Survey for the Manning River Helmeted Turtle Conservation Program March 2019

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For NSW Office of Environment and Heritage

Contents

1.0 Summary

Project outline

The freshwater turtle *Myuchelys purvisi* (Manning River Helmeted Turtle) is listed as Endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act). The NSW Government's Saving our Species (SoS) program has developed a targeted strategy for managing *Myuchelys purvisi,* which aims to secure the species in the wild for 100 years and maintain their conservation status under the BC Act.

Under the SoS framework, *M. purvisi* is currently categorised as Data-Deficient, indicating a need for further research into the species' ecology, life-history and threats before any specific management actions can be implemented.

Project objectives

The aim of this project was to assist the recovery of the Manning River Helmeted Turtle (*Myuchelys purvisi*).

It is a species endemic to the Manning River system and listed as endangered under the NSW Biodiversity Conservation Act, 2016.

These objectives form part of a larger program to manage *Myuchelys purvisi*. Data collected as part of this scope will be used to inform a change in SoS management streams and subsequent management and monitoring actions.

The objective of the project was to carry out surveys to

- Gain a better understanding of the distribution of *Myuchelys purvisi* in the Manning valley
- Gain a better understanding of the distribution of *Emydura macquarii* in the Manning valley
- Understand the extent, prevalence and severity of threats to *Myuchelys purvisi*
- Provide the basis for the development of site-based management activities
- Contribute to movement of this species from the data-deficient management stream.

The March 2019 survey undertook trapping of Manning River Helmeted Turtles at thirty three locations in the head of the Barnard River. The survey was to determine its distribution, health, population demographics, and identify threats to the species including possible hybridisation with the Macquarie turtle *Emydura macquarii*, which is known to have been introduced into the Manning River system.

The results of the survey will help to identify specific locations where targeted programs can be implemented to further assist the recovery of the *M. purvisi* and identify sites suitable for an ongoing monitoring program.

Very little was known about the population of *M. purvisi* prior to surveys in April 2018. The available records and habitat modelling indicated that there were populations in at least five of the seven sub-catchments of the Manning River.

The habitat value of the upper catchment areas and conservation reserves was unknown due to a lack of targeted surveys in the more remote and inaccessible parts of the catchments.

John Cann commented (April 2016) that the abundance of *M. purvisi* appears to have declined dramatically. The total population size of the *M. purvisi* is inferred to be moderately low. Terrestrial movements between river systems are unlikely. Thus, the distribution of *M. purvisi* is inferred to be severely fragmented (NSW Scientific Committee 2017).

The *M. purvisi* faces multiple threats including predation, illegal collecting, habitat degradation, and potentially disease and competition and hybridisation with *E. macquarii*. Short-necked turtles are thought to be particularly vulnerable to fox predation because they are unable to fully retract their limbs and head (Spencer and Thompson 2005).

Nest predation rates for *M. purvisi* are unknown. Recent surveys of Bell's Turtle (*M. bellii*) nests on the tablelands found a predation rate of >90%. Also, six female Bell's turtle shells were found near the entrance to a fox den.

Results

The March 2019 surveys were undertaken in Back River, and the Barnard River in Barry Station, Glenrock Station, and Curracabundi National Park. Two other tributaries were also trapped: Schofields Creek and Orham Creek.

All those streams are in the Manning River catchment. Sites included public and private properties with the approval of landholders and National Parks. A map of the survey sites and their tenure are shown in Figures 1- 3.

Figure 1. Map of 61 trap locations in Back River, Barry Station, Glenrock Station, & Curracabundi NP March 2019

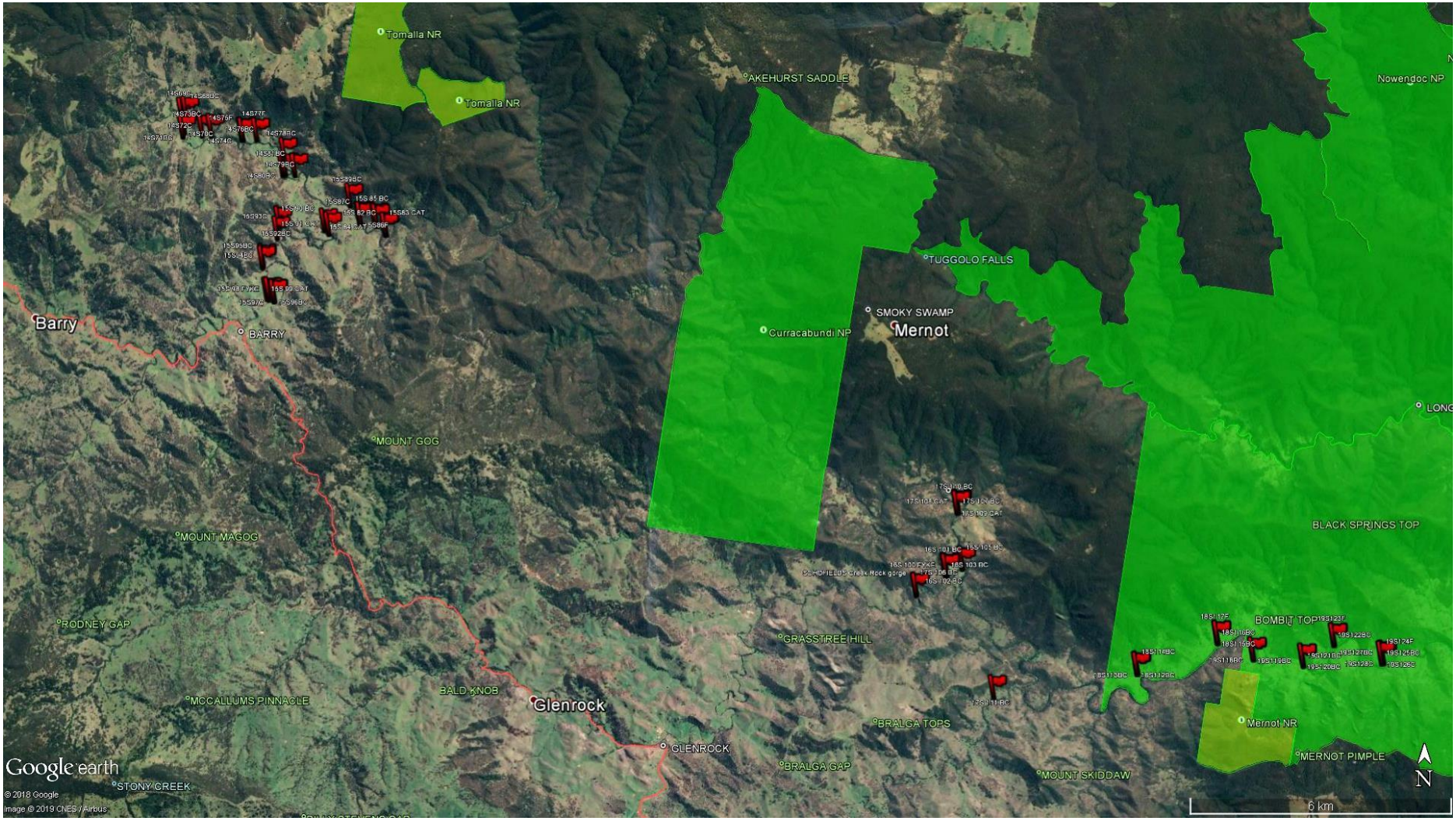


Figure 2. Enlarged map of trap locations in Back River, and Barnard River in Barry Station, March 2019

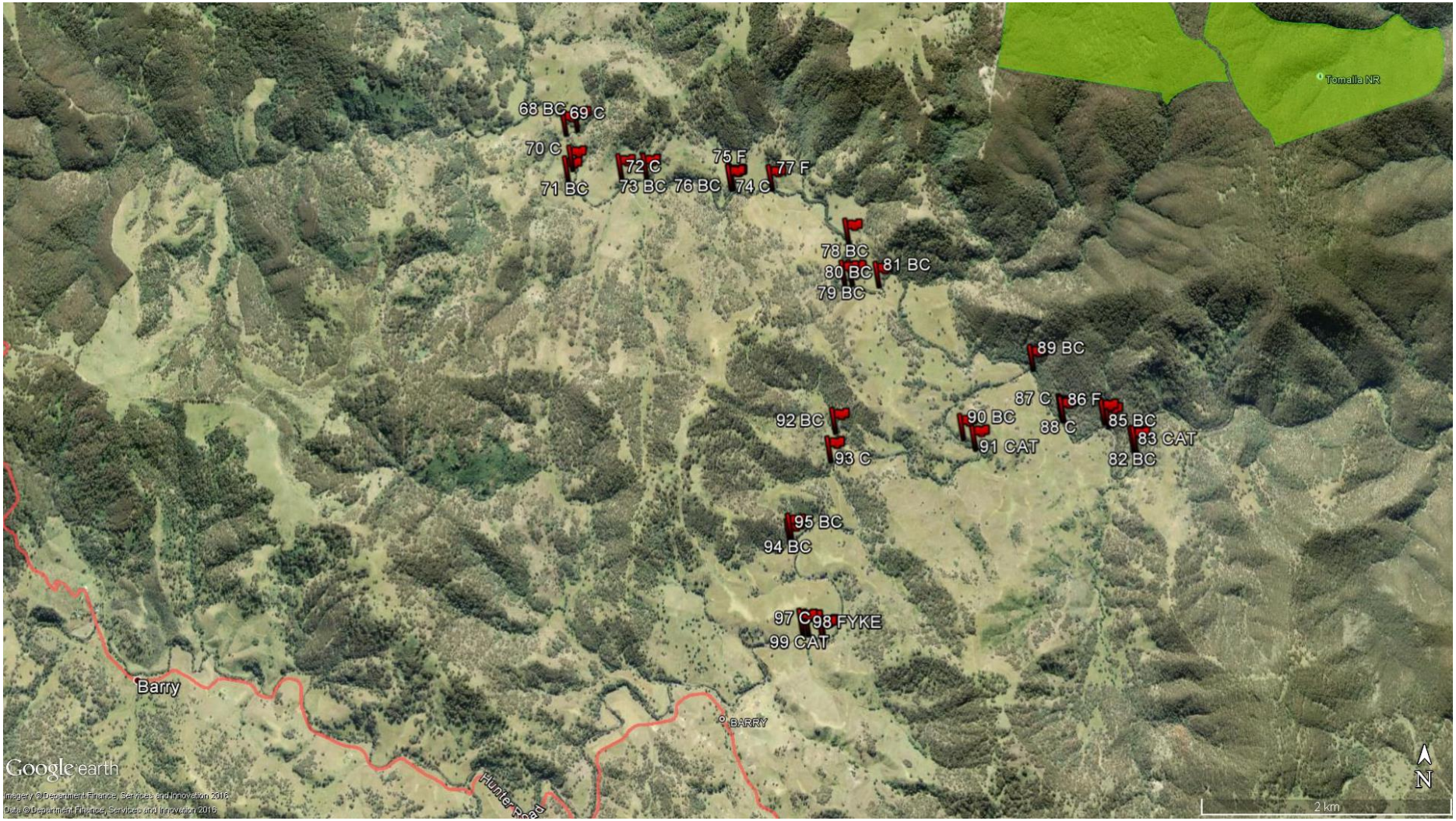
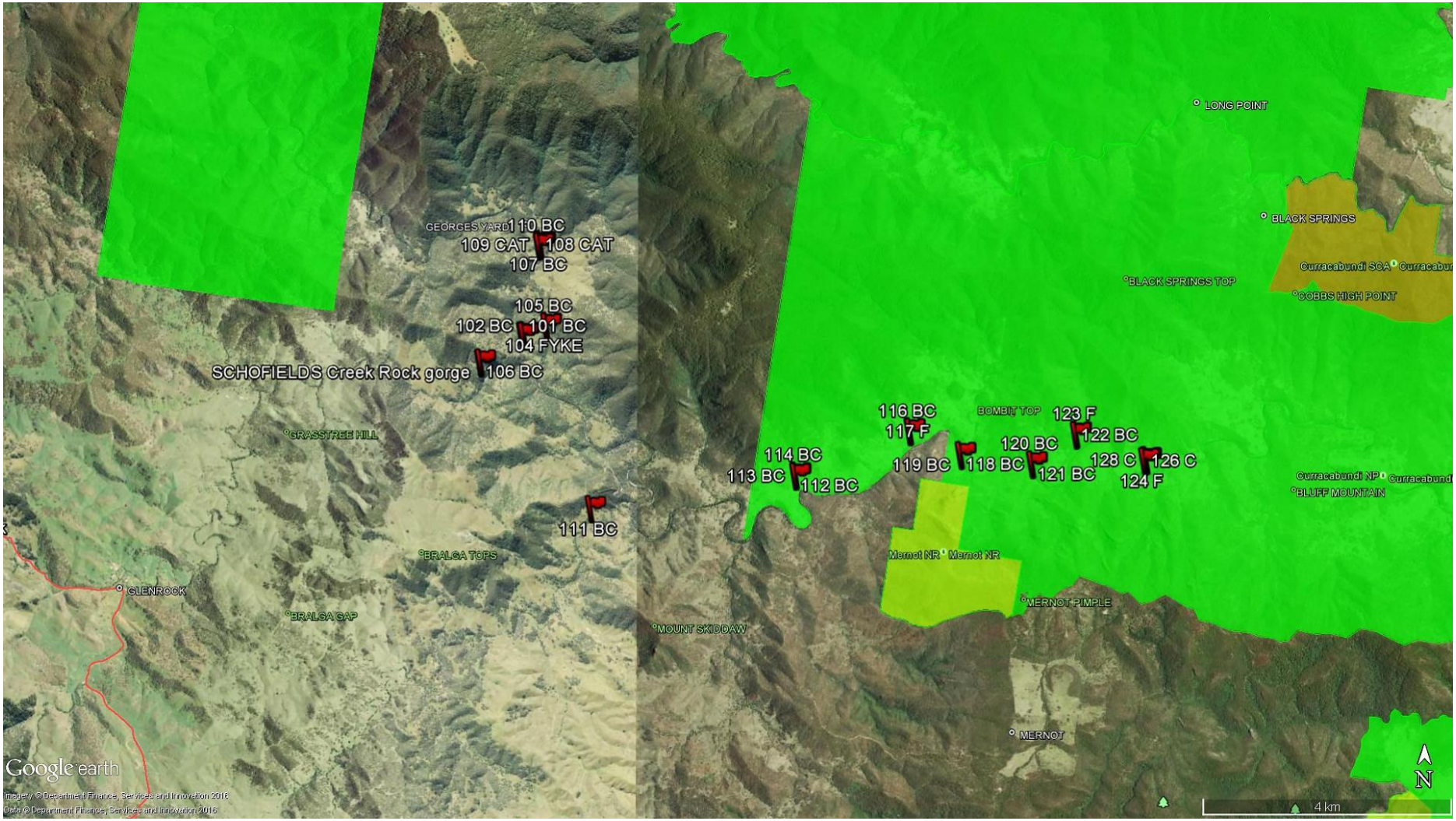


Figure 3. Enlarged map of trap locations in the Barnard River at Glenrock Station & Curracabundi NP March 2019



The March 2019 turtle survey collected data from 115 *M. purvisi* caught in sixty one traps at thirty three survey locations. The data recorded from this survey and the April 2018 survey has begun to provide the information required to address the project objectives.

Table 1 Summary of March 2019 survey results

Locations	sites	traps	*Myuchelys purvisi*	*Chelodina longicollis*
Back River Osland	12	14	nil	nil
Barry Station Barnard River	10	18	26	2
Glenrock Station Barnard River	3	10	28	7
Glenrock Station Schofields Creek	1	1	1	nil
Glenrock Station Orham Creek	1	1	nil	nil
Curracabundi NP Barnard River	6	17	60	9
Totals	**33**	**61**	**115**	**18**

All of the streams had been dry for over a year with only the deepest holes containing water. The Barnard River was dry when the first turtle surveys were conducted in February – April 2018.

Judging by the sediment in the holes and plants growing in the river bed there have been no flows for over 13 months. Very few holes were deep enough to use a Cathedral trap, and finding water deep enough for Big Crab traps required wading around to find the deepest spots. As Figure 5 shows most turtles were caught in Fyke traps in water 0.8 to 1m deep.

Twenty seven trap locations caught no *M. purvisi*; fourteen of those sites were in Back River which is considered above the upper limit of *M. purvisi* during such dry times, although after a couple of good seasons they are considered likely to occur. The other thirteen trap locations were in the Barnard River in large holes of potential habitat however they also caught nothing.

Water quality was low, turbidity ranged from 10 to 40 cm and the more exposed holes had algae floating on the surface.

The amount of algae cover was a rough guide to hole depth, being greatest on the surface of the shallow holes presumably because they were warmer than the deeper holes.

Water depth was further reduced by deep sediment build-up in the holes; in some holes sediment build-up was as deep as 50 cm. In those holes water quality was very low, and the water had a pungent odour.

Despite that, turtles and platypus were still caught, although small fish were sparse and in one large hole absent. The large holes appeared to be the major drought refuge for all river life.

White-bellied Sea Eagles were observed in a couple of locations patrolling the holes.

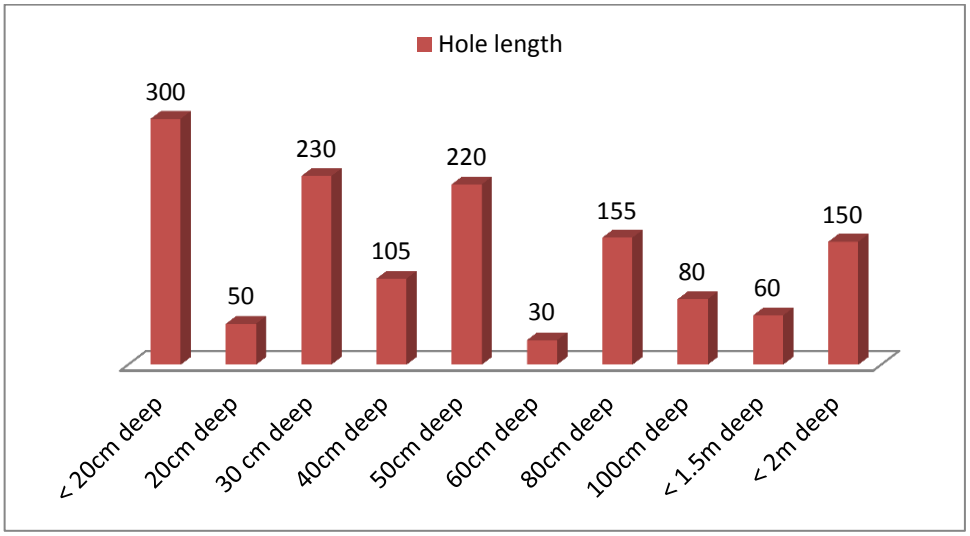
The dry conditions provided an opportunity to get a rough estimate of the turtle population in each of the river sections surveyed. The opportunity was based on the assumption that turtles would be concentrated in the deeper refuge holes. Each of the river sections trapped were either walked or driven to find the largest and deepest holes for trapping.

The water hole assessment in the Glenrock section of the Barnard River above the weir also recorded the length and maximum depth of every puddle and hole to get an idea of the extent of potential turtle habitat in a seven kilometre section of river in Glenrock Station.

That seven kilometre section of river was walked measuring each hole with a range finder recording its length and deepest depth into a Garmin GPS. The three largest holes were then trapped for one night.

The total length of river containing some water came to 1380m or approximately 20% of the seven kilometre section: of that only 475m (7%) contained water deeper than 50cm, considered enough to support turtles.

Figure 4. Combined lengths of each depth of water holes in 7km section



Trapping the three deepest refuge holes that measured a total length of 210m x 1.5 – 2m deep (3% of 7km length) recorded 4 Platypus, 7 *C. longicollis*, and 28 *M. purvisi*.

When the Barnard River becomes dry, turtle abundance per hole appears to be strongly related to hole size, as results from that Glenrock section of river indicate in Table 2 below. From the survey results it seems unlikely that *M. purvisi* would be present in holes less than 50cm max depth.

Table 2. Turtle abundance in four isolated holes in Barnard River at Glenrock

Location	Hole size	Traps	*Myuchelys purvisi*	*Chelodina longicollis*	Platypus
Glenrock Barnard River traps 100-103	80L x 11W x 2m max depth (Av depth 1m)	3 big crab and 1 Fyke	22	7	3
Glenrock Barnard River traps 107-110	70L x 10W x 2m max depth (Av depth 1m)	2 Big crab and 2 Cathedral	3		1
Glenrock Barnard River traps 104-105	60L x 11W x 1.5m max depth (Av depth 50cm)	2 Big crab	3		
Remikoes Kalungra NP Feb 2018	90L x 11W x 1.5m max depth (Av depth 1m)	1 big crab and 1 Fyke	18		

Based on the assumption that turtles are unlikely to occur in the shallow holes and would be concentrated to the largest holes and the capture success is likely to be only 50%, a rough estimate of the average number of *M. purvisi* per km for the Glenrock section would be 4 – 8.

The other sections trapped also targeted the largest holes in which turtles would be congregated. Table 3 below approximates the number of turtles per km for the three sections. Interestingly the number increases with river size, so it could be a valid estimate.

Table 3. Turtle abundance in three sections of the Barnard River

Locations	River length km	traps	*M. purvisi*	*Per km*	*C. longicollis*	*Per km*
Barry Station Barnard River	7.3km	18	26	3.5	2	0.3
Glenrock Station Barnard River	7km	10	28	4	7	1
Curracabundi NP Barnard River	9.2km	17	60	6.5	9	1

It is likely that the habitat area of deep hole refuges in dry seasons is one of the main factors limiting turtle abundance. The trapping results indicate the minimum number turtles per km to be in the range of 3.5 to 6.5 per km, actual numbers per km are likely to be double that based on a 50% capture rate.

The impact and limitation of drought is the only new threat identified this survey. The threats of weed invasion and tree regeneration in riparian zones, stock and feral animal trampling of nests, and predation by native and exotic predators were reinforced by observations this survey.

Weed diversity and abundance increased with stream size and at lower elevations, as did tree regeneration in the bed and banks of the river. Weeds that were observed as a threat to the riparian zone and adjacent woodlands and open forests were Green Panic, Kikuyu, Broadleaf Privet, Cobblers peg, Stinking Rodger, Blue Heliotrope, Maynes Pest, Jacaranda, White Cedar, Peppercorn, and Swan Plant.

Foxes were observed in the Glenrock, Barry and Back River sections, six Dingos were seen and heard in Glenrock and Curracabundi NP, Red deer were abundant in Glenrock, and Fallow Deer were common at higher locations in Barry Station. Pigs were found throughout. Large Eels were abundant in all the large holes; they would have to be a turtle predator. The author once dissected a large eel and found a large water dragon in it.

The new observation was that there is an abundance of turtle nesting sites in the upper reaches of the Barnard above Curracabundi NP, mainly due to less weed infestation of the banks, particularly by Kikuyu grass which dominates the riparian zone downstream from the NP.

Habitat quality is considered to be higher where there are beds of aquatic plants: those plants occur only in the deeper, more permanent holes and appear to be currently suffering from the high turbidity. Small streams like Back River do not have beds of aquatic plants.

Other threatened species observed were Rock Wallabies on several outcrops in Glenrock and Curracabundi NP, Little Lorikeets were common in Barry Station, Speckled Warblers were sparsely present in Barry. Spotlighting failed to find Booroolong Frogs in any of the streams surveyed. In 2016 they were sparsely present in the Barnard River down to Leahurst hut.

Back River trapping recorded no turtles. It was flowing at the time but according to Bruce Moore, owner of "Osland", it was dry until recently which may have eliminated the turtles. There are very few deep refuge holes in it.

The weather during the survey was ideal, with warm to hot days 30 – 35C and warm nights 13 – 20C. The first two nights had drizzle and the last day had rain which was a problem running traps and packing up, estimated to be about 30mm of rain. Water temperatures averaged 21C - some exposed sites were higher at 22C, and some sheltered sites as low as 19C.

Despite the dry streams, the surrounding landscape was green everywhere with good grass cover; presumably the catchment has had small but frequent rainfall events.

Like Back River, the Schofields Creek would only support turtles during good seasons; the lower half of it above the junction with the Barnard was very dry - maybe 1- 2 % water holes.

One turtle was trapped in the largest hole where the creek goes through a rock gorge. Its upper reaches had shallow holes in the area near Glen Rock homestead, but those were all less than 50cm deep and very turbid from cattle crossing and the banks were mostly Kikuyu, leaving very few nesting sites.

Orham Creek had even less water in it. The only large hole trapped was associated with a limestone outcrop and was spring fed: no turtles were caught. Higher up it had holes, but those were very degraded by cattle, and Kikuyu on the banks. The other problem with Orham is that it no longer has stream connectivity to the Barnard River, as it has a concrete weir that would block turtle passage.

In summary, both of those creeks are considered marginal habitat in good seasons only; from what we know about *M. purvisi* habitat preferences, they are too small and most likely too ephemeral to support populations.

Conclusion

Trapping success was considered high, much higher than April 2018, probably due to the warm water and the captive turtles in the refuge holes. The mix of lamb heart, liver, beef heart and sardines, seemed to work very well as bait.

Table 4. Comparison of trap types, effort, and captures between March 2019 & April 2018

Survey	Fyke traps	*M. purvisi*	Big crab traps	*M. purvisi*	Cathedral traps	*M. purvisi*	Total *M. purvisi*	Total trap effort
March 2019	9	53	36	53	16	9	115	61
April 2018	15	40	40	20	18	2	62	73

The mix of age classes captured has reinforced prior assumptions from the April 2018 survey that the population is presently secure and not under any new threat other than climate change which is affecting all aquatic species. See Figures 6 and 7.

Juveniles of 2 to 4 years old were recorded in numerous locations and judging by the algae growth on their carapaces they are living in sediment and aquatic plant habitats and despite the abundance of large eels are managing to survive. They were noted to be very active, and quick to dive into cover to escape, which would help them survive.

The overall ratio of males to females was similar to April 2018 but varied greatly at some sites. The largest hole trapped was dominantly male which was interesting; it also was the only hole with catfish. See Figures 7 and 8.

2.0 Survey Methodology

Surveys were conducted in accordance with DPI Procedure – Effective decontamination of equipment used in association with a suspected pathogen impacting *Myuchelys georgesi* Bellinger River V3, 24/3/15.
Site selection prioritised a spread of locations across the catchment without records of *M. purvisi* targeting locations with ease of access to suitable trapping sites.

There was no systematic survey method used due to the variability of the trapping locations. The trapping method at each site was determined by the depth and size of the holes, Cathedral traps were used in the deep holes up to 2m, Big Crab traps were used up to 1.5m deep, and fyke nets were used in streams up to 1 m deep. The largest and deepest holes were targeted. The majority of the river and creeks were dry, and had been dry for a year.

The trapping procedure involved:

- Traps were baited with a mix of lamb heart, liver, beef heart, and sardines. Bait was replaced daily for each new site
- All the traps were fitted with factory floating devices, but to ensure the safety of turtles and platypus additional floatation was added to all traps.
- Depth selection for each trap type was critical to ensure the traps functioned to catch turtles and ensure the internal funnel was open to enable air- breathing fauna to easily reach the upper section to breath.
- Traps were set for a maximum of 15 hours.
- Animals captured were processed and then released at the pool of capture
- Each Manning River turtle was swabbed around the eye. Swabs were sealed in vials and kept refrigerated.
- During processing, female turtles were palpated to identify if any had retained eggs
- Any abnormalities were recorded for each turtle.
- Potential threats to turtles were considered throughout the surveys.

Photo of a Cathedral trap

Photo of Big Crab trap modified for catching turtles

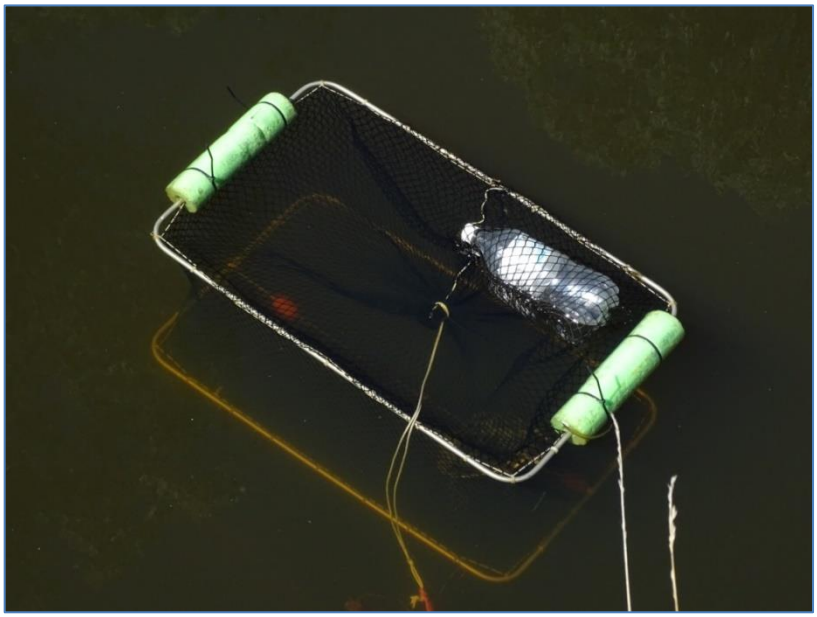
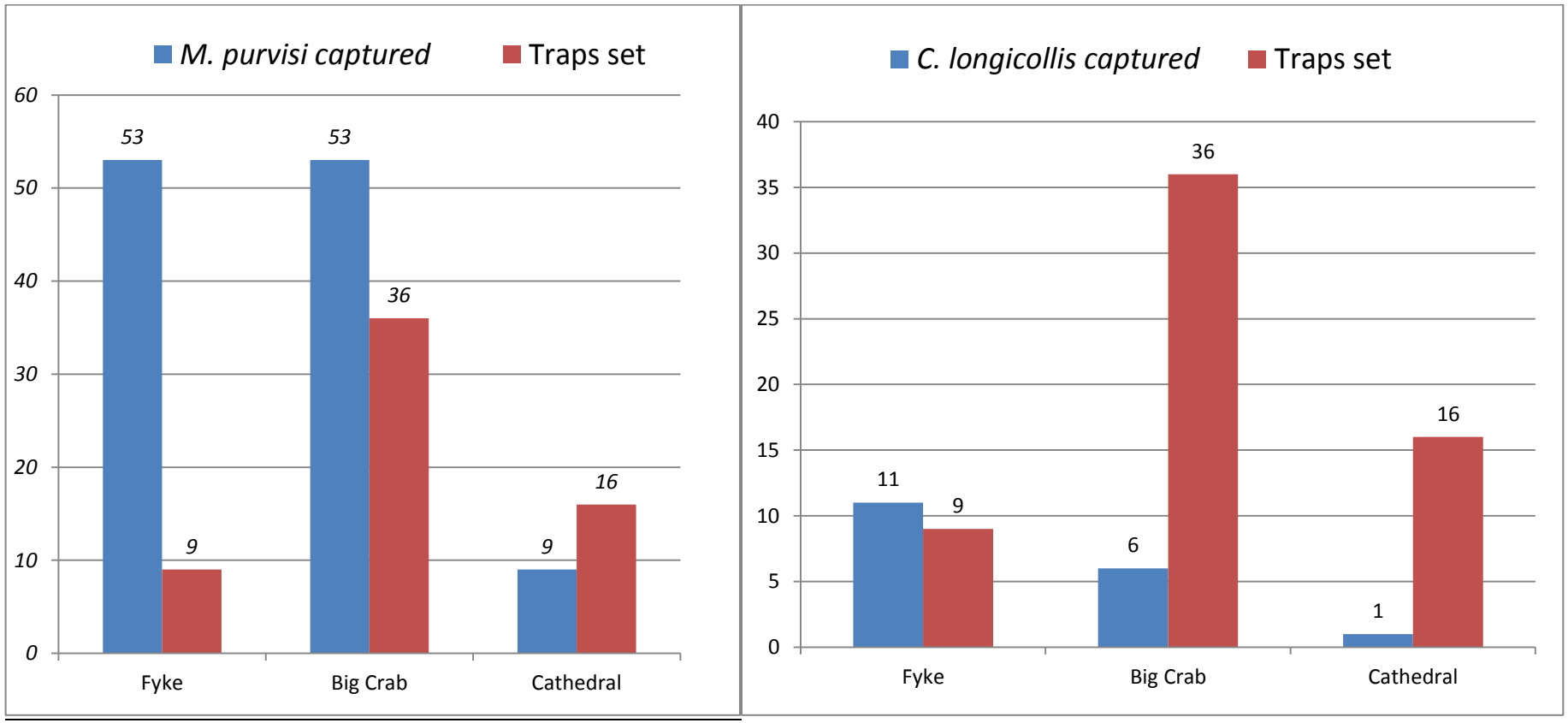


Photo of a Fyke net

Other equipment used

- Plastic tubs were used for holding animals out of the sun after removal from the water while waiting for processing.
- Large callipers were used for measuring length and width of turtles carapace (top of shell) and plastron (bottom of shell);
- electronic scales were used for weighing turtles;
- cotton tipped swabs were used for conjunctival swabbing of animals for diagnostic purposes;
- a cordless drill was used to mark turtle shell scutes to give each an individual mark.

Figure 5. Comparison of the results from the different trapping methods used March 2019



The results shown in Figure 5 show Fyke nets had the best capture of 64 turtles (53 *M. purvisi* & 11 *C. longicollis*), Big Crab traps caught 59 turtles (53 *M. purvisi* & 6 *C. longicollis*) , and Cathedral traps caught just 10 turtles (9 *M. purvisi* & 1 *C. longicollis*).

3.0 Results

Observations from March 2019 survey when 115 Manning River Helmeted Turtle – *Myuchelys purvisi* were captured

Largest female weighed 1.450 kg, largest male weighed 1008 grams.
Photo below shows females are considerably larger than males, and males have much longer tails.

The largest female (below) weighed 1.450kg

The smallest turtle 1—3—5 weighed 43g. (2 photos below)
Eleven turtles weighed below 150 grams

Second smallest Turtle 1—2—9 weighed 63 grams, camouflaged to elude predators

Sixth smallest turtle 9—2 weighed 100grams

18 Eastern Longneck Turtles – *Chelodina longicollis* were captured, 2 in Barry Station section, 7 in Glenrock Station section, and 9 in Curracabundi NP section

Damaged and deformed turtles captured

Many adult *M. purvisi* turtles had unusual marks on their rear scutes, as lines that extended from the joins toward the tail as shown in the turtle below.

This female turtle 5—4 sustained damage to her mouth but was still in good health

This female turtle 7—10 lost her left leg but was still in good health

Damage to the marginal scutes of turtle 9—10, appeared to have been a predator attack as she had a tear in the webbing of the adjacent foot as well

The silted up and dry weir on the Barnard River in Glenrock section

The silted up and dry weir on Orham Creek in Glenrock section

Lowest elevation hole in Curracabundi traps 124 – 128 was also the largest hole and caught the highest number of turtles 18, also only site to catch Catfish

Highest elevation hole in "Osland" Back River trap 68 was smallest hole. 14 traps in Back River caught no turtles - only Eels, Cox's Gudgeon, Shrimp, and Australian Smelt

Fish trapped

Cox's Gudgeon

Australian Smelt

Long-finned Eels

Weed issues identified

Tall thick weeds growing in the riparian zone of the dry Barnard River bed in Glenrock section, Broadleaf Privet is probably the worst

Weeds growing in the dry river bed in Glenrock section

Trees dying along the Barnard River in Glenrock section

3.1 Graphed March 2019 Survey Results

Figure 6. Shows the mix of weight/age classes of the 115 *M. purvisi* turtles

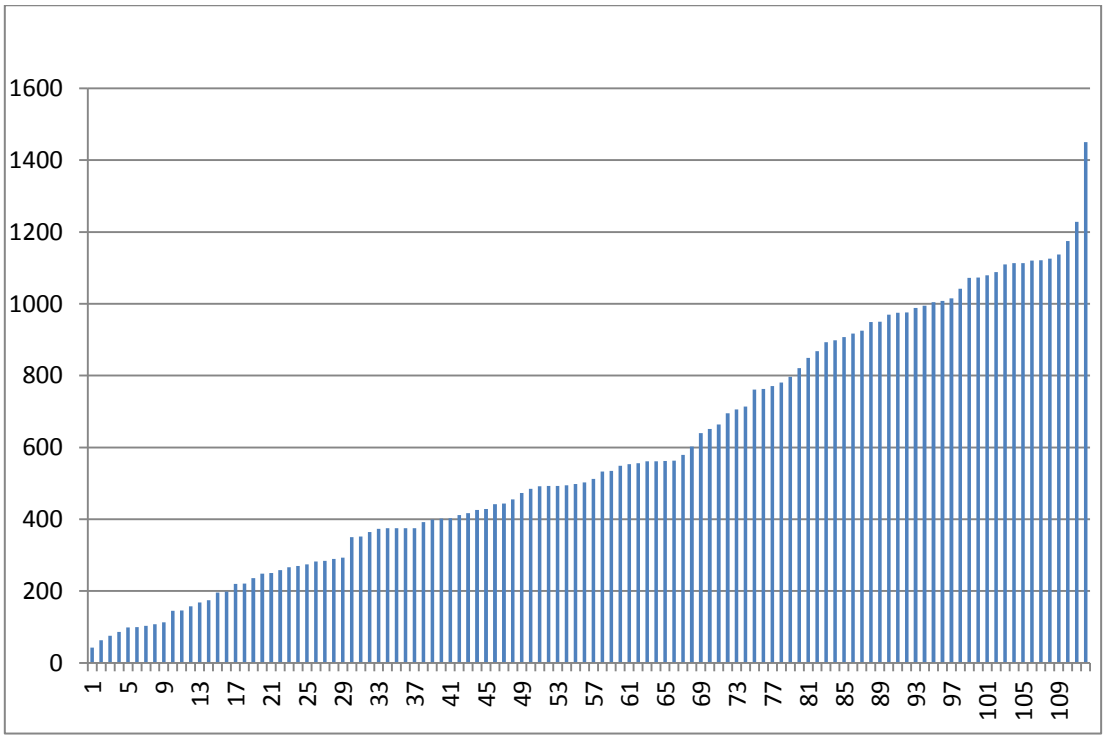


Figure 7. Sex, number and weights of the 115 *M. purvisi* turtles captured, note males smaller and fewer, sex of smallest difficult to determine

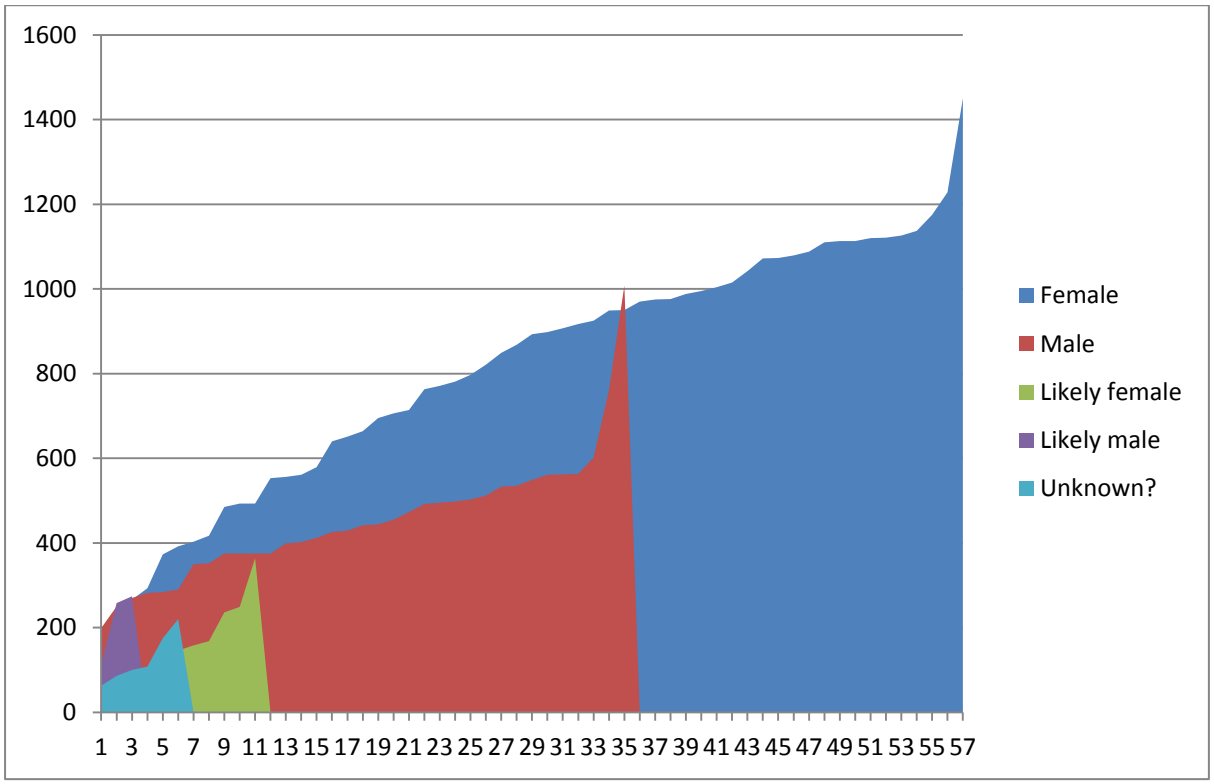


Figure 8. Number of each sex of the 115 *M. purvisi* turtles captured March 2019

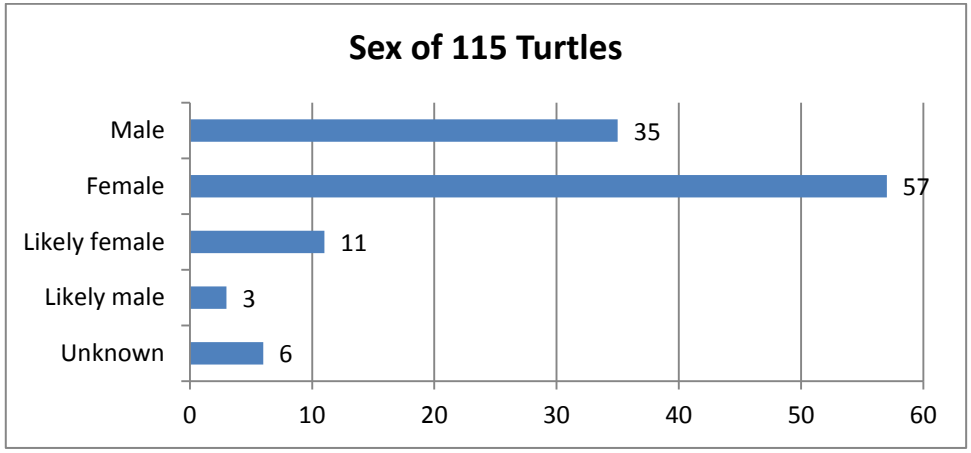
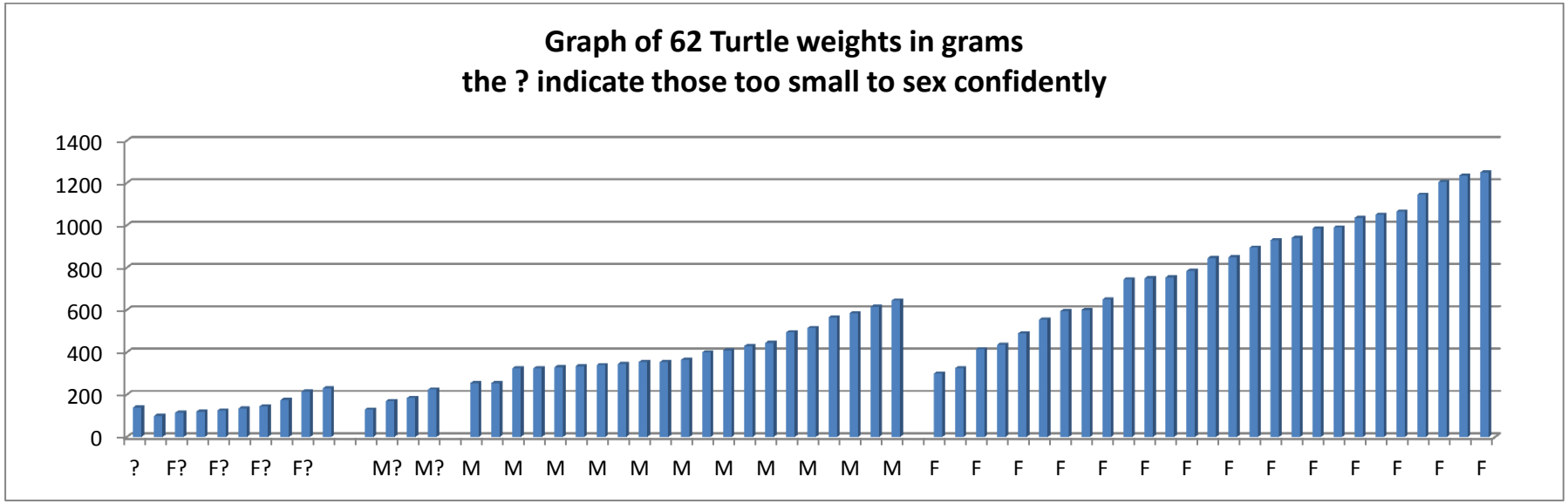


Figure 9. Weights of 62 *M. purvisi* turtles captured Feb and April 2018



4.0 Discussion of results

The survey results have been supplied to OEH in an excel spreadsheet and the photos and maps have also been supplied.

Trapping success was much higher in March 2019 as compared to April 2018. The increase could have been due to the dry river which forced the turtles to be congregated in refuge holes with less food sources. Other possibilities are the earlier survey timing when both and air and water temperatures were warmer, or it may indicate that section of stream normally has a higher abundance. The refuge hole theory is most likely the reason, as the same high abundance of 18 turtles in a refuge hole was observed in the Barnard River in the Kalungra section of Curracabundi NP in Feb 2018.

Comparison of trap types, effort, and captures between March 2019 & April 2018

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March 2019	9	53	36	53	16	9	115	61
April 2018	15	40	40	20	18	2	62	73

The March 2019 results show
9 Fyke nets had the best capture of 64 turtles (53 *M. purvisi* & 11 *C. longicollis*),
36 Big Crab traps caught 59turtles (53 *M. purvisi* & 6 *C. longicollis*),
and 16 Cathedral traps caught just 10 turtles (9 *M. purvisi* & 1 *C. longicollis*).

The April 2018 survey results found
15 Fyke nets had the best capture of 48 turtles (40 *M. purvisi* & 8 *C. longicollis*),
40 Big Crab traps caught 21 turtles (20 *M. purvisi* & 1 *C. longicollis*),
And 18 Cathedral traps caught just 3 turtles (2 *M. purvisi* & 1 *C. longicollis*).

The seasonal timing for the March 2019 survey was considered okay, but ideally a couple of months earlier would have been optimal.

The seasonal timing of the April 2018 survey was the last few warmer days of turtle activity, any later and turtle activity would have plummeted with the falling temperatures and shorter daylight length.

Combined, the two survey results provide a picture of the *M. purvisi* population in the length of the Barnard and Myall River catchments.

4.1 Mix of age classes and sexes

The Figure 6 graph shows that the population of *M. purvisi* has a healthy mix of age classes, sexes, and a healthy recruitment of juveniles. The larger number of females is considered normal, as is their larger size. The population appears stable with no evidence of lack of recruitment in recent times.

The results from April 2018 surveys shown in Figure 9, show the same healthy mix of age classes.

Unfortunately there have been no systematic surveys in the past to compare the results to. The decline of *M. purvisi* is based on general observations of turtle experts.

The current mix of age classes and sexes gives no clue as to what has happened to the population over the last 200 years. It only indicates that there are no recent threats to recruitment as has been observed with the Bell's turtle population on the tablelands which dominantly consists of old turtles.

None of the females caught in either surveys were gravid. November surveys will be conducted this year (2019) to identify breeding times and hopefully locate nests.

4.2 Mix of species

It appears that *M. purvisi* dominates *C. longicollis* in permanent streams throughout the area surveyed, as only 18 *C. longicollis* were captured as compared to the 115 *M. purvisi*. The April 2018 survey found a similar dominance with 10 *C. longicollis* captured as compared to the 62 *M. purvisi*.

It was odd that no *C. longicollis* were trapped in Back River. *C. longicollis* is likely to be more abundant in the farm dams and small creeks that are highly ephemeral. In the tablelands permanent streams, *M. bellii* is also dominant over *C. longicollis*, whereas in ephemeral dam habitats *M. bellii* does not occur and *C. longicollis* is common.

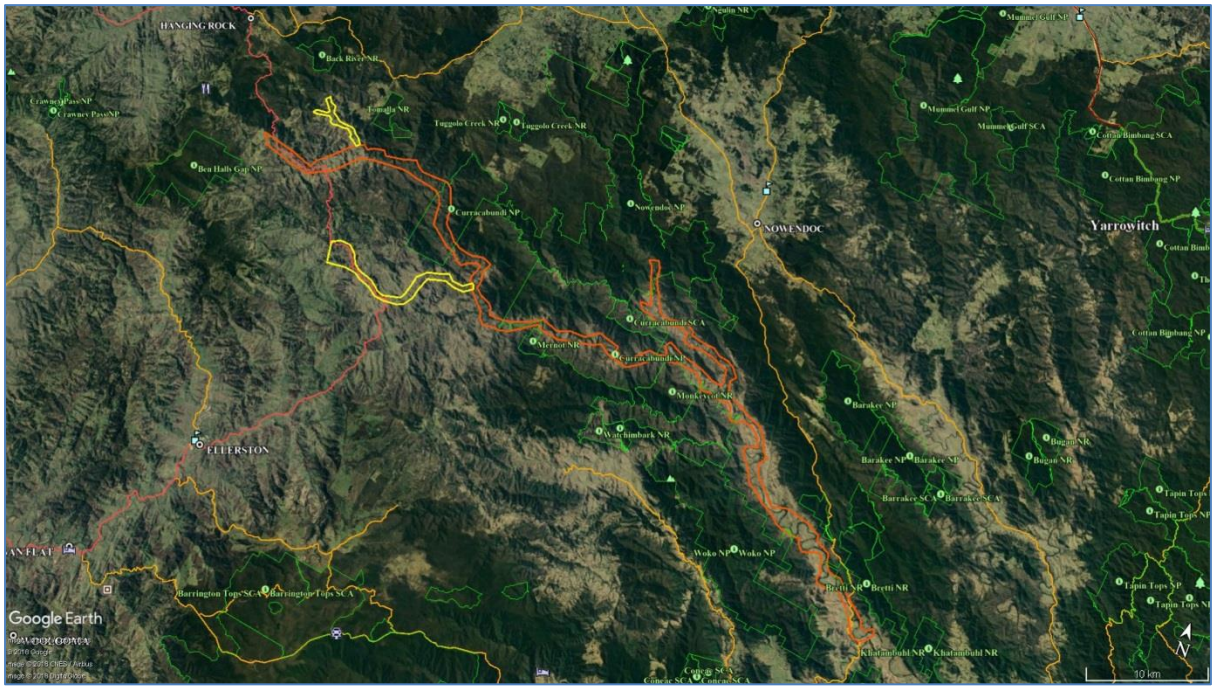
It is likely that *M. purvisi* would be reluctant to walk overland, although the concentration of *M. purvisi* turtles in the refuge holes suggests that travel over the dry river bed to get to water holes may be a necessity during drought. They would be particularly vulnerable to predation at that time.

4.3 Habitat preferences and distribution

The April 2018 survey found the upstream limit to *M. purvisi* appears to be where streams are confined through narrow valleys, where stream beds are dominantly solid rock or boulders and they lack gravel and loam banks, gravel riffles, and adjoining alluvial flats. Such streams have a faster flow, fewer aquatic plants, little or no potential nesting sites, cooler temperatures, and less direct sunlight due to the narrow valleys and riparian vegetation.

This March 2019 survey found the upstream limit to *M. purvisi* to be smaller streams that are more highly ephemeral such as Back River. Turtles were caught above and below its junction with the Barnard River but none in Back River. The lack of *M. purvisi* may be seasonal in such small streams; finding one female in a small isolated hole in Schofield Creek confirmed they do use those small creeks during good seasons.

The map below shows the area of known *M. purvisi* habitat at April 2018 in the orange outlined section along the Barnard and Myall Rivers. The yellow marked sections show the unknown habitat streams targeted this March 2019 survey.



The top yellow section includes Back River, Cascade Creek, and Wild Cattle Creek where no turtles were recorded. The bottom yellow area includes Mackenzies Creek and Orham Creek where no turtles were recorded and Schofields Creek where one *M. purvisi* was recorded March 2019. After some good seasons it may be worth surveying those creeks again.

It seems that the preferred habitat for *M. purvisi* is the more permanent headwater streams of the Manning River catchment that have gravel riffles and rapids, deep slow flowing holes with beds of benthic aquatic plants, and gravel and sandy loam banks and beaches.

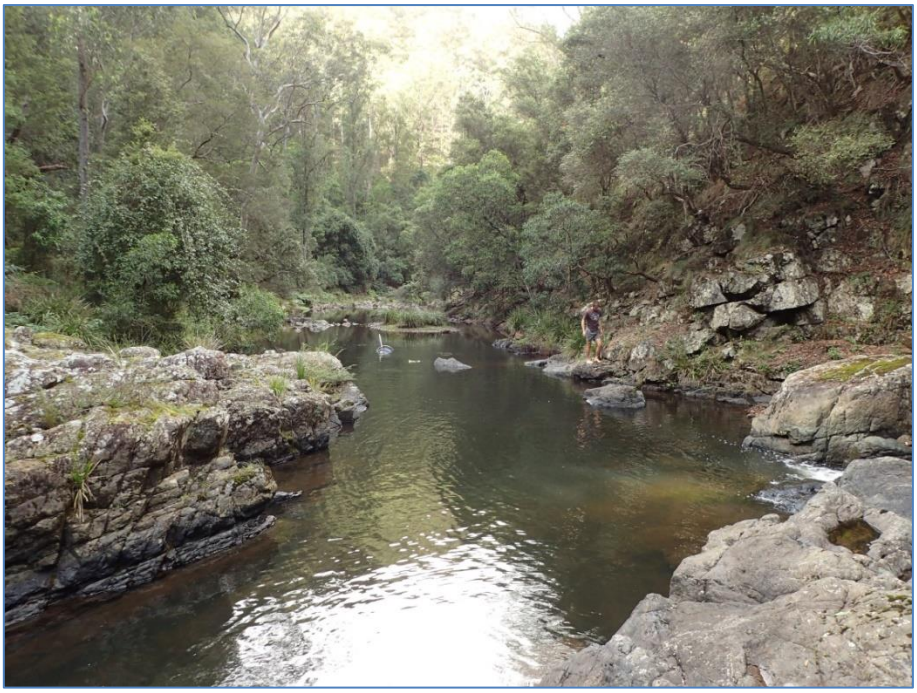
Schofield Creek isolated hole of water just over 1 m deep, captured 1 female *M. purvisi*

Photo below shows the upper reaches of Schofield Creek, mostly dry, contains some shallow holes which are very degraded by cattle and kikuyu on the banks, considered *C. longicollis* habitat.

Highest elevation known *M. purvisi* location found during the April 2018 survey was site 4 Barry Station Barnard River, a large hole with benthic plant beds at 600m elevation

The highest elevation in the Barnard valley where *M. purvisi* was recorded in April 2018 at Barry Station at 600m elevation still stands. Such suitable habitat at high elevations is very restricted; most of the streams are too shallow.

The April 2018 survey recorded no turtles at 697m elevation in Myall Creek at site 1 Callagans Rocks (shown below). It had no benthic plants, cooler temperature, no loam beds for nesting, fewer fish and shrimps, caught just two tadpoles and a big eel. Downstream at site 3 Christies Hut (316m elevation) where the valley widened to include alluvial flats, four *M. purvisi* were recorded.



At lower elevations suitable habitat is much more common. During the April 2018 survey the lowest elevation was site 10 near Bretti at 90m elevation. Both the highest and lowest sites were deeper holes with extensive benthic aquatic plants with gravel and rock beds and slow flows.

Lowest *M. purvisi* location found during April 2018 was site 10 'Kauthi Station' Barnard River, a wide and deep river with extensive beds of aquatic plants at 90m elevation

From what we know now about *M. purvisi* habitat, it should now be possible to model and map what is likely to be suitable and occupied habitat. Seems that preferred habitat is largely driven by stream size, structure, and water permanency. Most of it adjoins land cleared for agriculture, however it also includes natural open forests and woodlands in the Barnard valley.

5.0 Threats identified

It is not known how abundant *M. purvisi* was once, part of the brief for this project was to consider what may have caused decline.

The lack of published long-term monitoring on this species makes estimation of past rates of decline difficult to determine. All we have is John Cann's observations April 2016 that he had observed recent declines in abundance.

This March 2019 survey should be a good indication of turtle abundance as the turtles were likely congregated into the larger holes and the survey conditions were hot weather and warm water.

The previous April 2018 survey was a bit late in the season when the cooler conditions and shorter days were likely to have lowered turtle activity. Future surveys should be conducted during early summer; such timing would be conducive to optimal results for population estimates.

The documented major threats for this species are disease and predation of nests and nesting females by the Red Fox, feral pigs and goannas.

Hybridisation with *E. macquarii* is also a real threat now that they have been trapped in the lower streams of the catchment. The last two years have also provided a glimpse of the potential impact of climate change which is seriously degrading habitat quality in the isolated refuge holes.

Other less critical threats are cattle trampling of nests, stream pollution, and native regrowth and weed invasion of riparian habitats. Natural threats include Quolls, Dingos, large native fish of Eels, Catfish and Bass, White-bellied Sea Eagles and water birds such as egrets and cormorants.

It is likely that big eels are a major predator of juvenile turtles, as they are very abundant, and known to swallow adult water dragons. It is unknown if big eels were always as abundant, or if there has been change to the aquatic ecosystem that has enabled them to increase in abundance. A few White-bellied Sea Eagles were observed patrolling the holes; they are also likely to be taking any turtle that attempts to go overland or is caught out basking.

Big eels were caught in every fyke net and many turtle traps, large catfish were caught in the largest hole

Disease

The turtles captured in both March 2019 and Feb – April 2018 were in good health. Very few turtles have damage or deformities, and none have eye issues like what the Bells turtles suffer from.

That healthy outlook could change quickly with the introduction of the Bellingen River turtle disease, which remains their greatest threat until further studies are done to determine how susceptible *M. purvisi* is to that disease.

Until that is known, there needs to be serious biosecurity warnings for the public, landholders and researchers to prevent the spread of that disease from the Bellingen River to the Manning Catchment. Landholders should be requested to report any sick or dead turtles.

Agriculture

The majority of *M. purvisi* streams are within grazing paddocks, where cattle, deer and horses forage along the edge of the streams and make tracks down the banks to preferred water points along the river.

Bell's Turtle research on the tablelands has found that Bell's turtle females selectively chose to lay their eggs at exposed sites with soft erodible soil including cattle tracks, which can result in nests getting trampled. On the tablelands, landholders are being assisted to address that threat with fencing streams and providing off-stream water points.

In this case, fencing streams and providing off-stream water points is not a warranted action, as the area of cattle track impact is very limited.

No turtle nests of *M. purvisi* have been found, although if *M. purvisi* females are found to selectively seek cattle tracks to nest in such an action could be warranted.

Extensive lengths of stream are now part of the National Park estate where stock are being removed. This provides an opportunity to monitor the impact of their removal on stream banks and vegetation regeneration. Such monitoring would enable a better understanding of what impact grazing and regeneration has on potential turtle nesting sites and stream shading.

Other potential impacts from agriculture include clearing of vegetation, stream sedimentation from erosion, and chemical pollution.

One of those impacts was observed at Barry Station where drought and grazing were causing erosion and stream sedimentation in the head of the Barnard River. Further downstream the water quality and clarity was good.

Chemical use in riparian areas is already regulated to minimise impacts, providing the instructions for use are adhered to.

Weed control in riparian areas appears to be neglected, as weeds such as Lantana, and Wild Tobacco and Kikuyu are rampant along streams. Weed invasion of potential turtle nesting sites and unnatural shading of streams and nesting sites is considered an active threat that needs attention.

The incremental loss of turtle nesting habitat from natural regeneration and weed invasion could well be a major cause of *M. purvisi* decline. The mix of age classes does not indicate a recent loss of recruitment, however progressive loss of nesting habitat is a potential cause of decline that could be happening over multiple generations.

Weed invasion of riparian areas is a serious problem, below are Wild Tobacco Bush and Lantana

There has also been a large regeneration event of native trees and shrubs along water ways which is having the same impact as weed invasion: its potential impact should be monitored to determine if physical removal of vegetation at strategic points is required to maintain sunlight exposure to the stream and potential nesting sites.

A small research project is recommended to determine if that impact is significant, and at the same time identify if *M. purvisi* females select nesting sites according to soil disturbance and sunlight exposure. A similar project is planned for the tablelands for the Bell's Turtle, as it seems females actively seek areas of soil disturbance in exposed locations. The artificially created sites and artificial nests could be monitored with cameras over the summer, which may also identify what threat foxes are to *M. purvisi* nests. Ideally a plot at the top in Barry Station and one at the bottom near Bretti would provide the best results.

No turtle nests were found during the survey, it is likely sandy banks such as the one below in Barry Station on the Barnard River at site 4b would be suitable, such bare banks are rare due to tree, grass and weed growth.

Potential nesting site on a loam and gravel bank in Barry Station

River Oak regeneration in the Barnard River at Barry Station site 4b.

Tree, shrub and grass regrowth has overgrown what was a likely nesting spot on a sandy beach on the corner of the Myall River at Myall House site 5.

Below Barnard River site 7b shows Water Couch growing over a gravel bank, which would make nesting difficult to access the bank and dig through the grass.

Trees, Kikuyu and annual weed growth over a gravel bank at site 7a.

Fox predation

The nest predation rate of *M. purvisi* is unknown but for *E. macquarii* the rate exceeds 90% from foxes alone (Thompson 1983).

For *M. georgesi*, nest predation rates of 72% (from foxes and Lace Monitors Varanus varius) have been recorded and foxes are also known to prey on nesting females (Spencer and Thompson 2000; Blamires et al. 2005; Spencer et al. 2007).

Similar high rates of nest predation are also known for Bell's turtle on the tablelands, and also include hatching juveniles and nesting females.

Based on the results of these surveys there appears to be no evidence to suggest that the *M. purvisi* population is currently under serious threat from recent fox predation, as there is a good mix of age classes and sexes. However the population could have declined from fox predation over multiple generations. Surveys of the Bell's Turtle population on the tablelands found it is under serious threat from recent fox predation, as that population is dominantly old turtles.

From personal experience, foxes are common in the headwaters at Barry Station; further downstream they are likely to be less common due to the influence of Dingo presence and possibly other factors such as parasite and prey differences. It would be useful to survey landholders in the lower catchment around Giro to see how common foxes are in that locality. Foxes were observed in the Glenrock, Barry and Back River sections this March survey.

Fox abundance in coastal slopes does not appear to be as high as on the tablelands and inland slopes and plains. If that is the case just a lower fox population may reduce turtle nest predation. Fox abundance in near natural remnants should be even lower where the Dingo is still common.

Foxes are not a recent threat, having been around for a long while, although the trend to increased predation of turtle nests across the southern states indicates their adaptation to detect turtle nests is evolving to be increasingly effective. Considering that, and the current mix of age classes it seems unlikely that they have been a significant impact, or are a significant impact to turtle recruitment, but that needs to be proven with the remote camera studies recommended as is being done on the tablelands.

The report for the April 2018 survey investigated differences between the mix of sex and size classes of turtles captured from fox inhabited areas, to captures from near natural areas where foxes are unlikely to occur.
The result was very little difference between the mix of size classes from streams in highly disturbed landscapes grazed by cattle, as compared to those captured in natural National Park remnant locations where both the natural structure and dingo presence should be limiting Foxes and feral predators in general.

Feral Pigs

Feral pigs were observed in all sections surveyed March 2019, and pig diggings were observed at several locations. Glenrock had the most pigs, elsewhere there appears to be few pigs: it is likely that pig numbers are also suppressed by Dingo predation.

The photo below shows a pig digging in a gravel bank that could potentially be a turtle nesting site, although the Kikuyu grass ground cover is probably too thick for turtles to attempt to dig there.

Based on the observations so far any decline of *M. purvisi* could not be attributed to feral pigs. The remote camera study proposed will provide the evidence to determine if nest predation is a current threat to *M. purvisi.*

Evidence of pig digging in a gravel bank - that if not overgrown with Kikuyu may be a potential turtle nesting site.

Climate change

Extreme weather events will worsen and become more frequent. We can expect there'll be more severe droughts and fires, which will damage the vegetation protecting the soils, making them more vulnerable to erosion. Both of those processes will add more sediment to the river, increasing instability and degrading the habitats of the plant and animal life living in the river.

The Manning River Helmeted Turtle's need for permanent water and its reduced ability to walk overland would put it at increased risk from increasing stream drying associated with climate change.

The photo below shows the long dry stretch of Barnard River adjoining the hole where 22 *M. purvisi* were captured at trap sites 100 – 103 in Glenrock.

Barnard River refuge hole where 22 *M. purvisi* were captured at trap sites 100 – 103 in Glenrock. The prolonged dry has caused deep sediment and algae that must be impacting all aquatic life.

The other potential impact associated with prolonged dry weather and low flows is vegetation encroachment into the river bed and banks that would normally be removed by high flows. Such thick encroachment of native and exotic trees, shrub and grass is presently modifying potential nesting habitat and changing the sunlight exposure into the riparian zone as shown below.

Hybridisation and Competition

Hybridisation between *E. macquarii* and *M. georgesi* is occurring in the Bellinger River catchment producing some morphologically atypical individuals (Georges et al. 2007; Spencer et al. 2007; NSW Scientific Committee 2009; OEH in litt. June 2015; Georges and Spencer 2015).

Hybridisation with, and competition from Macquarie River Turtle (*E. macquarii),* are potential threats to *M. purvisi* and have been identified as significant threats to *M. georgesi* (Blamires et al. 2005; Spencer et al. 2007, 2014) and as a potential threat to *M. bellii* (Chessman 2015).

No *E. macquarii* were recorded this survey, however they have been recorded elsewhere in the Manning catchment and could occur at undetectably low numbers.

Continued monitoring will reveal if they are increasing and becoming a competition and hybridisation problem. Both *E. macquarii* and European Carp are common in the Hunter catchment, which is only one ridge west of the Barnard Valley in the Glenrock area.

Alteration of natural stream flows

Changes to natural stream flows and artificial barriers that prevent movement (e.g. dams or weirs) are recognised as significant threats to aquatic species in some catchments. Those potential threats are not presently active in the catchments surveyed.

The is a weir on the Barnard River which is 2m high that was used to divert water to Orham Creek that was then pumped to Oaky Creek which flows into Glenbawn Dam. It supplemented supply for Macquarie Power Generation. In March 2019 it was idle when the streams were dry.

There are *M. purvisi* turtles above and below that weir and it does not regulate the stream flow. Water extraction is limited to protect low flows, however its impact on normal flows require further investigation.

Of concern for the future is a proposal to build a large dam on the Barnard River to transfer water from the Manning catchment across to Chaffey Dam near Tamworth for use in irrigation.

The water resources of the Manning River are already heavily exploited and further reducing the flow would be environmentally damaging, increase habitat fragmentation and degradation, or directly injure turtles. In the past, when similar plans elsewhere along the coast have been objectively analysed, they have proved to be both economically and environmentally unsound.

Illegal collecting

Illegal collecting of turtles is known to occur and removal of the adult females can cause population declines (J. Cann pers. comm. April 2016).

In this case it is highly unlikely that illegal collecting would be a significant threat considering how much of the river is remote with no access.

6.0 Recommendations

Future Surveys

The extent of potential *M. purvisi* habitat in the Barnard and Myall River catchments has now been surveyed. Repeat surveys in Back River and Schofields Creek may prove worthwhile during a good season.

Repeat surveys of the sites in the table below that were surveyed Feb & April 2018 are recommended for ongoing monitoring of *M. purvisi* and to compare trapping success at optimal seasonal timing. These sites cover the known range of *M. purvisi* in the Barnard and Myall River catchments and are also suitable for the projects listed below.

Survey locations	Zone	Easting	Northing	Alt	*M. purvisi* recorded
Site 3b Christies Hut Myall River	56 J	371133	6505793	316 m	2m & 2f
Site 4a Barry Station Barnard River	56 J	338693	6503962	558 m	1m & 3f
Site 4b Barry Station Barnard River	56 J	339863	6505002	597 m	2m & 1f
Site 5 Myall House Myall River	56 J	372627	6501807	259 m	2m & 5f
Site 6 Myall River Giro Campground	56 J	380151	6497949	208 m	5m & 5f
Site 8 Karamea NP Barnard River	56 J	381654	6495655	172 m	6m & 5f
Site 10 'Kauthi Station' Barnard River	56 J	392939	6485759	90 m	2m & 2f
Site 11 Curracabundi NP Barnard River	56 J	352967	6502100	429 m	6m & 12f

- Monitor *M. purvisi* at the locations identified to mark and record all turtles and monitor changes over time e.g. growth rates, mix of age classes and sexes, turtle movements, and determine if *M. purvisi* is in decline.
- Conduct future surveys during the egg laying season of *M. purvisi* (likely to be early November) to maximise chance of catching larger numbers of turtles, and identify the percentage of gravid females, laying times, laying sites, and observe potential threats at that time.
- Continue to collect swabs for health analysis, in particular any turtles that have signs of ill health or abnormalities.
- Collect eggs from gravid females for research.
- Remove Macquarie River turtles captured.

Projects

- Monitor likely and known nesting sites with remote cameras over the October to March period to observe turtle nesting behaviour, identify potential predators, and estimate the abundance of Pigs, Foxes, Dingos, Goannas, Quolls and Cats.
- Trial removal of weeds at locations identified to be likely nesting sites, disturb the ground to encourage turtle nesting in the soft soil, monitor with remote cameras.
- Trial stock exclusion at locations identified to be likely nesting sites
- Using eggs induced from captured turtles and eggs from poultry set up artificial nest sites in the field to monitor with remote cameras
- Using artificial incubation set up an experiment to determine the impact of increased shading and cooler temperatures on sex determination and hatchling success. Replicate field conditions where riparian vegetation becomes increasingly shady lowering water and soil temperatures.
- Establish vegetation monitoring plots in riparian zones to monitor species change and canopy cover change over time
- Under laboratory conditions trial exposure of *M. purvisi* to Bellinger River virus
- Under laboratory conditions determine if juvenile turtles are a preferred food source for Eels and Catfish
- Using artificial lures modelled on the shape and movement of juvenile turtles, trial fishing in the field and laboratory conditions to determine likely predators of juvenile turtles.

Community Engagement - include on all brochures or signage about *M. purvisi* that:

- It is illegal to collect or remove them from the river
- That the Macquarie River turtle is an introduced threat to *M. purvisi* and must not be released into the Manning catchment.
- That exotic fish such as European Carp, Trout and Tilapia must not be released into the Manning River catchment, or for that matter any native fish from other coastal and inland catchments.
- Work closely with fishing clubs and acclimatisation societies to make them aware of the significance of *M. purvisi* and potential threats from introduced fish and disease on *M. purvisi*.

General

- Conduct landholder surveys to determine abundance of foxes in the lower, mid and upper catchments of Barnard and Myall Rivers. Remote cameras will also provide a rough guide of predator abundance.
- Monitor water extraction and diversion developments in the Manning catchment, object to any that will have a significant impact on stream flows and/or water quality
- Work closely with water management authorities to make them aware of potential impacts to *M. purvisi* from water diversion or extraction.

Saving our Species Management Stream

The *M. purvisi* is currently listed as a data-deficient species which includes all the threatened species that we need to know more about before we can secure them in the wild and/or we don't know enough about them to develop a successful conservation project. For example data-deficient species often have unknown distributions, threats, and life histories.

This project has now captured *M. purvisi* across three sub catchments of the Manning River to provide a good baseline understanding of its distribution, abundance, mix of sexes and age classes and potential threats, its life history was already known from captive animals.

With that information known, there appears to be no justification for leaving *M. purvisi* in the data-deficient stream, and the recommendations have identified several projects that require funding to advance the conservation of the species.

Being restricted to riparian habitats within the Manning River catchment this species is probably best moved to the Site-managed stream of SoS.

References

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APPENDIX 1 Grid References for Trap Locations

Site No.	Survey locations	Zone	Easting	Northing	Altit	Trap Type	*M. purvisi*	*C. longicollis*
68	Back River "Osland"	56 J	339008	6509485	599 m	Big crab	Nil	
69	Back River "Osland"	56 J	338914	6509448	598 m	Cathedral	Nil	
70	Back River "Osland"	56 J	338976	6509150	595 m	Cathedral	Nil	
71	Back River "Osland"	56 J	338941	6509058	596 m	Big crab	Nil	
72	Back River "Osland"	56 J	339385	6509083	588 m	Cath	Nil	
73	Back River "Osland"	56 J	339593	6509088	585 m	Big crab	Nil	
74	Back River "Osland"	56 J	340298	6509007	577 m	Cathedral	Nil	
75	Back River "Osland"	56 J	340312	6509010	578 m	Fyke	Nil	
76	Back River "Osland"	56 J	340306	6509015	578 m	Big crab	Nil	
77	Back River "Osland"	56 J	340637	6509010	572 m	Fyke	Nil	
78	Back River "Osland"	56 J	341275	6508568	567 m	Big crab	Nil	
79	Back River "Osland"	56 J	341247	6508219	562 m	Big crab	Nil	
80	Back River "Osland"	56 J	341307	6508224	562 m	Big crab	Nil	
81	Back River "Osland"	56 J	341527	6508212	559 m	Big crab	Nil	
82	Barnard River Barry Station	56 J	343635	6506887	527 m	Big crab	2 f	
83	Barnard River Barry Station	56 J	343616	6506888	526 m	Cathedral	1 f	
84	Barnard River Barry Station	56 J	343414	6507082	530 m	Cathedral	Nil	
85	Barnard River Barry Station	56 J	343378	6507109	529 m	Big crab	Nil	
86	Barnard River Barry Station	56 J	343044	6507122	534 m	Fyke	9	
87	Barnard River Barry Station	56 J	343038	6507132	535 m	Cathedral	1	
88	Barnard River Barry Station	56 J	343033	6507140	536 m	Cathedral	3	
89	Barnard River Barry Station	56 J	342798	6507541	531 m	Big crab	1	
90	Barnard River Barry Station	56 J	342223	6506967	543 m	Big crab	Nil	
91	Barnard River Barry Station	56 J	342322	6506882	545 m	Cathedral	Nil	
92	Barnard River Barry Station	56 J	341178	6507003	556 m	Big crab	1	
93	Barnard River Barry Station	56 J	341141	6506770	560 m	Cathedral	Nil	
94	Barnard River Barry Station	56 J	340827	6506139	570 m	Big crab	Nil	
95	Barnard River Barry Station	56 J	340817	6506096	569 m	Big crab	2	
96	Barnard River Barry Station	56 J	341097	6505336	578 m	Big crab	1	1
97	Barnard River Barry Station	56 J	341088	6505330	578 m	Cathedral		1
98	Barnard River Barry Station	56 J	340971	6505373	579 m	Fyke	3	
99	Barnard River Barry Station	56 J	340927	6505377	580 m	Cathedral	2	
100	Barnard River Glenrock Station	56 J	356552	6499298	357 m	Fyke	15	6
101	Barnard River Glenrock Station	56 J	356574	6499291	356 m	Big crab	Nil	
102	Barnard River Glenrock Station	56 J	356584	6499295	357 m	Big crab	5	1
103	Barnard River Glenrock Station	56 J	356593	6499300	357 m	Big crab	2	
104	Barnard River Glenrock Station	56 J	356947	6499462	360 m	Fyke	2	
105	Barnard River Glenrock Station	56 J	356941	6499446	359 m	Big crab	1	
106	Schofield Creek Glenrock	56 J	355895	6498857	357 m	Big crab	1	

Site No.	Survey locations	Zone	Easting	Northing	Altit	Trap Type	*M. purvisi*	*C. longicollis*
	Station							
107	Barnard River Glenrock Station	56 J	356835	6500760	364 m	Big crab	1	
108	Barnard River Glenrock Station	56 J	356822	6500749	363 m	Cathedral	Nil	
109	Barnard River Glenrock Station	56 J	356811	6500743	364 m	Cathedral	1	
110	Barnard River Glenrock Station	56 J	356806	6500728	365 m	Big crab	1	
111	Orham Creek Glenrock Station	56 J	357699	6496538	361 m	Big crab	Nil	
112	Barnard River Curracabundi NP	56 J	360978	6497109	304 m	Big crab	2	2
113	Barnard River Curracabundi NP	56 J	360987	6497111	304 m	Big crab	8	2
114	Barnard River Curracabundi NP	56 J	360987	6497122	305 m	Big crab	7	
115	Barnard River Curracabundi NP	56 J	362812	6497851	301 m	Big crab	1	
116	Barnard River Curracabundi NP	56 J	362812	6497848	301 m	Big crab	4	
117	Barnard River Curracabundi NP	56 J	362812	6497849	301 m	Fyke	5	
118	Barnard River Curracabundi NP	56 J	363633	6497488	346 m	Big crab	8	
119	Barnard River Curracabundi NP	56 J	363639	6497476	347 m	Big crab	Nil	
120	Barnard River Curracabundi NP	56 J	364780	6497354	312 m	Big crab	3	
121	Barnard River Curracabundi NP	56 J	364788	6497347	314 m	Big crab	Nil	
122	Barnard River Curracabundi NP	56 J	365478	6497829	264 m	Big crab	1	
123	Barnard River Curracabundi NP	56 J	365491	6497842	264 m	Fyke	3	2
124	Barnard River Curracabundi NP	56 J	366580	6497433	264 m	Fyke	16	3
125	Barnard River Curracabundi NP	56 J	366596	6497435	264 m	Big crab	1	
126	Barnard River Curracabundi NP	56 J	366610	6497433	267 m	Cathedral	1	
127	Barnard River Curracabundi NP	56 J	366614	6497442	266 m	Big crab	Nil	
128	Barnard River Curracabundi NP	56 J	366622	6497445	266 m	Cathedral	Nil	