Platypus News & Views

Newsletter of the Australian Platypus Conservancy (Issue 80 – May 2020)

WHAT MAKES THE PLATYPUS SO SPECIAL?

The platypus is one of the most distinctive mammals in the world in terms of its evolutionary position: it has no really close relatives, and is one of just five species to be classified as monotremes, or egg-laying mammals. Its largely unshared evolutionary history means that the platypus also has many odd physical features as compared to most other mammals.

A really interesting question is therefore as follows: To what extent have the platypus's unusual attributes affected its survival? Are they best viewed as liabilities reducing the platypus's ability to compete with other animals, including both marsupial (or pouched) mammals and placental mammals? Or are they adaptations that genuinely confer a competitive edge?

The answer probably varies, depending on the attribute.

Production of eggs. A female platypus lays a clutch of up to three eggs after a short gestation lasting 2-3 weeks. The eggs are small – just 15-17 mm long – with papery shells like those of reptiles. Hatching occurs 10 to 11 days later and the newly hatched babies are tiny and quite undeveloped, resembling newborn marsupials. They remain in the nesting burrow for another 3-4 months and are nourished by milk throughout this period, growing to about 80% of their adult length before first emerging into the water. Although this sequence of reproductive events differs from those of marsupial or placental mammals, there's no reason to believe that it's either better or worse as an effective reproductive strategy.

Contribution of the platypus's egg-laying ability to its competitive ability and evolutionary success: Presumably neutral

Low body temperature. The platypus's active body temperature (32^{o}C.) is about 5^{o} less than that of most placental mammals (including humans), with a marsupial's body temperature lying about halfway in between. It's therefore been suggested that marsupials and monotremes should find it harder to cope with cold conditions than placental mammals. However, research has shown that this isn't true for marsupials: no special thermal or metabolic adaptations are needed for marsupials such as the small carnivorous marsupial "mice" in the genus *Antechinus* to survive just fine in snowy mountain regions. Similarly, platypus populations thrive in many alpine lakes in Tasmania, with one animal famously filmed travelling across snow in Mount Field National Park (https://www.youtube.com/watch?v=do0-1VharzU). In fact, it's presumed that the platypus's relatively low body temperature actually assists its survival in cold conditions - whether these occur through much of the year at high elevations/latitudes or only in winter - because it reduces the rate that animals lose heat to the environment, particularly to water. Regardless of how cold the environment is, the platypus's relatively low body temperature means that it can eat less than marsupials or placental mammals of the same size and still maintain a healthy body weight – a great survival feature for tough times.

Contribution of low body temperature to platypus competitive ability and evolutionary success: Presumably positive

WHAT MAKES THE PLATYPUS SO SPECIAL? (cont. from page 1)

Venom and spurs. The platypus is one of just a handful of mammals known to be venomous. Other venomous species (including the European mole, several types of shrew and solenodons) produce toxic saliva that is delivered by biting and is mainly used to help subdue prey. In contrast, platypus venom is produced by a gland in the upper thigh and delivered by a pointed spur, about 15 mm long, located on each hind ankle (as shown at right).

Platypus venom is only secreted by adult males and – given that venom production peaks just before and during the platypus breeding season – presumably mainly functions to help males gain access to breeding females. Like the fangs, sharp claws, antlers, horns, etc. used by other male mammals to compete for mates, platypus spurs presumably are also sometimes used to deter predators, though they're unlikely to be an effective defence against aerial predators such as sea eagles that swoop from above. There is no evidence that platypus venom is ever used to secure prey (mostly consisting of aquatic insects).

Contribution of venom to platypus competitive ability and evolutionary success: Important to individual male breeding success, but otherwise probably fairly neutral

Electroreception. The platypus's bill contains thousands of specialised receptors used to detect either tiny changes in water pressure or the electricity produced when the muscles of prey contract. These receptors work together to help the platypus obtain food – for example, the difference in the time required for a change in water pressure and an electrical signal to be received by a platypus after a freshwater shrimp flicks its tail is believed to be used by the platypus to judge the distance to the shrimp. Electroreceptors may have been present in the earliest monotremes – there is some evidence for this in the fossilised jaw of a mouse-sized monotreme living at least 112 million years ago – and echidnas (which diverged from the platypus lineage at least 18 million years ago) also have some electroreceptive ability. Importantly, use of electroreception hugely increases the range of conditions when a platypus can forage successfully, including in murky water or at night.

Photo courtesy of Ken Mival

Contribution of electroreceptors to platypus competitive ability and evolutionary success: Very positive

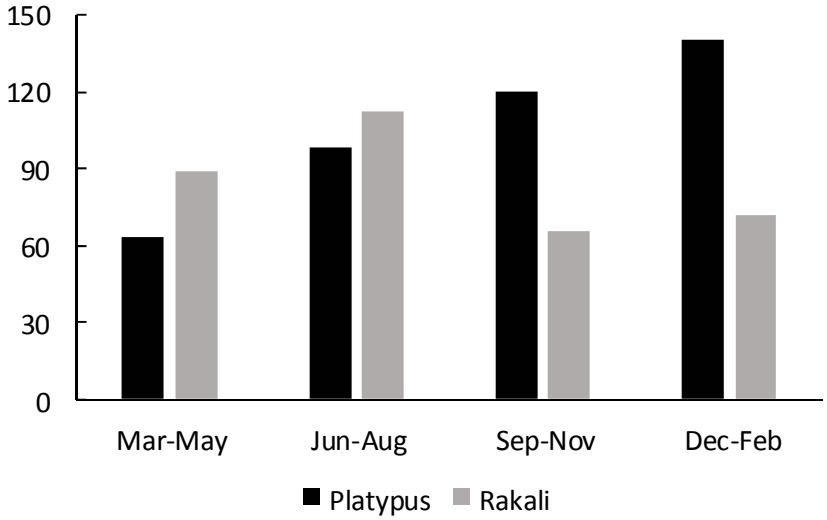
Arrangement of the skeleton. The platypus's upper limb bones (the humerus and femur) extend out from its body in a horizontal plane like those of a lizard, rather than being positioned more or less vertically below its body like those of four-legged marsupials or placental mammals. This means that a platypus is forced to adopt an inefficient waddling gait when it travels on land. However, extra bones in the platypus's shoulder region that provide extra support and bracing for its limbs while walking also confer exceptional strength when a platypus digs or swims. It's reasonable to conclude that the platypus has prospered in its aquatic niche at least partly because of these ancient features of its skeleton.

Contribution of the platypus's shoulder and limb structure to its competitive ability and evolutionary success: Very positive

'TIS THE SEASON FOR PLATYPUS – OR RAKALI?

Platypus and water-rats/rakali are challenging to trap and often occur in low numbers, thereby limiting the effectiveness of live-trapping surveys. Reports of sightings can help to fill in knowledge gaps about where these animals occur. Sightings data can also provide insight into temporal activity patterns that might otherwise be difficult to detect.

For example, the graph below shows how the number of platypus and water-rat/rakali sightings reported to the APC in the past two years (from March 2018 to February 2020) have varied by season. In both cases, sightings originated from across the two species' respective ranges, though about half were made in Victoria (49% of platypus records, 53% of rakali records). As you can see, the graph reveals distinct seasonal differences in how often the two species are seen through the year.



In the case of the platypus, the frequency of sightings is lowest in autumn and then progressively increases from winter to spring and into summer. This pattern can't be explained by seasonal variation in population size: juveniles can almost double the size of a platypus population for a few months, but this spike in numbers only occurs from late summer to autumn (when most juveniles disperse or otherwise disappear for good). Alternatively, seasonal variation in platypus sightings plausibly reflects changes in adult activity, with males predicted to be most active (and hence visible) just before and during the breeding season in winter and spring, and female activity expected to peak in winter (particularly if food resources dwindle) and again in summer (when females are lactating and therefore particularly hungry). It's also quite likely that the number of platypus sightings reported in summer is artificially inflated to some extent by the fact that so much human outdoor recreation occurs then.

In contrast, rakali are most likely to be seen in winter and to a lesser extent in autumn, with many fewer sightings made in spring and summer. When conditions are favourable, a female water-rat can potentially raise several litters, starting in spring. It is therefore possible (though by no means proven) that the spike in rakali sightings in autumn and winter at least partly reflects the fact that large numbers of dispersing juveniles are on the move then, looking for a place to settle. Alternatively, it's definitely the case that water-rats are not well adapted to cold weather – their body temperature starts dropping within minutes if the water temperature is less than 20^{o}C. – so it's also plausible that rakali may become more diurnal in autumn and winter (and hence be seen more often) primarily in a bid to stay warm.

To help shed further light on where and when platypus and rakali are most active, persons who have seen these animals in the wild are strongly encouraged to report the details to the APC website (www.platypus.asn.au).

WILL PLATYPUS RECOVER FROM THE RECENT DROUGHT?

In *PN&V* no.78 (Nov 2019) we considered some of the issues arising from the drought prevailing over much of eastern Australia. Since then, conditions have changed for the better and some landowners are now asking "When will platypus return to my creek?"

Platypus numbers have undoubtedly been depleted wherever flow was severely reduced during the recent drought – particularly if the channel more or less dried out. However, based on information obtained in Victoria following the dire Millennium Drought, platypus populations generally seem to be capable of recovering once conditions improve. Although the process of post-drought recolonisation has not been closely studied, it's believed that vacant habitats are mainly reoccupied by dispersing juveniles, starting with the offspring of females that survived at reliably wet refuge sites elsewhere in the river catchment. In practice, it seems that this recovery process typically takes a few years. Accordingly, it may be some time yet before platypus are again abundant enough for people to start seeing them locally.

Of course, this presumes that flow regimes also recover to at least their pre-drought level. Ironically, this has sometimes failed to occur after the Millennium Drought due to accelerated construction of small off-stream dams that intercept natural run-off – built mainly by landholders to help drought-proof their properties.

APMN UPDATE

Since the Australian Platypus Monitoring Network was launched last year, the APC has conducted several regional rollouts to promote community participation and develop better public awareness of platypus conservation needs. One such rollout was undertaken in partnership with the Goulburn Broken Catchment Management Authority in Victoria. Eighteen community information and training sessions were presented in the CMA's region in 2019, with 39 monitoring sites subsequently established. The rollout and its associated media coverage also contributed to a seven-fold increase in the number of incidental platypus sightings that have been reported as compared to the previous year.

The widespread bushfires earlier this year plus the onset of Covid-19 restrictions have unfortunately forced the rollout program for 2020 to be suspended for now. However, we're hopeful that activities can resume in the second half of this year. In the meantime, going out to monitor platypus on a regular basis remains a great way to stay active and in tune with the natural environment. For more information about how to get involved, please visit the APMN website at www.platypusnetwork.org.au.

TAKING A DIVE FOR PLATYPUS

The Australian Platypus Conservancy is a non-profit organisation that relies on donations from individuals and groups to help support monitoring and educational activities and fieldwork that can't otherwise be readily funded. In this context, the APC would like to acknowledge the recent generosity of Undercurrent magazine in assisting the Conservancy's work.

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