



**MARINE
CONSERVATION
PHILIPPINES**

Semiannual Report

SIATON



APR 2026

marineconservationphilippines.org

EXECUTIVE SUMMARY



Marine Conservation Philippines Report Siaton - September 2025 - February 2026

Marine Conservation Philippines (MCP) conducted a total of **1,728 surveys** across four survey methodologies (Fish, Substrate, Invertebrates, and Predation) across the three municipalities we monitor (Zamboanguita, Siaton and Santa Catalina) between September 2025 and February 2026. With **808 surveys** conducted in the September - November 2025 season, and **920 surveys** conducted in the December - February season.

	Fish	Substrate	Invertebrates	Predation
Number of Surveys	412	472	419	435

The chart below presents the average fish biomass for the latest survey season at the four sites monitored in Siaton Municipality, specifically highlighting the density and average size of fish in each of the reefs (Figure 1). Given our focus on food security, we have specifically selected fish families of commercial interest for analysis. **The average commercial biomass for Siaton was ~10kg per 150m².**

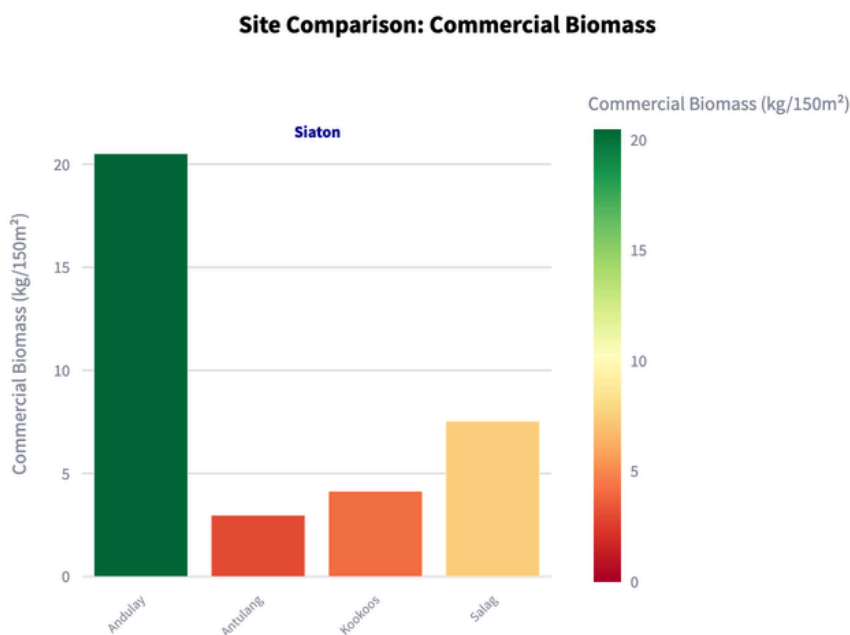


Figure 1. Commercial fish biomass (kg per 150m²) across all survey sites in the Siaton Municipality, September–February 2025/26. . Biomass values represent the estimated weight of commercially important reef fish, providing an indicator of food security potential and MPA effectiveness.

Hard coral cover is an excellent indicator of the overall health of a coral reef, as it is this type of coral that builds the long-term physical structure of the reef. The average hard coral cover in Siaton was 26.9%, compared to 41% in 2017, when monitoring began. This is **classified as moderate hard coral cover**, according to the Australian Institute of Marine Science (Figure 2).

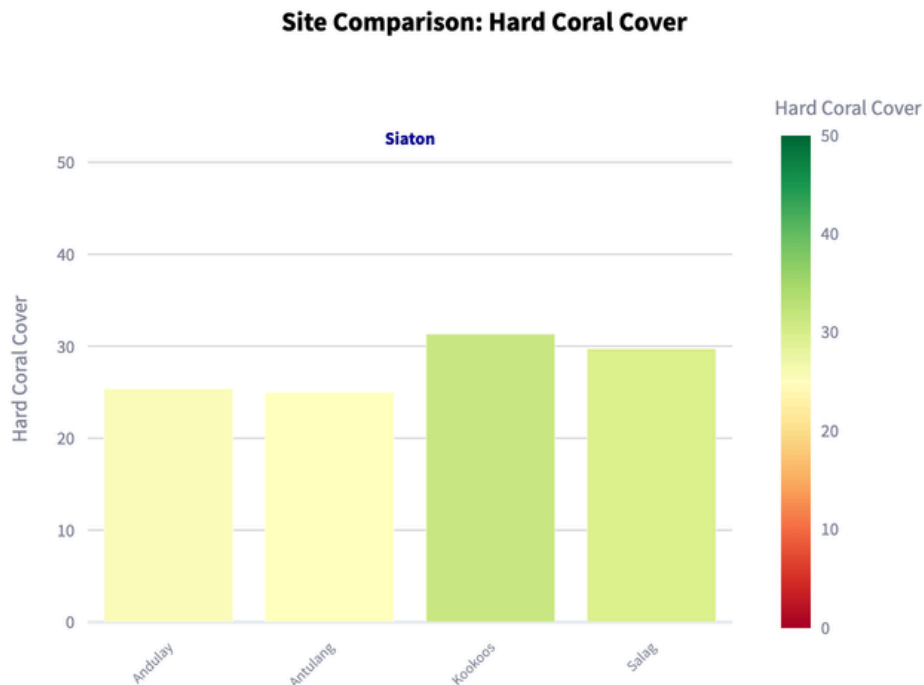


Figure 2. Average hard coral cover across survey sites in the Siaton Municipality September–February 2025/26 Data is expressed as average percentage cover.

Of the hard coral present, 99% was recorded as healthy, with approximately 1% observed to be affected by bleaching. Predation and silt were present, but only in small amounts. Globally, ocean temperatures are rising in response to human-caused climate change, and incidences of bleaching are becoming increasingly widespread and severe. However, it is interesting to note that the waters off the eastern and southern coasts of Southern Negros can be as much as 1 degree Celsius cooler than the waters of the Sulu Sea to the west, which does afford the area some natural protection against bleaching events. Events of bleaching in the municipality have gradually reduced since 2022, when 18% of hard corals were recorded as bleaching.

1728

**SURVEYS
COMPLETED**

**1.05%
Increase**



26.9%

**HARD CORAL
COVER**

**5.64%
Decrease**



9.96 KG

**COMMERCIAL
BIOMASS**

**3.16%
Decrease**



Using science to understand how local and global pressures affect marine ecosystems, we empower, engage, and build local and national capacity to reduce and adapt to these pressures, aiming for a sustainable future for the Philippine people and environment.





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MONITORING AND SCIENCE AT MCP



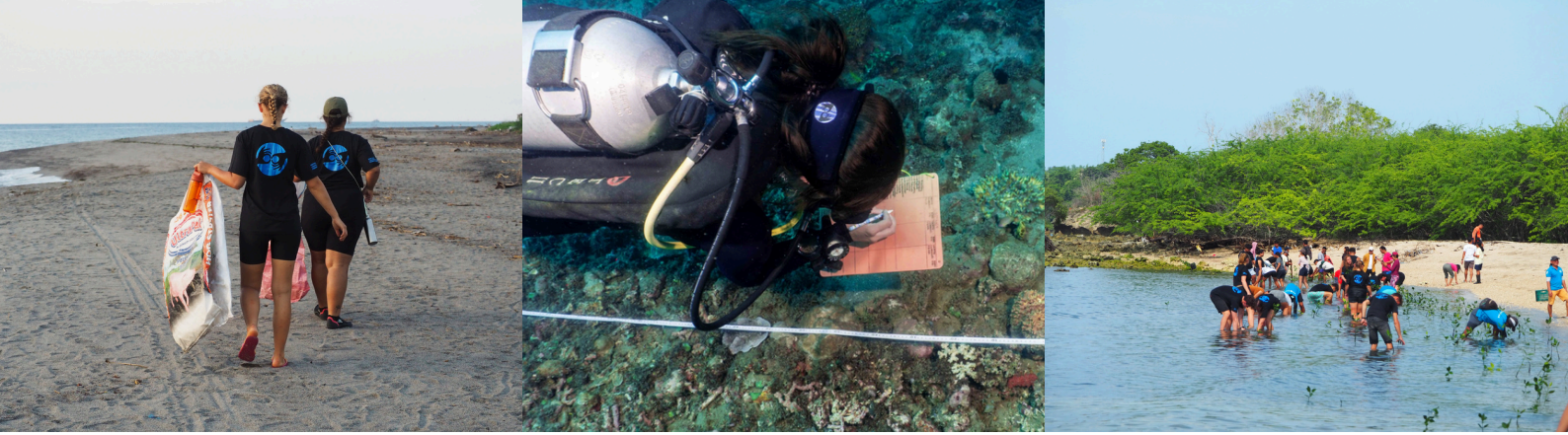
The Philippines, situated in the heart of the Coral Triangle, boasts the highest number of Marine Protected Areas (MPAs) of any country in the world, with approximately 1,600-1,800 protected areas. Some of these, such as Tubbataha Reef, are managed at a national level under the NIPAS program and have been implemented to protect and enhance biodiversity. However, the majority are much smaller in scale and managed in combination by the LGU and local community. These MPAs have been created to promote food security and sustainability for the local community. The 1998 Fisheries Code legislation calls for 15% of coastal municipal waters to be protected within no-take MPAs.

Despite the encouraging number of MPAs in the Philippines, they need to be managed effectively if they are to succeed in their goal of enhancing food security. Three things are of fundamental importance to effective management.

- Engagement with, and support from, the local community
- Effective demarcation of the boundaries of the MPA
- Consistent and sustained support from the LGU to patrol and enforce the MPA.

Through a volunteer-based scientific diving program, Marine Conservation Philippines focuses on collecting and analysing biophysical data on the effectiveness & resilience of locally managed MPAs, and offers support to local and regional management units.

MCP's expertise is focused on utilising a wide range of commercial biomass and MPA effectiveness as primary indicators of progress in ensuring long-term food security. Substrate composition and resilience are considered as indirect indicators, being essential for maintaining the commercial productivity of the ecosystem.



MCP's ecological monitoring program has been developed to provide a broad understanding of the regional health and abundance within the reef ecosystems. Its well-refined scope of data collection across all MPA sites, through all depth levels, ensures high coverage and accurate data input, with transparency and data quality remaining constant priorities.

The diversity, abundance, and fluctuations of commercial fish and invertebrates, as well as the composition & resilience of substrate lifeforms in the MPAs, are being monitored on a seasonal basis. By collecting the same representative dataset per season, change can be tracked, giving a much more detailed picture of change in the MPA over time. Seasons have been defined following PAGASA's (Philippines Atmospheric, Geophysical and Astronomical Services Administration) local recommendation ([December, January, February]; [March, April, May]; [June, July, August]; [September, October, November]).

The monitoring method employed uses 30m transects in a stratified random sampling strategy that recognises three depth ranges (3-7m, 9-13m, 15-19m). The depth ranges selected were chosen based on the spatial distribution of indicator life forms and the difference in indicator densities at different depths.

To collect a dataset representative of the ecosystem, it was necessary to identify these spatial differences and account for them to avoid bias. By observing each depth range and treating the results as an ecologically representative set, it is possible to generate an accurate model of the entire reef structure and community, determine its relative health, and track changes in the ecosystem over time.

The challenge in collecting an ecologically representative dataset lies in conducting a sufficient number of replicates to ensure that all present life forms are accounted for. For each of our sites, monitoring is therefore conducted across the three depth ranges and repeated a calculated number of times to ensure high validity. At least 12 replicates were conducted per site, per season, and for each ecological indicator group (invertebrates, substrate, and fish) to accurately represent the ecosystems of interest. These replicates were used to create a representative average of the ecosystem for each site and season.



MONITORING SITES

Siaton Municipality



MCP has been conducting its Long-Term Monitoring Program since 2017, although monitoring at some sites began later. The complete list of survey sites, along with some key details, can be found below.

Site Name	Status	Size (hectares)	Established	Monitored Since
Andulay	MPA	6	1993	2017
Antulang	Non-MPA	-	-	2017
Kookoos	Non-MPA	-	-	2017
Salag	MPA	10	2001	2019

SIATON

Community Projects



Marine Conservation Philippines is pleased to continue our work for and with the local community. The following is a summary of the community projects we have undertaken in the last report period of September 2025 - February 2026

- **International Coastal Clean-Up Day**

For International Coastal Clean-Up Day 2025, beach and dive cleans were conducted in Salag and Andulay, alongside Pro Ocean, Siaton Fisher Folk Association, members of the LGU and the local community, collecting 89 kgs of waste.

- **SCUBA Training**

Continuing our work in training members of LGU departments across Negros, in October, we hosted 22 people from BATASS, training them in a mixture of Open Water and Advanced Open Water.

- **Monitoring Dashboard**

Our new dashboard is now live on our website, giving communities instant access to the current and historical data for each MPA.

- **Dumaguete Youth Congress**

In December, MCP was invited to speak at the Youth Congress - Building a future for good Governance.

- **Immersion Program**

Ten science students from Basay National High School joined us for a 2-day immersion program in December. Taking part in presentations, fisher folk forums, seaweed surveying and a discovery dive.

- **White Gifts**

In 2025 we held a White Gift event in Olympia to help local communities that suffered due to the untreated molasses spill in Bias. We also held a White Gift event in Lutoban and Siaton.

- **Mangrove Planting**

Together with MENRO, Tourism officers and DNER we planted 200 mangrove seedlings at the Santa Catalina Mangrove Boardwalk.

FOOD SECURITY

Biomass of Commercial species



One fundamental measure of an MPA's success is the amount of fish biomass it produces. If there is higher fish biomass within an MPA, then more fish will be available for the community to harvest outside of the MPA. This is known as the 'spillover effect', and is one of the main ways in which an MPA can promote food security.

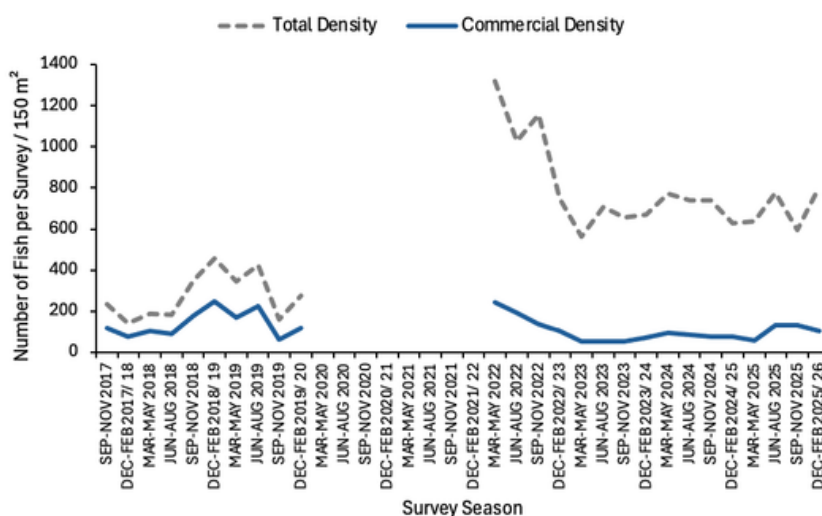


Figure 3. Temporal trends in total fish density and commercial fish density across the Siaton Municipality, Sep-Nov 2017 to Dec-Feb 2025/26. Values represent average individuals per 150m² recorded during seasonal surveys. Data gaps (2020–2022) reflect periods when surveys were suspended due to COVID-19.

Current Status:

In September–February 2025/26, Siaton municipality recorded an average **total fish density of ~700 individuals per 150 m²** (per survey), with commercial species contributing ~119 individuals per 150 m² (Figure 3).

We consider these data separately as we monitor some non-commercial fish that often occur in high numbers (particularly Damselfish), which would misrepresent the data if they were combined. The average fish density of the reefs in this municipality has remained relatively consistent, with minor seasonal fluctuations. Damselfish were added to the indicator list after the COVID-19 gap, resulting in a significant increase in total density.

Commercial biomass reached ~10 kg per 150 m² (~667 kg/ha) (Figure 4). Herbivores (~597 ind.) dominated the fish community, followed by carnivores (~71 ind.), while omnivores (~10.4 ind.), corallivores (10 ind.), and detritivores (~10.3 ind.) were present in lower numbers. These results indicate that the fish community in Siaton is strongly dominated by herbivorous species, with moderate commercial biomass across the municipality.

Figure 4. Temporal trends in commercial fish biomass (kg per 150m²) across the Siaton Municipality, Sep–Nov 2017 to Dec-Feb 2025/26. Biomass values represent the estimated weight of commercially important reef fish, providing an indicator of food security potential and MPA effectiveness. Data gaps (2020–2021) reflect periods when surveys were suspended due to COVID-19.

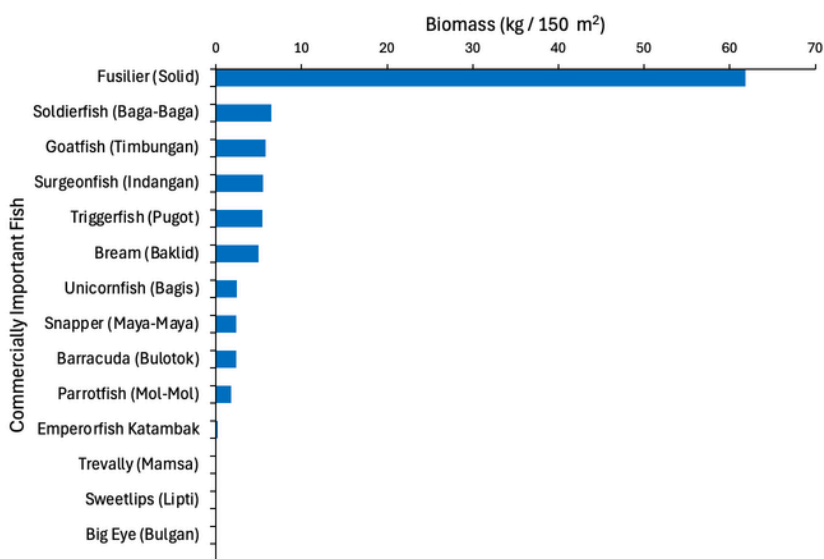
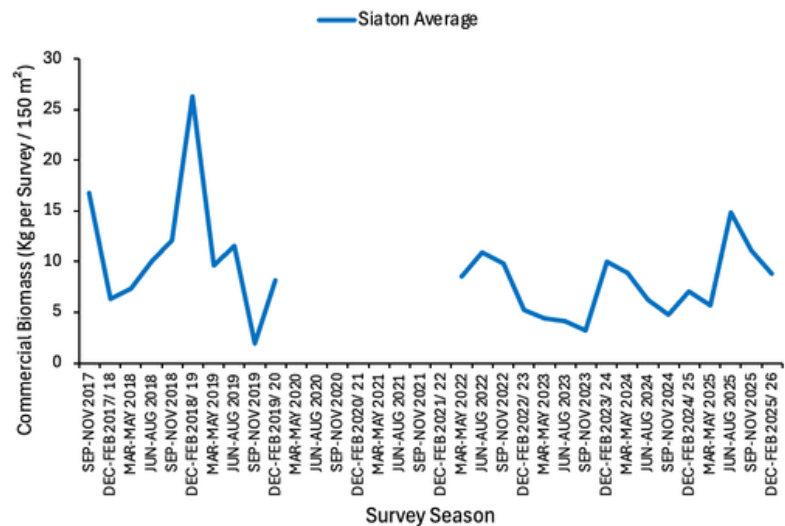


Figure 5. Biomass (kg per 150m²) of commercially important reef fish groups in Siaton Municipality, averaged across MPAs during Sep-Feb 2025/26. The values represent the average (mean) biomass observed on each survey, highlighting variation in key target families that contribute to local fisheries, food security, and ecosystem resilience.

Commercial Groups:

Across Siaton, fusiliers are consistently the most abundant commercial group and contribute the most to biomass, followed by soldierfish, goatfish, and surgeonfish (Figure 5). Larger predatory fish, such as groupers, are present but occur in relatively low densities, indicating that commercial biomass is largely driven by mid-sized schooling species rather than large predators. This pattern is typical of reef systems experiencing fishing pressure, where large predatory fish are removed first, leaving smaller and mid-trophic level commercial species to dominate the biomass.

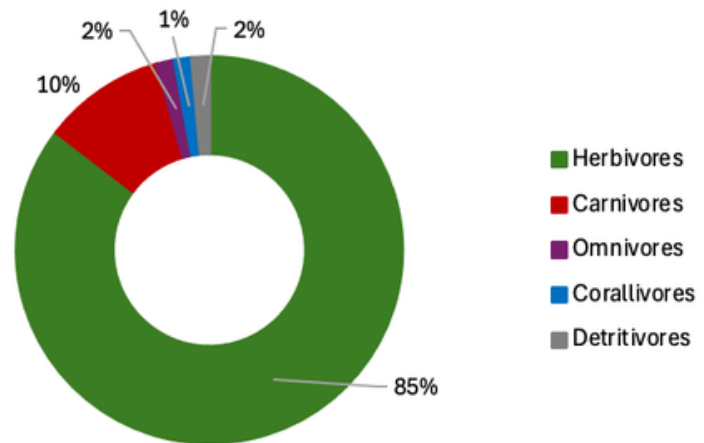
Recent Change:

Compared with the previous reporting season, total fish density decreased slightly (725 → 700 ind. per 150 m², similar to overall levels), while commercial density increased (96.7 → 118.7 individuals per 150 m²). However, commercial biomass decreased slightly (10.28 → 9.96 kg per 150 m²). Herbivore density remained relatively stable (567 → 596 ind.), while carnivore density decreased slightly (90.6 → 71.4). Omnivores, corallivores, and detritivores remained relatively stable between periods. This suggests that while the number of commercial fish increased, their average size may have decreased, resulting in slightly lower biomass.

Dietary Structure:

Across the Siaton municipality, the fish community is strongly dominated by herbivores (~85%), followed by carnivores (~10%), with omnivores, corallivores, and detritivores together making up ~5% of total fish density (Figure 6). This trophic structure indicates that reef fish communities are primarily structured around grazing species, which play an important role in controlling algae and maintaining reef health.

Figure 6. Proportional contribution (%) of dietary groups to total fish density for the Siaton Municipality during Sep-Feb 2025/26. Data include both commercial and non-commercial species, highlighting the ecological importance of abundant herbivores in supporting algal-coral balance.



Long-term Context:

Long-term data show that fish density in Siaton increased substantially after 2022, largely driven by increases in herbivorous fish density. However, commercial biomass has fluctuated over time and has not shown a consistent increasing trend, suggesting that increases in fish numbers are not necessarily translating into increases in fish size or biomass. This indicates that while fish abundance may be increasing, the fish community may still be dominated by smaller individuals and mid-trophic level species.

Ecological Interpretation:

Overall, the Siaton municipality supports a relatively high fish density, primarily driven by herbivorous species, which is a positive for reef resilience. However, commercial biomass remains moderate and appears to be driven largely by mid-sized commercial species rather than large predatory fish.

The comparison between MPAs (Andulay and Salag) and non-MPA sites (Antulang and Kookoos) suggests that MPAs are contributing to higher biomass and more stable fish communities, while non-MPA sites show more variability and lower predator abundance.

This indicates that marine protected areas in Siaton are playing an important role in supporting fish biomass and maintaining trophic structure, although full recovery of large predatory fish populations may still be ongoing.

REEF HEALTH AND RESILIENCE

Substrate Composition



The Philippines is situated in the Coral Triangle, an area of huge biodiversity that contains 30% of the world's reefs. Many factors determine the health of coral reefs, but two of the most important are Hard Coral Cover (HCC) and Algae Cover. Hard corals build the reef itself, providing habitat for thousands of other species, many of which are commercially important. Algae, particularly fleshy macroalgae, compete with coral for space. Too much algae can lead to algae dominating the reef. Without the coral and the living space it provides, much of the biodiversity of the reef is lost. Globally, hard coral cover has been decreasing since 2010.

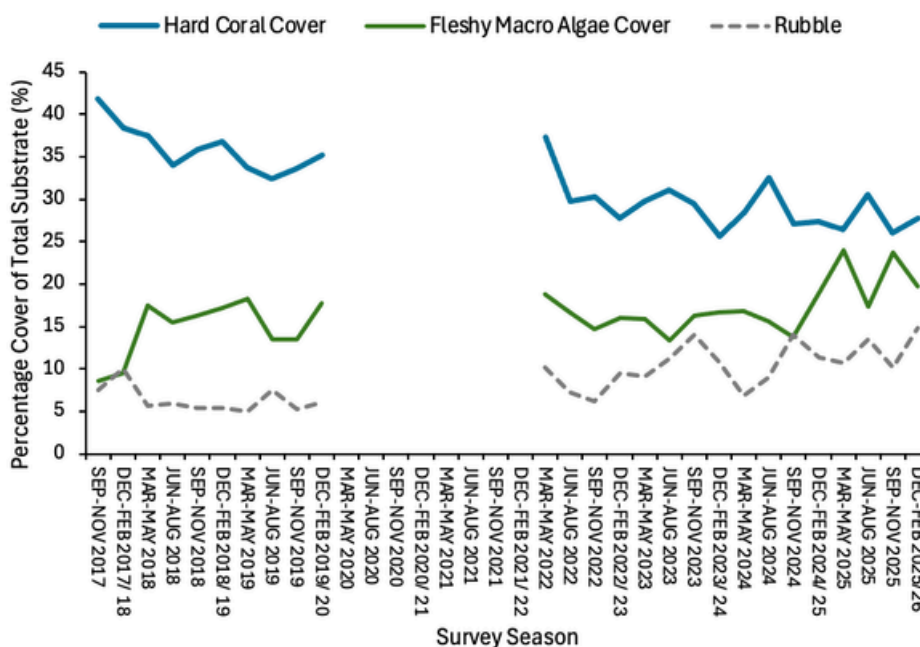


Figure 7. Temporal trends in average hard coral cover, fleshy macroalgae cover, and rubble across the Siaton Municipality (2017–2026). Data is expressed as average percentage cover per survey season.

Current status:

During the September 2025–February 2026 monitoring period, reefs across the Siaton municipality recorded an average **hard coral cover of ~26.9%**, **fleshy macroalgae of ~21.8%**, and **rubble of ~12.5%** (Figure 7). Bleaching levels were low across the municipality during this monitoring period, averaging ~1.1%, suggesting low thermal stress at the time of survey period. Overall, the Siaton municipality reefs can be described as moderately coral-dominated but structurally mixed, with noticeable algal presence and areas of unconsolidated substrate. Elevated macroalgal cover can reduce reef biodiversity, limit coral recruitment, and weaken long-term climate resilience if sustained.

Recent change:

Compared with the previous reporting period, hard coral cover decreased slightly (28.5% → 26.9%), indicating a small decline in coral dominance at the municipality scale. Macroalgae increased slightly (18.9% → 17.3%), while rubble also increased marginally (12.1% → 12.5%), suggesting a small shift toward more degraded substrate and increased algal presence. Bleaching levels decreased (0.9% → 2.2%), indicating reduced coral stress across the municipality (Figure 8). Overall, the municipality shows a slight decline in coral cover alongside small increases in macroalgae and rubble, suggesting gradual reef pressure rather than acute disturbance.

Structural implications:

The combination of moderate coral cover, moderate macroalgae, and moderate rubble, suggests that reefs across Siaton are in a transitional state, rather than clearly coral-dominated or algae-dominated. The presence of rubble at ~12% indicates that substrate instability may be limiting coral recruitment in some areas, while macroalgae at ~22% suggests ongoing competition for space between algae and corals. This balance indicates that reef condition is being shaped by both physical disturbance (rubble) and biological competition (macroalgae).

Bleaching incidence has been highly variable, ranging from 1% to 17%, with severe peaks during regional heat stress events in 2022–2023 (Figure 8). Encouragingly, bleaching has since declined to around 2% in mid-2025, highlighting some recovery capacity within coral assemblages.

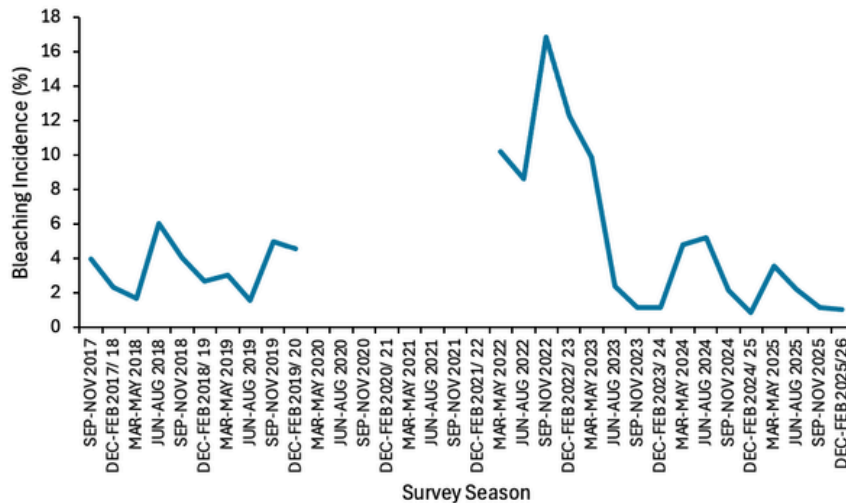
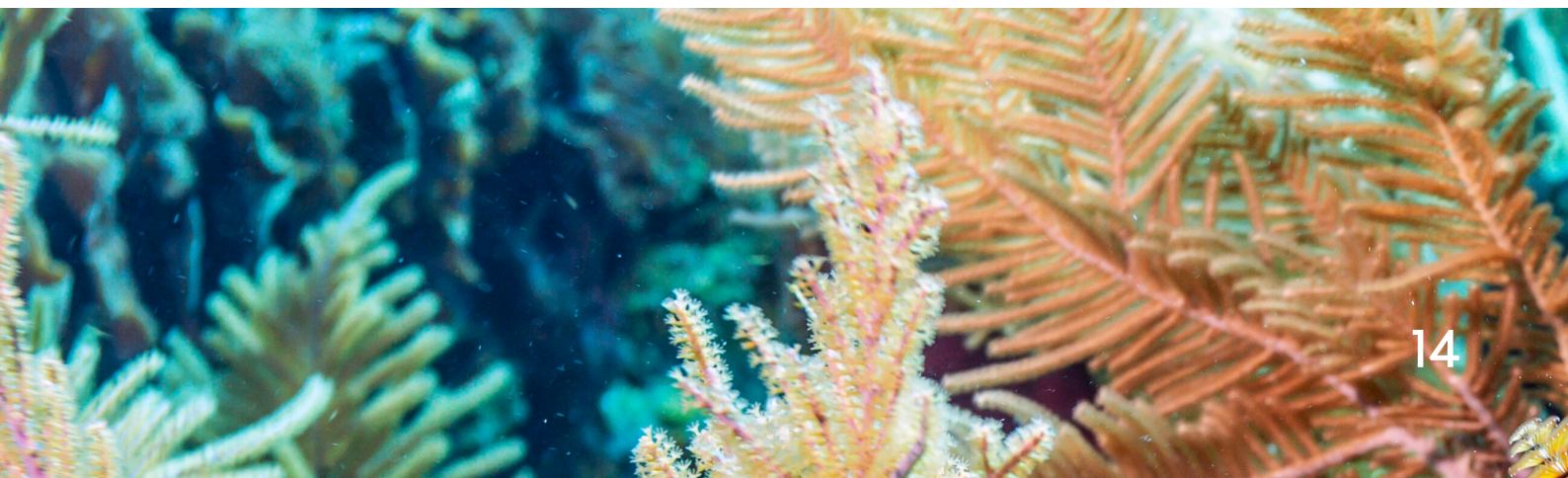


Figure 8. Seasonal bleaching incidence in Siaton Municipality (2017–2026), shown as average percentage of colonies observed with visible bleaching (either partially or fully bleached) per survey season.



Long-term context:

Since monitoring resumed following the COVID-19 interruption, Siaton's reefs have exhibited variability driven by bleaching events and disturbance. Coral cover declined significantly during 2022-2023, coinciding with elevated bleaching (peaking above 15%) and increased macroalgal dominance. Bleaching has now remained below 5% for over a year, allowing partial stabilisation of coral communities. However, coral cover remains below late-2010s levels (35-42%), and macroalgae continue to fluctuate around 18-24%, suggesting an ongoing competitive balance between coral recovery and algal expansion. Rubble has remained consistently elevated since 2022, highlighting persistent structural limitations.

Ecological interpretation:

Siaton's reefs appear to be in a phase of cautious stabilisation rather than active recovery. The substantial decline in bleaching during this reporting period is encouraging and reduces immediate thermal stress. However, the slight reduction in coral cover combined with increasing macroalgae suggests that competitive dynamics remain active. Persistent rubble continues to limit structural stability and may constrain coral recruitment potential. If macroalgal cover remains above 20% and rubble remains elevated, coral recovery may plateau rather than accelerate.

Some sites are recovering or stable, such as Salag and Antulang, other sites are experiencing algal increases, e.g. Kookoos, and other sites are showing higher rubble and structural damage, such as Andulay. This indicates that local site conditions and management effectiveness likely play a major role in reef condition. Overall, the municipality demonstrates resilience in the face of past bleaching stress but remains vulnerable to renewed disturbance. Continued MPA enforcement, herbivory maintenance, and reduction of physical impacts will be critical to ensure coral dominance is strengthened rather than eroded.



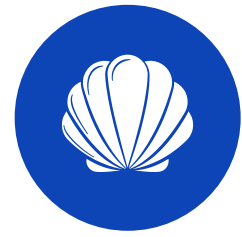
Algae are less biodiverse than corals and support fewer species of fish and invertebrates. A shift from hard corals to algae will result in lower climate change resilience, as well as significantly reduced commercial value. Since monitoring resumed after the COVID-19 pandemic, the cover of fleshy macroalgae has at times exceeded that of hard coral, suggesting a risk of algae becoming dominant. Algae thrive on phosphorus and nitrogen, which can be found in high amounts in nutrient runoff from agriculture and sewage. Reefs located near river mouths are likely to see more algal growth in the wet seasons due to upland agricultural runoff. It is unlikely that corals can reclaim the lost substrate in the dry seasons, unless the area supports a healthy population of herbivorous species that can consume the algae.

The increase in rubble cover in recent years likely reflects a combination of destructive natural events (typhoons, storms) and anthropogenic impacts, such as anchor damage, fishing gear, or blast fishing. Rising rubble reduces substrate stability and limits the potential for coral recruitment, further constraining reef resilience.

Overall, reefs in Siaton are under significant pressure, with long-term declines in coral cover, elevated algal competition, and persistent rubble, all of which point to reduced resilience. Without reductions in local stressors and protection of herbivore populations, the trajectory risks favouring algae over corals. Continued monitoring and management will be essential to stabilise these reefs and support recovery capacity.

BENTHIC COMPOSITION

Invertebrate Status



Across all sites, the average invertebrate density in Siaton municipality was ~25 individuals per survey, with values varying considerably between sites. The highest invertebrate densities were recorded at Antulang and Andulay, while the lowest density was recorded at Salag (Figure 9). Species richness followed a similar pattern, with Andulay and Antulang recording the highest species richness (~2.21 - 2.22 species per survey), while Kookoos and Salag recorded lower species richness (~1.71 - 1.61 species per survey) (Figure 10). These results indicate that invertebrate communities are more abundant and slightly more diverse at Andulay and Antulang compared to Kookoos and Salag.

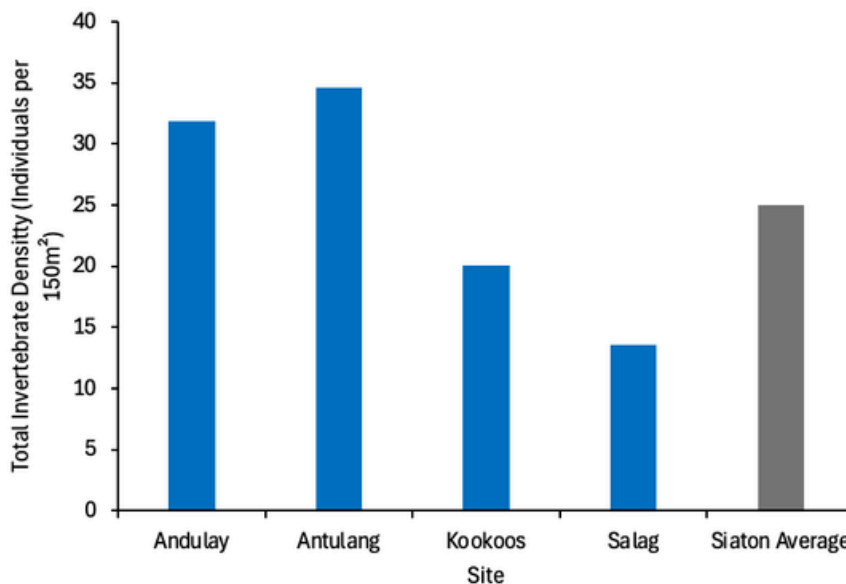


Figure 9. Invertebrate density across sites within the Siaton Municipality during Sep–Feb 2025/26. Values represent average density per survey.

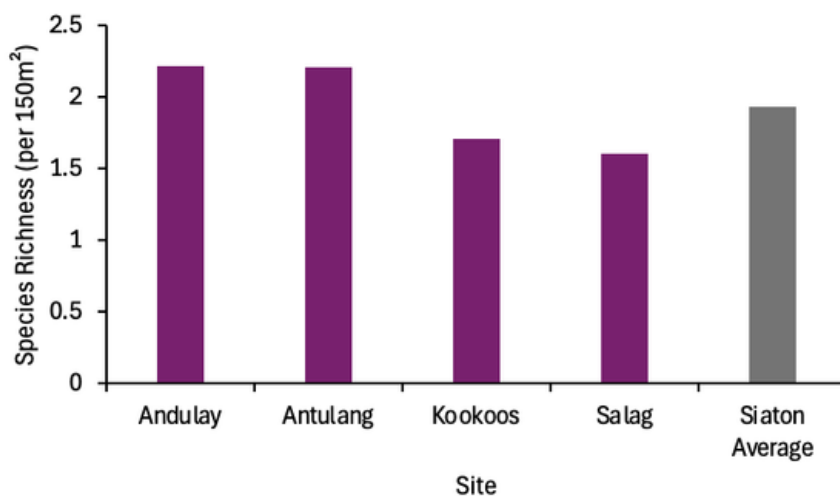


Figure 10. Species richness across sites within the Siaton Municipality during Sep–Feb 2025/26. Values represent average species richness per survey.

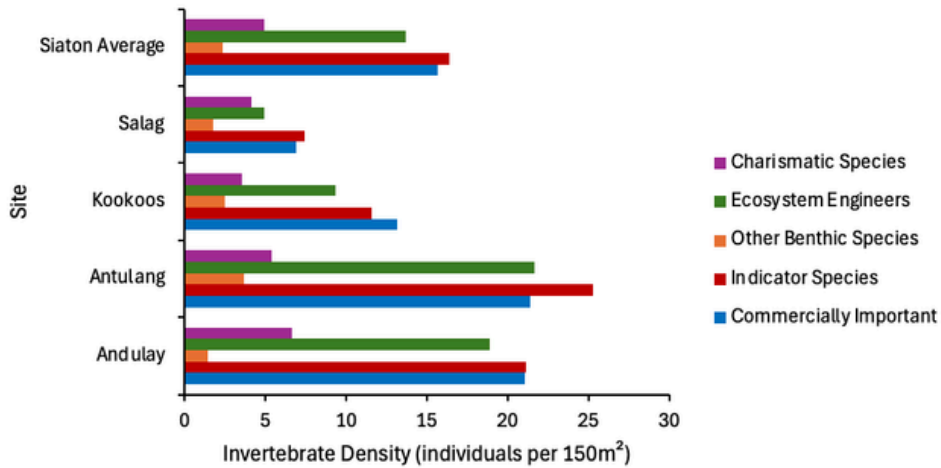


Figure 11. Composition of invertebrate functional group density at Santa Catalina reef sites (September - February 2025/2026).

In terms of functional groups, indicator (sensitive) species and commercially important species were the most abundant groups across Siaton municipality, followed by ecosystem engineers (Figure 11). Other benthic-associated species were recorded at relatively low densities across all sites, while charismatic species such as sea cucumbers and giant clams were present at moderate densities. The relatively high abundance of indicator species suggests that some reef areas within Siaton still support species associated with healthier reef conditions. The high abundance of ecosystem engineers, primarily sea urchins, indicates that herbivory and bioerosion are likely important ecological processes across these reef sites.

Sea Urchins - Diadema	8.10
Sea Urchins - Rock Boring	1.24
Gastropods - Scorpion Spider Conch	0.87
Gastropods - Other Shell	0.73
Sea Cucumbers - Black Spotted	0.71
Gastropods - Nilo Top	0.69
Bivalves - Giant Clam	0.60
Gastropods - Cone	0.59

Table 1. Most abundant commercial invertebrates in the Siaton Municipality during Sep–Feb 2025/26. Values represent average density per survey and highlight the dominant contributors to the commercial benthic community.

Analysis of commercially important invertebrates showed that the community was strongly dominated by sea urchins, particularly *Diadema*, followed by rock-boring sea urchins, scorpion spider conch, other gastropod shells, black-spotted sea cucumbers, nilo top shells, and giant clams (Table 1). The dominance of sea urchins suggests that herbivory plays an important role in controlling algal growth on these reefs, which can be beneficial for coral recruitment.

However, the relatively lower densities of high-value commercial species such as sea cucumbers and giant clams may indicate fishing pressure, slow recovery rates, or habitat limitations.

When comparing Marine Protected Areas to non-protected sites, the results show a mixed pattern. Andulay MPA recorded high invertebrate density and species richness, suggesting that protection may be benefiting invertebrate populations at this site. However, Salag MPA recorded the lowest invertebrate density and species richness among all sites, indicating that protection alone does not necessarily result in higher invertebrate abundance. Antulang, a non-protected site, recorded the highest overall invertebrate density, which may be due to habitat preferences, reef complexity, or lower fishing pressure in specific areas rather than protection status alone. Kookoos, another non-protected site, recorded moderate invertebrate density and lower species richness.

Overall, the Siaton municipality reefs support moderately abundant invertebrate communities dominated by commercially important species, indicator species, and herbivorous sea urchins. Differences between sites suggest that local habitat conditions, reef structure, and management effectiveness likely play an important role in influencing invertebrate populations, in addition to protection status. The results suggest that while MPAs, such as Andulay, appear to be supporting higher invertebrate abundance and diversity, others may require improved management, enforcement, or longer recovery time to show clear ecological benefits.

TOURISTIC VALUE

Iconic and Charismatic Species



Southern Negros not only hosts some beautiful coral reefs, but is world famous for the abundance of small, rare animals found in its waters. This is a significant draw for divers and contributes substantially to the local tourism industry.

Tourism has an increasingly important role to play in the success of Marine Protected Areas, provided it is managed in a thoughtful and conservation-minded manner. The effective ticketing of recreational diving activities will generate income for the communities around an MPA, as well as help to cover ongoing maintenance costs. This will enhance the MPA's ability to provide food security.

The table below summarises a wide range of animals with high potential tourism value that divers and snorkellers would be interested in seeing. The figures represent the percentage of times an indicator was observed during dives between September 2025 and February 2026 (Table 2). This provides a representation of how likely divers are to encounter these creatures, aiding dive operations in selecting sites that suit customers.

	Andulay MPA	Antulang	Kookoos	Salag MPA	Municipal Average
Barracudas	19.82	31.56	17.51	8.76	19.41
Cephalopods	4.72	4.40	2.84	6.74	4.67
Cowries	37.74	36.73	29.35	16.04	29.96
Eels and Snakes	34.91	42.68	45.99	42.69	41.57
Frogfish	6.61	2.83	0.86	-	2.57
Giant Clams	46.23	31.72	64.37	76.61	54.73
Porcupinefish and Pufferfish	83.02	89.33	78.93	79.24	82.63
Scorpaenidae	42.46	62.95	57.11	56.16	54.67
Sharks	-	-	-	-	-
Shrimps	44.34	48.5	40.83	55.61	47.32
Slugs	72.64	65.78	62.78	76.06	69.32
Stingrays	-	1.73	1.11	4.105	1.74
Syngnathidae/ Pegasidae	12.27	18.84	2.84	10.23	11.04
Turtles	23.59	20.56	20.46	8.21	18.20

Table 2- Average percentage frequency of sightings for key charismatic species across sites in the Siaton Municipality between September and February 2025/26.

The Siaton municipality presents a strong and diverse portfolio of marine tourism values, with several sites excelling in different niches. On average, Siaton delivers particularly high encounters with porcupinefish and pufferfish (82.6%), slugs (69.3%), and giant clams (54.7%), making it especially attractive for divers seeking macrofauna and vibrant reef invertebrate experiences (Figure 12). Scorpaenidae (54.7%), eels and snakes (41.6%), and shrimps (47.3%) add consistent value across sites.

In terms of megafauna, sightings are more variable. Turtles (18.2%) are regularly encountered, though they peak at Andulay (23.6%) and remain scarce at Salag (8.2%). Barracudas (19.4%) are seen at most sites, especially Antulang (31.6%), while sharks were not seen this monitoring period. Stingrays are infrequent overall (1.7%), though Salag offers slightly higher chances (4.1%).

Overall, Siaton’s tourism value lies in its reliable macro-diversity and reef invertebrates, complemented by moderate opportunities to encounter turtles, barracudas, and rays. These sites offer dependable encounters with iconic species and unique opportunities to observe rarer taxa. This makes it highly attractive to underwater photographers, macro enthusiasts, and recreational divers, although less so to visitors focused on high-frequency shark or pelagic sightings.

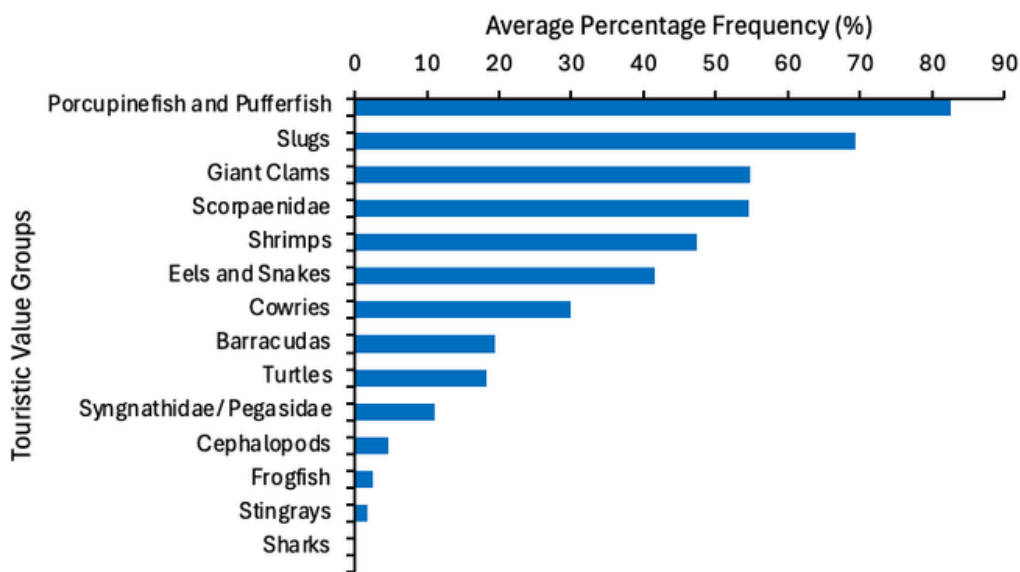


Figure 12. Sightings of high-value tourist species across the Siaton Municipality during Sep–Feb 2025/26. Data is presented as the percentage of dives in which each group was recorded.

In this context, Scorpaenidae refers to lionfish, scorpionfish, and stonefish, while Syngnathidae and Pegasidae includes seahorses, pipefish, sea moths, and sea dragons.



Approximately 200 million tons of trash are currently circulating in our global oceans, with around 11 million tons added each year. The Philippines is responsible for approximately 2.7 million tons of plastic waste alone that is introduced into the sea.

This trash can have devastating effects on marine and coastal ecosystems, from ghost nets killing animals that go to waste and large pieces physically smothering the reef, to microplastics being ingested and concentrated in animals that we ultimately eat, introducing potentially dangerous plastics into our own bodies.

Our partner NGO, Pro Ocean, conducts beach cleans 6 days a week along the coastline from Sibulan to Bayawan, playing a vital role in limiting the ecological damage that trash can cause. The following chart summarises the trash they've collected from September 2025 to February 2026 (Figure 12).

In addition, MCP conducted 8 beach and 9 dive cleans between September 2025 and February 2026, collecting a further 304.44 kg of trash, complementing Pro Ocean's ongoing efforts.

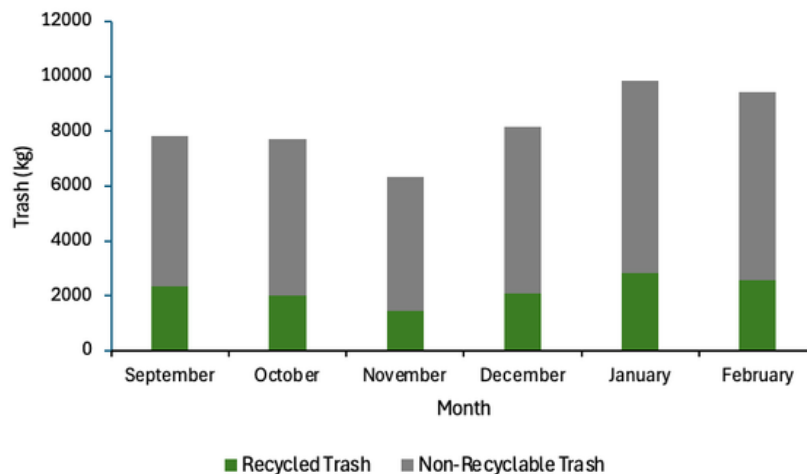


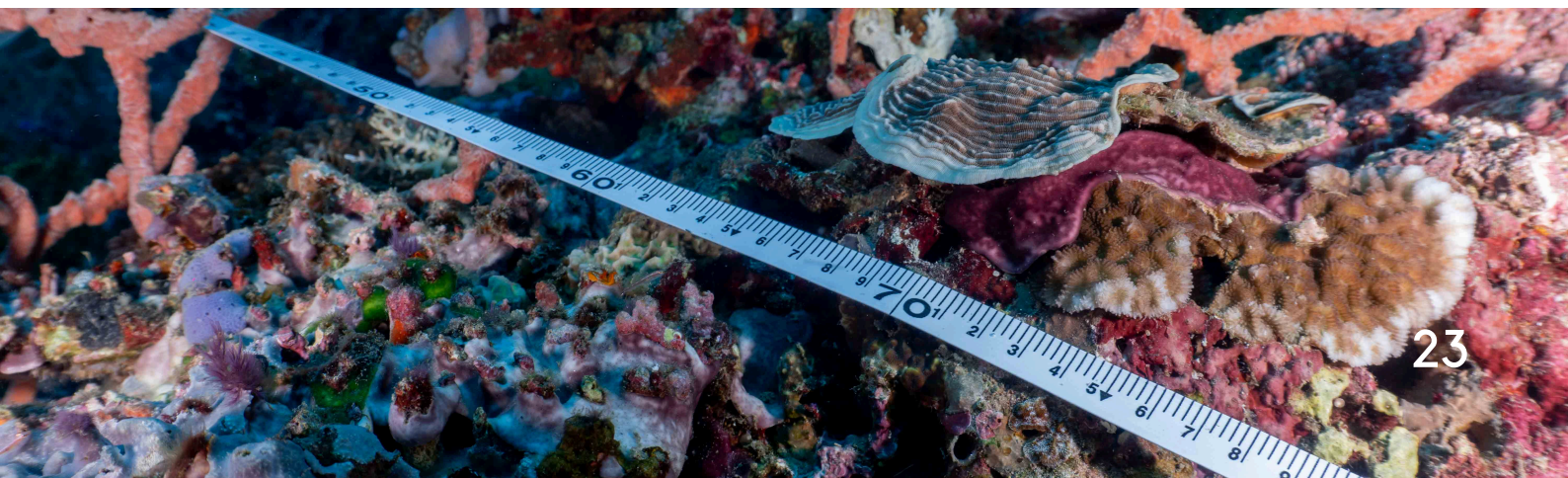
Figure 12. Monthly totals of recycled and non-recyclable trash (kg) collected by Pro Ocean during beach cleans along the Sibulan–Bayawan coastline, Sep–Feb 2025/26. Regular clean-up efforts play a key role in reducing the ecological impacts of marine debris in a region where plastic pollution poses a major threat to coastal ecosystems.



MANAGEMENT SUGGESTIONS



- Demarcation is ongoing for sites in Siaton
- Develop enforcement strategies
- Community engagement and education
- Continue long-term monitoring
- Regular coastal and underwater clean-ups
- Consider MPAs in coastal activities that could lead to runoff, especially sites in the vicinity of river mouths
- Sustainable tourism management - Implement or improve environmental user fees for divers and snorkelers.
- Use of safe materials in artificial reefs:
<https://www.marineconservationphilippines.org/wp-content/uploads/2018/02/factors-and-principles-artificial-reef-creation.pdf>
- Consider expanding MPAs to include areas with high coral cover and fish biomass.
- Seasonal closures for commercially important species to protect predatory fish
- Consideration of temporary restriction on herbivorous fish in sites of algal domination.
- Maintain restrictions on catching key herbivores (parrotfish, surgeonfish, rabbitfish) to prevent algal overgrowth and support coral recovery.
- Identify and manage nutrient inputs from sewage, agriculture, and coastal development
- Increase protection for groupers, snappers, trevallies, and barracudas to improve ecosystem balance and increase biomass.





**MARINE
CONSERVATION
PHILIPPINES**

Semiannual Report

SIATON

Section 2

Site Specific Results

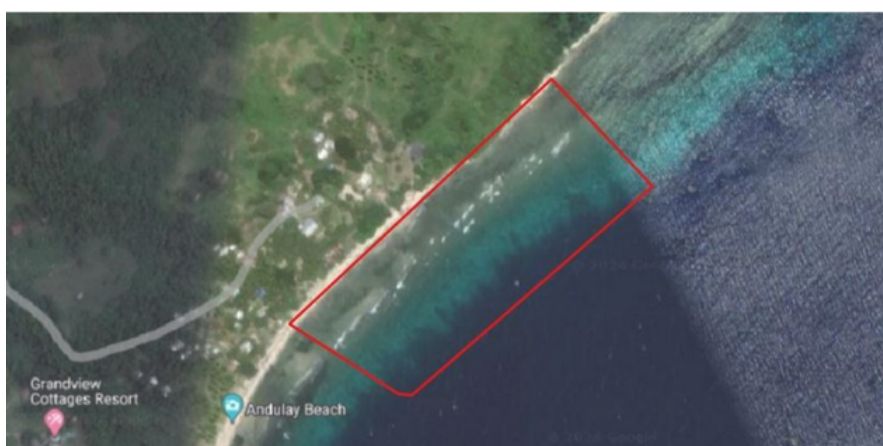


APR 2026

ANDULAY MPA



Andulay MPA has an area of 6 hectares and is one of the oldest MPAs in the region, having been established in 1993. It consists of dense and continuous coral reefs ranging from 1 - 25 m, with seagrass beds present in the shallows. The substrate between the shore and the beginning of the shallow reef is densely covered in macroalgae. Due to the location, the reef is moderately exposed and occasionally experiences longshore currents and strong wave action.



MPA demarcation based on DENR coordinates

ANDULAY MPA

Food Security



Current Status:

During the most recent reporting period (Sep–Feb 2025/26), Andulay MPA recorded an average total fish density of ~1109 individuals per 150 m², with **commercial species contributing ~166 individuals per 150 m²** (Figure 14).

The **average commercial biomass observed at Andulay MPA was approximately 14.7 kg of fish** per survey area of 150 m² (~980kg/ha), representing a substantial increase compared to the previous reporting period (Figure 15). Herbivores (~958 ind.) made up the largest group, followed by carnivores (~114 ind.), while omnivores (~15 ind.), corallivores (~12 ind.), and detritivores (~10 ind.) were present in lower numbers.

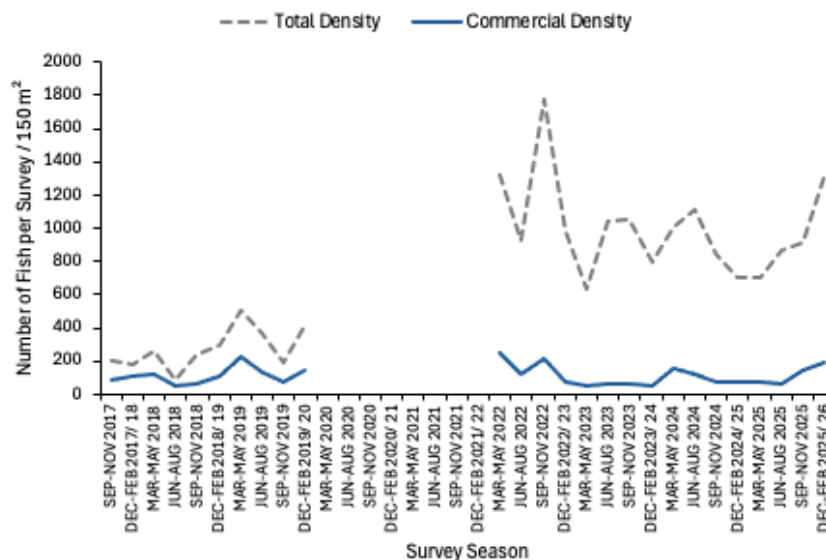


Figure 14. Temporal trends in total fish density and commercial fish density across at Andulay MPA (2017 - 2026). Values represent average individuals per 150m² recorded during seasonal surveys.

Recent Change:

Compared to the previous reporting season, total fish density increased (786 → 1109 individuals per 150 m²). Commercial density also increased markedly (67 → 166 individuals), while commercial biomass more than doubled (5.93 → 14.72 kg per 150 m²). This pattern indicates a strong increase in overall fish abundance, particularly herbivores and commercial species, suggesting a period of recovery or increased recruitment and survival.

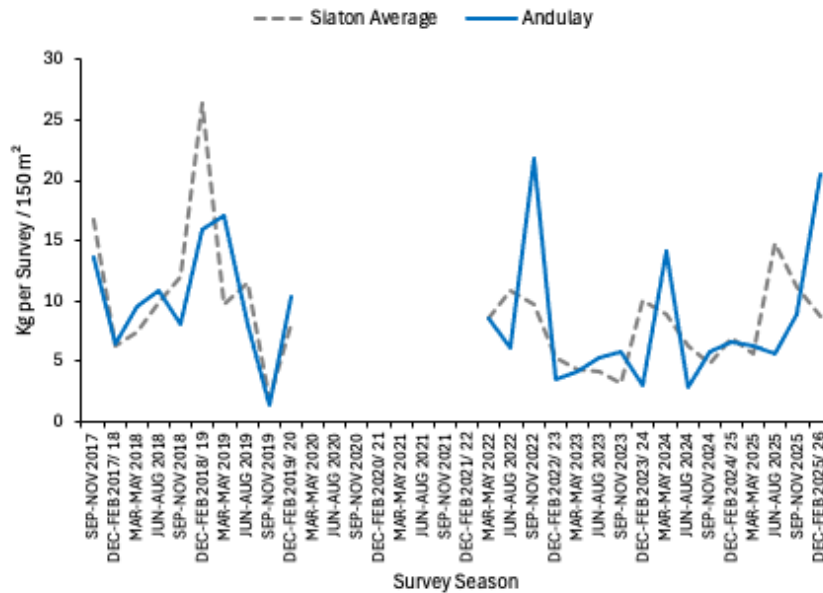


Figure 15. Temporal trends in commercial fish biomass (kg per 150m²) at Andulay MPA, (2017-2026). Biomass values represent the estimated weight of commercially important reef fish, providing an indicator of food security potential and MPA effectiveness. Data gaps (2020–2022) reflect periods when surveys were suspended due to COVID-19.

Dietary structure:

The fish community remains strongly dominated by herbivores (~87%), increasing from 626 to 958 individuals, followed by carnivores (~10%), with omnivores, corallivores and detritivores together making up only a small proportion of the community (~3%) (Figure 16). This trophic structure indicates strong grazing pressure, which is beneficial for controlling algal growth and supporting coral reef resilience.

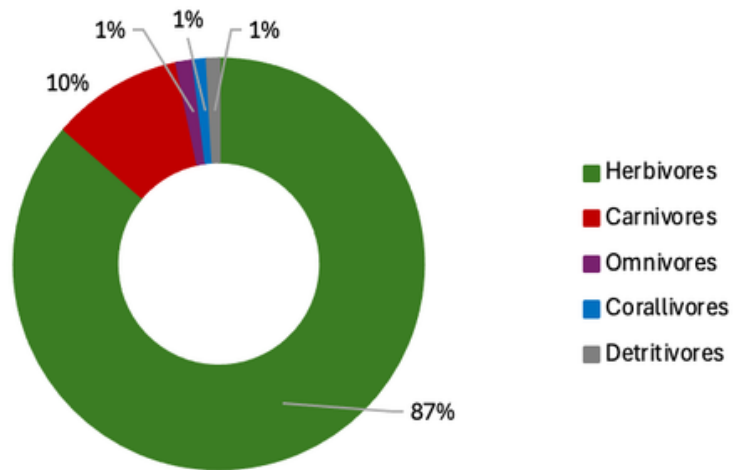


Figure 16. Proportional contribution (%) of dietary groups to total fish density at Andulay MPA during Sep–Feb 2025/26. Data include both commercial and non-commercial species, highlighting the ecological importance of abundant herbivores in supporting algal–coral balance.

Commercial Groups:

Fusiliers remain the most abundant commercial taxa at Andulay, contributing strongly to both density and biomass (Table 3). Surgeonfish and barracuda provide secondary contributions, while groupers, triggerfish, and goatfish are present in lower numbers. Despite the recent increase in biomass, larger-bodied predators such as groupers are still relatively scarce, meaning biomass recovery is being driven primarily by schooling and mid-sized commercial species.

Fusilier	66.31	Goatfish	2.95
Surgeonfish	9.68	Soldierfish	2.31
Barracuda	4.32	Bream	1.48
Grouper	3.42	Unicornfish	1.11
Triggerfish	3.12	Parrofish	1.01

Table 3 - Mean biomass (kg per 150m²) of the ten most abundant commercial fish groups at Andulay MPA during Sep–Feb 2025/26. Values represent average biomass per survey and highlight the dominant contributors to the commercial fish community.

Long-term context:

Since MCP monitoring began in 2017, Andulay has consistently shown the highest fish densities relative to other sites in Siaton. The recent increase in both density and biomass represents one of the strongest recorded periods for this site in recent years. Commercial biomass is now approaching levels expected in moderately well-enforced MPAs, although still below pristine reef levels (>1000 kg/ha).

Ecological interpretation:

Andulay MPA shows clear signs of positive recovery, with substantial increases in total fish density, herbivore abundance, and commercial biomass over the last six months. The strong dominance of herbivores supports reef resilience through grazing, while the increase in commercial biomass suggests that some fish are surviving long enough to grow to larger sizes.

However, the continued low abundance of large apex predators indicates that full trophic recovery has not yet been achieved. Continued enforcement of the MPA will be important to maintain this positive trend and allow further increases in biomass, particularly among larger predatory species that play key roles in reef ecosystem stability and fisheries productivity.

ANDULAY MPA

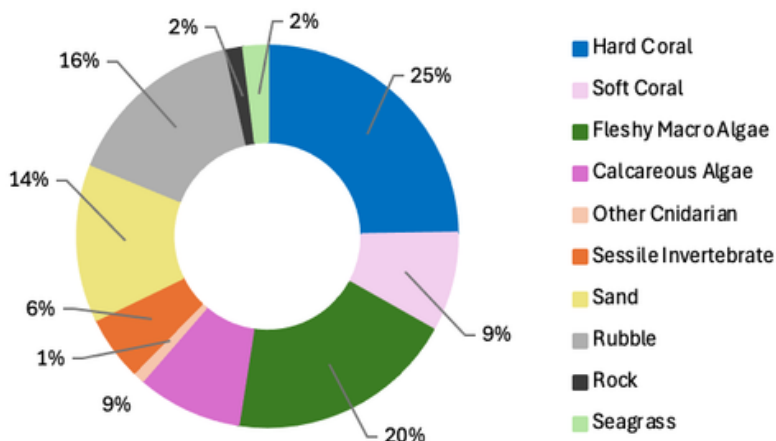
Reef Health And Resilience



Current status:

In September–February 2025/26, Andulay MPA recorded an **average hard coral cover of ~25.2%**, **fleshy macroalgae of ~19.5%**, and **rubble of ~15.2%**. The broader substrate composition shows hard coral as the dominant category, followed by rubble, sand (~14%) and fleshy macroalgae, with smaller contributions from sessile invertebrates and other benthic groups (Figure 17). Bleaching levels were very low (~0.9%), indicating minimal visible stress across the reef. Andulay supports a coral-dominated but structurally mixed reef system, with a substantial proportion of unconsolidated substrate.

Figure 17. Average benthic substrate composition at Andulay MPA (Sep-Feb 2025/26). Values represent the proportional contribution (%) of different benthic categories pooled across all surveys.



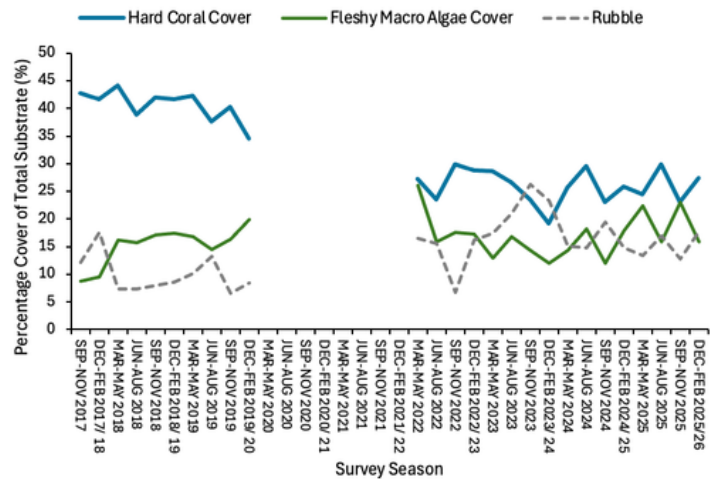
Recent change:

Since the last report, the hard coral cover has declined slightly (from 27.2% to **25.2%**), **suggesting a small reduction in coral presence** (Figure 18). Macroalgae remained relatively stable (19.1% → 19.5%), showing little overall change between reporting periods. Rubble levels remained almost unchanged, indicating consistent substrate conditions. Bleaching declined markedly (3.4% → 0.9%), reflecting reduced coral stress. Andulay shows minor fluctuations in coral cover with largely stable benthic composition, alongside a notable improvement in bleaching conditions.

Structural implications:

The combination of moderate coral cover and relatively high rubble suggests that while corals contribute significantly to reef structure, a considerable portion of the substrate remains unconsolidated. Stable macroalgal levels indicate that algal competition is present but not increasing, suggesting that grazing pressure may be sufficient to prevent algal growth. However, the persistence of rubble at moderate levels may limit coral recruitment if substrate instability persists in certain areas. Despite this, the overall balance between coral, algal and other benthic components indicates a relatively stable but not fully consolidated reef system.

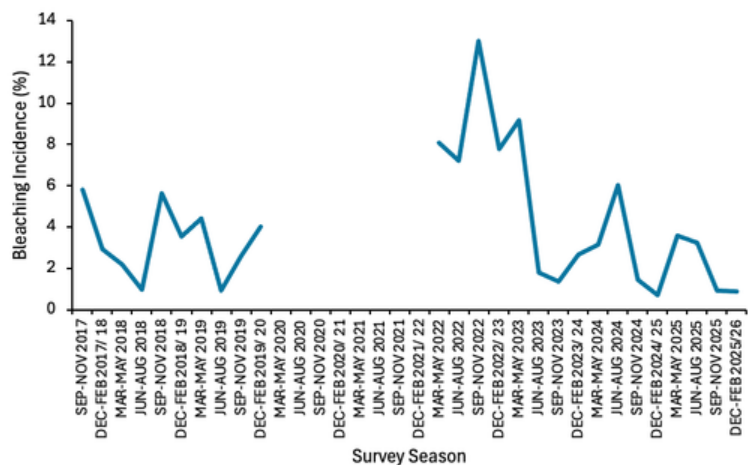
Figure 19. Temporal trends in hard coral cover, fleshy macroalgae cover, and rubble at Andulay MPA (2017–2026). Data is expressed as average percentage cover per survey season.



Long-term context:

Andulay has historically supported some of the highest coral cover in Siaton, with values exceeding 40% during 2017–2019, indicating a strongly coral-dominated reef in earlier monitoring years. Since 2022, coral cover has declined but stabilised in the range of 20–30% representing a shift toward a more moderate coral-dominated state. Over the same period, rubble has increased, at times exceeding 20–25%, suggesting periods of disturbance or reef degradation. Macroalgae have remained relatively consistent, generally fluctuating between 12–20%, without evidence of a sustained phase shift to algal dominance. Bleaching levels peaked during 2022–2023, reaching >10%, but have since declined significantly and are now low in recent monitoring periods (Figure 20).

Figure 20. Seasonal bleaching incidence at Andulay MPA (2017–2026), shown as average percentage of colonies observed with visible bleaching (either partially or fully bleached) per survey season.

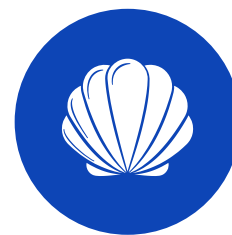


Ecological interpretation:

Andulay appears to be a recovering reef system that has transitioned from historically high coral cover to a more moderate and structurally mixed state. The recent stability in macroalgae and rubble, combined with reduced bleaching, suggests that environmental conditions may currently be favourable for reef recovery. However, the slight decline in coral cover indicates that recovery is not yet consistent. The persistence of rubble suggests that past disturbances continue to influence reef structure, potentially limiting coral recruitment in some areas. The relatively balanced benthic composition and low current bleaching pressure indicate that Andulay retains good potential for gradual coral recovery. Continued protection within the MPA and stable environmental conditions will be important support this trajectory and prevent further decline.

ANDULAY MPA

Invertebrate Status



During the September 2025 to February 2026 monitoring period, Andulay MPA supported a moderately abundant invertebrate community, with an average density of approximately 32 individuals per survey and a relatively low species richness of approximately 2.2 species per survey. This indicates that the invertebrate community at the site is dominated by a small number of species rather than a highly diverse assemblage.

The invertebrate community was primarily composed of commercially important species, indicator (sensitive) species, and ecosystem engineer species, all of which were recorded at relatively similar densities throughout the survey period (Figure 21). Commercially important invertebrates were particularly well represented, indicating that the MPA continues to support species that are typically targeted by fisheries. Indicator species were also recorded at relatively high densities, suggesting that environmental conditions at the site are suitable for disturbance-sensitive invertebrates. Ecosystem engineer species were present in moderate densities, indicating that species contributing to sediment turnover, reef bioerosion, and habitat creation are present and contributing to reef ecosystem functioning.

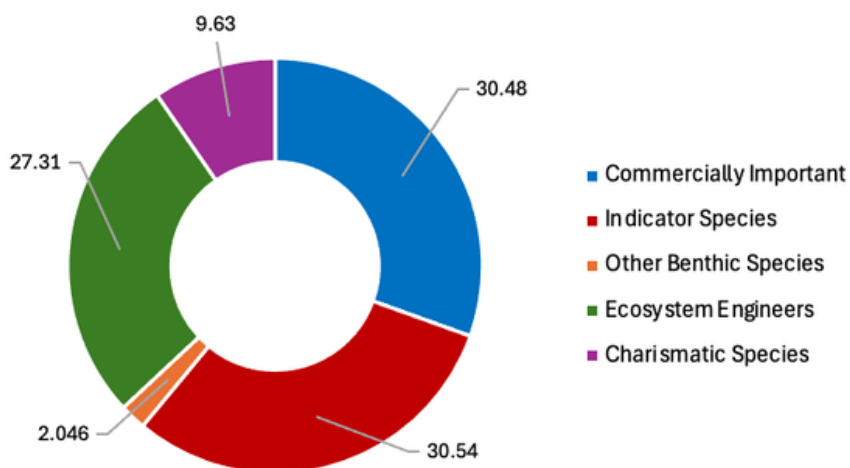


Figure 21. Proportional contribution (%) of invertebrate functional groups at Andulay MPA during Sep–Feb 2025/26.

Ecological interpretation:

The invertebrate community at Andulay MPA appears to be functionally important but relatively low in diversity, with the community dominated by a small number of commercially important species, particularly sea urchins. The high abundance of sea urchins, particularly juvenile *Diadema*, suggests that herbivory may play an important ecological role at this site, as sea urchins graze algae and help maintain space for coral recruitment, which is important for reef resilience (Table 4). The high number of juvenile sea urchins indicates recent recruitment, suggesting that the reef is providing suitable habitat for sea urchin settlement and survival.

Sea Urchins - Diadema	10.43
Sea Urchins - Rock Boring	2.9
Gastropods - Scorpion Spider Conch	1.04
Gastropods - Nilo Top	0.76
Sea Cucumbers - Black Spotted	0.74
Bivalves - Other	0.73
Gastropods - Cone	0.72
Bivalves - Giant Clam	0.66

Table 4 - Most abundant commercial invertebrates at Andulay MPA during Sep–Feb 2025/26. Values represent average density per survey and highlight the dominant contributors to the commercial benthic community.

The presence of indicator species and ecosystem engineer species suggests that the reef is supporting a range of functional invertebrate groups and that habitat conditions are suitable for disturbance-sensitive species. The presence of sea cucumbers across multiple size classes, including large individuals, indicates that some individuals are able to reach maturity within the MPA, contributing to sediment turnover and nutrient cycling, which are important ecological functions in coral reef systems.

Although giant clams were recorded in low numbers, the presence of multiple size classes suggests that some recruitment is occurring and that individuals are surviving to larger sizes, which may indicate some level of protection within the MPA. However, the overall low abundance suggests that the population is still relatively small and may still be recovering from past harvesting pressure.

Overall, the invertebrate data suggest that Andulay MPA supports a stable and functionally important invertebrate community, with evidence of recruitment in sea urchins and giant clams and the presence of mature sea cucumbers. However, low species richness and low abundance of some commercially valuable species indicate that some invertebrate populations may still be recovering, and continued protection and management will be important to allow these populations to increase and maintain their ecological roles on the reef.

ANDULAY MPA

Tourism Value



Barracudas	19.82	Scorpaenidae	42.46
Cephalopods	4.72	Sharks	0
Cowries	37.74	Shrimps	44.34
Eels and Snakes	34.91	Slugs	72.64
Frogfish	6.61	Stingrays	0
Giant Clams	46.23	Syngnathidae and Pegasidae	12.27
Porcupinefish and Pufferfish	83.02	Turtles	23.59

Table 5 - Mean encounter rates (%) of selected indicator and charismatic taxa recorded at Andulay MPA from September - February 2025/26. Values represent the percentage of dives in which each group was observed, providing an indication of their relative tourism and ecological value.

Andulay benefits from a passionate and engaged local community that strives to protect the MPA, as well as relatively good infrastructure, including the Bantay Dagat Guardhouse that overlooks the site, and comprehensive demarcation in the form of buoys that mark the MPA's boundaries. The MPA itself is pretty compact, making it convenient to explore.

Andulay offers substantial tourism value, with very high encounter rates for porcupinefish and pufferfish (83%), and slugs (72.6%), both of which are above the municipal average (Table 5). Giant clams (46.2%), shrimps (44.3%) and scorpaenidae (42.5%) also contribute substantially to the site's macro-diving appeal. Sightings of cowries (37.7%) and eels and snakes (34.9%) add to the interest for divers.

In contrast, megafauna sightings are more limited: turtles occur occasionally (23.6%), and frogfish are less common (6.6%). The Fisherfolk Association also sighted a whale shark, which was confirmed by research divers. However, cowries, turtles and frogfish at Andulay are the highest percentages in the Siaton Municipality. **The relatively frequent presence of syngnathidae and pegasidae (12.3%) adds niche tourism value** for macro enthusiasts. Overall, Andulay is a strong site for invertebrate and cryptic species, with particularly reliable sightings of molluscs and pufferfish; however, it offers fewer opportunities for larger, charismatic megafauna compared to other MPAs.

ANTULANG



Antulang does not have protected status and, as such, functions as a non-MPA control site. It is close to Andulay and displays similar broad characteristics. The reef ranges from 2 to 25 m deep and consists of a relatively narrow band of shallow reef before the reef slope. Due to the location, the reef is moderately exposed and occasionally experiences longshore currents and strong wave action.

ANTULANG

Food Security



Current Status:

In the most recent six-month period (September–February 2025/26), Antulang recorded an **average total fish density of ~749 individuals per 150 m²**, with commercial species contributing ~87 individuals per 150 m² (Figure 22). The average **commercial biomass was ~5.6 kg per 150 m² (~375 kg/ha)**. Herbivores made up the largest group (~653 ind.), followed by carnivores (~59 ind.), while omnivores (~15.6 ind.), corallivores (~10.1 ind.), and detritivores (~10.6 ind.) were present in lower numbers (Figure 22). These values indicate a moderately abundant fish community, though commercial biomass remains relatively low.

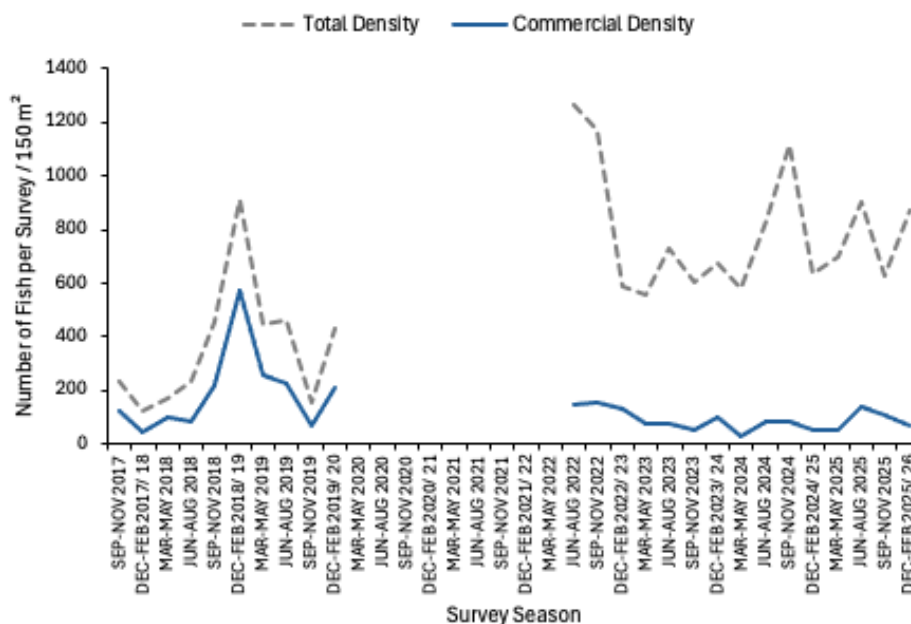


Figure 22. Temporal trends in total fish density and commercial fish density across at Antulang from Sep–Nov 2017 to Dec–Feb 2026. Values represent average individuals per 150m² recorded during seasonal surveys.

Recent Change:

Compared with the previous reporting period, total fish density decreased slightly (799 → 749), ind. per 150 m²). Commercial density also declined slightly (93 → 87 ind. per 150 m²).

Herbivore density remained relatively stable (664 → 653 ind.), while carnivores decreased notably (89.6 → 59.5 ind.). Omnivores declined slightly, while corallivores and detritivores remained relatively stable. The decline in commercial biomass suggests that fewer large-bodied commercial fish were recorded in the most recent period, despite similar overall fish densities (Figure 23).

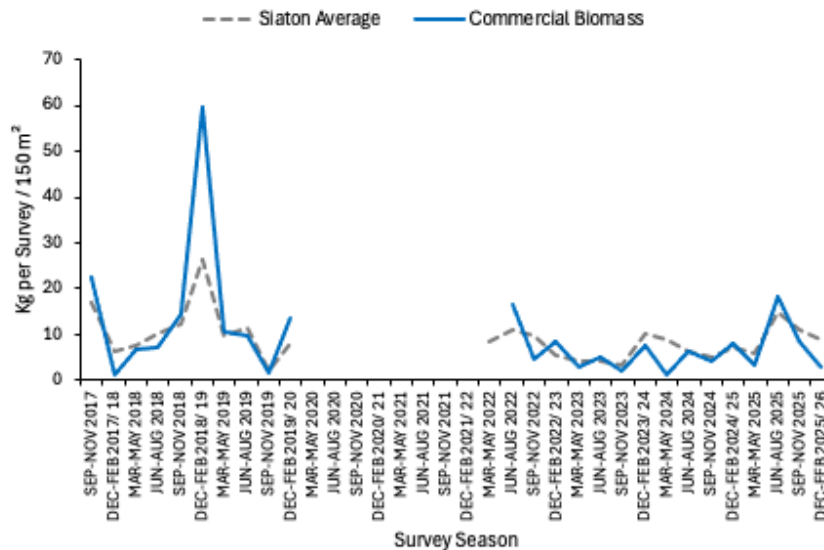


Figure 23. Temporal trends in commercial fish biomass (kg per 150m²) at Antulang MPA, Sep–Nov 2017 to Dec–Feb 2026. Biomass values represent the estimated weight of commercially important reef fish, providing an indicator of food security potential and MPA effectiveness.

Dietary structure:

The fish community at Antulang is dominated by herbivores (~87%), followed by carnivores (~8%), with omnivores, corallivores, and detritivores making up the remaining ~5% of the community (Figure 24). This trophic structure indicates strong grazing pressure but relatively low predator abundance.

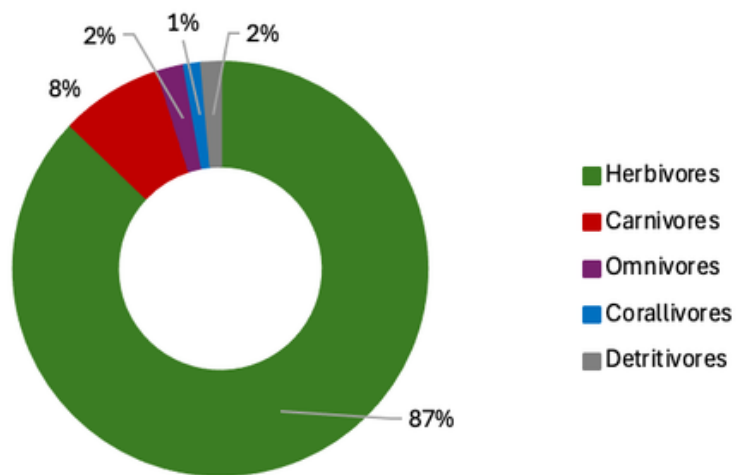


Figure 24. Proportional contribution (%) of dietary groups to total fish density at Antulang MPA during Sep–Feb 2025/26. Data include both commercial and non-commercial species, highlighting the ecological importance of abundant herbivores in supporting algal–coral balance.

Commercial Groups:

Fusiliers remain the most abundant commercial species at Antulang, contributing the largest proportion of commercial density (Table 6). Goatfish, triggerfish, bream, and groupers are present in smaller numbers, while unicornfish, parrotfish, barracuda, surgeonfish and soldierfish contribute relatively little to overall biomass. The relatively low abundance of large predators such as groupers suggests fishing pressure likely continues to limit biomass at this site, which is expected for a non-MPA site.

Fusilier	23.6	Unicornfish	0.76
Goatfish	4.05	Parrotfish	0.73
Triggerfish	2.75	Barracuda	0.67
Bream	2.02	Surgeonfish	0.53
Grouper	1.37	Soldierfish	0.31

Table 6. Mean biomass (kg per 150m²) of the ten most abundant commercial fish groups at Antulang during Sep–Feb 2025/26. Values represent average biomass per survey and highlight the dominant contributors to the commercial fish community.

Long-term context:

Antulang has shown highly variable fish densities and biomass over time, with occasional peaks in biomass but no consistent upward trend. Unlike MPA sites, where biomass tends to increase over time, Antulang shows fluctuating biomass and density, likely reflecting ongoing fishing pressure and environmental variability.

Ecological interpretation:

As a non-MPA site, Antulang supports a moderately abundant fish community but relatively low and fluctuating commercial biomass. The recent decline in biomass despite stable fish density suggests that larger commercial fish are being removed faster than they can grow, resulting in a fish community dominated by smaller individuals.

Herbivores remain abundant, which is beneficial for reef health, but the relatively low predator abundance and declining biomass indicate that the reef is likely experiencing continued fishing pressure. This site provides a useful comparison to nearby MPAs, highlighting the role of protection in allowing fish to grow larger and biomass to increase.

ANTULANG

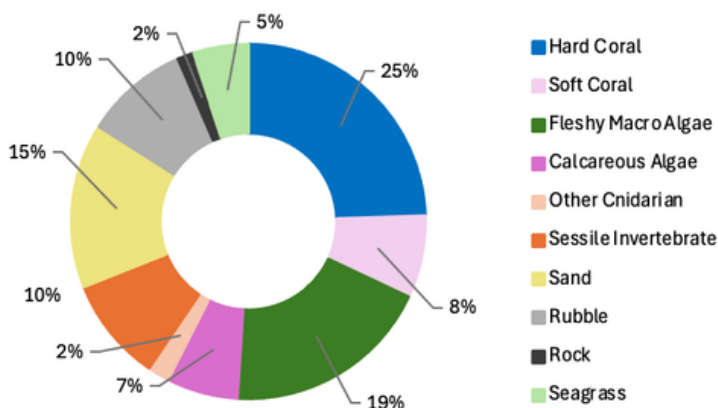
Reef Health And Resilience



Current status:

In September–February 2025/26, Antulang MPA recorded an **average hard coral cover of ~24.5%**, **fleshy macroalgae of ~19.2%**, and **rubble of ~9.8%**. The broader substrate composition indicates that hard coral is the dominant benthic component, followed by macroalgae and sand (~15%), with additional contributions from sessile invertebrates (~10%), rubble, and soft corals (~8%) (Figure 25). Bleaching levels remained low, averaging ~1.5%, indicating minimal visible thermal stress across the reef. Antulang supports a moderately coral-dominated reef system with relatively low rubble, suggesting stable substrate conditions.

Figure 25. Average benthic substrate composition at Antulang (Sep-Feb 2025/26). Values represent the proportional contribution (%) of different benthic categories pooled across all surveys.



Recent change:

Compared with the previous reporting period, hard coral cover remained stable (24.7% → 24.5%), indicating little overall change in coral presence (Figure 26). Macroalgae decreased slightly (21.4% → 19.2%), suggesting a modest reduction in algal cover. In contrast, rubble increased marginally (9.4% → 9.8%), although levels remain relatively low overall. Bleaching showed a small decrease (1.8% → 1.5%), not indicating significant stress (Figure 27). Antulang exhibited stable coral cover with a slight reduction in macroalgae and minimal change in rubble, suggesting relatively consistent reef conditions between monitoring periods.

Figure 26. Temporal trends in hard coral cover, fleshy macroalgae cover, and rubble at Antulang (2017–2026). Data is expressed as average percentage cover per survey season.

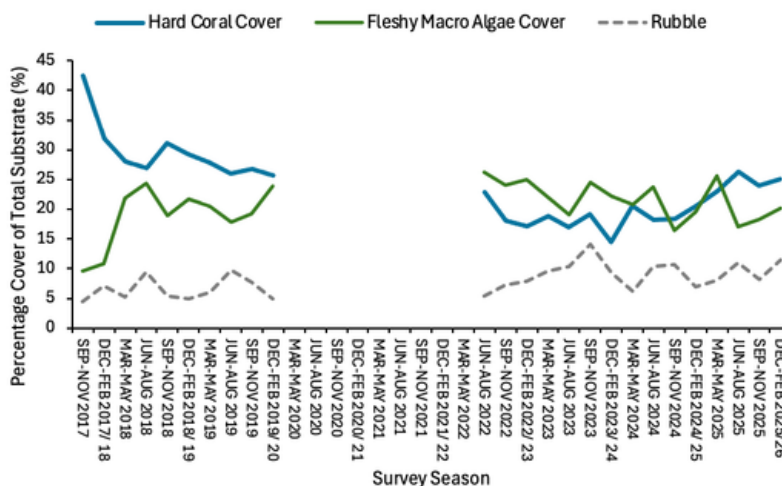
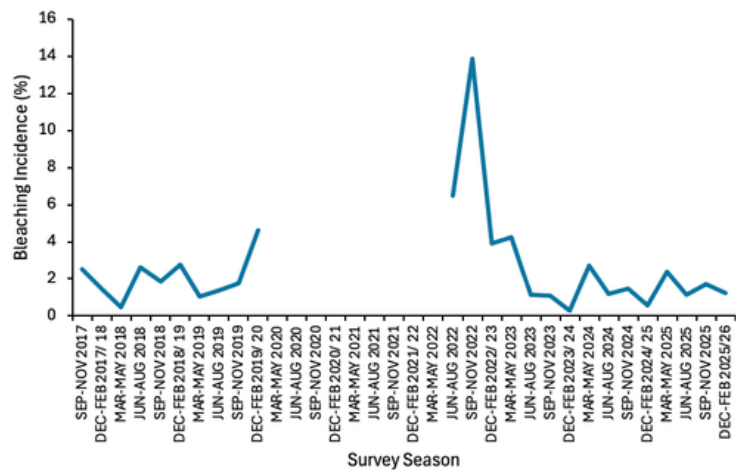


Figure 27. Seasonal bleaching incidence at Antulang (2017–2026), shown as average percentage of colonies observed with visible bleaching (either partially or fully bleached) per survey season.



Structural implications:

The combination of moderate coral cover and relatively low rubble indicates that much of the reef substrate is stable and suitable for coral growth and recruitment. The slight reduction in macroalgae suggests that algal competition may be easing, potentially allowing greater availability of substrate for coral settlement. This may reflect effective grazing pressure or favourable environmental conditions. The presence of sand (~15%) and sessile invertebrates (~10%) contributes to habitat diversity but also indicates that a proportion of the reef is not occupied by reef-building corals. Antulang appears to maintain a balanced and relatively stable benthic structure, with conditions that may support gradual coral persistence or recovery.

Long-term context:

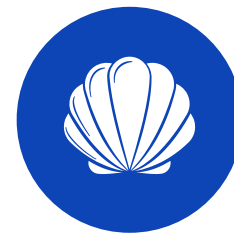
Historical data indicate that Antulang supported higher coral cover (>40%) in 2017, followed by a decline to lower levels in subsequent years. Since 2018, coral cover has generally stabilised within a ~17-27% range, indicating a shift towards a moderate coral-dominated state. Macroalgae have remained relatively consistent over time, typically fluctuating between 18-25%, without becoming overwhelmingly dominant. Rubble levels have remained comparatively low throughout the monitoring record, generally below ~12%, suggesting limited long-term structural disturbance compared with some other sites. Bleaching levels peaked during 2022 (>13%), but have since declined significantly and remain low in recent seasons.

Ecological interpretation:

Antulang appears to represent a relatively stable reef system, where coral cover has remained consistent in recent years and substrate conditions are generally favourable for reef persistence. The recent reduction in macroalgae, combined with low rubble levels, suggests that competition for space may be less intense than at more algal-dominated sites, potentially supporting continued coral stability. Although coral cover is lower than historical levels, the current balance between coral, algae, and other benthic components indicates a functioning and resilient reef community. With continued low bleaching pressure and stable conditions, Antulang has the potential to maintain or gradually improve coral cover over time, particularly if herbivore populations remain sufficient to control algal growth.

ANTULANG

Invertebrate Status



During the September 2025 to February 2026 monitoring period, Antulang MPA supported a moderately abundant invertebrate community, with an average density of ~33–36 individuals per survey and relatively low species richness ~2.21 per survey. This indicates that, similar to Andulay, the invertebrate community is moderately abundant but low in diversity, with a small number of species dominating the assemblage.

The invertebrate community was primarily composed of commercially important species, indicator (sensitive) species, and ecosystem engineer species, all of which were recorded at relatively similar and consistently high densities (Figure 28). Indicator species were the most abundant functional group, suggesting that the reef is supporting species that are sensitive to environmental disturbance. Ecosystem engineer species were also well represented, indicating active ecological processes such as sediment turnover and bioerosion. Commercially important invertebrates were also abundant, showing that the MPA supports species typically targeted by fisheries.

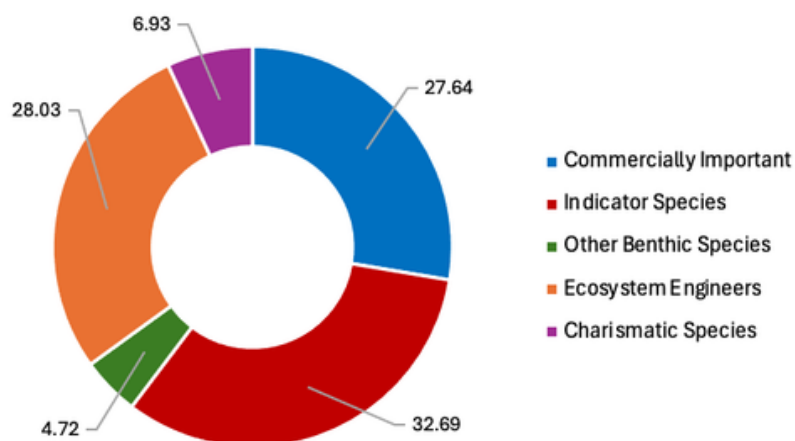


Figure 28. Proportional contribution (%) of invertebrate functional groups at Antulang during Sep–Feb 2025/26.

Ecological Interpretation:

The invertebrate community at Antulang appears to be functionally important but relatively simplified, with the community dominated by a small number of species, particularly sea urchins. The high abundance of *Diadema* sea urchins suggests that herbivory is likely to play a key ecological role at this site, helping to control algal growth and maintain space for coral recruitment (Table 7). However, the dominance of small size classes indicates that the population is largely composed of juveniles, which may reduce the overall effectiveness of grazing compared to a population with a full size range.

Sea Urchins - Diadema	14.22
Sea Urchins - Rock Boring	1.07
Sea Cucumbers - Black Spotted	0.96
Bivalves - Other	0.86
Gastropods - Scorpion Spider Conch	0.83
Gastropods - Other Shell	0.61
Sea Cucumbers - Pinkfish	0.43
Bivalves - Giant Clam	0.36

Table 7. Most abundant commercial invertebrates at Antulang during Sep–Feb 2025/26. Values represent average density per survey and highlight the dominant contributors to the commercial benthic community.

The relatively high densities of indicator species and ecosystem engineer species suggest that the reef is supporting a range of ecologically important invertebrate groups, indicating generally suitable habitat conditions. The presence of sea cucumbers across multiple size classes, including larger individuals, is a positive sign, suggesting that these organisms are contributing to sediment turnover and nutrient cycling, key processes in maintaining reef health.

Despite this, the low abundance and limited size range of giant clams suggest that this group is suffering from exploitation or experiencing limited recruitment (Table 7). Similarly, the overall low species richness indicates that the invertebrate community, while functionally active, is not highly diverse and may be dominated by a few resilient or fast-recruiting species.

Overall, the invertebrate data suggest that Antulang supports a stable and functionally important invertebrate community, with strong evidence of recruitment in sea urchins and the presence of mature sea cucumbers. However, low diversity and low abundance of some key commercial species indicate that parts of the invertebrate community may still be recovering, and the lack of protection impacts population growth to maintain ecosystem function.

ANTULANG

Tourism Value



Barracudas	31.56	Scorpaenidae	62.95
Cephalopods	4.40	Sharks	0
Cowries	36.73	Shrimps	48.5
Eels and Snakes	42.68	Slugs	65.78
Frogfish	2.83	Stingrays	1.73
Giant Clams	31.72	Syngnathidae and Pegasidae	18.84
Porcupinefish and Pufferfish	89.33	Turtles	20.56

Table 8. Mean encounter rates (%) of selected indicator and charismatic taxa recorded at Antulang from September - February 2025/26. Values represent the percentage of dives in which each group was observed, providing an indication of their relative tourism and ecological value.

Antulang provides high tourism value with strong and diverse sightings across multiple groups (Table 8). Porcupinefish and pufferfish (89.3%), slugs (65.8%), and scorpaenidae (63%) are all recorded at high frequencies, while shrimps (48.5%), cowries (36.7%), and eels and snakes (42.7%) add consistent macro-diving appeal.

Barracuda (31.6%) scorpaenidae, porcupinefish and pufferfish, and syngnathidae and pegasidae (18.8%) are the highest percentages in Siaton Municipality, further strengthening Antulang's macro-diversity profile.

Turtle (20.6%) and barracuda encounters are increasing the site's megafauna interest. Stingrays (1.7%) are also recorded rarely. We had some exciting, rarer sightings this season of an eagle ray and a harlequin shrimp.

Overall, Antulang stands out as one of the municipality's strongest sites for both macro-diversity and the occasional occurrence of high-value megafauna.

KOOKOOS



Kookoos does not have protected status and, as such, functions as a non-MPA control site. The reef ranges from 1 to 20m deep and consists of a wide area of irregular, shallow reef and extensive, dense reef at deeper depths, characterised by high amounts of soft coral. It is often subject to fishing activity, particularly in the shallow portion of the reef.



KOOKOOS

Food Security

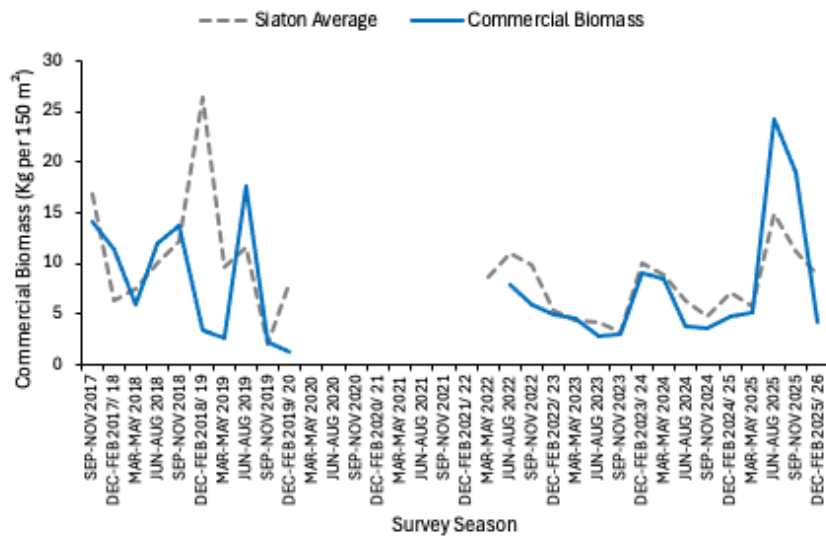


There is anecdotal support for the idea that the local fishing community is fishing thoughtfully and limiting their extraction of fish. It should be noted when considering any data collected at this site in the recent periods may have been influenced by recent nearby dredging activity for the expanded port at adjacent Tambobo Bay.

Current Status:

In September–February 2025/26, Kookoos recorded an average total fish density of ~549 individuals per 150 m², with commercial species contributing around 137 individuals per 150 m². The average **commercial biomass was approximately 11.6 kg per 150 m² (~773 kg/ha) (Figure 29)**. Herbivores (~462 ind.) dominated the community, followed by carnivores (~61.6 ind.), while omnivores (~8.1 ind.), corallivores (~8 ind.), and detritivores (~9.1%) were present in lower numbers. These values indicate a moderately abundant fish community with relatively strong commercial biomass for a non-MPA site.

Figure 29. Temporal trends in commercial fish biomass (kg per 150 m²) at Kookoos (2017–2026). Biomass values represent the estimated weight of commercially important reef fish, providing an indicator of food security potential and MPA effectiveness.



Recent Change:

Compared with the previous reporting season, total fish density decreased notably (734 → 549 ind. per 150 m²) (Figure 30). Commercial density also declined (158 → 137 individuals), and commercial biomass decreased (14.71 → 11.59 kg per 150 m²) (Figure 30). Herbivores showed the largest decline (603 → 462 ind.), while carnivores also decreased (84.6 → 61.6 ind.). Omnivores and corallivores declined slightly, while detritivores remained relatively stable. This indicates an overall reduction in fish abundance across most trophic groups, alongside a moderate decline in biomass.

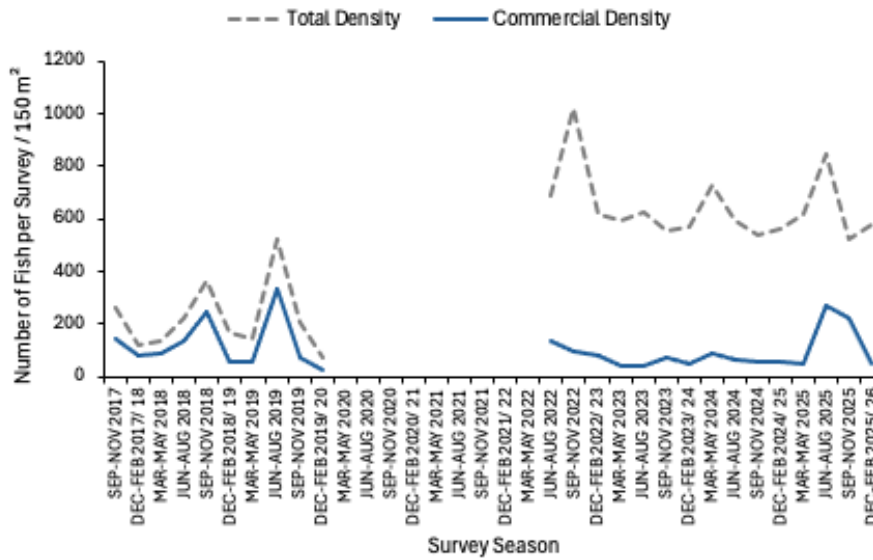


Figure 30. Temporal trends in total fish density and commercial fish density at Kookoos (2017–2026). Values represent average individuals per 150 m² recorded during seasonal surveys.

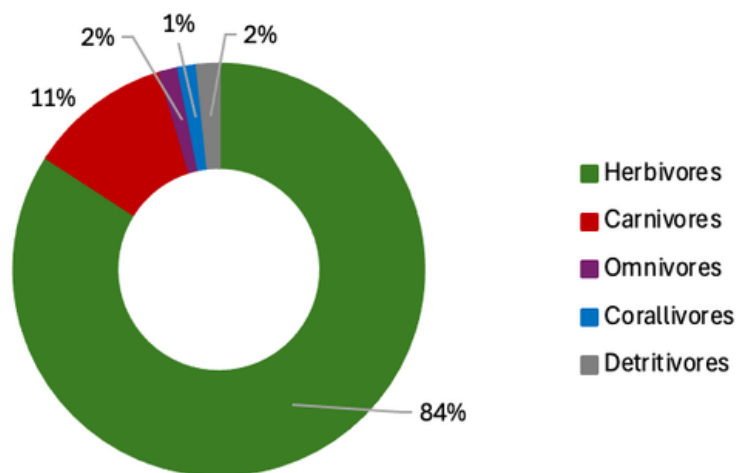


Figure 31. Proportional contribution (%) of dietary groups to total fish density at Kookoos during Sep–Feb 2025/26. Values include both commercial and non-commercial species, ensuring that the role of abundant herbivores in maintaining algal–coral balance is represented.

Dietary structure:

The fish community remains dominated by herbivores (~84%), followed by carnivores (~11%), with omnivores, corallivores, and detritivores together contributing ~5% of the total density (Figure 31). This structure reflects a herbivore-driven system, supporting grazing processes important for reef health.

Commercial Groups:

At Kookoos, fusiliers remain the most abundant commercial species at Kookoos, contributing strongly to both density and biomass (Table 9). Soldierfish, triggerfish, and snappers also contribute to the commercial assemblage, while groupers, parrotfish, and bream are present in lower numbers. Despite relatively strong biomass compared to other non-MPA sites, the continued low abundance of large predators such as groupers suggests that biomass is largely driven by mid-sized and schooling species rather than top predators.

Fusilier	16.34	Unicornfish	1.64
Soldierfish	3.27	Grouper	1.53
Triggerfish	2.76	Parrotfish	1.15
Snapper	2.65	Bream	0.89
Goatfish	2.50	Surgeonfish	0.46

Table 9. Mean biomass (kg per 150 m²) of the ten most abundant commercial fish groups at Kookoos during September–February 2025/26. Values represent average biomass per survey and highlight the dominant contributors to the commercial fish community.

Long-term context:

Since monitoring began, Kookoos has shown fluctuating trends in both density and biomass over time, with occasional peaks driven by increases in commercial species. Unlike MPA sites, there is no clear long-term increase in biomass, reflecting the absence of protection and ongoing fishing pressure.

Ecological interpretation:

Kookoos supports a moderately productive fish community for a non-MPA site, with relatively strong commercial biomass compared to Antulang. However, the recent decline in both density and biomass suggests that this productivity is not stable and may be influenced by fishing pressure or seasonal variability.

The dominance of herbivores supports reef resilience, but the reduced abundance of carnivores and larger commercial species indicates that trophic structure remains incomplete. Without protection, the site is unlikely to sustain long-term increases in biomass, highlighting the importance of MPAs in maintaining stable and mature fish communities. Continued enforcement and spillover benefits from adjacent MPAs could assist this reef.

KOOKOOS

Reef Health And Resilience

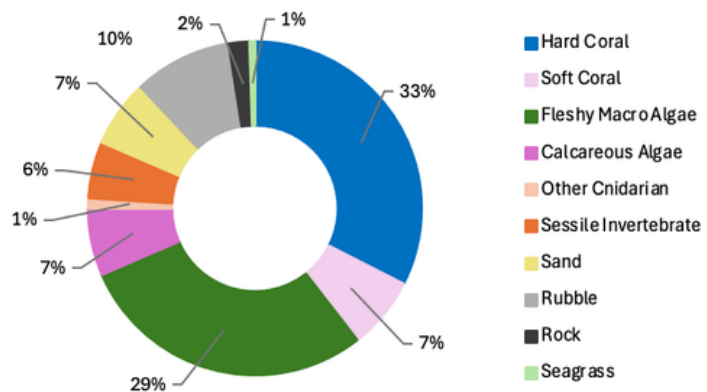


Kookoos is remarkable for its high coverage of hard coral, which was the highest level recorded anywhere in Siaton. This is classified as high cover by the Australian Institute of Marine Science.

Current status:

In September–February 2025/26, Kookoos recorded an **average hard coral cover of ~32.7%**, fleshy **macroalgae of ~28.9%**, and **rubble of ~9.6%**. The broader substrate composition shows that hard coral and fleshy macroalgae dominate the benthic community, with contributions from rubble, soft corals (~7%), and calcareous algae (~7%) (Figure 32). Bleaching levels remained low, averaging ~1.2%, indicating minimal visible thermal stress during this monitoring period. Kookoos represents a coral-algae competitive system, where both hard coral and macroalgae occupy large portions of the reef.

Figure 32. Average benthic substrate composition at Kookoos (September-February 2025/26). Values represent the proportional contribution (%) of different benthic categories pooled across all surveys.



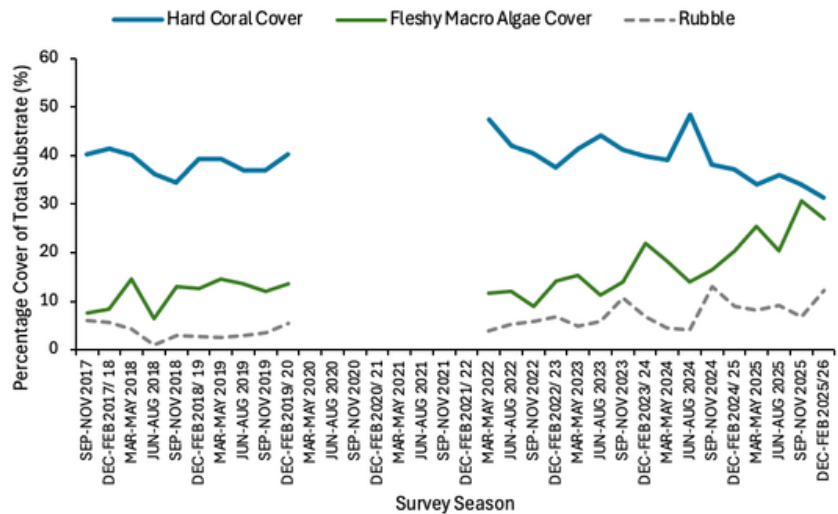
Recent change:

Since the last report, hard coral cover declined (35.2% → 32.7%), indicating a reduction in coral dominance. Fleshy macroalgae increased notably (22.9% → 28.9%), suggesting a shift toward stronger algal presence. Rubble also increased slightly (8.6% → 9.6%), though it remains relatively low overall. Bleaching levels decreased (3.1% → 1.2%), indicating reduced coral stress in the most recent monitoring period. Overall, Kookoos shows a shift from coral dominance toward increased algal competition, despite low bleaching pressure.

Structural implications:

The near balance between hard coral and macroalgae suggests that competition for space is a key ecological process at this site. The increase in macroalgae may indicate reduced grazing pressure or favourable conditions for algal growth, which could limit coral recruitment if the trend continues. Meanwhile, relatively low rubble levels suggest that substrate stability is not a major limiting factor for coral recovery. This combination implies that biotic interactions (e.g. herbivory and competition) rather than physical disturbance, are likely the primary drivers shaping the benthic community at Kookoos.

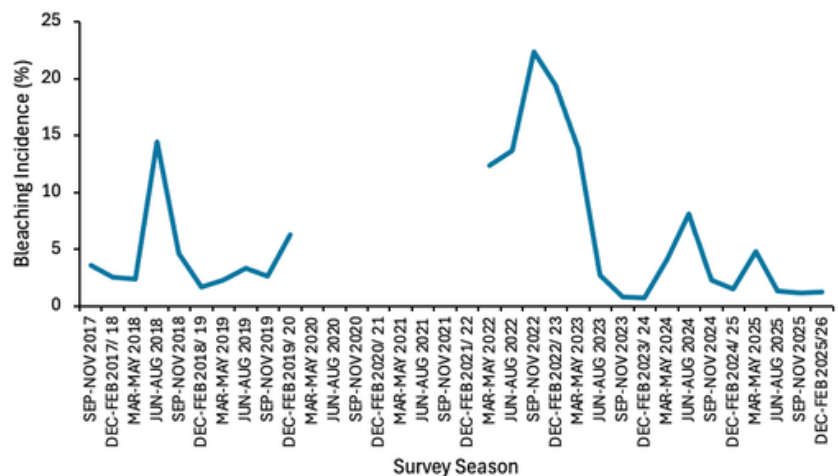
Figure 32. Temporal trends in hard coral cover, fleshy macroalgae cover, and rubble at Kookoos (2017–2026). Data is expressed as average percentage cover per survey season.



Long-term context:

Kookoos has historically maintained some of the highest coral cover across Siaton, with values generally ~35–45% since 2017, though it has rarely exceeded early peaks (~42–44%) (Figure 32). More recently, coral cover has begun to decline slightly, while macroalgae have increased, particularly in 2024–2026, where values have reached ~25–30%. This represents a gradual shift towards a closer coral and algal competing system. Rubble has remained relatively low throughout the monitoring record, generally below ~10–12%, suggesting limited long-term structural disturbance. Bleaching peaked during 2022–2023 (up to ~20%+), but has since declined substantially and remains low in recent seasons (Figure 33).

Figure 33. Seasonal bleaching incidence at Kookoos (2017–2026), shown as average percentage of colonies observed with visible bleaching (either partially or fully bleached) per survey season.

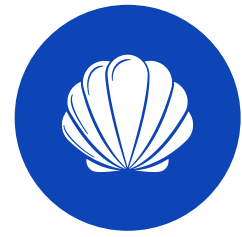


Ecological interpretation:

Kookoos appears to be undergoing a subtle ecological shift from coral dominance toward increased algal competition. While coral cover remains relatively high compared to many other sites, the rapid increase in macroalgae suggests that the reef may be approaching a tipping point where algae begin to limit coral recovery and expansion. The low levels of rubble and bleaching indicate that physical disturbance and thermal stress are currently not the primary pressures, highlighting the importance of herbivory and ecological balance in maintaining reef condition. If macroalgal growth continues unchecked, it could reduce coral recruitment and shift the reef toward a more algae-dominated state. However, with strong grazing pressure and continued protection, Kookoos still has strong potential to maintain coral dominance and overall reef resilience.

KOOKOOS

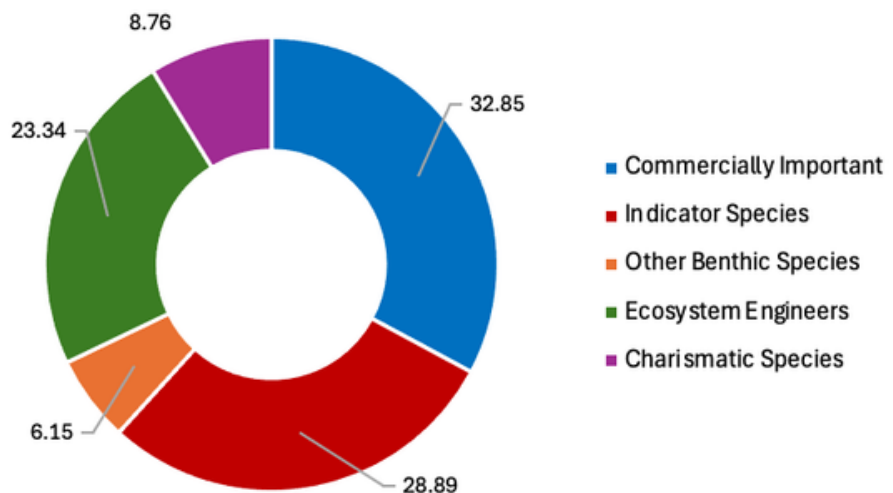
Invertebrate Status



During the September 2025 to February 2026 monitoring period, Kookoos supported a relatively low abundance invertebrate community compared to other sites, with an average invertebrate density of ~20 individuals per survey and a low species richness of ~1.71 species per survey. This indicates that the invertebrate community at Kookoos is less abundant and less diverse than at Andulay and Antulang, suggesting a simpler invertebrate assemblage dominated by a few key species.

The invertebrate community was primarily composed of commercially important species and indicator (sensitive) species, with lower densities of benthic-associated species, ecosystem engineers, and charismatic species compared to other sites (Figure 34). Commercially important invertebrates occupied ~33%, while indicator species occupied 29%, suggesting that both commercial-target species and disturbance-sensitive species are present but at lower densities than at other MPAs.

Figure 34. Proportional contribution (%) of invertebrate functional groups at Kookoos during Sep–Feb 2025/26.



Ecological Interpretation:

The invertebrate community at Kookoos appears to be less abundant than at other sites but relatively well structured, with representation from multiple functional groups and several commercially important species present. The lower overall invertebrate density and species richness suggest that the site may have less habitat complexity, lower productivity, or higher environmental pressure compared to other sites.

The presence of sea urchins, particularly juvenile individuals, indicates that herbivory is present and recruitment is occurring, which is important for controlling algal growth and supporting coral recruitment (Table 10). However, the relatively low abundance of sea urchins compared to other sites may mean that grazing pressure is lower.

Sea Urchins - Diadema	5.56
Gastropods - Nilo Top	1.60
Gastropods - Scorpion Spider Conch	0.97
Sea Cucumbers - Black Spotted	0.96
Gastropods - Other Shell	0.83
Bivalves - Giant Clam	0.68
Gastropods - Cone	0.62
Sea Urchins - Rock Boring	0.32

Table 10. Most abundant commercial invertebrates at Kookoos during Sep–Feb 2025/26. Values represent average density per survey and highlight the dominant contributors to the commercial benthic community.

The presence of sea cucumbers across multiple size classes and the relatively wide size range of giant clams suggests that some long-lived invertebrates are surviving and growing at this site, which may indicate that the topography of the site is providing effective protection for some commercially important species (Table 10). In particular, the presence of larger giant clams suggests that individuals are surviving for extended periods, which is important for reproduction and population stability.

Overall, the invertebrate data suggest that Kookoos supports a moderately stable invertebrate community, with evidence of recruitment and survival of larger individuals, particularly for giant clams and sea cucumbers. However, lower overall density and species richness compared to other sites suggest that the invertebrate community is less abundant and may be more vulnerable to disturbance, and continued protection will be important to maintain and potentially increase invertebrate populations at this site.

KOOKOOS

Tourism Value



Barracudas	17.51	Scorpaenidae	57.11
Cephalopods	2.84	Sharks	0
Cowries	29.35	Shrimps	40.83
Eels and Snakes	46	Slugs	62.78
Frogfish	0.86	Stingrays	1.11
Giant Clams	64.37	Syngnathidae and Pegasidae	2.84
Porcupinefish and Pufferfish	78.93	Turtles	20.46

Table 11. Mean encounter rates (%) of selected indicator and charismatic taxa recorded at Kookoos from September - February 2025/26. Values represent the percentage of dives in which each group was observed, providing an indication of their relative tourism and ecological value.

Kookoos is well known for its interesting underwater topography and landscape. There are large-scale features, such as coral bommies and small canyons, that provides very rewarding diving and highlight its potential for dive tourism. There is easy access to the public beach, which makes diving there relatively easy.

Kookoos demonstrates a very high tourism value, particularly through frequent sightings of porcupinefish and pufferfish (78.9%), slugs (62.7%), and giant clams (64.4%) (Table 11).

Scorpaenidae (57.1%), eels and snakes (46%), and turtles (20.5%) add further to its appeal, while cowries (29.4%) and shrimps (40.8%) support strong macro-diving opportunities. Frogfish (0.9%) and stingrays (1.1%) are recorded occasionally, though sharks were absent. Eels and Snakes were seen most frequently at Kookoos compared to the rest of Siaton Municipality.

Overall, Kookoos combines reliable megafauna sightings with macro-diversity, making it one of the most attractive dive sites in the Siaton municipality.

SALAG MPA



Salag MPA has an area of 10 hectares and is surrounded by no seagrass or mangroves. MCP began monitoring at Salag in 2019. The dense reef ranges from 1 to 15 m in depth and then becomes patchy, with sandy areas extending up to 19m in depth. Due to its location, the reef is well protected from prevailing winds and generally experiences little to no longshore current or wave action.



MPA demarcation based on DENR coordinates

SALAG MPA

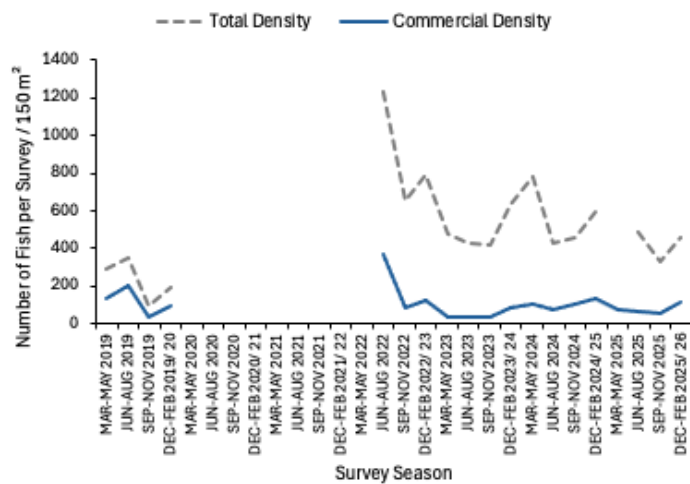
Food Security



Current Status:

In Sep–Feb 2025/26, Salag MPA recorded an average total fish density of ~393 individuals per 150 m², with commercial species contributing ~84 individuals per 150 m² (Figure 35). **Commercial biomass reached ~7.9 kg per 150 m² (~527 kg/ha)** (Figure 36). Herbivores dominated the assemblage (~318 individuals per 150 m²), followed by carnivores (~50), while omnivores (~3) and corallivores (~10), and detritivores (~11.5) were present in smaller numbers. These values indicate a moderately abundant fish community with moderate commercial biomass for an MPA.

Figure 35. Temporal trends in total fish density and commercial fish density at Salag MPA from (2019-2026). Values represent average individuals per 150 m² recorded during seasonal surveys.



Recent Change:

Compared to the previous report, total fish density decreased (489 → 393 ind. per 150 m²). Commercial density increased slightly (68.5 → 83.9 individuals), while commercial biomass decreased slightly (9.75 → 7.91 kg per 150 m²).

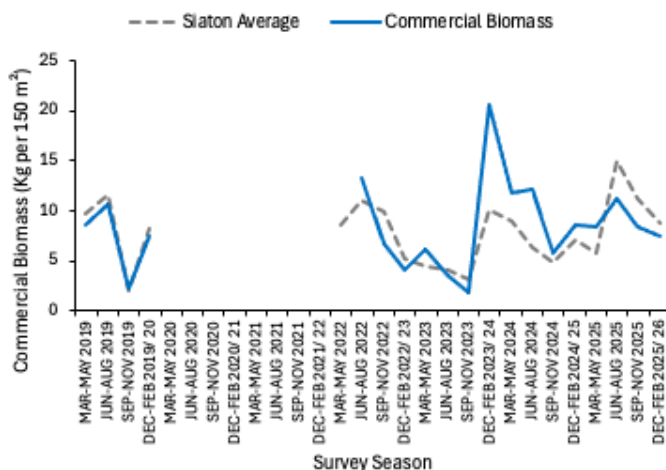
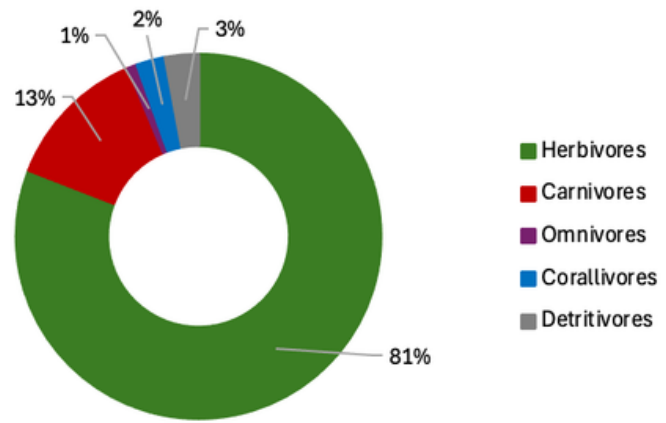


Figure 36. Temporal trends in commercial fish biomass (kg per 150m²) at Salag MPA (2019-2026). Biomass values represent the estimated weight of commercially important reef fish, providing an indicator of food security potential and MPA effectiveness.

Figure 37. Proportional contribution (%) of dietary groups to total fish density at Salag MPA during Sep–Feb 2025/26. Data include both commercial and non-commercial species, highlighting the ecological importance of abundant herbivores in supporting algal–coral balance.



Herbivores decreased (393 → 318 ind.), and carnivores also declined (77 → 50 ind.), while omnivores decreased slightly. Corallivores and detritivores remained relatively stable. This indicates a decline in overall fish abundance, while commercial fish remained relatively stable in density but slightly smaller on average, resulting in reduced biomass.

Dietary structure:

The fish community at Salag is dominated by herbivores (~81%) followed by carnivores (~13%), with omnivores, corallivores, and detritivores making up the remaining ~6% (Figure 37). This trophic structure indicates a functioning reef system with strong grazing presence but relatively low predator abundance.

Fusilier	32.52	Grouper	2.23
Soldierfish	7.89	Triggerfish	1.95
Bream	5.74	Unicornfish	1.75
Snapper	3.18	Surgeonfish	1.46
Goatfish	2.57	Parrotfish	0.91

Table 12 - Mean biomass (kg per 150 m²) of the ten most abundant commercial fish groups at Salag MPA during September - February 2025/26. Values represent average biomass per survey and highlight the dominant contributors to the commercial fish community.

Commercial Groups:

At Salag, fusiliers are the most abundant commercial group at Salag, contributing strongly to both density and biomass (Table 12). Soldierfish, bream, and snappers also contribute to the commercial assemblage, while groupers, triggerfish, surgeonfish, and parrotfish are present in lower numbers. The relatively low abundance of large predators such as groupers indicates that although Salag is an MPA, predator biomass remains limited, suggesting incomplete trophic recovery.

Long-term context:

Since monitoring began, Salag has shown variable fish density and biomass, with periods of high biomass followed by declines. While biomass levels are generally higher than non-MPA sites, they remain lower than expected for a fully recovered no-take MPA, suggesting that recovery is ongoing but not yet complete.

Ecological interpretation:

Salag MPA supports a moderately productive fish community, with higher commercial biomass than non-MPA sites but lower biomass than the stronger MPA site Andulay. The recent decline in total density suggests some short-term variability, but the relatively stable commercial density indicates that the MPA is still supporting commercially important species.

The dominance of herbivores supports reef resilience, but the relatively low abundance of large predators indicates that the full trophic recovery has not yet been achieved. Continued protection and enforcement will be important to allow biomass, particularly among large predatory fish, to increase over time.

SALAG MPA

Reef Health And Resilience

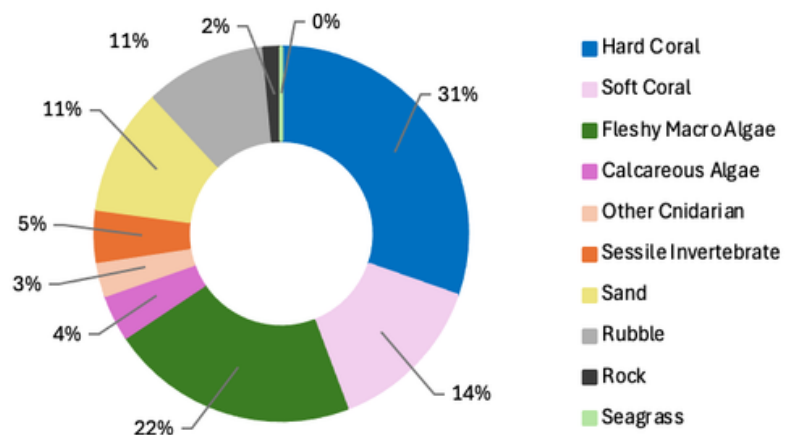


Salag MPA is most similar to Kookoos in terms of underwater landscape and general features.

Current status:

In September–February 2025/26, Salag MPA recorded an **average hard coral cover of ~30.3%**, **fleshy macroalgae of ~21.5%**, and **rubble of ~10.2%**. The broader substrate composition (Figure 38) indicates that hard coral is the dominant benthic component, followed by macroalgae, with notable contributions from soft coral (~14%), sand (~11%) and rubble. Bleaching levels were very low during this period, averaging ~0.7%, indicating minimal visible thermal stress across the reef. Salag supports a moderately coral-dominated reef system with a diverse benthic composition, including a relatively high proportion of soft corals.

Figure 38. Average benthic substrate composition at Salag MPA (September-February 2025/26). Values represent the proportional contribution (%) of different benthic categories pooled across all surveys.



Recent change:

Compared with the previous reporting period, hard coral cover increased (28.1% → 30.3%), indicating a positive shift toward greater coral dominance (Figure 39). Fleshy macroalgae decreased (24.7% → 21.5%), suggesting a reduction in algal competition. In contrast, rubble increased (7.5% → 10.2%), indicating a rise in unconsolidated substrate. Bleaching levels declined substantially (3.1% → 0.7%), reflecting reduced coral stress during the most recent surveys (Figure 40). Overall, Salag shows encouraging coral recovery and reduced algal competition, though accompanied by a moderate increase in rubble.

Structural implications:

The increase in coral cover alongside declining macroalgae suggests that conditions are currently favourable for coral growth, potentially supported by effective herbivory limiting algal expansion. However, the rise in rubble indicates some level of disturbance or substrate instability, which could locally limit coral recruitment if persistent. The relatively high proportion of soft corals (~14%) contributes to habitat complexity but may also compete with hard corals for available space. Salag displays a balanced reef structure, where coral recovery is occurring despite moderate levels of disturbance.

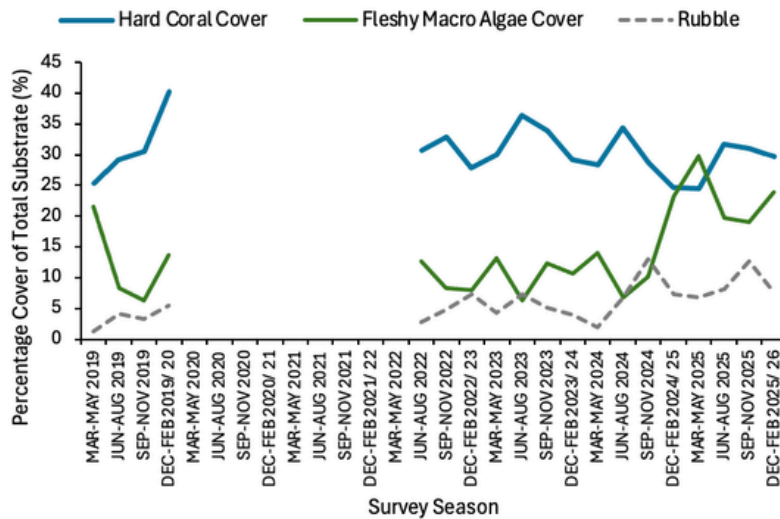


Figure 39. Temporal trends in hard coral cover, fleshy macroalgae cover, and rubble at Salag MPA (2019–2026). Data is expressed as average percentage cover per survey season.

Long-term context:

Historically, Salag has shown moderate to high coral cover (~25-40%), with some variability across years. Coral cover peaked around ~40% in 2019-2020, before fluctuating in the years that followed. Macroalgae have varied widely, ranging from ~6% to nearly 30%, indicating periods of both low and high algal presence. The recent decline from higher values in early 2025 suggests a return toward more balanced conditions. Rubble has generally remained low to moderate, although occasional spikes (e.g. >10% in 2024-2026) suggest episodic disturbance. Bleaching levels were elevated during 2022-2023 (up to 18%), but have since declined sharply and are now consistently low.

Another health concern noted at Salag MPA but not reflected in the data is the presence of large amounts of fabric and textile trash. These have been observed to smother and damage corals.

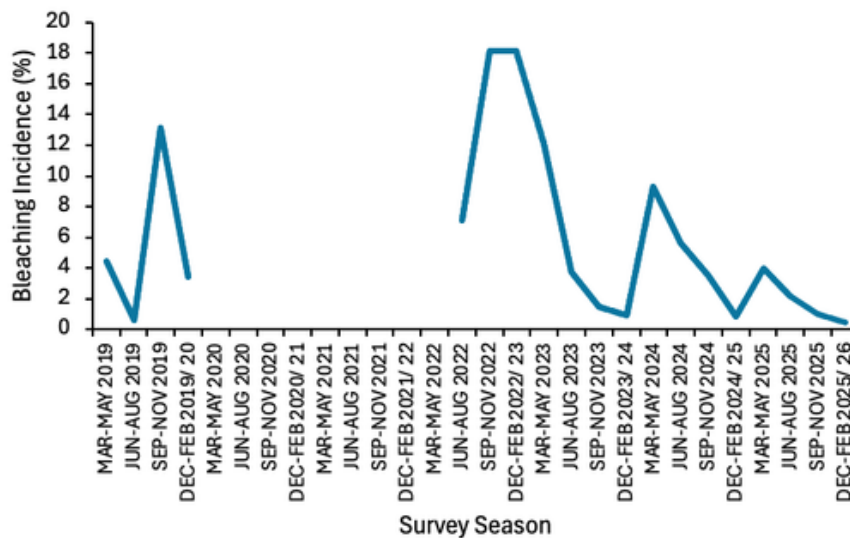


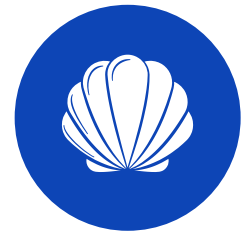
Figure 40. Seasonal bleaching incidence at Salag MPA (2019–2026), shown as average percentage of colonies observed with visible bleaching (either partially or fully bleached) per survey season.

Ecological interpretation:

Salag MPA appears to be a recovering and resilient reef system, currently showing positive trends in coral cover and reductions in macroalgal competition. The increase in coral cover, combined with low bleaching pressure, indicates that environmental conditions are currently supportive of reef recovery. However, the concurrent rise in rubble suggests that disturbance events of substrate instability may still be influencing reef structure. The presence of substantial soft coral cover highlights a diverse but competitive benthic environment, where space is shared among multiple functional groups. Salag demonstrates strong recovery potential, with improving coral dominance and reduced algal pressure, provided that disturbance remains limited and grazing pressure continues to regulate algal growth.

SALAG MPA

Invertebrate Status



During the September 2025 to February 2026 monitoring period, Salag MPA supported a relatively low abundance and low diversity invertebrate community, with an average invertebrate density ranging from ~12–15 individuals per survey and species richness of ~1.61 species per survey. These values are among the lowest recorded across the monitored sites, indicating that the invertebrate assemblage at Salag is relatively sparse and dominated by a small number of species.

Commercially important invertebrates occupied 27%, while indicator (sensitive) species had similar densities occupied 30% (Figure 41). Lower densities were recorded for benthic-associated species and ecosystem engineers, suggesting that functional diversity is relatively limited at this site compared to sites such as Andulay and Antulang.

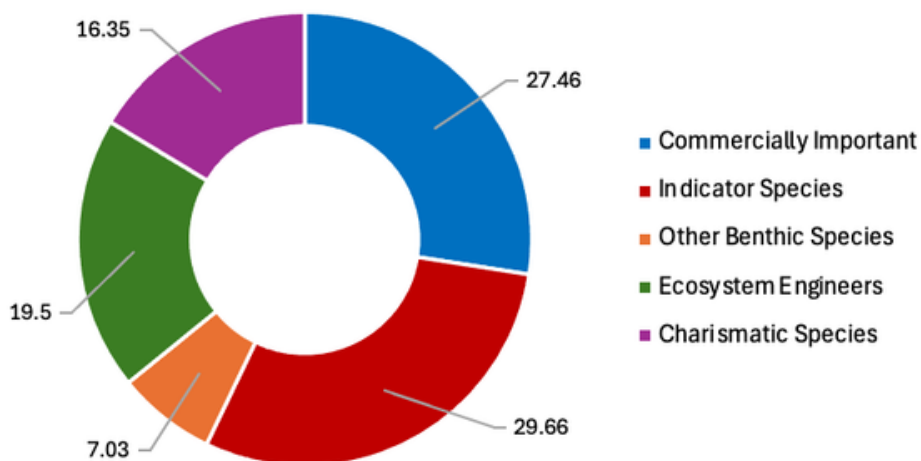


Figure 41. Proportional contribution (%) of invertebrate functional groups at Salag during Sep–Feb 2025/26.

Ecological Interpretation:

The invertebrate community at Salag MPA is characterised by low overall density and low species richness, with the community dominated primarily by sea urchins and a small number of commercially important gastropods and bivalves. Compared to other sites, Salag appears to support fewer invertebrates overall, which may be due to habitat type, lower structural complexity, or environmental conditions.

The high number of juvenile sea urchins suggests that recruitment is occurring, but the lack of larger individuals suggests that few individuals are surviving to adulthood, which may indicate predation pressure, harvesting, or environmental stress.

Sea Urchins - Diadema	2.22
Gastropods - Other Shell	0.87
Bivalves - Giant Clam	0.71
Sea Urchins - Rock Boring	0.69
Gastropods - Scorpion Spider Conch	0.63
Gastropods - Cone	0.48
Gastropods - Nilo Top	0.22
Sea Cucumber - Black Spotted	0.19

Table 13. Most abundant commercial invertebrates at Salag MPA during Sep–Feb 2025/26. Values represent average density per survey and highlight the dominant contributors to the commercial benthic community.

Sea cucumber populations were very low, although the presence of some larger individuals suggests that a small adult population is present (Table 13). However, the low number of juveniles may indicate limited recruitment or recovery, which could be a concern given the commercial importance of sea cucumbers.

In contrast, giant clams showed a relatively healthy size distribution, with individuals present across multiple size classes, including larger individuals. This suggests that giant clams may be benefiting from protection within the MPA and are surviving long enough to reach reproductive size, which is important for population sustainability.

Overall, the Salag MPA invertebrate community appears to be low in abundance but shows some positive signs, particularly in the presence of multiple size classes of giant clams and some adult sea cucumbers. However, the low overall invertebrate density and low sea cucumber abundance suggest that continued protection and management are important to allow populations to recover and increase over time.

SALAG MPA

Tourism Value



Barracudas	8.76	Scorpaenidae	56.16
Cephalopods	6.74	Sharks	0
Cowries	16.04	Shrimps	55.61
Eels and Snakes	42.69	Slugs	76.06
Frogfish	0	Stingrays	4.105
Giant Clams	76.61	Syngnathidae and Pegasidae	10.23
Porcupinefish and Pufferfish	79.24	Turtles	8.21

Table 14. Mean encounter rates (%) of selected indicator and charismatic taxa recorded at Salag MPA from September - February 2025/26. Values represent the percentage of dives in which each group was observed, providing an indication of their relative tourism and ecological value.

Salag MPA is renowned for its fascinating underwater topography and landscape. There are large-scale features, such as coral bommies and small canyons, that make for very rewarding diving and highlight its potential for dive tourism. It is also the site of 'Hidden Beach', which is already established as a popular destination.

Salag provides moderate tourism value, with very strong encounters for porcupinefish and pufferfish (79.2%), slugs (76%), and giant clams (76.1%) (Table 14). Scorpaenidae (56.2%), shrimps (55.6%), and eels and snakes (42.7%) add further appeal for divers, especially those interested in macro-diversity.

In contrast, megafauna are limited: turtles are rarely observed (8.2%), and barracudas are infrequent (8.8%). Stingrays are seen occasionally (4.1%), providing some larger-species interest. Cowries are relatively rare (16%), and frogfish and sharks were not recorded. This is potentially due to the lack of surrounding and adjacent seagrass ecosystems that play a crucial role in supporting their presence, particularly that of turtles.

Salag hosts the highest percentages in the Siaton Municipality for cephalopods, giant clams, shrimps, slugs and stingrays.

Overall, Salag offers substantial value for divers seeking invertebrates, slugs, and pufferfish; however, its low turtle frequency and limited pelagic encounters make it less competitive for megafauna-focused tourism compared to other sites in the municipality.

FISH MONITORING

Our fish surveys are conducted using a visual census method based on a 30-meter x 5-meter belt transect. This yields an area of 150 square meters per survey. All target fish that enter the survey zone, from the seafloor to the surface, are counted and sized. The transect is left undisturbed for 15 minutes after it has been laid out, allowing fish to return to the survey area. Surveys are timed to last 10 minutes.

The following is our complete fish indicator list (commercial in bold):

- Angelfish - Bicolor
- Angelfish - Keyhole
- Angelfish - Midnight
- Angelfish - Pearl-Scale
- Angelfish - Other
- Anthias
- **Barracuda**
- **Big Eye**
- **Bream**
- Bristletooth
- Brushtail Tang
- Butterflyfish
- Cornetfish
- Damselfish - Other
- Damselfish - Sergeant
- **Emperorfish - Other**
- **Emperorfish - Long Face**
- **Fusilier**
- **Goatfish**
- **Grouper - Barramundi**
- **Grouper - Brown-Marbled**
- **Grouper - Other**
- Long-Jawed Mackerel
- Moorish Idol
- Needlefish
- **Rabbitfish**
- **Parrotfish - Other**
- **Parrotfish - Bumphead**
- **Parrotfish - Raggedtooth**
- **Parrotfish - Stareye**
- **Pufferfish - Other**
- **Pufferfish - White-Spotted**
- Scad
- Sea Rays
- Sea Snakes
- Sharks
- **Snapper**
- **Soldierfish**
- Squid
- Spadefish
- **Surgeonfish - Other**
- **Surgeonfish - Whitetail**
- **Surgeonfish - Yellow Mask**
- **Sweetlips**
- **Trevally - Other**
- **Trevally - Scad**
- **Triggerfish - Other**
- **Triggerfish - Redtooth**
- **Triggerfish - Titan**
- **Tuna**
- Turtles - Green
- Turtles - Hawksbill
- **Unicornfish - Blue-Spine**
- **Unicornfish - Orangespine**
- **Unicornfish - Other**
- Wrasse - Cleaner
- Wrasse - Humphead
- Wrasse - Other

SUBSTRATE MONITORING

Our substrate surveys utilise a Point Intercept Method, based around a transect length of 30 meters. The substrate directly below every 25 cm increment on the line is identified and recorded. This yields a total of 120 data points per survey.

The following is our comprehensive list of substrate indicators.

Hard Coral

- Branching
- Tabulate
- Plate-like
- Encrusting
- Submassive
- Columnar
- Massive
- Solitary

Soft Coral

- Other Soft Coral
- Gorgonian
- Organ Pipe

Other Cnidarians

- Anemone
- Corallimorph
- Hydroid
- Zoanthid

Sessile Invertebrates

- Sponge - Barrel
- Sponge - Encrusting
- Sponge - Irregular
- Ascidian - Regular
- Ascidian - Encrusting
- Bryozoan

Algae

- Coralline
- Halimeda
- Filamentous
- Macro
- Turf

Health and Vulnerability

- Bleaching
- Disease
- Infestation
- Predation - Coralliophila
- Predation - Crown of Thorns
- Predation - Drupella
- Silt

Substrate

- Giant Clam
- Live Coral Fragment
- Rock
- Rubble
- Sand

INVERTEBRATE MONITORING

Our invertebrate surveys are conducted using a visual census method based on a 30-meter x 5-meter belt transect. All target invertebrates present or that enter the survey zone are identified, counted and sized.

The following is our complete invertebrate indicator list.

Echinoderms

- Sea Star ●●●
- Cushion Star ●●●
- Urchin ●●●
 - *Diadema*
 - *Rock Boring*
 - *Collector*
 - *Other*
- Sea Cucumber ●●●
 - *Black Spotted*
 - *Leopard*
 - *Pinkfish*
 - *Sandfish*
 - *Volcano*
 - *Amberfish*
 - *Magnum*
 - *Other*

Arthropods

- Cleaner Shrimp ●
 - *Banded Coral*
 - *Other*
- Harlequin Shrimp ●
- Other Shrimp ●
- Mantis Shrimp ●●●
- Lobster ●
- Crab ●

Gastropods

- Conch ●
 - *Scorpion Spider*
 - *Other*
- Turban ●
 - *Giant*
 - *Other*
- Top ●
 - *Nilo*
 - *Other*
- Triton's Trumpet ●●●
- Horned Helmet ●●●
- Cone Shell ●●●
- Cowrie ●●●
 - *Tiger*
 - *Common Egg*
 - *Other*
- Other Shell ●

Bivalves

- Giant Clam ●●●
- Giant Boring Clam ●●●
- Thorny Oyster ●
- Pearl Oyster ●
- Pen Oyster ●
- Honeycomb Oyster ●
- Scallop ●
- Other Bivalve ●

Slugs

- Nudibranch ●●
- Headshield Slug ●
- Sapsucking Slug ●●
- Flatworm ●●

Cephalopods

- Blue-ringed Octopus ●
- Other Octopus ●
- Cuttlefish ●●
- Flamboyant Cuttlefish ●

Benthic Fish(Ish)

- Eel ●
- Ribbon Eel ●●
- Pipefish ●●
- Seahorse ●
- Frogfish ●
- Lionfish ●
- Scorpionfish ●
- Porcupinefish ●
- Blue Spotted Singray ●●
- Blue Spotted Ribbontail Ray ●

Key:

- **Commercially Important Species**
- **Ecosystem Engineers**
- **Indicator Species (Reef Health & Diversity)**
- **Other Benthic Species**
- **Charismatic Species**



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THANK YOU

Please contact us if you would like any additional information, or require assistance with any conservation activities

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