

Dengue mosquito incursion and the eradication program on Groote Eylandt NT.

Myron Kulbac and Peter Whelan MEB, CDC Darwin

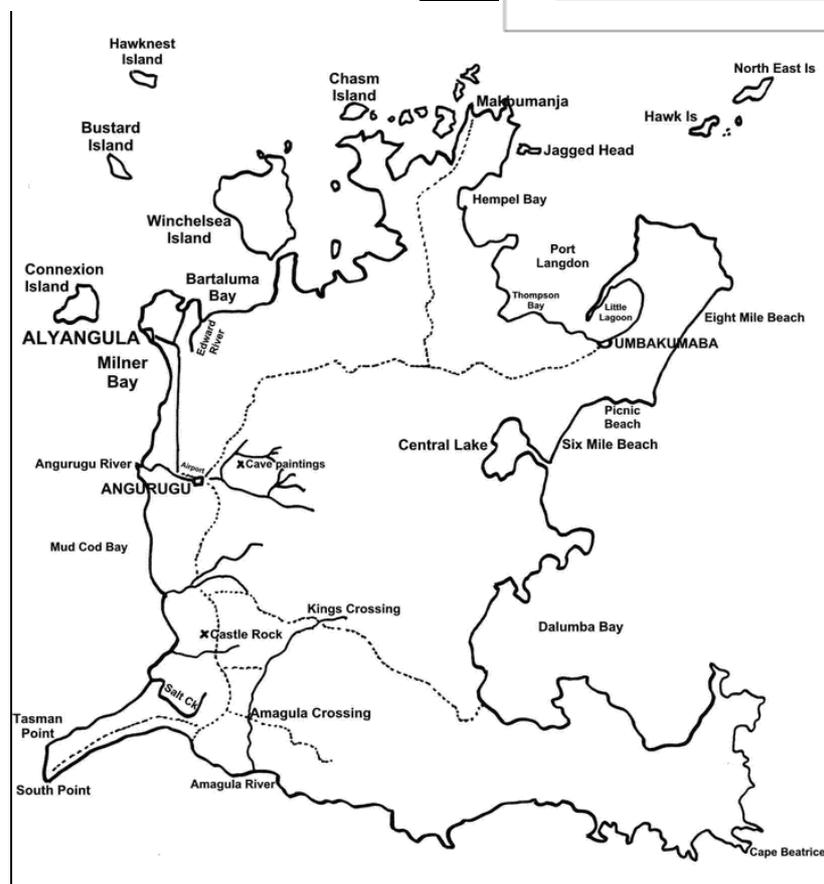
Introduction

Groote Eylandt, located in the Gulf of Carpentaria approximately 50 km off the east coast of Arnhem Land in the Northern Territory (NT), is Australia's third largest island (2258 sq km) (Figure 1). The largest town on the island is the mining town of Alyangula. The traditional owners are the Anindilyakwa people and there are a number of communities on the island, with the largest, Angurugu, located near the airport (Figure 2). A large manganese ore deposit in the western portion of Groote Eylandt is mined by GEMCO (Groote Eylandt Mining Company Pty Ltd) and regular shipments of ore are loaded at the wharf located near Alyangula. In Alyangula there are approximately 400 properties which house or support 1400 people who are mainly GEMCO employees or employees of support services. The town has a shopping arcade,

Figure 1. Groote Eylandt*



Figure 2. Groote Eylandt†



* Source: CRASE, B. and C. Hempel (2005): Object based land cover mapping for Groote Eylandt: a tool for reconnaissance and land based surveys. In: Proceedings of NARGIS 2005 - APPLICATIONS IN TROPICAL SPATIAL SCIENCE. 4th - 7th July 2005 Charles Darwin University, Darwin, NT, Australia.

† Source: Groote Eylandt Map (black/white) <http://www.users.bigpond.com/mjantke>

recreation club, school and health centre, with the port located approximately one kilometre from the town centre.

In October 2006, the dengue mosquito (*Aedes aegypti*), which is capable of transmitting the dengue virus, was discovered in the port area of Alyangula. This report outlines the detection and NT response to this exotic vector incursion.

Dengue disease and the mosquito vector.

Dengue is a viral disease that causes high fever lasting 3-7 days, severe frontal headache and muscle and joint pains. A more severe form, dengue haemorrhagic fever, can progress to coma and can be fatal. Dengue is an increasing public health problem in tropical regions of the world, with large outbreaks involving many thousands of cases of disease and many deaths in various tropical countries to our north.

Although dengue virus disease is not endemic in Australia, the major vector of this disease, *Aedes aegypti*, is present in North Queensland where importation of the virus in infected travelers leads to regular outbreaks of dengue disease.¹ The NT has been free of *Aedes aegypti* since the late 1950s to early 1960s when it disappeared as a result of a combination of elimination of rainwater tanks and a reduction of other favoured breeding sites.²

The NT is particularly vulnerable and receptive to the reintroduction of the dengue mosquito. There have been numerous interceptions of *Aedes aegypti* on vessels and cargo in the Darwin Port area by the Australian Quarantine Inspection Service (AQIS) and a number of detections have also been made in ovitraps around the Darwin Port area.^{3,4,5}

The NT is also vulnerable to importation of *Aedes aegypti* from North Queensland. An incursion of *Aedes aegypti* into Tennant Creek in 2004 during the building of the Alice Springs to Darwin railway project was declared eradicated in 2006 after an intensive program by the Medical Entomology Branch (MEB) of the Department of Health and Community Services (DHCS).⁶ DNA analysis of these mosquitoes indicated the incursion was imported from North Queensland.⁷

Detection of incursion

The MEB operates a surveillance program across the NT to detect the possible importation or establishment of exotic mosquitoes and particularly those *Aedes* species that can carry dengue.⁸ This surveillance is aimed particularly at ports that are visited by overseas vessels, and includes Alyangula.

The surveillance program includes the use of special egg traps (ovitraps) that consist of a black coated, 2-litre glass jar containing water and a 'masonite' paddle. The paddle provides a very attractive place for female *Aedes aegypti* to lay eggs. Each week the ovitraps are inspected for larvae and the paddles are sent to the MEB in Darwin for inspection and rearing of any eggs to 4th instar larvae for identification.

During routine sampling of an ovitrap from the Alyangula wharf area retrieved on 31 October 2006, 5 *Aedes aegypti* mosquito larvae were identified from eggs reared from the paddle. The detection of these larvae indicated that at least 1 female *Aedes aegypti* had been imported to the island. An analysis of the DNA of these specimens indicated that this incursion was not imported from North Queensland, but rather from some unknown overseas location. The likely mode of transport was probably as eggs on freight or rubbish items from an overseas vessel arriving at Alyangula, or discarded water receptacles from an illegal fishing vessel.

Eradication program - Alyangula

Following the discovery of the *Aedes aegypti* mosquito at Alyangula port, the MEB quickly deployed a control team of MEB and other DHCS staff to Groote Eylandt to survey and treat any water holding receptacles in the port and nearby residential area. The methods used were those employed in the Tennant Creek eradication program and for receptacle treatment on receptacles onboard overseas vessels arriving in the NT.⁹ At the same time, the NT DHCS applied to the Commonwealth Department of Health and Ageing for financial assistance for an eradication program.

An initial survey indicated that the dengue mosquito was widely established in the

Alyangula residential area. A program of house-to-house surveying and spraying of insecticides was initiated in November 2006. Every potential mosquito-breeding receptacle was sprayed with the residual insecticide lambda-cyhalothrin (DEMAND) and many sites that were likely to harbour adult dengue mosquitoes were treated with bifenthrin (BRIGADE). Receptacles used for pet or human food, water consumption, or recreation were cleaned with chlorine to ensure any eggs on the insides of the container were destroyed. Pools of water found in tanks, boats or other large receptacles that could not be drained were treated with methoprene (Prolink) mosquito growth hormone pellets or briquettes to prevent further mosquito breeding.

At the completion of the first round of inspection and treatment in December 2006, 45 (10.1%) Alyangula properties were found to be positive for *Aedes aegypti*. As can be seen in Table 1, subsequent surveys and treatments of Alyangula have reduced the presence of *Aedes aegypti* in Alyangula properties, with 18 (4.0%) properties positive for *Aedes aegypti* at the end of Round 3 in April 2007 and 1 (0.2%) property positive at the end of Round 4 in June 2007. By continuing regular rounds of survey and treatment, it is hoped that this trend will continue until the mosquito is completely eradicated. It is anticipated that this will take until the end of the 07/08 wet season.

Survey and treatment programs – other Groote Eylandt and neighbouring communities

The other major communities on Groote Eylandt include Angurugu (169 properties) and Umbukumba (67 properties). There are also a number of smaller communities and outstations, which range from 2 to 10 properties. As can be seen from Table 1, most of these communities have been surveyed and treated at least 2 or 3 times since November 2006.

Angurugu, which is located approximately 20 kms from Alyangula, was the only other community where *Aedes aegypti* larvae were found. They were present only in a single property. The larvae were found in a boat, which had been recently towed from Alyangula and fortunately were discovered before the mosquito was able to establish itself in Angurugu. After the first rounds of survey and treatment in Angurugu, no further properties have been found

positive for *Aedes aegypti* in this or any of the other communities on Groote Eylandt, apart from Alyangula.

Bickerton Island and Numbulwar are 2 communities located relatively close to Groote Eylandt. These communities have regular barge and private dinghy sea connections to Groote Eylandt and are possible sources or destinations where *Aedes aegypti* could be transported to or from Alyangula. Both communities have been visited twice by the eradication teams and to date there have been no properties positive for *Aedes aegypti*.

Ongoing eradication program

The NT DHCS requested and received \$582,000 funding assistance from the Commonwealth Department of Health and Ageing in March 2007 for a 2-year program to conduct full scale eradication and surveillance operations on Groote Eylandt and nearby island and mainland localities. This enabled the funding of a 6-person eradication team, who have been conducting the eradication program since December 2006 on a fly-in-fly-out weekly basis. Other financial and logistic support has been provided by GEMCO and the NT Government. GEMCO acknowledge the potential consequences of a dengue outbreak in the Groote Eylandt communities and have been very supportive by providing staff and facilities to assist the program.

In the dry season months of 2007, the eradication teams will focus on Alyangula to further reduce the number of actual and potential breeding sites by treating all receptacles with insecticide, by promoting clean up strategies to remove potential breeding receptacles, and by operating adult mosquito trapping devices in higher potential breeding locations. The traps will be used in higher potential breeding locations to both detect any remaining *Aedes aegypti* and to locate potential breeding places by detecting the location of endemic *Aedes* species. GEMCO has also committed to help by purchasing equipment which will clean out and improve the towns underground storm water drainage systems and clean house roof gutters to prevent water pooling. Staff of the GEMCO Health, Safety, Environment and Quality Department have also agreed to participate in a general cleanup operation of the township to minimise water-bearing receptacles able to provide breeding locations.

Table 1. Groote Eylandt *Aedes aegypti* Eradication Program 2006 / 07

Groote Eylandt and nearby Major Communities Progress Data Summary				PROPERTIES		
Location	Round No.	Start Date	Finish Date	Surveyed & Treated	Surveyed Only	Positive for <i>Aedes aegypti</i> (%)
Alyangula	Round 1	07/11/2006	11/12/2006	445		45 (10.1)
	Round 2	18/12/2006	19/01/2007	445		22 (4.9)
	Round 3	06/03/2007	12/04/2007	445		18 (4)
	Round 4	27/05/2007	22/06/2007	445		1 (0.2)
Alyangula Port/Industry	Round 1	15/11/2006	23/11/2006	29		0 (0)
	Round 2	15/02/2007	23/02/2007	29		0 (0)
	Round 3	13/04/2007	23/04/2007	29		0 (0)
	Round 4	18/06/2007	25/06/2007	29		0 (0)
Angurugu	Round 1	27/11/2006	01/12/2006	169		1 (0.6)
	Round 2	15/01/2007	01/02/2007	169		0 (0)
	Round 3	19/04/2007	29/05/2007	169		0 (0)
Mine Site	Round 1	16/04/2007	17/04/2007	14		0 (0)
Umbukumba	Round 1	13/12/2006	13/12/2006	67		0 (0)
	Round 2	08/02/2007	08/02/2007		61	0 (0)
Milyakburra (Bickerton Is.)	Round 1	12/12/2006	12/12/2006	47		0 (0)
	Round 2	13/02/2007	13/02/2007		48	0 (0)
Numbulwar Mainland	Round 1	20/12/2006	20/12/2006	84		0 (0)
	Round 2	14/02/2007	14/02/2007		130	0 (0)

Table 2. Groote Eylandt *Aedes aegypti* Eradication Program 2006 / 07

Groote Eylandt Minor Communities Progress Data Summary				PROPERTIES		
Location	Round No.	Start Date	Finish Date	Surveyed & Treated	Surveyed Only	Positive for <i>Aedes aegypti</i> (%)
Malkala	Round 1	28/11/2006	28/11/2006	10		0 (0)
	Round 2	07/02/2007	07/02/2007	10		0 (0)
	Round 3	18/04/2007	18/04/2007	10		0 (0)
Bartalumba Bay	Round 1	17/11/2006	17/11/2006	4		0 (0)
	Round 2	07/02/2007	07/02/2007	4		0 (0)
	Round 3	18/04/2007	18/04/2007	4		0 (0)
Dugong Beach Resort	Round 1	19/04/2007	19/04/2007	1		0 (0)
	Round 2	21/06/2007	21/06/2007	1		0 (0)
Gibie Development	Round 1	17/04/2007	17/04/2007	6		0 (0)
	Round 2	21/06/2007	21/06/2007	6		0 (0)
Ndunga	Round 1	17/04/2007	17/04/2007	6		0 (0)
Emerald River	Round 1	30/11/2006	30/11/2006	3		0 (0)
	Round 2	23/04/2007	23/04/2007	3		0 (0)

Summary

Ten months after the discovery of *Aedes aegypti* on Groote Eylandt, the incursion is currently confined to the community of Alyangula and is at a very low level. It will be necessary to continue to survey all communities on Groote Eylandt and to maintain vigilance on other island and mainland sites. However most of the treatment effort for the foreseeable future will be focused on Alyangula. Survey and treatment of Alyangula properties will continue with new rounds of inspection and treatment every 6 weeks, with more intensive surveying, trapping and treatment operations in the 07/08 wet season. Adult mosquito trapping programs using visual attraction BG traps, dry ice baited EVS traps, and insecticide laced lethal ovitraps will help locate any possible remaining *Aedes aegypti* breeding sites, and further reduce the number of adult mosquitoes.

The aim of the program is to completely eradicate the dengue mosquito from Groote Eylandt and to put in place a continuous surveillance program to ensure that the island and the rest of the NT stays free of *Aedes aegypti*, and is hence free of the threat of dengue disease.

Acknowledgments

The current success of the eradication team has been made possible by the enormous contribution and cooperation of GEMCO and all the residents of Groote Eylandt who have provided assistance and allowed access to properties for inspection and treatment. The efforts of eradication team are specially acknowledged including past members Geoff Cole, Graham Goodwin and Sam Gualandi, present members Brett Devitt, Bruce Hitchins, Kevin Horig, and Melina McDowell, and all the staff of the MEB who were all involved initially in field activities and continue to be part of both

field and support activities. The contribution of members of NAMAC and DoHA, particularly Phil Wright, in advocating for funding for the project, and Dr Vicki Krause of CDC, DHCS for organising bridging funding and overall support is also gratefully acknowledged.

References

1. Ritchie SA Hanna JN, Hills SL et al 2002. Dengue control in north Queensland: case recognition and selective indoor residual spraying. *Dengue Bulletin* 26:7-13
2. Whelan PI. 1981. The vulnerability and receptivity of the Northern Territory to mosquito borne disease, *Transactions of the Menzies Foundation*. Vol. 2, 'Living in the North'. pp. 165-171.
3. Whelan PI, Hayes G, Tucker G, Carter J, Wilson A and Haigh B. 2001. 'The detection of exotic mosquitoes in the Northern Territory of Australia'. *Arbovirus Research in Australia*, Vol 8; 395-403.
4. Whelan PI, Russell RC, Hayes G, Tucker G and Goodwin G 2001. 'Exotic *Aedes* Mosquitoes: Onshore Detection and Elimination in Darwin, Northern Territory, Australia.' *CDI*,25; 4;283-285.
5. Whelan PI, Lamche G, Prosser C and Espinoza H 2003: 'Exotic Mosquitoes Detected in Cargo at East Arm Port Area 19 March 2003' *The Northern Territory Disease Control Bulletin* 10; 2; 29-30.
6. Whelan PI, Krause V, Lamche G and Kurucz N. 2004. '*Aedes aegypti* mosquitoes, vectors for dengue, found in Tennant Creek – Elimination Campaign in Progress'. *The Northern Territory Disease Control Bulletin*. 11:1:1-3.
7. Whelan PI, Pettit W, and Krause V. 2005. 'Dengue Mosquito Eradication Project Tennant Creek. End of January 2005 Progress Report'. *The Northern Territory Disease Control Bulletin*. 12:1:24-29.
8. Whelan PI. 2007. Mosquito Vector Control in the NT *The Northern Territory Disease Control Bulletin*. 12: 1; 24-29.
9. Shortus M, Whelan PI. 2006. Recommended Interim Water Receptacle Treatment for Exotic Mosquitoes on International Foreign Fishing Vessels Arriving in Australia. *Northern Territory Disease Control Bulletin*. 13:2.32-34.
