

OCT 2026



**Marine
CONSERVATION
PHILIPPINES**

Semiannual Report

SIATON



marineconservationphilippines.org

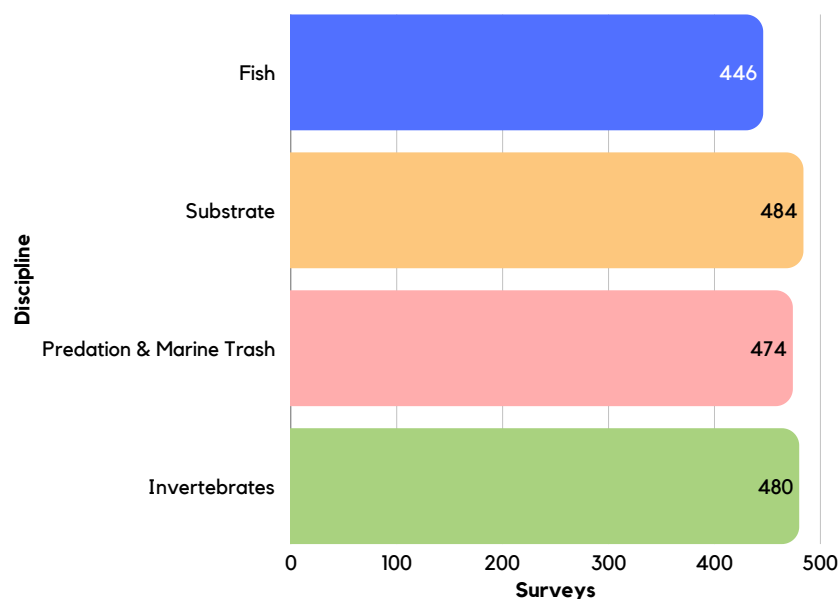
EXECUTIVE SUMMARY

Marine Conservation Philippines Report Siaton - March - August 2026



Marine Conservation Philippines (MCP) conducted a total of **1,884 surveys** across four survey methodologies (Fish, Substrate, Invertebrates, and Predation) across two out of the three municipalities we monitor (Zamboanguita, Siaton) between March and August 2026. With **1002 surveys** conducted in the March - May 2026 season, and **882 surveys** conducted in the June - August 2026 season. We were unable to collect data from the Santa Catalina Municipality this six month period.

Two super typhoons crossed the area during this reporting period. Super Typhoon Inday and Super Typhoon Kiyapo both passed in July 2026, inside the June–August 2026 season. Storm damage breaks branching and plating coral, converts standing structure into rubble and stirs sediment, and the effect lands on the second half of this six-month average.

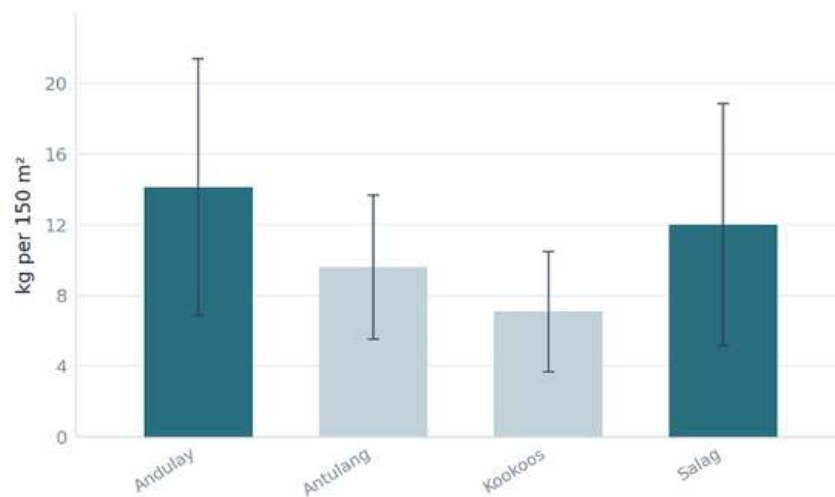


Surveys Collected. The number of surveys collected this six month period for each science discipline.

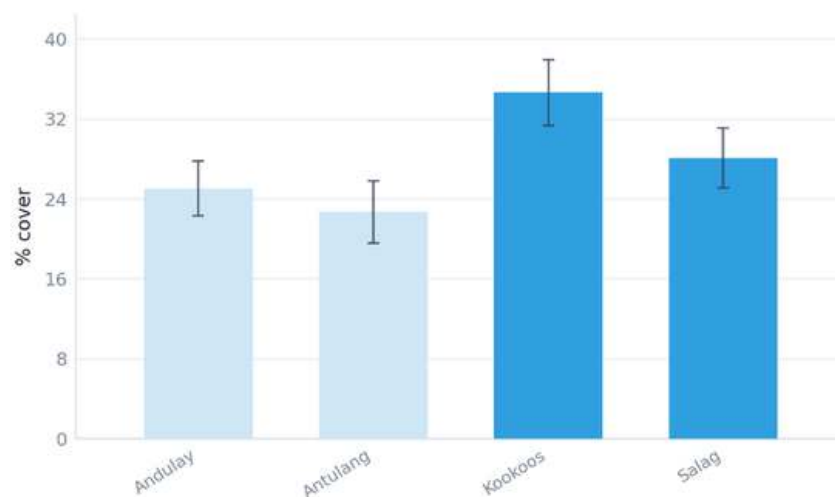
Headline Indicators. The four headline indicators for Siaton, current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged), with the change against the preceding six months. Colour is keyed to whether the movement is favourable rather than to whether the number rose – falling bleaching reads green. A change under 5% is shown flat.

Hard Coral Cover	Commercial Biomass	Fish Density	Bleaching
27.6% of substrate	10.7 kg / 150 m ²	714.7 / 150 m ²	2.3% of hard coral
— 0.8%	▲ 8.5%	— 0.8%	▼ 29.7%

Across Siaton, municipal marine monitoring demonstrated overall stability across benthic habitats paired with strong macro-invertebrate recovery. Hard coral cover currently averages **27.6%**, maintaining its position within the "fair" category (25-49.9%) under Philippine national classification standards. Thermal stress remained well managed, with bleaching affecting just **2.3%** of hard corals. However, a sharp rise in macroalgae cover to **16.4%** signals emerging competitive pressure on the substrate, likely driven by seasonal agricultural and terrestrial run-off following heavy rainfall.



Commercial Biomass by Site. Commercial fish biomass at each Siaton site, Mar-May 2026 and Jun-Aug 2026 averaged. Sites at or above the municipal average are highlighted.



Hard Coral Cover by Site. Hard coral cover at each Siaton site, current reporting period. Sites at or above the municipal average are highlighted.

Mobile species metrics reflected steady, positive trajectories across higher trophic levels. Commercial fish biomass logged at 8% gain, reaching 10.70 kg / 150 m², while total fish density stabilized at 714.7 individuals / 150 m². Macro-invertebrates achieved substantial population expansions in both abundance and species richness. While habitat baselines remain resilient, proactive land-based catchment management and marine debris controls will be essential to prevent expanding macroalgae from compromising long-term coral stability.

INDICATORS AT A GLANCE



Siaton Indicators at a Glance. Key indicators for Siaton, current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged) against the preceding six months. Each row shows the current value, the preceding six months, and the change. Colour is keyed to whether the movement is favourable. Green indicates improvement, red indicates decline — e.g. macroalgae, rubble, bleaching or debris rising reads red, coral cover rising reads green. A change smaller than 5% is shown as flat.

Indicator	Current	Prior 6 months	Change
Hard coral cover (%)	27.6	27.8	▬ -1%
Macroalgae cover (%)	16.4	11.3	▲ +45%
Rubble (%)	10.3	11.3	▼ -9%
Bleaching (of hard coral) (%)	2.27	3.23	▼ -30%
Total fish density (per 150 m ²)	714.7	720.7	▬ -1%
Commercial fish biomass (kg per 150 m ²)	10.7	9.86	▲ +8%
Invertebrate density (per 150 m ²)	40.4	25.0	▲ +61%
Invertebrate species richness (per 150 m ²)	10.8	9.30	▲ +17%
Coral predators (per 150 m ²)	46.2	49.1	▼ -6%
Marine debris (items per 150 m ²)	2.76	2.22	▲ +24%

Siaton's key indicators present a stable structural habitat paired with significant invertebrate recovery, though expanding macroalgae and marine debris highlight the need for continued catchment management.

Benthic & Substrate Health

- Hard Coral Cover: Virtually unchanged at 27.6% (-1%), holding steadily within the "fair" category.
- Coral Bleaching & Rubble: Bleaching dropped to 2.27% (-30%), while loose rubble declined to 10.3% (-9%).
- Macroalgae Cover: Surged to 16.4% (+45%), marking an increase in algal competition across benthic substrates.

Mobile Fauna & Environmental Pressures

- Fish Communities: Commercial biomass increased to 10.7 kg / 150 m² (+8%), with total fish density remaining stable at 714.7 individuals / 150 m².
- Invertebrates: Abundance jumped sharply to 40.4 per survey (+61%), accompanied by gains in species richness to 10.8 species (+17%).
- Threats & Debris: Coral predator density remained stable at 46.2 per survey, while marine debris rose to 2.76 items per survey (+24%), pointing to heightened coastal runoff or waste accumulation.

SITE COMPARISON

	Andulay	Antulang	Kookoos	Salag
Hard Coral Cover (%)	25.1	22.7	34.6	28.1
Commercial Biomass (kg)	14.1	9.6	7.1	12.0
Fish Density (incl. damselfish)	794.2	951.7	522.0	591.0
Invert Density	40.5	48.4	36.0	36.7
Invert Species Richness	11.8	12.1	10.5	9.0
Bleaching (%)	3.2	1.8	1.7	2.3
Overall rank	2	1	3	3

Site Comparison Heatmap. Key indicators at each site during the current reporting period. Colours are scaled against fixed program-wide reference ranges. Hard Coral Cover follows the Philippine classification scale (0–75%; Poor <25%, Fair 25–50%, Good >50%). Bleaching is evaluated on a 0–15% scale with 5% as the critical threshold of concern (inverted scale: green is better). Remaining metrics are normalised against the full historical program dataset across all sites and seasons. Overall ranks represent the unweighted average rank across all six primary indicators within the municipality.

Siaton’s monitoring sites present distinct ecological profiles, balancing benthic structural health against mobile fauna recovery. Overall municipal rankings average performance across six key indicators: Hard Coral Cover, Commercial Biomass, Total Fish Density, Invertebrate Density, Invertebrate Species Richness, and Coral Bleaching. Across all Siaton sites, coral bleaching remains at exceptionally favorable levels (1.7%–3.2%), staying well below the 5% threshold of concern.

Antulang ranks highest overall among the Siaton monitoring sites (Rank 1), driven by superior total fish density (951.7 individuals per 150 m²), invertebrate density (48.4 per 150 m²), and species richness (12.1 species). Although its hard coral cover (22.7%) falls into the "poor" category below the 25% threshold and its commercial biomass sits at a moderate 9.6 kg per 150 m², its strong overall biodiversity metrics elevate its total rank. Andulay secures the second rank with the highest commercial biomass in the municipality (14.1 kg per 150 m²) and solid fish density (794.2 individuals per 150 m²), supported by a stable "fair" hard coral cover baseline (25.1%) and strong invertebrate richness (11.8 species).

Kookoos and Salag share third position (Rank 3 tied), presenting contrasting ecological profiles. Kookoos has the strongest benthic foundation in Siaton, with the highest hard coral cover (34.6%) and lowest bleaching prevalence (1.7%), yet its overall position is constrained by lower fish density (522.0 individuals per 150 m²) and the lowest commercial biomass (7.1 kg per 150 m²). Salag balances moderate hard coral cover (28.1%) and commercial biomass (12.0 kg per 150 m²), but records lower invertebrate metrics, including the municipality's lowest species richness (9 species).

SITES TO WATCH

Compared against each site's own preceding six months, not against the other sites.

Andulay

- **Key Volatility:** Macroalgae cover increased sharply (+52%), rubble accumulation rose (+36%), and marine debris surged (+64%).
- **Interpretation:** The concurrent rise in macroalgae and loose coral rubble, alongside a steep influx of marine debris, indicates recent localised physical disturbance, such as wave impact from severe weather, anchor damage, or unsustainable fishing practices. Exposed rubble patches, combined with excess terrestrial nutrient inputs, create prime substrate for rapid macroalgae colonisation over coral larvae.
- **Recommended Action:** Execute targeted marine debris cleanup dives, investigate potential localised sources of mechanical damage (e.g., vessel mooring practices), and maintain herbivore protections to prevent algal phase-shifts on new rubble patches.

Kookoos

- **Key Volatility:** Marine debris surged substantially (+81%), accompanied by an increase in macroalgae cover (+37%).
- **Interpretation:** A dramatic spike in solid waste alongside expanding macroalgae suggests localised coastal runoff, inadequate municipal solid waste management, or illegal dumping. These factors introduce physical pollutants and excess dissolved nutrients that spur opportunist algal growth.
- **Recommended Action:** Coordinate waste management interventions with coastal barangays, schedule targeted debris retrieval dives, and initiate periodic water quality/turbidity monitoring to track land-based nutrient enrichment.

Salag

- **Key Volatility:** Macroalgae cover experienced a steep surge (+75%), while coral bleaching increased sharply (+33%).
- **Interpretation:** The combination of elevated bleaching and a rapid macroalgal bloom points to compound stress: localised thermal stress paired with water quality deterioration (such as elevated turbidity or agricultural runoff). Bleached corals suffer reduced immunity and competitive ability, making them vulnerable to algal overgrowth.
- **Recommended Action:** Conduct localised temperature and bleaching monitoring, enforce strict zero-discharge policies along adjacent shorelines, and minimise human activity and physical disturbance during the recovery window.

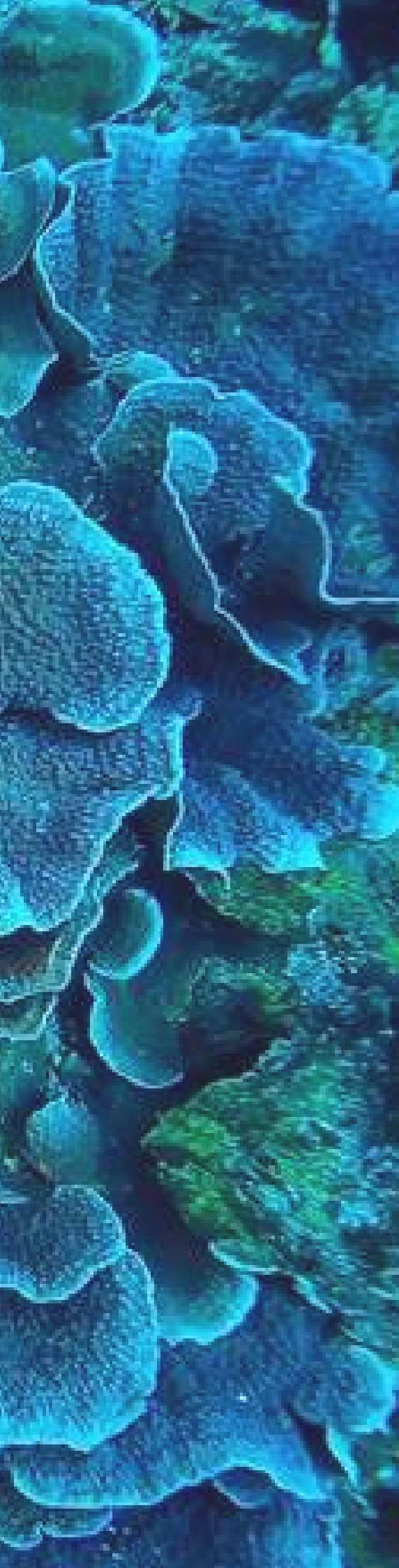


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MONITORING AND SCIENCE AT MCP



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, predation 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

COMMUNITY PROJECTS



Marine Conservation Philippines is proud to continue working alongside local government units (LGUs), partner agencies, and coastal communities. Between March and August 2026, our joint initiatives spanned habitat restoration, ghost gear retrieval, capacity building, and MPA expansion across Southern Negros.

Reporting Period Impact Highlights

- 1,428 kg total marine waste and ghost gear recovered across 10 targeted clean-up operations.
 - 300 mangrove propagules planted to strengthen coastal buffering and nursery habitats.
 - 39 local community members, fisherfolk, and Bantay Dagat officers certified/trained.
 - 1 new Marine Protected Area (MPA) established with MCP technical support.
-
- **Clean-ups and Ghost Net Removal**

Abandoned, lost, or discarded fishing gear represents the single largest category of benthic debris recorded in both Zamboanguita and Siaton. Because lost nets continue to trap and kill marine life indefinitely, gear retrieval directly mitigates ongoing ecological mortality.

- **SCUBA Surero Dive (Tambobo Bay, Siaton):** Recovered **457 kg** of underwater waste in collaboration with the Philippine Coast Guard (PCG), LDRRMO, and the Siaton Fishery Office.
- **Women's Month Coastal & Dive Clean (Salag, Siaton):** Removed **94 kg** of debris alongside nine partner agencies, including PCG, MENRO, ProOcean, Maritime Police, Agriculture Office, Tourism Office, LDRRMO, BFAR, and Fire & Rescue.
- **Earth Day Clean-Up (Antulang, Siaton):** Collected **172 kg** of waste (140 kg non-recyclable, 32 kg recyclable) with ProOcean.
- **World Oceans Day Clean-Up:** Executed our largest shoreline retrieval of the period in partnership with ProOcean and DENR, recovering **390 kg** (327 kg non-recyclable, 63 kg recyclable).
- **World Mangrove Day Clean-Up (Turtle Island):** Combined a targeted mangrove cleanup with an environmental education campaign for local youth.

- **Targeted Ghost Net Retrievals**

Ghost fishing gear was retrieved from four high-priority reef sites identified during routine UVC monitoring:

- **Siaton:** Salag and Bangcolotan (**64.5 kg** total gear recovered).
- **Zamboanguita:** Lutoban Pier and Maluay Malatapay.

- **Habitat Restoration & MPA Expansion**

- **Mangrove Reforestation (Bonbonon, Siaton):** Planted **300 mangrove propagules** in coordination with the LGU and PCG. Mangroves trap terrestrial runoff and sediment before it reaches fringing reefs while serving as critical nursery grounds for juvenile reef fish.
- **New MPA Support (San Jose):** Technical and logistical support contributed to the formal opening of the **Hidden Treasure Marine Sanctuary** alongside the LGU and Tourism Office, securing long-term habitat protection.

- **Capacity Building & Training**

Building local capacity ensures marine stewardship remains sustainable independent of visiting volunteer programs.

- **Emergency First Response (EFR):** Trained **25 local Bantay Dagat** at Maluay, Malatapay in emergency first response and water safety.
- **Diver Certifications:** Certified **10 local residents** through Open Water Diver courses in Siaton and **4 divers** from Tanjay through a Rescue Diver course.
- **Community Snorkel Surveys:** Provided equipment and logistical assistance to Dr. Rene (University of the Philippines) to train local community members in standardised snorkel-based monitoring techniques.

- **Education, Youth & Research Collaboration**

- **MCP Summer Camp:** Brought together 12 participants from Microbea and local fisherfolk youth for Discover Scuba Diving sessions, fish identification workshops, and community engagement activities. Campers collected **251 kg** of waste (188 kg non-recyclable, 63 kg recyclable).
- **Juvenile Fish Research:** Contributed data and participation to the Fisherfolk Association forum on the Juvenile Fish Research Project, assessing larval recruitment and stock replenishment across local reefs.
- **Eco-Tourism Promotion:** Produced underwater visual data and media footage to support sustainable marine eco-tourism initiatives in San Jose.



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 March to August 2026.

In addition, MCP conducted bi-weekly beach cleans throughout 2026, collecting a further 470 kg of trash, complementing Pro Ocean's ongoing efforts.



Pro Ocean Trash Collection. Monthly totals of recycled and disposable trash (kg) collected by Pro Ocean during beach cleans along the Sibulan–Bayawan coastline, March–August 2026. 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.



FOOD SECURITY - MUNICIPALITY RESULTS



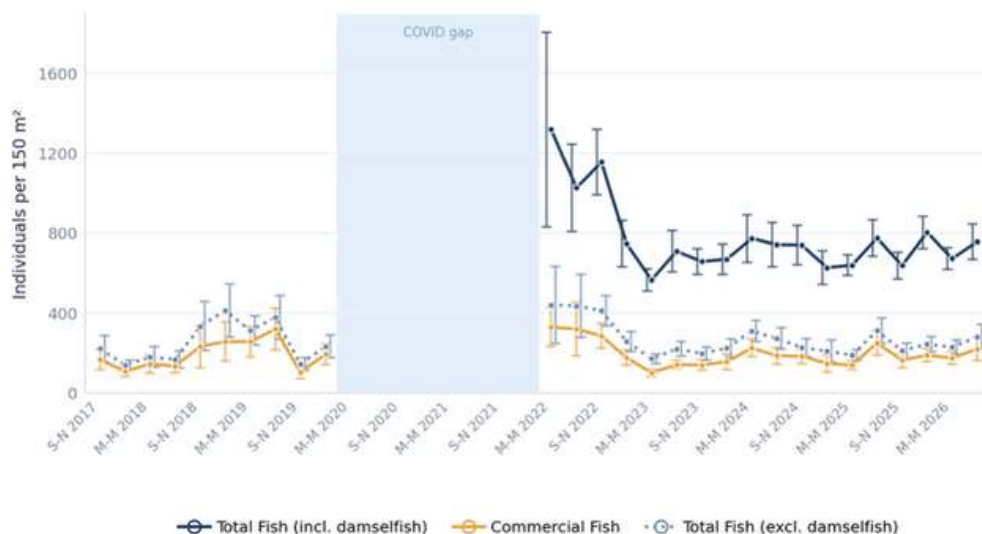
Biomass of Commercial species

One fundamental measure of a Marine Protected Area's (MPA) success is the fish biomass it produces. Where biomass inside a reserve is higher, adults and larvae move across its boundaries into surrounding waters, the spillover effect, directly supporting local food security. Biomass provides a far more meaningful measure of fishery health than individual counts alone, as fish weight scales exponentially with length. Consequently, a reef holding a few large fish offers significantly greater fishery value than one holding many small individuals of the same combined count.

Commercial and total density are reported separately throughout. Some abundant species are of no food value, damselfish in particular, which entered the protocol in 2022 and now make up roughly two thirds of everything counted, and combining them would misrepresent what is available to fisherfolk.

Current Status:

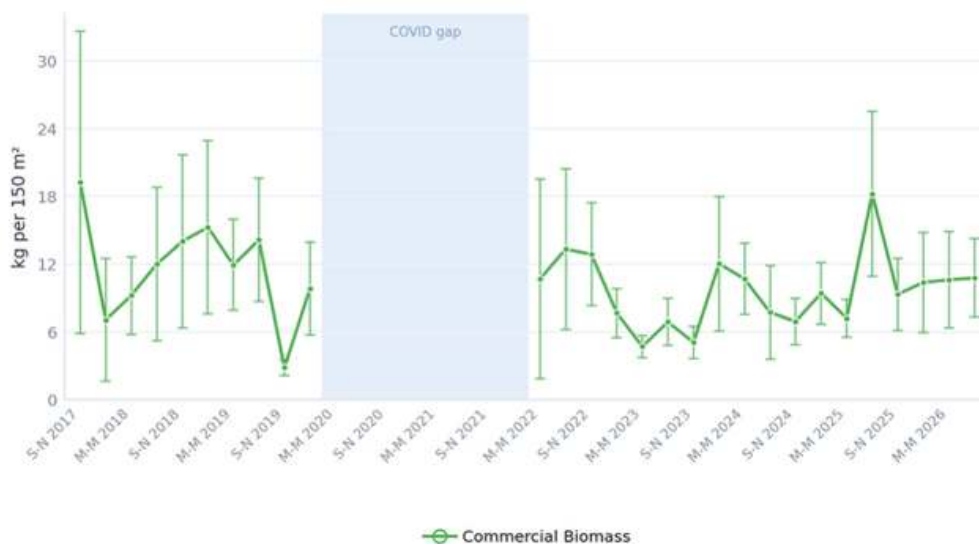
In March–August 2026, Siaton recorded an average total fish density of **714.7 individuals per 150 m²**, with commercial species contributing **197.7 individuals per 150 m²**. Commercial biomass averaged **10.70 kg per 150 m²**, equivalent to roughly **713 kg per hectare**, which sits in the moderately high range for the program. By dietary group the assemblage was led by herbivores (~474.9 ind.), planktivores (~109.7 ind.), carnivores (~98.2 ind.), detritivores (~14.4 ind.), corallivores (~9.9 ind.), omnivores (~3.9 ind.) and parasitivores (~3.8 ind.), so herbivores dominate the fish community at this scale.



Fish Density Trends. Total and commercial fish density, Siaton, 2017–2026. The solid total is everything counted, damselfish included, and begins at Mar–May 2022 — the season damselfish entered the survey protocol. The dotted line excludes them and runs the whole record. The gap between them is the damselfish contribution, currently around two thirds of all individuals counted.

Recent Change:

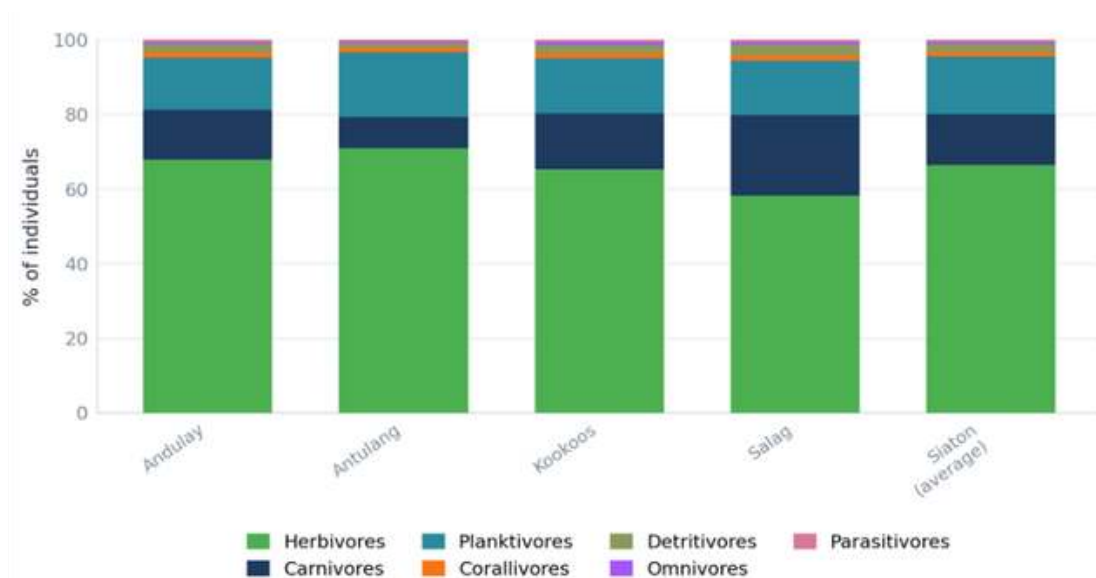
Against the preceding six months, total fish density is little changed (720.7 → 714.7 individuals per 150 m² including damselfish, 228.0 → 255.3 excluding them), commercial density slightly higher (176.6 → 197.7) and commercial biomass slightly higher (9.86 → 10.70 kg per 150 m²). Within the assemblage, herbivores moved 506.3 → 474.9, carnivores moved 85.0 → 98.2 and planktivores moved 98.4 → 109.7 individuals per 150 m².



Commercial Biomass Trends. Commercial fish biomass, Siaton, 2017–2026. Estimated from visual length and count records using species-specific length–weight relationships; values are a relative index of standing stock rather than a fisheries yield estimate.

Dietary Structure:

By share of individuals, the community is dominated by herbivores (66.4%), followed by planktivores (15.3%) and carnivores (13.7%), with the remaining groups (detritivores, corallivores, omnivores, and parasitivores) together making up 4.6%. Trophic structure matters because grazing species control algal growth and so mediate the competition between coral and algae described in the next section.



Dietary Composition by Site. Share of fish counted in each dietary group at each Siaton site, current reporting period, with the municipal average at the right.

Commercial Groups:

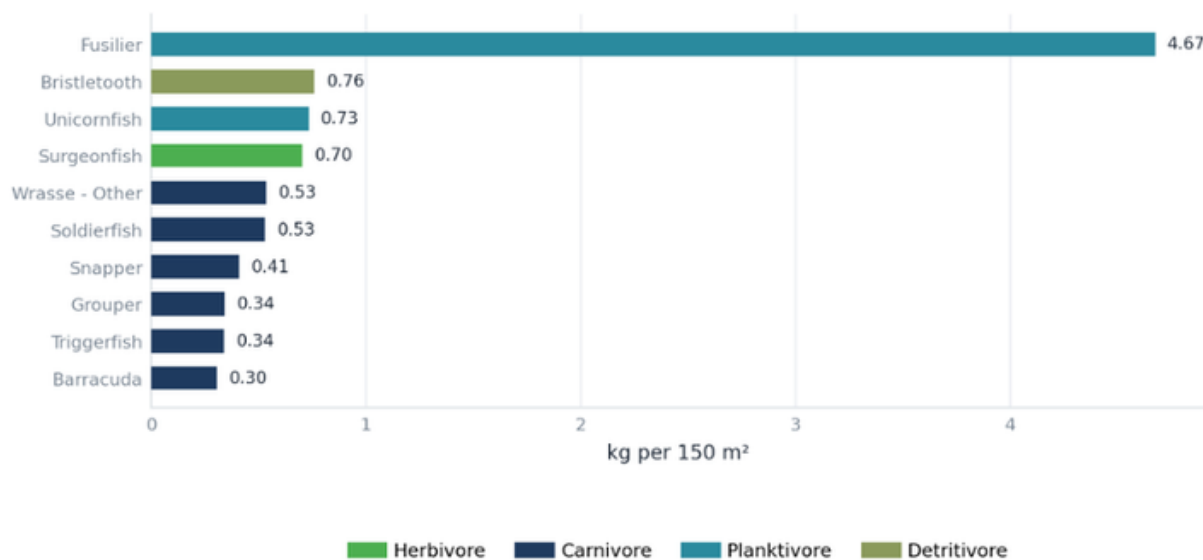
Commercial fish biomass across Siaton is overwhelmingly dominated by fast growing, mid-sized schooling planktivores, with Fusiliers alone accounting for 4.67 kg per 150 m² (42.9% of total commercial biomass). In contrast, high-value apex predators persist at heavily suppressed densities, with Snappers (0.41 kg per 150 m²), Groupers (0.34 kg per 150 m²), and Barracudas (0.3 kg per 150 m²) occurring only in low single-digit numbers (1.9 to 3.8 ind. / 150 m²). Essential herbivorous taxa, including Bristletooth (0.79 kg / 150 m²), Unicornfish (0.73 kg / 150 m²), and Surgeonfish (0.7 kg / 150 m²), collectively represent 20.1% of commercial biomass, though non-damselfish herbivores comprise just 6.9% of overall fish counts. This severe taxonomic skew towards planktivorous schooling species rather than resident apex predators is a classic signature of selective fishing pressure, where larger target species are sequentially extracted first. The depressed abundance of functional grazers reduces vital top-down pressure on macroalgal expansion, leaving the reef vulnerable to phase shifts if benthic disturbances occur.

Top Commercial Fish Families. The ten commercial fish families contributing most to biomass at Siaton, current reporting period. Sub-types are rolled into their family.

Commercial Families	Biomass (kg/ 150 m ²)	Density (ind./150 m ²)	% of Commercial Biomass
Fusilier	4.67	67.8	42.9
Bristletooth	0.76	14.6	7
Unicornfish	0.73	4.9	6.7
Surgeonfish	0.7	1.9	6.4
Wrasse - Other	0.53	71.4	4.9
Soldierfish	0.53	3.9	4.9
Snapper	0.41	3.3	3.8
Grouper	0.34	3.8	3.1
Triggerfish	0.34	3.2	3.1
Barracuda	0.3	1.9	2.8

Long-term context:

The 2017–19 baseline for Siaton is 12.86 kg per 150 m² of commercial biomass and 268.4 fish per 150 m². Current biomass stands -17% against that baseline and density -5%. The highest commercial biomass on record here was 19.23 kg per 150 m² in Sep–Nov 2017. Current levels are 44% below it. Two protocol changes limit what the long record can be asked. Damselfish entered the list in 2022, so only the damselfish-excluded series is comparable across the full period; and fish size bins changed in 2025 with both schemes running side by side through 2025–26, which biases early biomass slightly low.



Top Commercial Fish by Biomass. The ten commercial fish families contributing most biomass in Siaton, current reporting period, coloured by trophic group. Sub-types are rolled into their family.

Ecological interpretation:

Herbivores are only 6.9% of the fish counted once damselfish are set aside, a thin grazing guild for a reef of this type. With macroalgae at 16.4% of substrate, the combination is consistent with grazing pressure being insufficient to hold algal cover down, the mechanism that keeps a reef on the algal side of a phase shift once it arrives there. Planktivores make up 42.2% of the assemblage. Planktivore abundance tracks current and plankton supply rather than reef condition, so it inflates total density without indicating recovery. Across the municipality, protected sites (Andulay, Salag) average 13.06 kg per 150 m² of commercial biomass against 8.34 at the unprotected sites (Antulang, Kookoos). That gap is consistent with the MPAs contributing to higher standing stock, though site habitat and depth differ too and the comparison is not controlled.

The average commercial fish counted weighs about 54 g. Against the 2017–19 baseline of 63 g that is -15%. Fish are smaller on average than they were, which is the clearest single sign of fishing pressure: extraction removes large individuals first, and the stock responds by shifting to fast-growing small ones. It matters disproportionately because weight rises with roughly the cube of length, so a modest fall in mean size is a large fall in yield. Carnivores are 38.4% of the assemblage once damselfish are set aside, which is a high share. On a lightly fished reef the pyramid narrows towards the top; a wide carnivore band usually means small mid-water carnivores rather than large predators, so it should be read with the commercial table above rather than as evidence of an intact predator community.

REEF HEALTH AND RESILIENCE - MUNICIPALITY RESULTS



Substrate Composition

Located within the Coral Triangle, a global hotspot encompassing nearly 30% of the world's coral reefs, Siaton's marine ecosystem depends fundamentally on its benthic composition. Hard corals form the structural architecture of the reef, providing critical shelter and breeding grounds for diverse marine life, including economically vital fishery species. Conversely, fleshy macroalgae compete directly with corals for space and light. When algal overgrowth goes unchecked, reefs risk phase-shifts that reduce both biodiversity and economic value. Globally, hard coral cover has experienced a sustained decline since 2010, driven by compound thermal, physical, and land-based stressors. Macroalgae thrive on elevated nitrogen and phosphorus inputs from coastal agricultural runoff and untreated wastewater, particularly during wet-season discharge events. In the absence of robust herbivorous fish populations to graze down seasonal blooms, corals struggle to reclaim lost substrate.

Current Status:

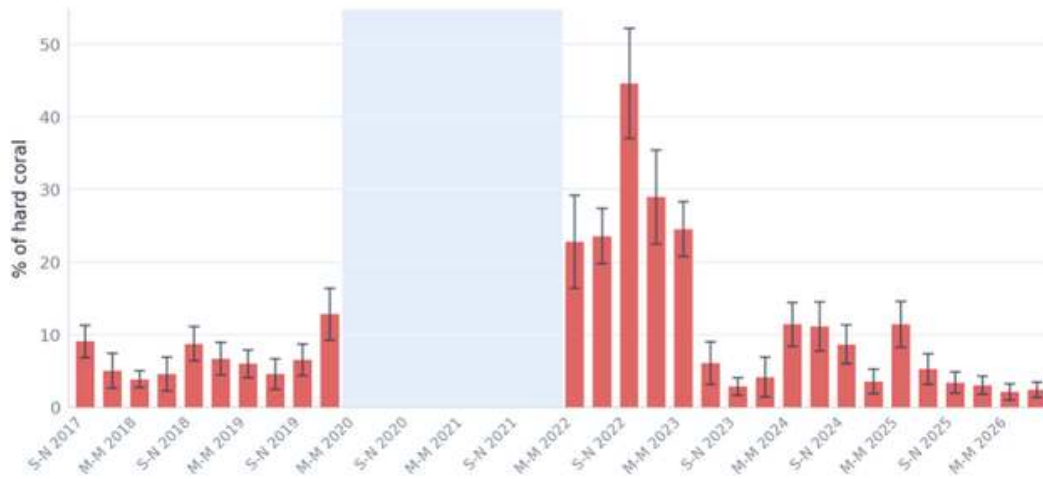
During March–August 2026, Siaton recorded an average hard coral cover of **27.6%**, macroalgae of **16.4%** (24.8% once turf is included) and rubble of **10.3%**. Coral cover places the reef in the **fair** band of the Philippine classification. Bleaching affected 2.27% of hard coral, below the 5% level conventionally treated as a concern threshold, suggesting low thermal stress over the survey period. Beyond bleaching, 0.30% showed predation scarring; 0.06% was diseased; 0.24% was recently killed. Overall the reef can be described as coral-dominated, with noticeable algal presence and moderate unconsolidated substrate.



Reef Substrate Trends. Hard coral, macroalgae and rubble cover, Siaton, 2017-2026. Both algal conventions are shown: the solid line is macroalgae alone, the current headline definition, and the dashed line adds turf algae, which is what editions before 2026 published as "Fleshy Macro Algae Cover" and is the figure to compare against those.

Recent Change:

Compared with the preceding six months, hard coral cover is little changed (27.8 → 27.6%), macroalgae substantially higher (11.3 → 16.4%), rubble slightly lower (11.3 → 10.3%) and bleaching notably lower (3.23 → 2.27%). Taken together this indicates increased algal presence. Super Typhoon Inday and Super Typhoon Kiyapo crossed the area inside this reporting period, so physical damage is the first explanation for this, storm breakage converts standing coral into rubble directly, where gradual pressure does not.



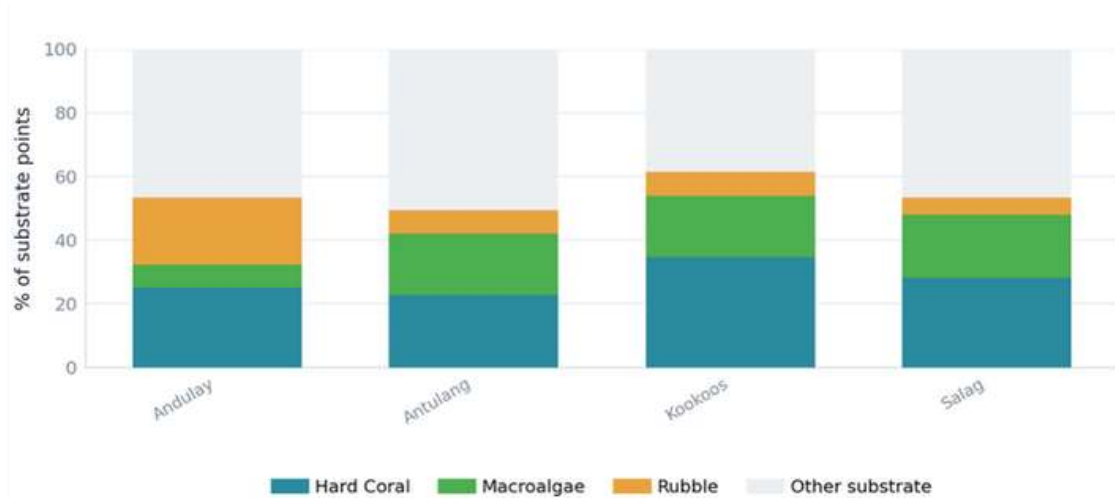
Bleaching Incidence. Bleached coral as a percentage of hard coral cover, Siaton, by season. Combines partially and fully bleached records. Bleaching is episodic, so each season is shown independently. Note this is a share of hard coral, not of all substrate points as reported in earlier editions.

Structural Implications:

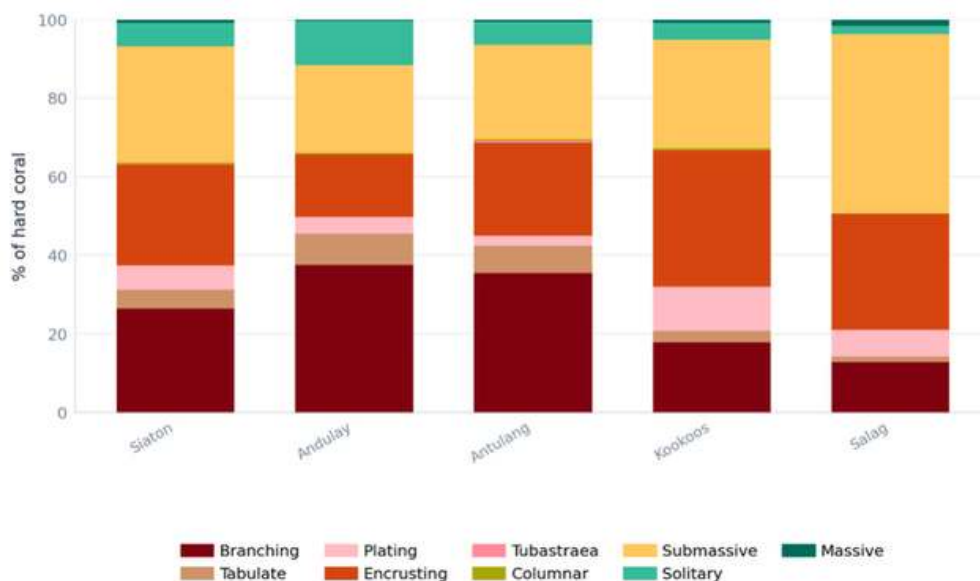
Of all points recorded, 27.6% is living hard coral, 26.7% is fleshy algae competing for the same space, 20.3% is unconsolidated material (rubble and sand), 6.5% is consolidated surface available for settlement (bare rock and coralline algae) and 19.0% is occupied by other stable but non-reef-building life, soft corals, sessile invertebrates and seagrass. The combination of fair coral cover and relatively low rubble (10.3%) indicates that most of the reef framework is stable and physically suitable for coral growth and recruitment. Sand accounts for a further 9.8% of points, which is habitat rather than damage. Macroalgae has risen against the preceding six months (+45%), so competition for settlement space is intensifying rather than easing. Fleshy algae pre-empt the surfaces coral larvae need and deter grazers once established, which is how a reef gets held on the algal side rather than crossing back.

Within the living coral, growth form determines how much shelter the reef offers and how well it resists disturbance. The cover present is led by submassive (29.6%), branching (26.4%) and encrusting (25.7%). On MCP's classification, 63.2% of the coral sits in low-resilience forms and 6.8% in high-resilience forms. Most of the cover is therefore in forms that provide good shelter but are first to be lost in a thermal or storm event, so the headline cover figure is more fragile than it appears.

Taken together, fair coral cover at 27.6%, macroalgae at 16.4% and rubble at 10.3% — this is a reef in a **transitional** state, shaped by both physical disturbance (the unconsolidated fraction) and biological competition (the algal fraction). Algal competition is the binding constraint, the substrate itself is stable enough to support recruitment if that competition eases.



Reef Substrate Composition by Site. Substrate composition at each Siaton site, current reporting period. Other substrate includes sand, rock, coralline algae, soft coral and sessile invertebrates.



Coral Growth Forms by Site. Share of hard coral in each growth form at every Siaton site, averaged over the current reporting period (Mar–May 2026 and Jun–Aug 2026 averaged). Growth forms are ordered from least to most resilient: low resilience covers branching, tabulate, plating, encrusting and Tubastraea; medium covers columnar and submassive; high covers solitary and massive.

Long-term Context:

Against the 2017–19 baseline of 36.4% hard coral, 5.6% macroalgae and 6.9% rubble, coral cover is -24%, macroalgae +193% and rubble +49%. Coral cover peaked at 42.0% in Sep–Nov 2017 and now stands 27.6%. Bleaching peaked at 44.6% of hard coral in Sep–Nov 2022, and has remained below the 5% concern level for the last 4 seasons, since Sep–Nov 2025. Two definitions changed for this edition and are not comparable with earlier reports: macroalgae is now macroalgae alone rather than macroalgae plus turf, and bleaching is a share of hard coral rather than of all substrate points, which makes it read three to four times higher on identical observations.

Ecological Interpretation:

Bleaching has stayed below the concern threshold for 4 consecutive seasons, which has allowed partial stabilisation; the reef is in a phase of cautious stabilisation rather than active recovery. Condition is not uniform across the municipality: Kookoos holds the highest coral cover (34.6%), Salag carries the most macroalgae (19.8%) and Andulay the most rubble (21.1%). Local conditions and management effectiveness therefore matter as much as municipality-wide pressures, and the site sections should be read for the detail. Protected sites average 26.6% hard coral against 28.7% at the unprotected sites.

Of the coral present, 37.4% is in fast-growing forms (branching, tabulate, plating) and 56.1% in slow, robust ones (massive, submassive, encrusting). That ratio sets how quickly cover can rebuild and how much survives a disturbance, and the two pull against each other: the fast forms drive recovery but are the first lost, the slow ones persist but add cover at a fraction of the rate. A cover figure held up mostly by slow forms is stable but will rebuild slowly from any loss, so recovery here should be measured in decades rather than seasons. For every point of substrate a coral larva could settle on, there are 4.1 points already held by fleshy algae. Settlement space is the binding constraint on recovery here, not larval supply: even a good recruitment year has little bare ground to land on.

Of the pressures acting here, the ones open to local action are enforcement, the herbivore populations that hold algae down, and the physical impacts that break coral and make rubble, anchoring, destructive fishing and trampling. Continued enforcement, maintenance of herbivore populations and reduction of physical impacts are the levers available locally.

PREDATION AND MARINE DEBRIS

- MUNICIPALITY RESULTS

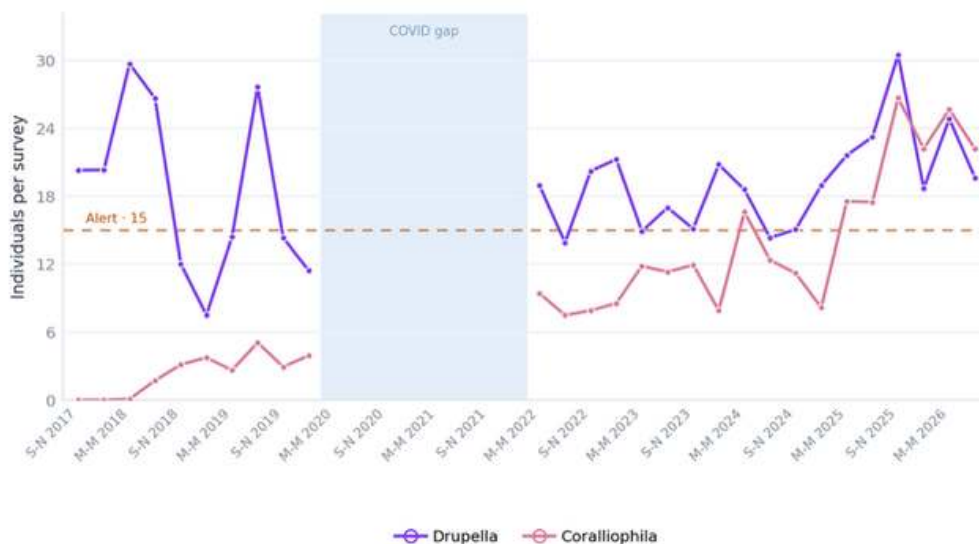


Corallivorous snails and Crown of Thorns feed directly on living coral. At low densities they are a normal part of the reef; above MCP's management thresholds they remove cover faster than it can regrow and become a target for direct intervention. Marine debris is reported alongside them because both are pressures that management can act on locally, unlike thermal stress.

Current Status:

Drupella averaged **22.2 per survey** (above the alert threshold) and Coralliophila **23.9** (above the alert threshold), giving a combined corallivorous snail load of 46.2 per survey. Crown of Thorns averaged 0.037 per survey (below the alert threshold).

Marine debris averaged **2.76 items per survey**. By category it breaks down as fishing gear 1.80 (65%), consumer plastics 0.57 (21%), household & sanitary 0.35 (13%) and other debris 0.03 (1%). Fishing gear is the largest category at 65% of items. That is a sea-based source: gear lost or discarded by boats working the reef, which responds to gear marking, retrieval dives and work with fishers rather than to municipal waste collection.



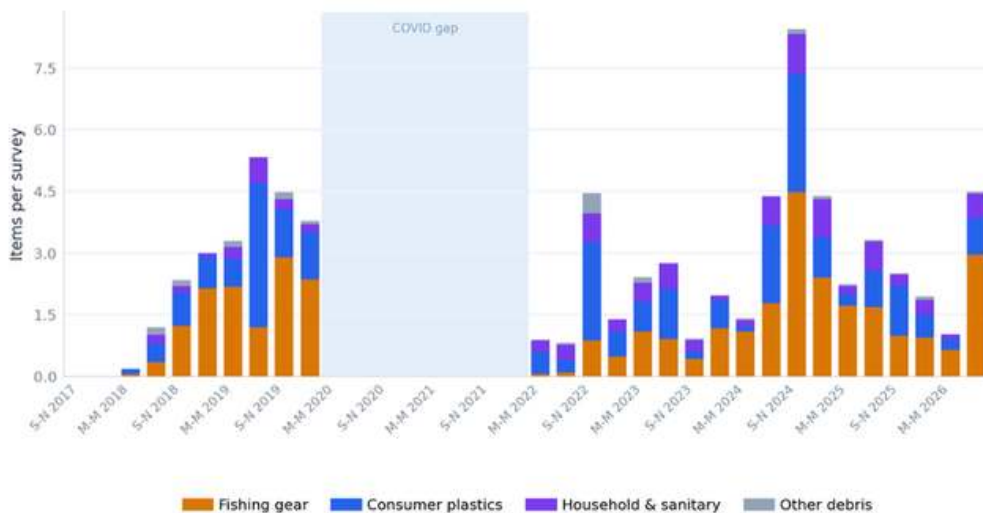
Coral Predators. Corallivorous snail abundance, Siaton, 2017-2026. Dashed rules mark MCP management thresholds (alert 15, outbreak 37.5, extreme 75 per survey).

Recent Change:

Against the preceding six months, Drupella is slightly lower (24.6 → 22.2), Coralliophila little changed (24.4 → 23.9), Crown of Thorns little changed (0.037 → 0.037) and debris notably higher (2.22 → 2.76 items per survey).



Crown of Thorns. Crown of Thorns abundance, Siaton, 2017–2026. Dashed rules mark MCP management thresholds for Crown of Thorns (alert 0.1125, outbreak 0.225, extreme 0.45 per survey).



Marine Debris Composition. Marine debris recorded per survey, Siaton, 2017–2026, broken down by category. Categories are mutually exclusive and sum to the recorded total, so bar height is total debris.

Long-term Context:

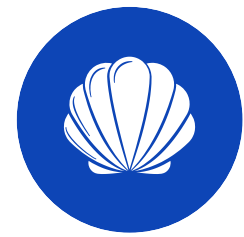
The 2017–19 baseline is 19.8 *Drupella*, 2.1 *Coralliophila* and 0.900 Crown of Thorns per survey, with 1.92 debris items. Current levels stand +12%, +1067%, -96% and +44% against those. *Drupella* peaked at 30.5 per survey in Sep–Nov 2025. These figures pool all depths. *Drupella* is roughly eleven times more abundant shallow than deep, so we have a depth-resolved workbook, where we can detect outbreaks in the shallows.

Ecological Interpretation:

Combined snail abundance is at outbreak level. *Drupella* and *Coralliophila* aggregate on already-stressed colonies, so high counts often follow coral damage rather than initiate it, but once aggregated they suppress the recovery of the colonies that survived. More than half the debris recorded (65.3%) is fishing gear. That is a different management problem from land-based waste: it points at gear loss by fishers working the reef and responds to gear marking, retrieval and fisher engagement rather than to municipal waste collection.

On management: corallivorous snails can be removed by hand and that is the standard response above outbreak level, but removal only works if it is repeated, the snails recruit from surrounding reef and a single clearance is recolonised. Directing effort at the aggregations on living coral, rather than spreading it across the site, is what makes the effort worthwhile. The debris is a fisheries problem before it is a waste problem. Lost gear keeps fishing after it is lost, so it is both a debris indicator and a mortality source, and it accumulates on exactly the structure that snags it, the high-relief coral that matters most. Gear marking and retrieval dives address it.

INVERTEBRATE STATUS - MUNICIPALITY RESULTS



Invertebrates carry functions the fish community does not. Urchins graze algae and erode old reef framework; sea cucumbers turn over and clean sediment; giant clams filter water and build structure. Many are also directly harvested commercially, which makes them among the first indicators to respond to fishing pressure — they are sedentary, conspicuous and slow to recover.

Current Status:

Siaton supported an average invertebrate density of **40.4 individuals per survey**, drawn from **10.8 distinct species per survey**. Density varies considerably between sites: highest at Antulang (48.4 per survey) and lowest at Kookoos (36). Richness follows a similar pattern, highest at Antulang (12.1 species per survey) and lowest at Salag (9).

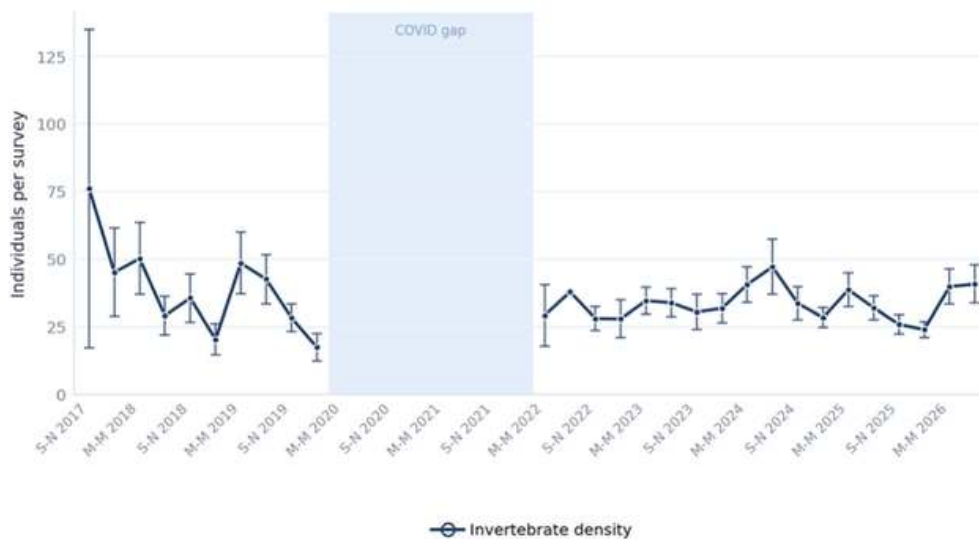
- **Species richness definition.** Richness is the average number of distinct species recorded per individual survey. Earlier editions divided a pooled species list by the number of surveys, which fell as more surveys were carried out; those figures are not comparable with these.

***Invertebrate status by site.** Invertebrate density, commercially important density and species richness at each Siaton site, current reporting period, with the municipal average. The municipal figure is the mean of the site values. Richness is the average number of distinct species recorded per individual survey, so it does not rise simply because more surveys were carried out.*

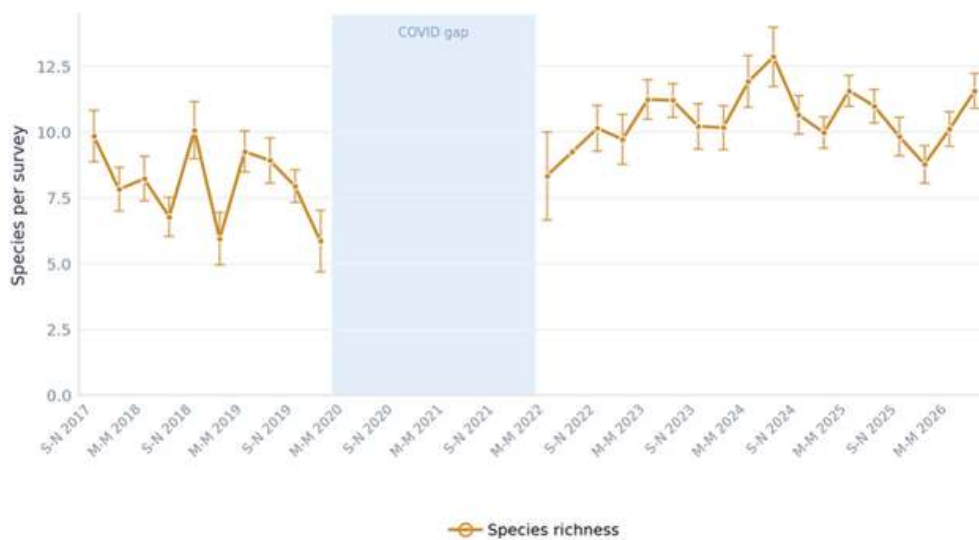
Site	Density (ind./150 m ²)	Commercially Important (ind./150 m ²)	Species Richness (species/150 m ²)
Andulay	40.5	27.6	11.8
Antulang	48.4	35.2	12.1
Kookoos	36	20.8	10.5
Salag	36.7	26.8	9.0
Siaton Average	40.4	27.6	10.8

Recent Change:

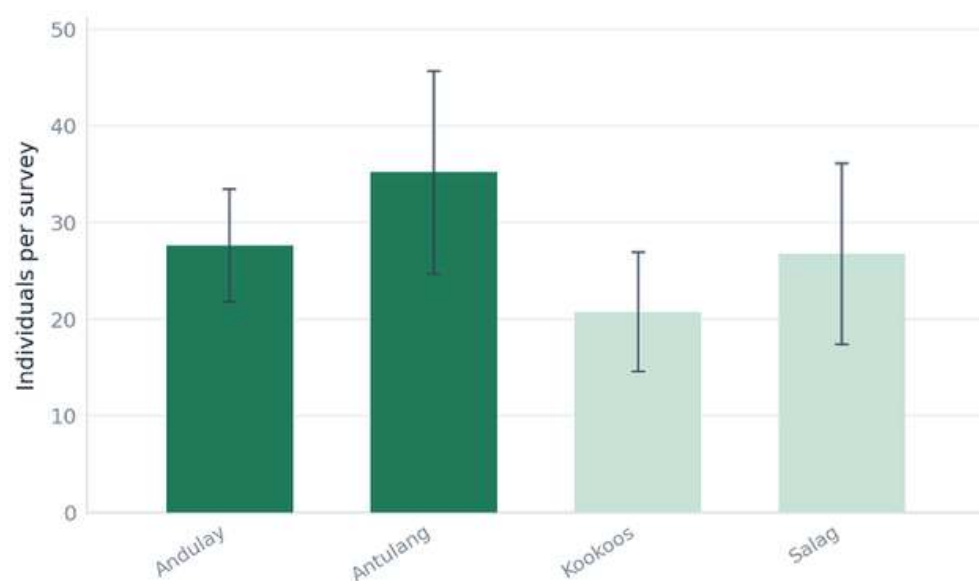
Against the preceding six months, density is substantially higher (25.0 → 40.4 per survey), richness notably higher (9.3 → 10.8 species) and commercially important species substantially higher (15.6 → 27.6).



Invertebrate Density. Total invertebrate density, Siaton, 2017-2026. Total invertebrates recorded per survey.



Invertebrate Species Richness. Invertebrate species richness, Siaton, 2017-2026.



Commercially Important Invertebrates by Site. Commercially important invertebrate density at each Siaton site, current reporting period. Sites at or above the municipal average are highlighted.

Commercial Groups:

Commercially important invertebrates averaged 27.6 per survey, 68.3% of all invertebrates counted. The ten harvested taxa in the table total 25.49 individuals per survey, 63% of all invertebrates counted, led by Urchin - Diadema at 18.42 per survey. The community is dominated by sea urchins. Their grazing helps keep settlement space open for coral recruitment, so high urchin abundance is a mixed signal rather than a bad one, beneficial for recruitment, but at sustained high density urchins also erode reef frameworks.

Most abundant invertebrate taxa. The ten most abundant invertebrates (left), and the ten most abundant commercially important invertebrates (right) by density in Siaton.

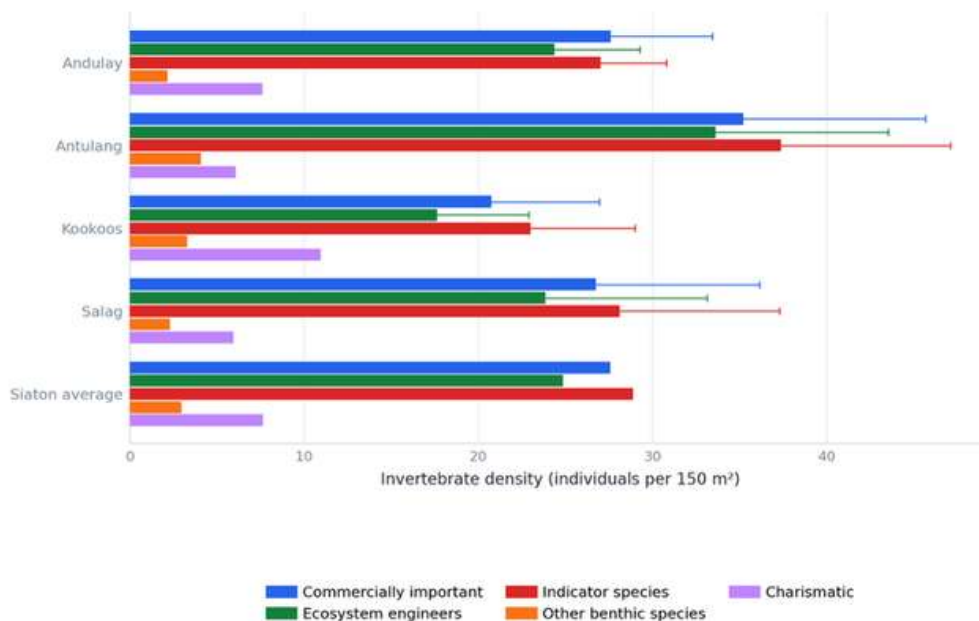
Top 10 Invertebrates	Individuals per 150 m ²	Top 10 Commercial	Individuals per 150 m ²
Urchin - Diadema	18.42	Urchin - Diadema	18.42
Nudibranch	3.52	Urchin - Rock Boring	1.38
Sea Star	2.49	Cone Shell	1.17
Cleaner Shrimp - Banded Coral	1.76	Sea Cucumber - Black Spotted	0.82
Lionfish	1.5	Other Shell	0.8
Urchin - Rock Boring	1.38	Giant Clam	0.73
Porcupinefish	1.24	Conch - Scorpion Spider	0.71
Cone Shell	1.17	Top - Nilo	0.54
Sea Cucumber - Black Spotted	0.82	Other Bivalve	0.53
Other Shell	0.8	Cowrie Tiger	0.39

Functional Groups:

Per survey: commercially important species 27.6, ecosystem engineers 24.9, sensitive indicator species 28.9, charismatic species 7.6, benthic associates and predators 2.9. These groups overlap by design, a species can be both commercially important and charismatic, so they do not sum to total invertebrate density. A relatively high abundance of sensitive indicator species suggests conditions still suitable for disturbance-intolerant taxa; a high abundance of ecosystem engineers, mostly urchins, indicates that herbivory and bioerosion are active processes here.

Long-term Context:

The 2017–19 baseline is 43.5 individuals and 8.4 species per survey. Density stands -7% against that and richness +30%. Richness figures in editions before 2026 divided a pooled species list by the number of surveys, which fell as survey effort rose. They are not comparable with these.



Invertebrate Functional Groups by Site. Invertebrate functional group density at each Siaton site, current reporting period. Shown as absolute density rather than as shares: a species can belong to more than one functional group, so the groups overlap and do not sum to total invertebrate density or to 100%. Each bar is therefore read against the axis, and against the same group at the other sites, not against the other bars in its own row.

Ecological Interpretation:

Protected sites average 38.6 invertebrates per survey against 42.2 at the unprotected sites. Protection status alone does not determine invertebrate abundance, habitat, reef complexity and local fishing pressure all contribute, so the comparison should be read as one factor among several rather than as a test of the MPAs. 68% of the invertebrates counted are on the commercially important list. A community that is mostly harvestable taxa is not automatically healthy, it usually means the abundant species happen to be targeted ones, here urchins, rather than that the harvested stocks are in good condition. The giant clam and sea cucumber figures are the better test of that, because they are the taxa fishers take first. Each species contributes 3.7 individuals per survey on average. A rising figure with flat richness means the same few taxa are becoming more abundant rather than the community broadening, which is the pattern that precedes an urchin-dominated reef.

Invertebrate grazers now outnumber herbivorous fish here (19.9 urchins against 17.5 herbivorous fish per survey, damselfish set aside). Urchins and herbivorous fish are partial substitutes, but not equivalent: urchins graze slowly and erode limestone as they feed, so a reef whose grazing has shifted to invertebrates loses algae and framework at the same time. It is also a less stable arrangement, because urchin populations boom and crash on disease in a way fish populations do not.

TOURISTIC VALUE - MUNICIPALITY RESULTS



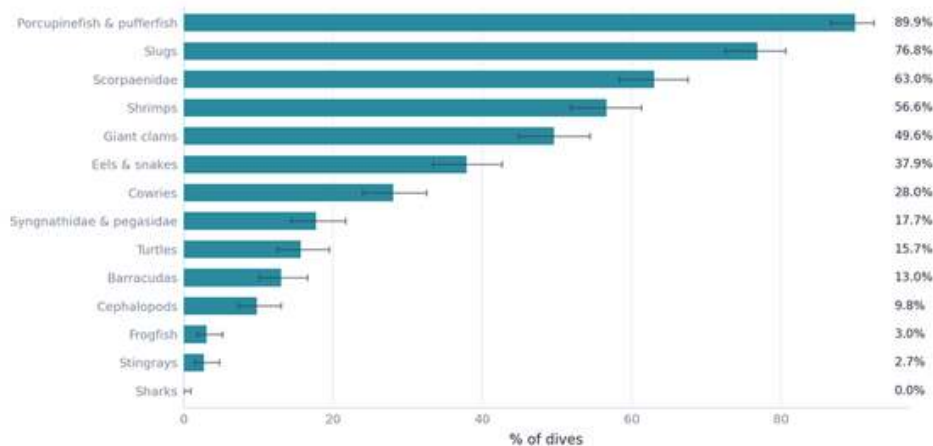
Iconic and Charismatic Species

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 dives between March and August 2026 on which each group was recorded. This provides a representation of how likely divers are to encounter these creatures, aiding dive operations in selecting sites that suit customers.

Touristic Species Encounter Rates Heatmap. The percentage of dives at sites in Siaton in which each touristic group was recorded, current reporting period.

	Andulay	Antulang	Kookoos	Salag	Siaton average
Barracudas	23	18.4	8.5	2.3	13
Cephalopods	11	6.1	11.8	10.3	9.8
Cowries	29.3	38.7	31.6	12.6	28
Eels & snakes	38	48.1	40.9	24.6	37.9
Frogfish	1.6	8.7	1.8	0	3
Giant clams	42.8	31.9	55.5	68.2	49.6
Porcupinefish & pufferfish	87.6	90.8	92.1	89.1	89.9
Scorpaenidae	55	74	65.2	57.9	63
Sharks	0	0	0	0	0
Shrimps	53.9	62.8	54.2	55.7	56.6
Slugs	84.3	70.3	68.9	83.8	76.8
Stingrays	0	2.3	1	7.5	2.7
Syngnathidae & pegasidae	16.6	27.4	19.3	7.5	17.7
Turtles	18.3	12.8	25.1	6.5	15.7



Touristic Species Encounter Rate. Percentage of dives in which each touristic species group was recorded, Siaton, current reporting period. Encounter rate is a presence measure and is not comparable to density.

Siaton's marine tourism portfolio over March–August 2026 shows a reef that is reliable for small subjects and thin on large ones. Porcupinefish and pufferfish were the most consistently recorded group, on 89.9% of dives across the municipality, followed by slugs (76.8%), Scorpaenidae (63.0%) and shrimps (56.6%). Giant clams were also prominent at 49.6%, with especially high rates at Salag (68.2%) and Kookoos (55.5%). Taken together, these are the conditions for macro and reef diving rather than for large-animal encounters.

The four sites have distinct profiles rather than a single shared one. Antulang leads the municipality on five groups, Scorpaenidae (74.0%), eels and snakes (48.1%), shrimps (62.8%), cowries (38.7%) and frogfish (8.7%), and has the highest syngnathid and pegasid rate at 27.4%, which makes it the strongest all-round site for cryptic subjects. Kookoos leads on porcupinefish and pufferfish (92.1%), turtles (25.1%) and cephalopods (11.8%), and is second for giant clams (55.5%). Salag is the giant-clam site at 68.2%, the highest in the municipality by thirteen points, and the only site where stingrays are recorded with any regularity (7.5%). Andulay has the highest slug rate (84.3%) and the highest barracuda rate (23.0%), nearly double the municipal average.

Large charismatic animals are the weak part of the portfolio. Turtles were recorded at all four sites but on only 15.7% of dives on average, ranging from 6.5% at Salag to 25.1% at Kookoos. Stingrays averaged 2.7% and were absent from Andulay altogether. Sharks were not recorded at any site during the period. A dive operator selling Siaton on the promise of a shark or a ray has nothing in this dataset to support it; one selling nudibranchs, scorpionfish, pipefish and shrimp has a great deal.

Antulang and Kookoos carry the broadest all-round value, Salag offers a specialised giant-clam and stingray product, and Andulay combines the best slug rate with the only reliable barracuda encounters. That spread supports different itineraries on different days rather than one standard dive, which is worth more to an operator than four similar sites would be.

MANAGEMENT SUGGESTIONS



Corallivore removal at Andulay and Antulang.

Combined *Drupella* and *Coralliophila* abundance is 57.7 per survey at Andulay and 51.7 at Antulang, against MCP's outbreak threshold of 37.5 and a municipal average of 46.2, more than double the 2017–19 baseline of 22.8, on a reef that has lost a quarter of its coral cover since then. Almost all of the increase is *Coralliophila*, which has gone from 2.1 per survey in 2017–19 to 23.9 now, while *Drupella* has barely moved (19.8 → 22.2). Removal by hand is the standard response above outbreak level, but it only works if it is repeated, the snails recruit from surrounding reef and a single clearance is recolonised. Effort directed at the aggregations on living coral, rather than spread evenly across the site makes it worthwhile.

Gear retrieval at Kookoos — not municipal waste collection.

Marine debris at Kookoos rose 81% to 4.38 items per survey, the highest in Siaton and 59% above the municipal average, and 92% of it is fishing gear. Lost gear keeps fishing after it is lost, so it is both a debris indicator and a continuing mortality source, and it accumulates on exactly the structure that snags it, the high-relief coral that matters most. Gear marking and retrieval dives reach this; municipal collection does not. Across Siaton as a whole fishing gear is 65% of all debris recorded, so this is the municipality's debris problem in general, not only Kookoos's.

Evaluate Kookoos for formal protection.

Kookoos holds the highest hard coral cover in Siaton (34.6%, up 7%), the lowest bleaching (1.68%) and the lowest commercial fish biomass (7.09 kg per 150 m²), and it is unprotected. Good benthic habitat that is not carrying fish is the signature of extraction on a reef that still has the structure to support more, which is the condition under which protection delivers fastest. Siaton's two MPAs average 13.06 kg per 150 m² of commercial biomass against 8.34 at the two unprotected sites; that 57% gap is what a closure at Kookoos would be aiming at.

MANAGEMENT SUGGESTIONS



Confirm whether Andulay's rubble is recent.

Andulay carries 21.1% rubble, double any other Siaton site and twice the municipal average, and it rose 36% this period, alongside macroalgae (+52%) and debris (+64%). Two super typhoons crossed the area in July, inside this reporting period. Freshly broken rubble is sharp-edged and unconsolidated and a single swim survey will settle it. The answer changes what the algal rise means: colonisation of new broken ground is a disturbance signal that will resolve, whereas a nutrient or grazing signal will not.

Protect the grazing guild, starting at Salag.

Herbivorous fish across Siaton are at 17.5 individuals per 150 m², 62% below the 2017–19 baseline, while macroalgae cover is close to triple its baseline (5.6% → 16.4%). A reef carrying three times its baseline algae with a third of its herbivore guild is in the configuration that keeps algae in place once they arrive, because the grazing that would clear settlement space for coral is no longer there. Urchins have partly filled the gap (9.4 → 19.9 per survey) but they graze slowly, erode limestone as they feed, and boom and crash on disease, not a stable substitute. Salag is where to test any measure first: it carries the municipality's highest macroalgae (19.8%, up 75%) and its lowest invertebrate species richness (9.0).

OCT 2026



**MARINE
CONSERVATION
PHILIPPINES**

Semiannual Report

SIATON

Section 2

Site Specific Results



marineconservationphilippines.org

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

Indicators At A Glance



Andulay is a marine protected area in Siaton. Hard coral cover is **25.1%** (fair on the national classification) and commercial fish biomass **14.12 kg per 150 m²** (notably lower) and invertebrate density **40.5** per survey (notably higher). Bleaching affected 3.2% of hard coral. This period rests on **50 surveys**, with 29 seasons on record since 2017.

Hard Coral Cover	Commercial Biomass	Fish Density	Bleaching
25.1% of substrate	14.1 kg / 150 m ²	794.2 / 150 m ²	3.2% of hard coral
▬ 3.4%	▼ 15%	▼ 30.8%	▲ 7.1%

Andulay indicators at a glance. Every headline indicator for Andulay, current reporting period, against this site's own preceding six months and the Siaton average for the same period. Colour is keyed to whether the movement is favourable rather than to whether the number rose. Green indicates improvement, red indicates decline — e.g. macroalgae, rubble, bleaching or debris rising reads red, coral cover rising reads green. A change smaller than 5% is shown as flat.

Indicator	Current	Prior 6 months	Change	Siaton Average
Hard coral cover (%)	25.1	24.2	▬ +3%	27.6
Macroalgae cover (%)	7.2	4.7	▲ +52%	16.4
Rubble (%)	21.1	15.5	▲ +36%	10.3
Bleaching (of hard coral) (%)	3.22	3.01	▲ +7%	2.27
Total fish density (per 150 m ²)	794	1147	▼ -31%	715
Commercial fish biomass (kg per 150 m ²)	14.12	16.62	▼ -15%	10.7
Invertebrate density (per 150 m ²)	40.5	31.8	▲ +27%	40.4
Invertebrate species richness (per 150 m ²)	11.8	10.8	▲ +9%	10.8
Coral predators (per 150 m ²)	57.7	70.6	▼ -18%	46.2
Marine debris (items per 150 m ²)	1.49	0.91	▲ +64%	2.76

What moved this period:

- Marine debris substantially higher (+64%) — unfavourable
- Macroalgae cover substantially higher (+52%) — unfavourable
- Rubble substantially higher (+36%) — unfavourable

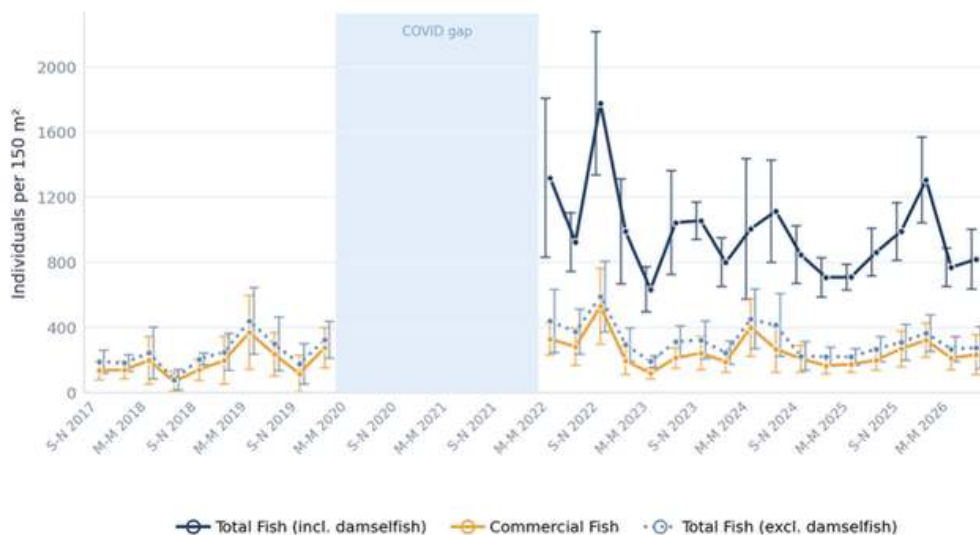
ANDULAY MPA

Food Security

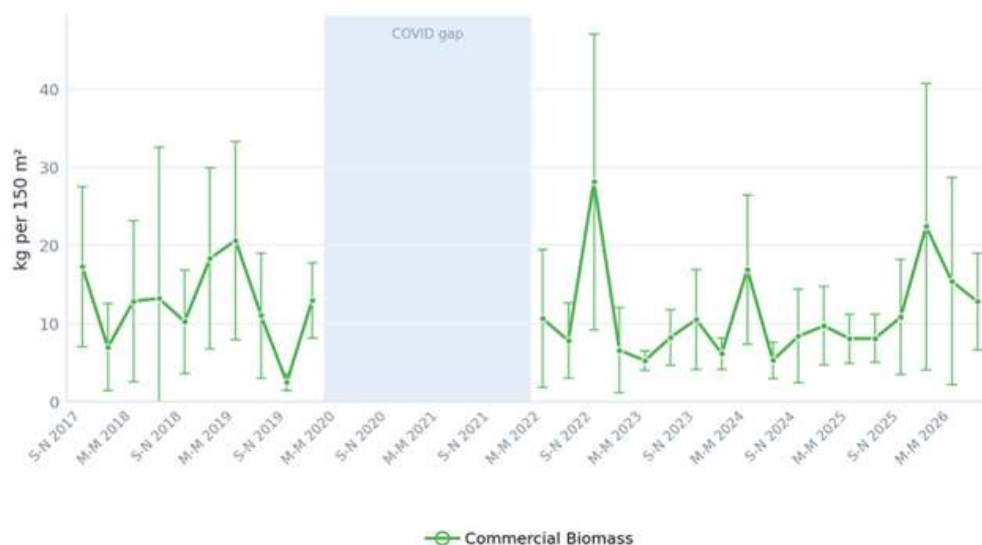


Current Status:

In March–August 2026, Andulay recorded an average total fish density of **794.2 individuals per 150 m²**, with commercial species contributing **223.3 individuals per 150 m²**. Commercial biomass averaged **14.12 kg per 150 m²**, equivalent to roughly **942 kg per hectare**, which sits in the moderately high range for the program. By dietary group the assemblage was led by herbivores (~539.2 ind.), planktivores (~110.7 ind.), carnivores (~106.6 ind.), detritivores (~18.6 ind.), corallivores (~11.0 ind.), omnivores (~4.2 ind.) and parasitivores (~3.9 ind.), so herbivores dominate the fish community at this scale.



Fish Density Trends. Total and commercial fish density at Andulay, 2017–2026. The solid total includes damselfish and begins at Mar–May 2022, the season they entered the protocol; the dotted line excludes them and runs the whole record, so it is the comparable series across the COVID gap and against the 2017–19 baseline. The gap between the two is the damselfish contribution.



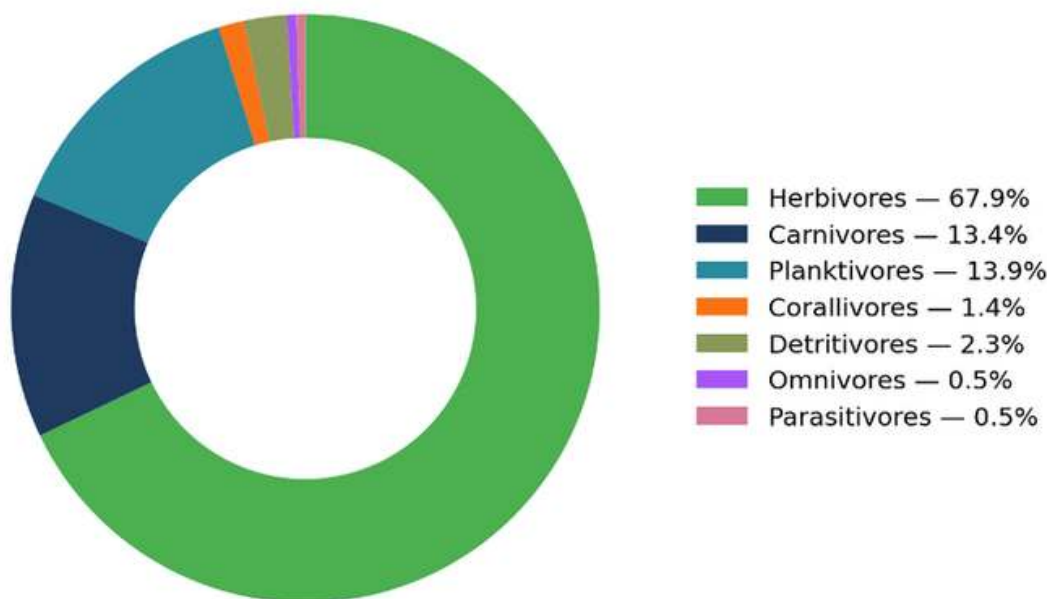
Commercial Biomass Trends. Commercial fish biomass at Andulay, 2017–2026.

Recent Change:

Against the preceding six months, total fish density is substantially lower (1,147.0 → 794.2 individuals per 150 m² including damselfish, 337.4 → 271.7 excluding them), commercial density notably lower (295.8 → 223.3) and commercial biomass notably lower (16.62 → 14.12 kg per 150 m²). Within the assemblage, herbivores moved 830.4 → 539.2, carnivores moved 126.5 → 106.6 and planktivores moved 156.9 → 110.7 individuals per 150 m².

Dietary Structure:

By share of individuals the community is herbivores (67.9%), planktivores (13.9%) and carnivores (13.4%), with the remaining groups together making up 4.8%. Trophic structure matters because grazing species control algal growth and so mediate the competition between coral and algae described in the next section.



Dietary Composition. Share of fish recorded in each dietary group, Andulay, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Commercial Groups:

The ten commercial fish families contributing most to biomass at Andulay this period are listed on the following page. Sub-types are rolled into their family. Fusilier is the largest single contributor at 6.47 kg per 150 m², 45.5% of commercial biomass. Larger predatory taxa (Emperor, Barracuda, Grouper) are present but at lower densities, so commercial biomass is carried largely by mid-sized and schooling species rather than by large predators. That is the pattern expected on reefs under fishing pressure, where the largest predatory fish are removed first.

Long-term Context:

The 2017–19 baseline for Andulay is 13.83 kg per 150 m² of commercial biomass and 236.7 fish per 150 m². Current biomass stands +2% against that baseline and density +15%. The highest commercial biomass on record here was 28.14 kg per 150 m² in Sep–Nov 2022. Current levels are 50% below it. Two protocol changes limit what the long record can be asked.

Top commercial fish families. The ten commercial fish families contributing most to biomass at Andulay, current reporting period, with the share of commercial biomass each carries. Sub-types are rolled into their family.

Commercial Families	Biomass (kg/ 150 m ²)	Density (ind./150 m ²)	% of Commercial Biomass
Fusilier	6.47	71.3	45.5
Bristletooth	1.09	18.7	7.7
Emperor	0.84	2.3	5.9
Unicornfish	0.78	5.8	5.5
Barracuda	0.58	2.8	4.1
Wrasse - Other	0.54	79.7	3.8
Grouper	0.51	5.3	3.6
Surgeonfish	0.49	2	3.5
Triggerfish	0.47	3.8	3.3
Soldierfish	0.45	2.8	3.1

Damselfish entered the list in 2022, so only the damselfish-excluded series is comparable across the full period; and fish size bins changed in 2025 with both schemes running side by side through 2025–26, which biases early biomass slightly low.

Ecological Interpretation

Andulay ranks first of the 4 sites surveyed in the municipality on commercial biomass this period. Herbivores are only 8.3% of the fish counted once damselfish are set aside, a thin grazing guild for a reef of this type. Damselfish do not make up the difference: they defend small algal territories rather than grazing the reef broadly, so they add to the herbivore count without adding much grazing pressure. Planktivores make up 38.6% of the assemblage. Planktivore abundance tracks current and plankton supply rather than reef condition, so it inflates total density without indicating recovery.

The average commercial fish counted weighs about 63 g. Against the 2017–19 baseline of 74 g that is -15%. Fish are smaller on average than they were, which is the clearest single sign of fishing pressure: extraction removes large individuals first, and the stock responds by shifting to fast-growing small ones. It matters disproportionately because weight rises with roughly the cube of length, so a modest fall in mean size is a large fall in yield. Carnivores are 39.2% of the assemblage once damselfish are set aside, which is a high share. On a lightly fished reef the pyramid narrows towards the top; a wide carnivore band usually means small mid-water carnivores rather than large predators, so it should be read with the commercial table above rather than as evidence of an intact predator community.

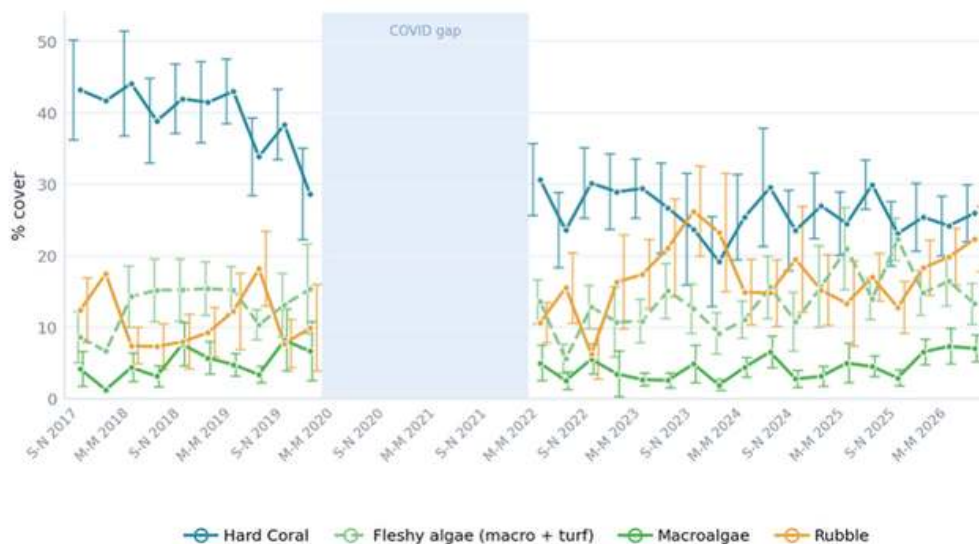
ANDULAY MPA

Reef Health And Resilience

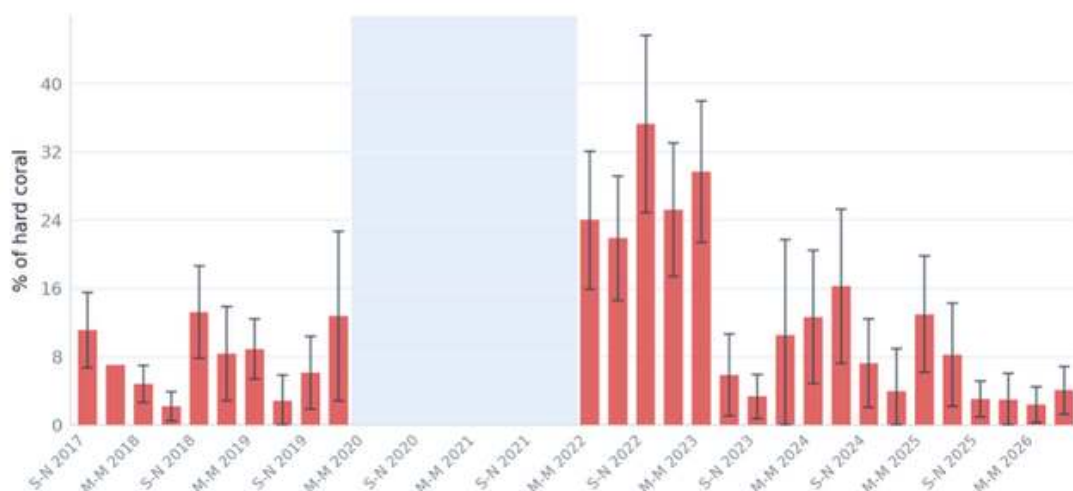


Current status:

During March–August 2026, Andulay recorded an average hard coral cover of 25.1%, macroalgae of 7.2% (14.9% once turf is included) and rubble of 21.1%. Coral cover places the reef in the fair band of the Philippine classification. Bleaching affected 3.22% of hard coral, below the 5% level conventionally treated as a concern threshold, suggesting low thermal stress over the survey period. Beyond bleaching, 0.86% showed predation scarring; 0.25% was diseased; 0.48% was recently killed, as a share of all points. Overall the reef can be described as coral-dominated, with limited algal presence and substantial unconsolidated substrate.



Reef Substrate Trends. Hard coral, macroalgae and rubble cover at Andulay, 2017–2026. Solid line is macroalgae alone; dashed adds turf, the pre-2026 published definition.



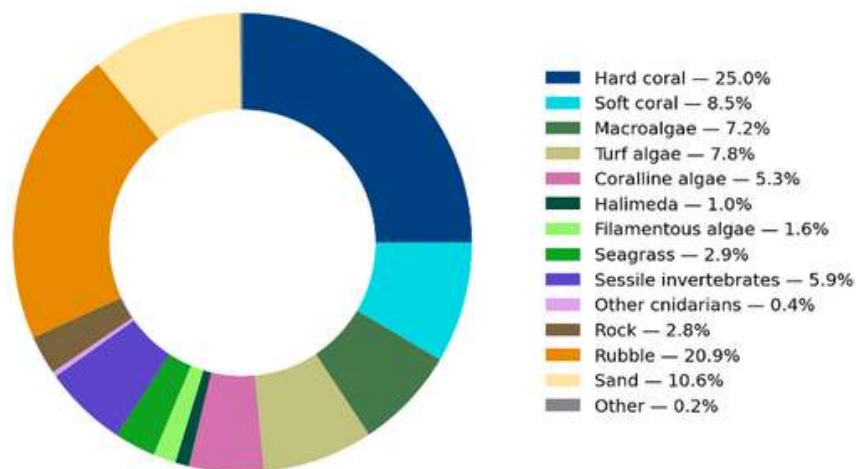
Bleaching Incidence. Bleached coral as a percentage of hard coral cover at Andulay, by season. Combines partially and fully bleached records.

Recent Change:

Compared with the preceding six months, hard coral cover is little changed (24.2 → 25.1%), macroalgae substantially higher (4.7 → 7.2%), rubble substantially higher (15.5 → 21.1%) and bleaching slightly higher (3.01 → 3.22%). Taken together this indicates increased algal presence and more unconsolidated substrate. Super Typhoon Inday and Super Typhoon Kiyapo crossed the area inside this reporting period, so physical damage is the first explanation for this, storm breakage converts standing coral into rubble directly.

Structural Implications:

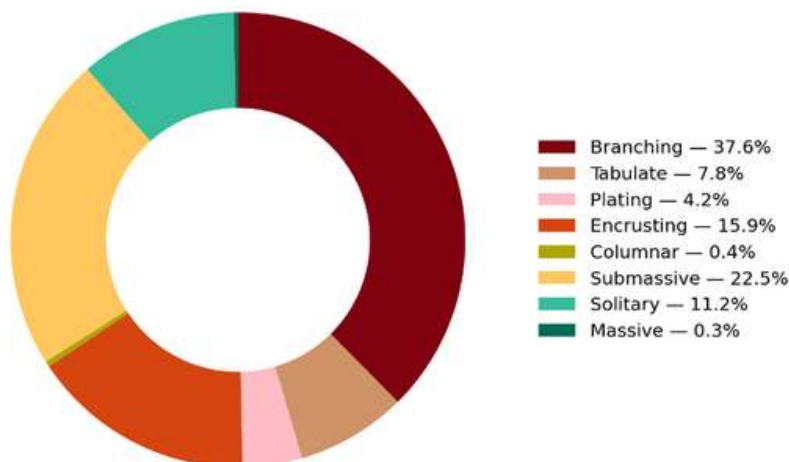
Of all points recorded, 25.1% is living hard coral, 17.6% is fleshy algae competing for the same space, 31.6% is unconsolidated material (rubble and sand), 8.0% is consolidated surface available for settlement (bare rock and coralline algae) and 17.7% is occupied by other stable but non-reef-building life, soft corals, sessile invertebrates and seagrass. The combination of fair coral cover and rubble at 21.1% indicates that substrate instability is likely to be limiting recruitment in places: rubble moves in swell, and larvae that settle on it are abraded or buried before they can consolidate, so rubble fields tend to persist rather than recover on their own. Sand adds a further 10.6%, bringing the unconsolidated fraction to 31.6% in total. Macroalgae has risen against the preceding six months (+52%), so competition for settlement space is intensifying rather than easing. Fleshy algae pre-empt the surfaces coral larvae need and deter grazers once established, which is how a reef gets held on the algal side rather than crossing back.



Substrate Composition. Full substrate composition, Andulay, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged). Each category is a share of all points recorded on the transect.

Within the living coral, growth form determines how much shelter the reef offers and how well it resists disturbance; this protocol records no rugosity, so growth form is the closest available proxy for structural complexity. The cover present is led by branching (37.6%), submassive (22.5%) and encrusting (15.9%). On MCP's classification, resistance to disturbance, not shelter, 65.6% of the coral sits in low-resilience forms and 11.5% in high-resilience forms. Most of the cover is therefore in forms that provide good shelter but are first to be lost in a thermal or storm event, so the headline cover figure is more fragile than it appears.

Taken together, fair coral cover at 25.1%, macroalgae at 7.2% and rubble at 21.1%, this is a reef in a **transitional** state, shaped by both physical disturbance (the unconsolidated fraction) and biological competition (the algal fraction). Both are currently at levels that would slow any recovery from here.



Coral Growth Forms. Share of hard coral in each growth form at Andulay, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged). Forms are ordered from least to most resilient: low resilience covers branching, tabulate, plating, encrusting and *Tubastraea*; medium covers columnar and submassive; high covers solitary and massive.

Long-term Context:

Against the 2017–19 baseline of 41.0% hard coral, 4.3% macroalgae and 11.5% rubble, coral cover is -39%, macroalgae +67% and rubble +83%. Coral cover peaked at 44.1% in Mar–May 2018 and now stands 25.1%. Bleaching peaked at 35.3% of hard coral in Sep–Nov 2022, and has remained below the 5% concern level for the last 4 seasons, since Sep–Nov 2025. Two definitions changed for this edition and are not comparable with earlier reports: macroalgae is now macroalgae alone rather than macroalgae plus turf, and bleaching is a share of hard coral rather than of all substrate points, which makes it read three to four times higher on identical observations.

Ecological Interpretation:

Andulay ranks third of the 4 sites surveyed in the municipality on hard coral cover and first on macroalgae, counting the least algal site first. Bleaching has stayed below the concern threshold for 4 consecutive seasons, which has allowed partial stabilisation; the reef is in a phase of cautious stabilisation rather than active recovery. Of the coral present, 49.7% is in fast-growing forms (branching, tabulate, plating) and 38.7% in slow, robust ones (massive, submassive, encrusting). That ratio sets how quickly cover can rebuild and how much survives a disturbance, and the two pull against each other: the fast forms drive recovery but are the first lost, the slow ones persist but add cover at a fraction of the rate. A cover figure held up mostly by fast forms can fall sharply and recover sharply, so the headline number is more volatile than it looks.

For every point of substrate a coral larva could settle on, there are 2.2 points already held by fleshy algae. There is workable settlement space relative to algal cover, so recruitment is not obviously space-limited, which makes larval supply and post-settlement survival the things to look at if cover is not rebuilding.

Of the pressures acting here, the ones open to local action are enforcement, the herbivore populations that hold algae down, and the physical impacts that break coral and make rubble, anchoring, destructive fishing and trampling. Thermal stress is not one of them, which is why the bleaching figure is reported as context rather than as something to manage.

ANDULAY MPA

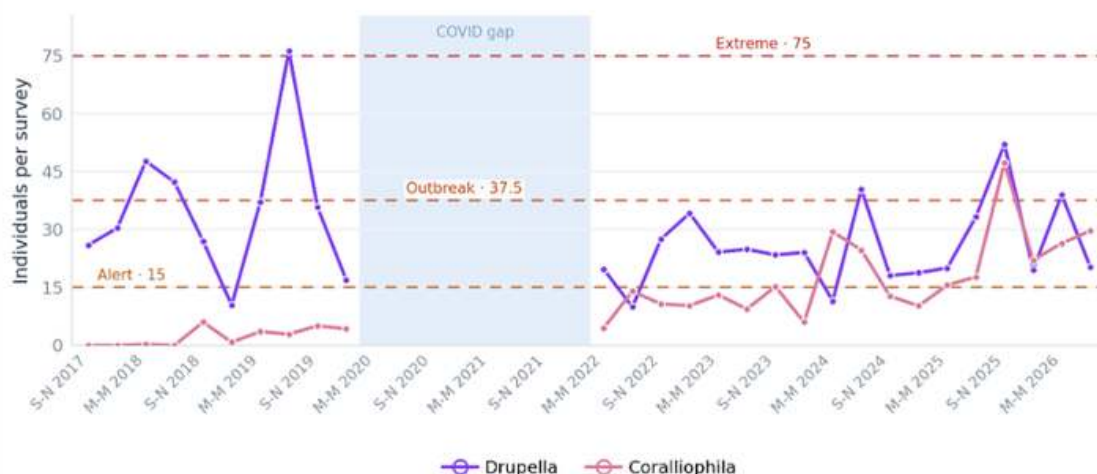
Predation and Marine Debris



Current Status:

Drupella averaged **29.6 per survey** (above the alert threshold) and *Coralliophila* 28.0 (above the alert threshold), giving a combined corallivorous snail load of 57.7 per survey. Crown of Thorns averaged 0.034 per survey (below the alert threshold).

Marine debris averaged **1.49 items per survey**. By category it breaks down as fishing gear 1.01 (67%), consumer plastics 0.32 (21%), household & sanitary 0.13 (8%) and other debris 0.04 (3%). The categories are mutually exclusive and sum to the total, so nothing is double-counted between them. Fishing gear is the largest category at 67% of items. That is a sea-based source: gear lost or discarded by boats working the reef, which responds to gear marking, retrieval dives and work with fishers rather than to municipal waste collection.



Coral Predators. Corallivorous snail abundance at Andulay, 2017-2026. Dashed rules mark MCP management thresholds (alert 15, outbreak 37.5, extreme 75 per survey).



Crown of Thorns. Crown of Thorns abundance at Andulay, 2017-2026. Dashed rules mark MCP management thresholds for Crown of Thorns (alert 0.1125, outbreak 0.225, extreme 0.45 per survey).

Recent Change:

Against the preceding six months, *Drupella* is notably lower (35.8 → 29.6), *Coralliophila* notably lower (34.7 → 28.0), Crown of Thorns substantially lower (0.076 → 0.034) and debris substantially higher (0.91 → 1.49 items per survey).



Marine Debris. Marine debris at Andulay, current reporting period. The centre figure is total items per survey and the ring is what that total is made of; the categories are mutually exclusive, so the slices sum to the centre figure. The sparkline is the site's own total debris per survey across the full record, 2017–2026, with the COVID gap left empty.

Long-term Context:

The 2017–19 baseline is 37.1 *Drupella*, 1.7 *Coralliophila* and 2.097 Crown of Thorns per survey, with 0.69 debris items. Current levels stand -20%, +1559%, -98% and +116% against those. *Drupella* peaked at 76.2 per survey in Jun–Aug 2019. These figures pool all depths. *Drupella* is roughly eleven times more abundant shallow than deep, so we have a depth-resolved workbook, where we can detect outbreaks in the shallows.

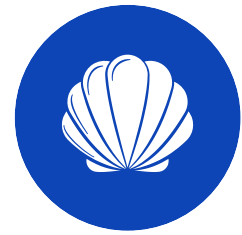
Ecological Interpretation:

Combined snail abundance is at outbreak level. *Drupella* and *Coralliophila* aggregate on already-stressed colonies, so high counts often follow coral damage rather than initiate it, but once aggregated they suppress the recovery of the colonies that survived. More than half the debris recorded (67.5%) is fishing gear. That is a different management problem from land-based waste: it points at gear loss by fishers working the reef and responds to gear marking, retrieval and fisher engagement rather than to municipal waste collection. Debris rose sharply against the previous period. Debris is episodic and one season is not a trend, but a repeat next season would warrant action.

On management: corallivorous snails can be removed by hand and that is the standard response above outbreak level, but removal only works if it is repeated, the snails recruit from surrounding reef and a single clearance is recolonised. Directing effort at the aggregations on living coral, rather than spreading it across the site, is what makes the effort worthwhile. The debris is a fisheries problem before it is a waste problem. Lost gear keeps fishing after it is lost, so it is both a debris indicator and a mortality source, and it accumulates on exactly the structure that snags it, the high-relief coral that matters most. Gear marking and retrieval dives address it; municipal collection does not.

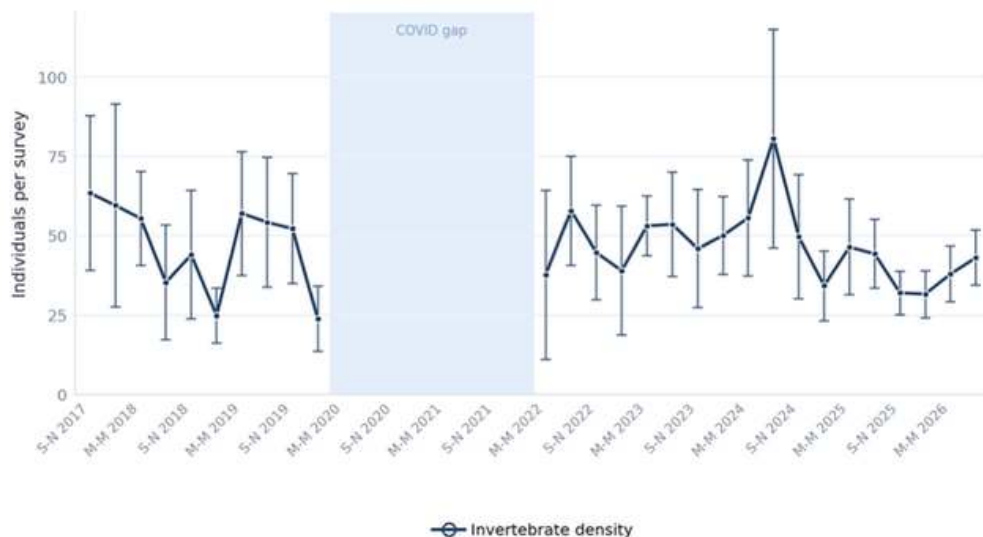
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Invertebrate Status

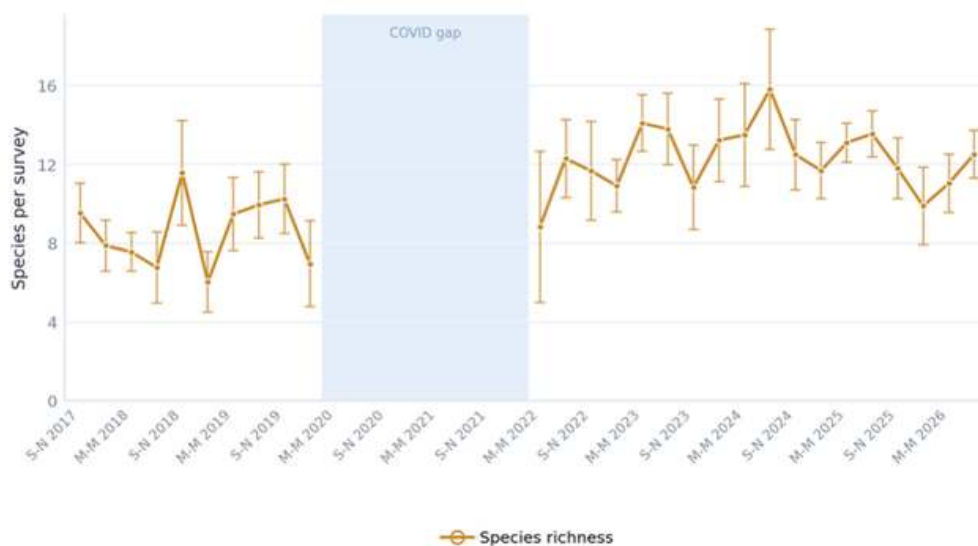


Current Status:

Andulay supported an average invertebrate density of **40.5 individuals per survey**, drawn from **11.8 distinct species per survey**.



Invertebrate Density. Total invertebrate density at Andulay, 2017-2026.



Invertebrate Species Richness. Invertebrate species richness at Andulay, 2017-2026.

Recent Change:

Against the preceding six months, density is notably higher (31.8 → 40.5 per survey), richness slightly higher (10.8 → 11.8 species) and commercially important species substantially higher (21.1 → 27.6).

Most abundant invertebrate taxa. The ten most abundant invertebrates (left), and the ten most abundant commercially important invertebrates (right) by density at Andulay.

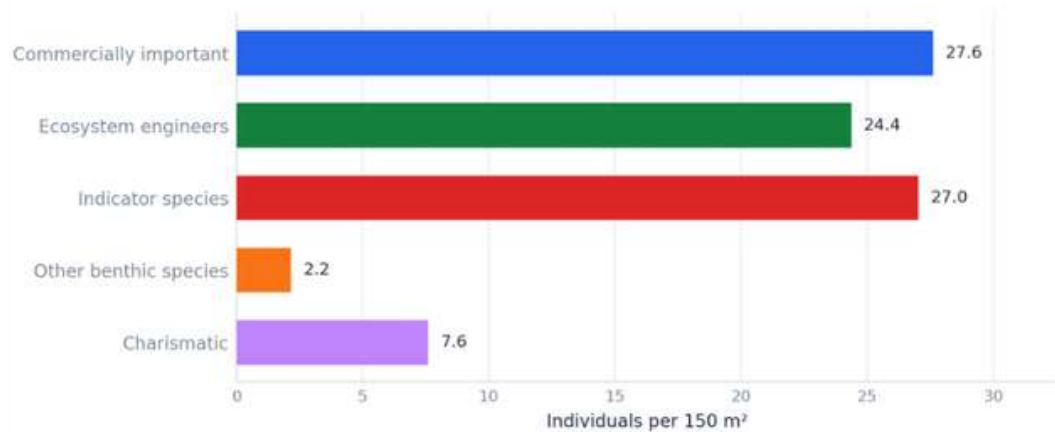
Top 10 Invertebrates	Individuals per 150 m ²	Top 10 Commercial	Individuals per 150 m ²
Urchin - Diadema	14.61	Urchin - Diadema	14.61
Nudibranch	4.41	Urchin - Rock Boring	3.03
Sea Star	4.28	Cone Shell	1.53
Urchin - Rock Boring	3.03	Conch - Scorpion Spider	1.26
Cone Shell	1.53	Top - Nilo	1.2
Conch - Scorpion Spider	1.26	Other Shell	0.98
Top - Nilo	1.2	Sea Cucumber - Black Spotted	0.77
Cleaner Shrimp - Banded Coral	1.16	Other Bivalve	0.66
Other Shell	0.98	Conch - Other	0.64
Lionfish	0.92	Giant Clam	0.58

Commercial Groups:

Commercially important invertebrates averaged 27.6 per survey, 68.1% of all invertebrates counted. Within the key harvested groups, urchins averaged 17.7 per survey, sea cucumbers 1.49 and giant clams 0.58. The community is dominated by sea urchins. Their grazing helps keep settlement space open for coral recruitment, so high urchin abundance is a mixed signal rather than a bad one, beneficial for recruitment, but at sustained high density urchins also erode reef framework.

Functional Groups:

Per survey: commercially important species 27.6, ecosystem engineers 24.4, sensitive indicator species 27.0, charismatic species 7.6, benthic associates and predators 2.2. These groups overlap by design, a species can be both commercially important and charismatic, so they do not sum to total invertebrate density. A relatively high abundance of sensitive indicator species suggests conditions still suitable for disturbance-intolerant taxa; a high abundance of ecosystem engineers, mostly urchins, indicates that herbivory and bioerosion are active processes here.



Invertebrate Functional Groups. Invertebrate functional group density, Andulay, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged). A species can belong to more than one group – so these groups overlap and do not sum to total invertebrate density, which was 40.5 per 150 m² here. Each bar is read against the axis, not as a share of the others.

Long-term Context:

The 2017–19 baseline is 49.2 individuals and 8.6 species per survey. Density stands -18% against that and richness +37%. Richness figures in editions before 2026 divided a pooled species list by the number of surveys, which fell as survey effort rose. They are not comparable with these.

Ecological Interpretation:

Andulay ranks second of the 4 sites surveyed in the municipality on invertebrate density and second on species richness. Giant clams sit well below baseline. As a sessile, conspicuous and valuable species they are among the first taken and among the slowest to return. 68% of the invertebrates counted are on the commercially important list. A community that is mostly harvestable taxa is not automatically healthy, it usually means the abundant species happen to be targeted ones, here urchins, rather than that the harvested stocks are in good condition. The giant clam and sea cucumber figures are the better test of that, because they are the taxa fishers take first.

Each species contributes 3.4 individuals per survey on average. A rising figure with flat richness means the same few taxa are becoming more abundant rather than the community broadening, which is the pattern that precedes an urchin-dominated reef. Herbivorous fish still outnumber urchins (22.6 against 17.7 per survey), so grazing pressure remains mostly in the fish community. That is the more stable arrangement of the two, and it is worth protecting: herbivorous fish crop algae without eroding the framework the way urchins do.

ANDULAY MPA

Tourism Value



Touristic Species	Mean Encounter Rate (%)		
Barracudas	23	Scorpaenidae	55
Cephalopods	11	Sharks	0
Cowries	29.3	Shrimps	53.9
Eels and Snakes	38	Slugs	84.3
Frogfish	1.6	Stingrays	0
Giant Clams	42.8	Syngnathidae and Pegasidae	16.6
Porcupinefish and Pufferfish	87.6	Turtles	18.3

Touristic species encounter rates. The percentage of dives at Andulay in which each touristic group was recorded, current reporting period.

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 through buoys marking the MPA's boundaries. The MPA itself is relatively compact, making it convenient to explore and potentially well suited to guided dive tourism.

Andulay offers substantial tourism value, with very high encounter rates for porcupinefish and pufferfish (87.6%) and slugs (84.3%), the latter the highest rate for this group in the municipality. These are complemented by strong sightings of Scorpaenidae (55.0%), shrimps (53.9%), giant clams (42.8%) and eels and snakes (38.0%), providing a diverse range of opportunities for divers interested in reef fish, macrofauna and cryptic species. Cowries (29.3%) and cephalopods (11.0%) further contribute to Andulay's invertebrate and macro-diving appeal.

Andulay also records the highest barracuda encounter rate in Siaton, at 23.0% of dives, nearly double the municipal average of 13.0% and ten times the rate at Salag. This is the one pelagic component the site offers, and it is a genuine point of difference. Syngnathids and pegasids (16.6%) add important niche tourism value, particularly for experienced macro divers and underwater photographers seeking specialised taxa.

Megafauna sightings remain more limited. Turtles were recorded in 18.3% of dives, while frogfish were relatively uncommon (1.6%), and no sharks or stingrays were recorded during the monitoring period. Overall, Andulay remains a strong site for macro-diving, reef biodiversity and cryptic species encounters, with the barracuda aggregation adding a component the other Siaton sites cannot match. The site's compact layout, community involvement and existing MPA infrastructure further support its potential as a well-managed dive tourism destination.

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

Indicators at a Glance



Antulang is a **non-MPA reference site** in Siaton. Hard coral cover is 22.7% (poor on the national classification) and commercial fish biomass 9.59 kg per 150 m². This period rests on **43 surveys**, with 27 seasons on record since 2017.

Hard Coral Cover	Commercial Biomass	Fish Density	Bleaching
22.7% of substrate	9.6 kg / 150 m ²	951.7 / 150 m ²	1.8% of hard coral
▼ 7.3%	▲ 77%	▲ 13.8%	▼ 60.2%

Antulang indicators at a glance. Every headline indicator for Antulang, current reporting period, against this site's own preceding six months and the Siaton average for the same period. Colour is keyed to whether the movement is favourable rather than to whether the number rose. Green indicates improvement, red indicates decline — e.g. macroalgae, rubble, bleaching or debris rising reads red, coral cover rising reads green. A change smaller than 5% is shown as flat.

Indicator	Current	Prior 6 months	Change	Siaton Average
Hard coral cover (%)	22.7	24.5	▼ -7%	27.6
Macroalgae cover (%)	19.4	15.1	▲ +29%	16.4
Rubble (%)	7.3	9.8	▼ -25%	10.3
Bleaching (of hard coral) (%)	1.84	4.62	▼ -60%	2.27
Total fish density (per 150 m ²)	952	837	▲ +14%	715
Commercial fish biomass (kg per 150 m ²)	9.59	5.42	▲ +77%	10.7
Invertebrate density (per 150 m ²)	48.4	34.6	▲ +40%	40.4
Invertebrate species richness (per 150 m ²)	12.1	10.8	▲ +12%	10.8
Coral predators (per 150 m ²)	51.7	41.2	▲ +25%	46.2
Marine debris (items per 150 m ²)	1.39	2.15	▼ -35%	2.76

What moved this period:

- Commercial fish biomass substantially higher (+77%) — favourable
- Bleaching (of hard coral) substantially lower (-60%) — favourable
- Invertebrate density substantially higher (+40%) — favourable

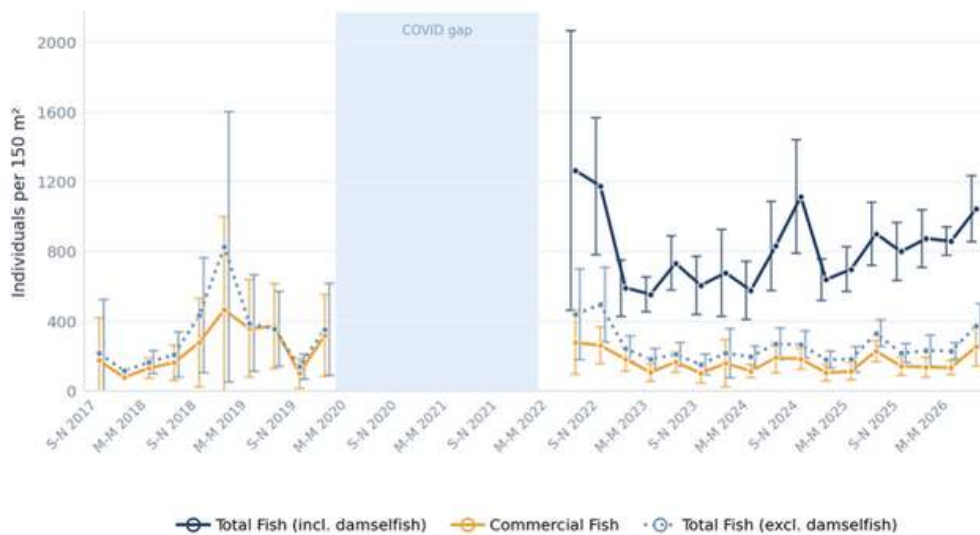
ANTULANG

Food Security



Current Status:

In March–August 2026, Antulang recorded an average total fish density of **951.7 individuals per 150 m²**, with commercial species contributing **194.2 individuals per 150 m²**. Commercial biomass averaged **9.59 kg per 150 m²**, equivalent to roughly **639 kg per hectare**, which sits in the moderate range for the program. By dietary group the assemblage was led by herbivores (~674.7 ind.), planktivores (~164.2 ind.), carnivores (~80.9 ind.), corallivores (~12.4 ind.), detritivores (~11.2 ind.), parasitivores (~4.2 ind.) and omnivores (~4.1 ind.), so herbivores dominate the fish community at this scale.



Fish Density Trends. Total and commercial fish density at Antulang, 2017–2026.



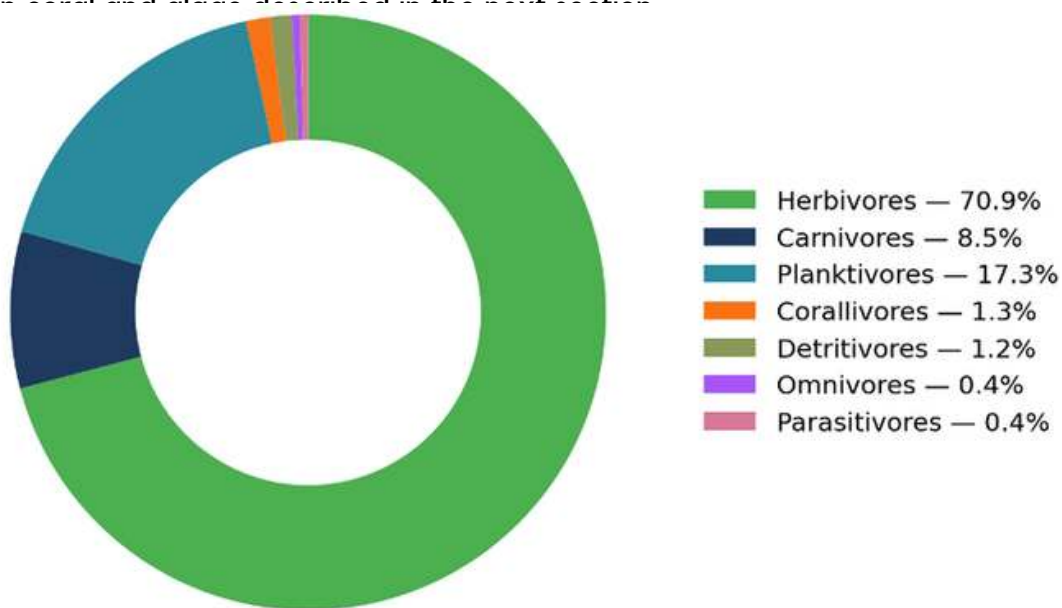
Commercial Biomass Trends. Commercial fish biomass at Antulang, 2017–2026.

Recent Change:

Against the preceding six months, total fish density is slightly higher (836.5 → 951.7 individuals per 150 m² including damselfish, 224.1 → 301.1 excluding them), commercial density substantially higher (139.6 → 194.2) and commercial biomass substantially higher (5.42 → 9.59 kg per 150 m²). Within the assemblage, herbivores moved 631.9 → 674.7, carnivores moved 73.9 → 80.9 and planktivores moved 102.5 → 164.2 individuals per 150 m².

Dietary Structure:

By share of individuals the community is herbivores (70.9%), planktivores (17.3%) and carnivores (8.5%), with the remaining groups together making up 3.4%. Trophic structure matters because grazing species control algal growth and so mediate the competition between coral and algae described in the next section.



Dietary Composition. Share of fish recorded in each dietary group, Antulang, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Commercial Groups:

The ten commercial fish families contributing most to biomass at Antulang this period are listed on the following page. Sub-types are rolled into their family. **Fusilier** is the largest single contributor at 4.23 kg per 150 m², 44.4% of commercial biomass. Larger predatory taxa (Barracuda, Grouper, Emperor) are present but at lower densities, so commercial biomass is carried largely by mid-sized and schooling species rather than by large predators. That is the pattern expected on reefs under fishing pressure, where the largest predatory fish are removed first.

Long-term Context:

The 2017–19 baseline for Antulang is 13.49 kg per 150 m² of commercial biomass and 338.9 fish per 150 m². Current biomass stands -29% against that baseline and density -11%. The highest commercial biomass on record here was 25.66 kg per 150 m² in Sep–Nov 2017. Current levels are 63% below it.

Top commercial fish families. The ten commercial fish families contributing most to biomass at Antulang, current reporting period, with the share of commercial biomass each carries. Sub-types are rolled into their family.

Commercial Families	Biomass (kg/ 150 m ²)	Density (ind./150 m ²)	% of Commercial Biomass
Fusilier	4.23	79.9	44.4
Unicornfish	1.54	8.5	16.2
Bristletooth	0.56	11.2	5.9
Wrasse - Other	0.54	62.1	5.7
Barracuda	0.52	3.8	5.5
Triggerfish	0.28	2.7	2.9
Grouper	0.26	3.3	2.7
Brushtail Tang	0.23	5.3	2.4
Emperor	0.22	0.2	2.3
Surgeonfish	0.18	1.5	1.9

Ecological interpretation:

Antulang ranks third of the 4 sites surveyed in the municipality on commercial biomass this period. Commercial biomass at Antulang sits well below its 2017–19 baseline, which is what would be expected where extraction has continued to outpace replacement. Herbivores are only 8.7% of the fish counted once damselfish are set aside, a thin grazing guild for a reef of this type. Damselfish do not make up the difference: they defend small algal territories rather than grazing the reef broadly, so they add to the herbivore count without adding much grazing pressure. With macroalgae at 19.4% of substrate, the combination is consistent with grazing pressure being insufficient to hold algal cover down, the mechanism that keeps a reef on the algal side of a phase shift once it arrives there.

Planktivores make up 53.8% of the assemblage. Planktivore abundance tracks current and plankton supply rather than reef condition, so it inflates total density without indicating recovery. The average commercial fish counted weighs about 49 g. Against the 2017–19 baseline of 53 g that is -8%. Mean size is holding up, which suggests individuals are surviving long enough to grow and that the size structure has not been truncated.

ANTULANG

Reef Health And Resilience

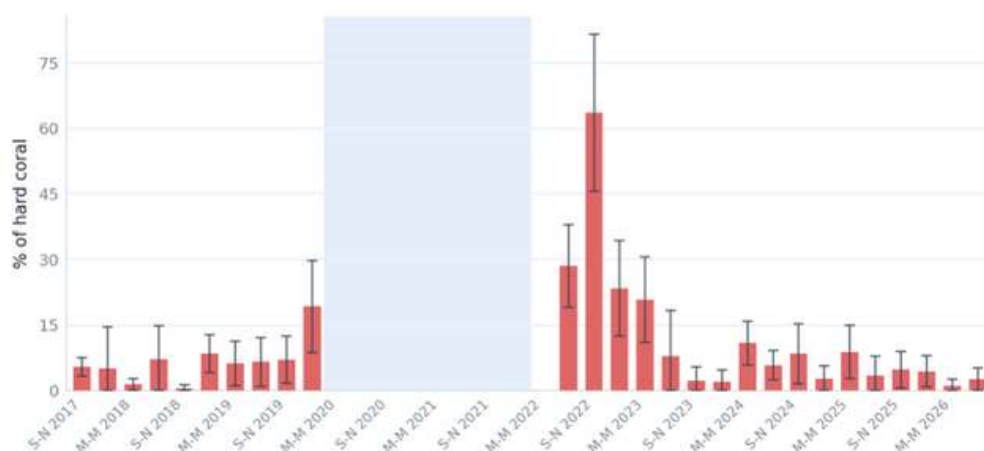


Current status:

During March–August 2026, Antulang recorded an average hard coral cover of **22.7%**, macroalgae of **19.4%** (25.1% once turf is included) and rubble of **7.3%**. Coral cover places the reef in the **poor** band of the Philippine classification. Bleaching affected 1.84% of hard coral, below the 5% level conventionally treated as a concern threshold, suggesting low thermal stress over the survey period. Beyond bleaching, 0.10% showed predation scarring; 0.08% was recently killed, as a share of all points. Overall the reef can be described as structurally mixed, with noticeable algal presence and moderate unconsolidated substrate.

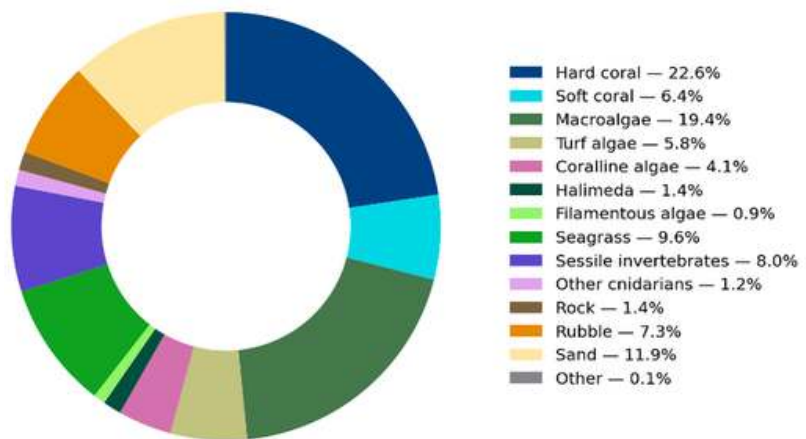


Reef Substrate Trends. Hard coral, macroalgae and rubble cover at Antulang, 2017-2026. Solid line is macroalgae alone; dashed adds turf, the pre-2026 published definition.



Bleaching Incidence. Bleached coral as a percentage of hard coral cover at Antulang, by season. Combines partially and fully bleached records.

Substrate Composition. Full substrate composition, Antulang, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).



Recent Change:

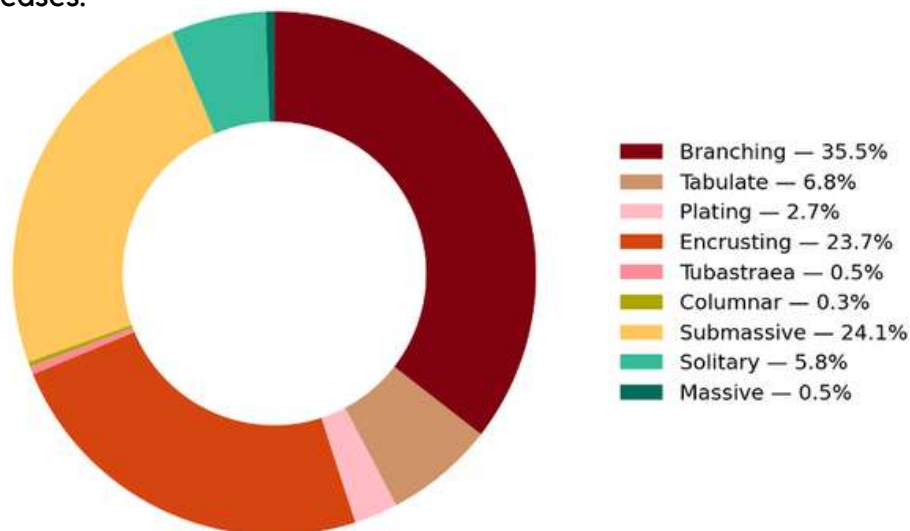
Compared with the preceding six months, hard coral cover is slightly lower (24.5 → 22.7%), macroalgae notably higher (15.1 → 19.4%), rubble notably lower (9.8 → 7.3%) and bleaching substantially lower (4.62 → 1.84%). Taken together this indicates a decline in coral dominance and increased algal presence. Super Typhoon Inday and Super Typhoon Kiyapo crossed the area inside this reporting period, so physical damage is the first explanation for this.

Structural Implications:

Of all points recorded, 22.7% is living hard coral, 27.4% is fleshy algae competing for the same space, 19.2% is unconsolidated material (rubble and sand), 5.4% is consolidated surface available for settlement (bare rock and coralline algae) and 25.2% is occupied by other stable but non-reef-building life, soft corals, sessile invertebrates and seagrass. The combination of poor coral cover and relatively low rubble (7.3%) indicates that most of the reef framework is stable and physically suitable for coral growth and recruitment. Sand accounts for a further 11.9% of points, which is habitat rather than damage. Macroalgae has risen against the preceding six months (+29%), so competition for settlement space is intensifying rather than easing. Fleshy algae pre-empt the surfaces coral larvae need and deter grazers once established, which is how a reef gets held on the algal side rather than crossing back.

Within the living coral, growth form determines how much shelter the reef offers and how well it resists disturbance; this protocol records no rugosity, so growth form is the closest available proxy for structural complexity. The cover present is led by branching (35.5%), submassive (24.1%) and encrusting (23.7%). On MCP's classification, resistance to disturbance, not shelter, 69.2% of the coral sits in low-resilience forms and 6.4% in high-resilience forms. Most of the cover is therefore in forms that provide good shelter but are first to be lost in a thermal or storm event, so the headline cover figure is more fragile than it appears.

Taken together, poor coral cover at 22.7%, macroalgae at 19.4% and rubble at 7.3%, this is a reef in a **transitional** state, shaped by both physical disturbance (the unconsolidated fraction) and biological competition (the algal fraction). Algal competition is the binding constraint here; the substrate itself is stable enough to support recruitment if that competition eases.



Coral Growth Forms. Share of hard coral in each growth form at Antulang, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged). Growth forms are ordered from least to most resilient: low resilience covers branching, tabulate, plating, encrusting and Tubastraea; medium covers columnar and submassive; high covers solitary and massive.

Long-term Context:

Against the 2017–19 baseline of 29.0% hard coral, 8.3% macroalgae and 7.2% rubble, coral cover is -22%, macroalgae +132% and rubble +2%. Coral cover peaked at 42.4% in Sep–Nov 2017 and now stands 22.7%. Bleaching peaked at 63.6% of hard coral in Sep–Nov 2022, and has remained below the 5% concern level for the last 5 seasons, since Jun–Aug 2025.

Ecological Interpretation:

Antulang ranks fourth of the 4 sites surveyed in the municipality on hard coral cover and third on macroalgae, counting the least algal site first. Macroalgae is rising while coral falls, consistent with algae occupying space the coral has vacated rather than the two varying independently. Bleaching has stayed below the concern threshold for 5 consecutive seasons, which has allowed partial stabilisation; the reef is in a phase of cautious stabilisation rather than active recovery.

With cover in the poor band this reef has little margin: a single disturbance removes a large share of what remains, and recovery from a low base is slow. Of the coral present, 45.0% is in fast-growing forms (branching, tabulate, plating) and 48.4% in slow, robust ones (massive, submassive, encrusting).

That ratio sets how quickly cover can rebuild and how much survives a disturbance, and the two pull against each other: the fast forms drive recovery but are the first lost, the slow ones persist but add cover at a fraction of the rate. A cover figure held up mostly by slow forms is stable but will rebuild slowly from any loss, so recovery here should be measured in decades rather than seasons. For every point of substrate a coral larva could settle on, there are 5.1 points already held by fleshy algae. Settlement space is the binding constraint on recovery here, not larval supply: even a good recruitment year has little bare ground to land on.

Of the pressures acting here, the ones open to local action are enforcement, the herbivore populations that hold algae down, and the physical impacts that break coral and make rubble, anchoring, destructive fishing and trampling. Thermal stress is not one of them, which is why the bleaching figure is reported as context rather than as something to manage.

ANTULANG

Predation and Marine Debris



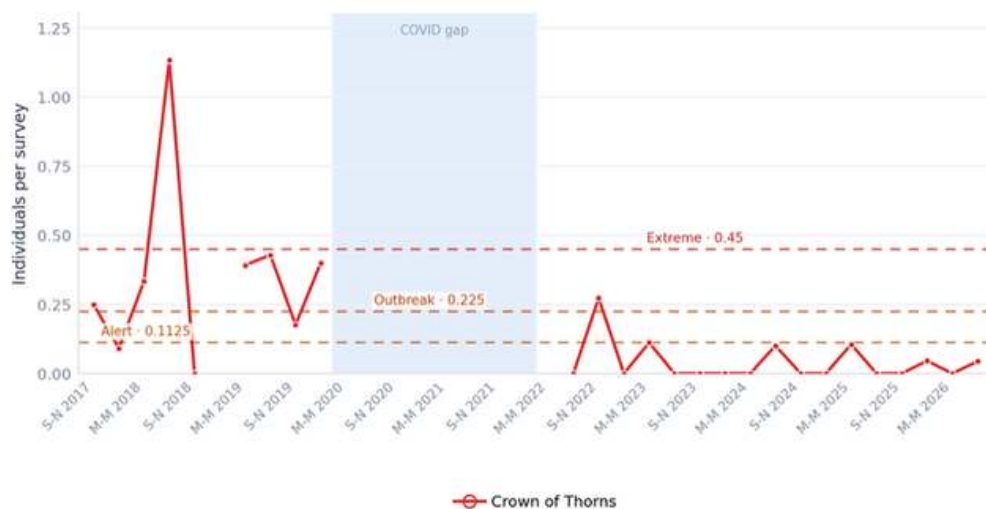
Current Status:

Drupella averaged **27.7 per survey** (above the alert threshold) and *Coralliophila* **23.9** (above the alert threshold), giving a combined corallivorous snail load of 51.6 per survey. Crown of Thorns averaged 0.022 per survey (below the alert threshold).

Marine debris averaged **1.39 items per survey**. By category it breaks down as fishing gear 0.97 (70%), consumer plastics 0.37 (27%) and household & sanitary 0.05 (3%). The categories are mutually exclusive and sum to the total, so nothing is double-counted between them. Fishing gear is the largest category at 70% of items. That is a sea-based source: gear lost or discarded by boats working the reef, which responds to gear marking, retrieval dives and work with fishers rather than to municipal waste collection.



Coral Predators. Corallivorous snail abundance at Antulang, 2017-2026. Dashed rules mark MCP management thresholds (alert 15, outbreak 37.5, extreme 75 per survey).



Crown of Thorns. Crown of Thorns abundance at Antulang, 2017-2026. Dashed rules mark MCP management thresholds for Crown of Thorns (alert 0.1125, outbreak 0.225, extreme 0.45 per survey).

Recent Change:

Against the preceding six months, *Drupella* is substantially higher (20.3 → 27.7), *Coralliophila* slightly higher (20.9 → 23.9), Crown of Thorns little changed (0.023 → 0.022) and debris substantially lower (2.15 → 1.39 items per survey).



Marine Debris. Marine debris at Antulang, current reporting period. The centre figure is total items per survey and the ring is what that total is made of; the categories are mutually exclusive, so the slices sum to the centre figure. The sparkline is the site's own total debris per survey across the full record, 2017–2026, with the COVID gap left empty.

Long-term Context:

The 2017–19 baseline is 17.0 *Drupella*, 0.7 *Coralliophila* and 0.375 Crown of Thorns per survey, with 1.50 debris items. Current levels stand +63%, +3574%, -94% and -7% against those. *Drupella* peaked at 31.2 per survey in Jun–Aug 2022. These figures pool all depths. *Drupella* is roughly eleven times more abundant shallow than deep, so we have a depth-resolved workbook, where we can detect outbreaks in the shallows.

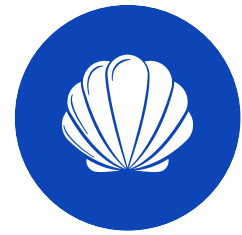
Ecological Interpretation:

Combined snail abundance is at outbreak level. *Drupella* and *Coralliophila* aggregate on already-stressed colonies, so high counts often follow coral damage rather than initiate it — but once aggregated they suppress the recovery of the colonies that survived. More than half the debris recorded (69.9%) is fishing gear. That is a different management problem from land-based waste: it points at gear loss by fishers working the reef and responds to gear marking, retrieval and fisher engagement rather than to municipal waste collection.

On management: corallivorous snails can be removed by hand and that is the standard response above outbreak level, but removal only works if it is repeated, the snails recruit from surrounding reef and a single clearance is recolonised. Directing effort at the aggregations on living coral, rather than spreading it across the site, is what makes the effort worthwhile. The debris is a fisheries problem before it is a waste problem. Lost gear keeps fishing after it is lost, so it is both a debris indicator and a mortality source, and it accumulates on exactly the structure that snags it, the high-relief coral that matters most. Gear marking and retrieval dives address it; municipal collection does not.

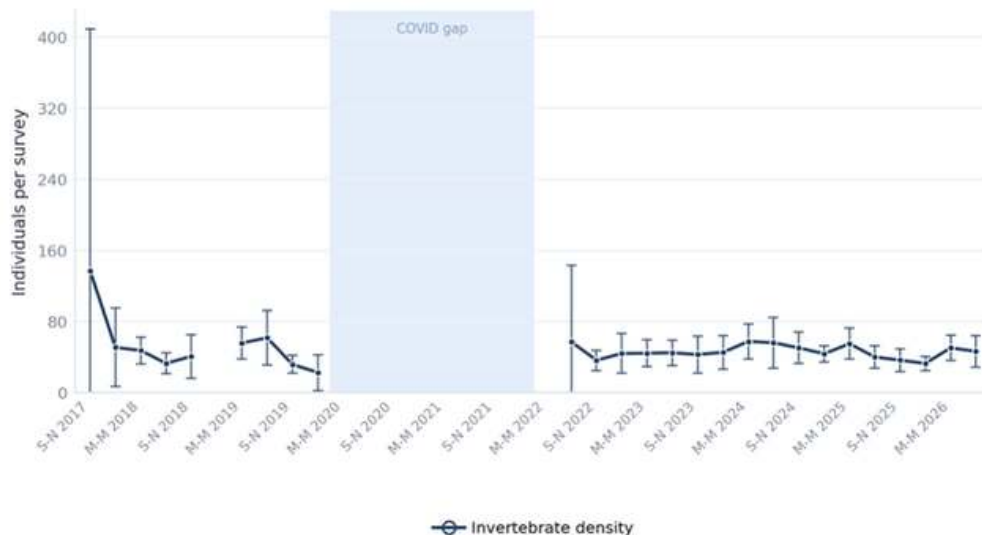
ANTULANG

Invertebrate Status

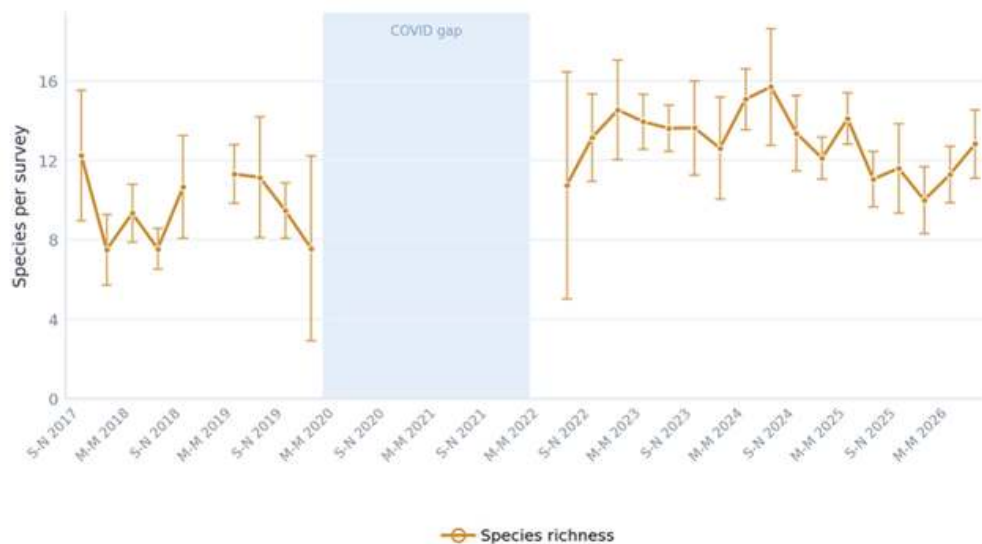


Current Status:

Antulang supported an average invertebrate density of **48.4 individuals per survey**, drawn from **12.1 distinct species per survey**.



Invertebrate Density. Total invertebrate density at Antulang, 2017-2026.



Invertebrate Species Richness. Invertebrate species richness at Antulang, 2017-2026.

Recent Change:

Against the preceding six months, density is substantially higher (34.6 → 48.4 per survey), richness slightly higher (10.8 → 12.1 species) and commercially important species substantially higher (21.4 → 35.2).

Most abundant invertebrate taxa. The ten most abundant invertebrates (left), and the ten most abundant commercially important invertebrates (right) by density at Antulang.

Top 10 Invertebrates	Individuals per 150 m ²	Top 10 Commercial	Individuals per 150 m ²
Urchin - Diadema	27.03	Urchin - Diadema	27.03
Sea Star	3.66	Cone Shell	0.99
Lionfish	2.35	Other Bivalve	0.9
Nudibranch	2.33	Cowrie - Tiger	0.84
Cleaner Shrimp - Banded Coral	1.46	Other Shell	0.77
Cone Shell	0.99	Sea Cucumber - Black Spotted	0.64
Other Bivalve	0.9	Conch - Scorpion Spider	0.62
Cowrie - Tiger	0.84	Sea Cucumber - Pinkfish	0.61
Other Shell	0.77	Giant Clam	0.45
Cushion Star	0.65	Cowrie - Common Egg	0.44

Commercial Groups:

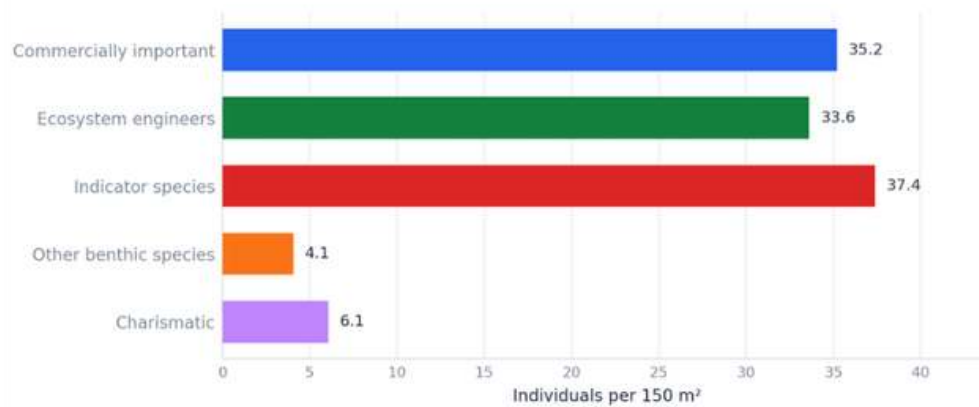
Commercially important invertebrates averaged 35.2 per survey, 72.8% of all invertebrates counted. Within the key harvested groups, urchins averaged 27.7 per survey, sea cucumbers 1.35 and giant clams 0.47. Those ten total 33.28 individuals per survey, 69% of all invertebrates counted, led by Urchin - Diadema at 27.03 per survey. The community is dominated by sea urchins. Their grazing helps keep settlement space open for coral recruitment, so high urchin abundance is a mixed signal rather than a bad one, beneficial for recruitment, but at sustained high density urchins also erode reef framework.

Functional Groups:

Per survey: commercially important species 35.2, ecosystem engineers 33.6, sensitive indicator species 37.4, charismatic species 6.1, benthic associates and predators 4.1. These groups overlap by design, a species can be both commercially important and charismatic, so they do not sum to total invertebrate density. A relatively high abundance of sensitive indicator species suggests conditions still suitable for disturbance-intolerant taxa; a high abundance of ecosystem engineers, mostly urchins, indicates that herbivory and bioerosion are active processes here.

Long-term Context:

The 2017–19 baseline is 60.9 individuals and 10.0 species per survey. Density stands -21% against that and richness +21%. Richness figures in editions before 2026 divided a pooled species list by the number of surveys, which fell as survey effort rose. They are not comparable with these.



Invertebrate Functional Groups. Invertebrate functional group density, Antulang, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Ecological Interpretation:

Antulang ranks first of the 4 sites surveyed in the municipality on invertebrate density and first on species richness. Urchin abundance is high. Urchins are effective algal grazers and keep settlement space open, but at sustained high density they also erode reef framework, so the benefit is not unbounded. Giant clams sit well below baseline. As a sessile, conspicuous and valuable species they are among the first taken and among the slowest to return.

73% of the invertebrates counted are on the commercially important list. A community that is mostly harvestable taxa is not automatically healthy, it usually means the abundant species happen to be targeted ones, here urchins, rather than that the harvested stocks are in good condition. The giant clam and sea cucumber figures are the better test of that, because they are the taxa fishers take first. Each species contributes 4.0 individuals per survey on average. A rising figure with flat richness means the same few taxa are becoming more abundant rather than the community broadening, which is the pattern that precedes an urchin-dominated reef. Invertebrate grazers now outnumber herbivorous fish here (27.7 urchins against 26.1 herbivorous fish per survey, damselfish set aside). Urchins and herbivorous fish are partial substitutes, but not equivalent: urchins graze slowly and erode limestone as they feed, so a reef whose grazing has shifted to invertebrates loses algae and framework at the same time. It is also a less stable arrangement, because urchin populations boom and crash on disease in a way fish populations do not.

ANTULANG

Tourism Value



Touristic Species	Mean Encounter Rate (%)		
Barracudas	18.4	Scorpaenidae	74
Cephalopods	6.1	Sharks	0
Cowries	38.7	Shrimps	62.8
Eels and Snakes	48.1	Slugs	70.3
Frogfish	8.7	Stingrays	2.3
Giant Clams	31.9	Syngnathidae and Pegasidae	27.4
Porcupinefish and Pufferfish	90.8	Turtles	12.8

Touristic species encounter rates. The percentage of dives at Antulang in which each touristic group was recorded, current reporting period.

Antulang sits close to Andulay and displays similar broad characteristics, with a relatively narrow band of shallow reef before the reef slope. Due to its location the reef is moderately exposed and occasionally experiences longshore currents and strong wave action.

Antulang provides high tourism value, with diverse encounter rates across multiple indicator and charismatic species. Porcupinefish and pufferfish (90.8%), Scorpaenidae (74.0%), shrimps (62.8%), slugs (70.3%) and eels and snakes (48.1%) are all recorded frequently, providing a strong foundation for the site's macro-diving and reef wildlife appeal. Cowries (38.7%) and giant clams (31.9%) further contribute to the diversity of benthic and invertebrate encounters. The high frequency of syngnathids and pegasids (27.4%) is particularly notable, providing additional niche value for experienced macro divers and underwater photographers. A Napoleon wrasse sighting was also reported during this monitoring period.

Antulang leads the municipality on six of the fourteen groups, Scorpaenidae, eels and snakes, shrimps, cowries and frogfish, which makes it the strongest all-round site in Siaton for cryptic and camouflaged subjects. Frogfish were recorded in 8.7% of dives, the highest rate among the monitored sites, while stingrays were encountered occasionally (2.3%). Barracudas (18.4%) provide some pelagic interest. Turtles were recorded in 12.8% of dives, and no sharks were observed during the monitoring period.

Overall, Antulang remains one of Siaton Municipality's strongest sites for macro-diversity, supported by consistently high encounter rates for porcupinefish and pufferfish, slugs, Scorpaenidae, shrimps, and eels and snakes. Its particularly strong sightings of syngnathids and pegasids and relatively frequent frogfish encounters add specialised value for macro enthusiasts and underwater photographers. The site continues to offer a broad and varied wildlife experience, with the combination of abundant reef fauna and occasional unusual or cryptic species making Antulang a particularly attractive destination for divers seeking species diversity rather than relying on megafauna encounters.

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

Indicators at a Glance



Kookoos is a **non-MPA reference site** in Siaton. Hard coral cover is **34.6%** (fair on the national classification) and commercial fish biomass **7.09 kg per 150 m²**. This period rests on **43 surveys**, with 28 seasons on record since 2017.

Hard Coral Cover	Commercial Biomass	Fish Density	Bleaching
34.6% of substrate	7.1 kg / 150 m ²	522 / 150 m ²	1.7% of hard coral
▲ 7.3%	▼ 17.7%	— -1%	▼ 52.4%

Kookoos indicators at a glance. Every headline indicator for Kookoos, current reporting period, against this site's own preceding six months and the Siaton average for the same period. Colour is keyed to whether the movement is favourable rather than to whether the number rose. Green indicates improvement, red indicates decline — e.g. macroalgae, rubble, bleaching or debris rising reads red, coral cover rising reads green. A change smaller than 5% is shown as flat.

Indicator	Current	Prior 6 months	Change	Siaton Average
Hard coral cover (%)	34.6	32.3	▲ +7%	27.6
Macroalgae cover (%)	19.3	14.1	▲ +37%	16.4
Rubble (%)	7.4	9.5	▼ -22%	10.3
Bleaching (of hard coral) (%)	1.68	3.54	▼ -52%	2.27
Total fish density (per 150 m ²)	522	527	— -1%	715
Commercial fish biomass (kg per 150 m ²)	7.09	8.61	▼ -18%	10.7
Invertebrate density (per 150 m ²)	36	20	▲ +79%	40.4
Invertebrate species richness (per 150 m ²)	10.5	8.5	▲ +24%	10.8
Coral predators (per 150 m ²)	39.2	54	▼ -27%	46.2
Marine debris (items per 150 m ²)	4.38	2.42	▲ +81%	2.76

What moved this period:

- Marine debris substantially higher (+81%) — unfavourable
- Invertebrate density substantially higher (+79%) — favourable
- Bleaching (of hard coral) substantially lower (-52%) — favourable

KOOKOOS

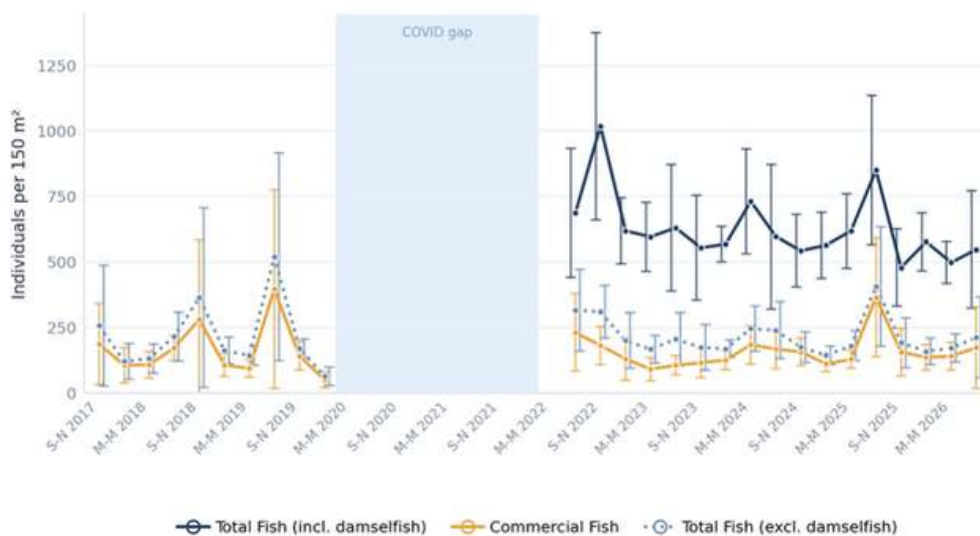
Food Security



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:

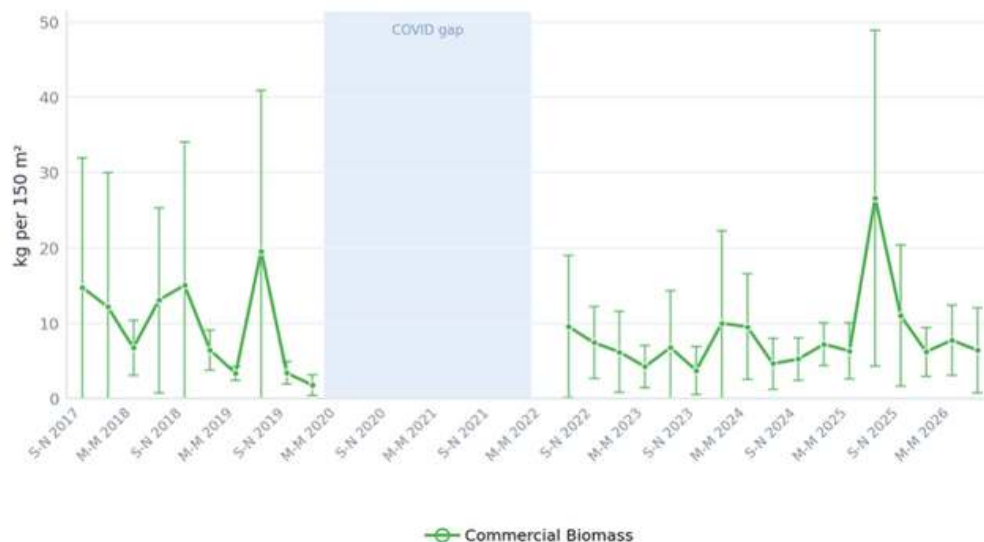
In March–August 2026, Kookoos recorded an average total fish density of **522.0 individuals per 150 m²**, with commercial species contributing **156.4 individuals per 150 m²**. Commercial biomass averaged **7.09 kg per 150 m²**, equivalent to roughly 473 kg per hectare, which sits in the moderate range for the program. By dietary group the assemblage was led by herbivores (~341.2 ind.), carnivores (~78.1 ind.), planktivores (~77.2 ind.), detritivores (~10.8 ind.), corallivores (~7.7 ind.), omnivores (~3.6 ind.) and parasitivores (~3.3 ind.), so herbivores dominate the fish community at this scale.



Fish Density Trends. Total and commercial fish density at Kookoos, 2017–2026.

Recent Change:

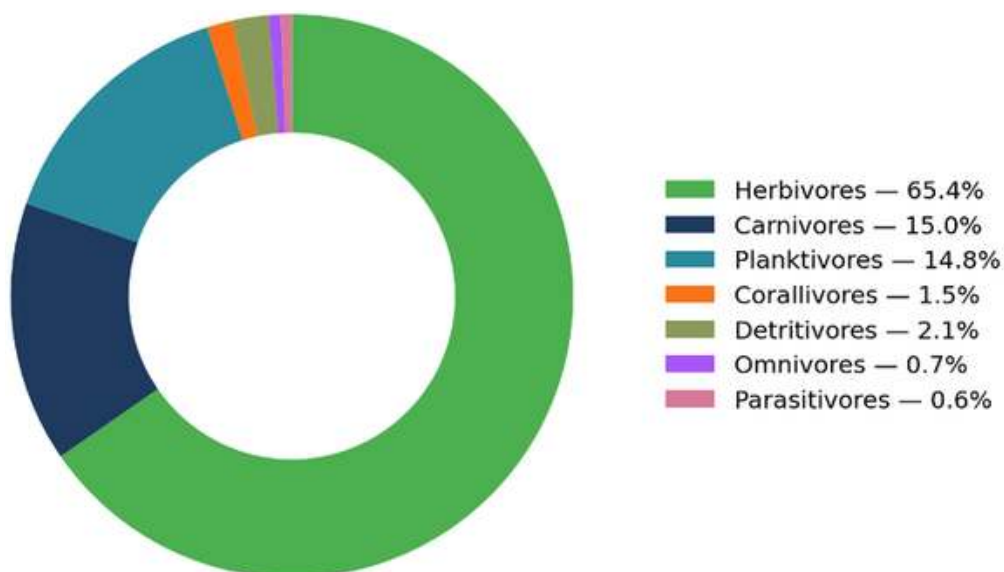
Against the preceding six months, total fish density is little changed (527.1 → 522.0 individuals per 150 m² including damselfish, 175.4 → 191.3 excluding them), commercial density slightly higher (146.0 → 156.4) and commercial biomass notably lower (8.61 → 7.09 kg per 150 m²). Within the assemblage, herbivores moved 359.3 → 341.2, carnivores moved 79.4 → 78.1 and planktivores moved 56.7 → 77.2 individuals per 150 m².



Commercial Biomass Trends. Commercial fish biomass at Kookoos, 2017–2026.

Dietary Structure:

By share of individuals the community is herbivores (65.4%), carnivores (15.0%) and planktivores (14.8%), with the remaining groups together making up 4.9%. Trophic structure matters because grazing species control algal growth and so mediate the competition between coral and algae described in the next section.



Dietary Composition. Share of fish recorded in each dietary group, Kookoos, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Commercial Groups:

The ten commercial fish families contributing most to biomass at Kookoos this period are listed on the following page. Sub-types are rolled into their family. **Fusilier** is the largest single contributor at 2.87 kg per 150 m², 40.4% of commercial biomass. Larger predatory taxa (Snapper, Trevally, Grouper) are present but at lower densities, so commercial biomass is carried largely by mid-sized and schooling species rather than by large predators. That is the pattern expected on reefs under fishing pressure, where the largest predatory fish are removed first.

Top commercial fish families. The ten commercial fish families contributing most to biomass at Kookoos, current reporting period, with the share of commercial biomass each carries. Sub-types are rolled into their family.

Commercial Families	Biomass (kg/ 150 m ²)	Density (ind./150 m ²)	% of Commercial Biomass
Fusilier	2.87	57.8	40.4
Snapper	1.03	11	14.6
Trevally	0.73	1.9	10.3
Soldierfish	0.46	4.9	6.5
Bristletooth	0.4	10.8	5.7
Wrasse - Other	0.38	49.1	5.3
Triggerfish	0.27	3.3	3.8
Surgeonfish	0.22	1	3.1
Grouper	0.15	2.3	2
Goatfish	0.14	3.1	2

Long-term Context:

The 2017–19 baseline for Kookoos is 11.38 kg per 150 m² of commercial biomass and 238.9 fish per 150 m². Current biomass stands -38% against that baseline and density -20%. The highest commercial biomass on record here was 26.59 kg per 150 m² in Jun–Aug 2025. Current levels are 73% below it. Two protocol changes limit what the long record can be asked. Damselfish entered the list in 2022, so only the damselfish-excluded series is comparable across the full period; and fish size bins changed in 2025 with both schemes running side by side through 2025–26, which biases early biomass slightly low.

Ecological Interpretation:

Kookoos ranks fourth of the 4 sites surveyed in the municipality on commercial biomass this period. Commercial biomass at Kookoos sits well below its 2017–19 baseline, which is what would be expected where extraction has continued to outpace replacement. Herbivores are only 5.5% of the fish counted once damselfish are set aside, a thin grazing guild for a reef of this type.

Damselfish do not make up the difference: they defend small algal territories rather than grazing the reef broadly, so they add to the herbivore count without adding much grazing pressure. With macroalgae at 19.3% of substrate, the combination is consistent with grazing pressure being insufficient to hold algal cover down, the mechanism that keeps a reef on the algal side of a phase shift once it arrives there.

Planktivores make up 40.4% of the assemblage. Planktivore abundance tracks current and plankton supply rather than reef condition, so it inflates total density without indicating recovery. The average commercial fish counted weighs about 45 g. Against the 2017–19 baseline of 63 g that is -28%. Fish are smaller on average than they were, which is the clearest single sign of fishing pressure: extraction removes large individuals first, and the stock responds by shifting to fast-growing small ones. It matters disproportionately because weight rises with roughly the cube of length, so a modest fall in mean size is a large fall in yield. Carnivores are 40.8% of the assemblage once damselfish are set aside, which is a high share. On a lightly fished reef the pyramid narrows towards the top; a wide carnivore band usually means small mid-water carnivores rather than large predators, so it should be read with the commercial table above rather than as evidence of an intact predator community.

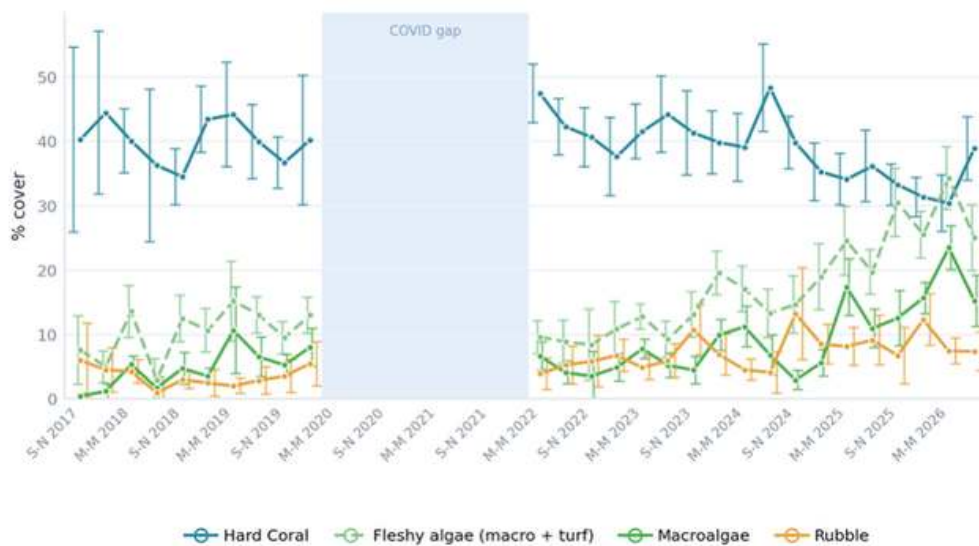
KOOKOOS

Reef Health And Resilience

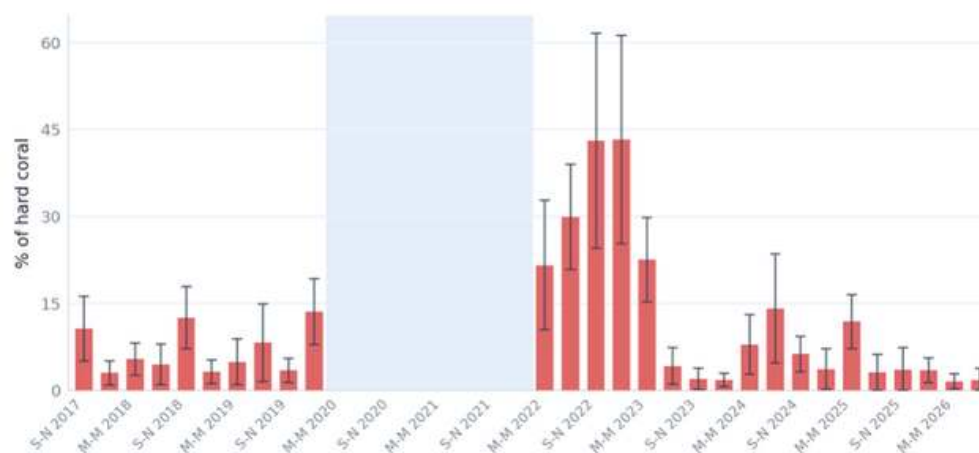


Current status:

During March–August 2026, Kookoos recorded an average hard coral cover of 34.6%, macroalgae of 19.3% (29.6% once turf is included) and rubble of 7.4%. Coral cover places the reef in the fair band of the Philippine classification. Bleaching affected 1.68% of hard coral, below the 5% level conventionally treated as a concern threshold, suggesting low thermal stress over the survey period. Beyond bleaching, 0.18% was recently killed, as a share of all points. Overall the reef can be described as coral-dominated, with noticeable algal presence and moderate unconsolidated substrate.



Reef Substrate Trends. Hard coral, macroalgae and rubble cover at Kookoos, 2017–2026. Solid line is macroalgae alone; dashed adds turf, the pre-2026 published definition.



Bleaching Incidence. Bleached coral as a percentage of hard coral cover at Kookoos, by season. Combines partially and fully bleached records.

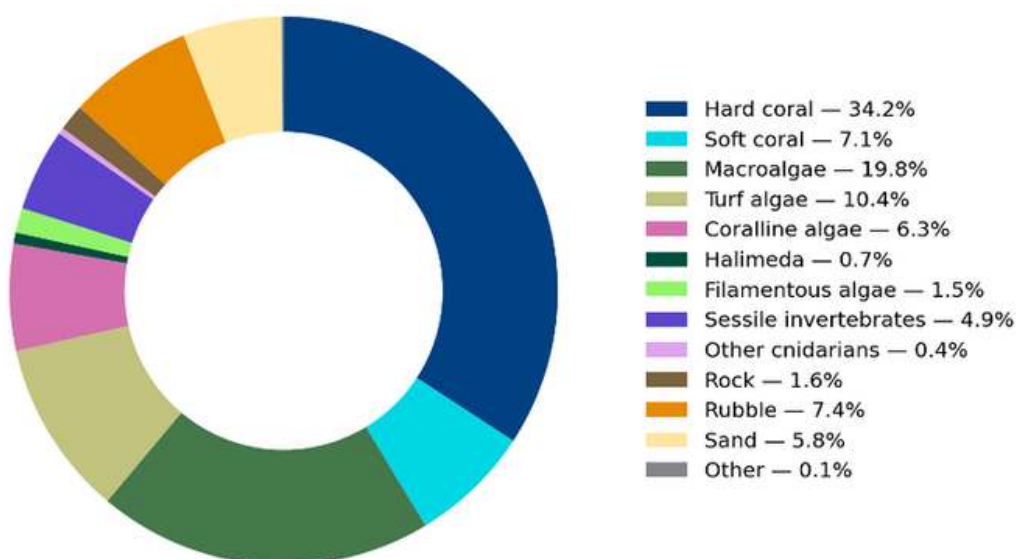
Recent Change:

Compared with the preceding six months, hard coral cover is slightly higher (32.3 → 34.6%), macroalgae substantially higher (14.1 → 19.3%), rubble notably lower (9.5 → 7.4%) and bleaching substantially lower (3.54 → 1.68%). Taken together this indicates increased algal presence. Super Typhoon Inday and Super Typhoon Kiyapo crossed the area inside this reporting period, so physical damage is the first explanation for this.

Structural Implications:

Of all points recorded, 34.6% is living hard coral, 32.2% is fleshy algae competing for the same space, 13.2% is unconsolidated material (rubble and sand), 7.8% is consolidated surface available for settlement (bare rock and coralline algae) and 12.4% is occupied by other stable but non-reef-building life, soft corals, sessile invertebrates and seagrass. The combination of fair coral cover and relatively low rubble (7.4%) indicates that most of the reef framework is stable and physically suitable for coral growth and recruitment. Sand accounts for a further 5.8% of points, which is habitat rather than damage. Macroalgae has risen against the preceding six months (+37%), so competition for settlement space is intensifying rather than easing. Fleshy algae pre-empt the surfaces coral larvae need and deter grazers once established, which is how a reef gets held on the algal side rather than crossing back.

Within the living coral, growth form determines how much shelter the reef offers and how well it resists disturbance; this protocol records no rugosity, so growth form is the closest available proxy for structural complexity. The cover present is led by encrusting (34.7%), submassive (27.7%) and branching (17.9%). On MCP's classification, resistance to disturbance, not shelter, 66.7% of the coral sits in low-resilience forms and 5.1% in high-resilience forms. Most of the cover is therefore in forms that provide good shelter but are first to be lost in a thermal or storm event, so the headline cover figure is more fragile than it appears.

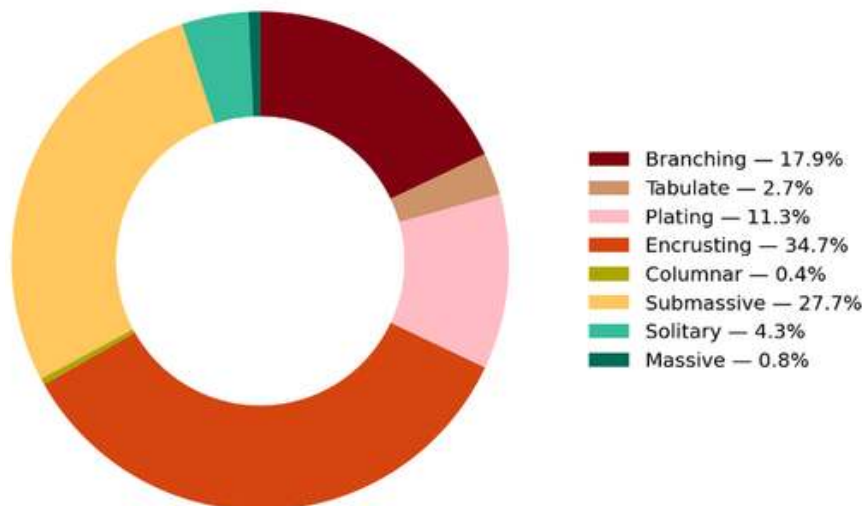


Substrate Composition. Full substrate composition, Kookoos, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Taken together, fair coral cover at 34.6%, macroalgae at 19.3% and rubble at 7.4%, this is a reef in a **transitional** state, shaped by both physical disturbance (the unconsolidated fraction) and biological competition (the algal fraction). Algal competition is the binding constraint here; the substrate itself is stable enough to support recruitment if that competition eases.

Long-term Context:

Against the 2017–19 baseline of 40.4% hard coral, 4.3% macroalgae and 3.2% rubble, coral cover is -14%, macroalgae +355% and rubble +129%. Coral cover peaked at 48.3% in Jun–Aug 2024 and now stands 34.6%. Bleaching peaked at 43.3% of hard coral in Dec–Feb 2022/23, and has remained below the 5% concern level for the last 5 seasons, since Jun–Aug 2025. Two definitions changed for this edition and are not comparable with earlier reports: macroalgae is now macroalgae alone rather than macroalgae plus turf, and bleaching is a share of hard coral rather than of all substrate points, which makes it read three to four times higher on identical observations.



Coral Growth Forms. Share of hard coral in each growth form at Kookoos, averaged over the current reporting period (Mar–May 2026 and Jun–Aug 2026 averaged). Forms are ordered from least to most resilient: low resilience covers branching, tabulate, plating, encrusting and *Tubastraea*; medium covers columnar and submassive; high covers solitary and massive.

Ecological Interpretation:

Kookoos ranks first of the 4 sites surveyed in the municipality on hard coral cover and second on macroalgae, counting the least algal site first. Bleaching has stayed below the concern threshold for 5 consecutive seasons, which has allowed partial stabilisation; the reef is in a phase of cautious stabilisation rather than active recovery. Of the coral present, 32.0% is in fast-growing forms (branching, tabulate, plating) and 63.2% in slow, robust ones (massive, submassive, encrusting). That ratio sets how quickly cover can rebuild and how much survives a disturbance, and the two pull against each other: the fast forms drive recovery but are the first lost, the slow ones persist but add cover at a fraction of the rate. A cover figure held up mostly by slow forms is stable but will rebuild slowly from any loss, so recovery here should be measured in decades rather than seasons.

For every point of substrate a coral larva could settle on, there are 4.1 points already held by fleshy algae. Settlement space is the binding constraint on recovery here, not larval supply: even a good recruitment year has little bare ground to land on.

Of the pressures acting here, the ones open to local action are enforcement, the herbivore populations that hold algae down, and the physical impacts that break coral and make rubble, anchoring, destructive fishing and trampling. Thermal stress is not one of them, which is why the bleaching figure is reported as context rather than as something to manage.



Predation and Marine Debris

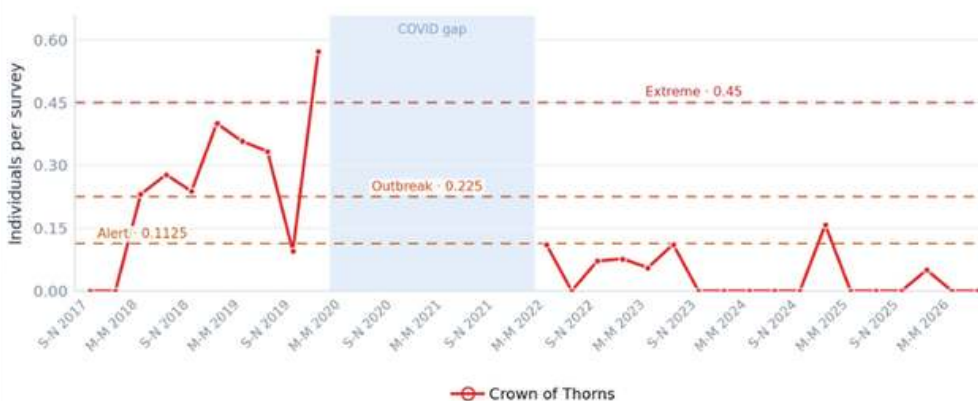
Current Status:

Drupella averaged **22.4 per survey** (above the alert threshold) and *Coralliophila* 16.8 (above the alert threshold), giving a combined corallivorous snail load of 39.2 per survey. Crown of Thorns averaged 0.000 per survey (below the alert threshold).

Marine debris averaged **4.38 items** per survey. By category it breaks down as fishing gear 4.04 (92%), consumer plastics 0.22 (5%), household & sanitary 0.10 (2%) and other debris 0.03 (1%). The categories are mutually exclusive and sum to the total, so nothing is double-counted between them. Fishing gear is the largest category at 92% of items. That is a sea-based source: gear lost or discarded by boats working the reef, which responds to gear marking, retrieval dives and work with fishers rather than to municipal waste collection.



Coral Predators. Corallivorous snail abundance at Kookoos, 2017-2026. Dashed rules mark MCP management thresholds (alert 15, outbreak 37.5, extreme 75 per survey).



Crown of Thorns. Crown of Thorns abundance at Kookoos, 2017-2026. Dashed rules mark MCP management thresholds for Crown of Thorns (alert 0.1125, outbreak 0.225, extreme 0.45 per survey).

Recent Change:

Against the preceding six months, *Drupella* is substantially lower (34.2 → 22.4), *Coralliophila* notably lower (19.8 → 16.8), Crown of Thorns substantially lower (0.025 → 0.000) and debris substantially higher (2.42 → 4.38 items per survey).



Marine Debris. Marine debris at Kookoos, current reporting period. The centre figure is total items per survey and the ring is what that total is made of; the categories are mutually exclusive, so the slices sum to the centre figure. The sparkline is the site's own total debris per survey across the full record, 2017–2026, with the COVID gap left empty.

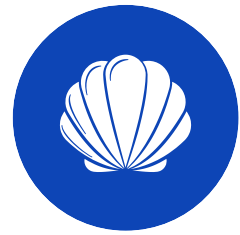
Long-term Context:

The 2017–19 baseline is 9.9 *Drupella*, 3.3 *Coralliophila* and 0.230 Crown of Thorns per survey, with 1.71 debris items. Current levels stand +125%, +417%, -100% and +155% against those. *Drupella* peaked at 38.9 per survey in Mar–May 2024. These figures pool all depths. *Drupella* is roughly eleven times more abundant shallow than deep, so we have a depth-resolved workbook, where we can detect outbreaks in the shallows.

Ecological Interpretation:

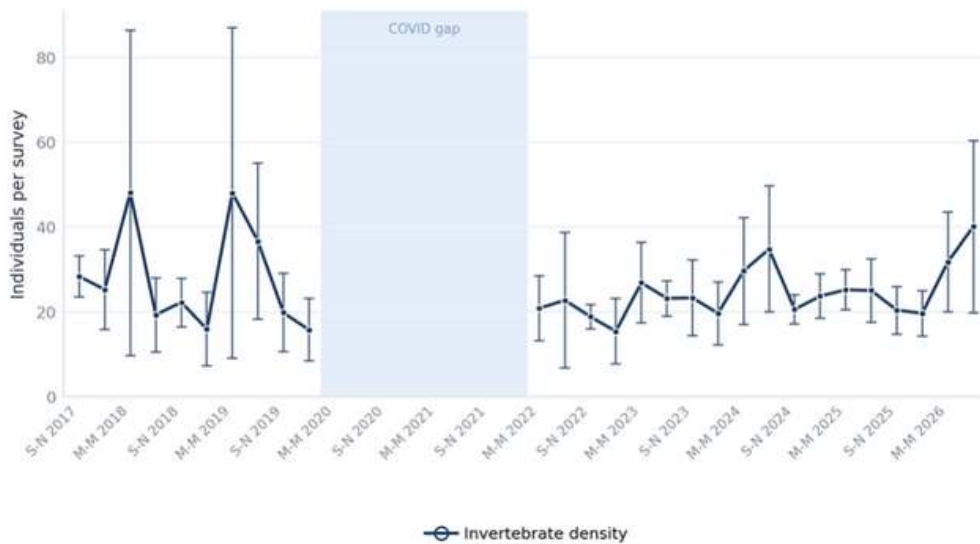
Combined snail abundance is at outbreak level. *Drupella* and *Coralliophila* aggregate on already-stressed colonies, so high counts often follow coral damage rather than initiate it — but once aggregated they suppress the recovery of the colonies that survived. Almost all the debris recorded (92.3%) is fishing gear. That is a different management problem from land-based waste: it points at gear loss by fishers working the reef and responds to gear marking, retrieval and fisher engagement rather than to municipal waste collection. Debris rose sharply against the previous period. Debris is episodic and one season is not a trend, but a repeat next season would warrant action.

On management: corallivorous snails can be removed by hand and that is the standard response above outbreak level, but removal only works if it is repeated, the snails recruit from surrounding reef and a single clearance is recolonised. Directing effort at the aggregations on living coral, rather than spreading it across the site, is what makes the effort worthwhile. The debris is a fisheries problem before it is a waste problem. Lost gear keeps fishing after it is lost, so it is both a debris indicator and a mortality source, and it accumulates on exactly the structure that snags it, the high-relief coral that matters most. Gear marking and retrieval dives address it; municipal collection does not.

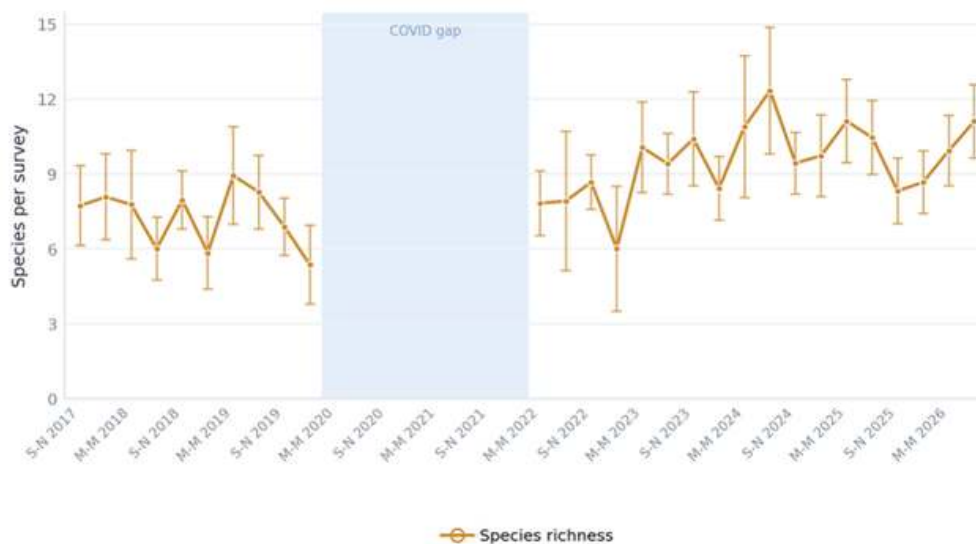


Current Status:

Kookoos supported an average invertebrate density of **36.0 individuals per survey**, drawn from **10.5 distinct species per survey**.



Invertebrate Density. Total invertebrate density at Kookoos, 2017-2026.



Invertebrate Species Richness. Invertebrate species richness at Kookoos, 2017-2026.

Recent Change:

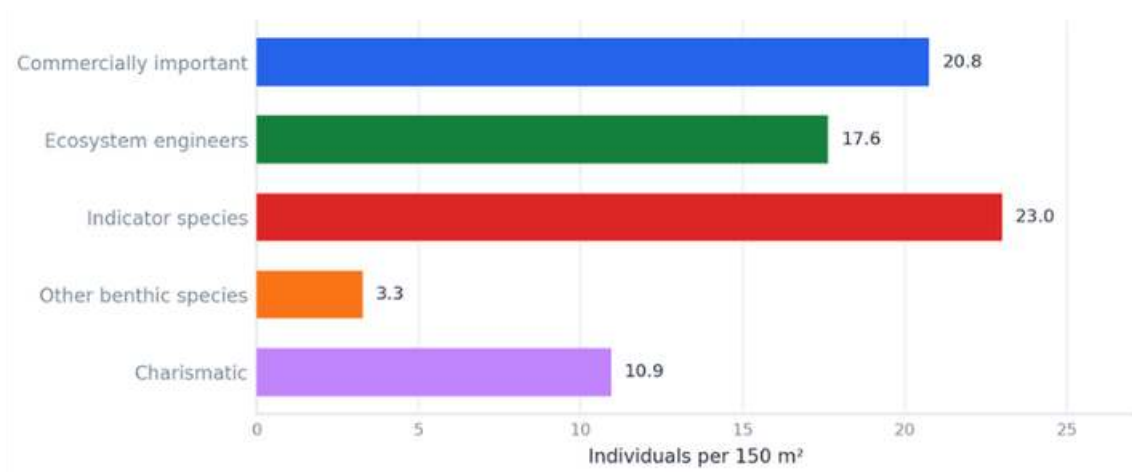
Against the preceding six months, density is substantially higher (20.0 → 36.0 per survey), richness notably higher (8.5 → 10.5 species) and commercially important species substantially higher (13.2 → 20.8).

Most abundant invertebrate taxa. The ten most abundant invertebrates (left), and the ten most abundant commercially important invertebrates (right) by density at Kookoos.

Top 10 Invertebrates	Individuals per 150 m ²	Top 10 Commercial	Individuals per 150 m ²
Urchin - Diadema	12.45	Urchin - Diadema	12.45
Nudibranch	3.69	Sea Cucumber - Black Spotted	1.46
Porcupinefish	3.65	Cone Shell	1.31
Cleaner Shrimp - Banded Coral	1.82	Other Shell	0.95
Lionfish	1.58	Giant Clam	0.9
Sea Star	1.56	Top - Nilo	0.56
Sea Cucumber - Black Spotted	1.46	Conch - Scorpion Spider	0.45
Cone Shell	1.31	Other Bivalve	0.36
Other Shell	0.95	Mantis Shrimp	0.33
Giant Clam	0.9	Urchin - Rock Boring	0.26

Commercial Groups:

Commercially important invertebrates averaged 20.8 per survey, 57.7% of all invertebrates counted. Within the key harvested groups, urchins averaged 12.8 per survey, sea cucumbers 1.84 and giant clams 0.94. Those ten total 19.03 individuals per survey, 53% of all invertebrates counted, led by Urchin - Diadema at 12.45 per survey. The community is dominated by sea urchins. Their grazing helps keep settlement space open for coral recruitment, so high urchin abundance is a mixed signal rather than a bad one, beneficial for recruitment, but at sustained high density urchins also erode reef framework.



Invertebrate Functional Groups. Invertebrate functional group density, Kookoos, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Functional Groups:

Per survey: commercially important species 20.8, ecosystem engineers 17.6, sensitive indicator species 23.0, charismatic species 10.9, benthic associates and predators 3.3. These groups overlap by design, a species can be both commercially important and charismatic, so they do not sum to total invertebrate density. A relatively high abundance of sensitive indicator species suggests conditions still suitable for disturbance-intolerant taxa; a high abundance of ecosystem engineers, mostly urchins, indicates that herbivory and bioerosion are active processes here.

Long-term Context:

The 2017–19 baseline is 30.5 individuals and 7.6 species per survey. Density stands +18% against that and richness +39%. Richness figures in editions before 2026 divided a pooled species list by the number of surveys, which fell as survey effort rose. They are not comparable with these.

Ecological Interpretation:

Kookoos ranks fourth of the 4 sites surveyed in the municipality on invertebrate density and third on species richness. Each species contributes 3.4 individuals per survey on average. A rising figure with flat richness means the same few taxa are becoming more abundant rather than the community broadening, which is the pattern that precedes an urchin-dominated reef. Invertebrate grazers now outnumber herbivorous fish here (12.8 urchins against 10.5 herbivorous fish per survey, damselfish set aside). Urchins and herbivorous fish are partial substitutes, but not equivalent: urchins graze slowly and erode limestone as they feed, so a reef whose grazing has shifted to invertebrates loses algae and framework at the same time. It is also a less stable arrangement, because urchin populations boom and crash on disease in a way fish populations do not.

KOOKOOS

Tourism Value



Touristic Species		Mean Encounter Rate (%)	
Barracudas	8.5	Scorpaenidae	65.2
Cephalopods	11.8	Sharks	0
Cowries	31.6	Shrimps	54.2
Eels and Snakes	40.9	Slugs	68.9
Frogfish	1.8	Stingrays	1
Giant Clams	55.5	Syngnathidae and Pegasidae	19.3
Porcupinefish and Pufferfish	92.1	Turtles	25.1

Touristic species encounter rates. The percentage of dives at Kookoos in which each touristic group was recorded, current reporting period.

Kookoos is well known for its interesting underwater topography and landscape. Large-scale features, including coral bommies and small canyons, provide rewarding diving experiences and strengthen the site's potential for dive tourism. Easy access from the public beach also makes Kookoos relatively convenient for divers and operators to access.

Kookoos demonstrates very high tourism value, particularly through its extremely frequent sightings of porcupinefish and pufferfish (92.1%), the highest rate in the municipality. Slugs (68.9%), Scorpaenidae (65.2%), shrimps (54.2%) and eels and snakes (40.9%) provide further strong opportunities for reef and macro-diving experiences. Giant clams (55.5%) are also particularly prominent, making Kookoos one of the two strongest sites in the municipality for encounters with this visually distinctive and conservation-relevant group. Cowries (31.6%), cephalopods (11.8%) and syngnathids and pegasids (19.3%) further contribute to the site's macro-diversity. Unique sightings of a blue-ringed octopus and brown-marbled grouper have both been recorded here.

Kookoos also provides relatively good opportunities for charismatic megafauna. Turtles were recorded in 25.1% of dives, the highest turtle encounter rate among the monitored sites and well above the municipal average of 15.7%, providing an important attraction for divers interested in larger marine wildlife. Barracudas (8.5%) and stingrays (1.0%) were encountered less frequently, while frogfish were rare (1.8%) and sharks were not recorded during the monitoring period.

Overall, Kookoos combines strong physical characteristics with exceptionally reliable wildlife encounters, making it one of the municipality's most attractive sites for dive tourism. The relatively frequent turtle sightings add a complementary megafauna attraction, while the site's distinctive underwater topography enhances the overall quality of the diving experience.

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

Indicators at a Glance



Salag is a **marine protected area** in Siaton. Hard coral cover is **28.1%** (fair on the national classification) and commercial fish biomass 12.00 kg per 150 m². This period rests on **43 surveys**, with 21 seasons on record since 2019.

Hard Coral Cover	Commercial Biomass	Fish Density	Bleaching
28.1% of substrate	12 kg / 150 m ²	591 / 150 m ²	2.3% of hard coral
▼ 7.5%	▲ 36.5%	▲ 58.8%	▲ 33.5%

Salag indicators at a glance. Every headline indicator for Salag, current reporting period, against this site's own preceding six months and the Siaton average for the same period. Colour is keyed to whether the movement is favourable rather than to whether the number rose. Green indicates improvement, red indicates decline — e.g. macroalgae, rubble, bleaching or debris rising reads red, coral cover rising reads green. A change smaller than 5% is shown as flat.

Indicator	Current	Prior 6 months	Change	Siaton Average
Hard coral cover (%)	28.1	30.4	▼ -8%	27.6
Macroalgae cover (%)	19.8	11.3	▲ +75%	16.4
Rubble (%)	5.3	10.1	▼ -47%	10.3
Bleaching (of hard coral) (%)	2.35	1.76	▲ +33%	2.27
Total fish density (per 150 m ²)	591	372	▲ +59%	715
Commercial fish biomass (kg per 150 m ²)	12	8.79	▲ +36%	10.7
Invertebrate density (per 150 m ²)	36.7	13.6	▲ +170%	40.4
Invertebrate species richness (per 150 m ²)	9	7.1	▲ +28%	10.8
Coral predators (per 150 m ²)	36.2	30.4	▲ +19%	46.2
Marine debris (items per 150 m ²)	3.77	3.4	▲ +11%	2.76

What moved this period:

- Invertebrate density substantially higher (+170%) — favourable
- Macroalgae cover substantially higher (+75%) — unfavourable
- Total fish density substantially higher (+59%) — favourable

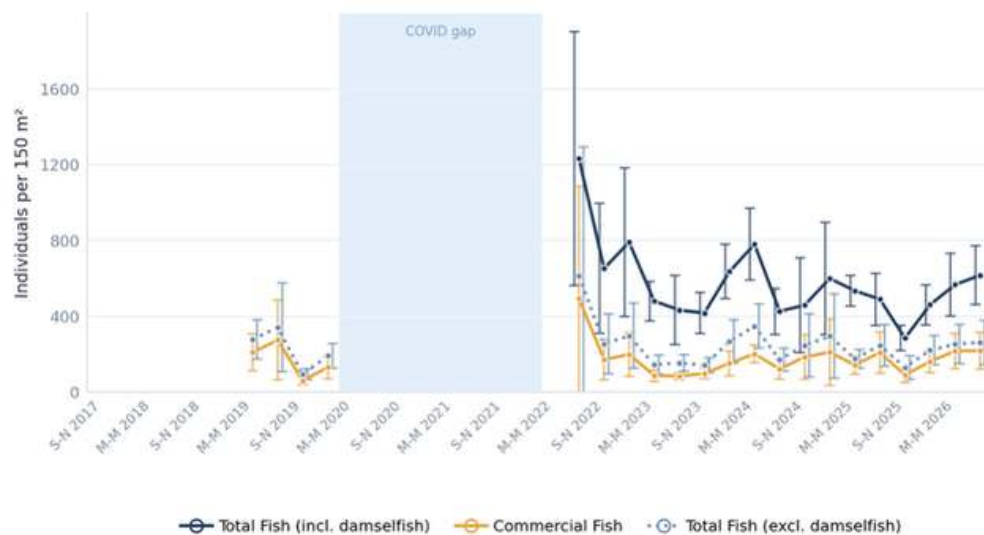
SALAG MPA

Food Security



Current Status:

In March–August 2026, Salag recorded an average total fish density of **591.0 individuals per 150 m²**, with commercial species contributing **216.8 individuals per 150 m²**. Commercial biomass averaged **12.00 kg per 150 m²**, equivalent to roughly **800 kg per hectare**, which sits in the moderately high range for the program. By dietary group the assemblage was led by herbivores (~344.5 ind.), carnivores (~127.0 ind.), planktivores (~86.7 ind.), detritivores (~17.0 ind.), corallivores (~8.4 ind.), parasitivores (~3.7 ind.) and omnivores (~3.6 ind.), so herbivores dominate the fish community at this scale.



Fish Density Trends. Total and commercial fish density at Salag, 2017–2026.



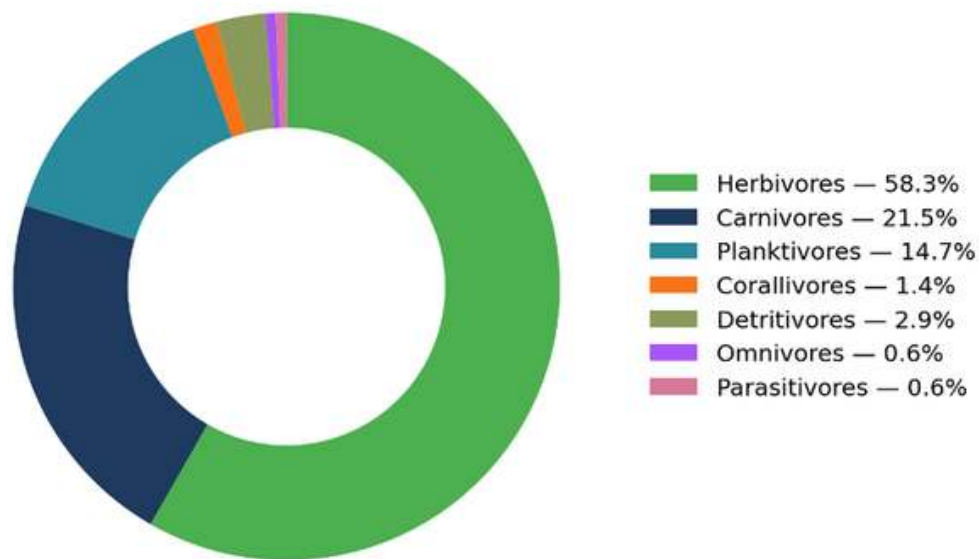
Commercial Biomass Trends. Commercial fish biomass at Salag, 2017–2026.

Recent Change:

Against the preceding six months, total fish density is substantially higher (372.1 → 591.0 individuals per 150 m² including damselfish, 175.0 → 257.3 excluding them), commercial density substantially higher (125.0 → 216.8) and commercial biomass substantially higher (8.79 → 12.00 kg per 150 m²). Within the assemblage, herbivores moved 203.6 → 344.5, carnivores moved 60.3 → 127.0 and planktivores moved 77.6 → 86.7 individuals per 150 m².

Dietary Structure:

By share of individuals the community is herbivores (58.3%), carnivores (21.5%) and planktivores (14.7%), with the remaining groups together making up 5.5%. Trophic structure matters because grazing species control algal growth and so mediate the competition between coral and algae described in the next section.



Dietary Composition. Share of fish recorded in each dietary group, Salag, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Commercial Groups:

The ten commercial fish families contributing most to biomass at Salag this period are listed on the following page. Sub-types are rolled into their family. Fusilier is the largest single contributor at 4.84 kg per 150 m², 39.8% of commercial biomass. Larger predatory taxa (Grouper, Snapper) are present but at lower densities, so commercial biomass is carried largely by mid-sized and schooling species rather than by large predators. That is the pattern expected on reefs under fishing pressure, where the largest predatory fish are removed first.

Long-term context:

The 2017–19 baseline for Salag is 12.58 kg per 150 m² of commercial biomass and 308.7 fish per 150 m². Current biomass stands -5% against that baseline and density -17%. The highest commercial biomass on record here was 23.23 kg per 150 m² in Dec–Feb 2023/24. Current levels are 48% below it. Two protocol changes limit what the long record can be asked.

Top commercial fish families. The ten commercial fish families contributing most to biomass at Salag, current reporting period, with the share of commercial biomass each carries. Sub-types are rolled into their family.

Commercial Families	Biomass (kg/ 150 m ²)	Density (ind./150 m ²)	% of Commercial Biomass
Fusilier	4.84	61.8	39.8
Surgeonfish	1.95	3	16
Soldierfish	1.14	7.3	9.4
Bristletooth	0.93	17.1	7.6
Wrasse - Other	0.68	93.5	5.6
Unicornfish	0.47	2.2	3.9
Grouper	0.43	4	3.5
Goatfish	0.38	6.7	3.1
Triggerfish	0.32	2.7	2.6
Snapper	0.27	1.4	2.2

Damselfish entered the list in 2022, so only the damselfish-excluded series is comparable across the full period; and fish size bins changed in 2025 with both schemes running side by side through 2025–26, which biases early biomass slightly low.

Ecological interpretation:

Salag ranks second of the 4 sites surveyed in the municipality on commercial biomass this period. Herbivores are only 4.2% of the fish counted once damselfish are set aside, a thin grazing guild for a reef of this type. Damselfish do not make up the difference: they defend small algal territories rather than grazing the reef broadly, so they add to the herbivore count without adding much grazing pressure. With macroalgae at 19.8% of substrate, the combination is consistent with grazing pressure being insufficient to hold algal cover down, the mechanism that keeps a reef on the algal side of a phase shift once it arrives there. Planktivores make up 33.7% of the assemblage. Planktivore abundance tracks current and plankton supply rather than reef condition, so it inflates total density without indicating recovery.

The average commercial fish counted weighs about 55 g. Against the 2017–19 baseline of 52 g that is +6%. Mean size is holding up, which suggests individuals are surviving long enough to grow and that the size structure has not been truncated. Carnivores are 49.4% of the assemblage once damselfish are set aside, which is a high share. On a lightly fished reef the pyramid narrows towards the top; a wide carnivore band usually means small mid-water carnivores rather than large predators, so it should be read with the commercial table above rather than as evidence of an intact predator community.

SALAG MPA

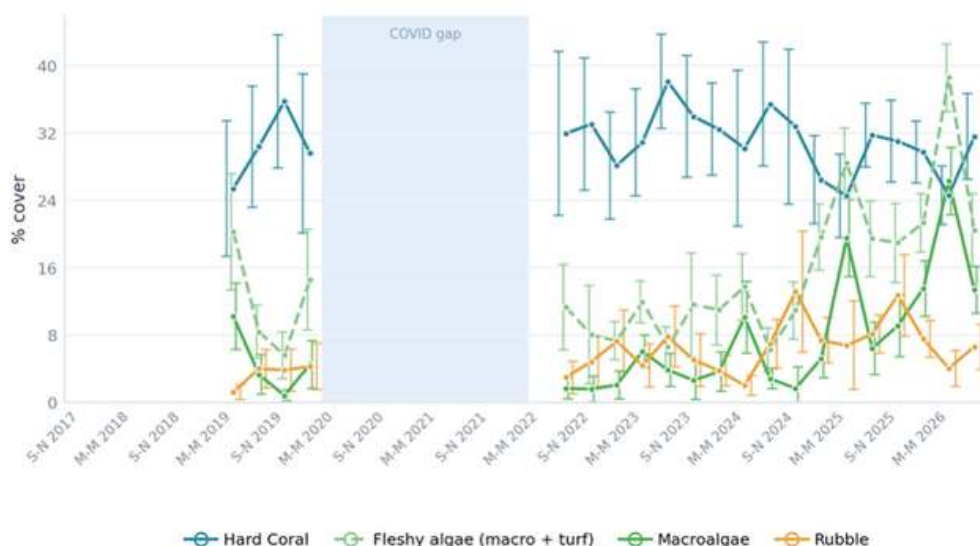
Reef Health And Resilience



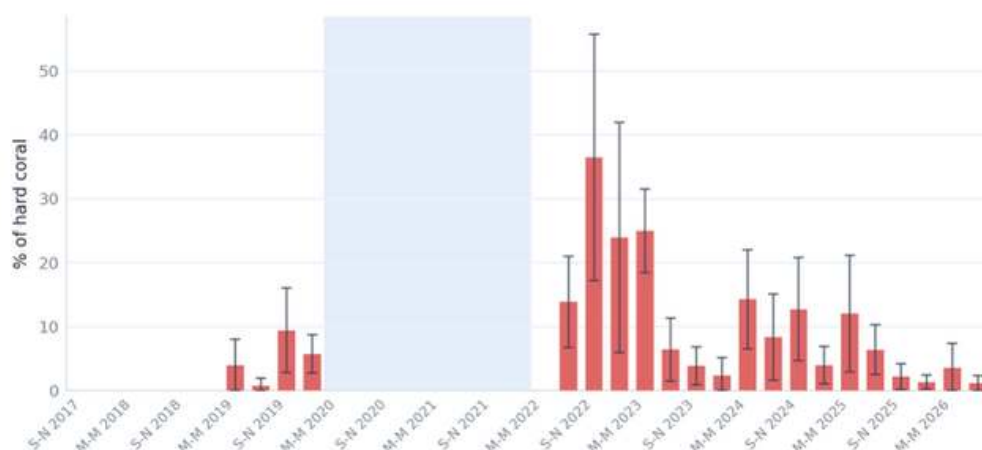
Salag MPA is most similar to Kookoos in terms of underwater landscape and general features.

Current status:

During March–August 2026, Salag recorded an average hard coral cover of **28.1%**, macroalgae of **19.8%** (29.5% once turf is included) and rubble of **5.3%**. Coral cover places the reef in the fair band of the Philippine classification. Bleaching affected 2.35% of hard coral, below the 5% level conventionally treated as a concern threshold, suggesting low thermal stress over the survey period. Beyond bleaching, 0.25% showed predation scarring; 0.22% was recently killed, as a share of all points. Overall the reef can be described as structurally mixed, with noticeable algal presence and moderate unconsolidated substrate.



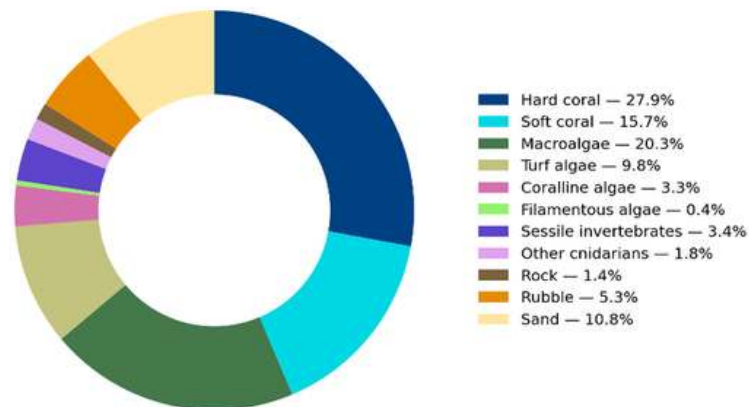
Reef Substrate Trends. Hard coral, macroalgae and rubble cover at Salag, 2017–2026. Solid line is macroalgae alone; dashed adds turf, the pre-2026 published definition.



Bleaching Incidence. Bleached coral as a percentage of hard coral cover at Salag, by season. Combines partially and fully bleached records.

Recent Change:

Compared with the preceding six months, hard coral cover is slightly lower (30.4 → 28.1%), macroalgae substantially higher (11.3 → 19.8%), rubble substantially lower (10.1 → 5.3%) and bleaching substantially higher (1.76 → 2.35%). Taken together this indicates a decline in coral dominance and increased algal presence. Super Typhoon Inday and Super Typhoon Kiyapo crossed the area inside this reporting period, so physical damage is the first explanation for this, storm breakage converts standing coral into rubble directly, where gradual pressure does not.



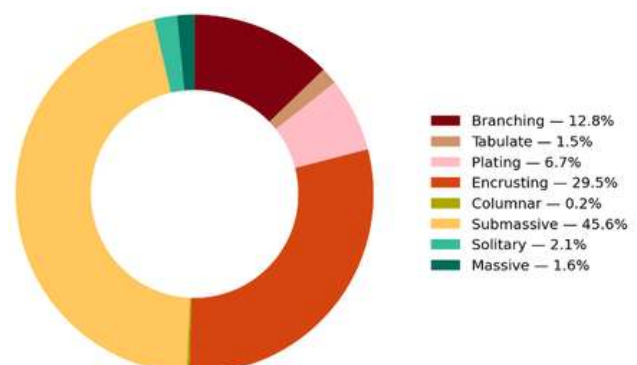
Substrate Composition. Full substrate composition, Salag, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Structural Implications:

Of all points recorded, 28.1% is living hard coral, 30.5% is fleshy algae competing for the same space, 16.1% is unconsolidated material (rubble and sand), 4.6% is consolidated surface available for settlement (bare rock and coralline algae) and 20.9% is occupied by other stable but non-reef-building life, soft corals, sessile invertebrates and seagrass.

The combination of fair coral cover and relatively low rubble (5.3%) indicates that most of the reef framework is stable and physically suitable for coral growth and recruitment. Sand accounts for a further 10.8% of points, which is habitat rather than damage. Macroalgae has risen against the preceding six months (+75%), so competition for settlement space is intensifying rather than easing. Fleshy algae pre-empt the surfaces coral larvae need and deter grazers once established, which is how a reef gets held on the algal side rather than crossing back. Within the living coral, growth form determines how much shelter the reef offers and how well it resists disturbance; this protocol records no rugosity, so growth form is the closest available proxy for structural complexity.

Coral Growth Forms. Share of hard coral in each growth form at Salag, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).



The cover present is led by submassive (45.6%), encrusting (29.5%) and branching (12.8%). On MCP's classification, resistance to disturbance, not shelter, 50.5% of the coral sits in low-resilience forms and 3.6% in high-resilience forms. Most of the cover is therefore in forms that provide good shelter but are first to be lost in a thermal or storm event, so the headline cover figure is more fragile than it appears.

Taken together, fair coral cover at 28.1%, macroalgae at 19.8% and rubble at 5.3%, this is a reef in a **transitional** state, shaped by both physical disturbance (the unconsolidated fraction) and biological competition (the algal fraction). Algal competition is the binding constraint here; the substrate itself is stable enough to support recruitment if that competition eases.

Long-term Context:

Against the 2017–19 baseline of 27.9% hard coral, 6.8% macroalgae and 2.6% rubble, coral cover is +1%, macroalgae +192% and rubble +103%. Coral cover peaked at 38.1% in Jun–Aug 2023 and now stands 28.1%. Bleaching peaked at 36.5% of hard coral in Sep–Nov 2022, and has remained below the 5% concern level for the last 4 seasons, since Sep–Nov 2025. Two definitions changed for this edition and are not comparable with earlier reports: macroalgae is now macroalgae alone rather than macroalgae plus turf, and bleaching is a share of hard coral rather than of all substrate points, which makes it read three to four times higher on identical observations.

Ecological Interpretation:

Salag ranks second of the 4 sites surveyed in the municipality on hard coral cover and fourth on macroalgae, counting the least algal site first. Macroalgae is rising while coral falls, consistent with algae occupying space the coral has vacated rather than the two varying independently. Bleaching has stayed below the concern threshold for 4 consecutive seasons, which has allowed partial stabilisation; the reef is in a phase of cautious stabilisation rather than active recovery.

Of the coral present, 21.0% is in fast-growing forms (branching, tabulate, plating) and 76.7% in slow, robust ones (massive, submassive, encrusting). That ratio sets how quickly cover can rebuild and how much survives a disturbance, and the two pull against each other: the fast forms drive recovery but are the first lost, the slow ones persist but add cover at a fraction of the rate. A cover figure held up mostly by slow forms is stable but will rebuild slowly from any loss, so recovery here should be measured in decades rather than seasons. For every point of substrate a coral larva could settle on, there are 6.6 points already held by fleshy algae. Settlement space is the binding constraint on recovery here, not larval supply: even a good recruitment year has little bare ground to land on.

Of the pressures acting here, the ones open to local action are enforcement, the herbivore populations that hold algae down, and the physical impacts that break coral and make rubble, anchoring, destructive fishing and trampling. Thermal stress is not one of them, which is why the bleaching figure is reported as context rather than as something to manage.

SALAG MPA

Predation and Marine Debris



Current Status:

Drupella averaged **9.2 per survey** (below the alert threshold) and *Coralliophila* **26.9** (above the alert threshold), giving a combined corallivorous snail load of 36.1 per survey. Crown of Thorns averaged 0.092 per survey (below the alert threshold).

Marine debris averaged **3.77 items per survey**. By category it breaks down as consumer plastics 1.38 (37%), fishing gear 1.18 (31%), household & sanitary 1.15 (31%) and other debris 0.05 (1%). The categories are mutually exclusive and sum to the total, so nothing is double-counted between them. Consumer plastics is the largest category at 37% of items, ahead of fishing gear. That points at a land-based source, waste reaching the reef from shore or from rivers, which is a municipal collection and drainage problem rather than a fisheries one.



Coral Predators. Corallivorous snail abundance at Salag, 2017-2026. Dashed rules mark MCP management thresholds (alert 15, outbreak 37.5, extreme 75 per survey).



Crown of Thorns. Crown of Thorns abundance at Salag, 2017-2026. Dashed rules mark MCP management thresholds for Crown of Thorns (alert 0.1125, outbreak 0.225, extreme 0.45 per survey).

Recent Change:

Against the preceding six months, *Drupella* is notably higher (8.0 → 9.2), *Coralliophila* notably higher (22.3 → 26.9), Crown of Thorns substantially higher (0.024 → 0.092) and debris slightly higher (3.40 → 3.77 items per survey).



Marine Debris. Marine debris at Salag, current reporting period. The centre figure is total items per survey and the ring is what that total is made of; the categories are mutually exclusive, so the slices sum to the centre figure. The sparkline is the site's own total debris per survey across the full record, 2017–2026, with the COVID gap left empty.

Long-term Context:

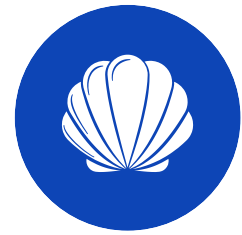
The 2017–19 baseline is 7.3 *Drupella*, 4.5 *Coralliophila* and 0.000 Crown of Thorns per survey, with 10.94 debris items. Current levels stand +27%, +496%, not comparable, and -66% against those. *Drupella* peaked at 14.8 per survey in Dec–Feb 2024/25. These figures pool all depths. *Drupella* is roughly eleven times more abundant shallow than deep, so we have a depth-resolved workbook, where we can detect outbreaks in the shallows.

Ecological Interpretation:

Corallivore abundance sits below the thresholds that would trigger management action. On management: corallivorous snails can be removed by hand and that is the standard response above outbreak level, but removal only works if it is repeated, the snails recruit from surrounding reef and a single clearance is recolonised. Directing effort at the aggregations on living coral, rather than spreading it across the site, is what makes the effort worthwhile. Most of the debris is land-based rather than lost gear, which places the response with municipal waste collection and drainage rather than with the fishery. Land-based debris also arrives in pulses after rain, so the timing of the surveys relative to the last heavy rainfall affects what was counted.

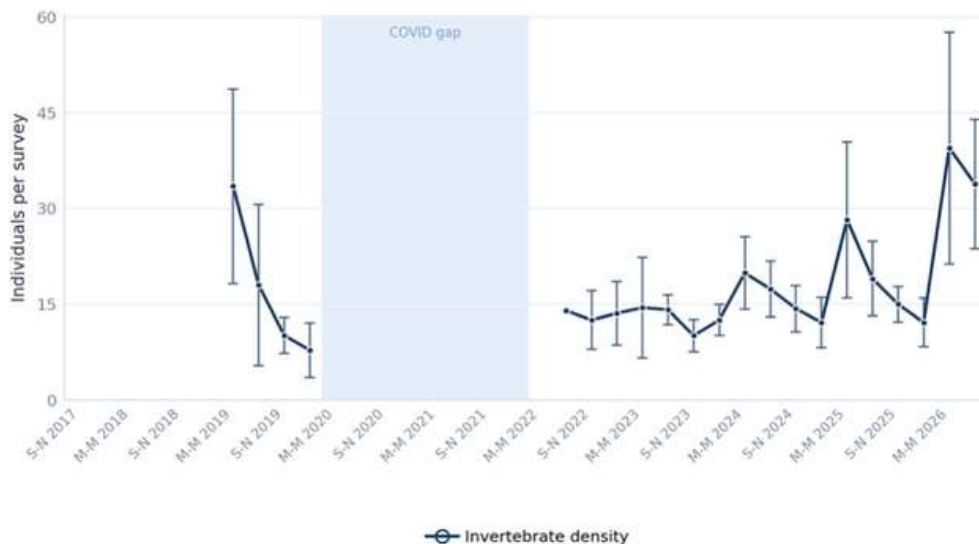
SALAG MPA

Invertebrate Status



Current Status:

Salag supported an average invertebrate density of **36.7 individuals per survey**, drawn from **9.0 distinct species per survey**.



Invertebrate Density. Total invertebrate density at Salag, 2017-2026.



Invertebrate Species Richness. Invertebrate species richness at Salag, 2017-2026.

Recent Change:

Against the preceding six months, density is substantially higher (13.6 → 36.7 per survey), richness notably higher (7.1 → 9.0 species) and commercially important species substantially higher (6.9 → 26.8).

Most abundant invertebrate taxa. The ten most abundant invertebrates (left), and the ten most abundant commercially important invertebrates (right) by density at Salag.

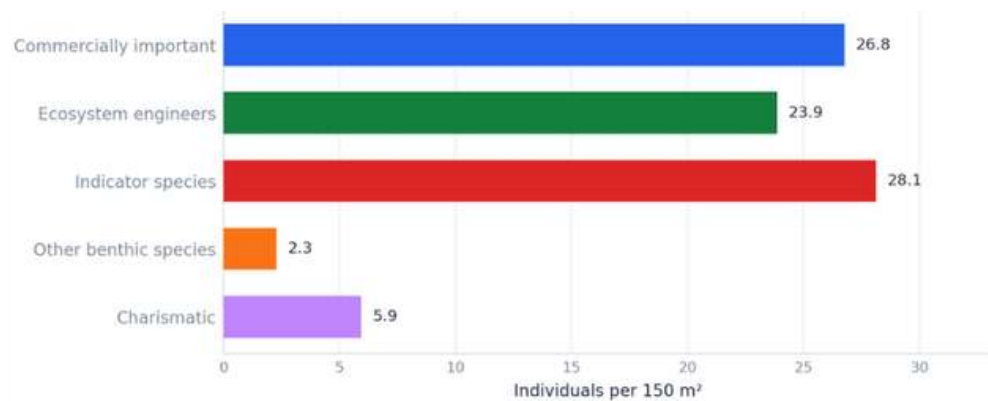
Top 10 Invertebrates	Individuals per 150 m ²	Top 10 Commercial	Individuals per 150 m ²
Urchin - Diadema	19.58	Urchin - Diadema	19.58
Nudibranch	3.67	Urchin - Rock Boring	1.82
Cleaner Shrimp - Banded Coral	2.58	Giant Clam	1
Urchin - Rock Boring	1.82	Cone Shell	0.86
Lionfish	1.15	Conch - Scorpion Spider	0.51
Giant Clam	1	Other Shell	0.49
Cone Shell	0.86	Other Shrimp	0.43
Conch - Scorpion Spider	0.51	Sea Cucumber - Black Spotted	0.4
Other Shell	0.49	Other Bivalve	0.2
Sapsucking Slug	0.47	Turban - Other	0.17

Commercial Groups:

Commercially important invertebrates averaged 26.8 per survey, 73.0% of all invertebrates counted. Within the key harvested groups, urchins averaged 21.5 per survey, sea cucumbers 0.70 and giant clams 1.07. Those ten total 25.45 individuals per survey, 69% of all invertebrates counted, led by Urchin - Diadema at 19.58 per survey. The community is dominated by sea urchins. Their grazing helps keep settlement space open for coral recruitment, so high urchin abundance is a mixed signal rather than a bad one, beneficial for recruitment, but at sustained high density urchins also erode reef framework.

Functional Groups:

Per survey: commercially important species 26.8, ecosystem engineers 23.9, sensitive indicator species 28.1, charismatic species 5.9, benthic associates and predators 2.3. These groups overlap by design, a species can be both commercially important and charismatic, so they do not sum to total invertebrate density. A relatively high abundance of sensitive indicator species suggests conditions still suitable for disturbance-intolerant taxa; a high abundance of ecosystem engineers, mostly urchins, indicates that herbivory and bioerosion are active processes here.



Invertebrate Functional Groups. Invertebrate functional group density, Salag, averaged over the current reporting period (Mar-May 2026 and Jun-Aug 2026 averaged).

Long-term Context:

The 2017–19 baseline is 25.8 individuals and 6.8 species per survey. Density stands +42% against that and richness +33%. Richness figures in editions before 2026 divided a pooled species list by the number of surveys, which fell as survey effort rose. They are not comparable with these.

Ecological Interpretation:

Salag ranks third of the 4 sites surveyed in the municipality on invertebrate density and fourth on species richness. 73% of the invertebrates counted are on the commercially important list. A community that is mostly harvestable taxa is not automatically healthy — it usually means the abundant species happen to be targeted ones, here urchins, rather than that the harvested stocks are in good condition. The giant clam and sea cucumber figures are the better test of that, because they are the taxa fishers take first. Each species contributes 4.1 individuals per survey on average. A rising figure with flat richness means the same few taxa are becoming more abundant rather than the community broadening, which is the pattern that precedes an urchin-dominated reef.

Invertebrate grazers now outnumber herbivorous fish here (21.5 urchins against 10.8 herbivorous fish per survey, damselfish set aside). Urchins and herbivorous fish are partial substitutes, but not equivalent: urchins graze slowly and erode limestone as they feed, so a reef whose grazing has shifted to invertebrates loses algae and framework at the same time. It is also a less stable arrangement, because urchin populations boom and crash on disease in a way fish populations do not. Giant clams at 1.07 per survey are present in numbers that suggest the site is not being systematically gleaned. They are among the first taxa to disappear under collection pressure, so their presence is a more informative sign than total density.

SALAG MPA

Tourism Value



Touristic Species		Mean Encounter Rate (%)	
Barracudas	2.3	Scorpaenidae	57.9
Cephalopods	10.3	Sharks	0
Cowries	12.6	Shrimps	55.7
Eels and Snakes	24.6	Slugs	83.8
Frogfish	0	Stingrays	7.5
Giant Clams	68.2	Syngnathidae and Pegasidae	7.5
Porcupinefish and Pufferfish	89.1	Turtles	6.5

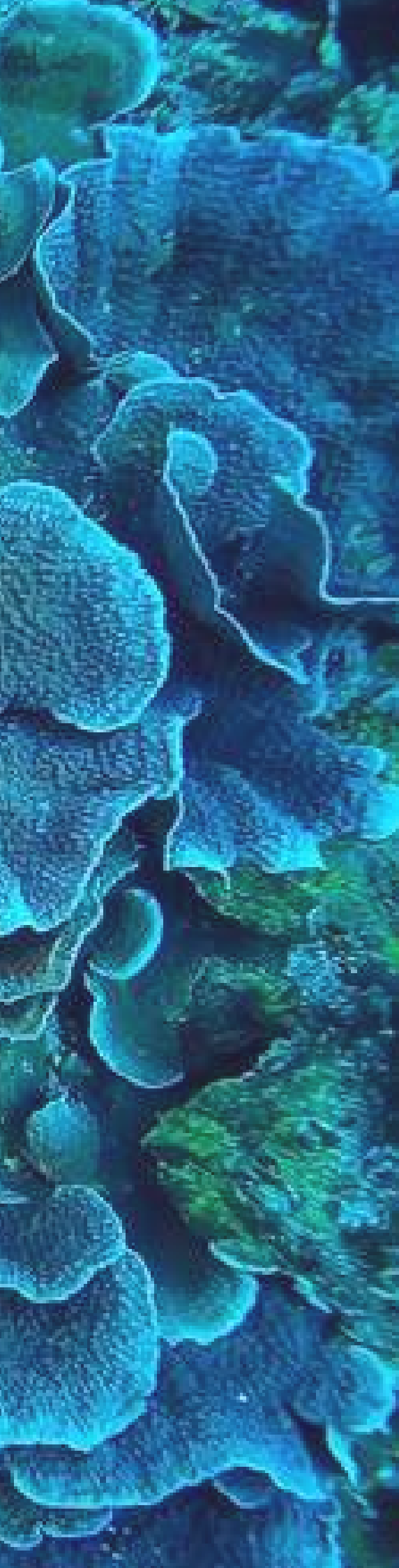
Touristic species encounter rates. The percentage of dives at Salag in which each touristic group was recorded, current reporting period.

Salag MPA is renowned for its fascinating underwater topography and landscape. Large-scale features, such as coral bommies and small canyons, make for rewarding diving and highlight the site's potential for dive tourism. It is also the location of 'Hidden Beach', an already established and popular destination, providing a strong opportunity to connect terrestrial and marine tourism experiences.

Salag provides strong tourism value for divers interested in reef biodiversity and macrofauna, with particularly high encounter rates for porcupinefish and pufferfish (89.1%), slugs (83.8%) and giant clams (68.2%). The giant-clam rate is the highest in the municipality by thirteen points and well above the Siaton average of 49.6%, and it is the single clearest reason to dive this site. These are complemented by frequent sightings of Scorpaenidae (57.9%) and shrimps (55.7%), providing consistent opportunities for macro divers and underwater photographers. Cephalopods (10.3%) also contribute to the site's appeal, while eels and snakes (24.6%), cowries (12.6%) and syngnathids and pegasids (7.5%) provide additional diversity.

Megafauna encounters remain limited, although stingrays (7.5%) were recorded relatively frequently compared with the other monitored sites and represent the highest stingray encounter rate in the municipality. Turtles were recorded in only 6.5% of dives, the lowest rate among the four sites, while barracudas were rare (2.3%), also the lowest in the municipality. No sharks or frogfish were recorded during the monitoring period. The continued low frequency of turtle sightings may reflect the limited availability of surrounding seagrass habitat, which can provide important foraging habitat for turtles.

Salag continues to stand out within Siaton Municipality for its particularly strong benthic and invertebrate diversity. It recorded the highest encounter rates in the municipality for giant clams, slugs and stingrays, and the lowest for barracudas, turtles, syngnathids and pegasids, cowries, and eels and snakes, while frogfish were not recorded. These results give Salag a distinctive tourism profile centred on abundant benthic and macrofaunal species rather than large charismatic or pelagic fauna, supported by its distinctive underwater topography and proximity to Hidden Beach.



GLOSSARY

Benthic: Relating to the bottom of the sea or the organisms that live there.

Biomass: The total mass of living organisms in a given area, here estimated as weight (kg) of fish per survey area.

Bleaching: Loss of symbiotic algae from coral tissue due to stress (typically heat), causing corals to turn white.

Corallivore: An organism that feeds on coral, such as butterflyfish.

Detritivore: An organism that feeds on dead organic matter (detritus).

Diadema: A genus of long-spined sea urchins that are important algae grazers on coral reefs.

Ecosystem Engineer: A species that significantly modifies its habitat, affecting other species (e.g. sea urchins, giant clams).

Herbivore: An organism that feeds on plants/algae. On reefs, herbivorous fish control algae growth.

MPA: Marine Protected Area — a designated zone where human activities are restricted to protect marine life.

Rubble: Broken fragments of dead coral on the reef substrate, often from storm damage or destructive practices.

Spillover Effect: The movement of fish from inside an MPA to surrounding fishing grounds, benefiting local fisheries.

Trophic Group: A classification of organisms by their diet/feeding behaviour within the food web.

SITES SUMMARY

Every Siaton site on the same indicators for the current reporting period, so the sites can be read against each other and against the municipal average. Municipal figures are the mean of the site values, so a site above the municipal figure is above its own municipality's average, not a national benchmark.

Site	Andulay	Antulang	Kookoos	Salag	Siaton Average
Hard Coral (%)	25.1	22.7	34.6	28.1	27.6
Macroalgae (%)	7.2	19.4	19.3	19.8	16.4
Rubble (%)	21.1	7.3	7.4	5.3	10.3
Bleaching (% coral)	3.22	1.84	1.68	2.35	2.27
Commercial Biomass (kg / 150 m ²)	14.12	9.59	7.09	12	10.7
Fish Density (ind / 150 m ²)	794	952	522	591	715
Invertebrate Density (ind / 150 m ²)	40.5	48.4	36	36.7	40.4
Invertebrate Species Richness (species / 150 m ²)	11.8	12.1	10.5	9	10.8
Predators (ind / 150 m ²)	57.7	51.7	39.2	36.2	46.2
Marine Debris (pieces/150 m ²)	1.49	1.39	4.38	3.77	2.76

Where the Sites Differ:

- **Hard coral (%)** — best at Kookoos (34.6), worst at Antulang (22.7)
- **Macroalgae (%) (lower is better)** — best at Andulay (7.2), worst at Salag (19.8)
- **Rubble (%) (lower is better)** — best at Salag (5.3), worst at Andulay (21.1)
- **Bleaching (% coral) (lower is better)** — best at Kookoos (1.68), worst at Andulay (3.22)
- **Comm. biomass (kg)** — best at Andulay (14.12), worst at Kookoos (7.09)
- **Fish density** — best at Antulang (952), worst at Kookoos (522)
- **Invert density** — best at Antulang (48.4), worst at Kookoos (36.0)
- **Invert richness** — best at Antulang (12.1), worst at Salag (9.0)
- **Predators (lower is better)** — best at Salag (36.2), worst at Andulay (57.7)
- **Marine debris (lower is better)** — best at Antulang (1.39), worst at Kookoos (4.38)

Sites that Stand Apart:

Sites differing from the municipal average by half or more on any indicator:

- **Andulay** — macroalgae (%) 56% below the municipal figure (favourable); rubble (%) 105% above the municipal figure (unfavourable)
- **Kookoos** — debris 59% above the municipal figure (unfavourable)

Sites Carrying the Flags

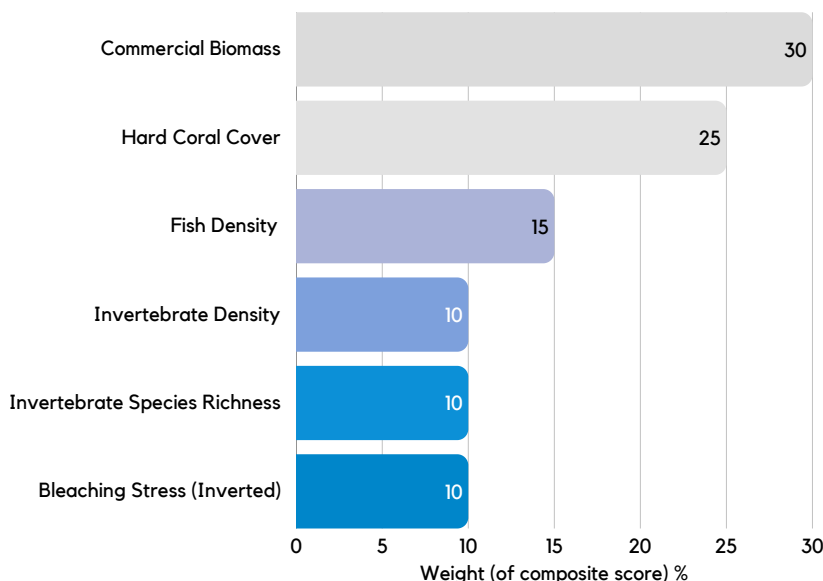
From the rule-based flagging at the top of this report, the following sites met two or more criteria:

- **Andulay** — macroalgae cover substantially higher (+52%); rubble substantially higher (+36%); marine debris substantially higher (+64%)
- **Kookoos** — macroalgae cover substantially higher (+37%); marine debris substantially higher (+81%)
- **Salag** — macroalgae cover substantially higher (+75%); bleaching (of hard coral) substantially higher (+33%)

MUNICIPAL SITE PERFORMANCE RANKING

This ranking evaluates the 4 Siaton sites against each other using a composite weighted model. Rather than averaging the indicators equally, it weights them by their relative ecological and socio-economic importance, so that the measures most closely tied to management success carry the most influence.

Weighted Score = Σ (indicator rank $\times$ weight). Lower is better, because rank 1 is the best on an indicator. A site ranking first on everything would score 1.00.



Weighted Model Breakdown. Indicator weights in the Siaton site performance ranking. The weighted score is the sum of each indicator rank multiplied by its weight, so commercial biomass and hard coral cover together decide 55% of where a site lands. Bleaching is inverted, so the least-bleached site ranks first on it. Weights are set by MCP and reflect management priority, not statistical importance.

The Weights and Why

Indicator	Weight	Rationale
Commercial Biomass	30%	Heavily weighted to reflect MPA enforcement strength, spillover potential and functional fishery recovery.
Hard Coral Cover	25%	The fundamental baseline for structural complexity, nursery habitat and overall reef resilience.
Fish Density	15%	Tracks general community abundance, recruitment success and trophic diversity.
Invertebrate Density	10%	Assesses macro-invertebrate population health — e.g. grazing sea urchins, giant clams, sea cucumbers.
Species Richness	10%	A proxy for benthic biodiversity and ecological niche availability.
Bleaching	10%	Measures acute thermal vulnerability. Inverted, so sites with lower bleaching rank higher and climate-resilient microclimates are rewarded.

Site Ranking

Site Rank by Indicator. Every Siaton site ranked on each of the six indicators in the composite, current reporting period. Note: Individual indicator ranks are in parentheses alongside site metrics. Lower weighted scores denote superior overall performance. This is the composite taken apart: a site can lead on habitat and trail on fish stock in the same row, which the single weighted score cannot show.

	Andulay	Antulang	Kookoos	Salag
Status	MPA	Non-MPA	Non-MPA	MPA
Commercial Biomass (kg / 150 m²)	14.12 (1)	9.59 (3)	7.09 (4)	12.00 (2)
Hard Coral Cover (%)	25.1 (3)	22.7 (4)	34.6 (1)	28.1 (2)
Fish Density (ind / 150 m²)	794 (2)	952 (1)	522 (4)	591 (3)
Invertebrate Density (ind / 150 m²)	40.5 (2)	48.4 (1)	36.0 (4)	36.7 (3)
Invertebrate Species Richness (species / 150 m²)	11.8 (2)	12.1 (1)	10.5 (3)	9.0 (4)
Bleaching (%)	3.22 (4)	1.84 (2)	1.68 (1)	2.35 (3)
Weighted Score	2.15	2.45	2.85	2.55
Final Rank	1	2	4	3

Key Findings

- **Andulay** takes the overall top rank with a weighted score of 2.15, as a protected site. It leads the municipality on Commercial biomass.
- **Antulang** leads on invertebrates (48.4 per survey, 12.1 species) while ranking 4 on hard coral cover (22.7%). Invertebrate abundance tracks habitat type and harvesting pressure more than coral cover, so the two need not move together.
- **Kookoos (non-MPA)** ranks 1 on hard coral cover (34.6%) but only 4 on commercial biomass (7.09 kg per 150 m²). Good benthic habitat is not translating into standing fish stock, which is the signature of extraction on a reef that still has the structure to support more.
- Protected sites average rank 2.0 against 3.0 for the unprotected ones, so on this composite the MPAs are ahead. That is what protection is supposed to produce, though habitat and depth differ between sites and the comparison is not controlled.
- **Kookoos** sits last at 2.85, weakest in the municipality on Commercial biomass, Fish density and Invertebrate density.

Priority Action Plan

- **Watch thermal stress at Andulay.** Bleaching is 3.22% of hard coral, the highest in Siaton. Track it against the sea-temperature record and check whether the site has a local reason for higher exposure.
- **Evaluate Kookoos for formal protection.** It carries 34.6% hard coral, among the highest in Siaton, with no formal protection and commercial biomass at 7.09 kg per 150 m². High-quality benthic habitat left open to extraction is the clearest case for a closure or a seasonal restriction.

MPA VS. NON-MPA

Siaton has two protected sites, **Andulay** (6 ha, declared 1993) and **Salag** (10 ha, declared 2001), and two unprotected reference sites, **Antulang** and **Kookoos**. Two against two is the most balanced comparison in the program, and it is the most direct test this monitoring can offer of whether protection is doing what it is meant to do.

Protected against unprotected sites. Mean of the site values for each group, current reporting period. Differences are not controlled for depth, exposure, reef type or history, and the sites were assigned to protection decades ago on grounds unrelated to survey design, so the comparison is indicative rather than a test.

Indicator	MPAs (Andulay, Salag)	Non-MPA (Antulang, Kookoos)	Difference
Commercial fish biomass (kg / 150 m ²)	13.06	8.34	+57% in MPAs
Hard coral cover (%)	26.6	28.7	−7%
Macroalgae cover (%)	13.5	19.4	−30% (favourable)
Rubble (%)	13.2	7.4	+80% (unfavourable)
Bleaching (% of hard coral)	2.79	1.76	+58% (unfavourable)
Total fish density (ind / 150 m ²)	693	737	−6%
Invertebrate density (ind / survey)	38.6	42.2	−9%
Invertebrate species richness (species / survey)	10.4	11.3	−8%
Coral predators (ind / survey)	47	45.5	3%
Marine debris (items / survey)	2.63	2.88	−9% (favourable)
Mean rank on the weighted composite	2	3	MPAs ahead

Commercial biomass is where protection shows. The 57% gap is the largest difference in the table and it is in the one indicator protection actually acts on: what gets taken off the reef. Biomass matters more than numbers here, because weight rises with roughly the cube of length, a reef holding many small fish and one holding fewer large ones can report the same density while offering very different catches. Higher biomass inside a reserve is also the mechanism behind spillover, by which adults and larvae cross the boundary into the surrounding fishery.

Total fish density does not show the same gap — it is marginally higher at the unprotected sites. That is not a contradiction. Density counts individuals regardless of size or food value and is dominated by damselfish and schooling planktivores, whose abundance tracks current and plankton supply rather than fishing pressure. Biomass and density answer different questions, and biomass is the one that answers this one.

On benthic condition the MPAs are level or behind, and that is not evidence against them. Protection restricts extraction; it does not restrict storms, thermal stress or sediment. The clearest demonstration is inside the protected pair itself: Andulay carries 21.1% rubble and Salag 5.3%, the two extremes of the municipal range, both protected. The physical indicators are set by exposure and habitat, not by management status.

The comparison is not controlled and should not be read as a trial. Four sites, assigned to protection decades ago on grounds that had nothing to do with statistical design, differing in depth, exposure, reef type and distance from landing sites. Andulay has 29 seasons on record and Salag 21. The honest statement is that the biomass difference is consistent with the MPAs contributing to higher standing stock, alongside site differences that pre-date protection.

What would strengthen the test. The two unprotected sites are not equivalent controls. Kookoos has the best coral cover in the municipality (34.6%) and the lowest commercial biomass (7.09 kg per 150 m²), the pattern of a good reef under extraction, not of a natural reference condition. Protecting Kookoos would leave Siaton with three MPAs and one reference site and weaken this comparison further, but the reef would almost certainly be better off. That trade is worth naming rather than leaving implicit.



DATA NOTES AND DISCLAIMERS

Reading the figures. Three conventions apply throughout and are not repeated under each figure. **Whiskers are 95% confidence intervals** for the average the point or bar shows, calculated from the individual surveys behind it; no whisker is drawn where fewer than three surveys contributed, because an interval from two dives is arithmetic rather than information.

Coral predator thresholds. The dashed rules on the predator figures are MCP's own management thresholds, not statistical ones: for *Drupella* and *Coralliophila*, which share a threshold set and an axis, alert 15, outbreak 37.5 and extreme 75 individuals per survey. Crown of Thorns is charted separately because its thresholds, alert 0.1125, outbreak 0.225, extreme 0.45 per survey, are roughly a hundred times lower and are not proportional to the snail ones, so putting both on one scale would make whichever series is not being read invisible.

Bleaching figures combine partially and fully bleached records.

Survey design, and what the error bars mean. Surveys are randomly located within three depth strata, shallow, medium and deep, at each site, with effort targeted evenly across the three. Depths are pooled in every figure in this report; because the strata are sampled at close to equal effort, the pooled average needs no reweighting. The whiskers on the figures are 95% confidence intervals for the average, calculated from the individual surveys behind each point. They describe how well the average is pinned down, not how variable the reef is from dive to dive. Two intervals that do not overlap indicate a real difference; two that do overlap are not proof that there is no difference, because the correct test is on the difference between the averages rather than on the overlap. Where a point rests on fewer than three surveys no interval is drawn, because an interval from two dives is arithmetic rather than information. Municipal averages carry the survey-level uncertainty propagated through the average of the sites, they describe how well the average of these monitoring sites is known, and the sites are the program's fixed stations rather than a random sample of the municipality's reefs.

Survey effort is not equal across sites. Some sites carry many more surveys than others, and some have fewer zones or depth ranges. Every figure in this report is an average per survey rather than a total, so effort differences do not inflate a site's numbers, but sites with few surveys carry more uncertainty and their season-to-season movement should be read cautiously.

Baseline lengths differ. Mojon and the Santa Catalina sites entered the program recently and have far shorter records than the established Zamboanguita and Siaton sites. Where a site has fewer than eight surveyed seasons its data is shown as bars rather than a trend line, because a line through a handful of points implies a trajectory the data cannot support.

The COVID-19 gap. Monitoring was suspended for eight consecutive seasons, March 2020 to February 2022. This appears as a shaded band on every long-term chart, drawn to the true width of the gap, and no values are plotted inside it.

DATA NOTES AND DISCLAIMERS



Damselfish were added to the protocol in 2022. They now account for roughly two thirds of all individuals counted. Including them makes total fish density appear to double across the COVID gap when, on a consistent species set, it has declined by about a fifth. Both are quoted because damselfish entered the survey protocol only in 2022, the inclusive total is what the survey counts today, and the damselfish-excluded figure is the only one that can be read against the 2017–19 baseline or across the COVID gap.

Two definitions changed for this edition and are not comparable with earlier reports: macroalgae is now macroalgae alone rather than macroalgae plus turf, and bleaching is a share of hard coral rather than of all substrate points, which makes it read three to four times higher on identical observations.

Species richness is now the average number of distinct species per survey. Earlier editions divided a pooled species list by the number of surveys, producing a figure that fell as survey effort rose. The two are not comparable.

Commercial biomass is now a per-survey average. Earlier editions reported a multi-survey total labelled as an average, which scaled with the number of dives carried out.

Lutoban North and South are combined into a single reporting site, as in previous editions. South has a sparser early record, so the combined figure is weighted towards North in the earliest seasons.

Biomass is an index, not a yield. It is estimated from visual length and count records using published length–weight relationships, and indicates standing stock rather than harvestable catch.

Touristic value is presence-based. Encounter rate is the percentage of dives in which a group was seen at least once, regardless of how many individuals were present. The dataset begins in December 2024.

Observer variation. Surveys are carried out by different divers over the years. Training and protocols are standardised, but some between-observer variation is unavoidable.

Disturbance events this period. Two super typhoons crossed the area in July 2026, **Super Typhoon Inday** and **Super Typhoon Kiyapo**, both inside the Jun–Aug 2026 season and therefore inside the second half of this reporting period. Because every figure in this report averages Mar–May and Jun–Aug together, a storm effect is diluted by the pre-storm season and will read as a smaller movement than it was. The Jun–Aug season alone is in the workbooks for anyone who needs the post-storm figure on its own.

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):

A note on how these are used. Dietary groups drive the fish composition figures; a species carrying two groups is counted in the first listed so the shares total 100%. The commercial flag drives commercial density and biomass.

Category	Dietary Group
Angelfish - Bicolour	Herbivore
Angelfish - Keyhole	Herbivore
Angelfish - Midnight	Herbivore
Angelfish - Other	Omnivore
Angelfish - Pearl Scale	Herbivore
Anthias	Planktivore
Barracuda	Carnivore
Big Eye	Carnivore
Bream	Carnivore
Bristletooth	Detritivore
Butterflyfish	Corallivore
Damselfish	Herbivore
Damselfish - Sergeantfish	Planktivore
Emperor	Carnivore
Emperor - Longface	Carnivore
Fusiliers	Planktivore
Goatfish	Carnivore / Omnivore
Grouper - Barramundi	Carnivore
Grouper - Brown-Marbled	Carnivore
Grouper - Other	Carnivore
Moorish Idol	Omnivore
Needlefish	Carnivore
Parrotfish - Bumphead	Herbivore
Parrotfish - Other	Herbivore
Parrotfish - Raggedtooth	Herbivore
Parrotfish - Stareye	Herbivore
Pufferfish - Other	Omnivore
Pufferfish - White Spotted	Omnivore
Rabbitfish	Herbivore / Omnivore

Category	Dietary Group
Sea Ray	Carnivore
Sea Snake	Carnivore
Snapper	Carnivore
Soldierfish	Carnivore
Spadefish	Omnivore
Squid	Carnivore
Surgeonfish - Brushtail Tang	Herbivore
Surgeonfish - Other	Herbivore / Omnivore
Surgeonfish - Whitetail	Planktivore
Surgeonfish - Yellowmask	Omnivore
Sweetlips	Carnivore
Trevally	Carnivore
Trevally - Scad	Carnivore / Planktivore
Triggerfish - Other	Carnivore
Triggerfish - Redtooth	Planktivore
Triggerfish - Titan	Carnivore
Tuna - Long-Jawed Mackerel	Planktivore
Tuna - Other	Carnivore
Turtle - Green	Herbivore / Omnivore
Turtle - Hawksbill	Omnivore
Turtle - Other	Omnivore
Unicornfish - Blue-Spine	Herbivore
Unicornfish - Orange-Spine	Herbivore
Unicornfish - Other	Planktivore
Wrasse - Cleaner	Parasitivore / Carnivore
Wrasse - Humphead	Carnivore
Wrasse - Other	Carnivore / Omnivore

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.

Coral Growth Forms

Resilience is MCP's classification of how well each form withstands disturbance.

Hard Coral	Resilience
Branching	Low
Columnar	Medium
Encrusting	Low
Massive	High
Plating	Low
Solitary	High
Submassive	Medium
Tabulate	Low
Tubastraea	Low

Coral Condition

Recorded against a coral point to describe its state.

Health and Vulnerability
Bleaching - Fully
Bleaching - Partially
Coral Disease
Infestation - Flatworm
Infestation - Terpios Sponge
Predation - COT
Predation - <i>Coralliophila</i>
Predation - <i>Drupella</i>
Recently Killed
Silt

Other Benthic Categories

Everything else scored on the point-intercept transect.

Benthic Categories	
Algae	Sessile Invertebrates
Coralline	Barrel Sponge
<i>Halimeda</i>	Encrusting Sponge
Filamentous	Irregular Sponge
Macroalgae	Ascidian
Turf	Encrusting Ascidian
Soft Coral	Bryozoan
Soft Coral	Substrate
Gorgonian	Giant Clam
Organ Pipe	Live Coral Fragment
Other Cnidarians	Rock
Anemone	Rubble
Corallimorph	Sand
Hydroid	
Zoanthid	

PREDATION & MARINE DEBRIS MONITORING

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

The following is our complete predation and marine debris indicator list. Three coral predators and 24 debris categories. Corallivores and debris are both recorded on the predation survey.

Coral Predators

Category	Scientific name	Feeding group
<i>Coralliophila</i>	<i>Coralliophila</i> spp.	Corallivore
Crown of Thorns (COTS)	<i>Acanthaster planci</i> species complex	Corallivore
<i>Drupella</i>	<i>Drupella</i> spp.	Corallivore

Marine Debris

Category	
Cigarette Butts	Metal
Diapers and Nappies	Other
Electronics	Paper and Card
Fish Cage (in use)	Plastic Bag
Fish Cage (not in use)	Rope
Fishing Line	Hard Plastic (Other)
Fishing Net	Soft Plastic (Other)
Ghost Net	Soft Plastic Drinking Bag
Glass and Ceramics	Soft Plastic Straw
Hard Plastic Bottle	Soft Plastic Wrapper
Hard Plastic Cutlery	Textiles & Bags
Hard Plastic Toys	(Nothing Found)

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.

Key:

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

The following is our complete invertebrate indicator list. Invertebrate functional groups overlap, so a species can appear in more than one and the group densities do not sum to total invertebrate density.

Category	Functional Groups				
	Co	E	I	B	Ch
Echinoderms					
Sea Star					
Cushion Star					
Urchin - Collector					
Urchin - Diadema					
Urchin - Other					
Urchin - Rock Boring					
Sea Cucumber - Amberfish					
Sea Cucumber - Black Spotted					
Sea Cucumber - Sandfish					
Sea Cucumber - Leopard					
Sea Cucumber - Magnum					
Sea Cucumber - Other					
Sea Cucumber - Pinkfish					
Sea Cucumber - Volcano					
Gastropods					
Conch - Other					
Scorpion Spider Conch					
Giant Turban					
Turban - Other					
Nilo Top					
Top - Other					
Triton's Trumpet					
Horned Helmet					
Cone Shell					
Common Egg Cowrie					
Cowrie - Other					
Tiger Cowrie					
Other Shell					
Slugs					
Nudibranch					
Headshield Slug					
Sapsucking Slug					
Flatworm					

Category	Functional Groups				
	Co	E	I	B	Ch
Bivalves					
Giant Clam					
Giant Boring Clam					
Thorny Oyster					
Pearl Oyster					
Pen Oyster					
Honeycomb Oyster					
Scallop					
Other Bivalve					
Arthropods					
Banded Coral Shrimp					
Cleaner Shrimp - Other					
Harlequin Shrimp					
Shrimp - Other					
Mantis Shrimp					
Lobster					
Crab					
Cephalopods					
Blue-ringed Octopus					
Octopus - Other					
Cuttlefish - Other					
Flamboyant Cuttlefish					
Benthic Fish(Ish)					
Eel					
Ribbon Eel					
Pipefish					
Seahorse					
Frogfish					
Lionfish					
Scorpionfish					
Porcupinefish					
Blue Spotted Stingray					
Blue Spotted Ribbontail Ray					



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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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