The impact of fox and feral cat predation on the population viability of the threatened, endemic Socotra Cormorant on Siniya Island, United Arab Emirates


By: Kayla Jones 4/14/14
Phalacrocorax nigrogrularis

- Socotra Cormorants are seabirds
- Endemic to Arabian Gulf and Gulf of Oman
- Threatened, populations collapsing (½ in 30 yr.)
- 15,000 breeding pairs on Siniya Island

Fig. 1. Map of Siniya Island, Umm Al Quwain, showing the approximate location of the breeding colony in 2011.
**Vulnerability & Threats**

- **Reasons for vulnerability:**
  - Long reproductive cycles
  - Delayed maturity
  - Low productivity

- **Threats to the cormorants:**
  - Habitat loss
  - Breeding site disturbance
  - Oil spills
  - Fishing line entrapment
  - Predation (major)
Predation

- Introduced feral cats are found on the islands & pose a threat to nesting seabirds

- Red foxes are native and expanding, but not reported on seabird colonies (dilemma?)

- Altricial chicks, historically not a problem

- Higher mortality rates could = long-term population collapse
Study Area

- Siniya Island, Umm Al Quwain, UAE
- Largest known colony of Socotra Cormorants
- 3 individual foxes and 3 feral cats recorded during 2011 breeding season
- Island is large enough to hold many more predators
Estimation of Predation Rates – Methods:

• 200x10 m transects outside colony border

• Walked during 2 mo. breeding season

• Looked for dead birds with signs of fresh predation

• Calculated daily mortality rates per m²

• Total mortality rates extrapolated
Estimation of Predation Rates – Methods:

• Determined mortality due to predation by:
  • Calculating mean # cormorants killed by 3 foxes and 3 cats based on dietary requirements from published literature

• Assumed 90% of cat/fox diet was cormorants
  • Foxes eat 30% of carcass
  • Cats consume 50%

• Kills that were hoarded or not eaten were not estimated.
Population Viability Analysis Methods:

- Vortex software used to model impact
- Parameters based on best estimates from other cormorant species
  - Initial pop size
  - Sex ratio
  - # of broods
  - Clutch size
  - Age-specific mortality
  - Max breeding age
  - Carrying capacity
  - 3 mortality scenarios
Population Viability Analysis Methods:

- 3 mortality scenarios:
  - 2000 kills/season (transects)
  - 1800 kills/season (E requirements)
  - 900 kills/season (arbitrary ½)

- Sensitivity of population persistence tested

- Modeled population for 50 years using 100 simulations
### Baseline Parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate for baseline model</th>
<th>Range for sensitivity analyses</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial population size</td>
<td>31,000</td>
<td>—</td>
<td>Jennings 2010</td>
</tr>
<tr>
<td>Sex ratio (assumed)</td>
<td>1:1</td>
<td>—</td>
<td>Nelson 2005</td>
</tr>
<tr>
<td>Number of broods</td>
<td>1</td>
<td>—</td>
<td>Muzaffar et al. 2012, Jennings 2010</td>
</tr>
<tr>
<td>Clutch size</td>
<td>1 to 3</td>
<td>—</td>
<td>Muzaffar et al. 2012</td>
</tr>
<tr>
<td>Proportion of clutches with 1, 2, 3 eggs (%)</td>
<td>35, 55, 10</td>
<td>—</td>
<td>Muzaffar et al. 2012</td>
</tr>
<tr>
<td>Mortality rates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ages 0–1 (%)</td>
<td>40</td>
<td>—</td>
<td>Muzaffar et al. 2012</td>
</tr>
<tr>
<td>Ages 1–2 (%)</td>
<td>13</td>
<td>20, 30, 40</td>
<td>Harris et al. 1994</td>
</tr>
<tr>
<td>Ages 2+ (%)</td>
<td>10</td>
<td>20, 30, 40</td>
<td>Nelson 2005</td>
</tr>
<tr>
<td>Maximum age at breeding (estimated)</td>
<td>10 years</td>
<td>—</td>
<td>Nelson 2005</td>
</tr>
<tr>
<td>Carrying capacity (estimated)</td>
<td>50,000</td>
<td>—</td>
<td>This study</td>
</tr>
<tr>
<td>Mortality (per season)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 1</td>
<td>900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 2</td>
<td>1,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 3</td>
<td>2,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Sources could include other cormorant species.*
*No mortality from predation was assumed in the baseline model.*
Predation Results:

- 29 kills recorded over 35 days covering 12,000 m² of transects
- More kills early in the season
- Estimated total mortality (individuals: entire season) = 2013

<table>
<thead>
<tr>
<th>Date</th>
<th>Kills (all transects)</th>
<th>Estimate kills/season/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Oct</td>
<td>16</td>
<td>0.0013333333</td>
</tr>
<tr>
<td>26 Oct</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31 Oct</td>
<td>3</td>
<td>0.00025</td>
</tr>
<tr>
<td>14 Nov</td>
<td>9</td>
<td>0.00075</td>
</tr>
<tr>
<td>20 Nov</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27 Nov</td>
<td>1</td>
<td>8.3333 x 10⁻⁵</td>
</tr>
<tr>
<td>Total kills</td>
<td>29</td>
<td>0.002416667</td>
</tr>
</tbody>
</table>

Total area of transects, m²: 12,000
Area (predation), m²: 190,558
Mortality rate/m² (season): 0.01056
Estimated total mortality (individuals: entire season): 2,013
Population Viability Analyses Results:

- Pop size could be reduced to the hundreds in 50 years based on these models
- Populations were more vulnerable to decline when adult mortality was high
Discussion — Estimation of Mortality from Foxes and Feral Cats:

- Carcasses of larger adults and fledglings were assumed to be fox kills
- Smaller chicks assumed to be feral cat kills
- Combination of predators in particular could be detrimental
- Foxes are known to hoard food (could ↑ mortality)
- 1800 birds probably underestimate, but realistic and informative
Discussion – Population Viability Analyses:

- Baseline model showed gradual pop ↑ in the absence of predation

- Population could be seriously threatened by foxes in particular

- Island could support 8+ foxes and 30+ cats

- Threats could be higher than perceived
Discussion – Conservation Implications & Ethical Management Concerns:

- Foxes & feral cats pose a threat

- Cats were introduced predators, eradication can be justified.

- Foxes are native, control is considered unethical.

- Red fox is categorized as Least Concern while Socotra Cormorant is Vulnerable (getting closer to Endangered)

- Immediate fox & feral cat eradication measures recommended.