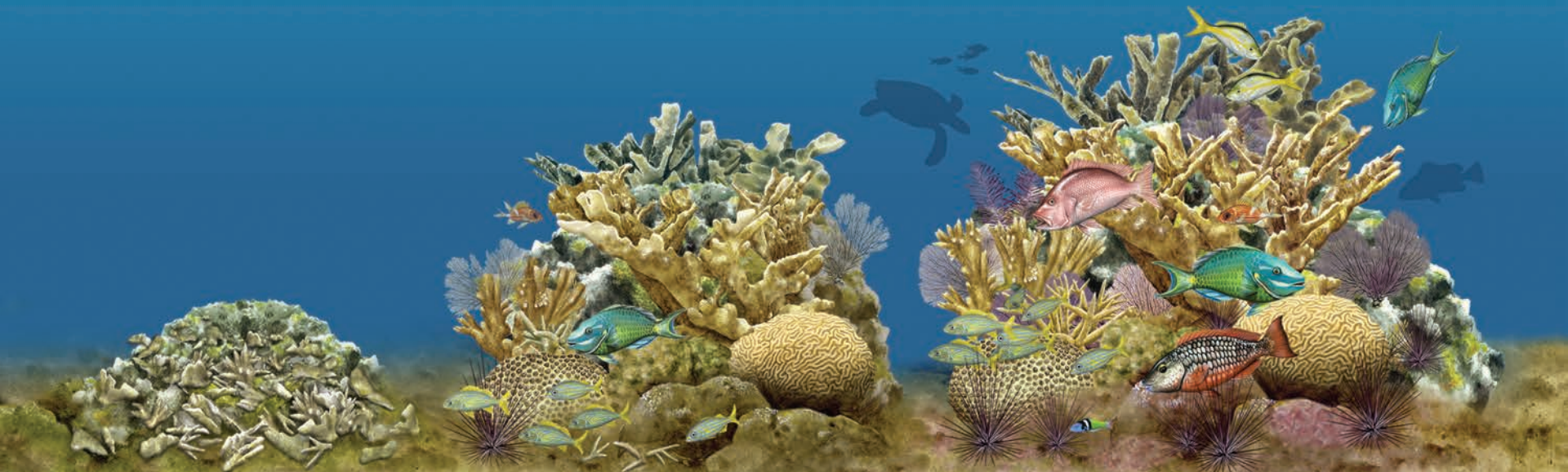


# NEW PROVIDENCE & ROSE ISLAND THE BAHAMAS



Tomorrow?

Today

2014

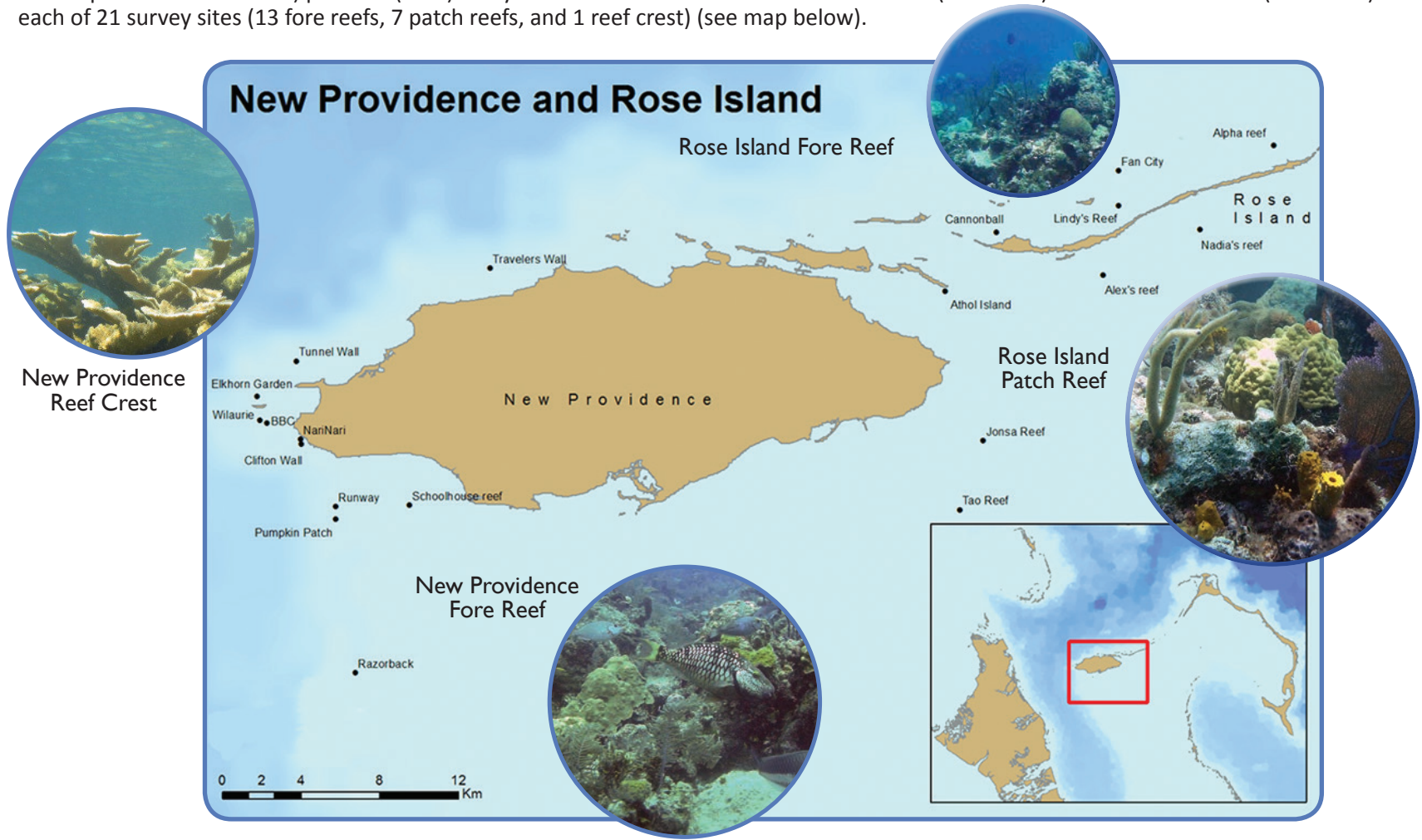


Tomorrow?

Coral Reef Report Card

# Coral Reefs of New Providence and Rose Island

The Bahamas is a vast archipelago of over 700 islands and 2,400 cays surrounded by crystal clear blue waters, intricate coral reefs and productive seagrass beds, mangrove forests, and creeks. New Providence is the vibrant political and commercial center of the country and home to more than 70% of its population. A few miles to the northeast is Rose Island, a sparsely populated, narrow island. In 2008, the Atlantis Blue Project Foundation (ABPF) supported the first comprehensive baseline survey of coral reefs around New Providence and Rose Island. In 2011 and 2012, a team of local and international scientists and partners resurveyed coral reef health using the AGRRA (Atlantic and Gulf Rapid Reef Assessment) protocol (v5.5). They conducted 6 benthic and 2 coral transects (10m each) and 10 fish transects (30m each) at each of 21 survey sites (13 fore reefs, 7 patch reefs, and 1 reef crest) (see map below).



The coral reefs around New Providence and Rose Island vary in location, type, and extent. Along the northern coasts of both islands there are intertidal reef crests, some with remnant populations of elkhorn coral, and submerged fore reefs dominated by massive corals. Fore reefs are also found along the shelf edge of the Tongue of the Ocean off the southwest coast of New Providence. Hundreds of shallow patch reefs are clustered on the bank just south of Rose Island while scattered patch reefs dot the Great Bahama Bank to the south of New Providence.

# Measures of Coral Reef Health

This Report Card provides an easy-to-understand summary of the current condition of New Providence and Rose Island’s coral reefs. It includes four measures of coral reef health (pgs. 3, 5, 7, 9), illustrations to explain what these measures are and how they influence coral reef health (pgs. 4, 6, 8, 10), and key messages of how communities can help keep their coral reefs healthy and thriving (pgs. 13-14). Each of the four measures - Benthic index, Reef structure, Grouper and Grazer index—is given a score of degraded, poor, fair or good.\* These values are then combined into an integrated Coral Reef Health Index Map (pg. 12) and provide an overall measure of coral reef health. The Report Card provides an initial baseline to help The Bahamas track the state of the reef over time, as well as their progress in protecting their reefs.



**Benthic Index** – Is a measure of the amount of the reef surface covered by a) live corals and other organisms that promote their well-being and b) competitive organisms capable of overgrowing and displacing corals. The combined grade is based on the percent cover of these organisms, with reefs with more live corals and organisms promoting reef growth scoring higher.



**Reef Structure** – Is a measure of the amount of reef habitat available for other organisms. The grade is based on the vertical relief of the reef, with higher relief reefs scoring higher.



**Grouper** – Is a measure of the grouper population, which is a key predator and culturally important food species in The Bahamas. The grade is based on the density of groupers, with reefs with more larger-sized groupers scoring higher.



**Grazer Index** – Is a measure of the abundance of key grazers of the seaweed that overgrows corals. The combined grade is based on the density of parrotfish greater than 20 cm in length and the density of long-spined urchins, with reefs with higher densities scoring higher.



**Degraded Reef**

Degraded reefs occur when many live corals die and are overgrown with fleshy seaweed or other organisms that displace coral and prevent coral larval settlement.

Degraded reefs can lose their three-dimensional structure when dead corals and the reef framework are eroded away.

Degraded reefs occur when unsustainable fishing of groupers, especially during critical spawning times, reduces their populations and removes a key predator from the reef food chain.

Degraded reefs occur when key seaweed grazers are missing. The loss of long-spined urchins from disease in 1983, combined with the loss of parrotfish to fishing, allows seaweeds to overgrow corals.

\*For technical information visit [www.atlantisblueproject.org](http://www.atlantisblueproject.org).



## Coral Reef Health

- Good
- Fair
- Poor
- Degraded



**Healthy Reef**



Healthy reefs have abundant, healthy live corals and other reef-building organisms, like crustose coralline algae.



Healthy reefs have three-dimensional structures that provide habitat and shelter for many reef organisms.



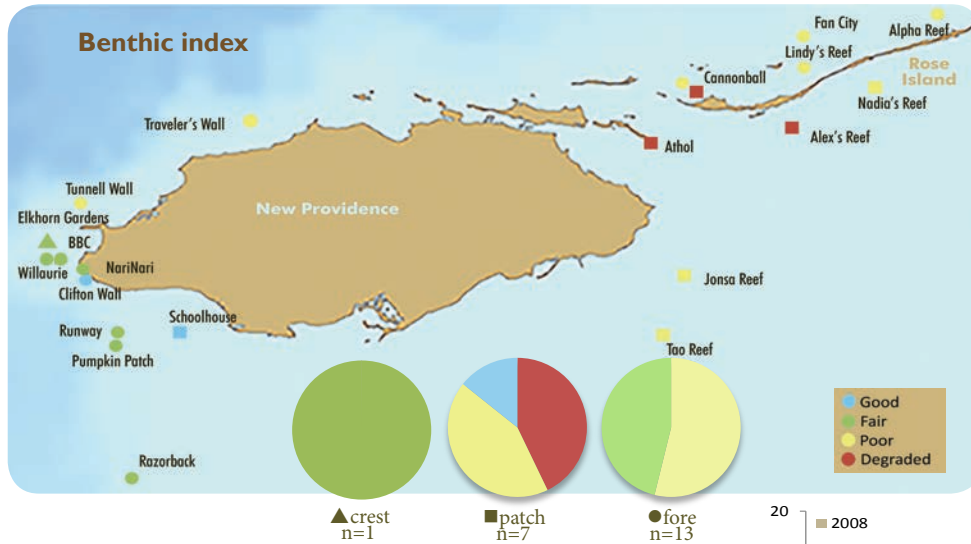
Healthy reefs have large-sized groupers that migrate to spawning aggregations and produce young.



Healthy reefs have abundant large-sized parrotfish or long-spined urchins that keep seaweed from overgrowing reefs.



# Benthic Index



## Coral cover remains similar to 2008.

Between 2008 and 2011-2012, the average cover of live corals on reef habitats in the New Providence and Rose Island area remained above 12% on the reef crest, 13% on patch reefs, and 15% on fore reefs.

## New Providence reefs have twice as many reef promoters as competitors.

Organisms promoting reef growth, including live corals, crustose coralline algae, and sparse turf algae, were more abundant than reef competitors on all reef types of New Providence. With fewer reef competitors, corals have more open space to grow.

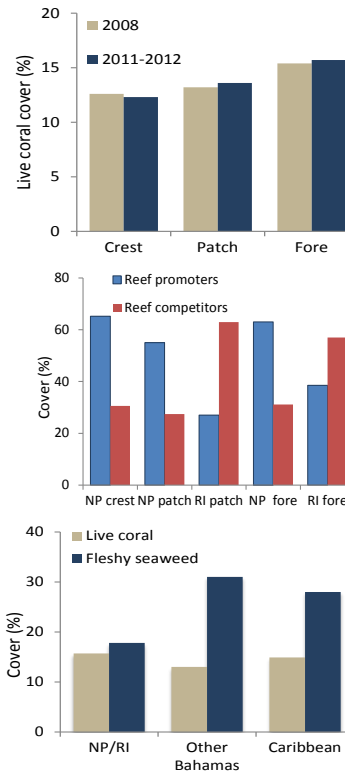
## Rose Island reefs are vulnerable to seaweed overgrowth.

Many corals on the reefs around Rose Island died during a severe, mass bleaching event in 1998. Competitors of corals, especially fleshy seaweed, now occupy more space on both the fore and patch reefs than live corals or other reef promoters.

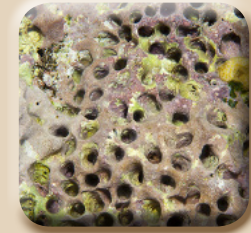
## Fleshy seaweed are less dominant than on other fore reefs.

New Providence/Rose Island fore reefs have similar amounts of live coral cover (~15%) as on other Bahamian and Caribbean reefs.\* Fleshy seaweed cover is lower here (18%) than on other Bahamian Caribbean reefs (28%).

\* See pg. 5 footnote



Net algae overgrowing coral



Crustose coralline algae

## Coral recruits prefer settlement areas that are seaweed free.

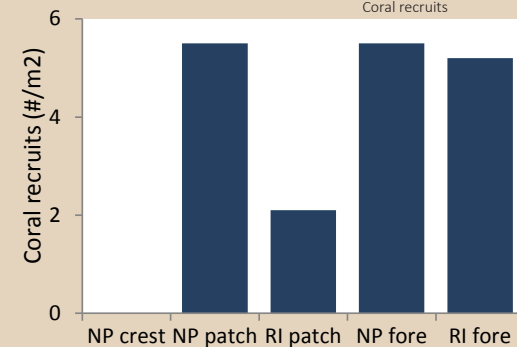
More coral recruits (young corals  $\leq 2$  cm in diameter) were found on New Providence patch reefs and fore reefs where plenty of good settlement space is available ( $\sim 5/m^2$ ). Fewer recruits ( $\sim 2/m^2$ ) were found on Rose Island patch reefs where fleshy seaweeds and other competitors are so abundant that less space is available for coral larvae to settle.

## Recruits of reef-building corals are rare.

Few young elkhorn, staghorn, mountain star, and lobed star corals were observed. Instead, most recruits were relatively short-lived corals that grow to small adult sizes and contribute less to the three-dimensional reef structure.



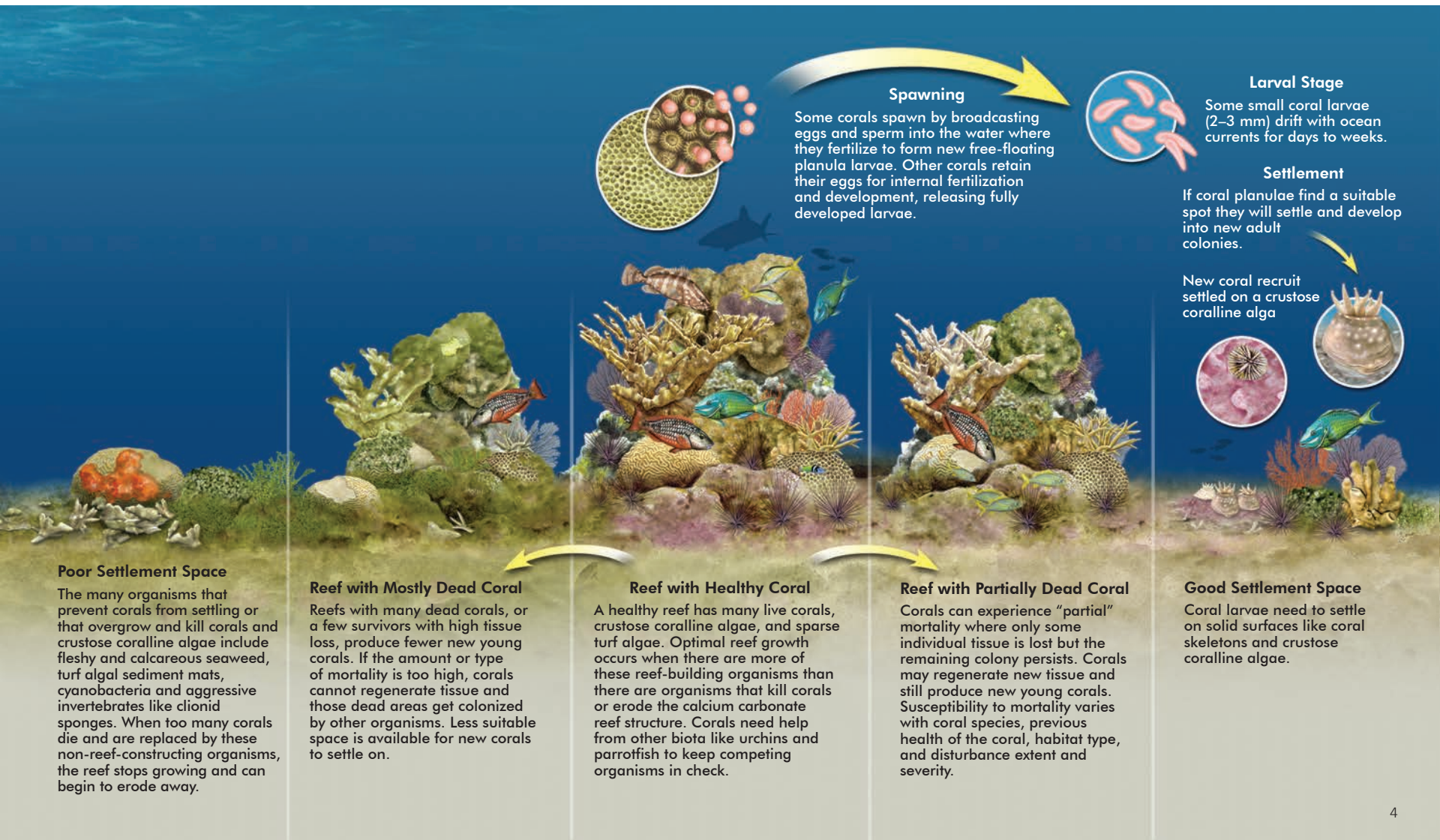
Coral recruits



# Corals are the architects of the reef.

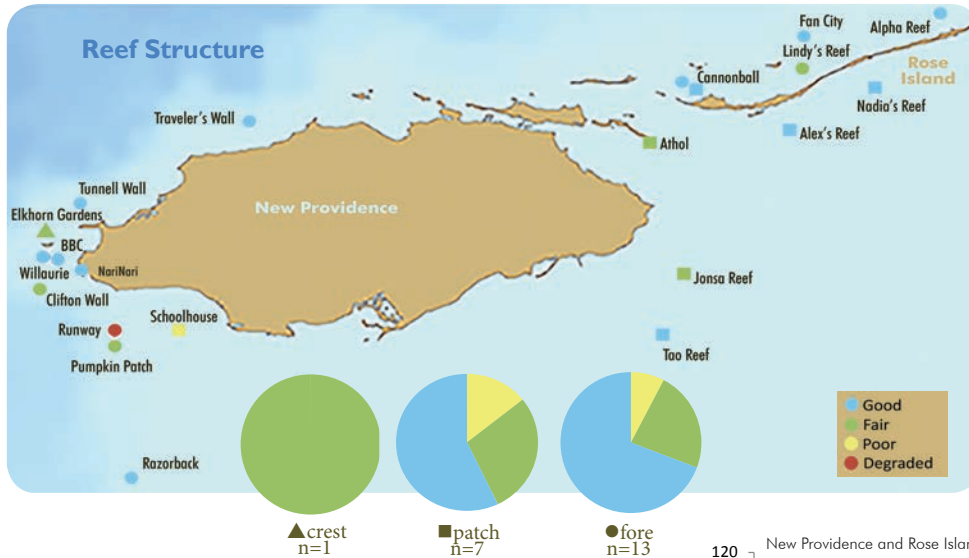


Corals need good surfaces to grow and settle on.





# Reef Structure



## High relief coral reefs provide important habitat.

Most Bahamian reefs have good relief (>1 m), providing homes and shelter for other reef creatures. Although reef structure in the New Providence area is scored as good, especially on fore reefs, individual coral colonies were severely impacted by sustained ocean warming during an unusually strong El Niño in 1998.

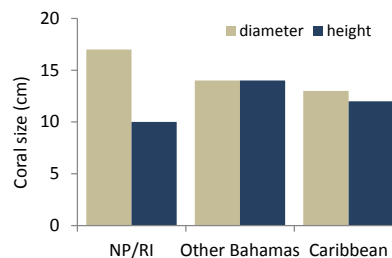
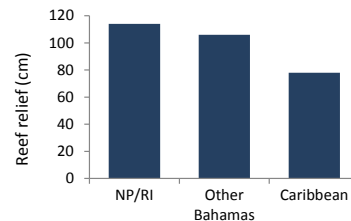
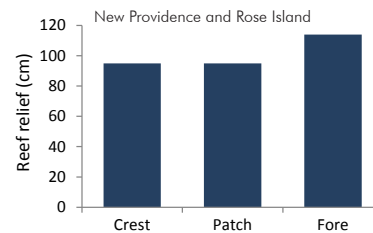
## Fore reefs have high relief.

The Bahamas' fore reefs have higher relief than other recently surveyed Caribbean sites, although the amount of living coral is similar.\*

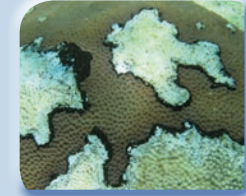
## Surviving corals are often small in size.

Corals that survived the 1998 bleaching event were susceptible to disease, and some are smaller in size due to partial mortality or reduced rates of growth. Corals are also vulnerable to storm waves, excessive inputs of sediment, nutrients or other pollutants, and predators.

\*2011-2012 survey data from NP/RI: New Providence and Rose Island; Other Bahamas=Cay Sal, Inaguas, Hogsty, Andros, and SE Bahamas (Samana & Plana Cays, Mayaguana, Crooked and Acklins); and Other Caribbean=Belize, N. Colombian Banks, Honduras Bay Islands, Mexico, Pedro Banks, Jamaica, and St. Kitts and Nevis.



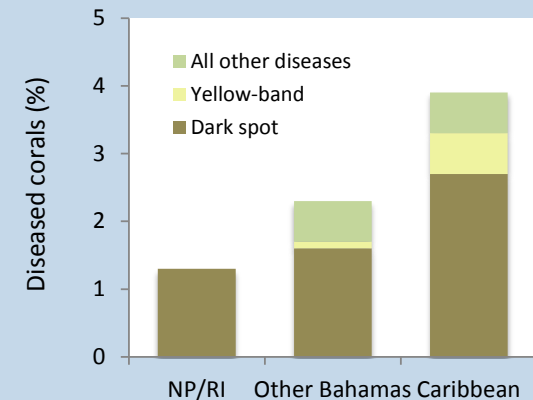
Dark spot disease



Black band disease

## Corals are vulnerable to diseases associated with temperature extremes.

Prolonged exposure to extreme temperatures can kill corals. Those that survive tend to be more susceptible to disease and show reduced rates of growth. During the survey, ~1% of the corals examined showed signs of disease. All diseased corals were affected by dark spot disease. Yellow-band disease, which is killing large star corals in the Caribbean, is rare in The Bahamas and not seen in the New Providence area transects. Black band disease was not observed but has been reported on other reefs of The Bahamas after past bleaching events.



# Reefs with high, complex structure provide homes for more plants and animals.



*Coral reefs are natural storm buffers that protect our shorelines.*



Live coral tissue (arrow) with exposed white dead skeleton above



Black band disease and recently dead exposed skeleton



Snail predation and seaweed overgrowth



Competitive encrusting sponge



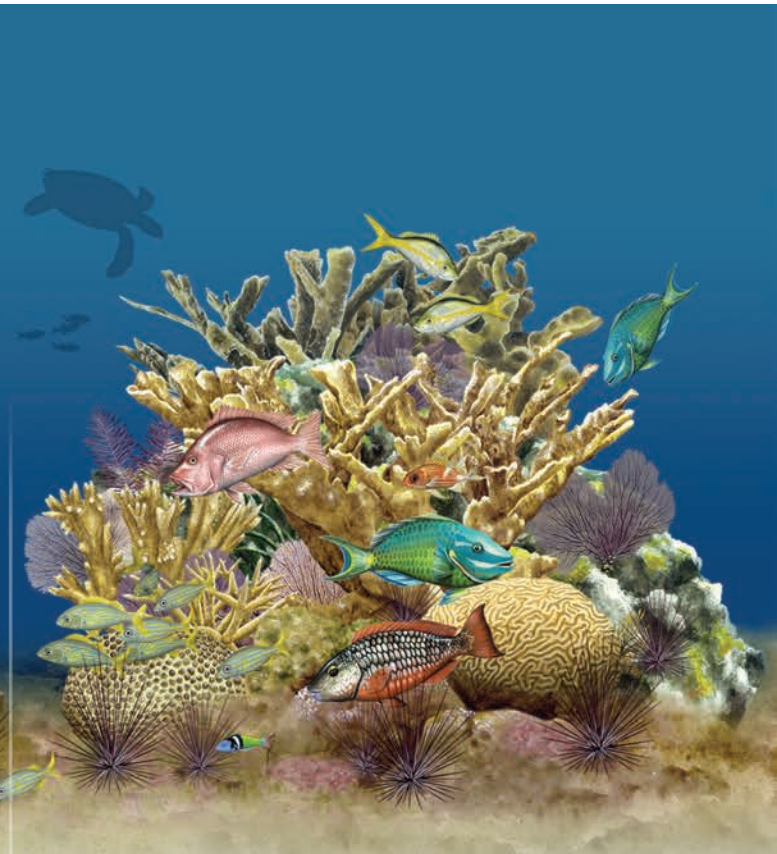
## An Eroded Reef

The loss of key grazers like urchins and parrotfish allows algae to outcompete reef-building corals in the battle for limited space on the bottom. Without enough live corals and other reef-cementing organisms like crustose coralline algae, the reef is vulnerable to erosion. Both reef habitat and natural buffers against storms are lost.



## A Vulnerable Reef

Corals die faster than they can be replaced on unhealthy reefs. When corals die, their dead coral skeletons remain for a period of time and are still valuable habitat, but gradually they are worn away by bioeroding fungi, algae and animals, or are broken by storm waves. When key seaweed grazers are rare, then coral skeletons, crustose coralline algae, and eventually even the remaining live corals are overgrown by seaweeds or other benthic organisms.

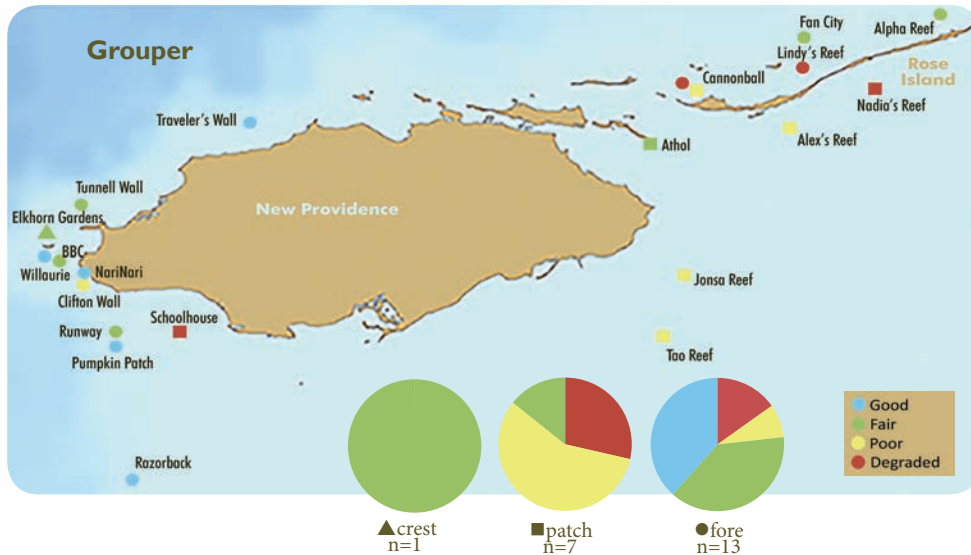


## A Healthy Reef

Higher, structurally complex reefs provide a wide variety of habitat (nooks and crannies) for a high diversity of fish and other reef organisms. Corals are the main reef builders. Reef-associated fish include predators that feed on animals that eat corals. Healthy reefs, with many live corals and with key processes like seaweed grazing intact and predation in balance, can maintain their structure better than unhealthy reefs. Coral reefs create natural barriers that protect coastlines against storm waves.



# Grouper



## Fore reefs are essential habitats for adult and subadult groupers.

Deep fore reefs along southwest New Providence had higher grouper density indicator scores than the shallow patch reefs of SW New Providence and Rose Island. More larger groupers (*Mycteroperca* and *Epinephelus* species) were observed on fore reef sites (38 cm total length) than on patch reef sites (27 cm). These fore reefs warrant special management to protect future grouper populations.

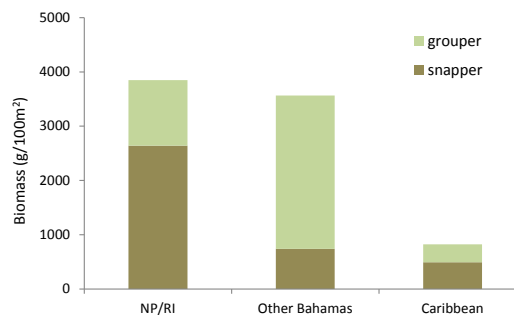
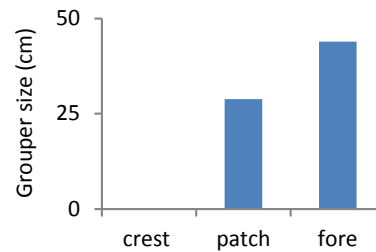
## Nassau groupers are in danger of being overfished.

Nassau groupers were found on ONLY 1/3 of reefs surveyed. Shallow patch reefs south of Rose Island have high fishing pressure resulting in few Nassau groupers.

## The Bahamas, including New Providence, have the highest grouper & snapper biomass.

The combined biomass of targeted grouper and snapper species was higher in New Providence compared to other areas surveyed in the Caribbean.\* Grouper populations in many areas of the Caribbean have been overfished.

\* See pg. 5 footnote



Black grouper



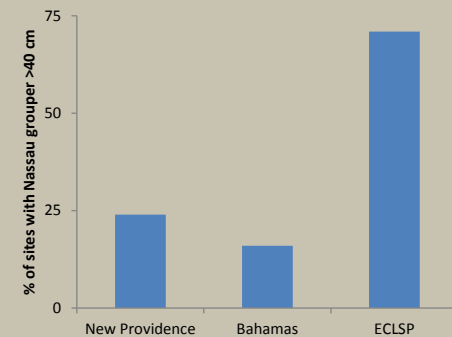
Nassau grouper

## Smaller fish mean less fish and food for the future.

Only 1/4 of the groupers around New Providence and Rose Island have reached adult reproductive size (50-60 cm or larger depending on the species). Fewer reproductive groupers are available to migrate to, and participate in, future spawning aggregations.

## Marine protected areas result in larger fish.

Most Nassau groupers in New Providence and other areas of The Bahamas average ~40 cm in length. Larger-sized Nassau groupers are more common in the Exuma Cays Land & Sea Park (ECLSP) than in unprotected areas of New Providence and on other Bahamian reefs. The density of grouper that are >60 cm long is nearly 3 times greater in ECLSP than outside the park.

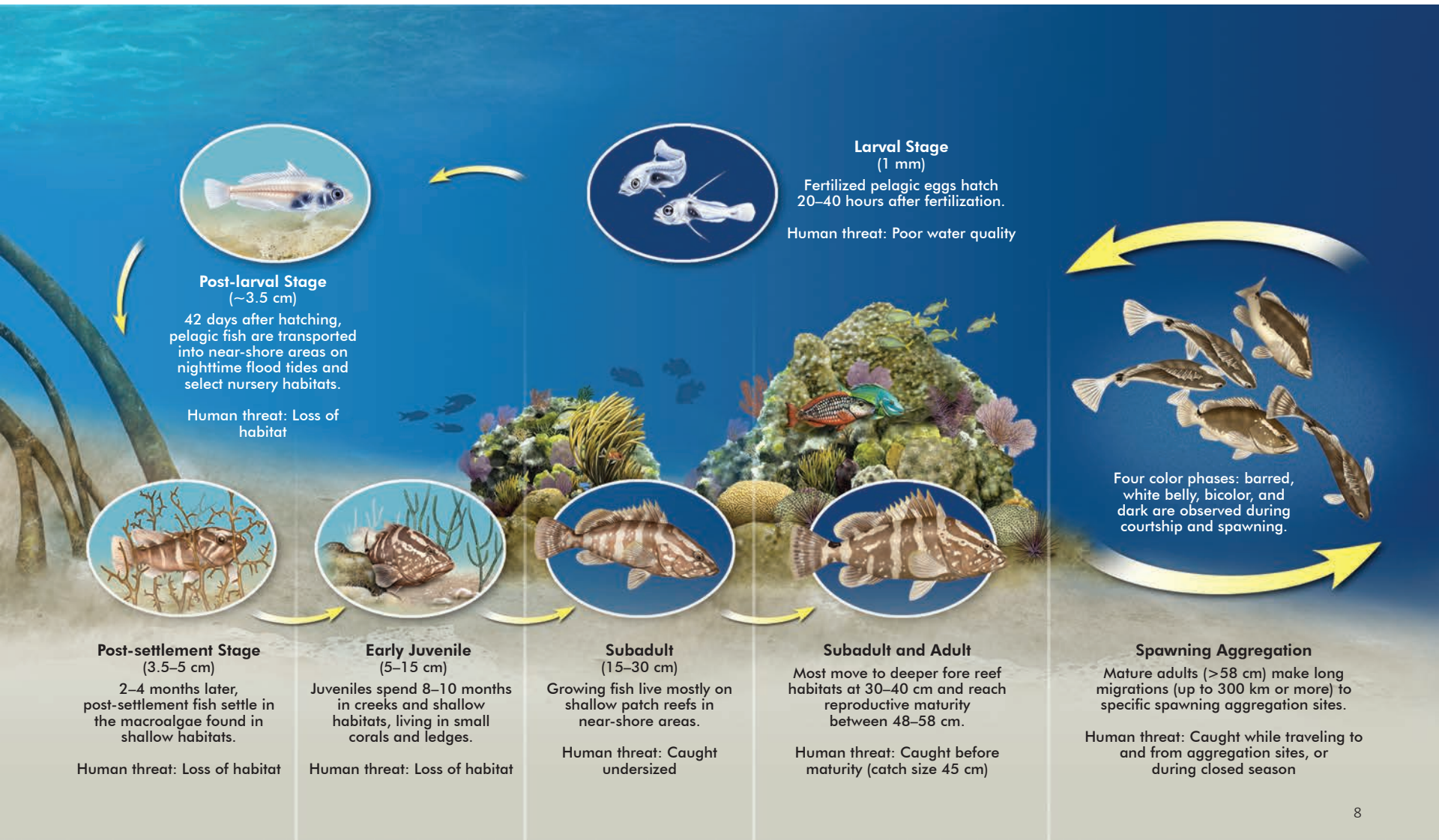




# Groupers and snappers are key predators on coral reefs and help keep the food chain in balance.

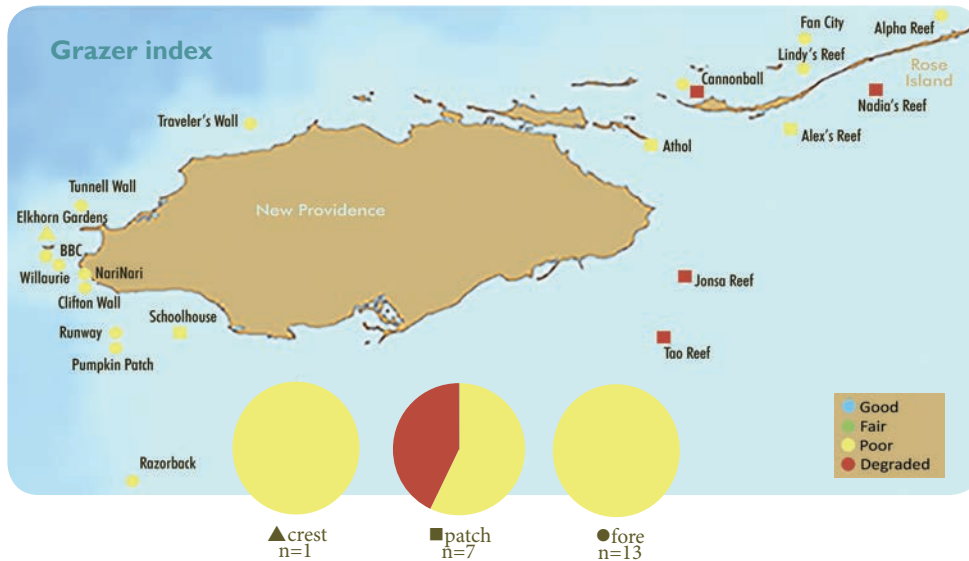


Large-sized groupers of **at least 50-60 cm** are needed to produce more new offspring.





# Grazer Index



Queen parrotfish



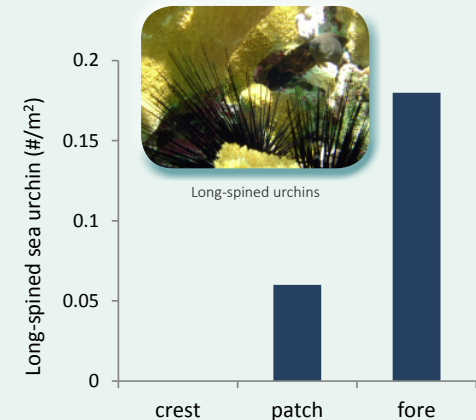
Midnight parrotfish

## Long-spined urchins are still rare.

Long-spined urchins were found on only 6 of 21 sites and were more abundant on fore than on patch reef habitats. When observed, they were low in abundance. Lindy's Reef, a fore reef, had the highest abundance at over 1/m<sup>2</sup>, which is still lower than needed for effective grazing.

## Lack of long-spined urchins increases the need to protect large-sized parrotfish.

Healthy reefs need large (>20 cm) parrotfish and/or abundant (3-4 urchins/m<sup>2</sup>) long-spined urchins to attain effective grazing levels. With long-spined urchins currently absent or in very low abundance, New Providence and Rose Island reefs rely more on large parrotfish to keep the reef surface clear from competitive seaweed.



## Small-sized parrotfish are common on New Providence reefs.

Most parrotfish observed were small in size (13 cm average). Striped, redband, princess, and stoplight parrotfish were the most common species. Smaller-sized parrotfish crop seaweed but are unable to keep reef surfaces clear where coral larvae can settle and grow.

## Fewer big parrotfish results in less grazing and more seaweed.

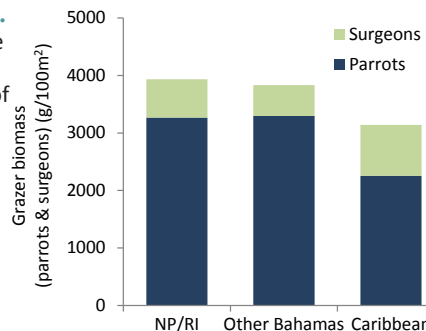
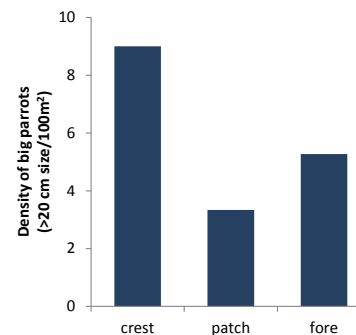
Positive effects of reducing seaweed by parrotfish grazing depend on having fish greater than 20 cm. Larger (>20 cm) parrotfish were relatively abundant on the Elkhorn Garden (crest), Schoolhouse patch reef, and the Nari Nari and Willaurie fore reefs. Parrotfish grazing increases survival of corals and coral recruits.

## Fewer large stoplight parrotfish means less fish for the future.

Only 1/3 of all stoplight parrotfish observed were of reproductive size. Elkhorn Garden (crest) and two of the Rose Island fore reefs (Lindy's Reef, Fan City) had the most stoplight parrotfish of reproductive size.

## Grazing fish are at risk of unsustainable fishing.

The biomass of parrotfish and surgeonfish in The Bahamas is greater than other areas of the Caribbean that are overfished and where grazers are regularly harvested.\* The Bahamas' parrotfish are now being targeted by fishers and are at growing risk of population decline.

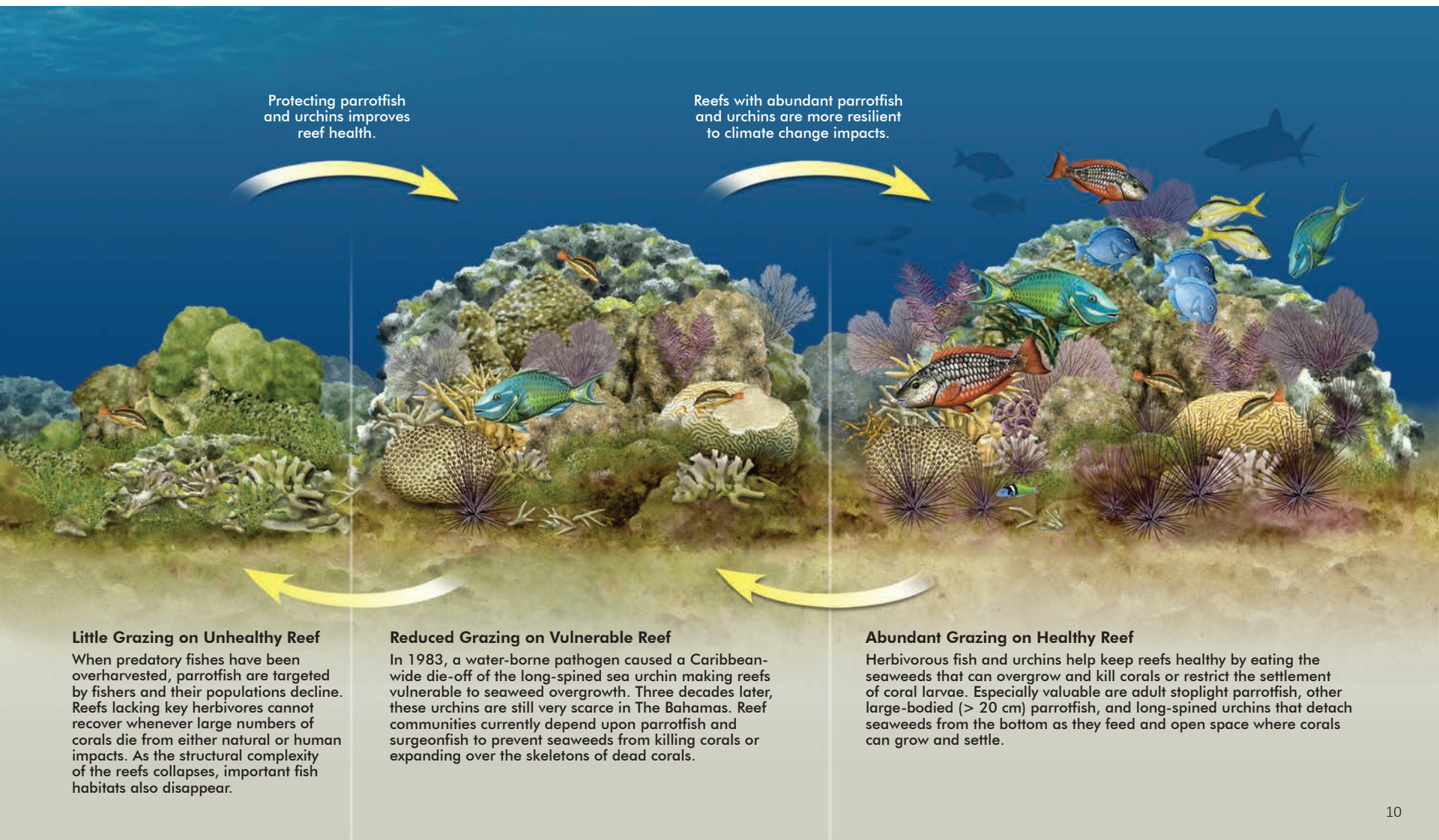


\* See pg. 5 footnote

# Parrotfish are key grazers that keep seaweed from overgrowing and killing coral.



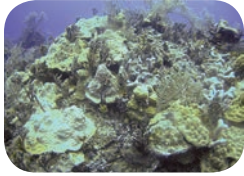
Large-sized parrotfish (>20cm) remove more seaweed.



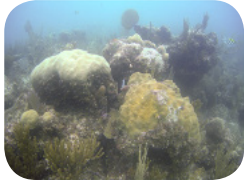
# Up close: New Providence and Rose Island



## Benthic Index



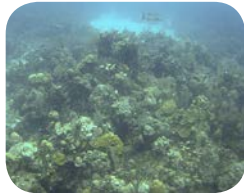
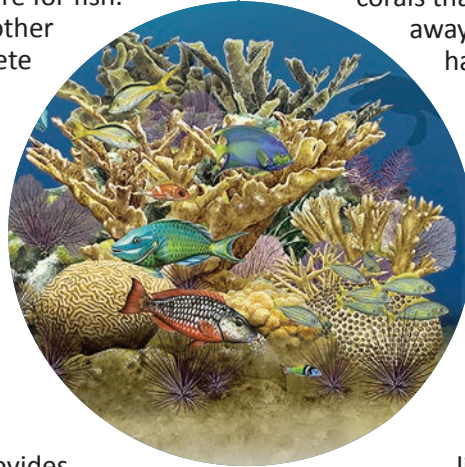
Pumpkin Patch Reef – Good



Cannonball Reef – Poor

**Pumpkin Patch** is a good example of a reef with fairly high coral cover spanning over an extensive area, with patches of pink crustose coralline algae suitable for coral larvae to settle.

**Cannonball Reef** has a low cover of living coral, although abundant standing dead coral provides structure for fish. Fleshy seaweed and other organisms that compete with coral had taken up most of the space where corals had died off in the past.



Willaurie Reef – Good



Lindy's Reef – Poor

The reef at the **Willaurie** dive site has several large groupers over 30 cm, including tiger, black and Nassau groupers. The reef structure provides excellent habitat for these species.

**Lindy's Reef** has a good high relief reef structure, but large groupers were absent. This site and others to the east and southeast of New Providence have fewer groupers, especially large groupers, probably because of increased fishing pressure and the proximity to Nassau.



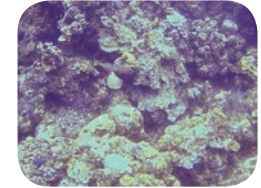
## Grouper

## Reef Structure



**Razorback Reef** has high relief ridges and large, but mostly dead, mound corals with high relief structure that serve as excellent habitat for groupers and snappers.

**Runway Wall**, a low relief fore reef, has poor reef development and small, dead corals that are being eroded away, providing limited habitat for many fish and invertebrates.



Razorback Reef – Good



Runway Wall – Poor

**Elkhorn Gardens** has an abundance of large parrotfish, such as terminal-phase stoplight parrotfish. Grazing at this site is limited by the scarcity of long-spined urchins.



Elkhorn Gardens – Good

Patch reefs to the south of Rose Island, such as **Nadia's Reef**, typically have low abundance of large parrotfish, with grazers limited to smaller parrotfish that are unable to reduce the abundance of seaweeds and clear space on the reef for corals to settle on.



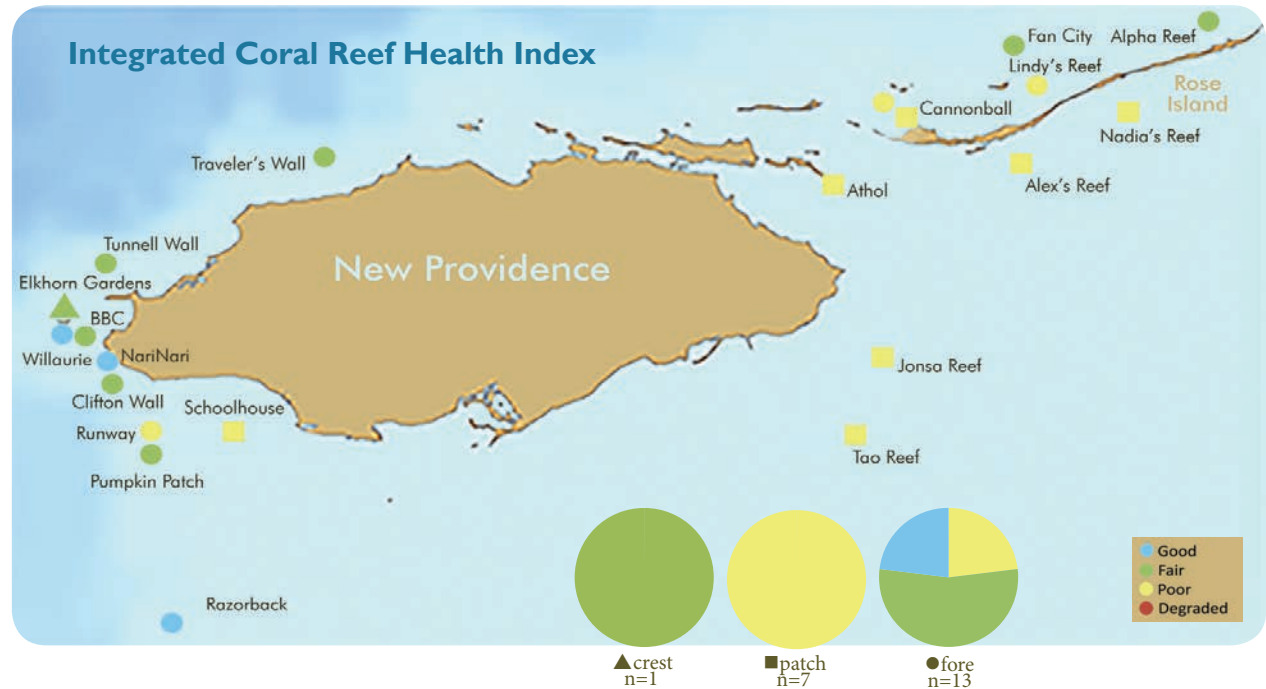
Nadia's Reef – Poor

## Grazer Index



# New Providence and Rose Island Coral Reef Health

*Overall, about half of the reefs surveyed in the New Providence area were in fair to good condition and about half were in poor condition.*



## Key findings

### Patch reefs are in poor condition and at high risk for future disturbance.

Sparse patch reefs are found south of New Providence, while just south of Rose Island there are hundreds of small patch reefs like Nadia's Reef and Alex's Reef. All patch reefs showed poor overall health due to a combination of impacts. Located in shallow accessible waters and fairly close to land, fish populations here are very vulnerable to fishing. Shallow waters also heat up considerably during the summer, with high light levels causing corals to be more susceptible to coral bleaching, like the event that occurred in 1998. Despite these impacts, there is hope for these reefs since their reef structure is intact and still providing habitat for key species. Some reefs even had remnant populations of endangered staghorn and elkhorn coral (e.g., Schoolhouse Reef). Reducing human impacts and encouraging proactive restoration can help these areas recover from past stressors and provide some protection against future bleaching events.

### Fishing pressure and habitat complexity influence groupers and parrotfish.

Groupers and parrotfish reside in shelters such as the complex of holes and crevices created by coral formations on a reef. Reefs that are degraded and are being eroded lack this habitat and can support fewer parrotfish that are needed to graze on seaweeds and allow new corals to recruit, as well as groupers that are needed to reduce populations of coral-eating fish and invertebrates. Because groupers, and more recently parrotfish, are also targeted fishery species, their abundance is also lower in areas with greater fishing pressure.

### The most complex healthy fore reefs are SW of New Providence.

Most of the good condition reefs were southwest of New Providence and had high relief and complex habitat for parrotfish, groupers, and other reef organisms. Their health is likely to benefit from their proximity to the Tongue of the Ocean since they may be buffered against the effects of bleaching by their depth and the upwelling of cooler waters. Popular dive sites, like Nari Nari, Willaurie, Pumpkin Patch, and reefs like Razorback that are deeper and far from land, may be fished less than other surveyed reefs, resulting in their greater abundance of large groupers. Nevertheless, these reefs remain at risk from human impacts, such as pollution from the nearby petroleum port. The virtual absence of long-spined urchins may have reduced resistance to spatial competition from seaweeds, thus underscoring the importance of protecting parrotfish to maintain reef health.

### Reducing human pressures can help New Providence reefs recover.

All reefs surveyed in 2011-2012 showed signs of human impacts and stressors that negatively affect their health. This is not surprising, based on the proximity of these reefs to the population center and tourist center of The Bahamas. With cruise ship visitation rates tripling in the past 30 years along with growth in the Bahamian population on New Providence, stresses to reefs and nearshore habitats are on the increase. These stresses may be mitigated by active management aimed at reducing impacts from coastal development, loss of nursery habitats, overfishing, and increased tourism. A good way to achieve positive results is by establishing protected areas that are managed to allow, but also regulate, human uses of the area and restrict adverse land-based impacts.

# Helping Reefs Heal

**1. Marine Protected Areas (MPAs) help coral reefs recover and improve human well-being.** They may be zoned for multiple uses and protection that range from areas where no anchoring is allowed to ones where fishing is limited or prohibited entirely. Benefits of MPAs have been shown in The Bahamas and around the world.

- **Create coral reef-protected areas for the New Providence area**

– Currently, there are no MPAs around New Providence that include coral reef habitats. Protecting at least 10% of reef areas around New Providence with effective management and compliance will benefit people and reefs. Creation of MPAs would help populations of key species like grouper and snapper to recover, prevent declines of parrotfish, improve overall reef health, and replenish fisheries.

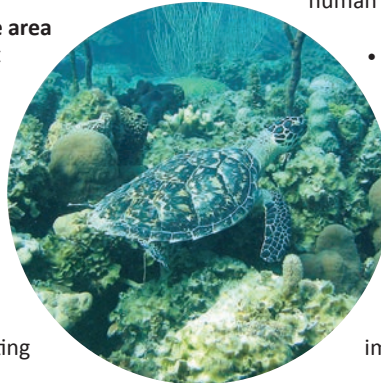
**2. Rebuilding native fish populations improves reef health and enhances economic livelihoods.** Increased demand for seafood is reducing New Providence Island's native fish populations, disrupting natural reef processes, and eliminating important spawning grounds. Action is needed quickly to halt further losses, reverse declining trends, and rebuild robust native fish populations vital to the economic and cultural well-being of The Bahamas.

- **Ban fishing for parrotfish** – Parrotfish are essential for keeping coral reefs healthy and are at risk of population collapses if they become targeted fishery species. Similar to efforts in Belize, Bermuda, and Bonaire, protecting parrotfish can help keep reefs from becoming seaweed dominated.

- **Improve protection of fish at spawning times** – Groupers and snappers are highly vulnerable as they migrate great distances to spawn. To prevent any further loss of viable spawning aggregations, permanent well-enforced seasonal closures and adherence to size regulations are required.

- **Increase minimum size for Nassau groupers and establish size-based fishing regulations for other species** – The current minimum size limit for Nassau groupers (3 lbs.) allows many fish to be caught before they reproduce. Increasing the minimum size limit to 5 lbs. or more will result in more fish. Size regulations for snappers, grunts, and other target species will result in more fish.

- **Remove invasive lionfish from selected reefs** – Exotic lionfish have established populations throughout The Bahamas and were found at 23% of sites around New Providence. Lionfish are a predator of native fish and may economically impact commercial fisheries. Removing lionfish as part of an ongoing management activity, especially at select priority sites, will help protect important native fish stocks.



**3. Minimizing human pressures benefits both coastal habitats and people's livelihoods.** New Providence reefs have been affected by many human activities, including vessel groundings, anchor damage, pollution, coastal development and dredging as well as increased nutrients from septic systems, lawn fertilizers, and golf courses. Reducing these impacts benefits ecosystem and human health.

- **Reduce impacts from coastal development** – Development of the New Providence coastline is important for economic growth, but it can be designed to maintain or improve the quality of marine habitats and resources.

- **Reduce anchor damage and likelihood of vessel groundings** – Moorings can be installed at dive sites to prevent anchoring on reefs. Anchoring of commercial vessels should be limited to sandy seafloors away from reefs and boat channels marked to encourage safe navigation. A system of fines should be implemented for vessels that impact reefs, using these funds to assess, restore, and monitor impact sites.

- **Rehabilitate reefs** – Several degraded reefs around New Providence may benefit from rehabilitation efforts. These efforts could include restoring populations of reef-building corals from nurseries and the reintroduction of long-spined sea urchins.

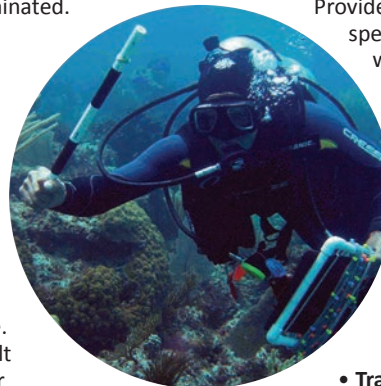
- **Further protect and restore nursery habitats** – Dramatic loss of New Providence's mangrove habitats has impacted nurseries for important species. Restoring remaining stands like Bonefish Pond and Adelaide Creek will increase fisheries, improve water quality, and protect coastal shorelines.

**4. Investments made now to protect coral reefs will yield benefits for the future.**

- **Invest in education and training** – Building awareness of the risks reefs face and how they can be reduced through positive action helps inspire people to do their part in protecting reefs. Investments made now to train the next generation of leaders will yield long-term benefits.

- **Track reef health through research and monitoring** – Much is to be learned about the stressors responsible for causing declines and the processes needed to improve reef health. Sound science helps improve effective, adaptive management. Effective monitoring can involve trained researchers who conduct detailed assessments every three to five years along with citizen volunteers and students who examine key indicators on a more frequent basis.

- **Reporting** – Conducting research and monitoring is important, but without an effective means of reporting, information often gets lost or overlooked. Report cards like this one are a tool for linking science to sound management.





*Respecting closed seasons and other fishery regulations results in big groupers needed for healthy reefs and food for our future.*



Craig Dahlgren



*Restoring mangroves improves ecosystem health and nursery habitats important for conch, fish, and lobsters.*



Janeen Bullard



*Establishing coral nurseries helps restore threatened species and creates new habitat.*



Tanya Kamerman



*Protecting parrotfish can help save reefs from seaweed overgrowth and promote new coral growth on reefs.*



Craig Dahlgren

# ATLANTIS BLUE PROJECT

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