



2018

ANNUAL REEF REPORT

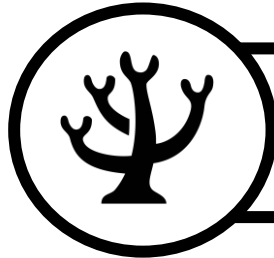
Maldives, North Male Atoll

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BANYAN TREE
GLOBAL FOUNDATION

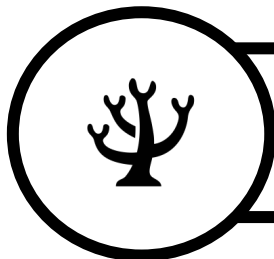
FINDINGS AT A GLANCE 2018



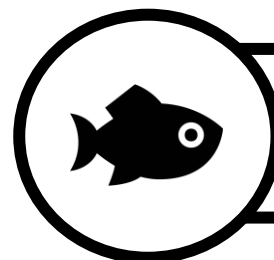
All ten reef sites surveyed exhibited positive signs of recovery, with live coral cover increasing for most sites.



For house reefs on Ihuru and Vabbinfaru, turf algal cover decreased while live coral and bare rock increased.



Mean recruit density increased at nine out of ten reef sites, exhibiting positive signs of recovery.



Biomass of herbivorous fish families (parrotfish and surgeonfish) decreased from 2017 across all reefs surveyed.



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 [<http://www.banyantreeglobalfoundation.com/biodiversity-environment/>]

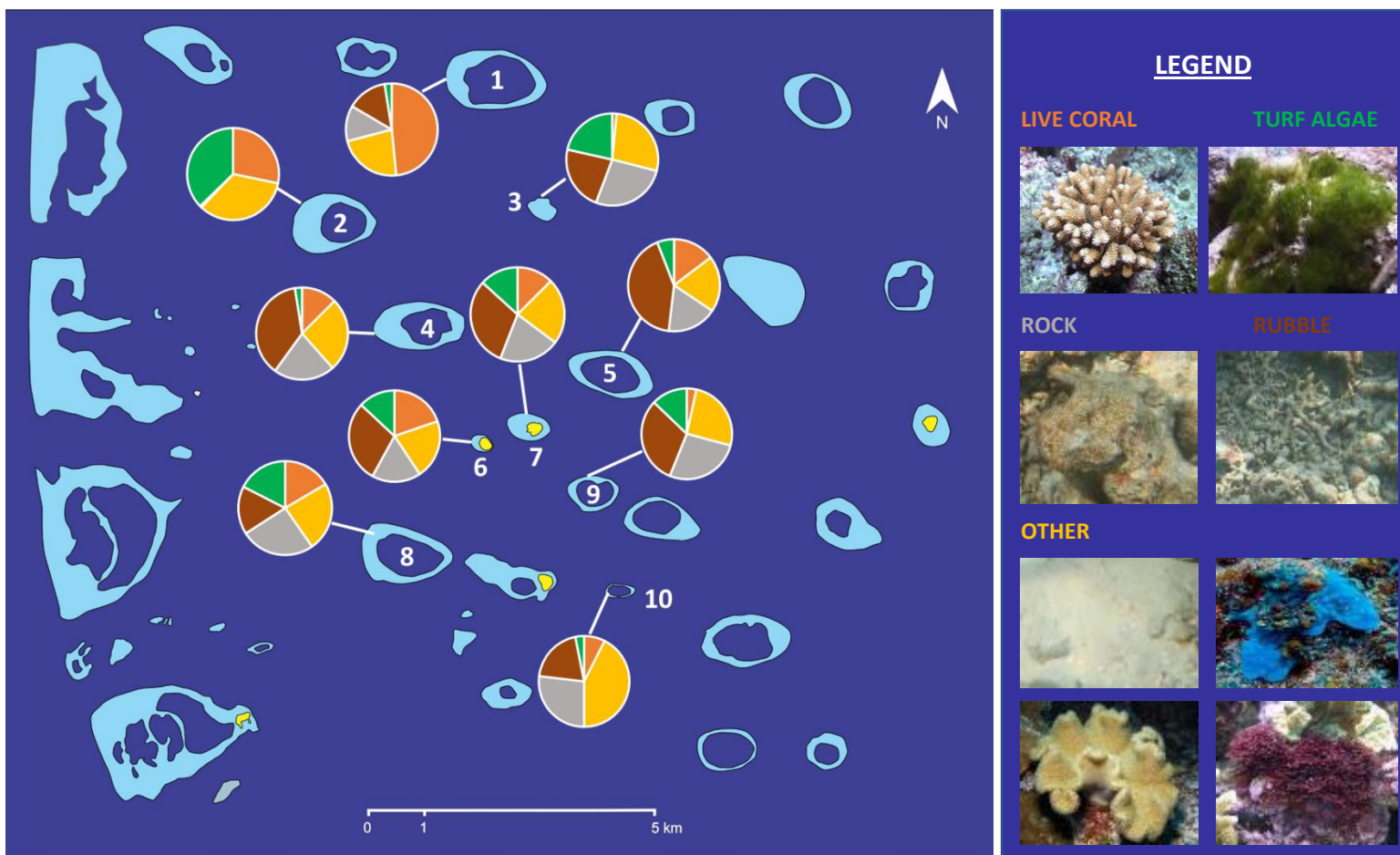
Why? Establishing baselines and understanding long-term change:

- 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**

2016 Global Bleaching Event

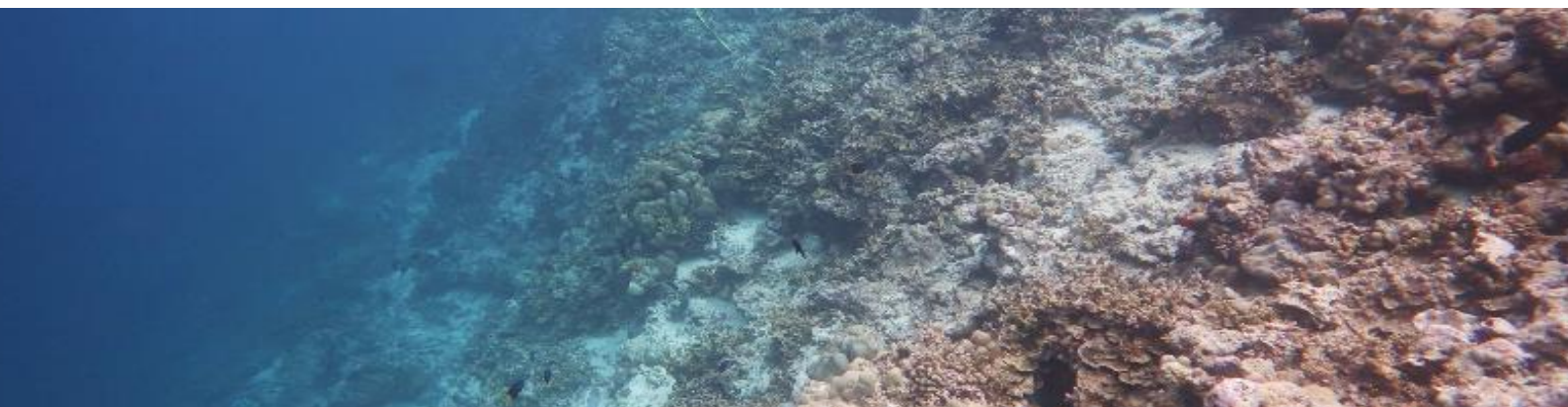
This was the **longest global coral bleaching event** in history since the 1980s. Corals in every major reef region were bleached –dead. One quarter of the Great Barrier Reef was declared dead.

REEF CONDITION

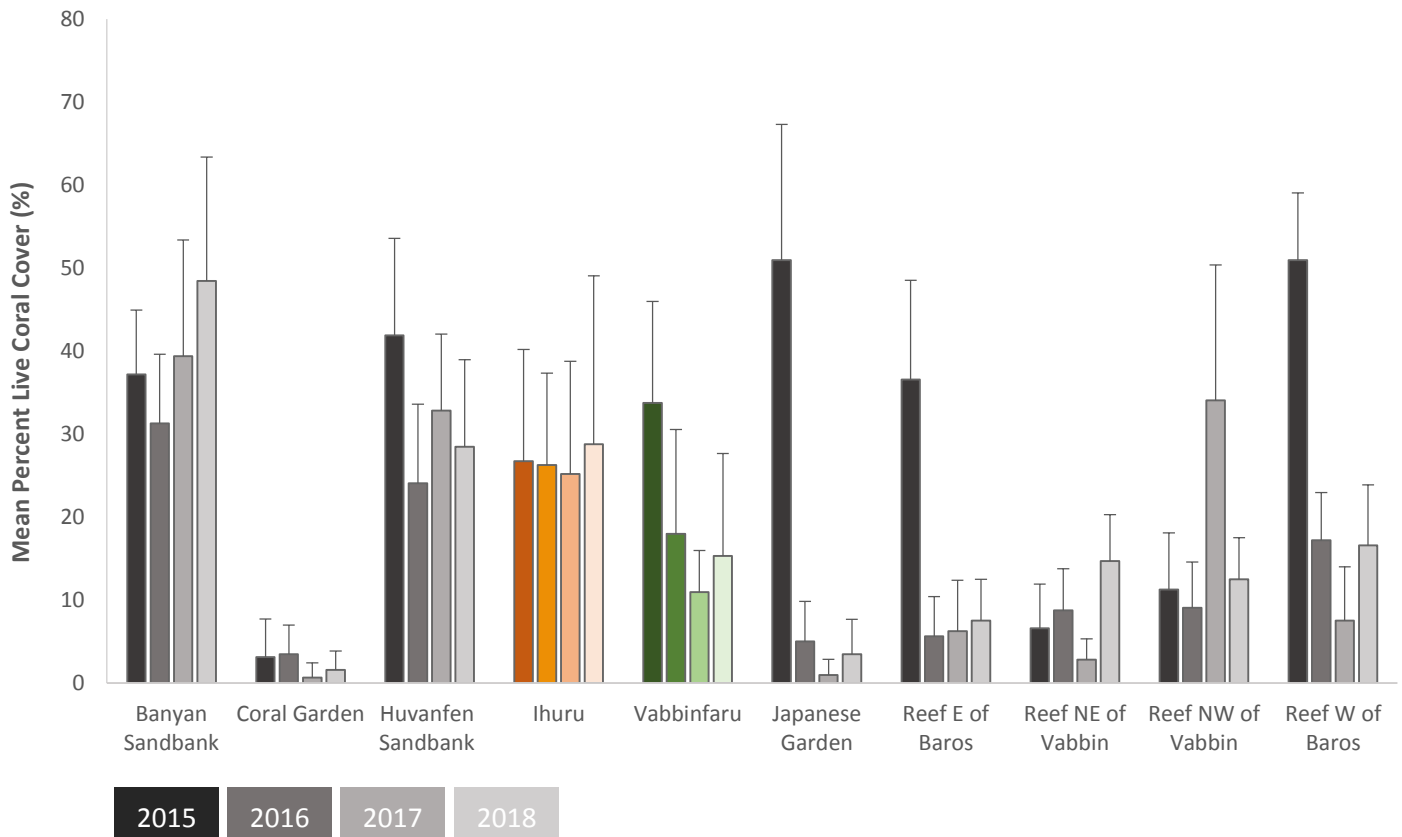


Benthic categories from 8 sights surveyed in North Male' Atoll: 1 Banyan Sandbank, 2 Huvanfen Sandbank, 3 Coral Garden, 4 Reef NW of Vabbinfaru, 5 Reef NE Vabbinfaru, 6 Ihuru, 7 Vabbinfaru, 8 Reef W of Baros, 9 Japanese Garden and 10 Reef E of Baros.

The mean coral cover across ten reefs in North Malé Atoll was relatively low at 17.7%. Reef 1 had the highest mean live coral cover (48.4%), although this was predominantly a single species, *Porites rus*. Reefs 3 and 9 had the lowest mean live coral cover (<5%). The majority of reefs were characterised by rock and rubble; apart from Reefs 1 and 2, all other sites had around 50% cover of rock and rubble. High rubble cover suggested a continued breakdown of the reef, while high cover of bare rock could be due to fish feeding on turf algae.



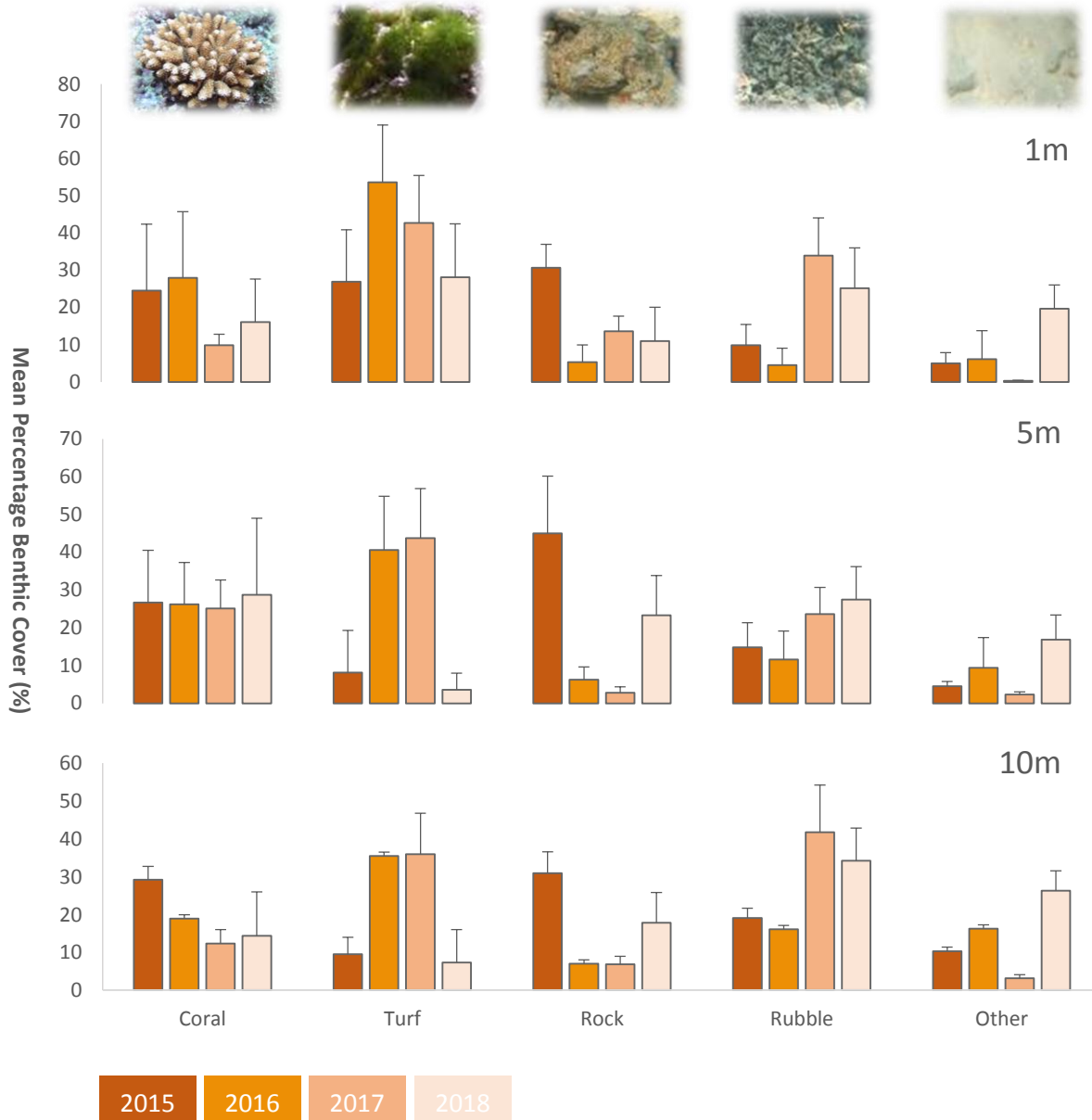
CHANGE IN CORAL COVER



Following the bleaching event in 2016, mean percent live coral cover declined substantially from 2015 to 2018 (dark to light coloured bars) at 5 m depth on all ten reefs surveyed. However, majority of reef sites showed an increase in live coral cover from 2017 (8 out of 10 sites). Reef NE of Vabbinfaru, Banyan Sandbank and Reef W of Baros showed the greatest increase in mean live coral cover (+11.9%, +9.1%, +9.1% respectively), while Reef NW of Vabbinfaru and Huvanfen Sandbank were the only two reefs to show a decline in live coral cover (-21.6% and -4.4% respectively). It is possible that the reduction in turf algal cover and thus increase in bare rock surface led to more recruitable space available for coral larvae to settle on. The absence of major bleaching events in 2017 and 2018, likely increased the survival of live coral and recruits. Hence, reefs are showing signs of recovery from the mass bleaching event of 2016.



HOUSE REEF STATUS

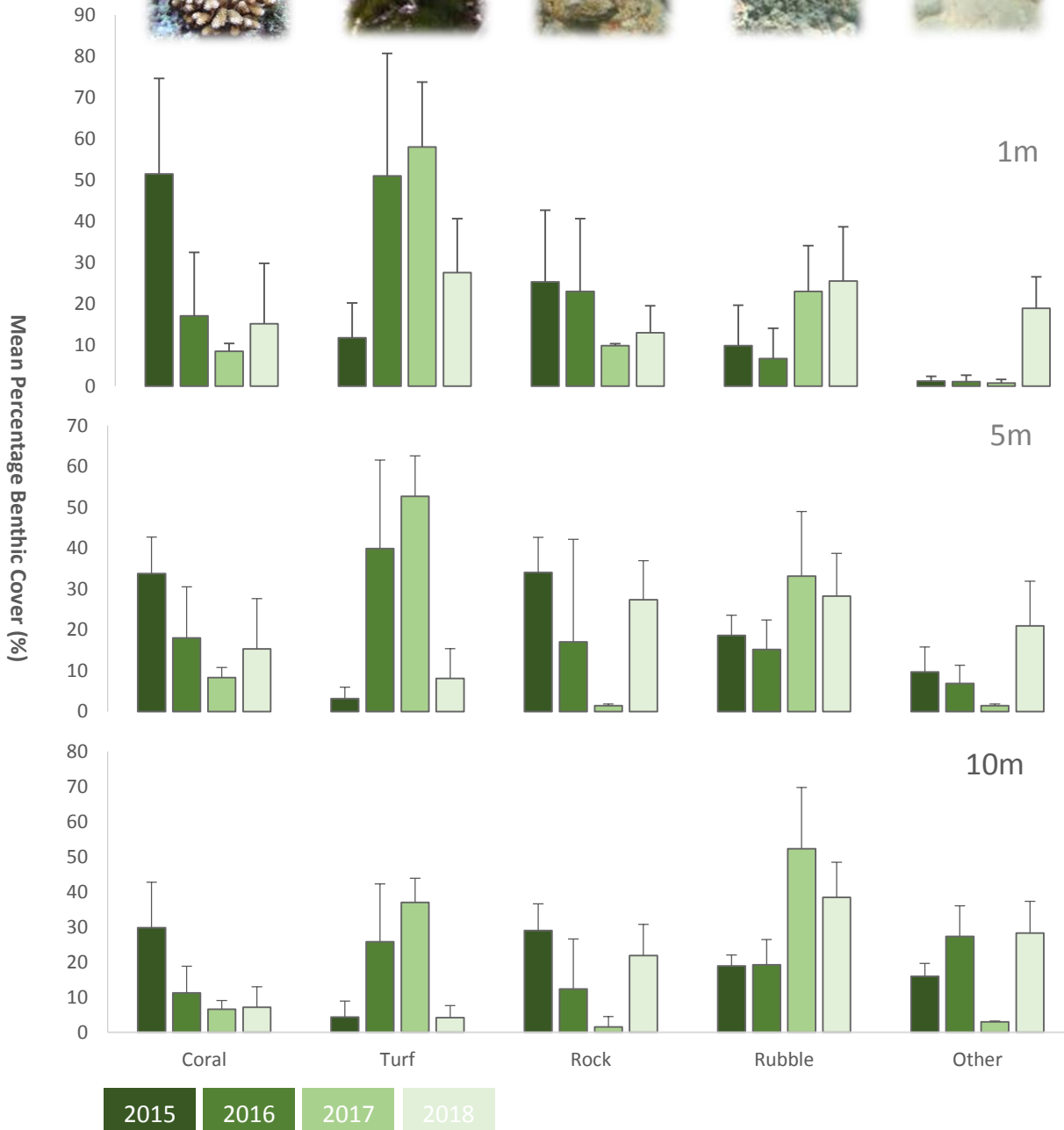


IHURU

Live coral cover increased from 2017 at all depths, with highest cover at 5m. While this increase appears slight, many recruits were observed by surveyors, suggesting reef recovery.

Turf has been consistently high since the bleaching event in 2016, but declined at all depths in 2018. The greatest decline was observed at 5 m and 10 m, with highest turf algal cover on the top reef. Consequently, bare rock cover notably increased at 5m and 10m. Rubble, which indicates the breakdown of coral, showed a decrease at the top reef and at 10m. These findings support coral recruitment, and the observation that this reef is on a recovery trajectory.





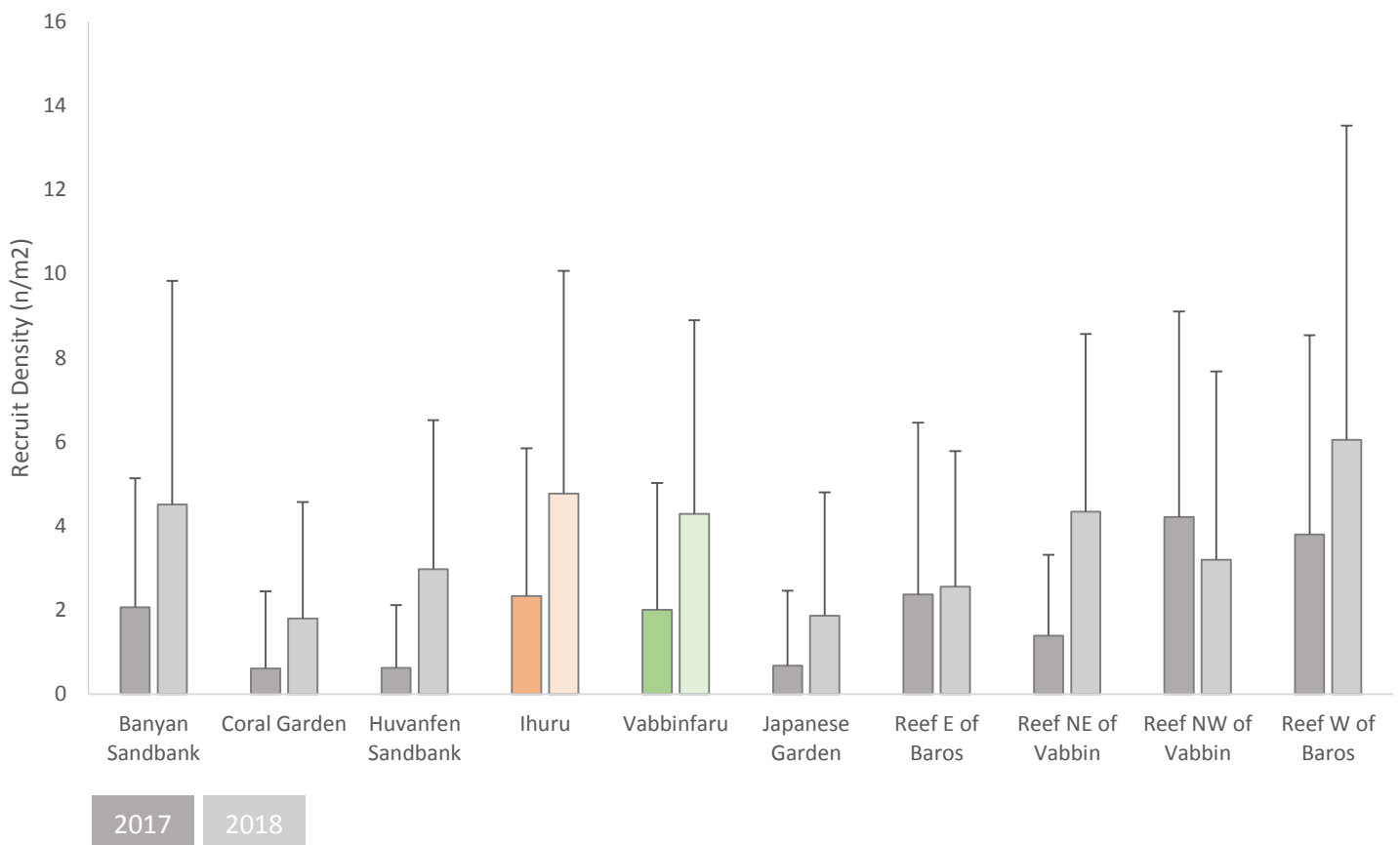
VABBINFARU

Similar to Ihuru, live coral cover increased from 2017 at all depths, with highest cover at 5m.

A trend in turf algae was similar to Ihuru. Turf has been consistently high since the bleaching event in 2016, but declined at all depths in 2018. The greatest decline was observed at 5 m and 10 m, with highest turf algal cover on the top reef. Consequently, rock increased across all depths, notably at 5m and 10m. Rubble decreased from 2017 at 5m and 10m. These findings also support coral recruitment, and the observation that this reef is on a recovery trajectory.



CORAL RECRUITMENT

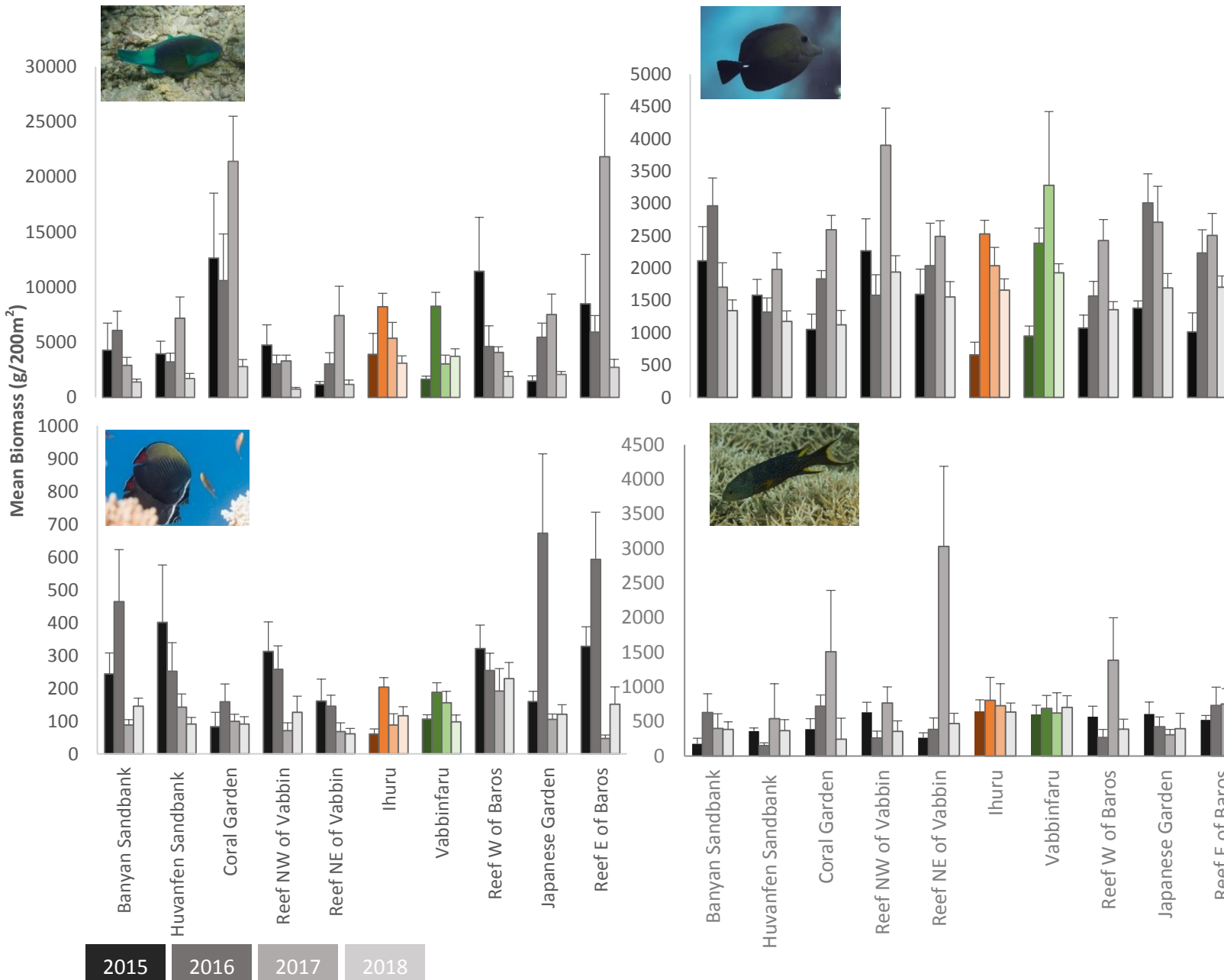


Recruitment density refers to the number of juvenile corals that are found per m² of colonisable space. This metric is an important indicator of reef recovery. Decrease in turf cover and increases in cover of bare rock, which is suitable for settlement of coral larvae, can explain these positive trends in recruit densities. This can be seen from the noticeable increase in recruit density from 2017- 2018 for all sites apart from 1 (NW of Vabbin).

Huvenfen Sandbank and Reef NE of Vabbinfaru showed the greatest increase in recruit density from 2017-2018. Ihuru and Vabbinfaru are on similar recovery trajectories after the 2016 bleaching event.



FISH COMMUNITIES



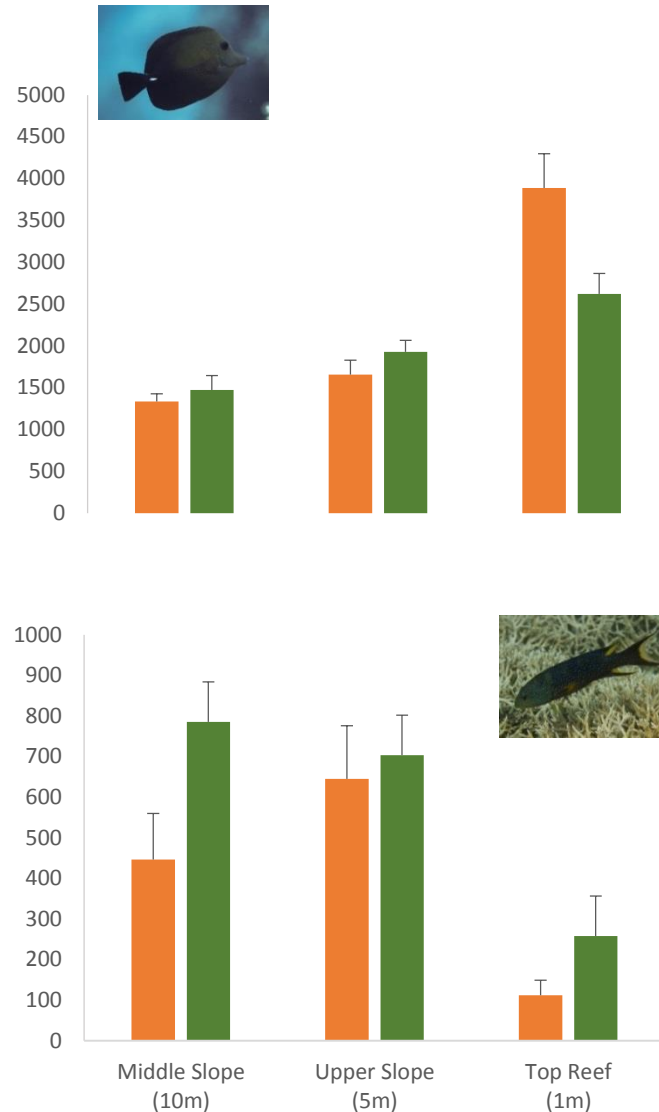
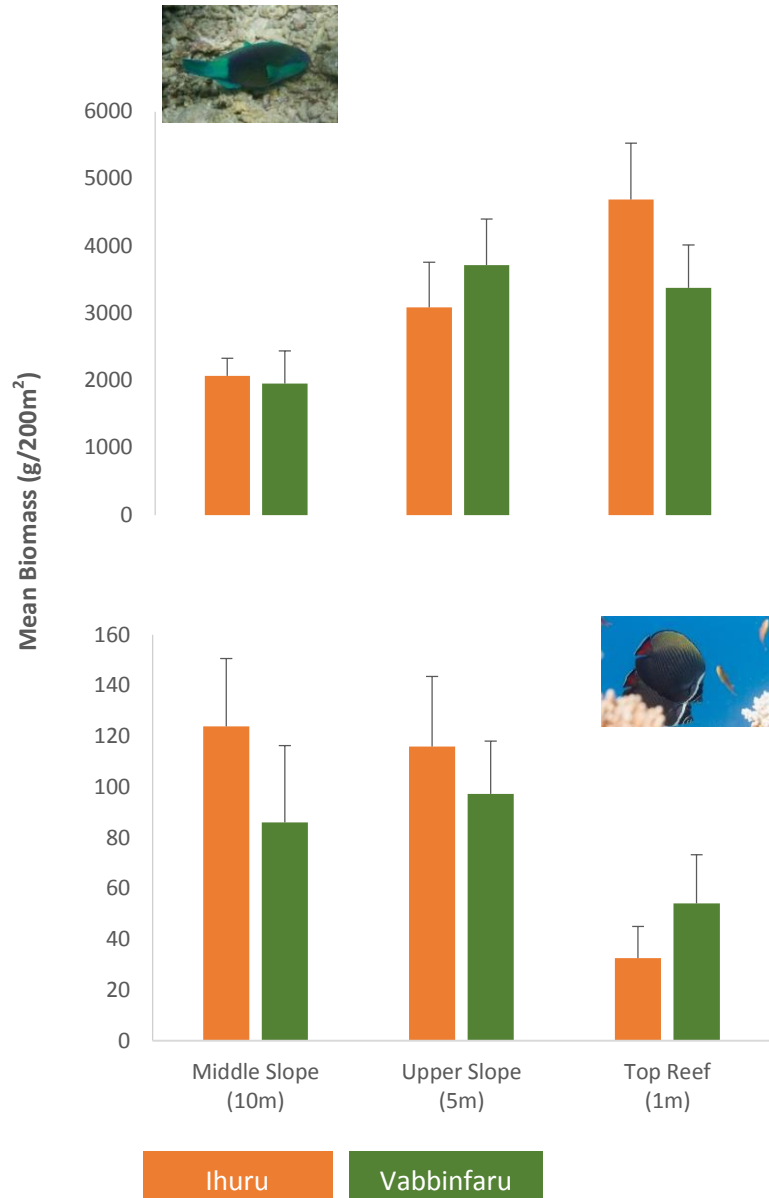
Overall, fish biomass for all four families declined in 2018 at 5 m depth.

Decreased turf algae abundance across all sites could explain the decline in herbivorous fish species such as parrots and surgeons across all sites.

Butterflyfish are an indicator of reef health and their numbers correlate with increased live coral cover. This could explain increased populations at more than half of the sites.

Grouper biomass remained relatively unchanged, suggesting little variability in fishing pressure over the past few years.

HOUSE REEFS



Higher cover of turf algae at top reefs could explain the upward movement of these herbivorous fish such as surgeons on both reefs. For Vabbinfaru, parrotfish biomass was lowest at 10m, while mean biomass was highest at 5m.

An opposite trend was observed for butterflyfish and groupers, where mean biomass was lowest at both top reefs. Butterflyfish biomass was higher at depth, likely because live coral cover (food source) was lowest at the top reef for both sites.

Larger groupers were observed to be more common at greater depths, which may indicate a preference for deeper habitats amongst groupers.