Commentary: Population declines and generation lengths can bias estimates of vulnerability

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A recent analysis of avian population trends (Dunn 2002) has engendered debate over the use of trend data in attempts to identify species of conservation and management concern (Butchart 2003, Dunn 2003). Dunn (2002) used breeding-bird survey data (Sauer et al. 2003) and methods proposed by the International Union for Conservation of Nature and Natural Resources ([IUCN] 2001) and Gibbons et al. (1996) to identify vulnerable species. Dunn (2002) found that many bird species triggering conservation alerts (i.e., perceived to be imperiled) due to population declines were not actually suitable candidates for management attention because the species were widespread and still common. As Dunn (2002) stressed, alerts based exclusively on population declines can be misleading because extinction risk is a multidimensional problem requiring simultaneous consideration of several variables.

Conservation and management alerts based on population trends are influenced by 1) the level of decline producing an alert, and 2) the time period over which trends are evaluated (Dunn 2002). Managers must carefully weigh these parameters and the costs (Millsap et al. 1990) associated with species considered vulnerable. However, the parameters commonly used vary considerably (Millsap et al. 1990, Gibbons et al. 1996, IUCN 2001). A fixed time period was used by Millsap et al. (1990) and Gibbons et al. (1996), while IUCN (2001) used flexible time periods determined by an organism’s generation length. The latter approach may seem more appropriate because it includes species-specific parameters, but the approach can produce distorted estimates of relative extinction risks. This note provides an example of this problem and serves to bolster recommendations provided by Dunn (2002) to consider population trends in combination with other variables associated with extinction risk.

In 2002 the Florida Fish and Wildlife Conservation Commission (FFWCC) adopted criteria developed by IUCN (2001) for estimating extinction risk and incorporated the criteria in the state’s legal definitions of protected species (Florida Administrative Code Rule 68A-27.0012). The FFWCC’s goal was similar to IUCN (2001), namely to gauge the global extinction risk of hundreds of species falling under the agency’s jurisdiction (FFWCC 2001). The new criteria considered population declines as well total population size, area occupied, and geographic distribution. The history and development of FFWCC’s new laws were described in Cox et al. (2002).

Proposed reclassifications of the red-cockaded woodpecker (Picoides borealis) and the gopher tortoise (Gopherus polyphemus) occurred soon after the new criteria were adopted (Cox et al. 2002). The petition for the red-cockaded woodpecker (FFWCC 2002a) concluded that the species
fell in the lowest category of endangerment, which FFWCC called *Species of Special Concern*. The definition for this category is a species “...which is facing a moderate risk of extinction in the future...” (FFWCC 2002a:19). The FFWCC’s criteria for this category were identical to the IUCN (2001) category of *Threatened*.

The petition for the gopher tortoise (FFWCC 2002b) concluded that this species fell in a higher category of endangerment, which FFWCC called *Threatened*. The definition for *Threatened* is “...a species...which is facing a very high risk of extinction in the future...” (FFWCC 2002a: 18). The definition implied a higher risk of extinction, and the quantitative criteria were identical to criteria used in the IUCN (2001) category of *Endangered*.

The proposed reclassifications were based on thorough literature reviews (FFWCC 2002a, b) and the best available information, but a description of the ecology of these 2 species and their status on managed areas raised questions concerning the placement of gopher tortoise in the higher category of risk. The red-cockaded woodpecker requires large areas (ca. 120 ha) of mature (>80 years old) pine (*Pinus* spp.) forests, the species is susceptible to habitat fragmentation and does not disperse great distances (United States Fish and Wildlife Service [USFWS] 2003), and the species requires frequent fires to maintain its preferred habitat of open pine forests. The USFWS (2003) estimates that approximately 14,000 individuals remain.

The gopher tortoise also occupies fire-maintained pine woodlands, but gopher tortoises use many other natural habitats (Diemer 1992) that include treeless scrub and brush, prairies, and coastal grasslands. The gopher tortoise also can be found in ruderal landscapes such as open pastures, roadside verges, transmission line rights-of-way, and clear-cuts (Diemer 1992). Gopher tortoise home-range requirements fall in the range of 1–5 ha (Cox et al. 1987, Diemer 1992, Breininger et al. 1994), or approximately 1–10% of the area required by red-cockaded woodpecker (USFWS 2003). The global population size of tortoises is unknown, but conservation lands in the southeastern United States appear to support >100,000 individuals (L. Smith, Jones Ecological Research Center, unpublished data). In addition, Hermann et al. (2002) estimated a mean density of 1.1 active tortoise burrows per hectare over a 523,800-ha area in southwest Georgia. The ratio of active burrows to adult tortoises varies but often is <5:1 (Cox et al. 1987, Breininger et al. 1991). Given the broader habitat tolerances, smaller home-range requirements, and common occurrence on private lands, the global tortoise population probably exceeds 300,000 individuals.

Data describing the distribution of populations on conservation lands (USFWS 1986; L. Smith, Jones Ecological Research Center, unpublished data) also raise questions about rankings assigned by FFWCC. The gopher tortoise is better represented on managed areas throughout the southeastern United States (Table 1). Looking exclusively at the number of large (>200) populations on managed areas, the gopher tortoise has approximately 8 times as many protected populations (Table 1). Furthermore, whereas managed areas support only 1 woodpecker population exceeding 1,000 individuals, managed areas support an estimated 50 such gopher tortoise populations.

Other methods for evaluating the vulnerability of these 2 species have produced different estimates. Millsap et al. (1990) ranked red-cockaded woodpecker at a higher level of concern than gopher tortoise. The USFWS (2003) considers the red-cockaded woodpecker to be endangered throughout its range but lists the gopher tortoise as threatened in the western portion of its range (USFWS 1986). Natureserve (2004) places the 2 species at the same level of risk but lists the woodpecker at a higher level of risk within Florida.

So why did the FFWCC system place the red-cockaded woodpecker in a lower category of endangerment when the global tortoise population was at least 20 times larger and the number of large tortoise populations on managed conservation lands was 8 times larger? The answer is that the

<table>
<thead>
<tr>
<th>Population sizes on managed areas</th>
<th>Gopher tortoise&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Red-cockaded woodpecker&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
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<tbody>
<tr>
<td>&lt;25</td>
<td>46</td>
<td>44</td>
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<tr>
<td>26–100</td>
<td>107</td>
<td>30</td>
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<tr>
<td>101–200</td>
<td>64</td>
<td>12</td>
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<td>201–500</td>
<td>52</td>
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<td>501–1,000</td>
<td>27</td>
<td>5</td>
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<tr>
<td>&gt;1,000</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>346</td>
<td>99</td>
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</table>

<sup>a</sup> L. Smith, Jones Ecological Research Center, unpublished data.  
<sup>b</sup> United States Fish and Wildlife Service (2003).
The red-cockaded woodpecker is a long-lived (>70 years) species (Landers et al. 1980, Cox et al. 1987, Diemer 1992).

The criterion making gopher tortoise eligible for Threatened status was an observed, estimated, inferred, or suspected reduction of at least 50% over the last 10 years or 3 generations, whichever is longer (FFWCC 2002b). The FFWCC (2001) and IUCN (2001) defined generation length as the average age of adults in a population. The estimated generation length for gopher tortoise was >30 years (FFWCC 2002b), so the time frame used to evaluate tortoise declines was approximately 100 years. Meanwhile, the estimated generation length for red-cockaded woodpecker was 5–6 years (FFWCC 2002a), so even though this species has declined >90% over the past 100 years (USFWS 2003), woodpecker trends were assessed over a maximum of 20 years. Interestingly, the petition for red-cockaded woodpecker (FFWCC 2002a) suggested that the woodpecker might not warrant listing because population declines over the past 20 years only marginally satisfied criteria in the new law (Cox et al. 2002).

The IUCN (2001) and FFWCC (2001) accepted the highest ranking emerging from all criteria considered. This approach has important implications (Todd and Burgman 1998) because other criteria (e.g., population size, area occupied, and geographic distributions) trigger conservation alerts only for small (i.e., <10,000 individuals) or highly restricted populations. The number of vertebrate species in Florida with populations <10,000 is small (Millsap et al. 1990), so population trends likely will be the primary determinant of extinction risk for most vertebrates evaluated under the new law. Without consideration of other data, this system may place other long-lived species in a higher category of risk than short-lived species that are in greater jeopardy.

As Millsap et al. (1990: 40) warned, quantitative ranking systems can “...never replace human judgement in the allocation of conservation resources.” Unlike IUCN (2001), FFWCC’s methods essentially fixed the IUCN criteria for population declines in the Florida legal code and thus did not allow “human judgement” to correct distorted rankings. In comparison to gopher tortoise, the red-cockaded woodpecker faces much higher risks of global extinction in all meaningful comparisons (e.g., habitat specificity, population size, and status on managed areas), yet it barely qualifies for listing in Florida because the time frame used to assess population trends does not take into account historic losses (Cox et al. 2002).

It is important to use objective criteria when evaluating rare species (Millsap et al. 1990), but criteria tied to population declines must be treated carefully and include consideration of other factors (Beissinger et al. 2000, Carter et al. 2000, Dunn 2002). It seems especially important to weigh population threats (Carter et al. 2000) and status on managed areas in places such as Florida where large-scale habitat destruction is taking place and millions of dollars are spent annually to purchase environmental lands (Kautz and Cox 2001). The land purchases may effectively protect scores of viable populations of some species, yet the purchases will not lower perceived vulnerability if trends outside protected areas continue sharply downward. Interestingly, when trend data are used exclusively, a species such as red-cockaded woodpecker can lose ground outside managed areas and remain listed as an imperiled species until only the populations on managed areas remain. At that point, if populations on managed areas are stable (i.e., not declining), the red-cockaded woodpecker suddenly becomes eligible for removal because the declines will have ceased.

The important ecological role that some species play also should be considered when evaluating conservation alerts (Carroll et al. 1996). In this light, the red-cockaded woodpecker and gopher tortoise are on equal footing. The red-cockaded woodpecker plays a key role in the management of endangered southern pine forests (Jackson 1995, James 1995, Noss et al. 1995), while burrows excavated by gopher tortoises provide habitat for hundreds of rare and endemic species (Diemer 1992). Despite what FFWCC’s analysis of trend data suggests, both species are equally threatened, and any ranking system that places the red-cockaded woodpecker at a lower level of imperilment than the gopher tortoise is seriously flawed.

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James (Jim) Cox received his B.A. and M.S. degrees from Florida State University. He worked as a nongame biologist with the Florida Fish and Wildlife Conservation Commission for 14 years before moving to Tall Timbers Research Station in 1998. His work at Tall Timbers focuses on red-cockaded woodpeckers, brown-headed nuthatches, Bachman’s sparrow, and other pinelands birds.