Hihi Adaptive Management Plan

Summary of alternative management strategies

Each strategy is composed of:

1. **Harvest** component – where to take birds from;
2. **Release** component – where to put birds;
3. **Feeding** component – where to feed.

**Strategy 1 – Status quo**

**Harvest** 40 juveniles (=20 female juveniles) from Tiritiri Matangi if there are at least 60 adult females there.

**Release** at the unoccupied site with the highest fed carrying capacity. Commit to at least two consecutive release years, stopping when either (1) there are fewer than 3 females left, in which case the site is marked as a failure, or (2) the population reaches the fed carrying capacity or the “success” cutoff.

**Feed** ad libitum everywhere, except *remote islands* where feeding is not possible.

**Strategy 2 – Sequential**

**Harvest** 40 juveniles (=20 female juveniles) from:

1. Tiritiri Matangi if there are at least 40 adult females there
2. Any site where there are at least 40 females and the population is greater than 75% of the current carrying capacity.

**Release** at, in sequential order of priority (1-2-3-4, then cycle through until all sources have been used):

1. The unoccupied *island* site with greatest non-fed carrying capacity. Commit to two consecutive release years, stopping when either (1) there are fewer than 3 females left, in which case the site is marked as a failure, or (2) the population reaches the non-fed carrying capacity or the “success” cutoff. Within this priority level, rank by non-fed carrying capacity (largest first).
2. The unoccupied *mainland* site with greatest fed carrying capacity. Commit to at least two consecutive release years, stopping when either (1) there are fewer than 3 females left, in which case the site is marked as a failure, or (2) the population reaches the fed carrying capacity or the “success” cutoff. Within this priority level, rank by fed carrying capacity (largest first).
3. Occupied original site (top-up) with long-term feeding where the population is smaller than the cutoff and fed carrying capacity is greater than 135. Within this priority level, rank sites by available space (proportion of fed carrying capacity currently occupied).
4. Occupied new site (top-up) without long-term feeding, where the population is smaller than the cutoff and non-fed carrying capacity is greater than 40. Within this priority level, rank sites by available space (proportion of non-fed carrying capacity currently occupied).

**Feed** at:

1. At libitum at all initially occupied sites.
2. Never at new *island* sites.
3. At new *mainland* sites, feed for a maximum of 4 years during releases, or until the population fails or reaches the non-fed carrying capacity or the success cutoff.
4. Restart feeding at sites where the population drops (1) below the cutoff or (2) by more than 25% or (3) below the non-fed carrying capacity.

**Strategy 3 – Seasonal**

**Harvest** 40 juveniles (=20 female juveniles) from any site where there are at least 40 females.

**Release** at, by order of priority (use all release sites with priority level 1, then all those with level 2, and so on until all sources have been used):

1. Any unoccupied site where the non-fed carrying capacity is greater than the cutoff. Commit to four consecutive release years, stopping when either (1) there are fewer than 3 females left, in which case the site is marked as a failure, or (2) the population reaches the non-fed carrying capacity or the “success” cutoff. For remote island sites where feeding is not possible, use 50% Hauturu birds. Within this priority level, rank by non-fed carrying capacity (largest first).
2. Currently occupied site (top-up) where the population drops (1) below the cutoff or (2) below the current carrying capacity or (3) by more than 25%. Within this priority level, rank sites by available space (proportion of non-fed carrying capacity currently occupied).

**Feed** at:

1. At libitum at all initially occupied sites. Reduction in months of low demand does not affect main feeding regime.
2. Never at new *remote island* sites.
3. At new sites, feed for a maximum of 4 years during releases, or until the population fails or reaches the non-fed carrying capacity or the success cutoff.
4. Restart feeding at sites where the population drops (1) below the cutoff or (2) by more than 25% or (3) below the non-fed carrying capacity.

**Strategy 4 – New Learning**

**Harvest** 40 juveniles (=20 female juveniles) from any site where there are at least 40 females.

**Release** at, by order of priority (use all release sites with priority level 1, then all those with level 2, and so on until all sources have been used):

1. Any unoccupied site where the non-fed carrying capacity is greater than the cutoff. Commit to four consecutive release years, stopping when either (1) there are fewer than 3 females left, in which case the site is marked as a failure, or (2) the population reaches the non-fed carrying capacity or the “success” cutoff. For remote island sites where feeding is not possible, use 50% Hauturu birds. Within this priority level, rank by non-fed carrying capacity (largest first).
2. Occupied original site (top-up) with long-term feeding where the population is smaller than the cutoff and fed carrying capacity is greater than 135. Within this priority level, rank sites by available space (proportion of fed carrying capacity currently occupied).
3. Occupied new site (top-up) without long-term feeding, where the population is smaller than the cutoff and non-fed carrying capacity is greater than 40. Within this priority level, rank sites by available space (proportion of non-fed carrying capacity currently occupied).

**Feed** at:

1. At libitum at all initially occupied sites.
2. Never at new sites.

**Strategy 5 – Visitor**

**Harvest** 40 juveniles (=20 female juveniles) from any site where there are at least 40 females.

**Release** at, by order of priority (use all release sites with priority level 1, then all those with level 2, and so on until all sources have been used):

1. Any unoccupied site where the non-fed carrying capacity is greater than the cutoff. Commit to four consecutive release years, stopping when either (1) there are fewer than 3 females left, in which case the site is marked as a failure, or (2) the population reaches the non-fed carrying capacity or the “success” cutoff. For remote island sites where feeding is not possible, use 50% Hauturu birds. Within this priority level, rank by non-fed carrying capacity (largest first).
2. Currently occupied site (top-up) where the population drops (1) below the cutoff or (2) below the current carrying capacity or (3) by more than 25%. Within this priority level, rank sites by available space (proportion of non-fed carrying capacity currently occupied).

**Feed** at:

1. Never at new *remote island* sites.
2. At new sites, feed for a maximum of 4 years during releases, or until the population fails or reaches the non-fed carrying capacity or the success cutoff.
3. Remove food from all sites that are above the success cutoff or the non-fed carrying capacity. Keep feeding at sites that are well above (CHECK) the non-fed carrying capacity, to avoid catastrophic crashes.
4. Restart feeding at sites where the population drops (1) below the cutoff or (2) by more than 25% or (3) below the current carrying capacity.

**Strategy 6 – Responsive**

**Harvest** 40 juveniles (=20 female juveniles) from any site where there are at least 40 females.

**Release** at, by order of priority (use all release sites with priority level 1, then all those with level 2, and so on until all sources have been used):

1. Any unoccupied site where the non-fed carrying capacity is greater than the cutoff. Commit to four consecutive release years, stopping when either (1) there are fewer than 3 females left, in which case the site is marked as a failure, or (2) the population reaches the non-fed carrying capacity or the “success” cutoff. For remote island sites where feeding is not possible, use 50% Hauturu birds. Within this priority level, rank by non-fed carrying capacity (largest first).
2. Currently occupied site (top-up) where the population drops (1) below the cutoff or (2) below the current carrying capacity or (3) by more than 25%. Within this priority level, rank sites by available space (proportion of non-fed carrying capacity currently occupied).

**Feed** at:

1. At libitum at all initially occupied sites.
2. Never at new *remote island* sites.
3. At new sites where feeding is possible, feed for a maximum of 4 years during releases, or until the population fails or reaches the non-fed carrying capacity or the success cutoff.
4. At new sites where the non-fed carrying capacity is lower than the cutoff.
5. Restart feeding at sites where the population drops (1) below the cutoff or (2) by more than 25% or (3) below the non-fed carrying capacity.

**Strategy 7 – Reinforcement**

**Harvest** 40 juveniles (=20 female juveniles) from any site where there are at least 40 females and the population is more than 75% of the current carrying capacity

**Release** at, by order of priority (use all release sites with priority level 1, then all those with level 2, and so on until all sources have been used):

1. Occupied original sites (reinforcement) where the population is smaller than 75% of the fed carrying capacity. Within this priority level, rank by fed carrying capacity (largest first).
2. Occupied new sites (reinforcement) where the population is smaller than 75% of the non-fed carrying capacity. Within this priority level, rank by non-fed carrying capacity (largest first).
3. Any unoccupied site where the fed carrying capacity is greater than the cutoff. Within this priority level, rank by non-fed carrying capacity (largest first).

**Feed** at:

1. At libitum at all initially occupied sites. Reduction in months of low demand does not affect main feeding regime.
2. Never at new *remote island* sites.
3. At new sites, feed for a maximum of 4 years during releases, or until the population fails or reaches the non-fed carrying capacity or the success cutoff.
4. Restart feeding at sites where the population drops (1) below the cutoff or (2) by more than 25% or (3) below the non-fed carrying capacity.

*Additional notes*

**Decision cycle.** Decisions about the three components are made annually on the basis of updated available data. Due to the long process (data collection – analysis – decision – permitting – logistics), decisions about feeding are made a year in advance (made in year *y* for implementation in year *y*+1), whereas decisions about harvest and release are made two years in advance (made in year *y* for implementation in year *y*+2). In reality, the latter is closer to a year and a bit but is modelled as two years because this is the simulation cycle.

**Ongoing releases**. Within each strategy (except 7), ongoing releases are always the first priority over other release criteria.

**Genetic releases.** Every fifth year, harvest 20 juveniles (=10 female juveniles) from Hauturu, mix and allocate them to the site with the smallest population and the longest time without genetic imports. If two such sites are tied, the releases are equally split and release half to both.

**Excess sources**. When there are more sources than destinations, discard excess sources by population size (smaller first).

**Hauturu**. Never fed, never a release destination, and never a source site except for (1) genetic releases (2) part of releases to remote island sites.