

# Tagging Results 2025

## Introduction

### Matched Movement Dataset – Summary Description

The matched movement dataset contains **one row per Release–Sighting pair**. It integrates cleaned fields from both the tagging and sighting datasets, extracted temporal/spatial attributes, and computed movement metrics.

### 1. Variables Included in the Matched Dataset

#### 1.1 Tagging Dataset Fields

Original Field	Description	Variable Name
Tag No.	Tag number recorded at release	tag_no_release
Date of release	Date and time of release	release_datetime
Release address	Cleaned and geocoded release address	release_address_clean
Sex of butterfly	Male / Female / Unknown	sex
Sunny conditions	Weather at release	sunny_release

#### Extracted fields:

- Release date - release\_date\_only
- Release time – release\_time\_only
- Release longitude – release\_lon
- Release latitude – release\_lat

#### 1.2 Sighting Dataset Fields

Original Field	Description	Variable Name
Tag No.	Tag number recorded at sighting	tag_no_sighting
Sighting Date	Date and time of sighting	sighting_datetime
Condition	Alive / Dead	dead_or_alive
Notes on plants / nearby butterflies	Ecological context	plants_notes
Sunny	Weather conditions	sunny_sighting
Windy	Wind conditions	windy_sighting

#### Extracted fields:

- Sighting date - sighting\_date\_only
- Sighting time – sighting\_time\_only
- Sighting longitude – sighting\_lon
- Sighting latitude – sighting\_lat

### 1.3 Computed Fields:

Metric	Description	Variable Name
Days between release & sighting	Difference in days between release_date_only and sighting_date_only	days_between_release_sighting
Geodesic distance (m)	Straight-line distance using WGS84 ellipsoid	dist_geodesic
Haversine distance (m)	Straight-line distance using spherical model	dist_haversine
Bearing (°)	Bearing from release → sighting	bearing_deg
Compass direction	Categorised bearing	direction_compass

## 2. Dataset Overview

- **Total butterfly releases: 4362**
- **Total sightings: 257**

Only matched records were used for movement analysis.

All in all, 4362 tagged monarch butterflies were released, and there were 257 total sightings.

The 258 total sightings correspond to 221 unique tags.

Key observations were that most monarchs moved short distances (129 occurred within 100 m of their release site). 10 alive and 4 dead individuals made long-distance movements (over 5 km),

A female which flew from Feilding to Napier (Clive, Hawke's Bay), a distance of approximately 140 km in a span of 23 days.

### 3. Summary of Releases

This table shows a summary of the number of releases.

Region	Count	Cumulative Count	Cumulative Percentage
Auckland	618	618	14.17%
Christchurch City	510	1128	25.86%
Tasman District	508	1636	37.51%
Wellington City	300	1936	44.38%
Waimakariri District	246	2182	50.02%
Grey District	235	2417	55.41%
Waipa District	201	2618	60.02%
Rotorua District	167	2785	63.85%
Whanganui District	154	2939	67.38%
Kapiti Coast District	149	3088	70.79%
Western Bay of Plenty District	141	3229	74.03%
Tauranga City	106	3335	76.46%
Nelson City	102	3437	78.79%
New Plymouth District	96	3533	80.99%
Dunedin City	95	3628	83.17%
Lower Hutt City	74	3702	84.87%
Manawatu District	65	3767	86.36%
Marlborough District	56	3823	87.64%
Waikato District	55	3878	88.90%
Hamilton City	53	3931	90.12%

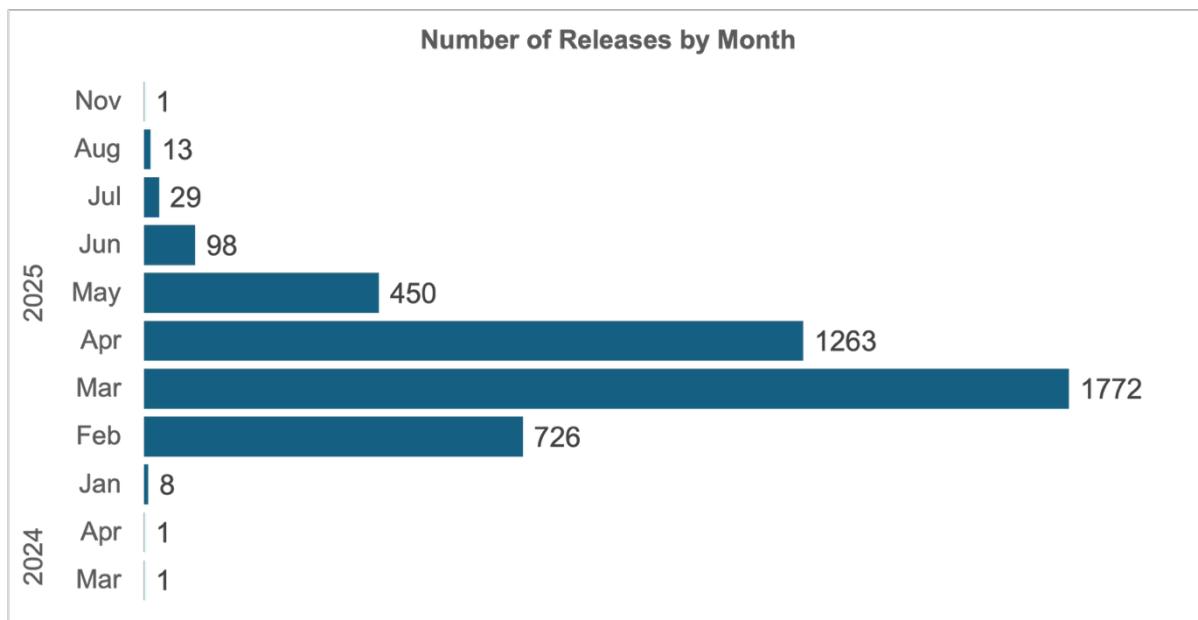
Butterflies were released from 44 regions in New Zealand. 90 per cent of these releases were from 20 locations with over 500 releases from Auckland, Christchurch city and Tasman District

Map of releases and sightings are shown here in this [map](#)

Row Labels	Count of Tags
Female	2334
Male	1876
NA	152
<b>Grand Total</b>	<b>4362</b>

Of the 4362 releases, 2334 were female and 1876 were male butterflies. Sex of 152 butterflies were not recorded.

These were mainly in the months of **February, March, April, and May in 2025**. February had **726** releases, March had **1772** releases, April had **1263** releases, and May had **450** releases.



#### 4. Summary of Sightings

Row Labels	Count of Butterflies
Alive	219
Dead	38
<b>Grand Total</b>	<b>257</b>

These **257** sightings correspond to **221** unique butterflies. Of the 221 butterflies, 183 butterflies were sighted alive and 38 butterflies were sighted dead.

**108** of these alive butterflies were sighted within **100** metres of their release sites for up to two weeks since the releases. **66** of these sites had swan plants or milk weeds or other plants – flowering, bushes or trees in their vicinity.

## 5. Movement Analysis

### 5.1 Straight-line Distance Calculations

Both **Haversine** and **Geodesic** distances were computed for each matched movement.

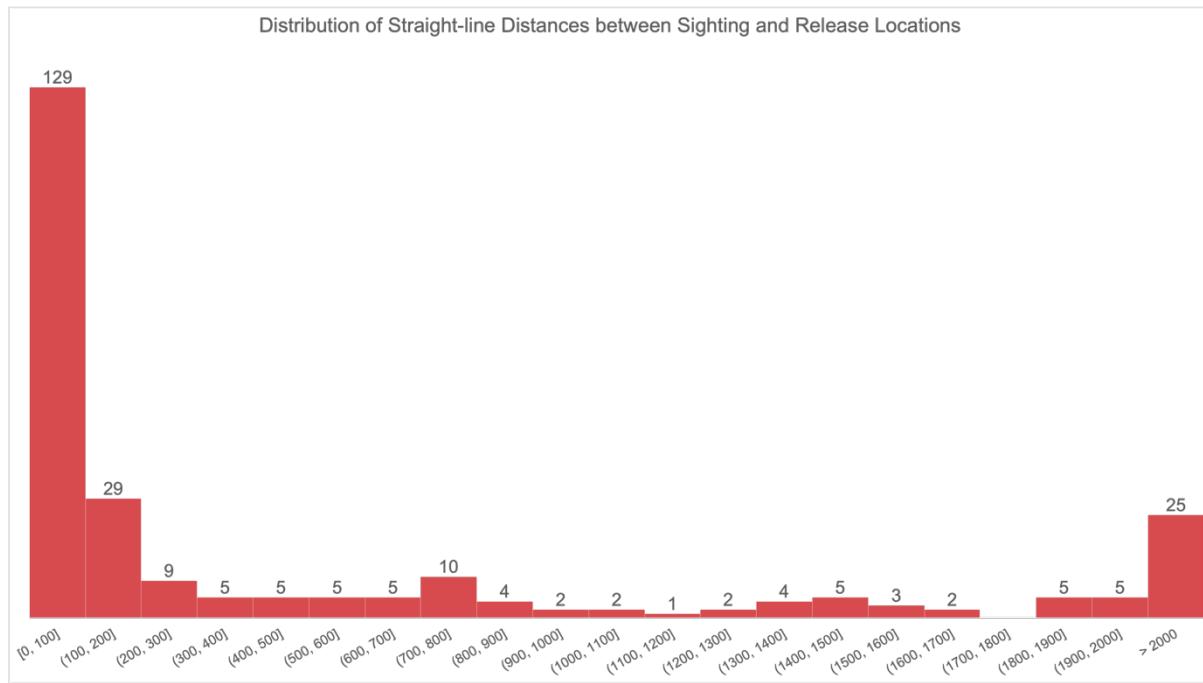
#### Summary of Geodesic Distance (in metres)

metric	Distance
min	0
q1	13.2
median	88.4
mean	2588
q3	746
iqr	733
p95	5156
max	294696 ( $\approx$ 295 km)

#### Key observations

- Most monarchs moved short distances. The median distance travelled by a monarch is about **88 m**.
- A small number of individuals made long-distance movements ( $>10$  km), including a long distance case up to **295 km**.
- A female monarch tagged WAA585 travelled a distance of approximately 140 km in a span of 23 days.

## 5.2 Distribution of Distances

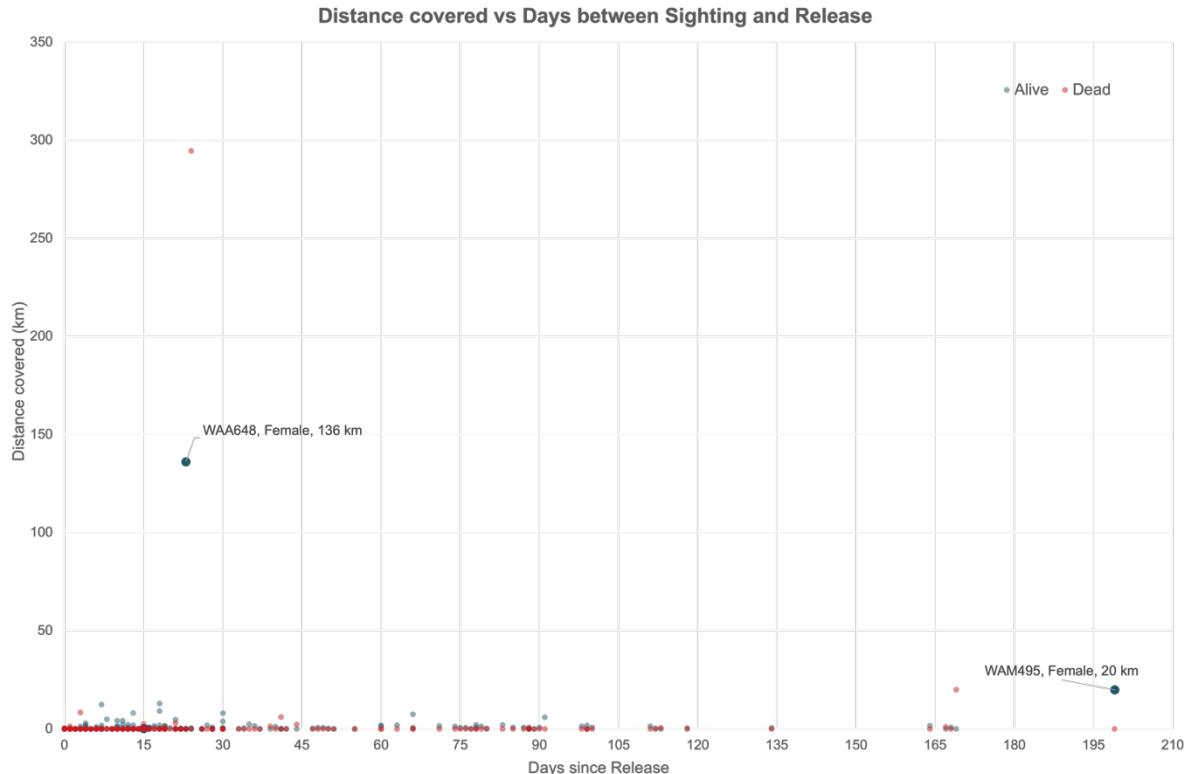


**Observation:** The movement of the butterflies is strongly right-skewed, with a predominance of very short distances (0–100 m). **129 of the 257 sightings (approximately 50%) were sighted within 100 m of the location of release.**

25 of the tagged butterflies flew over a distance of 2 km.

### 5.3 Days Since Release

The chart below shows the distribution of the distance covered by the sighted butterflies against the number of days since release. The highlighted ones are the alive butterflies that travelled great distances.



The summary of days between sighting and release is as follows:

metric	days
min	0
q1	3
median	11
mean	23.9
q3	26
max	199

**Observation:** The median number of days between sighting and release is **11 days**, with a long tail of late recoveries.

## 5.4 Straight-Line Movement Map

An **interactive leaflet map** named '*monarch\_movement\_map*' showing the straight-line movements of tagged monarchs has been generated separately.

Lines illustrate the movement between release and recovery locations.

Hover labels include tag ID, distance travelled, days since release, sex (where available) and condition (dead or alive).

## 5.5 Sighting patterns

### Key Observations:

- **Long-distance butterflies** were significantly more likely to be sighted near **general flowering plants** ("other") compared to "no plants", but distance did **not** meaningfully influence sightings near swan plants.
- **Male butterflies** had substantially higher odds of being sighted near **general flowering plants**, which might be consistent with their nectaring and territorial behaviour.
- **Females** sightings showed a slightly higher likelihood of being associated with **swan plants**, which might support expected egg-laying behaviour.
- **Continuous geodesic distance** had a negligible influence on plant association.

Overall, the model suggests that plant-type associations are shaped more by butterfly sex and broad movement category (long-distance vs short-distance) than by the exact distance travelled.

### Disclaimer:

These results provide early insight into how monarch butterflies in New Zealand interact with their environment during movement, but they should be interpreted within the limitations of citizen-science data. The behavioural patterns identified are consistent with behavioural patterns but future studies and analysis can look deeper into more of these behavioural patterns when coupled with more predictors.

### Other observations:

#### Plant Presence at Sighting Locations

Of the 257 sighting records, plant-related observations were reported as follows:

- **83 sightings** (32%) mentioned the presence of **swan plants or milkweed**.
- **87 sightings** (34%) mentioned **other flowering plants, bushes, or trees**.
- **42 sightings** (16%) indicated **no plant species** present.
- **46 sightings** (18%) contained **no comment** on plant presence and were excluded from plant-presence analysis.

This distribution suggests that the majority of monarch sightings occur in locations where **either nectar plants or host plants** are present. It is also important to consider that the majority of sightings were near release locations.

### Overall Odds of Sighting Monarchs Near Plants

Across all sightings where plant information was available, the **odds of sighting a monarch butterfly were approximately four times higher when any plant species** (swan plant/milkweed or other flowering plants) were present compared to locations with no recorded plants.

This pattern remained consistent under multiple distance thresholds, including butterflies that had travelled more than:

- **100 metres**
- **500 metres**
- **1,000 metres**

This reinforces the ecological expectation that **plant-rich environments support both everyday monarch activity and longer-distance movement**, regardless of how far the butterfly has travelled.

### Association Between Sex and Plant Type

A breakdown of plant observations by sex (n = 67 sightings with complete data) showed:

Plant Type	Female	Male	Total
No plants	6	6	12
Other plants (flowering plants, bushes, trees)	7	22	29
Swan plants / milkweed	19	7	26
Total	32	35	67

Two clear behavioural patterns emerged:

#### 1. Male monarchs were more strongly associated with “other” flowering plants.

For butterflies that travelled more than **500 metres**, males were **1.7 times more likely** to be sighted on **general flowering plants** than on swan plants or locations without plants.

This might align with expected male behaviour, which includes nectaring and patrolling around flower-rich areas.

## **2. Female monarchs were more strongly associated with swan plants/milkweed.**

Females were **approximately 1.5 times more likely** to be sighted near **swan plants or milkweed** than near other flowering plants or plant-poor areas. This reflects female oviposition behaviour and host-seeking ecology.

### **Additional analysis:**

A bias-reduced multinomial logistic regression was used to examine whether plant presence ("swan plant", "other flowering plants", or "no plants recorded") was associated with butterfly sex, long-distance movement, and geodesic distance travelled. "No plants" was used as the baseline comparison category. The analysis examined whether monarch butterflies were more likely to be sighted near **swan plants/milkweed, other flowering plants, or no recorded plants**, based on their **sex** and **movement patterns**. A bias-reduced multinomial logistic regression was used to ensure stable estimates.

#### **1. Male and female monarchs use plants differently**

##### **Males were strongly associated with "other flowering plants" (nectar sources)**

Male monarchs showed a substantially higher likelihood of being sighted near general flowering plants (e.g., nectar sources) compared to areas with no plants.

This could possibly support the behaviour where male monarchs spend time **feeding, patrolling flowering areas, and waiting for females**.

Nectar-rich areas act as both food sources and territorial spaces for males.

##### **Females were more likely to be associated with swan plants or milk weeds**

Females showed a slightly greater likelihood of being sighted near swan plants/milkweed compared with males.

This could possibly align with female behaviour

- **seeking oviposition sites,**
- **locating host plants,** and
- prioritising habitats suitable for egg-laying.

## **2. Long-distance movement influences plant associations**

**Long-distance butterflies were more likely to be sighted near general flowering plants**

Butterflies that travelled beyond the median movement distance of 100 metres had moderately increased odds of being seen near “other” flowering plants.

This might ecologically align with:

- Long-distance movement requiring sustained nectar intake.
- Butterflies refuelling at nectar sources during or after travel.

Thus, **nectar plants appear to support long-range dispersal**, even though the effect is modest.

### **Long-distance butterflies were *not* more likely to be found near swan plants**

There was no meaningful increase in the association between long-distance movement and swan plant presence.

This suggests that:

- **Swan plants are not a resource associated with long-range movement,**
- but rather with more specific egg-laying behaviour (usually by females).

Long-distance travel is therefore more strongly linked to **energy needs** (nectar), not **reproductive needs** (host plants).

### **3. Exact distance travelled (geodesic distance) does *not* predict plant association**

The continuous measure of distance travelled had no statistically meaningful influence on whether butterflies were found near swan plants or other flowering plants.

This might indicate that:

- Butterflies do not exhibit plant-type preferences based on how far they have travelled,
- Plant association is better explained by **sex** and **whether the butterfly made a long-distance movement**, not by the exact kilometres travelled.

### **4. Overall behaviour pattern**

Across the dataset, a consistent ecological narrative emerges:

#### **Males congregate near nectar sources**

Because nectar fuels daily activity and male patrolling behaviour.

#### **Females seek swan plants for egg-laying**

Explaining their higher association with swan plant sightings.

#### **Long-distance travellers rely on nectar**

Supporting movement, but do not show stronger associations with host plants.

**Distance alone does not determine plant preference**

Behavioural roles (male vs female) and context (long-distance vs short-distance movement) were shown as more important.