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ELRC Niloticus News

April 2020

General Information

Dr Christoff Truter's temperature article (*Niloticus News #1*) received positive feedback and a number of suggestions from all over the world – thank you!

We have a PhD student who has started with a research project to investigate high temperatures and crocodile behaviour on commercial farms in South Africa.

We are doing this project in collaboration with Prof Jeff Lang from the USA who is the world authority on crocodile behaviour and ambient temperature. We will keep you up to date with the progress of our investigations.

All insect-borne infectious diseases are more commonly seen during the second half of the summer. Pix skin lesions should be more prevalent from December to the end of the summer. We believe that it is caused by a virus and that it is transmitted by mosquitoes.

In the next edition of *Niloticus News*, viral causes of skin problems will be discussed. The picture above was taken by Dr Xander Combrink. He is busy with interesting ideas for the conservation of crocodiles outside protected areas. More about this in the July edition of *Niloticus News.*

For this edition, Prof Gerry Swan prepared a short summary of our e-stunning research and farm investigations.

We are very concerned that numerous e-stunners, used on crocodile farms in South Africa, are not up to standard.

Specific Topic

Electrical stunning – an essential management tool for crocodile farmers

Electrical stunning (e-stunning) is widely used as an efficient and less stressful method to capture and restrain farmed crocodiles for the purpose of handling them or during the slaughter of crocodiles. E-stunning was investigated for the first time in American alligators (*Alligator mississippiensis*) in the 1970s. The technique was then refined and tested on juvenile *Crocodylus porosus* in Australia in the early 2000s. It is now used extensively to restrain crocodilians worldwide.

Although various aspects of e-stunning remain under investigation, it has become an essential management tool on commercial farms and has contributed significantly to improve the safety of animal handlers and the welfare of crocodiles. Research has confirmed that the stress responses in captive crocodiles were less in e-stunned crocodiles, compared to manual capture using blood chemistry parameters. In addition, manual capture takes significantly longer compared to e-stunning. It not only causes stress in the manually captured crocodile, but also causes agitation among the surrounding crocodiles.

E-stunning consists of the application of sufficient current to the head of the animal to induce *grand mal* epilepsy in the brain, rendering the animal unconscious. Typically, under this condition, the brain is unable to respond to stimuli such as pain. Effective e-stunning is, therefore, needed to render an animal completely unconscious (stunned) before any painful management procedure or decapitation can be performed. Confirmation that the brain is in an unconscious state using electroencephalogram (EEG) monitoring is a specification set by some regulatory authorities (e.g. European Council Regulation No. 1099/2009) for e-stunning of animals during killing.

Conversely, electro-immobilisation stunning is a method of restraint produced when a very small current is passed through the body that paralyses the skeletal muscles. With electro-immobilisation, the animal remains fully conscious and will perceive pain, but will be completely unable to react to the painful stimulus. This method is undesirable and should not be used for the capture and restraint of crocodiles.

Clinical evaluation of the level of consciousness and analgesia is difficult in any species, and is further complicated in reptiles because they have a high tolerance to noxious stimuli and hypoxia. The Exotic Leather Research Centre (ELRC) recently undertook an EEG study to assess the effects of e-stunning in Nile crocodiles on a commercial farm in South Africa. The EEG is an electrophysiological monitoring method to record electrical activity of the brain, over a period of time, as recorded by multiple electrodes placed on the head. Voltage fluctuations (recorded as waves) give an indication of brain activity.

The research involved preliminary anatomical measurements and magnetic resonance imaging (MRI) scanning to determine the thickness of the skull, position of the brain in the skull and confirm the external sites for the placement of the EEG electrodes on the head of the crocodile. The type of EEG electrodes, portable EEG machine, suitability of pre-selected electrical dose to be applied, selected EEG electrode placement sites and verifying EEG recording device settings using the farm's e-stunner and wand were evaluated and established in two pilot trials.

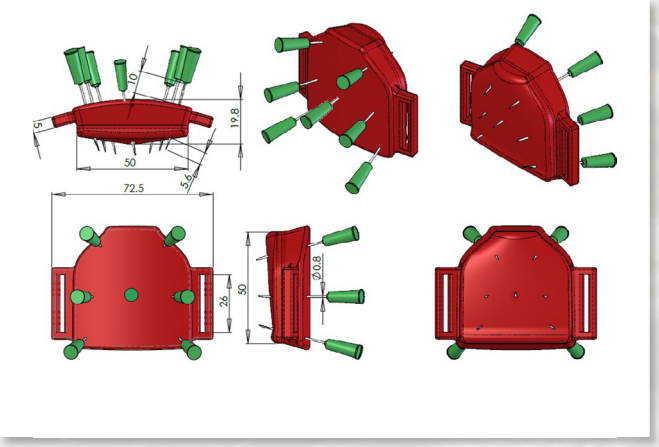

Figure 1: Plastic injection mould with hypodermic needles designed to reproducibly position the needles on the cranial plate on the head of crocodiles to connect the EEG clip electrodes.

A plastic 3D-mould was designed (Figure 1) and printed for the purpose of this study, based on the anatomical measurements and MRI imaging, to fit on the cranial plate and securely hold the blunt

hypodermic needles in place on the head for the attachment of the EEG clip electrodes during the EEG assessment (Figure 2).

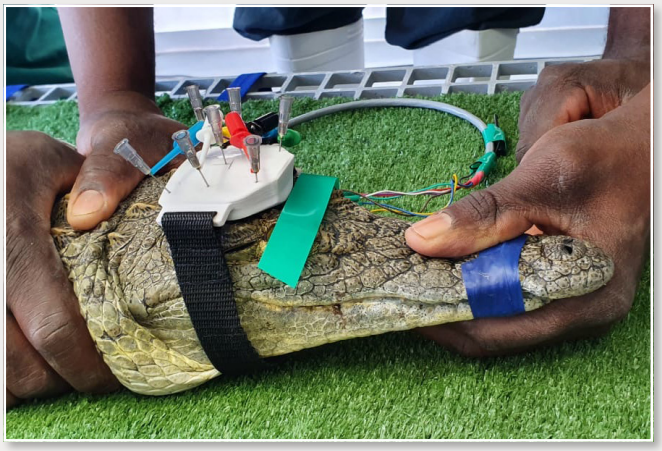

Figure 2: Placement and securing of the plastic injection mould and hypodermic needles on the cranial plate of a crocodile.

The main study was conducted in 15 growers of 143.4 – 159.9 cm TL on the same farm. A custom-built power-operated e-stunner (I'Vimbi Technologies) with the capacity to set the voltage, frequency (Hz) and stun time (in minutes) and a data logger to record the actual frequency, voltage, electrical current (amperes) and stun time applied to each animal was used in the study. The newly designed e-stunner pole was approximately 1.4 m long with a push button to activate the stunning sequence. Once activated, it continued for the duration that the timer had been set. The two wands were modified to include metal buttons (three on each side) to improve contact and electrical conductivity when applied to the crocodile (Figure 3).

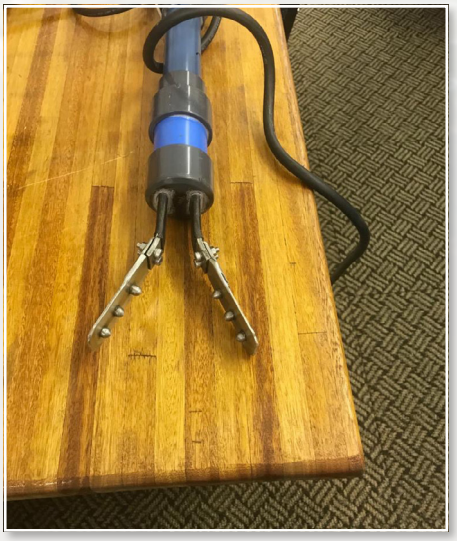

Figure 3: Electrode prongs of the e-stunner wand with three metal buttons on each electrode to improve skin contact and electrical conductivity.

The results of the study confirmed that e-stunning at 170.9 ± 1.84 V, 50 Hz and a mean maximum electrical current of 1.05 ± 0.24 amps applied to the neck (behind the cranial plate) of each animal for five to seven seconds, delivering a calculated electrical dose of ± 5.16 amps per second over the time period stunned could immobilise all crocodiles and induce unconsciousness in some, but not all crocodiles as indicated by the EEG waves. These results are consistent with e-stunning data in other species.

Since unconsciousness is not guaranteed after every stun due to multiple factors, it is recommended that no painful procedures be performed following e-stunning without the concurrent use of analgesics. It is also recommended that, at slaughter, an additional killing step such as the use of a captive bolt be implemented before spinal cord severance and brain pithing. An ineffective or incomplete stun can be a very stressful event for crocodiles. It is therefore essential that the staff involved with e-stunning should be suitably trained to recognise an effective stun. Good practice will be to record the electrical current delivered to each crocodile, the behaviour of individual animals and the outcome of the stun.

The e-stunning equipment used by farms need to be of suitable design to supply sufficient electrical current to the brain and be in good working condition and checked daily before use. Investigations on farms where e-stunning is used successfully indicated that the best results are obtained when crocodiles are stunned in water and that a solid and effective earth is necessary for a comprehensive and successful e-stunning outcome. Apart from having a really good connection to earth, the connections between the power unit and the stunner wands must be regularly checked. The concern is that cables may become loose or frayed due to daily use.

Further studies are required to improve the success rate of e-stunning in crocodiles, including the electrical current required, improvement of the conductivity of the stunning wand, the site of stunning and the duration of the stun. The ELRC plans to continue with further research to improve the outcomes of e-stunning, as well as to investigate alternative methods such as microwave energy delivery systems for the reversible and effective stunning of crocodiles.

A Good Operating Practice document has been prepared for e-stunning and is available, on request, to all paid-up members of SACIA.

For more information, contact Prof Gerry Swan at gerry.swan@up.ac.za

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EXOTIC LEATHER SA benchmarking sustainability
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News & Events

NEXT

The Specific Topic for the May edition of *Niloticus News* will focus on the most important skin disorders currently seen in the Nile crocodile (Jan Myburgh and Johan Steyl).

The ELRC's workshop will be postponed to the second half of this year due to the COVID-19 pandemic. This worldwide crisis is going the have a significant effect on the crocodile industry in southern Africa. One of the sessions at the workshop will be to discuss our industry's post-Corona strategy. We will keep you posted.

Please also visit our webpage. We plan to post new articles and ideas on the ELRC webpage at least once a month.

Wild crocodiles: ecological justification for their conservation

Crocodilians are important role-players in aquatic ecosystems. Chemicals (e.g. organo-chlorine pesticides) bioaccumulate in the apex or top predators and may affect their health and fertility negatively.

Apex predators are, therefore, considered to be good sentinels of ecosystem health. Dr Xander Combrink (see picture) was involved, as a co-author, in producing this very interesting article (see reference below).

The authors reviewed the ecological roles of crocodilians in freshwater ecosystems and discussed their contributions under five points: as indicators of ecological health, as ecosystem engineers, apex predators, keystone species, and as contributors to nutrient and energy translocation across ecosystems.

Their final conclusions were that most of the claims regarding the importance of crocodilians are unfortunately not scientifically confirmed and that the paucity of focused evidence-based biological and ecological research influences the effective conservation of wild crocodilians.

It is a scientific article worth reading.

You are welcome to contact Dr Xander Combrink for a pdf copy of this article.
Email address: CombrinkAS@tut.ac.za

Reference: Somaweera et al. 2020. The ecological importance of crocodilians: towards evidence-based justification for their conservation.

Biological Reviews:
https://doi.org/10.1111/brv.12594.

Dr Jonathan Warner (left) and Dr Xander Combrink (right) with a mature Nile crocodile that was caught in the Mphathe Stream (northern KwaZulu-Natal) for research purposes.