Update
COSEWIC STATUS REPORT
on
Peale's Peregrine Falcon
(*Falco peregrinus pealei*)

David A. Kirk and R. Wayne Nelson

Special Concern
1999

COSEWIC
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DANGERED WILDLIFE
IN CANADA

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Cover illustrations: Peale's Peregrine Falcon - C. Douglas, *Natural History Notebook Series 1*, Canadian Museum of Nature, Ottawa, ON.

Peale's Peregrine Falcon

Reason for status: Population is small and appears stable but is is vulnerable to threats that affect populations of seabirds upon which the peregrine feeds. [Designated rare (vulnerable) in 1978 and reconfirmed as vulnerable (special concern) in 1999.]

Occurrence: British Columbia

NOTES

COSEWIC status reports are working documents used in assigning status. Reports are released in their original form in the interest of making scientific information available to the public.

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COSEWIC

A committee of representatives from federal, provincial and private agencies that assigns national status to species at risk in Canada and the chairs of the scientific species specialist groups

COSEPAC

Un comité de représentants d'organismes féderaux, provinciaux et privés qui attribue un statut national aux espèces canadiennes en péril ainsi que des président(e)s des groupes des spécialistes scientifiques.

Update

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on

Peale's Peregrine Falcon

(*Falco peregrinus pealei*)

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Executive Summary

Description

A falcon is a crow-sized bird of prey with pointed wings and a long tail. A black "moustache" (black stripe below the eye) and bluish-grey or slate-coloured upper parts characterize both sexes. The underparts are white to buff with brown bars on the sides and thighs, and the abdomen is spotted. The Peale's Peregrine Falcon (*Falco peregrinus pealei*) is similar in appearance to the other two subspecies of falcon that occur in Canada, but it is larger and darker.

Distribution

In Canada, the Peale's Peregrine Falcon occurs only on the Queen Charlotte Islands, Triangle Island (a Gulf Island) and southeast Vancouver Island. In the United States, the subspecies also breeds in southern Alaska to the Aleutian Islands. The Peale's Peregrine Falcon may intergrade with the American Peregrine Falcon (*Falco peregrinus anatum*) subspecies in the Gulf Islands, where their ranges overlap.

Habitat

Peale's Peregrine is a coastal species that nests on ledges of island cliffs, usually near to colonies of small seabirds. Most hunting is done at sea within several kilometres of the nest.

General biology

Most peregrines begin breeding in their second year. Females lay from 2-5 eggs in a hollow scraped in the ground. The female is responsible for most of the incubation effort. During the incubation period and for the first few weeks after hatching, the male does most of the hunting for the female and the hatchlings. The young fledge about 35-40 days after hatching, but are still dependent on the parents for several more weeks. Unlike other subspecies of falcon, Peale's Peregrines are resident year-round, although there is some migration, especially by young birds, along the west coast of Canada and the United States.

Peale's Peregrines feed almost exclusively on burrowing seabirds. The average lifespan is 4-5 years, although individuals have been known to live much longer. Falcons in their first year have higher mortality than older falcons.

Population size and trends

Surveys in 1995 indicated 6 pairs on Langara Island (in the Queen Charlotte Islands), 45 pairs on the remainder of the Queen Charlotte Islands, 8 pairs on

Vancouver and Gulf Islands, and 4 pairs on the north mainland seabird islands. This is a total of 63 pairs.

Historical records are quite complete for the Langara Island population. There were 21-23 pairs of falcons in early-mid 1950s. This declined to only 6 pairs in the late 1960s, and has fluctuated from 5-9 pairs since that time. Surveys on NE Moresby Island (part of the Queen Charlotte Islands) indicated13-16 pairs in 1962, 15 pairs in 1968, and only 6, 10 and 8 pairs in 1975, 1980 and 1986, respectively.

In other peregrine populations, global declines were associated with the widespread use of organochloride pesticides, such as DDT, which peaked in the 1950s and early 1960s. However, unlike other falcons, monitoring of Peale's Peregrine Falcon populations on Langara Island indicated levels of DDT that were inadequate to cause declines. Declines that did occur appeared to be caused by reductions in seabird populations on the island. The Langara Island population appears to have been stable and healthy since 1968. Other populations in the Queen Charlotte Islands also may have been affected by reductions in seabird populations. The population on the Gulf Islands is relatively new (i.e., post-DDT) and appears to be increasing.

Limiting factors and threats

The main factor limiting this species is food supply (seabird populations). The population on Langara Island (currently seven pairs) has not reached historical levels (12-15 pairs in 1952), perhaps as a result of dramatically reduced seabird (Ancient Murrelet, *Snythliboramphus antiquus*) populations on the island. Recent attempts to eradicate seabird predators (especially introduced rats) on islands is expected to secure a food base for Peale's Peregrine.

Other possible or minor threats include oil spills, tourism and illegal removal of eggs or birds.

Existing protection

Removal of eggs, adults or destruction of active nest sites is prohibited by the Wildlife Act in British Columbia, and the subspecies also is protected from harvest for falconry. There is potential for a forest practices code that would prohibit logging of trees on cliffs directly above nest sites. Much of the habitat of falcons' prey base, the seabirds, is protected through a variety of parks, reserves and Crown land.

Evaluation and proposed status

Relatively few individuals of this subspecies exist. The subspecies is especially vulnerable as its main food source is limited to seabirds, and these populations can be

dramatically affected by introduced predators. Oil spills also could devastate seabird populations. For these reasons, it is recommended that the Peale's Peregrine Falcon be considered Vulnerable, as originally listed by COSEWIC.

Text by G. Schalk 1999

Résumé

Description

Un faucon est un oiseau de proie de la grosseur d'une corneille, qui a des ailes effilées et une longue queue. Une « moustache » noire (bande noire sous l'œil) et la couleur gris-bleuté ou ardoise des parties supérieures caractérisent les deux sexes. Les parties inférieures vont de blanc à chamois, les flancs et les cuisses portent des raies brunes et l'abdomen est tacheté. La sous-espèce *pealei* du Faucon pèlerin (*Falco peregrinus pealei*) est similaire en apparence aux deux autres sous-espèces de Faucons qui vivent au Canada, sauf que les individus sont plus gros et leurs couleurs, plus sombres.

Répartition

Au Canada, le Faucon pèlerin, *pealei*, ne se trouve que dans les îles de la Reine-Charlotte, l'île Triangle (une des îles Gulf) et dans le Sud-Est de l'île Vancouver. Aux États-Unis, cette sous-espèce niche également dans le Sud de l'Alaska jusqu'aux îles Aléoutiennes. Il est possible que le Faucon pèlerin, *pealei*, s'accouple au Faucon pèlerin, *anatum*, (*Falco peregrinus anatum)* dans les îles Gulf, où leurs aires de répartition se recoupent.

Habitat

Le Faucon pèlerin, *pealei*, est une espèce côtière qui niche sur les saillies des falaises des îles, en général près de colonies de petits oiseaux de mer. La plus grande partie de la chasse s'effectue en mer à plusieurs kilomètres du nid.

Biologie générale

La plupart des Faucons pèlerins commencent à s'accoupler au cours de leur deuxième année. Les femelles pondent de deux à cinq œufs dans un trou creusé dans le sol. La femelle se charge de la majeure partie de l'incubation. Pendant la période d'incubation et les premières semaines après l'éclosion, le mâle effectue la plus grande partie de la chasse pour la femelle et la couvée. Les jeunes prennent leur envol de 35 à 40 jours environ après l'éclosion des œufs, mais dépendent encore des parents pendant plusieurs semaines. À la différence des autres sous-espèces de Faucons, le Faucon pèlerin, *pealei*, reste sur place à l'année, bien que les jeunes oiseaux en particulier effectuent une certaine migration le long de la côte Ouest du Canada et des États-Unis.

La sous-espèce *pealei* se nourrit presque exclusivement d'oiseaux de mer fouisseurs. L'espérance de vie moyenne est de quatre à cinq ans, quoique certains individus puissent vivre beaucoup plus longtemps. Le taux de mortalité des Faucons est beaucoup plus élevé au cours de leur première année que par la suite.

Taille et tendances de la population

Des relevés effectués en 1995 indiquent qu'il y avait six couples sur l'île Langara (dans les îles de la Reine-Charlotte), 45 couples dans le reste des îles de la Reine-Charlotte, huit couples sur les îles Vancouver et Gulf et quatre couples dans les îles du Nord du continent, soit au total 63 couples.

Les documents historiques sont assez complets pour la population de l'île Langara. De 21 à 23 couples de Faucons s'y trouvaient au début, et pendant la première moitié, des années 1950. Il n'en restait que six à la fin des années 1960 et, depuis ce temps, le nombre de couples varie entre cinq et neuf. Des relevés dans le Nord-Est de l'île Moresby (dans les îles de la Reine-Charlotte) indiquent qu'il y avait de 13 à 16 couples en 1962, 15 couples en 1968 et six, dix et huit couples seulement en 1975, en 1980 et en 1986 respectivement.

En ce qui concerne d'autres populations de Faucons pèlerins, les diminutions globales ont été associées à l'utilisation répandue de pesticides organochlorés, comme le DDT, qui a atteint un sommet dans les années 1950 et au début des années 1960. Cependant, le suivi de la population de Faucons pèlerins, *pealeis*, de l'île Langara indique que, au contraire, de ce qui s'est produit pour les autres Faucons, le niveau de DDT n'était pas suffisant pour entraîner le déclin de la population. Ce dernier semble avoir été causé par la réduction du nombre d'oiseaux de mer sur l'île. La population de l'île Langara semble être stable et saine depuis 1968. D'autres populations dans les îles de la Reine-Charlotte ont peut-être également été touchées par la réduction des populations d'oiseaux de mer. La population des îles Gulf est relativement récente (c.-à-d. antérieure au DDT) et semble augmenter.

Facteurs limitants et menaces

Le principal facteur limitant cette espèce est l'approvisionnement alimentaire (populations d'oiseaux de mer). La population de l'île Langara (actuellement sept couples) n'a pas atteint le niveau historique (de 12 à 15 couples en 1952), peut-être en raison de la diminution spectaculaire des populations d'oiseaux de mer sur l'île (Guillemot à cou blanc, *Synthliboramphus antiquus*). Des tentatives récentes d'éradication des prédateurs des oiseaux de mer (surtout des rats qui ont été introduits dans les îles) devraient assurer la base alimentaire du Faucon pèlerin, *pealei*.

Parmi les autres menaces possibles ou mineures, il y a le déversement d'hydrocarbures, le tourisme et l'enlèvement illégal des œufs ou des oiseaux.

Protection actuelle

L'enlèvement des œufs, la capture ou la prise des adultes, ou la destruction de sites de nidification utilisés sont interdits par la *Wildlife Act* de la Colombie-Britannique, et la sous-espèce est également protégée contre la prise pour servir à la fauconnerie. Il pourrait exister un code des pratiques forestières qui interdirait l'abattage d'arbres se

trouvant sur les falaises directement au-dessus des sites de nidification. Une grande partie de l'habitat des oiseaux de mer, les proies des Faucons, est protégée par divers parcs et diverses réserves et terres publiques.

Évaluation et statut proposé

Il existe relativement peu d'individus de cette sous-espèce. Cette sous-espèce est particulièrement vulnérable étant donné que les oiseaux de mer constituent sa source d'alimentation principale et que les populations de ces oiseaux peuvent être grandement affectées par des prédateurs introduits. Des déversements d'hydrocarbures pourraient aussi les détruire. Pour ces raisons, il est recommandé que le Faucon pèlerin, *pealei*, soit considéré comme une espèce préoccupante (anciennement « vulnérable », comme l'indique au départ la liste du COSEPAC.

Texte rédigé par G. Schalk, 1999

Introduction

Adult Peale's Peregrine Falcons *Falco peregrinus pealei* are resident year-round in much of their range, unlike the other two subspecies of Peregrine Falcon in Canada: the American Peregrine Falcon *F. p. anatum* and Tundra Peregrine Falcon *F. p. tundrius*. However, there is some migration, especially of young birds, along the west coast of Canada and the United States. Its largely sedentary nature and almost exclusive reliance on seabirds as prey may explain why this subspecies was less affected by contaminants during the "Peregrine crash" in North America during the 1950s to 1970s.

Despite several studies and a number of surveys during the last 45 years in the centre of their Canadian range, the Queen Charlotte Islands (QCI), it is not clear when and to what extent this sizeable population has changed, nor what factors were important in causing changes. An isolated tiny number of pairs inhabit some small northern mainland seabird islands, a small population resides around northern Vancouver Island, and a small population (possibly an intergrade with *F. p. anatum*) has arisen on the British Columbia Gulf Islands since 1970.

As a result of its small population and possible susceptibility to contaminants, the Peale's Peregrine Falcon was considered vulnerable by COSEWIC in 1978 (Martin 1979).

Distribution

In Canada Peale's Peregrine Falcon occurs only in British Columbia, on the Queen Charlotte Islands, Triangle Island, and south-east Vancouver island (Figure 1). In the United States, the subspecies also breeds in southern Alaska from the Aleutian Islands south to the Queen Charlotte Islands in British Columbia. The *anatum* Peregrine subspecies is found on the coastal mainland as well as north and south Vancouver Island, so there are some complications in counting Peale's Peregrines during the 5-yearly Peregrine surveys. There may be some intergrading of the subspecies in the Gulf Islands. The provincial Conservation Data Centre rank for Peale's Peregrine is S3, meaning that it is rare or uncommon in the province, with 21-100 occurrences (S. Cannings pers. comm.).

Habitat

Peale's Peregrines nest on ledges on island cliffs, usually near to colonies of small seabirds. Most hunting is done at sea within several kilometres of the nest. A very small number of nests have been found in trees, four in Bald Eagle nests, and probably two in holes in large tree trunks on islands of the northern B.C. coast (Campbell *et al.* 1977), one in a Bald Eagle nest on the QCI (R. W. Campbell pers. comm.), and one on the Gulf Islands (R. W. Campbell pers. comm.).

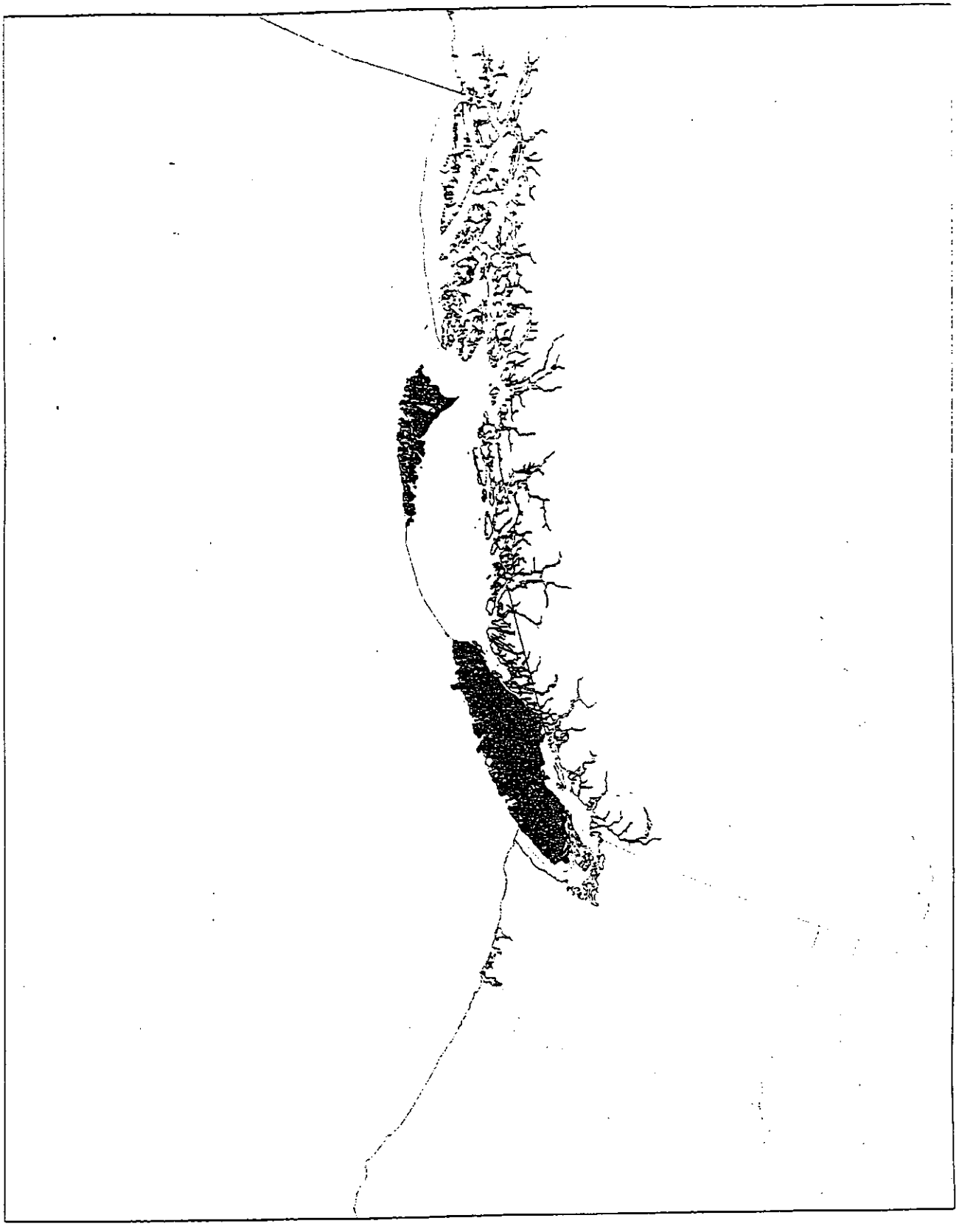

Figure 1. Distribution of Peale's Peregrine Falcon in British Columbia.
Area of occupancy: 42,228 sq km.
Extent of occurrence: 52,169 sq km.

Trends in habitat - logging and other land use changes

In the immediate vicinity of a falcon nesting cliff, late winter, spring, or summer logging may disrupt the breeding effort for that one year. Where logging damages the falcons' prey base, as by cutting the forest over a nocturnal burrowing seabird colony, loss of that prey population may be complete for a century or more until appropriate canopy and understory structure arises again. Although apparently unstudied, such displaced seabirds may be able to shift to nearby unused habitat or to other colony areas. The affected falcon cliff may nevertheless be unoccupied for a very long time as a result of the logging through a seabird colony. Other land use changes may affect individual nest sites, but much less extensively than might logging.

Population Numbers, Size and Trends

During the 1995 Peregrine Falcon survey (M. Chutter pers. comm.), occupied sites (pairs) were: Langara Island 8 (6), Queen Charlotte Islands (minus Langara) 65 (45), North mainland seabird islands 4 (4), and Vancouver and Gulf Islands 17 (8). This gives a grand total of 91 occupied sites (63 pairs).

There are two recent estimates for numbers of Peale's Peregrines in Alaska. Ambrose *et al.* (1988) estimated 600 pairs, composed roughly of 300 pairs in the Aleutians, 69 recorded on the Alaska Peninsula and Kodiak Island, and probably more than 140 (91 reported) pairs from the Kenai Peninsula to Southeast Alaska (Ambrose *et al.* 1988). Schempf (1989) estimated 500 pairs and noted that there are no long-term productivity or population data, so it was not possible to estimate trends.

It has recently been suggested that the QCI Peale's Peregrine Falcon population, or a part of it, declined as a result of DDE eggshell thinning (Noble and Elliott 1990, Noble *et al.* 1993, Peakall *et al.* 1990, Gaston 1992, 1994a). However, in fact, DDE levels and the degree of eggshell thinning in the QCI Peregrines was near, but not at or beyond, the levels at which population decline would have occurred. Most of the data are from Langara Island at the Northwest corner of the QCI.

Impact of biocides

Peregrine populations show declines when average DDE egg levels reach 15-20 mg/kg (ppm)(wet weight) and average egg shell-thinning reaches 17% (Fyfe *et al.* 1988, Peakall and Kiff 1988, Peakall *et al.* 1990). Population recovery is associated with mean DDE levels no greater than 15 ppm, mean shell thinning no more than 15-20% below normal, and productivity exceeding 0.6 young per territorial pair (Newton *et al.* 1989).

DDE levels

Twelve eggs collected from Peale's Peregrines on Langara Island (1965-1972) contained a mean level of 7.84 mg/kg DDE (Noble and Elliott 1990, Noble *et al.* 1993), about half of the mean level of 15-20 mg/kg at which populations decline. Moreover, four eggs from Langara in 1986 contained somewhat lower DDE levels (Noble *et al.* 1993).

Shell-thinning and breakage

Anderson and Hickey (1972) did not record significant shell-thinning in eggs taken from Langara Island between 1947-1953 (D. W. Anderson pers. comm. to Nelson) Of the twelve Langara eggs collected in 1965-1972, four were collected in 1965 and 1967 and DDE levels ranged from 2.24 to 7.28 mg/kg DDE (Noble *et al.* 1993); those levels were lower than seven of the eight remaining eggs, collected in 1968-1972. That is, the highest DDE levels were apparently reached during 1968-1972. Egg-shell thickness indices during the latter period averaged 12.6% (range 4.2-19.9%) less than pre-DDE *pealei* eggs (Nelson 1990). This level of shell-thinning was below the average of 17% at which populations begin to decline. Furthermore, during 1968-1972, 12 Langara clutches were observed for all or part of the incubation phase, and single eggs disappeared from only four nests (Nelson 1976), with minimal effect on reproductive output (Nelson and Myres 1976).

Productivity and adult survival

During 1952-1958 productivity at Langara Island was 2.4 young per successful pair and 1.95 young per territorial pair, whereas during 1968-1973 it was 2.35 young per successful pair and 1.49 young territorial pair (Beebe 1960, Nelson and Myres 1976). In 1962, productivity in the NE Moresby Island area (mid-lower east side of the QCI) was 1.78 nestlings per successful pair that was visited (16 young in nine nests; uncounted young in three nests, and another pair with no nest located) (Beebe 1963). Thus, throughout the DDE era reproductive output on the QCI appears to have been adequate to maintain the population.

Adult male mortality was significantly lower during 1968-1974 (when DDE levels were higher) than during 1980-1985 (female mortality and combined mortality did not show a significant difference between the time periods); this resulted from the effect of brood size: smaller broods in the earlier period resulted in lower adult male mortality before the next breeding season (Nelson 1988).

In conclusion, several lines of evidence show that the Langara Island falcons, and probably the falcons elsewhere on the QCI, were brought close to, but not past, the point at which DDE-induced egg breakage causes a decline in the falcon population.

Therefore, the declines observed in some subpopulations on the QCI had other causes.

Population Changes at Langara Island, QCI

In the QCI, the only long-term study of Peale's Peregrine Falcons is at Langara Island. Therefore we describe the situation at Langara Island in some detail. As noted above, biocides did not cause major problems for the falcons, and productivity remained adequate or good during the DDE era. However, a drastic decline in their seabird food supply apparently caused the breeding population of falcons to decline dramatically. However, between 1968-1996 the falcon decline and seabird decline were not in close parallel, and the cause of the seabird decline - widescale or local? - has been a matter of disagreement in the literature.

Anecdotal, unquantified reports of large numbers of nesting falcons and seabirds at Langara Island are sprinkled through the literature back to 1916. The island is about 6 km wide and 9 km long, but in the early-mid 1950s the island held at least 21-23 pairs (Beebe 1960, Nelson and Myres 1976). In 1958 about one-quarter of the breeding pairs suddenly disappeared, and further decline occurred during the early-mid 1960s, so that about six pairs remained in the late 1960s. Except for three years which were covered by B.C. Wildlife Branch, Nelson visited the Langara falcons annually from 1968 to 1996 (and continuing). In 1968-1996 the number of pairs of falcons at Langara fluctuated between 5 and 9 pairs, usually 6 or 7 (Nelson and Myres 1976, Nelson 1990, and pers. observ.)

The Ancient Murrelet (*Synthliboramphus antiquus*) was and is the primary prey species of the Langara falcons (Beebe 1960, Nelson pers. obsn.). In the 1950s and earlier its numbers at Langara were estimated at 200,000 pairs (Gaston 1994b) and may have been 250,000 to one-half million pairs (Nelson 1990). By 1971 the population was estimated at 80-90,000 pairs by S. G. Sealy (*in* Vermeer *et al.* 1984), and it had dropped to 22-24,000 in surveys in 1981 and 1988 (Rodway *et al.* 1983, Bertram 1989, 1995), and 15,000 in 1993 (Harfenist 1994). Bertram (1989, 1995) and Harfenist (1994) provided convincing evidence that introduced rats (*Rattus norvegicus*) were killing large numbers of murrelets in the nesting colonies, and concluded that rats were the primary cause of the murrelet decline at Langara.

The year 1958 may have been a triggering year for the seabird and falcon declines. Also in 1958-1959, the number of nests of Glaucous-winged Gulls (*Larus glaucescens*) and Pelagic Cormorants (*Phalacrocorax pelagicus*) at the colonies near Langara Lightstation suddenly dropped to 1/2 or 1/3 of their 1957 numbers (Drent and Guiguet 1961). Those colonies remained at roughly those reduced numbers through the 1980s (Nelson 1990, Rodway *et al.* 1994). They further dwindled in the first half of

the 1990s. It is not easily conceivable that rat predation could have been responsible for the gull and cormorant population declines, especially on the cormorants' sheer nesting cliffs (Nelson pers. obs.).

The sudden drop in the number of pairs of falcons in 1958 suggests that a large drop in nesting Ancient Murrelets suddenly occurred at that time, in parallel with the drop in number of gulls and cormorants nesting at Langara Lightstation in 1958-59. These sudden changes may have occurred as a result of the anomalous intrusion of warm water onto the B.C. coast in 1957-58 that increased water temperatures 1-2°C, brought lower densities and smaller species of zooplankton, resulted in smaller adult pink salmon (*Oncorhynchus gorbuscha*), and caused unusual movements of salmon, whales, and other species (Tully *et al.* 1960, Fulton and LeBrasseur 1985, Peterman 1987, Nelson and Myres 1976). The maintenance of reduced numbers at the Langara Lightstation gull and cormorant colonies suggests that they were affected by the generally warmer waters that persisted off the B.C. coast through 1971 (Nelson and Myres 1976). However, through the 1970s and 1980s the ocean along the B.C. coast again warmed considerably (Freeland 1990).

Nelson (1990) suggested the warmer waters near Langara (and the QCI) may have caused changes in the ocean food chain that resulted in long-term reductions in seabird numbers, and falcon numbers. Gaston (1992:35) concluded that oceanographic changes were not involved in changes in Ancient Murrelet numbers. Bertram (1995), discussed the decline of the Langara murrelets, and, using zooplankton data from Ocean Station P in the central northeastern Pacific Ocean for 1956-1980, he argued that there was no consistent decline in plankton production from 1957 to 1971 or to 1980. However, Peterman (1987) noted that the 1957-1958 intrusion of warm water along the B.C. coast did not extend out to Ocean Station P and that Ocean Station P recorded no decline of zooplankton in that year.

However, the 1957 year class of pink salmon was unusually small relative to the zooplankton biomass at "P" that year - and Peterman hypothesized that the young salmon were poorly nourished that year as they travelled from the mouth of the Fraser River out through the intrusion of warm water. Also of interest is Ware and Thomson's (1991) analysis showing a reduction in upwelling-stimulating winds along the California coast (i.e. a reduction in deep-water nutrients brought near the surface) and a parallel reduction in fish biomass during this century. And Roemmich and McGowan (1995) reported that from 1951 to 1993 the biomass of macrozooplankton off southern California decreased by 80%, apparently caused by warmer surface waters and reduced upwelling of deepwater nutrients. No comparable analysis appears to have been done for zooplankton or fish abundance for the B.C. coast, but Freeland's (1990) evidence for warming of B.C. coast waters suggests that a reduction of productivity should be expected there.

In the early years the tremendous numbers of murrelets may have swamped the introduced rat population, but an ocean-change reduction in the murrelet population may have reduced it to a size that could be brought into decline by rat predation (Nelson 1990). Alternatively, the rat population may have been building, and causing increased impact on the murrelet population, at the same time that the seabird populations were suddenly dropped in 1958-59. Bertram (1995) described two additional pressures on the murrelet population in the 1950s and early-mid 1960s. In the early 1950s the May-June number of fishing vessels in the Langara area rose markedly, and remained high into the mid-1960s. Attraction of murrelets to lights on anchored fishing boats resulted in substantial mortality. From 1956 to 1961 a small number of gillnetting fishing boats were present, but a large number were present in 1962-1964. Gillnets were reported to kill numbers of murrelets, and this occurred at least into the early 1970s. While both of these mortality factors probably were substantial, the present knowledge does not allow a determination of the scale of that mortality nor its exact timing, and there appears to be no clear relationship between the fishing activities and the documented sudden changes in 1958-59 in the numbers of nesting falcons, gulls, and cormorants.

From the above it will be noted that the Langara falcon population did not decline exactly in parallel with the murrelet population. With 200,000+ pairs of murrelets in the 1950s there were 21-23 pairs of falcons. By 1971, when the murrelet population was estimated at 80-90,000 pairs, the island held six pairs of falcons. However, in 1981 and 1988 the murrelet population was surveyed at 22-24,000 pairs, but there were still 6 and 7 pairs of falcons respectively. And in 1993, with the murrelet colony at only 15,000 pairs, the island held 8 pairs of falcons. (In 1994 there were 7 pairs and possibly an 8th, in 1995 6 pairs and two territorial singles, and in 1996 9 pairs: Nelson pers. obsn). Nelson (1990) suggested that from about the mid-1960s onward the Langara falcons were feeding substantially on murrelets commuting over the ocean, largely from the Frederick Island and Forrester Island colonies 33 km and 65 km away, respectively, and the further decline of the Langara murrelets therefore did not cause the number of falcons to diminish further. The situation may resemble that of the 16-22 pairs of falcons at Amchitka Island (Aleutians) which had no local nesting seabird prey for the falcons but the nesting falcons subsisted largely on commuting seabirds (plus some landbirds) (White 1975). Nelson suggested that 5-7 pairs of falcons might be sustained at Langara if the Langara murrelet colony disappeared entirely but the Frederick and Forrester colonies continued to thrive. Other factors, such as the distribution of the commuting murrelets, and their availability to the Langara falcons, appear to be important in causing the year-to-year changes in the sizes of the falcons' territories and therefore in the numbers of the resident pairs on the island.

An immense experiment was conducted in 1995-1997 when the Canadian Wildlife Service (CWS) carried out a massive, difficult, rat poisoning campaign on Langara, with the intention of totally removing the rat population and allowing the

murrelet, other small seabird, and falcon populations to rebuild (Harfenist 1994, Rodway *et al.* 1994, Gary Kaiser pers. comm.). Assuming that the poisoning program is successful, and that rats can be prevented from re-invading Langara, from Nelson's model of the Langara system as outlined above it is hypothesized that the murrelet and falcon populations will rebuild substantially but will reach saturation - a balance with ocean productivity - at populations markedly less than were found in the early 1950s and earlier; only if the ocean productivity improved considerably would the murrelet, falcon, gull, and cormorant numbers return to the abundances seen in those earlier years. There appears to be no data on how swiftly an Ancient Murrelet or other small alcid population can rebuild when freed from a major limiting or decimating factor. If the murrelet population were able to increase at the rate that depressed Atlantic Puffin (*Fratercula arctica*) populations have done, a calculated maximum rate of increase of about 7% was greatly surpassed at one colony because of immigration from colonies about 100 km away, with an overall increase of 22% per year through the 1970s (Harris 1984). For Ancient Murrelets at Langara Island, increasing at 7% per year means doubling every 10 years, which could mean four decades before the murrelet population reached saturation. This population recovery probably would be hastened by some colonisation from nearby colonies.

Population Changes Elsewhere

QCI - NE Moresby Island

On the QCI the only other area that provides relatively early data is NE Moresby Island, but for this area the data do not extend back to or beyond the 1957-58 ocean temperature anomaly to provide hints as to its effect here. The area extends from Cumshewa Inlet to Juan Perez Sound. It was first surveyed, relatively quickly, in 1962, when 13 pairs were found; later surveys suggested that a full survey in 1962 would have located at least 16 pairs (Nelson unpublished data). In 1968, 15 pairs were found, however in the QCI surveys in 1975, 1980, and 1986, the numbers of pairs were 6, 10, and 8 respectively (B.C. Wildlife Branch survey data).

Gaston (1994) and Bertram and Nagorsen (1995) have discussed the considerable damage known to have been done by introduced rats and introduced raccoons (*Procyon lotor*) to Ancient Murrelet and other burrowing seabird colonies on the QCI. A number of affected colonies are in the NE Moresby area, and elimination or reduction of some seabird colonies there may have caused the reduction of that falcon subpopulation.

Gulf Islands

The Gulf Islands have harboured an increasing population of falcons in the 1980s-1990s that appears to be entirely new, i.e. not present pre-DDE. This population has built to 11 pairs (R. W. Campbell pers. comm. to Nelson) in 1995. The adjacent San Juan Islands has a similar sized population that has built since the early 1980s (sDeBruyn and Knapp 1996, and P. DeBruyn pers. comm. to Nelson). These

falcons are relatively dark-headed and relatively rosy-breasted (P. DeBruyn pers. comm.), characteristics that suggest a strong *anatum* influence.

Limiting Factors

Food supply

Peregrine Falcons are only as secure as their food supply, and for Peale's Peregrines on northern Vancouver Island and the Queen Charlotte Islands, their existence is entirely dependent on the presence of large numbers of nocturnal burrowing seabirds. Ultimately the Peale's subspecies of Peregrine in Canada depends on healthy populations of small, nocturnal burrowing seabirds. The seabird populations, and the falcon populations, will benefit by regular monitoring of the seabird populations, protection of their nesting habitat, protection of the seabirds' food supplies from exploitation or mismanagement, and vigilance for and vigorous control of introduced mammalian predators that can devastate seabird nesting colonies.

Introduced land predators

Gaston (1994), Harfenist (1994), Bertram (1995), and Hartman *et al.* (1997) have described the devastating effects of introduced rats and raccoons on colonies of nocturnal burrowing seabirds on the Queen Charlotte Islands. The recent poisoning program for rats conducted on Langara Island, although very labour intensive and expensive, holds some hope that this technique may be used to reverse declines in still-existing seabird colonies and to reclaim some islands that had historic seabird colonies apparently eradicated by rat predation. The ability of raccoons to swim a kilometre or more to reach seabird nesting islands (Hartman *et al.* 1997) points to even greater challenges to keep these predators from reaching and eradicating more seabird colonies. Continuing vigorous efforts must be maintained against these two extremely destructive predators of seabirds.

Oil on the ocean

The ocean currents that trend northward close to the B.C. coast year-round pose a continuing threat to the seabirds and the falcons that rely upon them. Oil spills off the Oregon, Washington, and B.C. coasts may be moved northward through ocean conditions that prevent all cleanup efforts, sweeping thousands of square kilometres of ocean surface en route to and past the coastlines of Vancouver Island and the Queen Charlotte Islands. One well-placed shipping accident could be devastating for B.C. seabirds and coastal-nesting falcons. Offshore oil development poses similar long-term concerns. Nettleship (1998) notes the immensity of seabird mortality from the chronic spillage off the Atlantic coast of Canada, a scene that potentially may unfold on the Pacific coast if sufficient safeguards and care are not implemented.

Tourism

Increases in tourism are not anticipated to create significant problems for Peale's Peregrine Falcons. Isolated incidents may occur when birders, ecotourists, photographers, picnickers, and others may spend too much time near a falcon nest and cause the chilling or overheating of eggs or nestlings or the starvation of nestlings.

Poaching

A number of factors strongly dissuade the illegal removal from the wild of falcons or their eggs, including: the unavailability of Peregrines from the wild in North America; the North American use of seamless bands (that must be slipped on over the foot before 12 days of age) for individual recognition of captive bred Peregrines; the CITES requirement that only F2 or greater captive bred offspring of Peregrines can be exported internationally; the advent of DNA parentage testing in Peregrines (Longmire *et al.* 1988); the heavy penalties that can be applied for poaching and transportation of illegally taken falcons; the relatively common availability of captive bred Peregrines; the relatively low price (about one to three thousand dollars) for captive bred Peale's Peregrines; and the vigilance and vested interest of falconers and falcon breeders. At worst, poaching will be rare, localised, extremely risky, and of no consequence to overall populations.

Special Significance of the Species

The *pealei* subspecies is restricted to North America. It is an indicator of the status of seabird populations in the Pacific as well as an environmental indicator of the health of the marine environment (pesticide contamination).

Protection

The subspecies is on the blue list in British Columbia and therefore it is not permitted to harvest it for falconry (M. Chutter pers. comm.). Section 34 of the Wildlife Act in British Columbia prohibits the taking of eggs, adults or the destruction of active nest sites. There is potential for a forest practices code that would prohibit logging of trees on cliffs directly above nest sites.

Various measures of protection have been afforded most of the important seabird colonies on the B.C. coast upon which Peregrines rely. Ecological Reserves, a large National Park Reserve, Wildlife Protection Areas, and general Crown land protection measures provide environmental protection criteria that should be adequate to protect the food supply and nest cliffs of almost all the falcons on the B.C. coast, except for those on the Gulf Islands that nest on private land and feed primarily on land birds.

Evaluation and Proposed Status

Relatively permanent changes in the ocean beginning in the late 1950s may have reduced both seabird populations and Peale's Peregrine Falcon populations on the Queen Charlotte Islands. Documentation of numbers prior to 1960 is available only for Langara Island. On the B.C. coast, in the 1960s and 1970s Peregrines experienced some DDE-induced eggshell thinning and egg breakage, but the Queen Charlotte Islands population did not experience widescale egg loss, breeding failure, and population decline. Since 1960 some local, apparently permanent, losses of falcon pairs have occurred in parts of the Queen Charlotte Islands that appear to have suffered losses of seabird colonies as a result of rat and/or racoon predation. Logging may have caused some relatively permanent loss of seabird nesting habitat. Removal of rats and raccoons may allow re-colonisation of some presently vacant seabird nesting islands, and may result in reoccupation of some vacant falcon nest cliffs.

In general, the Queen Charlotte Islands and northern Vancouver Island populations of Peale's Peregrines appear to be in balance with their seabird prey and are relatively stable. The threats to the seabird prey, and therefore the falcons, posed by introduced mammalian predators and by oil spills necessitate action on two fronts: (1) to monitor and protect seabird colonies from introduced predators and remove these predators from historic abandoned colonies, and (2) to minimise as far as possible the chances of shipping accidents and oil spills that might wash into seabird-inhabited waters. Given these two threats to the Peale's Peregrine Falcon we recommend that the subspecies still be considered 'vulnerable' as originally listed by COSEWIC (Martin 1978).

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Biographical Summary of Author(s)

David A. Kirk obtained his Masters degree in conservation from University College London in England in 1983 and his Ph. D. in zoology from the University of Glasgow (Scotland) in 1989. He has 16 years experience as a research ecologist designing and conducting fieldwork and scientific writing. He has a special interest in applied ecological research and has worked the last nine years as a consulting research ecologist. He has provided recommendations on forest management or farmland management to enhance and conserve wildlife, especially birds. More specifically, he has a long-standing interest in raptor conservation and management and for nine years he re-habilitated raptors to the wild that were orphaned or were incapacitated (1969-1978).

R. Wayne Nelson completed his Ph.D. on Peale's Peregrines in 1977 and prepared a report on the species' status on Langara Island, B.C. in 1990.

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Table 1. Total number of occupied Peale's Peregrine Falcon nests found on coastline of British Columbia from 1965-66 to 1995. Number in parenthesis shows number of pairs present.

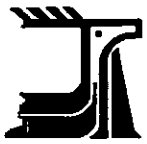
Area	1965-66	1970	1975	1980	1985-86	1990	1995
Langara Island	9 (6)	6 (5)	6 (6)	6 (6)	6 (5)	7 (7)	8 (6)
Queen Charlotte Islands	76 (55)	56 (46)	60 (51)	73 (58)	50 (ND)	64 (53)	65 (45)
Vancouver and Gulf Islands	ND	ND	ND	5 (4)	13 (10)[c]	18 (7)[d]	17 (8)[d]

[a] First number is an estimate of occupied sites which includes pairs, singles defending/attached to sites plus, except in 1965-66, an extrapolation to unsurveyed areas based on results of other surveys. A correction for detection error is not included.
[b] Only Gulf Islands data
[c] Includes one site from Triangle Island (not surveyed)
[d] Excludes Triangle Island. Triangle Island in 1989 had 7 occupied territories.

Table 2. Productivity of Peale's Peregrine Falcons breeding on coast of British Columbia on 5-yearly surveys from 1970-1990. Numbers are average young per successful pair (average young per territorial pair in parenthesis).

Area	1970	1975	1980	1985-86	1990	1995
Langara Island	2.2 (2.2)	2.4 (2.0)	2.2 (2.2)	2.0 (1.6)	2.8 (2.0)	2.0 (1.7)
Queen Charlotte Islands	2.5[a] (ND[b])	3.2[c] (ND)	2.5 (2.1)	ND	ND	ND
Vancouver and Gulf Islands	ND	ND	ND	ND	ND	ND

[a] Young per 11 successful pairs (Munro and Van Drimmelen 1988)
[b] ND = not determined
[c] Young plus 2 pipping eggs per 5 successful pairs (Munro and Van Drimmelen 1988)



MANDATE

COSEWIC determines the national status of wild species, subspecies, varieties and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following groups: fish, amphibians, reptiles, birds, mammals, molluscs, lepidoptera, vascular plants, mosses and lichens.

MEMBERSHIP

COSEWIC is comprised of representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Fisheries and Oceans Canada, and the Federal Biosystematic Partnership), three national conservation organizations (Canadian Nature Federation, Canadian Wildlife Federation, and World Wildlife Fund Canada) and the chairs of the scientific species specialist groups. The Committee meets twice a year to consider status reports on candidate species.

DEFINITIONS

Wildlife Species	- A species, subspecies, variety or biographically distinct population of animal, plant or other organism, other than a bacteria or virus, that is wild by nature and (a) is native to Canada; or (b) has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Species at Risk	- An extirpated, endangered or threatened species or a species of special concern.
Extinct (X)	- A wildlife species that no longer exists.
Extirpated (XT)	- A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.
Endangered (E)	- A wildlife species that is facing imminent extirpation or extinction.
Threatened (T)	- A wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
Special Concern* (SC)	- A wildlife species that is of special concern because it is particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species.
Not at Risk (NAR)**	- A species that has been evaluated and found to be not at risk.
Data Deficient* (DD)**	-A species for which there is insufficient scientific information to support a status designation.

* Formerly described as "vulnerable" from 1990 to 1999, or "rare" prior to 1990.
** Formerly described as "Not in any category", or "no designation required".
***Formerly described as "indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. COSEWIC meets annually in April each year. Species designated at this meeting are added to the list.

Environment Canada
Canadian Wildlife Service

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.