

This submission is opposed to the **2023 Assessment** (Attachment A) that proposes to remove the Hardhead (*Aythya australis*) from the Vulnerable list. We support the original **2021 Assessment** (Attachment B) that justified the inclusion of this waterbird on that list under IUCN Criterion C. We also submit that this species meets IUCN Criterion A.

## **FLAWS IN THE 2023 ASSESSMENT**

The 2023 Assessment (hereafter referred to as “A23”) does not refer to the relevant provision of the FFG Regulations, but focuses on IUCN criteria as follows, with claims these have not been met.

### **IUCN Criterion A – Population size reduction**

- **EAWS**

A23 is incorrect in claiming the Eastern Australian Waterbird Aerial Survey (EAWS) data 1983-2022 (EAWS) supports its view. EAWS claims there is no trend for the Hardhead across the (now 41) years of its survey. However IUCN Criterion A states any changes must be “*measured over the longer of 10 years or 3 generations*”. Both A23 and the 2021 Assessment (hereafter referred to as “A21”) state that the “*generation length of the Hardhead is estimated to be 6 to 8 years*”. Taking a mid-point of 7 years, we need to consider what has occurred over a timespan of approximately 21 years.

There is a clear decline in the last 21 years – refer trend line in Fig 1.

Further, our analysis of Hardhead abundance from EAWS data shows that the median value for the period 1983-2003 was 14,081 and the median value for the period 2003-2023 was 8,495, a decrease of 40%.

Hence, contrary to the claim in A23, this DOES meet the threshold for eligibility under criterion A2.

Our Fig 1 is a plot of the EAWS data with a regression (trend) line added. There is a clear downward trend, but due to the extreme variability of this species, the data points are spread quite widely above and below the line. That likely explains why the EAWS analysis obtains a high “p” value and concludes there is “no trend”.

For such a fluctuating species, declines are best estimated by the trend line. **This indicates likely extinction by mid-century. It also indicates decline of more than 30% in the last 21 years, which meets criterion A2.**

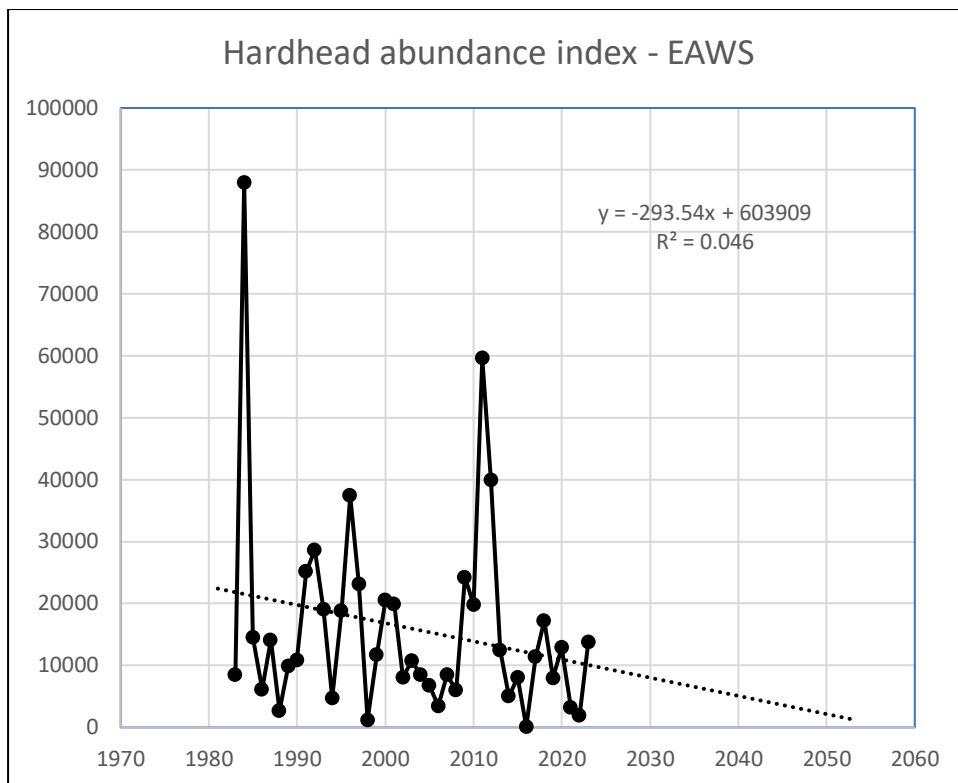


Fig 1: Plot of EAWS abundance index for Hardhead (1983-2023); trend line added.

- **Victorian Duck Season Priority Waterbird Counts (PWC) 2014-2021**

This data is inappropriate for use in A23 because the 8-year data set is too short to be used for IUCN Criterion A, which needs a timescale of 3 generations (approx. 21 years) in this case.

Even if the earlier Summer Waterbird Counts (SWC) are included, extending the data back to 1987, it is inappropriate for trend analysis because:

- The number of wetlands surveyed is inconsistent, varying enormously from year to year (e.g. the average is 284 wetlands but the peak was 786 wetlands in 1991); and
- In many years some of the counts have been performed by volunteers from hunting groups who may have lacked skill in species identification and accurate counting, and who had a clear conflict of interest (higher numbers are favourable for duck policy decisions). Birdlife and Field Naturalist volunteers have also been involved but have no vested interest in inflating the numbers.

Qualitative corroborating evidence can be found in the NSW Riverina survey report<sup>1</sup>. While its results are controversial (for example the survey uses the controversial N-mixture modelling technique discussed later in this submission), it regularly repeats a warning for minor species like the Hardhead:

<sup>1</sup> [https://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0017/1483100/2023-24-ngb-quota-report.pdf](https://www.dpi.nsw.gov.au/_data/assets/pdf_file/0017/1483100/2023-24-ngb-quota-report.pdf)

See p.18

*“... the population dynamics of the other species (such as Pink-eared Ducks, Plumed Whistling-Ducks, Blue-winged Shoveler, Chestnut Teal, **Hardhead**, and Australian Shelduck) have not shown to respond predictably to changes in climate or only occur in low abundance throughout the Riverina.”*

- Eligibility under A3 and A4:

We draw attention to the fact that the Hardhead is mainly supported by an artificial habitat, namely the sewage ponds at the Western Treatment Plant (WTP), an 11,000 ha site managed by Melbourne Water. Recent figures from the PWC (Table 1 below) illustrate this, with at least two-thirds or even more of the counts based at the WTP.

The WTP habitat is at risk (as are the Hardhead that rely on it) due to rising sea level from global warming. The Port Phillip Bay Coastal Hazard Assessment (PPBCHA) has been modelling the impacts on WTP and other vulnerable areas from erosion, inundation and critically, groundwater (salt content):

- Erosion – refer p.10:  
[https://www.marineandcoasts.vic.gov.au/\\_data/assets/pdf\\_file/0022/693400/PPBCHA-communications-summary6-erosion-hazard-assessment.pdf](https://www.marineandcoasts.vic.gov.au/_data/assets/pdf_file/0022/693400/PPBCHA-communications-summary6-erosion-hazard-assessment.pdf)
- inundation – refer p.12:  
[https://www.marineandcoasts.vic.gov.au/\\_data/assets/pdf\\_file/0038/693398/PPBCHA-communications-summary4-inundation-hazard-assessment.pdf](https://www.marineandcoasts.vic.gov.au/_data/assets/pdf_file/0038/693398/PPBCHA-communications-summary4-inundation-hazard-assessment.pdf) and
- groundwater (salinity): see p.10 that states: *“The Bay’s western shoreline – including ... the Bellarine Peninsula Ramsar site [WTP] may be increasingly impacted.”*  
[https://www.marineandcoasts.vic.gov.au/\\_data/assets/pdf\\_file/0039/693399/PPBCHA-communications-summary5-groundwater-hazard-assessment.pdf](https://www.marineandcoasts.vic.gov.au/_data/assets/pdf_file/0039/693399/PPBCHA-communications-summary5-groundwater-hazard-assessment.pdf)

This map of the WTP shows how close to the ocean the WTP sewage ponds are:

<https://static1.squarespace.com/static/589bf93b9f7456ed1d1b9be2/t/58d32e02e3df28a02496d03c/1490234895654/Western+Treatment+Plant+Bird+Watching+Map%5B1%5D.pdf>

If WTP becomes unsuitable for the Hardhead, then the Victorian population can be expected to drop by approximately two-thirds (67%) or more in the future –further satisfying A3. Together with our earlier comments about past decline, we submit that A4 is also met.

## IUCN Criterion C – Small population size and decline

- A23 suggests an average estimate (18,700) of mature Hardhead 2014-2021. The estimate is false and misleading.

YEAR	Wetlands surveyed	Total Hardhead in VIC	Hardhead at Western Treatment Plant (WTP)	Percentage of Hardhead at WTP	Total game ducks counted
2021	84	NA *	NA *	NA *	45,730
2020	59	NA *	NA *	NA *	3,250
2019	135	16,870	11,511	68	225,733
2018	144	24,473	21,655	88	262,397
2017	104	19,296	12,430	64	283,430
2016	125	2,059	1,318	64	74,452
2015	126	2,479	1,936	78	74,290
2014	166	16,347	11,733	72	267,055

*Table 1 – Published data for Hardhead, extracted from GMA reports of PWC.*

*\* Covid-affected years: For 2020 and 2021 respectively, minor species (including Hardhead) were grouped, and reported only as 17% (5 species) and 14% (4 species) of game ducks.*

Given the date range and GMA reference, it seems this estimate of 18,700 is related to the PWC 2014-2021. However the correct average is 13,587 over the 6 years of published data that are available in this table (2014-2019). Further, when approximations for the low counts in 2020 and 2021 are included, this substantially reduces the average to the order of 10,000. It is important to note the very low counts that occurred in 2015 and 2016 – these are well below the IUCN threshold of 10,000.

Although, as mentioned above, the PWC may suffer from an inflationary bias, it is likely that the relationship between total Hardhead and those found at the WTP is meaningful. At least two-thirds (64% to 88%) of our Hardhead are located in one population, at the WTP. The 2017 report of the PWC<sup>2</sup> states that the WTP provides important refuge for **the two “least common game ducks” – Hardhead and Blue-Winged Shoveler.**

A reasonable estimate can be made by combining the percentages from the above Table with the data from a meticulous study (Loyn et al 2014<sup>3</sup>) at the WTP during the 12-year period 2000 – 2012, where waterbirds were counted six times per year. Importantly, A23 quotes only one figure from that report, namely the highest average (4,800), after the Millennium drought broke. This is misleading.

<sup>2</sup> [https://www.gma.vic.gov.au/data/assets/pdf\\_file/0007/513673/Victorian-summer-waterbird-count-2017-final-reformatted.pdf](https://www.gma.vic.gov.au/data/assets/pdf_file/0007/513673/Victorian-summer-waterbird-count-2017-final-reformatted.pdf) See p.8.

<sup>3</sup> R.H. Loyn, D.I. Rogers, R.J. Swindley, K.Stamation, P. Macak and P. Menkhorst, ARI Technical Report Series No. 256, 2014: *Waterbird Monitoring at the Western Treatment Plant 2000-12*

If that 4,800 figure:

- represents 2/3 of the Victorian total (as in 2019 in the above Table), then the Victorian total would be 7,200.
- represents 88% of the Victorian total (as in 2018 in the above Table), then the Victorian total would be only 5,455.

In fact, Loyn et al quote four averages, one for each stage of the cycle of drought and rains. Overall, the average Hardhead figure for the 12 years (2000-2012) is only 3,429 (significantly less than the 4,800 quoted) but the maximum count recorded is 15,518. This illustrates the significant variability of the species, a relevant point for IUCN criterion C (C2(b)).

Fig 2 shows significant Hardhead fluctuations within each year at WTP, as well as longer-term trends. The Hardhead does not generally breed in Victoria, but flies north for that purpose<sup>4</sup>. For such a fluctuating species, it is important to count during the year, rather than just taking a “snapshot” count once a year (as GMA does).

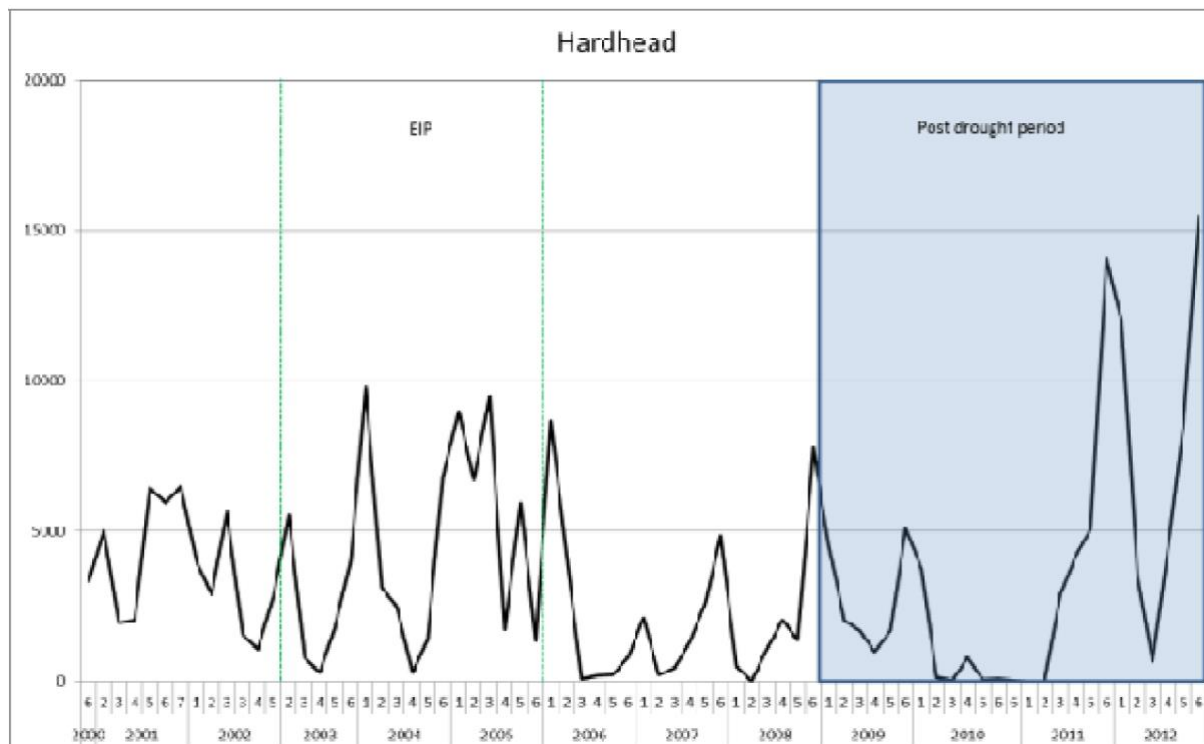


Fig 2: Loyn et al (p.22): Hardhead at WTP: 2000-2012

In 2022 and again in 2023 (with Hardhead officially on the Threatened list), the government banned the shooting of Hardhead for that season only. So, if the Hardhead is removed from the Threatened listing, it will most likely become fully available for shooting (up to 10 birds per hunter, for each day of a three-month shooting season), further risking the population.

<sup>4</sup> The *Waterbirds of Australia*, Australian Museum, 1985. See p. 200. See also further discussion later in this submission..

Additional WTP data (Fig 3) for the 23 years (2001-2023) emphasizes the extreme variability of Hardhead populations. There are 8 data points above 10,000 and 15 points below 10,000. Note the 10 data points on or below 5,000.

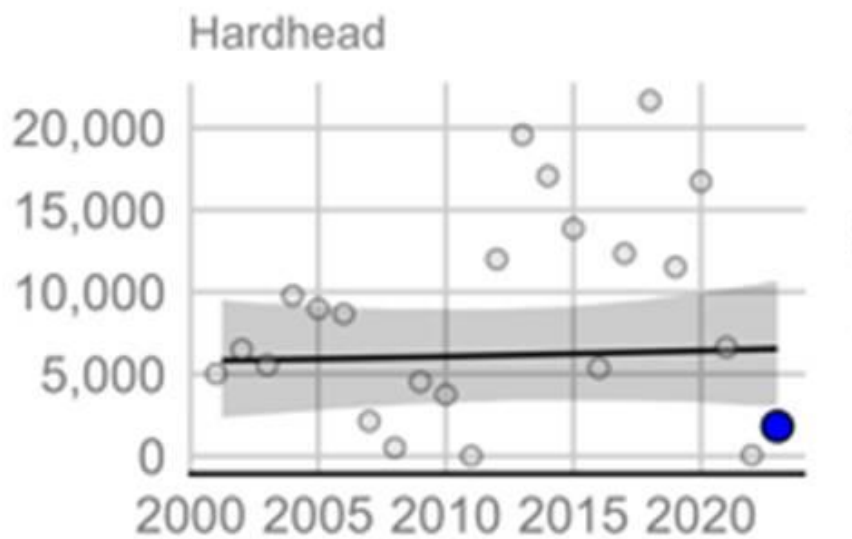


Fig 3: WTP annual counts of Hardhead (personal communication 18.1.24): This data is averaged, based on counts 6 times a year (2000-2018); later it was 3 times a year.

- Reliance on the experimental new (highly mathematical) aerial survey of game ducks in Victoria

A23 appears to rely heavily on two estimates from a controversial new aerial survey designed and analysed by Dr Ramsay and Dr Fanson at Arthur Rylah Insititute (ARI). (*Little else has changed since A21*).

This survey acknowledges that its results are inaccurate for the rarer species such as Hardhead:

- In 2020, the first “trial” year of its operation, [the survey counted only 441 Hardhead](#)<sup>5</sup> but this number was extrapolated up to 55,300 Hardhead. It acknowledged the unacceptable accuracy for this figure; its Coefficient of Variation (a measure of error) was 0.51<sup>6</sup>, the least accurate result for any of the species estimated that year.
- In September 2021, the study was subjected to [independent peer review](#) by Prof Kingsford (UNSW ecologist and EAWS leader) and Dr Prowse (mathematician from University of Adelaide). Their report was very diplomatic but pointed out a number of shortcomings, most of which would likely inflate the results, for example over-correction for possible under-detection of birds by observers. To our knowledge, there has been no follow-up review to assess ongoing flaws in the approach.

<sup>5</sup> See p.16 and p.18

<sup>6</sup> The authors state the Coefficient of Variation should be below 0.15.

- In [2021, the aerial survey was repeated](#) and A23 quotes its estimate of 13,300 Hardhead, again not mentioning that the accuracy of this result was acknowledged by Ramsay and Fanson to be unacceptable (its Coefficient of Variation was 0.30, twice the acceptable value).<sup>7</sup>

Surprisingly, A23 fails to mention the results of [ARI's 2022 survey](#) which reported that across the state, only 41 Hardhead were counted (0.2% of total count). **This figure was so low that no population estimate was made for Hardhead in 2022.**<sup>8</sup>

While the mathematics underlying these surveys is highly specialised and complex, it has been criticised by experts in the field. The surveys make use of a technique known as “N-mixture modelling”, which was developed in 2004 and has since become popular for wildlife surveys because it reduces the amount of data required. However, in a recent damning critique, Link et al<sup>9</sup> write:

:  
*“Our attention to the N-mixture models is prompted by their obvious and critical dependence on assumptions in place of data. There is no such thing as a free lunch: extra data have been replaced with extra assumptions, and the assumptions are stringent. Small, undetectable violations of assumptions lead to substantial biases. Similar concerns regarding N-mixture models are being expressed by other authors...”*

GMA/ARI have stated that harvest records can be used as a proxy to study population trends. Within Victoria, the GMA harvest reports<sup>10</sup> show that hunters have found few Hardhead recently:

- 2019: 621 Hardhead in a total harvest of 238,666 (0.2% of harvest)
- 2020: zero Hardhead in a Covid-affected harvest of 60,403 (0% of harvest)
- 2021: 61 Hardhead in a Covid-affected harvest of 52,456. (0.1% of harvest)
- 2022 and 2023: Hardhead temporarily protected due to its Threatened listing.

Further, the renowned bird expert H.J. Frith wrote in 1982<sup>11</sup>: *“owing to a very dense plumage and apparently great stamina, [the Hardhead] is hard to kill. When wounded it swims and dives expertly and is hard to retrieve – **perhaps more crippled Hardhead are lost than any other species.**”* [emphasis added.]

So the fact that shooters failed to “bag” many Hardhead does not indicate that they failed to wound them. It is widely acknowledged, even by the GMA, that most wounded birds do not survive.

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<sup>7</sup> See p.15.

<sup>8</sup> See p.13 and p.18.

<sup>9</sup>Link, W. A., Schofield, M. R., Barker, R. J., and Sauer, J. R. (2018). *On the robustness of N-mixture models. Ecology* 99, 1547-1551. doi:10.1002/ecy.2362 See page 1551.

<sup>10</sup> Available from <https://www.gma.vic.gov.au/research/duck-research>

<sup>11</sup> Op. cit. p.257.

Despite these undocumented losses, the above harvest results cast further doubt on the ARI aerial surveys (quoted in A23) that suggest Hardhead populations of 55,300 (in 2020) and 13,300 (in 2021).

We submit that the Hardhead does satisfy IUCN Criterion C (Small Population size and decline) and that it further satisfies both C1 (as shown by trend line on EAWS graph, our Fig.1 above) and C2(a)(ii) because the species does not generally breed in Victoria, so the Victorian sub-population is almost 100% mature individuals.

For evidence to support the claim that Hardhead do not breed in Victoria, we refer to “*The Waterbirds of Australia*” published by the Australian Museum in 1985 (p200). This was a Bicentennial project and it garnered information and photographs from bird experts and observers around Australia. For corroborating observations, we quote from the annual reports of the Field & Game Association (FGA), some of which include count data for broods as well as ducks. For Hardhead broods, FGA reported:

2013-14: 0 broods

2014-15: 1 brood

2015-16: 1 brood

2016-17: 22 broods (1% of total broods in a prolific year)

2017-18: 0 broods

2018-19: no information about game duck broods.

The *Waterbirds of Australia* repeats the concern of renowned expert H.J. Frith, that in light of the hunting toll on the Hardhead, there must be “*serious doubts for its survival as a common species*”. We note that A21 quoted Frith’s view (1977) that Hardhead is in greater danger than any other waterfowl in southern Australia. We concur with A 21 that loss of habitat is a threat and will not be reversed anytime soon but will likely continue. Along with climate change, the species is expected to continue its decline.

We also contend that Criterion C2 (b) is satisfied. The Hardhead population in Victoria appears to be highly variable as discussed above.

In light of the PPBCHA concerns referred to previously in this submission, it is likely that the Hardhead’s main Victorian habitat (WTP) will be seriously impaired during this century, resulting in further significant decline of this species. Hence Criterion C1 is also satisfied for Vulnerable status.

We also contend that the Hardhead satisfies criterion 5.1.3 in the FFGA Regulations 2020, specifically under its sub-paragraphs (a) and (b)(ii) and (iii). This submission has addressed all the aspects relevant to this claim:

*Sub-criterion 5.1.3*

*The estimated total number of mature individual members of the taxon is moderately low and evidence suggests that—*

*(a) the number will continue to decline at a substantial rate; or*



- (b) the number is likely to continue to decline and any one of the following apply—*  
*(i) each subpopulation is small;*  
*(ii) most of the individual members are in one subpopulation;*  
*(iii) extreme fluctuations occur in the number of mature individual members.*

We draw attention to s4A of the FFGA Act 1988 that sets out principles for processes and decisions. It is thus necessary for the Committee to give proper consideration to:

- (b) the potential impacts of climate change;
- (c) the best practicably available information relevant to biodiversity;
- (d) the precautionary principle, such that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- (e) enabling public participation;

It is difficult to understand why the Hardhead would be removed from the threatened list so soon after it was added, especially in light of its dramatically fluctuating numbers, coupled with long-term decline, and in the face of climate change and habitat loss.

## **CONCLUSION:**

As discussed in this submission, the available data does not support the removal of *Aythya australis* (Hardhead) from the Threatened list.

We have affirmed the grounds on which A21 relied - IUCN Criterion C(C2(a)(ii)). Our submission is in line with the Global Biodiversity Framework, in particular Australia's commitment to zero new extinctions.

We have also identified wider grounds to support inclusion of Hardhead as a Threatened species - IUCN Criterion A (A2, A3 and A4); and IUCN Criterion C (C1 and/or C2(b)).