Envirotalk

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PROMOTING APPRECIATION, ENHANCEMENT AND CONSERVATION OF BERMUDA'S ENVIRONMENT

WELCOME

to our fall edition of Envirotalk.

In this issue –

- **Corey Eddy**, a PhD Candidate of the University of Massachusetts, talks about the 14 species of shark found in Bermuda waters
- Department of Conservation Services Summer Student, **Miguel Mejias**, gives an overview of his work on tropicbird breeding success.
- **Claire Jessey**, Entomologist and Plant Protection Officer, continues to help us identify some of the more common citrus pests in the continuation of this two-part article.
- See the planting calendar to get a head start on what to plant this Fall.

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ONE SHARK, TWO SHARKS, WHITE SHARK, BLUE SHARK

Most Bermudians don't think there are many sharks here. They would be surprised to learn that at least 14 species can be found in the local waters. Unfortunately, they might also be scared of that reality because of ancient, mistaken and misleading stereotypes that suggest sharks are dangerous man-eaters. That is not the case of course and it is important to note that, despite the variety and abundance of sharks here, there has never been a fatality. This fact may hopefully reinforce the truth: they are not as dangerous as popular media wants you to think. The reason that few people know we have so many sharks is that most are found offshore or in deep water, and few come into the shallows; those that do typically only do that at night.

The most common sharks are Galapagos sharks (*Carcharhinus galapagensis*), known locally as duskies, and tiger sharks (*Galeocerdo cuvier*). We know more about these species than the others and have recently learned some very interesting things. Work by a scientist at the University of Rhode Island, in collaboration with the Bermuda Shark Project, has shown that some of our tiger sharks travel to the Bahamas in the winter before returning here again when the water warms up. Preliminary results from my own research, the Galapagos Shark Research Program, suggest that true duskies (*Carcharhinus obscurus*) and Galapagos sharks, two species assumed to be distinct, may in fact be the same shark. If this is the case, all Galapagos sharks the world over will have been misidentified and will need to be reclassified as true dusky sharks.

Offshore, usually more than 50 miles from land, we have makos (*Isurus oxyrinchus*), blues (*Prionace glauca*), and oceanic whitetips (*Carcharhinus longimanus*). Makos are one of the fastest sharks in the ocean, capable of reaching burst speeds of 30 miles per hour and sometimes, usually when caught by rod and reel, they may leap 15 feet out of the water. Similarly, blue sharks,

one of the prettiest sharks in the sea, can reach speeds of over 20 miles per hour. In contrast, oceanic whitetips are a much slower, more languid swimmer. These latter sharks are open ocean predators and, as there is limited food out there, they typically move leisurely through the water to conserve energy. Another shark we see well offshore is the whale shark (*Rhincodon typus*), the largest fish in the ocean, maxing out around 60 feet long. Surprisingly, this giant primarily eats microscopic plankton.

In the deep water, we have two very interesting sharks. The sixgill shark (*Hexanchus griseus*) can be found as deep as 6,000 feet and grow up to 16 feet in length. While the great majority of sharks have five gill slits, this animal and a few of its closest relatives have one or two extras, hence the name. Two years ago, a St. David's fishermen caught an obscure shark in about 1,000 feet of water. It turned out to be a gulper shark (*Centrophorous sp.*), but we are not sure exactly which species of gulper it may have been as he released it before it could be identified; thankfully he took photos. A third species that can sometimes be found in deep water up to 700 feet is the gummy shark (also known as the smooth dogfish, *Mustelus canis*). This is not purely a deep water shark though, as it is often found right off the rocks too. These sharks have flat teeth, much like our molars, designed for crushing their normal prey: crustaceans like lobsters, crabs, and mollusks.

Inshore, we have nurse sharks (*Ginglymostoma cirratum*), one of the most docile sharks around. Unfortunately, they are very rare these days. Very few people will be fortunate enough to see them in any given year, although recently one was spotted on the wreck of the *Cristóbal Colón*.

It is also interesting to note that we have bigeye thresher sharks (*Alopias superciliosus*), great hammerheads (*Sphyrna mokarran*), and scalloped hammerheads (*Sphyrna lewini*). Threshers have a greatly elongated tail,

sometimes over one-half the total body length, which they whip through schools of bait to paralyze fish before turning around to swallow them. Scalloped hammers are known to aggregate in massive schools and before the US base closed, helicopter pilots saw this exact phenomenon, just a few miles out of St. David's.

Last, but not least, we have great whites (*Carcharodon carcharias*). This is surprising, as they generally prefer cool water, but there is a lot of deep, cool water nearby. They are not often found on the surface in Bermuda for that reason, but could pop up from time to time. In general, they are only seen in the winter months and early spring, but well offshore. That being said, one was spotted this past May by a foreign charter boat off Challenger Bank.

Those are the 14 we know of, but it is my opinion that we have more out there. Some may be known from other parts of the world, but it is possible that something might be here that is completely unknown to science. An example of the first possibility has arisen just recently. A local fisherman caught a shark several weeks ago that looks similar to the Galapagos shark, but its head is much more pointed and the teeth are distinctly different. I had a chance to take photos and examine the teeth, but I have not had the time to properly identify it. My first two guesses are that it might be an Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) or a smalltail shark (*Carcharhinus porosus*). Stay tuned.

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STUDENT CONSERVATIONIST TROPICBIRD STUDY

My name is Miguel Mejias and I am a fourth year undergraduate student currently attending Trent University. I'm striving to attain a B.Sc in biology, and then continue on with my studies to achieve a master's degree in conservation. There is no greater feeling than knowing exactly what you want to do. But this wasn't always the case. I've questioned my purpose in life many times and I must say, finding the answer was not easy. It was only in the summer of 2010 that I met Dr. David B. Wingate and became fascinated by his work. I was so fascinated that I began to accompany him as an apprentice on conservation projects throughout Bermuda, mostly involving Bermuda's native seabirds. It wasn't long until I realized that I

wanted to work as an ornithologist, a scientist who studies the biology of birds. Since becoming an apprentice to Dr. Wingate, my knowledge in Bermuda's natural history, bird species and the desire to be a conservationist grew. In the summer of 2012, I found myself heavily involved in the breeding success of the white-tailed tropicbird, better known as the longtail.

Despite its abundance along Bermuda's coastline, the white-tailed tropicbird is prone to numerous threats that continuously inhibit their reproductive success. Such threats include fierce hurricanes, which have been responsible for the loss of tropicbird nest locations through erosion and cliff collapse. In 2003 Hurricane Fabian, a category 3 storm, was responsible for an estimated loss of 300 white-tailed tropicbird nest sites within the Castle Harbour islands of Bermuda (Madeiros, 2011). Threats to white-tailed tropicbirds are not just limited to natural disasters. There have been instances of invasive species competing with Bermuda's tropicbirds for nest sites. The invasive domestic pigeon (*Columba livia*), is known to utilize crevices within cliff faces and rocky shorelines, effectively occupying potential nesting sites for Bermuda's native avian species (Talbot and Wingate, 2003).

Bermudian conservationists have taken extreme measures to protect and preserve the nesting success of white-tailed tropicbirds, more specifically the construction and installation of several artificial "igloo" nests for the white-tailed tropicbirds to nest in (Talbot and Wingate, 2003). These artifi-

cial nests offer protection against animals such as cats and dogs, and have narrow openings which discourage pigeons (Talbot and Wingate, 2003). As new artificial nests are installed annually, it has become increasingly important to monitor nest success during the breeding season, as well as observe the reproductive outputs of natural and artificial nest sites.

The Study

This summer, I conducted a white-tailed tropicbird breeding success study. My study had three primary objectives:

- To compare the nest success of white-tailed tropicbirds living in natural or artificial "igloo" nests situated on the mainland and small islands of Bermuda.
- To compare the overall nesting success of artificial and natural nests.
- To compare the nesting success of artificial nests on the mainland to artificial nests on the islands of Bermuda.

My study consisted of 200 nests in total: 100 on the mainland (50 artificial and 50 natural nests) and 100 on small islands off of the mainland (50 artificial and 50 natural nests). My mainland study sites included Ferry Reach, Shelly Bay, Cooper's Island and the Bermuda Aquarium Museum and Zoo. The island sites included Nonsuch Island, Bay Island, and Pearl Island. This study was conducted between April and mid-August, which is during the breeding season of the white-tailed tropicbird.

The results of my study revealed that:

- Nests stationed on the mainland had a significantly different fledging success than nests stationed on the islands, with island nests having 50% breeding success compared to a 35% breeding success of mainland nests.
- Artificial nests showed a 50% breeding success, which was significantly higher than the 36% breeding success of natural nests.
- Artificial nests on the islands showed a 58% breeding success, which was significantly higher than the 40% breeding success of artificial nests on the mainland.

The Future

My plans for next summer are to conduct a very similar study on the white-tailed tropicbird, but I will be looking at additional nesting factors that could explain the trend I am observing. I encourage anyone who is undecided about their future dreams to not give up. Reach out and connect with people who can help put you on the right path. Discover what it is that you are passionate about and use that passion to drive you.

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IDENTIFYING CITRUS PESTS – PART TWO

Producing a good crop of citrus fruit can be frustrating and not as easy as anticipated. However, with care and persistence, a good fruit crop can be expected. Learning to identify and control the insect and related pests is one of the first steps to your healthy citrus crop! (Please see previous issue, *Envirotalk* Vol. 80. No. 2, for part one)

Red Spider Mite

These mites are oval in shape and about 1/56 inch (0.5 mm) long. As the name suggests they are red in colour and difficult to notice without experience.

The citrus red mite feeds on leaves, fruit and green bark of all citrus varieties. Experience has found that these mites are most easily noticed on the upper surfaces of intermediate growth. As before, learning to identify mite damage is easier than identifying the mites themselves.

These mites also have piercing-sucking mouthparts. When the mite feeds on the upper leaf surface injury is characterized by light coloured scratched areas called stippling which gives a greyish or silvery appearance to the leaves or fruit. The leaves seem to lose their sheen. Damage can also occur on the underside of leaves leading to water loss and plant stress. In extreme situations, leaf drop will occur, as well as smaller, poorer quality fruit.

Spray with horticultural oils in the early spring and again in the early summer to control mite numbers, or use chemical miticides if necessary.

Interesting Fact: *It is estimated that there are more than 42,000 different*

species of mite living in diverse habitats. One species of mite lives in the tracheae (respiratory system) of honey bees.

Six-Spotted Spider Mite
This mite is slightly smaller than the citrus red mite and yellowish-white in colour with a few dots on the body. They are found on the undersides of the citrus leaves. In response to the feeding of the mite, the leaf turns yellow at the injury area and bulges upwards. Damage is often noticed close to veins, but the bright yellow blotches are hard to miss. In drought conditions, leaves will drop off and in severe cases, the entire tree is defoliated.

Again, sprays with horticultural oils in the early spring and again in the early summer can help keep mite numbers down. Chemical miticides labelled for use on citrus can also reduce numbers.

Interesting Fact: *Conventional chemical miticides must not be used repeatedly to control mites as the pest can develop resistance to the chemical, rendering it ineffective. Horticultural oils, by contrast, smother the pest and they cannot develop resistance. Soap sprays break down the waxy coating on the mite and resistance is not possible.*

Citrus Mealybug
Mealybugs derive their name from the white 'mealy' looking wax which

covers their soft oval body. Unlike the scales, mealybugs remain mobile throughout their life cycle. Mealybugs like protected areas and will crawl under the stem joint of the fruit. Eggs are laid in a white cottony mass which is often noticable between fruit in a cluster or in stem joints or cracks. Mealybug infestations near fruit stems may result in premature fruit drop.

Mealybugs cause injury by extracting sap from the tree and excreting large amounts of 'honeydew' which serves as the medium for sooty mold growth. Feeding on the fruit results in discoloured, bumpy, and scarred fruit. Mealybugs on foliage and twigs lower the vitality of the tree and can occasionally result in defoliation.

Timing of sprays is very important. Very little control can be expected if sprays are applied too early and only partial control if applied after the mealybugs become established in protected feeding areas. Periodic inspections will assist in determining the appropriate time to spray. Soap sprays, oils, and chemicals labelled for mealybug control on citrus can be used for control.

Interesting Fact: *Another species of mealybug that feeds on the prickly pear cactus was crushed and used as a beautiful red dye called Cochineal by the Aztecs and Indians.*

Whiteflies

Whitefly adults resemble tiny, white moths (approx. 1.2 mm). Eggs are laid on the underside of leaves and young whiteflies hatch and begin feeding in the same area. The young do not resemble the adults at all and are oval, semi-transparent and sessile.

Adults are found feeding on new-ish growth. If the leaves are disturbed the adults will immediately begin flying around the plant like tiny moths. Immature stages are found on intermediate growth. Both adults and immature stages are found on the underside of leaves, very rarely on the upper surface.

Whiteflies suck plant sap. Feeding results in large amounts of secretions of 'honeydew' which falls onto the leaves below. 'Sooty mold' fungi soon cover the leaves and retards photosynthesis. Thus whiteflies drain the plant of nutrients and then prevent it, through the action of sooty mold, from producing additional nutrients through photosynthesis.

Whitefly infestations rarely cause serious injury. The 'sooty mold' looks

unsightly on leaves and fruit. These pests can be controlled if necessary using oil, soap sprays or chemicals labelled for whitefly on citrus.

Interesting Fact: *Bermuda quarantines against whitefly importation by inspection of all incoming plant material. Of particular concern is a species of whitefly that is not white. It is appropriately called citrus blackfly. Heavy infestations of this pest cause rapid deterioration of citrus and drastically reduce bearing ability of the tree.*

Important To Note: Use Pesticides Sparingly and Safely
Many non-toxic or less-toxic products are available for citrus pest control including horticultural oils, neem and soap products. We suggest you use toxic chemicals as a last resort to control pests. Ensure that you are using the right product to control the right pest and that the product is labelled for use on citrus. Many products are NOT. Use the product according the label instructions and follow all safety equipment requirements. Take into consideration that chemical pesticides will also kill any natural enemies that are trying to help control your pest problem. Also ensure your trees have adequate water before applying pesticides. Drought stressed trees are more likely to have a negative reaction to a treatment

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PLANTING CALENDAR – WHAT TO PLANT IN THE FALL...

VEGETABLES
September
Beans, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Cucumber, Eggplant, Kale, Leeks, Mustard Greens, Parsley, Pepper, Potatoes, Radish, Rutabaga, Tomato, Turnip.

October
Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Chives, Cucumber, Eggplant, Endive, Kale, Leeks, Lettuce, Mus-

tard Greens, Onions, Parsley, Pepper, Potatoes, Radish, Rutabaga, Spinach, Squash, Strawberries, Thyme, Tomatoes, Turnip.

November
Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Chives, Kale, Leeks, Mustard Greens, Onions, Parsley, Potatoes, Radish, Rutabaga, Spinach, Squash, Strawberries, Thyme, Tomatoes, Turnip.

FLOWERS
September
Celosia, cosmos, gazania, globe amaranth, impatiens, marigold, salvia, snow-on-the-mountain, vinca and zinnia.

October
Ageratum, antirrhinum, aster, aubrieta, begonia, bells of Ireland, candytuft, carnation, centaurea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salipiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet William, verbena and viola.

November
Ageratum, antirrhinum (snapdragon), aster, aubrieta, begonia, bells of Ireland, candytuft, carnation, centuarea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salipiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet William, verbena and viola.

ON HER MAJESTY'S SERVICE

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