APPENDIX ONE

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July 25, 2006 Our file: 4703 001 032

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RE: NIRB 06EN048 - Wolfden Resources Ltd. – High Lake Project – Amendment to Relicencing Program

On behalf of Environment Canada (EC), I have reviewed the information submitted with the above-mentioned application. The following specialist advice has been provided pursuant to Environment Canada's mandated responsibilities for the enforcement of the *Canadian Environmental Protection Act*, Section 36(3) of the *Fisheries Act*, the *Migratory Birds Convention Act,* and the *Species at Risk Act*.

Environment Canada has recently been made aware of the July 6, 2006 response by Wolfden Resources Ltd. (Wolfden) to the recommendations made by EC in our June 27/06 letter to the Nunavut Impact Review Board (NIRB). Wolfden also responded to the other interveners in a letter dated July 5, 2006. Environment Canada has since reviewed this information, and is pleased to provide the following revised comments to the NIRB for the consideration. The requests for clarification contained in this letter supercede those that were submitted to the NIRB on July 24, 2006.

After reviewing the new information submitted on July 5, July 6 and July 18, 2006, EC notes that a number of concerns identified in our review of the original application remain outstanding. The original numbering scheme from EC's June 27/06 letter has been retained for ease of comparison. Those issues that are no longer applicable have been removed. All of the recommended terms and conditions included in EC's original letter are still valid and relevant.

Environment Canada requests that Wolfden provide the following information in order to facilitate EC's review of potential environmental impacts:

1. It is mentioned that treated domestic and grey water effluent from the camp at Weatherhaven will be discharged to Lake L20, which is a non-fish bearing waterbody. The proponent is requested to clarify the discharge rates and water quality (i.e. TDS, TS, nutrients)?
2. The proponent is requested to clarify the following points in regards to the incineration of camp waste:
    b. The training that the incinerator operator has/will complete;
    c. The volume of waste to be incinerated;

5. The terminus of the airstrip is within how many metres of Sand Lake, and what mitigation does the Proponent suggest to prevent the release of deleterious substance into Sand Lake from run-off, spills, accidents and natural drainage?
6. Can the Proponent please clarify why the fuel storage site was chosen at the present suggested location instead of on the other side, away from the Kennarctic River?
7. What mitigation measures will be implemented during the construction of the all-season road to prevent permafrost degradation, subsidence and an increase in the active-layer over time?

10. In the Proponent's summary Table 1, it is indicated that the *disturbance of land and marine habitat in event of accidental spill/mishap* requires no mitigation as the *shallow nearshore waters contain only small, mobile fauna (amphipods) because of the presence of landfast ice in winter*. This statement is not showing due diligence on the part of the Proponent, and the Proponent is reminded of Section 36 (3) in the *Fisheries Act.* The Proponent is requested to please indicate how such a spill/mishap will be prevented and mitigated.
11. The Proponent indicates under the *temporary storage of equipment* that proposed mitigation for accidental spill/mishap is proper site preparation with grading to ensure *minimal* contaminant drainage to the marine environment. The Proponent is again reminded of Section 36(3) under the *Fisheries Act,* and is asked to please clarify how grading will prevent the introduction of deleterious substances into the marine environment.
12. The Proponent is asked to clarify how run-off from the airstrip will be dealt with and controlled.

14. Construction of Weatherhaven camp fails to include discussions of the affect to permafrost. The proponent is requested to please clarify effects and mitigation.
15. The construction of quarry pits indicates that sediment from run-off will be subject to proper drainage control to *minimize* drainage to fish bearing waters. The Proponent again is reminded of Section 36(3) under the *Fisheries Act,* and is asked to please clarify how grading will prevent the introduction of deleterious substances into the marine environment.

17. In the *Revegetation Plan,* revegetation is discussed. The Proponent is asked to clarify which seed mixes will be used, and if they will be native seed mixes (i.e. seeds collected prior to construction) or if they will be southern blended mixes.
18. The Proponent is asked to please identify where on the map the pump house for Lake L22 is located. Is it within the Weatherhaven campsite, or is it on the shores of Lake L22?
19. At the decommissioning phase of the project, the Proponent mentions that remaining fuel in the diesel tanks will be drained; where will these remaining fuels be drained into?

In regards to Wolfden's letter of July 5, 2006, EC has reviewed the proponent's responses to the recommendations made in EC's June 27/06 letter to the NIRB. In general, EC is pleased that Wolfden is willing to implement the recommendations that were made. In regards to the suggestion that an elevation of 300 m is sufficient to minimize disturbance to nesting birds, EC offers the following comments for consideration by the NIRB and Wolfden:

Wolfden Response

#2 In order to reduce disturbance to nesting birds, CWS recommends that aircraft used in conducting project activities maintain a flight altitude of at least 610 m during horizontal (point to point) flight.

We note that the 610m (2000 ft) is a relatively new recommendation from CWS and suggest that 300m is appropriate for minimizing disturbance to nesting birds. Fixed wing aircraft can maintain the 610 m clearance on flights in to and out of the airstrip. For helicopter operations in the area, a significant amount of extra fuel (also an environmental concern) will be used up climbing to 610m for helicopter flights in the

area. Helicopter operations can be modified as needed to fly around sensitive areas where possible.

While the 610 m flight recommendation is not a relatively new recommendation from the Canadian Wildlife Service of Environment Canada (CWS), it is only recently that EC has begun to focus on trying to encourage higher flight height altitudes for activities in Nunavut. In 2002, the Inuvialuit Game Council (IGC) released guidelines to reduce the impact of flights on wildlife in the Inuvialuit Settlement Region (ISR), which included minimum flight altitudes of 610-650 m when wildlife such as birds are present (see attached document from the IGC). The CWS contributed to the development of these guidelines. These guidelines were developed to minimize disturbance to wildlife above the tree-line, and would also be applicable in Nunavut. Given the increased development activity in Nunavut and the potential for impacts to wildlife from cumulative effects, EC would like to see Nunavut adopt similar flight recommendations as have been adopted in the ISR.

In order to provide Wolfden with background information as to how these minimum altitudes were determined, the attached document, prepared by the CWS for the IGC on this topic, are attached for the proponent's reference. The results of this literature review on aircraft disturbance on birds would also be applicable in Nunavut.

Environment Canada is pleased that Wolfden will have fixed wing aircraft maintain the 610 m clearance on flights in to and out of the airstrip, and that helicopter operations can be modified to fly around sensitive areas. Environment Canada also encourages Wolfden to have helicopters maintain at least 610 m in altitude over areas likely to have birds.

Environment Canada appreciates the opportunity to provide input into the NIRB's decision-making process for the High Lake Relicensing Program. Environment Canada recommends that if the NIRB decides to approve the proposed project, the recommendations contained within EC's original letter be incorporated into the screening decision to help ensure compliance. Environment Canada apologizes for the confusion caused by the delayed receipt and subsequent review of Wolfden's responses to the intervener comments. Please do not hesitate to contact me with any questions or comments with regards to the foregoing at (867) 975-4639 or by email at colette.spagnuolo@ec.gc.ca.

Yours truly,

Original signed by

Colette Spagnuolo
Environmental Assessment / Contaminated Sites Specialist

cc: (Stephen Harbicht, Head, Assessment and Monitoring, Environment Canada, Yellowknife)
(Jen Anthony, Environmental Assessment Specialist, Environment Canada, Yellowknife)

Inuvialuit Game Council

INUVIALUIT GAME COUNCIL

August 2, 2002

see distribution list

To whom it may concern:

RE: Flight altitudes/routes and interference with Inuvialuit harvesting

The Inuvialuit Game Council(IGC) represents the collective Inuvialuit interest in wildlife and wildlife habitat in the Inuvialuit Settlement Region(ISR). With the increase in development activity from seismic exploration and tourism in recent years, the IGC has been hearing more and more complaints from harvesters regarding helicopters and fixed wing aircraft. Some of these complaints center around incidental overflights that are flying low enough to affect their harvesting practices. Some have observed aircraft that have deliberately gone off course to "get a closer look" at wildlife that they may have observed from the appropriate flight altitude. Others are saying that the amount of air traffic over particular areas is preventing them from harvesting in their traditional hunting range. There have also been complaints from beluga harvesters of unnecessary overflights that are impacting on their harvesting.

These are complaints that the IGC takes very seriously. While everyone would agree that the increase in air traffic is inevitable during this period of development, the IGC feels that there are mitigative measures that are not always being followed by some pilots/aviation companies.

The IGC would like to provide the following suggestions to help mitigate the impacts of air traffic on harvesters and wildlife:

1. All flights, unless they have been given special authorization, are to follow the minimum flight altitudes that have been provided to all proponents and aviation companies. A copy has been attached.

2. Where there are several flights to the same location/area, the best possible flight corridor should be selected and used for all flights. This flight corridor should be selected based on avoidance of harvesters and concentrations of wildlife.

3. When wildlife is observed, the pilot is not to go off course "to get a closer look." This is considered harassment of wildlife, puts undue stress on the animal(s), and may affect harvesting.

The Joint Secretariat - Inuvialuit Renewable Resource Committees
P.O. Box 2120 Inuvik, Northwest Territories, Canada X0E 0T0
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4. During the months of June, July, August and September, beluga zones 1(a) and 1(b) should be avoided by aircraft. A map has been provided identifying these zones which are areas where beluga congregate during summer months and are also important traditional harvesting areas for the Inuvialuit.

Where possible, all observed flights over particular areas are being recorded along with the company that owns/operates the aircraft. Over time this will give a better picture of which companies are causing the most disturbances. Any documented flights of harassment will be reported to the appropriate authorities.

The IGC would like to thank you in advance for respecting the wishes of Inuvialuit harvesters whose harvesting rights are protected under the Inuvialuit Final Agreement.

Respectfully,

Duane Smith
Chair, Inuvialuit Game Council

cc Wildlife Management Advisory Council(NWT)
Wildlife Management Advisory Council(NS)
Environmental Impact Screening Committee
Environmental Impact Review Board
Inuvialuit Development Corporation
Oil and Gas Companies

Distribution List

Adlair Aviation (1983) Ltd.
Air Inuit Ltd.
Air North
Air Nunavut
Air Thelon Ltd.
Air Tindi Ltd.
Aklak Air
Arctic Air
Arctic Excursions Ltd.
Arctic Sunwest
Arctic Tern Aviation Ltd.
Arctic Wings Ltd.
Aurora Market
Beaudel Air Ltd.
Big River Air Ltd.
Buffalo Air Express
Buffalo Airways Ltd.
Calm Air International Ltd.
Canadian Helicopters Ltd.
Custom Helicopters Ltd.
Deh Cho Air Ltd.
Deh Cho Helicopters
Denendeh Helicopters Ltd.
First Air
Great Slave Helicopters Ltd.
Highland Helicopters Ltd.
Hudson Bay Helicopters Ltd.
Ken Borek Air Ltd.
Kivalliq Air
Midwest Helicopters Ltd.
North Cariboo Air
North-Wright Airways Ltd.
Northwestern Air Lease Ltd.
Northwest International Airways Ltd.
Numasi Helicopters Inc.
Sahtu Helicopters
Simpson Air
Skyward Aviation Ltd.
South Nahanni Airways
Summit Air Charters Ltd.
Thebacha Helicopters Ltd.
Trans North Helicopters
Ursus Aviation
Wolverine Air

SUMMARY OF ADVICE RECEIVED BY EISC FROM THE CO-MANAGEMENT GROUPS FOR RECOMMENDED ENVIRONMENTALLY ACCEPTABLE MINIMUM FLIGHT ALTITUDES

Aircraft Type	Species / Situation	Recommended Altitude	Source
Not specified	Over areas likely to have birds	>650 m (2100 ft)	CWS [WMAC(NWT)]
Not specified	Over areas where birds are known to concentrate (Sanctuaries, colonies, moulting areas)	>1100 m (3500 ft)	CWS [WMAC(NWT)]
Subsonic Aircraft	Over large mammals during ferry flights	>300 m (975 ft)	DRWED [WMAC(NWT)]
Subsonic Aircraft	During wildlife surveys	>100 m (325 ft)	DRWED [WMAC(NWT)]
Subsonic Aircraft	Aeromagnetic surveys in areas with large mammals	Timing should be restricted rather than altitude	DRWED [WMAC(NWT)]
Not specified	When flying point to point in vicinity of caribou and other wildlife species	>610 m (2000 ft)	Transport Canada [WMAC(NS)]
Not specified	Over parks, reserves, and refuges	>610 m (2000 ft)	Transport Canada
Not specified	Over areas where there are belugas and bowhead whales	>300 m (975 ft)	FJMC
Not specified	Zone 1	>760 m (2500 ft)	Tourism Guidelines Beluga Management Plan [FJMC]
Not specified	Zone 2	>610 m (2000 ft)	Tourism Guidelines Beluga Management Plan [FJMC]

General Advice

- Minimize the number of flights whenever possible
- Fly at times when few birds are present (e.g., early spring, late fall, winter)
- Avoid large concentrations of birds (e.g., Migratory Bird Sanctuaries, breeding colonies, moulting areas)
- Avoid especially sensitive areas such as seabird colonies and raptor nesting sites
- Plan routes that minimize flights over habitats likely to have birds
- Use small aircraft rather than large aircraft whenever possible
- Use fixed-wing aircraft rather than helicopters whenever possible
- Inform pilots of these recommendations and areas known to have birds

- Hovering or circling may greatly increase disturbance and must be avoided.
- Caribou calving grounds should be avoided whenever possible.
- Aeromagnetic surveys should be controlled to prevent disturbance to large mammals by restricting the timing of the surveys rather than the elevation. These surveys should not take place near or on calving and post-calving areas during the period of May 25 to July 15. After July 15 they should avoid any areas know to have large aggregations of caribou.

- Animals reactions will depend on a variety of situations including aircraft type, noise levels, speed of travel, overflight frequency, and animal activity (e.g., loafing, feeding, traveling) and its surroundings (water depth and clarity, substrate). The EISC may have to consider the circumstance of the activity on a case by case basis.
- DFO often recommends a minimum altitude of 400 m (1200 ft) for flights over marine mammal habitat in this region. Recommended or required minimum altitudes may be higher in areas of particularly intense aircraft activity, and in cases where flights are over marine mammal concentrations areas, or at particularly sensitive times of their life cycle.

- Exceptions to these recommendations may be warranted for scientific studies (e.g., wildlife surveys) in which the benefits for conservation clearly outweigh the risks and should be evaluated on a case by case basis.

Acronyms

CWS	Canadian Wildlife Service
DFO	Department of Fisheries and Oceans
DRWED	Department of Resources, Wildlife and Economic Development
EISC	Environmental Impact Screening Committee
FJMC	Fisheries Joint Management Committee
WMAC(NS)	Wildlife Management Advisory Committee (North Slope)
WMAC(NWT)	Wildlife Management Advisory Committee (Northwest Territories)

Recommended Minimum Altitudes for Aircraft Flying near Birds in the Inuvialuit Settlement Region

Introduction

This report was written in response to the request by the Inuvialuit Wildlife Management Advisory Council (N.W.T.) for recommendations on minimum flight altitudes for aircraft in areas where birds are present. It is our understanding that these recommendations will be used to provide the Environmental Impact Screening Committee with environmentally acceptable and defensible minimum flight altitudes for developments subject to screening in the Inuvialuit Settlement Region. Our recommendations are based on a literature review of scientific studies on aircraft disturbance as well as our own observations of the response of birds to aircraft.

Effects of Disturbance

Most birds alter their behaviour when an aircraft is flying in the vicinity. Typically, the first response of birds to aircraft is the "alert" posture in which birds raise their heads and straighten their necks. This can occur when the aircraft is 10 km or more away. Flocked birds may also mass together (move together in a tight group without flying). If the aircraft continues to approach, birds may fly and circle their previous location, or they may fly to a new location. Waterfowl that are flightless because they are moulting usually swim or run away from the aircraft. The response of birds to aircraft can depend on a number of factors such as aircraft type, distance from birds (both horizontal and vertical), reproductive status of the birds, time of year, frequency of flights, species, flock size, and individual differences among birds (Table 1). Thus, the aircraft altitude at which birds will be disturbed is a difficult value to determine.

Aircraft or other forms of human-induced disturbance can negatively affect birds in a number of different ways. Disturbance during the breeding season may result in nest abandonment and increased mortality of eggs and young from predation, exposure to adverse weather conditions, and accidental damage or injury. Disturbance that disrupts feeding can lead to low-weight birds that may have reduced survival and reproductive success. As well, birds may avoid disturbed areas, resulting in short- or long-term changes in population distributions and potentially reduced opportunities for harvesting birds.

A summary of a broad range of studies of the impacts of aircraft on birds is presented in Appendix 1. Most of these studies were done in the Arctic with small helicopters and planes that are similar to aircraft used in the Inuvialuit Settlement Region.

A number of these studies present information on flight altitudes at which birds show a significant change in behaviour in response to aircraft. A smaller subset of the studies recommend minimum flight altitudes. Recommended flight altitudes in most studies were aircraft altitudes at which the majority of birds did not fly or otherwise move away from approaching aircraft.

Recommendations

We found that there was much variation in the results of studies on the effects of aircraft disturbance on birds. Recommended minimum altitudes in 10 studies that we reviewed ranged from as low as 153 m (500 feet) to as high as 1070 m (3500 feet). Most of the recommended altitudes were between 400 and 600 m (1300-2000 feet) (Figure 1).

From 16 studies in our literature review, we were able to determine aircraft altitudes above which birds no longer showed significant reactions to aircraft disturbance (Figure 2). There was a large drop between 450 m (1500 feet) and 650 m (2100 feet) in the number of studies that showed a reaction by birds to aircraft. Birds reacted to aircraft in 69% of the studies when the aircraft was above 450 (1500 feet), whereas birds reacted in only 25% of the studies when aircraft was above 650 m (2100 feet). Thus, a minimum aircraft altitude of 650 m (2100 feet) would minimize much of the disturbance. This agrees with our own observations that in most situations birds are unlikely to change their behaviour when an aircraft at 650 m (2100 feet) flies over them. The 4 studies in which birds flew when the aircraft was >650 m were all situations in which geese were in large moulting or migration flocks. Therefore, higher aircraft altitudes may be required to minimize disturbance when birds are in large concentrations.

We recommend that aircraft maintain a minimum altitude of 650 m (2100 feet) whenever flying over areas likely to have birds.

Flight altitudes above 1100 m (3500 feet) should be maintained near areas where birds are known to concentrate (e.g., Migratory Bird Sanctuaries, breeding colonies, moulting areas).

Because aircraft disturbance also depends on other factors in addition to altitude, we also recommend the following:

- Minimize the number of flights whenever possible.
- Fly at times when few birds are present (e.g., early spring, late fall, winter).
- Avoid large concentrations of birds (e.g., Migratory Bird Sanctuaries, breeding colonies, moulting areas).
- Avoid especially sensitive areas such as seabird colonies and raptor nesting sites.
- Plan routes that minimize flights over habitats likely to have birds.
- Use small aircraft rather than large aircraft whenever possible.
- Use fixed-wing aircraft rather than helicopters whenever possible.
- Inform pilots of these recommendations and areas known to have birds.

Exceptions to these recommendations may be warranted for scientific studies (e.g., wildlife surveys) in which the benefits for conservation clearly outweigh the risks.

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Table 1. Some factors that influence the response of birds to aircraft disturbance. (See Appendix 1 for summaries of the various studies).

Factor	Comment
Aircraft type	Helicopters usually cause more disturbance than planes.
Aircraft size	Large aircraft cause more disturbance than small aircraft.
Altitude of aircraft	Low-altitude flights cause more disturbance than high-altitude flights.
Distance of aircraft	Aircraft flying close to birds cause more disturbance than aircraft flying further away.
Reproductive status	Birds are often less likely to fly away from aircraft during nesting.
Frequency of flights	Frequent flights can cause birds to abandon area.
Species	Geese are generally less tolerant of aircraft disturbance than ducks and swans.
Flock size	Large flocks of birds are more likely to react to aircraft than small flocks.
Individual differences	Some individuals are more tolerant of disturbance than other individuals.

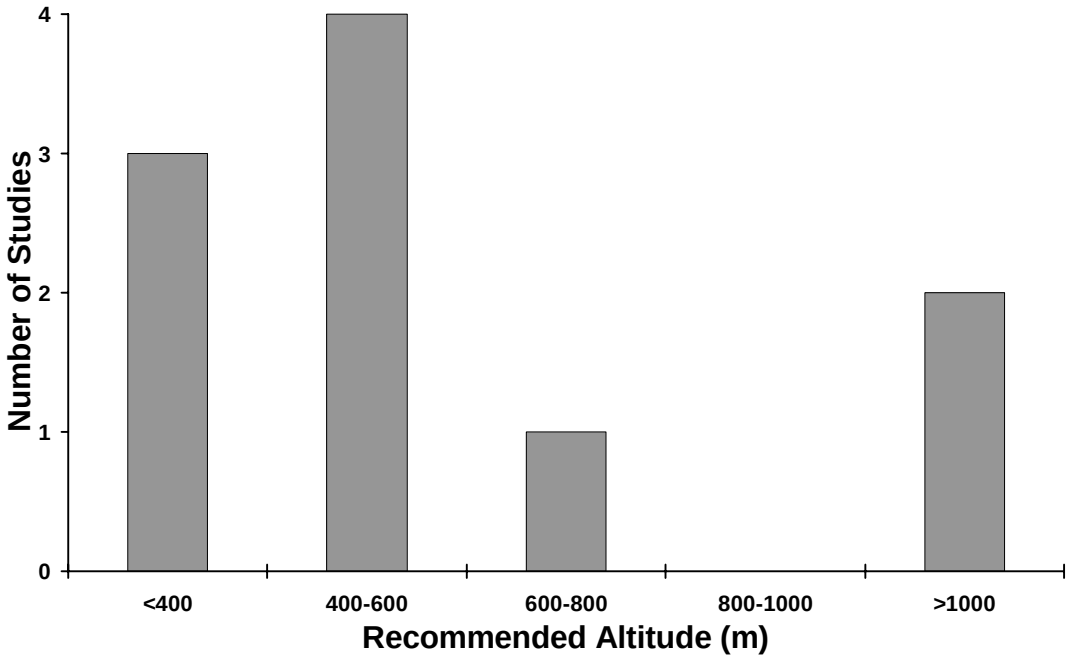

Figure 1. Range of recommended minimum altitudes for minimizing aircraft disturbance on birds.

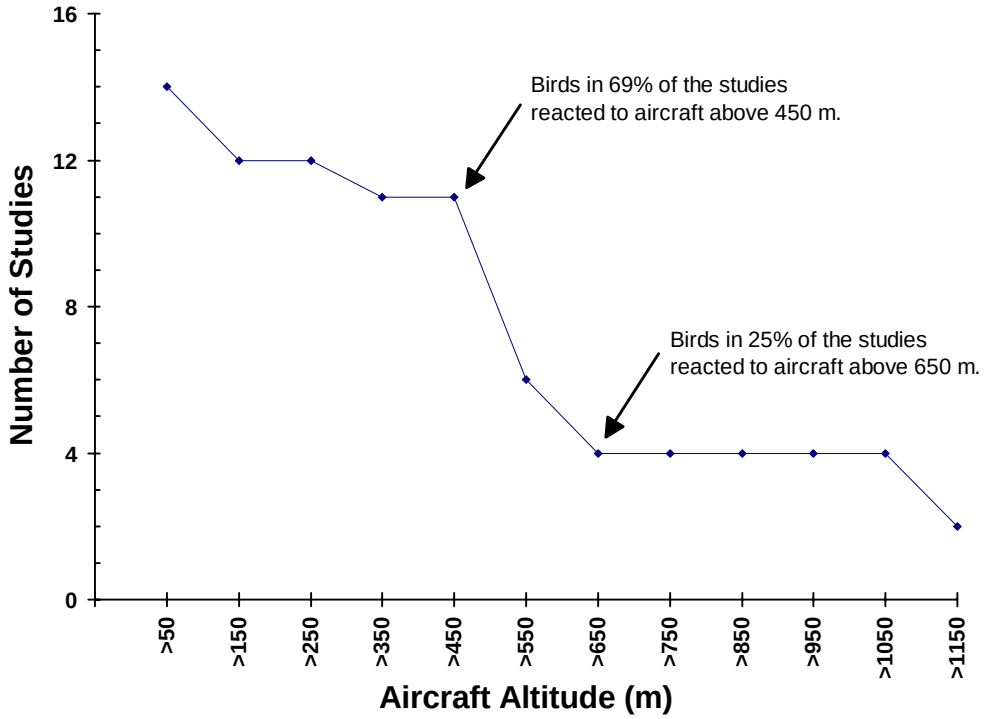

Figure 2. Altitudes at which birds showed reactions to aircraft disturbance, based on 16 studies in our literature review.

Appendix 1. Results of studies of responses of birds to aircraft and recommended aircraft flight altitudes (table continued on next 3 pages).

Aircraft Type	Species (season)	Response	Recommended Altitude	Source
Helicopter (Bell 206)	Brant (moulting flocks in Alaska)	Response of Brant varied with altitude and lateral distance. Large flocks (> 100) reacted longer than small flocks. Disturbed Brant moved more between sites.	> 1070 m	Jensen 1990
Helicopter	Brant (moulting flocks in Alaska)	Results based on simulation model.[1] Slightly altering flight paths greatly reduced the number of geese with heavy weight loss. Large helicopters (Bell 412) caused 15% more weight loss than the small ones (Bell 206). Increasing flight frequency increased weight loss. Weight loss reduced if helicopters fly only when most Brant in 2nd week of moult.	> 1065 m	Miller et al. 1994, Miller 1994
Fixed-wing < 1524 m	Brant (flocks in Alaska in fall)	68% of flocks flew when plane low (< 610 m) and nearby (< 0.8 km), which was 2x more than when plane higher and further away.	> 610 m and 0.8 km away	Ward et al. 1994
Aircraft	Snow Geese (flocks in Quebec in fall and spring)	Over half of the geese in a flock reacted to aircraft. Geese flew longer and took longer to resume feeding compared to most other disturbances (e.g., gun shots, vehicles, pedestrians, ferry boats, other animals). Less geese the next day after high rates of disturbance.	> 500 m	Bélanger and Bédard 1989
Aircraft	Brant (flocks wintering in Britain)	86% of flock disturbed (“alert” posture and most flew). Birds flew longer compared to other disturbances (e.g., gunshots, vehicles, pedestrians, other animals).	> 500 m	Riddington et al. 1996
Aircraft	Brant (flocks wintering in Britain)	Any aircraft < 500 m and < 1.5 km away could put birds into flight, especially slow, noisy aircraft. Helicopters caused “widespread panic”.	> 500 m	Owens 1977

[1] Previous field work was used to develop a model to study the effects of helicopters on moulting Brant near Teshekpuk Lake, Alaska. Helicopters were simulated to fly along different flight lines at various altitudes and frequencies. The model predicted the responses of Brant to the helicopters and the resulting weight loss of the birds at the end of the moult.

Aircraft Type	Species	Response	Recommended Altitude	Source
Helicopter	Brant, Glaucous Gull, Arctic Tern, Common Eider (nesting in Yukon)	Normal incubation behaviour of Brant, Glaucous Gulls and Arctic Terns was affected. No Glaucous Gulls flew when helicopter was at 763 m, some flew at 610 m, and all flew at 153 m. All Arctic Terns flew when helicopter < 305 m but none flew when > 458 m. Many Arctic Terns in disturbed areas abandoned their nests. Common Eiders showed no response.	> 458 m	Gollop et al. 1974a
Helicopter (Bell 206)	Oldsquaw and Surf Scoters (moulting flocks on Herschel Island, Yukon)	Some ducks moved off land and swam away if helicopter at < 229 m, all moved if < 92 m. Some ducks dove if helicopter at < 153 m, all dove if < 31 m. Normal behaviour quickly resumed. Scoters more sensitive than oldsquaw. Similar numbers of ducks in area for two years despite disturbance.	> 305 m If flight > 229, maintain normal cruising speed (193 km/hr)	Gollop et al. 1974b, Ward and Sharp 1974
Helicopter	Waterfowl (brood rearing at the Mackenzie Delta)	Non-breeding White-fronted Geese flew in response to helicopters and most of these birds left area after 2 days of disturbance. White-fronted Geese with broods on land moved to water and ones on water moved to land. Other waterfowl species generally did not show much response when helicopter at 61-153 m. At 31 m, American Wigeon and Northern Pintails swan rapidly away.	> 153 m	Anonymous 1972
Fixed-wing	Glaucous Gull, Arctic Tern, Common Eider (flocks in Yukon in summer)	All Arctic Terns flew when plane < 153 m. All Glaucous Gulls and Common Eiders flew when plane < 76 m.	> 153 m	Gollop et al. 1974a
Fixed-wing (Cessna 185)	Snow Geese (flocks on Yukon-Alaska north slope in Sept)	Geese flew when plane 3050 m or lower. Geese flew at greater distances when plane < 305 m. Geese flew when plane up to 15 km away. Frequent low flights caused geese to abandon area.	No recommended height. Avoid areas with geese from Aug 15 - Sept 30.	Salter and Davis 1974

Aircraft Type	Species	Response	Recommended Altitude	Source
Fixed-wing	Herring Gulls (nesting and loafing in eastern U.S.A.)	No effects for subsonic planes. Supersonic planes caused more nesting gulls to fly and gulls engaged in more fights when they landed, which resulted in eggs being damaged.	More studies needed	Burger 1981
Float Plane (Cessna 185)	Waterfowl (Yukon in summer)	60% reaction in birds on a small lake after 4 days of disturbance from float plane landing on lake	More studies needed	Schweinsburg 1974
Helicopter < 1524 m	Brant (flocks in Alaska in fall)	Birds flew longer compared to responses for other aircraft. 83% of flocks left area.	More studies needed	Ward et al. 1994
Aircraft	Brant, Emperor Geese, and Canada Geese (flocks in Alaska in fall)	Response depended on aircraft type and proximity to flock. Brant and Emperor Geese were more likely to show “alert” posture and fly compared to Canada Geese. Response of Brant to helicopters did not decrease with increasing altitude up to 610 m.	No recommendations	Ward and Stehn 1989
Fixed-wing (Cessna 185) and Helicopter (Bell 206 - B)	Snow Geese (flocks on Yukon-Alaska north slope in Sept)	Aircraft flying at 153 m and up to 7 km away caused some flocks to fly. Some geese flew when aircraft altitude was 2440 - 3050 m. Geese reacted slower but spent more time in flight from planes compared to helicopters. No difference in the distance that geese reacted to small and large planes. Geese usually flew greater distances for large planes than small.	No recommendations	Davis and Wiseley 1974
Fixed-wing < 615 m	Trumpeter Swans (nesting in Alaska)	Most swans showed “alert” posture but none left nest during normal aircraft overflights. Incubating females rapidly left nest on 2 occasions when plane circled nest at 60 m.	No recommendations	Henson and Grant 1991
Fixed-wing at 92 m	Waterfowl (flocks at the Mackenzie Delta in Sept)	American Wigeon and Northern Pintails showed “alert” posture and some flew.	No recommendations	Anonymous 1972
Float Plane (Cessna 185)	Waterfowl (Mackenzie valley, NT in Aug)	Birds without young generally flew. Almost all birds on one lake left after 4 days of disturbance. Broods generally swam away or dove if plane close.	No recommendations	Schweinsburg et al. 1974
Float Plane	Waterfowl (Norman Wells, NT in summer)	Scaup, Red-necked Grebes, and Arctic Loons showed little change in behaviour when planes landed at float base.	No recommendations	Schweinsburg et al. 1974

Aircraft Type	Species	Response	Recommended Altitude	Source
Helicopter	Pink-footed Geese and Barnacle Geese (moulting flocks in Greenland)	Some flocks reacted to helicopters 10 km or more away. Geese were more likely to react to large helicopters (Bell 212) than to small helicopters (Bell 206). Pink-footed Geese were more affected by helicopters than Barnacle Geese	No recommendations	Mosbech and Glahder 1991
Helicopter at 15 m	Lapland Longspurs and ptarmigan (nesting in Yukon)	More Lapland Longspur young fledged in undisturbed compared to disturbed areas. Ptarmigan flew in response to low-flying helicopters.	No recommendations	Gollop et al. 1974c

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