

THE BITING MIDGE PROBLEM IN TWEED SHIRE, NEW SOUTH WALES

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INTRODUCTION

In May 1981 in response to public pressure an Entomological Control Officer was appointed to Tweed Shire Council. The main work of this officer was to investigate and evaluate the biting midge (sandfly) problem affecting the residents and tourists of the coastal areas of Tweed Shire in far northern New South Wales. As tourism is the biggest industry in this Shire, there was considerable pressure to find a solution to the problem of these biting insects. Tourism brings in \$56 million and 850,000 visitors per year. Although these insects do not carry any human disease in Australia, their vicious bite is inverse in proportion to their size (some folk declare them impossible to see although they measure approximately 1 mm in length), making them extremely annoying.

A STATEMENT OF THE PROBLEM

The area studied in the period June 1981-83 was the coastal fringe of Tweed Shire in far northern New South Wales. The Tweed Heads area has a large tourist industry and an increasing permanent population. Residents and tourists in Tweed Shire were badly affected by biting midges between September and April. These insects, of the family Diptera, measure no more than 1 mm in length and require a blood meal to mature their eggs. Consequently, they seek out and bite the closest warm blooded creature; in many cases this is man. The bite and subsequent reaction is in the majority of cases very similar to that of a mosquito bite. Victims exhibit an itchy red lump that may turn into a sore if scratched often enough. However, unlike a mosquito bite, the person may not be aware that he or she is being bitten due to the small size of the creature and so may suffer dozens of bites. Biting midges are capable of causing visitors to cut short a good holiday or cause residents to sell their homes.

The size of biting midges also offers them another advantage in that they can easily go through fly screens and bite the unfortunate individual who has sought refuge indoors.

Three pest species of biting midge in Tweed Shire were identified. All three species breed in intertidal areas. The Tweed Shire abounds in such areas either natural or man-made (Figure 1). This fact combined with the pleasant sub-tropical climate which draws many new residents and tourists to the area each year makes the Shire a haven for biting midges. In short, there are plenty of places to breed and plenty of places to feed!

BIOLOGY OF THREE PEST SPECIES OF BITING MIDGE

The main pest species of biting midge in Tweed Shire were identified in the adult stage from specimens caught biting people, and the use of emergence traps. Three species were identified from throughout various areas in the Shire. They were *Culicoides subimmaculatus*, *Culicoides molestus* and *Culicoides ornatus*.

Culicoides subimmaculatus is found breeding in sandy (Lee, 1949) to sandy-mud areas, open or with sparse vegetation or open forest, usually sheltered from wave action (Marks and Reye, 1966). Reye (1969a, b) suggested that the presence of soldier crabs (*Myctyrus livingstonei*) is essential for the breeding of this species and that the upper limit of oyster growth in the intertidal zone may provide a rough guide to the lower limit of the larval habitat, within a few centimetres (Debenham, 1978). In Tweed Shire by using emergence traps and detailed field data, this species was found in open sandy to sandy-mud, to sandy-clay areas protected from wave action. These areas often had sparse clumps of *Sporobolus* sp. and pneumatophores. Using emergence traps *C. subimmaculatus* have

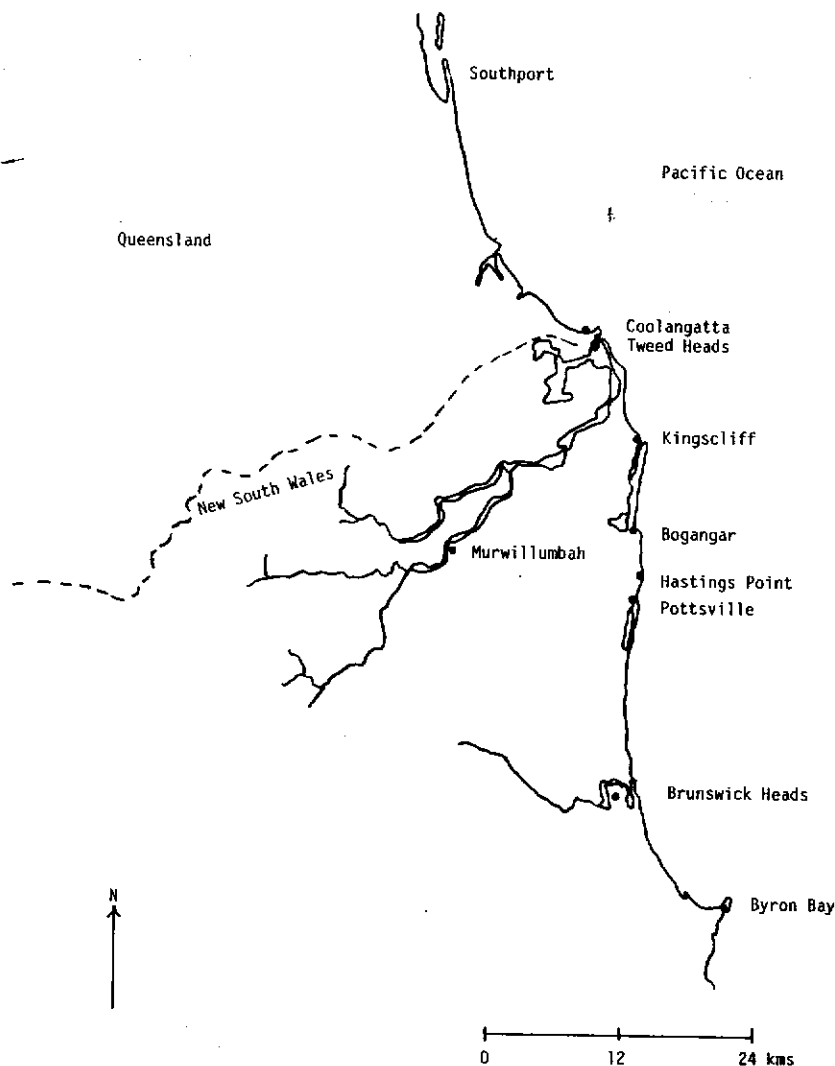


Figure 1A: North eastern New South Wales and South eastern Queensland.

entertainment centres, and restaurants. Many of the caravan parks are situated adjacent to large midge breeding areas and so quite often are plagued by these pests. Midges may ruin holidays, especially if a member of the party is allergic to midge bites.

To gauge the public attitude to biting midges two questionnaires were circulated for public comment. One questionnaire was circulated prior to the commencement of larval spraying and the other some time after the spray programme had been implemented. The main aim of these questionnaires was to obtain the location of people who had problems with biting midges. These were then able to be plotted on maps and the worst areas identified. Residents were also asked which time of year they found to be worst for biting midges and at what time of day midges were worst. Overall it was felt that biting was significantly bad from October to March and the worst time between 3 p.m. to 7 p.m.

It was obvious from our work in Tweed Shire that something must be done about these insect pests. Not only were outdoor activities greatly curtailed by these insects but for some residents, life indoors was made very unpleasant.

POSSIBLE SOLUTIONS

Five possible solutions to the biting midge problem were considered. The advantages and disadvantages of these methods are outlined in the following table. One of these methods had to be chosen for Tweed Shire as the problem of biting midges was too big to ignore.

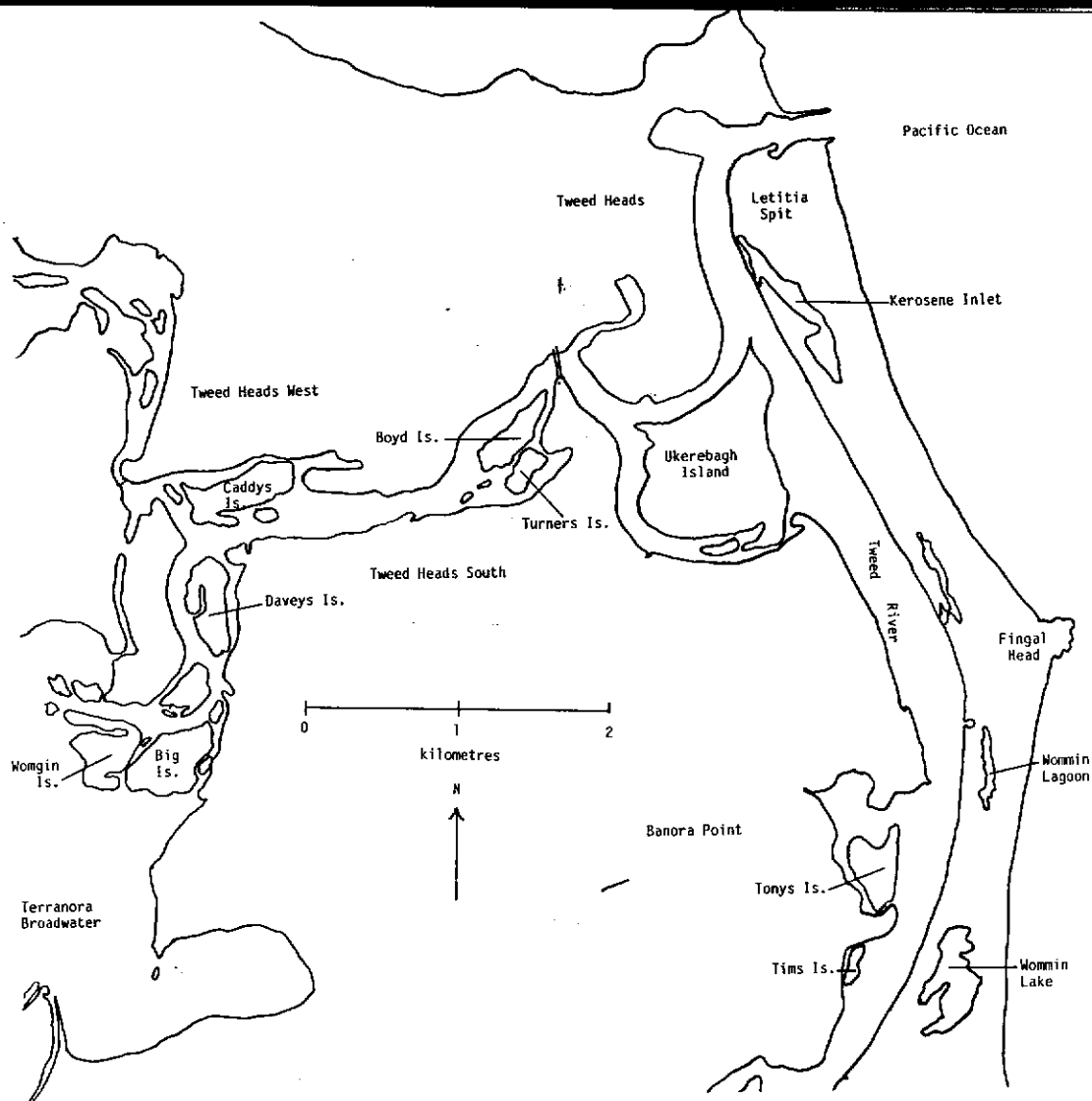


Figure 1B: A map of Tweed Heads and surrounding areas showing islands which are biting midge breeding areas.



Aerial photograph of Tweed Heads and surrounding areas. Note the proximity of mangrove islands to areas of dense population.



Front and side views of a typical sandfly: *Culicoides* sp. X20.

TABLE 1

Available Control Methods: The available control methods for biting midges range from flooding the breeding area to use of larvicides. Midge control is efficient only if it is carried out at the midge source, that is, in the breeding place itself

METHOD	ADVANTAGES	DISADVANTAGES
Removal of breeding areas by filling or dredging	Will stop midges breeding in that area	May divert the flow of water into other channels causing sandbank buildup in other areas creating new breeding areas (Kettle and Reye, 1981) kills crabs, mangroves, destroys fish breeding areas, costly
Permanent flooding of breeding areas	Will stop midges breeding and remove biting adults	Will probably kill mangroves and any other species which live intertidally, could make a breeding area for mosquitoes
Exclusion of tidal water by the use of barages with or without tide valves	Will stop midges breeding in that area, could be cheap in some areas	May divert the flow of water into other channels causing biting midge breeding in other areas, kills crabs, mangroves, destroys fish breeding areas
Surface alteration to one unsuitable for midge breeding e.g., sandy canal banks could be covered with rocks	Will reduce midge breeding in that area	Costly, kills any crabs on banks, destroys the private sandy beach of residents
Larvicide	Temporary reduction in larvae numbers which leads to reduction in biting adults, does not disturb mangroves	Costly, has to be repeated at regular intervals, may interfere with inter-tidal fauna

WIDER ECOLOGICAL IMPLICATIONS

The very nature of the Tweed River and estuary system makes control of biting midges very difficult. Within the river system there are 10 mangrove islands which all provide breeding sites for biting midges. These islands been captured on North Ukerebagh Island, the upper reaches of Cudgen Creek and the centre of Boyds Island and Turners Island (Figure 1).

At Brunswick River, New South Wales, Reye (1972) noted that emergence of females began two days before half moon. Half had emerged by half moon plus two days and emergence was completed by half moon plus four days. The males emerged in a similar pattern one and a half to two days in advance of the females (Debenham, 1978). In Tweed Shire, adult *C. subimmaculatus* were captured when biting in large numbers (greater than 20 adults caught biting in 10 minutes) around half moon. There was an obvious decrease in numbers caught biting around new and full moon. Activity was found to be largely crepuscular but can be diurnal on calm days and on overcast days. Marks and Reye (1966) give the pest range as 0.4 km but this may increase to 2.0 km from abnormally large breeding areas set up by man or natural changes.

Reye (1972a) characterised the larval habitat of *C. molestus* as clean sand in the open or among trees, disturbed by slight to moderate wave or current action. A wide range of salinities is tolerated. The larvae occur within the top 7.5 cm of sand, the wetter the sand, the nearer they are to the surface. A small staphylinid beetle which makes surface tunnels in the sand is usually found above the *C. molestus* zone and intruding into it (Debenham, 1978). The larvae are found in a narrow vertical belt around mean high water neap tide level (Kettle, 1977). The man-made canals of West Tweed Heads with their sandy beaches and moderate current action are ideal breeding grounds for *Culicoides molestus*. Other breeding grounds in the Shire include the shores of Cudgen Creek, the sandy banks of some of the islands, the Banora Point sandbank, a small area on Turners Island and parts of North Ukerebagh Island. Although it was more usual to find this species and *C. subimmaculatus* separately, they were occasionally picked up together from the same site by using an emergence trap.

According to Reye (1972), emergence of female *Culicoides molestus* begins three days before a new or full moon, half emerge the next day, and emergence is completed on the day of the new or full moon; the males emerge in a similar pattern one and a half to two days before the females. In Tweed Shire no neat pattern of emergence was found. Large adult biting catches (greater than 20 biting adults in 10 minutes) were taken around the new moon but also around first and last quarter. The flight range of this species is thought to be 400-500 metres but our experience was that it was up to 1-2 km.

The third pest species in Tweed Shire proved to be an enigma. Not only was its identification disputed, being variously identified as *Culicoides marmoratus*, *Culicoides ornatus*, *Culicoides* near *ornatus* and *Culicoides longior* by various authorities but the exact nature of its breeding area proved elusive. This species was recovered using emergence traps throughout Tweed Heads from sandy-mud to muddy areas well protected from wave action. Pneumatophores were usually present. Pupae may attach themselves to soil and algae on these pneumatophores. This complicates the picture as these pupae may have floated from any type of breeding area and attached themselves to pneumatophores that were subsequently under the fabric tent of the emergence traps. Areas where emergence traps have caught this species include Caddys Island, Ukerebagh Island, Womgin Island and Turners Island. The suspected breeding areas of this species seem to be characterised by moist conditions over summer but often dry over winter. Sampling these areas over winter often indicated zero larvae. These areas became increasingly favourable for larvae as the tides increase in height. In Tweed Shire adults of this species were captured biting in large numbers (greater than 20 in 10 minutes) around the full or new moon. The flight range would appear to be no more than 1 km.

SOCIAL PRESSURES FOR A SOLUTION

With the increase in tourist trade and population, there has been a corresponding increase in concern for something to be done about the biting midge problem. The pressure came on the Tweed Shire Council after they were presented with a petition from residents from South Tweed Heads in 1980 complaining of biting midges. The sandfly problem has been well known by the locals for a long time. Gold Coast residents living on man-made canals were annoyed quite regularly by *C. molestus* which bred on their doorstep. The Gold Coast City Council started a biting midge spray programme attacking the larval stage of the pest using Abate 100E (Active ingredient Temephos). This was done at enormous expense over the few hundred kilometres of canals. Tweed Heads residents knew of this programme and wanted similar eradication steps taken. That seemed very simple in theory and an Entomological Control Officer was employed by Tweed Shire Council.

Like the Gold Coast, Tweed Heads had new canal estates and *C. molestus* found these quite habitable. However, a detailed survey of the area revealed that although canal estate residents did have a problem, many other residents not near canals had an even worse time with biting midges. Thus it was found that *C. ornatus* was the major pest in the area followed by *C. subimmaculatus* and then *C. molestus*.

Tourism is a big industry on the coastal strip of south-east Queensland and north-east New South Wales. It provides employment for a large proportion of the population who work in caravan parks, hotels, motels and show an amazing variation in form. Each is at a different stage of development. They support a diverse community of wildlife including water birds, bats, lizards, snakes, bandicoots, fish and crabs. Some of the islands are showing a progression to sand with a decline in the outer mangrove fringe. Others are completely covered with mangrove forests. The four major species of mangrove found were *Rhizophora stylosa*, *Brugiera gymnorhiza*, *Avicennia marina* and *Aegiceras corniculatum*. *Excoecaria agallocha* was occasionally found. Some islands have large sandy areas covered by salt water couch, *Sporobolus* sp. The lower growing species *Sarcocornia* sp., *Suaeda* sp. and *Sesuvium* sp. were also found. Along with mangrove islands the shores of protected inlets such as Kerosene Inlet and Wommin Lagoon at Fingal also provide biting midge breeding areas. Large mangrove forests on the edge of these inlets and on the mainland shore are mainly *Avicennia marina*. Tidal pools within these forests provide breeding for mosquitoes. Modification of the natural landscape by building canal systems in Tweed Heads and putting groynes at the entrance of Cudgen Creek, Kingscliff has greatly increased the number of breeding sites for *C. molestus*.

Control measures must be taken in the Tweed Heads area to enable people to live there with some degree of comfort. As always, biological control would be the best. However, as this may be years ahead or may even never eventuate, some other measures must be taken. After investigating all the available control methods, it was considered that larviciding was the best method for Tweed Shire. This is a short term control only. The further building of canals with sandy banks makes the problem worse and ideally should be stopped. Wet canals, in concrete walls rather than small sandy beaches, would be much better for eliminating any breeding area.

Control methods used within mangrove islands must be aimed at the minimum disruption of the ecosystem but at the same time the comfort of the resident and tourist has to be the main concern. As tourism and population increases on the north coast of New South Wales, this problem of the biting midge will also increase and research into a solution to the problem should be an important and ongoing concern.

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