

Envirotalk



GOVERNMENT OF BERMUDA
Department of Environment and Natural Resources

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TO PROTECT BERMUDA'S ENVIRONMENT AND RESPONSIBLY MANAGE ITS NATURAL RESOURCES

WELCOME

to our summer edition of Envirotalk.

In this issue –

- Patrick Talbot reports on the rehabilitation and post-release tracking of Milly the Peregrine falcon.
- Dr. Geoff Smith explains how the reduction in traffic during April's COVID-19 shelter in place is reflected in Bermuda's air pollution data.
- Dr. Joanna Pitt and Dr. Robbie Smith share some new information on Bermuda's six species of baitfishes.
- Dr. Jonathan Nisbett provides a veterinarians perspective on the COVID-19 pandemic.
- Also see:
 - Our **News & Notices** for reminders and upcoming events.
 - The **Environmental Calendar** to see what events are happening at this summer.
 - The **Planting Calendar** to get a head start on what to plant this summer.



Baitfish school, Coney Island

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REHABILITATION AND POST-RELEASE TRACKING OF MILLY THE PEREGRINE FALCON

Early in November, 2019, a member of the Bermuda Audubon Society came across a Peregrine Falcon on the ground at Spittal Pond. Concerned about the well-being of the bird he contacted Bermuda Aquarium Museum and Zoo (BAMZ), the only local authority permitted to care for sick and injured protected wildlife. Our staff who responded were able to easily capture the bird, which is not a good sign and a clear indicator that the animal was compromised in some way.

Raptors or birds of prey are a small group of birds that feed on other vertebrates. Members of this group include eagles, hawks, falcons, vultures and owls. There are some resident Barn Owls in Bermuda but most birds of prey, like Peregrines, are visitors only staying for short periods of time. Small birds are the preferred meal for Peregrines; however, they will also eat small rodents and reptiles. They are the fastest animals on Earth, capable of reaching speeds of 240mph in a dive when hunting flying birds. Only the female Peregrine can claim the falcon nametag; the male is smaller in size and called a tiercel.



**The female Peregrine falcon
in care at BAMZ
(Photo: Patrick Talbot)**

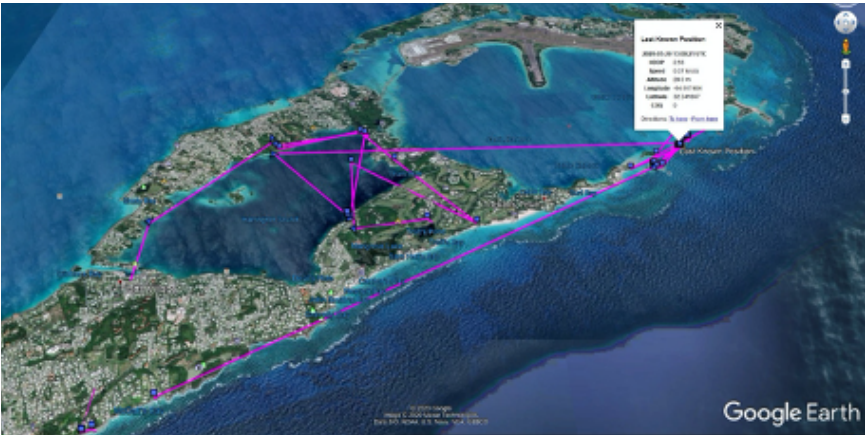
While our animal care staff have extensive experience with seabirds and small perching birds, raptors are rare accessions into our rehabilitation program and they normally arrive in such bad shape that they seldom survive. It was found to be a young female that was extremely underweight; however, 2 weeks of intensive care by our dedicated staff brought her back up to the weight of an average adult. During her rehab she was offered a daily menu of large mice which we stock for animals in our zoo collection and fitted with a steel leg band with a unique number as an identifier. Due to the rarity of acquiring a raptor capable of being released back to the wild, we saw this as a valuable opportunity to put a tracking tag on her.

The day before her release she was fitted with a cellular tracking tag purchased by the Atlantic Conservation Partnership, the US based support charity for the Bermuda Aquarium. These tags are new technology that utilise GPS to pinpoint location, which is then transmitted via GSM cellular networks for cloud-based access. The tag has a solar panel for power and only weighs 15gms. She was observed overnight to see if there were any ill effects from the tag or if the fitting



Milly after her release, flying with her tracking tag
(Photo: Simon DeCouto)

was incorrect; however, the tag seemed to go unnoticed by the falcon. While we typically don't name rehab animals, she was affectionately named Milly (for Millennium Falcon) and released the next day. Since her release the tag has been transmitting data daily. This information can be used to help us know more about migrant raptors – like their movement around the island, site fidelity, when they depart Bermuda and where they go once they do leave the island and the duration of that journey.



A map of Milly's tracks up to May 20th, 2020
(Map: Patrick Talbot)

She seems to prefer the East End of Bermuda, spending the majority of her time around Harrington Sound and the Mid Ocean Golf Course. We have been able to go out periodically to check on her and she seems to be faring well. As she is still a young bird it is unclear if and when she would leave the island, but recent identification by an expert believes she is of the tundrius race. This group of peregrines nests in the tundra in the summer then migrates to South America in the fall and are well adapted for long distance travel. They tend to start breeding at 3 years of age so, she should have the urge to leave Bermuda soon. If not, then she will hopefully help control the feral pigeon population on the island and, if her present movements are any indication, she would be a St. George's supporter if we have the annual Cup Match Classic take place this year.

Patrick Talbot

Curator-Aquarium and Zoo, BAMZ

EFFECTS OF BERMUDA'S SHELTER IN PLACE ON OUTSIDE AIR QUALITY

The reduction in traffic on Bermuda's roads, due to the COVID-19 shelter in place regulations in April 2020 has provided the Pollution Control Section of the Department of Environment and Natural Resources (DENR) with an opportunity to compare concentrations of airborne pollutants at sites with normally busy road traffic. Air pollutants are monitored to standards provided in the Clean Air Regulations 1993, which are designed to be protective of human health, sensitive plants and crops, wildlife and building materials and surfaces.

Clear evidence exists of the direct relationship between high levels of air pollution and impacts on human health; however, this relationship becomes uncertain at low levels. In general, the population groups at risk from air pollution include children, the elderly, individuals predisposed by some particular disease, such as asthma, bronchitis, emphysema and cardiovascular disease and hypersensitive individuals. The levels selected in Bermuda's standards were considered to reflect a 'no effect' to any receptor and are periodically considered for review to align with other jurisdictions.

Air Quality Monitoring Stations: DENR monitors the concentrations of key air pollutants at five monitoring sites across Bermuda including:

- 1) Cemetery Lane [BELCO],
- 2) Langton Hill [BELCO],
- 3) Prospect [Tynes Bay Waste to Energy Facility],
- 4) East Broadway [Road vehicles] and
- 5) Bermuda Institute of Ocean Science (BIOS) [Control site].

The square brackets above suggest the primary emission sources that each monitoring site was designed to monitor. The latter three sites are monitored by the Bermuda Institute of Ocean Sciences (BIOS) under a contract with DENR and the two BELCO sites are monitored by BELCO as required by their Operating Licence conditions under the Clean Air Act 1991. Data from these sites is submitted annually to the United Nations Environment Programme (UNEP) for publication as national statistics.

Due to the dramatic effect of the COVID-19 regulations on vehicle traffic, the data from the East Broadway [Road Vehicles] monitoring station has been used to compare a period from 4th – 21st April 2020, during the shelter in place, with a similar period in 2019. The air pollutants compared are as follows:

Air Pollutant - Sulphur dioxide: Sulphur dioxide (SO₂) originates from the combustion of fossil fuels that naturally contain sulphur. Sulphur dioxide is an acid gas and when inhaled will affect the mucous membranes of the respiratory tract and lungs thereby largely affecting people with associated diseases (i.e. asthma, bronchitis, cardiovascular diseases). Due to sulphur dioxide being

toxic to people and the environment, coupled with its negative impact on vehicle emission control systems (i.e. catalytic converters), fuels are required to be further refined to remove sulphur. Gasoline typically contains up to 10 ppm (parts per million) sulphur and Diesel fuel, used in road vehicles, is today described as Ultra-Low Sulphur Diesel and contains up to 15 ppm sulphur (i.e. 0.0015%). These sulphur levels are designed to ensure that air quality around busy roads is safe to breathe.

With the significant reduction in vehicular traffic during the COVID-19 shelter in place, the concentrations of sulphur dioxide at East Broadway were reduced to effectively the detection limit of the instrument (i.e. $<0.01\mu\text{g}/\text{m}^3$ – micrograms per cubic metre of air) – See Figure 1. Comparison to a similar period one year before in 2019 shows that the emissions from commuting traffic were clearly visible at the beginning and end of the day, with concentrations rising by a factor of 70 to almost $0.7\mu\text{g}/\text{m}^3$. It is noted that the annual concentration limit for SO_2 in Bermuda’s Clean Air Regulations 1993 is a lot higher at $30\mu\text{g}/\text{m}^3$, suggesting that the current sulphur limits in fuel for vehicles is sufficient to ensure that sulphur dioxide is not a significant health concern from road traffic in Bermuda.

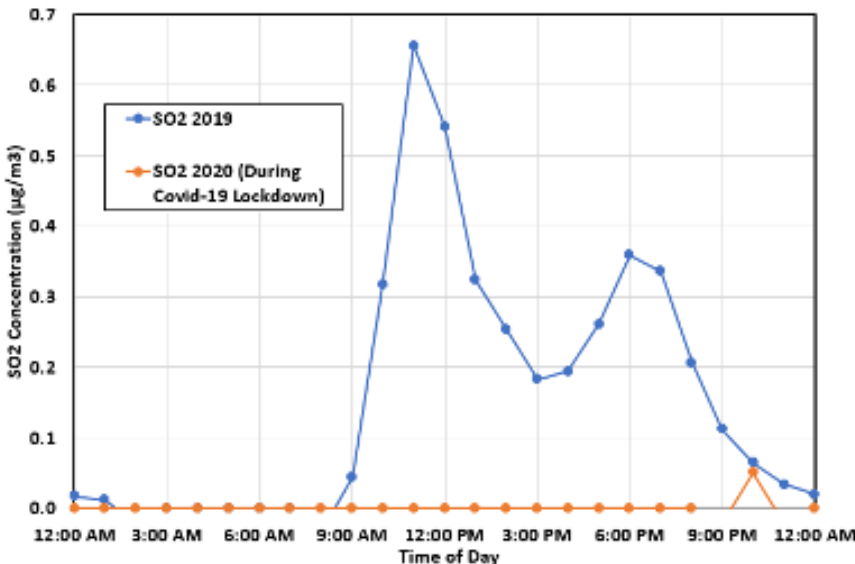


Figure 1: Sulphur dioxide (SO₂) concentrations from 4th-21st April 2019 and during COVID-19 shelter in place, 4th-21st April 2020, at East Broadway monitoring station.

Nitrogen dioxide (NO₂) largely originates from man-made sources when fossil fuels are burnt in the presence of nitrogen, which is in air. Nitric oxide (NO) is initially formed from the combustion process and this further oxidises in the atmosphere to NO₂, which is more toxic. Road vehicle exhaust is a major source of NO₂, and short-term exposure is known to lead to respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma or bronchitis, for example.

With the significant reduction in vehicular traffic during the COVID-19 shelter in place the concentrations of nitrogen dioxide at East Broadway showed a dramatic reduction, as shown in figure 2. The concentrations of airborne NO₂ at East Broadway during heavy morning traffic reached a peak over the averaged data of 18µg/m³, where the annual limit for NO₂ in the regulations is 60 µg/m³. The highest hourly reading recorded over this 17-day period was 33.7µg/m³. This data suggests that vehicles at the busy road area of East Broadway are a major source of NO₂ but the concentrations fall within the hourly, 24-hourly and annual limits of Bermuda’s regulations.

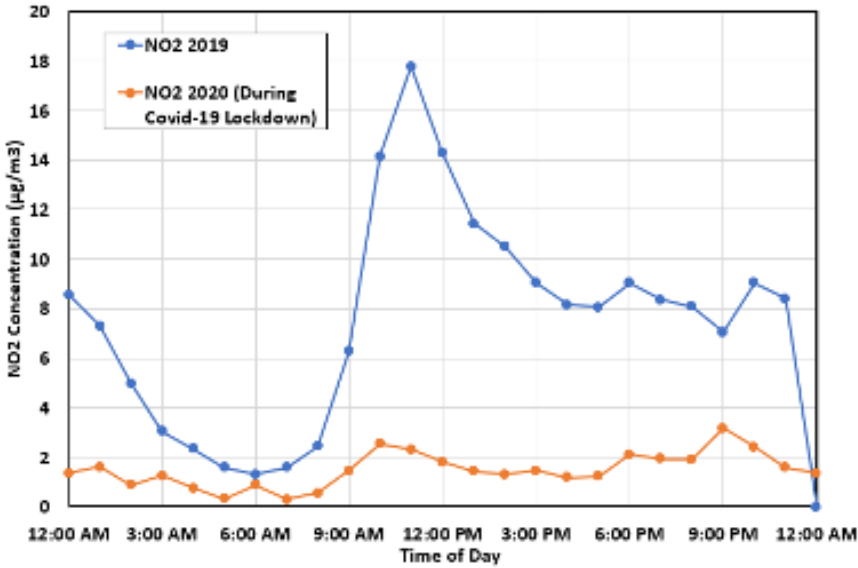


Figure 2: Nitrogen dioxide (NO₂) concentrations from 4th-21st April 2019 and during COVID-19 shelter in place, 4th-21st April 2020, at East Broadway monitoring station.

Air Pollutant - PM₁₀: Particulate Matter, specifically less than ten [10] micrometres in diameter [PM₁₀] (i.e. ten thousandths of a milli-metre in diameter) are airborne and can be readily breathed deep into the lungs where they can remain. It includes the more harmful particulates from engine exhausts, open-fires and

incinerators in addition to airborne dust, including that from grinding/sifting, and some natural plant pollens and marine aerosols. The elderly, children, and people with chronic lung disease and asthma are especially sensitive to the effects of particulate matter as it can often be a trigger for acute reactions. Furthermore, the harmful chemicals within PM10s, generated from vehicle and other combustion sources, can also lead to chronic medical conditions many years later after exposure.

Concentrations of PM10 at East Broadway are regularly higher than the other monitoring sites in Bermuda and have exceeded the Clean Air Regulations 1993 annual limit of 30µg/m³ in 2008, 2012 and 2017. Comparison of the PM10 data in figure 3 suggested that there was a statistically significant reduction in PM10 during the COVID-19 shelter in place when compared to one year ago in April 2019. However, the difference in PM10 concentration was not as striking as observed for SO₂ or NO₂. This may reflect the presence of other natural particles such as pollens, soil dust or marine aerosols present in 2019. Further comparisons to more recent months are currently underway. Finer particles such as **PM2.5** (i.e. Particulate matter less than 2.5 micro-metres in diameter) can be more indicative of vehicle emissions and the data in figure 3 showed a consistent but only 10-20% reduction in concentration over the shelter in place period compared to one year ago. This may suggest more naturally sourced finer particulates being present in 2020 that are contributing to the background concentration.

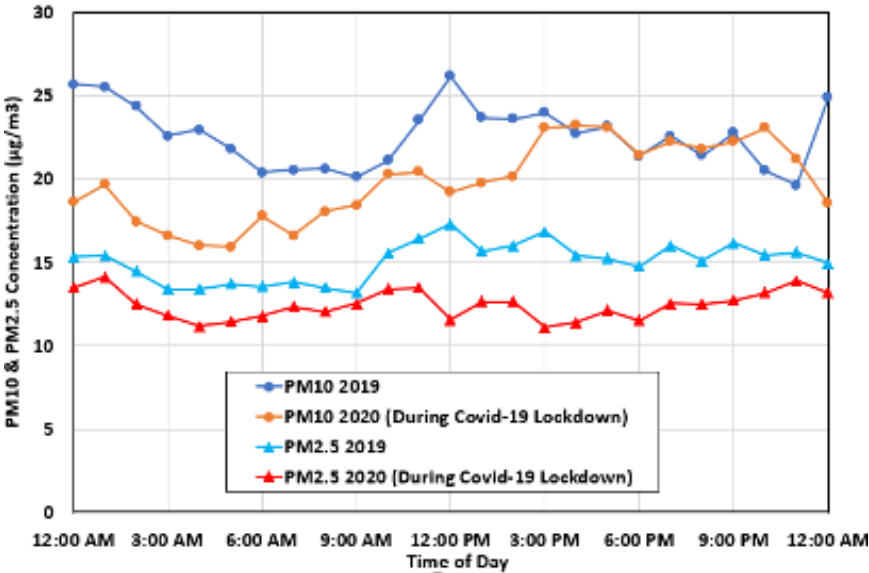


Figure 3: Concentrations of Particulate Matter less than 10 micro-metres [PM10] and less than 2.5 micro-meters [PM2.5] from 4th-21st April 2019 and during Covid-19 shelter in place, 4th-21st April 2020, at East Broadway monitoring station.

There are many publications that show a strong statistical link between a range of health issues and diseases in people and the proximity of their homes to busy roads in major cities. This data highlighted that vehicle emissions are a major contributor of airborne pollutants in a Bermuda road-side setting. Concentrations of sulphur dioxide and nitrogen dioxide showed the greatest decrease over the COVID-19 shelter in place but before that period, these concentrations were considered safe and were within Bermuda’s standards, in addition to those of other developed jurisdictions. Fine particulate matter, however, demonstrated a smaller but significant decrease over the shelter in place period compared to a year prior. Other more natural fine particulates may be contributing to this background reading and more analysis of the data is required to understand this contribution. Nonetheless, the concentration of airborne fine particulate matter has historically shown exceedances of the annual limits over some recent years and this can lead to both short-term acute medical issues, such as asthma, and chronic diseases after many years of exposure. Ensuring that vehicles are regularly serviced will help to reduce airborne pollution from fine particulates.

Dr. Geoff Smith,

Environmental Engineer, DENR - Pollution Control Section

CHARACTERISING BERMUDA’S BAITFISH POPULATIONS TO IMPROVE MANAGEMENT AND FISHERY SUSTAINABILITY – A MULTIDISCIPLINARY COLLABORATION

Small fishes play an important role in marine food webs, providing food for larger fishes and for birds as well, but they are also caught by commercial and recreational fishers for bait. These species therefore need to be managed in a way that takes all of these functions into account.

In Bermuda, there are six species of so-called baitfishes that often form large, multi-species schools. The Reef silverside, Dwarf herring and endemic Bermuda anchovy attain adult sizes of less than 10 cm, while the Redear herring, Atlantic thread herring and Round sardinella reach sizes over 20 cm (Figure 1).



Figure 1: The six baitfish species with common, local and scientific names.

Currently, management measures restrict the size and type of nets that may be used to catch them, and there are four inshore bays - Coot Pond, Whalebone Bay and Shelly Bay in the east end, and Somerset Long Bay in the west end - where net fishing of any kind is prohibited (Figure 2). However, stakeholders had expressed concern regarding the population status of at least some of the species, and the existing management plan identified critical knowledge gaps, noting that a greater understanding of baitfish populations could create opportunities for a wider range of management measures. The Marine Resources Section of DENR and the Bermuda Aquarium Museum and Zoo, in partnership with the Bermuda Zoological Society, Bermuda Institute of Ocean Sciences (BIOS) and Murdoch Marine, obtained a Darwin Plus grant from the UK's Department of Environment, Food and Rural Affairs (DEFRA) to investigate this issue from different angles.

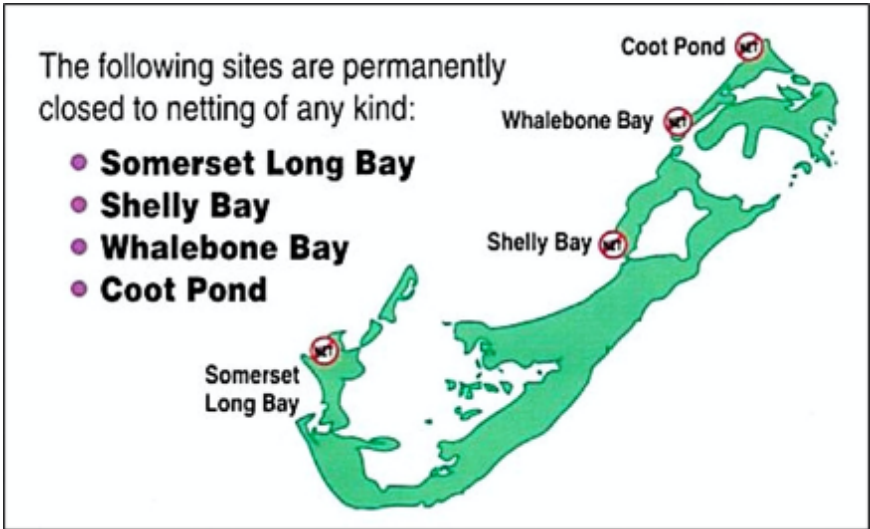


Figure 2. Map showing bays that are closed to net fishing of any kind.

Our team observed and sampled baitfishes at six bays, including two bays that are closed to net fishing, in order to monitor seasonal changes in abundance, track the reproductive cycles of the various species, and evaluate the contribution of protected bays to the maintenance of local populations. The six bait species exhibited different annual cycles, and while baitfish presence and species richness were relatively consistent at some locations, including one protected bay (Figure 3), they were highly variable at others. Overall abundance and species diversity were greatest in the autumn months, and baitfish were only present at the other protected bay at this time, but the abundance of some species peaked earlier in the year.



Figure 3. A school of Redear herring (Pilchards) at Shelly Bay, where net fishing is prohibited.

Based on this information, a broadscale survey around Bermuda the following autumn found that the three smaller baitfish species were relatively abundant and widely distributed, preferring particular types of inshore habitats. However, while the Redear herring was relatively common, the other two large species were rarely found.

Further, our observations showed that multi-species shoaling puts juveniles of the larger species at risk when they mingle with adults of the smaller species in large shoals that are targeted by fishers (Figure 4).



Figure 4. Underwater photograph of a multispecies bait shoal.

Interestingly, although the larger baitfish species appear to reproduce primarily in the spring and summer, the three smaller species produce small quantities of eggs but spawn throughout the year to compensate. These differences have implications for the effectiveness of seasonal closures as a potential management measure.

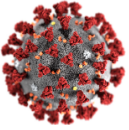
We also interviewed commercial and recreational fishers to examine bait fishing and bait use practices, as well as perceptions regarding the status of baitfish populations. Fishers corroborated our field survey results, reporting that Atlantic thread herring and Round sardinella are now uncommon. These interviews highlighted that bait fishing is largely opportunistic and takes place before primary fishing activity, which peaks in the summer months, so management measures that would reduce flexibility were viewed unfavorably. Fishers also raised concerns about the impact of large debris items in inshore bays. Further, although commercial fishers were familiar with the bays that are closed to net fishing, awareness was poor amongst recreational fishers. This, along with some poaching incidents observed during monitoring, indicates a need for increased outreach regarding this important management measure.

A population genetics study showed that Bermuda's baitfish populations have well-mixed gene pools, but are not well connected to populations of the same species elsewhere. This means that management should be precautionary, as replenishment from populations outside Bermuda is highly unlikely, but that the exact location of protected bays is less important as there is no need to account for small scale genetic differences locally.

Based on all this information, a new management plan for baitfish species has been drafted. As the plan enters the stakeholder consultation process, the multi-disciplinary approach of this project should mean that the proposed changes are both practical and largely acceptable to fishers. Importantly, data on the distribution and habitat preferences of baitfish species will be included in the marine spatial planning process currently being undertaken as part of the Bermuda Ocean Prosperity Programme, and will contribute to the conservation of important inshore habitats. We anticipate that these measures will improve the sustainability of baitfish fisheries and ensure that these species continue to fulfil their key ecological role.

Dr. Joanna Pitt, Marine Resources Officer & Dr. Robbie Smith,
Curator-Natural History Museum, BAMZ

THE VETERINARY CONTRIBUTION TO THE COVID-19 RESPONSE



The COVID-19 pandemic has been a stark reminder of the need for a collaborative 'One Health' approach towards health and environmental issues; that human health, animal health and the health of our environment are intricately linked.

The roles of the animal health sector have not been as apparent as that of the health officials and political leaders, but it contributes to the guidance given to the public. Animal health professionals seek to answer a zillion and one questions, including:

- From where did the SARS-CoV-2 virus come?
- What species of animals are affected?
- What animal species may be playing a role in spreading this virus to people, or to other animals?
- What domestic animal species are affected?
- How do we protect the humans having contact with these species?
- How will the outbreak affect the food supply?

Whether an animal health professional finds himself or herself in a companion animal practice, food animal practice, in a zoo, in the wild, in a research laboratory or in a public health agency, each has a role to play and contribute to the global COVID-19 knowledge base.

1. On the veterinary frontline

Despite the explosion of cases of COVID-19 in the human population, the veterinary profession has not seen concurrent outbreaks amongst pets and livestock. Nonetheless, we have had to counsel clients during periods of uncertainty, when little was known about the new virus, and when that which was known was continuously evolving.

We have learned that people are not at risk of catching the COVID-19 virus from their animals. There is no evidence of animals contributing to the spread of SARS-CoV-2 amongst people. However there is evidence of human-to-animal transmission, with documented cases of dogs, cats, a zoo tiger, and farmed mink having tested positive for SARS-CoV-2, following contact with humans known or suspected to be infected. All of these appear to be cases of human-to-animal transmission.

We did learn enough to advise pet owners that people in COVID-19 quarantine did not have to remove pets from the household. Owners that tested COVID-19 positive must limit contact with animals, if possible. When handling and caring for animals, basic hygiene measures should always be employed, including hand washing before and after handling animals, their food, feed and water bowls, toys, as well as avoiding kissing, licking or sharing food.

Of the domestic species found in Bermuda, cats seem to be most susceptible. In experiments, cats passed SARS-CoV-2 virus onto other cats. Based upon this finding, the British Veterinary Association recommends that cats from households in which a person has been confirmed positive, be kept indoors if the cat is tolerant of such keeping. This will reduce the potential for spreading the virus amongst cats.

The evidence of human-to-animal transmission and evidence of cat-to-cat transmission, are cause to recommend that infected persons and persons in COVID-19 quarantine must not participate in feeding of feral cats in Bermuda. An infected person may infect the colony of cats. The prospect of asymptomatic carriers also means that the hygienic practices described above should be employed at cat feeding stations.

2. Veterinarians in a support role

The veterinary profession contributed to the pandemic response in unusual ways. Like nearly every business, veterinary practices were markedly affected by the COVID-19 shutdowns; reducing their operations to essential services only. Nearly-idle veterinary practices then found themselves holding essential personal protective equipment (PPE) that was falling into short supply at human hospitals, and so veterinarians donated much needed PPE to the human health care workers. Also, veterinary anaesthesia machines were donated for conversion to serve as human respirators that were in short supply. Veterinary laboratories were sought out for their equipment and skilled staff to conduct COVID-19 tests on human samples, thus increasing COVID-19 testing capacity and surveillance. Veterinary epidemiologists have been supporting their counterparts in the public health agencies to track the disease in humans and to support the development of an effective public health response.

3. Veterinarians in research

With SARS-CoV-2 infections being widely distributed in the human population, it is a possible that animal species will become infected through close contact with infected humans. Studies are underway to better understand the susceptibility of different animal species to SARS-CoV-2 and to assess infections in susceptible animal species. The results of these studies will form our expectations and advice regarding pets, livestock, zoo animals, and animals in the wild.

Although several animal species have been infected with SARS-CoV-2 experimentally, none of these infections have been shown to be the cause of the COVID-19 pandemic; the pandemic remains driven by human-to-human transmission primarily through coughing, sneezing, talking, and contact with contaminated surfaces.

Our pets and livestock present no COVID-19 risk to people. This pandemic is not cause to abandon or reject our animals from our households and lives. In fact, they may be a source of comfort during this period of uncertainty and stress.

Jonathan Nisbett, DVM
Chief Veterinary Officer

NEWS & NOTICES

Spearfishing Statistics Reminder

Recreational spear fishers are reminded that spearfishing statistics should be submitted monthly using the online portal at www.fisheries.gov.bm. There should be an entry for each date / location that you fished, and a “No fishing” entry for the final day of any month in which you did not fish. Your catch statistics must be up to date through at least the end of July if you are applying for a spearfishing licence for the upcoming season, which starts on September 1st. Please call 293-5600 or email fisheries@gov.bm if you are having difficulties accessing the portal.

Recreational lobster diving

The 2020-2021 lobster season will begin on Tuesday, September 1st. DENR will be taking applications for recreational lobster diving licences for the upcoming season at the main offices in the Botanical Gardens from Monday, August 3rd. Please note that if you held a lobster diver licence for the 2019-20 season and did not submit any statistics then you will NOT be granted a licence for the upcoming season. This decision has been made at the ministerial level, in consultation with the Marine Resources Board, and exceptions cannot be granted by DENR staff. Anyone who acts in an abusive manner towards any staff member will be given a two-year suspension.

ENVIRONMENTAL CALENDAR SUMMER 2020

JULY 2020

July 26th:

International Day for the Conservation of the Mangrove Ecosystem

The International Day for the Conservation of the Mangrove Ecosystem, adopted by the General Conference of UNESCO in 2015 and celebrated each year on 26 July, aims to raise awareness of the importance of mangrove ecosystems as “a unique, special and vulnerable ecosystem” and to promote solutions for their sustainable management, conservation and use.

Mangroves contribute to the wellbeing, food security, and protection of coastal communities worldwide. They support a rich biodiversity and provide a valuable nursery for fish and crustaceans. Mangroves also act as a form of coastal defense against storm surges, rising sea levels and erosion. They are highly effective carbon sinks, sequestering vast amounts of carbon.

Take the time on this day to appreciate a mangrove! <https://en.unesco.org/commemorations/mangroveday>



AUGUST 2020

August 22nd: National Take Your Cat to the Vet Day

As humans, we tend to take our health pretty seriously. But when was the last time you took your cat for a general checkup? If the answer is ‘you can’t remember’ then use today as a gentle reminder to get your feline friend booked in for a health check. National Take Your Cat to the Vet Day on August 22nd is the day used to remind cat owners to pay a visit to the Vets.

SEPTEMBER 2020

September 19th: World Cleanup Day

The 3rd weekend in September is World Cleanup Day. In Bermuda, events on this day are led by Keep Bermuda Beautiful, who will host their annual coastal clean-up in September. Sign up here: <http://www.kbb.bm/cleanups.html>

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

VEGETABLES

June: Beans, Cucumber, Squash, Tomato.

July: Beans, Carrots, Tomato.

August: Beans, Broccoli, Brussel sprouts, Cabbage, Carrots, Kale, Leeks, Mustard Greens, Pepper, Radish, Rutabaga, Tomato.

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

FLOWERS

June: Amaranthus, balsam, calendula, celosia, coreopsis, cosmos, gaillardia, gazania, globe amaranth, hollyhock, marigold, portulaca, rudbeckia, vinca and zinnia.

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

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

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

ON HER MAJESTY'S SERVICE



GOVERNMENT OF BERMUDA
Department of Environment and Natural Resources
