

BANYAN TREE MARINE LAB

2019

ANNUAL REEF REPORT

MALDIVES, NORTH MALE ATOLL



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BANYAN TREE

FINDINGS AT A GLANCE 2019



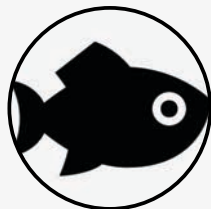
A continued decrease in live coral cover was recorded across a majority of the sites.



Vabbinfaru and Ihuru house reefs continued to show a decrease in turf algal cover and an increase in bare rock at all depths.



Coral recruitment density increased on average by 3.5 recruits per square meter since 2018.



Parrotfish biomass increased at most sites. Surgeonfish, butterflyfish and groupers biomass showed little change.

REEF MONITORING

WHAT? Long term data is required to understand natural and human induced change in ecosystems, including impact, recovery and resilience assessments needed for effective conservation. Implemented in 2015, the Banyan Tree Long Term Monitoring Program (BTLMP) collects baseline data from coral reefs using robust methods based on ReefCheck can be found [here](#).

WHY? Establishing baselines and understanding long-term change:

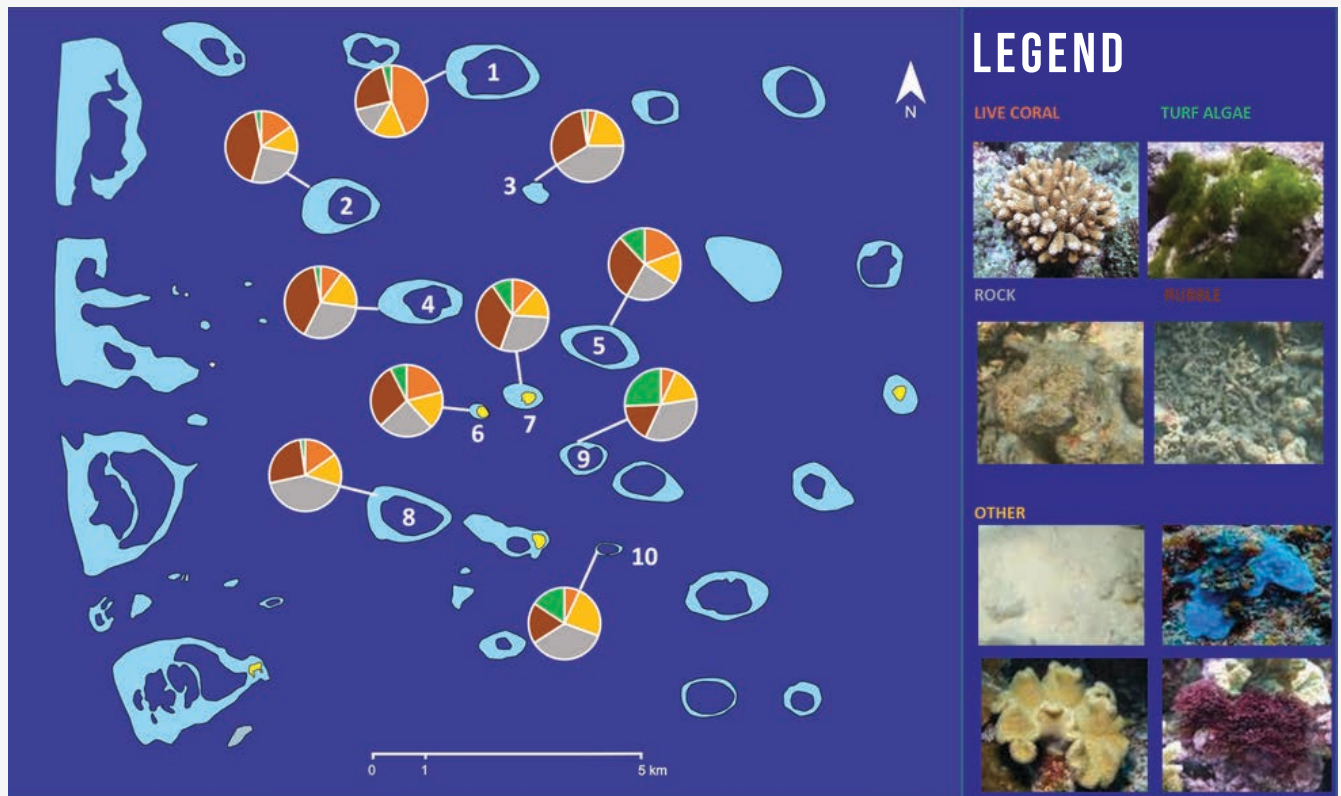
- Understand the state of reefs
- Identify changes in reef composition
- Identify coral bleaching patterns
- Monitor progress on reef recovery
- Support targeted reef restoration efforts
- Identify changes in abundance and biomass of important fish groups

REEF RECOVERY

In 2016 coral reefs suffered from the most severe bleaching event since the 1980's. Reefs that suffer significant mortality become smothered in algae and gradually break down. Successful reef recovery relies on grazing fish species, a robust larval supply and favorable recruitment conditions (water quality, clear substrate). Reefs may not return to the natural state but adapt to changing conditions, therefore it is important to monitor and record this information.



REEF CONDITION

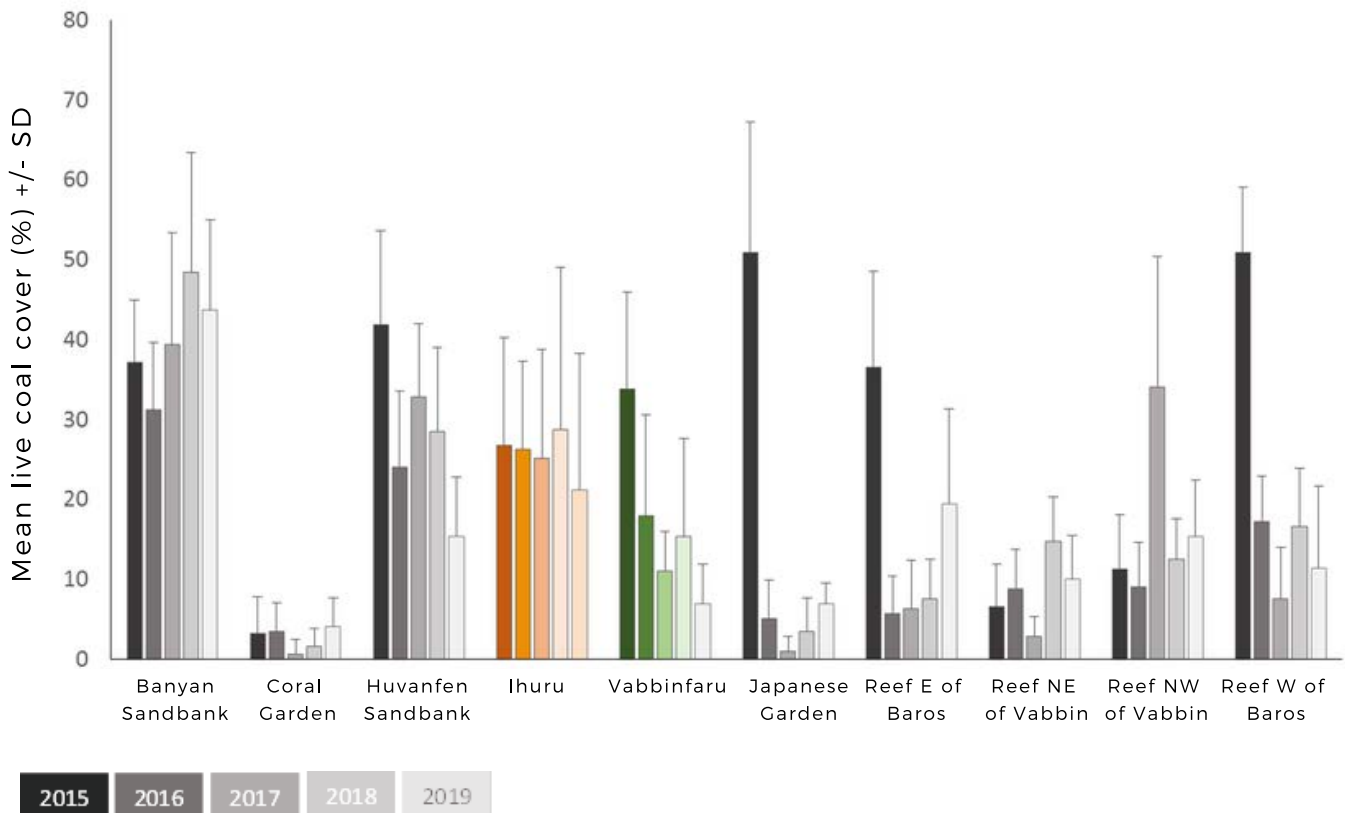


Benthic categories from 8 sights surveyed in North Male' Atoll: 1 Banyan Sandbank, 2 Huvanfen Sandbank, 3 Coral Garden, 4 Reef NW of Vabbinfaru, 5 Reef NE Vabbinfaru, 6 Ihuru, 7 Vabbinfaru, 8 Reef W of Baros, 9 Japanese Garden and 10 Reef E of Baros.

Compared to 2018 there was a notable decrease in turf and therefore, an increase in rock at all sites, especially Reef 3 and 8 with the highest percent rock cover (41.3% & 41.9% respectively). All the sites except Reef 1 were dominated by rock and rubble as reef three-dimensional structure continued to break down post-bleaching. Mean coral cover at all ten sites remained low (15.4%). Live coral cover was predominantly a single species, *Porites rus*. Similar to last year, Reef 1 had the highest mean live coral cover (43.7%) while Reefs 3, 9 and 10 remained below 7%. Coral cover is expected to increase in the coming years as more colonizable space is being made available.



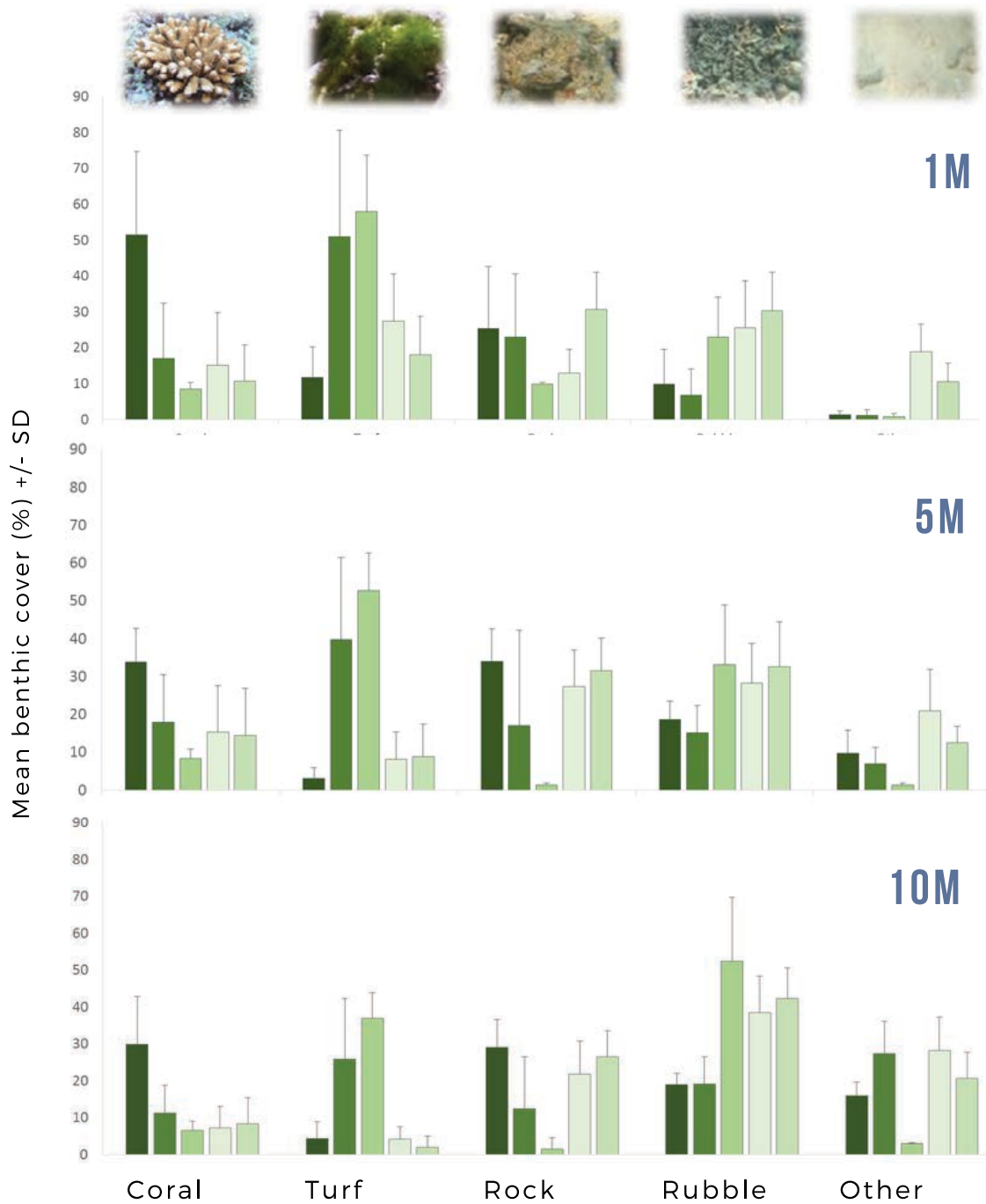
CHANGE IN CORAL COVER



Coral cover declined greatly after the 2016 bleaching event. Since, live coral cover increased from 2017 to 2018 was observed. In 2019, there was a decrease in mean live coral cover on 6 of the 10 sites surveyed. There was a mild bleaching event in 2019 which could explain the small decrease. Absolute mean live coral cover decline ranged from -4.7% since 2018 (Banyan Sandbank and NE of Vabbinfaru) to -13.1% (Huvanfen Sandbank). NW of Vabbinfaru exhibited the greatest increase in mean live coral cover from 2018 (11.9%). Although Coral Garden, Japanese Garden and E of Baros also showed an increase in live coral cover, the increase was low (+2.5%, +3.4% and +2.8% respectively).



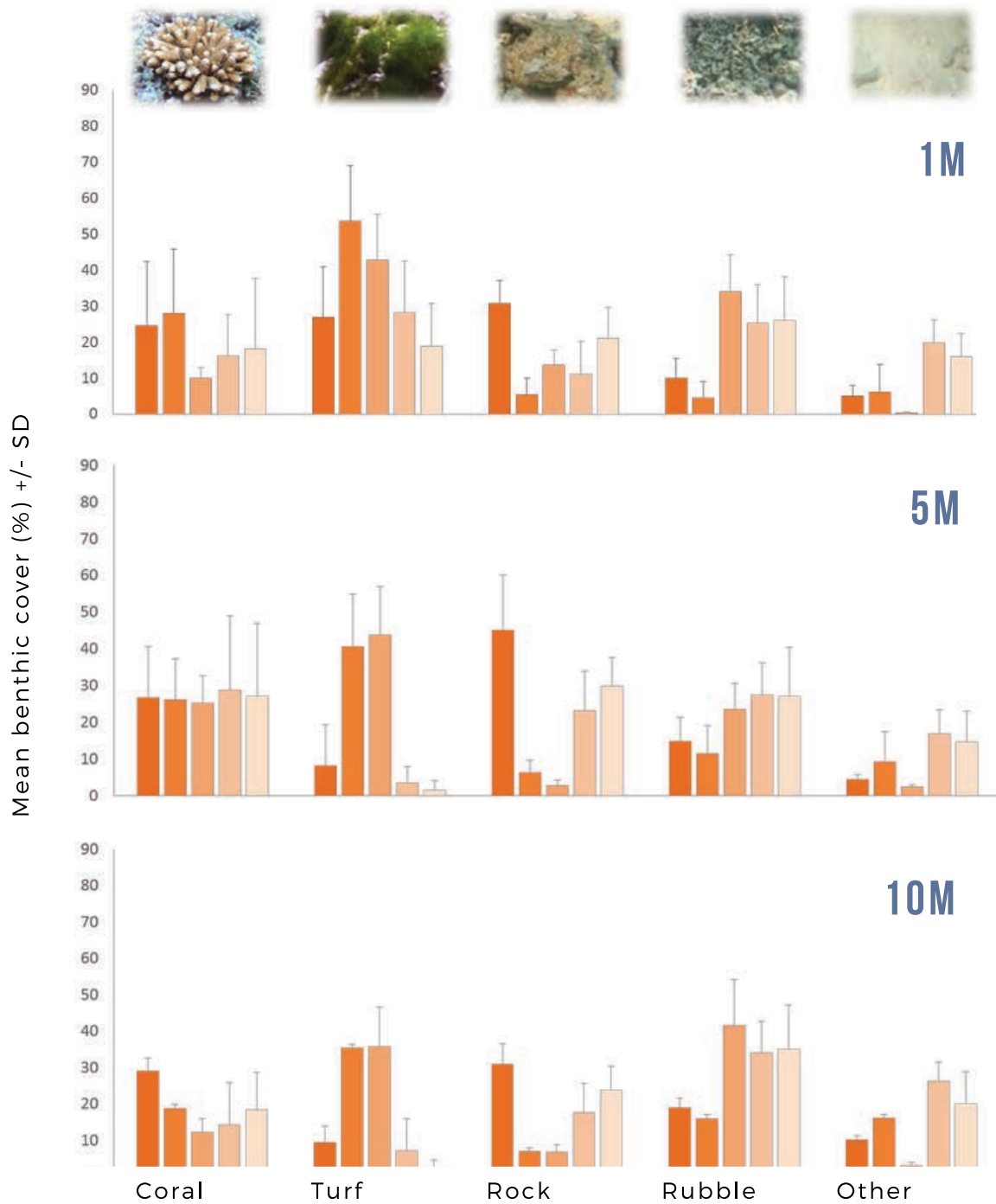
HOUSE REEF STATUS - VABBINFARU



2015 2016 2017 2018 2019

All depths surveyed exhibited an increase in bare rock and rubble cover. As the reef continues to degrade and break down, an increase in rubble is seen at all depths, Turf algae on the top reef decreased since the peak in 2017, giving space to bare rock, suggesting further signs of recovery after the bleaching in 2016. The complex nature of the reef before 2016 and the significant coral mortality suffered on Vabbinfaru could explain a relatively low rate of recovery.

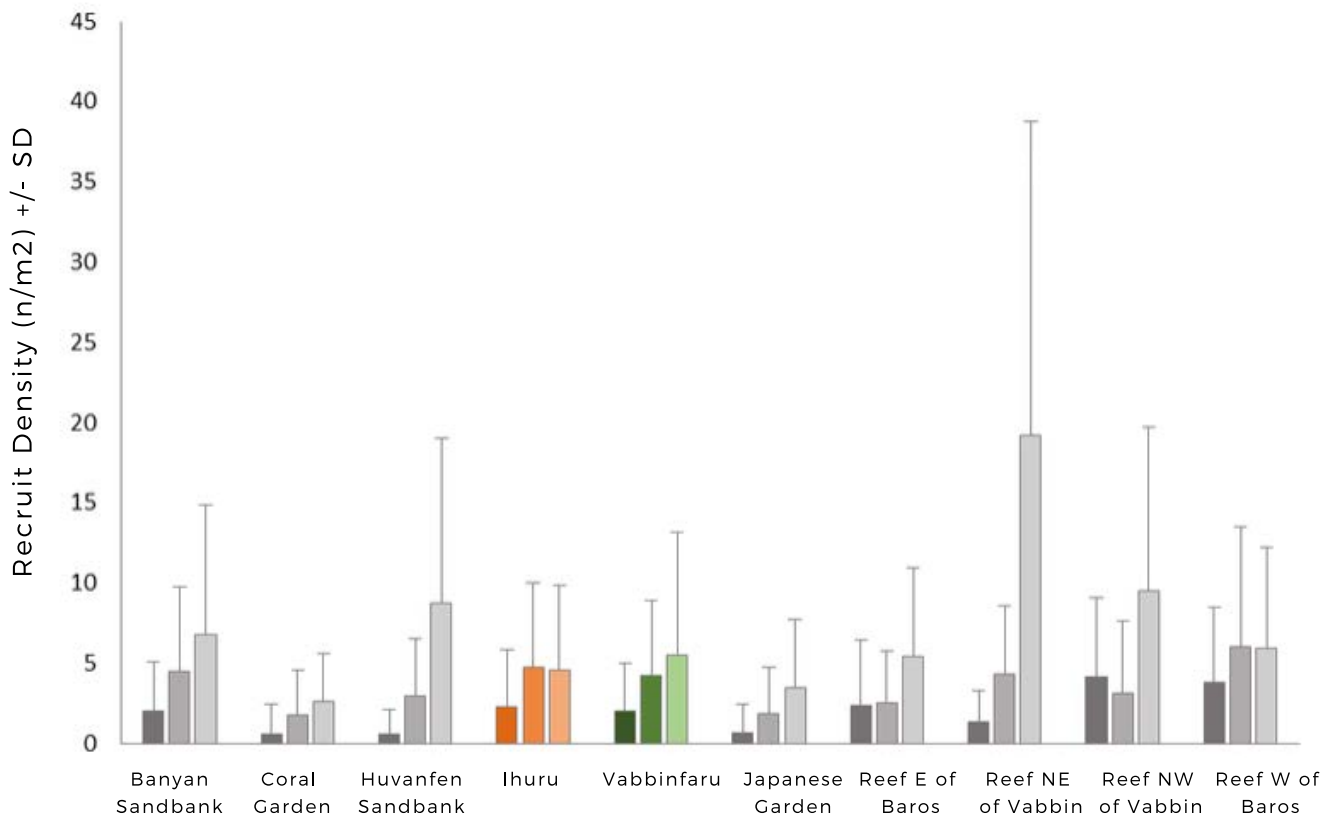
HOUSE REEF STATUS - IHURU



2015 2016 2017 2018 2019

A similar pattern was observed on Ihuru house reef, with a continued decrease in turf algae at all depths and an increase in bare rock. Rubble remained consistently high at all depths, suggesting the majority of the structural breakdown has already occurred and moving forwards the reef will start to consolidate again. There was little change in live coral cover at all depths and the majority of live coral cover was one species, *P.rus*.

CORAL RECRUITMENT

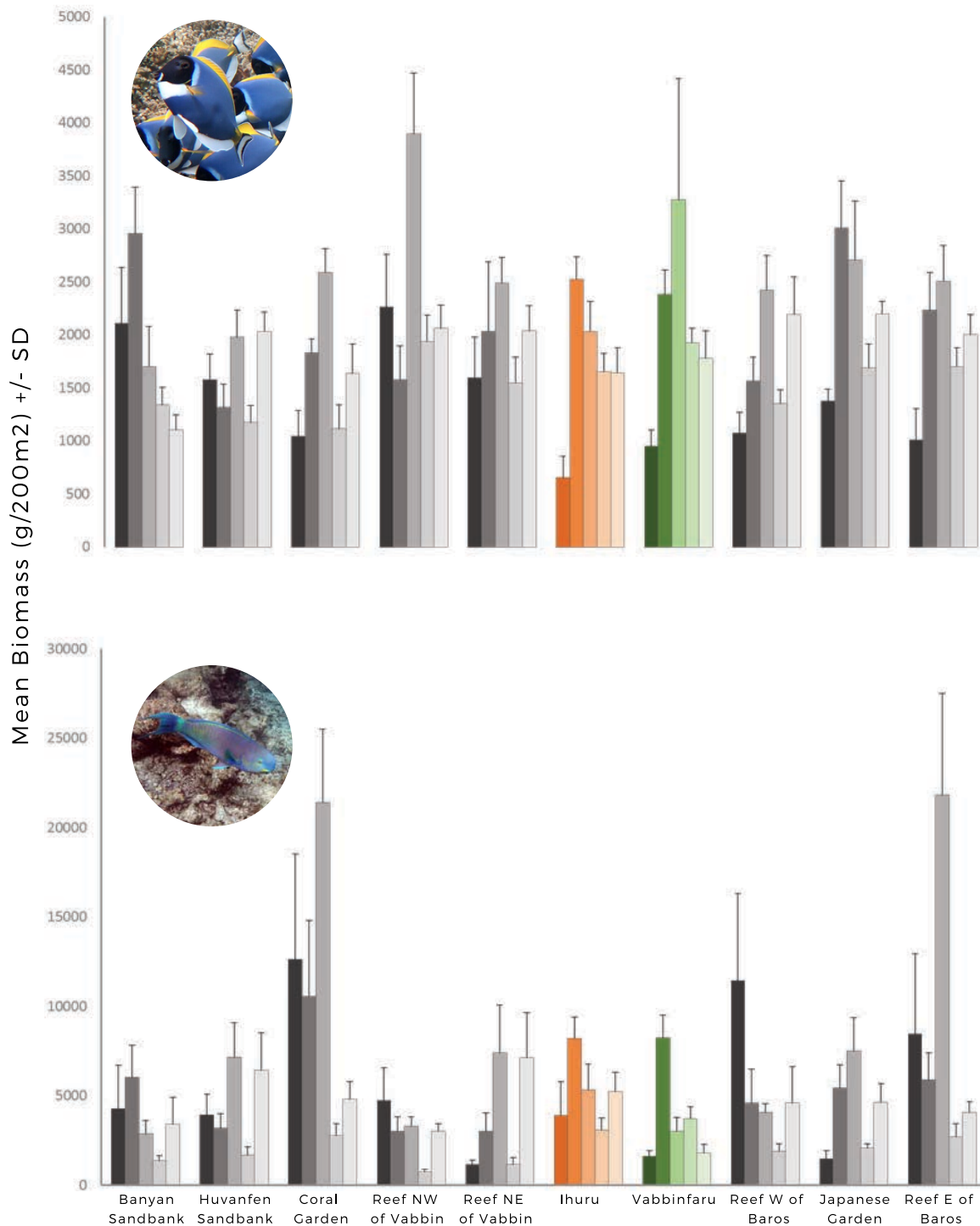


2015 2016 2017 2018 2019

Recruitment density refers to the number of juvenile corals that are found per square meter of colonisable space. This metric is an important indicator of reef recovery. Coral recruit density continued to increase at all sites; a positive sign for the reefs in North Male atoll. The reef NE of Vabbin exhibited the largest increase in recruit density, which also had an increase in surgeon and parrotfish (figure on page 8) compared to 2018. Herbivorous fish communities play a vital role in clearing the algae from the substrate, creating colonisable space for coral recruits.

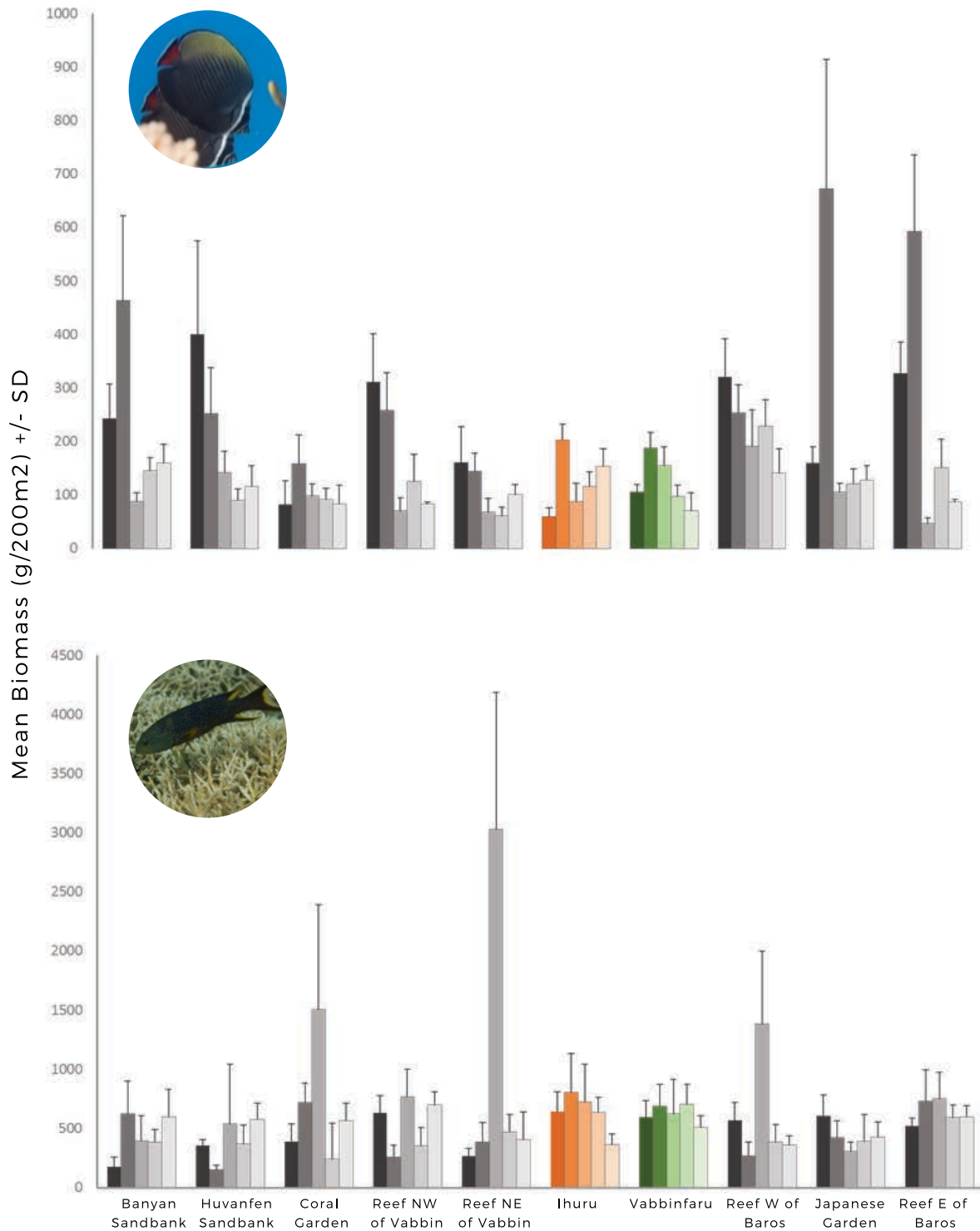


FISH COMMUNITIES



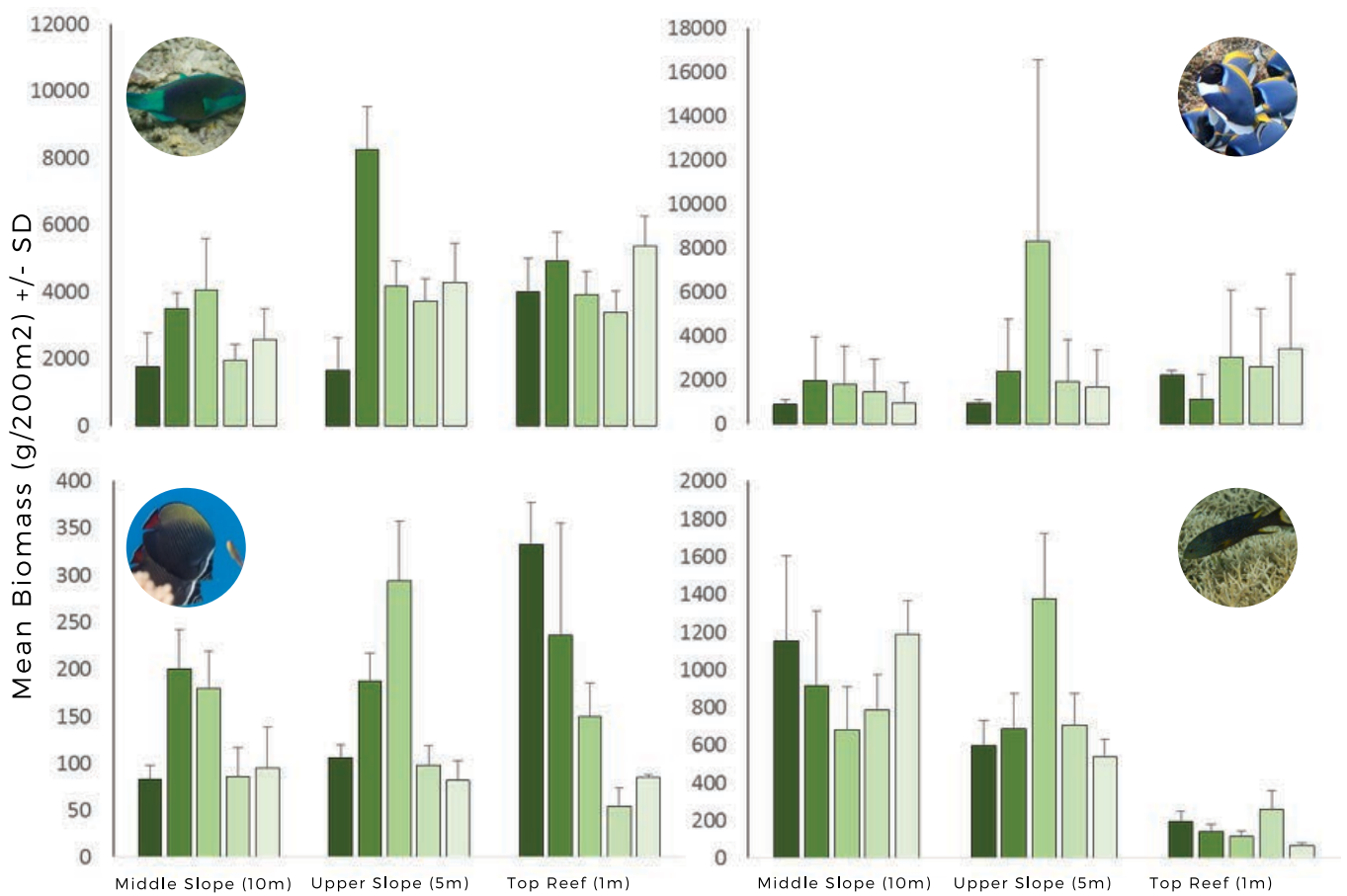
In general there were no major changes in the fish biomass from 2018 to 2019. Surgeonfish biomass remained relatively unchanged. The largest increase was recorded at Huvanfen Sandbank, which also displayed a large increase in coral recruits in 2019. Parrotfish biomass increased at all sites apart from Vabbinfaru. The largest increase at NE of Vabbinfaru may support the observed increase in coral recruits in 2019.

FISH COMMUNITIES



Little change was observed in the biomass of Butterflyfish, apart from a decline on Vabbinfaru, consistent with the decline in live coral. Grouper biomass has remained consistent.

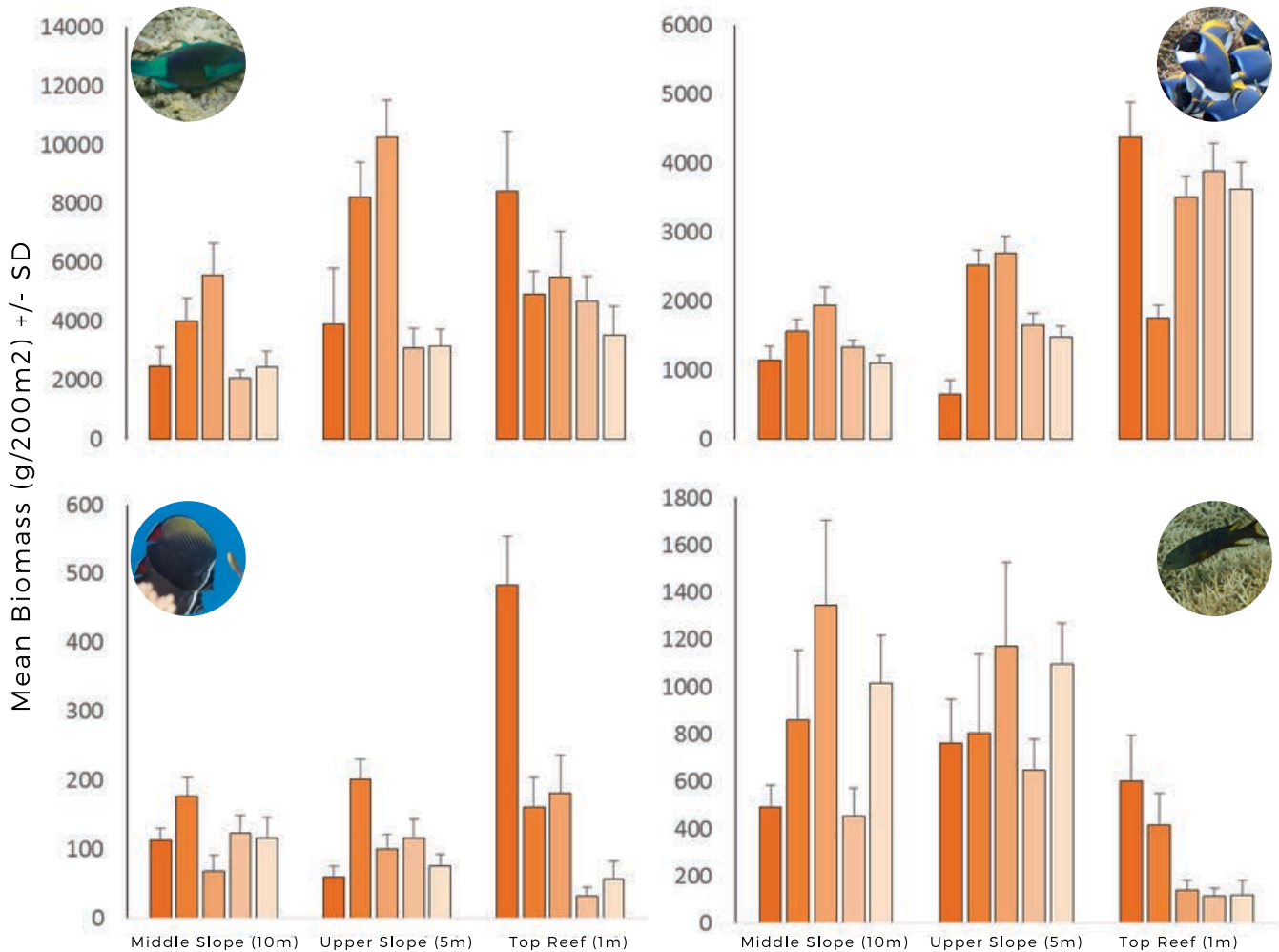
FISH COMMUNITIES - VABBINFARU



Fish communities responded to the bleaching event in 2016 with the biggest change noted with in the butterflyfish community, who feed directly on live coral. After 2016 there was a large decline, especially on the top reef. Now we see a stable but low biomass of butterflyfish. One year after the bleaching there was a large increase in surgeonfish, correlated with the increase in algae. The same can also be said for the parrotfish biomass. The grouper biomass remained consistent; however decline on the top reef in 2019 could indicate less food or less refuge.



FISH COMMUNITIES - IHURU



The changes in fish communities on Ihuru were similar to patterns on Vabbinfaru. The butterflyfish community exhibited a large decline on the top reef and migration to the upper slope in 2016. Surgeonfish and parrotfish communities both increased at 5m after the bleaching event due to increased availability of food (algae). Ihuru saw a spike in biomass 2017 for both families but Vabbinfaru was later in 2017. A large spike in parrotfish in 2017 was followed by a decrease in 2018 and 2019 once most of the algae had been cleared. After 2016 there was a decline in groupers on the top reef, similar to Vabbinfaru.

