Envirotalk

GOVERNMENT OF BERMUDA
Ministry of Environment, Planning and Infrastructure Strategy

SUMMER 2011
VOLUME 79 No. 2

PROMOTING APPRECIATION, ENHANCEMENT AND CONSERVATION OF BERMUDA'S ENVIRONMENT

WELCOME

to our summer edition of Envirotalk.

In this issue –

- **Dr. Jonathan Nisbett,** Government Veterinary Officer, details an incident concerning stranded cattle travelling to Turkey.
- **Mark Rowe,** Hydrogeologist, talks with us about rainwater harvesting, roof catchments and supplemental water sources.
- The Department of Conservation Services' Conservation Officer, **Jeremy Madeiros**, updates us on the Cahow Recovery Project.
- Check and see what is worth planting this summer in our summer planting calendar.

Please contact:

Caroldey Douglas (Tel: 239-2307 or e-mail: cdouglas@gov.bm) with ideas for future articles.

Kimberly Burch (Tel: 239-2322 or e-mail: kmburch@gov.bm) to be added to the subscriber list.

THE CRISIS THAT QUIETLY SAILED IN

On a peaceful Monday evening in March, a grey, nondescript freighter limped quietly into Dockyard assisted by two tugboats. As the crew and shoremen conducted their routine procedures to secure the boat alongside and a sole Customs Officer waited patiently to clear the vessel, the serenity of the scene was not reflective of the havoc that had taken place beforehand, or of the fact that a crisis had begun to unfold.

M/V Friesian Express *freighter at port in Bermuda. Photo courtesy of Jonathan Nisbett*

The M/V *Friesian Express*, a livestock freighter carrying a crew of 25 and a cargo of nearly 1,500 Holstein-Friesian cattle, made an unscheduled call to Bermuda because mechanical difficulties occurred during the trans-Atlantic portion of its voyage to Turkey. The Department of Environmental Protection had learned of the vessel's pending arrival only that morning and with little information to go by, its officers were forced to consider many 'what ifs' and prepare various contingencies. There were too many questions and too few answers. We didn't know what awaited us, but we knew we had several important goals to achieve.

Protection of local cattle

The Department of Environmental Protection had a duty to protect the local dairy industry from exposure to the arriving animals. This meant quarantining the on-board animals, disinfecting soiled clothes and shoes going on or off the vessel and keeping the crew away from local farms, all of which could spread potential disease agents.

Protection of local waters

Standard protocol for any vessel in inshore waters is to prevent discharge of waste into the environment. On the *Friesian Express,* the stalls are usually cleaned while on the high seas, but how would they be cleaned now that the vessel was in port? The manure and soiled bedding could not be handled by Wedco's sewage system, but how would this waste be collected and removed from the vessel? Where would the manure and soiled bedding go, and how would it get there? In collaboration with Public Works, Marsh Folly was chosen as the primary disposal site with Tynes Bay as the secondary site, if incineration was deemed necessary.

Health, welfare and security of livestock

The livestock on board the vessel were entitled to food, clean water, clean air and free movement. Before the vessel arrived, we didn't know whether these needs were being met and the onboard conditions were unknown. Was on-board feed sufficient to sustain the animals while in Bermuda and get them to their destination? If housing conditions were good upon arrival, how long could satisfactory conditions be maintained? What would happen if the animals had to be removed from the vessel? Where would we put them? How would we secure them and how would we segregate the animals into distinct groups if need be? Would Turkey still accept the animals if they were off-loaded in Bermuda?

These were some of the questions we were facing. We didn't have clear answers, but the situation was present and unavoidable, this was no theoretical exercise. The Department of Environmental Protection took the lead in handling the situation but had to rely on other departments that had the resources to assist.

Inspections of the livestock

Upon docking, the crew of the *Friesian Express* placed a disinfecting footbath at the base of the gangway. This practice lessens the likelihood of germs being carried onto or off of the vessel on shoes thereby controlling the spread of infectious diseases.

The Veterinary Officer and two Animal Wardens boarded the vessel upon its arrival and the livestock and accompanying health documentation were inspected. The documentation indicated that the animals qualified to enter Bermuda, so disease control became a lesser issue should unloading the animals become necessary. The cattle appeared to be in good health, with feed, hay and water available. Housing conditions were acceptable and feedstuffs were plentiful, but I was concerned about how long acceptable conditions could be maintained and whether feedstuffs were sufficient to

sustain the animals through the delay and to the next port of call.

Several options were explored, but much depended on when the vessel would be repaired. Feed was a critical element. Although there was feed for the immediate need, the concern was whether sufficient feed would remain when it was time to set sail again. With the number of cattle on board being 2–3 times the Island's entire cattle population, there was insufficient feed on-Island to restock the vessel. Feedstuffs would take about one week to arrive by sea, and we had a very short time frame to place an order to ensure a timely arrival. A feed supplier was located and an expedited shipment was put on standby. The US Department of Agriculture also became aware of our scenario and offered to organize emergency feed deliveries and other relief as needed. They too were put on standby.

Follow-up visits

Follow-up inspections of the animals occurred approximately every other day with cleanliness and air quality strictly monitored. Cleaning of the stalls normally took place on the high seas but maintaining the stalls while in port would require extensive manual labour, potentially off-loading the animals with a system to contain and transport manure and bedding to Marsh Folly or Tynes Bay. Malabar Field appeared to be the best available location to contain the animals, even though getting them there would involve relocating the vessel and a cattle drive through Dockyard.

Cattle onboard Friesian Express. *Photo courtesy of Jonathan Nisbet*

However off-loading the animals would present additional problems as off-loading could invalidate the animals' health documents. The Bermuda Government would have to secure and protect the animals to a level that the Turkish Government would continue to accept them. Based on the extensive content of the initial documentation, Bermuda may not have been able to meet Turkish demands, and the cattle could have been rejected. This prospect raised questions of costs and a multi-million dollar liability for the rejected cattle.

During the days that followed, the conditions of the animals and housing remained largely unchanged. The cattle were eating well, were bright

and alert and displayed good body condition with no signs of respiratory disease. Manure, urine and soiled bedding were present, and the ship's ventilation system combated increased ammonia in the air.

The progress in repairs to the vessel made neither relief supplies of feed nor off-loading the animals necessary. Repairs were completed by the sixth day, and by the seventh day, the vessel departed Bermuda bound for the Azores where it was due to collect additional feedstuffs. The cattle had another 12–14 days ahead to reach their destination.

Lessons learned

This was my first encounter with a ship built (or re-fitted) exclusively for transporting livestock, and several lessons were learned. A disabled vessel housing 1,500 cows conjured up visions of deep muck, foul stench, and stressed, unhappy and sickly animals. Many of my concerns were allayed as I found no major issues on the *Friesian Express*.

This vessel had four decks of stalls. Each stall contained between six and eight animals, and each stall had sufficient room for all of the animals to move freely and lay down. Each deck had a 'sick pen' for animals needing closer attention and an overhead ventilation system ran constantly to provide fresh air.

The captain and stockman were highly concerned about the welfare of their live cargo. After all, it is their business and in the interest of the shipping line to have the animals' welfare at heart. The experienced stockman was in charge of the animals care and had basic veterinary medications available. He produced daily reports documenting various items, including housing conditions, observations, feed consumption, veterinary treatments, illnesses, births, deaths and abortions. These reports were forwarded to the ship's corporate headquarters and onto shipping regulators in Australia as this particular shipping line followed Australian standards.

'Dodged a bullet'

On the Sunday morning, the *Friesian Express* sailed away just as quietly as it arrived. Cognizant and thankful that the situation did not develop into the disaster it could have been, I prepared for the next item on my agenda, which was a conference of Caribbean-based chief veterinary officers. 'My cow boat' was a hot side-topic, as it was one of those incidents no one wants to face.

Jonathan Nisbett, DVM
Veterinary Officer, Department of Environmental Protection

THE ADEQUACY OF RAINWATER HARVESTING IN BERMUDA

Every building in Bermuda has a roof catchment to collect rain water and an associated water storage tank. This is mandated under The Public Health (Water Storage) Regulations, 1951. For many households, this system of rain water harvesting meets all of their water supply needs. For the majority, however, supplementary water is required, either on a regular basis, due to a small catchment area (relative to demand) or, occasionally, due to episodes of lower than normal rainfall. Sources of supplementary water are: raw ground water from private wells, treated ground water from Government and commercial wells, and treated sea water.

There are currently approximately 30,500 'dwelling units' in Bermuda (1.7 dwelling units per house). Close to 20% of these supplement their supply of harvested rain water with raw water from private wells. More than one-third of these private wells produce 'fresh' (low salinity) water because they are located within fresh ground water lenses, the remainder are 'brackish' (high salinity). Regardless of the quality, the use of raw well water for potable purposes is not permitted (the Public Health Act, 1949); so it must be supplied, via a dedicated plumbing system, for non-potable purposes such as toilet flushing and laundering (salinity permitting).

Another 20% of dwelling units are connected to water mains (pipelines) operated by Bermuda Government and Watlington Waterworks. These are fed from reservoirs containing a blend of treated water, both from low salinity ground water wells and from coastal sea water wells. The remaining, more than 60%, of dwelling units have neither a well nor a mains connection and, therefore, rely on harvested rainfall supplemented only by trucked water, as needed. There are 41 water trucks (tankers) in Bermuda, many of which are individually owner-operated. The majority of the trucks have a capacity of 900 Igal (Imperial gallons). Most of the water supplied to the truckers for distribution is from the same source as that supplied by the water mains.

Not all rain which falls within the guttered area of a Bermuda roof is transferred to the storage tank. The term 'tank rain' was coined to distinguish rain which greatly benefits water storage levels from that which does not. Studies show that the amount of rain water that is delivered to a tank relative to the amount that falls on a roof — the 'catchment efficiency' — increases with the length and intensity of the rainfall event.

The ineffectiveness of short showers is in part attributable to roof surface roughness and porosity, which must be saturated before run-off will occur. Evaporation is another loss which will reduce run-off and delay its onset, particularly in the summer months. Finally, there is wind, which at

exposed locations has the potential to significantly diminish catchment efficiency. The average long-term efficiency of a Bermuda roof (compared to a standard 4-inch rain gauge) has been measured at 87%.

Based on a long-term average annual rainfall of 57.7 inches, the supply of rainwater harvested from the roof of the 'typical' Bermuda house (defined by Rowe. M.P, 2010) is calculated at 94 Igal/day or 23.5 Igal per occupant (after correction for catchment efficiency). Whilst prior to the 1970s this rate of supply was well matched to the demand of a 4-person household estimated at 80 Igal/day, the typical 4-person household of today, with a demand of 120 Igal/day, experiences a deficit in rain water supply of 26 Igal/day. This figure is consistent with the findings of a homeowner's survey of water use habits conducted by the Ministry of Public Works. The average quantity of supplementary water purchased by those respondents who rely on trucked water was 8.6 truck loads per year (at 900 Igal per load).

A typical Bermuda roof has a catchment area of 1360 square feet.

Using a different approach, it was calculated from the Bermuda Topographic Map Database (based on aerial photography) that there is an average of 382 sq.ft of residential roof catchment area available per person. This is compared to 450 sq.ft per person required to satisfy per capita water consumption at home of 30 Igal/day, based on average annual rainfall.

One recommendation coming out of recent studies is that the overall deficit in harvested rain water relative to demand, should be offset by stepping up the use of non-potable well water (from on-site private wells) for toilet flushing and other purposes, as quality permits. This would foster traditional Bermudian self-sufficiency and reduce the demand for 'produced'

supplementary water which has to be: a) treated to a potable standard and then b) delivered, at significant expenditure of fossil fuel, respectively. Most water consumed at home need not be of a potable standard and, in these days of PVC pipes and fittings, it is a myth that salt water cannot be used for toilet flushing due to corrosion issues.

Tank capacity is another factor which has been investigated in recent studies. Contrary to the apparent belief of some builders, a large tank does not substitute for a deficit in the supply of harvested rainfall, caused by insufficient catchment area relative to occupancy/water demand. In fact, only under 'balanced' conditions, when the quantity of harvested rain water is approximately equal to demand, is the maximum regulation tank capacity beneficial. Many residences in Bermuda have unexploited tank capacity, some are always overflowing and others are always depleted. It is recommended that for new high density housing, the regulations be modified such that construction of costly over-sized tanks, which are destined to remain permanently depleted, can be substituted with installation of a well for flushing water.

A typical Bermuda tank has a capacity of 13,500 Imperial gallons. Photo courtesy of Mark Rowe

Further reading:

Peters, A.J., K.L. Weidner and C.L. Howley, 2008. The Chemical Water Quality in Roof-harvested Water Cisterns in Bermuda. *Journal of Water Supply: Research and Technology* – AQUA 57 (3): 153–163.

Rowe, M.P., 2010. *Bermuda's Water Supply*. Department of Environmental Protection, the Bermuda Government.

Mark Rowe
Hydrogeologist, Department of Environmental Protection

CAHOW RECOVERY PROJECT UPDATE: 2011 NESTING SEASON

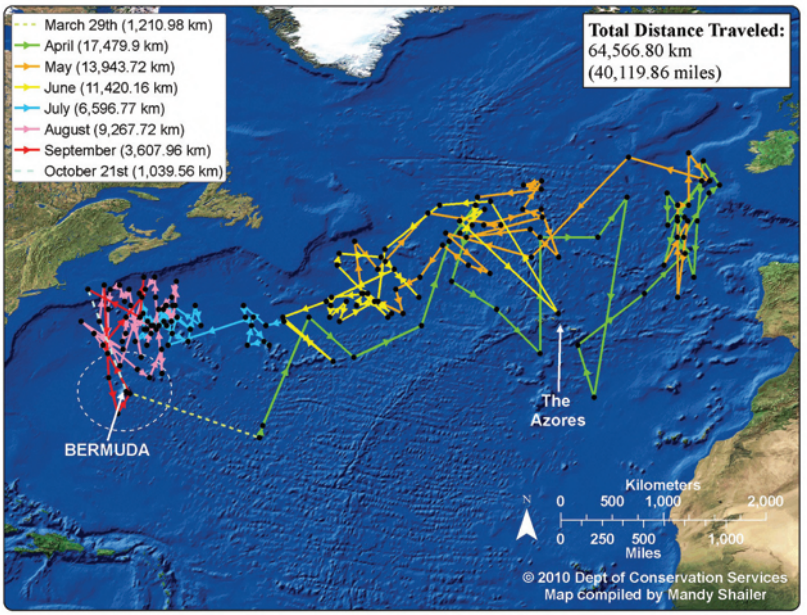
News about Bermuda's national bird, the endemic and critically-endangered cahow, or Bermuda petrel, *Pterodroma cahow*, continues to be positive. The recovery programme has experienced exciting new developments for the 2011 nesting season, highlighting the continuing return of the cahow from the very edge of extinction.

The cahow is a 'Lazarus' species, that is, one that was found to be still surviving after being considered extinct for 330 years. The impact of mammal predators introduced by man, coupled with hunting by the early settlers, quickly reduced the cahow from a population estimated in the hundreds of thousands in the 1500s, to supposed extinction by 1620. Following the rediscovery of the cahow in 1951, decades of conservation work were carried by Dr. David Wingate. This allowed the cahow to begin to recover from only 18 nesting pairs in 1960, to 56 pairs in 2000 upon Dr. Wingate's retirement.

After taking up the post of Conservation Officer in 2001, my main objectives have been: (1) to address threats and further increase the breeding population of the cahow, (2) to establish new, storm-resistant nesting colonies on the larger and higher Nonsuch Island Nature Reserve, and (3) to use new technology to answer long-standing questions of where the cahow goes when at sea, both during the nesting season when they are foraging for food to feed the chicks, and during the summer, non-breeding season.

For the 2011 nesting season, we are well on our way to achieving all three objectives. As of late May, I can confirm that the population has risen to a record 98 nesting pairs. A record total of 57 chicks have now also been confirmed on all of the nesting islands (compared to only eight chicks produced by 18 nesting pairs when management of the species commenced in 1960).

At the new colony on Nonsuch Island, out of 102 cahow chicks that were moved, or translocated to the new site between 2004 and 2008, a total of 30 have been confirmed returning so far as adults. As of May 2011, a total of 12 active nest burrows on Nonsuch have been occupied by nesting cahows. Seven of these produced eggs this year, with four chicks hatching, which should fledge out to sea by early June, not to return for three to five years. During this period, they live entirely on the open ocean until reaching maturity. Male cahows arrive back first to look for their own burrow and attract a mate, with cahow pairs usually staying together for life.



The use of archival geolocational data loggers to track the movements of cahows at sea has been outstandingly successful. Twelve loggers were fitted to adult cahows, of which 10 were recovered with useable information. The results have shown that many cahows carry out foraging trips far to the north of Bermuda in Canadian waters, with at least five loggers recording trips to the area of the Grand Banks, southeast of Nova Scotia and Newfoundland. Other foraging trips by individual birds went to areas east of Cape Hatteras, North Carolina, and to the northeast of Bermuda. These trips all occurred during the egg-incubation and chick rearing periods of the nesting season. During late February and March, several Cahows foraged in very cold water temperatures in the mouth of the Gulf of St. Lawrence, quite close to the edge of areas covered by pack ice! From these tracks, it is becoming increasingly obvious that Canadian waters are an important foraging habitat, especially during the nesting and chick-rearing period.

During the summer, non-breeding months (mid-June to late October), two-thirds of cahows fitted with loggers spent part or all of the summer just west or north of the Azores Islands, about 2,400 miles northeast of Bermuda. One cahow travelled even further, in one month moving over 3,000 miles to the northeast and foraging about 150 miles southwest of Ireland. From there it moved south to spend a month about 400 miles west of Spain and Portugal before moving back west across the width of the Atlantic towards Bermuda. Two of the cahows fitted with loggers spent the

summer months in an entirely different area, mainly staying north of the Gulf Stream, from off the coast of North Carolina to south of Nova Scotia.

Many of the recovered loggers were reset and re-deployed on other cahows for a second year. Another four of these loggers have been recovered, one after being on the same cahow for two full years. We will be using data stored on these loggers to make additional maps of the routes followed by these birds, adding to the wealth of new knowledge being obtained about the oceanic range of this impressive, and endangered, ocean wanderer.

Jeremy Madeiros,
Conservation Officer (Terrestrial), Department of Conservation Services

PLANTING CALENDAR – WHAT TO PLANT IN 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

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 and Vinca

ON HER MAJESTY'S SERVICE

GOVERNMENT OF BERMUDA

Ministry of Environment, Planning and Infrastructure Strategy

PUBLISHED BY: GOVERNMENT OF BERMUDA • MINISTRY OF THE ENVIRONMENT, PLANNING AND INFRASTRUCTURE STRATEGY• DAME LOIS BROWNE EVANS BUILDING • 58 COURT STREET • HAMILTON HM 12 • BERMUDA • DESIGN: DEPARTMENT OF COMMUNICATION AND INFORMATION