The Underwater Acoustic Repertoire of the Long-necked, Freshwater Turtle *Chelodina oblonga*

Chelodina oblonga Photo courtesy of Gerald Kuchling, 2005

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DECLARATION

Except where specifically acknowledged, this project is my own account of the research that I have undertaken and has not been submitted for any other awards from other institutions.

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With all the modern technology
hearing-aids of the 21st Century
listening into the quiet.

And lo – this is no longer a world of amber and silence.
This is a world full of voices and songs.
Ancient melodies modulating to a 200 million year old beat.

And now that we have heard the songs and the voices in the amber
what would they tell us ?
and are we going to listen….

.
J.C.G 2004

ABSTRACT

The major question addressed by this project was to determine if the long-necked, freshwater turtle *Chelodina oblonga,* vocalise underwater and whether their vocal activity could be related to behavioural or ecological aspects of their lives. These turtles often live in wetlands where visibility is restricted due to habitat complexity or light limitation caused by factors such as tannin-staining, or turbidity. For many aquatic animals, sound is a useful means of communication over distances beyond their visual acuity. This thesis gives the first detailed account of the underwater vocal repertoire of *C. oblonga.*

In total, over 230 days were spent in the field and more than 500 hours of tape recordings were made for this research. Initially, a number of recordings took place in three wetlands known to support turtle populations: Blue Gum Lake; Glen Brook Dam; and Lake Leschenaultia in Perth, Western Australia; in order to determine the nature of the freshwater sound field and place turtle vocalisations into the context in which they were vocalising. The wetlands differed in terms of degree of enrichment, substrate material, water depth and habitat complexity. Recordings were made over a four-week period in the last month of summer and the first week of autumn (Feb-Mar 2003). Invertebrate sweeps were also taken over a two-week period at each recording site to determine if invertebrate distributions were related to patterns of sonic activity. To determine the influence of wind on ambient noise; recordings were undertaken on winter mornings (June-August, 2003) at Blue Gum Lake and Glen Brook Dam at locations north, south, west and east for four different wind speeds – Beaufort Wind Scale (BWS) 0,1,2 & 3.

There were seven distinctive calls recognised in the recordings. The frequency bandwidth most utilised by organisms was between 3 kHz up to around 14 kHz, with the exception of

the 'bird-like song'; which extended from 500 Hz up to around 10 kHz. Blue Gum Lake contained a more diverse and abundant assemblage of invertebrates than Lake Leschenaultia and Glen Brook Dam. Correspondingly, a greater diversity of calls was recorded at Blue Gum Lake, as well as the presence of chorus activity, which was not heard at the two less-enriched sites. The periods of greatest diversity and abundance of macroinvertebrates was synonymous with the increased sonic activity at dusk and midnight with noise levels greatest at dusk in particular, and to a lesser extent at midnight. There was no difference in ambient noise at Blue Gum Lake or Glen Brook Dam at wind speeds of Beaufort Wind Scale 0, 1 and 2.

Turtles from three populations were recorded in artificial environments: consisting of round, plastic, above-ground ponds (1.8m dia. x 0.65m depth), which were set up to re-create small wetlands. Recordings occurred from September to October, 2003 and from February to December, 2004 as well as January, 2005. Seven hatchling and five juvenile turtles (CL <10cm) were also recorded in order to ascertain whether very young turtles vocalised. Hatchlings were recorded in a glass aquarium (35.5cm length x 20cm width x 22.0cm depth) and juveniles were placed into a below-ground outdoor pond (1m length x 0.5m width x 0.4m depth). Recordings occurred from as early as 4.30am (dawn recordings) to as late as 1.30am (evening recordings).

The recordings revealed that turtles utilise an underwater acoustic communication system (calling at the water's surface was also noted but these were not recorded or a part of this research) involving a repertoire of both complex and percussive sounds with short, medium and potentially long-range propagation characteristics. Complex structures included

harmonically related elements (richly or sparsely) and different rates of frequency modulation. Frequency use extended beyond the in-air auditory sensitivity known for a single species of turtle studied from the family Chelidae; with calls ranging from around 100 Hz in some of the percussive displays, to as high as 3.5 kHz in some complex calls, with 'clicks' extending beyond the 20 kHz upper limit of the recording system. However, most of *C. oblonga's* vocalisations had dominant frequencies below 1 kHz. Turtles were intermittent callers with an extensive vocal repertoire of seventeen (17) vocal categories - highly suggestive of complex social organisation. Vocalisations included: a) clacks; b) clicks; c) squawks; d) hoots; e) short chirps; f) high short chirps; g) medium chirps; h) long chirps; i) high calls; j) cries or wails; k) cat whines; l) grunts; m) growls; n) blow bursts; o) staccatos; p) a wild howl; and q) drum rolling. Also, two sustained 'pulse-bouts' were recorded during the breeding months, hypothesised to function as acoustic advertisement displays – possibly 'calling songs'. Hatchling turtles were not heard to vocalise within the audible range. Only a single complex vocalisation was heard produced by the juvenile turtles, with a number of percussive calls.

Preliminary playback trials were conducted under free-field conditions and within an artificial environment, which consisted of a below ground rectangular tank (2.4m length x 0.8m width x 0.6m deep). A number of turtle calls recorded in the artificial ponds were selected for playback. A UW 30 speaker was used for broadcast of calls. The free-field playbacks occurred at Mabel Talbot Lake and Blue Gum Lake during the months of April and May, 2005. Playback using 14 seconds of an artificially constructed sequence from the sustained 'pulse-bout' occurred in the artificial channels. This sequence consisted of some of the first phase pulses followed by a section of the 'vibrato'.

The preliminary free-field playback trials indicated that turtles had some interest in the calls being played by responding with an 'alert posture'. Turtles were shown to remain in the alert posture for a significantly longer time than when no sound was played or when white noise was played. The extensive repertoire and initial responses to the free-field playbacks indicated that sound has some biological importance for *C. oblonga*, although results of playbacks under artificial conditions were inconclusive.

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