NEW ZEALAND BIOSECURE
Entomology Laboratory

A DIVISION OF SMS SOUTHERN MONITORING SERVICES LIMITED

Aedes (Ochlerotatus) camptorhynchus (Thomson)

southern saltmarsh mosquito

NZ Status: This species is present in New Zealand and is currently the subject of an eradication campaign – Unwanted Organism

Vector and Pest Status

Aedes camptorhynchus is a vicious biter of humans, and is a pest species both in Australia and New Zealand. It is a major vector of Ross River virus in Australia (Ballard and Marshall, 1986), and laboratory studies have shown it is a potential vector of Murray Valley encephalitis (McLean, 1953). It is also known to carry dog heartworm (*Dirofilaria immitis*) (Russell and Geary, 1997), myxomatosis (Bull and Mules, 1944) and *Eperythrozoon ovis*; a blood parasite of sheep (Howard, 1973) (Russell, 1993).

Incursions and Interceptions

Aedes camptorhynchus was first discovered in New Zealand in Hawke's Bay in December 1998, as a result of public complaints about unusual nuisance biting (Hearnden, 1999). Following the discovery, an eradication programme was undertaken.

In October 2000, mosquito larvae were also found at the Wherowhero Lagoon, 20km south of Gisborne, and in November 2000, three larvae and one adult mosquito were found at two small sites near the Porongahau Estuary, ~85 km south of the positive sites in Hawke's Bay. Larvae and adults were also discovered at Mahia in November 2000.

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This species has subsequently spread to other localities on both the North and South Islands of New Zealand, namely Whitford, Mangawhai, Kaipara Harbour, Whangaparaoa, Coromandel and Wairau/Grassmere.

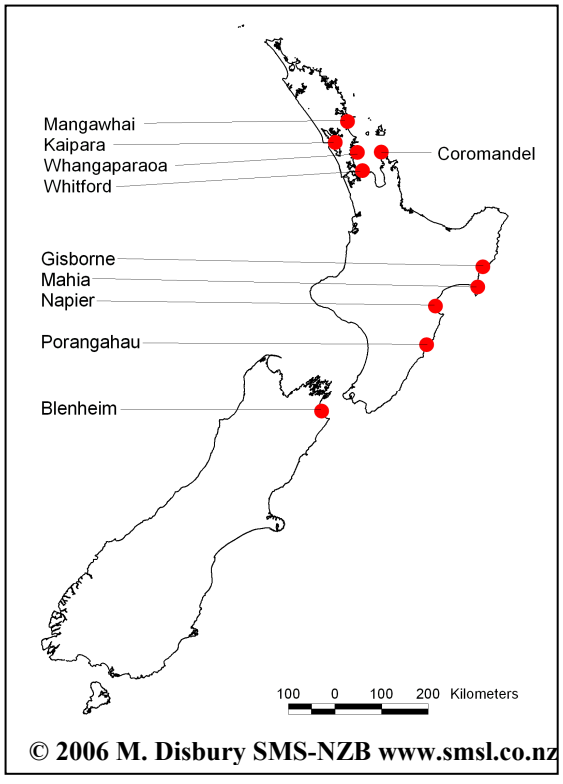
Aedes camptorhynchus has been officially eradicated from Napier, Mahia, Gisborne, Porangahau, Whitford, Mangawhai and the northern Kaipara Harbour. The southern Kaipara Harbour, Whangaparaoa, Coromandel and Wairau/Grassmere programmes are still operating.

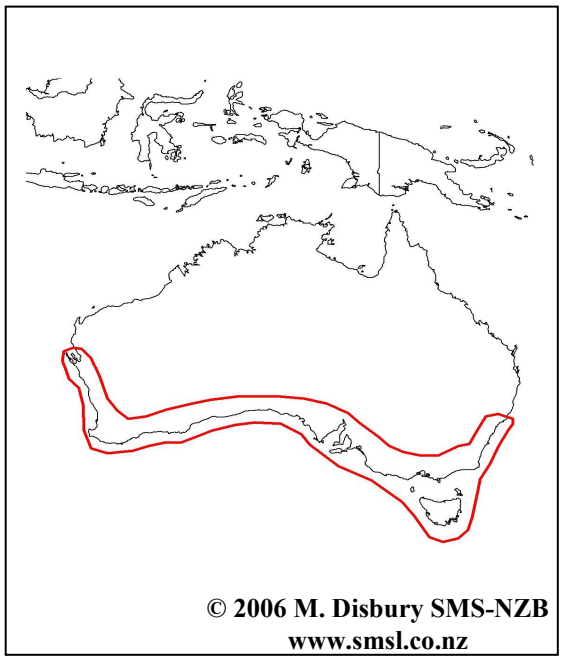
Aedes camptorhynchus has been intercepted on one occasion. A dead adult male was discovered in a container of electrical cables at the Port of Lyttleton on the 24th September 2004. The package originated from Adelaide and was loaded onto a vessel in Melbourne, Australia.

Geographic Distribution

This mosquito is a native of Australia and is found in coastal wetlands from the central coast of New South Wales, south through Victoria, Tasmania, South Australia (Lee *et al*., 1984; Russell, 2003), and in Western Australia as far north as Northampton (Britten, 1958).

In New Zealand, *Ae. camptorhynchus* was present in each of the sites indicated on the map below, but is currently restricted to the southern Kaipara Harbour, Whangaparaoa, Blenheim and Coromandel.





Taxonomy

Aedes camptorhynchus belongs to the subgenus *Ochlerotatus*. Adult females may sometimes be confused with other species which have a mottled proboscis, such as *Ae. vigilax in* Australia (Russell, 1993). In New Zealand, this species is morphologically very similar to the native *Ae. subalbirostris*.

Habits and Habitat

Aedes camptorhynchus is a cold tolerant species which breeds mainly in coastal brackish waters, such as brackish swamps, pools in rock platforms, lagoons, lake edges, ground pools, drainage ditches and drainage ditches (Lee *et al*., 1984; Liehne, 1991; Russell, 1993). It is common in Australia for this species to be collected inland, in brackish areas away from coastal habitats (Dobrotworsky, 1960; Lee *et al*., 1984; Russell, 1993), e.g. in salt pans around Mildura, Victoria, 363 km inland (Dobrotworsky, 1960). It has been also documented breeding in freshwater swamps in the absence of a more suitable habitat (Dobrotworsky, 1960).

In New Zealand this species has been found in brackish to saline water, but as yet has not been found in freshwater habitats. Larvae have been found in hypersaline pools at 86ppt during eradication programme surveillance activities (M. Disbury, SMS-NZBEL, pers. com., 2006). Reclaimed land with temporary and permanent water bodies can provide a suitable habitat for this species to breed in.

This species disperses widely from its breeding sites (Lee *et al*., 1984) for host seeking or shelter, however they may be easily dispersed over longer distances by winds (Dobrotworsky, 1960). Howard (1973) noted that adults were frequently found up to five miles (8km) from recognizable breeding sites. A recent mark-release-recapture experiment in Western Australia found that some individuals of this species migrated up to 6km from the release point, however, of the 16% recaptured, 99% were within 3km of the release point, even after two weeks (Lindsay *et al*., 2006).

Aedes camptorhynchus females mate before seeking a blood meal. This species requires a blood meal before the development of eggs (Barton and Aberton, 2005). In the laboratory adult females have been observed to take up to five blood meals and produce eggs following each feed (Howard, 1973). They have also been observed to produce three batches of eggs from one blood feed, however sometimes up to three blood meals were taken before the first batch of eggs were produced (Howard, 1973). They have been observed to lay 42-138 eggs per batch (Howard, 1973; Barton and Aberton, 2005).

Oviposition sites are selected according to physical, chemical and biological characteristics best suited to the egg, larvae and pupae development (Liehne, 1991). Desiccation resistant eggs are usually laid on a damp substrate (Howard, 1973), but are also laid on the water surface. The eggs float, but will sink if the water is agitated (Howard, 1973). The eggs of this species are believed to be viable for at least nine months.

Hatching of eggs usually occurs in response to water level increases, such as rainfall or high tides and even a decrease in dissolved oxygen (Howard, 1973). Eggs may remain on a water body unhatched if no trigger event occurs. Howard (1973) observed that 41% of eggs hatched when exposed to a trigger event after 24 weeks on distilled water. Eggs from one batch may not necessarily hatch all at once following a trigger event. Subsequent inundations may be needed for all eggs to hatch. This is called installment hatching (Howard, 1973; Hearnden, 1999).

During the eradication programmes in New Zealand, there have been occasions where small numbers of eggs have hatched 12 months after the last adult had been detected, and where the habitat had been dry for six months. Larvae and pupae may survive in drying habitat by lying on damp soil or burrowing into crevices, as long as the substrate remains damp, they can continue their development following re-inundation (Howard, 1973).

In a study on larval development of *Ae. camptorhynchus* collected in the field in Australia and reared in the laboratory, specimens were allowed to develop at three different salinities 0, 18 and 36ppK and different temperatures (Barton and Aberton, 2005). No differences in development or survival were detected for the three salinities (Barton and Aberton, 2005). Mean development time was 12+/-0.9 days at 35°C and 37.1 +/- 1.3 days at 15°C and the minimum threshold temperature for development was 7.3°C and the thermal constant was 324.0 +/- 12.8 SE degree days. (Barton and Aberton, 2005). Survival to adult stage was significantly different between temperature treatments with 84.4% survival at 20°C and 35% at 35°C. Fecundity of blood fed females ranged from 40 to 112 eggs per mosquito (based on examination of ovaries) (Barton and Aberton, 2005).

Adults are present all year round (Dobrotworsky, 1960; Howard, 1973), with higher numbers in winter, possibly due to greater habitat availability (Howard, 1973). Adults are captured in highest numbers following high rainfall and/or high tide events. Collection data from eradication programmes in New Zealand also show year round adult activity with all life stages collected throughout the year. Egg to adult development in New Zealand has been observed to take eight weeks in some East Coast sites in winter, however potential effects on development times by treatment with S-methoprene are not known. Males usually develop faster and emerge before females (Howard, 1973).

Aedes camptorhynchus is a vicious biter attacking humans, horses, cattle, rabbits, birds and marsupials in Australia (Dobrotworsky, 1960; Howard, 1973; Lee *et al*., 1984). Biting occurs in open, shaded places during the day, at dusk, and particularly after sunset. This species prefers humans and guinea-pigs to chickens, and in the field they are attracted to sheep (Howard, 1973). In New Zealand, sheep and cattle were usually in the vicinity of larval habitats of *Ae. camptorhynchus.*

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