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Recognising the impact of sight record assessment on the scientific record and a species' conservation status

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On Wednesday, 12 February 1845, Charles Sturt and his horse Punch were 50 kilometres south of the Wilson River and Cooper Creek junction in far south-western Queensland. Alongside expedition member Joseph Cowley, they were trudging north through endless sandhills covered in spinifex 'so matted that we could hardly work our way through it'. Some time that day, they 'flushed a ground parrot. The one which as far as I know its habits invariably frequents the Sea Coast. Dark green speckled black. It rose and fell like a quail and Joseph thought it was a young bird until he made a vain attempt to catch it' (Sturt 1845).

Sturt probably wrote a note of the encounter that night, before writing this account when updating his diary some days later. Although brief, the descriptions of the bird's plumage and behaviour, and noted similarity to the Ground Parrot (*Pezoporus wallicus*) which does not occur in central Australia, mean this previously unknown record is almost certainly the first documented sighting of the Night Parrot (*Pezoporus occidentalis*) by a European. 175 years later, Sturt's record is more than just a curio from the dawn of Australian ornithology. His report draws attention to an old problem: how we assemble and interpret a scientific record that relies largely on sight-based records, not specimens. Here we bring new perspectives to this problem, and the influence it can have on conservation outcomes.

What constitutes the 'accepted' scientific record is sometimes not clear. HANZAB (Higgins 1999) presents the single-most comprehensive record of Night Parrot sightings, detailing around 35 'confirmed' encounters, and several 'unverified' reports. As expected, most 'confirmed' sightings are from the late 19th century, with five between 1912 and 1990. This contradicts the oft-reported claim there had been no confirmed records between 1912 and 1990 (Garnett *et al.* 1993), which is true if only specimens represent confirmed sightings.

It is unusual that two such different narratives persist in parallel, derived from the same dataset. Why does one narrative claim multiple 'confirmed' records, while another claims few? Surely the catalogue of reported Night Parrot sightings has been carefully curated and exhaustively reviewed by experts? This is of course not true. Instead, the catalogue of historical Night Parrot sightings is a motley accumulation of evidence and anecdote; a few undisputed records supported by skins, alongside a healthy corpus of reports and recollections. Like Sturt's record, most are supported by nothing more than sketchy descriptions of a green parrot, speckled black.

For species like the Night Parrot, where a large proportion of the scientific record is sight-based records, this creates an issue. A scientific record that is a true representation of a species' distribution, status and population trajectory is the foundation of good conservation (Whittaker *et al.* 2005). It underpins any effort to understand the spatial and temporal patterns of occurrence that define a species' conservation status. If that scientific record relies largely on sight records, the process for assessing the veracity of those sight records will be the foundation for defining that species' conservation status.

The problems associated with trying to determine the veracity of a sight record are not new. While some reports of Night Parrots, and many other rare species, contain the descriptive detail necessary to easily establish their veracity, most do not. Necessarily, any assessment of veracity assumes good faith before quickly becoming a subjective decision considering specific and contextual information associated with the observation. A common example is reports by observers that have experience with a rare species, from known sites,

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but which lack detail. Should the observer's experience outweigh the lack of detail given the likelihood of occurrence? Conversely, an observer with no experience of a species might provide a detailed report, but from outside that species' usual range, or a brief report that inadvertently captures a species' key field marks, as Sturt did. Should Sturt's brief account qualify for acceptance? Would it be assessed differently if reported the same way in 2005?

Ultimately, the issue boils down to one question: what standard of proof is required to consider a sighting 'confirmed'? Requiring irrefutable evidence will see some legitimate records rejected. These 'false negatives', or type II errors, may obscure the actual presence of a species, as occurred with the Night Parrot's extinction narrative. Equally, reducing the required level of certainty increases the likelihood some illegitimate records will be 'accepted'. These 'false positives', or type I errors, potentially create the illusion of presence with repercussions for a species' conservation status and availability of funding. We know now the Night Parrot's persistence narrative was correct, at least in some places, but false positives however they arise, could have a serious impact on Night Parrot conservation (Olsen and Menkhorst 2020).

Because these deliberations introduce uncertainty into a scientific record, decisions about when to accept a sighting with minimal evidence, or when to require high evidentiary standards, must consider the implications of that decision. Reports of a genuinely common, well-known species from an expected location can be safely accepted with little evidence; the implications of accepting a false positive are not significant. Indeed, the same could apply to a rare species reported from a well-known location, demonstrating that reduced scrutiny is not a consequence of being common, but of the potential repercussions of a mistake.

If the common, well-known species was instead reported from an unexpected location where there has never been a photo or specimen taken, this may invoke scrutiny. Similarly, a report of a rare species from a location where there are no historical records but an undetected population could conceivably persist, should invoke scrutiny. However, the nature of the scrutiny will differ. Accepting a false positive record of a common species from an unexpected location might dilute an otherwise interesting local biogeographical phenomenon, but will not distort regional conservation policy. Conversely, accepting a false positive report of a rare or threatened species from a new location could have far-reaching implications for land managers and regulators. The required standard of evidence should be high, but how high? That decision depends on the repercussions of an error in either direction.

Because subjective decisions underlie what eventually becomes the 'scientific record' for rare species, the scientific record itself it cannot be viewed as infallible or static. This could lead to incorrect conclusions and poor decisions. Rather, the scientific record and resulting interpretations are mutable. It should be constantly reviewed to ensure it is fit-for-purpose. As new information comes to hand, the record should be reassessed. As the repercussions of an error and the balance of risk associated with maintaining an applied standard of certainty shifts, the record should be revised. The false positive record of the common species from an unexpected location, accepted when there was little at stake, should be carefully reviewed if due to a subsequent decline, the impact of a possible type I error is compounded. A conservative assessment made with acceptance of the increased likelihood of a type II error, may be more appropriate.

The Night Parrot again provides an example of this, illustrating how sight records are treated over time. Until 1870 at least, the Night Parrot was widespread, and probably common in the southern Lake Eyre Basin. In this context, acceptance of Sturt's relatively brief record is uncontroversial. However, recent claims from that region, supposedly supported by physical evidence, have rightly been subject to intense scrutiny and found to be wanting (Olsen and Menkhorst 2020). The resulting conclusion should not be that Night Parrots do not occur in the region. A sensible interpretation of historical sight records suggests the species could persist at low densities. Land managers and regulators should acknowledge this and manage the region's conservation values accordingly. Concurrently, the bar for proving the species' presence in the region can, and should, remain high.

Because interpretation of the scientific record, if not the record itself, is mutable, the scientific record is not just those records classified as 'confirmed', under circumstances appropriate at the time. Instead, it includes all those records that may be accepted or rejected as circumstances change. The inherent veracity of these records may never change, but through different interpretation, their contribution to our understanding of a species may. Had Sturt's record been made in 2005, it would not contain the detail necessary to be accepted as the first 'confirmed' sighting of a live Night Parrot in nearly a century. However, given the context, it contains enough detail to be considered a record of high veracity. It usefully adds to evidence that Night Parrots then occurred in the Lake Eyre Basin, in far south-western Queensland, despite no specimen records from that region. The risk of type I error is low, and the record is important for understanding historical changes in distribution and status. Also,

the conservation implications of incorrectly accepting it are not profound, given we now know Night Parrots do occur in that region.

In summary, we appeal to researchers, land managers and regulators to think critically about how we rely on the accepted scientific records for all threatened, declining, and poorly known species, particularly those species whose conservation status is based largely on sight records. Understand that the peer-reviewed scientific record you base your decisions on was created by applying a standard for certainty developed with a specific purpose in mind. It is prone to the same errors of omission and commission as any scientific conclusion, and may no longer be fit for that purpose. It is not the gospel.

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