Life and Death of the Mariana Crow:
How updating life history and demography can have implications for conservation

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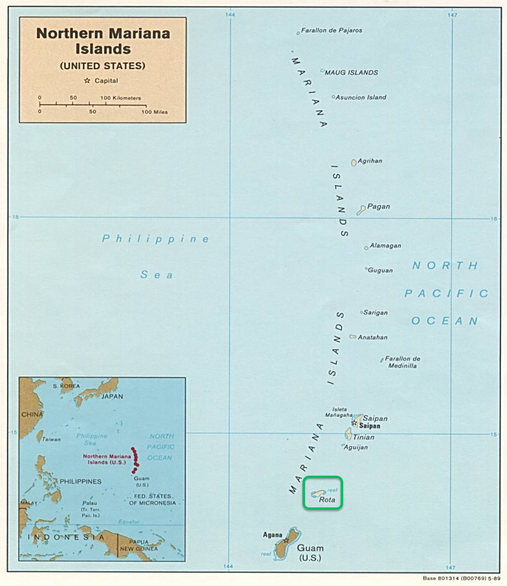

Introduction

The Mariana crow is a critically endangered island endemic species on the island of Rota, in the Commonwealth of Northern Mariana Islands. Demographic parameters are critical values for accurate species-specific population modeling for wildlife and conservation managers working to recover the Mariana crow. However, these models are only as good as the accuracy of the values used for reproduction and survival, and the demographic values themselves may change over time. Here we present both new and updated demographic parameters for the Mariana crow. Some of these values differ notably from prior estimates, while others have not been previously reported. These longitudinal records provide accurate parameters for future population modeling, and raise the question of whether demographic changes have occurred over time.

Methods

Reproductive success

- All nesting records were queried for banded adults
- All resight records of any banded individual that survived to the average age of independence (8 months), or was banded as an adult, were searched for sightings in which an individual might have been seen tending to a fledgling

Methods (cont)

Survivorship of juveniles

- Between 1990 and 2013 129 individuals were color banded as fledglings or nestlings for resighting in the field.
- Survivorship to 1 year was assessed through opportunistic resightings. Analysis was done using Cormak-Jolly-Seber models in the Progam MARK, using RMark as an interface to build models[2].

VORTEX modeling

- Models were made using VORTEX 10.1.6
- The initial population for all models was based on the 1999 estimate of 117 pairs; all other values were based on the most recent literature for each model.
- 1000 iterations were run for each model
- Population estimates reported in pairs were converted to individuals using a normal age distribution[1].

Results

Reproductive success

- 217 Mariana Crows were color banded and 123 nests belonging to 45 color banded crows were found since efforts began in 1990.
- Ages at which nesting attempts were made, regardless of outcome, range from 1.04 years to 16.94 years, whereas the age range for successfully fledging young ranged from 1.3 years to 15.76 years. (Figure 1)

Survivorship

- The best fitting model is now the constant survivorship model.
- Depending on the model used, first year survivorship is now estimated between 59-68%
- A large amount of variation was seen in earlier years, but has decreased in the last three periods (Figure 2).

VORTEX Modeling

- For the Original Outcome model, 12.2% of the iterations went extinct before year 30; in the Updated Demog 2013 simulations, 13.6% of iterations went extinct before year 30.
- Only one iteration (0.1%) went extinct in the Updated 2016 model. This trend provided the best fit for the 2008 and 2016 Mariana crow pair surveys.
- Changes to mortality inputs had the greatest effect on the model's trend.
- Changes to max lifespan and age of 1st breeding had large effects on the size of the juvenile cohort for each model and thus affected the conversion of breeding pairs to total population (Figure 3).

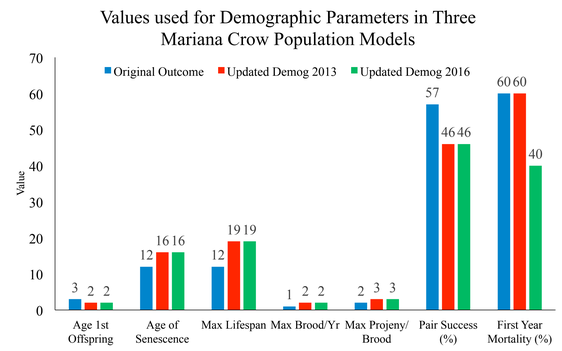

Figure 1: A comparison of the demographic values used in each Mariana crow population model[1,4-6].

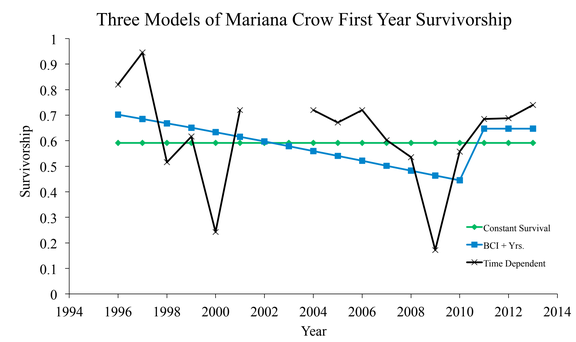

Figure 2: Three models of first year survivorship. Constant survival model is currently the most parsimonious, however the "BCI + years" model was most parsimonious in when it was run 2010[2].

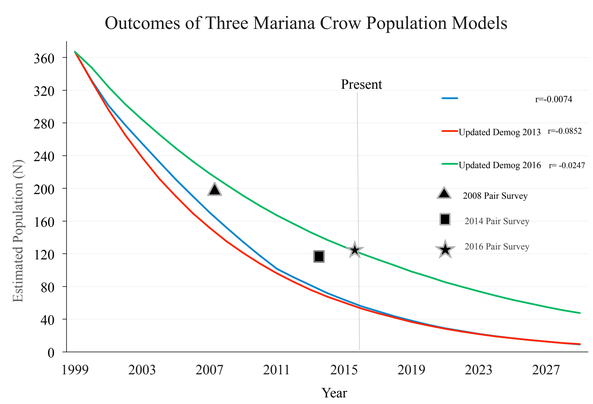

Figure 3: A comparison of projected Mariana crow population trends made by three different models. Each model utilized the most updated demographic values available[3,5,6].

Conclusions

- Mining long-term data sets made a large difference in VORTEX model outcomes and allowed for a model that better fit real-world Mariana crow population trends.
- While some demographic parameters may have changed over time, it is likely that many prior estimates of demographic metrics were based on insufficient data. The most recent measurements of the Mariana crow's reproductive life and the parsimonious nature of the Constant Survivorship Model support this.
- It is important to implement a consistent amount of effort when conducting population surveys meant to be compared over time. Reporting error may have resulted in the apparent variation in Mariana crow survivorship.
- The method used for converting reported breeding pairs to a total population assumes that the population has a stable age distribution; however, the age distribution of Rota's Mariana crow population is currently unknown.
- These models do not account for future population management scenarios, such as the implementation of a rear and release program or changes to the predator removal program.
- Our updated model will serve as a foundation for determining how to best augment the population moving forward.
- Because reductions in first year mortality had the greatest impact on the population trend, continuing efforts to reduce mortality by predators and investigate other potential contributions to mortality are recommended.

Literature cited

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