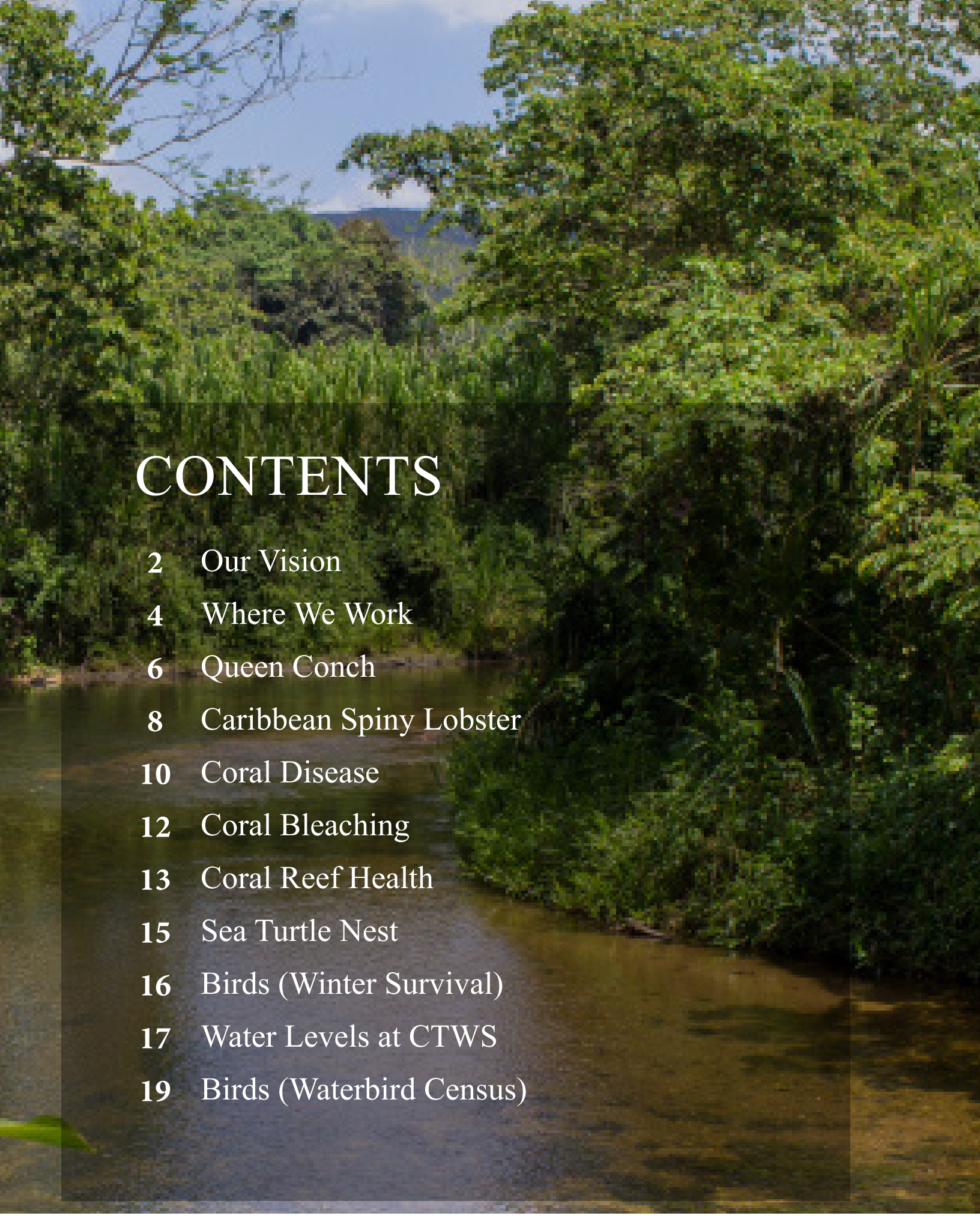


BELIZE AUDUBON SOCIETY

Belize Audubon Society's Research and Monitoring Annual Report 2020-2021



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Our Vision

The Belize Audubon Society (BAS) is a national conservation leader and development partner that inspires people to live in harmony with and benefit from the environment.

Our Mission

The Belize Audubon Society is a non-governmental membership organization dedicated to the sustainable management of our natural resources through leadership and strategic partnerships with stakeholders for the benefit of people and the environment.

Our History

The Society was formed in 1969 as a foreign chapter of the Florida Audubon Society and in 1973, became a completely independent Belizean organization.

BAS is the longest standing conservation NGO in Belize charged with co-managing seven of Belize's most biologically and topographically diverse protected areas. BAS helped establish Belize's first protected area at Half Moon Caye, and now co-manages seven protected areas in partnership with the Government of Belize.

BAS is a membership organization with an elected Board of Directors. It is a registered NGO under the Non-Governmental Organizations Act of Belize 2000, and is a member of several international organizations and local allies.

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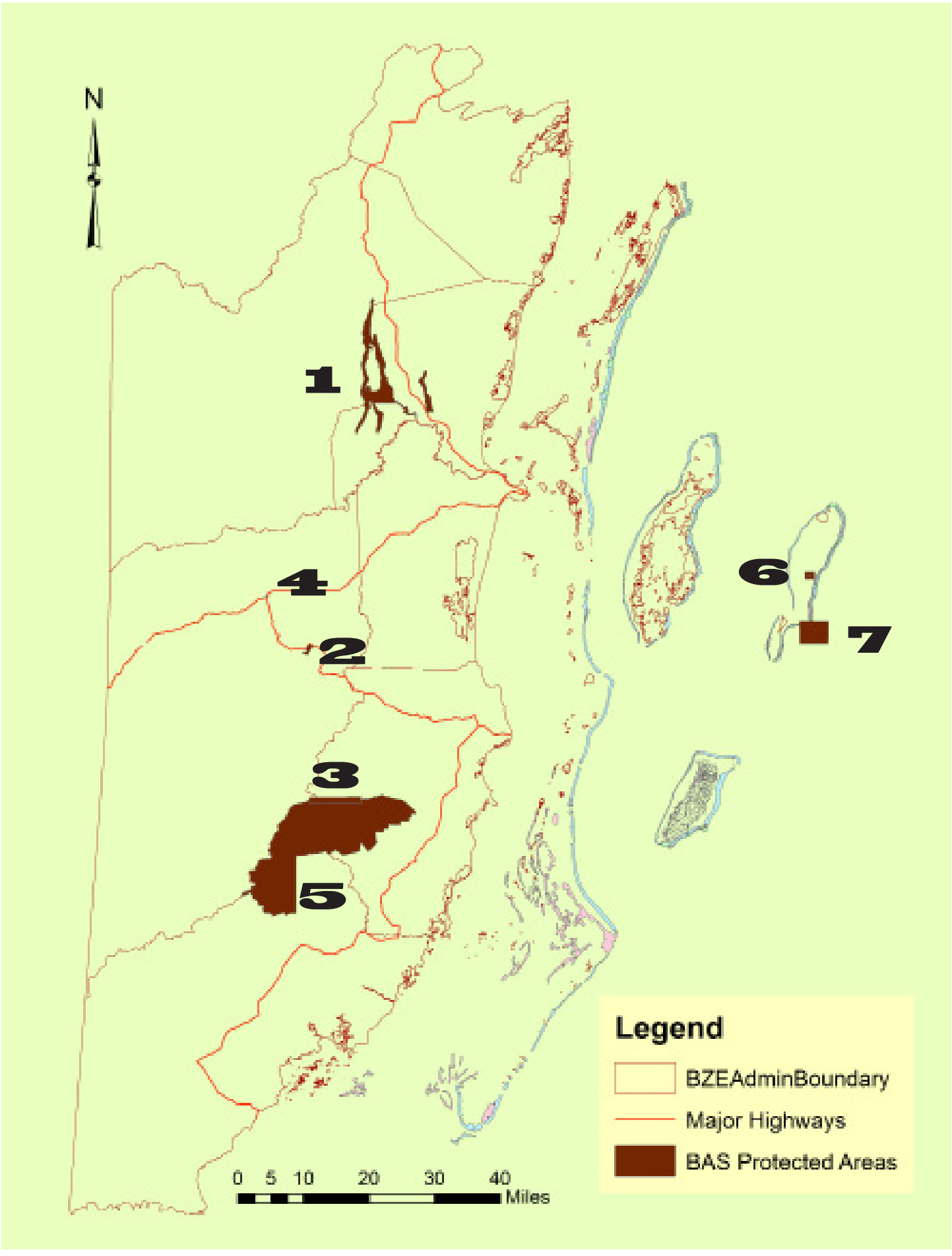
BELIZE AUDUBON SOCIETY

PROUD MEMBER OF:

BirdLife INTERNATIONAL

IUCN

ASSOCIATION OF PROTECTED AREAS MANAGEMENT ORGANIZATIONS
APAMO
The Voice of Belize's Protected Areas


N
1
2
3
4
5
6
7
0 5 10 20 30 40
Miles
Legend
BZEAdminBoundary
Major Highways
BAS Protected Areas

The BELIZE AUDUBON SOCIETY co-manages the following seven protected areas:

1



CROOKED TREE Wildlife Sanctuary

4



GUANACASTE National Park

2



ST. HERMAN'S BLUE HOLE National Park

5



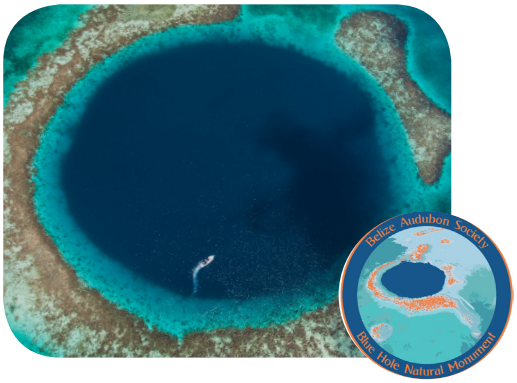
COCKSCOMB BASIN Wildlife Sanctuary

3



VICTORIA PEAK Natural Monument

6



BLUE HOLE Natural Monument

7



HALF MOON CAYE Natural Monument



BIODIVERSITY RESEARCH & MONITORING

2020 was a year filled with the most uncertainty, having unprecedented societal, economic and environmental challenges due to COVID-19. Nevertheless, our programme efforts continued within the seascape of Lighthouse Reef Atoll, which includes the Half Moon Caye and Blue Hole Natural Monuments. Biodiversity and ecosystem monitoring are conservation tools used to inform protected areas management. Highlighted here are the key research and monitoring activities.

Marine Monitoring

Queen Conch Monitoring



The Queen Conch (*Aliger gigas*) continues to thrive within the boundaries of Lighthouse Reef Atoll (LHRA) which is a prime nursery ground; however, this CITES listed species remains as a highly sought-after marine product across its range. A harvesting season exists and runs for 9 months from 1st October to June 30th of the following year. However, the high demand often results in the illegal extraction of juveniles and the black-market trade which continues to threaten regional populations. 2020 marked the second year in a row the conch season was closed early, and the three extra months produced positive results in the fishery. Data collected just before the opening of the season in Oct 2020, showed that the average densities as well as shell lengths up to the end of the closed season increased in both the General Use and Restricted Zones of the Lighthouse Reef Atoll; however, data collected a the close of the season shows densities fell from what was previously determined at the beginning of the. This is the expected trend. General use zones showed a drop from 415-283 conch per hectare while the restricted zones saw a drop from 545-170 conch per hectare. This cycle should continue to repeat itself year after year if fishing is sustainable. Fortunately, average conch densities are still above the CITES 88 conch/hectare regulation.

The data for each habitat type shows that majority of the sample measured, failed to meet the lip thickness maturity size limit of 12 mm for females and 9mm for males resulting in the indication of a juvenile population existing at LHRA. 2020 pre-season and 2021 post surveys in the Atoll showed the preferred conch habitat was sparse seagrass, specifically in the Restricted Zones.

CONCH DENSITY AT LIGHTHOUSE REEF ATOLL

SANDY



At Open of Season 2020

CONCH/HA

RZ: 0 GUZ: 127

SHELL LENGTH

≥7in: 51%
<7in: 49%

LIP THICKNESS

Juvenile: 74%
Sub adult: 24%
Spawner: 2%

At Close of Season 2021

CONCH/HA

RZ: 0 GUZ: 471

SHELL LENGTH

≥7in: 4%
<7in: 96%

LIP THICKNESS

Juvenile: 99%
Sub adult: 1%
Spawner: 0%

SPARSE SEAGRASS



At Open of Season 2020

CONCH/HA

RZ: 1378 GUZ: 444

SHELL LENGTH

≥7in: 22%
<7in: 78%

LIP THICKNESS

Juvenile: 47%
Sub adult: 14%
Spawner: 39%

At Close of Season 2021

CONCH/HA

RZ: 460 GUZ: 99

SHELL LENGTH

≥7in: 25%
<7in: 75%

LIP THICKNESS

Juvenile: 42%
Sub adult: 8%
Spawner: 51%

DENSE SEAGRASS



At Open of Season 2020

CONCH/HA

RZ: 83 GUZ: 27

SHELL LENGTH

≥7in: 69%
<7in: 31%

LIP THICKNESS

Juvenile: 25%
Sub adult: 50%
Spawner: 25%

At Close of Season 2021

CONCH/HA

RZ: 13 GUZ: 14

SHELL LENGTH

≥7in: 64%
<7in: 36%

LIP THICKNESS

Juvenile: 43%
Sub adult: 29%
Spawner: 29%

Key Terms

Conch/HA - CITES regulation (88 conch/hectare for a viable population)
Shell Length - the legal shell length for harvesting must be 7 inches or more
Lip Thickness - Juvenile: 0mm
Sub Adult: 1-9mm
Spawner: >10 mm
RZ: Restricted Zone (zero extraction is allowed in this area)
GUZ: General Use Zone (fishers with a managed access license for zone 7 is allowed to fish in this area)

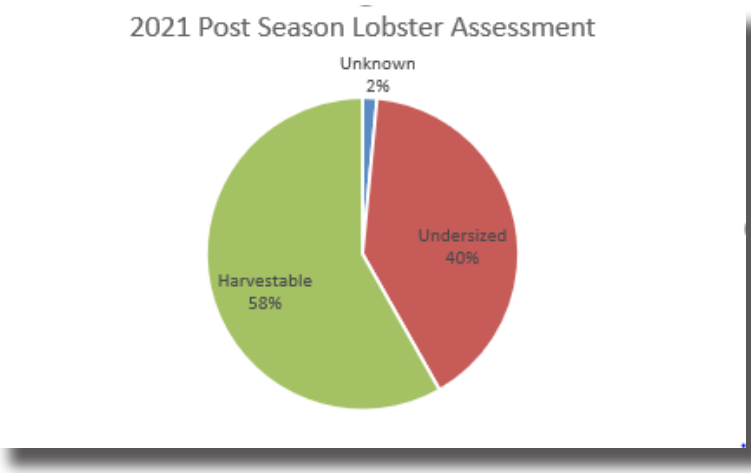
Caribbean Spiny Lobster Monitoring

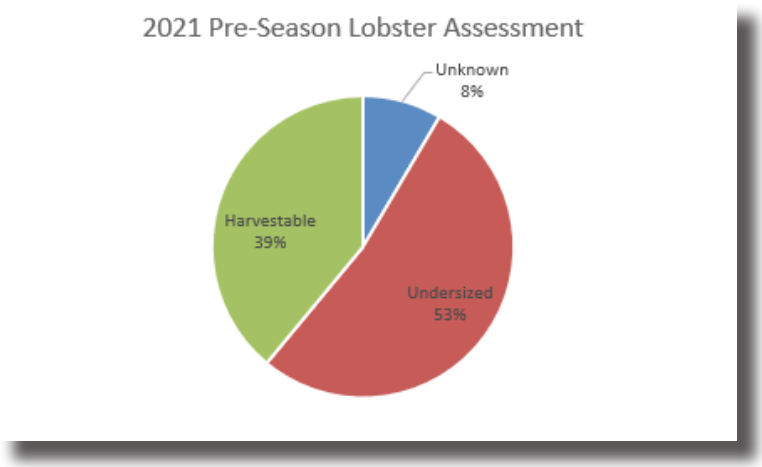


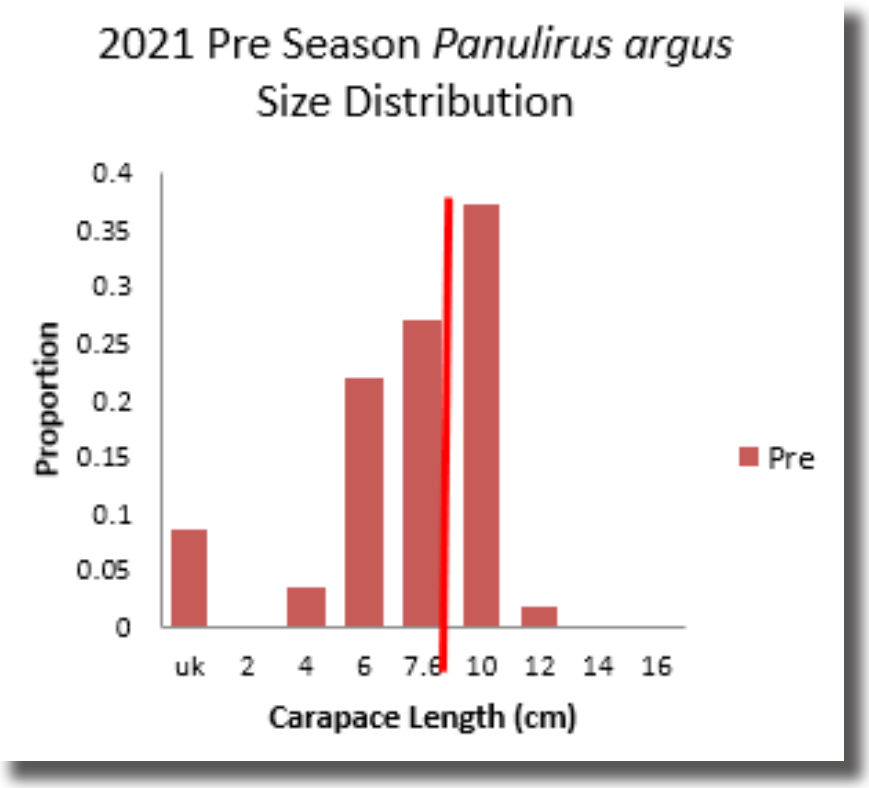
The lobster pre-season survey was conducted in June 2021. Data collection efforts were influenced by rough weather and possibly contributed to low a catch per unit effort (CPUE) when compared to the post-season efforts.

Post-season collection in February 2021 using timed surveys showed 3.65 and 10.29 lobsters being encountered per hour in the General Use Zones and Restricted Zones, respectively. Of those measured, 58% met the harvestable size limit, while 40% were classified as undersized (juveniles). The remaining 2% were recorded; however, not close enough to be measured. The adult to juvenile ratio favored adults in both zones; however, the males were favored in both zones when considering the gender ratio.

Pre-season collection in June 2021 for the timed surveys showed only 4.35 and 6.29 lobsters being encountered per hour in the same two zones. Historically, data shows trends of marginally increased abundance from the end of a fishing season to the start of the new fishing season, hence the reason, weather was considered when comparing the two data sets. Of the total lobsters measured during the pre-season survey, it was noted that 39% fell in the harvestable category measuring 7.6cm while a majority, 53% were undersized. The remaining 8% were recorded; however, not close enough to be measured. The dominant size category was 8-10cm carapace length. The adult to juvenile ratio favored adults in both zones; however, the males were favored in both zones when considering the gender ratio.







Zones	Average CPUE	Avg CPUE in Stage Category			Avg CPUE Gender		
		Juvenile	Adult	Unknown	Male	Female	Unknown
RZ	6.29	4.00	6.29	0.00	7.14	3.14	0.00
GUZ	4.35	1.65	2.00	0.00	3.06	0.47	0.12

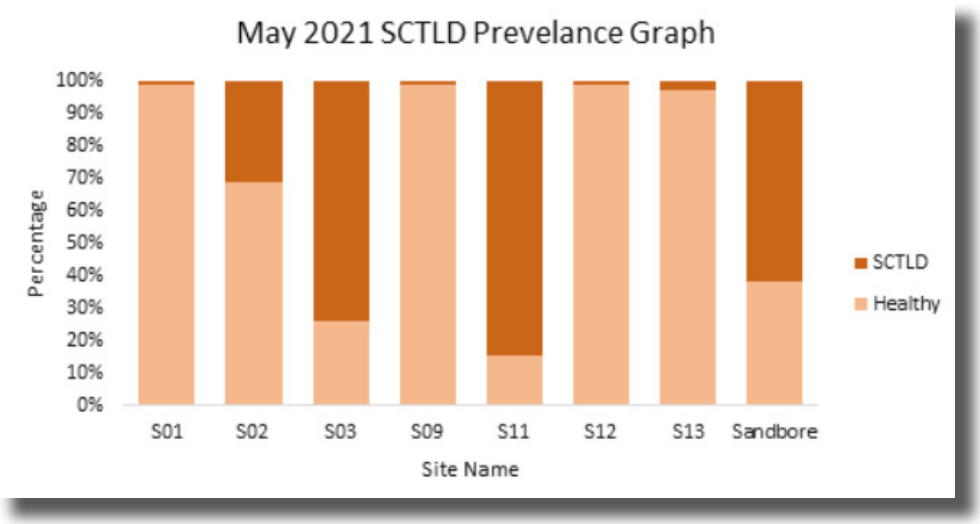
Coral Disease

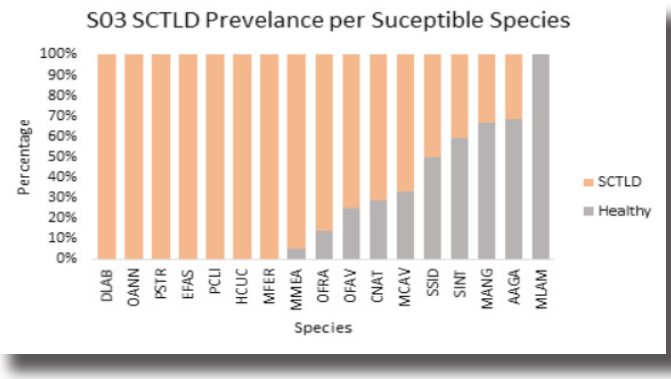


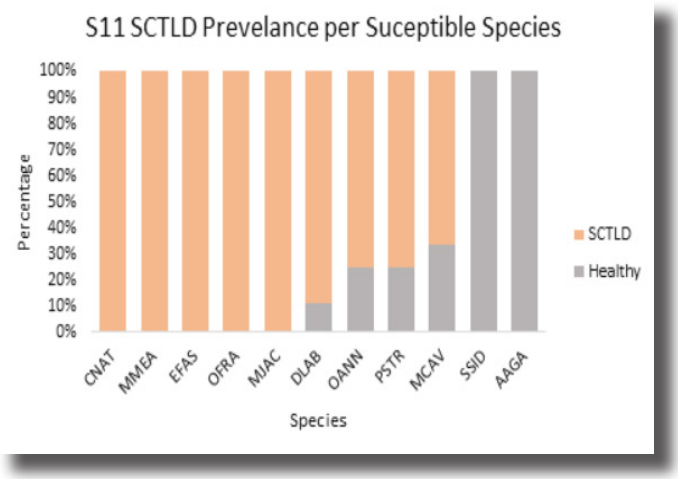
The lethal Stony Coral Tissue Loss Disease (SCTLD) was confirmed at LHRA September 2020 at the northern most tip just outside of the atoll. By the end of Dec 2020, it had spread ~600m east of the "ground zero" site, but not significantly and remained outside the atoll. Up to June 2021, sites with highly susceptible species on both the forereef and patch reefs were continuously monitored and corals were assessed for presence of SCTLD. The general trend is that the disease is spreading more on the western side in a southerly direction and also moving inside the atoll. As a result, the only area of the atoll that are free of SCTLD is the south eastern edge and the middle reef. For a full view of all affected sites in the region and Belize, visit agrra.org.

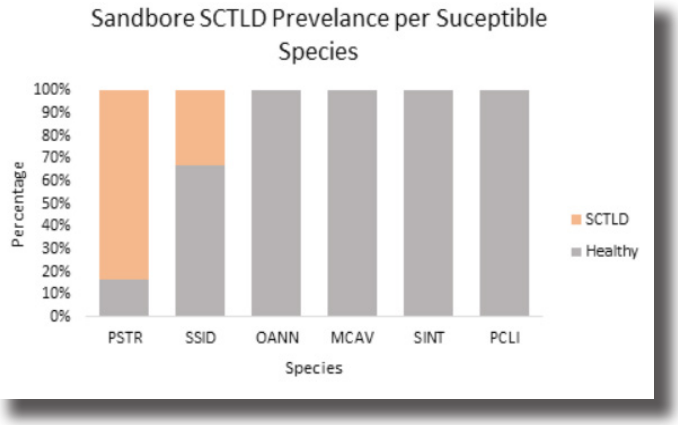
Data collection using the roving diver methodology occurred initially at 15 sites when the rapid assessment was conducted to assess the prevalence of Stony Coral Tissue Loss Disease (SCTLD) and determine presence in new areas. However, only 8 sites were selected for continuous data collection. This allows for continuous disease tracking to determine SCTLD stage progression.

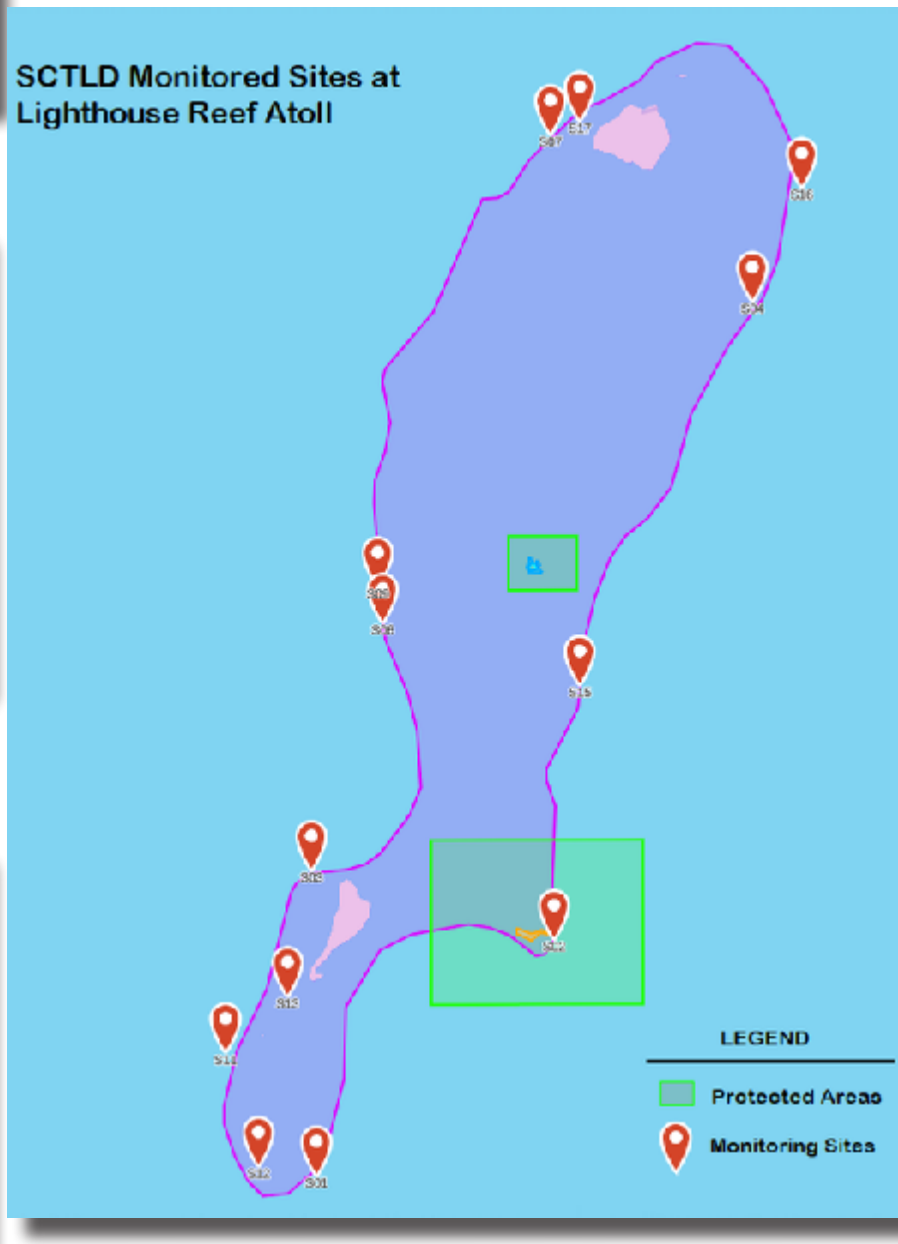
The affected sites that had over 50% prevalence of the disease were S03 (Aquarium dive site), S11 (south of Hat Caye on forereef) and Sandbore (ground zero site) at the north of the atoll. Of the sites with more than 50% SCTLD prevalence, generally 100% of individual species exhibit SCTLD lesions.




S03 SCTLD Prevelance per Suceptible Species
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
DLAB
OANN
PSTR
EFAS
PCLI
HCUC
MFER
MMEA
OFRA
OFAV
CNAT
MCAV
SSID
SINT
MANG
AAGA
MLAM
Species
SCTLD
Healthy


S11 SCTLD Prevelance per Suceptible Species
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
CNAT
MMEA
EFAS
OFRA
MJAC
DLAB
OANN
PSTR
MCAV
SSID
AAGA
Species
SCTLD
Healthy


Sandbore SCTLD Prevelance per Suceptible Species
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
PSTR
SSID
OANN
MCAV
SINT
PCLI
Species
SCTLD
Healthy


SCTLD Monitored Sites at Lighthouse Reef Atoll
LEGEND
Protected Areas
Monitoring Sites

Coral Bleaching

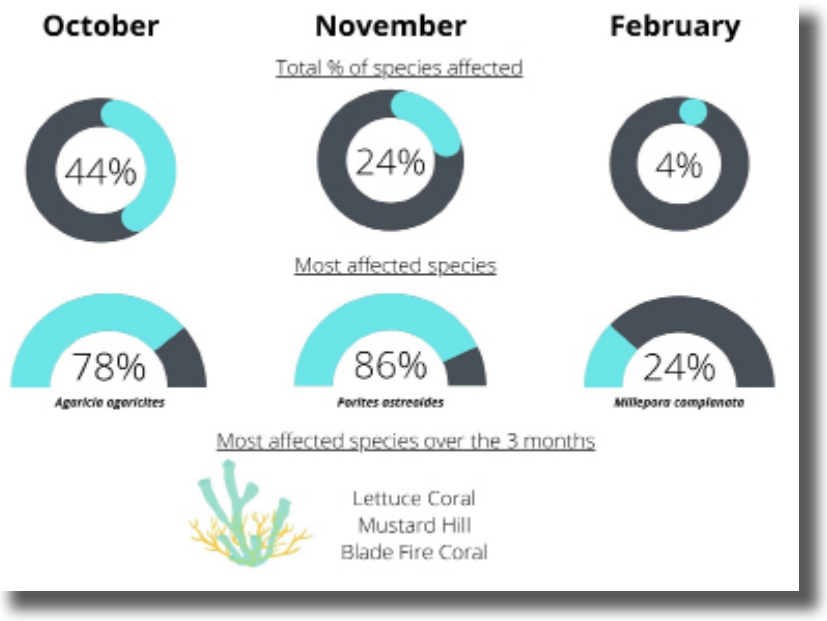


Coral Reefs face many threats/stressors and coral bleaching, is just one. The zooxanthellae algae is expelled in response to stress and in the case of coral bleaching, it is often as a result of extreme heat.

At LHRA the most severe bleaching year to date is 2017 with 40% of all corals surveyed exhibiting either partial or whole bleaching. In 2020, only 19% of corals surveyed were affected in the same way. Monitoring was conducted October and November and it was noted that sampling sites on the north-west and west side of the atoll had the most affected corals than the east with the least affected species.

Results for October showed that of all species recorded, 44% were affected with *Agaricia agaricites* (lettuce coral) being the most affected primarily at the Aquarium site. In November, the percentage decreased at most sites with only 24% of corals being affected, except for those sites where *Porites astreoides* (mustard hill coral) was the dominant species and resulted in an adverse effect ranging from 62 to 86% of species being affected. Notably, Aquarium still showed a high occurrence of bleaching in November when compared to other sites.

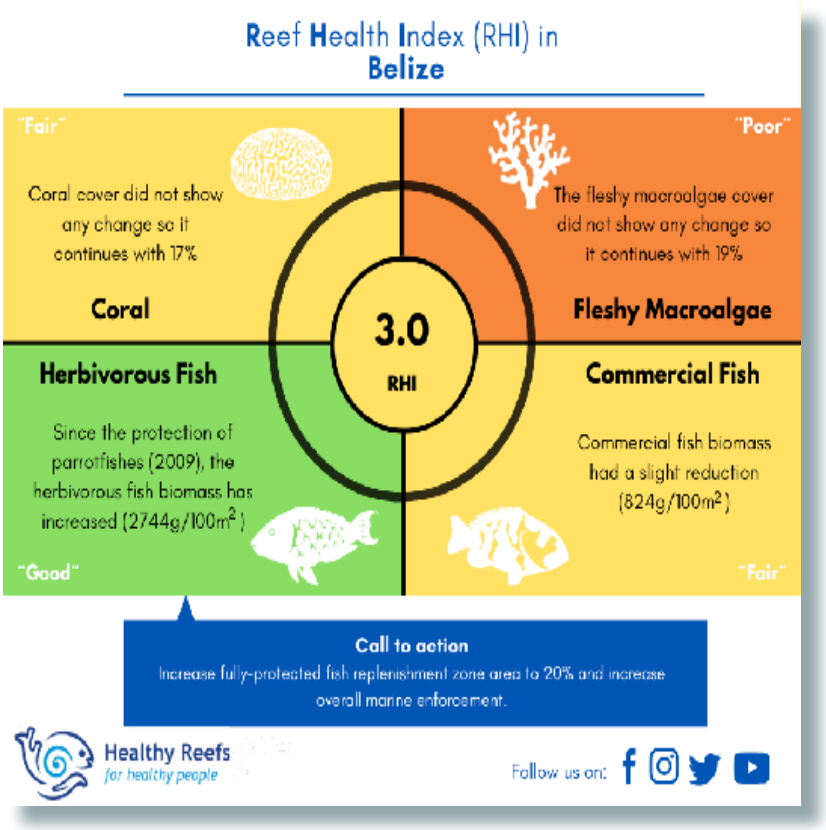
In February 2021, data was only collected at 6 sites due to weather conditions. An overall 4.37% of corals were affected. At specific sites, the results showed bleaching levels at a low 7% at Mitch Bay, 8% at Hat Caye, and 5% at Halfmoon Wall (HM Wall). All other sites surveyed had less than 2% of corals bleached.



October 19 species were affected, but in November it rose to 23; however, only three species were severely impacted overall. By February only 17 species were affected. It was noted that three 3 species of brain corals (reef building spp.) were affected, but only 5% of sample size. This species is highly susceptible to Stony Coral Tissue Loss Disease (SCTLD).

Coral Reef Health

Long-term reef monitoring also includes observations of the benthic composition and the reef fish diversity and abundance. Of the 10 sites monitored at the LHRA, 9 were surveyed this year. The 2020 Reef Health Index for Belize was 3.0 and LHRA achieved the same score landing the atoll in "fair" health. This is a steady increase from "poor" with a 2.3 score in 2015.



Benthic composition

Data collected focused on benthic species composition (diversity), condition, abundance, size-structure, and distribution of these communities. The mean coverage for each category was noted for each reef type. Of note, Crustose coralline algae is important for coral recruitment. The reef type with the highest live coral cover, crustose coralline algae, macroalgae and aggressive invertebrates was the fore reef, but recorded the lowest for biofilms/cyanobacteria & turfs.

	Reef Type			
Benthos	Fore Reef (%)	Back Reef (%)	Patch Reef (%)	Mean (%)
Live coral	23	19	13	18
Crustose Coralline Algae	15	8	10	12
Other Macroalgae	24	5	21	20
Aggressive Invertebrates	7	4	2	4
Other Invertebrates	3	4	4	4
Biofilms/cyanobacteria & turfs	17	37	22	21
Non-living	12	24	28	21

Reef fish diversity

A total of 3,679 fish were recorded during the 2020 survey. Summary results note that:

- Patch reef recorded the overall highest for fish abundance while the fore reef recorded the highest for species richness.

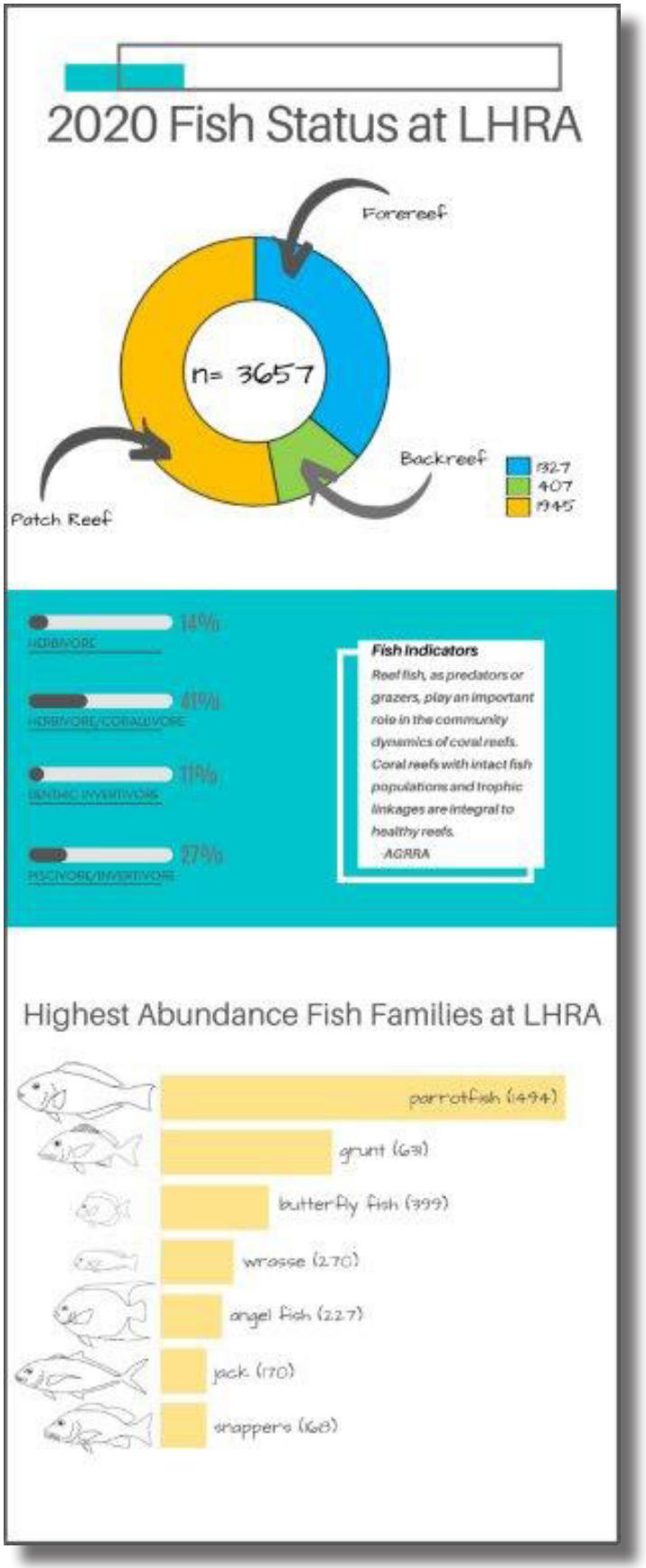
- The dominant size category (6-10 cm) was evident in all reef types with fish in the fore reef being the highest.

- Majority of fish documented were less than 20 cm in length. In the fore reef this represented 87%; 93% in the back reef and 94% in the patch reef.

- Very few fish over 40 cm were recorded in the back and patch reefs and less than 50 individuals being recorded on the fore reef.

- Herbivores/corallivores (parrotfishes) showed the highest densities per hectare in the patch reef followed by back reef and fore reef.

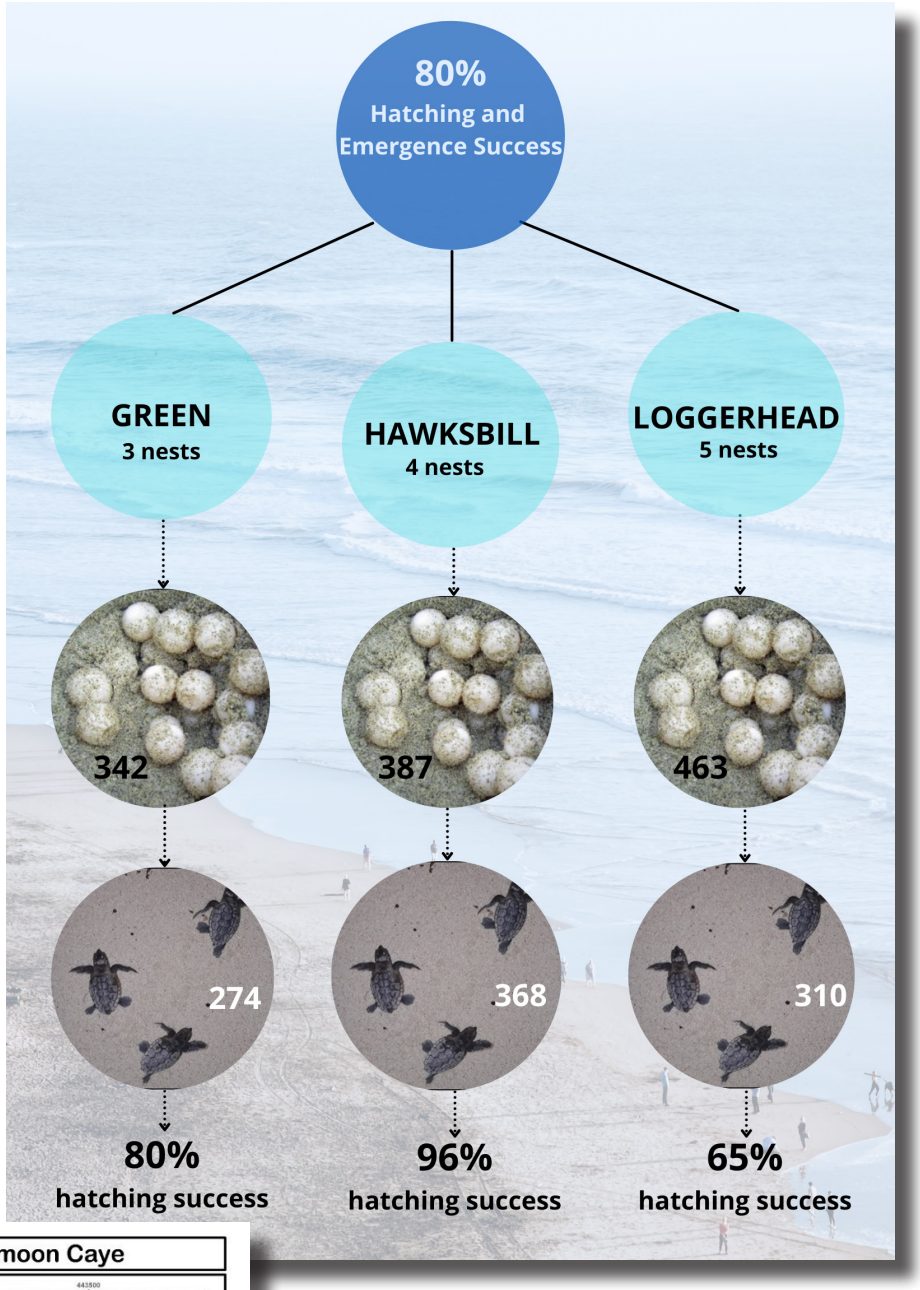


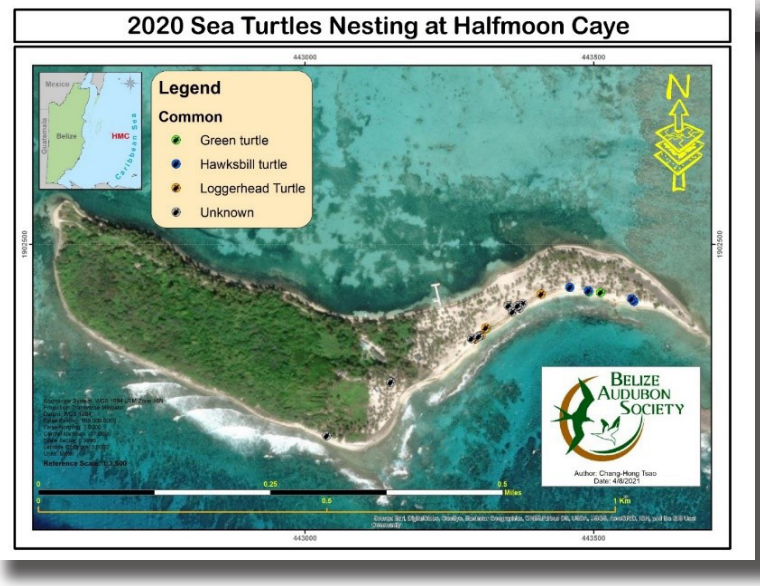


Sea Turtle Nest Monitoring

Turtles continue to nest on the beaches within the Lighthouse Reef Atoll. Along the HMC south east beach, nesting activity was recorded during the nesting season for the three turtle species. Majority of the nests were found on this side of the island compared to the west (sunset beach). In 2020, there were no significant changes to impact nesting activity. Of the 21 nests recorded, full nesting data was only recorded for 12 as the species for 9 nests were unknown.

The highest total number of eggs was laid by the Loggerhead species however, the Hawksbill had the highest total number of eggs hatched. Hawksbill sea turtles showed the highest hatching and emergence success at 95.54%. Historically, this has not been the case; this species often exhibits the lowest success rates.

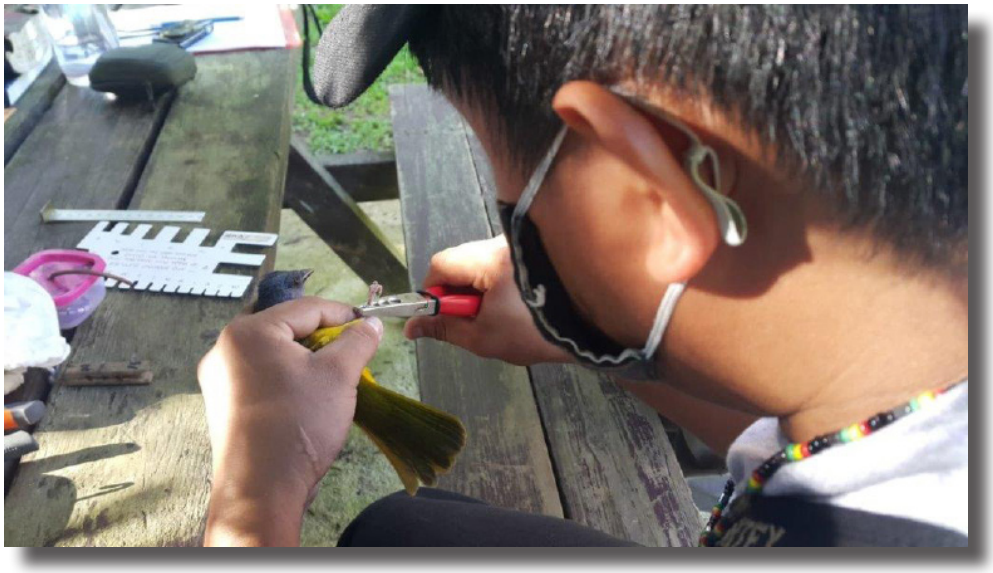




Terrestrial Monitoring

Bird Monitoring: Monitoreo de Sobrevivencia Invernal (MoSI)

As a safe haven for migrating birds during their winter migration from North American to Central and South America, Belize is well poised as a winter destination! The MoSI season lasted from November 2020 to March 2021. This monitoring effort continues to be led by the University of Belize-Environmental Research Institute and supported by its partners for the different MoSI stations --Belize Audubon Society, Black Rock Lodge, Toledo Institute for Development and Environment, Corozal Sustainability Future Initiative, Foundation for Wildlife Conservation, the Belize Forest Department. To date, there have been five monitoring seasons. The Assistant Terrestrial Research and Monitoring Officer is a key member of the team based at CBWS.







Seasonal highlights

- Total 386 captures
- Of a total of 20 target species to be caught in Belize, Black Rock Lodge had the highest (16) and CBWS the second highest (13)
- 33 recaptured migrants and 44 recaptured residents
- 5 migrants and 11 residents were common across all stations

Long-term trend

- Newly banded individuals varied from season to season for each species, but the recaptured individuals increased each season
- Species richness for migrants is also decreasing.
- Species with the highest capture rate were Wood Thrush and Gray Catbird followed by White-eyed Vireo, Northern Waterthrush, Ovenbird, Kentucky Warbler and Magnolia Warbler.
- November and December are the most active months having the highest number of newly banded birds and highest in recaptures.



Popular captures

Migrants: Wood Thrush, Worm-eating Warbler, Kentucky Warbler, Ovenbird, Gray Catbird

Residents: Greenish Elaenia, Tawny-winged Woodcreeper, Ochre-bellied flycatcher, Red-capped Manakin, Northern Bentbill, Red-throated Ant-tanager

CBWS highlights

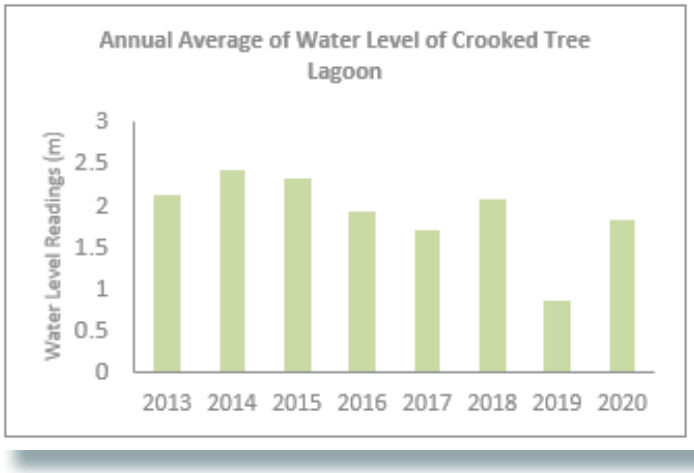
- CBWS had the highest number of birds captured than all other MOSI stations.
- CBWS had the highest number of newly banded residents and migrant individuals
- CBWS had the highest resident species captured and second highest migrant species captured
- A total of 41 migrant individuals and 76 resident individuals were recaptured
- 25 migrant individuals and 18 resident individuals caught during the MoSI season were repeat captures from previous seasons
- Gray Catbird and Wood Thrush were the most common species
- "Returns" highlight the importance of CBWS as a critical habitat for birds and their survival and shows that birds exhibit site fidelity.

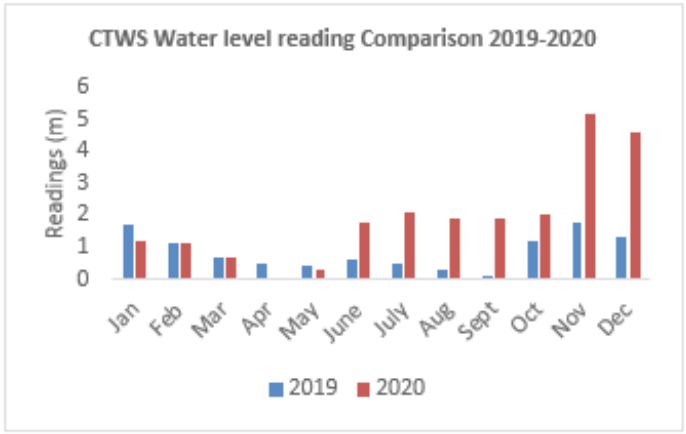
University of Belize, Environmental Institute 2021
Summary based on 2020-2021 MOSI season report
"Improving Natural Resources Management in Belize through Bird Monitoring"

Water Level Monitoring at CTWS

In general, monitoring water levels can have numerous environmental benefits and particularly so for the Crooked Tree Wildlife Sanctuary, which serves as sponge for excess water overflowing from the Belize River during flood events. In addition, the fact that Crooked Tree Village sits on an island surrounded by the lagoon, makes it even more important for the Metrology Office and BAS to monitor the water levels as severe flooding events affect people and wildlife.

The first graph shows the comparison of 2019 and 2020 which corresponds with 2019 being a drought year and 2020 being one that experienced severe flooding in the last quarter. All readings starting from Jan 2019 fell below the 2m mark, particularly for months during the rainy season which normally ranges from 2m and above, while November and December recorded levels up to 5m. The second graph compares average water levels across eight years, again showing many of the years above the 2m mark and reiterating that 2019 was an unusually dry year.



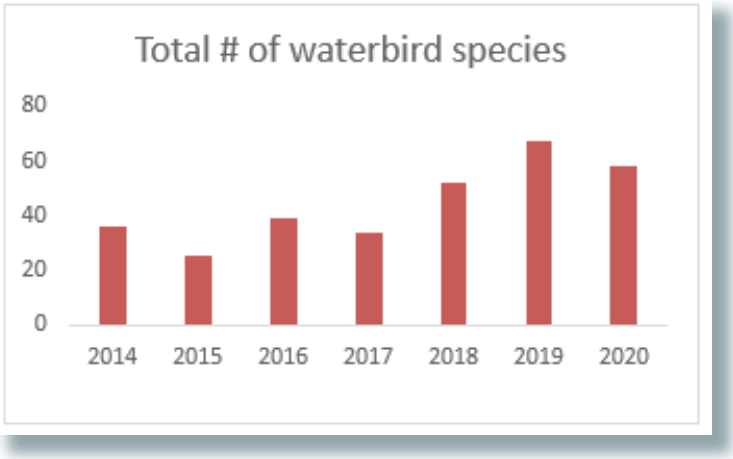


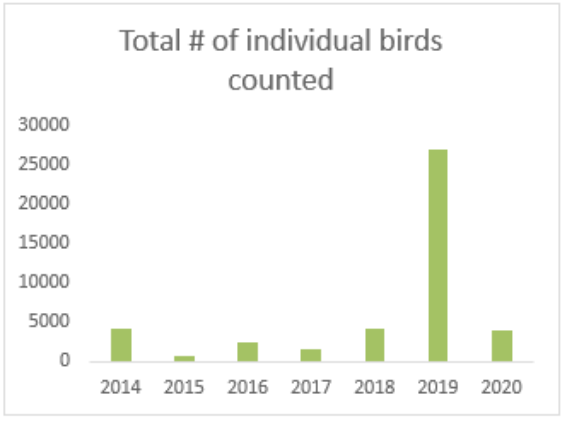


Central American Waterbird Census

In 2011, the Waterbird Conservation Council, in coordination with Wetlands International and BirdLife International, launched the Central American Waterbird Census (CAWC). The Belize Audubon Society as the BirdLife partner for Belize and co-manager of CTWS, participates in collecting the data for the CAWC in Belize. There are now four (4) general locations across three (3) main regions (north, central and south) in the country. Besides conducting the CAWC, BAS also provides environmental education to the community schools around the wetlands, emphasizing its importance for conservation during the celebration of World Wetlands Day.

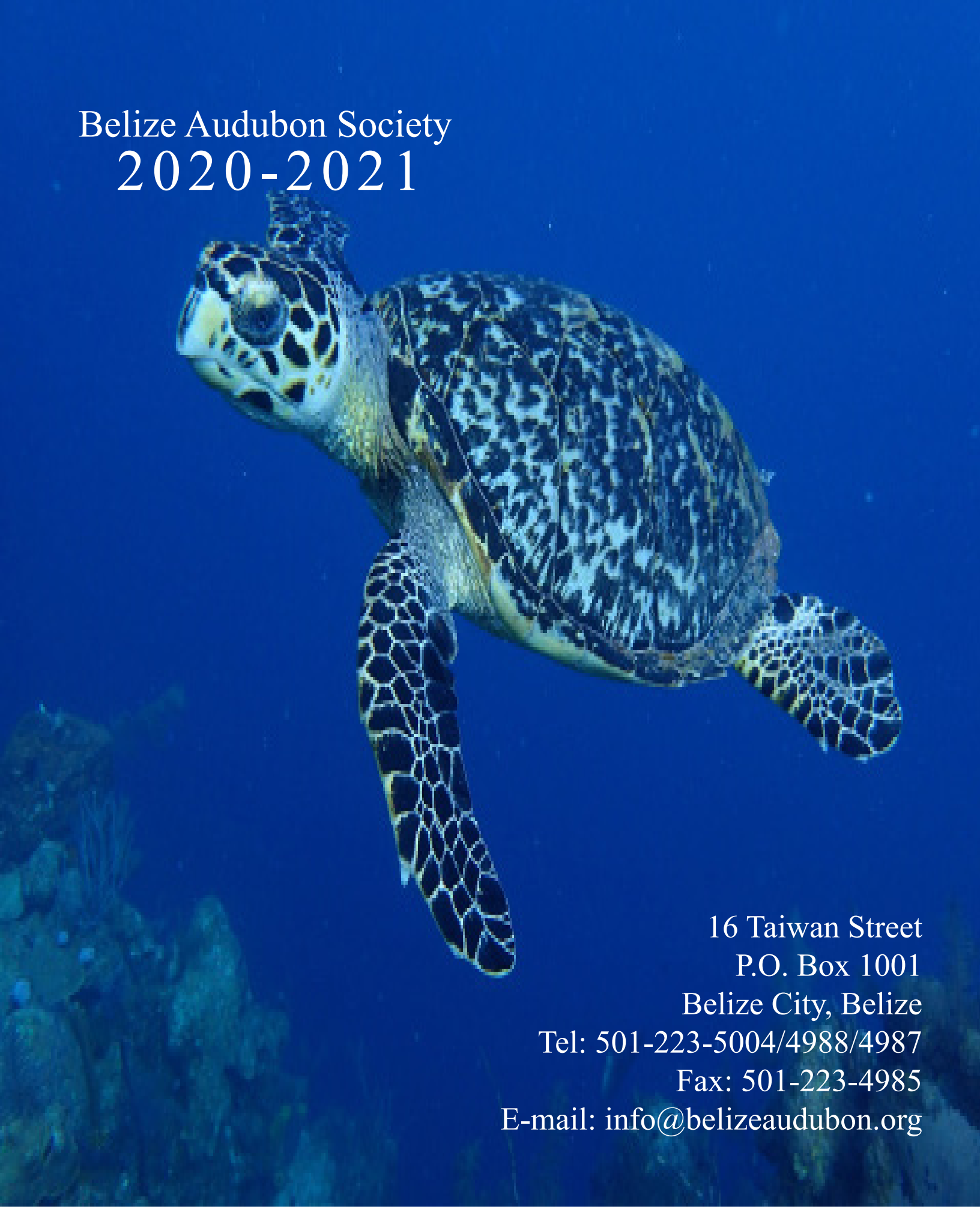
Focusing just on Crooked Tree Wildlife Sanctuary-central, and looking at February being the month with the most consistent data across the years, 2020 fell below the 2019 record with only a total of 1361 individuals from 32 species. Results for the other locations yielded north-24 species & 728 individuals and south 39 species & 1769 individuals. 8 people assisted (BAS staff, staff of Sarteneja Alliance for Conservation and Development and birders).







Belize Audubon Society
2020-2021



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