Final Project report for

CANBERRA COMMUNITY URBAN TURTLE MONITORING Ginninderra Catchment Group

presented to the

ACT Government, Conservation Research and Evaluation Branch

Dickson Wetland, inlet.

Introduction

Urbanisation is one of the leading causes of biodiversity loss worldwide (Blair and Launer 1997; Chase and Walsh 2006). Despite some species thriving in urbanised landscapes (Brown et al. 1994; Lindeman 1996), many others will be negatively impacted by the growing urban sprawl (McKinney 2002, 2008). Consequently, understanding the effects of urbanisation on vertebrates and monitoring their population is vital to understand their persistence in the cities (Pautasso 2006; McKinney 2008).

The Eastern Long-necked Turtle (*Chelodina longicollis*) is an Australian freshwater turtle with a large distribution in south eastern Australia (Kennett et al., 2009). Fox predation and road mortalities are among the main factors for their decline in some locations within their range, especially along the Murray River (Kennett et al., 2009; Van Dyke et al., 2019). It is well known that *C. longicollis* can inhabit urban ponds and in some cases establish abundant populations (Rees et al., 2009; Hamer et al., 2016). However, little is known about how habitat connectivity within urban landscapes, or the lack thereof might affect the population structure, recruitment and survival of these long-lived animals.

To address these questions, we studied *C. longicollis* under two contrasting scenarios: a highly urbanised stormwater drainage system providing minimal habitat connectivity, and a peri-urban stormwater drainage system, with good habitat connectivity.

Methods

Study sites

Our study areas consisted of two stormwater pond clusters (four ponds each):

1. The lower section of Sullivans Creek catchment. This area is close to the Inner City of Canberra, therefore highly urbanised and comprises a series of constructed wetlands connected by concrete drains, replacing the natural creek (Fig. 1).
2. The Ginninderra Creek catchment in West Belconnen. The area is moderately urbanised but the creek is in its natural state (Fig. 2) and flows in close vicinity to the stormwater ponds along the urban fringe.

Fig.1 Sullivans creek drainage and stormwater ponds where turtles were sampled (David Street Wetland, Dickson Wetland, Lyneham Wetland and Banksia Street Wetland)

Fig.2 Ginninderra creek drainage and stormwater ponds where turtles were sampled (Refshauge Crescent Wetland, Fassifern Pond, Hollows Circuit wetland and Jarramlee Pond)

Trapping
Turtle sampling occurred from September 2021 to March 2022, once per month, during the turtle active season. Turtles were capture-marked-released at each study site, following the same protocol. Four cathedral traps per wetland, baited with sardines, were set in the morning and removed and checked in the afternoon (intervals of 4 hours). We marked captured turtles with unique codes by notching the shell and measured maximum straight-line carapace length (CL), carapace width (CW), midline plastron length (PL) and plastron width (PW) with callipers (0.1 mm) and body mass with a scale (5 g). Turtles with a PL ≤ 120mm were considered juveniles. Individuals with a PL > 120 mm were identified as males or females on the basis of external morphological features. Marked and measured turtles were released back into the wetland in which they had been captured.

The trapping effort consisted of seven sampling occasions for each wetland, which amounts to approximately 28 hours of trapping per trap or 112 hours per site. Volunteers were involved in the field work and assisted with measuring and releasing turtles (Fig. 3). Research was conducted with the appropriate approvals and permits from the University of Canberra Committee for Ethics in Animal Experimentation (Project ID 3379) and Environment ACT (LT20211).

Fig.3 Volunteers in the field, helping to measure turtles

Other data collected

Primary (nitrates and phosphorus) and secondary (standing crop biomass) productivity samples were taken in each wetland, twice during the study. Additionally, a measure of anthropogenic impact (road density) will be calculated within 700m of each study site using ArcGIS. This distance is based on typical movement distances of *C. longicollis* determined from previous studies in the region. Statistical analysis will be conducted for all results and presented in various scientific manuscripts.

Results of trapping Season 2021/22

In the 2021/22 season, we captured a total of 21 turtles in the Inner North cluster (Females = 7, Males = 6 and Juveniles = 8), and 72 turtles in the West Belconnen cluster (Females = 27, Males = 15 and Juveniles = 30; Table 1). Of the captured turtles, seven were re-captures from the 2020/21 season in West Belconnen, and two from Inner North (2020/21 season).

All recaptures occurred at the same location as their initial capture.

Table 1. Number of turtles captured during the 2021/22 season

Inner North Cluster	N. of turtles	West Belconnen Cluster	N. of turtles
David St.	2	Refshauge	11
Dickson	9	Fassifern	22
Lyneham	10	Hollows	11
Banksia St.	0	Jarramlee	28

The population structure within the West Belconnen cluster was more uniformly distributed (Fig. 4), while the Inner North cluster showed only a few individuals in the juvenile categories, and the majority of animals in the mid-size category (Fig. 5).

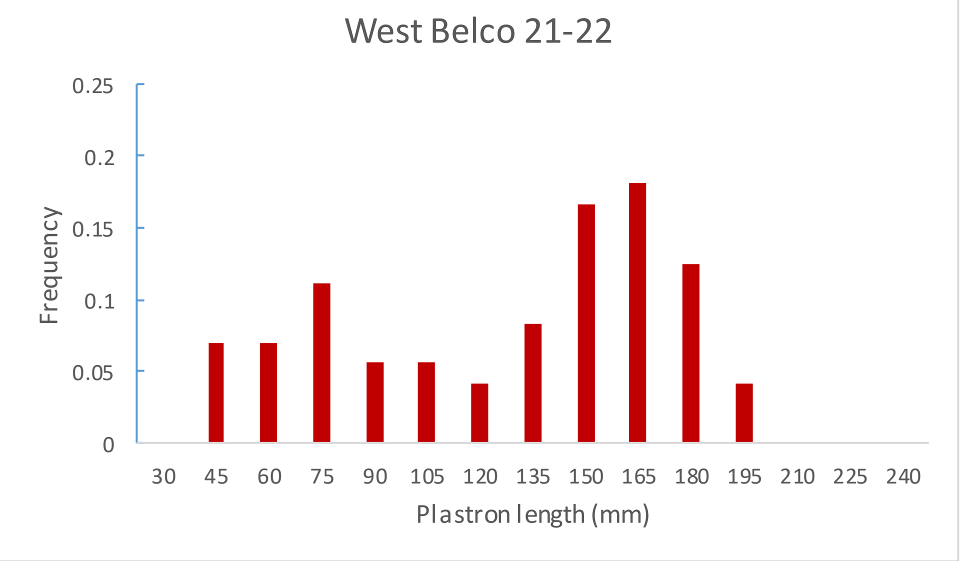

Fig.4 Population structure of *Chelodina longicollis* from Ginninderra Creek drainage, West Belconnen (note that turtles with plastron length ≤ 120 mm are considered juveniles). Field Season September 2021 to March 2022, Canberra, Australian Capital Territory.

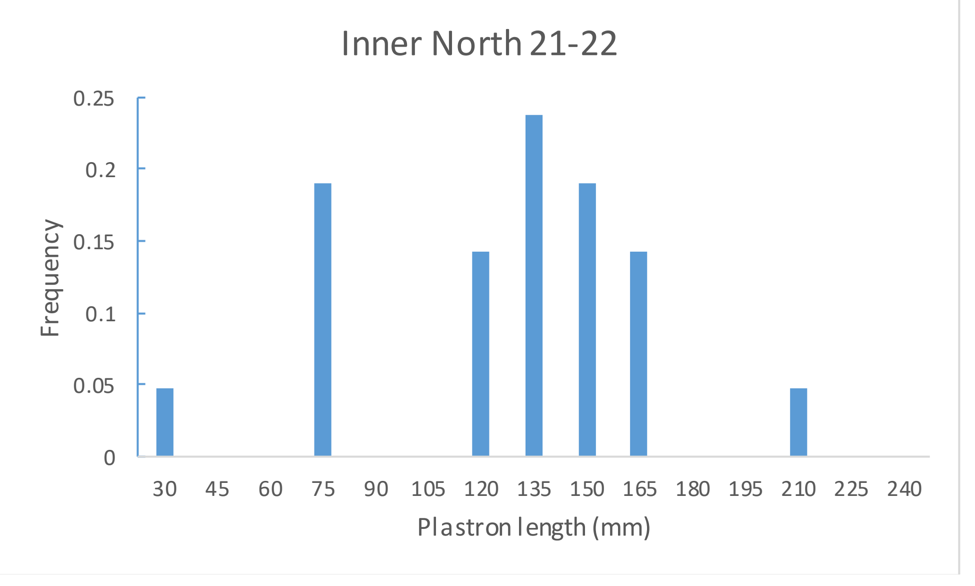

Fig.5 Population structure of *Chelodina longicollis* from Sullivans Creek drainage, Inner North (note that turtles with plastron length ≤ 120 mm are considered juveniles). Field Season September 2021 to March 2022, Canberra, Australian Capital Territory.

Engagement

During the 2021/22 season seven dedicated volunteers assisted with trapping efforts in the Inner North cluster, with most being consistently involved. In the West Belconnen cluster, 10 volunteers helped and similarly, many of them helped throughout the season. During September and October, owing to the Covid lockdown, only the project coordinators conducted the field work, but with the easing of restrictions, volunteers could participate again from November to March.

Our team delivered an on-line training workshop on turtle biology and field work activities to the volunteers prior to the sampling (10/11/21), 47 participants, (https://docs.google.com/presentation/d/1qzcJEhk7k080RPrWg5FqsONH6jXp8DPa/edit?usp=sharing&ouid=105673333956253826430&rtpof=true&sd=true), then additional training and knowledge was passed on during the hands-on component of the project, the turtle trapping events.

Our team delivered talks about the results of the project at conferences (Turtle Survival Alliance 13/08/21, 35 participants, link (https://turtlesurvival.org/2021-symposium/schedule/day2/); Australian Citizen Science Association 27/10/21, 45 participants, link (https://www.youtube.com/watch?v=ku1KGDmjHDE), to university students (University of Canberra, Environmental Science 28/10/21, 13 students, link (https://docs.google.com/presentation/d/1Y93D3cmPXgdJlshH3EeIT04-Oqzwv9mH/edit?usp=sharing&ouid=105673333956253826430&rtpof=true&sd=true), and to community groups (Waterwatch QAQC event 05/12/21, 12 participants, link (https://docs.google.com/presentation/d/1T_14DGARTVHZ6QuyOf_x87VPgAQ4nFjl/edit?usp=sharing&ouid=105673333956253826430&rtpof=true&sd=true); Lions Club Gungahlin 17/03/22, 16 participants, link (https://docs.google.com/presentation/d/1ajUYp3uAEvqWoZx_VShcFTXtfWCMEOQq/edit?usp=sharing&ouid=105673333956253826430&rtpof=true&sd=true).

Additionally, we also have been interviewed by the ABC 666 Radio (Afternoons, Georgia Stynes 08/12/21, link (https://www.abc.net.au/radio/canberra/programs/afternoons/afternoons/13658006), Bruno at 18min 40s, 10min chat) and caught up with with Minister Rebecca Vassarotti and her assistant Paula Sutton at Dickson wetland and explained the goals and results of the project (16/03/22). Our project was also featured at the Citizen Science report by the Office of the Commissioner for Sustainability and the Environment, link (https://actenvirovolunteers.com.au/citizen-science/why-did-the-turtle-cross-the-road/).

Discussion

The findings in the present study demonstrate that *Chelodina longicollis* can inhabit a range of urban wetlands within the Australian Capital Territory, including in highly urbanised areas. However, it appears that in areas with less habitat connectivity turtle abundance is lower and their population structure is less uniform than in well connected areas on the urban fringe. Our findings reinforce the importance of maintaining good habitat connectivity within urban landscapes in order to sustain viable populations and the long-term survival not only of turtles but also of other native fauna.

It is believed that *C. longicollis'* abilities to display overland movements and a carnivorous and generalist diet, facilitate their survival and colonisation of urban wetlands (Kennett et al., 2009). There are several reports of *C. longicollis* thriving in urban landscapes (Kennett et al., 2009, Rees et al., 2009; Hamer et al., 2016).

In the Inner North cluster we found a lower abundance (21 versus 72 in the West Belconnen cluster, Fig.4, 5) and a less uniform population structure, with several size classes missing. These results seem to reflect that physical barriers to turtle movements make them prone to become road mortalities or fall to predation while migrating through unsuitable habitat. Within the Sullivans Creek cluster turtles are only able to migrate during short lived floods, once the stormwater drains are filled with water.

In contrast, the higher number of turtles and the healthy population structure within the West Belconnen cluster (72 versus 21 in the Inner North cluster) indicates the absence of physical barriers to turtle movements. Turtles in this area can use the natural creek line and the surrounding grasslands to freely migrate between wetlands and colonize new ones.

Further analysis on sex ratios, capture-marked-recapture demographic models, primary and secondary productivity, and anthropogenic impact (road density) will be conducted over the next few months and will be submitted to a scientific journal. We will combine results from the 2020-21 and 2021-22 season for further analysis. It is important to note that the results from 2020-21 and 2021-22 season were similar in terms of the abundance and population structure of turtles, with turtles within the West Belconnen cluster being around 3.5 times more abundant than the Inner North cluster, and displaying a healthier and more uniform population structure, respectively (Fig. 4).

Recommendations

The ability for *C. longicollis* to persist within Australian urban areas seem to correlate with their basic need of freely migrating overland, while avoiding road traffic and predation. In growing cities and new suburbs, it would be recommended to design stormwater ponds and their associated stormwater systems in a way that they are more wildlife friendly, having in mind water sensitivity and wildlife sensitivity urban designs. This should include consultation with wildlife specialists during the planning phase to avoid large roads bisecting habitats.

In turtle specific terms this would mean to have at least two wetlands within a 2-5km range, with excellent connectivity corridors between those wetlands to allow for safe migration. For more details see Roe and Georges (2007). Additionally, any stormwater ponds in proximity to Nature Reserves must be designed with excellent connectivity corridors as turtles will migrate between urban and natural areas, using urban wetlands as a drought refuge (Rees et al., 2009, Ferronato et al., 2014).
For established and older suburbs and stormwater systems, increasing or maintaining base flows within stormwater drains could be an important step to improve habitat connectivity in

the interim. A higher base flow would provide an opportunity for turtles to migrate for a longer period of time after rain events. This should be considered in consultation with engineers, while also considering the risks of floods and property damage. Re-naturalizing concrete drains and re-establishing natural creeks and drainage channels will be the long-term goal to create well connected wetland habitats for turtles, as well as for many other fauna, such as frogs, lizards, birds and invertebrates.

In addition, public education on turtle migration is paramount to limit the detrimental effects of road mortalities on turtle populations. An increase in public knowledge and skills in regards to assisting migrating turtles would empower people to confidently move them off a road and to safer grounds, such as to the closest wetland or stormwater pond in the same drainage. Higher survival rates generally lead to better recruitment success and to stronger populations, and this is much needed to ensure the long-term survival of the iconic long-necked turtles in urban Canberra.

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