Acting fast helps avoid extinction

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Abstract

Failure to act quickly on evidence of rapid population decline has led to the first mammal extinction in Australia in the last 50 years, the Christmas Island Pipistrelle (*Pipistrellus murrayi*). The fate of another iconic species, the migratory Orange-bellied Parrot (*Neophema chrysogaster*), monitored intensively for over 20 years, hangs in the balance. To inform future conservation management and decision making, we investigate the decision process that has led to the plight of both species. Our analysis suggests three globally relevant recommendations for minimizing species extinction worldwide: (1) informed, empowered, and responsive governance and leadership is essential; (2) processes that ensure institutional accountability must be in place, and; (3) decisions must be made whilst there is an opportunity to act. The bottom line is that, unless responsive and accountable institutional processes are in place, decisions will be delayed and extinction will occur.

Introduction

After 15 years of monitoring its consistent decline, the Christmas Island Pipistrelle (*Pipistrellus murrayi*) is now presumed extinct (Lumsden 2009; Beeton *et al.* 2010). Another Australian species, the Orange-bellied Parrot (*Neophema chrysogaster*), monitored systematically since 1990, has narrowly escaped extinction. In 2010, responding to information indicating that extinction of the parrot in the wild was likely within 3–5 years, immediate action was taken to secure an effective insurance population. Understanding the decision process (Clark 2002) for these two species, one lost forever, one hanging in the balance, has global relevance and should guide future decisions to prevent extinction. The material in this article and lessons learned were drawn from the direct experiences of the authors in the management of the two species, reviewing the published and gray literature, as well as unstructured interviews conducted in person, over the phone and via e-mail with scientists and bureaucrats working closely with these two species. Interviews were conducted by TGM between 2010 and 2011.

Christmas Island Pipistrelle

The Christmas Island Pipistrelle, a small 3.5 g insectivorous bat, was endemic to the 135 km^2 Christmas Island, an Australian External Territory, located 1500 km north west of Australia in the Indian Ocean. Management of Christmas Island is the responsibility of the Australian

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Commonwealth (federal) Government. The species was widespread when described in 1900. Subsequent observations suggest it remained common until 1984 (Tidemann 1985; Lumsden & Cherry 1997). In 1994 and 1998, systematic surveys of the pipistrelle using harp traps and echolocation detectors revealed that the species was in marked decline (Lumsden *et al.* 1999). The precise cause of the decline remains unknown but it was likely the result of a complex cascade of negative impacts due to the colonization of the bat's habitat by a suite of invasive species and possibly some form of disease (Schulz & Lumsden 2004; Beeton *et al.* 2010). In 2001, the bat was listed as Endangered under the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act 1999. Following a recommendation in the recovery plan (Schulz & Lumsden 2004), the species was monitored intensively from 2004 onward. The main objectives of the recovery plan included maximizing population viability in the wild, monitoring the population, and investigating potential threats to determine the cause of the decline.

Monitoring revealed ongoing rapid population decline. In 2005, the Australian Mammal Society and Australasian Bat Society wrote to the Commonwealth Minister for the Environment raising concerns about the pipistrelle's continuing decline (Beeton *et al.* 2009) resulting in some funding being allocated to investigate the collapse. In 2006, the species' status was changed to Critically Endangered based on a population decline of over 80% between 1994 and 2005 (Lumsden & Cherry 1997; Lumsden *et al.* 1999; James 2004, 2005; Lumsden *et al.* 2007). In their 2006 recommendation to the Minister regarding the change of status, the Commonwealth Threatened Species Scientific Committee (TSSC) stated, that "radical conservation action may be required" and "this could include translocation, captive breeding, habitat sterilization, and reintroduction or population supplementation by means yet to be determined" (Beeton *et al.* 2009). At the same time, scientists involved in monitoring the species urged the Minister to immediately initiate an emergency response plan of capturing the remaining individuals to provide an insurance population while the threats were identified and mitigated (James & Retallick 2007; Lumsden *et al.* 2007). In January 2009, an investigation of the feasibility of establishing a captive breeding program concluded that knowledge was sufficient to support captive rearing (Lumsden & Schulz 2009) as techniques for keeping *Pipistrellus* spp. have been known for over 40 years (Kleiman 1969).

In January 2009, when it was estimated that as few as 20 individuals remained (Lumsden 2009a; Lumsden & Schulz 2009), representations by researchers and the Australasian Bat Society led the Minister to seek advice from the TSSC on the feasibility of a captive breeding program (Beeton *et al.* 2009). After receiving the advice, the Minister recommended a captive husbandry trial on an analogous bat species, despite existing knowledge (Kleiman 1969; Lumsden & Schulz 2009) and predictions that the pipistrelle would be extinct by June 2009 if emergency collection of remaining individuals was not undertaken immediately (Lumsden & Schulz 2009). The Minister also followed advice from senior public servants to set up an Expert Working Group in February 2009 (Beeton *et al.* 2009, 2010) to review and advise on threats to biodiversity on Christmas Island. The Expert Working Group's interim report to the Minister on 28 June 2009 recommended "that Christmas Island Pipistrelles are captured from the wild as soon as practicable, as founders of a captive breeding colony" (Beeton *et al.* 2009).

On July 1, 2009 the Commonwealth government decided to capture the remaining pipistrelles (Beeton *et al.* 2010). However, this rescue attempt came too late. Only a single pipistrelle was detected in August 2009, and it could not be caught. The last echolocation call was detected on August 26, 2009 (Lumsden 2009). In September 2009, the Minister announced that the emergency rescue had failed (Lumsden 2009; Figure 1).

The decision to start captive breeding was delayed for at least 3 years after it was first recommended. In 2006, when a captive breeding program was first proposed, there were four possible courses of action; (1) immediately commence captive breeding program, (2) continue research and management of suspected threatening processes (dooming the pipistrelle but potentially benefiting other Christmas Island species facing similar threats), (3) explicitly decide to do nothing and spend scarce resources on saving species elsewhere (effectively a triage evaluation), and (4) avoid or delay making a decision (implicitly dooming the pipistrelle to extinction). In the end, by failing to act quickly on information showing the urgent need to start captive breeding, option 4 was apparently selected and the species was monitored to extinction. Perhaps extinction was unavoidable for the pipistrelle, but, in the absence of a decision to commence captive breeding, their fate was sealed.

Orange-bellied parrot

Estimates from the 1800s to early 1910s suggest the migratory Orange-bellied Parrot was common across its breeding range in Tasmania and its wintering range in southern Victoria and South Australia (Jarman 1965). By 1917, concerns were being raised over the parrot's decline (Matthews 1917) and a survey across the species' entire range in 1981 confirmed it was on the brink

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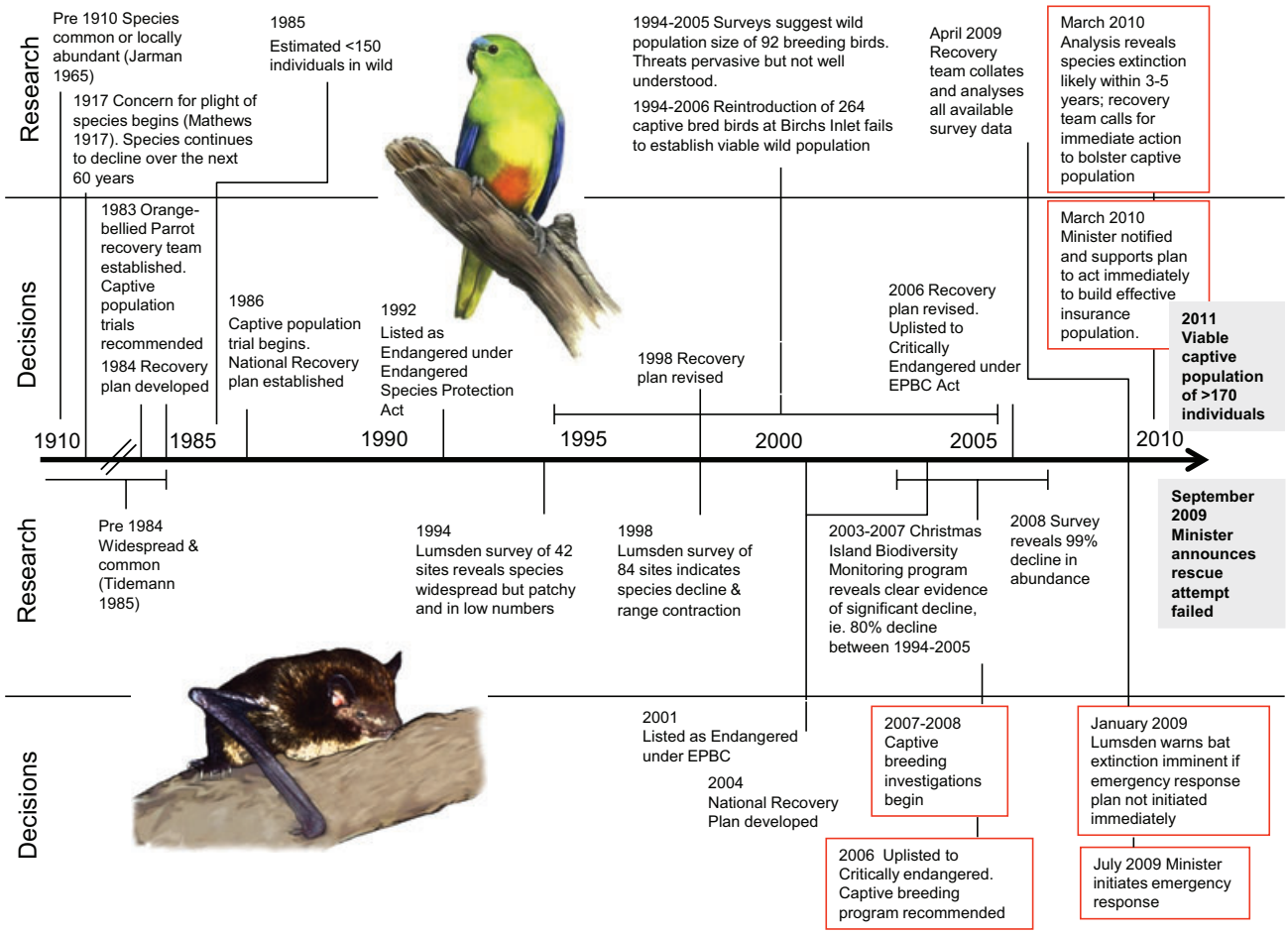

Figure 1 Timeline showing key research findings and management decisions relating to the conservation management of the Orange-bellied Parrot and Christmas Island Pipistrelle. Boxes outlined denote the final series of actions that led to species extinction or preservation. Original image of the Christmas Island Pipistrelle by L. Lumsden.

of extinction (Brown & Wilson 1981). On-ground conservation action for this species rests with the State Governments of Tasmania, Victoria, South Australia, and to a lesser extent New South Wales under their respective endangered species legislation, but because of federal listing, the Commonwealth Government also has a responsibility to conserve the species. The Orange-bellied Parrot was listed as Endangered in 1992 under the Commonwealth of Australia's Endangered Species Protection Act, the highest available designation under that Act, and the listing was amended to Critically Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999, in 2006 (Figure 1). A multi-agency, multigovernment recovery team, which also included members from universities and nongovernment organizations, was established in 1983. When the first recovery plan was developed in 1984, it was estimated that fewer than 150 individuals existed in the wild (Brown & Wilson 1984; Orange-bellied Parrot Recovery Team 2006). Intensive monitoring at the primary breeding location began in 1990 and estimates based on data collected between 1994 and 2005 suggested a minimum population of 92 birds (range 71–116; Orange-bellied Parrot Recovery Team 2006). Like the Christmas Island Pipistrelle, threats to the Orange-bellied Parrot are poorly understood. They include habitat loss and degradation, weed invasion, introduced competitors, and inappropriate fire regimes (Orange-bellied Parrot Recovery Team 1999). The objectives of the 2006 recovery plan included increasing the number of breeding sub-populations and maintaining a viable captive population (Orange-bellied Parrot Recovery Team 2006).

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The Orange-bellied Parrot recovery team was one of the first such bodies established in Australia and has met at least annually since 1984. The recovery team provided the opportunity for local land managers, research workers, volunteers and observers to participate (Orange-bellied Parrot Recovery Team 2006). Under the United States of America's Endangered Species Act 1973 (ESA) and Canada's Species at Risk Act 2002 (SARA) government agencies often procure the services of public and private entities to develop and implement recovery plans, including the appointment of recovery teams. However, like Australia, the formation of a recovery team is not a legislative requirement. Although some recovery teams are appointed by and report to State conservation agencies, some are formed on an *ad hoc* basis, and have a variety of administrative systems and reporting arrangements. In the case of the Orange-bellied Parrot, the 2006 recovery plan explicitly acknowledged the importance of the recovery team and included actions aimed at increasing recovery effectiveness.

In 1986, the first trial captive breeding population was established (Smales *et al.* 2000). By 2009, around 170 birds were in captivity. Although captive-bred released birds had successfully completed migration both to and from the breeding grounds, the release of 264 birds from 1994 to 2006 at a former breeding site failed to reestablish a viable wild population (Smales *et al.* 2000; Orange-bellied Parrot Recovery Team 2006). In April 2009, the Orange-bellied Parrot recovery team expressed concern about the state of the species and commenced collating and analyzing all available monitoring data. In March 2010, on reviewing the analysis, it became evident that the species would become extinct in the wild within three to five years unless drastic action was taken. The recovery team decided that immediate action was required to bolster the captive population into an effective insurance population (Figure 1). Within 1 day of this decision, implementation of time-critical actions, including the capture of two new juvenile founders, was under way.

Within 3 weeks, the recovery team had drafted an action plan to augment the existing captive breeding program to form an insurance population based on an increased number of founders. In addition to being endorsed and supported by the relevant State Environment Ministers, the Commonwealth Environment Minister was notified and the Commonwealth committed further resources in response to the recovery team's proposed actions. During the 2010–2011 breeding season a further 21 juveniles were taken into captivity to increase genetic diversity, enhancing the possibility of future conservation options, including population augmentation and reintroduction once threats are managed. As captive breeding had been successful in the past, it is anticipated that it will be successful again.

Table 1 Assessment of which decision functions (Clark 2002) were carried out in the case of the Christmas Island Pipistrelle and Orange-bellied Parrot

Decision Functions	Definition	Christmas Island Pipistrelle	Orange-bellied Parrot
Intelligence	Obtaining, processing, and delivering information to decision makers	√	√
Promotion	Recommending and mobilizing support for alternative policies	√	√
Prescription	Turning policies into actions	X	√
Invocation	Implementing actions in a timely manner	X	√
Application	Implement actions in the manner in which they were prescribed	X	√
Appraisal	Assessing whether prescriptions achieved goal	√	Ongoing
Termination	Canceling or updating the prescription	√	Ongoing

The decision process

Management of endangered species is a process of decision making. The decision process can be conceived as a sequence of decision functions that precede and follow rule making or norm setting (Clark 2002; Table 1). Examining these cases in the context of these decision functions reveals some clear differences. In both cases, the intelligence or information on species decline was obtained and delivered to decision makers and recommendations for action were promoted (Table 1). The divergence in the decision process occurred in the functions of prescription, invocation, and application. The Orange-bellied Parrot had a champion in the form of an active recovery team to guide species management and ensure recommendations were turned into action (prescription, Table 1). The recovery team included the necessary expertise as well as members of relevant government agencies and nongovernment organizations.

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The recovery team was informed, had a history of credible action and advice, and was willing to respond. These recommendations were based on the best available science, were invoked as intended, and applied quickly enough to avoid foregoing opportunities (invocation, application, Table 1). With the Christmas Island Pipistrelle, the information conveyed by credible researchers, professional bodies such as the Australasian Bat Society, the Australian Mammal Society, and even of the statutory TSSC, did not lead to a decision until it was too late.

Leadership has emerged as a critical component of endangered species recovery, underpinning conservation program success (Manolis *et al.* 2009; Kenward *et al.* 2011). Good leadership can ensure the decision process is carried through, in other words, that policies are turned into actions and actions are implemented in a timely and appropriate manner (Table 1). In an analysis of two critically endangered species in the United States, Black *et al.* (2011), assert that the style of leadership was a key factor resulting in the recovery of the California Condor (*Gymnogyps californianus*) and the extinction of the Po'ouli (*Melamprosops phaeosoma*), a Hawaiian honeycreeper. In the case of the Po'ouli, the leadership style was predominantly one of command and control whereby a government agency directed those in the field to undertake tasks (Holling & Meffe 1996). Leadership attitudes reflected caution and uncertainty regarding how to proceed, inevitably resulting in little action until it was too late (Black *et al.* 2011). Those in the field with the greatest knowledge of the Po'ouli had no authority to make decisions. The case of the Po'ouli is strikingly similar to that of the Christmas Island Pipistrelle, whereby the decision-making authority was held within a large government agency with many layers of bureaucracy, leading to an accountability vacuum. Those in the field most acutely aware of the state of the pipistrelle were powerless to act without the authority of senior bureaucrats in the government agency. In the case of the Po'ouli, by the time the decision was made to capture the remaining individuals, only three birds remained and attempts to start a captive population failed.

In the case of the California Condor, the leadership style reflected a top-down, command and control style for the first 60 years of management, during which time the population declined from 150 to 27 birds. In the 1980s, a shift in leadership style was spearheaded by an individual who had intimate knowledge of the condors' ecology. Through his leadership, by 1987, all remaining condors were captured and taken into a captive breeding facility, with the aim of releasing the progeny (Black *et al.* 2011). By 2010, there were 195 birds in captivity and 188 birds had been released into the wild.

Recommendations

From these sobering accounts of species decline, loss and decision making, the following recommendations emerge:

(1) Informed, empowered, and responsive governance and leadership is essential. Governance is the physical exercise of determining influence, and for endangered species where legislation provides for their conservation, government is the instrument that does it. Leadership is the ability to inspire and mobilize others to achieve purposeful change (Manolis *et al.* 2009) and is a component of governance (Kenward *et al.* 2011). Central to the outcomes for both the Christmas Island Pipistrelle and the Orange-bellied Parrot was the difference in governance and leadership between the two cases. Although knowledge about the parlous state of the pipistrelle was available, as were expert recommendations to act (Lumsden *et al.* 1999; James 2004, 2005; Schulz & Lumsden 2004; James & Retallick 2007; Lumsden *et al.* 2007; Lumsden 2009a; Lumsden & Schulz 2009), these individuals had no authority to make decisions, nor was there an effective leader to champion the urgent need to act. The result was that a decision to act was not taken. The internal decisions that resulted in no action were not transparently available and there was no consistent body with expert and public membership involved in guiding decisions. In the case of the Orange-bellied Parrot, the authority to make informed management recommendations resided in a single body the Orange-bellied Parrot recovery team. The recovery team was recognized by the States and Commonwealth, contained all the necessary expertise on the parrot's biology, ecology, threats, and management. The recovery team took responsibility for collating and analyzing information, adaptively determining actions, coordinating activity and advising the community and governments of the actions that were required. As the team had broad representation from interested parties including NGO's and community members, any failure to act would have drawn a public response. This collective authority provided governments with confidence to make decisions based on biological evidence and on evidence that there was scientific, jurisdictional and community support. The recovery team model also provided an opportunity to generate an ongoing commitment of resources to enable responsiveness including leveraging urgent investments of additional resources. We identify the existence of an

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effective leadership body—the Orange-bellied Parrot recovery team—as a central ingredient in the persistence of the species (Boersma *et al.* 2001).

(2) Processes that ensure institutional accountability must be in place. In both cases, monitoring indicated that population declines continued despite action to abate some identified threats. As a result, only two options remained: do nothing or establish captive insurance populations. Both recovery plans included objectives and actions to monitor and undertake research to better understand the cause of the declines, but only the parrot's recovery plan contained specific actions that should be undertaken as a result of this monitoring and research. Recovery plans must specify or include requirements to generate triggers to transform monitoring into action and institutions must be accountable for ensuring these actions are carried out. Monitoring of declining populations without the intention to decide between different management options will only document extinction. Monitoring should be undertaken within an adaptive management framework (McDonald-Madden *et al.* 2010; Keith *et al.* 2011), whereby explicitly stated actions will be taken when certain events occur, known as state-dependent decision making (Possingham *et al.* 2001).

(3) Decisions must be made whilst there is opportunity to act. Delaying decisions removes opportunities to act and risks species' extinction. The Orange-bellied Parrot would almost certainly have followed the Christmas Island Pipistrelle to extinction if the decision to augment the captive population had not been made and acted upon immediately. In the case of the pipistrelle, failure to act immediately on the 2006 information about its critical decline likely contributed to its extinction three years later. Failure of key functions in the decision process concerning the pipistrelle resulted in slow decision making. Such delayed decision making has been cited as a key contributor to the failure of endangered species recovery programs (Clark *et al.* 1994).

We are only too aware that insufficient conservation resources exist to manage all endangered species and, without greater investment, difficult decisions about how to allocate resources between species must be made. It is conceivable, in the case of the Christmas Island Pipistrelle, that the appropriate decision was to do nothing because of a perceived low likelihood of success relative to the cost of management and limited resources that could be better allocated elsewhere (Bottrill *et al.* 2008; Joseph *et al.* 2009). Instead no decision was apparent. In the case of the Orange-bellied Parrot, a timely decision to augment the captive-bred population has avoided extinction, at least for now.

Of the four species highlighted, one cannot escape the fact that the two which have been saved from the brink of extinction are relatively charismatic—a vulture with a 3 meter wingspan and a brightly colored parrot, each supported by strong leadership, whereas the two species which have been lost were small and occurred on islands whose governance and decision processes were not supported by effective leadership. Only through a systematic meta-analysis of conservation success can the relationships between leadership, governance and the charisma of a conservation problem be untangled.

What is clear is that stemming the global loss of biodiversity through recovery planning will require brave, effective governance, leadership and decision making in the face of uncertainty. Informed responsive governance has many faces from a single empowered agency to delegation to a multiorganization recovery team. Finally, monitoring must be linked to decisions, institutions must be accountable for these decisions and decisions to act must be made before critical opportunities, and species, are lost forever.

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