

Field visit 8th June 2006

Mosquito breeding was located in several areas within or adjacent to the mining lease. The most productive site was the dam located adjacent to the south-west corner of the development site, nearby to the Helene 9 pit. The southern edge of this dam was surveyed, with *Culex palpalis* and *Anopheles annulipes* s.l. larvae located in densities of 4 larvae per 270ml/vol ladle dip at the shallow grassy margins.

Other areas found breeding were small ephemeral creeklines within the mining lease, with *Anopheles annulipes* s.l. and *Anopheles bancroftii* larvae recovered in densities of 2 larvae per ladle dip in a small vegetated section of a creekline approximately halfway between Ochre Hill and Thelma Rosemary. Another small ephemeral creekline towards the Ochre Hill area was found breeding *Anopheles annulipes* s.l. in densities of 1 larvae per ladle dip, at the grassy margins.

Another area found breeding within the mining lease was a low lying area cut off by the construction of the road embankment, between the Thelma 1 and Jasmine pits. *Culex palpalis* and *Anopheles annulipes* s.l. larvae were recovered in densities of 0.5 larvae per ladle dip in relatively open, shallow water. Only one mosquito larvae was recovered from the largest water dam, with the species found being *Anopheles meraukensis*.

Other areas surveyed include the old tailings clarification dam, the Helene 11 and Jasmine pits, and the small dam between the Helene 4 & 5 pits. No mosquito breeding was located.

Adult mosquito trapping 14 June 2006

Overall mosquito numbers were relatively low (see attached results). The most abundant species was *Culex annulirostris*, with a highest total of 51 females collected at the trap site located adjacent to the largest dam. The second most common mosquito species collected was *Anopheles annulipes* s.l., with a highest total of 55 females collected at the trap site located to the west of Ochre Hill, adjacent to a low lying area. Other mosquito species were recorded in very low numbers.

Interpretation of field survey and trap results

Breeding sites

The field survey located several actual and potential mosquito breeding sites of significance. The small dam adjacent to the Helene 3 pit contained shallow grassy areas that were productive mosquito breeding sites, and it is possible that there are other similar shallow grassed sections in this dam that are also breeding sites for *Cx. palpalis* and *An. annulipes* s.l., as well as *Culex annulirostris*.

The tailings clarification dam was relatively shallow, and contained some large grassy areas in the middle sections of the dam that could not be surveyed, but were probable breeding sites for species such as *Cx. annulirostris*, *Culex palpalis* and *Anopheles* species mosquitoes. The adjacent Helene 11 pit contained relatively dense *Typha* sp. reeds that could be habitat for *Cx. annulirostris* and *Coquillettidia xanthogaster* during

certain periods of the year. The *Typha* sp. reeds were probably present due to seepage into the Helene 11 pit from the tailings clarification dam.

The large dam appeared to have limited potential for mosquito breeding along the east boundary of the dam, although there are likely to be shallow grassy habitats in the upstream reaches of the dam where the ephemeral creeklines feed into the dam, which would be likely sources of *Cx. annulirostris*, *Cx. palpalis* and *Anopheles* species mosquitoes.

The small dam between the Helene 4 & 5 pits contained some small areas of grass that could be minor breeding sites for *Cx. annulirostris*, *Cx. palpalis* and *Anopheles* species mosquitoes

The numerous small ephemeral creeklines within the mining lease are all likely breeding sites for *Anopheles* species mosquitoes, *Cx. annulirostris*, *Cx. palpalis* and *Ochlerotatus normanensis*, wherever there is vegetation growth in the water.

Several broad floodways were also noticed near the Ochre Hill area, these sites are likely *Oc. normanensis*, *Cx. annulirostris*, *Cx. palpalis* and *Anopheles* sp. breeding sites during the wet season.

The existing pits within the mining lease appear to be minimal mosquito breeding sites, due to the predominantly steep sites and deep water.

Pest potential

The adult mosquito trap results revealed relatively low numbers of mosquitoes. Further information on the mosquito species and pest and disease significance can be found in the attachment 'Problem mosquito species in the Top End of the NT'.

The relatively low numbers of mosquitoes in the adult monitoring traps indicate the breeding sites in and adjacent to the mining lease were relatively localised or of relatively low productivity during the time of the trapping. All water bodies contained fish and other aquatic predators of mosquito larvae, which would have contributed to the relatively low numbers of adult mosquitoes. Further trapping will determine the likely seasonal variation of mosquitoes in the mining lease, as it is probable that mosquito numbers will be higher in the mining lease during other periods of the year.

The most important pest mosquito recorded during trapping was the common banded mosquito *Cx. annulirostris*, as this species can reach very high levels when breeding conditions are suitable. This mosquito species can be a significant pest species when numbers are high, although this species only bites after sundown. The highest individual total of 51 females, recorded in the trap set adjacent to the large water dam during the June 2006 trapping, represents nuisance problems only to exposed people after sundown. This species is likely to be present in higher levels at the mine site during other months of the year.

The next most abundant mosquito *An. annulipes* s.l. can be also be a pest mosquito, although this species generally does not reach very high levels. The highest individual total of 55 females, recorded in the trap site located to the west of Ochre Hill during the

June 2006 trapping, represents nuisance problems only to exposed people after sundown. This species is likely to be present in higher levels at the mine site during other months of the year.

Of other species recorded during trapping, *Cq. xanthogaster*, *Cx. palpalis* and *An. bancroftii* can be significant pest species when numbers are high. These mosquitoes bite after sundown, although *An. bancroftii* and *Cq. xanthogaster* are also known to bite in shaded areas during the daytime. These species could be present in higher levels at the mine site during other months of the year.

Two species that were not recorded during the June trapping but are expected to cause pest problems at the development site are the salt marsh mosquito *Ochlerotatus vigilax* and the floodwater mosquito *Ochlerotatus normanensis*. Both of these species were recorded in numbers significant to cause a moderate pest problem during baseline trapping at the nearby Union Reefs Gold Mine from December 1993 - December 1994. Due to the presence of poorly draining floodways associated with ephemeral creeklines in and adjacent to the mining lease, it is likely that *Oc. normanensis* will also be present in at least low to moderate numbers in the Frances Creek mining lease during certain periods of the year. The salt marsh mosquito *Oc. vigilax* will be sourced from tidal areas up to 50km away, so are likely to be present in similar numbers to that recorded at the Union Reefs mine during certain periods of the year.

Seasonal abundance and disease potential

The seasonal abundance of the above mentioned mosquito species and disease potential can be found in the attachment "Problem mosquito species in the Top End of the NT".

Recommendations

General guidelines on how to prevent the mine site from creating new mosquito breeding sites can be found in the attached guideline 'Guidelines for preventing mosquito breeding sites associated with mining sites'.

Some specific recommendations that can be made from field observations and the June trap results are;

- a) All workers should be advised that there are likely to be seasonal problems caused by pest and disease carrying mosquito species at the mine site, and be supplied with the Medical Entomology Branch handout 'Personal protection from mosquitoes and biting midges in the NT'.
- b) Where practical, drainage paths that have been disrupted by previous mining operations should be reinstated, to reduce mosquito breeding habitat.
- c) Shallow grassy edges of any water dam should be burnt before the wet season, to reduce organic loads that can promote mosquito breeding when the dams re-flood in the wet season. If practical, shallow grassy edges can be deepened to minimise grass growth, although this may not be necessary unless the baseline trapping program reveals high levels of disease carrying adult mosquito species.

Also, the draw down of water during the dry season is likely to minimise the time available for mosquito breeding in the shallow grassy edges of water dams, the baseline trap results should reveal how long the period of productive mosquito breeding in the dams will be. The Typha sp. reeds in the Helene 11 pit should be burnt annually, or removed from the pit altogether, to prevent mosquito breeding.

- d) There is the option to use mosquito larvicides if mosquito breeding reaches significant levels. This will be discussed further in the report to be produced upon completion of the baseline trapping program. The most practical larvicide to use at the mine site will be methoprene 30 day residual pellets, see attached information.
- e) Due to the presence of Anopheles species mosquitoes, there is the potential for the local transmission of malaria at the mine site, if a person with the infectious stages of malaria is bitten by Anopheles mosquitoes at the mine site. It is therefore recommended that any worker sourced or returning from overseas where malaria is endemic be screened for symptoms of malaria before entering the mine site.
- f) Workers should be encouraged to report any mosquito problems to the relevant officer, so that mitigation measures can be implemented. If adult mosquitoes reach significant levels and larval control is not practical for various reasons, mitigation measures such as impregnating clothing with permethrin can be utilised. Adult mosquito control using the residual barrier insecticide bifenthrin can also be utilised around site offices and other personnel areas at the mine site. Further information can be found in the attachment 'Personal protection from mosquitoes and biting midges in the NT'.