Eastern Australian Waterbird Aerial Survey - October 2022 Annual Summary Report

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2022 Eastern Australian Waterbird Aerial Survey
Annual Summary Report

Aim:

The annual Eastern Australian Waterbird Aerial Survey (EAWS) began in 1983 to monitor annual continental scale changes in the distribution and abundance of waterbirds and their breeding, as well as the extent of wetland habitats over time.

Methods:

Methods are described in detail in Braithwaite et al. (1985) and Kingsford et al. (2020) – a short description follows here. All waterbirds (including nests and broods) were counted from high-winged aircraft (e.g. Cessna 206 or 208) at 167–204 km hr−1 and a height of 30–46 m, within 150 m of the wetland's shoreline where waterbirds concentrated. A front-right observer (navigator) and a back-left observer independently record counts on audio recorders, with their combined counts making up a completed count. Counts are attributed on the recorder to a unique number for each wetland, and a geolocation (longitude, latitude), as well as the exact time of day the count commenced. All timing is synchronised to GPS time – this enables audio counts to be linked to location via a GPS track log of the flight path. The percent fullness (inundated area) of each wetland is also estimated, relative to the mapped high water mark. Inundated areas (ha) are also estimated for wetlands which are not mapped.

An area of 2,697,000 km^2 is systematically sampled with ten survey bands 30 km in width, spaced every 2° of latitude from 38°30'S to 20°30'S. Waterbirds are counted on all waterbodies (river and wetlands) larger than 1 ha within survey bands; additional counts are made on an ad-hoc basis of wetlands smaller than 1 ha. This ensures information is collected across a representative sample of waterbodies (wetlands, dams, lakes, estuaries and rivers).

All waterbirds are identified to species, except those few that cannot be consistently identified to species' level from the air and were grouped: small grebes (Australasian Little Grebe, Hoary Headed Grebe), small egrets (Cattle Egret, Little Egret and Intermediate Egret), terns and small and large migratory wading birds (Charadriformes). Counts of no birds are also recorded, as are dry wetlands. Waterbirds are counted singly and in groups, progressively increasing up to 1,000 individuals.

Three counting techniques are used: total counts, proportion counts and transect counts. For total counts, all birds are counted during a circumnavigation of the wetland, the preferred method for wetlands with large concentrations of waterbirds. For proportion counts, a proportion (usually >50%) of a large wetland with few water-birds (e.g. large dam) is surveyed, with counts extrapolated to give total counts. For the final transect method, waterbirds are counted within 200 m-wide transects (100 m on each side of the aircraft, delineated by tape markers on each aircraft wing strut), a technique only used for braided complex large wetlands. Total estimates are formed from the relative area of the transects, compared to total area flooded. Most counts are total counts or proportion counts greater than 50%.

2022 Eastern Australian Waterbird Aerial Survey Summary

1. Australia's climate has warmed by around 1.47°C since 1910 (BOM 2022[a]). There has also been a trend towards a greater proportion of rainfall from high intensity short duration rainfall events, especially across northern Australia (BOM 2022[b]).

2. The 2022 eastern Australia floods were one of the continent's highest on record in some places, from February to November, primarily in south east Queensland, northern coastal New South Wales, the Central Coast and parts of Sydney. For Australia as a whole, October rainfall was the second-highest on record. Rainfall was just or significantly above average for most of Australia, and highest on record for large parts of the Murray–Darling Basin in New South Wales and Victoria (BOM 2022). Major rivers in the central and southern Murray-Darling Basin experienced some of the highest flood levels recorded.

3. The combined storages in the Murray–Darling Basin were 101% full. This is up from 90% at the end of October last year. However, low storage conditions continued in some parts of central Queensland, south-east New South Wales, and the Wimmera–Mallee region of the Murray–Darling Basin. (BOM 2022)

4. Multi-year rainfall deficiencies, originating from the 2017–2019 drought, have been almost entirely removed from the eastern states following the heavy cool season rain. Pockets of rainfall deficiencies or below average rainfall remain in Queensland and south-eastern South Australia (BOM 2022).

5. Despite record breaking rainfall in much of the Murray-Darling Basin, around 41% of Queensland was in drought or drought affected[3] (as of November 2022); in NSW 0% of the state was in drought or drought affected[2]. South Australian and Victorian drought maps are not available.

6. Despite two successive La Niňa years three major indices for waterbirds (total abundance, number of species breeding and wetland area index) continued to show significant declines over time. If 1983 & 1984 peak years are omitted then 3 of the 4 major indices still showed significant decline (OLS regression at p=0.05; variables 4th root or log transformed where appropriate and autocorrelation plots examined for serial autocorrelation; Fig. 1; Table 1). Long term trends are more informative for predicting population status than year to year fluctuations.

7. Total waterbird abundance in 2022 (n=187,175) increased significantly from 2021 but still remained well below the long term average: the 11th lowest in 40 years. Waterbirds were most abundant in Survey Bands 3 and 5 (Figs 2 & 5), largely concentrated in the Lowbidgee and Macquarie Marshes wetlands.

8. Breeding species' richness and breeding abundance, increased considerably compared to the previous year; breeding largely occurred in Survey Bands 3, 4 and 5 (Fig. 6) and comprised mostly Straw-necked Ibis, Royal Spoonbill, Pelicans, egrets and Whiskered Terns.

9. Species functional response groups (feeding guilds) all showed significant long term declines (OLS regression at p=0.05; variables 4th root or log transformed where appropriate and autocorrelation plots examined for serial autocorrelation. Fig. 3; Table 2). Long term changes were also observed in decadal averages of total abundance, wetland area index, breeding index and breeding species' richness (Fig. 4).

2022 Eastern Australian Waterbird Aerial Survey Summary (continued)

10. Wetland area index (326,769 ha), increased sharply from the previous year, well above the long term average for the first time since 2012. Central Australia did not receive heavy rainfalls that were seen in the south east and coastal areas and Lake Eyre only had minor flooding. Some rivers and wetlands in the northern Lake Eyre Basin including the Diamantina and Georgina rivers, experienced a small to moderate flood and supported low numbers of waterbirds. Lakes Torquinnie, Mumbleberry and Galilee had little flooding with small numbers of waterbirds; The largest concentrations of waterbirds were located in the Macquarie Marshes, Lowbidgee wetlands, Talyawalka Creek, Menindee Lakes and Lake Moondarra in the north (Fig. 5).

11. The Macquarie Marshes had extensive flooding and supported large numbers and diversity of waterbirds. The Lowbidgee wetlands also experienced extensive inundation, and supported very high numbers of waterbirds with large breeding colonies in the Gayini wetlands. Most wetlands in the regulated Menindee Lakes system were full, including outside the survey band to the north - Copi Hollow and Lakes Wetherell, Pamamaroo, Bijiji and Balaka. Overall, there were moderate waterbird numbers and breeding activity on these wetlands. The Talywalka Lakes system also held considerable water and moderate to high numbers of waterbirds (Fig. 7).

12. Waterbirds had 75% of their total abundance concentrated in a small number (eight) of wetlands; two of these wetlands supported more than 120,000 waterbirds representing 65% of the total abundance – both of them (Lowbidgee wetlands and Macquarie Marshes) occur in the Murray-Darling Basin (Fig. 5). These wetlands generally supported large breeding aggregations and high species diversity (Figs 2 & 6). Conversely around 41% of surveyed wetlands supported no waterbirds (includes wetlands that were dry).

13. Total breeding index (nests + broods) was 60,580 (all species combined), an order of magnitude increase from the previous year (2,494) and well above the long-term average (Figs. 1 & 6). Breeding species' richness also increased steeply with 21 species recorded breeding well above the long term average and the fifth highest on record. Five species comprised 96% of the total breeding recorded, primarily numbers of nests (straw-necked ibis,48,505; Australian Pelican 5,000; Royal Spoonbill 1,794; Whiskered tern 1,619, and; egrets 1,167).

14. Most game species of ducks had abundances well below long term averages, in some cases by an order of magnitude; six out of eight species continued to show significant long term declines (OLS regression at p=0.05; variables 4th root or log transformed where appropriate Table 3). Grey Teal declined from the previous year. Australian Wood Duck was the only species above (slightly) the long term average (Fig. 19). Some duck species declined in abundance compared to 2021 – Grey Teal, Pink-eared Duck and Hardhead.

15. Waterbird indices (abundance, breeding species richness), across river basins responded to widespread rainfall and intense flooding and generally reflected extensive areas of habitat; 2022 overall abundance increased, and wetland areas increased in the Murray-Darling Basin compared to the previous year (Fig. 8). Species relative abundances were relatively even compared to previous years – with 11 species comprising 70% of total abundance. These species were, in order of decreasing abundance: straw-necked ibis, grey teal, whiskered terns egrets, Australian Wood Duck, small waders, Black Swans, Great Cormorants, Pacific Black Duck, Black-winged Stilts and Little Black Cormorants.

2022 Eastern Australian Waterbird Aerial Survey Summary (continued)

16. Selected species distribution and abundances are shown in Figures 10-19; Freckled Duck and Plumed Whistling Duck were included for comparison with game species. Map plots in these figures show 2022 distribution and trend plots show changes in abundance over time (1983-2022). Horizontal lines in trend plots indicate the long-term average.

17. Across Eastern Australia overall abundance, breeding index and breeding species richness were positively related to available habitat (wetland area index). Conversely, declines in wetland area were likely to result in declines in waterbird abundance, breeding and breeding species richness (Fig. 9).

This survey is managed by the Centre for Ecosystem Science, University of NSW and resourced by the NSW Department of Planning & Environment, the South Australian Department for Environment and Water, the Queensland Department of Environment and Science, the Victorian Department of Environment, Land, Water & Planning and the Victorian Game Management Authority. The Murray-Darling Basin Authority funds complementary surveys in the Murray-Darling Basin.

We thank Sharon Ryall for help with logistics, along with staff from our collaborative agencies. We also thank Alex Katopodis and Tim Dugan of NSW National Parks and Wildlife, for piloting the aircraft and Paul Wainwright (SA Landscapes), Terry Korn, Scott Henshall (VIC GMA), Heath Dunstan (VIC GMA), Shannon Dundas (NSW DPI) and Lauren McLeod (MDBA) for acting as aerial observers. We also thank Matt Smith, Matt Davis, Julie Hall, Jan Kreibich, Skye Davis, Ada Sanchez-Mercado, Zoe Ford, Julie Hall, Ben Walker and Daniel Simpson for support, data entry and management, graphics and quality assurance. Cover Picture: Main Richard Kingsford.

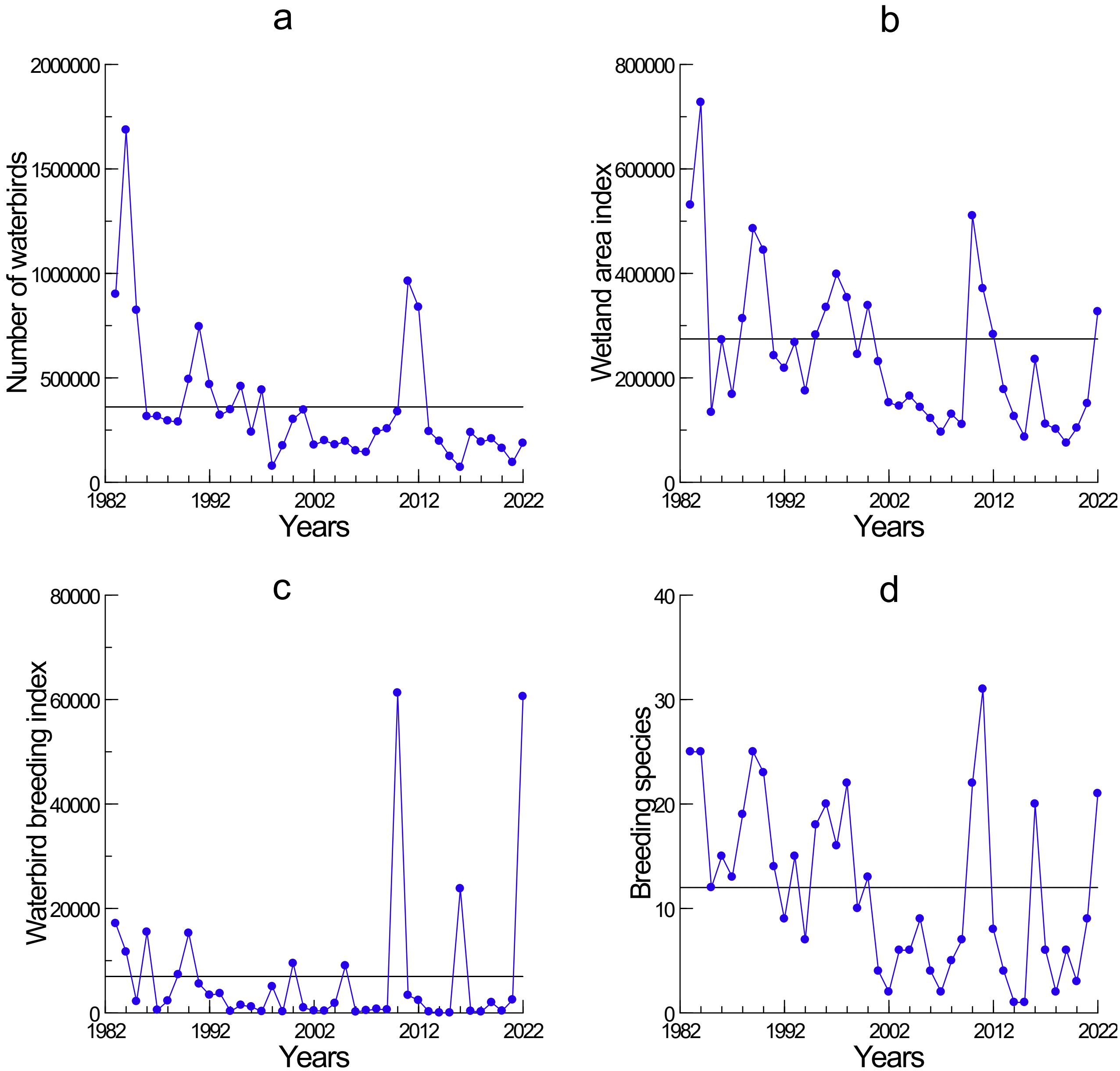


Figure 1. Changes over time in a) total abundance, b) wetland area, c) breeding and d) number of breeding species in the Eastern Australian Waterbird Aerial Survey (1983-2022); horizontal lines show long-term averages.

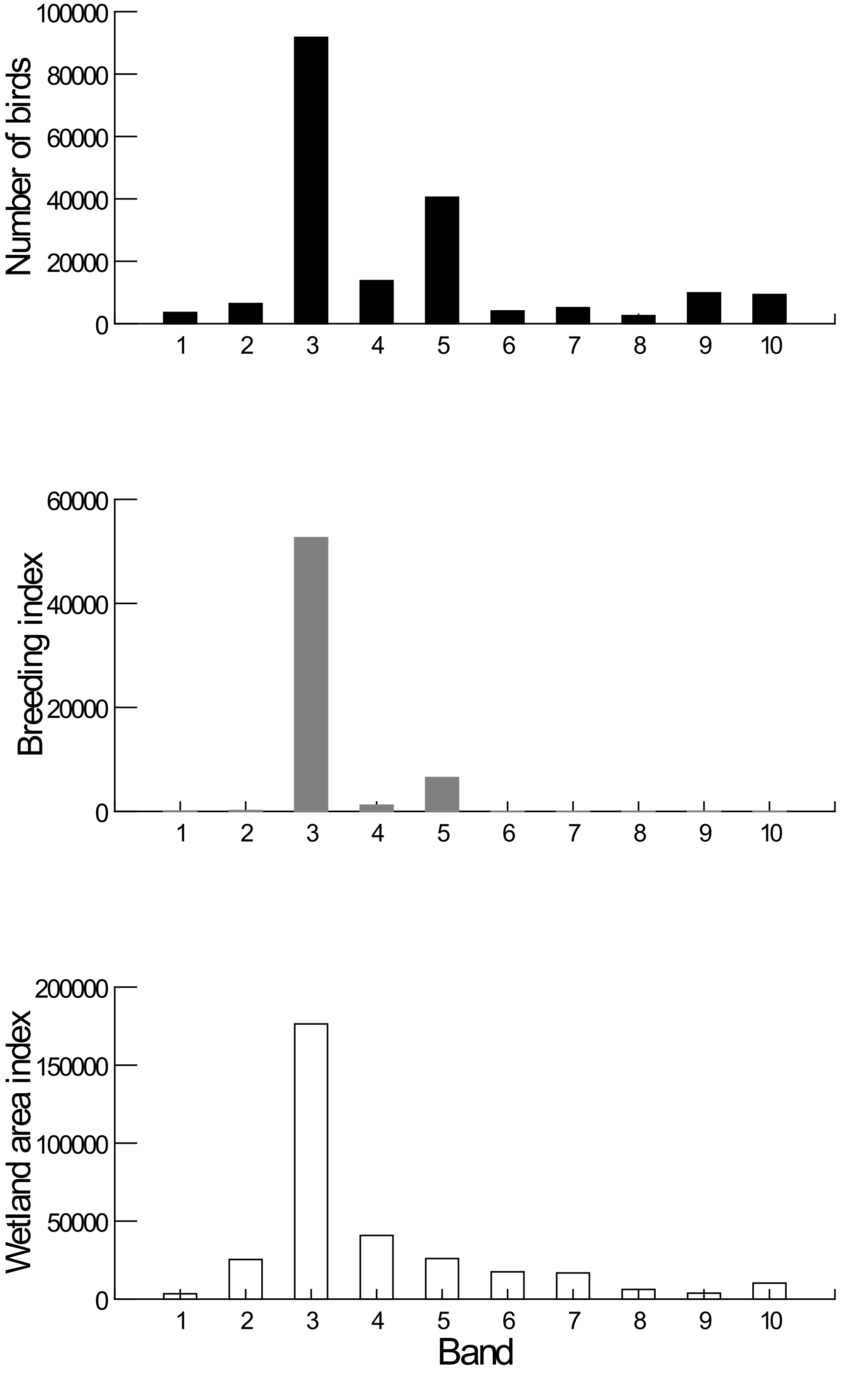


Figure 2. Distribution of waterbird abundance, breeding index and wetland area index in survey bands 1-10 (south to north respectively) of the Eastern Australian Waterbird Aerial Survey in 2022.

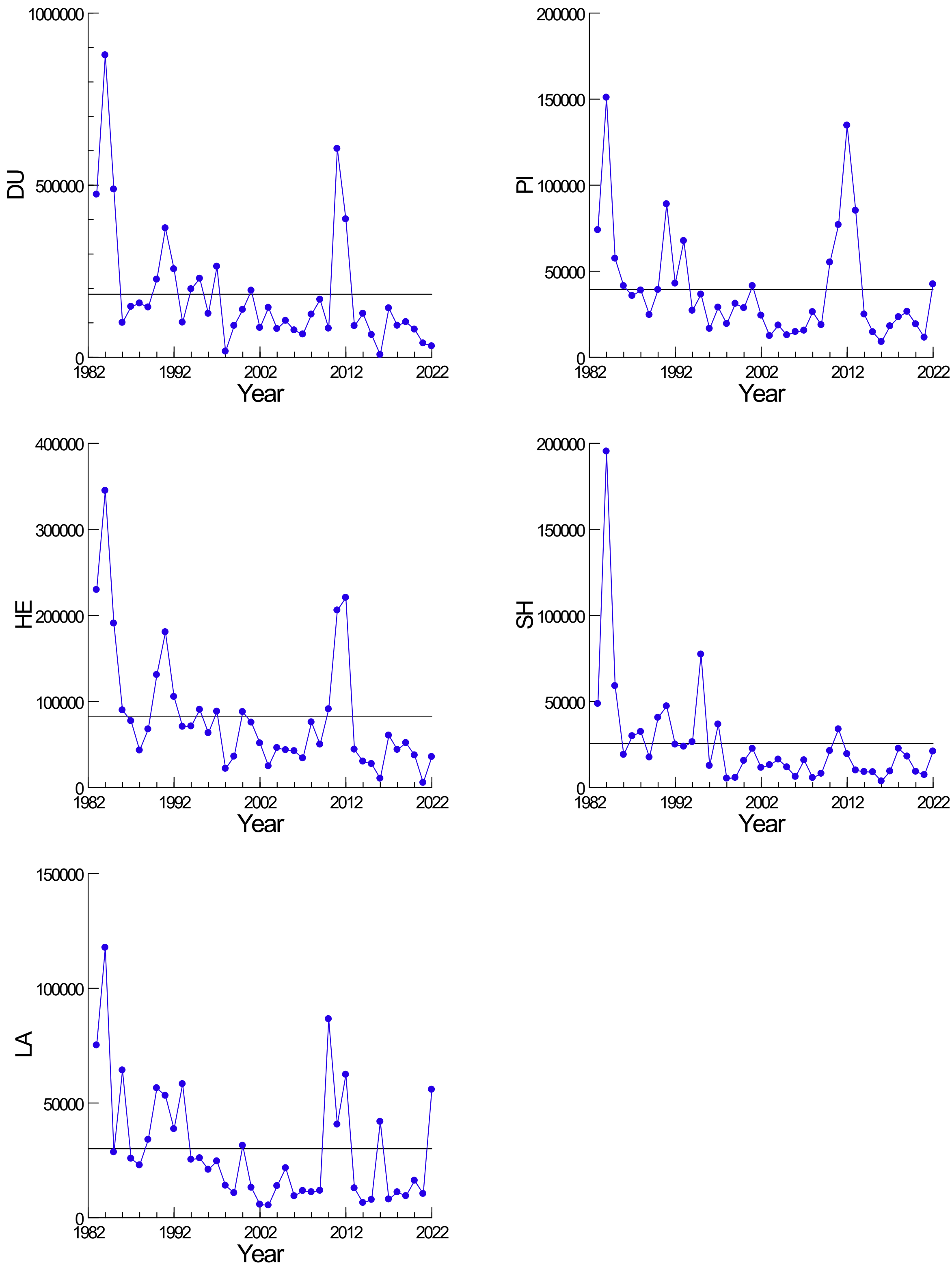


Figure 3. Changes in abundances of waterbird functional response groups (Du=ducks; Pi=piscivores; He=herbivores; Sh=shorebirds; La=large wading birds) over time in the Eastern Australian Waterbird Aerial Survey (1983-2022).

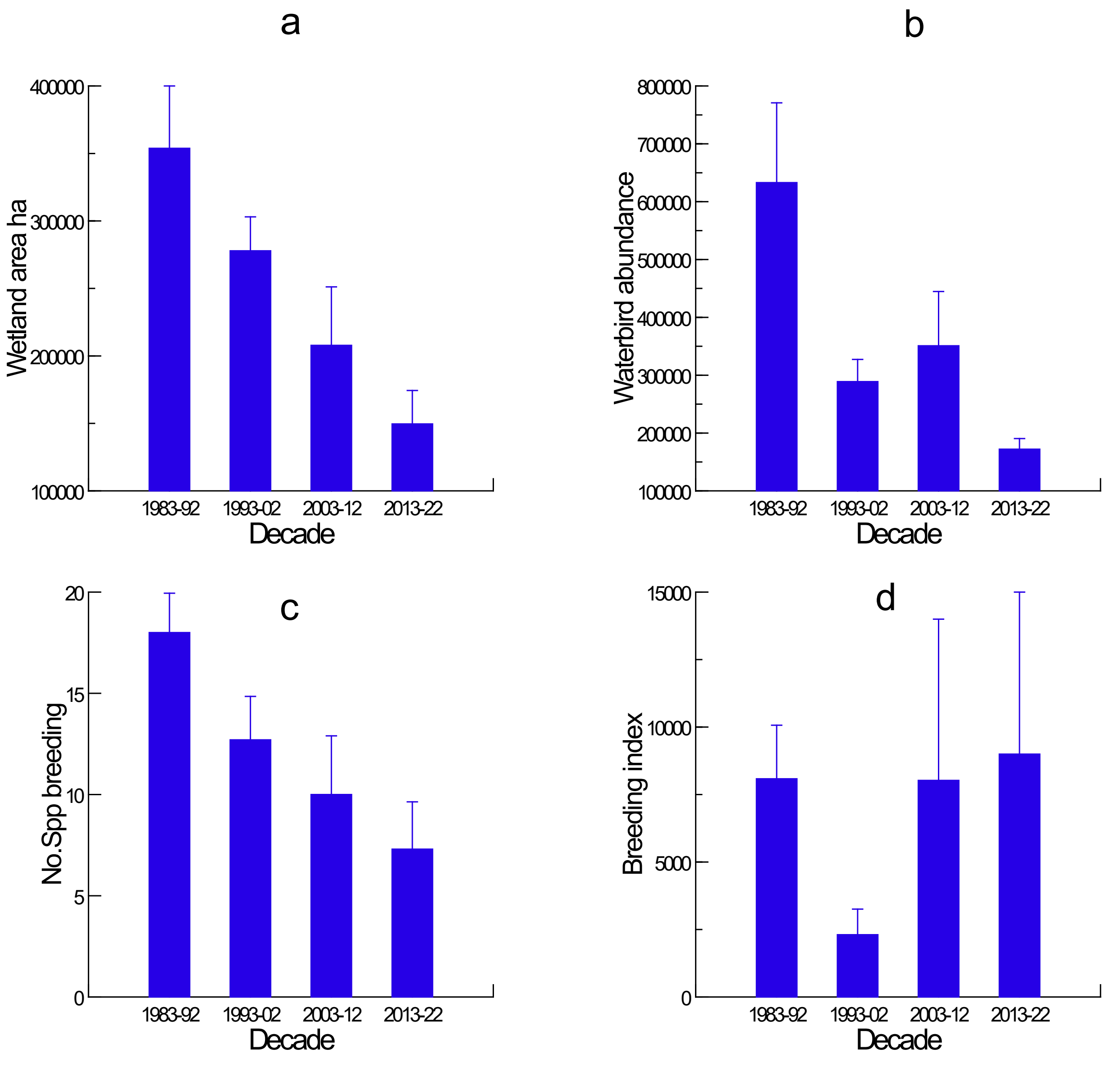


Figure 4. Decadal means of a) wetland area, b) total abundance, c) number of breeding species and d) breeding index in the Eastern Australian Waterbird Aerial Survey (1983-2022). Error bars are SE.

Table 1. Trends in total waterbird abundance, wetland area index, breeding index and breeding species richness in the Eastern Australian Waterbird Aerial Survey (1983-2022).

Variable	Trend	Regression all years	Trend	Regression 1983-84 omitted
Total waterbird abundance	decline	r^2=0.29, p<0.001	decline	r^2=0.20, p=0.005
Wetland area index	decline	r^2=0.29, p<0.001	decline	r^2=0.20, p=0.004
Breeding index	decline	r^2=0.03, p=0.278	no trend	r^2=0.01, p=0.627
Breeding species richness	decline	r^2=0.20, p=0.004	decline	r^2=0.13, p=0.027

Table 2. Trends in abundances of functional response (Fx) groups, in the Eastern Australian Waterbird Aerial Survey (1983-2022).

Fx group code	name	Trend	Regression all years	Trend	Regression 1983-84 omitted
Du	Ducks	decline	r^2=0.29, p<0.001	decline	r^2=0.20, p=0.004
He	Herbivores	decline	r^2=0.29, p<0.001	decline	r^2=0.19, p=0.006
La	Large wading birds	decline	r^2=0.21, p<0.003	decline	r^2=0.12, p=0.032
Pi	Piscivores	decline	r^2=0.15, p=0.015	no trend	r^2=0.07, p=0.117
Sh	Shorebirds	decline	r^2=0.35, p<0.001	decline	r^2=0.28, p=0.001

Table 3. Trends in abundances of game species from the Eastern Australian Waterbird Aerial Survey (1983-2022).

Species	Trend	Regression all years	Trend	Regression 1983-84 omitted
Pacific black duck	decline	r^2=0.32, p<0.001	decline	r^2=0.21, p=0.004
Australasian shoveler	decline	r^2=0.54, p<0.001	decline	r^2=0.49, p<0.001
Chestnut teal	decline	r^2=0.11, p=0.035	no trend	r^2=0.08, p=0.083
Grey teal	decline	r^2=0.26, p=0.001	decline	r^2=0.16, p=0.014
Hardhead	no trend	r^2=0.06, p=0.118	no trend	r^2=0.03, p=0.275
Mountain duck	decline	r^2=0.35, p<0.001	decline	r^2=0.28, p=0.001
Pink-eared duck	no trend	r^2=0.12, p=0.032	no trend	r^2=0.09, p=0.074
Australian Wood duck	decline	r^2=0.19, p=0.005	no trend	r^2=0.08, p=0.091

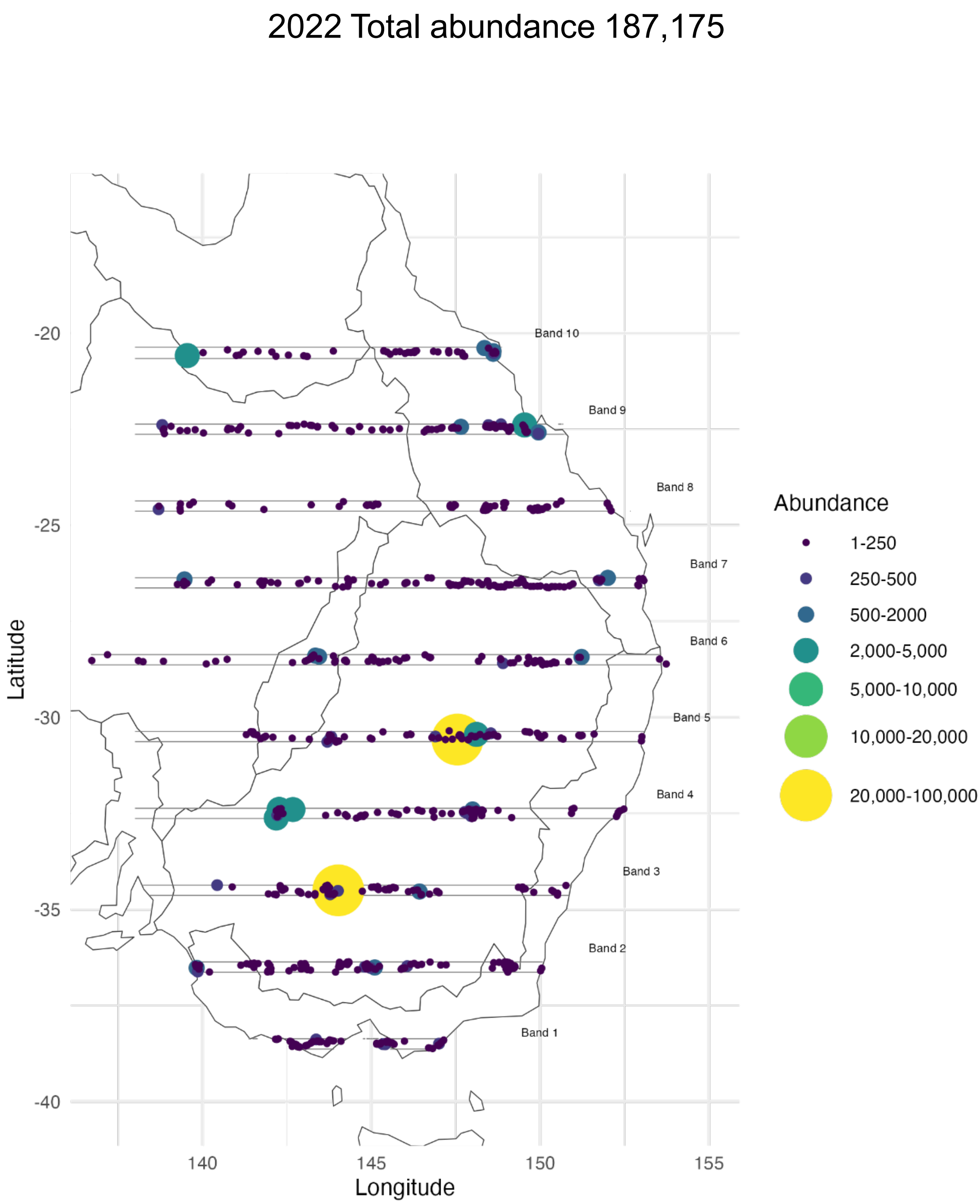


Figure 5. Distribution and abundance of waterbirds in the 2022 Eastern Australian Waterbird Aerial Survey. Dry wetlands and those with zero waterbirds not plotted.

2022 Breeding index – 60,580

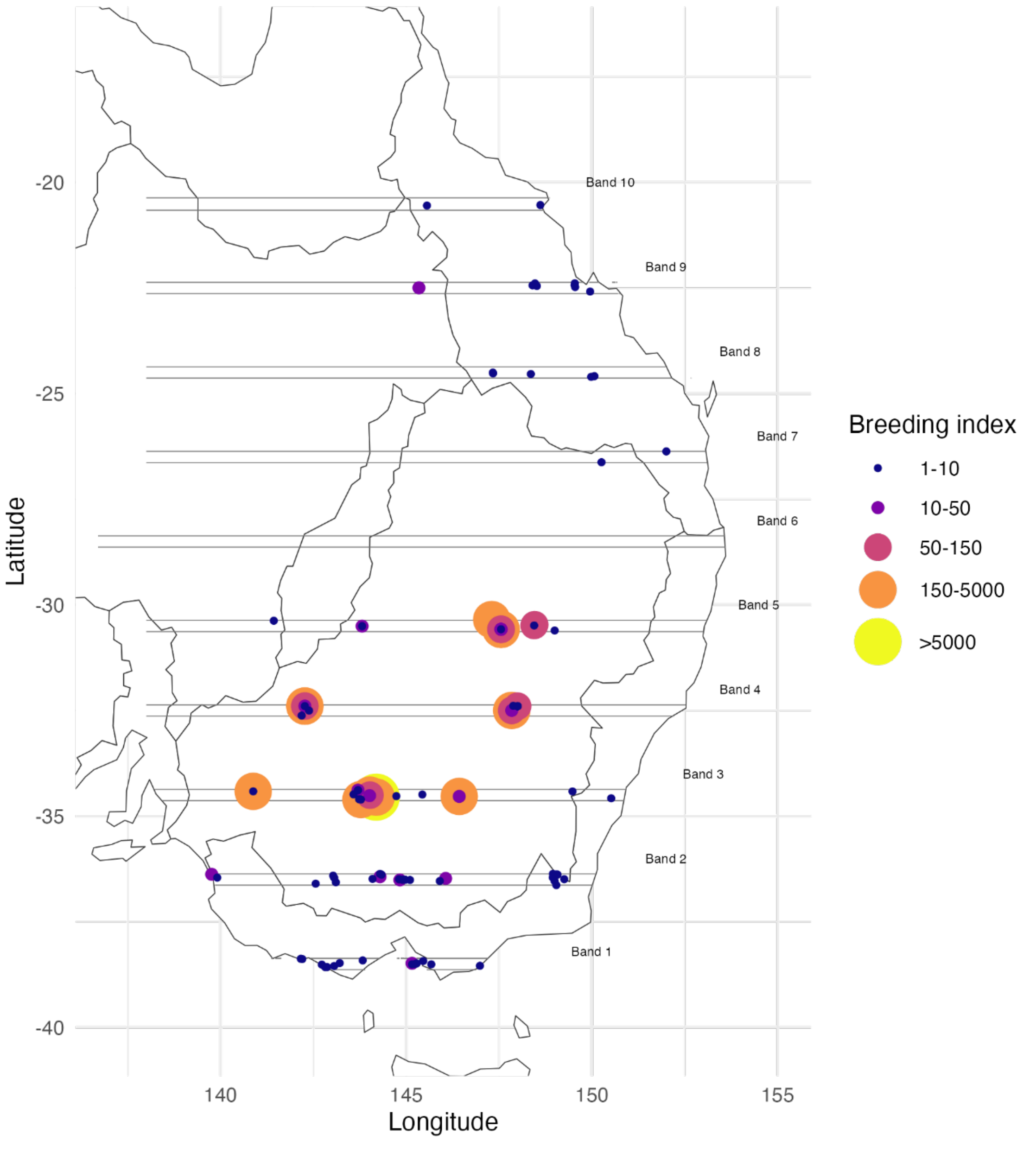


Figure 6. Distribution of waterbird breeding in the 2022 Eastern Australian Waterbird Aerial Survey. Only wetlands with breeding recorded are plotted.

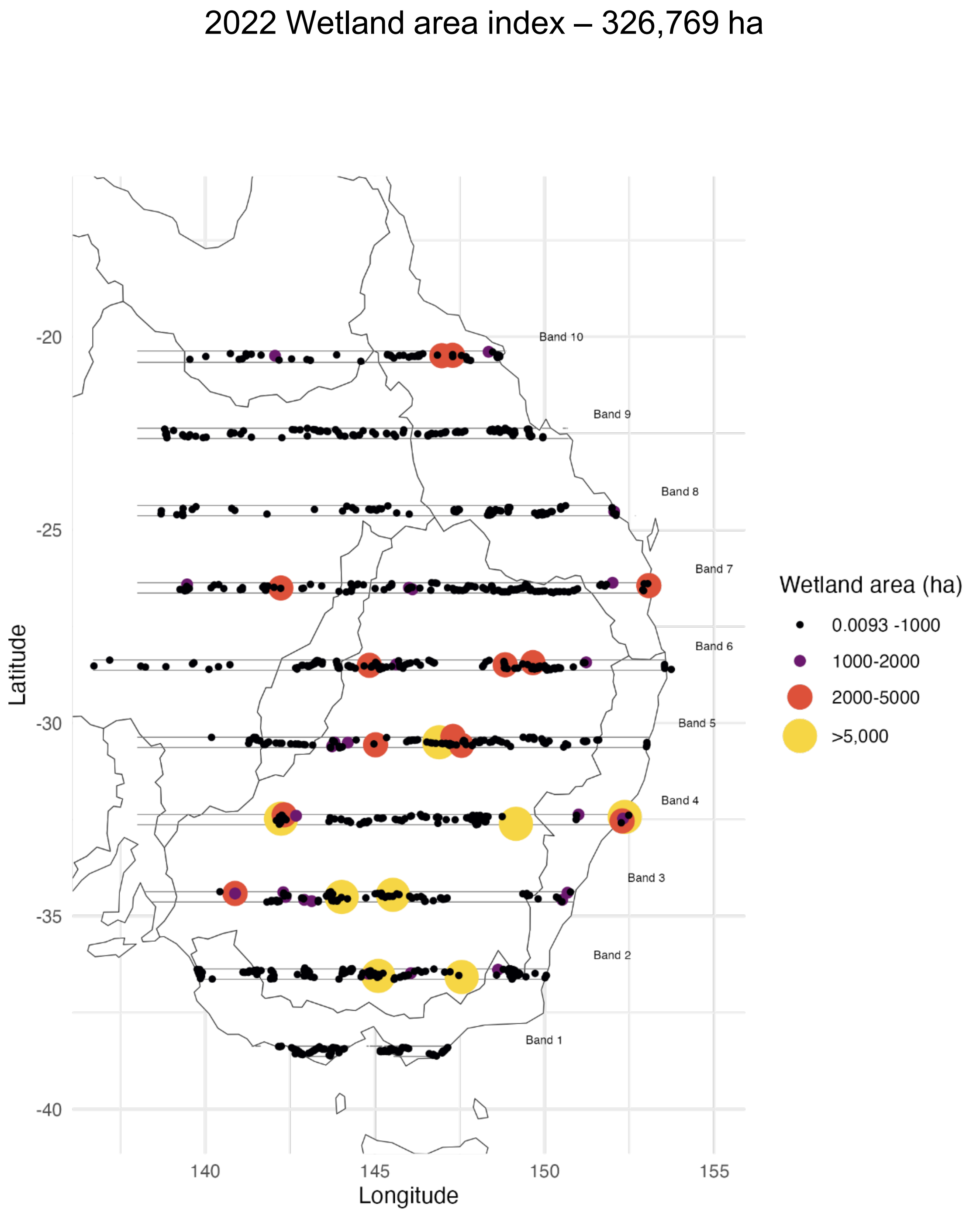


Figure 7. Distribution of wetland area in the 2022 Eastern Australian Waterbird Aerial Survey. All surveyed wetlands with surface water present are plotted; dry wetlands not plotted.

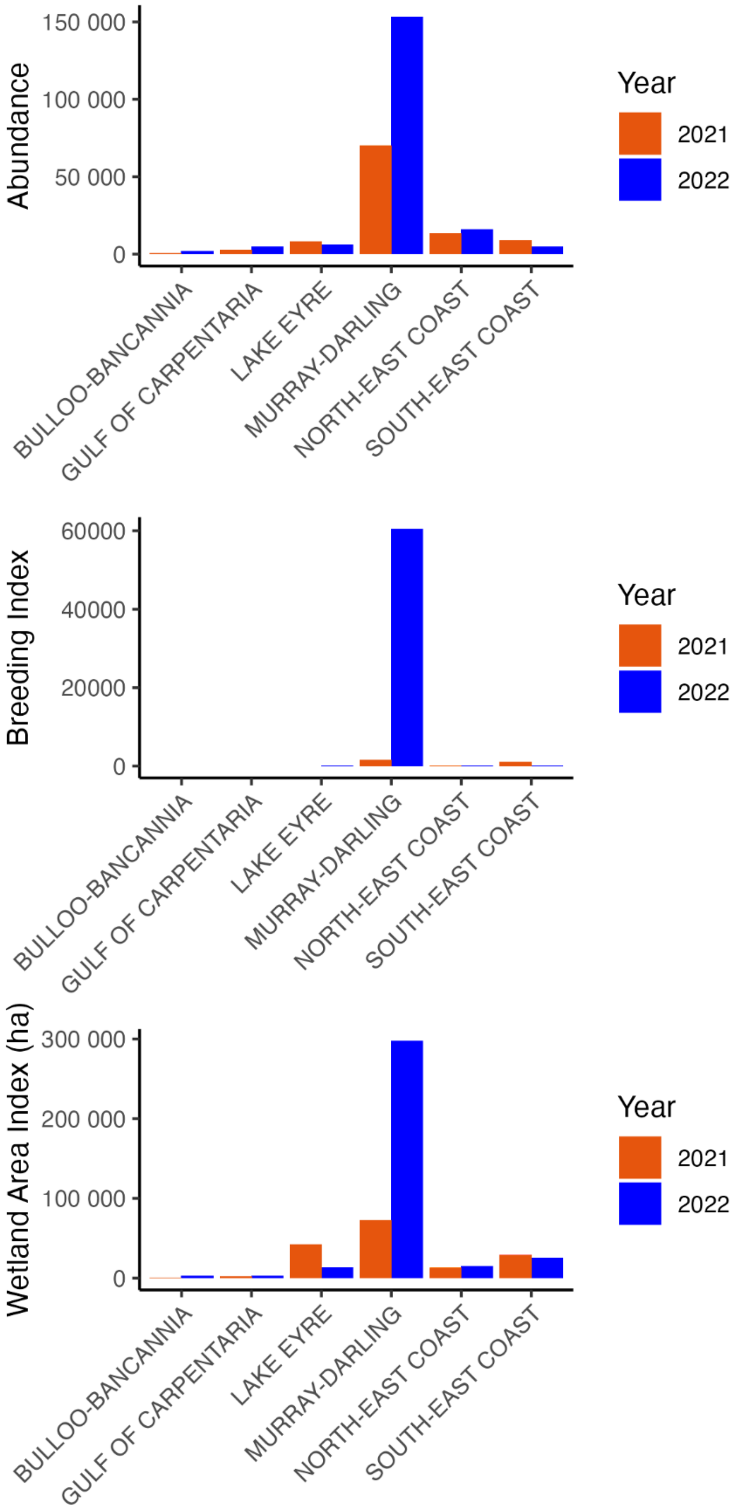


Figure 8. Comparison of waterbird abundance, breeding index and wetland area in major river basins 2021-2022.

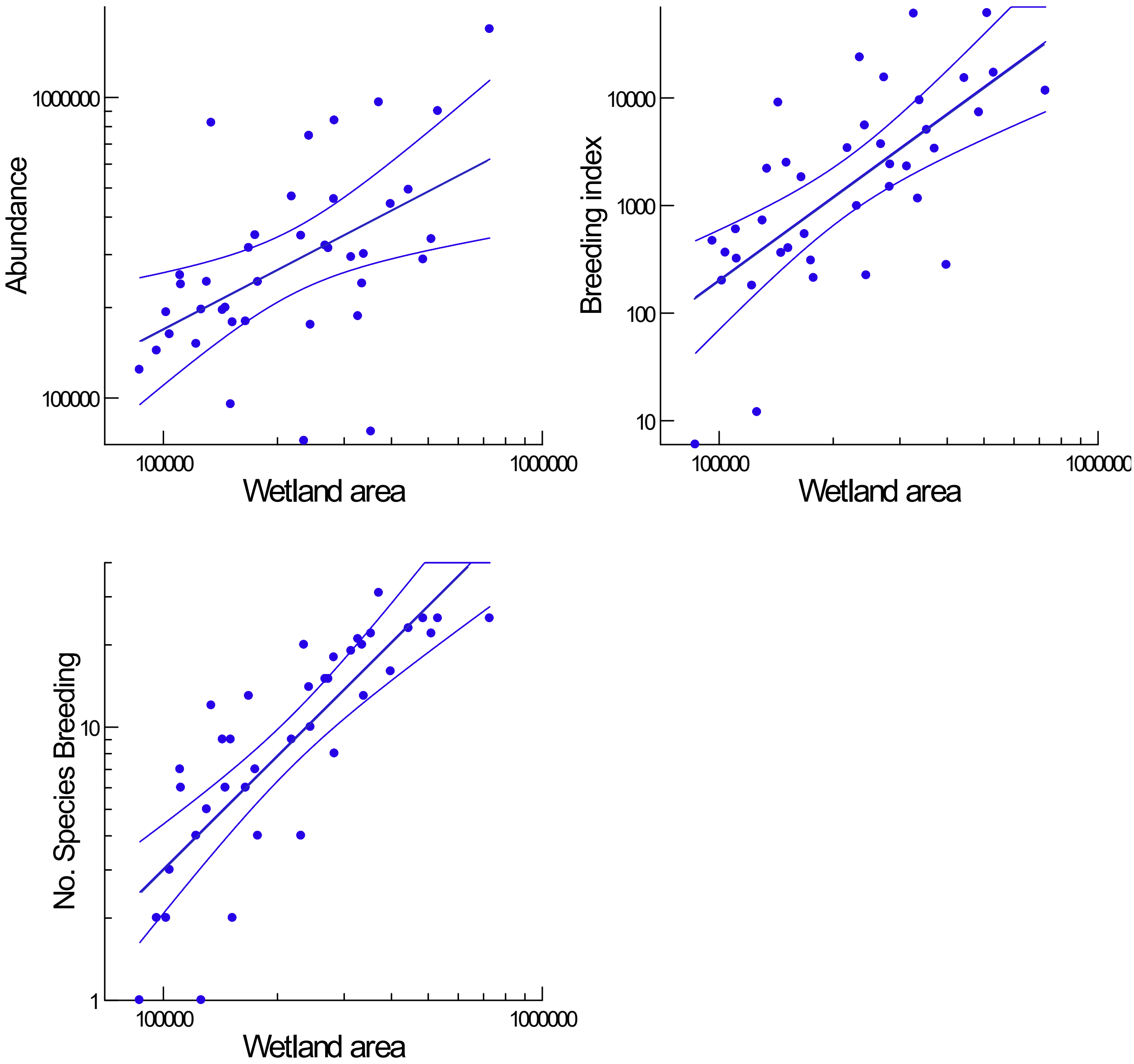


Figure 9. Interactions – abundance, breeding and number of breeding species with wetland area index (ha) for the Eastern Australian Waterbird Aerial Survey (1983-2022) Dashed lines are 95% confidence limits.

Pacific black duck

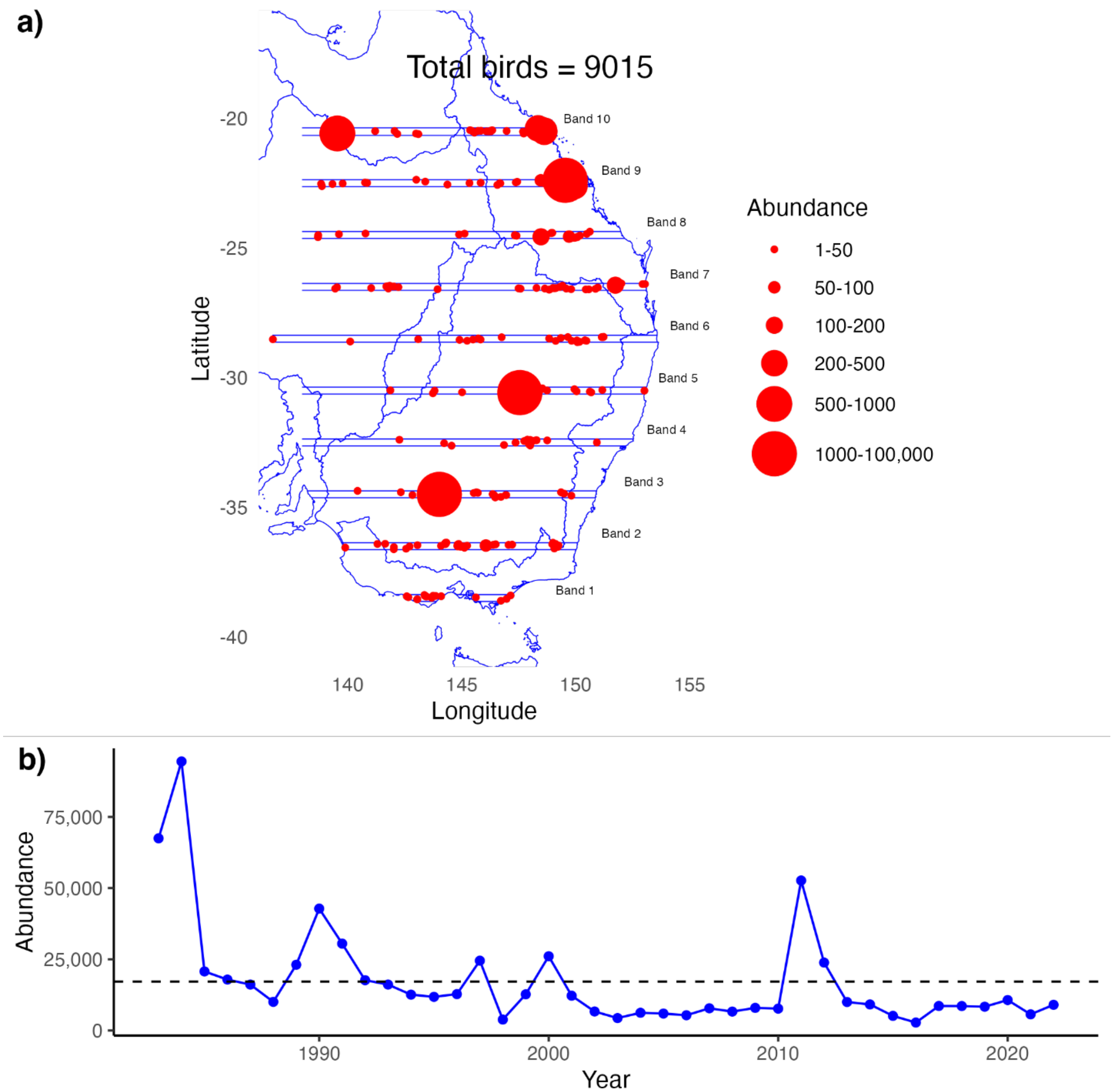


Figure 10. a. Distribution and abundance of Pacific Black Duck during the 2022 Eastern Australian Waterbird Aerial Survey. b. Changes in abundance (1983-2022).

Australasian shoveler

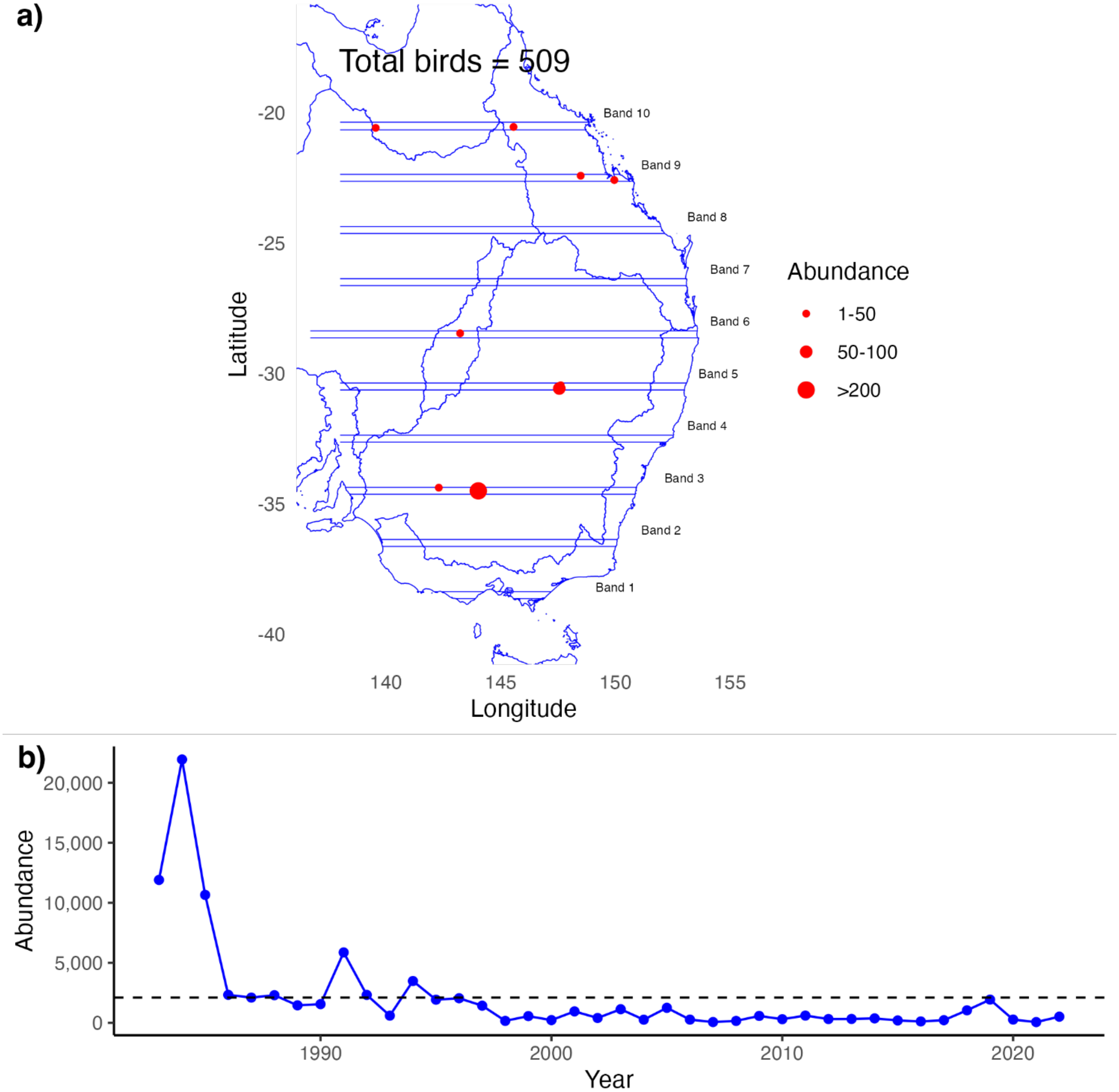


Figure 11. a) Distribution and abundance of Australasian Shoveler during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

Chestnut teal

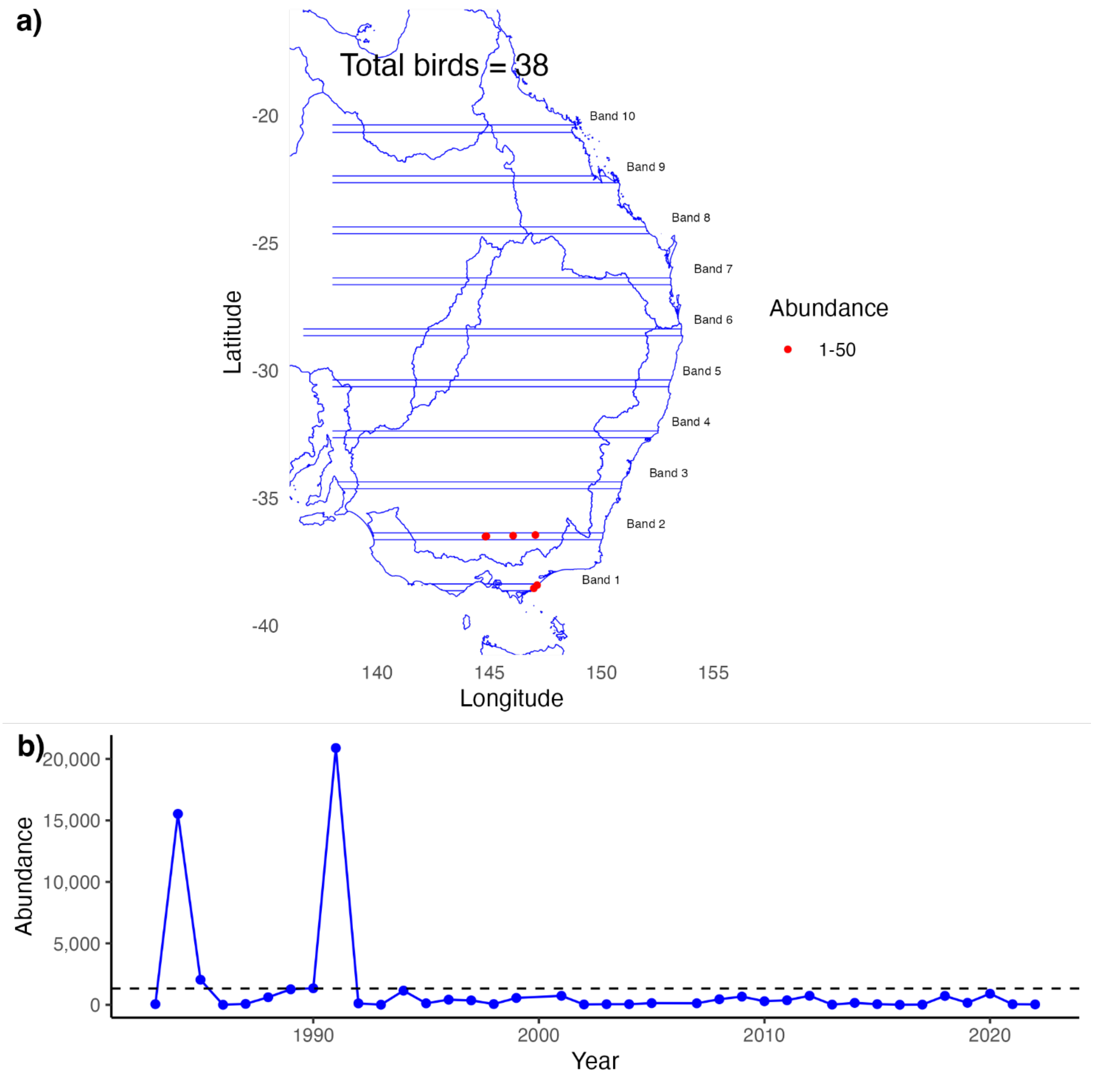


Figure 12. a) Distribution and abundance of Chestnut Teal during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

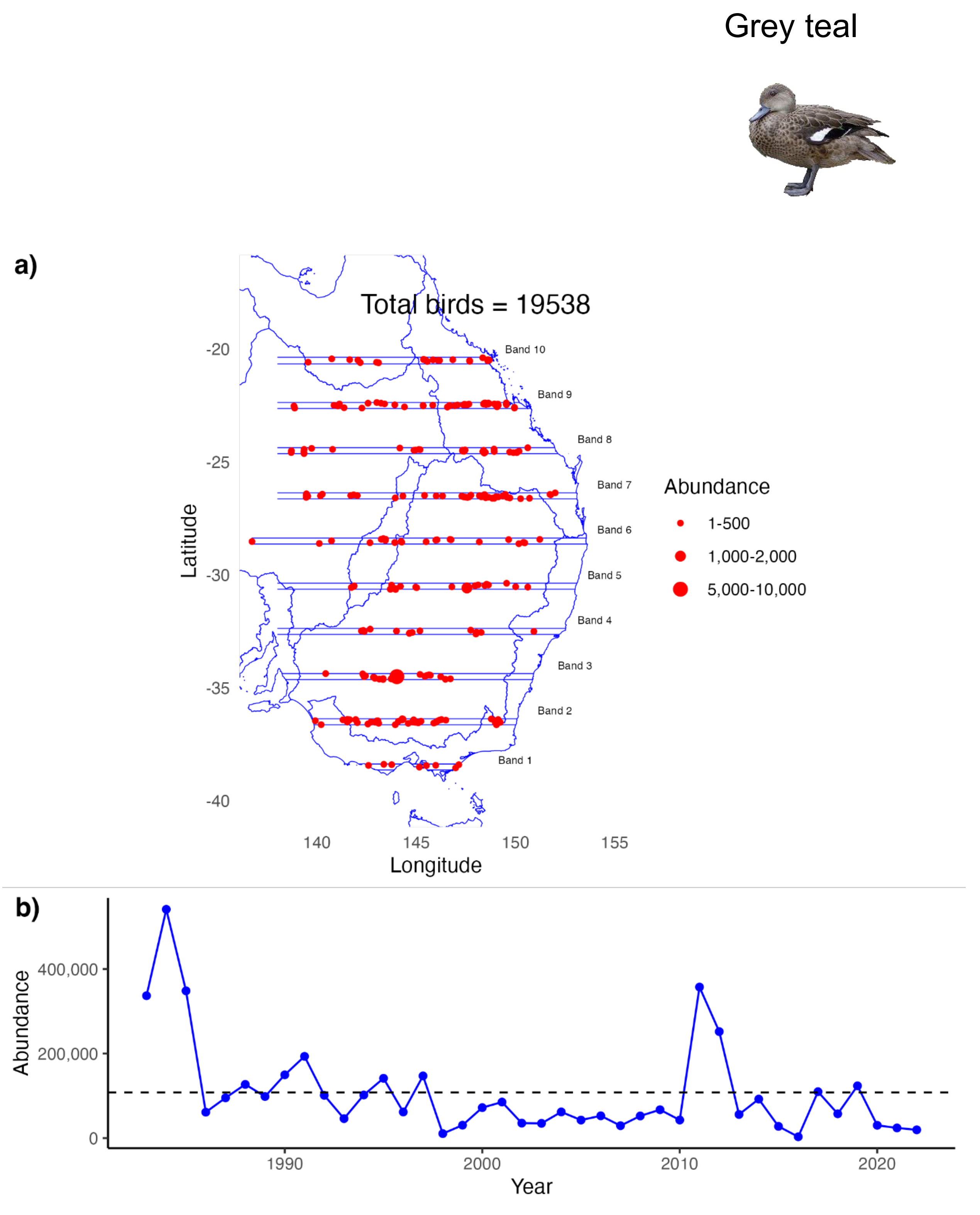


Figure 13. a) Distribution and abundance of Grey Teal during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

Hardhead

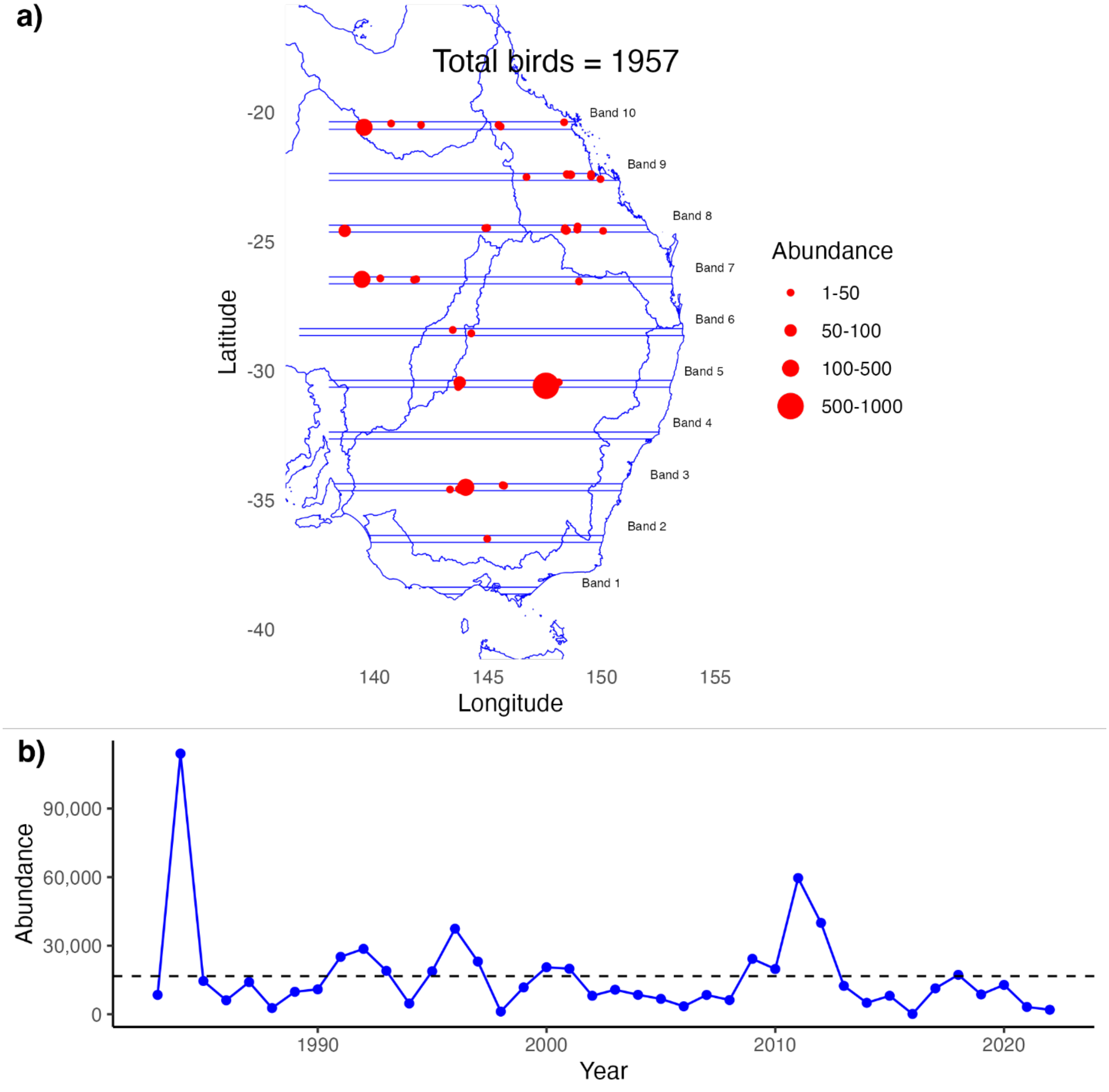


Figure 14. a) Distribution and abundance of Hardhead during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

Freckled duck

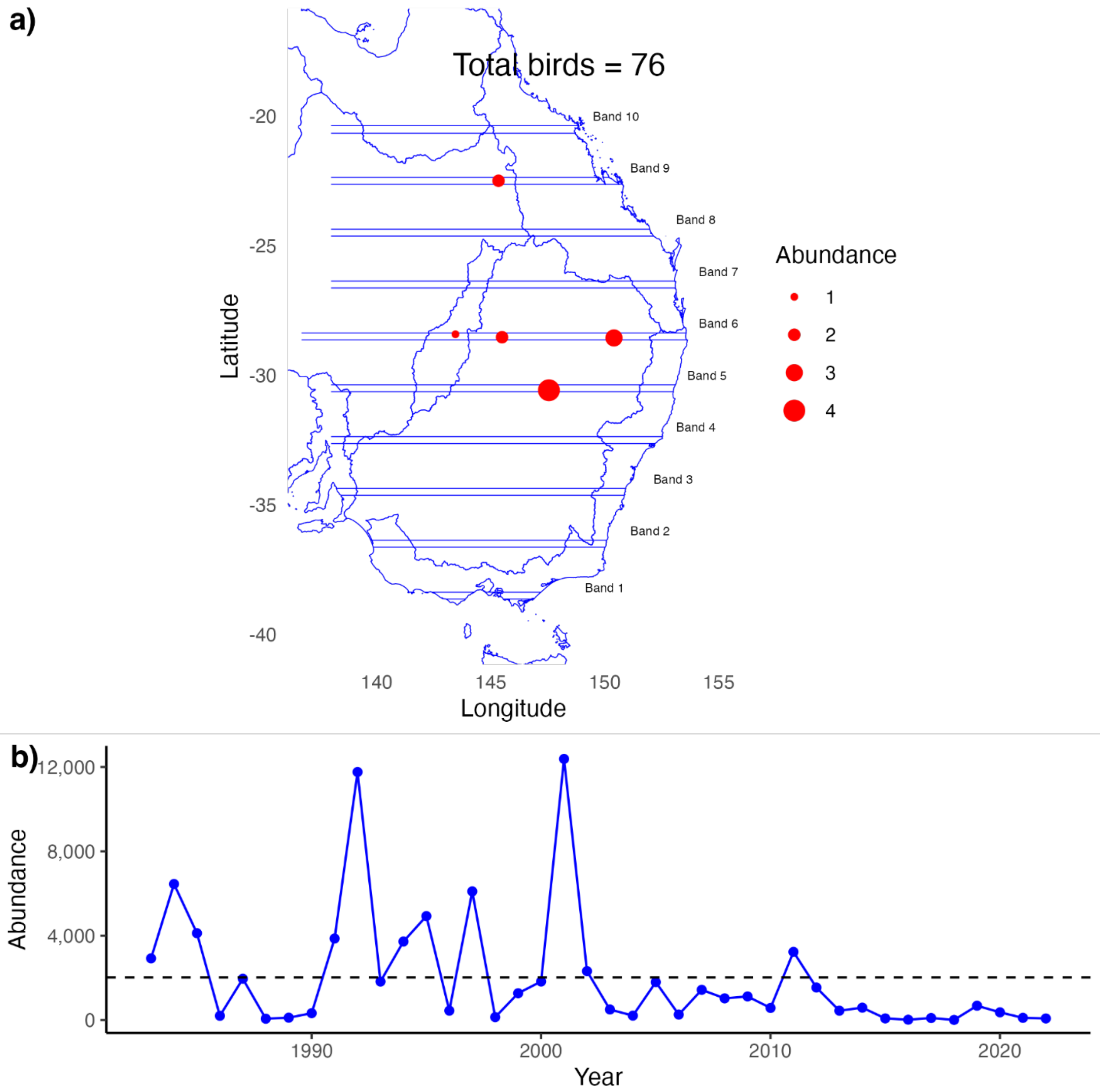
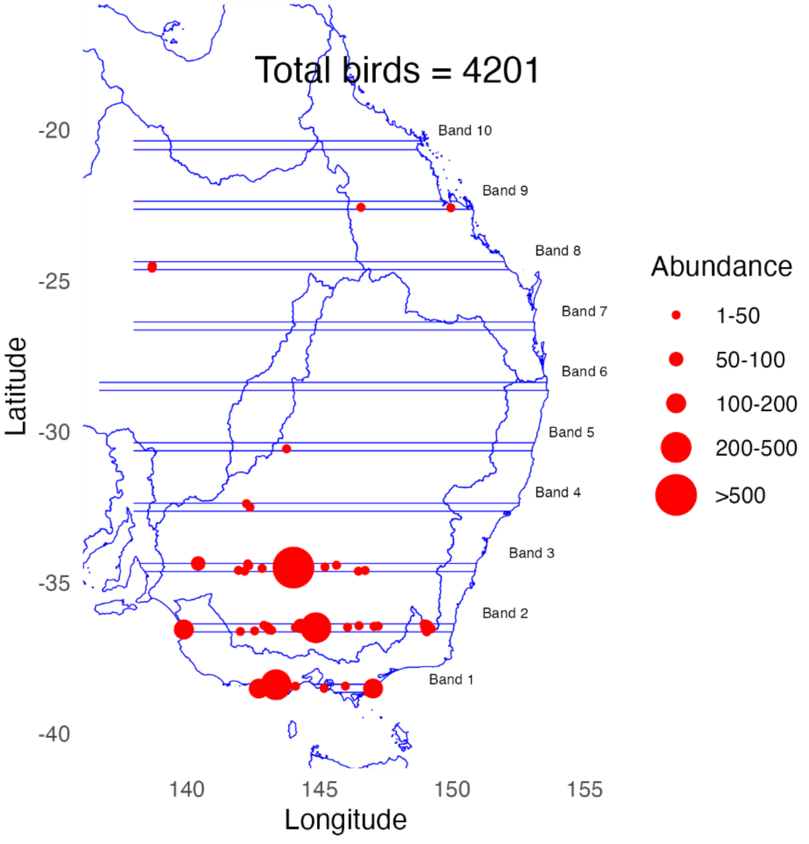


Figure 15. a) Distribution and abundance of Freckled Duck during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

Australian shelduck

a)



b)

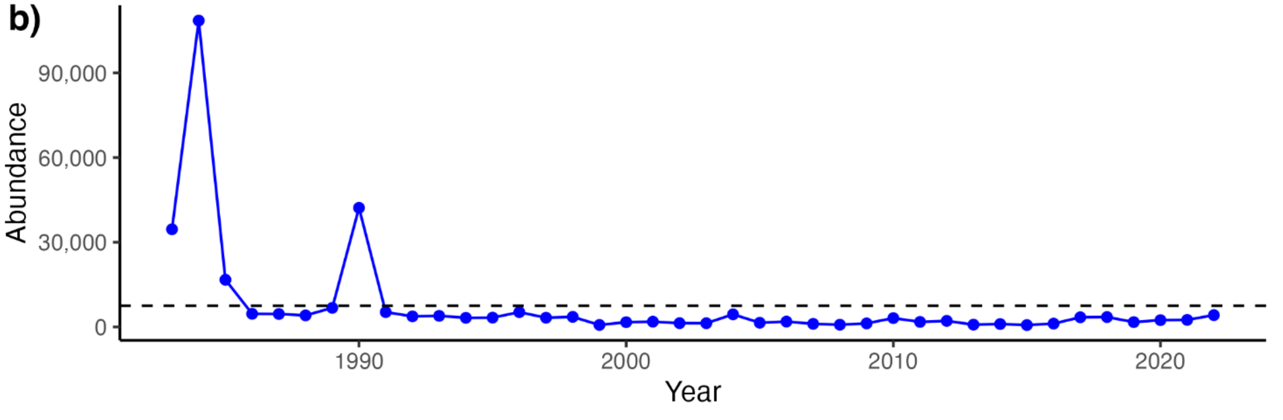


Figure 16. a) Distribution and abundance of Australian Shelduck during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

Pink-eared duck

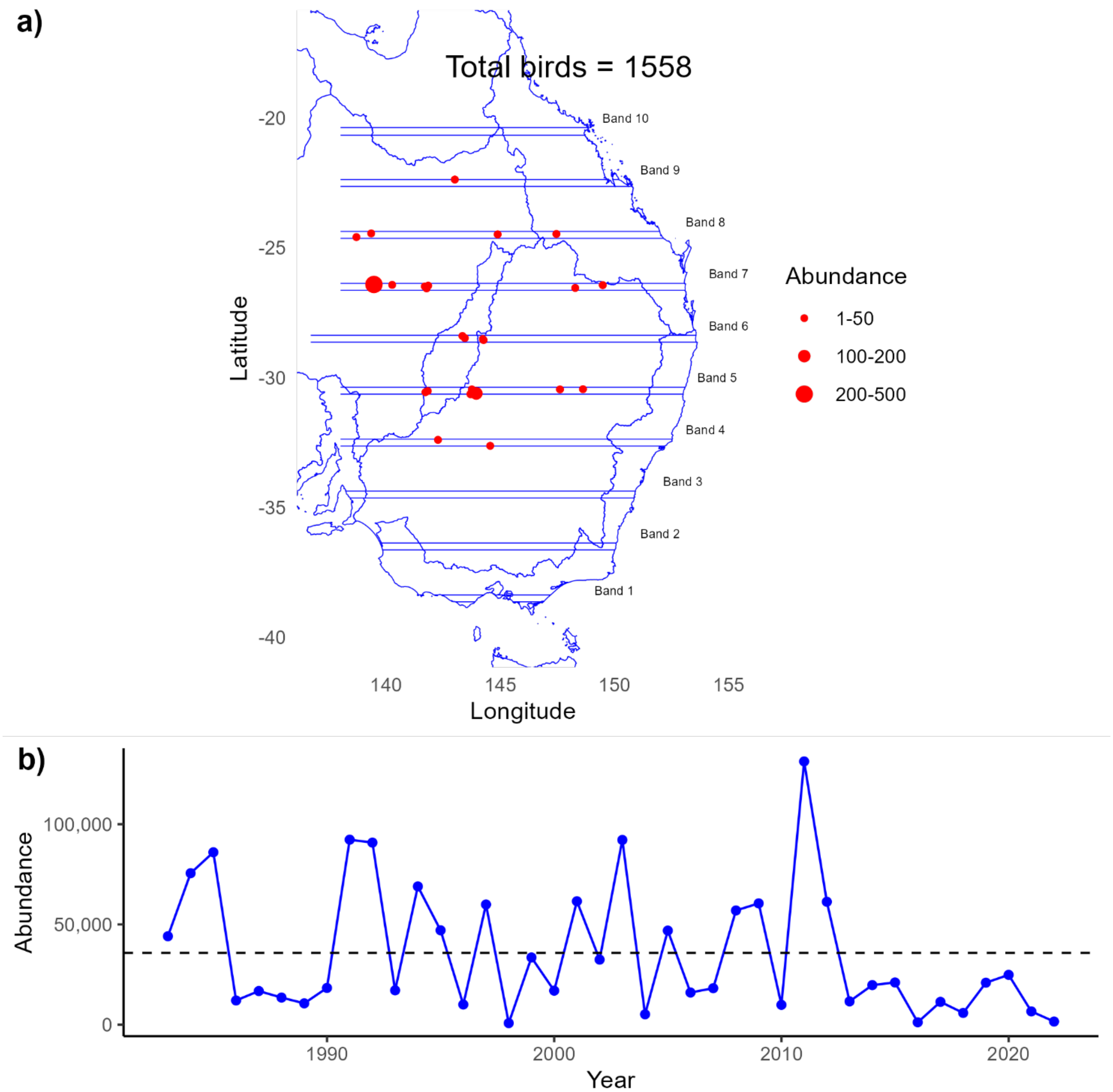
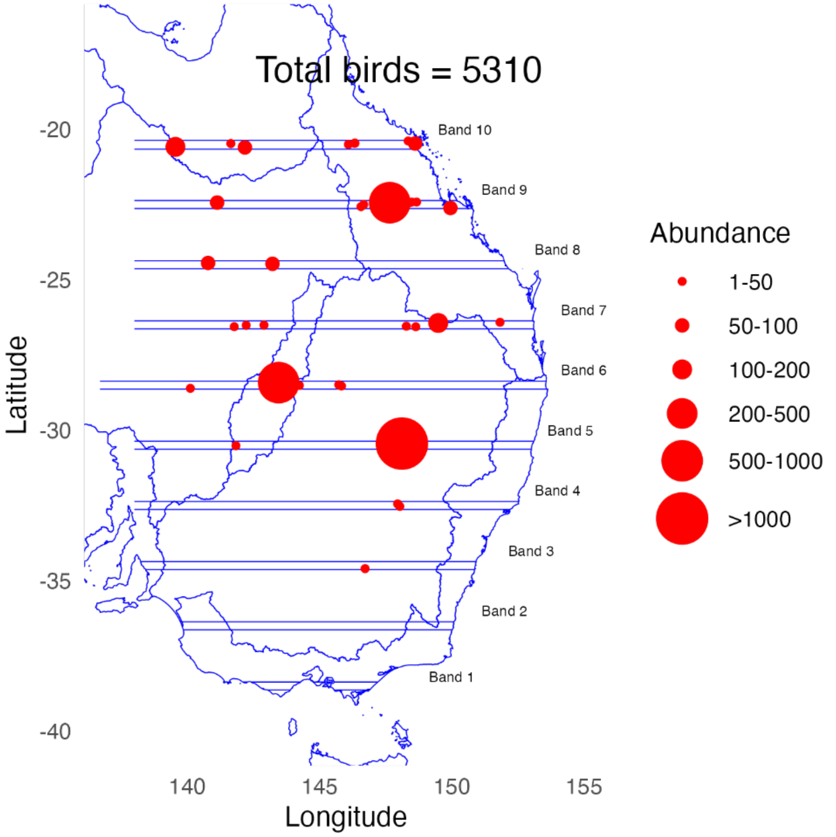


Figure 17. a) Distribution and abundance of Pink-eared Duck during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

Plumed whistling- duck

a)



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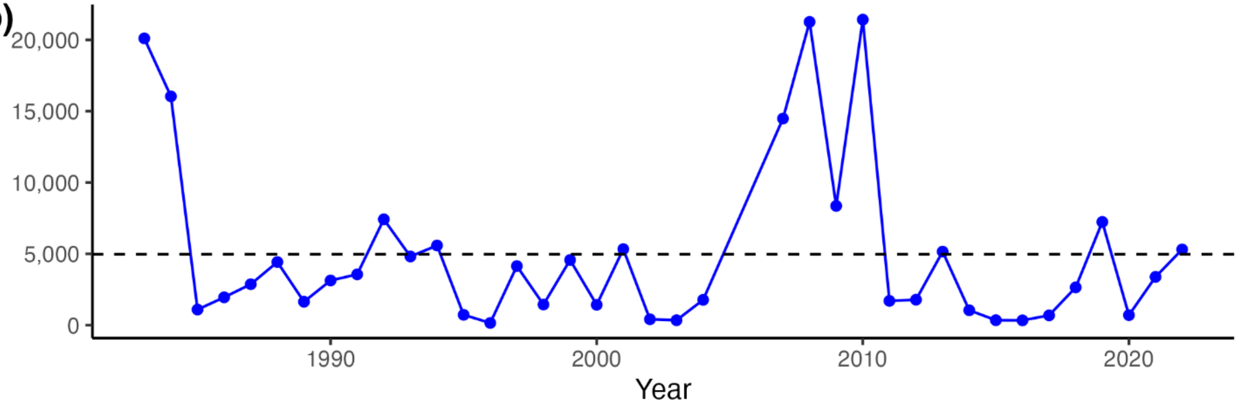

Figure 18. a) Distribution and abundance of Plumed Whistling Duck during the 2022 Eastern Australian Waterbird Aerial Survey. b) Changes in abundance (1983-2022).

Australian wood duck

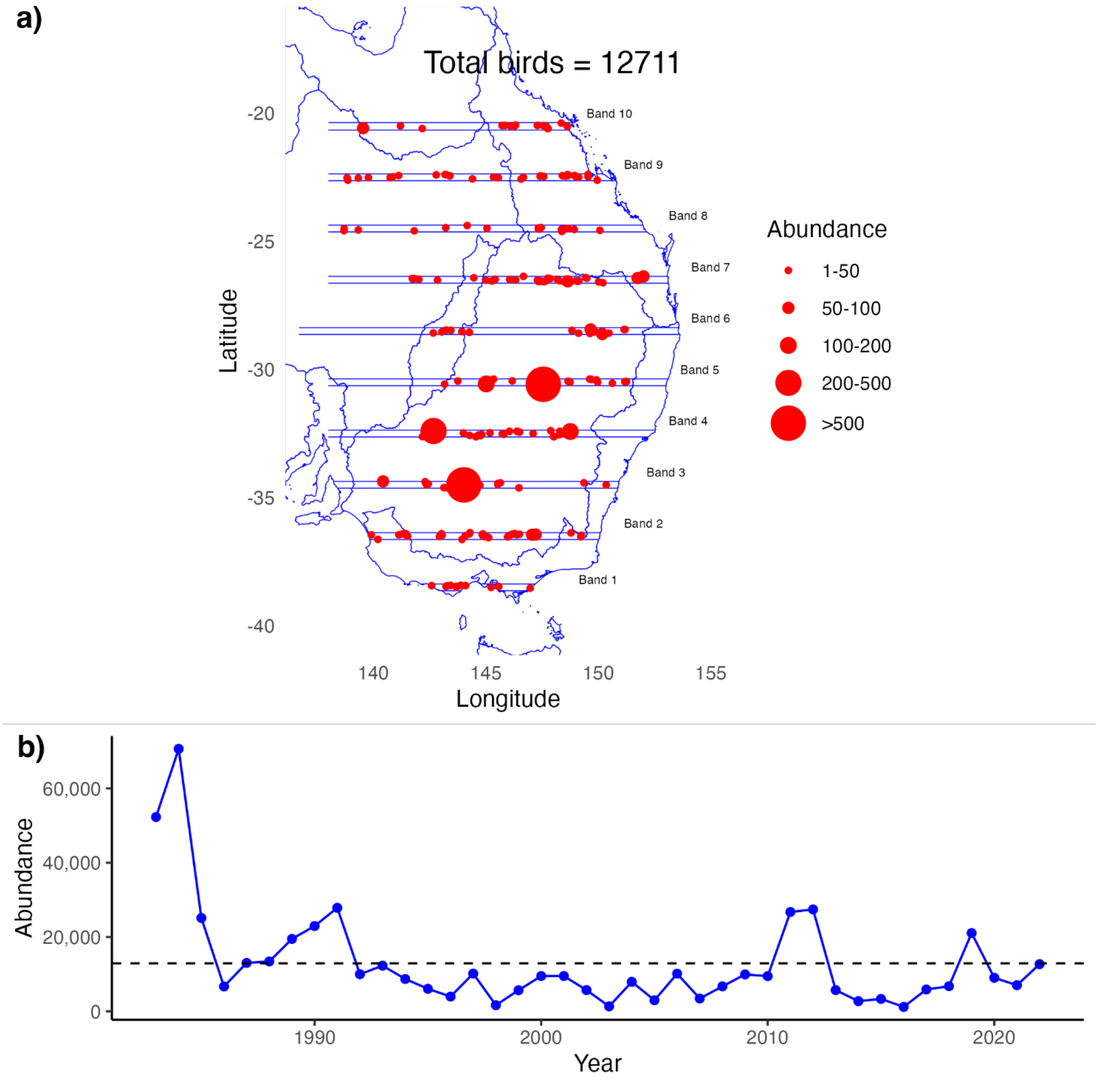

Figure 19. a) Distribution and abundance of Australian Wood Duck during the 2022 Eastern Australian Waterbird Survey. b) Changes in abundance (1983-2022).

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