

Envirotalk



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PROMOTING APPRECIATION, ENHANCEMENT AND CONSERVATION OF BERMUDA'S ENVIRONMENT

WELCOME

to our summer edition of Envirotalk.

In this issue –

- **Dr. Geoff Smith**, Environmental Engineer, tells us about Bermuda's oil spill exercise which was held this March.
- Biodiversity Officer, **Alison Copeland**, discusses a survey done on Bermuda's endemic killifish.
- See the planting calendar to get a head start on what to plant this Summer.

Please contact:

Envirotalk mailing list: envirotalk@gov.bm to be placed on the mailing list or for suggestions for future articles.

Editor's note

June is a very busy month for the environmental world as there are a multitude of events and activities being held to support the environment. Important dates to note are: 5 June for World Environment Day (<http://www.unep.org/wed/>), 8 June for World Oceans Day (<http://worldoceansday.org/>) and 17 June for World Day to Combat Desertification and Drought <http://www.un.org/en/events/desertificationday/>.

Kimberly Burch – Editor

BERMUDA'S PREPAREDNESS AND RESPONSE TO AN OIL SPILL TO THE MARINE ENVIRONMENT

From 11 to 14 March 2013 Bermuda participated in an oil spill exercise that was hosted by Esso Bermuda Ltd and ExxonMobil North America Regional Response Team and involved many Ministries and Departments across Government in addition to personnel from BELCO, BIOS and Clean Caribbean America's. The goal of this exercise was to test Bermuda's national response to a major oil spill to address risks to the public, marine environment and energy security.

Bermuda is dependent on its energy from fuels delivered from overseas by ship to the Esso Bermuda Ltd docks in St George's. Bermuda currently receives the following annual fuel imports:

- Heavy fuel oil (HFO), 120,000 cubic metres. For use at BELCO (East Power Station Engines)
- Light fuel oil (LFO – i.e. diesel), 49,000 cubic metres. For use at BELCO (North Power Station and gas turbines), road vehicles, boilers, backup generators and other equipment.
- Gasoline, 33,000 cubic metres. For use for vehicles and other equipment.
- Jet fuel, 26,000 cubic metres. For use at Kindley Field Airport

HFO and LFO are pumped periodically to the holding tanks located at BELCO directly from the Esso Bermuda facility in St George's via a dedicated pipeline that spans near-shore marine areas at Coney Island, Bailey's Bay and Flatts Inlet. Jet fuel is also pumped directly from the St George's facility under Ferry Reach to the Kindley Field Airport.

In addition to the necessary checks and maintenance to the pipeline, it is also prudent for the owners of the fuel and fuel pipeline, in addition to the Government of Bermuda, to prepare for and to practise response efforts that are focused on addressing an oil spill into the marine environment.

The Marine Pollution Contingency Plan (MPCP) for Bermuda is managed by the Department of Environmental Protection together with direct input from the Department of Marine and Ports Services and the Department of Tourism. This plan provides details of the command structure and procedure to respond to a marine oil spill and includes a comprehensive call-out list for Government assets, commercial organisations and international assistance. The Government maintains a range of oil spill equipment located at Penno's Wharf, Dockyard and Coney Island that includes: (i) boom used to absorb, deflect or contain floating oil on the sea, (ii) skimmers that pick

up and collect the floating oil and (iii) a range of boats, personal protective and ancillary equipments necessary to support these activities.

The oil spill exercise comprised of a practical exercise on Day 1 followed by training on Day 2 and the desk-top simulated oil spill exercise on Days 3 and 4. The first day was spent coordinating the deployment of the boom into a range of configurations (absorption, deflection, containment) in Ferry Reach and providing familiarisation with the types of skimmers that are present in Bermuda and the rationale behind choosing specific configurations of equipments. The photo below shows deployment of the boom between a Fisheries and an Esso boat and the set up of an oil collection skimmer and pump.



Most oil spill response plans typically try and rank the scale of response effort to the potential risk to human health, the environment or economic costs. The scale of response will therefore be a function of the type of oil and volume spilt, the proximity to the public and the environmental sensitivity and economic value of the area impacted, or at risk of being impacted. As with other oil spill plans, such as for Esso Bermuda, Rubis or BELCO, the Government oil spill contingency plan ranks oil spills into the following categories:

- Tier 1 Oil Spill. This category of spill is contained on the same property as the oil storage and can be addressed by resources specific to that property.
- Tier 2 Oil Spill. This category will move, or have the potential to move, outside of the immediate location of the spill and will require a coordinated response by additional organisations.
- Tier 3 Oil Spill. This category has the potential to require all of the

oil spill resources (equipment and trained personnel) available to Bermuda and could also require mobilisation of international assistance under pre-arranged agreements.

The two-day simulated desktop oil spill exercise was conducted at the Fairmont Southampton Hotel. The North America Regional Response Team (NARRT) of Exxon Mobil Inc. has been established to respond to all international oil spill events where Exxon Mobil Inc. has assets and is very experienced in this role. The NARRT also employed an independent company to coordinate a range of personnel from Bermuda, who were known as the 'Backroom', to help to develop the spill scenario and related impacts in order to test and stretch the response effort with respect to a range of environmental, health and safety and logistical challenges that were pertinent to Bermuda. Within the hotel the NARRT had set up 20 telephone lines to simulate the Incident Command Centre, Planning, Operations, Logistics, Finance, Safety and Publicity sections of the response effort, in addition to simulating communications with the public, ministers, politicians, local and international media and a range of ministries and non-government organisations in Bermuda.

The actual oil spill scenario that was developed as part of this exercise included an overnight leak of heavy fuel oil from the Esso to BELCO pipeline at the Coney Island location and resulted in simulated aerial maps and oil spill forecast modelling tools being provided to show the development of the spill into Castle Harbour, Ferry Reach and the St George's Harbour area over the two-day period of the exercise. The initial response, simulating the first hours of the spill, was coordinated by Esso Bermuda Ltd personnel and as the scenario developed and the spill worsened, these were then incorporated into the Incident Command Structure with the Government of Bermuda coordinating efforts. BELCO and BIOS also added value to this nationally coordinated response. Once the potential scale of the spill was understood, both Government and Esso Bermuda Ltd agreed that this represented a major Tier 3 oil spill incident. This resulted in Exxon Mobil Inc. starting the process to bring experienced personnel from their NARRT in addition to oil spill remediation equipment and personnel from Clean Caribbean America's (CCA), Fort Lauderdale who are under contract with ExxonMobil to provide this response to Bermuda within 24 hours.

The national Bermuda response utilised personnel, boats and equipment from a range of Government, commercial and non-government organisations to coordinate the initial response. The Exxon Mobil Inc. NARRT personnel and CCA arrived early afternoon on Day 1, which necessitated a transition whereby the approach became that of a Unified Response Team

where Government had the final approval of the response plan that was developed to protect personnel and the environment.

One hundred and twenty personnel from the following Government departments, commerce and international organisations were directly involved in this exercise:

- Ministry of Environment and Planning – Departments of Environmental Protection, Parks and Conservation Services
- Ministry of Tourism Development and Transport – Airport Operations, Marine and Port Services
- Ministry of Health – Department of Environmental Health
- Ministry of Finance – Accountant General and Customs and Revenue
- Ministry of Public Safety – Fire and Rescue Service and Police Service
- Ministry of Public Works – Works and Engineering
- Minister of Legal Affairs – Attorney-General’s Chambers
- Cabinet Office – Communication and Information
- Ministry of Home Affairs – Immigration
- Ministry of Economic Development – Department of Energy
- The Bermuda Regiment
- Bermuda Electric Light Company Ltd (BELCO)
- Bermuda Institute of Ocean Sciences (BIOS)
- Clean Caribbean & Americas (CCA)
- ESSO Bermuda Ltd
- ExxonMobil North America Regional Response Team (NARRT)

The photograph below shows two of the response sections (Operations and Logistics) and a visit by the Premier who, with some of the Ministers, took great interest in the exercise.



The goal of the unified response effort under the Incident Command System is to change from that of a reactionary response to a more planned and proactive response effort that has clearly defined tasks established at the end of the day that are to be put into practice for the following day.

The exercise provided a range of lessons learnt that will be considered for incorporation into the Government Marine Pollution Contingency Plan. For example, managers who have more than typically 5–7 personnel providing direct feedback to them would need to appoint a middle manager or unit leader in order to avoid information overload that can ultimately lead to delayed or even missed communications, decisions or actions. By having an organic management structure the numbers of personnel and the associated management structure can grow according to the requirements of the scale of the response effort.

The NARRT were very impressed by the coordinated effort across the Bermuda national response team and their ability and willingness to transition into the unified response effort once the international expertise arrived on the scene. Following the end of the exercise the NARRT were quickly redeployed on 29 March to the response effort of a real oil spill from a pipeline to a wetland area in Arkansas USA. The Government of Bermuda would like to express its thanks to Esso Bermuda Ltd for the assistance in servicing many of its oil spill response equipment in addition to the opportunity for key stakeholders in Bermuda to participate in such an invaluable exercise, where good practices and experiences were shared by the NARRT.

Dr. Geoff Smith

Environmental Engineer, and Government Incident Commander for the Oil Spill Exercise

Dept of Environmental Protection

PADDLING IN THE POND: THE 2011/2012 KILLIFISH SURVEY

What are killifish?

There are at least two species of killifish which are endemic to Bermuda. The Lover's Lake killifish (*Fundulus relictus*) is found in saltwater ponds in the east end of the island. The Bermuda killifish (*Fundulus bermudae*) lives in both brackish and saltwater ponds from Hamilton Parish to Somerset. They are sometimes referred to as 'mangrove minnows'. The two species look identical, and grow to around 10cm long. The females are olive green, dark grey or light orange-brown with a light coloured belly. Males are dark coloured, and often with a yellow or gold belly. Both sexes may have vertical dark coloured bars. In the breeding season. the males display an ocellus



or eye spot, which is a dark spot circled with white on the dorsal fin.

Killifish are a key part of the ecology of Bermuda's ponds. They eat a variety of small prey, including mosquito larvae. They in turn are eaten by resident and migrant water birds (particularly herons)

and larger fish such as freshwater eels and marine fish like snappers.

Status

Fundulus relictus and *Fundulus bermudae* are considered endangered, and were added to the protected species list in January 2012 as level 2 protected species. A Protected Species Recovery Plan for killifish was published in December 2012. The plan details the threats to killifish and actions needed to improve the conservation status of both species (Outerbridge and Sarkis, 2012).

Objectives of this Study

Prior to 2005, very little was known about Bermuda's killifish. There was no data indicating the number of killifish remaining in Bermuda's ponds, or the health of these populations. The first work to estimate the size of Bermuda's killifish populations is reported in Outerbridge et al. 2006. A number of management actions were taken as a result of this work, and a follow-up survey was needed to determine the success of these actions, and what further recovery efforts were needed. An island-wide survey of Bermuda's killifish populations was undertaken in the spring and summer of 2011 and 2012 in a collaboration between the Bermuda Zoological Society and the Department of Conservation Services, led by Dr. Jamie Bacon, Mr. Mark Outerbridge and myself. The objectives of the survey were to:

- Determine the current distribution of Bermuda's killifish and compare it with previously reported distributions.
- Estimate the size of each killifish population, and compare these to 2005 population estimates.

- Describe and analyse the structure of each population in order to determine health.
- Ensure that up to date information is available to support management of Bermuda's *Fundulus* species and their habitats.

2011/2012 Pond Surveys

Over 12 months we surveyed 15 ponds where killifish were captured in 2005 or introduced since then. Sites included ponds containing natural killifish populations and man-made ponds in nature reserves and golf courses containing killifish introduced from natural sources. These carefully managed introductions represent important 'life boats' for threatened natural populations and recording the success or failure of these introductions was key to understanding future management needs and establishing protocols for future introductions.



At each of the ponds we set a number of minnow traps baited with herring, using an inflatable kayak. A portion of the trapped fish were sexed and measured to determine the ratio of males to females in each pond and a size distribution. A selection of the measured fish were marked using either an injected dye marker or a fin clip. We visited each pond three times, marking and measuring fish on the first visit, and counting trapped fish and looking for marked ones on the second and third visit. Using the Petersen Index mark and recapture method we were able to estimate the population of each pond based on how many marked fish we put into the pond, and how many marked fish we subsequently recaptured. Over the

course of two summers we marked 1,552 fish, then checked 17,091 fish for marks and found 507 marked ones.

Results

The smallest fish we measured was 2.5 cm long at Lover’s Lake and the biggest fish we found was 11.2 cm at Shelly Bay Pond. Juvenile killifish smaller than 2.5 cm would not have been captured in the traps that we used, as they could escape through the mesh. These two ponds also had the smallest and largest mean fish lengths respectively. The reasons for this will need to be explored further, but may include the genetics of the population, competition, predation, the conditions in their pond (e.g., temperature, pollution) and the type and quality of available food.

At Evan’s Pond, and the three ponds at east Walsingham, schools of approximately 50 to 200 killifish were seen, but we were not able to trap any. Population estimates were not calculated for Port Royal Golf Course or Paget Marsh as only one killifish was trapped in both of these locations. The population estimates for ponds where we did successfully capture fish are as follows:

| | 2011–2012 population estimate (Petersen) | 2004–2005 population estimate (Petersen) with SE + / - |
|---------------------|--|--|
| Mangrove Lake | 69,373 | 11,325 (1,884) |
| Trott’s Pond | 1,934 | 7,926 (1,576) |
| Blue Hole Bird Pond | 12,922 | 5,394 (480) |
| Lover’s Lake * | 7,907 | 8,508 (1,347) |
| Cooper’s Island * | 2,329 | N/A |
| Bartram’s Pond * | 1,244 | 1,793 (224) |
| Shelly Bay Pond | 1,012 | N/A |
| West Walsingham | 5,389 | 2,202 (178) |
| Seymour’s Pond | 10,316 | N/A |

*indicates *Fundulus relictus*, the rest are *F. bermudae*

The natural *Fundulus bermudae* populations at Mangrove Lake and West Walsingham appear to be healthy, while there were declines at Trott’s Pond. The natural source population of *Fundulus relictus* at Lover’s Lake also showed a slight decline.

Seymour’s Pond was the most recent introduction site. Four hundred Bermuda killifish were introduced in 2011, and the population estimate one year later was a whopping 10,316! The introduction of Lover’s Lake killifish

into the restored salt pond at Cooper's Island was also very successful. The boardwalk at the Cooper's Island pond provides the best opportunity to view killifish in the wild.

Follow-up and future work

Genetic research of Bermuda's killifish indicates that each pond has a genetically unique population and that more endemic species or possible subspecies may be found with more research. From a management standpoint, this means it is imperative to keep fish from different ponds separated and to manage ponds with small or threatened populations as a discrete unit.

Evan's Pond was identified as the most at risk population, due to its small size and genetic uniqueness. In May 2012, 49 killifish from the Evan's Pond population were captured and transferred to a pond at Riddell's Bay Golf Course, with the hope that they could establish an additional breeding population. This new 'lifeboat' pond will be surveyed this summer to determine if the translocation was successful.

The Bermuda killifish and Lover's Lake killifish have both been sent to the world-class killifish breeding facility at the Vienna Zoo, where they have successfully bred in captivity. This important project has resulted in an off-island population of both species as insurance against a natural disaster, and will also lead to improved husbandry knowledge of Bermuda's killifish which will aid future attempts to breed killifish in Bermuda.

References

- Outerbridge, Mark E., Anne F. Glasspool and John Davenport. 2006. Ecology and conservation of Bermuda's endemic killifishes (*Fundulus bermudae* and *Fundulus relictus*). Bermuda Biodiversity Project Special Publication 2006-002.
- Outerbridge, M. and S. Sarkis. 2012. Recovery Plan for Killifish in Bermuda (*Fundulus bermudae* and *Fundulus relictus*). Department of Conservation Services, Government of Bermuda. pp 47. http://bermudaconservation.square-space.com/publications/species-recovery-plans/Killifish%20recovery%20plan%201112_s.pdf

Alison Copeland
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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

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

ON HER MAJESTY'S SERVICE



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