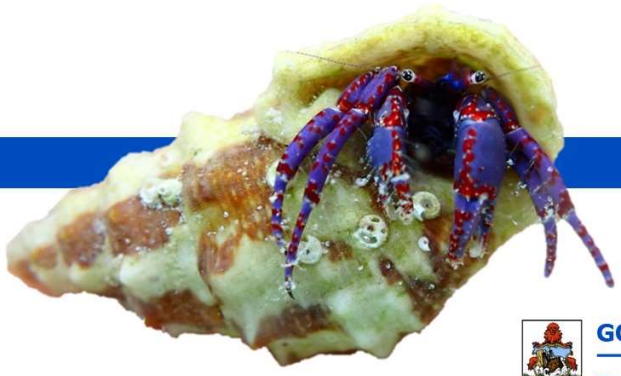
Envirotalk



Summer 2025
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PROTECTING BERMUDA'S ENVIRONMENT

GOVERNMENT OF BERMUDA
Department of Environment and Natural Resources

WELCOME

to our summer edition of Envirotalk.

In this issue –

- Dr Mark Outerbridge talks about the appearance of the **giant water fern** in some of Bermuda's freshwater ponds
- Dr Miguel Mejias describes some of the **marine hermit crabs** found in the shallow water surrounding Bermuda
- Dan Dickinson publishes a user guide to the new **Bermuda historic shipwreck and mooring locator** – an interactive GIS mapping tool
- Dr Philippe Rouja discusses some of the features of the **Montana shipwreck**
- Ronald Burchall shines the spotlight on Bermuda's smallest passionflower – the **inkberry vine**
- Dr Mark Outerbridge gives a recipe for making **feral pigeon jerky**

  Also See:
  - Our **News & Notices** section
    - Librarian's update
    - A new endemic species has been discovered
    - High Point Nature Reserve is now open to the public
    - Updated maps for the seasonal fishing closure areas
  - The **Planting Calendar** to get a head start on what to plant this summer

Please contact the Envirotalk mailing list 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

WHERE DID THE PONDS GO?

Some readers may have noticed that a few of Bermuda's freshwater ponds have been replaced with what appears to be grassy lawn when seen from a distance. Closer inspection, however, reveals a dense mat of floating water plants. The plants forming these mats are aquatic ferns belonging to the genus *Salvinia*. There are a few species within this genus, and all appear to be popular in water gardens and the global aquarium trade. Giant salvinia *Salvinia molesta* and common salvinia (aka water spangles) *Salvinia minima* are the two found growing here. Nathaniel Britton reported salvinia growing in the ditches of Pembroke Marsh over 100 years ago[1] however these days it can also be found growing in Cloverdale Pond, the Edmund Gibbons Nature Reserve, and in Seymour's Pond. Introductions into the wild occur as intentional releases or via hitchhiking on waterfowl and waterbirds. Flooding also distributes fragments that can create new colonies. Salvinia can only grow in freshwater wetlands where the salinity is less than 7 parts per thousand (ppt), anything greater and the plants weaken and die.

Salvinia has small, oval shaped leaves that grow in pairs along horizontal stems. Isolated plants have petite leaves which lie flat on the water surface (primary form) – a typical sight during the early stage of an invasion. As the plants develop, the young leaves grow larger and start to fold (secondary form). Eventually the salvinia leaves get bigger, curl upwards and become deeply folded (tertiary form) and large infestations form dense mats which can completely cover the surface of the water, giving the illusion of being solid ground. The upper surfaces of floating leaves are uniformly covered with rows of white, bristly hairs. The stalks of each hair divide into four thin branches that are either spreading and free at the tips (common salvinia) or joined at the tips (giant salvinia). These specialized hairs create a water repellent, protective covering and give the leaves a velvety appearance. The plants reproduce prolifically through vegetative growth and sporadic fragmentation, in other words by forming new branches which break off. Under ideal conditions salvinia grows extremely fast. In nutrient rich waters it may reach a density of 30,000 small plants per m² and can double its biomass in two days[2]. These are just a few of the qualities which have earned it a spot on the list of the 100 most invasive species on the planet[3].

The giant water fern *Salvinia molesta* in its primary growth form (left) and tertiary form (right)
Image credit: M. Outerbridge

The Louisiana State University College of Agriculture produced the following to help distinguish the giant water fern from the common water fern:

Giant salvinia *(Salvinia molesta)*

Note "egg-beater" shaped leaf hairs

- Large, vertical leaves
- Folded plant form
- Forms thick mats

Common salvinia *(Salvinia minima)*

Note open, branched leaf hairs

- Small, horizontal leaves
- Flat plant form
- Mat often single layer

Dense mats of salvinia cause numerous ecological problems. They prevent atmospheric oxygen and sunlight from entering the water, seriously affecting the survival of aquatic flora and fauna. Also, the ferns create a large amount of organic matter which settles and rots on the bottom. This rotting matter depletes oxygen in the water, causing fish kills and harming other aquatic wildlife. Furthermore, waterbirds have a very difficult time accessing food resources below the mats and migratory birds are much more likely to overlook our wetlands as they pass by. In other countries salvinia clogs waterways causing problems to agricultural irrigation and hydroelectric power generation as well as restricting commercial and recreational boating activities.

Cloverdale Pond (left) and Seymour's Pond (right) covered by dense mats of the giant water fern
Image credits: M. Outerbridge

Salvinia can be controlled using the following methods:

1. Physical removal. This includes raking the surface of the water or using large nets for mat removal. After removal, the plants need to be disposed of in a manner that ensures they will not re-enter the waterway (i.e. composted, dried, or incinerated).
2. Chemical application. Aquatic herbicides that have been used with success in other countries contain the active ingredients carfentrazone, copper complexes, diquat, fluridone, flumioxazin, glyphosate, imazamox, or penoxsulam. Some of these herbicides are more effective when a surfactant is added to make the chemicals stick to the surface of the leaves. Many require prolonged contact, and efficacy is reduced if it rains after treatment. The Department of Environment and Natural Resources and the Department of Health regulate the importation and use of herbicides and pesticides, so not all these chemicals are available in Bermuda.
3. Biological control. Control efforts in other countries have focused on the salvinia weevil *Cyrtobagous salviniae* (native to South America) and the salvinia stem-borer moth *Samea multiplicalis* (native to the southern region of the United States). Both species live and feed on salvinia plants and have been used to successfully control their spread in Australia, Papua New Guinea, Sri Lanka, India, and parts of Africa. Adult weevils consume the leaves, but the larvae do the most damage as they tunnel into the rhizomes (or stems) causing the affected plants to lose buoyancy and sink. The giant gourami fish *Osphronemus goramy* has also been used in Sri Lanka to control salvinia because it is an avid herbivore. None of these species currently live on Bermuda so risk assessments would be required before any could be imported for use a bio-control agent.
4. Increasing salinity to lethal limits. This can happen naturally during long periods of drought or a hurricane event. It can also happen artificially when saline water is pumped into a waterbody. Research has shown that plants maintained at 11 ppt can be killed after 20 hours of exposure[4] (note: sea water around Bermuda is about 35 ppt).

Mechanical methods alone have proven to be the least effective because any plant fragments left behind will grow and quickly recolonize the treated area. Combining two or more methods increases the chances of success, and repeating the control activities is necessary to deal with residual plants.

References:

[1] Britton, N. 1918. Flora of Bermuda. Hafner Publishing Company, Inc. 585 pp.

[2] US Fish & Wildlife Service 2019. Giant salvinia ecological risk screening summary: https://www.fws.gov/sites/default/files/documents/Ecological-Risk-Screening-Summary-Giant-Salvinia.pdf

[3] Global Invasive Species Database https://www.iucngisd.org/gisd/100_worst.php

[4] Divakaran, O., M. Arunachalam, and N. Balakrishnan Nair. 1980. Growth rates of *Salvinia molesta* with special reference to salinity. Proceedings of the Indian Academy of Sciences Plant Sciences 89(3):161–168.

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THE SMALL HERMIT CRABS LIVING IN BERMUDA'S SHALLOWS

Bermuda lies in the northwestern corner of a slow, clockwise spinning gyre, and, like a conveyer belt, it delivers the island's indigenous marine life. In summary, the gyre consists of the westerly flowing North Equatorial Current, near the Caribbean, which merges with the north-northeasterly flowing Gulf Stream along the eastern US. The Gulf Stream then meets with the easterly flowing North Atlantic Current, which descends into the south flowing Canary Current off Western Africa, before finally terminating back to the North Equatorial Current. Since the eggs, larval stages, and adult forms of marine organisms can be carried by or actively swim with currents, it's not surprising that Bermuda shares many species from faraway places, including small, marine hermit crabs[1].

The term "hermit" in hermit crab comes from their tendency to live alone inside a single shell. Ironically, several species of marine hermit crabs are quite social, often feeding, travelling, and resting in either same or mixed species groups (personal observation). These crustaceans are not born with a shell. Rather, juveniles must explore the sand and rocks on the seabed, naked, in search of an empty shell of an appropriate size. An empty shell is essential to a hermit crab's survival because, unlike the rest of their bodies, their abdomen is not calcified. Once an appropriate shell is found empty, the hermit crab will enter the shell and proceed to carry it around and use it as armour for its soft abdomen. When threatened, it can quickly withdraw into its shell for full protection. While hermit crabs grow with age, the shell they occupy does not, inevitably forcing occupants to search for and claim bigger shells throughout their lifetime. The Bermuda shallows are home to four species of small, marine hermit crabs: Verrill's Hermit Crab (*Calcinus verrillii*), Orange Claw Hermit Crab (*Calcinus tibicen*), Blue-legged Hermit Crab (*Clibanarius tricolor*), and Shortfinger Hermit Crab (*Pagurus brevidactylus*). Here, I will briefly describe the physical characteristics and habits of all four of these readily distinguishable species and conclude with their importance to our marine ecosystem.

Verrill's Hermit Crab (*Calcinus verrillii*) was named after Addison Verrill, an American invertebrate zoologist who last surveyed Bermuda's fauna in 1901 and is the only endemic crab species known to Bermuda. Genetic work suggests *C. verrillii* evolved from *Calcinus tubularis*, a hermit crab species native to the Azores, Cape Verde, and throughout the Mediterranean[2]. This evidence supports the hypothesis that *C. tubularis* larvae (i.e., zoea) was carried across the Atlantic by ocean currents to Bermuda, where it settled, adapt to, and evolved in Bermuda's environment over millions of years into a Bermuda endemic. *C. verrillii* is a small hermit crab species, with larger individuals occupying shells up to 34 mm in length (M. Mejías, unpublished data). Their exoskeleton is a distinctive bluish-purple with irregular red spots and blotches all over, and individuals can either be found inside gastropod shells or inside vermetid tubes fixed onto a hard surface; their red and blue colours inspired me to nickname the species the "Somerset Crab." They have a pair of long, transparent antenna with red "pearls" running the full length of the structure. Their left pincer claw (chela) is larger than their right. Using their pincers, *C. verrilli* pick and feed on algae gleaned from rocks and corals or pieces floating in the water column. They also consume dead animal matter, including the remains of the marine snail, Stocky Cerith (*Cerithium litteratum*), a shell species they commonly occupy (personal observations). *C. verrillii* is the most abundant marine hermit crab in Bermuda. Shell carrying and tube-dwelling individuals can be found in patch reefs, boiler reefs, and shipwrecks across the Bermuda platform, from depths of a few feet to several hundred feet[3].

Examples of the two shelter types *C. verrilli* use: an empty gastropod shell (Shortneck Triton *Gutturnium muricinum*) (top left) and vermetid snail shell *Thylacodes bermudensis*, aka "tubeworm" (top right).
Image credits: M. Mejías

C. verrillii are one of the few species of hermit crabs in the world that inhabit both an empty gastropod shell and vermetid tubes. While individuals carrying gastropod shells are free to roam, those living in vermetid tubes live a sessile life, and must opportunistically grab food items that move within reach of their walking legs and pincers, essentially becoming a filter feeder. Research suggest males are more likely to inhabit gastropod shells, and females prefer vermetid tubes[4]. *C. verrilli* are the only hermit crab species in Bermuda to use these two shelter types; the remaining three species only use empty gastropod shells.

The photograph to the left shows a larger Verrill's Hermit Crab occupying the shell of a West Indian Top Snail (*Cittarium pica*), a protected species in Bermuda. The shell measured 28.2 mm in height and 27.3 mm in width and was the largest *C. verrilli* I've encountered yet.

The Orange Claw Hermit Crab (*Calcinus tibicen*) belongs to a genus which includes at least 47 hermit crab species found in tropical and subtropical waters across the globe. The Orange Claw Hermit Crab is an Atlantic species native to the coasts of Brazil, Venezuela, Colombia, Central America, the entire Caribbean, Gulf Coast, and Florida; Bermuda represents the northern limits of its distribution. Their exoskeleton is mostly maroon in colour, except for the tips of their walking legs and pincers, which are cream coloured. Their two antennae are long and a uniform bright orange, like their eye stalks, which are tipped with solid black eyes. In Bermuda, they are mostly seen carrying the shells of *Cerithium litteratum*, although they accept other gastropod shell species. Unlike their endemic cousin, *C. verrillii*, they are not as common and are restricted to inshore waters, at maximum depths of about 15-20 feet, where they lumber around boiler reefs and tide pools (personal observations). They feed on algae and carrion on coral reefs, rocks, and sandy bottoms.

Photographs of Orange Claw Hermit Crabs inside the shell of a worn Stocky Cerith (*Cerithium litteratum*; left image) and a larger individual inside the shell of a Gold-mouthed Triton (*Monoplex nicobaricus*; right image). The latter shell measured ~51 mm in length and was the largest *C. tibicen* I've encountered yet; this species might be the largest of the small marine hermit crabs in Bermuda. Note the larger left pincer. Neither image is to scale. Image credits: M. Mejías

Blue-legged Hermit Crab (*Clibanarius tricolor*) belongs to a genus which has about 60 recognized species spread across temperate, subtropical, and tropical waters. It is native to topical western Atlantic Ocean, inhabiting intertidal zones of Venezuela, Colombia, the Caribbean, Central America, the Gulf of Mexico, and Florida; Bermuda is the northern most place Blue-legged Hermt Crabs occurs. They have a predominately dark blue exoskeleton, with alternating reddish-orange and cream bands on the joints of their walking legs; these three colours also give this crab the common name Tricolored Hermit Crab. They have two long, orange antenna, two, equal sized dark brownish-black pincers with small cream dots, and two dark blue eye stalks tipped with black eyes covered in white spots. As with most other small hermit crabs in Bermuda, they are mostly seen carrying the shells of *Cerithium litteratum*. However, *Cl. tricolor* is smaller than *C. verrillii* and *C. tibicen*, as the two latter species are often found carrying larger shells than *Cl. tricolor* (personal observations).

Cl. tricolor is probably the most familiar marine hermit crab species in Bermuda, due to their high abundance in tidepools across the island. In Bermuda, juveniles (~2-5 mm) often choose West Indian False Cerith (*Lampanella minima*) as their first shell, and large congregations of them can also be seen in tidepools island wide. As with Bermuda's other hermit crabs, they feed on algae and carrion. The adult crab shown to the left is surrounded by juveniles.

Shortfinger Hermit Crab (*Pagurus brevidactylus*) is a member of the *Pagurus* genus, alongside over 100 other species of marine hermit crabs found in temperate, subtropical, and tropical waters across the planet. *Pagurus* crabs are "right-handed," meaning their right claw is much larger than their left; the opposite is true for *Calcinus* species. The Shortfinger Hermit Crab (hereafter, *P. brevidactylus*) is an Atlantic species native to the coasts of Central America, the entire Caribbean, Gulf Coast, and Florida; Bermuda serves as the northern limits of its range. Individuals in Bermuda either have a reddish brown or entirely white exoskeleton. Their two antennae are long and transparent, with alternating reddish-brown and white "pearls" along the entire length of each. Their walking legs may be covered with multiple long setae, giving the crab a hairier look than the other three species in Bermuda. *P. brevidactylus* have two whitish eye stalks that are topped with orangey-red eyes. As seen with other small, marine hermit crabs in Bermuda, they're mostly seen in empty *Cerithium litteratum* shells. Fully grown *P. brevidactylus* are found occupying smaller gastropod shells (personal observations), making them the smallest marine hermit crab species in Bermuda. Like *C. verrillii, P. brevidactylus* are abundant and can be found across the entire Bermuda platform, from depths ranging from 5-100 feet (personal observations). Their diet is comprised of algae and carrion.

Photographs showcasing two distinct colourorphs seen in Shortfinger Hermit Crabs in Bermuda: brownish-red exoskeleton (top left) and an all-white individual (top right). Note the larger right pincer. Both individuals are inside the shell of *C. litteratum*. Image credits: M. Mejías

In summary, all four species of small, marine hermit crabs can be found in the shallowest depths of the Bermuda platform. Despite using the same gastropod shells, each hermit crab species is distinctly coloured, making them easy to identify. Given their reliance on empty gastropod shells, and their significant role in algae and carrion removal, all of which keeps Bermuda's corals, reefs, and sand clean, non-researchers should refrain from removing any shells from Bermuda's waters. Hermit crabs are fascinating creatures to observe and photograph in the wild. I believe Dr. William Beebe, who studied Bermuda's fauna in 1930-1934, said it best: "If we live out our span of life on the earth without ever knowing a crab intimately, we have missed having a jolly friendship."

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[1]Sterrer, W. 1986. Marine fauna and flora of Bermuda: a systematic guide to the identification of marine organisms. Wiley, New York

[2]Malay, M. C. M. D., & Paulay, G. (2010). Peripatric speciation drives diversification and distributional pattern of reef hermit crabs (Decapoda: Diogenidae: Calcinus). Evolution 64(3) 634-662.

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[4]Rodrigues, L. J. (2000). Shelter use by *Calcinus verrilli*, Bermuda's endemic hermit crab (Doctoral dissertation).

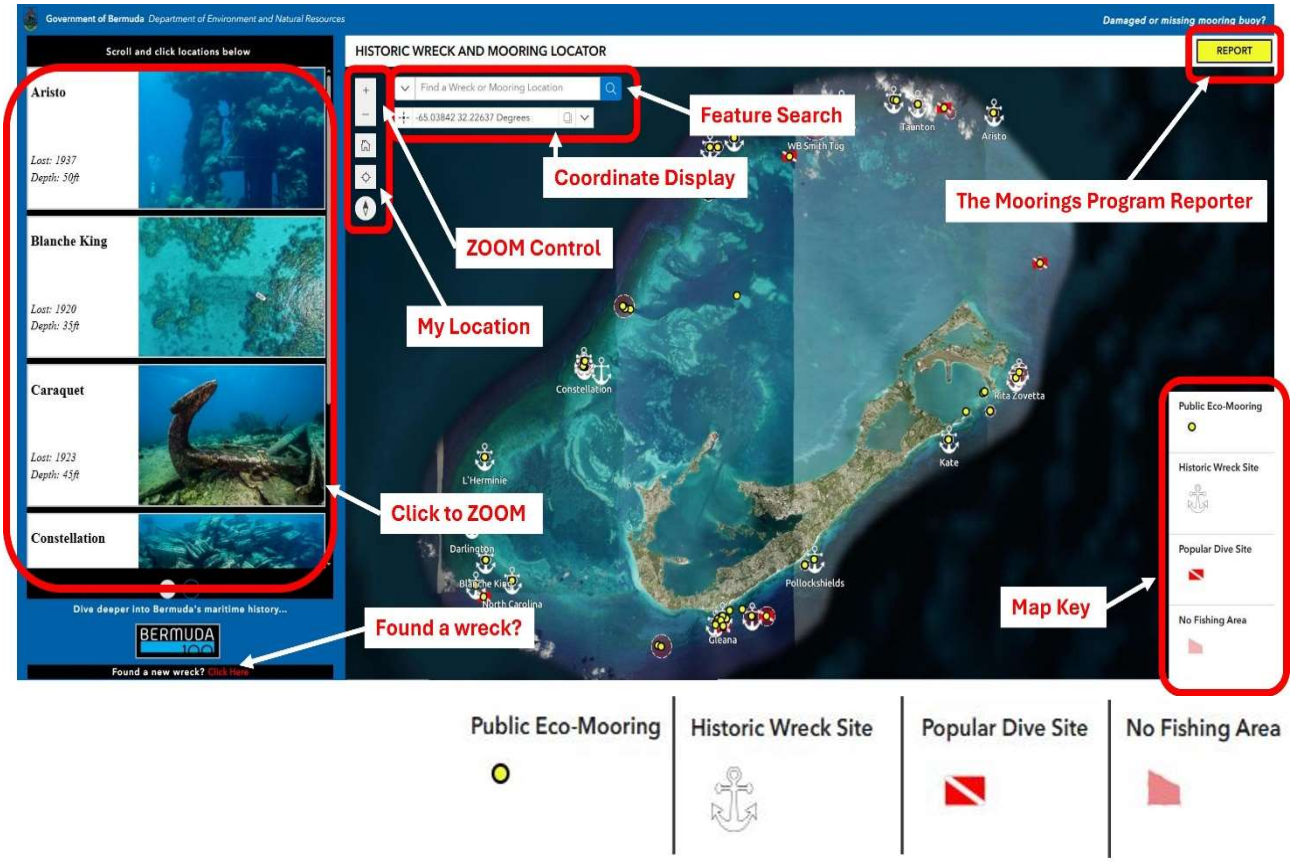
Dr. Miguel Mejías
Conservationist, Ornithologist, Naturalist, BZS

EXPLORE BERMUDA'S HISTORIC SHIPWRECKS AND THE MOORINGS PROGRAMME: A GUIDE TO THE WEB APP

Amid Bermuda's vibrant marine environment, eco-moorings and centuries-old shipwrecks lie side by side, reflecting both our island's rich seafaring history and our ongoing efforts to protect the ocean's future. To help everyone discover and explore Bermuda's underwater heritage, the Government of Bermuda has created an interactive mapping tool—perfect for curious locals, visiting snorkelers, and experienced divers alike.

With just a few clicks, users can explore historic shipwrecks, view their depths and locations, and access the coordinates of public eco-moorings around Bermuda. This user-friendly platform opens the door to the island's maritime history and supports safe, informed ocean use.

From planning a dive to reporting a mooring issue, the web app equips you with the maps and tools needed to enjoy and help protect Bermuda's underwater world. Start by reviewing the guide below, then click here: https://experience.arcgis.com/experience/6453e12469fd4ac586af1b6cb762be2f to launch the interactive map and explore the features.



Screenshot of the web app viewer's home screen, highlighting the main components and navigation options available to the user while using the application.

The First Dive

The interface is designed to be simple and user-friendly on both desktop and mobile devices. When you open the web app, it works much like Google Earth imagery, displaying an interactive map of Bermuda. You'll find symbols marking different features and clicking on these will show you detailed information about that exact location.

Zoom In and Out: Use the **+** and **–** buttons on the map or **pinch to zoom** using your mobile device.
Pan: Click and drag the map to move around and explore different areas.
Home Button: Will reset the view to a larger overview.
My Location: Click the target icon to zoom to your current location. Allow your browser or device to access your location when prompted.
Coordinate Display: View the geographic coordinates of the pointer or the selected feature on the map.
Map Key: Symbols of features found on the interactive map.
Found a wreck?! Follow this link for more information on reporting a new find.
The Moorings Program Reporter: Click to report issues with public moorings.

Under The Waves

The data tables available in the app provide a detailed and searchable summary of Bermuda's historic wrecks, highlighting names, coordinates, depths, and the dates they were found.

Each entry is associated with a mapped location, allowing for straightforward exploration of maritime heritage through both spatial context and informative descriptions.

Click: Any symbol representing a shipwreck, mooring, or designated protected area will open a pop-up window when clicked, showing information about that feature.
Feature Search: Find a feature by typing into the search box; (E.g. North Carolina).
Image Gallery: On the left side of the screen, click to zoom.

Example of the data table displaying available information on the North Carolina shipwreck.

This easy-to-use feature is ideal for boaters looking for accurate mooring information, divers and snorkelers planning visits to historic wreck sites, and researchers or educators interested in marine areas connected to shipwreck protection and management. Please note that the viewer does not display all of Bermuda's marine protected or conservation zones—only those listed in the *Fisheries (Protected Area) Order, 2000*. These specific no-fishing zones are included because they relate directly to shipwreck protection and The Moorings Program. A more comprehensive viewer is currently in development and will provide detailed information on all designated marine protected areas across the island.

Feature Type	Data	Information Description
Historic Wreck	Wreck name	The name or identifier of the wreck
*Designated as open to public	Sunk	Approximate year the vessel sank
	Length	Reported length of the vessel
	Depth	Water depth at wreck site
	Coordinates	Geographic location
Mooring Buoy	Mooring name	The name or identifier of the buoy
	Type	Reef of wreck site
	Depth	Water depth at mooring site
	Protection	No Fishing Zone buffer (distance from buoy)
	Status	Is site currently buoyed (active or non-active)
	Coordinates	Geographic location

Popular Dive Site	Site name	The name or identifier of the site
	Sunk	Approximate year the vessel sank
	Length	Reported length of the vessel
	Depth	Water depth at mooring site
	Protection	Water depth at mooring site
	Coordinates	Geographic location
No Fishing Area	Name	The name or identifier of the protected area
	Type	Reef of wreck site
	Protection	No Fishing Zone buffer
	Restrict	What activity is restricted
	Coordinates	Geographic location

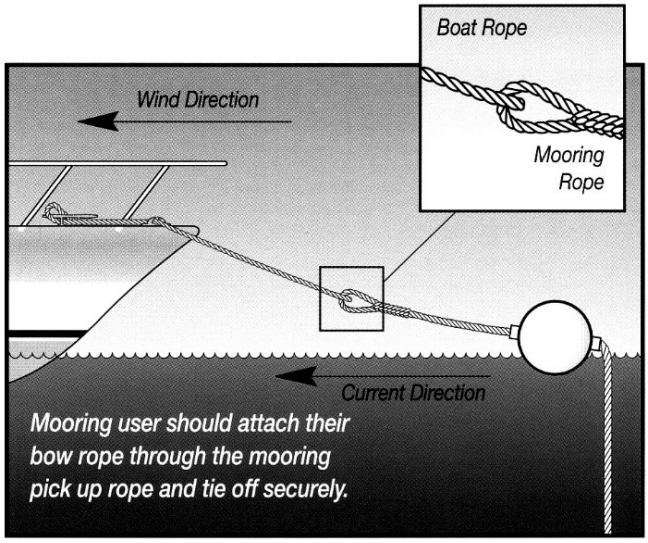
Overview of the data attributes available, detailing the types of information collected and recorded for each mapped feature.

Where To Drop That Anchor?

The Moorings Program began as a grassroots initiative, sparked by concerns from local citizens and divers about the environmental damage caused by repeated anchoring at Bermuda's most popular dive sites. Recognizing the importance of protecting these fragile reef ecosystems, the Bermuda Government formally adopted the concept, eventually establishing legislation to protect the vicinity and offer support for the installation and management of moorings in key locations.

Since 2020, the initiative has been sustained through generous funding from the Ernest Stempel Foundation, provided via a grant to the Bermuda Zoological Society. This support has enabled the purchase, installation, and ongoing maintenance of eco-friendly moorings by a specialized local marine contractor.

Strategically placed at dive sites and open wreck locations, these moorings allow boaters to safely secure their vessels without harming nearby coral reefs or the vessels themselves. Many of these moorings are located within long-established marine protected areas that have been legally designated as "No Fishing" zones for more than 25 years.



How to correctly attach your boat to one of our moorings.

Screenshot of The Moorings Program reporter, showing the initial data entry fields.

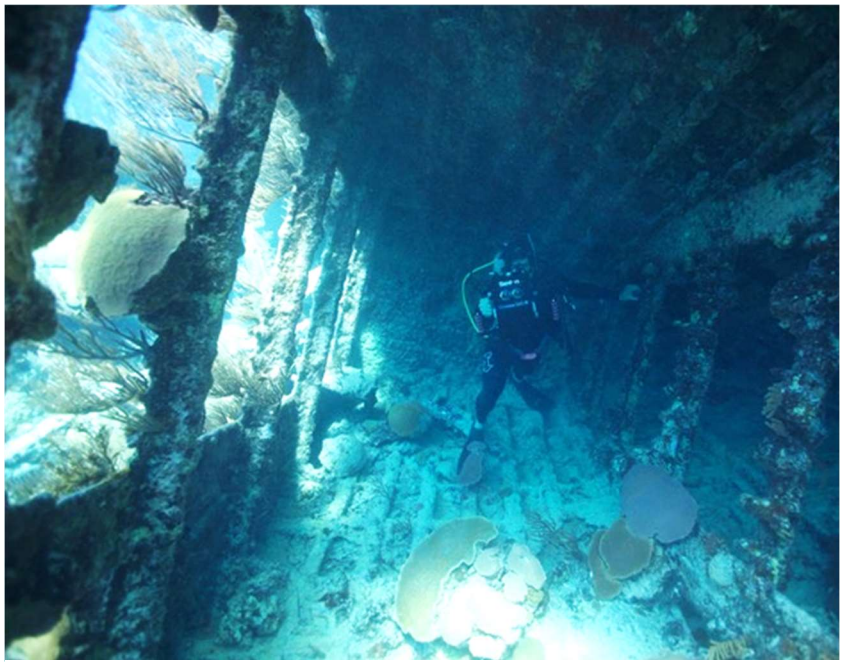
Noticed a damaged mooring? Missing some hardware? Is there something that seems unsafe? That's where the Moorings Program Reporter is here to help. It's a simple and fast online form you can fill out to inform the team. Just hit the **REPORT** button on the web app to communicate what you observe, and you can also upload a photo of your issue. Your input is vital for maintaining the safety of our moorings and ensuring our waters are well looked after.

The Historic Wreck and Mooring Locator is more than just a map—it's a gateway into Bermuda's maritime heritage and a tool for responsible ocean stewardship. For the best experience, it is accessible on both desktop and mobile browsers. While the mobile version is streamlined for ease of use, the desktop version offers enhanced features and a richer, more interactive viewing experience.

Dan Dickinson
GIS Analyst, DENR

THE MONTANA (WAIT, THE NOLA): A LOOK AT BERMUDA'S MOST SNORKELLED SHIPWRECK

In September 2019, just before the pandemic began, Bermuda faced a category 3 storm - Hurricane Humberto. It wasn't a direct hit, but it brought high winds and significantly large offshore swells. The outer reef protects the island and the inner lagoon, but this storm was different; the surge reached deep into the reef platform, affecting the wreck of the *Montana*, a side paddle steamer that sank at Western Blue Cut in 1863 on her maiden voyage. The waves penetrated further onto the platform than in the past, and the bow of the *Montana* suffered substantial damage. The storm's impact collapsed what was once an accessible bow section and transformed it into a jumble of metal ribs and coral remnants.



Inside the bow of the *Montana* before Hurricane Humberto passed Bermuda in 2019.
Image credit: P. Rouja

Divers were not present during the storm, so we have no witnesses to the immediate effects, but days later, the devastation was evident. Instead of entering the ship, divers encountered a chaotic structure, with large chips of rusting metal and upside-down coral that had grown on the wreck since its sinking in 1863. The damage was irreversible, yet amidst the destruction, we found hope. Many corals remained alive and salvageable. Bermuda's hard corals thankfully naturally withstand hurricane forces. We carefully relocated over 30 brain corals into a nearby gravel-filled dip in the reef, hoping they would thrive in this safer environment.

We had captured the *Montana* in high-resolution photogrammetry as part of the Bermuda 100 Project before the hurricane and have since recorded the changes and the movement of the corals, allowing us to monitor the success of our coral rescue. The remaining bow section still holds a certain romance, but future generations of divers will not experience the same dramatic, open, coral-encrusted structure experienced by those in the past. Perhaps a virtual 3D version will allow them to appreciate its beauty. The rest of the ship, aside from a slight shift seaward of one of the boilers, remains there as it was, a giant historical artifact, slowly being consumed by the sea.

Western Blue Cut is unique because it is an aggregation area for several well-known wreck events, including the *Constellation* in 1943 and the *Lartington* in 1879. This layering of wrecks and their cargo was the inspiration for Peter Benchley's book and film "The Deep". There are at least three other older wrecks we can see evidence of but cannot identify. Calling it a cut is somewhat deceptive; while it appears navigable, the reef is ever-present, and experienced mariners know that calm days can be the most treacherous. The sun reflects off the surface, making it difficult to see the underwater landscape. One must navigate slowly, unless in a channel, as hidden shallow reefs can suddenly appear.

Bow of the *Montana* after Hurricane Humberto passed Bermuda in 2019.
Image credit: P. Rouja

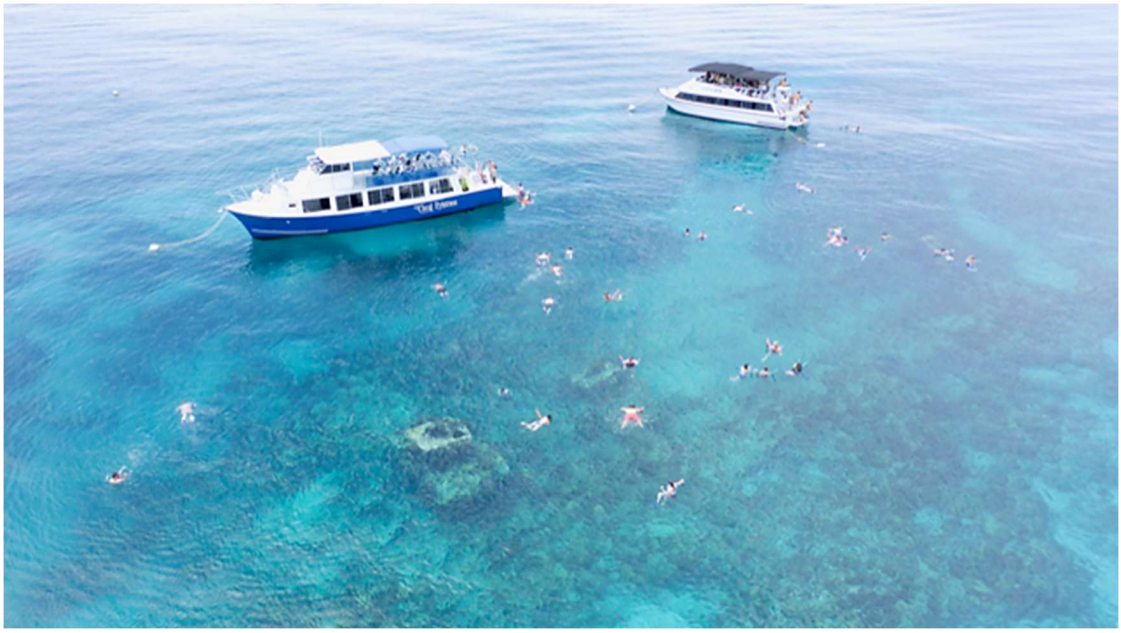
The *Montana* is unique among shipwrecks as it is laid out in an uninterrupted line from bow to stern. The shape of the ship is clearly evident, much like one would expect a cartoon shipwreck to appear. In reality, shipwrecks are seldom like this; most are hidden, and many are scattered over miles.

Today, several of Bermuda's tour operators navigate through the two stakes at Western Blue Cut, transporting fortunate guests to explore these underwater treasures. This Mid Atlantic experience is, in truth, the equivalent of being airlifted to the top of Mount Everest to see a lost shipwreck. For many visitors, particularly Americans, these sites are touchstones of shared history, offering a glimpse into the world of Blockade Runners and their country's Civil War past that might otherwise remain unknown. The passage from the Dockyard to Western Blue Cut is stunning and bound to impress many of the people on board, not to mention the jaw-dropping experience of seeing a 19th-century side paddle steamer laid out on the bottom, feet below your face, like a lost smashed pocket watch on the sidewalk.

Bermuda's ability to offer access to such historically significant sites is remarkable. The Bermuda Government and organizations like the Stempel Foundation, the Bermuda Zoological Society, and Bermuda Marine Services who build and install the systems, play critical roles in ensuring that our marine treasures are preserved and accessible, with mooring systems that are part of the Protected Moorings Program that prevent damage to the reef and wrecks.

This allows both inexperienced snorkelers and seasoned divers to explore the beauty and history of our underwater world while impacting it as little as possible. For the price of a ticket, a 30-minute glass-bottom boat ride, and the ability to snorkel, tourists can time travel and visit an historic wreck site that many international seasoned divers and explorers have put on their bucket lists. It results in some pretty dramatic and incongruous images.

Aerial photograph of the *Montana* and *Constellation* shipwrecks (top) and the same shipwrecks with snorkeling tourists (bottom).



Over a thousand visitors a year likely snorkel and dive on these shipwrecks. As with all shipwreck stories, there is always something new to learn. Bermuda shipwreck historian and legacy diver Michael Davis has informed us that the *Montana*, among other shipwrecks, is popularly misnamed! Like many ships involved in the illegal movement of goods during the Civil War, it was not unusual to have several names. The diving community had known a few of these for this site—*Nola* and *Paramount* come to mind. How she came to be primarily known as the *Montana*, a name that was never her true identity, is its own mystery and we are excited to work with Mr. Davis to decipher how this wreck came to be so misattributed. While involved in the blockade trade, the *Montana* wasn't actually an active blockade runner as we have been quite happily describing her. The wreck and its sinking have been romanticised, and maybe that name just had a better ring to it? It's a little bit embarrassing, but thankfully, when we feature her we usually get it right, as seen in a BBC show Clyde Built hosted by the great Scottish actor David Hayman who came down and visited the wreck in 2015.

The experience of these wrecks serves as a metaphor for the story of Bermuda today — a safe and accessible place that is, in actuality, an unbelievably remote location that is globally interconnected, with an interesting and sometimes embellished history, surrounded by an incredibly beautiful ocean.

Dr Philippe Rouja
Custodian of Historic Wrecks, DENR

INDIGENOUS PLANT SPOTLIGHT: THE RARE AND RESILIENT INKBERRY VINE

The massive challenge to Bermuda's biodiversity and ecological balance that invasive species presents is well known to many. While harm was never intended, the reality is that out of their own environment, these introduced plants tend to overpower native species. Dealing with the invasives issue is a drain on resources – but, happily, the ongoing effort is paying off.

Right: the diminutive and delicate flowers of the native inkberry vine are only about 1 cm in size. *Image credits: R. Burchall*

Left: miniscule fruit of the inkberry vine.

Four years of woodland restoration at the Bermuda National Trust's Sherwin Nature Reserve in Warwick has resulted in the eradication of several invasive species. They have been replaced with 20-plus distinct species of rare endemic trees, shrubs, grasses and ferns no longer commonly found throughout the islands. And an exciting discovery has been made: the rarely seen native vine, Inkberry *Passiflora suberosa*, is flourishing in a restored woodland area at the Sherwin Nature Reserve. Nestled over a compost pile, this unassuming yet resilient plant has become a true survivor, thriving in challenging conditions. A member of the passionflower family, this delicate vine typically grows up to six feet or more, preferring full sun to partial shade. It is remarkably drought-tolerant and resistant to overgrazing, making it well-suited for Bermuda's environment. Though uncommon, it can still be found elsewhere in undisturbed sandy soils, safe from development and invasive species. Inkberry's small, soft green berries ripen to a deep purple and are edible. The leaves can either appear as trilobed or oblong, and occasionally both forms will be present on the same plant. Beyond its aesthetic and culinary appeal, the plant serves a vital ecological role. This native vine is an essential host plant for the Gulf Fritillary butterfly *Dione vanillae* caterpillar, further supporting Bermuda's delicate biodiversity. Beyond its importance to local wildlife, Inkberry makes an excellent addition to gardens and landscapes, gracefully climbing trellises, fences, and even tree trunks. With its natural beauty and ecological benefits, it's an easy way to support native flora while enhancing outdoor spaces. However, conservation is key. In some parts of Warwick, we've noticed the spread of the woodland passionflower *Passiflora morifolia*, a non-native species that closely resembles Inkberry but grows much larger. Understanding and protecting the right species is crucial to maintaining balance.

A call to action

Our conservation work is only as strong as the community that supports it. By preserving habitats, planting natives, and fostering awareness, we can ensure that Bermuda's natural wonders remain **for everyone, forever**. Want to get involved? Whether through volunteering, planting natives in your own garden, or simply spreading awareness, every effort counts. Let's continue to champion Bermuda's unique biodiversity together! Contact Ronald Burchall (Ronald.Burchall@bnt.bm) or Myles Darrell myles.darrell@bnt.bm) if you want to volunteer with the Bermuda National Trust preserve and protect our heritage together.

The introduced Inkberry *Passiflora morifolia* in flower seen at the Sherwin Nature Reserve. This species is naturalizing in Warwick and Pembroke.

Ronald Burchall
Conservation Officer, Bermuda National Trust

EATING INVASIVE SPECIES: FERAL PIGEON JERKY

Feral pigeons are essentially domestic pigeons (*Columba livia domestica*) that have returned to the wild. Originally brought to Bermuda as a food source during the period of early human settlement[1], pigeons are now managed as a pest species[2]. There are thousands currently living across Bermuda, some of which are causing problems and raising concerns about human health. Pigeons that nest in coastal rocky cliffs actively compete with native longtails for locations to lay eggs and raise their young. Furthermore, they can foul a nest site to such an extent that it becomes unusable to longtails, even after the pigeons have departed. Copious pigeon droppings below roosting sites in public areas create dirty and unsightly conditions and cause much consternation and exasperation, especially to those people tasked with keeping those areas clean. It is certainly ill-advised to allow pigeons to perch on the roof of your home because rainwater used for drinking can become contaminated by fecal coliform and salmonella bacteria when droppings get washed into the water tank.

The most effective way to catch feral pigeons is to trap them. Live-capture traps baited with cracked corn can work particularly well in locations where hungry pigeons gather for food. Once you have the birds in-hand they need to be humanely killed and prepared for cooking. There are many different educational websites showing how to do these jobs. Also be sure to practise meat processing safety (e.g. https://www.mass.gov/info-details/best-practices-for-wild-game-processing-and-preparation). Pigeon meat is lean, very dark and can be cooked in a variety of ways. The recipe below only requires the breast meat, so plucking the entire bird is unnecessary. The most expedient way of getting at the breast meat is by a process known as 'crowning a pigeon'. This does not refer to a coronation ceremony, but rather the means of removing the crown (the breastbone with both breast muscles attached). Once that has been accomplished the breast meat can be easily cut from the bone.

Jerky can be made using an oven or a food dehydrator. This receipe calls for the latter.

Ingredients:

- 1.5 lbs pigeon breasts (about 15 plump birds)
- 1 cup water
- 1 tablespoon kosher salt
- 1/8 cup Worcestershire sauce
- ½ teaspoon garlic powder
- ½ teaspoon dried thyme
- 2 tablespoons brown sugar
- ¼ teaspoon liquid smoke (optional)

Pigeon breast meat ready for dehydrating
Image credits: M. Outerbridge

Preparation:

- Cut each pigeon breast into 3 strips.
- Mix the remaining ingredients together and marinade the meat strips in a non-reactive container for at least 1 day in the refrigerator (3 days max). The longer it marinades, the saltier and more flavorful the jerky will be. Make sure to occasionally mix the meat around while it is in the marinade.

- Remove the meat and pat dry with paper towels (don't rinse off the marinade).
- Lay the strips on your dehydrator racks, ensuring there is space between them to allow for proper drying.
- Follow your dehydrator's instructions, bearing in mind the meat needs to be dry but should still be pliable. For example, I use three trays and dehydrate the strips for 16 hours, switching the top and bottom trays half-way through.

Feel free to experiment with other herbs for different flavors but it is important to keep the ratio of meat to salt to Worcestershire sauce the same to make certain the meat is adequately preserved.

References:

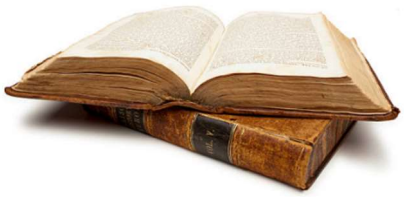
[1] Verrill, A.E. 1902. The Bermuda Islands.

[2] Outerbridge, M.E. 2016. Feral pigeon management plan for Bermuda. Department of Environment and Natural Resources, Government of Bermuda. 29 pp. (https://environment.bm/invasive-species-management)

Dr Mark Outerbridge
Senior Biodiversity Officer, DENR

NEWS & NOTICES

Librarian's update



- The introduced and invasive flora of Bermuda. Published online in Biological Invasions, March 2025 (https://doi.org/10.1007/s10530-025-03559-8)
- Evidence of an Eroded Volcano: Origin of Mafic Grains in Whalebone Bay, Bermuda. Published online in Geological Society of America Abstracts with Programs, 2023 (https://gsa.confex.com/gsa/2023SE/webprogram/Paper385919.html)
- Hurricane-driven transport of Bermuda reef carbonate platform sediments to the deep ocean. Published online in the Journal of Geophysical Research, March 2025 (https://doi.org/10.1029/2023JC020500)
- Sinking seaweed in the deep ocean for carbon neutrality is ahead of science and beyond the ethics. Published online in Environmental Research Letters, August 2022. (https://doi.org/10.1088/1748-9326/ac82ff)
- Ten years of snail conservation at the Chester Zoo. Published online in the newsletter of the IUCN Mollusc specialist group, March 2023 https://www.hawaii.edu/cowielab/Tentacle/Tentacle_31.pdf

A new endemic species has been discovered

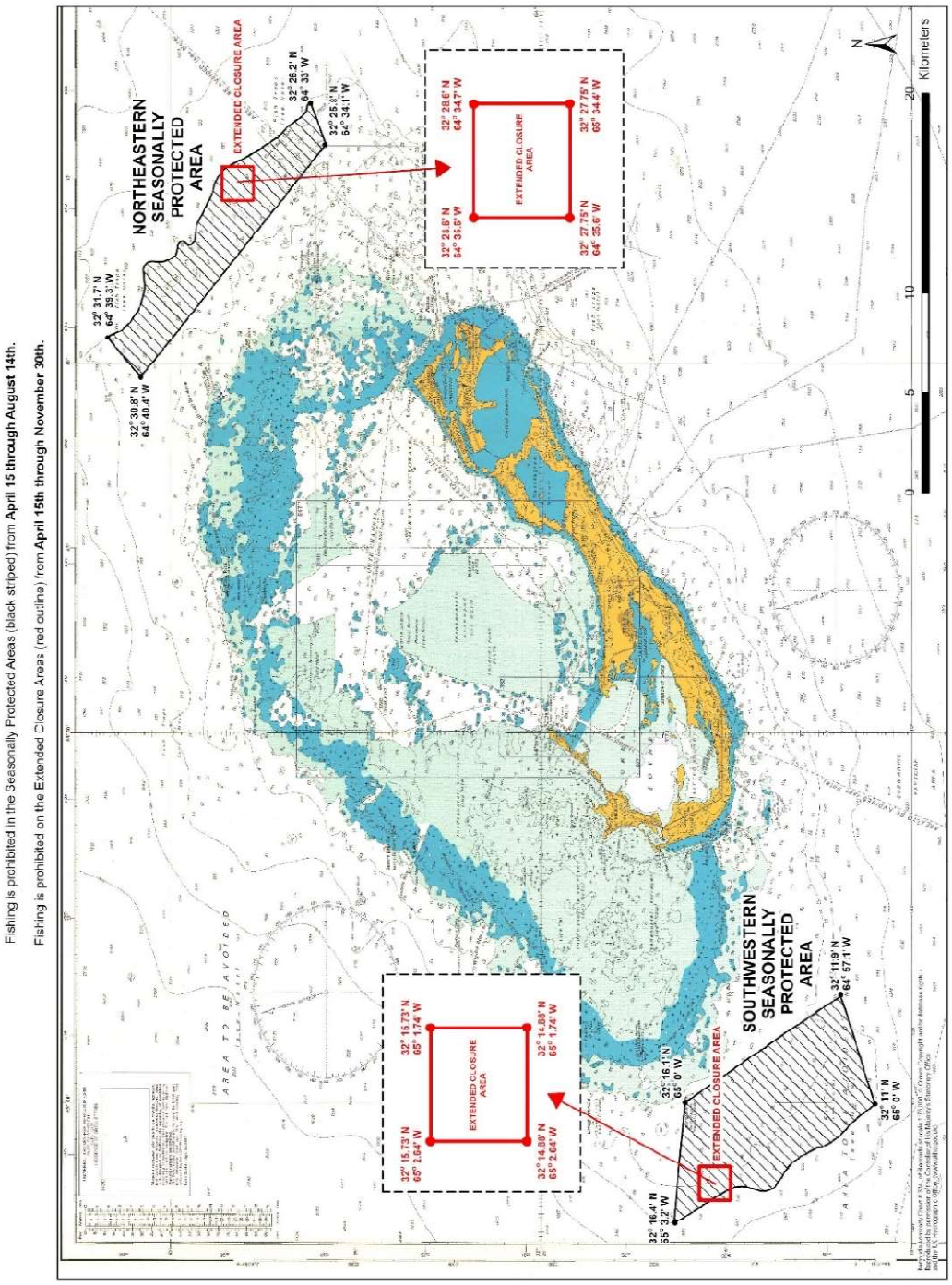
A team of scientists has recently published an article in ZooKeys (https://doi.org/10.3897/zookeys.1239.144436) describing a small cave-dwelling marine copepod. Its name is *Tetragoniceps bermudensis* and not only is it unique to Bermuda, but it is also a species previously unknown to the scientific community! Discovered within the Walsingham cave system, a well-known hotspot for indigenous stygobitic biodiversity (creatures that live exclusively in groundwater environments), these small crustacean invertebrates represent the first known anchialine species of *Tetragoniceps*, and the first record of the genus, in Bermuda. Read more about it here: https://www.royalgazette.com/general/news/article/20250526/confirmed-bermudian-discovery-is-new-crustacean-species/

New nature reserve opens to the public

The Bermuda Audubon Society and the Bermuda National Trust, under the auspices of the Buy Back Bermuda campaign, have opened a new nature reserve to the public: High Point. This 10-acre reserve is in Southampton Parish near Frank's Bay. The entrance to the reserve is located on Alton Hill off Middle Road. Parking is on Alton Hill where visitors will find themselves at the start of a loop trail which will take them through woodlands, along agricultural fields, and past the ruins of Beek House to a beautiful vista of south shore showing Southwest Breaker in the distance. The trails are well defined, however some sections (e.g. the coastal path) are still presently under development and will be completed in the future.

Updated maps for the seasonal fisheries protected areas

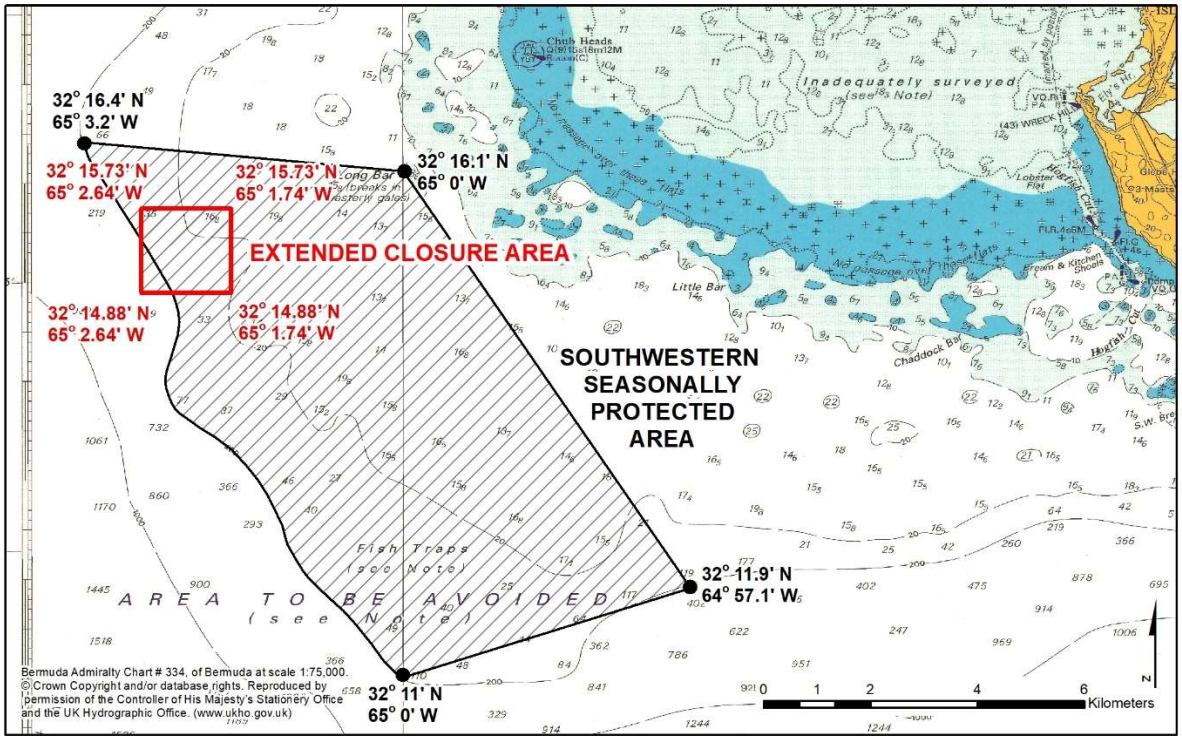
The Fisheries Division has updated the maps that show the northeastern and southwestern red hind and black grouper spawning grounds as well as the blue striped grunt aggregating area on north shore off Fort St. Catherine. The maps showing the commercial and recreational lobster fishing areas around Bermuda have also been updated.

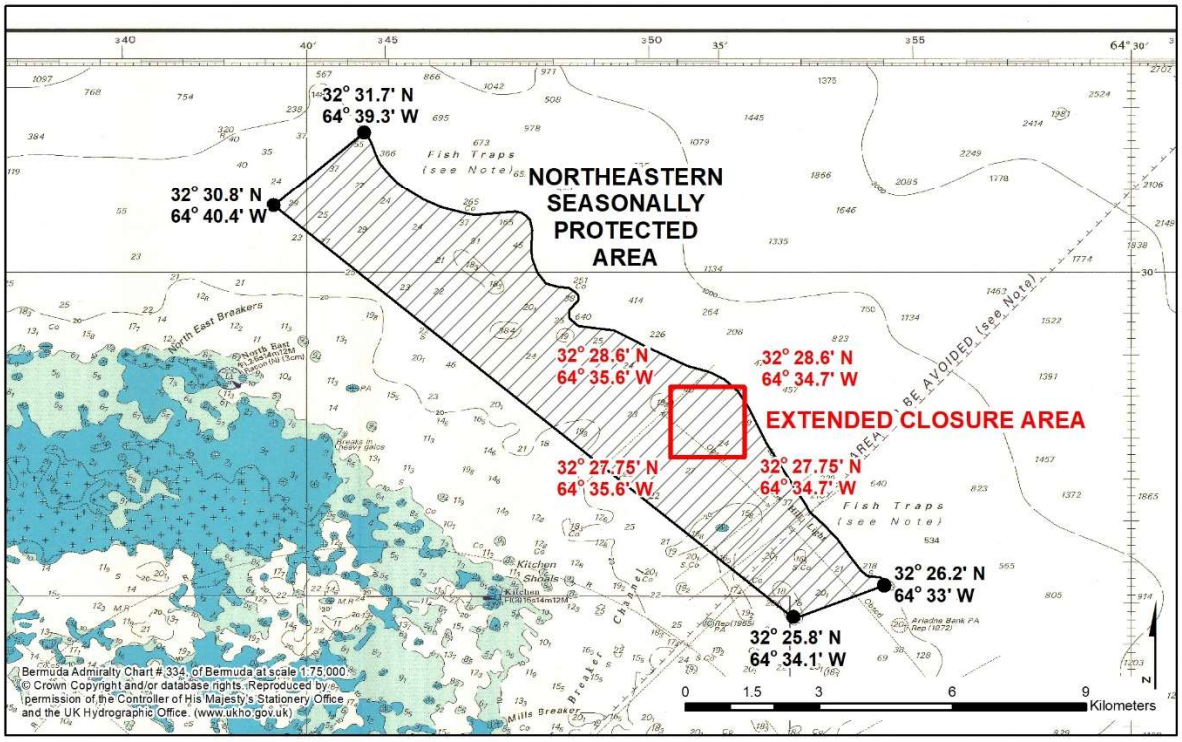


FISHERIES SEASONALLY PROTECTED AREAS

Fishing is prohibited in the SEASONALLY PROTECTED AREAS (black striped) from April 15 through August 14.
Fishing is prohibited on the EXTENDED CLOSURE AREAS (red outline) from April 15 through November 30.

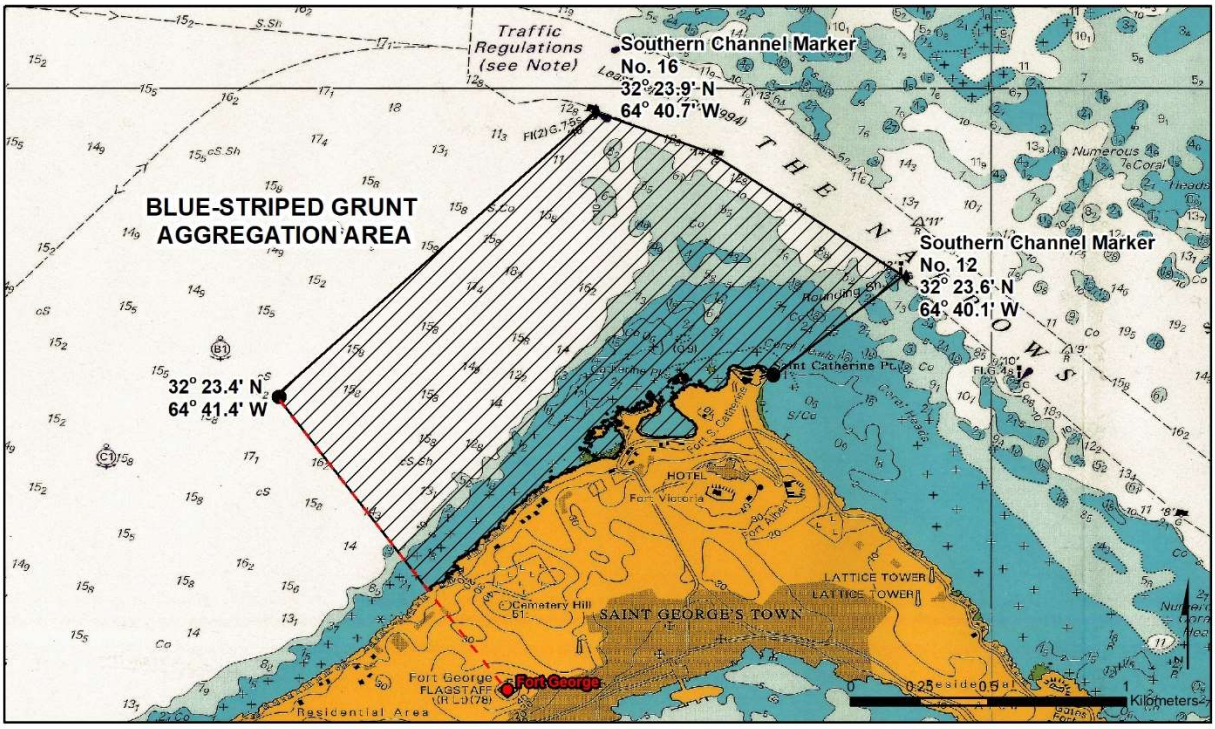
Trolling for game fish is permitted outside of the 30 fathom depth contour.





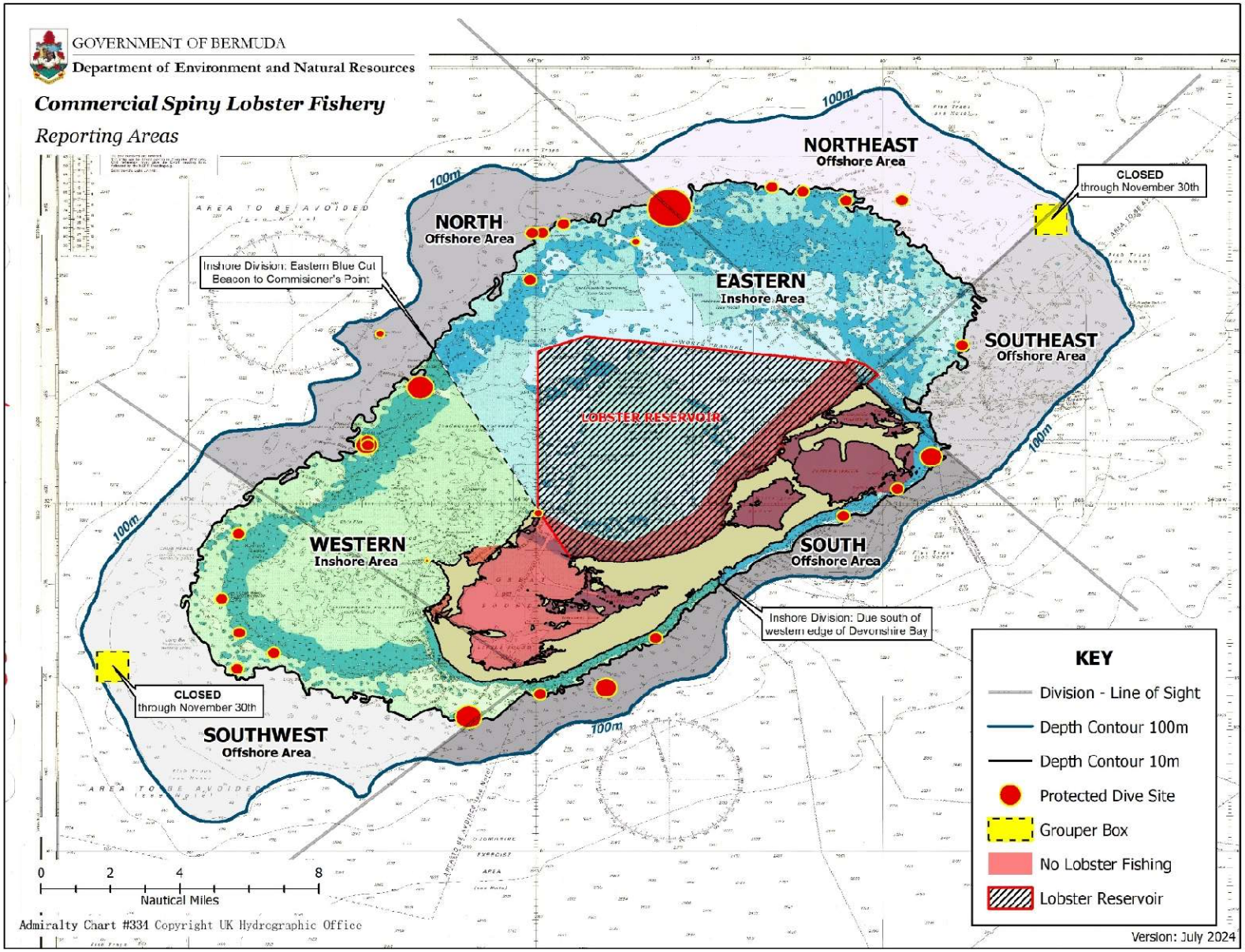
Version: May 2025

Fishing is prohibited in the Blue-striped grunt aggregation area (black striped) from May 1 through June 30.



Bermuda Admiralty Chart # 868, of Bermuda at scale 1:25,000.

Version: May 2025


GOVERNMENT OF BERMUDA
Department of Environment and Natural Resources
Commercial Spiny Lobster Fishery
Reporting Areas
NORTHEAST
Offshore Area
NORTH
Offshore Area
EASTERN
Inshore Area
SOUTHEAST
Offshore Area
WESTERN
Inshore Area
SOUTH
Offshore Area
SOUTHWEST
Offshore Area
LOBSTER RESERVOIR
100m
CLOSED
through November 30th
Inshore Division: Eastern Blue Cut Beacon to Commisioner's Point
Inshore Division: Due south of western edge of Devonshire Bay
CLOSED
through November 30th
0 2 4 8
Nautical Miles
Admiralty Chart #331 Copyright UK Hydrographic Office
KEY
Division - Line of Sight
Depth Contour 100m
Depth Contour 10m
Protected Dive Site
Grouper Box
No Lobster Fishing
Lobster Reservoir
Version: July 2024

PLANTING CALENDAR – WHAT TO PLANT IN THE SUMMER

VEGETABLES

July
Beans, carrots, tomato

August
Beans, broccoli, Brussels sprouts, cabbage, carrots, kale, leeks, mustard greens, sweet & hot peppers, radish, rutabaga, tomato

September
Beans, broccoli, Brussels sprouts, cabbage, carrots, cauliflower, celery, chard, cucumber, eggplant, kale, leeks, mustard greens, parsley, sweet & hot peppers, potatoes, radish, rutabaga, tomato, turnip




FLOWERS

July, August, & September
Celosia, cosmos, gazania, globe amaranth, impatiens, marigold, salvia, snow-on-the-mountain, vinca and zinnia