Maths in Context: ‘Park Ranger Problem-Solving’

An AMSI Schools Rich Task
for Students in Years 3 & 4

Thanks to Cassandra at St Joseph’s Primary School, Denman, New South Wales, for her collaboration on the development of this task.

LEVELS 3 & 4 ('Stage 2' / Years 3 & 4): Addition & Subtraction[1]

Aims and Objectives for this Task:

The aim of this task is to provide a rich, contextual activity through which students can begin to explore the addition and subtraction of one- and two-digit of numbers in everyday contexts.

- Students will demonstrate **understanding** by connecting number representations with number sequences, partitioning and combining numbers flexibly and extending place value to decimals;
- Students will demonstrate **fluency** by recalling addition and subtraction facts, using familiar metric units to order and compare objects and collecting and recording data;
- Students will demonstrate **problem-solving** by comparing large numbers with each other, formulating and modelling authentic situations and using number properties to continue number patterns;
- Students will demonstrate **communication skills** by using appropriate terminology to describe, and symbols to represent, mathematical ideas; and
- Students will demonstrate **reasoning** by using generalising from number properties and results of calculations, communicating information using graphical displays and evaluating the appropriateness of different displays.

Intended Syllabus Outcomes (Years 3 & 4)

Australian Curriculum (Mathematics):

- Recognise and explain the connection between addition and subtraction (ACMNA054)
- Recall addition facts for single-digit numbers and related subtraction facts to develop increasingly efficient mental strategies for computation (ACMNA055)
- Recognise, represent and order numbers to at least tens of thousands (ACMNA072)
- Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems (ACMNA073)
- Construct suitable data displays, with and without the use of digital technologies, from given or collected data, include tables, column graphs and picture graphs where one picture can represent many data values (ACMSP096)

NSW Syllabus (Mathematics)

- Uses appropriate terminology to describe, and symbols to represent, mathematical ideas (MA2-1WM)
- Selects and uses appropriate mental or written strategies, or technology, to solve problems (MA2-2WM)
- Checks the accuracy of a statement and explains the reasoning used (MA2-3WM)
- Uses mental and written strategies for addition and subtraction involving two-, three-, four and five-digit numbers (MA2-5NA)
- Selects appropriate methods to collect data, and constructs, compares, interprets and evaluates data displays, including tables, picture graphs and column graphs (MA2-18SP)

[1] *(and a little bit of 'Data & Statistics'!)*

Science Outcomes (Australian Curriculum, Science, and NSW Syllabus, Science)

- Investigates their questions and predictions by analysing collected data, suggesting explanations for their findings, and communicating and reflecting on the processes undertaken - ST2-4WS (NSW Syllabus); ACSIS053 & ACSIS064 (AC, Science).
- Describes that living things have life cycles, can be distinguished from non-living things and grouped based on their observable features - ST2-10LW (NSW Syllabus); ACSSU044, ACSSU072 (AC, Science)
- Describes ways that science knowledge helps people understand the effect of their actions on the environment and on the survival of living things ST2-11LW (NSW Syllabus), ACSHE051 & ACSHE062 (AC, Science)
- Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS057) & (ACSIS068).

Timing: At least one double-period (60 – 90 minutes)

Resources: Student workbook (attached)
Pencil, ruler
Coloured pencils
Working paper.

Preparation: Teachers may choose to organise students into groups for completing this task.

Student Activity: "Park Ranger Problem Solving at _____ National Park"

Task 1: - You decide! *Invent a name for your national park, and fill in the blanks!*

Congratulations! You have just been appointed as the new Park Ranger for _____ National Park! Your job is to ensure the wellbeing of the park and all its flora and fauna. It's a big and rewarding job… and believe it or not, it's going to involve plenty of maths!

Your very first job at _____ is to conduct something called a **species audit** for the native birdlife in the park. This means you need to identify, count and record the numbers of birdlife in the park, so that you and your colleagues and fellow-scientists can examine what might be happening to the native birds in the park over time. This will help you manage the conservation of native birdlife.

Blue-faced Honey-eater. Courtesy of Wikipedia – URL https://en.wikipedia.org/wiki/Blue-faced_honeyeater. Labelled for non-commercial reuse.

The correct scientific word for 'bird species' is ***'avifauna'***. Most national parks have many, many species of avifauna. For example, in Royal National Park in NSW there are an estimated 140 species! However, your park is a very small park and there are only 9 native bird species here – not a very biodiverse environment! This is all the more reason why your conservation efforts are essential to the life and wellbeing of the park's environment.

Here's where you get to make some decisions about the composition of birdlife in your park.

- There are **9 different species** of native avifauna in your park;
- **4** of these species are classified as 'common' and so their populations are numbered in the **thousands**;
- **3** of these species are classified as 'rare' and their populations are numbered in the **hundreds**;
- **2** of these species are classified as 'endangered' and their populations are numbered in the **tens**; and
- **There is an estimated total of 12 840 native birds in your park.**

Task 2 - Find out!

What does 'endangered' mean? What is the difference between 'endangered' and 'extinct'?

Discuss the meaning of these words with your class, and write down your own meanings below:

_____
_____
_____

Task 3 - You decide! Following the rules above:

(a) Use the table to make up a name for each of the 9 species of avifauna in your park;

(b) Provide numbers for each species of bird in your park. REMEMBER – Species 1-4 (Common) each have populations in the thousands; Species 5-7 (Rare) have populations in the hundreds; and Species 8 & 9 (Endangered) have populations in the tens. ***However****, the* ***total*** *number of birds in your park must add up to* ***12 840****.*

(c) Calculate the total number of bird populations in each of your 'Common', 'Rare' and 'Endangered' conservation classifications (groupings).

Name of Avifauna (Bird) Species	**Conservation Classification**	**Numbers in Park**
(1)	Common	
(2)	Common	
(3)	Common	
(4)	Common	
(5)	Rare	
(6)	Rare	
(7)	Rare	
(8)	Endangered	
(9)	Endangered	
TOTAL:		**12 840**

Total 'Common': _____ Total 'Rare': _____ Total 'Endangered': _____

Task 4 – Use your reasoning:

How might you check that your totals are correct in Task 3? Explain how you could use ***subtraction*** *to check your totals in the table above. Give one example of your checking from your table in Task 3.*

Checking example (use subtraction!)

_____

_____

_____

_____

_____

_____

Disaster!

A bushfire has just struck your beautiful park! Unfortunately, the fire has been quite devastating for a number of flora and fauna, and in particular the loss in trees has meant a significant fall in your bird populations.

There is now a total of **3 800** birds in total were lost in the fire.

Bushfire at Captain Creek, QLD. Courtesy of Wikipedia – URL https://en.wikipedia.org/wiki/2010%E2%80%9311_Australian_bushfire_season. Labelled for non-commercial reuse.

Task 5: Use your head!

Using the previous total bird population number, use a ***mental strategy*** *to calculate the new total bird population in your park.*

New total = _____

One of your endangered species may now be extinct; sadly, your avifauna specialist can find no examples of this bird in the park at all. There is thus only a total of **8 species** of bird recorded in your post-bushfire park.

In addition, one of your rare species is now recording such low numbers of this bird (in the tens) that it is now classified as 'endangered'.

So, you now have 4 common species (thousands); 2 rare species (hundreds) and 2 endangered species (tens).

Task 6 - Re-calculate your new table of bird species in the national park below.

After the Fire: Name of Avifauna (Bird) Species	Conservation Classification	Numbers in Park
(1)	Common	
(2)	Common	
(3)	Common	
(4)	Common	
(5)	Rare	
(6)	Rare	
(7)	Endangered	
(8)	Endangered	
TOTAL:		

You need to write a report for your head office which explains the impact of the bushfire in your park on the conservation of species in the park. To start with, you think it would be a great idea to present a graph showing the impact of the fire on the bird species and population numbers in the park.

Task 8 – Graph it!

(a) *Have a class discussion about what kinds of graphs might be suitable to show the impact of the fire on the bird species and population numbers in the park. Are column graphs the only kind of graph that might show this information? Why / why not? What other graphs could be used?*

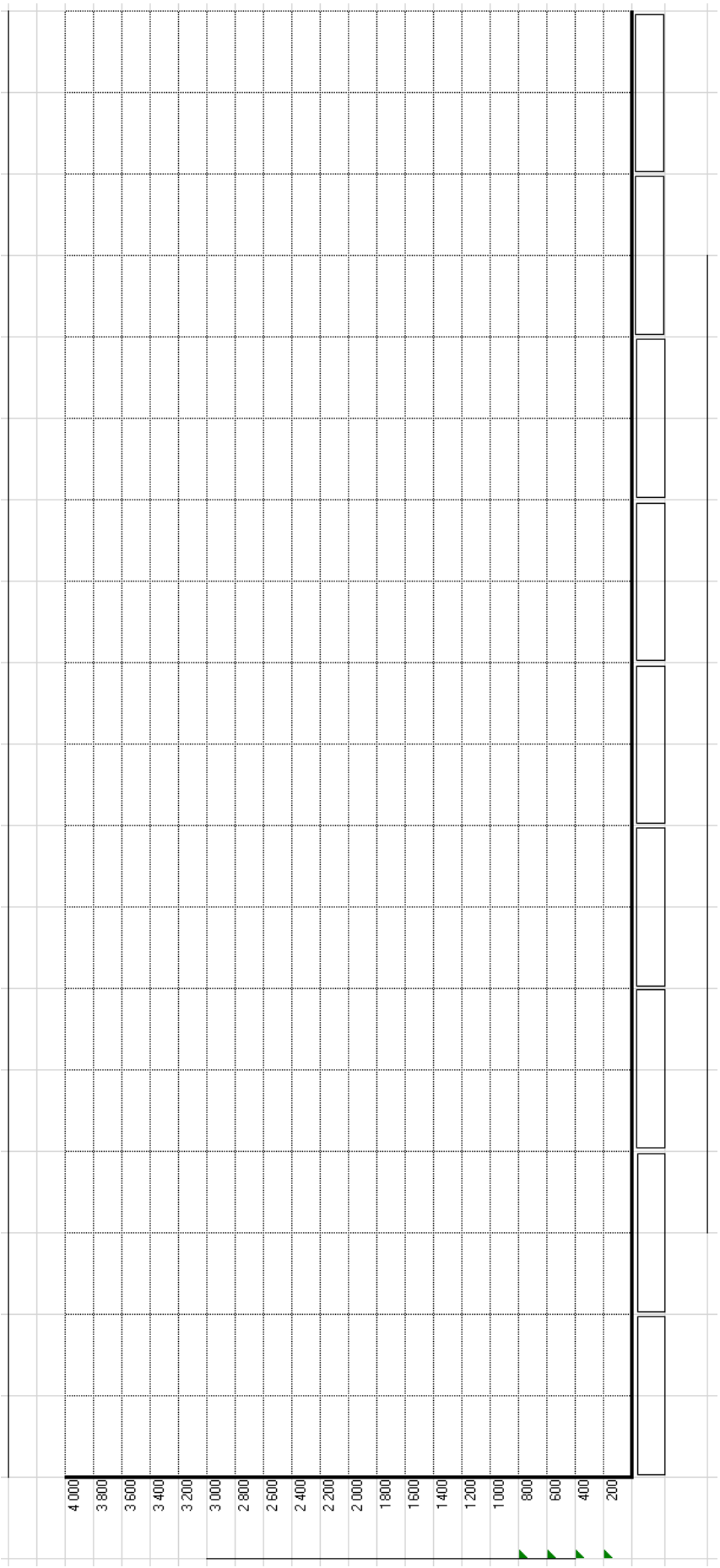
(b) *Use the table and the blank graph paper to graph each species of bird in your park both before and after the bushfire. Don't forget to label your axes and to give your graph a heading!*

Impact of Bushfire on Bird Species in _____ National Park

Name of Avifauna (Bird) Species	Conservation Classification	Population Numbers in Park Before the Fire	Population Numbers in Park After the Fire	Difference Between Before and After
(1)				
(2)				
(3)				
(4)				
(5)				
(6)				
(7)				
(8)				
(9)				
TOTALS:		**12 840**		

Handy Hints:

- Think carefully about how you can graph the information from the table above onto the graph on the next page. For example, how could you show both the 'before the Fire' and 'After the Fire' data for each species?
- What colours could you use to make your information clear and stand out? Would lots of different colours be appropriate, or more confusing? Why / why not?
- Don't forget to clearly label your graph – both with a heading and with labels on the axes.
- What is it that you want your graph to most clearly show the reader?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