	43	20	0	20
Short mackerel	- Phetra Island - Laem Chin Port - Sukorn Island - Sai Khaw Beach - Kluay Island	All the year From 5 PM onwards Monsoon: July – December	- Local fishing boat - Walk - Motorcycle	- Fish gillnets mesh size 1.7” - Fish traps	300	4	88	10	4	10	300	10	88
mullet	- Jumpee Island - Sukorn Island	All the year Except monsoon season	- Walk - Local fishing boat	- Fish gillnets mesh size 4”,1.2”	40	10	25	5	3	4	10	5	11
Notchedfin threadfin bream	- Phetra Island - Hua Hin Tai - Lao Liang Island	April – November 5 AM – 2 PM	- Walk - Local fishing boat	- Fish traps - Hook and lines	30	3	16	280	10	89	15	1	20

Species	Fishing Areas	Fishing period / Fishing time	Transport	Fishing Gears	quantities of aquatic animals caught (kg. / time)			Price (THB / kg.)			Number of Fisher (vessel)		
					Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
Fourfinger threadfin	- Phetra Island - Laem Chin Port - Sukorn Island	All the year 6 AM – 8 AM Except monsoon season	- Local fishing boat	- Hook and lines - Fourfinger threadfin gillnets mesh size 4”	20	10	15	10	8	9	10	6	8
Areolate grouper	- Artificial coral reef - Phetra Island - Laem Chin Port - Sukorn Island - Hua Hin Tai - Lao Liang Island - Khu Loan Island	April – November 5 AM – 2 PM	- Walk - Local fishing boat	- Hook and lines - Fish gillnets mesh size 3.5” - Fish traps	50	2	20	60	10	26	50	1	17
Narrow-barred Spanish mackerel	- Phetra Island - Sukorn Island - Lao Liang Island - Sai Khaw Beach	All the year 4 AM – 2 PM	- Local fishing boat	- Hook and lines - Fish gillnets - Fish traps	30	5	18	36	5	17	40	3	24
Barracuda	- Phetra Island - Sukorn Island - Lao Liang Island - Hua Hin Tai	All the year 5 AM – 2 PM	- Walk - Local fishing boat	- Hook and lines - Fish gillnets - Fish traps	24	4	13	20	5	11	10	1	4
Silver sillago	- Daeng Island - Phetra Island - Sukorn Island	All the year 5 AM – 1 PM	- Local fishing boat	Fish gillnets	20	10	15	7	4	5	3	2	2
Bigeye trevally	- Phetra Island	October – February 2 AM – 2 PM	- Local fishing boat	- Hook and lines	100	20	90	12	7	10	30	8	18

Species	Fishing Areas	Fishing period / Fishing time	Transport	Fishing Gears	quantities of aquatic animals caught (kg. / time)			Price (THB / kg.)			Number of Fisher (vessel)		
					Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
Siganus spp.	- Khu Loan Island	spawning season: May	- Local fishing boat	- Fish traps	100	0	100	30	0	30	5	0	5
Donkey croaker	- Laem Chin Port	All the year	- Local fishing boat	- Crab gillnets	25	0	25	25	0	25	N/A	N/A	N/A
Doublespotted queenfish	N/A	N/A	N/A	- Gill nets	19	0	19	N/A	N/A	N/A	N/A	N/A	N/A
Giant tiger prawn	- Laem Chin Port	All the year 7 AM – 12 AM	- Local fishing boat	- Shrimp trammel nets	10	4	7	75	0	75	50	0	50
Banana prawn	- Sukorn Island - Laem Chin Beach - Hua Hin Tai - Daeng Island - Phetra Island - Kluay Island	All the year 6 AM – 3 PM	- Local fishing boat - Walk - Motorcycle	- Shrimp trammel nets mesh size 1.2”, 1.6”	20	3	8	100	15	59	300	2	74
Whiteleg shrimp	- Laem Chin Port	All the year	- Local fishing boat	- Shrimp trammel nets	18	0.5	9.25	400	15	208	N/A	N/A	N/A
Blue-spotted stingray	- Sukorn Island	All the year	- Local fishing boat	- Fish gillnets mesh size 6.2”	30	0	30	40	0	40	6	0	6
Bengal whipray	- Sukorn Island - Daeng Island - Phetra Island	All the year 5 AM – 9 AM	- Local fishing boat	- Fish gillnets mesh size 6.2”	30	5	18	15	0	15	10	6	8
Common cuttlefish	- Sukorn Island - Phetra Island	September – June	- Local fishing boat	- Squid traps - Squid trammel	40	5	22	44	3	17	50	2	26

Species	Fishing Areas	Fishing period / Fishing time	Transport	Fishing Gears	quantities of aquatic animals caught (kg. / time)			Price (THB / kg.)			Number of Fisher (vessel)		
					Max	Min	Avg.	Max	Min	Avg.	Max	Min	Avg.
				nets mesh size 3”									
Bigfin reef squid	- Sukorn Island - Phetra Island	November – June	- Local fishing boat	- Squid trammel nets - Squid traps	30	2	13	200	15	87	100	1	38
Indian squid	- Sukorn Island - Hua Hin Tai	All the year	- Walk	- Squid traps - Hook and lines	10	3	6	40	20	30	N/A	N/A	N/A

Catch Landing

According to the survey conducted on 12 landing sites on Sukorn Island, 84.27% of respondents reported using crab gillnet for fishing. Figure 11 illustrates various types of fishing gears used by respondents in the survey. the variability in fishing gear sizes in small-scale fisheries, and it's related to the length of the gear. Designing fishing gear that aligns with the needs of users and specific fishing activities. While 2.6% reported walking as their fishing method, the majority of respondents engaged in fishing using vessels (46.75%). the majority of respondents, 72.53%, reported engaging in fishing activities with two members. The prevalence of fishing activities in areas around Sukorn Island is 39.76%. as a pie chart on Figure 12, to visually represent the distribution of fishing activities in different ecosystem areas. Summarize the key takeaway from the survey, emphasizing that 32.15% of fishing activities occur in both beach and deep-sea areas. Reference the pie chart (Figure 13) or include an excerpt of it to visually represent the distribution of caught aquatic species. This can help viewers quickly grasp the dominance of blue swimming crabs, within 86%. Other crab species are Gladiator swimming crab and Indo-Pacific swamp crab. The data indicates that the aquatic catch comprises a diverse variety of fishes such as Short mackerel, Stingray, Silver sillago, Tonguesole, Narrow-barred Spanish mackerel, Barracuda, Grouper, Trevally, Emperor, Indian mackerel. In addition to the variety of fishes, the data reveals the presence of specific shrimp species like Banana prawn and Lobster have been identified as crucial contributors to the economic value of the aquatic industry.

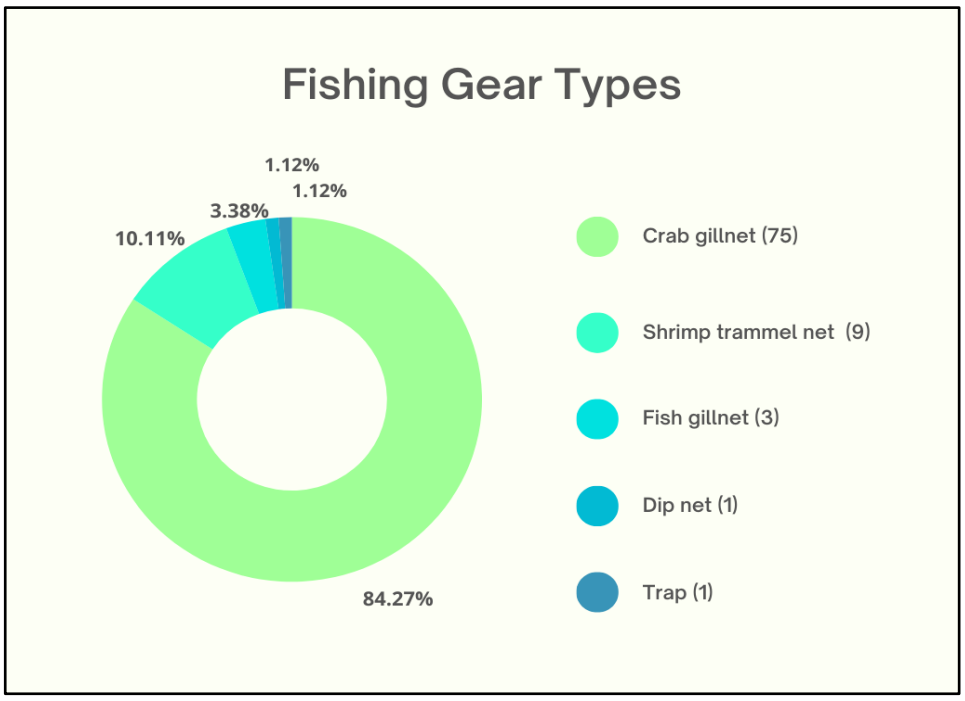


Figure 11 Fishing Gear Types

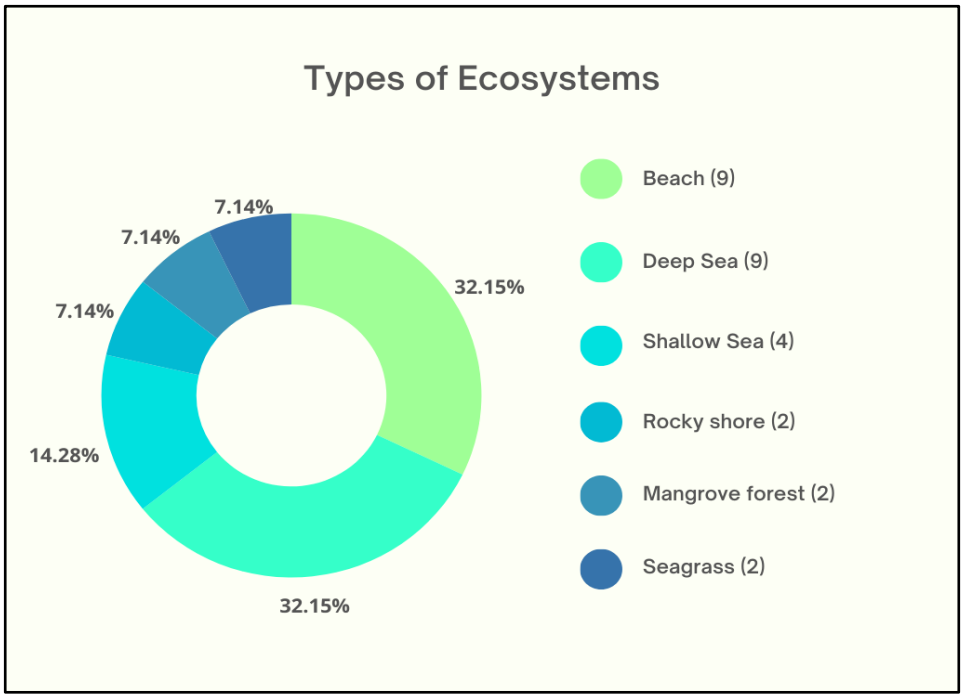


Figure 12 Types of Ecosystems

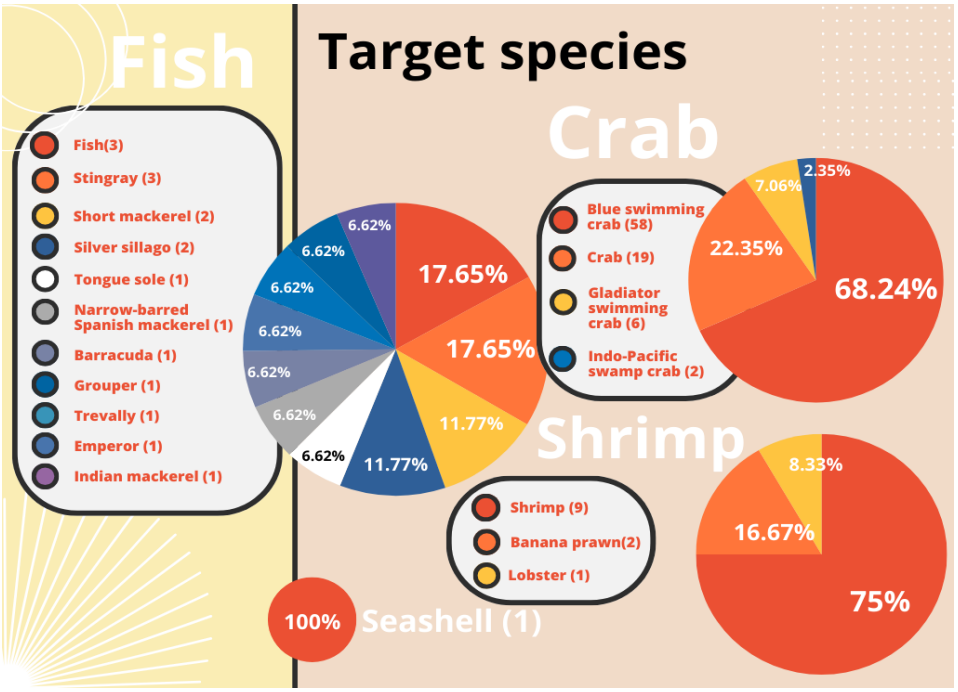


Figure 13 Target Species

Household Fishing for Consumption: Insights on Figure 14 indicates that the marketing data pertains to fishing blue swimming crabs for household consumption. And Other Caught Fish Species are Stingray, Whipray, Short mackerel, Donkey croaker, Tonguesole and Silver sillago for consumption. Invertebrates such as Rarespined murex and Indian volute caught from the sea specifically for the purpose of cooking and enjoying as part of a meal.

The variety of aquatic species caught for commercial purposes shown on Figure 15. Aquatic Species for Sale on Sukorn island. The blue swimming crab is the predominant species among those sold. the prevalence of banana shrimp in the catch and communicates the dominance of this species. Although banana shrimp dominates in terms of quantity, lobster commands the peak price in sales. The presence of Fish Species Silver sillago and Stingray are the prevalence of the specified fish species in the market sites.

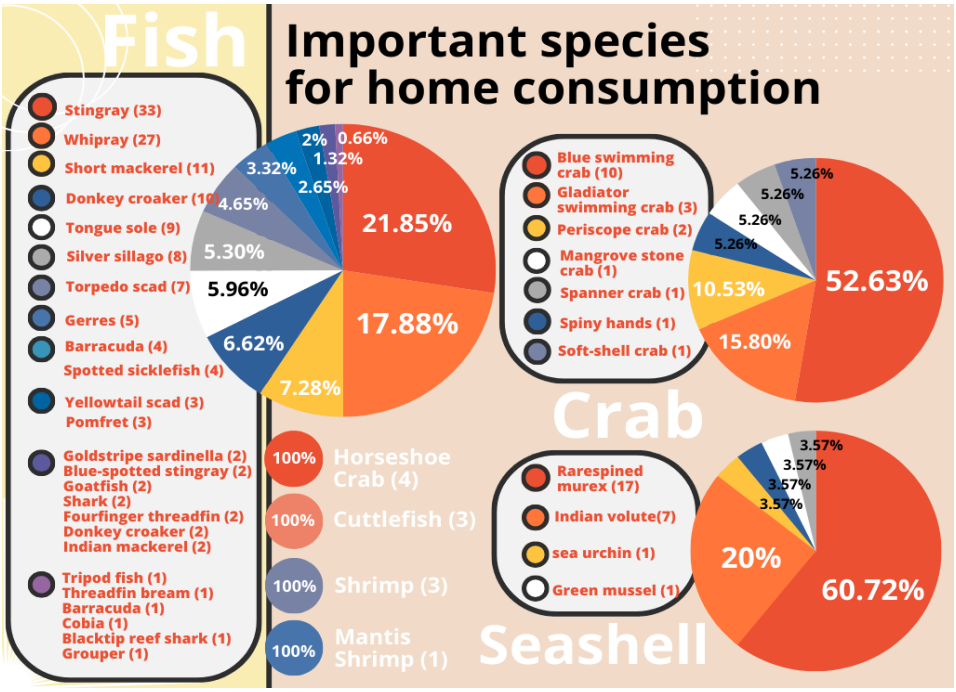


Figure 14 Household Fishing for Consumption

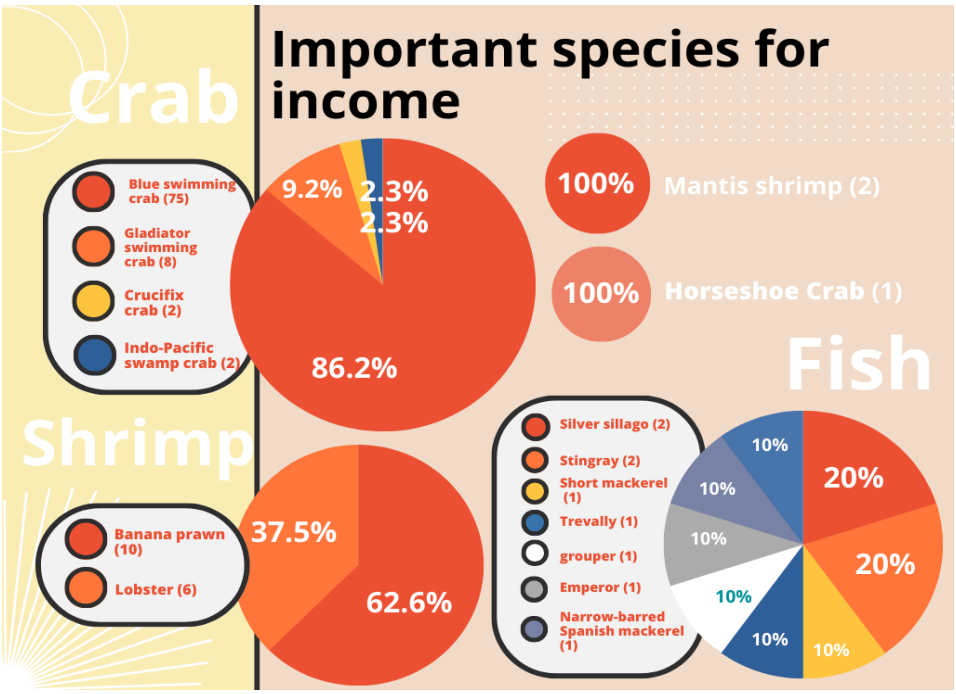


Figure 15 The Commercial Harvest contributing to Income

To summarize the selling patterns after fishing activity, 79.82% of Fishermen Sell Aquatic Animals to Middlemen. Fishermen preferred to sell at Landing Sites, while 20.18% Directly Sell to Customers. the primary markets where fish caught during fishing activities are sold at the provincial market level, within 61.54%, The data of Market Distribution (Figure 16) indicated where that the content will delve into the various places within the marketplace where aquatic animals are sold.

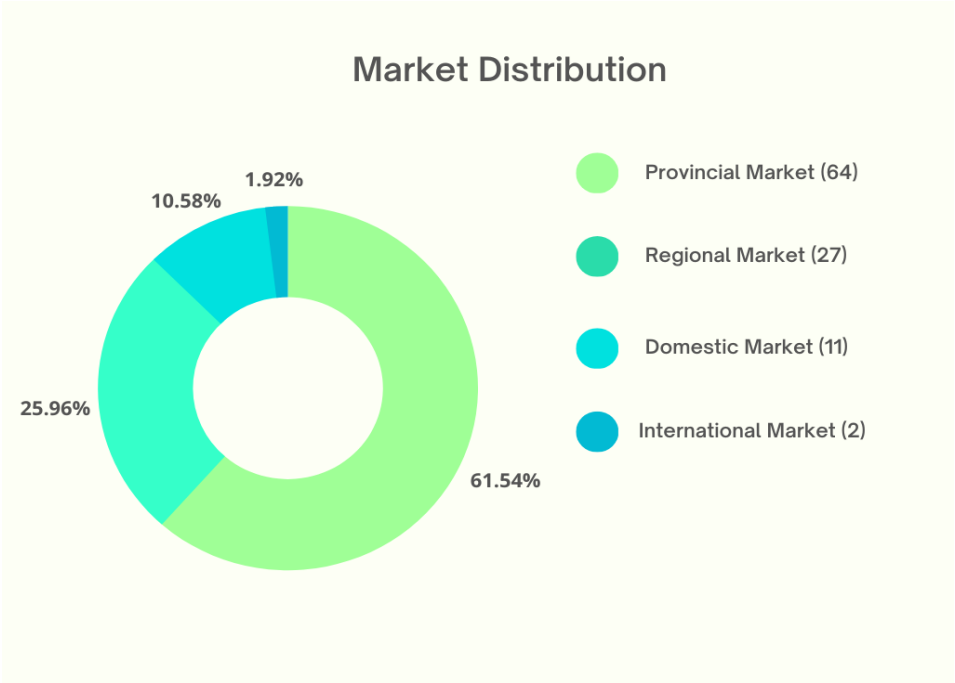


Figure 16 Market Distribution

The findings regarding the changing price for purchases, where the observed trend is an increase in purchase prices, 62.65% of respondents answered that the purchase prices surge from past comparisons (Figure 17). the changing demand for purchases, the opinions and thoughts of fishermen regarding the observed decrease in demand, 66.66% (Figure 18).

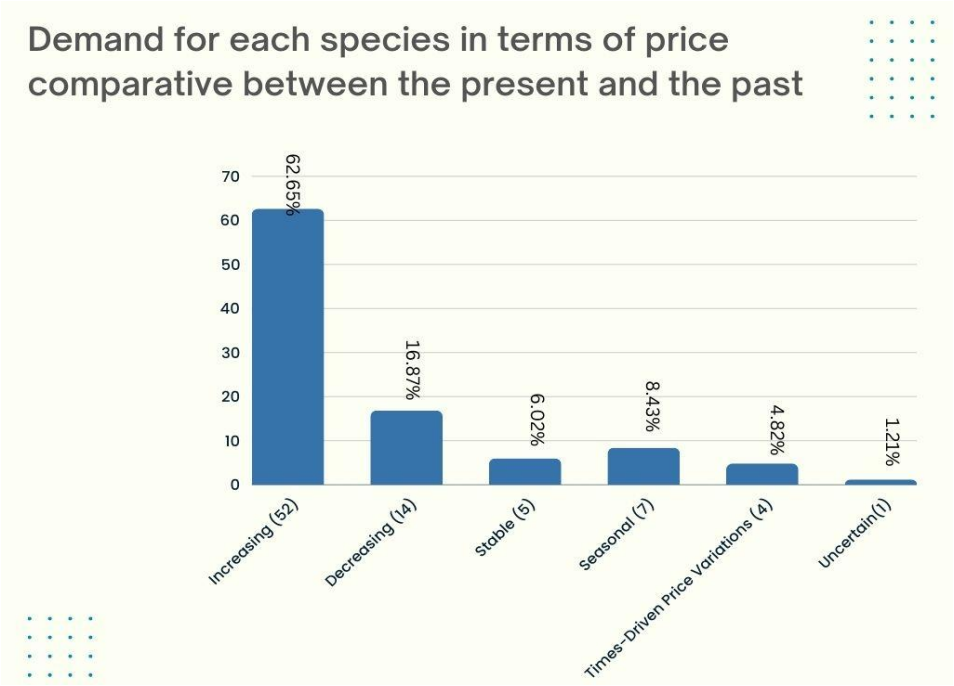


Figure 17 Demand for each species in terms of price comparative between the present and the past

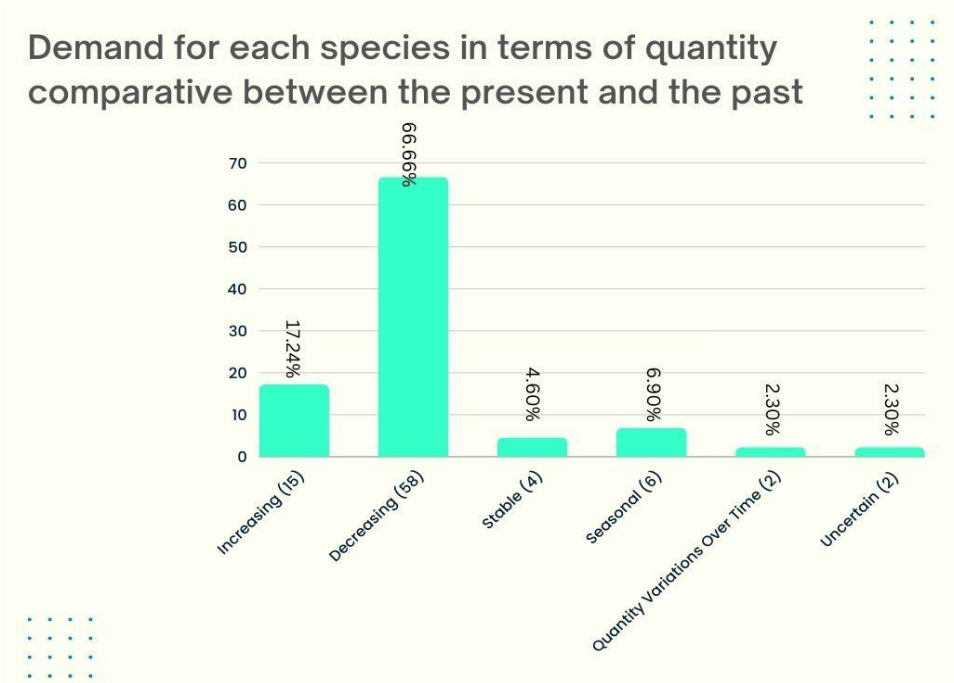


Figure 18 Demand for each species in terms of quantity comparative between the present and the past

Cost Analysis: Average Aquatic Animal Catch Expenditure per Time and Year 81,305 THB Cost Breakdown in Fisheries: Average Oil Fuel, Fishing Gear, Maintenances, Labor, Delivery and Other Expenditures; The cost of oil fuel is 304 THB. The average cost of fishing gear is 9430 THB. (depending on the duration of use), The average fishing gear maintenance cost per month is 6340 THB. The average labour cost is 0.32% (in case to hire more labour). The cost of vessel maintenance (annual) is 9968 THB. The cost for the delivery product to the landing site is 34 THB. The other cost is 85 THB (for foam and ice). The monthly average is 12477 THB. The annual average is 149778 THB. The percentage of average income from fisheries is 81.98 THB.

Table 7 presents a comprehensive overview of the maximum and minimum average measurements of various aquatic animals. The data provides valuable insights into the size variations within this diverse group, offering a glimpse into the range of dimensions observed across different species.

Table 7 Maximum and Minimum Average Measurements of Aquatic Animals

Species	Weight (Unit: kg.)			Length (Unit: cm.)		
	Min	**Max**	**Average**	**Min**	**Max**	**Average**
Fish						
Silver sillago	0.6	6.2	2.46	13	25	18.09
Grey bambooshark	1	16.4	8.7	52	70	57.78
Barracuda	0.7	0.7	0.7	18	18	18
Stingray	9	9	9	12	15	14
Whipray	2.9	14	8.45	12	17	15.34
Painted sweetlips	1.4	1.4	1.4	46	46	46
Tonguesole	27	27	27	26.5	26.5	26.5
Tripodfish	N/A	N/A	N/A	21.6	21.6	21.6
Donkey croaker	N/A	N/A	N/A	18	24.7	20.05
Shrimp						
Lobster	0.48	5.5	2.19	22	25	23.41
Banana prawn	0.08	7.6	2.38	10.4	20.2	15.53
Seashell						
Indian volute	0.42	1.92	1.17	14	23	18.5
Mantis shrimp						
Mantis shrimp	0.3	0.3	0.3	34	34	34
Tiger mantis shrimp	N/A	N/A	N/A	29.4	29.4	29.4

Economic Insights: Blue Swimming Crab Catch Analysis (Table 8), contains valuable information on the economic aspects of blue swimming crab, details on sizes, and the demand for other crab species see in Table 9.

Table 8 Buying Rates for Blue Swimming Crab by Size

Species	Size	Weight (g.)			Width/Length (cm.)			Price (THB/kg.)		
		Min	Max	Avg.	Min	Max	Avg.	Min	Max	Avg.
Blue Swimming Crab	XS	0.04	0.12	0.08	N/A	N/A	5/10	60	120	90
	S	0.07	0.17	0.12	5.2/11	7/13	6.1/12	160	230	195
	M	0.11	0.18	0.145	7/12.5	10/13.2	8.5/12.85	200	250	225
	L	0.13	0.22	0.175	8/13.5	12/15	10/14.25	275	300	287.5
Deceased Crab	XS	0.08	0.13	0.105	N/A	N/A	/11	100	120	110
	S	0.1	0.17	0.135	N/A	N/A	/13	130	200	165
	M	0.12	0.19	0.155	N/A	N/A	7/11.5	150	250	200
	L	0.14	> 0.2	0.2	N/A	N/A	N/A	180	300	240
	Mixed	0.11	0.15	0.13	N/A	N/A	N/A	N/A	N/A	110
Living Crab	XS	0.04	0.12	0.08	N/A	N/A	N/A	100	130	115
	S	0.07	0.15	0.11	N/A	N/A	/12	150	180	165
	M	0.13	0.18	0.155	N/A	N/A	/12	190	220	205
	L	0.17	> 0.2	0.22	N/A	N/A	7.5/14	270	300	285
Reproductive Crab	S	0.07	0.11	0.09	N/A	N/A	N/A	N/A	N/A	160
	M	0.13	0.18	0.155	N/A	N/A	N/A	190	200	195
	L	N/A	N/A	0.22	N/A	N/A	N/A	N/A	N/A	260
	Mixed	0.14	0.17	0.155	N/A	N/A	N/A	N/A	N/A	150

Table 9 Buying Rates by Species: A Crab Comparison

Species	Size	Weight (g.)			Width/Length (cm.)			Price (THB/kg.)		
		Min	Max	Avg.	min	max	Min	Max	Avg.	avg.
Crucifix crab	S	0.11	0.14	0.125	N/A	N/A	N/A	N/A	N/A	160
	M	0.15	0.19	0.17	N/A	N/A	N/A	N/A	N/A	200
	L	0.2	> 0.2	> 0.2	N/A	N/A	N/A	N/A	N/A	300
	Mixed	N/A	N/A	0.14	N/A	N/A	N/A	N/A	N/A	110
Indo-Pacific swamp crab	S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100
	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	150
	L	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	220
	Mixed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100
Mixed crab	Mixed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	60
Gladiator swimming crab	Mixed	0.02	0.15	0.085	N/A	N/A	N/A	50	70	60
Periscope crab	Mixed	0.03	0.11	0.07	N/A	N/A	N/A	N/A	N/A	35
Soft-shell crab	Mixed	0.04	0.18	0.11	N/A	N/A	N/A	100	120	110

Diverse Aquatic Catch: Beyond Crabs - the range of purchase prices for various aquatic animals and provides information on their purchase range is detailed in lists below,

- Banana prawn Pricing: 250-300 THB per Kilogram.
- Lobster Pricing:300-900 THB per Kilogram.
- Mantis shrimp Pricing: 300-700 THB per Kilogram.
- Barracuda Pricing: 60 THB per Kilogram.
- Silver sillago Pricing: 70 THB per Kilogram.
- Areolate grouper Pricing: 70-160 THB per Kilogram.
- Bengal whipray Pricing: 10-15 THB per Kilogram.

Conclusions, remaining evidence and management gaps

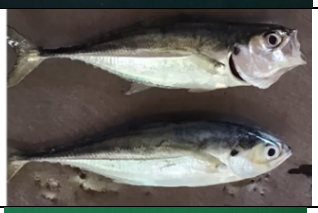
There remain significant gaps in the knowledge base and capacity for seagrass management. Scientific evidence gaps include Seagrass Survey on Mook island focused on seagrass data information about the distinct periods dedicated to the Dry and Wet seasons. The figure provides a visual representation of the seagrass cover, Canopy height, Epiphyte cover and Seagrass species richness, the targeted approach to capture seasonal differences in the aquatic environment. and assesses the impact of green turtle overpopulation to overgrazing, Overgrazing Threatens Seagrass Beds with No Rapid Response, Resulting in Destruction. Lack of the drive of policy emphasising the need for urgent attention to prevent further damage to seagrass areas. the need for academic contributions to tackle the challenges associated with the seagrass crisis as well as the socioeconomic and environmental drivers of seagrass overexploitation and habitat quality decline. the key issues faced by Sukorn Island, emphasizing the threats from illegal fishing. Formal recognition and protection of seagrass meadows remains elusive and effective management is yet to be demonstrated. the absence of organized the area of seagrass conservation and restoration efforts through co-management and the call for organized conservation efforts. Community seagrass conservation action plans are required which fit well within a coordinated regional management framework that is supported though national policy and legislation.

In examining both historical records and recent survey data, a concerning trend emerges — a decrease in the available fishing areas. While remnants of the past still offer opportunities for fishing, it's evident that fishermen are navigating challenges by venturing into new, more distant territories. The juxtaposition of historical evidence with current survey findings underscores the dynamic nature of fisheries and the adaptive strategies employed by fishermen to secure their livelihoods. As we grapple with these changes, it becomes imperative to strike a balance between conservation efforts and the sustainable utilization of available resources. Understanding the shifting dynamics will guide us in shaping effective policies that safeguard both the marine ecosystems and the livelihoods of those dependent on them.

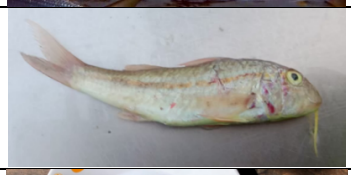
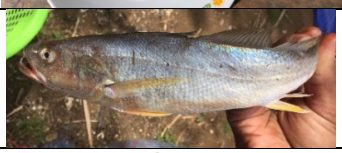
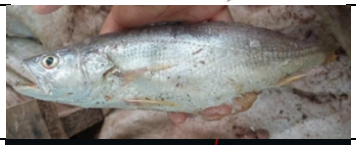
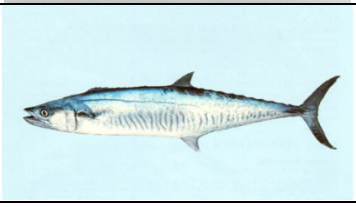
While the quantity of blue swimming crab has shown remarkable stability from the past to the present, the landscape is transformed when we consider the economic aspect. The doubling of prices signals a significant shift, indicating heightened market demand or changes in the economic dynamics surrounding this coveted marine resource. As we navigate these fluctuations, a comprehensive understanding of the factors influencing both abundance and market value is crucial for informed management strategies and sustainable fisheries practices moving forward.

In conclusion, the seagrass areas we explored are not just ecological treasures but crucial hubs for social service. From supporting fisheries and providing economic opportunities to preserving cultural heritage, seagrass ecosystems are intertwined with the well-being of local communities. Recognizing their importance is the first step towards effective conservation and sustainable management. As we move forward, let us unite in our efforts to protect these vital ecosystems, ensuring a harmonious balance between environmental preservation and the social fabric of our communities.

Appendix

Family	Scientific name	Common name	Picture
Fish			
Ariidae	*Hexanematichthys sagor*	Sagor catfish	
Carangidae	*Atule mate*	Yellowtail scad	
Carangidae	*Caranx sexfasciatus*	Bigeye trevally	
Carangidae	*Megalaspis cordyla*	Torpedo scad	
Carangidae	*Scomberoides lysan*	Doublespotted queenfish	
Carcharhinidae	*Carcharhinus melanopterus*	Blacktip reef shark	
Cynoglossidae	*Cynoglossus arel*	Largescale tonguesole	
Dasyatidae	*Neotrygon kuhlii*	Blue-spotted stingray	

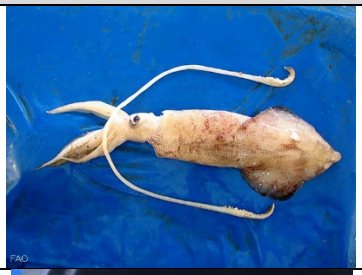
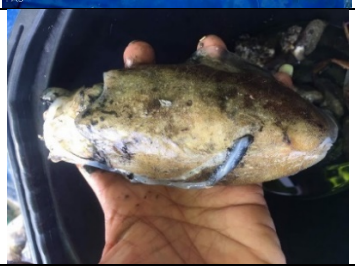
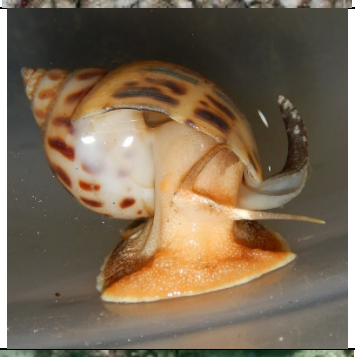
Family	Scientific name	Common name	Picture
Dasyatidae	*Brevitrygon imbricata*	Bengal whipray	
Dorosomatidae	*Sardinella gibbosa*	Goldstripe sardinella	
Drepaneidae	*Drepane punctata*	Spotted sicklefish	
Epinephelidae	*Epinephelus areolatus*	Areolate grouper	
Gerreidae	*Gerres spp.*		
Haemulidae	*Diagramma pictum*	Painted sweetlips	
Hemiscylliidae	*Chiloscyllium griseum*	Grey bambooshark	
Latidae	*Latidae spp.*	Seabass	

Family	Scientific name	Common name	Picture
Lethrinidae	*Lethrinus spp.*	Emperor	
Mugilidae		Mullet	
Mullidae	*Mulloidichthys martinicus*	Yellow goatfish	
Nemipteridae	*Nemipterus peronii*	Notchedfin threadfin bream	
Polynemidae	*Eleutheronema tetradactylum*	Fourfinger threadfin	
Rachycentridae	*Rachycentron canadum*	Cobia	
Sciaenidae	*Pennahia aneus*	Donkey croaker	
Scombridae	*Rastrelliger kanagurta*	Indian mackerel	
Scombridae	*Rastrelliger brachysoma*	Short mackerel	
Scombridae	*Scomberomorus commerson*	Narrow-barred Spanish mackerel	

Family	Scientific name	Common name	Picture
Siganidae	*Siganus spp.*	Rabbitfish/Spinefish	
Sillaginidae	*Sillago sihama*	Silver sillago	
Sphyraenidae	*Sphyraena tome*	Barracuda	
Stromateidae	*Pampus argenteus*	Silver pomfret	
Triacanthidae	*Triacanthus nieuhofii*	Silver tripodfish	
Crab			
Limulidae	*Tachypleus gigas*	Coastal horseshoe crab	
Menippidae	*Myomenippe hardwickii*	Mangrove stone crab	
Portunidae	*Charybdis feriata*	Crucifix crab	

Family	Scientific name	Common name	Picture
Portunidae	*Charybdis hellerii*	Spiny hands	
Portunidae	*Podophthalmus vigil*	Periscope crab	
Portunidae	*Portunus gladiator*	Gladiator swimming crab	
Portunidae	*Portunus pelagicus*	Blue swimming crab	
Portunidae	*Portunus sanguinolentus*	Threespot swimming crab	
Portunidae	*Scylla serrata*	Indo-Pacific swamp crab	
Raninidae	*Ranina ranina*	Spanner crab	

Family	Scientific name	Common name	Picture
Shrimp			
Palinuridae	*Palinurus spp.*	Lobster	
Penaeidae	*Penaeus merguiensis*	Banana prawn	
Penaeidae	*Penaeus monodon*	Giant tiger prawn	
Penaeidae	*Penaeus vannamei*	Whiteleg shrimp	
Stomatopoda	*Stomatopod*	Mantis shrimp	
Squid			
Loliginidae	*Sepioteuthis lessoniana*	Bigfin reef squid	

Family	Scientific name	Common name	Picture
Loliginidae	*Uroteuthis duvaucelii*	Indian squid	
Sepiidae	*Sepia officinalis*	Common cuttlefish	
Seashell			
Arcidae	*Tegillarca granosa*	Granular ark/Bloody cockle	
Babyloniidae	*Babylonia areolata*	Spotted Babylon/Maculated ivory whelk	
Diadematidae	*Diadema setosum*	Porcupine sea urchin	
Muricidae	*Murex trapa*	Rarespined murex	

Family	Scientific name	Common name	Picture
Mytilidae	*Arcuatula senhousia*	Green mussel	
Ostreidae		Oyster	
Strombidae	*Laevistrombus canarium*	Dog conch/Yellow connch	
Turritellidae	*Neohaustator fortilirata*		
Volutidae	*Melo melo*	Indian volute