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Problem Description

The numbat (Myrmecobius fasciatus), a small, termite-eating marsupial, has faced severe po pulation declines throughout its history in Australia. Weighing between 300g and 752g, numbats have a body length of 175mm to 290mm and a tail measuring 120mm to 210mm. Unlike many mammals, numbats do not have proper teeth but instead have blunt “pegs” since they do not chew their food. Their forefeet, which bear five toes, and hind feet, with four toes, are equipped with strong, sharp claws used for digging termites from the soil.

Historically, numbats inhabited semi-arid and arid woodlands with Eucalyptus and Acacia trees, as well as grasslands. Today, they are restricted to eucalypt woodlands at elevations around 317 meters, where they find shelter in hollow logs. These logs not only offer refuge at night but also provide a place to hide from predators during the day, including birds and foxes. Numbats feed primarily on termites, consuming up to 20,000 termites daily, and have evolved specific physical traits to capture their prey efficiently.

Despite conservation efforts, numbats have experienced dramatic declines, leading to their current endangered status. Although the available dataset includes records from as far back as 1856, this report will focus on the period from 2000 to 2023, analyzing population trends within this time frame.

Data Description

- The data used in this report was obtained from the TidyTuesday project, which is a weekly data sharing initiative that provides datasets for analysis and learning. The specific dataset used in this analysis was focused on the numbat population and was accessed via the TidyTuesday GitHub repository.

  We named the data set as **numbats** has 805 observations and 16 variables. The numbats dataset contains observations of Numbat sightings and related environmental data. Key variables include the latitude and longitude coordinates of each sighting, as well as the date and time of the observation. The scientific name of the species observed is recorded, along with a taxon concept identifier for the species. Each sighting is uniquely identified by a record ID, and the data source responsible for the information is noted. The dataset also includes temporal information such as the year, month, day of the week, and hour of each observation. Furthermore, environmental data such as precipitation, maximum temperature, and minimum temperature on the sighting day are provided. Lastly, the dataset records whether the observation took place in Dryandra Woodland.Below Table 1 is the glimpse of our data set

Table 1: Glimpse Numbats dataset

Table 2: Summary of Numbats Dataset with Specific Values

variable	type	example_value
decimalLatitude	double	-37.65000
decimalLongitude	double	145.5333
eventDate	datetime	2014-06-05 02:00:00
scientificName	character	Myrmecobius fasciatus
taxonConceptID	character	https://biodiversity.org.au/afd/taxa/6c72d199-fof1-44d3-8197-224a2f7cff5f
recordID	character	73830609-3d94-461f-a833-01c0a30c5a0d
dataResourceName	character	Queen Victoria Museum Art Gallery provider for OZCAM
year	double	2014
month	character	Jun
wday	character	Thu
hour	integer	13
day	date	2014-06-05
dryandra	logical	FALSE
prcp	double	1.2
tmax	double	15.6
tmin	double	1.5

- The data was sourced from the Global Historical Climatology Network Daily (GHCND) using the ghcnd_stations() function. The dataset was filtered for Australian stations (ID starting with "ASN"). The dataset consists of 643 observations and 6 variables and was named aus_stations. and includes key variables such as the latitude and longitude coordinates, elevation, station name, station id and WMO ID.

  The variables in the dataset include the station IDs, which identify each Australian station, and the latitude and longitude values that provide the geographic location of the station. The elevation variable records the height of the station above sea level in meters, while the station name provides a label for the station. Lastly, the WMO ID is the numeric identifier assigned to each station by the World Meteorological Organization.

```r
aus_stations <- ghcnd_stations() |>
  filter(str_starts(id, "ASN")) |>
  filter(last_year >= 2020) |>
  mutate(wmo_id = as.numeric(wmo_id),
         name = str_to_lower(name)) |>
  select(-state, -gsn_flag) |>
  filter(element %in% c("PRCP", "TMAX", "TMIN")) |>
  nest(element: last_year) |>
```

```
  rowwise() |>
  filter(nrow(data) == 3) |>
  select(-data)
```

- The first step of the data cleaning process involved filtering out rows with missing values in the year column and retaining only records from the year 2000 onwards. This was accomplished using the filter() function with the conditions !is.na(year) to remove rows where the year is missing, and year >= 2000 to include only observations from the year 2000 and later. This ensures that the dataset is clean and focused on the relevant timeframe for analysis..

```
numbats_new <- numbats |>
  filter(!is.na(year),# remove the missing value
         year>=2000)
```

Analysis

Part 1: Numbats Sighting Locations: A Geographic Overview

First, we look at the distribution of Numbat sightings across Australia, which gives us an idea about the regions where these sightings are most frequent. Understanding the location of these sightings helps us identify potential habitats, areas of conservation focus, and regions where Numbat populations are thriving or struggling. For this purpose, a map is the best way to visualize the geographic spread of Numbats and to make the data more accessible and understandable.

The map Figure 1 highlights the locations of Numbat sightings, with red dot representing sightings. As seen, sightings are concentrated mainly in the southern and western parts of the country, with a particularly dense cluster in the southwest. This visualization is useful for assessing the spatial distribution of Numbats and identifying conservation hotspots. By analyzing these patterns, conservationists and researchers can gain valuable insights into where efforts might be focused to protect this endangered species.

This map serves as a foundation for further research into environmental factors, such as climate and habitat type, that might be influencing the distribution of Numbats. Ultimately, this visualization is a crucial tool in understanding how to manage and protect the Numbat population in Australia.

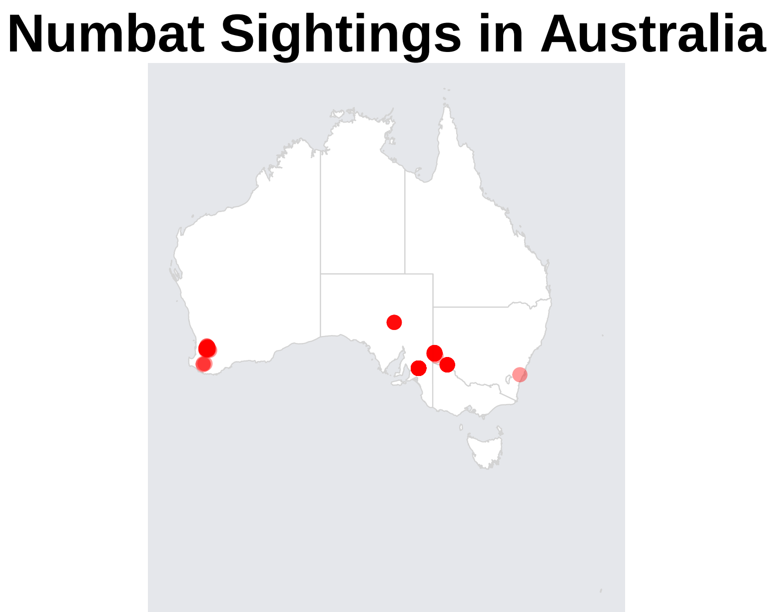

Figure 1: Numbats

Part 2: Numbats Population Trends Between 2000 and 2023

Now we concentrate on the trend of Numbat sightings between 2000 and 2023, which offers a glimpse into the population dynamics and sighting frequency of Numbats over time. This Figure 2 provides valuable insight into how the number of sightings has fluctuated across different years.

The data shows that sightings were minimal in the early 2000s, with a sharp increase starting in 2007. A significant spike occurred in 2014, where the number of recorded sightings peaked dramatically, far surpassing other years. This surge could be due to increased observation efforts, improved reporting mechanisms, or possibly environmental factors that led to a temporary rise in Numbat visibility. Following this spike, the number of sightings fluctuated but remained relatively stable between 2015 and 2023, though never reaching the heights seen in 2014. These fluctuations could indicate changing environmental conditions, habitat loss, or other challenges affecting the Numbat population.

It's important to note that there are missing values for the years 2001 to 2005 and 2012, during which no sightings were recorded. This gap in the data may suggest a lack of reporting or data collection during those years, which leaves some uncertainty in understanding the Numbat population trend during those periods.

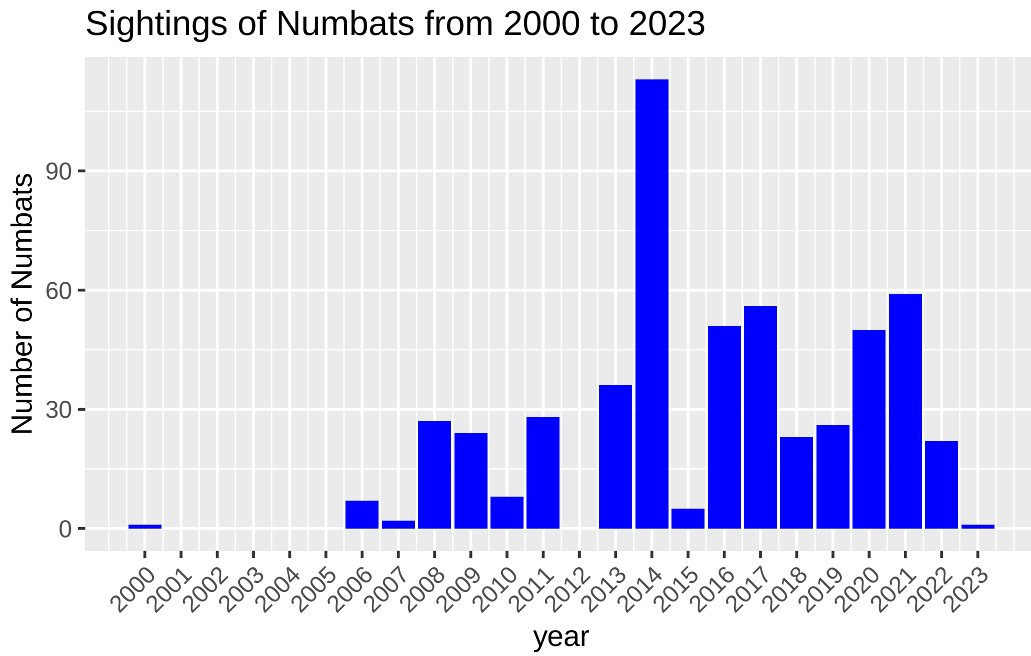

Figure 2: Sightings of Numbats

References