S. 37

File With ____________

SECTION 131 FORM

Appeal NO:_ABP_314485

TO:SEO

Defer Re O/H ☐

Having considered the contents of the submission ~~dated/~~ received 23/12/24 from Siobhan Isdale I recommend that section 131 of the Planning and Development Act, 2000 ~~be/not~~ be invoked at this stage for the following reason(s):. no new issues

E.O.: [signature]

Date: 23/12/2024

To EO: ____________

Section 131 not to be invoked at this stage. ☐

Section 131 to be invoked – allow 2/4 weeks for reply. ☐

S.E.O.: ____________ Date: ____________

S.A.O: ____________ Date: ____________

M ____________

Please prepare BP ____________ - Section 131 notice enclosing a copy of the attached submission

to: ____________

Allow 2/3/4weeks – BP____________

EO: ____________ Date: ____________

AA: ____________ Date: ____________

S. 37

File With ____________

CORRESPONDENCE FORM

ppeal No: ABP 314485

M ____________

Please treat correspondence received on 23/12/24 as follows:

1. Update database with new agent for Applicant/Appellant ____________
2. Acknowledge with BP 23
3. Keep copy of Board's Letter ☐

1. RETURN TO SENDER with BP ____________
2. Keep Envelope: ☐
3. Keep Copy of Board's letter ☐

Amendments/Comments

4. Attach to file
(a) R/S ☐
(b) GIS Processing ☐
(c) Processing ☑
(d) Screening ☐
(e) Inspectorate ☐

RETURN TO EO ☐

Plans Date Stamped ☐
Date Stamped Filled in ☐

EO: [signature]
Date: 23/12/24

AA: F. Mistipon
Date: 24/12/24

Alfie Staunton

From: Siobhan Isdale <siobhan.isdale@live.ie>
Sent: Monday 23 December 2024 15:04
To: Appeals2
Subject: Case number 314485

Sent from Outlook for Android

Subject: Draft Decision on relevant Action Case No 314485

Re Draft Decision on relevant Action Case No 314485

Siobhain Isdale
Macepool,
Kilsallagahan,
Co Dublin.

Tel 086 4172837

To whom it may concern,

I have a history of working in the aviation field, specifically with Ryanair, and I had a very good relationship with Mr. Eugene O'Neill during the early stages of the airline's development. As someone who was once a part of Ryanair's growth, I am not per se against the aviation sector, but the current situation is quite different. I am deeply concerned by the negative impacts that the aviation industry is having on local communities, specifically in North Dublin and Meath.

The environmental issues are pressing, and as someone who has horses and works with animals, I am particularly troubled. There seems to be no one standing up for animal rights, and the exposure of livestock to fumes and pollutants is a growing concern. These animals, which may be part of the food chain, are being affected, and I fear the long-term consequences. Additionally, arable land is becoming contaminated, which is a critical issue for both agriculture and food safety.

I own land below the current flight paths and am worried now by the implications that these flights path will have for the home I was intending to build for myself and my family. There is no way I would consider building under a flight path. These are currently as far as I am concerned unauthorised flight paths and are breaching planning conditions.

Whether any planning proposal by the applicant, the dublin airport authority (daa) may be considered is questionable, given that there are already several planning enforcements currently in operation against them should also be considered.

I respectfully request that An Bord Pleanála prioritise people's as well as animal's health and well-being. I urge them to refuse this application in its entirety, as it would simply not be in the best interest of the community or the environment. It may indeed, give rise to significant public unrest as the issue is becoming more and more controversial.

NPC Library: Chapter 5 of Report on Effects of Aircraft Overflights on the National Park System

[redacted]

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CHAPTER 5

EFFECTS OF OVERFLIGHTS ON WILDLIFE

5.1 Introduction

In general, wild animals do respond to low-altitude aircraft overflights. The manner in which they do so depends on life-history characteristics of the species, characteristics of the aircraft and flight activities, and a variety of other factors such as habitat type and previous exposure to aircraft. The potential for overflights to disturb wildlife and the resulting consequences have drawn considerable attention from state and Federal wildlife managers, conservation organizations, and the scientific community. This issue is of special concern to wildlife managers responsible for protecting populations, and to private citizens who feel it is unwise and/or inappropriate to disturb wildlife. Two types of overflight activities have drawn the most attention with regard to their impacts on wildlife: 1) low-altitude overflights by military aircraft in the airspace over national and state wildlife refuges and other wild lands, and 2) light, fixed-wing aircraft and helicopter activities related to tourism and resource extraction in remote areas.

The primary concern expressed is that low-level flights over wild animals may cause physiological and/or behavioral responses that reduce the animals' fitness or ability to survive. It is believed that low-altitude overflights can cause excessive arousal and alertness, or stress (see Fletcher 1980, 1990, Manci et al. 1988 for review). If chronic, stress can compromise the general health of animals. Also, the way in which animals behave in response to overflights could interfere with raising young, habitat use, and physiological energy budgets. Physiological and behavioral responses have been repeatedly documented, that suggest some of these consequences occur. While the behavioral responses by animals to overflights have been well-documented for several species, few studies have addressed the indirect consequences. Such consequences may or may not occur, and may be detectable only through long-term studies.

The scientific community's current understanding of the effects of aircraft overflights on wildlife are found in the literature. Such studies identify: collision with aircraft(Burger 1985, Dolbeer et al. 1993); flushing of birds from nests or feeding areas (Owens 1977, Kushlan 1979, Burger 1981, Anderson and Rongstad 1989, Belanger and Berad 1989, Cook and Anderson 1990); alteration in movement and activity patterns of mountain sheep (Bleich et al. 1990); decreased foraging efficiency of desert big horn sheep (Stockwell and Bateman 1991); panic running by barren ground caribou (Calef et al. 1976); decreased calf survival of woodland caribou (Harrington and Veitch 1992); increased heartrate in elk, antelope, and rocky mountain big horn sheep (Bunch and Workman 1993); and adrenal hypertrophy in feral house mice (Chesser et al. 1975). Over 200 published and unpublished reports can be found on the subject. These reports range in scientific validity from well designed, rigorous studies to professional natural resource manager and pilot reports.

Recent concerns have focused on the significance of impacts as they affect wildlife populations. Defining a population as "a group of fish or wildlife in the same taxon below the subspecific level, in common spatial arrangements that interbreed when mature,"[1] it is possible to draw the conclusion that impacts to wildlife populations are occurring from low level aircraft overflights. This assertion is supported by numerous studies including the following:

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1. 50 CFR Part 17.3

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- (decreased calf survival of woodland caribou (Harrington and Veitch 1992)
- disturbance to wintering snow geese documents the effects on staging/wintering subgroup (Belanger and Beard 1989)
- impacts on nesting herring gulls documents effects on a subgroup during production periods (Burger 1991)

Additional research will be required to fully address the significance of such population impacts. However, waiting for and relying on future research results for current policy decisions is not possible. Therefore, it is necessary to make informed decisions recognizing that all of the consequences of disturbance will not be completely understood.

5.2 Physiological Responses to Aircraft Overflights

When disturbed by overflights, animal responses range from mild "annoyance," demonstrated by slight changes in body position, to more severe reactions, such as panic and escape behavior. The more severe reactions are more likely to have damaging consequences. Studies of aircraft impacts suggest that whether or not disturbance occurs, and whether or not disturbance has a harmful effect depends on a variety of characteristics associated with both the animal and with the aircraft.

When the sudden sight and/or sound of aircraft causes alarm, the physiological and behavioral responses of animals are characterized as manifestations of stress. The effects of chronic stress from overflights have not been formally studied, though several national wildlife refuge managers suspect that stress from overflights makes waterfowl more susceptible to disease (Gladwin et al. 1987, US Fish and Wildlife Service 1993). Other types of disturbance-induced -stress have been documented to produce a variety of other problems, such as toxemia in pregnant sheep (Reid and Miles 1962) and abnormal births (Ward 1972, Denneberg and Rosenberg 1967). That exposure to low-altitude aircraft overflights does induce stress in animals has been demonstrated. Heart rate acceleration is an indicator of excitement or stress in animals, and increased heart rates have been shown to occur in several species exposed to low-altitude overflights in a wild- or semi-wild setting. Species that have been tested include pronghorn, elk, and bighorn sheep (MacArthur et al, 1982, Workman et al. 1992a,b,c). Stress responses such as increased heart rates by themselves are an adaptation for encounters with predators and other environmental threats, which presumably must be faced daily. It is not known, therefore, if the addition of stressful events such as overflights actually harm animals. It may be that a few overflights do not cause harm, but that overflights occurring at high frequencies over long periods of time, do.

Biologists caution that the consequences of disturbance, while cumulative, are not additive. Effects could be synergistic, especially when coupled with natural catastrophes such as harsh winters or water shortages (Bergerud 1978, Geist 1994). Also, the tendency for additional stress to be harmful probably depends on other factors, such as the general health of animals to begin with. Some species are likely to be more susceptible to damage than are others. Research has shown that stress induced by other types of disturbance produces long-term, deleterious effects on the metabolism and hormone balances in wild

ungulates (hoofed mammals) such as bighorn sheep (Geist 1971, Stemp 1983). Many animal biologists maintain that excessive stimulation of the nervous system can amount to chronic stress, and that continuous exposure to aircraft overflights can be harmful for the health, growth and reproductive fitness of animals (see Fletcher 1980, 1990 for review).

The auditory systems of some animals may be particularly susceptible to physical damage, and such animals may experience hearing loss from exposure to chronic aircraft sound. Animals living in quiet desert environments have evolved particularly fragile ears and hence appear to be at great risk of sound-induced hearing damage (Bondello and Brattstrom 1979, Fletcher 1990). While aircraft noise and its effects on animal hearing have not been tested, other types of sound such as motorcycle noise have been shown to cause hearing loss in desert species, including the desert iguana (Bondello 1976) and the kangaroo rat, an endangered species (Bondello and Brattstrom 1979). Hearing loss can occur after as little as an hour of exposure to loud noise, and can be temporary or permanent, depending on the degree of exposure to sound and the susceptibility of the individual animal.

Conclusion 5.1

Overflights can induce physiological responses in animals, such as increased heart rates, but whether or not such responses cause harm is unknown. Effects may be synergistic, as when combined with natural events such as harsh winters or water shortages.

5.3 Behavioral Responses to Aircraft Overflights

Behavioral responses of wild animals to overflights nearly always accompany physiological responses. Behavioral responses reflect a variety of states, from indifference to extreme panic. To some extent, responses are species-specific, whereby some species are more likely to respond in a certain manner than are others. However, even within a species, individual animals vary. Documented variations between individuals may be due to differences in temperament, sex, age, prior experience with aircraft, or other factors. For these reasons, anecdotal information about one animal's response to an overflight is not useful for drawing conclusions for that or any other species. Often, animals exhibit very subtle and seemingly minor behavioral responses to overflights. Minor responses that are typical of both birds and mammals include head-raising, body-shifting, and turning and orienting towards the aircraft. Animals that are moderately disturbed usually show "nervous" behaviors such as trotting short distances (mammals), standing up with necks frilly extended and sunning the area, or walking around and flapping wings (birds).

When animals are more severely disturbed, escape is the most common response. Perching or nesting birds may flush (fly up from a perch or nest) and circle the area before landing again. Some birds, particularly waterfowl and seabirds, may leave the area if sufficiently disturbed. There are dozens of reports, mostly from national wildlife refuges, of waterbirds flying, diving or swimming away from aircraft (e.g. U.S. Fish and Wildlife Service 1993). This is apparently a widespread and common response. Bird flight responses are usually abrupt, and whole colonies of birds often flush together. Disturbed mammals will run away from overflight paths. Table 1 lists behavioral responses to overflights that have been documented during studies and incidental observations.

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This table was generated from a review of published literature on the subject. Reports varied widely in how information was gathered. Aircraft altitudes are noted where known. Some reports are from rigorous studies, others from anecdotal information. In general, more severe responses (such as panic and escape) were a result of lower-altitude overflights. Responses that were not described in detail are in quotation marks.

As Table 1 illustrates, only a handful of the thousands of animal species in the United States have been studied for their responses to overflights. Also, a disproportionate number of studies have concentrated on ungulates such as caribou and bighorn sheep. Carnivorous mammals have been virtually ignored, as have marine mammals, small mammals, and bats. Birds are more evenly represented, with studies on waterfowl, shorebirds, marine birds, and raptors, although songbirds and owls are notably absent. Reptiles and amphibians have never been studied for responses to aircraft. This uneven distribution of species representation is likely a result of two factors: 1) researchers acknowledge that some species are more susceptible to harm than are others, and have allocated efforts accordingly; and 2) some animals are easier to study than others.

Generally, fish have not been considered at risk from aircraft disturbance. Because most fish and other aquatic organisms live entirely below the surface of the water, they do not experience the same sound levels that terrestrial animals do. Marine mammals (besides dolphins and whales) are an exception because they spend time above water, on shore. Data on behavioral responses of marine mammals to aircraft overflights are scarce. However, a study at Copalis National Wildlife Refuge in Washington State (where the U.S. Navy conducted pilot training from 1944 to 1993) reported responses of harbor seals and northern sea lions to military A-6 jet overflights as ranging from no response to abruptly leaving resting sites on the rock shore and entering the sea (Speich et al. 1987): California gray whales and harbor porpoises, conversely, showed no obvious behavioral responses during this study.

Conclusion 5.2

Researchers have documented a range of wildlife behavioral responses to aircraft overflights. Variations in response may be due to differences between individuals, and anecdotal information about one animal's response is not useful for drawing conclusions regarding that or other species. Behavioral responses may be subtle.

5.4 Indirect Effects of Disturbance from Overflights, and Consequences for Animals

The behavioral responses to aircraft overflights described above are direct, or immediate, responses. Biologists and others are concerned that indirect effects of these responses may have harmful consequences for animals, especially when overflights (and responses) are frequent. Behavioral reactions have the potential to cause injury, to influence breeding success, energetics and habitat use, and to result in bird strikes. Whether or not such indirect effects occur depends on other factors associated with the natural history of a species. Some animals are more susceptible than others to disturbance, because of unique life history patterns such as colonial breeding, habitat requirements, and restricted distribution. Others may need special protection during certain periods. Indirect effects are difficult to detect. However, some effects, such as habitat avoidance, have been detected (e.g. McCourt et al. 1974, Schweinsburg 1974b, Krausman et al. 1986). Large-scale consequences such as permanent habitat abandonment or regional or national population declines have not been well documented, though some

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Table 5.1. General responses by specific animal species to aircraft overflights

Species	Response	Air-craft[2]	Flight Alt.[3]	Reference
Large Mammals				
Pronghorn	Accelerated heart rate Run short distance Bolt and run	FW MJ H	500 5000 100	Workman et al. 1992a
	No response Stop feeding, tense muscles	H	150-400	Luz & Smith 1976

	Run			
Mule Deer	No response Minor behavior changes	MJ	<3000	Lamp 1989
Bighorn Sheep	Accelerated Heart rate	MJ FW H	5000 100 100	Workman et al. 1992b
	Decreased food intake while feeding (interruption) Take more steps while feeding	H	--	Stockwell et. al. 1979
	No response Accelerated heart rate Run	H H	1640-4920 490-660	Mac Arthur et al. 1979
	No response Minor behavior changes Leave area	MJ	<3000	Lamp 1989
	Leave area	H	160-650	Bleich et al. 1990
	No response Interrupt normal activities Run< 330 feet Run .62-1.2 miles	FW	100-990	Krausman & Hervert 1983
	Run > 1 mile	H	--	Horejsi 1975 Kiger 1970
Desert Mule Deer	No movement Move < .6 mile to new habitat	H	--	Krausman et al. 1986
Elk	Accelerated heart rate	MJ H	5000 100-500	Workman et al. 1992c

	Congregate together Watch aircraft	MJ	--	McCullough 1969
	Run away	H	--	Horejsi, 1975
Mountain Goat	React "adversely" *May* abandon areas	H	--	Ballard 1975
	Run away	H	--	Horejsi 1975
	Are "terrified" *May* abandon areas	H	--	Chandwick 1973
Dall Sheep	No response Get "excited" Do not abandon habitat	FW	--	Nichols 1972
	Run away	H FW	-- --	Feist et al. 1974 Schweinsburg 1974a
	Alarm behavior Crowd together	FW H	-- --	Linderman 1972
	React "severely"	H	--	Andersen 1971
Gray Wolf	Initially fright response, (scatter, run), later accept	FW	--	Burkholder 1959
Grizzly Bear	Run Hide	FW H	-- --	Harding & Nagy 1976
	"Mild" behavior response Run away	H	>3280	Ruttan 1974
	Run in "panic" Hide (may associate aircraft with capture)	H	--	Pearson 1975

	Interrupt activity, leave area Run towards cover	FW FW H	>1000 200-500 200-500	McCourt et al. 1974a Klein 1973
Bison	No response	MJ	--	Frazier 1972
	No response Run 1 mile Run 5 miles	FW	200-490	Fancy 1982
Reindeer	Crowd together, panic	FW H	<100 <100	Ericson 1972
	Run away	FW	--	Slaney & Co. Ltd. 1974
Caribou	Move short distance Rarely leave area	FW	--	Bergerud 1963
	No response Panic, flee	FW H	200-500 200-500	Klein 1973
	Walk, trot, gallop away Momentarily stop feeding	H	980	Gunn et al. 1985
	Panic, escape	FW H	500 500	Calef et al. 1976
	Brief startle response Run for 8-27 seconds No effect on daily activity No effect on distances traveled	MJ H	100-500 100-500	Harrington & Veitch 1973
	Mothers and calves not separated	H	--	Miller & Broughton 1973

	Run away from area	FW	--	Valkenburg & Davis 1985
	Minor changes in behavior Panic and run	FW H	<1300 <1300	Miller & Gunn 1979
	Calves died from trampling during escape *from either wolves or aircraft*		--	Miller and Broughton 1974
	Calves died	MJ	--	Harrington & Veitch 1992
	Panic and escape	H FW	<790 <790	Surrendi & DeBock 1976
Small mammals				
House Mouse	Enlarged adrenal glands	C		Chesser et al. 1975
Marine mammals				
Atlantic Walrus	Raise head towards aircraft Shift body position Leave rocks, enter ocean	H	4270	Salter 1979
Harbor Seal, Northern Sea Lion	Leave rocks, enter ocean	MJ	<500	Speich et al. 1987
Raptors				
Bald Eagle* Golden Eagle Peregrine Falcon Gyrfalcon Rough-legged Hawk	No response Panic, frantic escape No effect on raising young	H	--	White & Sherrod 1973

Peregrine Falcon* Coopers Hawk Common Black Hawk Harris' Hawk Zone-tailed Hawk Red-tailed Hawk Golden Eagle Prairie Falcon	"Minimal response" Alarm behavior Fly from perch or nest No effect on raising young	MJ	<980	Ellis et al. 1991
Osprey	No effect on raising young	H	--	Carrier & Melquist 1976
	Rarely leave nest No effect on raising young	FW H	-- --	Poole 1989
Northern Harrier	No response	MJ	--	Jackson et al. 1977
Peregrine Falcon	No response "Severe" response	H	<2000	Ritchie 1987
Gyrfalcon	Fly away Alert behavior No nest abandonment No effect on daily activity patterns *May* avoid returning to breed in following years	H FW	500-1000 500-1000	Platt 1975 Platt and Tull 1977
Prairie Falcon	Flush from perches	H	--	Craig & Craig 1984
Red tailed Hawk	No response Flush from perches	H	--	Craig & Craig 1984
Golden Eagle	No response	H	--	Craig & Craig 1984

Ferruginous Hawk	No response	FW	<100	White & Thurlow 1985
Red-tailed Hawk	Flush from nests No effect on raising young	H	100-150	Anderson et al. 1989
Waterbirds				
Brant Emperor Geese Canada Geese	No response Alert behavior Flight	FW H	0-500 1-500	Ward & Stehn 1989
Oldsquaw* Surf Scoter	Swim away Dive into water No response	H	100-750	Ward & Sharp 1974
Oldsquaw* Surf Scoter	Escape Alert behavior Dive into water Flock together Change activity budgets (resting, feeding, sleeping)	H	100-750	Gollop et al. 1974a
Migrating ducks* (various species)	No reaction Minor behavior changes Flush from lakes	MJ	<3000	Lamp 1989
Ducks and geese* (various species)	Fly away Swim away Dive into water Abandon some lakes for >4 days	FW	--	Schweinsburg 1974a Schweinsburg 1974b
Canada goose	Arouse from sleep Alert behavior Call	MJ	<3000	Lamp 1989

Trupeter Swan	Stop activity; head up Flush from nests	FW H C	200-2000	Henson & Grant 1991
	Seek cover in tall vegetation Cygnets crowd together	FW H	740-990 500	Shandruk & McCormick 1989
Snail Kite	No response Watch aircraft	C	--	Snyder et al. 1978
Brant	Panic and escape area	FW H	<500-1000	Henry 1980
	Fly away Widespread "panic" Lost feeding time	FW H	< 1650	Owens 1977
Brant* Glaucous Gull Arctic Tern	Flushing from nests Disrupt nesting behavior	FW H	500-1000 500-1000	Gollop et al. 1974b
Common Eider	No effect on nesting behavior	FW H	-- --	Gollop et al. 1974b
Tufted Puffin* Brant Double-crested Cormorant Common Murre Glaucous Gull	No response Wing-flapping Flush from perches Abrupt departure of area	MJ MJ	>500 <500	Speich et al. 1987
Sooty Tern	May disrupt breeding May cause hatching failure	MJ	super-sonic	Austin et al. 1970
Crested Tern	Scan sky	C	250-1000	Brown 1990

	Alert behavior Startle and escape			
White Pelican	Stampede, panic Eggs lost, abandoned, eaten	C	>33	Bunnell et al. 1981
Herring Gull	No effect on breeding No response	C	--	Burger 1981
	Flush from nests Eggs broken, lost, eaten	C	super-sonic	
Cattle Egret* Double-crested Comorant Great Blue Heron Great Egret White Ibis	No effect on colony establishment No effect on colony size No effect on nesting behavior No effect on breeding success	MJ	<500	Black et al. 1984
Oldsquaw* Scaup species Redhead Canvasback	Flush up and away from lake	H	--	Christiansen & Yonge 1979
Snow Goose	Raise head Crowd together, call Stop feed Fly away (return in 5 min.)	FW H	--	Davis & wisely 1974
	No response Minor behavior changes Flush, circle over, depart or land again	MJ	<3000	Lamp 1989
	Leave lake area	FW	98-9800	Spindler 1983

	Flush from lakes	FW	300-1000	Salter & Davis 1994
Kittiwake* Northern Fulmar	Stay on nest (no response)	H	--	Dunnett 1977
Brunnich's Guillemot* Kittiwake	No response Flush from nests No egg or chick losses	H	0.5-3 miles distant	Fjeld et al. 1988
Snow Goose* Canada Goose Purple Gallinule Northern Pintail American Coot	Flush	H	--	Edwards et al. 1979
Pacific Eider	No response	H	--	Johnson et al. 1987
Great Egret* Snowy Egret Louisiana Heron	Flush from nest, return <5 minutes No response	FW H	395	Kushlan 1979
Songbirds				
Lapland Longspur	No avoidance of nest sites Nestlings died	FW H	50	Gollop et al. 1972
Game birds				
Chukar	Flush No response	MJ	<3000	Lamp 1989

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2 FW = small, fixed-wing aircraft, H = helicopters, MJ = military jet aircraft, C = commercial jet aircraft

3 Aircraft flight altitudes in feet, rounded to nearest 10.

* Studies of more than one species generally documented all of the listed responses occurring by all of those species

experts suspect that they occur. For example, refuge managers at Key West National Wildlife Refuge suspect that the only known colony of magnificent frigatebirds in the United States is declining due to frequent low-altitude overflights by tour planes (Gladwin et al, 1987).

5.4.1 Accidental Injury

A common concern among biologists is that animals will occasionally fall, run into objects, or become trampled when they panic and run from aircraft. For example, at Cabeza Prieta National Wildlife Refuge, it was reported that a low-flying helicopter startled a deer, which ran off of a 26-ft, cliff and broke its leg (USFWS 1993). Young ungulates are especially vulnerable to being trampled. One study of caribou calf mortality documented that three young caribou were trampled during panic and flight from either wolves or aircraft (Miller and Broughton 1974). Startle responses that cause panic and quick movements are most likely to cause injuries to animals in rugged topography (boulder fields, cliffs, scree slopes), at river crossings, or on icy ridges, especially when animals are grouped closely together (Harrington and Veitch 1991).

5.4.2 Reproductive Losses

For many species, it has been argued that disturbance could cause reproductive losses by altering patterns of attendance to young. Disturbed mammals and birds have been noted to run or fly away from the stimulus (i.e. the aircraft), and leave eggs or young exposed. Birds that quickly flush from nests may accidentally break eggs or kick eggs or young from their nests. Mammal adults and young may become separated when they panic and flee. Leaving the young exposed also makes them vulnerable to predators.

Numerous studies have addressed the effects of aircraft overflights on the breeding success of ungulates such as caribou and Dall sheep. Generally, overflights have not been shown to cause adults and young to separate. Yet one study attributed Caribou calf mortalities to frequent low-level military aircraft overflights (Harrington and Veitch 1992). This study compared calf mortality rates in groups that were exposed to overflights with rates in groups that were not exposed. Mortality rates were significantly higher in the exposed group. The researchers hypothesized that milk release was inhibited in caribou mothers that were disturbed by the overflights, and so young became malnourished. As this example suggests, calves might not die directly from overflights, and so mortalities cannot be detected unless studies are designed to compare rates of survival between calf groups that are and are not exposed to overflights. Numerous studies have reported that overflights do not affect survivorship in young, yet they do not compare survivorship of young that were and were not subjected to overflights. This example demonstrates how complex cause and effect relationships can be between disturbance and effects. It also shows that casual observations of how animals respond to overflights do not necessarily reveal ultimate consequences.

Waterfowl and seabirds nesting on national wildlife refuges are commonly exposed to both military and private aircraft overflights. Whether or not overflights have indirect effects on breeding success depends on the circumstances and types of behavioral responses of the adult birds: whether or not they flush from their nests, whether the exposed nests are vulnerable to predators, proximity of other nests (some birds nesting close together tend to fight after a disturbance, resulting in egg breakage), and physical characteristics of nests and of the adults. Many refuge managers have reported that birds flush from nests in response to overflights (Gladwin et al. 1987, USFWS 1993). This is considered a problem because of the potential for losses of eggs and young. Gulls, cormorants, and murres, for example, kick eggs from nests when they flush during disturbance, and eggs are lost, broken or eaten by predators. These events have been documented to occur on several national wildlife refuges (USFWS 1993). Some species, such as tundra swans and pelicans, apparently abandon nests due to chronic disturbance from overflights (Gladwin et al. 1987, USFWS 1993). Leaving eggs exposed to sun or rain also jeopardizes their survival.

Several studies have been conducted on nesting birds and their responses to overflights. Both American white pelicans and brown pelicans appear to be particularly susceptible to disturbance. Pelican biologists have discovered that low-flying aircraft can contribute to dramatic reductions in survivorship of young and in overall productivity of a nesting colony (Bunnell et al. 1981, Gladwin et al. 1987). Some species, when subjected to overflights during studies, did not flush from nests and so losses did not occur. Such species include: trumpeter swans (Henson and Grant 1991), cattle egrets, double-crested cormorants, great blue herons, great egrets, and white ibises (Black et al, 1984). Others did flush from nests but did not tend to kick eggs from them and so no losses occurred. These species include: great egrets, snowy egrets, and tricolored herons (Kushlan 1979). These species have only been tested for responses to overflights during the studies referenced above. Therefore it is not known whether more intense stimuli such as aircraft flying at lower altitudes might cause more panic and subsequent egg or chick losses.

Disrupted patterns of parental attendance to eggs or chicks is also a concern. Although this phenomenon has been noted on a local scale, it has not as yet been widely linked to reproductive losses at a regional or national scale. One study, however, suggests that supersonic overflights might cause large-scale losses. In 1969 low-altitude supersonic aircraft overflights of the Dry Tortugas during the nesting season were suspected to cause a massive hatching failure for sooty terns (Austin et al. 1970). This incident is widely cited as one of severe disturbance, though the cause and effect relationship cannot be proven. Studies of some nesting birds that respond to less intense (i.e., subsonic) overflights generally return to the nest to resume incubation after the aircraft has passed.

Raptors (birds of prey) have also been monitored for signs of disturbance from overflights during the breeding season. Occasionally, raptors are disturbed by aircraft enough to respond by flushing from their perches or nests. One pair of bald eagles at Cross Creeks National Wildlife Refuge in Georgia reportedly abandoned nesting activities altogether and left the area after repeated overflights by a military helicopter (Gladdys 1983). On the other hand, once eggs are laid, raptors may be less inclined to abandon nests. Ellis et al. (1991) reported that nest abandonment and nest failures through predation, exposure of the eggs, or egg losses did not occur during a study of raptor responses to low-flying military jet aircraft. Although conclusions cannot be made from these two reports alone, the evidence suggests that the seasonal timing of overflights may be an important factor in the outcome of disturbance.

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5.4.3 Energy Losses

Panic reactions and escape responses to overflights can be energetically "expensive" to animals for two reasons. First, feeding animals nearly always stop ingesting food when disturbed, which means a decrease in energy intake. Second, disturbed animals usually run or otherwise move away from the aircraft, thus increasing their energy expenditure. Running can increase an ungulate's metabolism twenty-fold over the normal resting rate (Mattfeld 1974). Hence frequent disturbance imposes a burden on the energy and nutrient supply for animals (Geist 1978), which can compromise growth and reproduction.

There is a particular concern that birds may suffer from energy losses due to chronic disturbance, especially during periods when increasing and storing energy reserves is critical for survival. During winter, the energetic costs of daily activities, such as keeping warm and feeding, mean that animals can spare little extra energy. During other seasons, such as the staging period or breeding season, large net grins of energy are required for migration and/or raising young. For example, the high energy requirements of ducks and geese during the molting season may not be met if these birds continuously swim, dive, or run from aircraft (Gollop et al. 1974b). Migrating birds such as snow geese may be vulnerable to disturbance during the staging season, when energy accumulation must be great enough to prepare for the high energetic demands of migration. Salter and Davis (1974) documented snow geese flushing repeatedly in response to overflights during the staging period just prior to their migration. The amount of time available for and the limits to compensatory feeding, or making up for lost time, are unknown. When animals are already feeding for a significant portion of the day, the opportunity for compensatory feeding is probably limited.

There have been four notable attempts to examine the effects of aircraft disturbance on bioenergetics of animals. Three were conducted on birds during the staging season; two of these used snow geese as models, (Davis and Wisley 1974, Belanger and Bedard 1989a,b), the other used brant (Ward and Stehn 1989). All three of these studies found that, in the presence of frequent overflights, birds lost feeding time because they stopped feeding to react to the aircraft. Belanger and Bedard observed snow geese and their responses to human-induced disturbance, including aircraft, on their staging grounds over three years. They found that snow geese both increased their energy expenditure and decreased energy intake in response to aircraft disturbance. They found that, if disturbance occurred at a rate of 1.46 per hour (as it did during their study), birds could compensate for energy losses by feeding at night, but if they flushed from disturbance and did not return to feeding areas, they would have to feed during 32 percent of the night- a significant time commitment. They also found that birds did not compensate during the day by increasing the rate at which they fed after disturbance. These researchers concluded that man-induced disturbance can have significant energetic consequences for staging snow geese.

The amount of food that bighorn sheep ingest while grazing in the presence and absence of tourist helicopters was investigated in Grand Canyon National Park (Stockwell and Bateman 1987). Sheep spent 14-42 percent less time (depending on the season) foraging in the presence of helicopters. In addition, sheep increased the number of walking steps while foraging by 50 percent. This study suggests that the increase in energy expended, coupled with a decrease in energy consumed, might contribute to an energy deficit for animals when disturbance is chronic. Disturbance has been documented as influencing pronghorn foraging also (Berger et al. 1983).

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5.4.4 Habitat Avoidance and Abandonment

Many wildlife biologists are concerned that the disturbance from overflights could cause sensitive animals to abandon their habitats. This subject has drawn attention because the consequences of habitat abandonment can be serious, particularly for species whose high-quality habitat is already scarce. Observations suggest that some animals do abandon their habitats in response to overflights, and some do not. This difference may be due to differences in the sensitivities of individual animals. On the other hand it may be a factor of different levels of exposure to aircraft during these studies (different flight altitudes, aircraft types, and flight frequencies). Two studies found that caribou did not abandon areas in response to small aircraft overflights (Bergerud 1963, Harrington and Veitch 1991), and one found that they did (Gunn et al. 1985). Grizzly bears (McCourt et al. 1974), mountain sheep (Krausman and Hervert 1983, Bleich et al, 1990), and mountain goats (Chadwick 1973, Ballard 1975) all have been noted to abandon areas in response to small aircraft overflights, even when overflights were infrequent. It is not known how many other species avoid areas used by aircraft.

Waterfowl biologists and national wildlife refuge managers have expressed concern about how waterfowl use of open water and emergent wetland habitats is disrupted by aircraft overflights. Overflights have been reported to cause disturbance at dozens of wildlife refuges in 30 states (Gladwin et al. 1987). Most often, waterfowl flush from lakes and fly away, but return once the noise levels in the area return to ambient. On the other hand, several refuges have reported that some waterfowl species have been completely driven off by frequent aircraft activity. Belanger and Bedard's (1989a,b) study on snow geese energetics and disturbance showed a significant drop --50 percent in the number of geese using feeding grounds on days following aircraft disturbance. Waterfowl using lakes in Canada were displaced for several days when disturbed by light aircraft overflights (Schweinsburg et al. 1974b). Wintering sandhill cranes leave feeding and loafing areas (resting areas) for extended periods when low-altitude overflights take place over Cibola and Imperial Wildlife Refuges (USFWS 1993). Wood storks may also abandon habitat in response to overflights (USFWS 1993). Observations by refuge biologists suggest that the endangered Palila Bird in Hawaii underutilizes a sizable portion of its critical habitat because of low-altitude military aircraft overflights (Gladwin et al. 1987). It is not currently known how the use of ponds, lakes and wetlands in national parks is affected by overflights.

Wildlife refuge and national park managers are also concerned because game animals are sometimes chased from parks and refuges into areas where they may be hunted. This has been documented in several refuges and one national park[4] (USFWS 1993). This harassment is suspected to be intentional; hunters are gaining access to animals which are usually protected.

Aircraft activities appear to have varying impacts on raptors' use of habitat. In general, raptors are sensitive to the activities of people, although species-specific differences are evident. Raptors have been documented to abandon both wintering and breeding habitats as a result of human disturbance (Stalmaster and Newman 1978, White and Thurow 1985). Ellis et al. (1991) found little evidence, however, that raptors abandon habitat in response to aircraft overflights.

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4. Memorandum dated March 7, 1994 from Superintendent, Olympic National Park, to Acting Associate Director, Operations, National Park Service.

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5.4.5 Potential Bird Strike Hazards

There is some concern over potential aircraft collisions with airborne birds among national wildlife refuge managers. Collisions are a misfortune for both birds and pilots. Bird strikes have cost the lives of many pilots and/or damaged aircraft. Military aircraft are most vulnerable to bird strikes since they fly at low altitudes and high speeds. The US Air Force reports 3,500 bird strikes annually (Spectrum Bird Aircraft Strike Hazard Team 1994). The Air Force continues to develop methodologies for avoiding concentrations of birds, in order to reduce this frequency. The FAA further recognizes that large concentrations of migratory birds are a safety hazard to pilots.

Conclusion 5.3

Researchers have documented some indirect effects for some species and individuals, such as eggs kicked from nests when birds flush in response to overflights, loss of feeding due to overflight disturbance, abandonment of habitat in response to overflights. Other studies have found no such effects for some species and individuals.

5.5 Factors that Influence Animal Responses to Aircraft

It is clear from numerous studies that differences in animal responses to aircraft do not depend solely upon the species in question. Many other factors contribute to the responses to overflights, some having to do with the animal and its particular environment and some having to do with the aircraft stimulus itself.

5.5.1 How Animals Perceive the Aircraft Stimulus

An animal's sensory perception of aircraft activity depends, in part, on the physical features of its environment, as well as on its own physiological attributes. Some habitats enhance stimuli associated with aircraft overflights. For example, high canyon walls have the effect of amplifying and repeating (echoing) aircraft sound, and yet they can also obstruct the aircraft from view. The sound and visual stimuli associated with aircraft have different effects in an open desert than in a forest where trees can obscure the sight and may reduce the sound of aircraft. A further consideration is the animal's sensitivity to different types of stimuli, which depends on physical limitations of the senses. Some animals can clearly see aircraft when they are barely visible to others, and the range of frequencies of sound that can be detected varies greatly from species to species.

One relationship between aircraft and animals is clear: the closer the aircraft, the greater the probability that an animal will respond, and the greater the response. Unfortunately, there is no particular overflight altitude at which all animals are or are not disturbed. Even within a species, no particular altitude can be identified as causing a sudden increase in disturbance, because so many other factors influence disturbance. Notably, some studies have shown that animals react in the same manner regardless of altitude (e.g., Lenarz 1974, McCourt et al, 1974). It is unlikely that one overflight altitude exists that is sufficient for avoiding disturbance to all animals while not necessarily imposing undue restrictions on pilots. For instance, a 5,000 foot minimum altitude may avoid disturbance to all species, but may not

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be necessary at all times. Researchers have reported disturbances to walruses by helicopters flying as far away as 4,270 feet (Salter 1979). Grizzly bears run away from aircraft flying at altitudes as high as 3,000 feet. Few other animals have been tested for responses to aircraft at altitudes this great, though many show disturbance from aircraft at lower altitudes.

5.5.2 Aircraft Sound and Animal Hearing

It is apparent that animals can be disturbed by either the sight or sound of aircraft (McCullough 1969, Snyder et al. 1978, Ward and Stehn 1989, Brown 1990). The relative importance of each stimulus is not known, and may depend on the species in question. Both birds and mammals respond to the sound of aircraft before it is visible, yet they also tend to track aircraft visually as they pass overhead (McCullough 1969, Snyder et al. 1978, Brown 1990).

Aircraft sound is broadband, containing sound energy over a wide frequency range, rather than a pure tone. There is some evidence that the high-frequency whine of some turbine-powered helicopters is less disturbing to raptors than the low-frequency sound of piston-engine helicopters (White and Sherrod 1973). Other than this, little is known about how the frequencies of aircraft sound influence animal responses. Sound levels at which animals show strong negative responses in the wild generally have not been determined.

Helicopters apparently disturb some animals more than other types of aircraft. Comparisons of how animals respond to helicopters versus other aircraft types have shown that animals respond more strongly to helicopters. For example, caribou ran longer and farther in response to helicopter overflights than they did in response to low-altitude overflights by military jets during a study in the Yukon (Harrington and Veitch 1991). Ward and Stehn (1989) also noted that greater percentages of brant responded to helicopters than to fixed-wing aircraft in Alaska. Colonially-breeding marine birds also generally flushed when helicopters flew over them at 1,000 feet above ground level (AGL), while light, fixed-wing aircraft could pass over at 500 feet AGL before generating a similar response (Gollop et al. 1974b). In addition to their engine and "rotor-wash" sound, helicopter flight patterns may contribute to disturbance. Brant (Henry 1980), reindeer (Ericson 1972), caribou (Calef and Lortie 1973, Miller and Gunn 1977), pronghorn, elk, bighorn sheep (Workman et al. 1992a, 1992b, 1992c), and Dall sheep (Andersen 1971) all have been documented to show a more extreme panic response when helicopters fly slowly or hover over animals.

Sudden aircraft approaches -that cause surprise may also influence responses. Raptors, for example, panicked and exhibited frantic escape behavior when helicopters appeared from over the tops of cliffs, but did not do so when helicopters could be seen approaching from a distance (White and Sherrod 1973). Hence topography should be taken into consideration when predicting animal responses to overflights.

5.5.3 Increased Tolerance to Overflights

In some cases, animals may develop an increased tolerance to frequent overflights. This has been demonstrated by correlating changes in behavior with sequences of overflights. Other studies have compared reactions of animals having a history of exposure to aircraft with those that were naive. In

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many cases, experienced animals were more tolerant of aircraft, showing less extreme responses than naive animals.

For animals to become desensitized to sound, there must be consistent stimuli (Borg 1979); frequent, predictable overflights, such as those at major airports, are more likely to promote tolerance than occasional ones. Several studies suggest that animals might not become tolerant of infrequent aircraft activity. Colonially-breeding wading birds in Florida, for example, never adapted to infrequent low-altitude military flight activities conducted over two breeding seasons (Black et al. 1984). It is not known just how frequently a stimulus must occur in order for an animal to become desensitized to it, though it probably depends upon the species in question, as well as other factors.

It is important to note that some studies do not support the idea that animals' tolerances of aircraft overflights increase with exposure, even when overflights have been frequent. For example, brant, emperor geese, and Canada geese in Alaska (Ward and Stehn 1989) exhibited alert and flight behavior in response to aircraft activity, despite previous exposure for several seasons. Harding and Nagy (1976) noted that grizzly bears also never became tolerant of aircraft, despite very frequent exposure.

The degree of disturbance to which animals can habituate is probably limited. Evidence suggests that aircraft activities that cause mild responses may become tolerated more so than those that cause panic. This has been demonstrated in reindeer (Ericson 1972), Dall sheep (Summerfield and Klein 1974), and herring gulls (Burger 1981). Also, while some species have the ability to become tolerant, others may not. For example, whooping cranes appeared to have become tolerant of light aircraft activity on Aransas National Wildlife Refuge in Texas, but sandhill cranes had not (Gladwin et al. 1987).

Conclusion 5.4

Factors that can influence animal responses include distance to the aircraft, aircraft type, suddenness of aircraft appearance and frequency of overflights. Closer aircraft generally are more likely to produce a response, though no minimum distance that produces no effect has been found, the responses being species dependent. Some tolerance for overflights has been observed when flights are frequent or regular, but not among all species.

5.6 Biotic Factors that Influence Animal Responses to Aircraft

While sound levels and aircraft proximity to animals are probably the most important factors affecting the levels and types of responses elicited, an animal's immediate activities are also important. Animals show different levels of response to overflights depending in part on whether they are traveling, feeding, resting, or attending young. Habitat features may also influence the degree to which animals react to overflights. For example, bighorn sheep in the San Andreas National Wildlife Refuge appeared more at ease in response to helicopters when in open terrain where they could escape more easily (Kiger 1970).

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An animal's seasonal activities such as reproducing or hibernating influence how they respond to overflights as well. Consequently, during some seasons, animals may be more reactive than during other seasons. Slight seasonal differences in responses to overflights have been noted in reindeer (Slaney and Co. 1974), bighorn sheep (Stockwell and Bateman 1987), and caribou (Klein 1973, McCourt and Horstman 1974, Jakimchuk et al, 1974, Calef et al, 1976). Generalizations cannot be made across species correlating specific seasons with greater reactions.

At present, general relationships between external factors and animal responses are unclear because other variables have not been held constant during studies. In other words, to determine how habitat type (for example) influences responses, all other factors such as group size, season, etc., must be held constant so that habitat differences alone can be compared. Stronger patterns should emerge once more controlled studies are conducted. The existence of many variable factors may explain inconsistencies between reports of species-specific responses to overflights. Clearly, whether an animal (or group of animals) responds to aircraft overflights depends on many factors, and those mentioned here constitute only a partial list. Therefore, when attempting to assess the possible impacts of proposed or existing low-altitude aircraft operations on wildlife, it is essential to keep in mind that each situation is unique and must be evaluated accordingly. Figures 5.1 and 5.2 summarize some of the influential factors associated with aircraft overflights and animals that have been addressed.

Conclusion 5.5

The type of animal activity affects response to overflights. Whether an animal is feeding, resting, caring for young, etc., can affect how it responds to an overnight.

5.7 Problems with Detecting Long-Term Effects of Aircraft Disturbance

While short-term responses are easily documented, long-term responses are more difficult to verify. This is due both to the limitations of ecological research and to the nature of long-term responses. Long-term responses that might occur include permanent changes in habitat use, increased mortality of birds during migration (due to lower weight gains during staging, as described previously), or population effects due to reduced reproductive success (due to egg losses, for example). Assigning a cause and effect relationship between overflight disturbance and these types of phenomena is difficult because there are so many other variables that also cause them. It is very difficult to quantify small decreases in the survivorship of young that are directly attributable to overflights, because predators, weather, food availability, and adult skills all affect survivorship as well. For example, several studies have examined overall survivorship of young across a season by comparing young subjected to overflights with control animals and have concluded that overflights have little effect. However, closer examination has revealed that mortality rates increased during the specific periods of overflights, though these increases were not detectable by the end of the season (e.g., Harrington and Veitch 1992). Other long-term effects are difficult to correlate with overflights because they occur during a time or in a place not immediately associated with the overflights, such as migrating birds that die enroute to their destination after energy losses at feeding grounds.

Figure 5.1 Animal Responses to Low-Altitude Aircraft Overflights

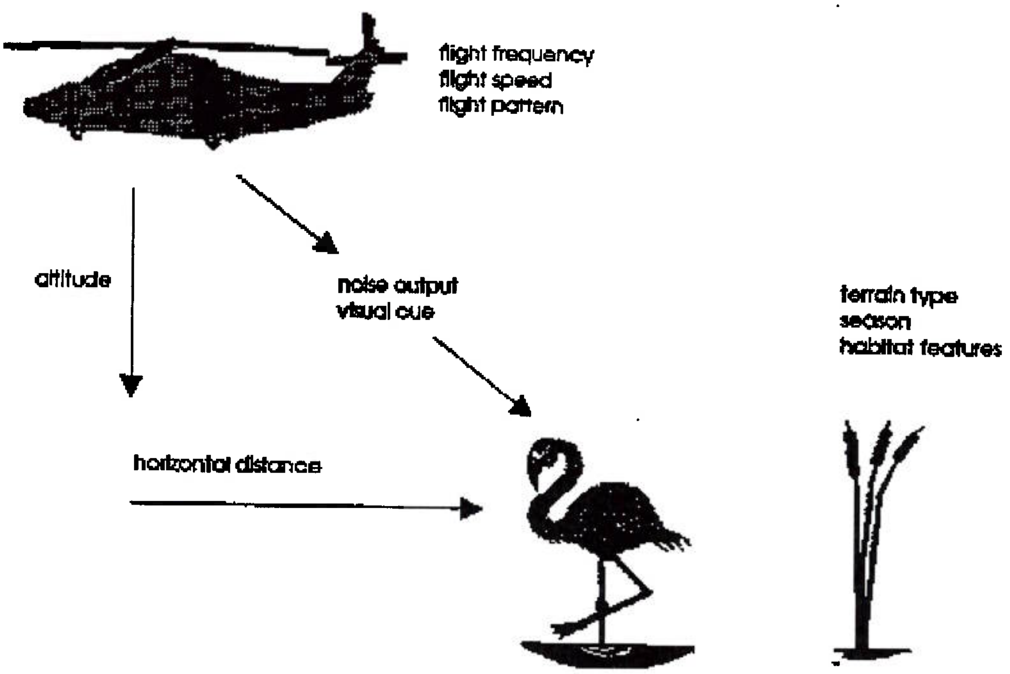

Figure 5.2 External Factors that Influence Animal Responses to Overflights

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Long-term effects are difficult to detect also because they may occur infrequently. This is due, in part, to the fact that most studies are short-term, making documentation of infrequent events unlikely. With the exception of an eight-year study of white pelicans (Bunnell et al. 1981), too little time has been spent assessing long-term effects.

Many biologists have published reports on the effects of the use of aircraft to survey animals. In most cases, overflights do no harm (Carrier and Melquist 1976, Kushlan 1979) because normal behavior is interrupted only briefly. In addition, the surveys are conducted only once or twice per season, and generally they are avoided during poor weather, when stressing an animal could result in harm, and during parts of the breeding season, when the consequences of disturbance might be compounded (White and Sherrod 1973, Poole 1989). Hence the argument that biologists themselves make overflights of animals should not be used to suggest that overflights do not cause disturbance.

Conclusion 5.6

The long-term effects of overflights on wildlife have not been determined, and are unlikely to be investigated because of the magnitude of the effort required. Occasional use of aircraft to survey animals is unlikely to cause harm.

5.8 Overflight Impacts on Endangered Species

There are 98 species on national park lands that have been identified as threatened or endangered. Of these, 36 are bird and 29 are mammal species. The impacts on threatened or endangered species from overflights is largely unknown. Of all threatened or endangered species Federally listed in the United States, there is information regarding responses to overflights only for the grizzly bear, sonoran pronghorn, peregrine falcon, bald eagle, and everglades kite. None of these species have been studied enough to differentiate between aircraft activities that do and do not cause harm. However, observations do indicate that some species are susceptible to disturbance and subsequent harm. The grizzly bear, for example, has been noted to panic and flee areas from overflights in nearly all cases where they have been observed (see Table 1). Biologists recognize that impacts may occur. Wildlife refuge managers have cited concern for many threatened or endangered species regarding impacts from overflights, including wood storks, Hawaiian geese, marbled murrelets, bald eagles, peregrine falcons, masked bobwhite quails, Stellar sea lions and least terns (USFWS 1993). In Washington State, USFWS is developing recovery plans for both the marbled murrelet and northern spotted owl which include 2,000-foot minimum flight restrictions over feeding grounds and nesting sites for these birds.[5]

Many threatened or endangered species have achieved their special status due to habitat loss from development and general human encroachment. They are species for which habitat is limited; their natural histories prevent them from using any but specific habitat types. For this reason, it is important that overflights not cause further habitat loss to these species, since they cannot simply "relocate".

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5. Memorandum dated March 7, 1994 from Superintendent, Olympic National Park, to Acting Associate Director, Operations, National Park Service.

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Whether or not a taking of a threatened or endangered species from Federal action occurs from overflights may be an area for additional research. It would be prudent for Federal agencies to take an active approach to evaluating this, rather than letting the decision lie with the courts. Studying threatened and endangered species and their responses to overflights is within the purview of the law so long as research enhances the survival of the species. However, some have expressed concern for the idea of subjecting animals to overflights and monitoring their responses if indeed those responses suggest that damage is occurring.

Conclusion 5.7

Ninety-eight threatened or endangered species inhabit units of the National Park System. Their responses to overflights are largely undocumented, but Federal agencies may nevertheless be held responsible for impacts related to overflights.

5.9 Overflight Impacts on National Park Animals

Disturbance levels and consequent impacts to animals living on national park lands have been anecdotally reported but not quantified. Several NPS superintendents have prepared reports on the subject which can be used as indicators of the types of problems some parks are having. Yet the degree to which these problems are occurring in other parks cannot be measured without a comprehensive survey.

Reports of park disturbance to animals from overflights exemplify the general points described earlier: 1) Animals have been noted to modify their behavior in response to overflights in parks, and 2) the consequences of this disturbance can only be inferred in the absence of long-term studies. At Hawaii Volcanoes National Park, the endangered Hawaiian (Nene) goose has been seen flushing from feeding and socializing areas after tour helicopters passed overhead.[6] Aircraft also alter normal feeding and socializing habits in response to frequent overflights. The consequences of altering social behaviors and time and energy budgets of animals have not been identified. Forest birds at this park also stop calling or flee from local habitat, as noted by biologists monitoring songbird behavior. Biologists speculate that bird behavior is modified because their calls are interrupted, hence territories cannot be properly delineated. Feeding is also interrupted, and other critical activities cannot be consummated when birds are disturbed by overflights.

At Congaree Swamp National Monument, bald eagles and osprey are believed to avoid habitats they would otherwise use because of overflights by military jets and helicopters.[7] Similar impacts to raptors have been reported from Glacier National Park. There, overflights are suspected of disrupting nesting and foraging activities of bald eagles, golden eagles and falcons. Biologists are concerned about possible

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6. Memorandum dated March 7, 1994 from Superintendent, Hawaii Volcanoes National Park, to Acting Associate Director, National Park Service.

7. Pers. comm., Robert McDaniel, Superintendent, Congaree Swamp National Monument, to D. Gladwin, Sterna Fuscata Inc. 1994.

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impacts to raptors that use corridors through the park for migration.[8] Colonial seabirds have been seen flushing in response to overflights in Olympic National Park as well.[9] Other birds that may suffer harm from overflights in this park include the bald eagle, peregrine falcon, northern spotted owl, and marbled murrelet. These are all Federally-listed species.

Mammals are also disturbed by overflights in parks. Over 80 percent of grizzly bears observed in remote areas of Glacier National Park showed a "strong" reaction to helicopters, according to studies in the park from 1982-1986.

Aircraft disturbing park animals include both military and civilian fixed-wing aircraft and helicopters. Helicopter tours for the public are most often cited as causing problems for wildlife. Most problems occur when aircraft fly at low altitudes such as 500 feet AGL. Helicopter tour operations are frequent in some parks; Glacier National Park reports 10 per day, and Hawaii Volcanoes National Park reports 60-80 per day. Hence cumulative effects of disturbance are likely, as animals are chronically interrupted from important life-maintenance activities.

Several efforts to solve disturbance problems have been initiated by park personnel in recent years. Monitoring low-level overflights and maintaining statistics at Congaree Swamp National Park have helped to quantify the frequency of problems. At Olympic National Park, the staff are cooperating with the USFWS refuge staff and the endangered species field office in documenting and reporting aircraft harassment of seabird colonies. At Glacier National Park, employees are trained to identify aircraft and estimate altitude. A strict plan is in place there for the use of the park's own aircraft. Parks have also discussed problems with aviation proponents. Meetings with tour operators, FAA, and military personnel have been somewhat successful, though problems do not always cease. For example, Congaree Swamp national park managers note that, although military personnel are receptive to cooperation in avoiding disturbance, no efforts have been made by the military to address problems themselves or to offer mitigation strategies. At Hawaii Volcanoes National Park, staff have been negotiating a voluntary agreement with the helicopter operators association, with assistance from the FAA.

Park superintendents have an interest in addressing cumulative effects of aircraft disturbance on wildlife. They also support continued efforts to work with the military and civilian aircraft operators to develop mutually agreeable solutions. Preparing educational material on the sensitivity of wildlife and natural areas has been suggested as a means of reducing disturbance.

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8. Memorandum dated March 7, 1994 from Superintendent, Glacier National Park, to Acting Associate Director, Operations, National Park Service.

9. Memorandum dated March 7, 1994 from Superintendent, Olympic National Park, to Acting Associate Director, Operations, National Park Service.

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Conclusion 5.8

In general, reports from national park about the effects of overflights on wildlife tend to mirror the points made earlier in this chapter: animals have been observed to modify their behavior in response to overflights, but without long term study, the consequences of such modifications can only be inferred.

5.10 Development of Impact Criteria

Studies to-date have verified that physiological and behavioral responses by wildlife to low-flying aircraft do occur. The nature of these responses suggests that at least some animals suffer other consequences. The studies by Stockwell et al. (1991) and Belanger and Bedard (1989a,b) provide compelling evidence that energy losses and habitat avoidance are occurring in response to overflights. Unfortunately, these studies cannot be used to infer damages in other species or from other overflight regimes. Only a handful of the many species that inhabit national parks have been studied for responses to overflights. It is very likely that there are park species that are susceptible to disturbance that have never been studied. There is also little information suggesting how flight patterns, frequencies and altitudes affect any species, other than the broad generalizations described earlier. Data to support the occurrence of damage in a variety of situations would require many years of extensive and costly research.

It is also not possible to evaluate the after-effects of overflights because in most cases, animal responses fall across a spectrum so that the question of whether or not a disturbance occurs cannot be answered with a yes or no. For example, an overflight generally causes some animals to panic, some to be mildly disturbed, and some animals to ignore the aircraft. At a lower altitude, the overflight causes more to panic and fewer to be mildly disturbed? At what degree of disturbance in what percentage of animals should overflights be considered detrimental or otherwise unacceptable? At present, these questions have only largely subjective answers.

Defining impacts according to some specific, measurable criteria is a useful first step towards developing a policy. There is no consensus in public or scientific communities regarding impact definition. The following, categories of impacts are adapted in part from a matrix of definitions developed by Oak Ridge National Laboratory staff members Roger Kroodsma and Warren Webb in cooperation with the U.S. Air Force (Braid 1992). They are meant to help agencies in determining the severity of impacts. In these definitions, " species of concern" include Federally- or state-listed threatened, endangered, and candidate species, species of local economic importance, or species of particular concern to conservation or other interest groups. This definition can be expanded to include any species that is known to be susceptible to disturbance. "Habitat" is used to refer to the physical landscape and its ecosystem components that are subjected to overflights.

Negligible impacts

- No species of concern are present and no or minor impacts on any species are expected.
- Minor impacts that do occur have no secondary (long-term or population) effects. .

Low impacts

- Non-breeding animals of concern are present in low numbers.
- Habitat is not critical for survival and not limited to the area targeted for overflight use; other habitat meeting the requirements of animals of concern is found nearby and is already used by those species.
- Occasional flight responses are expected, but without interference with feeding, reproduction, or other activities necessary for survival.
- No serious concerns are expressed by state or federal fish and wildlife officials.

Moderate impacts

- Breeding animals of concern are present, and/or animals are present during particularly vulnerable life-stages such as migration or winter (depends upon the species in question).
- Mortality or interference with activities necessary to survival are expected on an occasional basis.
- Mortality and interference are not expected to threaten the continued existence of the species in the area. State and federal officials express some concern.

High impacts

- Breeding individuals are present in relatively high numbers, and/or animals are present during particularly vulnerable life-stages.
- Habitat targeted for overflights has a history of use by the species during critical periods, and this habitat is somewhat limited to the area targeted for overflight use; animals cannot go elsewhere to avoid impacts (animals can rarely "relocate" except temporarily).
- Mortality or other effects (injury, physiological stress, effects on reproduction and young-raising) are expected on a regular basis. These effects could threaten the continued survival of the species.
- State and federal wildlife officials express serious concern.

This evaluation process relies on the opinions of wildlife managers and researchers. In general, members of the scientific community agree that damage to animals should not need to be proven before impacts are considered likely. In the conclusion of the majority of studies, researchers caution that, though they cannot prove that impacts occur, overflights that cause disturbances should be avoided.

In defining what level of disturbance to park animals by overflights is unacceptable, the NPS must rely on less than complete information. It is clear that disturbances can result as direct and indirect effects, and that consequences may affect survivorship. Until more information is available, it is recommended that the NPS use the levels of impact listed to "trigger" actions to eliminate or reduce such impacts. In general, the NPS would regard situations consistent with "low impacts" to warrant monitoring, while situations that represent "moderate impacts" or "high impacts" would require pursuit of solutions.

5.11 Summary

A wide range of impacts (disturbances) to wildlife due to aircraft overflights have been reported in the literature. There are many reports of behavioral responses in animals, these responses are highly variable depending on the type of study, the species under consideration, spatial and temporal parameters, and other broad ecosystem characteristics.

Indirect effects on wildlife such as accidental injury, energy losses and impacts to offspring survival have been documented. Current literature supports the argument that aircraft overflights negatively impact wildlife populations. However, the significance of such impacts is not clear. Additional studies are still needed to better assist land managers in substantiating the effects on population subgroups.

It is certain that some impacts do occur under certain circumstances and that it is a NPS priority to protect wildlife, especially threatened and endangered species, whenever a probable impact exists or is expected. Hence, a series of conditions, applicable system-wide, have been listed that can be used to define general levels of impacts. Working with these guidelines at specific parks will lead to setting of priorities, both for possible alteration of overflight times, locations and numbers, and for identification of further research needs.

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