



## WELCOME

to our winter edition of Envirotalk.

In this issue –

- Dr Robbie Smith brings to our attention some subtle changes which are occurring in **coastal reef fish communities** and the people who care about them
- Dr Mark Outerbridge describes a **creative form of predation**
- Dr Mark Outerbridge teaches how to turn **New Zealand spinach** into a savory meal of spanakopita

Also See:

- Our **News & Notices** for reminders and upcoming events
- The **Planting Calendar** to get a head start on what to plant this winter

Please contact the Envirotalk mailing list [envirotalk@gov.bm](mailto:envirotalk@gov.bm) if you would like to be added to it or if you wish to make suggestions for future articles.

*Mark Outerbridge - Editor*

## **SUBTLE CHANGES IN OUR COASTAL REEF FISH COMMUNITIES AND THE YOUNG PEOPLE WHO CARE ABOUT THEM**

Bermuda has always been progressive in the management of our marine resources, with restrictions on sizes, numbers, timing of catch, and gear for fishes and lobsters repeatedly imposed in every century since colonization. For example, in 1627 there were limits on the harvest of baitfishes, which were being used for oil (not food), and today we have several bays where bait cannot be caught. We protected red hind spawning sites in 1975, eliminated fish pots in 1990, protected parrotfishes in 1993 and our black grouper spawning sites in 2005.

Fisheries statistics tell part of the story of how our fish communities have responded to active management but spending time in the water to survey fish communities expands our knowledge of changes, both positive and negative. Dr. Brian Luckhurst, then Government's Senior Fisheries Officer, was busy in the 1990s and early 2000s surveying reefs repeatedly to assess changes after the fish pot ban. Jack Ward studied fishes in seagrass beds in the 1990s. Dr. Joanna Pitt, then at BIOS, was active studying juvenile fishes and their habitats in the 2000s. Jo joined the Fisheries team and worked with Dr. Tammy Warren on assessing activity at black grouper spawning sites in the 2010s. Jo and I worked on lionfish impacts on our reef fishes along with Dr. Gretchen Goodbody-Gringley (BIOS) and graduate students Corey Eddy and Taylor Tucker. Gretchen, Jo and myself worked with the Nekton Project in 2016 to study fishes on our deeper reefs. Dr. Tim Noyes (BIOS ASU) has continued working on deep reefs using baited camera systems.

Dr. Thad Murdoch's Bermuda Reef Ecosystem Analysis and Monitoring project (BREAM) did extensive work on our reef fish communities inside and outside our MPAs, across North Lagoon and down on our outer fore-reef from the mid-2000s to 2016. It has been very clear that our protected parrotfishes have recovered well but snappers and groupers remain at low levels although their catch statistics have been steady over the past 15 years.

I have been busy with my summer interns since 2018 to survey fishes on our outer reefs, lagoonal patch reefs, and the coasts of our harbours, sounds and bays and in mangrove areas. We used a standard method of randomly placed 30m x 2m transects along the coast or over a reef, usually 4-6 per site, as done by Thad and Jo. Several interns have returned for successive summers and this allowed me to expand the scope of the survey work. With their help I have been able to survey over 100 sites, with recurring surveys at most sites in 2020 and 2021. This summer and fall we have completed surveys at 54 sites and have made a new discovery: the presence of small juvenile red hinds along the North Shore (Fig 1).



Fig 1. Juvenile hinds were recorded at the green dots in 2023. No hinds were seen at the red dots and none were seen at any coastal sites in 2020 or 2021.

We had never seen these small hinds (10-20 cm long, Fig. 2) at any of the coastal sites until this year. We had seen a few small ones and larger hinds on patch reefs in 2021, 2022 and again in 2023, where the hind populations appear to be thriving. So it was quite a surprise this summer to have these curious little groupers peek out from under rocks along the shoreline as you pass over them and then swim out brazenly to watch you!

One of my interns (Ben Eddy) was fascinated by sea slugs and would carefully turn over rocks (after his surveys were done) to look for them and frequently found even smaller red hinds (5-10 cm). So perhaps they have been at these sites but remained carefully hidden until large enough to venture out. The presence of these smaller juveniles implies that the North Shore rocky coastline is functioning as a nursery habitat. But we will need to follow this for a few years to see if the pattern persists.

Jo Pitt had done a lot of work on juvenile fishes in 2002-2004 at some sites on the North Shore and on nearby patch reefs and never noted any, though she was focused on the smallest fishes (~5 cm). Thad Murdoch did report very few juvenile hinds at two coastal sites and three patch reefs in 2008. It is our experience, in returning to the same coastal sites, that we have detected a change. This is the intended

consequence of protecting spawning sites, imposing minimum sizes and a bag limit: you see more hinds in more places. I think there is something similar happening with small black groupers which are seen frequently along our shores but that will be another story!

Enough about the fish, I want to praise my interns and their sponsors. Jasper, Destiny and Tre have been BIOS ASU Bermuda Programme students, Fae was a BZS Stempel intern, Ben was a BZS Pye Intern, Charlotte a BZS Babcock Scholar and Naphisa and Elijah were supported by the Government Summer Employment Programme. Each one has overcome different challenges to develop into excellent fish surveyors, although Charlotte was responsible for coral disease surveys. They all worked together to ensure that the detailed field work was done safely and efficiently. Jasper and Tre worked very hard in 2022 to assemble the earlier data for GIS analysis, so that we can assess spatial as well as temporal changes, and now we have new data. It has been a great pleasure to mentor and guide these young people (as we need to develop our talent in this next generation of marine scientists) and to watch the growth in their knowledge of our marine environment and in their confidence and capabilities.



Fig 2. Juvenile red hind in Bailey's Bay,  
about 15 cm long.  
Credit: Robbie Smith

***Dr Robbie Smith***  
***Curator, Bermuda Natural History Museum***



L to R: Jasper Thomas (Dalhousie), Treiana Zuill (Bermuda College & Flagler College) in 2021



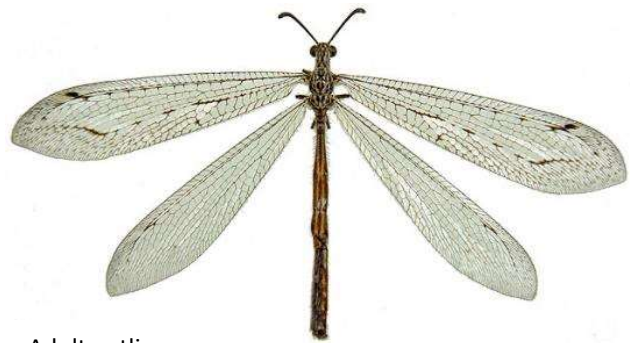
L to R: Elijah Grigsby (Virginia Tech), Ben Eddy (Dalhousie), Charlotte Kahn (Flagler College), Destiny Matthie (Plymouth) in 2023.



L to R: Naphisa Smith (Bermuda College, Nova Southeastern), Jasper and Tre, Fae Sapsford (Nottingham) in 2020.

## A CREATIVE FORM OF PREDATION

In this edition we return to the topic of extraordinary insects which reside on Bermuda, partly because I find it fascinating to write about them but also because I encountered another unusual species while working on Castle Island during the summers of 2022 and 2023. This article is about a rather formidable insect (at least in its larval form); the antlion. Antlions belong to the neuropteran family Myrmeleontidae, otherwise known as the net-winged insects. Also included in this group are the lacewings, mantidflies, and the owlflies. During the adult life stage, antlions are dainty and innocent looking vegetarians who feed on nectar and pollen. Easily mistaken for a damselfly, adult antlions possess a long, slender abdomen and two pairs of lustrous wings. Juvenile antlions (i.e. larvae), in stark contrast, are fearsome looking carnivorous creatures with large, flat heads terminating in an enormous pair of sickle-shaped jaws.



Adult antlion  
Internet image



Larval antlion  
Internet image

The larvae do not use these large jaws to actively hunt, but rather lay buried at the bottom of a funnel-shaped crater in the ground quietly waiting for their prey to come to them. These young insects are found in dry, sandy places where they can easily dig their pit-fall traps. They favour sheltered locations (e.g. under vegetation, fallen logs, and rock ledges) away from disturbances caused by rain and trampling. Once the depression is deep enough, the concealed antlion sits and waits with jaws wide-open. When a suitable insect (like an ant or small beetle) falls into the pit, the ensuing landslide takes it to those waiting jaws. If the hapless insect

manages to start crawling away, the antlion will throw a shower of sand into the air, destabilizing the pit walls, causing them to collapse and delivering the meal. Eating many not happen regularly, but the larval energy demands are pretty low so they can survive for many months without feeding.

The larvae of Bermuda's antlions (*Myrmeleon crudelis*) are small, typically less than 10 mm in length, and harmless to humans. They pass through several protracted stages of instar development before pupating into round, sand-covered cocoons. Antlions can take several years to complete their life-cycle, depending on the species and availability of food.

The juvenile antlion and its pitfall hunting method served as inspiration for the creation of the Sarlacc, a creature which briefly featured in the Star Wars movie Return of the Jedi, and again in the recently released mini-series The Book of Boba Fett. Antlions don't appear to be that common on Bermuda. Daniel Hilburn (a local entomologist for the Department of Agriculture and Fisheries during the 1980s) reported three adults collected from Nonsuch Island in July 1969, and larval pits were discovered on Nonsuch Island in July 1987<sup>1</sup>. More recently, Jeremy Madeiros (the Senior Terrestrial Conservation Officer) mentioned to me that he has occasionally observed larval pits on Cooper's Island as well.



Hunting pits created by larval antlions  
Credit: Alison Copeland

#### References:

<sup>1</sup> Hilburn, D.J. 1990. New records of Neuroptera, Mallophaga, and Strepsiptera from Bermuda. Florida Entomologist 73(1):186-187.

**Dr Mark Outerbridge**  
**Senior Biodiversity Officer**

## EATING INVASIVE SPECIES: NEW ZEALAND SPINACH SPANAKOPITA



New Zealand spinach (*Tetragonia tetragonioides*), also known as wild spinach or Warrigal greens, is a non-native perennial plant which was introduced to Bermuda over 100 years ago. Britton<sup>1</sup> reported that this plant had escaped from cultivation and had become naturalized by 1912. As the common name suggests, this species is native to New Zealand (as well as Australia and East Asia) where it is found growing in coastal regions.

The plant forms a low, dense, sprawl on the ground. The triangular leaves are covered in a light fuzz and can grow up to 15 cm long. Small yellow flowers form where the leaf meets the stem, which then develop into seed pods. New Zealand spinach is commonly found growing in coastal areas throughout Bermuda, such as the landward side of mangrove forests, sandy shorelines,

and even in relatively exposed rocky coastal areas with pockets of soil. The plants have very shallow roots which make them very easy to pull up by hand.

The taste is similar to that of regular spinach. The leaves contain appreciable amounts of vitamin B6 and vitamin C, as well as high amounts of vitamin K. You can prepare cooked New Zealand spinach in the same way as regular spinach and easily substitute it for regular spinach in recipes. The leaves also contain oxalates. If you wish to eat New Zealand spinach raw the leaves should be blanched for one or two minutes and then refreshed in iced water before consuming. To make spanakopita assemble the following ingredients:

- 3 tablespoons olive oil
- 1 large red onion, finely diced
- 1 bunch green onions, roughly chopped
- 2 cloves garlic, minced
- 2 pounds spinach leaves, rinsed and coarsely chopped
- ½ cup chopped fresh parsley
- 1 tablespoon of fresh dill, finely chopped
- 1 tablespoon of fresh mint, finely chopped
- 1 cup crumbled feta cheese
- ½ cup ricotta cheese
- 2 large eggs, lightly beaten
- 8 sheets phyllo pastry
- ¼ cup olive oil



#### Preparation:

- Sauté red onion, green onions, and garlic in olive oil until they're soft and lightly browned.
- Add spinach and sauté until limp.
- Add parsley, dill, and mint and cook for another minute or two then remove from heat.
- Squeeze out excess liquid and let cool.
- In a medium bowl, mix together eggs, ricotta, and feta. Stir into spinach mixture.
- Lay one sheet of phyllo pastry in a lightly oiled 9 x 9 inch baking pan. Brush lightly with olive oil. Lay down three more sheets, brushing each with olive oil. The sheets should overlap the pan.
- Spread the spinach and cheese mixture into the pan and fold all the overhanging pastry over the filling. Brush with oil, then layer with the remaining sheets of phyllo pastry, brushing each with oil. Seal the filling with the overhanging pastry.
- Bake until golden brown (about 30-40 minutes). Cut into squares, drizzle with olive oil, and leave to cool slightly before serving.

#### References:

<sup>1</sup> Britton, N. 1918. Flora of Bermuda.

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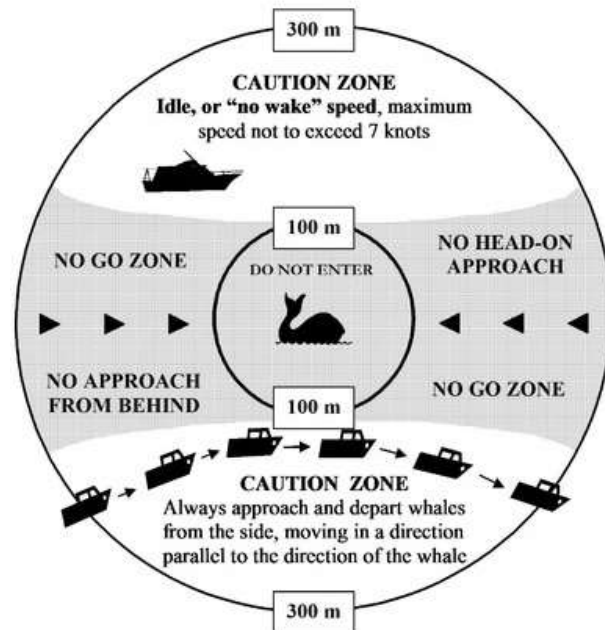


## NEWS & NOTICES

“Turtles on the Hill” is an enchanting 20 minute documentary about a small population of diamondback terrapins in a suburban Rhode Island wildlife refuge, a dedicated community conservation group, and the changing coastal landscapes they share. Watch a young scientist join this community to reveal how—despite the existential threats of coastal development, predation, and sea level rise—the lives of the people, the terrapins, and the estuary are intertwined. This documentary has won several film festival awards and can be viewed on Vimeo <https://vimeo.com/662082372>. Did you know that Bermuda has its own population of diamondback terrapins? To learn about them please visit <https://environment.bm/diamondback-terrapin>.

### Whale watching guidelines

Whale watching can be enjoyed in Bermuda’s waters in winter and spring. The public are reminded that all whales and dolphins are protected by law. Each year, for the past few years, DENR has received at least one complaint regarding inappropriate boating behavior around whales so all boaters should familiarize themselves with Bermuda’s whale watching guidelines (<https://environment.bm/whale-watching-guidelines>).



### Spearfishing statistics reminder

Recreational spear fishers are reminded that spearfishing statistics should be submitted monthly using the online portal at [www.fisheries.gov.bm](http://www.fisheries.gov.bm). There should be an entry for each date and location that you fished, and a “No fishing” entry for the final day of any month in which you did not fish. Please call 293-5600 or send an email to [fisheries@gov.bm](mailto:fisheries@gov.bm) if you are having difficulties accessing the portal.

### Lobster diving reminder

Now that lobster season is underway, recreational lobster divers are reminded that they should fly a standard red and white dive flag when they are diving for lobsters, and must avoid diving in the vicinity of commercial lobster traps. Catch statistics must be reported using the online portal mentioned above and a report of “No fishing” should be submitted for any month in which there was no lobster diving activity. Keeping lobster catch statistics up to date through the season helps improve accuracy, particularly when it comes to reporting locations, and avoids a rush or complications as the reporting deadline of April 30<sup>th</sup> approaches. Please call 293-5600 or send an email to [fisheries@gov.bm](mailto:fisheries@gov.bm) if you are having difficulties accessing the portal.

## PLANTING CALENDAR – WHAT TO PLANT IN THE WINTER

### VEGETABLES & FRUIT

#### December

Beans, beets, broccoli, Brussel sprouts, cabbage, carrots, cauliflower, celery, chard, chives, kale, leeks, lettuce, mustard greens, onions, potatoes, radish, rutabaga, spinach, squash, strawberry, tomato, turnip.

#### January

Beans, beets, broccoli, Brussel sprouts, cabbage, carrots, cassava, cauliflower, celery, chard, christophine, kale, leeks, lettuce, mustard greens, potatoes, radish, rutabaga, spinach, squash, tomato, turnip.

#### February

Beans, beets, broccoli, cabbage, carrots, cassava, cauliflower, celery, chard, christophine, corn, cucumber, kale, leeks, lettuce, mustard greens, potatoes, pumpkin, radish, rutabaga, spinach, squash, sweet potato, tomato, turnip.



### FLOWERS

#### December & January

Ageratu, 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, salpiglossis, salvia, snapdragons, statice, snow-on-the-mountain, spider flower, star-of-the-veldt, stock, sweet william, verbena and viola.

#### February

Acrolinium, ageratum, alyssum, aster, aubrieta, baby blue eyes, bachelor's buttons, bird's eyes, blanket flower, begonia, bells of Ireland, calendula, candytuft, carnation, centaurea, chrysanthemum, cineraria, coreopsis, dahlia, Africa daisy, dianthus, forget-me-not, geranium, gerbera, globe amaranth, globe gilia, godetia, gypsophila, hollyhock, impatiens, larkspur, lathyrus, marigolds (African & French), nasturtium, nicotiana, pansy, petunia, phlox, red tassel flower, rose everlasting, rudbeckia, salpiglossis, salvia, scabiosa, snapdragons, statice, snow-on-the-mountain, spider flower, star-of-the-veldt, stock, sweet pea, sweet william, verbena and viola.

