High mitochondrial and nuclear genetic diversity in one of the world's most endangered seabirds, the Chatham Island Taiko (Pterodroma magentae)

High Mitochondrial and Nuclear Genetic Diversity in One of the World's Most Endangered Seabirds, the Chatham Island Taiko *(Pterodroma magentae)*

Running title:
High Genetic Diversity in an Endangered Seabird

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Abstract Interpreting the levels of genetic diversity in organisms with diverse life and population histories can be difficult. The processes and mechanisms regulating this diversity are complex and still poorly understood. However, endangered species typically have low genetic variation as a consequence of the effects of genetic drift in small populations. In this study we examine genetic variation in the critically endangered Chatham Island Taiko (Tchaik, *Pterodroma magentae*), one of the world's rarest seabirds. The Taiko has a very small population size of between 120-150 individuals, including just 8-15 breeding pairs. We report surprisingly high mitochondrial and nuclear genetic diversity in this critically endangered long-lived species. We hypothesise that the present Taiko population has retained a significant proportion of its past genetic diversity. However, it is also possible that undiscovered birds are breeding in unknown areas, which could increase the population size estimate. Importantly from a conservation perspective we show that the high level of variation is unlikely to be maintained in the future since chicks currently being born have only a limited number of the mitochondrial DNA haplotypes found in adults. Reduced genetic variation will mean that our ability to infer past events and the population history of Taiko using genetics could soon be lost and the power to determine for example parentage and other close order relationships will be diminished. Therefore the maintenance of genetic diversity in future generations is an important consideration for conservation management of the Taiko.

Introduction

Interpreting the levels of genetic diversity in organisms with diverse life and population histories can be difficult. This is because the mechanisms and processes that regulate this diversity are complex and still poorly understood. Therefore, determining the level of genetic variation in an endangered long-lived seabird and comparing this to other avian species is helpful especially in the context of known population history, demography and life history characteristics. From a conservation perspective, priority should be given to the quantification and characterisation of levels of genetic diversity for all endangered species. This assessment of diversity can assist us in evaluating the likely genetic effects of future population changes, and can be a guide in conservation management that aims to maintain current levels of diversity (Roques and Negro 2005).

Endangered species typically have low genetic variation, especially when compared to closely related taxa that are not threatened (Ardern and Lambert 1997; Spielman et al. 2004; for exceptions see Avise 2004). Reductions in genetic variation associated with population bottlenecks effectively cause genetic homogenisation that therefore limits our ability to recover historical information. Moreover, a reduction in genetic diversity will also reduce the utility of genetic markers in resolving contemporary conservation issues such as identifying parentage and more distant relationships. These can in turn be used to elucidate an endangered species' behaviour, mating systems, philopatry, spatial genetic structure and population history.

We have investigated genetic variation in a study of one of the world's most endangered seabirds, the Chatham Island Taiko (Tchaik, *Pterodroma magentae*;

IUCN 2006). This burrowing gadfly petrel is endemic to the main Chatham Island (Rekohu/Wharekauri) located 860km east of New Zealand (Aikman et al. 2001). The Taiko was considered extinct by western science until 1978, and is now ranked "critically endangered" (Crockett 1994; IUCN 2006). Presently there are only 8 to 15 Taiko pairs known to have bred in recent years. In addition, there are a number of non-breeding individuals and the entire species is thought to comprise only 120-150 birds (Scofield unpubl. data). Many of the life history characteristics of Taiko that are known are shared with other related seabird species. These include delayed breeding (seven years being the youngest recorded; Lawrence, Millar et al. 2007), low reproductive rate (only one egg is laid per year), social monogamy, long-term partnerships, and a long lifespan (perhaps 30-40 years; Aikman et al. 2001). However the Taiko is difficult to observe and study because it is rare, pelagic, and only comes to land during the breeding season where it is nocturnal and inhabits underground burrows in a single remote location (Aikman et al. 2001). Therefore, the relationship between individuals is very difficult to determine by observation alone. A variety of molecular methods can provide an alternative approach to this problem but require the presence of a degree of genetic variation in the population. Knowledge of relatedness is important in understanding mating systems and behaviour such as philopatry.

Fledgling survival is critical in order to prevent the extinction of the Taiko. Taiko chicks are vulnerable to predation so intense predator control is maintained around burrows and fledgling flight paths during the breeding season (Aikman et al. 2001). A predator exclusion fence has been built around the site of an extinct Taiko colony and management plans for Taiko include the translocation of chicks to artificial burrows within this safer area (Aikman et al. 2001). Such a transfer would occur before chicks emerge from burrows so that they will potentially become imprinted on the new site

(as with other petrels; Gummer 2003). It is anticipated that the birds' philopatric behaviour will result in Taiko returning to the predator-excluded area after they return from the sea to breed. In addition, Taiko will be attracted to the new colony from flight by broadcasting of vocalisations (Aikman et al. 2001).

Mitochondrial DNA (mtDNA) is a useful marker to evaluate genetic diversity in Taiko because it has been used extensively in studies of birds thereby enabling comparison to other avian species. Mitochondrial DNA is haploid and generally maternally inherited so is more susceptible to genetic drift and bottlenecks (Avise 2004). Therefore, although useful, mtDNA variation can underestimate overall genomic variation and is not necessarily representative of nuclear diversity (Zhang and Hewitt 2003). Furthermore, Bazin et al. (2006) have also recently questioned the link between mtDNA diversity, population size and history in a study in which they compared a very diverse array of animal taxa. However, in contrast, when more closely related species are compared a positive correlation between population size, history and mtDNA diversity was found (e.g. Hughes and Hughes 2007) indicating the continued utility of the marker.

The different population history, life history and reproductive ecology of animals can affect genetic diversity and rates of decline (Kuo and Janzen 2004). To contribute to our understanding of this, we evaluated genetic diversity in a sample comprising almost the entire known Taiko population. To assess genetic diversity in the Taiko we have used mtDNA sequencing of the cytochrome *b* gene and both copies of a fragment of the duplicated control region domain I, and multilocus minisatellite DNA techniques. These genetic markers could be used to aid management initiatives important for the conservation management of the critically endangered Taiko.

Methods

Taiko breeding pairs, chicks, many unpaired male Taiko and a few unpaired females were caught on the ground. In addition, Taiko were caught in flight (using spotlighting techniques; Crockett 1994). Blood samples were collected from almost every Taiko caught since 1996 (N = 142; N = 117 were used in this study). DNA was extracted by proteinase K digestion and a modified version of the phenol/chloroform method (Sambrook et al. 1989).

The complete mitochondrial cytochrome *b* gene was amplified using the polymerase chain reaction (PCR) with primers L14863 (Nunn et al. 1996) and HTaikoThr2 5'-GGTTTTACAAGACCAATGTT-3' (designed by Leon Huynen; for PCR conditions, product purification and sequencing information see Lawrence, Taylor et al. 2007). Sequencing primers included L14863, HTaikoThr2 and internal primers LCytB432 5'-TGAGGACAAATATCATTCTGAGG-3' and HCytB571 5'-GGAAGGTGAGGTGGATTAAGG-3'.

Duplication of the mitochondrial control region is known in Procellariiform species (Abbott et al. 2005). We sequenced domain I of the control region in Taiko and found double peaks in sequencing electropherograms at some nucleotide sites, suggesting duplication also exists in Taiko. The possible existence of an amplified nuclear pseudogene was tested for and excluded (for details see Lawrence, Taylor et al. 2007). Both copies of a 315bp region in domain I were amplified and sequenced (for PCR conditions, product purification and sequencing information see Lawrence, Taylor et al. 2007). These regions were designated fragments 1 and 2. Fragment 1 was amplified by PCR with primers F1AF 5'- AATGGCCCATGTGCGGTTGT-3' and

HCRPtb 5'-CTAGGGGTGTAGGGGGAAAG-3', fragment 2 with F2AF 5'-AATGGTCTATGTGTGGGTGC-3' and HCRPtb. Sequences were deposited in the National Institutes of Health (U.S.A) genetic sequence database GenBank®. Accession numbers are XXXXXX. Sequences were aligned using Sequencher™ version 4.2.2 (GeneCodes©). We tested for selective neutrality of mtDNA haplotypes using Tajima's *D* calculated in Arlequin version 3.1 (Tajima 1989; Excoffier et al. 2005). Nucleotide and haplotype diversities were calculated according to Nei (1987) using Arlequin version 3.1 (Excoffier et al. 2005).

We performed a multilocus DNA profiling pilot study to determine which restriction enzyme / probe combination to use to achieve the optimal resolution of fragments. Subsequent minisatellite DNA profiling was performed as in Millar et al. (1994), with *Alu* I digestions in combination with the probe $(CA)_n$ (Ellegren 1991).

Results

Cytochrome *b* and domain I control region haplotypes were determined for 90 Taiko adults and 66 chicks born since intense predator control and monitoring began in 1993. Ten individuals fall into both categories since they were caught as chicks and returned as adults. In total, 117 individuals were sequenced and haplotypes for others were inferred from known maternal relationships.

A total of 12 polymorphic sites defined 10 unique haplotypes in Taiko for cytochrome *b* (Table 1). Fragment 1 contained 32 polymorphic sites defining 20 unique haplotypes. Fragment 2 contained 21 polymorphic sites defining 19 haplotypes. When the cytochrome *b*, fragment 1 and fragment 2 sequences are

combined, 21 haplotypes are apparent (Table 1). Only 11 of these haplotypes were recorded among the 66 chicks (Table 1).

There is one nucleotide site that has 'true' heteroplasmy in haplotype AY (Table 1). There is a double G/A peak at this site, whereas in fragment 1 haplotype AX at this site has a definite G. This is the only difference between these two fragment 1 haplotypes, but the uniqueness of these haplotypes is reinforced by fragment 2 haplotypes (Table 1).

Haplotype and nucleotide diversities are presented in Table 2. Standard error for haplotype diversities were as follows: for cytochrome *b* $\pm$ 0.0481, control region F1 $\pm$ 0.0140, control region F2 $\pm$ 0.0142. Standard error for nucleotide diversities were: for cytochrome *b* $\pm$ 0.000872, control region F1 $\pm$ 0.011704, control region F2 $\pm$ 0.009644.

Mitochondrial DNA diversity was compared between Taiko, seabird and other avian species, with respect to phylogeny and conservation status (Table 2). The number of cytochrome *b* and control region domain I (CR I) haplotypes were divided by the number of individuals included in the study, and number of variable nucleotides per 100bp were calculated to enable ease of comparison with mitochondrial DNA diversity in Taiko. For DNA samples collected prior to 1998, levels of minisatellite DNA bandsharing were calculated between pairwise combinations of Taiko adults (mean 0.17 ± 0.032 SE, range 0 - 0.25, N=19).

Discussion

Mitochondrial DNA diversity in Taiko can be usefully compared to that in other seabirds and in other avian groups. These comparisons include species with different degrees of phylogenetic relatedness to Taiko and varying conservation status. In the case of cytochrome *b*, Taiko had only slightly less variation than that found in the two other Procellariiformes (tube-nosed seabirds), but more than some Charadriiform seabirds and most other avian species (Table 2). The conservation status of Charadriiform and other avian species having less variation than Taiko included species that are endangered, vulnerable and in the least concern category (as ranked by the World Conservation Union, IUCN 2006).

The number of control region domain I (CR I) haplotypes in Taiko was less than that recorded for most other seabirds analysed. However the number of variable sites in CR I in Taiko is more than that found in two other seabirds (Table 2). In addition, Taiko had more CR I variation than most of the non-seabird avian species (Table 2). The species of Procellariiformes (albatross) we compared with Taiko were either endangered or vulnerable (IUCN 2006). However these albatross species are comprised of more than one population and have many thousands of breeding pairs (e.g. Burg and Croxall 2001; compared to the Taiko which has 8-15). The Taiko did have an equivalent number of CR I haplotypes, and many more variable sites than one non-threatened seabird (the Ancient Murrelet; Table 2). Moreover, Taiko had more CR I diversity than many threatened or near threatened avian species and most of the avian species of 'least concern' used for comparison (Table 2). Therefore, mitochondrial genetic variation in Taiko is relatively high especially considering the Taiko has extremely low numbers (estimated at 120-150 birds). Furthermore the

extensive sampling of Taiko provided a rare opportunity to obtain a very robust measure of mitochondrial DNA diversity in a vertebrate species.

The values of bandsharing between the multilocus profiles of Taiko individuals are generally very low in comparison to similar studies of New Zealand birds (Lambert and Millar 1995 Table 2) and low in comparison to other petrels (e.g. Storm-Petrels *Oceanodroma leucorhoa* 0.58 ± 0.059 SD Mauk et al. 1995; Short-tailed Shearwaters *Puffinus tenuirostris* 0.298 ± 0.017 SE Austin et al. 1993). Hence, the low levels of bandsharing between Taiko indicate that this endangered species has large amounts of nuclear genetic diversity. Therefore, our findings indicate that both mitochondrial and nuclear genetic diversity are reasonably high in the Taiko compared to other avian species, including non-threatened birds. This is surprising since endangered species typically have low genetic variation (e.g. Ardern and Lambert 1997; Spielman et al. 2004; for exceptions see Avise 2004).

When assessing genetic variation it is important to examine both mitochondrial and nuclear diversity for the same species. In the case of Taiko, mitochondrial DNA markers are useful because they enable a direct comparison with many other avian species. Evaluating diversity using nuclear genetic markers is also important so that both genomes are represented (Zhang and Hewitt 2003). The level of genetic variation in Taiko was higher in multilocus DNA profiles than in the mitochondrial DNA (as measured by comparison with other avian species).

Selection may occasionally favour the retention of high genetic diversity in small and isolated populations (Kaeuffer et al. 2007). We found no evidence for selection on mtDNA haplotypes (Tajima's D, $P > 0.05$ for each region). Another potential explanation for the reasonably high level of genetic variation in the critically endangered Taiko is the real possibility that undiscovered birds are breeding

elsewhere, this could increase the population size estimate. The mitochondrial diversity may be useful to detect the existence of any undiscovered birds. For example, if unique haplotypes are detected in birds caught in flight and not found in those caught on the ground this would suggest there are more Taiko breeding in undiscovered areas.

Another hypothesis for the high genetic diversity observed in Taiko could be that the current Taiko population retains a significant proportion of past genetic diversity. Relatively high genetic diversity in a rare species can indicate that decline in numbers is recent (Moritz 1994). Population contraction over a large number of generations may be required for loss of genetic variation, but this effect is influenced by a species' life history traits (Lippe et al. 2006). Long generation times and delayed sexual maturity can slow the loss of genetic variation (Kuo and Janzen 2004). Taiko are long-lived, reaching approximately 30-40 years, become sexually mature at a minimum of seven years, and have overlapping generations (Aikman et al. 2001; Lawrence, Millar et al. 2007). Furthermore, past demography could also be a contributing factor in the loss of diversity (Goossens et al. 2005). The Taiko was previously very numerous, once the most abundant burrowing seabird on Chatham Island (Aikman et al. 2001).

The speed of demographic fluctuation can also have an effect on genetic variation, e.g. more genetic diversity may be retained when a decline in population numbers is gradual (Lippe et al. 2006). It seems likely that the decline in Taiko numbers was initially gradual and probably the result of the arrival of the first humans on Chatham Island. However, the population probably underwent a steep decline in the early parts of the last century as predation and habitat clearance intensified. Knowledge of the history of the Taiko population allows inferences to be made from these genetic data.

Moriori (the indigenous people) discovered the Chatham Islands/Rekohu around 1100-1500 AD (King 2000). These people harvested Taiko/Tchaik for food and introduced Kiore (Pacific Rat, *Rattus exulans*), which may have negatively impacted Taiko numbers (Crockett 1994). Europeans arrived in the early nineteenth century and introduced many animals that are known predators of Taiko (Crockett 1994). Also, by the late 1930s, large areas of Taiko habitat were cleared for farming (Begg 1977). Records indicate that Taiko were still reasonably abundant at the beginning of the 20th century (Crockett 1994). For example, in 1903 1000 Taiko chicks were harvested (King 2000). Since only a proportion of the population breed, there still would have been a significant population of Taiko at this time, around a century ago.

It is therefore likely that the surprisingly high level of genetic variation in the living Taiko population is at least in part due to the significant retention of past diversity. High genetic diversity despite substantial population decline has been observed in other long-lived species with delayed sexual maturity (e.g. the Ornate Box Turtle *Terrapene ornate*, Kuo and Janzen 2004; Orang-utan *Pongo pygmaeus*, Goossens et al. 2005; Copper Redhorse *Moxostoma hubbsi*, Lippe et al. 2006). This suggests that the life history traits of long-generation time and delayed maturity can buffer loss of genetic variation, especially when decline is recent. Hence our findings support the population genetic theory prediction that severe bottlenecks may not drastically reduce the genetic diversity when they last for a small number of generations (Amos and Balmford 2001).

However, low population growth rate can cause bottlenecks to persist, during which time genetic diversity will be further eroded (Allendorf and Luikart 2007). The Taiko has a long life span and slow reproduction that reduces the rate of genetic drift but also slows recovery from a small population size. The effects of the population

bottleneck have not yet been detected in the adult generation, but the current high level of genetic variation may be transient and is not likely to be observed in future generations. Intense predator control around and monitoring of Taiko began in 1993, as a result the number of Taiko chicks fledged has substantially increased. However, the mtDNA diversity in this next generation is severely reduced. Of the 21 mitochondrial DNA haplotypes identified in the adult population, only half (11) are represented in the next generation (i.e. chicks born since 1993). Six of the adult haplotypes are only found in male birds, so will not be passed to the next cohort. Four adult haplotypes are found in females not known to breed. Therefore from a scientific and management perspective it is important that genetic markers are used to study the Taiko immediately while the population still retains sufficient genetic variation. More of the genetic history will be lost in the next generation and the power to determine parentage and close order relationships might be very significantly diminished just one generation from now.

A valuable conservation management tactic is to lessen average kinship in order to maintain genetic diversity (Avise 2004). This is relevant to a current conservation management initiative, i.e. the establishment of a new Taiko colony within a predator-excluded site. Chicks will be translocated so they will potentially become imprinted on the new site and return there to breed once mature. Chicks can be chosen in order to maximise the retention of genetic variation described in this study, and reduce founder effects in the future colony.

Table 1 Variable nucleotide sites of 21 mitochondrial DNA haplotypes in Taiko *(Pterodroma magentae)*.

Dots indicate identity to the reference sequence.

Haplotype	Number of Taiko Adults	Number of Taiko Chicks[a]	Cytochrome b (1143bp) Nucleotide Position[b]	Fragment 1 Control Region Domain I (315bp) Nucleotide position [c]	Fragment 2 Control Region Domain I (315bp) Nucleotide position [c]
			2 4 5 7 7 7 7 8 8 9 1 1 4 0 3 7 1 2 3 4 1 4 1 2 5 4 2 1 6 0 8 1 9 0 5 2	1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 1 1 5 6 6 6 7 7 7 9 9 9 9 0 0 1 1 3 4 5 6 6 6 9 0 0 2 2 3 3 5 7 1 4 8 3 5 7 5 7 9 4 5 6 9 1 6 0 5 9 6 5 1 2 4 4 6 7 3 9 0 1 0 9	1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 5 5 7 7 7 8 9 0 3 4 5 6 9 0 0 2 2 3 3 5 7 3 6 3 7 8 9 4 6 9 6 6 4 4 6 7 3 9 0 1 0 9
AZZ	3	0	C T G G C A C C A C T G	T T C A T C A T C C C T T G G G G C A C T C T C T C C G C C A C	C C A C T G C G C A A C C T C C G C C A C
AYY	18[a]	10	. . . . .	. . T . . . . . A . R . . . . . T . A . T . T	. T . T . A . . . . . T . A . T . T
AXX	1	0	. . . . .	. . T . . . . . A . . . . . T . A . T . T	. . . T . . . . . T . . T T A . T . T
AWW	6	0	. . . . .	. . T . . . . C . . . . . A . . . . . T . A . T G T	. . . T C A . . . . . T . A . T G T
AVQ	10	18	. . . . .	. . T . . . . . T . . C A A . . . . . T . . . . . A . . T	. . . T . . . . . T . . . . . A . . T
AUU	2	0	. . . . .	. . T . . . . C . . . . . A . . . . . T . A . T . T	. . . T . . . . . T . A . T . T
ATQ	1	1	. . . . .	. . . . . T . . C . A . A . . . T . . . . . A . . T	. . . T . . . . . T . . . . . A . . T
ATT	1[a]	1	. . . . .	. . . . . T . . C . A . A . . . T . . . . . A . . T	. . . T . A . . . . . A . . T
ASS	4	5	. . . . .	. . T . . . . C . . . . . A . A . . . . . T . . . T G .	. . . T . A . . . . . T . . . T G .
ARR	2	0	. . . . .	. . . . . C A . . . . . T . A . . T	. . . T . . . . . T . A . . T
BBB	8	7	. . A	. . . . . A . . . . . T . . . . A . . T	. . . T . . . . . T . . . . A . . T
CCC	3	4	T . . . . . T . G T C .	C C T . C . . C . . . . . A A A A . . . C T . T . . . . A . G .	. . . T . . . . . T T . . . . A . G .
DDD	4	0	T . . . . . T	. . T . . . . . T . . A A . . T G . . . . . A . . .	. . . T . . T . T G . . . . . A . . .
EEE	6	2	T . . . T	. . T . . . . . T . C A A . . . G . . . . . A . . .	. . . T . . T . . G . . . . . A . . .
FFF	3	2	. . . . . T	. . T G . . C . . . . . A . . . . . T . . . . A . . T	T . . T . A . . . . G T T . . . . A . . T
GKM	11	9	T . . . . . A	. . T . . T . . . . . A A . . . G . . . . . T . A . . .	. . . T . . T . . G . . . . . T . A . . .
GLM	2	7	T . . . . . A	. . T . . . . . T . . . A . . . . G . . . . . T . A . . .	. . . T . . T . . G . . . . . T . A . . .
HHH	1	0	T	. . T . . . . . T . . . A . A . . G . . . . . A . . .	. . G T . . T . . G . . . . . A . . .
III	1	0	T C	. . T . . . . . T . . A A A . . G . C T C . . . . . A . . .	. . . T . . T . . . . . A . . .
JOO	2	0	. . . A	. . T . . . . . T . . A . . . . . C T . . . T G .	. . . T . . . A . . . . . C T . . . T G .
JPP	1	0	. . . A	. . T . . . . . A A . . . . . C T . . . T G .	. . . T . . . . . C T . . . T G .
TOTAL	21	90	66		

Note: Ten individuals fall into both adult and chick categories since they were first caught as chicks and have returned to the colony as adults

[a] Two of the adult haplotypes were inferred from their chick's haplotype, many chick haplotypes were inferred from their mother's haplotype

[b] relative to the start of the gene.

[c] relative to the 3' end of the light strand primer.

Table 2 Comparisons of Taiko *(Pterodroma magentae)* mitochondrial DNA diversity with Procellariiform, Charadriiform and other avian species of varying conservation status (continued on next page)

Phylogenetic Groupings	Common Name	Scientific Name	Conservation Status [a]	Sample Size *(N)*	Marker Sequenced [b]	Number of Sampled Haplotypes / *N*	Haplotype Diversity *(h)*	Number of Variable Sites per 100bp	Nucleotide Diversity (π, x10^{-2})	Reference
Procellarii-formes	**Taiko**	***Pterodroma magentae***	**Critically Endangered**	**90**	Cyt-*b* (1143bp)	**0.11**	**0.68**	**1.05**	**0.13**	
	Herald Petrel	*Pterodroma heraldica*	Least Concern	33	Cyt-*b* (307bp)	0.15	-	2.28	-	Brooke and Rowe 1996
	European Storm Petrel	*Hydrobates pelagicus*	Least Concern	65	Cyt-*b* (910bp)	0.12	0.70	1.32	0.40	Cagnon et al. 2004
Charadrii-formes	Marbled Murrelet	*Brachyramphus marmoratus*	Endangered	47	Cyt-*b* (1045bp)	0.30	-	-	-	Friesen et al. 1996
	Least Tern	*Sterna antillarum*	Least Concern	51	Cyt-*b* (362bp)	0.06	-	0.55	-	Whittier et al. 2006
	Ancient Murrelet	*Synthliboramphus antiquus*	Least Concern	58	Cyt-*b* (306bp)	0.09	-	1.31	-	Pearce et al. 2002
Other Avian Orders	Black-faced Spoonbill	*Platalea minor*	Endangered	87	Cyt-*b* (548bp)	0.01	0	0	0	Yeung et al. 2006
	Great Bustard	*Otis tarda*	Vulnerable	66	Cyt-*b* (292bp)	0.03	-	0.34	0.13	Pitra et al. 2000
	Ferruginous Pygmy-Owl	*Glaucidium brasilianum*	Least Concern	103	Cyt-*b* (899bp)	0.29	-	3.34	0.43	Proudfoot et al. 2006
	Loggerhead Shrike	*Lanius ludovicianus*	Least Concern	72	Cyt-*b* (200bp)	0.04	-	1.00	-	Mundy et al. 1997

[a] as recognised by the World Conservation Union (IUCN 2006)
[b] Cyt-*b*: cytochrome *b*, CR I: control region domain I, CR II: control region domain II

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Survival and age-at-first-return estimates for grey-faced petrels (*Pterodroma macroptera gouldi*) breeding on Mauao and Motuotau Island in the Bay of Plenty, New Zealand

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Abstract We estimated apparent annual survival of adult and young grey-faced petrels (*Pterodroma macroptera gouldi*) and age of first return to the natal colony of young birds from 2 colonies in the Bay of Plenty, New Zealand, between 1991 and 2008. We analysed the capture histories of 5844 adult birds and 928 chicks in a mark-recapture framework. The apparent adult annual survival rate was 0.89 after accounting for transience effects, which were greater at the mainland site (Mauao, Mount Maunganui) than on the island colony (Motuotau, Rabbit Island). Annual survival of young birds between fledging and 2 years of age was 0.844 for Mauao and 0.865 for Motuotau. Around 50% of fledglings that returned to their natal colony did so by 4 years of age, and by age 6, the probability of a fledgling returning was approximately 1.0. These are the first reliable estimates of these parameters for grey-faced petrels and are vital for models aimed at predicting the effects of natural perturbations or management interventions on breeding populations.

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Keywords grey-faced petrel; *Pterodroma macroptera gouldi*; apparent survival; age-at-first-return; mark-recapture; multi-state models

INTRODUCTION

Population models of long-lived vertebrates typically emphasise the importance of adult survival in the dynamics of the population (Hunter *et al.* 2000; Saether & Bakke 2000). This is particularly so for long-lived seabird species, which typically show life histories with delayed sexual maturity, low reproductive output and high rates of adult survival, and are thereby considered *K*-selected species (Croxall & Rothery 1991; Russell 1999; Weimerskirch 2002). Also common to long-lived seabirds is the absence of juvenile birds from natal colonies for a number of years following fledging (Greenwood & Harvey 1982; Nichols *et al*. 1990; Weimerskirch 2002). This absence can make estimation of juvenile survival rate and true age of first return (*AFR*) to the colony, as opposed to age of first *observed* return,

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problematic. Reliable estimates of these parameters are vital for population models and for predicting the effects of natural perturbations or management interventions on seabird populations.

The grey-faced petrel (*Pterodroma macroptera gouldi*) is a gadfly petrel (average adult body mass 550 g) that breeds on headlands and on islands primarily off the east coast of northern New Zealand (Heather & Robertson 2005). The species is a winter breeder that lays eggs in burrow nests during Jun and Jul, with fledging of chicks in Dec and early Jan. Grey-faced petrels are of cultural significance to the northern *iwi* (Māori tribes, *e.g.,* Hauraki, Ngāti Awa, Ngāti Wai) of New Zealand who traditionally harvested pre-fledging chicks. This practice has largely ceased due to *rahui* (temporary harvest bans) imposed by iwi authorities following concerns over reported declines in the numbers of chicks over the last 30 years (Lyver *et al*. 2008). The total New Zealand population of grey-faced petrels has been estimated at over 1 million birds and the species is classified accordingly as 'not threatened' by the Department of Conservation (Taylor 2000). Abundant seabirds may be considered 'keystone' species in maintaining vital ecosystem processes and their careful management and conservation is therefore pivotal to managing wider ecological communities (Furness 1991; Wardle *et al*. 2009).

In this paper, we estimate adult and juvenile survival and *AFR* of grey-faced petrels using mark-recapture analyses of an 18-year banding record from 2 colonies, one on the mainland and one on an adjacent island, in the Bay of Plenty, New Zealand.

METHODS

Study sites and banding programme

Birds were banded at 2 sites: (i) Mauao (Mount Maunganui), and (ii) Motuotau (Rabbit I). Mauao is a 232 m high coastal rhyolite dome at the entrance to Tauranga Harbour (37° 37.75′ S; 176° 10.21′ E). Most of the area of this hill is contained in the Mauao Historic Reserve, comprising ~76 ha, which has unrestricted access and is heavily used by the public. Grey-faced petrel burrows were located mainly on the lower slopes, in some cases within a few metres of walking tracks. Vegetation cover in areas where burrows were located consists primarily of a mixture of native pohutukawa (*Metrosideros excelsa*) with kawakawa (*Macropiper excelsum*), māhoe *(Melicytus ramiflorus)* and hangehange *(Geniostoma rupestre)*. Some areas also include introduced weed species such as gorse (*Ulex europaeus*), and exotic grasses. Some petrel burrows were found in grazed pasture areas. The Mauao study site was adjacent to an urban area that has undergone significant redevelopment over the past 20 years and there are records and anecdotal reports of introduced cats (*Felis catus*), mustelids (*Mustela* spp.) and rats (*Rattus* spp.) at the site. Control of some predators took place during most of the latter part of the period reported here. This has been associated with increased chick productivity (Ornithological Society of New Zealand, *unpubl. reports,* 1991-2008). The site is subject to fire, landslips, and stock grazing, though at lower levels than in the past. The Motuotau (Rabbit I) study site was a small (2.5 ha) island, ~800 m offshore from Mauao. It is a steep-sided, flat-topped 45 m high rhyolite dome. The island is a scenic reserve with unrestricted access, but is little used by the public because of poor accessibility and dense vegetation. Grey-faced petrel burrows were mostly located on steep slopes around the higher parts of the island. The vegetation is dominated by pohutukawa with an understorey including *Pseudopanax* spp., *Coprosma* spp. and *Hymenanthera novae-zelandiae*. Mammalian predators are normally absent, although 1 stoat *(Mustela erminea)* was detected and trapped during this study. There are no recent records of traditional harvest of chicks at either site.

Banding of both adults and pre-fledging chicks has been carried out at the sites by volunteers associated with the Waikato Region of the Ornithological Society of New Zealand (OSNZ) since the breeding season of 1991. Work on Motuotau ceased in 2000 due to personnel and logistical constraints. Site visits took place throughout the breeding season with activity mainly focused on: (i) the prospecting period (Apr-May), during which adult birds return to the colonies to establish or reaffirm pair bonds and prepare burrows for incubation (range: 3-15 visits per year at Mauao; 2-6 visits per year at Motuotau); (ii) the early incubation period (Jul-Aug), when breeding adults frequently attend the colony (range: 3-9 visits per year at Mauao; 1-5 visits per year at Motuotau), and; (iii) the pre-fledging period (Dec-Jan) when chicks emerge from breeding burrows at night (range 2-10 visits per year at Mauao; 2-5 visits per year at Motuotau). Colonies were visited from just before dusk and birds banded on their return soon after. Effort per night varied between nights reflecting the voluntary nature of the banding project. Other occasional site trips took place outside of these periods. Adult birds were banded during all site visits, but in the immediate pre-fledging period the emphasis was on banding chicks. Sites were divided into a series of sections, which were visited sequentially throughout a night's banding, though not always in the same sequence. Limitations imposed by the availability of volunteers, and occasionally by deterioration in weather during the night, meant that not all sections were visited on all nights.

Banding took place just after dusk. Adults were captured by hand and placed in a cloth bag for ease and safety of handling and for weighing using a spring balance. Unbanded birds had a single, numbered stainless steel E-series band applied to the tarsus and the band number of previously banded birds was recorded when these were recaptured.

Apparent survival of adults

We used Cormack-Jolly-Seber (CJS) mark-recapture models (Cormack 1964; Jolly 1965; Seber 1965) implemented in Program MARK (White & Burnham 1999) to estimate apparent survival of adults. Note that the term 'apparent survival' is used because the complement (1 – apparent survival) includes losses due to both mortality and permanent emigration (Sandercock 2006). For estimating survival rates, it is necessary to define sampling occasions; survival rates are then estimated for the time periods between sampling occasions. Input data consisted of individual capture histories in which an annual sampling 'occasion' represented the combined prospecting and early incubation periods for each breeding season. Any data from outside of this period were excluded. Use of this 4-month capture period violates one of the standard assumptions of open mark-recapture models: that capture occasions are of negligible duration relative to the period between them and that mortality is negligible during the capture occasion (Pollock *et al*. 1990). Violation of this assumption is common as researchers attempt to maximise sample sizes and enhance what are often sparse data sets (O'Brien *et al*. 2005). Simulation of the effects of violating this assumption has shown that induced bias is minimal when survival rates during the occasion are high (Smith & Anderson 1987; Hargrove & Borland 1994; O'Brien *et al*. 2005). As petrel species are typically long-lived, with annual survival rates of around 0.9 for many species, we considered that short-term survival rates were unlikely to be so low as to violate this assumption for grey-faced petrels.

Standard CJS models also assume homogeneity of both survival and capture probabilities among individuals (Seber 1982; Pollock *et al*. 1990). This assumption is violated in many wildlife populations, leading to negative bias in estimates of apparent survival (Sandercock 2006). In seabirds, heterogeneity in these parameters frequently results from 2 behavioural mechanisms: transience and skipping (or trap-dependence). Transience occurs when birds, often younger adult 'pre-breeders,' are detected at a colony during a breeding season, but do not establish site-fidelity and are never detected again (Bradley *et al*. 1999; Oro *et al*. 1999; Dittmann *et al*. 2007). Inclusion of these individuals, with what is effectively a zero probability of apparent survival after 1st capture (Pradel *et al*. 1997), with resident individuals, will lead to underestimates of apparent survival for residents, as we were unable to differentiate between permanent emigration and mortality. Where this effect was suspected, we used a set of models where apparent survival rate of adult birds in the year following 1st capture (S_A^{1}) differs from that for all subsequent years (S_A^{2+}), based on the approach of Pradel *et al*. (1997).

It is also common for breeding-age seabirds not to be detected at a colony in one year, but to return and breed in subsequent years (Chastel 1995; Bradley *et al*. 2000). This 'skipping' or temporary emigration can be incorporated into models as a form of 'trap-dependence' in which the probability of detection in a breeding season is allowed to depend on whether or not an individual was captured in the previous year (Sandland & Kirkwood 1981; Pradel 1993). Where trap-dependence was modelled, we used the form:

$$\text{logit}\,(p) = a_{(g*t)} + bx\,,$$

where, p is the probability of detection and x is a covariate with a value of 1 if a bird was captured, or 0 if it was not encountered, in the previous year (Pradel 1993; Clucas *et al*. 2008). The subscripts g and t indicate variations due to group (breeding site) and time (between years) are allowed in the model.

Before assessing the relative merits of a candidate set of models we assessed the goodness of fit of a global model, with full time-dependence of parameters and with each colony defined as a separate group, using the programme U-CARE (Choquet *et al*. 2000). This assessment was based on 2 tests: Test 3 tests the assumption that all birds banded during one capture occasion have the same probability of surviving to the next occasion and thus tests for transience. Test 2 tests whether birds known to be alive in the period between 2 sampling occasions show homogeneity in capture probabilities and thus tests for trap-dependence. The overall goodness-of-fit statistic also provides an estimate of over-dispersion in the data (summarised by the variance inflation factor, $\hat{c}$) which can be used to adjust the standard error estimates of parameters in fitted models (Lebreton *et al*. 2003).

We used Akaike's information criterion corrected for over-dispersion (*QAICc*) to rank candidate models. Model ranking results are also expressed using 2 other relative measures: firstly, $\Delta QAICc$, the difference between the *QAICc* value for the most preferred model and the model of interest. A $\Delta QAICc$ of ≤ 2, suggests that both models are supported equally well by the data; secondly, the *QAICc* model weight, which provides a measure of the weight of evidence in support of a particular model (Burnham & Anderson 2002). To obtain overall estimates of the demographic parameters

Table 1. Goodness-of-fit statistics for global models in analysis of (a) adult survival, and (b) young survival and age of first return to a colony. Values are output from Program U-CARE for Cormack-Jolly-Seber and multi-state data, respectively. The term 'overall' reports the combined χ^2 statistic for all component tests and summarises the goodness of fit of the 'raw' model. Removal of component tests corresponding to transience (*3.SR* and *3G.SR*) and trap-dependence (*2.CT* and *M.ITEC*) effects improved the fit of both models, as measured by the variance inflation factor, $\hat{c}$, for which values closer to 1.0 indicate a better fit.

	Mauao				Motuotau I				Combined			
	χ^2	*df*	*P*	$\hat{c}$	χ^2	*df*	*P*	$\hat{c}$	χ^2	*df*	*P*	$\hat{c}$
(a) Overall	412.8	137	<0.001	3.0	55.2	35	0.016	1.6	468.0	172	<0.001	2.7
3.SR & *2.CT* removed	164.7	106	<0.001	1.6	28.8	24	0.227	1.2	193.5	130	<0.001	1.5
(b) Overall	178.7	118	<0.001	1.5	45.8	28	0.018	1.6	224.5	146	<0.001	1.5
3G.SR & *M.ITEC* removed	102.8	92	0.207	1.1	36.6	21	0.019	1.7	139.4	113	0.046	1.2

we used the model averaging function in Program MARK (White & Burnham 1999).

We knew that sampling effort varied between sites and years, so we only considered models with both time- and site-dependent effects on capture probabilities, in order to reduce the number of models in our candidate set. This also included models with both time- and site- dependent effects on adult survival. For occasions in which no fieldwork was carried out, capture probabilities were fixed at zero.

Apparent survival and *AFR* of juveniles

For this analysis we constructed capture histories from banding records of chicks and of adults returning to the colonies during the Apr-May prospecting period. We estimated *AFR* and apparent annual survival of juvenile birds using a multi-state mark-recapture model, also implemented in Program MARK (Lebreton & Pradel 2002; White *et al*. 2006). These models can estimate survival and capture probabilities for each demographic state and also the probability of transition between 2 states. Our approach followed that used previously to estimate similar parameters in other seabirds that delay their post-fledging return to a breeding colony by 1 or more years (Spendelow *et al*. 2002). This allowed estimation of the probability of first return to the colony at different ages.

In our models for these data, we defined 2 states: 'adult,' which is a bird that has returned to the colony at least once after fledging, and 'young,' which is a bird that has fledged, but not yet returned to the colony. Note that the adult category does not imply breeding status and therefore includes established breeders and pre-breeding individuals. Because young birds are never recaptured in the same state (*i.e.*, they are assumed to be adults on their return to the colony), recapture probabilities were fixed at zero for this state. Similarly, adults cannot become young birds, so the probability of this transition was also fixed at zero. In addition, it was necessary to set 2 thresholds for the estimation of *AFR*. These were a minimum age at which a returning bird could be encountered (k) and an age by which all individuals that return to the colony have done so (m). We set the minimum *AFR* threshold at 2 years, based on the minimum observed *AFR* in our raw data and on the earliest previously reported return at age 3 years-plus (G. Taylor, *pers. comm.*). For the upper threshold, a natural choice might be the maximum observed age at first return (11 years). However, only 5 of the 132 individuals that were observed to return did so after they were 8 years old, *i.e.*, there was almost no information on the probability of 1st return after this age. We therefore set the upper threshold to be 8 years. Because information was available on all individuals banded as chicks, we knew their age in subsequent years and we were therefore able to model the probability of first return ($\alpha^{(v)}$) as a function of age (v) over the range k to $m-1$. We set $\alpha^{(v)}$ to 0 for $v < k$ and to 1 for $v \geq m$, corresponding to the assumption that individuals will not return to the colony before age k and will all have returned by age m. We assumed that $\alpha^{(v)}$ does not vary over time.

Following Spendelow *et al.* (2002), for this modelling approach, it was necessary to assume:

(1) the age of 1st possible return to the colony (k) is known;
(2) of those that will return, all return to the colony by age m;
(3) every bird released as a chick has the same probability of survival until age k, and this probability does not vary between years;
(4) every marked bird of age $\geq k$ in a given year has the same probability of survival to the following year;
(5) every marked young bird in a given year has a capture probability of zero;

Table 2. Comparison of the 4 best-fitting models, as ranked by *AICc* values and using $\hat{c}$ = 1.5, for estimating survival of adult grey-faced petrels at Mauao and Motuotau, Bay of Plenty, New Zealand, from 1991 to 2008. For defining models, S_A = apparent survival of adults, *TR* = transience, *P* = probability of capture, *TD* = trap-dependence, (.) indicates a constant parameter, *g* = parameter varies by group (site), *t* = parameter varies through time, * indicates full interaction between terms is allowed. Models including time-dependence were included in the initial candidate set, but weights for these models were all << 0.001 so the models were excluded from further consideration.

Model	*DQAICc*	Weight	Number parameters
$S_A(.)\ TR(g)\ P^{TD}(g*t)$	0.0	0.665	30
$S_A(g)\ TR(g)\ P^{TD}(g*t)$	1.4	0.335	31
$S_A(.)\ TR(.)\ P^{TD}(g*t)$	14.7	0.000	29
$S_A(g)\ TR(.)\ P^{TD}(g*t)$	15.3	0.000	30

(6) every marked young bird of age v ($k \le v < m$) has the same probability of returning to the colony in a given year;
(7) every marked adult has the same probability of returning to the colony in a given year;
(8) every unmarked adult has the same probability of returning to the colony the following year.

We direct the reader to the Spendelow *et al*.'s (2002) original publication for a detailed discussion of these assumptions.

As with the estimation of adult survival, we first constructed a global model which we tested for goodness of fit using the multi-state procedures in U-CARE (Choquet *et al*. 2000). This also provided an estimate of over-dispersion in the data, which was incorporated in subsequent model fitting using *QAICc* (Burnham & Anderson 2002). In this case, taking into account the assumptions above and limitations in our data, our global model contained: group effects on survival of young (S_y), group and time effects on survival of adults (S_A), group effects on *AFR*, and both group and time effects on capture probabilities. Where the U-CARE analyses suggested transience or trap-dependence, we modelled these as outlined above.

RESULTS

For the estimation of adult survival we used capture histories of 5844 birds over the 17 years of sampling and for estimating *AFR* we used the histories of 928 chicks, of which 132 were observed to have returned, along with that subset of adults encountered during the Apr-May prospecting periods.

Adult survival

Goodness-of-fit testing of the global model for adult survival showed evidence of trap-dependence (Test 2) and transience (Test 3) effects at both sites (Table 1). When combining data from both sites, the overall χ^2 statistic was significant at both sites leading to a variance inflation factor of $\hat{c}$ = 2.7, indicating lack-of-fit. Removing the *3.SR* and *2.CT* components of the tests, corresponding to transience and trap-dependence, respectively, led to the χ^2 statistic no longer showing any evidence of lack-of-fit at Motuotau, whereas at Mauao there appeared to be some residual lack-of-fit. The removal of these components gave an estimate of $\hat{c}$ = 1.5 for the 2 sites combined. This value was used to correct for over-dispersion in subsequent models that incorporated trap-dependence and transience.

Table 3. Model-averaged estimates of apparent adult survival (and standard errors) and the proportion of transient birds in each annual sample for grey-faced petrels at Mauao and Motuotau I, Bay of Plenty, New Zealand. Models allowing for transience produce estimates for birds in the year following their first encounter (S_A^1) and in all subsequent years (S_A^{2+}).

	S_A^{2+}	S_A^1	Transience
Mauao	0.886 (0.009)	0.723 (0.025)	0.184 (0.007)
Motuotau I	0.890 (0.015)	0.844 (0.033)	0.052 (0.002)

Model fitting showed negligible support for temporal variation in adult survival at both sites, but indicated a site-specific transience effect (Table 2). Model-averaged estimates of key parameters are given in Table 3. We estimated the apparent adult annual survival rate to be 0.89 for resident birds. Apparent survival in the year following 1st capture differed between sites, being lower at the mainland site, Mauao, where the proportion of transient birds was 18%, than on the island, Motuotau (5% transience).

Probability of capture

We calculated model-averaged estimates of annual capture probabilities separately for birds seen and not seen in the previous year. At Mauao, these ranged from 0.12 to 0.52 (mean = 0.40) for a bird seen in the previous year and from 0.06 to 0.35 (mean = 0.25) for a bird not seen in the previous year. At Motuotau, they ranged from 0.15 to 0.45 (mean = 0.30) for a bird seen in the previous year and from 0.12 to 0.39 (mean = 0.25) for a bird not seen in the previous year. Thus both trap-dependence and transience were greater at Mauao than on the nearby island.

Age of first return and survival of young birds

For the global multi-state model, the overall χ^2 statistic was significant at both sites. Removing the *3G.SR* and *M.ITEC* components (which test for transience and trap-dependence, respectively) led to the χ^2 statistic no longer showing any evidence of lack-of-fit at Mauao, whereas at Motuotau there appeared to be some residual lack-of-fit.

Table 4. Comparison of the best-fitting models, as ranked by *AICc* values and using $\hat{c}$ = 1.2, for estimating survival of young grey-faced petrels (S_Y) and age of 1st return (*AFR*) at 2 sites in the Bay of Plenty, New Zealand, from 1991 to 2008. For defining models, S_A = apparent survival of adults, *TR* = transience, *P* = probability of capture, *TD* = trap-dependence, (.) indicates a constant parameter, *g* = parameter varies by group (site), *t* = parameter varies through time, * indicates full interaction between terms is allowed. Models including time-dependence were included in the initial candidate set, but weights for these models were all << 0.001 so the models were excluded from further consideration.

Model	*ΔQAICc*	Weight	No. parameters
S_Y (.) S_A(.) *TR*(.) *AFR*(*g*) P^{TD}(*g***t*)	0.0	0.219	31
S_Y (.) S_A(.) *TR*(*g*) *AFR*(*g*) P^{TD}(*g***t*)	1.1	0.128	32
S_Y (.) S_A(*g*) *TR*(.) *AFR*(*g*) P^{TD}(*g***t*)	1.4	0.108	32
S_Y (*g*) S_A(.) *TR*(.) *AFR*(*g*) P^{TD}(*g***t*)	1.4	0.108	32
S_Y (*g*) S_A(.) *TR*(*g*) *AFR*(*g*) P^{TD}(*g***t*)	2.1	0.078	33
S_Y (*g*) S_A(*g*) *TR*(.) *AFR*(*g*) P^{TD}(*g***t*)	2.5	0.063	33
S_Y (.) S_A(*g*) *TR*(*g*) *AFR*(*g*) P^{TD}(*g***t*)	2.7	0.057	33
S_Y (*g*) S_A(.) *TR*(.) *AFR*(.) P^{TD}(*g***t*)	2.8	0.053	31
S_Y (*g*) S_A(*g*) *TR*(*g*) *AFR*(*g*) P^{TD}(*g***t*)	3.4	0.041	34
S_Y (*g*) S_A(.) *TR*(*g*) *AFR*(.) P^{TD}(*g***t*)	3.7	0.035	32
S_Y (.) S_A(.) *TR*(.) *AFR*(.) P^{TD}(*g***t*)	3.8	0.032	30
S_Y (*g*) S_A(*g*) *TR*(.) *AFR*(.) P^{TD}(*g***t*)	4.2	0.027	32
S_Y (*g*) S_A(*g*) *TR*(*g*) *AFR*(.) P^{TD}(*g***t*)	5.2	0.016	33
S_Y (.) S_A(.) *TR*(*g*) *AFR*(.) P^{TD}(*g***t*)	5.3	0.015	31
S_Y (.) S_A(*g*) *TR*(.) *AFR*(.) P^{TD}(*g***t*)	5.7	0.013	31
S_Y (.) S_A(*g*) *TR*(*g*) *AFR*(.) P^{TD}(*g***t*)	7.3	0.006	32

Removing the *3G.SR* and *M.ITEC* components led to an improvement in $\hat{c}$ from 1.5 to 1.2 for the 2 sites combined (Table 1). We fitted a range of models that included both transience and trap-dependence using this value for $\hat{c}$.

Model fitting indicated support for a range of models (Table 4). Within these, 4 models accounted for most of the *QAICc* weighting. These models indicated that survival of young birds was not site-dependent, but that *AFR* differed between sites. The model-averaged, annualised estimates for S_Y in the first 2 years of life are 0.844 (*SE* = 0.023) for Mauao and 0.865 (*SE* = 0.032) for Motuotau.

Although the best-fitting models all suggest that *AFR* varies between the 2 sites, age-specific estimates for Motuotau were unreliable, with wide confidence intervals, which may be a result of the relatively short-term data set and lesser sampling effort at this site. Given these concerns, we report the variation in the probability of *AFR* for Mauao only in Fig. 1. This shows that around 50% of fledglings that will return to the natal colony do so by 4 years of age, and that by age 6, the probability of a fledgling returning is approximately 1.0. We tested these estimates by varying *m* (the maximum presumed *AFR*) between 6 and 9 years but this altered neither the shape of the resulting probability distribution, nor the asymptote and did not improve the model fit.

DISCUSSION

Our best-fitting models for estimating the apparent annual survival rate of adult birds made allowance for a transience effect. This led to separate estimates of S_A for birds in the year following their first encounter (S_A^1) compared with all subsequent years (S_A^{2+}). Estimates of S_A^1 were lower than S_A^{2+} at both sites with a greater disparity between the 2 at Mauao, the mainland site, where the adult population also contained a greater proportion of transients. This effect has been demonstrated in other similar analyses in which transient behaviour is taken into account. It appears to be common in seabird populations where immature birds may visit a number of potential breeding sites before establishing site fidelity at 1 of them (Prévot-Julliard *et al*. 1998; Clucas *et al*. 2008; Ratcliffe *et al*. 2008). Site-specific variation in levels of transience has also been shown in procellariids. For example, Tavecchia *et al.* (2008) found intraspecific variation in the proportions of transients in both European storm petrel (*Hydrobates pelagicus*) and Balearic shearwater (*Puffinus mauretanicus*) populations at 2 adjacent colonies in the western Mediterranean.

Table 5. Published estimates of apparent survival and average adult body mass for adult procellariids; * indicates a range of estimates depending on age since first observed breeding.

Species	Body mass (g)	S_A	Reference
Westland petrel (*Procellaria westlandica)*	1100	0.965	Waugh *et al*. (2006)
Sooty shearwater (*Puffinus griseus)*	850	0.952	Clucas *et al*. (2008)
Cory's shearwater (*Calonectris diomedea)*	600	0.89	Jenouvrier *et al*. (2008)
Short-tailed shearwater (*Puffinus tenuirostris)*	550	0.882–0.918*	Bradley *et al*. (1989)
Grey-faced petrel (*Pterodroma macroptera gouldi)*	550	0.89	This study
Balearic shearwater (*Puffinus mauretanicus)*	500	0.78	D'Oro *et al*. (2004)
Snow petrel (*Pagodroma nivea)*	400	0.913	Chastel *et al*. (1993)
Hutton's shearwater (*Puffinus huttoni)*	350	0.931	Cuthbert & Davis (2002)

There are at least 2 interpretations of the biological implications of transience. The 1st considers the effect as an index of prospecting behaviour by immature birds, which infers that a colony with a higher level of transience may be more attractive, as failure to establish may be linked to density-dependent processes (Clucas *et al*. 2008). This is unlikely to be the case at Mauao because breeding space is not a limiting factor. On the other hand, it may suggest that some characteristics of the site, perhaps local predation or other disturbances such as light and noise pollution, prevent prospecting birds from settling there. These factors may, in some cases, be sufficient to induce marked local variation in demographic processes within a species (Tavecchia *et al*. 2008).

The apparent annual survival rate of more established adults was estimated at 0.89 at both of our study colonies. Reliable estimates of similar rates for petrel species with which to compare ours are rare because of the requirement for long-term data sets and because of extended post-fledging absences from breeding sites and non-attendance by some breeding-age adults in some years. Assuming that adult survival rate within a taxonomic group scales with body mass (McCarthy *et al*. 2008), our estimate for grey-faced petrels appears to be reasonable, but possibly somewhat low compared with similar estimates for other procellariids (summarised in Table 5).

A range of factors may have contributed to our estimated values. Some individuals captured post-fledging will be immature birds that are yet to breed. If similar demographic trends occur in grey-faced petrels as in short-tailed shearwaters, where adult apparent survival increased with breeding age (Bradley *et al*. 1989), this may have caused an underestimate. It is also possible that birds may show transient behaviour after more than the 1 year accounted for in our models, or that permanent emigration from colonies contributes to lower apparent survival estimates. The close proximity of both colonies to an area of high human recreational use and, in the past decade, intensive coastal redevelopment may have contributed to this. The higher rate of transience at the mainland site could also be an indicator of disturbance.

We must also acknowledge the potential for our sampling procedures, including our dependence on volunteer effort, to have reduced the likelihood of encountering individual birds. For example, we banded birds found on the surface, so those birds that entered burrows soon after landing were less likely to have been encountered. If these birds were established breeders, as is likely, this would serve to under-estimate our estimates of survival through inducing intrinsic heterogeneity in recapture probabilities (Crespin *et al*. 2008; Oppel *et al*. 2011). Some birds may also have deserted the colonies after being handled, especially around the incubation period. Imber (1976) observed that ~10% of grey-faced petrels respond in this way. One approach to dealing with some of this uncertainty would be to restructure the banding programme so that, rather than attempting to cover all of a site with limited personnel, banding effort is concentrated in a consistent and defined sample of plots in every season. This would increase the likelihood of encountering individual birds and accordingly increase confidence that any subsequent estimates of apparent survival rates are driven by biological factors rather than some indeterminate mix of biological and sampling effects (Sainz-Aguilar *et al*. 2010). Also, if grey-faced petrels show similar patterns of colony attendance with respect to breeding status as short-tailed shearwaters, with younger, 'pre-breeding,' adults arriving at the colony later than established breeders (Serventy 1967), further concentration of effort in the Apr-May prospecting phase of the breeding season may give more reliable data with which to estimate S_{A}^{2+}.

It was necessary for us to define sampling occasions strategically to make the best use of the available data. These occasions risked violating the

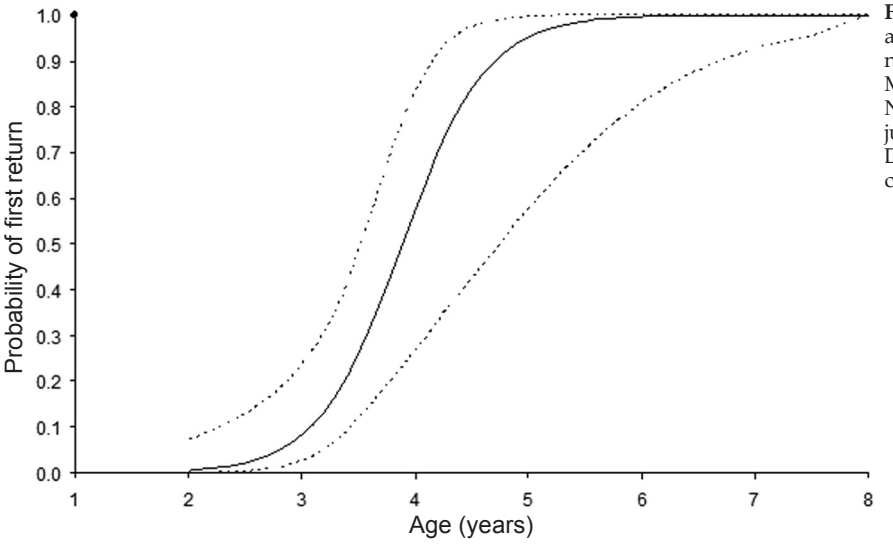

Fig. 1. Estimated probability of 1st return to natal breeding colony at Mauao, Bay of Plenty, New Zealand with age of juvenile grey-faced petrels. Dotted lines are 95% confidence intervals.

assumption of capture periods being of negligible duration compared to the period between them. Any resulting bias is likely to be small if recapture probabilities are greater than 0.2 and capture effort is similar between years (Smith and Anderson, 1987; O'Brien *et al*., 2005). Our data met these requirements.

The probability of encountering birds was lower if they had not been encountered during the previous breeding season and this effect was more marked at the mainland site than on the island. Although this appears as a 'trap-dependent' effect, it is important to note that this does not necessarily infer a true behavioural response to capture, but more a change in encounter probability subsequent to capture, which can result from other factors (Lebreton *et al*. 1992; Pradel 1993). Our estimates of capture probabilities showed a similar temporal pattern to those reported for other seabird species, which is commonly interpreted as temporary emigration, possibly linked to breeding performance in previous seasons (Barbraud & Weimerskirch 2001; Grosbois & Thompson 2005; Clucas *et al.* 2008). It is probable that more subtle effects related to sex, age and breeding status may be operating, but detection of these would require much more detailed information on individual birds than was available for this study.

Survival of young birds between fledging and 1st return was estimated as being very similar at both sites and also very similar to that of adult birds. This is surprising as survival rates of young birds are commonly reported as being markedly lower than those of adults (Weimerskirch *et al*. 1997; Waugh *et al*. 1999). Although common, this relative difference in survival is not universal. Sandvik *et al.* (2008) reported survival of immature Atlantic puffins (*Fratercula arctica*) as almost identical to that of adult birds. The similarity in our estimates may result from apparent adult survival being underestimated for the reasons outlined above, but also from relatively high encounter rates from juveniles on their return to their natal colonies if they spend more time on the surface than established breeders, who spend much of their time in burrows. This is clearly an area in need of further study.

The age at which pre-breeding juvenile birds 1st attend a colony varies between individuals (Bradley *et al*. 1999). We estimated that the probability of return is 0.5 at 4 years of age, rising to around 1.0 by age 6. This trend mirrors that reported for other long-lived seabirds, but our estimates of *AFR* also account for the incompleteness of detection of some returning individuals. This method would seem to be a very useful approach to adopt in the many cases where limited resources and large population sizes mean that it is impossible to identify all individuals attending a colony in all breeding seasons. The use of an estimate of the probability of a juvenile bird returning to a colony, with its associated estimate of variance, should prove to be useful in demographic models aimed at the management of bird populations where complete knowledge of population processes is an exception.

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Preface

The first edition of the *IUCN Red List Categories and Criteria: Version 3.1* was published in 2001, after its formal adoption by the IUCN Council in February 2000. Since then it has been used as the standard for global Red List assessments published on the *IUCN Red List of Threatened Species*™. It is also used alongside the *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels* (IUCN 2003, 2012), by many countries around the world as a standard system for national Red List assessments.

Over the last decade, the IUCN Red List Categories and Criteria have been used to assess an increasingly diverse range of taxa occurring in a wide variety of habitats. In addition, ongoing technological advances continue to provide more scope for improving data analysis. Therefore it is necessary for the IUCN Red List to adapt to maintain and further develop its usefulness as a conservation tool. However, it is also essential that the central rules for assessing extinction risk for the IUCN Red List remain stable to be able to compare changes in Red List status over time.

This second edition of the *IUCN Red List Categories and Criteria: Version 3.1* retains the same assessment system presented in the 2001 publication. To allow for occasional changes in documentation requirements for assessments, information that was previously outlined in Annex 3 has been moved to a separate reference document: *Documentation Standards and Consistency Checks for IUCN Red List Assessments and Species Accounts*.

To ensure full understanding of IUCN Red List assessments, it is very important to refer to all of the following documents:

(1) *IUCN Red List Categories and Criteria: Version 3.1* (IUCN 2001 and later editions)

(2) The latest version of the *Guidelines for Using the IUCN Red List Categories and Criteria* (available from www.iucnredlist.org/documents/RedListGuidelines.pdf; check the IUCN Red List website for regular updates of this document)

(3) The latest version of the *Documentation Standards and Consistency Checks for IUCN Red List Assessments and Species Accounts* (available from www.iucnredlist.org/documents/RL_Standards_Consistency.pdf; check the IUCN Red List website for regular updates of this document)

For national and regional level assessments using the IUCN Red List Categories and Criteria, the *Guidelines for Application of IUCN Red List Criteria at Regional and National Levels: Version 4.0* (IUCN 2012 and later versions) must also be used.

All of the above documents are freely available to download from the IUCN Red List website (www.iucnredlist.org). Note that documents (2) and (3) above are regularly updated, therefore it is important to check the website for the current versions.

Acknowledgements

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IUCN is indebted to the hundreds of scientists who participated in the criteria review workshops or who submitted comments and suggestions during the review process. This combined input has resulted in a far more robust, user friendly and widely applicable system.

As a result of the review process, several new topics have become the focus of active research and publication in the academic community. As a greater clarity emerges on tricky and unresolved issues, these will be addressed in a comprehensive set of user guidelines. The intention is to keep this revised system stable to enable genuine changes in the status of species to be detected rather than to have such changes obscured by the constant medication of the criteria.

The ***IUCN Red List Categories and Criteria: Version 3.1*** are available in booklet form in the following language versions: English, French and Spanish from the IUCN Publications Services (www.iucn.org/knowledge/publications_doc/publications/).

They are also available to download from the IUCN Red List website in English, French and Spanish, at: http://www.iucnredlist.org/technical-documents/categories-and-criteria.

I. INTRODUCTION

1. The IUCN Red List Categories and Criteria are intended to be an easily and widely understood system for classifying species at high risk of global extinction. The general aim of the system is to provide an explicit, objective framework for the classification of the broadest range of species according to their extinction risk. However, while the Red List may focus attention on those taxa at the highest risk, it is not the sole means of setting priorities for conservation measures for their protection.

   Extensive consultation and testing in the development of the system strongly suggest that it is robust across most organisms. However, it should be noted that although the system places species into the threatened categories with a high degree of consistency, the criteria do not take into account the life histories of every species. Hence, in certain individual cases, the risk of extinction may be under- or over-estimated.

2. Before 1994 the more subjective threatened species categories used in IUCN Red Data Books and Red Lists had been in place, with some modification, for almost 30 years. Although the need to revise the categories had long been recognized (Fitter and Fitter 1987), the current phase of development only began in 1989 following a request from the IUCN Species Survival Commission (SSC) Steering Committee to develop a more objective approach. The IUCN Council adopted the new Red List system in 1994.

   The IUCN Red List Categories and Criteria have several specific aims:

   - to provide a system that can be applied consistently by different people;
   - to improve objectivity by providing users with clear guidance on how to evaluate different factors which affect the risk of extinction;
   - to provide a system which will facilitate comparisons across widely different taxa;
   - to give people using threatened species lists a better understanding of how individual species were classified.

3. Since their adoption by IUCN Council in 1994, the IUCN Red List Categories have become widely recognized internationally, and they are now used in a range of publications and listings produced by IUCN, as well as by numerous governmental and non-governmental organizations. Such broad and extensive use revealed the need for a number of improvements, and SSC was mandated by the 1996 World Conservation Congress (WCC Res. 1.4) to conduct a review of the system (IUCN 1996). This document presents the revisions accepted by the IUCN Council.

   The proposals presented in this document result from a continuing process of drafting, consultation and validation. The production of a large number of draft proposals has led to some confusion, especially as each draft has been used for classifying some

set of species for conservation purposes. To clarify matters, and to open the way for modifications as and when they become necessary, a system for version numbering has been adopted as follows:

Version 1.0: Mace and Lande (1991)
The first paper discussing a new basis for the categories, and presenting numerical criteria especially relevant for large vertebrates.

Version 2.0: Mace *et al.* (1992)
A major revision of Version 1.0, including numerical criteria appropriate to all organisms and introducing the non-threatened categories.

Version 2.1: IUCN (1993)
Following an extensive consultation process within SSC, a number of changes were made to the details of the criteria, and fuller explanation of basic principles was included. A more explicit structure clarified the significance of the non-threatened categories

Version 2.2: Mace and Stuart (1994)
Following further comments received and additional validation exercises, some minor changes to the criteria were made. In addition, the Susceptible category present in Versions 2.0 and 2.1 was subsumed into the Vulnerable category. A precautionary application of the system was emphasised.

Version 2.3: IUCN (1994)
IUCN Council adopted this version, which incorporated changes as a result of comments from IUCN members, in December 1994. The initial version of this document was published without the necessary bibliographic details, such as date of publication and ISBN number, but these were included in the subsequent reprints in 1998 and 1999. This version was used for the *1996 IUCN Red List of Threatened Animals* (Baillie and Groombridge 1996), *The World List of Threatened Trees* (Oldfield *et al.* 1998) and the *2000 IUCN Red List of Threatened Species* (Hilton-Taylor 2000).

Version 3.0: IUCN/SSC Criteria Review Working Group (1999)
Following comments received, a series of workshops were convened to look at the IUCN Red List Criteria following which, changes were proposed affecting the criteria, the definitions of some key terms and the handling of uncertainty.

Version 3.1: IUCN (2001)
The IUCN Council adopted this latest version, which incorporated changes as a result of comments from the IUCN and SSC memberships and from a final meeting of the Criteria Review Working Group, in February 2000.

All new assessments from January 2001 should use the latest adopted version and cite the year of publication and version number.

4. In the rest of this document, the proposed system is outlined in several sections. Section II, the Preamble, presents basic information about the context and structure of the system, and the procedures that are to be followed in applying the criteria to species. Section III provides definitions of key terms used. Section IV presents the categories, while Section V details the quantitative criteria used for classification within the threatened categories. Annex 1 provides guidance on how to deal with uncertainty when applying the criteria; Annex 2 suggests a standard format for citing the Red List Categories and Criteria; and Annex 3 refers to the required and recommended supporting information for taxa to be included on IUCN's global Red List and where to find further guidance on these. It is important for the effective functioning of the system that all sections are read and understood to ensure that the definitions and rules are followed.

II. PREAMBLE

The information in this section is intended to direct and facilitate the use and interpretation of the categories (Critically Endangered, Endangered, etc.), criteria (A to E), and subcriteria (1, 2, etc.; a, b, etc.; i, ii, etc.).

1. Taxonomic level and scope of the categorization process

The criteria can be applied to any taxonomic unit at or below the species level. In the following information, definitions and criteria the term 'taxon' is used for convenience, and may represent species or lower taxonomic levels, including forms that are not yet formally described. There is sufficient range among the different criteria to enable the appropriate listing of taxa from the complete taxonomic spectrum, with the exception of micro-organisms. The criteria may also be applied within any specified geographical or political area, although in such cases special notice should be taken of point 14. In presenting the results of applying the criteria, the taxonomic unit and area under consideration should be specified in accordance with the documentation guidelines (see Annex 3). The categorization process should only be applied to wild populations inside their natural range, and to populations resulting from benign introductions. The latter are defined in the IUCN *Guidelines for Re-introductions* (IUCN 1998) as '...an attempt to establish a species, for the purpose of conservation, outside its recorded distribution, but within an appropriate habitat and eco-geographical area. This is a feasible conservation tool only when there is no remaining area left within a species' historic range'.

2. Nature of the categories

Extinction is a chance process. Thus, a listing in a higher extinction risk category implies a higher expectation of extinction, and over the time-frames specified more taxa listed in a higher category are expected to go extinct than those in a lower one (without effective conservation action). However, the persistence of some taxa in high-risk categories does not necessarily mean their initial assessment was inaccurate.

All taxa listed as Critically Endangered qualify for Vulnerable and Endangered, and all listed as Endangered qualify for Vulnerable. Together these categories are described as 'threatened'. The threatened categories form a part of the overall scheme. It will be possible to place all taxa into one of the categories (see Figure 1).

3. Role of the different criteria

For listing as Critically Endangered, Endangered or Vulnerable there is a range of quantitative criteria; meeting any one of these criteria qualifies a taxon for listing at that

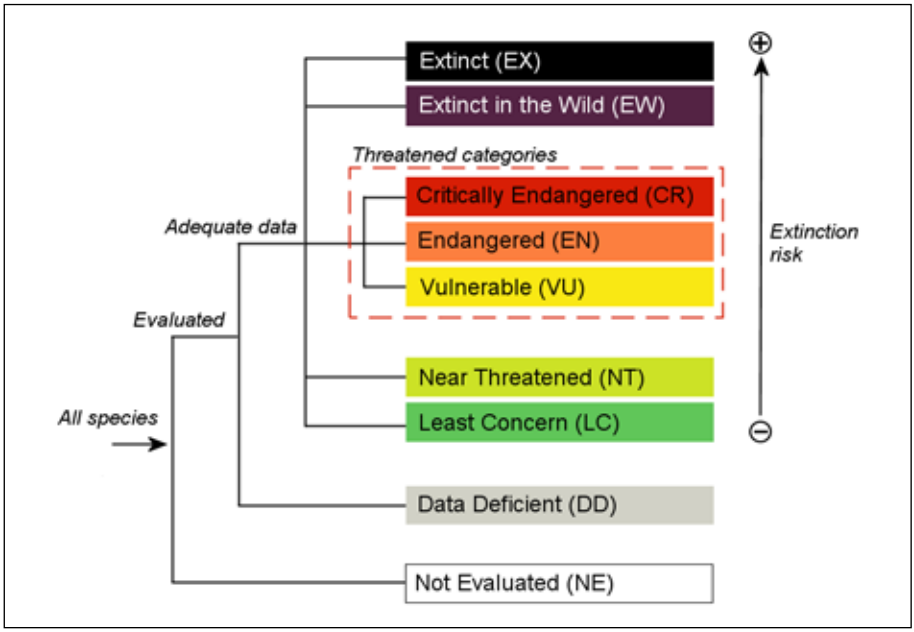

Figure 1. Structure of the categories

level of threat. Each taxon should be evaluated against all the criteria. Even though some criteria will be inappropriate for certain taxa (some taxa will never qualify under these however close to extinction they come), there should be criteria appropriate for assessing threat levels for any taxon. The relevant factor is whether *any one* criterion is met, not whether all are appropriate or all are met. Because it will never be clear in advance which criteria are appropriate for a particular taxon, each taxon should be evaluated against all the criteria, and *all* criteria met at the highest threat category must be listed.

4. Derivation of quantitative criteria

The different criteria (A-E) are derived from a wide review aimed at detecting risk factors across the broad range of organisms and the diverse life histories they exhibit. The quantitative values presented in the various criteria associated with threatened categories were developed through wide consultation, and they are set at what are generally judged to be appropriate levels, even if no formal justification for these values exists. The levels for different criteria within categories were set independently but against a common standard. Broad consistency between them was sought.

5. Conservation actions in the listing process

The criteria for the threatened categories are to be applied to a taxon whatever the level of conservation action affecting it. It is important to emphasise here that a taxon may require conservation action even if it is not listed as threatened. Conservation actions which may benefit the taxon are included as part of the documentation requirements (see Annex 3).

6. Data quality and the importance of inference and projection

The criteria are clearly quantitative in nature. However, the absence of high-quality data should not deter attempts at applying the criteria, as methods involving estimation, inference and projection are emphasised as being acceptable throughout. Inference and projection may be based on extrapolation of current or potential threats into the future (including their rate of change), or of factors related to population abundance or distribution (including dependence on other taxa), so long as these can reasonably be supported. Suspected or inferred patterns in the recent past, present or near future can be based on any of a series of related factors, and these factors should be specified as part of the documentation.

Taxa at risk from threats posed by future events of low probability but with severe consequences (catastrophes) should be identified by the criteria (e.g. small distributions, few locations). Some threats need to be identified particularly early, and appropriate actions taken, because their effects are irreversible or nearly so (e.g. pathogens, invasive organisms, hybridization).

7. Problems of scale

Classification based on the sizes of geographic ranges or the patterns of habitat occupancy is complicated by problems of spatial scale. The finer the scale at which the distributions or habitats of taxa are mapped, the smaller the area will be that they are found to occupy, and the less likely it will be that range estimates (at least for 'area of occupancy': see Definitions, point 10) exceed the thresholds specified in the criteria. Mapping at finer scales reveals more areas in which the taxon is unrecorded. Conversely, coarse-scale mapping reveals fewer unoccupied areas, resulting in range estimates that are more likely to exceed the thresholds for the threatened categories. The choice of scale at which range is estimated may thus, itself, influence the outcome of Red List assessments and could be a source of inconsistency and bias. It is impossible to provide any strict but general rules for mapping taxa or habitats; the most appropriate scale will depend on the taxon in question, and the origin and comprehensiveness of the distribution data.

8. Uncertainty

The data used to evaluate taxa against the criteria are often estimated with considerable uncertainty. Such uncertainty can arise from any one or all of the following three factors: natural variation, vagueness in the terms and definitions used, and measurement error. The way in which this uncertainty is handled can have a strong influence on the results of an evaluation. Details of methods recommended for handling uncertainty are included in Annex 1, and assessors are encouraged to read and follow these principles.

In general, when uncertainty leads to wide variation in the results of assessments, the range of possible outcomes should be specified. A single category must be chosen and the basis for the decision should be documented; it should be both precautionary and credible.

When data are very uncertain, the category of 'Data Deficient' may be assigned. However, in this case the assessor must provide documentation showing that this category has been assigned because data are inadequate to determine a threat category. It is important to recognize that taxa that are poorly known can often be assigned a threat category on the basis of background information concerning the deterioration of their habitat and/or other causal factors; therefore the liberal use of 'Data Deficient' is discouraged.

9. Implications of listing

Listing in the categories of Not Evaluated and Data Deficient indicates that no assessment of extinction risk has been made, though for different reasons. Until such time as an assessment is made, taxa listed in these categories should not be treated as if they were non-threatened. It may be appropriate (especially for Data Deficient forms) to give them the same degree of attention as threatened taxa, at least until their status can be assessed.

10. Documentation

All assessments should be documented. Threatened classifications should state the criteria and subcriteria that were met. No assessment can be accepted for the IUCN Red List as valid unless at least one criterion is given. If more than one criterion or subcriterion is met, then each should be listed. If a re-evaluation indicates that the documented criterion is no longer met, this should not result in automatic reassignment to a lower category of threat (downlisting). Instead, the taxon should be re-evaluated against all the criteria to clarify its status. The factors responsible for qualifying the taxon against the criteria, especially where inference and projection are used, should be documented (see Annexes 2 and 3). The documentation requirements for other categories are also specified in Annex 3.

11. Threats and priorities

The category of threat is not necessarily sufficient to determine priorities for conservation action. The category of threat simply provides an assessment of the extinction risk under current circumstances, whereas a system for assessing priorities for action will include numerous other factors concerning conservation action such as costs, logistics, chances of success, and other biological characteristics of the subject.

12. Re-evaluation

Re-evaluation of taxa against the criteria should be carried out at appropriate intervals. This is especially important for taxa listed under Near Threatened, Data Deficient and for threatened taxa whose status is known or suspected to be deteriorating.

13. Transfer between categories

The following rules govern the movement of taxa between categories:

A. A taxon may be moved from a category of higher threat to a category of lower threat if none of the criteria of the higher category has been met for five years or more.

B. If the original classification is found to have been erroneous, the taxon may be transferred to the appropriate category or removed from the threatened categories altogether, without delay (but see Point 10 above).

C. Transfer from categories of lower to higher risk should be made without delay.

14. Use at regional level

The IUCN Red List Categories and Criteria were designed for global taxon assessments. However, many people are interested in applying them to subsets of global data, especially at regional, national or local levels. To do this it is important to refer to guidelines prepared by the IUCN/SSC Regional Applications Working Group and the National Red List Working Group of the IUCN SSC Red List Committee (e.g. Gärdenfors *et al.* 2001; IUCN 2003, 2012). When applied at national or regional levels it must be recognized that a global category may not be the same as a national or regional category for a particular taxon. For example, taxa classified as Least Concern globally might be Critically Endangered within a particular region where numbers are very small or declining, perhaps only because they are at the margins of their global range. Conversely, taxa classified as Vulnerable on the basis of their global declines in numbers or range might be Least Concern within a particular region where their populations are stable. It is also important to note that taxa endemic to regions or nations will be assessed globally in any regional or national applications of the criteria, and in these cases great care must be taken to check that an assessment has not

already been undertaken by a Red List Authority (RLA), and that the categorization is agreed with the relevant RLA (e.g. an SSC Specialist Group known to cover the taxon).

III. DEFINITIONS

1. Population and Population Size (Criteria A, C and D)

The term 'population' is used in a specific sense in the Red List Criteria that is different to its common biological usage. Population is here defined as the total number of individuals of the taxon. For functional reasons, primarily owing to differences between life forms, population size is measured as numbers of mature individuals only. In the case of taxa obligately dependent on other taxa for all or part of their life cycles, biologically appropriate values for the host taxon should be used.

2. Subpopulations (Criteria B and C)

Subpopulations are defined as geographically or otherwise distinct groups in the population between which there is little demographic or genetic exchange (typically one successful migrant individual or gamete per year or less).

3. Mature individuals (Criteria A, B, C and D)

The number of mature individuals is the number of individuals known, estimated or inferred to be capable of reproduction. When estimating this quantity, the following points should be borne in mind:

- Mature individuals that will never produce new recruits should not be counted (e.g. densities are too low for fertilization).
- In the case of populations with biased adult or breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals, which take this into account.
- Where the population size fluctuates, use a lower estimate. In most cases this will be much less than the mean.
- Reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g. corals).
- In the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding.
- Re-introduced individuals must have produced viable offspring before they are counted as mature individuals.

4. Generation (Criteria A, C and E)

Generation length is the average age of parents of the current cohort (i.e. newborn individuals in the population). Generation length therefore reflects the turnover rate of breeding individuals in a population. Generation length is greater than the age at first breeding and less than the age of the oldest breeding individual, except in taxa that breed only once. Where generation length varies under threat, the more natural, i.e. pre-disturbance, generation length should be used.

5. Reduction (Criterion A)

A reduction is a decline in the number of mature individuals of at least the amount (%) stated under the criterion over the time period (years) specified, although the decline need not be continuing. A reduction should not be interpreted as part of a fluctuation unless there is good evidence for this. The downward phase of a fluctuation will not normally count as a reduction.

6. Continuing decline (Criteria B and C)

A continuing decline is a recent, current or projected future decline (which may be smooth, irregular or sporadic) which is liable to continue unless remedial measures are taken. Fluctuations will not normally count as continuing declines, but an observed decline should not be considered as a fluctuation unless there is evidence for this.

7. Extreme fluctuations (Criteria B and C)

Extreme fluctuations can be said to occur in a number of taxa when population size or distribution area varies widely, rapidly and frequently, typically with a variation greater than one order of magnitude (i.e. a tenfold increase or decrease).

8. Severely fragmented (Criterion B)

The phrase 'severely fragmented' refers to the situation in which increased extinction risk to the taxon results from the fact that most of its individuals are found in small and relatively isolated subpopulations (in certain circumstances this may be inferred from habitat information). These small subpopulations may go extinct, with a reduced probability of recolonization.

9. Extent of occurrence (Criteria A and B)

Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy (see Figure 2). This

measure may exclude discontinuities or disjunctions within the overall distributions of taxa (e.g. large areas of obviously unsuitable habitat) (but see 'area of occupancy', point 10 below). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence).

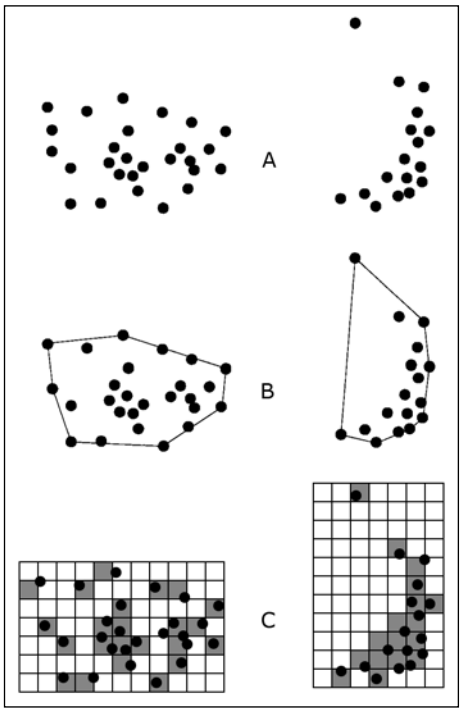

Figure 2. Two examples of the distinction between extent of occurrence and area of occupancy. (A) is the spatial distribution of known, inferred or projected sites of present occurrence. (B) shows one possible boundary to the extent of occurrence, which is the measured area within this boundary. (C) shows one measure of area of occupancy which can be achieved by the sum of the occupied grid squares.

10. Area of occupancy (Criteria A, B and D)

Area of occupancy is defined as the area within its 'extent of occurrence' (see point 9 above) which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g. irreplaceable colonial nesting sites, crucial feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data (see point 7 in the Preamble). To avoid inconsistencies and

bias in assessments caused by estimating area of occupancy at different scales, it may be necessary to standardize estimates by applying a scale-correction factor. It is difficult to give strict guidance on how standardization should be done because different types of taxa have different scale-area relationships.

11. Location (Criteria B and D)

The term 'location' defines a geographically or ecologically distinct area in which a single threatening event can rapidly affect all individuals of the taxon present. The size of the location depends on the area covered by the threatening event and may include part of one or many subpopulations. Where a taxon is affected by more than one threatening event, location should be defined by considering the most serious plausible threat.

12. Quantitative analysis (Criterion E)

A quantitative analysis is defined here as any form of analysis which estimates the extinction probability of a taxon based on known life history, habitat requirements, threats and any specified management options. Population viability analysis (PVA) is one such technique. Quantitative analyses should make full use of all relevant available data. In a situation in which there is limited information, such data as are available can be used to provide an estimate of extinction risk (for instance, estimating the impact of stochastic events on habitat). In presenting the results of quantitative analyses, the assumptions (which must be appropriate and defensible), the data used and the uncertainty in the data or quantitative model must be documented.

IV. THE CATEGORIES[1]

A representation of the relationships between the categories is shown in Figure 1.

EXTINCT (EX)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.

[1] *Note: As in previous IUCN categories, the abbreviation of each category (in parenthesis) follows the English denominations when translated into other languages (see Annex 2).*

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)

A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

V. THE CRITERIA FOR CRITICALLY ENDANGERED, ENDANGERED AND VULNERABLE

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing an extremely high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of ≥90% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

    (a) direct observation
    (b) an index of abundance appropriate to the taxon
    (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
    (d) actual or potential levels of exploitation
    (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of ≥80% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of ≥80%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of ≥80% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 100 km^2, and estimates indicating at least two of a-c:

    a. Severely fragmented or known to exist at only a single location.

    b. Continuing decline, observed, inferred or projected, in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) area, extent and/or quality of habitat
        (iv) number of locations or subpopulations
        (v) number of mature individuals.

    c. Extreme fluctuations in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) number of locations or subpopulations
        (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 10 km^2, and estimate indicating at least two of a-c:

    a. Severely fragmented or known to exist at only a single location.

    b. Continuing decline, observed, inferred or projected, in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) area, extent and/or quality of habitat
        (iv) number of locations or subpopulations
        (v) number of mature individuals.

    c. Extreme fluctuations in any of the following:
        (i) extent of occurrence
        (ii) area of occupancy
        (iii) number of locations or subpopulations
        (iv) number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or one generation, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

a. Population structure in the form of one of the following:
   (i) no subpopulation estimated to contain more than 50 mature individuals, OR
   (ii) at least 90% of mature individuals in one subpopulation.

b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years).

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a very high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of ≥70% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

   (a) direct observation
   (b) an index of abundance appropriate to the taxon
   (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat
   (d) actual or potential levels of exploitation
   (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of ≥50% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of ≥50%, projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of ≥50% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, AND where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 5,000 km^2, and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at no more than five locations.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals.

2. Area of occupancy estimated to be less than 500 km^2, and estimates indicating at least two of a-c:

   a. Severely fragmented or known to exist at no more than five locations.

   b. Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals.

   c. Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy

(iii) number of locations or subpopulations
(iv) number of mature individuals.

C. Population size estimated to number fewer than 2,500 mature individuals and either:

1. An estimated continuing decline of at least 20% within five years or two generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

a. Population structure in the form of one of the following:
(i) no subpopulation estimated to contain more than 250 mature individuals, OR
(ii) at least 95% of mature individuals in one subpopulation.

b. Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild is at least 20% within 20 years or five generations, whichever is the longer (up to a maximum of 100 years).

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the following criteria (A to E), and it is therefore considered to be facing a high risk of extinction in the wild:

A. Reduction in population size based on any of the following:

1. An observed, estimated, inferred or suspected population size reduction of ≥50% over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:

(a) direct observation
(b) an index of abundance appropriate to the taxon
(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation
(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

2. An observed, estimated, inferred or suspected population size reduction of ≥30% over the last 10 years or three generations, whichever is the longer, where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

3. A population size reduction of ≥30% projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of (b) to (e) under A1.

4. An observed, estimated, inferred, projected or suspected population size reduction of ≥30% over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, AND where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence estimated to be less than 20,000 km^2, and estimates indicating at least two of a-c:

a. Severely fragmented or known to exist at no more than 10 locations.

b. Continuing decline, observed, inferred or projected, in any of the following:
(i) extent of occurrence
(ii) area of occupancy
(iii) area, extent and/or quality of habitat
(iv) number of locations or subpopulations
(v) number of mature individuals.

c. Extreme fluctuations in any of the following:
(i) extent of occurrence
(ii) area of occupancy
(iii) number of locations or subpopulations
(iv) number of mature individuals.

2. Area of occupancy estimated to be less than 2,000 km^2, and estimates indicating at least two of a-c:

a. Severely fragmented or known to exist at no more than 10 locations.

b. Continuing decline, observed, inferred or projected, in any of the following:
   (i) extent of occurrence
   (ii) area of occupancy
   (iii) area, extent and/or quality of habitat
   (iv) number of locations or subpopulations
   (v) number of mature individuals.

c. Extreme fluctuations in any of the following:
   (i) extent of occurrence
   (ii) area of occupancy
   (iii) number of locations or subpopulations
   (iv) number of mature individuals.

C. Population size estimated to number fewer than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or three generations, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

   a. Population structure in the form of one of the following:
      (i) no subpopulation estimated to contain more than 1,000 mature individuals, OR
      (ii) all mature individuals in one subpopulation.

   b. Extreme fluctuations in number of mature individuals.

D. Population very small or restricted in the form of either of the following:

1. Population size estimated to number fewer than 1,000 mature individuals.

2. Population with a very restricted area of occupancy (typically less than 20 km^2) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

E. Quantitative analysis showing the probability of extinction in the wild is at least 10% within 100 years.

Annex 1: Uncertainty

The Red List Criteria should be applied to a taxon based on the available evidence concerning its numbers, trend and distribution. In cases where there are evident threats to a taxon through, for example, deterioration of its only known habitat, a threatened listing may be justified, even though there may be little direct information on the biological status of the taxon itself. In all these instances there are uncertainties associated with the available information and how it was obtained. These uncertainties may be categorized as natural variability, semantic uncertainty and measurement error (Akçakaya *et al.* 2000). This section provides guidance on how to recognize and deal with these uncertainties when using the criteria. More information is available in the *Guidelines for Using the IUCN Red List Categories and Criteria* (downloadable from www.iucnredlist.org/documents/RedListGuidelines.pdf; check the IUCN Red List website for regular updates of this document).

Natural variability results from the fact that species' life histories and the environments in which they live change over time and space. The effect of this variation on the criteria is limited, because each parameter refers to a specific time or spatial scale. Semantic uncertainty arises from vagueness in the definition of terms or lack of consistency in different assessors' usage of them. Despite attempts to make the definitions of the terms used in the criteria exact, in some cases this is not possible without the loss of generality. Measurement error is often the largest source of uncertainty; it arises from the lack of precise information about the parameters used in the criteria. This may be due to inaccuracies in estimating the values or a lack of knowledge. Measurement error may be reduced or eliminated by acquiring additional data. For further details, see Akçakaya *et al.* (2000) and Burgman *et al.* (1999).

One of the simplest ways to represent uncertainty is to specify a best estimate and a range of plausible values. The best estimate itself might be a range, but in any case the best estimate should always be included in the range of plausible values. When data are very uncertain, the range for the best estimate might be the range of plausible values. There are various methods that can be used to establish the plausible range. It may be based on confidence intervals, the opinion of a single expert, or the consensus opinion of a group of experts. Whichever method is used should be stated and justified in the documentation.

When interpreting and using uncertain data, attitudes toward risk and uncertainty may play an important role. Attitudes have two components. First, assessors need to consider whether they will include the full range of plausible values in assessments, or whether they will exclude extreme values from consideration (known as dispute tolerance). An assessor with a low dispute tolerance would include all values, thereby increasing the uncertainty, whereas an assessor with a high dispute tolerance would exclude extremes, reducing the uncertainty. Second, assessors need to consider whether they have a precautionary or evidentiary attitude to risk (known as risk tolerance). A precautionary attitude will classify

a taxon as threatened unless it is certain that it is not threatened, whereas an evidentiary attitude will classify a taxon as threatened only when there is strong evidence to support a threatened classification. Assessors should resist an evidentiary attitude and adopt a precautionary but realistic attitude to uncertainty when applying the criteria, for example, by using plausible lower bounds, rather than best estimates, in determining population size, especially if it is fluctuating. All attitudes should be explicitly documented.

An assessment using a point estimate (i.e. single numerical value) will lead to a single Red List Category. However, when a plausible range for each parameter is used to evaluate the criteria, a range of categories may be obtained, reflecting the uncertainties in the data. A single category, based on a specific attitude to uncertainty, should always be listed along with the criteria met, while the range of plausible categories should be indicated in the documentation (see Annex 3).

Where data are so uncertain that any category is plausible, the category of 'Data Deficient' should be assigned. However, it is important to recognize that this category indicates that the data are inadequate to determine the degree of threat faced by a taxon, not necessarily that the taxon is poorly known or indeed not threatened. Although Data Deficient is not a threatened category, it indicates a need to obtain more information on a taxon to determine the appropriate listing; moreover, it requires documentation with whatever available information exists.

Annex 2: Citation of the IUCN Red List Categories and Criteria

In order to promote the use of a standard format for citing the Red List Categories and Criteria the following forms of citation are recommended:

1. The Red List Category may be written out in full or abbreviated as follows (when translated into other languages, the abbreviations should follow the English denominations):

Extinct, EX	Near Threatened, NT
Extinct in the Wild, EW	Least Concern, LC
Critically Endangered, CR	Data Deficient, DD
Endangered, EN	Not Evaluated, NE
Vulnerable, VU	

2. Under Section V (the criteria for Critically Endangered, Endangered and Vulnerable) there is a hierarchical alphanumeric numbering system of criteria and subcriteria. These criteria and subcriteria (all three levels) form an integral part of the Red List assessment and all those that result in the assignment of a threatened category must be specified after the category. Under the criteria A to C, and D under Vulnerable, the first level of the hierarchy is indicated by the use of numbers (1-4) and if more than one is met, they are separated by means of the '+' symbol. The second level is indicated by the use of the lower-case alphabet characters (a-e). These are listed without any punctuation. A third level of the hierarchy under criteria B and C involves the use of lower case roman numerals (i-v). These are placed in parentheses (with no space between the preceding alphabet character and start of the parenthesis) and separated by the use of commas if more than one is listed. Where more than one criterion is met, they should be separated by semicolons. The following are examples of such usage:

EX	CR D
EN B1ac(i,ii,iii)	VU C2a(ii)
CR A2c+3c; B1ab(iii)	EN B2b(iii)c(ii)
EN B2ab(i,ii,iii)	VU B1ab(iii)+2ab(iii)
EN A1c; B1ab(iii); C2a(i)	VU A2c+3c
EN B1ab(i)c(ii,v)+2ab(i)c(ii,v)	CR C1+2a(ii)
CR A1cd	VU D1+2
EN A2c; D	VU D2

EN A2abc+3bc+4abc; B1b(iii,iv,v)c(ii,iii,iv)+2b(iii,iv,v)c(ii,iii,iv)

Annex 3: Required and Recommended Supporting Information for IUCN Red List Assessments

All assessments published on the IUCN Red List are freely available for public use. To ensure assessments are fully justified and to allow Red List assessment data to be analysed, thus making the IUCN Red List a powerful tool for conservation and policy decisions, a set of supporting information is required to accompany every assessment submitted for publication on the *IUCN Red List of Threatened Species*™.

The reference document *Documentation Standards and Consistency Checks for IUCN Red List Assessments and Species Accounts* is available to download from the Red List website (www.iucnredlist.org) and provides guidance on the following:

- Required supporting information for all IUCN Red List assessments.
- Required supporting information under specific conditions (e.g. taxa assessed under specific Red List Categories or Criteria, plant assessments, reassessed taxa, etc.).
- Recommended supporting information, if sufficient time and data are available.
- Tools available for preparing and submitting assessments for the IUCN Red List, including the IUCN Species Information Service (SIS) and RAMAS® Red List (Akçakaya and Ferson 2001).
- General formatting and style guidelines for documenting IUCN Red List assessments.

Note that the *Documentation Standards and Consistency Checks for IUCN Red List Assessments and Species Accounts* will be updated on a regular basis. Users should check the IUCN Red List website for the most current version of this reference document.

Annex 4: Summary of the IUCN Red List Criteria

See pages 28-29 for a summary of the five criteria (A-E) used to evaluate if a taxon belongs in an IUCN Red List threatened category (Critically Endangered, Endangered or Vulnerable).

SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN AN IUCN RED LIST THREATENED CATEGORY (CRITICALLY ENDANGERED, ENDANGERED OR VULNERABLE).[1]

A. Population size reduction. Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased.

A2 Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction projected, inferred or suspected to be met in the future (up to a maximum of 100 years) *[(a) cannot be used for A3]*.

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation *[except A3]*

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality

(d) actual or potential levels of exploitation

(e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.

B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)

	Critically Endangered	Endangered	Vulnerable
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented **OR** Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** area, extent and/or quality of habitat; **(iv)** number of locations or subpopulations; **(v)** number of mature individuals			
(c) Extreme fluctuations in any of: **(i)** extent of occurrence; **(ii)** area of occupancy; **(iii)** number of locations or subpopulations; **(iv)** number of mature individuals			

C. Small population size and decline				
		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1. An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):		25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2. An observed, estimated, projected or inferred continuing decline AND at least 1 of the following 3 conditions:				
(a)	**(i)** Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals				

D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
D. Number of mature individuals	< 50	< 250	**D1.** < 1,000
D2. *Only applies to the VU category* Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.	-	-	**D2.** typically: AOO < 20 km^2 or number of locations ≤ 5

E. Quantitative Analysis			
	Critically Endangered	Endangered	Vulnerable
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations, whichever is longer (100 years max.)	≥ 20% in 20 years or 5 generations, whichever is longer (100 years max.)	≥ 10% in 100 years

1 Use of this summary sheet requires full understanding of the *IUCN Red List Categories and Criteria* and *Guidelines for Using the IUCN Red List Categories and Criteria*. Please refer to both documents for explanations of terms and concepts used here.

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The IUCN Red List of Threatened Species™

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The IUCN Red List is not just a register of names and associated threat categories. It is a rich compendium of information on the threats to the species, their ecological requirements, where they live, and information on conservation actions that can be used to reduce or prevent extinctions.

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United States Department of the Interior

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IN REPLY REFER TO:

DEC 22 2017

M- 37050

Memorandum

To: Secretary
Deputy Secretary
Assistant Secretary for Land and Minerals Management
Assistant Secretary for Fish and Wildlife and Parks

From: Principal Deputy Solicitor Exercising the Authority of the Solicitor Pursuant to Secretary's Order 3345

Subject: The Migratory Bird Treaty Act Does Not Prohibit Incidental Take

I. Introduction

This memorandum analyzes whether the Migratory Bird Treaty Act, 16 U.S.C. § 703 ("MBTA"), prohibits the accidental or "incidental" taking or killing of migratory birds. Unless permitted by regulation, the MBTA prohibits the "taking" and "killing" of migratory birds. "Incidental take" is take that results from an activity, but is not the purpose of that activity.

This issue was most recently addressed in Solicitor's Opinion M-37041 – *Incidental Take Prohibited Under the Migratory Bird Treaty Act*, issued January 10, 2017 (hereinafter "Opinion M-37041"), which concluded that "the MBTA's broad prohibition on taking and killing migratory birds by any means and in any manner includes incidental taking and killing."[1] Opinion M-37041 was suspended pending review on February 6, 2017.[2] In light of further analysis of the text, history, and purpose of the MBTA, as well as relevant case law, this memorandum permanently withdraws and replaces Opinion M-37041.

Interpreting the MBTA to apply to incidental or accidental actions hangs the sword of Damocles over a host of otherwise lawful and productive actions, threatening up to six months in jail and a $15,000 penalty for each and every bird injured or killed. As Justice Marshall warned, "the value of a sword of Damocles is that it hangs—not that it drops."[3] Indeed, the mere threat

[1] 2017 DEP SO LEXIS 6, *2.

[2] Memorandum from K. Jack Haugrud, Acting Secretary, to Acting Solicitor, Temporary Suspension of Certain Solicitor M-Opinions Pending Review, 2017 DEP SO LEXIS 8 (Feb. 6, 2017).

[3] *Arnett v. Kennedy*, 416 U.S 134, 231 (1974) (Marshall, J., dissenting).

of prosecution inhibits otherwise lawful conduct. For the reasons explained below, this Memorandum finds that, consistent with the text, history, and purpose of the MBTA, the statute's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same apply only to affirmative actions that have as their purpose the taking or killing of migratory birds, their nests, or their eggs.[4]

II. The Evolution of the Migratory Bird Treaty Act

a. The Historical Context of the Treaty

In the late 19th and early 20th centuries, bird hunting devastated migratory bird populations. According to the U.S. Fish and Wildlife Service ("FWS"), "[b]y the late 1800s, the hunting and shipment of birds for the commercial market (to embellish the platters of elegant restaurants) and the plume trade (to provide feathers to adorn lady's fancy hats) had taken their toll on many bird species."[5] The scope of commercial hunting at the turn of the century is hard to overstate. One author, describing hunters descending upon a single pigeon nesting ground, reported "[h]undreds of thousands, indeed millions, of dead birds were shipped out at a wholesale price of fifteen to twenty-five cents a dozen."[6] Director of the New York Zoological Society and former chief taxidermist at the Smithsonian William Hornaday estimated that "in a single nine-month period the London market had consumed feathers from nearly 130,000 egrets"[7] and that "[i]t was a common thing for a rookery of several hundred birds to be attacked by plume hunters, and in two or three days utterly destroyed."[8] Further, commercial hunting was not limited to traditional game birds—estimates indicated that 50 species of North American birds were hunted for their feathers in 1886.[9] Thus, largely as a result of commercial hunting, several species, such as the Labrador Ducks, Great Auks, Passenger Pigeons, Carolina Parakeets, and Heath Hens were extinct or nearly so by the end of the 19th century.[10]

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[4] This memorandum recognizes that this interpretation is contrary to the prior practice of this Department. As explained below, the past expansive assertion of federal authority under the MBTA rested upon a slim foundation—one that ultimately cannot carry its weight. Neither the plain language of the statute nor its legislative history support the notion that Congress intended to criminalize, with fines and potential jail time, otherwise lawful conduct that might incidentally result in the taking of one or more birds.

[5] U.S. Fish and Wildlife Service, Other Relevant Laws *available at* https://www.fws.gov/birds/policies-and-regulations/laws-legislations/other-relevant-laws.php (last updated Oct. 17, 2016).

[6] Andrew G. Ogden, *Dying for a Solution: Incidental Taking Under the Migratory Bird Treaty Act*, 38 WM. & MARY ENVLT. L. & POL'Y REV. 1, 5 n.12 (Fall 2013) (quoting PETER MATTHIESSEN, WILDLIFE IN AMERICA 159-60 (1987)).

[7] William Sounder, *How Two Women Ended the Deadly Feather Trade*, SMITHSONIAN MAGAZINE, Mar. 2013, *available at* http://www.smithsonianmag.com/science-nature/how-two-women-ended-the-deadly-feather-trade-23187277/?all.

[8] *Id.*

[9] *Id.*

[10] Jesse Greenspan, *The Evolution of the Migratory Bird Treaty Act*, AUDUBON, May 22, 2015, *available at* http://www.audubon.org/news/the-evolution-migratory-bird-treaty-act.

Congress adopted the "first federal law protecting wildlife"—the Lacey Act of 1900[11]—in part in response to the threat that commercial hunting posed to wild birds.[12] The Lacey Act sought to limit the damaging effects of commercial hunting by prohibiting game taken illegally from being transported across state lines.[13]

Unfortunately, "the [Lacey] Act was ineffective in stopping interstate shipments."[14] Thus, in 1913 Congress followed the Lacey Act with two legislative actions. First, Congress included language in an appropriations bill directly aimed at limiting the hunting of migratory birds.[15] Better known as the "Weeks-McLean Law,"[16] this language gave the Secretary of Agriculture authority to regulate hunting seasons nationwide for migratory birds:

> All wild geese, wild swans, brant, wild ducks, snipe, plover, woodcock, rail, wild pigeons, and all other migratory game and insectivorous birds which in their northern and southern migrations pass through or do not remain permanently the entire year within the borders of any State or Territory, shall hereafter be deemed to be within the custody and protection of the Government of the United States, and shall not be destroyed or taken contrary to regulations hereinafter provided therefor.
>
> The Department of Agriculture is hereby authorized and directed to adopt suitable regulations . . . prescribing and fixing closed seasons . . . and it shall be unlawful to shoot or by any device kill or seize and capture migratory birds within the protection of the law during said closed season . . . .[17]

Second, the Senate adopted a resolution on July 7, 1913, requesting that the President "propose to the Governments of other countries the negotiation of a convention for the protection and preservation of birds."[18]

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[11] U.S. Fish and Wildlife Service, Lacey Act, *available at* https://www.fws.gov/international/laws-treaties-agreements/us-conservation-laws/lacey-act.html (last visited Oct. 18, 2017). *See generally* 16 U.S.C. §§ 3371–3378; 18 U.S.C. §§ 42–43.

[12] *See* U.S. Fish and Wildlife Service, Other Relevant Laws *available at* https://www.fws.gov/birds/policies-and-regulations/laws-legislations/other-relevant-laws.php (last updated Oct. 17, 2016).

[13] *Id.*

[14] *Id.*

[15] Act of March 4, 1913, ch. 145, 37 Stat. 828, 847–48 (repealed 1918).

[16] U.S. Fish and Wildlife Service, Other Relevant Laws *available at* https://www.fws.gov/birds/policies-and-regulations/laws-legislations/other-relevant-laws.php (last updated Oct. 17, 2016).

[17] Act of March 4, 1913, ch. 145, 37 Stat. 828, 847–48 (repealed 1918).

[18] SENATE JOURNAL, 63rd Cong. 1st Sess. 108 (Apr. 7, 1913).

For its time, this was an expansive assertion of federal authority over activities previously viewed as the exclusive purview of the states. Less than 20 years earlier, the Supreme Court declared that states owned wild game within their territories.[19] As a result, the Weeks-McLean Law came under Constitutional challenge almost immediately. Little more than a year after its passage, the district court for the Eastern District of Arkansas in *United States v. Shauver* ruled that "[t]he court is unable to find any provision in the Constitution authorizing Congress, either expressly or by necessary implication, to protect or regulate the shooting of migratory wild game when in a state, and is therefore forced to the conclusion that the act is unconstitutional."[20] The district court for Kansas echoed the same less than a year later.[21] By 1917, the Weeks-McLean Law had been declared unconstitutional by two state supreme courts and three federal district courts, with an appeal pending before the Supreme Court of the United States.[22]

b. The Migratory Bird Treaty of 1916

In light of the Constitutional cloud hanging over Weeks-McLean Law, proponents of nationwide hunting regulations turned to a novel Constitutional theory: under the Treaty Power, the federal government acted with the authority of the United States in a way that Congress, acting on its own accord, could not, placing treaties and accompanying implementing legislation on a different Constitutional footing than traditional laws.[23] This theory was invoked by Senator Elihu Root in proposing the 1913 Senate resolution calling for a migratory bird treaty:

> [I]t may be that under the treaty-making power a situation can be created in which the Government of the United States will have constitutional authority to deal with this subject. At all events, that is worthy of careful consideration, and for that purpose I open it by the offer of this resolution.[24]

As described by the Solicitor's Office for the Department of Agriculture:

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[19] *Geer v. Connecticut*, 161 U.S. 519 (1896).

[20] *United States v. Shauver*, 214 F. 154, 160 (E.D. Ark. 1914).

[21] *United States v. McCullagh*, 221 F. 288 (D. Kan. 1915).

[22] *Protection of Migratory Birds: Hearing on H.R. 20080 Before the House Comm. on Foreign Affairs*, 64th Cong. 25 (1917) (statement of R.W. Williams, Solicitor's Office, Department of Agriculture) ("There were three Federal courts, two State supreme courts; the Maine and Kansas supreme courts have declared [the Weeks-McLean Law] unconstitutional. In the eastern district of Arkansas Judge Trieber declared it unconstitutional; in the district of Kansas Judge Pollock declared it unconstitutional; and in the district of Nebraska Judge Lewis, of Colorado, who was sitting in place of one of the regular judges, sustained a motion in arrest of judgment. . . . They all followed the first decision in the eastern district of Arkansas. . . . The government removed the Arkansas case—the Shauver case—to the Supreme Court direct.").

[23] *See generally Missouri v. Holland*, 252 U.S. 416 (1920) (using this reasoning to uphold the MBTA's constitutionality).

[24] 51 Cong. Rec. 8349 (1914).

> Text-writers assert this doctrine, that the President, and the Senate, exercising the treaty making power, have a right to negotiate a treaty, and Congress has the right to pass an act to fulfill that treaty, although Congress, acting without any such treaty, would not have the power to legislate upon that subject. That is what text-writers say.[25]

In this way, proponents of hunting restrictions contended that Congress could overcome the Constitutional concerns that had derailed the Weeks-McLean Law and pass legislation asserting federal authority over wild game founded upon an international treaty.[26]

Against this backdrop the United States and the United Kingdom—acting on behalf of Canada—entered into the "Convention between the United States and Great Britain for the protection of migratory birds."[27] With the stated intent of "saving from indiscriminate slaughter and of insuring the preservation of such migratory birds as are either useful to man or are harmless,"[28] the Convention specified groups of birds to be protected,[29] and obligated the parties to:

- Establish "close[d] seasons during which no hunting shall be done except for scientific or propagating purposes under permits issued by proper authorities" that would serve "as an effective means of preserving migratory game birds;"[30]

- Prohibit the "taking of nests or eggs of migratory game or insectivorous or nongame birds . . . except for scientific or propagating purposes;"[31]

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[25] *Protection of Migratory Birds: Hearing on H.R. 20080 Before the House Comm. on Foreign Affairs*, 64th Cong. 25 (1917) (statement of R.W. Williams, Solicitor's Office, Department of Agriculture).

[26] *See* William S. Haskell, *Treaty Precludes Further Question as to Constitutionality of Migratory Bird Law*, BULLETIN – THE AMERICAN GAME PROTECTIVE ASSOCIATION, Oct. 1, 1916, at 4 ("The Canadian treaty precludes further question as to the constitutionality of the federal migratory bird law. It therefore makes it unnecessary to bring the case now pending in the United States Supreme Court to argument."). Consistent with this new approach, when the *Shauver* case was called on the Supreme Court's docket in October 1916, "the Attorney General moved that the case be passed." Hearings Before the Committee on Foreign Affairs, House of Representatives, Sixty-Fourth Congress, Second Session, on H.R. 20080 (Statement of R.W. Williams, Esq., Solicitor's Office, Department of Agriculture) at 25 (Feb. 3, 1917).

[27] Convention between the United States and Great Britain for the Protection of Migratory Birds, 39 Stat. 1702 (Aug. 16, 1916) (ratified Dec. 7, 1916) (hereinafter "Migratory Bird Treaty").

[28] *Id.*, chapeau.

[29] *Id.*, art. I.

[30] *Id.*, art. II.

[31] *Id.*, art. V.

- Prohibit during a closed season the "shipment or export of migratory birds or their eggs" except for scientific or propagating purposes;[32]

- Establish a "continuous close[d] season" for a series of specific, enumerated birds for a period of ten years;[33]

- Establish a continuous closed season of five years, refuges, or other appropriate regulations for the protection of certain types of duck;[34] and

- Provide for the issuance of permits to kill the specified birds.[35]

Under Article VIII of the Convention, the parties agreed to "take, or propose to their respective appropriate law-making bodies, the necessary measures for insuring the execution" of the Convention.[36]

c. Implementing the Treaty

1. The Migratory Bird Treaty Act of 1918

In order to fulfill the United States' obligations under Article VIII, Congress in effect reenacted a stricter version of the 1913 Weeks-McLean Law by passing what came to be known as the "Migratory Bird Treaty Act."[37] As originally passed, the MBTA provided:

> That unless and except as permitted by regulations made as hereinafter provided, it shall be unlawful to hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time or in any manner, any migratory

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[32] *Id.*, art. VI.

[33] *Id.*, art. III.

[34] *Id.*, art. IV.

[35] *Id.*, art. VII.

[36] *Id.*, art. VIII.

[37] Migratory Bird Treaty Act, ch. 128, 40 Stat. 755 (1918) (codified as amended at 16 U.S.C. § 703–12). When asked to compare the terms of MBTA with those of the 1913 Weeks-McLean Law, Mr. E.W. Nelson, the Chief of the Bureau of Biological Survey at the Department of Agriculture, noted that the main difference was that the Weeks-McLean Law did not give the Biological Survey power to arrest violators. Hearings Before the Committee on Foreign Affairs, House of Representatives, Sixty-Fourth Congress, Second Session, on H.R. 20080 (Statement of Mr. E. W. Nelson, Chief Bureau of Biological Survey, Department of Agriculture, Washington, D.C.) at 5 (Feb. 3, 1917). He went on to note that "[t]he second paragraph, I think, is practically the same as exists in our federal law." *Id.* at 9.

bird, included in the terms of the convention between the United States and Great Britain for the protection of migratory birds concluded August sixteenth, nineteen hundred and sixteen, or any part, nest, or egg of any such bird.[38]

Violation of MBTA was a misdemeanor criminal offense, punishable by a fine of no more than $500 and/or up to six months in jail.[39] This time, relying in part on the federal treaty power, the legislation survived constitutional scrutiny.[40]

2. The Migratory Bird Conservation Act

Subsequently, in 1929, Congress sought to "more effectively meet the obligations of the United States under the migratory bird treaty with Great Britain" by adopting the Migratory Bird Conservation Act.[41] The Migratory Bird Conservation Act created a commission to make recommendations to the Secretary of Agriculture, who was authorized to purchase or rent lands approved by the commission "for use as inviolate sanctuaries for migratory birds."[42] Thus, by the late 1920s, Congress had adopted two laws to implement the Migratory Bird Treaty: the MBTA, which protected birds from the specific acts described in that statute, and the Migratory Bird Conservation Act, which protected birds by establishing protected habitats.

d. Additional International Treaties and Implementing Legislation

In 1936, the United States entered into another international agreement to "protect the said migratory birds . . . in order that the species may not be exterminated," the "Convention between the United States of America and Mexico for the protection of migratory birds and game mammals."[43] As with the Migratory Bird Treaty, the Mexico Treaty focused primarily on hunting, calling for the establishment of "close[d] seasons, which will prohibit in certain periods of the year the taking of migratory birds,"[44] in addition to explicitly mandating the establishment of refuges, limiting hunting to a maximum of four months, prohibiting hunting from aircraft, establishing special protections for insectivorous birds and wild duck, enumerating a list of

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[38] MBTA § 2 (codified as amended at 16 U.S.C. § 703).

[39] *Id.* § 6 (codified as amended at 16 U.S.C. § 707).

[40] *See Missouri v. Holland*, 252 U.S. 416 (1920).

[41] Migratory Bird Conservation Act, ch, 257, 45 Stat. 1222 (1929) (codified as amended at 16 U.S.C. § 715–715s).

[42] *Id.* § 5 (codified as amended at 16 U.S.C. § 715d). The Migratory Bird Conservation Act has since been amended several times. *See* Wetlands Loan Extension Act of 1976, Pub. L. No. 94-215, 90 Stat. 189; Act of Oct. 30, 1978, Pub. L. No. 95-552, 92 Stat. 2071; Fish and Wildlife Improvement Act of 1978, Pub. L. 95-616, 92 Stat. 3110; Act of Dec. 2, 1983. Pub. L. No. 98-200, 97 Stat. 1378; "An Act to extend the Wetlands Loan Act," Act of Oct. 26, 1984, Pub. L. No. 98-2772, 98 Stat. 2774; Emergency Wetlands Resources Act of 1986, Pub. L. 99-645, 100 Stat. 3582.

[43] Convention between the United States of America and Mexico for the Protection of Migratory Birds and Game Mammals, chapeau, 50 Stat. 1311 (Feb. 7, 1936) (ratified Mar. 15, 1937) (hereinafter "Mexico Treaty").

[44] *Id.*, art. II(A).

specific migratory birds, and limiting the transport of migratory birds across the U.S.-Mexico border.[45]

In order to implement the Mexico Treaty, Congress adopted legislation amending the MBTA.[46] Among other changes, these amendments:

- Added the word "pursue" to the list of operative actions;
- Moved the phrase "by any means" to the beginning of the clause; and
- Moved the phrase "at any time or in any manner" to follow "by any means."[47]

The United States entered into two additional treaties concerning migratory birds. The first, in 1972 with Japan, prohibited the "taking of migratory birds or their eggs" and called for the establishment of refuges, provided for the exchange of research data, and set criteria for hunting seasons.[48] Implementing legislation extended restrictions on any part, nest, or egg of any bird to include "any product, whether or not manufactured, which consists, or is composed in whole or in part, of any such bird or any part, nest, or egg thereof."[49]

Second, in 1978 a U.S.-Soviet treaty prohibited the "taking of migratory birds, the collection of their nests and eggs and the disturbance of nesting colonies," limited the sale of migratory birds or products derived from them, placed limits on hunting, and called for the protection of habitats.[50] Implementing legislation did not amend Section 2 of the MBTA.[51]

The treaties with Canada and Mexico were amended in the mid-to-late 1990s. First, in 1995, the United States and Canada signed the Protocol Amending the 1916 Convention for the Protection of Migratory Birds.[52] According to the Secretary of State, the goal of this protocol

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[45] *Id.*, arts. II-IV. The Convention specifically prohibits killing of insectivorous birds unless they are damaging agricultural crops. *See id.*, art. II(E). The Mexico Treaty also limited the transport of other game mammals. *See id.*, art. V.

[46] Act of June 20, 1936, ch. 634, 49 Stat. 1555 ("Mexico Treaty Act").

[47] *Compare* MBTA, 40 Stat. 755, § 2 *with* Mexico Treaty Act, 49 Stat. 1555, § 3.

[48] Convention Between the Governments of the United States of America and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction, and Their Environment, 25 U.S.T. 3329 (Sep. 19, 1974).

[49] Act of June 1, 1974, Pub. L. No. 93-300, 88 Stat. 190.

[50] Convention between the United States of America and the Union of Soviet Socialist Republics Concerning the Conservation of Migratory Birds and Their Environment, 29 U.S.T. 4647 (Oct. 13, 1978).

[51] *See* Fish and Wildlife Improvement Act of 1978, Pub. L. No. 95-616, sec. 3(h), 92 Stat. 3110.

[52] Protocol Between the Government of the United States of America and the Government of Canada Amending the 1916 Convention Between the United Kingdom and the United States of America for the Protection of Migratory Birds in Canada and the United States, 1995 WL 877199 (signed Dec. 14, 1995) *reprinted in* S. Treaty Doc. No.

was to "bring the Convention into conformity with actual practice and Canadian law" concerning traditional subsistence hunting by aboriginal people of Canada and indigenous people in Alaska and "to permit the effective regulation for conservation purposes of the traditional hunt."[53]

Second, in 1997, the United States and Mexico signed a corresponding Protocol to "permit the full implementation" of the Canada Protocol.[54] The Mexico Protocol "conform[ed] the Canadian and Mexican migratory bird conventions in a manner that [] permit[ed] legal and regulated spring/summer subsistence hunt in Canada and the United States,"[55] and was necessary in order to allow the Department of the Interior to adopt regulations permitting spring/summer hunts in Alaska without violating the Mexico Treaty.[56]

The Canada and Mexico Protocols were considered interrelated, and were generally considered jointly by the United States Senate.[57] Thus, ratification of both agreements was

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104-28 at 1. This Protocol was intended to replace a similar protocol between the United States and Canada that was signed in 1979 but never ratified. *See* Letter of Transmittal from William J. Clinton, President of the United States, to the Senate of the United States (Aug. 2, 1996), *reprinted in* S. Treaty Doc. No. 104-28 at iii ("The Protocol would replace a protocol with a similar purpose, which was signed January 30, 1979, (Executive W, 96th Cong., 2nd Sess. (1980)), and which I, therefore, desire to withdraw from the Senate.").

[53] Letter of Submittal from Warren Christopher, Secretary of State, to William J. Clinton, President of the United States (May 20, 1996), *reprinted in* S. Treaty Doc. No. 104-28 at v ("The 1916 Convention for the Protection of Migratory Birds in Canada and the United States ('the Convention') presently does not permit hunting of the migratory species covered under the Convention from March 10 to September 1 except in extremely limited circumstances. Despite this prohibition, aboriginal people of Canada and indigenous people in Alaska have continued their traditional hunt of these birds in the spring and summer for subsistence and other related purposes. In the United States, the prohibition against this traditional hunt has not been actively enforced. In Canada, as a result of recent constitutional guarantees and judicial decisions, the Canadian Federal Government has recognized a right in aboriginal people to this traditional hunt, and the prohibition has not been enforced for this reason. The goals of the Protocol are to bring the Convention into conformity with actual practice and Canadian law, and to permit the effective regulation for conservation purposes of the traditional hunt.").

[54] Letter of Transmittal from William J. Clinton, President of the United States, to the Senate of the United States (Sept. 15, 1997), *reprinted in* S. Treaty Doc. No. 105-26 at iii; *see also* Protocol Between the Government of the United States of America and the Government of the United Mexican States Amending the Convention for the Protection of Migratory Birds and Game Mammals (signed May 5, 1997), *reprinted in* S. Treaty Doc. No. 105-26.

[55] Letter of Transmittal from William J. Clinton, President of the United States, to the Senate of the United States (Sept. 15, 1997), *reprinted in* S. Treaty Doc. No. 105-26 at iii.

[56] *See* Letter of Submittal from Madeleine Albright, Secretary of State, to William J. Clinton, President of the United States (Aug. 27, 1997), *reprinted in* S. Treaty Doc. No. 105-26 at vii ("The Mexico Protocol is needed in order for the United States to be able to implement the Canada Protocol. That Protocol, which similarly addresses the issue of the spring and summer hunt, is pending before the Senate. The spring/summer harvest provisions in the Canada Protocol as they apply to wild ducks cannot be implemented in the United States until the 1936 U.S.-Mexico Convention permits such a harvest of wild ducks. As a matter of U.S. domestic law, the Department of the Interior may not implement a provision of one convention that allows a hunt prohibited by the provision of another . . . .").

[57] *See, e.g.*, S. EXEC. REP. NO. 105-5 (1997), *available at* https://www.congress.gov/congressional-report/105th-congress/executive-report/5/1 (discussing the Canada Protocol and Mexico Protocol together in the same document).

advised by the Senate on October 23, 1997 and ratified by the President September 9, 1999.[58] In both cases, the Secretary of State advised that no additional statutory authority was required to implement the protocols,[59] and none was adopted.[60]

e. Additional Legislative Developments

Separately from implementation of the United States' treaty responsibilities, in 1960 Congress amended the MBTA to make the taking of any migratory bird with the intent to sell or barter such bird, to sell or barter any migratory bird, or to attempt to do the same a felony, punishable by a fine of up to $2,000 and/or imprisonment of up to two years.[61] Congress also provided for the forfeiture of all "guns, traps, nets and other equipment, vessels, vehicles, and other means of transportation used by any person" when violating the MBTA with the intent to offer for sale or barter any such migratory bird.[62]

Over the next several decades, Congress made several revisions to the MBTA in response to judicial decisions. In 1985, the Court of Appeals for the Sixth Circuit in an appeal of the dismissal of an MBTA indictment held that the felony provision adopted in 1960 was an unconstitutional violation of the defendant's due process rights.[63] As a result, Congress amended the felony provision, limiting it only to "knowing" violations.[64]

In 2002, the district court for the District of Columbia held that live-fire military training exercises that unintentionally killed migratory birds within the training area violated the

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[58] *See* CHRISTIAN L. WIKTOR, TREATIES SUBMITTED TO THE UNITED STATES SENATE: LEGISLATIVE HISTORY, 1989-2004 at 172–74, 226–27, *available at* https://books.google.com/books?id=0IUBb901Uq8C&pg=PA226&lpg=PA226&dq=ratification+of+protocol+migratory+bird+and+game+treaty+with+mexico&source=bl&ots=kwIMRSkB28&sig=PmNXa6WM4PzbI7mtMbk7F_C2e4c&hl=en&sa=X&ved=0ahUKEwjO5-bh6LnWAhWJ24MKHZyjB_MQ6AEIVTAJ#v=onepage&q=ratification%20of%20protocol%20migratory%20bird%20and%20game%20treaty%20with%20mexico&f=false.

[59] Letter of Submittal from Warren Christopher, Secretary of State, to William J. Clinton, President (May 20, 1996), *reprinted in* S. Treaty Doc. No. 104-28 at ix ("No additional statutory authority would be required to implement the Protocol."); Letter of Submittal from Madeline Albright, Secretary of State, to William J. Clinton, President of the United States at VI (Aug. 27, 1997), *reprinted in* S. Treaty Doc. No. 105-26 at vi ("No additional statutory authority is required to implement the Mexico Protocol.").

[60] *See* WIKTOR, *supra* note 58 ("No additional statutory authority was required to implement the protocol.").

[61] Act of Sept. 8, 1960, Pub. L. No. 86-732, 74 Stat. 866.

[62] *Id.*

[63] *United States v. Wulff*, 758 F.2d 1121 (6th Cir. 1985).

[64] Emergency Wetlands Resources Act of 1986, Pub. L. No. 99-645, sec. 501, 100 Stat. 3582, 3590–91. Congress also subsequently eliminated strict liability for baiting, limiting the MBTA's ban on taking migratory birds with the aid of bait to instances where "the person knows or reasonably should know that the area is baited." *See* Migratory Bird Treaty Reform Act of 1998, Pub. L. No. 105-312, sec. 102(2), 112 Stat. 2956. This Act also increased the maximum fine for misdemeanor violations from $500 to $15,000. *Id.* § 103.

MBTA.[65] Following the court's ruling, Congress adopted legislation, though it was not an amendment of the MBTA itself, excluding "the incidental taking of a migratory bird by a member of the Armed Forces during a military-readiness activity authorized by the Secretary of Defense or the Secretary of the military department concerned" from the MBTA's restrictions on killing or taking migratory birds.[66]

III. The Current State of the Law

a. The Migratory Bird Treaty Act

Section 2 of the MBTA provides:

> Unless and except as permitted by regulations made as hereinafter provided, *it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill*, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase, deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, *any migratory bird, any part, nest, or egg of any such bird*, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof, included in the terms of the conventions between the United States and Great Britain for the protection of migratory birds concluded August 16, 1916, the United States and the United Mexican States for the protection of migratory birds and game mammals concluded February 7, 1936, the United States and the Government of Japan for the protection of migratory birds and birds in danger of extinction, and their environment concluded March 4, 1972[,] and the convention between the United States and the Union of Soviet Socialist Republics for the conservation of migratory birds and their environments concluded November 19, 1976.[67]

U.S. Fish and Wildlife Service general wildlife regulations, promulgated to implement a number of statutes, including the MBTA, define the term "take" as: "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect."[68] For purposes of the MBTA, this definition subsumes a number of actions in the statute under the umbrella of "take."

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[65] *Ctr. for Biological Diversity v. Pirie*, 191 F. Supp. 2d 161 (D.D.C. 2002), *vacated on other grounds sub nom. Ctr. for Biological Diversity v. England*, 2003 App. LEXIS 1110 (D.C. Cir. 2003).

[66] Bob Stump National Defense Authorization Act for Fiscal Year 2003, Pub. L. No. 107-314, Div. A, Title III, § 315, 116 Stat. 2509 (2002), *reprinted in* 16 U.S.C.A. § 703, Historical and Statutory Notes; *see also* 50 C.F.R. § 21.15 (authorizing take incidental to military-readiness activities).

[67] 16 U.S.C. § 703 (2017) (emphasis added); *see also* 50 C.F.R. § 10.13 (list of applicable migratory birds).

[68] 50 C.F.R. § 10.12.

The phrase "incidental take" does not appear in either the MBTA or regulations implementing the Act. The U.S. Fish and Wildlife Service Manual provision issued in response to the now-withdrawn Opinion M-37041 defines "incidental take" as "take of migratory birds that directly and foreseeably results from, but is not the purpose of, an activity."[69] The manual further defines the term "kill" to include "any action that directly and foreseeably causes the death of a migratory bird where the death of the migratory bird is not the purpose of the action."[70] Due to the overlap of these definitions as they pertain to take, as used herein, the term "incidental take" refers to both takings and/or killings that directly and foreseeably result from, but are not the purpose of, an activity.[71]

Violations of the MBTA are criminal offenses. In general, violations of the MBTA are misdemeanor offenses, punishable by imprisonment of no more than six months, a fine of no more than $15,000, or both.[72] However, a felony offense arises by knowingly (1) taking a migratory bird with the intent to sell, offer to sell, or barter the bird, or (2) selling, offering to sell, bartering, or offering to barter a migratory bird; a felony is punishable by imprisonment for no more than two years, a fine of no more than $2,000, or both.[73] Taking a bird with the aid of bait if the person knows or reasonably should know that the area is baited is punishable by a fine, up to one year in prison, or both.[74] "All guns, traps, nets and other equipment, vessels, vehicles, and other means of transportation" used when violating the MBTA with the "intent to offer for sale, or sell, or offer for barter, or barter such bird" are to be forfeited to the United States.[75]

Courts have held that misdemeanor violations of the MBTA are strict-liability offenses.[76] Accordingly, if an action falls within the scope of the MBTA's prohibitions, it is a criminal

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[69] U.S. FISH AND WILDLIFE SERVICE MANUAL, part 720, ch. 3, *Incidental Take Prohibited Under the Migratory Bird Treaty Act* (Jan. 11, 2017).

[70] *Id.*

[71] This interpretation covers a nearly limitless range of otherwise lawful conduct as well as actions that may be crimes under other environmental statutes.

[72] 16 U.S.C. § 707(a).

[73] *Id.* § 707(b).

[74] *Id.* § 707(c).

[75] *Id.* § 707(d).

[76] *See, e.g., United States v. CITGO Petroleum Corp.*, 801 F.3d 477, 488 (5th Cir. 2015) ("The act imposes strict liability on violators, punishable by a maximum $15,000 fine and six months imprisonment."); *United States v. Apollo Energies, Inc.*, 611 F.3d 679, 686 ("As a matter of statutory construction, the 'take' provision of the Act does not contain a scienter requirement."); *United States v. Boynton*, 63 F.3d 337, 343 (4th Cir. 1995) ("Since the inception of the Migratory Bird Treaty in the early part of this century, misdemeanor violations of the MBTA, including hunting in a baited area, have been interpreted by the majority of the courts as strict liability crimes, not requiring the government to prove any intent element."); *United States v. Engler*, 806 F.2d 425, 431 (3d Cir. 1986) ("Scienter is not an element of criminal liability under the Act's misdemeanor provisions."); *United States v. Catlett*, 747 F.2d 1102, 1104 (6th Cir. 1984) ("The majority view, and the view of this circuit, is that . . . the crime is a strict liability offense."). *But see United States v. Sylvester*, 848 F.2d 520, 522 (5th Cir. 1988) ("Unique among the

violation, regardless of whether the violator acted with intent. Felony violations, however, require knowledge.[77] As one court noted, "[l]ooking first at the language of the MBTA itself, it is clear that Congress intended to make the unlawful killing of even one bird an offense."[78] At times the Department of Justice has taken the position that the MBTA permits charges to be brought for each and every bird taken, notwithstanding whether multiple birds are killed via a single action or transaction.[79]

b. Judicial Decisions Regarding Incidental Take

This Opinion is not written on a blank legal slate. Beginning in the 1970s, federal prosecutors began filing criminal charges under the MBTA against persons, including oil, gas, timber, mining, and chemical companies, whose activities "incidentally" resulted in the death of migratory birds.[80] In response, courts have adopted different views on whether Section 2 of the MBTA prohibits incidental take, and, if so, to what extent. Courts of Appeals in the Second and Tenth Circuits, as well as district courts in at least the Ninth and District of Columbia Circuits, have held that the MBTA criminalizes some instances of incidental take, generally with some form of limiting construction. By contrast, Courts of Appeals in the Fifth, Eighth, and Ninth Circuits, as well as district courts in the Third and Seventh Circuits, have indicated that it does not.[81]

Circuits, we require a minimum level of scienter as a necessary element for an offense under the MBTA."). As noted above, there is language in *CITGO* suggesting that the Fifth Circuit now considers the MBTA to be a strict-liability statute.

[77] *See* 16 U.S.C. § 707(b); *see also United States v. Wulff*, 758 F.2d 1121 (6th Cir. 1985).

[78] *United States v. Corbin Farm Serv.*, 444 F. Supp. 510, 529 (E.D. Cal. 1978), *aff'd*, 578 F.2d 259 (9th Cir. 1978).

[79] Robert S. Anderson & Jill Birchell, *Prosecuting Industrial Takings of Protected Avian Wildlife*, U.S. ATT'YS' BULL. July 2011, at 65, 68 ("Prosecutors and agents are often left to decide how many separate charges should be filed—one per bird, one per species, one per incident, one per site? Virtually all of these parsings have been used in past cases. *See, e.g.*, *United States v. Apollo Energies*, 611 F.3d 679, 683 (10th Cir. 2010) (one count per inspection that discovered dead birds); *United States v. Corbin Farm Services*, 578 F.2d 259, 260 (9th Cir. 1978) (one count per transaction that resulted in bird deaths); *United States v. FMC Corp.*, 572 F.2d 902, 903 (2d Cir. 1978) (one count per species per day); *United States v. Rogers*, 367 F.2d 998, 999 (8th Cir. 1966) (one count per day); *United States v. Fleet Management, Ltd.*, No. 3:08-CR-00160 (N.D. Cal. 2010) (one count per discharge); *United States v. Exxon Corp.*, No. A90-015 CR (D. Alaska Feb. 27, 1990); *United States v. Equity Corp.*, Cr. No. 75-51 (D. Utah Dec. 8, 1975) (one count per bird). Most of these cases are resolved by plea agreement, without litigation regarding the unit of prosecution."). *But see Corbin Farm Serv.*, 444 F. Supp. at 527–31 (E.D. Cal. 1978) (dismissing nine out of ten counts against the defendants on multiplicity grounds), *aff'd*, 578 F.2d 529 (9th Cir. 1978).

[80] Jesse Greenspan, *The Evolution of the Migratory Bird Treaty Act*, AUDUBON, May 22, 2015, *available at* http://www.audubon.org/news/the-evolution-migratory-bird-treaty-act; *see also United States v. FMC Corp.*, 572 F. 2d 902 (2d Cir. 1978); *Corbin Farm Serv.*, 444 F. Supp. 510.

[81] The Court of Appeals for the Ninth Circuit distinguished without explicitly overturning an earlier district court decision concerning incidental take.

i. Courts Extending the MBTA to Include Incidental Take

Cases that have applied the MBTA to the incidental taking of migratory birds generally rely upon a combination of two courts of appeals and two district court cases, beginning with *United States v. FMC Corporation.* In *United States v. FMC Corporation*, the Second Circuit upheld a conviction of a corporation stemming from the death of a number of birds after coming into contact with water tainted by that corporation's manufacture of pesticides.[82] The court found that "[i]mposing strict liability on FMC in this case does not dictate that every death of a bird will result in imposing strict criminal liability on some party."[83] The court further stated that the application of criminal liability to all instances of incidental take "would offend reason and common sense."[84] Nevertheless, analogizing FMC's criminal liability under the MBTA to the imposition of strict liability for the manufacture of dangerous products in civil tort law,[85] the court reasoned that FMC violated the MBTA because it "engaged in an activity involving the manufacture of a highly toxic chemical; and FMC failed to prevent this chemical from escaping into the pond and killing birds."[86]

At about the same time, the Eastern District of California reached a similar result by applying the MBTA to the deaths of birds resulting from pesticides.[87] According to the court, "[w]hen dealing with pesticides, the public is put on notice that it should exercise care to prevent injury to the environment and to other persons."[88] The court went on to adopt a *de facto* negligence standard, noting "[i]f defendants acted with reasonable care or if they were powerless to prevent the violation, then a very different question would be presented."[89]

In *United States v. Moon Lake Electric Association, Inc.*, the federal district court for Colorado held that the MBTA extended beyond conduct associated with hunting and poaching to criminalize the deaths of birds resulting from contact with Moon Lake's power lines.[90] In doing so, the court acknowledged that "[w]hile prosecutors necessarily enjoy much discretion, proper construction of a criminal statute cannot depend upon the good will of those who must enforce it."[91] The court went on to identify "an important and inherent limiting feature of the MBTA's

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[82] 572 F.2d 902 (2d Cir. 1978).

[83] *Id.* at 908.

[84] *Id.* at 905.

[85] *Id.* at 907.

[86] *Id.* at 908.

[87] *Corbin Farm Serv.* 444 F. Supp. 510.

[88] *Id.* at 536.

[89] *Id.*

[90] 45 F. Supp. 2d 1070, (D. Colo. 1999).

[91] *Moon Lake*, 45 F. Supp. 2d at 1084.

misdemeanor provision: to obtain a guilty verdict under § 707(a), the government must prove proximate causation," where proximate cause "is generally defined as 'that which, in a natural and continuous sequence, unbroken by any efficient intervening cause, produces the injury and without which the accident could not have happened, if the injury be one which might be *reasonably anticipated or foreseen as a natural consequence of the wrongful act.*'"[92]

The Tenth Circuit in *United States v. Apollo Energies, Inc.* followed a similar proximate-cause analysis in upholding a conviction under the MBTA for birds that were killed after becoming lodged in oil-drilling equipment.[93] According to the court, "[c]entral to all of the Supreme Court's cases on the due process constraints on criminal statutes is foreseeability – whether it is framed as a constitutional constraint on causation and mental state or whether it is framed as a presumption in statutory construction."[94] In context, the court clarified that "[w]hat is relevant . . . is what knowledge the defendants had or should have had of birds potentially dying in their heater-treaters."[95] Thus, for the court in *Apollo Energies*, incidental take is within the scope of the MBTA when defendants have or should have knowledge that their conduct may kill or injure migratory birds, and it does so.

ii. Courts Limiting the MBTA to Exclude Incidental Take

Courts holding that the MBTA does not extend to incidental take generally trace their roots to the Ninth Circuit's ruling in *Seattle Audubon Society v. Evans.* The court in *Seattle Audubon* held that the MBTA did not criminalize the death of birds caused by habitat destruction.[96] According to the court, the regulatory definition of "take" "describes the physical conduct of the sort engaged in by hunters and poachers, conduct which was undoubtedly a concern at the time of the statute's enactment in 1918."[97] The court went on to compare "take" under the MBTA, and its applicable regulatory definition, with the broader statutory definition of "take" under the Endangered Species Act, which includes "harm":

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[92] *Id.* (quoting BLACK'S LAW DICTIONARY 1225 (6th ed. 1990)) (emphasis in original).

[93] 611 F.3d 679 (10th Cir. 2010). Prior to the court's ruling in *Apollo Energies*, at least one district court in the Tenth Circuit ruled that the MBTA did not apply to incidental take. In *United States v. Ray Westall Operating, Inc.*, 2009 U.S. Dist. LEXIS 130674 (D.N.M. 2009), the district court for the District of New Mexico held that the death of migratory birds resulting from contact with a pit containing overflow discharge from an oil-production site was not a criminal act under the MBTA. According to the court, "[t]here is no language in the MBTA expressly extending the prohibition against killing migratory birds to acts or omissions that are not directed at migratory birds but which may indirectly kill migratory birds." *Id.* at *17–18. Rather, the court found "that it is highly unlikely that Congress intended to impose criminal liability on every person that indirectly causes the death of a migratory bird" and concluded "that Congress intended to prohibit only conduct directed towards birds and did not intend to criminalize negligent acts or omissions that are not directed at birds, but which incidentally and proximately cause bird deaths." *Id.* at *19.

[94] *Apollo Energies*, 611 F.3d at 690 (citations omitted).

[95] *Id.* at 690 n.5.

[96] 952 F.2d 297, 303 (9th Cir. 1991).

[97] *Id.* at 302.

> We are not free to give words a different meaning than that which Congress and the Agencies charged with implementing congressional directives have historically given them . . . . Habitat destruction causes "harm" to the [birds] under the [Endangered Species Act] but does not "take" them within the meaning of the MBTA.[98]

The court further distinguished actions leading "indirectly" to the death of birds, such as habitat destruction, from actions that lead directly to the death of birds, such as exposing birds to a highly toxic pesticide, leaving open whether the law reaches the later conduct.[99]

Building upon *Seattle Audubon*, the district court in *Mahler v. United States Forest Service* held that the cutting of trees by the U.S. Forest Service that could destroy migratory bird nesting areas did not violate the MBTA,[100] ruling "[t]he MBTA was designed to forestall hunting of migratory birds and the sale of their parts" and "declin[ing] [the] invitation to extend the statute well beyond its language and the Congressional purpose behind its enactment."[101] In response to plaintiff's motion to alter or amend judgment, the court reaffirmed that the MBTA did not reach the Forest Service's activity, holding "[p]roperly interpreted, the MBTA applies to activities that are intended to harm birds or to exploit harm to birds, such as hunting and trapping, and trafficking in bird and bird parts. The MBTA does not apply to other activities that result in unintended deaths of migratory birds."[102]

The Eighth Circuit in *Newton County Wildlife Association v. United States Forest Service* likewise rejected a claim that the destruction of forests containing migratory birds violated the MBTA.[103] Citing to *Seattle Audubon* and *Mahler*, among other cases, the *Newton County* court held:

> [I]t would stretch this 1918 statute far beyond the bounds of reason to construe it as an absolute criminal prohibition on conduct, such as timber harvesting, that *indirectly* results in the death of migratory birds. Thus, we agree with the Ninth Circuit that the ambiguous terms "take" and "kill" in 16 U.S.C. § 703 mean "physical conduct of the sort engaged in by hunters and poachers . . . ."[104]

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[98] *Id.* at 303.

[99] *Id.* at 303 ("Courts have held that the Migratory Bird Treaty Act reaches as far as direct, though unintended, bird poisoning from toxic substances. . . . The reasoning of those cases is inapposite here. These cases do not suggest that habitat destruction, leading indirectly to bird deaths, amounts to the 'taking' of migratory birds within the meaning of the Migratory Bird Treaty Act.").

[100] 927 F. Supp. 1559 (S.D. Ind. 1996).

[101] *Id.*

[102] *Mahler v. United States Forest Service*, 927 F. Supp. 1559, 1579 (S.D. Ind. 1996).

[103] 113 F. 3d 110 (8th Cir. 1997).

[104] *Id.* at 115 (quoting *Seattle Audubon*, 952 F.2d at 302) (emphasis in original). Contemporaneously, *Newton County* was echoed by the district court for the Western District of Pennsylvania in *Curry v. United States Forest*

Following *Newton County* as "controlling precedent," the court in *United States v. Brigham Oil & Gas, L.P.* held that the MBTA did not impose criminal liability on an oil company for the deaths of several migratory birds after coming into contact with a "reserve pit."[105] In doing so, the *Brigham Oil* court concluded "as a matter of law, that lawful commercial activity which may indirectly cause the death of migratory birds does not constitute a federal crime."[106] In addition to relying on the *Newton County* decision, the court in *Brigham* examined the text of the MBTA, concluding that the text "refers to a purposeful attempt to possess wildlife through capture, not incidental or accidental taking through lawful commercial activity."[107] The court also noted that "to extend the Migratory Bird Treaty Act to reach other activities that indirectly result in the deaths of covered birds would yield absurd results,"[108] potentially criminalizing "driving, construction, airplane flights, farming, electricity and wind turbines . . . and many other everyday lawful activities."[109]

Most recently, the Fifth Circuit in *United States v. CITGO Petroleum Corporation* examined "the statute's text, its common law origin, a comparison with other statutes, and [a] rejection of the argument that strict liability can change the nature of the necessary illegal act" and "agree[d] with the Eighth and Ninth circuits that a 'taking' is limited to deliberate acts done directly and intentionally to migratory birds."[110] The court further noted that "[t]he scope of liability under the government's preferred interpretation is hard to overstate," and "would enable the government to prosecute at will and even capriciously (but for the minimal protection of prosecutorial discretion) for harsh penalties."[111] *CITGO* is the most recent decision on this topic and triggered the Department's further evaluation of the question.[112]

Service, which ruled in the alternative that "the loss of migratory birds as a result of timber sales . . . do not constitute a 'taking' or 'killing' within the meaning of the MBTA." 988 F. Supp. 541, 549 (W.D. Penn. 1997).

[105] 840 F. Supp. 2d 1202 (D.N.D. 2012). A "reserve pit" is defined under state law as "an excavated area used to contain drill cuttings accumulated during oil and gas drilling operations and mud-laden oil and gas drilling fluids used to confine oil, gas, or water to its native strata during the drilling of an oil and gas well" and is subject to state regulation. *Id.* at 1204 (quoting N.D.C.C. § 38-08-02).

[106] *Id.* at 1214.

[107] *Id.* at 1209.

[108] *Id.* at 1212.

[109] *Id.* at 1213.

[110] 801 F.3d 477, 488–89 (5th Cir. 2015).

[111] *Id.* at 493–94.

[112] Some courts have suggested that the Eighth and Ninth Circuit decisions are limited to merely cases involving habitat destruction, rather than the direct taking or killing of birds, which could be viewed as "indirect take." *See Apollo Energies*, 611 F.3d at 686 (distinguishing the Eighth Circuit decision in *Newton Country* on the grounds that it involved logging that modified bird habitat in some way); *Moon Lake*, 45 F. Supp. 2d at 1075–76 (suggesting that the Ninth Circuit's ruling in *Seattle Audubon* may be limited to habitat modification or destruction). This limited interpretation seeks to cabin the Eighth and Ninth Circuit opinions to the narrow facts at issue in those cases, consistent with the government's own position that habitat destruction was not criminalized under the MBTA, while

IV. Analysis of Incidental Take Under the MBTA

Based upon the text and purpose of the MBTA, as well as sound principles of constitutional avoidance, this memorandum concludes that the MBTA's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same only criminalize affirmative actions that have as their purpose the taking or killing of migratory birds, their nests, or their eggs.

a. The Relevant Text of the MBTA is Limited to Affirmative Actions that Have as their Purpose the Taking or Killing of Migratory Birds

The Supreme Court has counseled "[t]he starting point in statutory interpretation is 'the language [of the statute] itself.'"[113] Thus, consistent with the ancient maxim *a verbis legis non est recedendum* ("do not depart from the words of the law"), the text of the law is the necessary starting point to determine the scope of conduct prohibited by the MBTA.[114] As described below, the relevant text indicates that the MBTA only criminalizes purposeful and affirmative actions intended to reduce migratory birds to human control.

The relevant portion of the MBTA reads "it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill . . . any migratory bird, [or] any part, nest, or egg of any such bird."[115] Pursuant to the canon of *noscitur a sociis* ("it is known by its associates"), when any words "are associated in a context suggesting that the words have something in common, they should be assigned a permissible meaning that makes them similar."[116] Section 2 of the MBTA groups together five verbs—pursue, hunt, take,

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disregarding the broad language and logic of the legal interpretations compelling the disposition of each case. *See, e.g.*, *Newton County*, 113 F.3d at 115 ("[W]e agree with the Ninth Circuit that the ambiguous terms 'take' and 'kill' in 16 U.S.C. § 703 mean 'physical conduct of the sort engaged in by hunters and poachers, conduct which was undoubtedly a concern at the time of the statute's enactment in 1918.'" (citing to *Seattle Audubon*, 952 F.2d at 302)). The disposition of those cases led logically to the Fifth Circuit's decision in 2015 holding that the MBTA reaches only affirmative and purposeful acts. *CITGO*, 801 F.3d at 488–89 ("[W]e agree with the Eighth and Ninth circuits that a 'taking' is limited to deliberate acts done directly and intentionally to migratory birds."). The Fifth Circuit went on to interpret this limitation to preclude the application of the MBTA to the death of birds as a result of contact with uncovered equalization tanks. *Id.* at 493–94; *see also Brigham Oil*, 840 F. Supp. 2d at 1209, 1211 (noting that "[t]he Eighth Circuit found that the ambiguous terms 'take' and 'kill' mean 'physical conduct of the sort engaged in by hunters and poachers, conduct which was undoubtedly a concern at the time of the statute's enactment in 1918'" and was "controlling precedent" in case involving uncovered oil reserve pits).

[113] *United States v. James*, 478 U.S. 597, 604 (1986) (quoting *Blue Chip Stamps v. Manor Drug Stores*, 421 U.S. 723, 756 (1975) (Powell, H., concurring); *see also* Felix Frankfurter, *Some Reflections on the Reading of Statutes*, 47 COLUM L. REV. 527, 535 (1947) ("Though we may not end with the words in construing a disputed statute, one certainly begins there.").

[114] *See* ANTONIN SCALIA & BRYAN A. GARNER, READING THE LAW: THE INTERPRETATION OF LEGAL TEXTS 56 (2012) (quoting DIGEST 32.69 pr. (Marcellus)).

[115] 16 U.S.C. § 703(a) (2017) (emphasis added); *see also* 50 C.F.R. § 10.13 (list of applicable migratory birds).

[116] SCALIA & GARNER, *supra* note 114, at 195; *see also Third Nat'l Bank v. Impac, Ltd.*, 432 U.S. 312, 321 (1977) ("As always, '[t]he meaning of particular phrases must be determined in context' . . . ." (quoting *SEC v. Nat'l Sec.*,

capture, and kill. Accordingly, the canon of *noscitur a sociis* counsels in favor of reading each verb to have a related meaning.[117]

Of these five verbs, three—pursue, hunt, and capture—unambiguously require an affirmative and purposeful action. To wit, according to the first entry for each word in the 1934 edition of Webster's New International Dictionary of the English Language:

- Pursue means "[t]o follow with a view to overtake; to follow eagerly, or with haste; to chase."[118]

- Hunt means "[t]o follow or search for (game or prey) for the purpose, and with the means of capturing or killing;"[119]

- Capture means "[t]o take captive; to seize or take possession of by force, surprise, or stratagem; to overcome and hold; to secure by the exercise of effort, skill, or ingenuity against competition or opposition;"[120]

Thus, one does not passively or accidentally pursue, hunt, or capture. Rather, each requires a deliberate action specifically directed at achieving a purposeful goal.

By contrast, the verbs "kill" and "take" may refer to active or passive conduct, depending on the context.[121] When read together with the other active verbs in Section 2 of the MBTA,

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Inc., 393 U.S. 453, 466 (1969)); *Babbitt v. Sweet Home Chapter of Cmtys. For a Greater Or.*, 515 U.S. 687, 720–21 (1995) (Scalia, J., dissenting) (referring to a similar list in the Endangered Species Act: "I would call it *noscitur a sociis*, but the principle is much the same: The fact that 'several items in a list share an attribute counsels in favor of interpreting the other items as possessing that attribute as well.'" (quoting *Beecham v. United States*, 511 U.S. 368, 371 (1994))).

[117] *See* SCALIA & GARNER, *supra* note 114, at 195 ("The canon especially holds that 'words grouped in a list should be given related meanings.'" (quoting *Third Nat'l Bank*, 432 U.S. at 322)).

[118] WEBSTER'S SECOND NEW INTERNATIONAL DICTIONARY at 2018-19 (1934). The 1934 edition is referenced because it is close in time to the adoption of the relevant language, and may provide greater insight into the commonly understood meaning of the terms at the time the MBTA was enacted. *See South Carolina v. United States*, 199 U.S. 437, 448 (1905) (The meaning of written instruments "does not alter. That which it meant when adopted it means now."). *See generally District of Columbia v. Heller*, 128 S. Ct. 2783, 2791-95 (2008) (examining 18th century dictionary definitions to assess the meaning of the phrase "keep and bear Arms" in the Second Amendment); *Molzof v. United States*, 502 U.S. 301, 307 (1992) (examining legal dictionaries in existence when the operative statute was drafted and enacted to interpret its meaning). *See also generally* SCALIA & GARNER, *supra* note 114, at 415–24 (2012) (describing principles for the use of dictionaries in statutory interpretation, noting that dictionaries are often lagging indicators of contemporary meaning); *id.* at 419 (identifying WEBSTER'S SECOND NEW INTERNATIONAL DICTIONARY (1934) as one of the "most useful and authoritative" sources "[a]mong contemporaneous-usage dictionaries—those that reflect meanings current at a given time").

[119] WEBSTER'S SECOND NEW INTERNATIONAL DICTIONARY at 1215 (1934).

[120] *Id.* at 400.

[121] *See id.* at 1362 ("kill" may mean the more active "to deprive of life; to put to death; to slay" or serve as "the general term for depriving of life"); *id.* at 2569 ("take" has many definitions, including the more passive "[t]o lay or

however, the proper meaning is evident. The operative verbs ("pursue, hunt, take, capture, kill") "are all affirmative acts . . . which are directed immediately and intentionally against a particular animal—not acts or omissions that indirectly and accidentally cause injury to a population of animals."[122] This conclusion is also supported by the U.S. Fish and Wildlife Service's implementing regulations, which define "take" to mean "to pursue, hunt, shoot, wound, kill, trap, capture, or collect" or attempt to do the same.[123] The component actions of "take" involve direct and purposeful actions to reduce animals to human control.[124] As such, they "reinforce[] the dictionary definition, and confirm[] that 'take' does not refer to accidental activity or the unintended results of other conduct."[125] This interpretation does not render the words "take" and "kill" redundant since each has its own discrete definition; indeed, one can hunt or pursue an animal without either killing it or taking it under the definitions relevant at the time the MBTA was enacted.[126]

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get hold of with arms, hands or fingers" or "[t]o get possession or control of" or the more active "[t]o catch, seize, or attack through the effect of a sudden force or influence").

[122] *Sweet Home*, 515 U.S. at 719–20 (Scalia, J., dissenting); *see also CITGO*, 801 F.3d at 489 n.10 ("Even if 'kill' does have independent meaning [from 'take'], the Supreme Court, interpreting a similar list in the [Endangered Species Act], concluded that the terms pursue, hunt, shoot, wound, kill, trap, capture, and collect, generally refer to deliberate actions. *Sweet Home*, 515 U.S. at 698 n.11, 115 S. Ct. at 2413. Accordingly, there is reason to think that the MBTA's prohibition on 'killing' is similarly limited to deliberate acts that effect bird deaths."); *Newton County*, 113 F.3d at 115 ("MBTA's plain language prohibits conduct directed at migratory birds . . . . [T]he ambiguous terms 'take' and 'kill' in 16 U.S.C. § 703 mean 'physical conduct of the sort engaged in by hunters and poachers . . . .'" (quoting *Seattle Audubon*, 952 F.2d at 302)); *Bingham Oil & Gas*, 840 F. Supp. 2d at 1208 ("In the context of the Act, 'take' refers to conduct directed at birds, such as hunting and poaching, and not acts or omissions having merely the incidental or unintended effect of causing bird deaths.").

[123] 50 C.F.R. § 10.12.

[124] In this same regard, the U.S. Fish and Wildlife Service's *Federal Register* notice adopting the current definition of "take" includes "Subpart C – Taking," which consists of four regulations addressing:

- Hunting methods;
- Shooting hours;
- Daily limit; and
- Wanton waste of migratory game birds (requiring hunters to make a reasonable effort to include crippled game birds in their daily bag limit).

Migratory Bird Hunting: Miscellaneous Amendments, 38 Fed. Reg. 22015, 22022 (Aug. 15, 1973). Notably, these regulations make no mention of incidental take, even though they were adopted the same year the government brought the known first criminal case alleging incidental take violated the MBTA. *See id.*; Meredith B. Lilley & Jeremy Firestone, *Wind Power, Wildlife, and the Migratory Bird Treaty: A Way Forward*, 38 ENVTL. L. 1167, 1181 (2008) ("In the early 1970s, United States v. Union Texas Petroleum [No, 73-CR-127 (D. Colo. Jul. 11, 1973)] marked the first case dealing with the issue of incidental take.").

[125] *Brigham Oil & Gas*, 840 F. Supp. 2d at 1209.

[126] The regulations governing exceptions to the prohibition contemplate permits for an array of activities that are affirmative and purposeful actions directed at protected birds, such as permits allowing for control of injurious birds,

Furthermore, the notion that "take" refers to an affirmative action directed immediately and purposefully against a particular animal is supported by the use of the word "take" in the common law. As the Supreme Court has instructed, "absent contrary indications, Congress intends to adopt the common law definition of statutory terms."[127] As Justice Scalia noted, "the term ['take'] is as old as the law itself."[128] For example, the Digest of Justinian places "take" squarely in the context of acquiring dominion over wild animals, stating:

> [A]ll the animals which can be taken upon the earth, in the sea, or in the air, that is to say, wild animals, belong to those who take them. . . . Because that which belongs to nobody is acquired by the natural law by the person who first possesses it. We do not distinguish the acquisition of these wild beasts and birds by whether one has captured them on his own property [or] on the property of another; but he who wishes to enter into the property of another to hunt can be readily prevented if the owner knows his purpose to do so.[129]

Likewise, Blackstone's Commentaries provide:

> A man may lastly have a qualified property in animals feroe naturoe, propter privilegium, that is, he may have the privilege of hunting, taking and killing them in exclusion of other persons. Here he has a transient property in these animals usually called game so long as they continue within his liberty, and may restrain any stranger from taking them therein; but the instant they depart into another liberty, this qualified property ceases.[130]

Thus, under common law "[t]o 'take,' when applied to wild animals, means to reduce those animals, by killing or capturing, to human control."[131] When used as part of a regulatory plan,

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scientific collecting permits, and rehabilitation permits—all activities well within the scope of Section 2. 50 C.F.R. part 21.

[127] *United States v. Shabani*, 513 U.S. 10, 13 (1994). The fact that Congress in other statutes later expanded "take" beyond its common-law meaning confirms that Congress intended to adopt the common-law definition for the MBTA. *See, e.g.*, 16 U.S.C. § 1532(19) (defining "take" under the Endangered Species Act (ESA) to include the terms "harass" and "harm"); 16 U.S.C. § 1362(13) (defining "take" under the Marine Mammal Protection Act (MMPA) to include the term "harass"); *see also Sweet Home*, 515 U.S. at 701 n.15 (suggesting that the definition of "take" in the ESA is broader than the definition of "take" at common law); *Seattle Audubon*, 952 F.2d at 303 (holding "that the differences in the proscribed conduct under ESA and the MBTA are 'distinct and purposeful,'" and that prohibitions under the ESA are broader than those under the MBTA).

[128] *Sweet Home*, 515 U.S. at 717 (Scalia, J., dissenting).

[129] *Geer v. Connecticut*, 161 U.S. 519, 523 (1896) (quoting DIGEST, Book 41, Tit. 1, De Adquir. Rer. Dom.).

[130] *Id.* at 526–27 (1896) (quoting 2 BLACKSTONE COMMENTARY 410).

[131] *Sweet Home*, 515 U.S. at 717 (Scalia, J., dissenting); *see also CITGO*, 801 F.3d at 489 ("Justice Scalia's discussion of 'take' as used in the Endangered Species Act is not challenged here by the government, nor was it criticized by the majority in *Sweet Home*, because Congress gave 'take' a broader meaning for that statute.").

such as that in Section 2 of the MBTA, "[t]he taking prohibition is only part of the regulatory plan . . . which covers all stages of the process by which protected wildlife is reduced to man's dominion and made the object of profit," and, as such, is "a term of art deeply embedded in the statutory and common law concerning wildlife" that "describes a class of acts (not omissions) done directly and intentionally (not indirectly and by accident) to particular animals (not populations of animals)."[132]

A number of courts, as well as the prior M-Opinion, have focused on the MBTA's direction that a prohibited act can occur "at any time, by any means, in any manner" to support the conclusion that the statute prohibits any activity that results in the death of a bird, which would necessarily include incidental take. However, this language does not change the nature of those prohibited acts and simply clarifies that activities directed at migratory birds, such as hunting and poaching, are prohibited whenever and wherever they occur and whatever manner is applied, be it a shotgun, a bow, or some other creative approach to deliberately taking birds.[133]

b. Interpreting Strict Liability as Dispositive Conflates *Mens Rea* and *Actus Rea*

In reaching a contrary conclusion, Opinion M-37041 assumed that because Section 703 is a strict-liability provision, meaning that no *mens rea* or criminal intent is required for a violation to have taken place, *any* act that takes or kills a bird must be covered as long as the act results in the death of a bird. This assumption conflates two separate questions: (1) the definitions of the prohibited acts—arrived at using traditional tools of statutory construction; and (2) the mental state, or lack thereof, required to establish a violation. The relevant acts prohibited by the MBTA are purposeful and voluntary affirmative acts directed at reducing an animal to human control, such as when a hunter shoots a protected bird causing its death. In this example, strict liability would arise even though the hunter did not know that the bird he took was protected under the MBTA or if the hunter shot protected birds when meaning to shoot game birds under a permit. The key remains that the actor was engaged in an activity the object of which was to render an animal subject to human control.[134]

By contrast, liability does not attach to actions the plain object of which does not include rendering an animal subject to human control. Classic examples of such actions include: driving

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[132] *Sweet Home*, 515 U.S. at 718 (Scalia, J., dissenting). We note that this language makes clear that the sort of "human control" referred to by Justice Scalia includes the act of intentionally killing even in the absence of further intent to reduce the particular animal to human *possession*. Thus, intentional killing is itself a form of "human control."

[133] *See generally CITGO*, 801 F.3d at 490 ("The addition of adverbial phrases connoting 'means' and 'manner,' however, does not serve to transform the nature of the activities themselves. For instance, the manner and means of hunting may differ from bowhunting to rifles, shotguns, and air rifles, but hunting is still a deliberately conducted activity. Likewise, rendering all-inclusive the manner and means of 'taking' migratory birds does not change what 'take' means, it merely modifies the mode of take.").

[134] *See* WAYNE R. LAFAVE, CRIMINAL LAW 5.2(e) (5th ed. 2010) ("[W]here the definition of a crime requires some forbidden act by the defendant, his bodily movement, to qualify as an act, must be voluntary. To some extent, then, *all crimes of affirmative action require something in the way of a mental element*—at least an intention to make the bodily movement that constitutes the act which the crime requires.") (emphasis added) (citations omitted). Thus, even strict-liability crimes may involve some element of intent.

a car, allowing a pet cat to roam outdoors, or erecting a windowed building. All of these actions could directly and foreseeably result in the deaths of protected birds, and all would be violations of the MBTA under the now-withdrawn M-Opinion, yet none of these actions have as their object rendering any animal subject to human control. Because no "take" has occurred within the meaning of the MBTA, the strict-liability provisions of the Act are not triggered. A comparison with other strict-liability crimes underscores this point. For example, selling alcohol to minors is generally a strict-liability crime—no *mens rea* is required to establish a violation and a crime is committed even if the seller did not know that the buyer was underage. This is true despite the fact that the act itself, the selling of alcohol, is an affirmative and purposeful act that requires a voluntary intentional act.

The prior M-Opinion posited that amendments to the MBT A that imposed mental state requirements for certain specific offenses were only necessary if no mental state is otherwise required. Again, this mixes separate questions—the definition of the prohibited acts and the *mens rea*, if any. The conclusion that the taking and killing of migratory birds is a strict-liability crime does not answer the separate question of what acts are criminalized under the statute.

The Fifth Circuit explained in *CITGO*:

> [W]e disagree that because misdemeanor MBTA violations are strict liability crimes, a "take" includes acts (or omissions) that indirectly or accidentally kill migratory birds. These and like decisions confuse the *mens rea* and the *actus rea* requirements. Strict liability crimes dispense with the first requirement; the government need not prove the defendant had any criminal intent. But a defendant must still commit the act to be liable. Further, criminal law requires that the defendant commit the act voluntarily. WAYNE R. LAFAVE, CRIMINAL LAW § 5.2(e) (5th ed. 2010). "To some extent, then, all crimes of affirmative action require something in the way of a mental element—at least an intention to make the bodily movement that constitutes that act which the crime requires." *Id.* Here, that act is "to take" which, even without a *mens rea*, is not something that is done unknowingly or involuntarily. Accordingly, requiring defendants, as an element of an MBTA misdemeanor crime, to take an affirmative action to cause migratory bird deaths is consistent with the imposition of strict liability. *See, e.g.*, *United States v. Morgan*, 311 F.3d 611, 616 (5th Cir. 2002).
>
> There is no doubt that a hunter who shoots a migratory bird without a permit in the mistaken belief that it is not a migratory bird may be strictly liable for a "taking" under the MBTA because he engaged in an intentional and deliberate act toward the bird. *Cf. Sweet Home*, 515 U.S. at 722, 115 S. Ct. at 2425 (Scalia, J., dissenting) (hunter's mistaken shooting of an elk is a "knowing" act that renders him strictly liable under the ESA); *United States v. Kapp*, 419 F.3d 666, 673 (7th Cir. 2005) (holding Kapp liable under the ESA over objection that the exotic cats he killed were unprotected hybrids). A person whose car accidentally collided with the bird, however, has committed no act "taking" the bird for which he could be held strictly liable. Nor do the owners of electrical lines "take" migratory birds who run into them. These distinctions are inherent in

the nature of the word "taking" and reveal the strict liability argument as a non-sequitur.[135]

The *Mahler* court further described the interplay between activities that are "intended" to harm birds and the strict liability standard of the MBTA:

> [A comment in the legislative history] in favor of strict liability does not show any intention on the part of Congress to extend the scope of the MBTA beyond hunting, trapping, poaching, and trading in birds and bird parts to reach any and all human activity that might cause the death of a migratory bird. Those who engage in such activity and who accidentally kill a protected migratory bird or who violate the limits on their permits may be charged with misdemeanors without proof of intent to kill a *protected* bird or intent to violate the terms of a permit. That does not mean, however, that Congress intended for "strict liability" to apply to all forms of human activity, such as cutting a tree, mowing a hayfield, or flying a plane. The 1986 amendment and corresponding legislative history reveal only an intention to close a loophole that might prevent felony prosecutions for commercial trafficking in migratory birds and their parts.
>
> Thus, there appears to be no explicit basis in the language or the development of the MBTA for concluding that it was intended to be applied to any and all human activity that causes even unintentional deaths of migratory birds.[136]

The use of the words "affirmative" and "purposeful" serve to limit the range of actions prohibited under the MBTA to activities akin to hunting and trapping and exclude more attenuated conduct, such as lawful commercial activity that unintentionally and indirectly results in the death of migratory birds.

c. The Legislative History Is Limited to Discussion of Affirmative Actions that Have as their Purpose the Taking or Killing of Migratory Birds

i. The Original Purpose of the MBTA was to Regulate Overhunting

Even if the text of the statute were ambiguous, the history of the MBTA and the debate surrounding its adoption illustrate that the Act was part of Congress's efforts to regulate the hunting of migratory birds in direct response to the extreme over-hunting, largely for commercial purposes, that had occurred over the years.[137] Testimony concerning the MBTA given by the Solicitor's Office for the Department of Agriculture underscores this focus:

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[135] 801 F.3d at 492–93 (footnotes omitted).

[136] *Mahler*, 927 F. Supp. at 1581 (referencing S. REP. NO. 99-445, at 16 (1986), *reprinted* in 1986 U.S.C.C.A.N. 6113, 6128).

[137] *See Moon Lake*, 45 F. Supp. 2d at 1080 ("the MBTA's legislative history indicates that Congress intended to regulate recreational and commercial hunting"); *Mahler*, 927 F. Supp. at 1574 ("The MBTA was designed to forestall hunting of migratory birds and the sale of their parts.").

> We people down here hunt [migratory birds]. The Canadians reasonably want some assurances from the United States that if they let those birds rear their young up there and come down here, we will preserve a sufficient supply to permit them to go back there.[138]

Likewise, the Chief of the Department of Agriculture's Bureau of Biological Survey noted that he "ha[s] always had the idea that [passenger pigeons] were destroyed by overhunting, being killed for food and for sport."[139]

Statements from individual Congressmen evince a similar focus on hunting. Senator Smith, "who introduced and championed the Act . . . in the Senate,"[140] explained:

> Nobody is trying to do anything here except to keep pothunters from killing game out of season, ruining the eggs of nesting birds, and ruining the country by it. Enough birds will keep every insect off of every tree in America, and if you will quit shooting them they will do it.[141]

Likewise, during hearings of the House Foreign Affairs Committee, Congressman Miller, a "vigorous fighter, who distinguished himself in the debate" over the MBTA,[142] put the MBTA squarely and exclusively in the context of hunting:

> I want to assure you . . . that I am heartily in sympathy with this legislation. I want it to go through, because I am up there every fall, and I know what the trouble is. The trouble is in shooting the ducks in Louisiana, Arkansas, and Texas in the summer time, and also killing them when they are nesting up in Canada.[143]

Outside interest groups also expressed a more specific view of the MBTA. For example, the American Game Preservation Association described the 1916 Migratory Bird Treaty as "an important part of federal law" that:

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[138] *Protection of Migratory Birds: Hearing on H.R. 20080 Before the House Comm. on Foreign Affairs*, 64th Cong. 22–23 (1917) (statement of R.W. Williams, Solicitor's Office, Department of Agriculture).

[139] *Protection of Migratory Birds: Hearing on H.R. 20080 Before the House Comm. on Foreign Affairs*, 64th Cong. 11 (1917) (statement of E. W. Nelson, Chief Bureau of Biological Survey, Department of Agriculture).

[140] *Leaders in Recent Successful Fight for the Migratory Bird Treaty Act*, BULLETIN – THE AMERICAN GAME PROTECTIVE ASSOCIATION, July 1918, at 5.

[141] 55 CONG. REC. 4816 (statement of Sen. Smith) (1917).

[142] *Leaders in Recent Successful Fight for the Migratory Bird Treaty Act*, BULLETIN – THE AMERICAN GAME PROTECTIVE ASSOCIATION, July 1918, at 5.

[143] *Protection of Migratory Birds: Hearing on H.R. 20080 Before the House Comm. on Foreign Affairs*, 64th Cong. 7 (1917) (statement of Rep. Miller).

[P]rovides in effect four principal things:

1. That no bird important to agriculture because of insect-destroying proclivities shall be shot at any time.
2. That no open season on any species of game birds shall extend for a longer period than three and one-half months.
3. That both countries shall so restrict open seasons on game birds as to prevent their being taken during the breeding season.
4. That there shall be no shipment from one country to the other of birds which are taken contrary to law.[144]

Upon passage of the MBTA, the American Game Preservation Association noted that "[t]he Enabling Act closely follows the provisions of the treaty."[145] Thus, since, as described by the American Game Preservation Association, the Migratory Bird Treaty only regulated hunting and the shipment of birds from one country to another and the MBTA "closely follow[ed]" the treaty, it follows that the MBTA itself was also limited to regulating hunting and the shipment of birds.

In seeking to take a broader view of congressional purpose, the *Moon Lake* court looked to other contemporary statements that cited the destruction of habitat, along with improvements in firearms, as a cause of the decline in migratory bird populations. The court even suggested that these statements, which "anticipated application of the MBTA to children who act 'through inadvertence' or 'through accident,'" supported a broader reading of the legislative history.[146] Upon closer examination, these statements are consistent with a limited reading of the MBTA.

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[144] *Success Crowns the Canadian Treaty Campaign*, BULLETIN – THE AMERICAN GAME PROTECTIVE ASSOCIATION, Oct. 1, 1916, at 1.

[145] William Haskell, *Invincible Legislation*, BULLETIN – THE AMERICAN GAME PROTECTIVE ASSOCIATION, July 1918, at 4.

[146] *Moon Lake*, 45 F. Supp. 2d at 1080–81. The court also noted that "the MBTA protects many species that are not considered game birds" and that "[m]any Congressmen also suggested that the true purpose of the MBTA was a desire to maintain a steady supply of game animals for the upper classes." *Id.* at 1081–82. These arguments are also unavailing.

The extension of the MBTA to birds that are not considered "game" birds does not suggest a broader reading of the MBTA. Plume birds are often not game birds. *See* KRISTINA ROZAN, DETAILED DISCUSSION ON THE MIGRATORY BIRD TREATY ACT, Animal Legal & Historical Ctr., Mich. St. Univ. Coll. of Law (2014), https://www.animallaw.info/article/detailed-discussion-migratory-bird-treaty-act. ("The MBTA was passed in 1918 to combat over-hunting and poaching that was decimating bird populations. At that time, the market for birds was dominated by the enormous demand not for food but for feathers by the millinery industry to adorn women's hats."). *See generally* Ogden, *supra* note 6, at 5–6 (discussing the plume trade). Given that one of the major purposes of the MBTA was to limit the danger to migratory birds posed by the commercial plume hunting industry, it would make no sense for Congress to have limited the MBTA to just game birds.

The court also cited to floor statements indicating that "[m]any Congressmen also suggested that the true purpose of the MBTA was a desire to maintain a steady supply of game animals for the upper classes." *Moon Lake*, 45 F. Supp. 2d at 1082. This argument was primarily advanced by opponents of the bill, and does not have clear implications one way or the other for the scope of conduct within the ambit of the MBTA.

One such contemporary statement cited by the court is a letter from Secretary of State Robert Lansing to the President attributing the decrease in migratory bird populations to two general issues:

- Habitat destruction, described generally as "the extension of agriculture, and particularly the draining on a large scale of swamps and meadows;"[147] and

- Hunting, described in terms of "improved firearms and a vast increase in the number of sportsmen."[148]

These statements were referenced by Representative Baker during the House floor debate over the MBTA, implying that the MBTA was intended to address both issues.[149] However, Congress addressed hunting and habitat destruction in the context of the Migratory Bird Treaty through two separate acts:

- First, in 1918, Congress adopted the MBTA to address the direct and intentionally killing of migratory birds;

- Second, in 1929, Congress adopted the Migratory Bird Conservation Act to "more effectively" implement the Migratory Bird Treaty by protecting certain migratory bird habitats.[150]

The Migratory Bird Conservation Act provided the authority to purchase or rent land for the conservation of migratory birds, including for the establishment of inviolate "sanctuaries" wherein migratory bird habitats would be protected from persons "cut[ting], burn[ing], or destroy[ing] any timber, grass, or other natural growth."[151] If the MBTA was originally understood to protect migratory bird habitats from incidental destruction, enactment of the Migratory Bird Conservation Act nine years later would have been largely superfluous. Instead, the MBTA and the Migratory Bird Conservation Act are complimentary: "Together, the Treaty Act in regulating hunting and possession and the Conservation Act by establishing sanctuaries and preserving natural waterfowl habitat help implement our national commitment to the protection of migratory birds."[152]

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[147] *Moon Lake*, 45 F. Supp. 2d at 1080–81 (quoting H. REP. NO. 65-243, at 2 (1918) (letter from Secretary of State Robert Lansing to the President)).

[148] *Id.* at 1081 (quoting H. REP. NO. 65-243, at 2 (1918) (letter from Secretary of State Robert Lansing to the President)).

[149] *Id.*

[150] Migratory Bird Conservation Act, ch, 257, 45 Stat. 1222 (1929) (codified as amended at 16 U.S.C. §§ 715–715s).

[151] *Id.* § 10, 45 Stat. at 1224. Congress also enacted the Neotropical Migratory Bird Conservation Act of 2000 to specifically provide funding for nongame migratory bird conservation. *See* 16 U.S.C. §§ 6101–6109.

[152] *United States v. North Dakota*, 650 F.2d 911, 913–14 (8th Cir. 1981), *aff'd on other grounds*, 460 U.S. 300 (1983).

Some courts have attempted to interpret a number of floor statements as supporting the notion that Congress intended the MBTA to regulate more than just hunting and poaching, but those statements reflect an intention to prohibit affirmative and purposeful acts directed at birds—whether accomplished through hunting or some other means intended to directly kill birds. For example, some Members "anticipated application of the MBTA to children who act 'through inadvertence' or 'through accident:'"

> What are you going to do in a case like this: A barefoot boy, as barefoot boys sometimes do, largely through inadvertence and without meaning anything wrong, happens to throw a stone at and strikes and injures a robin's nest and breaks one of the eggs, whereupon he is hauled before a court for violation of a solemn treaty entered into between the United States of America and the Provinces of Canada.[153]

"[I]nadvertence" in this statement refers to the boy's *mens rea*. As the rest of the sentence clarifies, the hypothetical boy acted "without *meaning* anything wrong," not that he acted unintentionally or accidentally in damaging the robin's nest. This is reinforced by the rest of the hypothetical, which posits that the boy threw "a stone *at* and strikes and injures a robin's nest." The underlying act is purposeful and affirmatively directed specifically at the robin's nest.[154] In other statements various members of Congress expressed concern about "sportsmen," people "killing" birds, "shooting" of game birds or "destruction" of insectivorous birds, and whether the purpose of the MBTA was to favor a steady supply of "game animals for the upper classes."[155] One Member of Congress even offered a statement that explains why the statute is not redundant in its use of the various terms to explain what activities are regulated: "[T]hey cannot hunt ducks in Indiana in the fall, because they cannot kill them. I have never been able to see why you cannot hunt, whether you kill or not. There is no embargo on hunting, at least down in South Carolina . . . ."'[156] That Congress was animated regarding potential restrictions on hunting and

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[153] *Moon Lake*, 45 F. Supp. 2d at 1081 (quoting 56 CONG. REC. 7455 (1918) (statement of Rep. Mondell)).

[154] A fuller examination of the context shows that these concerns were dismissed as absurd hyperbole:

> I can not see why we should take two whole days in summoning bogies from the depths, in seeing fantastic dreams of the liberties of the Republic sacrificed because of the fact that we are enacting a migratory-bird law. Gentlemen conjure up the idea that a bureaucracy will be created, and that every innocent boy who goes out to play upon the streets and breaks a bird's egg through accident is to be haled 500 miles away and punished as if he were committing an offense of the highest degree, and with all the rigors of the criminal law. Gentlemen, to imagine such things as that and to spend time in talking about them here would be bad enough if it were done in sport. It is worse when it is seriously suggested.

56 CONG. REC. 7456 (1918) (statement of Rep. Dempsey). Far from "anticipating the application of the MBTA to children who act 'through inadvertence' or 'through accident,'" Representative Dempsey was dismissing such applications as "fantastic dreams" that need not be "seriously suggested."

[155] *Moon Lake*, 45 F. Supp. 2d at 1080–81.

[156] *Id.* at 1081 (quoting 56 Cong. Rec. 7446 (1918) (statement of Rep. Stevenson)).

its impact on individual hunters is evident from even the statements relied upon as support for the conclusion that the statute reaches incidental take.

Finally, in 1918, federal regulation of the hunting of wild birds was a highly controversial and legally fraught subject. Taken together with the history of the Act, these factors make it highly unlikely that the MBTA was intended to criminalize a broad array of conduct that might incidentally take or kill birds. For example, on the floor of the Senate, Senator Reed proclaimed:

> I am opposed not only now in reference to this bill [the MBTA], but I am opposed as a general proposition to conferring power of that kind upon an agent of the Government. . . .
>
> . . . .
>
> . . . Section 3 proposes to turn these powers over to the Secretary of Agriculture . . . to make it a crime for a man to shoot game on his own farm or to make it perfectly legal to shoot it on his own farm . . . .
>
> When a Secretary of Agriculture does a thing of that kind I have no hesitancy in saying that he is doing a thing that is utterly indefensible, and that the Secretary of Agriculture who does it ought to be driven from office. . . .[157]

Federal regulation of hunting was also legally tenuous. As discussed in section II(a), whether the federal government had any authority to regulate the killing or taking of any wild animal was, at best, an open question in 1918. Just over 20 years earlier, the Supreme Court in *Geer* ruled that the states exercised the power of ownership over wild game in trust, implicitly precluding federal regulation.[158] When Congress did attempt to assert a degree of federal jurisdiction over wild game with the 1913 Weeks-McLean Law, it was met with mixed results in the courts, leaving the question pending before the Supreme Court at the time of the MBTA's enactment. It was not until *Missouri v. Holland* in 1920 that the Court, relying on authority derived from the Migratory Bird Treaty, definitively acknowledged the federal government's ability to regulate the taking of wild birds.[159]

Given the legal uncertainty and political controversy surrounding federal regulation of intentional hunting, it is highly unlikely that Congress intended to confer authority upon the executive branch to regulate all manner of economic activity that had an accidental or unintended impact on migratory birds.

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[157] 55 CONG. REC. 4813 (1917) (statement of Sen. Reed).

[158] *Geer v. Connecticut*, 161 U.S. 519 (1896).

[159] 252 U.S. 416 (1920). We note that the reason behind this decision has remained controversial. *See, e.g., Bond v. United States*, 134 S. Ct. 2077, 2109 (2014) (Thomas, J., concurring) (noting that the court in *Holland* "upheld a statute implementing [the Migratory Bird] treaty based on an improperly broad view of the Necessary and Proper Clause").

ii. The Original Meaning of the MBTA Has Not Changed

Subsequent legislative history further supports a limited interpretation of the MBTA. General canons of statutory construct direct that "[w]ords must be given the meaning they had when the text was adopted."[160] The meaning of written instruments "does not alter. That which it meant when adopted it means now."[161]

The operative language in Section 2 of the MBTA has changed little since its adoption in 1918. The current iteration of the relevant language—making it unlawful for persons "at any time, by any means or in any manner, to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess" specific migratory birds—was adopted in 1935 as part of the Mexico Treaty Act and has remained unchanged since then.[162] There is no indication that the Mexico Treaty Act was intended to broaden the scope of the MBTA beyond deliberate and purposeful actions, nor was it used to do so at the time.

It was not until more than fifty years after the initial adoption of the MBTA and twenty-five years after the Mexico Treaty Act that federal prosecutors began applying the MBTA to incidental actions.[163] This newfound federal authority was not accompanied by any corresponding legislative change. The only contemporaneous changes to Section 2 of the MBTA were technical updates recognizing the adoption of a treaty with Japan.[164]

Opinion M-37041 posits that broad language in the later conventions aspiring to preservation of bird populations, protection of their environments, and protection from pollution lends credence to the conclusion that the MBTA prohibits incidental take. However, the historical record is bereft of any discussion of specific protective mechanisms beyond regulation of hunting and preservation of habitat.[165] Furthermore, no changes were made to the section of

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[160] SCALIA & GARNER, *supra* note 114 at 78. Scalia and Garner note a caveat: "Proper application of the fixed-meaning canon requires recognition of the fact that some statutory terms refer to defined legal qualifications whose definitions are, and are understood to be, subject to change." *Id.* at 89. In the MBTA, the term "migratory bird" is an example of a legal qualification whose definition is understood to be subject to change. The terms "pursue," "hunt," "capture," "kill," and "take" are not.

[161] *South Carolina v. United States*, 199 U.S. 437, 448 (1905).

[162] *Compare* Mexico Treaty Act, 49 Stat. 1555, § 3 *with* 16 U.S.C. § 703(a).

[163] *See* Lilley & Firestone, *supra* note 124, at 1181 ("In the early 1970s, United States v. Union Texas Petroleum [No, 73-CR-127 (D. Colo. Jul. 11, 1973)] marked the first case dealing with the issue of incidental take.").

[164] *See* Act of June 1, 1974, Pub. L. No. 93-300, 88 Stat. 190. Implementing legislation for the treaty with the Soviet Union did not amend Section 2. *See* Fish and Wildlife Improvement Act of 1978, Pub. L. No. 95-616, sec. 3(h), 92 Stat. 3110.

[165] In 2008, Canada stated in a diplomatic note to the United States that the parties agreed that regulation of incidental take is consistent with the Canada Convention. *See* Note No. 0005 from Canadian Embassy to United States Department of State at 2 (July 2, 2008). The United States did not respond. The fact that Canada may view regulation of incidental take as consistent with the Canada Convention says nothing about the legal definition of the terms in the MBTA under United States law.

the MBTA at issue here following the later conventions except that the Act was modified to include references to these later agreements. Certainly many other federal laws may require consideration of potential impacts to birds and their habitat in a way that furthers the goals of the Conventions' broad statements.[166] Given the overwhelming evidence that the purpose of the Treaty and Act was to control over-hunting, these references do not bear the weight of the conclusion reached by the prior Opinion.

Thus, the only legislative enactment concerning incidental activity under the MBTA is the 2003 appropriations bill that explicitly exempted military-readiness activities from liability under the MBTA for incidental takings.[167] There is nothing in this legislation that authorizes the government to pursue incidental takings charges in other contexts. Rather, some have "argue[d] that Congress expanded the definition of 'take' by negative implication" since "[t]he exemption did not extend to the 'operation of industrial facilities,' even though the government had previously prosecuted activities that indirectly affect birds."[168]

This argument is contrary to the Court's admonition that "Congress . . . does not alter the fundamental details of a regulatory scheme in vague terms or ancillary provisions—it does not, one might say, hide elephants in mouseholes."[169] As explained above, the MBTA as originally enacted did not reach incidental take. Thus, Congress would have to affirmatively act to expand the reach of the MBTA.

As the Fifth Circuit explained, "[a] single carve-out from the law cannot mean that the entire coverage of the MBTA was implicitly and hugely expanded."[170] Rather, it appears Congress was acting in a limited fashion to preempt a specific and immediate impediment to military-readiness activities. "Whether Congress deliberately avoided more broadly changing the MBTA or simply chose to address a discrete problem, the most that can be said is that Congress did no more than the plain text of the amendment means."[171] It did not hide the

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[166] *See, e.g.*, *Mahler*, 927 F. Supp. at 1581 ("Many other statutes enacted in the intervening years also counsel against reading the MBTA to prohibit any and all migratory bird deaths resulting from logging activities in national forests. As is apparent from the record in this case, the Forest Service must comply with a myriad of statutory and regulatory requirements to authorize even the very modest type of salvage logging operation of a few acres of dead and dying trees at issue in this case. Those laws require the Forest Service to manage national forests so as to balance many competing goals, including timber production, biodiversity, protection of endangered and threatened species, human recreation, aesthetic concerns, and may others.").

[167] *See* Bob Stump National Defense Authorization Act for Fiscal Year 2003, Pub. L. No. 107-314, Div. A, Title III, § 315, 116 Stat. 2509 (2002), *reprinted in* 16 U.S.C.A. § 703, Historical and Statutory Notes.

[168] *CITGO*, 801 F.3d at 490-91.

[169] *Whitman v. Am. Trucking Ass'ns*, 531 U.S. 457, 468 (2001).

[170] *CITGO*, 801 F.3d at 491.

[171] *Id.*

elephant of incidental takings in the mouse hole of the negative implications of a narrow appropriations provision.[172]

d. The MBTA Should be Interpreted Narrowly to Avoid Constitutional Doubt

The Supreme Court has recognized that "[a] fundamental principle in our legal system is that laws which regulate persons or entities must give fair notice of conduct that is forbidden or required."[173] "No one may be required at peril of life, liberty or property to speculate as to the meaning of penal statutes."[174] Accordingly, a "statute which either forbids or requires the doing of an act in terms so vague that men of common intelligence must necessarily guess at its meaning and differ as to its application, violates the first essential of due process of law."[175] Thus, "[a] conviction or punishment fails to comply with due process if the statute or regulation

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[172] Some commentators have argued that a 2001 Executive Order issued by President Clinton, entitled "Responsibilities of Federal Agencies to Protect Migratory Birds," altered the definition of "take" to include incidental take. *See, e.g.*, Lilley & Firestone, *supra* note 124, at 1186 ("President Clinton's issuance of Executive Order 13186, in tandem with existing FWS regulations, solidified the MBTA's reach over incidental take. The Order clarifies the 'take' definition as including both 'intentional' and 'unintentional' take, thereby eliminating confusion over whether the MBTA, in fact, governs incidental take." (footnotes omitted)). This interpretation misreads the scope of the Executive Order. Executive Order 13186 is limited to the management of the federal government. Thus, to the extent it defined "take" to include incidental take, it was "for purposes of this order," which was "intended only improve the internal management of the executive branch." Exec. Order No. 13186, 66 Fed. Reg. 3853, §§ 2, 5(b) (Jan. 17, 2001). It did not, and, without further legislative or regulatory action, could not, change the underlying law or regulations. *See id.* § 5(b). Thus, the only responsibility Executive Order 13186 directly places on federal agencies concerning incidental take is to:

> [I]dentify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations, focusing first on species of concern, priority habitats, and key risk factors. With respect to those actions so identified, the agency shall develop and use principles, standards, and practices that will lessen the amount of unintentional take, developing any such conservation efforts in cooperation with the [Fish and Wildlife] Service. These principles, standards, and practices shall be regularly evaluated and revised to ensure that they are effective in lessening the detrimental effect of agency actions on migratory bird populations. The agency also shall inventory and monitor bird habitat and populations within the agency's capabilities and authorities to the extent feasible to facilitate decisions about the need for, and effectiveness of, conservation efforts.

Id. § 3(e)(9). In addition, the Executive Order implicitly addresses incidental take by directing each agency to "provide training and information to appropriate employees on methods and means of avoiding or minimizing the take of migratory birds," *id.* § 3(e)(12), given the Executive Order's broad definition of "take," which includes both intentional and unintentional take, *id.* § 2(a). The Executive Order does not redefine "take" for purposes of assigning criminal liability under the MBTA.

[173] *FCC v. Fox Television Stations, Inc.*, 567 U.S. 239, 253 (2012).

[174] *Lanzetta v. New Jersey*, 306 U.S. 451, 453 (1939); *see also Dunn v. United States*, 442 U.S. 100, 112 (1979) ("[F]undamental principles of due process . . . mandate that no individual be forced to speculate, at peril of indictment, whether his conduct is prohibited."). Unlike in the strict liability context, it matters not for due process that the MBTA is often a misdemeanor statute. "[A] violation of due process cannot be cured by light punishment." *United States v. Rollins*, 706 F. Supp. 742, 745 (D. Idaho 1989).

[175] *Fox Television*, 567 U.S. at 253 (quoting *Connally v. General Constr. Co.*, 269 U.S. 385, 391 (1926)).

under which it is obtained 'fails to provide a person of ordinary intelligence fair notice of what is prohibited, or is so standardless that it authorizes or encourages seriously discriminatory enforcement.'"[176]

Assuming, *arguendo*, that the MBTA is ambiguous, the interpretation that limits its application to affirmative and purposeful conduct is necessary to avoid grave constitutional infirmities. As the Court has advised, "where an otherwise acceptable construction of a statute would raise serious constitutional problems, the Court will construe the statute to avoid such problems unless such construction is plainly contrary to the intent of Congress."[177] Here, an attempt to impose liability for acts that are neither affirmatively nor directly aimed at migratory birds raises just such constitutional concerns.

Further, if the MBTA is ambiguous, a narrower construction of the MBTA is consistent with the rule of lenity. The rule of lenity requires the resolution of any ambiguity in a statute defining a crime in a defendant's favor.[178] The rule comes into play in "those situations in which a reasonable doubt persists about a statute's intended scope even *after* resort to 'the language and structure, legislative history, and motivating policies' of the statute."[179]

i. The Scope of Incidental Taking Liability Under the MBTA is Virtually Unlimited

The "scope of liability" under an interpretation of the MBTA that extends criminal liability to all persons who inadvertently or accidentally kill or take migratory birds incidental to another activity is "hard to overstate"[180] and "offers unlimited potential for criminal prosecutions."[181] "The list of birds now protected as 'migratory birds' under the MBTA is a long one, including many of the most numerous and least endangered species one can imagine."[182]

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[176] *Id.* (quoting *United States v. Williams*, 553 U.S. 285, 304 (2008)).

[177] *Edward J. DeBartolo Corp. v. Fla. Gulf Coast Bldg. & Constr. Trades Council*, 485 U.S. 568, 575 (1988); *see also* TREVOR W. MORRISON, THE CANON OF CONSTITUTIONAL AVOIDANCE AND EXECUTIVE BRANCH LEGAL INTERPRETATION IN THE WAR ON TERROR 1, (2006), *available at* https://www.acslaw.org/sites/default/files/Morrison_-_Constitutional_Avoidance.pdf (noting "the validity of the avoidance canon is typically taken as 'settled,' its accepted status in the courts treated as sufficient to justify its use in the executive branch as well." (footnote omitted) (citing 20 Op. Off. Legal Counsel 253, 265 (1996) (referring to the courts' use of the avoidance canon and stating that "[t]he practice of the executive branch is and should be the same."))).

[178] *See* SCALIA & GARNER, *supra* note 114, at 296 (2012).

[179] *Moskal v. United States*, 498 U.S. 103, 108 (1990) (emphasis in original) (quoting *Bifulco v. United States*, 447 U.S. 381, 387 (1980)).

[180] *CITGO*, 801 F.3d at 493.

[181] *Brigham Oil*, 840 F. Supp. 2d at 1213.

[182] *Mahler*, 927 F. Supp. at 1576.

Currently, over 1000 species of birds—"nearly every bird species in North America"[183]—are protected by the MBTA.[184] According to the U.S. Fish and Wildlife Service, the top "human-caused threats to birds" are:

- Cats, which kill an estimated 2.4 billion birds per year;
- Collisions with building glass, which kills an estimated 303.5 million birds per year;
- Collisions with vehicles, which kill an estimated 200 million birds per year;
- Poisons, which kill an estimated an estimated 72 million birds per year;
- Collisions with electrical lines, which kill an estimated 25 million birds per year;
- Collisions with communications towers, which kill an estimated 6.5 million birds per year;
- Electrocutions, which kill an estimated 5.4 million birds per year;
- Oil pits, which kill an estimated 750 thousand birds per year; and
- Collisions with wind turbines, which kill and estimated 174 thousand birds per year.[185]

Interpreting the MBTA to apply strict criminal liability to any instance where a migratory bird is killed as a result of these "human-caused threats" would be a clear and understandable rule.[186] It would also turn every American who owns a cat, drives a car, or owns a home—that is to say,

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[183] Anderson & Birchell, *supra* note 79, at 67 ("The MBTA protects nearly every bird species in North America, including waterfowl, songbirds, shorebirds, and raptors . . . .").

[184] *See* 50 C.F.R. § 10.13 (list of protected migratory birds) *see also* Migratory Bird Permits; Programmatic Environmental Impact Statement, 80 Fed. Reg. 30032, 30033 (May 26, 2015) ("Of the 1,027 currently protected species, approximately 8% are either listed (in whole or in part) as threatened or endangered under the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq.*) and 25% are designated (in whole or in part) as Birds of Conservation Concern (BCC)".).

[185] U.S. Fish and Wildlife Service, Threats to Birds: Migratory Birds Mortality—Questions and Answers, *available at* https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php (last updated May 25, 2016). While reliable numbers are difficult to determine, other forms of alternative energy, such as solar farms, also kill migratory birds. *See* Sammy Roth, *How Many Birds are Killed by Solar Farms*, THE DESERT SUN, Aug. 17, 2016, *available at* http://www.desertsun.com/story/tech/science/energy/2016/08/17/how-many-birds-killed-solar-farms/88868372/ (last updated Aug. 18, 2016). For example, Thomas Dietsch of the Migratory Bird Division of the Fish and Wildlife Service noted 3,545 reported bird deaths at seven Southern California solar farms from 2012 to April 2016. *See* Thomas Dietsch, Update on Solar-Avian Interactions in Southern California at 9 (May 10, 2016), *in* Multiagency Avian-Solar Collaborative Working Group: Stakeholder Workshop, *available at* http://blmsolar.anl.gov/program/avian-solar/docs/Avian-Solar_CWG_May_2016_Workshop_Slides.pdf.

[186] *See Apollo Energies*, 611 F.3d at 689 (concluding that under an incidental take interpretation, "[t]he actions criminalized by the MBTA may be legion, but they are not vague.").

the vast majority of Americans[187]—into a potential criminal.[188] Such an interpretation would lead to absurd results, which are to be avoided.[189]

These absurd results are not ameliorated by limiting the definition of "incidental take" to "direct and foreseeable" harm as some courts have suggested.[190] The court in *Moon Lake* identified an "important and inherent limiting feature of the MBTA's misdemeanor provision: to obtain a guilty verdict . . . , the government must prove proximate causation."[191] Quoting Black's Law Dictionary, the court defines proximate cause as "that which, in a natural and continuous sequence, unbroken by any efficient intervening cause, produces the injury and without which the accident could not have happened, if the injury be one which might be *reasonably anticipated or foreseen as a natural consequence of the wrongful act.*"[192] The Tenth Circuit in *Apollo Energies* took a similar approach, holding "the MBTA requires a defendant to proximately cause the statute's violation for the statute to pass constitutional muster" and quoting from Black's Law Dictionary to define "proximate cause."[193]

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[187] *See, e.g.*, Robin Chase, Does Everyone in America Own a Car?, U.S. Department of State, *available at* https://photos.state.gov/libraries/cambodia/30486/Publications/everyone_in_america_own_a_car.pdf ("It is true that 95 percent of American households own a car, and most Americans get to work by car (85 percent).").

[188] As at least one court has noted, this would also place a greater duty on to protect the lives of migratory birds than are currently exists for people. *See Mahler*, 927 F. Supp. 1577-78 ("[T]he criminal law ordinarily requires proof of at least negligence before a person can be held criminally liable for causing the death of another human being. [The plaintiff's] approach to the MBTA would impose criminal liability on a person for the death of a bird under circumstances where no criminal liability would be imposed for even the death of another *person*." (emphasis in original)).

[189] *See Griffin v. Oceanic Contractors*, 458 U.S. 564, 575 (1982) ("interpretations of a statute which would produce absurd results are to be avoided if alternative interpretations consistent with the legislative purpose are available"); *see also K Mart Corp. v. Cartier*, 486 U.S. 281, 324 n.2 (1988) (Scalia, J. concurring in part and dissenting in part) ("it is a venerable principle that a law will not be interpreted to produce absurd results"). Several courts that have interpreted the MBTA to include incidental takings have recognized that its literal application would be inappropriate. *See FMC*, 572 F.2d at 905 ("Certainly construction that would bring every killing within the statute such as deaths caused by automobiles, airplanes, plate glass modern office buildings or picture windows in residential dwellings into which birds fly, would offend reason and common sense."); *Corbin Farm Serv.*, 444 F. Supp. at 535 ("Obviously, prosecution would not be justified in the hypothetical presented by the defendant; the hypothetical car driver . . . .").

[190] *See* U.S. FISH AND WILDLIFE SERVICE MANUAL, part 720, ch. 3, *Incidental Take Prohibited Under the Migratory Bird Treaty Act* (Jan. 11, 2017).

[191] *Moon Lake*, 45 F. Supp. 2d at 1085.

[192] *Id.* (quoting BLACK'S LAW DICTIONARY 1225 (6th ed. 1990)) (emphasis in original). Based on this reasoning, and with no analysis, the court asserted "[b]ecause the death of a protected bird is generally not a probable consequence of driving an automobile, piloting an airplane, maintaining an office building, or living in a residential dwelling with a picture window, such activities would not normally result in liability . . . even if such activities would cause the death of protected birds." *Id.* This passage subtly shifts the standard from merely "reasonably anticipated or foreseen as a natural consequence" to a "probable consequence."

[193] *Apollo Energies*, 611 F.3d at 690.

Contrary to the suggestion of the courts in *Moon Lake* and *Apollo Energies* that principles of proximate causation can be read into the statute to define and limit the scope of incidental take, the death of birds as a result of activities such as driving, flying, or maintaining buildings with large windows is a "direct," "reasonably anticipated," and "probable" consequence of those actions. As discussed above, collisions with buildings and cars are the second and third most common human-caused threat to birds, killing an estimated 303.5 million and 200 million birds per year, respectively. It is eminently foreseeable and probable that cars and windows will kill birds.[194] Further, when cars kill birds, it is by virtue of a machine under the direct control of an individual physically striking a bird. An activity could hardly be any more "direct" and not be the intended purpose of the action. Thus, limiting incidental take to direct and foreseeable results does little to prevent absurd outcomes.

ii. Prosecutorial Discretion is Insufficient to Cure an Otherwise Vague Law

To avoid these absurd results, the government has historically relied on prosecutorial discretion.[195] Yet, the Supreme Court has declared "[i]t will not do to say that a prosecutor's sense of fairness and the Constitution would prevent a successful . . . prosecution for some of the activities seemingly embraced within the sweeping statutory definitions."[196] For broad statutes that may be applied to seemingly minor or absurd situations, "[i]t is no answer to say that the statute would not be applied in such a case."[197] Although "[p]rosecutors necessarily enjoy much discretion and generally use it wisely," they are still human; "the liberty of our citizens cannot rest at the whim of an individual who could have a grudge or, perhaps, just exercise bad judgement."[198]

Recognizing the challenge posed by relying upon prosecutorial discretion, the *FMC* court sought to avoid absurd results by limiting its holding to "extrahazardous activities."[199] The term

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[194] And it is at least as foreseeable as the electrical lines at issue in *Moon Lake*. Electrocutions kill approximately 5.4 million birds per year—vehicles kill approximately 56 times more birds, while windows only kill approximately 37 times more. In *Moon Lake*, "[t]he government allege[d] that Moon Lake has failed to install inexpensive equipment on 2,450 power poles, causing the death or injury of 38 birds of prey during the 29 month period commencing January 1996 and concluding June 1998." *Moon Lake*, 45 F. Supp. 2d at 1071. This equates to approximately 1.3 dead or injured birds per month, spread over 2,450 power poles.

[195] *See* Ogden, *supra* note 6, at 29 ("Historically, the limiting mechanism on the prosecution of incidental taking under the MBTA by non-federal persons has been the exercise of prosecutorial discretion by the FWS.") *See generally FMC*, 572 F.2d at 905 (situations "such as deaths caused by automobiles, airplanes, plate glass modern office buildings or picture windows in residential dwellings . . . properly can be left to the sound discretion of prosecutors and the courts").

[196] *Baggett v. Bullitt*, 377 U.S. 360, 373 (1964); *see also Mahler*, 927 F. Supp. 1582 ("Such trust in prosecutorial discretion is not really an answer to the issue of statutory construction" in interpreting the MBTA.).

[197] *Keyishian v. Bd. of Regents*, 385 U.S. 589, 599 (1967).

[198] *United States v. Wells*, 519 U.S. 482, 512 n.15 (1997) (Stevens, J. dissenting).

[199] *FMC*, 572 F.2d at 907. The court in *Corbin Farm* adopted a similar rationale. 444 F. Supp. at 536 ("When dealing with pesticides, the public is put on notice that it should exercise care to prevent injury to the environment

"extrahazardous activities" is not found anywhere in the statute, and is not defined by either the court or the Fish and Wildlife Service.[200] Thus, it is unclear what activities are "extrahazardous." In *FMC*, the concept was applied to the manufacture of "toxic chemicals," *i.e.*, pesticides. But the court was silent as to how far this rule extends, even in the relatively narrow context of pesticides.[201] What other activities outside the production of pesticides may be "extrahazardous?" The U.S. Fish and Wildlife Service reported that poisons alone kill an estimated 72 million birds per year. Are all of these deaths potential crimes under the MBTA? Even with this judicial gloss, ordinary people must necessarily guess at what is prohibited on pain of incarceration. This type of uncertainty is not permitted under the Supreme Court's due process jurisprudence.[202]

While the MBTA does contemplate the issuance of permits authorizing the taking of wildlife, it requires such permits to be issued by "regulation."[203] No permit scheme is generally available to permit incidental take, so most potential violators have no mechanism to ensure that

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and to other persons; a requirement of reasonable care under the circumstances of this case does not offend the Constitution.").

[200] *See Mahler*, 927 F. Supp. at 1583 n.9 (noting that the *FMC* court's "limiting principle . . . of strict liability for hazardous commercial activity . . . . ha[s] no apparent basis in the statute itself or in the prior history of the MBTA's application since its enactment."). *See generally United States v. Rollins*, 706 F. Supp. 742, 744–45 (D. Idaho 1989) ("The statute itself does not state that poisoning of migratory birds by pesticide constitutes a criminal violation. Such specificity would not have been difficult to draft into the statute."). Congress could have written the MBTA to explicitly apply to "extrahazardous activities." It did not. Relying on the judiciary to recast the MBTA in this manner is contrary to the longstanding guidance of the Supreme Court:

> It would certainly be dangerous if the legislature could set a net large enough to catch all possible offenders, and leave it to the courts to step inside and say who could be rightfully detained, and who should be set at large. This would, to some extent, substitute the judicial for the legislative department of the government.

United States v. Reese, 92 U.S. 214, 221 (1876).

[201] The court in *Corbin Farm* held that use of pesticides resulting in the deaths of migratory birds could constitute violations the MBTA. 444 F. Supp. at 532–36 (E.D. Cal. 1978). *But see Rollins*, 706 F. Supp. at 744–45 (holding that the MBTA was unconstitutionally vague as applied to a farmer who used due care in applying pesticides that subsequently killed migratory birds).

[202] *See Rollins*, 706 F. Supp. at 745 (dismissing charges against a farmer who applied pesticides to his fields that killed a flock of geese, reasoning "[f]armers have a right to know what conduct of theirs is criminal, especially where that conduct consists of common farming practices carried on for many years in the community. While statutes do not have to be drafted with 'mathematical certainty,' *Boyce Motor Lines, Inc. v. United States*, 342 U.S. 337, 340, 96 L. Ed. 367, 72 S. Ct. 329 (1952), they must be drafted with a 'reasonable degree of certainty.' *Id.* at 340. The MBTA fails this test. . . . Under the facts of this case, the MBTA does not give 'fair notice as to what constitutes illegal conduct' so that [the farmer] could 'conform his conduct to the requirements of the law.' *United States v. Dahlstrom*, 713 F.2d 1423, 1427 (9th Cir. 1983).").

[203] 16 U.S.C. § 703(a) ("Unless and except as permitted *by regulations* made as hereinafter provided . . . ." (emphasis added)). FWS published a notice of intent to develop a programmatic environmental impact statement that analyzed alternatives for developing an incidental take permit regulation under the MBTA in 2015. 80 Fed. Reg. 30,032 (May 26, 2015). Neither the statement nor regulations were issued.

their actions comply with the law.[204] There are "voluntary" Fish and Wildlife Service guidelines issued for different industries that recommend best practices to avoid incidental take of protected birds; however, these guidelines do little to cure infirmities in the law. First, as a preliminary matter, the degree to which such guidelines are truly "voluntary" when non-compliance is accompanied by a credible threat of prosecution is, at best, debatable.[205] Second, Fish and Wildlife Service's MBTA Guidelines rarely go through the formal Administrative Procedure Act processes to be considered "regulations," and are not issued under the permitting authority of Section 3 of the MBTA.[206] Unlike other statutes, the MBTA is an all-or-nothing proposition. In the absence of a permit issued pursuant to Department regulation it is not clear that there is any authority to require minimizing or mitigating actions that balance the environmental harm from the taking of migratory birds with the other societal goals, such as the production of wind or solar energy.[207] Accordingly, the guidelines do not provide enforceable legal protections for

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[204] Anderson & Birchell, *supra* note 79, at 69 ("FWS has not, to date, perceived authority to issue permits for 'non-purposeful' takings that are incidental to conducting a lawful activity such as operating energy or mining facilities. Thus, each incidental taking of a bird protected only by the MBTA is a potential criminal violation of the Act."). For example, *compare* 16 U.S.C. § 703(a) *with* 30 U.S.C. § 225 (2017) ("All leases of lands containing oil or gas, made or issued under the provisions of this Act, shall be subject to the condition that the lessee will, in conducting his explorations and mining operations, *use all reasonable precautions* to prevent waste of oil or gas developed in the land, or the entrance of water through wells drilled by him to the oil sands or oil-bearing strata, to the destruction or injury of the oil deposits." (emphasis added)); 43 U.S.C. § 1732(b) ("In managing the public lands the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands."); 54 U.S.C. § 306107 (2017) ("Prior to the approval of any Federal undertaking that may directly and adversely affect any National Historic Landmark, the head of the responsible Federal agency shall *to the maximum extent possible* undertake such planning and actions as may be necessary to minimize harm to the landmark." (emphasis added)).

[205] *See* Anderson & Birchell, *supra* note 79, at 75 ("The *Apollo* decision supports the government's approach to industrial avian takings that has developed over the past two decades: provide notice to industry of the risks posed by facilities and equipment, encourage compliance through remediation, adaptive management and, where possible, permitting, and *reserve for prosecution those cases in which companies ignore, deny, or refuse to comply with a [Best Management Practices] approach to avian protection in conducting their business*." (emphasis added)); Ogden, *supra* note 6, at 29 ("[D]iscretion has been used in conjunction with efforts to obtain the voluntary cooperation of certain parties and industries whose activities have caused, or have the potential to cause, incidental taking by consulting with the agency and taking steps to mitigate such taking. Indeed, prosecutorial discretion is the primary incentive for such cooperation, as reflected in various non-regulatory 'guidelines' that FWS has created as applicable to specific industries or activities . . . .").

[206] *See* Migratory Bird Permits; Programmatic Environmental Impact Statement, 80 Fed. Reg. 30,032 (May 26, 2015) (seeking comment on the prospect of establishing a regulatory program to permit certain incidental takings). *See generally* Ogden, *supra* note 6, at 29 (characterizing Fish and Wildlife guidelines as "non-regulatory"). *But see* 50 C.F.R. § 21.15 (authorizing take incidental to military-readiness activities).

[207] Anderson & Birchell, *supra* note 79, at 69 ("FWS has not, to date, perceived authority to issue permits for 'non-purposeful' takings that are incidental to conducting a lawful activity such as operating energy or mining facilities. Thus, each incidental taking of a bird protected only by the MBTA is a potential criminal violation of the Act."). For example, *compare* 16 U.S.C. § 703(a) *with* 30 U.S.C. § 225 (2017) ("All leases of lands containing oil or gas, made or issued under the provisions of this Act, shall be subject to the condition that the lessee will, in conducting his explorations and mining operations, *use all reasonable precautions* to prevent waste of oil or gas developed in the land, or the entrance of water through wells drilled by him to the oil sands or oil-bearing strata, to the destruction or injury of the oil deposits." (emphasis added)); 43 U.S.C. § 1732(b) ("In managing the public lands the Secretary shall, by regulation or otherwise, take any action necessary to prevent unnecessary or undue degradation of the lands."); 54 U.S.C. § 306107 (2017) ("Prior to the approval of any Federal undertaking that may directly and

people and businesses who abide by their terms. To wit, the guidelines themselves disclaim that "it is not possible to absolve individuals or companies" from liability under the MBTA.[208] Rather, the guidelines make explicitly clear that, while the Fish and Wildlife Service and the Department of Justice will take compliance into consideration in exercising their prosecutorial discretion, they retain the ability to prosecute individuals and companies, even if they fully comply with the terms therein.[209]

This is the epitome of vague law. Under this approach, it is literally impossible for individuals and companies to know what is required of them under the law when otherwise lawful activities necessarily result in some accidental bird deaths. Even if they comply with everything requested of them by the Fish and Wildlife Service, they may still be prosecuted, and

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adversely affect any National Historic Landmark, the head of the responsible Federal agency shall *to the maximum extent possible* undertake such planning and actions as may be necessary to minimize harm to the landmark." (emphasis added)).

[208] Even if incidental takings were authorized by a regulatory permit process, the 2015 proposal would not have met the due process standards described above. For example, the Fish and Wildlife Service's notice of proposed rule states: "We note that should we develop a permit system authorizing and limiting incidental take, we would not expect every person or business that may incidentally take migratory birds to obtain a permit, nor would we intend to expand our judicious use of our enforcement authority under the MBTA." Migratory Bird Permits; Programmatic Environmental Impact Statement, 80 Fed. Reg. 30,032, 30,034 (May 26, 2015). The notice further provides "our permit program, if implemented, will focus on industries and activities that involve significant avian mortality and for which reasonable and effective measures to avoid or minimize take exist." *Id.* Under this scheme, it seems that favored industries and persons would likely be exempted from enforcement by negative implication and the "judicious" use of prosecutorial discretion, while others might be subject to stringent mitigation regimes and prosecutions. Further, individuals outside of those specific regulated industries would be in the same position they are today, left to rely on the discretion of the Fish and Wildlife Service and Department of Justice to avoid prosecution. Even if some of these issues could be addressed, crafting any sort of permit program within Constitutional confines would be a challenge given the sheer breadth of actions that result in incidental takings of birds covered by the MBTA.

[209] *See, e.g.*, U.S. FISH AND WILDLIFE SERVICE, LAND-BASED WIND ENERGY GUIDELINES 6 (Mar. 23, 2012) ("The Service urges voluntary adherence to the Guidelines and communication with the Service when planning and operating a facility. While it is not possible to absolve individuals or companies from MBTA or BGEPA liability, the Office of Law Enforcement focuses its resources on investigating and prosecuting those who take migratory birds without identifying and implementing reasonable and effective measures to avoid the take. The Service will regard a developer's or operator's adherence to these Guidelines, including communication with the Service, as appropriate means of identifying and implementing reasonable and effective measures to avoid the take of species protected under the MBTA and BGEPA. The Chief of Law Enforcement or more senior official of the Service will make any decision whether to refer for prosecution any alleged take of such species, and will take such adherence and communication fully into account when exercising discretion with respect to such potential referral." (footnote omitted)); Memorandum from Jamie Rappaport Clark, Director, Fish and Wildlife Service, to Regional Directors, Regions 1-7, Service Guidance on the Siting, Construction, Operation and Decommissioning of Communications Towers 2 (Sept. 14, 2000), *available at* https://www.fws.gov/habitatconservation/com_tow_guidelines.pdf ("While it is not possible under the Act to absolve individuals or companies from liability if they follow these recommended guidelines, the Division of Law Enforcement and Department of Justice have used enforcement and prosecutorial discretion in the past regarding individuals or companies who have made good faith efforts to avoid the take of migratory birds.").

still found guilty of criminal conduct.[210] The absence of clear, public, and binding standards effectively authorizes or encourages discriminatory enforcement, particularly against disfavored industries or persons.[211] In sum, due process "requires legislatures to set reasonably clear guidelines for law enforcement officials and triers of fact in order to prevent 'arbitrary and discriminatory enforcement.'"[212] Current governmental practice suggests that the application of the MBTA to incidental activities fails to satisfy this requirement. As the Supreme Court has recognized, "[w]ell-intentioned prosecutors and judicial safeguards do not neutralize the vice of a vague law."[213]

Reading the MBTA to capture incidental takings casts an astoundingly large net that potentially transforms the vast majority of average Americans into criminals. Rather than relying on clear standards that are known in advance, prosecutors are asserting authority to bring cases where individuals and companies are not taking the precautions that the government and the court deem "reasonable."[214] This approach effectively substitutes the judgment of the court

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[210] *See generally* Anderson & Birchell, *supra* note 79, at 70 ("At trial, the jury [in *FMC*] was instructed not to consider the company's [Avian Protection Plan] efforts as a defense: 'Therefore, under the law, good will and good intention and measures taken to prevent the killing of the birds are not a defense.'" (quoting *FMC*, 572 F.2d at 904)).

[211] As some commentators have noted, "the lack of prosecutions of wind energy developers or operators creates a strong inference that prosecutorial discretion is being exercised unevenly to favor wind energy over other activities such as the oil and gas industry." Ogden, *supra* note 6, at 37; *see also* Alexander K. Obrecht, *Migrating Towards an Incidental Take Permit Program: Overhauling the Migratory Bird Treaty Act to Comport with Modern Industrial Operations*, 54 NAT. RESOURCES J. 107, 120 (2014) ("To date, the FWS has focused its prosecutions of MBTA violations on a handful of industries: wastewater storage, oil and gas, electricity transmission, and pesticide application." (footnotes omitted)). *See generally* Benjamin Means, Note, *Prohibiting Conduct, Not Consequences: The Limited Reach of the Migratory Bird Treaty Act*, 97 MICH. L. REV. 832, 836 (1998) (expressing concern that "prosecutorial discretion is less than ideal," particularly in a "pro-environment climate where, 'each year the Department of Justice announces "record levels" of fines imposed, persons indicted, and jail time served for infractions of environmental regulations." (quoting Timothy Lynch, *Polluting Our Principles: Environmental Prosecutions and the Bill of Rights*, 15 TEMPLE ENVTL. L. & TECH. J. 161, 161 (1996)); Gregory A. Zafris, Comment, *Limiting Prosecutorial Discretion Under the Oregon Environmental Crimes Act: A New Solution to an Old Problem*, 24 ENVTL. L. 1673, 1674 (1994) ("The breadth and complexity of environmental law further combine with its unique political nature to increase the chance that prosecutors will abuse their discretion if left completely unchecked."); Timothy Lynch, *Polluting Our Principles: Environmental Prosecutions and the Bill of Rights*, 15 TEMPLE ENVTL. L. & TECH. J. 161, 168, 170 (1996) (noting that "[o]wners and executives of small businesses are particularly vulnerable to prosecution when the law is unclear" and that some prosecutors "might allow public opinion and potential media coverage to affect their charging decisions"). Since Ogden's article was published in 2013, there have been at least two prosecutions of wind-energy companies. *See* E. Lynn Grayson, *Another Criminal Convention Under the Migratory Bird Treaty Act for Wind Farms*, LexisNexis Legal Newsroom (Mar. 3, 2015), *available at* https://www.lexisnexis.com/legalnewsroom/criminal/b/criminal-law-blog/archive/2015/03/03/another-criminal-conviction-under-the-migratory-bird-treaty-act-for-wind-farms.aspx.

[212] *Smith v. Goguen*, 415 U.S. 566, 572–73 (1974).

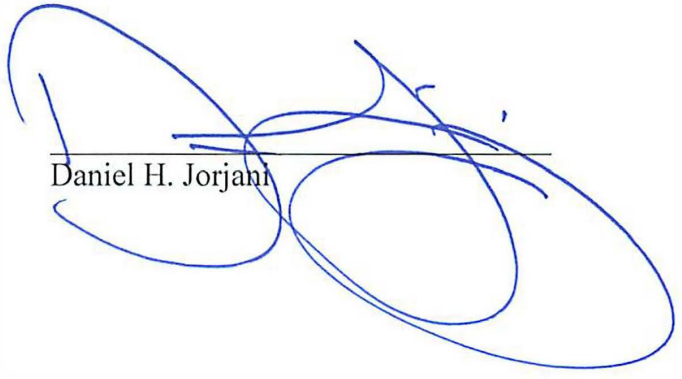
[213] *Baggett v. Bullitt*, 377 U.S. at 373.

[214] *See Apollo Energies*, 611 F.3d at 691 (upholding the conviction of Apollo Energies because "the record shows [Apollo] had notice of the heater-treater problem for nearly a year-and-a-half before the bird death resulting in its conviction. Indeed, Apollo admitted at trial that it failed to cover some of the heater-treaters' exhaust pipes *as Fish and Wildlife had suggested* after the December 2005 inspection. In effect, Apollo knew its equipment was a bird trap that could kill.").

for that of the Congress, which made the MBTA a strict-liability offense and did not provide for mitigation measures. Such an approach presents precisely the sort of recipe for arbitrary and discriminatory enforcement that the Supreme Court has cautioned against.

V. Conclusion

The text, history, and purpose of the MBTA demonstrate that it is a law limited in relevant part to affirmative and purposeful actions, such as hunting and poaching, that reduce migratory birds and their nests and eggs, by killing or capturing, to human control. Even assuming that the text could be subject to multiple interpretations, courts and agencies are to avoid interpreting ambiguous laws in ways that raise grave Constitutional doubts if alternative interpretations are available. Interpreting the MBTA to criminalize incidental takings raises serious due process concerns and is contrary to the fundamental principle that ambiguity in criminal statutes must be resolved in favor of defendants. Based upon the text, history, and purpose of the MBTA, and consistent with decisions in the Courts of Appeals for the Fifth, Eighth, and Ninth circuits, there is an alternative interpretation that avoids these concerns. Thus, based on the foregoing, we conclude that the MBTA's prohibition on pursuing, hunting, taking, capturing, killing, or attempting to do the same applies only to direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control.



Daniel H. Jorjani

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DOI/FWS **RIN:** 1018-BD76 **Publication ID:** Fall 2018

Title: ●Migratory Bird Permits; Regulations Governing Take of Migratory Birds

Abstract:

The U.S. Fish and Wildlife Service proposes to establish regulations that define the scope of the Migratory Bird Treaty Act (MBTA or Act) as it applies to conduct resulting in the injury or death of migratory birds protected by the Act. This rule would codify the legal opinion in the Department of the Interior Solicitor's Opinion M-37050 that incidental take resulting from an otherwise lawful activity is not prohibited under the MBTA. These regulations would reduce regulatory burdens and uncertainty on the public with regards to complying with bird take prohibitions.

Agency: Department of the Interior(DOI)
Priority: Other Significant
RIN Status: First time published in the Unified Agenda
Agenda Stage of Rulemaking: Proposed Rule Stage
Major: No
Unfunded Mandates: No
EO 13771 Designation: Deregulatory
CFR Citation: 50 CFR 10
Legal Authority: 16 U.S.C. 703 to 712
Legal Deadline: None
Timetable:

Action	Date	FR Cite
NPRM	11/00/2018	

Regulatory Flexibility Analysis Required: Undetermined
Government Levels Affected: Federal, Local, State, Tribal
Federalism: No
Included in the Regulatory Plan: No
RIN Data Printed in the FR: No

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