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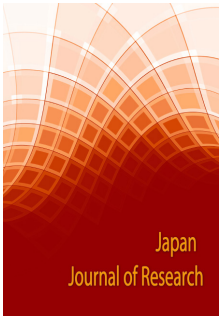

Caching, Cannibalism and Carrion-Feeding: A Review of Multiple Opportunistic Feeding Strategies Employed by Owls in Their Survival

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Abstract

Opportunistic feeding strategies, including cannibalism, carrion-eating, food hoarding, food sharing, and kleptoparasitism, are all important aspects of predator ecology. Food caching behaviour in owls has evolved to reduce the risk of starvation. Cannibalism in owls comprises five forms: siblicide, filicide, non-parental infanticide, conspecific strife, and conspecific scavenging. Scavenging is a behaviour in which animals consume carrion, sometimes via kleptoparasitism, whereby an individual actively steals procured food. Food sharing among siblings is a very little-known interaction among owl nestlings.

In this review, we document 21 owl species recorded as engaging in cannibalism, 25 known to scavenge carrion, 30 reported to practise food caching of excess food, and 8 species that have been observed engaging in kleptoparasitism to gain or lose captured prey.

Thus far, many of our observations are based on second-hand information derived from pellet analysis and occasional nest and field visits. A more comprehensive understanding of opportunistic feeding behaviours is required to assess their prevalence and to accurately interpret dietary data from previous studies. Modern nest filming using camera trap systems should help determine how frequently these opportunistic feeding strategies occur and under what circumstances they are used in the wild.

Introduction

Caching, cannibalism, carrion-eating, food sharing, and kleptoparasitism are all important aspects of predator ecology. Unfortunately, these opportunistic feeding behaviours are often misunderstood and sometimes even sensationalised, leading to hatred and dislike towards birds of prey. This overlooks the fact that owls and other raptors kill solely to feed themselves and their offspring. Owls do not kill wantonly or for pleasure, but only out of necessity [1].

Caching prey for later consumption has been reported in numerous owl species. Collins [2] was the first to clearly distinguish caching from the more frequently recorded stockpiling of food items at nest sites. Kaufman [3] had already used the term *stockpiling* appropriately in reference to the American Barn Owl *Tyto furcata*. Subsequently, various authors have introduced additional terminology for food-hoarding behaviour.

Some owls engage in either larder-hoarding—the accumulation of stored food in a single location—or scatter-hoarding, in which small quantities of food are hidden across multiple sites. The strategy employed appears to depend on factors such as prey type, availability of suitable hiding places, and the risk of pilferage by conspecifics or heterospecifics [4-7].

In this paper caching refers to the careful concealment of individual food items, generally in separate locations, for subsequent retrieval. This is an adaptive feeding strategy used both by nesting and non-nesting owls, which store food for periods of scarcity during breeding or winter. When hunting conditions are favourable and prey is abundant, owls may cache surplus food in a secure hiding place [8]. On occasion, food caching and stockpiling of prey are difficult to distinguish and define separately; however, in this paper we have attempted to differentiate between them. Both food caching and stockpiling can occur in captivity, but the latter is rare in the wild during winter.

Owls do not lay their eggs all at once or at regular intervals; instead, one to four or more days often elapse between successive eggs. Unlike many other birds, they do not delay the onset of active incubation until the clutch is complete. This results in pronounced differences in hatching times, a phenomenon known as asynchronous hatching. Consequently, nestlings vary markedly in age and size.

The first-hatched owlets are typically the strongest and most vigorous in begging and

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competing for food delivered by the parents. This leads to dominance by the oldest nestlings over their younger siblings, which may receive only leftovers—or nothing at all—until the dominant individuals are satiated. Only under favourable food conditions do the youngest nestlings have a realistic chance of survival.

If the youngest individual becomes too weak to defend itself or dies of starvation, it is often eaten by the larger siblings or fed to them by the parent owls. Some well-known researchers have been reluctant to acknowledge that this unsavoury behaviour occurs and have avoided studying or reporting cannibalism so as not to portray these well-loved birds in an unfavourable light [9].

Cannibalism occurs throughout the animal kingdom but remains a relatively little-known strategy for food acquisition [10]. In raptors, cannibalism comprises five forms. Siblicide is the killing and consumption of one sibling by another, either directly or indirectly through the deprivation of food of the younger, smaller sibling; it is therefore a form of competition linked to brood reduction. Filicide is the killing of nestlings by parents, who then consume the nestling or feed it to other young; typically, individuals unlikely to survive are selected. Non-parental infanticide refers to the killing and consumption of dependent young by conspecifics other than the parents. In birds, this type of predation is most common at nests.

To complicate matters, many papers use the term *kronism*, derived from Greek mythology, to describe the killing and consumption of offspring. However, the analogy is imperfect, as the mythological victims did not die but were eventually vomited by Kronos and later killed him.

Conspecific strife, in which birds engage in aggressive encounters and occasionally kill adult competitors, may also result in cannibalism if the victor consumes the individual it has killed. This behaviour is often interpreted as a means of increasing fitness and survival by improving nutrition while simultaneously reducing competition (for example, the killing of a sibling reduces immediate competition for food delivered by the parents). However, describing it simply as an in-built population regulator during periods of food scarcity oversimplifies the phenomenon and overlooks its broader ecological implications. Without web-cam recordings, it is not possible to verify most observations of cannibalism that are based solely on pellet analysis.

Carrion-eating among owls has been documented in only a limited number of species and is usually reported without much detail [11]. Failure to recognise scavenging as a feeding behaviour constrains our understanding of key ecological processes and trophic relationships [12,13]. For example, Hassler et al. [14] reported Barred Owls *Strix varia* preying on Eastern Spotted Skunks *Spilogale putorius* based on the recovery of a GPS collar and DNA evidence from pellets. However, pellet analysis alone cannot distinguish between prey that was hunted and food that was scavenged.

Food sharing among siblings is a very little-known interaction among owl nestlings, and only a few cases have been documented and discussed.

Food theft between animals is termed kleptoparasitism. Although uncommon in owls, it does occur. A few documented cases of kleptoparasitism and food piracy are presented in this review.

Caching of Food

Food caching is an adaptive strategy in owls. In two earlier reviews, Lyons & Mosher [15] and Korpimäki [16] listed, without distinguishing between caching and stockpiling, that the Burrowing Owl *Athene cunicularia*, Eastern Screech Owl *Megascops asio*, Eurasian Pygmy Owl *Glaucidium passerinum*, Great Grey Owl *Strix nebulosa*, Northern Hawk Owl *Surnia ulula*, Short-eared Owl *Asio flammeus*, Snowy Owl *Bubo scandiacus*, Tawny Owl *Strix aluco*, and Tengmalm's Owl *Aegolius funereus* are caching or stockpiling food.

Food hiding behaviour in owls has evolved to reduce the risk of starvation when food resources are scarce. A cache is defined as a hiding place or storage site, particularly for food. Excess food may also be stored for future consumption and is especially prevalent in certain owl species. These feeding strategies have often been conflated, complicating the interpretation of their causes and consequences.

Here, we present primarily new examples of species that engage in either caching or stockpiling food:

Aegolius acadicus

In the US, H.C. Mueller in Lyons & Mosher [15] and Bendire in Bent [17] observed Northern Saw-whet Owl caching in captivity.

In Canada, Catling [18] reported 31 instances of caching by Northern Saw-whet Owls; 25 caches (80.6%) occurred during the migration period (defined as 1 October to 15 November and 15 March to 30 April) and six (19.4%) during winter (15 November to 15 March). All 31 cached prey items were decapitated; mice typically had their forelimbs removed, while birds had their wings eaten.

In Connecticut, US, Devine and Smith [19] observed 16 instances of caching behaviour by Northern Saw-whet Owls between 30 October and 29 March over a 23-year period (1982–2004). Caches consisted of a single prey item in 13 instances and two prey items in three instances. Prey was cached either directly beneath the owl or at a distance of 5–28 cm, always on the same branch on which the owl was roosting. Observations of cached prey marked in the morning suggested that it was consumed after 14:30 on the same day. This delay indicates a true cache rather than delayed feeding [19].

The same authors also noted a clear correlation between weather and caching behaviour: 13 of the 16 caching events occurred during the coldest months of the year, usually coinciding with periods of prolonged snow cover lasting 1–5 weeks.

Aegolius funereus

In Canada, in southern Ontario, the Boreal Owl (North American subspecies *Aegolius funereus richardsoni*) caching was noted during the non-breeding season [20].

In Finland, Tengmalm's Owl (Eurasian race *Aegolius f. funereus)* caches prey, mainly voles, only in nest holes during the breeding season. This behaviour is regarded as a buffer against temporary food shortages caused by snowstorms in late spring [16]. Using Collins' [2] definition, this would be considered stockpiling of food items at the nest. Such stockpiling is thought to be a response to localized or temporary abundances of food rather than to surplus killing.

Korpimäki [16] referred to this behaviour as 'larder hoarding', which may be adaptive, since prey stored in trees is more easily detected by other birds and requires close guarding.

Furthermore, a prey store is easier to locate when it is inside a nest hole than when it is somewhere near the nest.

Korpimäki and Hakkarainen [21] described piling up prey items at the edges of nest boxes. Between 1973 and 2009, they recorded a total of 12,554 prey items in food stores during 4,249 visits. Food stores contained up to 35 prey items per nest during the egg-laying and hatching period. The energy requirements of the female are highest prior to and during egg-laying, while the small owlets cannot tolerate long periods of fasting immediately after hatching. Later, the family consumes practically all prey items caught by the parents, so the accumulation of food becomes less prominent.

In the USA, the Boreal Owl caches food for later retrieval and consumption during both the breeding season and the wintering period. Boreal Owls, although not so conspicuous in their food store defencing, often discourage pilferage by roosting near their cached food [22]. The owls have also been observed to remain on high alert in the presence of Gray Jays *Perisoreus canadensis*, in order to prevent these clever birds from raiding their caches [23].

Asio clamator

In Colombia, Riaño et al. [24] noted and photographed the carcasses of Brazilian guinea pig *Cavia aperea* found stored near the nest of a Striped Owl. A big prey caching is obviously typical for this owl, although not reported before.

Asio flammeus

In captivity, Short-eared Owls cache uneaten food and later return to consume the cached prey [25]. The same authors also reported Short-eared Owls caching freshly caught prey in grass tussocks on the River Ribble saltmarshes in the UK.

In Kuna, Idaho, USA, a Short-eared Owl was observed capturing a Montane Vole *Microtus montanus*, which was cached approximately 50 m away at the base of a shrub. The owl then resumed hunting in the same field where the vole had been captured. On 16 May 1986, the owl did not appear to be nesting, nor did it defend the cached vole against observers checking the site [26]. The authors suggested that food caching may reduce the negative impacts of kleptoparasitism by Northern Harriers *Circus hudsonius,* as the harriers were observed practising this behaviour towards Short-eared Owls in the same field [26].

Asio otus

In captivity, the Long-eared Owl has been observed to do food caching [27] but in the wild away from the nest caching has not been reported but may occur. In the US, prey captured by the male is often stockpiled at the nest during incubation, particularly shortly before the first young hatch [28]. Angell [23] observed a brooding female Long-eared Owl on a flattened Magpie *Pica pica* nest, surrounded by a circle of stacked carcasses of wood rats, voles, and the occasional lizard. Her young were just hatching. However, this habit of stockpiling prey on the nest is not entirely advantageous, as the accumulated smell of uneaten food could attract other predators [23].

Athene brama

In India, not all food items brought by the parents were eaten or fed to the nestlings, so many were accumulated in the nest [29]. The author proposed the interesting idea that parents were building this prey store not only as a food reserve but also to help increase the temperature of the nest hole. In particular, stored bat prey were thought to provide additional warmth to first-week nestlings, aiding in the maintenance of their body temperatures [29].

Athene cunicularia

In Lincoln County, Idaho, Rich and Trentlage [30] distinguished between stockpiling and caching behaviour. Female Burrowing Owls seldom leave the burrow during incubation and while the young are in the nest, making it advantageous to have any excess prey stockpiled at the burrow. The owls were also observed consuming burying beetles *Necrophorus* sp. that were attracted to surplus prey and uneaten carcasses at the nest.

The same authors also documented Burrowing Owl caches of long-horned beetles *Prionus integer* during the breeding season. Nineteen beetles were cached in three locations, 10, 12, and 15 m from the nest. Stockpiling may be preferred, as so few caches have been found, or perhaps caches are simply difficult to locate [30].

In Minnesota, Grant [31] suggested that male Burrowing Owls cached prey away from the nest solely for their own use. However, Rich and Trentlage [30] argued that more caches should be found even if males were caching only for themselves and emphasised the importance of studying caching behaviour more closely.

Athene noctua

Little Owls cache surplus food in captivity, often in some dark corner of their cage [25]. In the wild, uneaten food is cached in holes and cavities, including during the winter. In Germany, in optimal food situation in 2025 Little Owl stored up to 25 small mammals in one place [32].

In Switzerland, 22 voles were found cached during winter Blanc [33], and Juillard [34] photographed a total of 95 rodents stored in a nest box on 4 February 1978.

In the UK, a cache of 87 Storm Petrels *Hydrobates pelagicus* was located, all birds decapitated [35]. Moreau [36] reported that on 12 March 1947, several dead mice were cached in a hole in an elm tree not far from farmers threshing grain from a stack in Cambridge. The next day, with no threshing taking place, only four mice and a few fragments remained in the cache. This caching occurred after seven weeks of very severe weather.

During the breeding season, prey items hidden in holes and niches are often consumed within a single day [37]. Cached food is particularly important when hunting is difficult due to heavy rain or strong wind [38].

Glaucidium brasilianum

Ferruginous Pygmy Owls sometimes investigate the nesting cavities of smaller birds to capture the young; if a cavity is vacant, it may be used as a cache site for the prey they have caught [23,39].

Glaucidium gnoma

In Montana, USA, a Northern Pygmy Owl removed a road-killed Pine Siskin *Spinus pinus* from a highway and cached it in a nearby tree [40].

Glaucidium passerinum

In Central Europe, Eurasian Pygmy Owl is storing food to closed depots (like nest boxes) from November to March. Lichačev [41] calculated from one store 81 *Myodes glareolus*, 3 *Microtus agrestis* and 2 *Sorex minutus*. From March to November, single prey items are cached (open depots) by fixing them in branches of a spruce or pine tree.

In Northern Europe, this owl hoards food (small mammals and birds) in tree holes and nest boxes in late autumn to be

consumed during the snowy season, thereby improving over-winter survival [42-44]. In Pirkanmaa, Finland, Eurasian Pygmy Owls were studied between 1986 and 2006, and approximately 40,000 hoarded prey items were identified: 50% *Microtus* and *Myodes* voles, 35% shrews, 5% mice, and 5% birds [45]. (**Photo 1.)**

***Photo 1**. Typical Eurasian Pygmy Owl Glaucidium passerinum winter prey cache: 10 voles (53%), 5 shrews (26%) and 4 small birds (21%) in Enäjärvi, Finland . Photo: Esko Rajala*

In central Finland, the most intensive food hoarding occurred before the first snow, during which 73% of prey items were hoarded. The presence or absence of snow cover did not affect the number of hoarded birds, but snow cover dramatically reduced the number of hoarded voles. Pygmy Owls began to exploit caches before the onset of the snowy season and ceased exploitation in spring. The high utilisation of hoarded prey, especially during periods of permanent snow cover, suggests that the Pygmy Owl's food-hoarding behaviour acts as a buffer against seasonal variation in food availability [43].

This hoarding behaviour is highly susceptible to global warming. In several northern regions, autumns have become warmer and winters milder and wetter, a trend that is likely to continue, ultimately shortening the winter period [46]. The greater the number of days with persistent rainfall between mid-October and mid-December, the more likely it is that the owls' food hoards will spoil. In years of poor vole abundance, owls are forced to consume rotten food, which can result in mortality or compel them to leave the area [47].

Climate change impairs foraging efficiency and thereby reduces local overwinter survival. Future observations will reveal whether Pygmy Owls can adapt to these changes by delaying food hoarding, or whether they will suffer further declines due to the warming of autumns and winters [46].

Bubo bubo

Food storing is a typical behaviour of Eurasian Eagle Owls. For example, in France, large prey such as young foxes *Vulpes vulpes* were stored and consumed repeatedly over several consecutive days [48]. Eagle Owl parents hunt mainly at night, but the nestlings also feed during the day. Consequently, parents may build food stores to allow the young to feed when hungry, even outside the parents' hunting periods.

This observation aligns with Roulin's [49] 'feeding time hypothesis', originally formulated to explain food stores in Western Barn Owls, and appears to be applicable to Eurasian Eagle Owls as well.

In Germany, Baden-Württemberg, during incubation, the Eurasian Eagle Owl female never consumed prey brought by the male at the nest if it was too large to swallow whole, instead leaving the nest to eat larger prey elsewhere. In stark contrast, once the eggs had hatched, surplus prey items were consistently stored at the nest site for future consumption [50].

In southern Spain, food stores were located in the immediate vicinity of the nest during the breeding season [51]. Frequently, a dozen prey animals—mainly rabbits, rats, and Garden Dormice *Eliomys quercinus*—were cached around the nest.

Bubo scandiacus

Everett [1] noted that male Snowy Owls establish prey larders or food depots, where prey items are stored temporarily. Fast-growing young may later locate these caches and feed on the stored prey themselves.

Levin et al. [52] observed a Snowy Owl near a cache of three dead Short-eared Owls, presuming that the Snowy Owl had killed the smaller owls during a period of severe food shortage. The authors suggested that, in addition to obtaining food, the larger owl may benefit by eliminating a potential competitor. Lein and Boxall [53] argued that Short-eared Owls in the diet of Snowy Owls likely reflect opportunistic feeding rather than a deliberate mechanism to reduce competition. Previously, it was noted that at Logan Airport, Massachusetts, Snowy Owls consumed five Short-eared Owls, indicating that interspecific killing could also reduce competition for food [54].

Ketupa lactea

In South Africa, Kemp & Calburn [55] confirmed that the Milky Eagle-Owl, a regular carrion-eater, also caches surplus food for later consumption.

Megascops asio

Nesting pairs of Eastern Screech Owls require multiple cavities within their territory, which serve as alternate nest sites, roosts, and food caches [39]. Insects are also cached for later use, and fish as well; for example, Frazar [56] found 16 Horned Pouts *Ictalurus nebulosus* in a nest cavity in Massachusetts in January. A century later, in Ontario, Canada, Phelan [57] observed an Eastern Screech Owl storing Meadow Voles *Microtus pennsylvanicus* inside an old shack. On 12 April, seven voles were cached, but two days later only five remained, demonstrating turnover within the cache. This is advantageous, as decay can occur rapidly. Caching was thought to occur prior to the onset of breeding activity, which typically begins in mid-April [57].

Cope and Barber [58] recorded caching outside the nesting season in Indiana. Twenty-two dead day-old chicks (50 were initially placed near a barn in an enclosure on 4 March 1975) were found on a shelf near the ceiling. None of the chicks showed external damage, although 15 had been decapitated. Two additional dead chicks were later located on the rafters above the enclosure. In total, 24 day-old chicks were killed and cached within a six-hour period, providing further evidence that Eastern Screech Owls are highly opportunistic. Stockpiling of prey items in nests with young has also been frequently observed [59].

Stanback et al [60] claimed that information about the food caching behaviour of the Eastern Screech Owl has been

anecdotal. They did a strange test of providing the roosting owls with 32 pairs of boxes to choose from and a lot of frozen mice wondering why the owls did not move the excess food from one box to the other. Only in one case the owl moved a mouse from the original box to the adjacent box. However, they did not know what was happening all missing mice (only one mice was always consumed) suggesting that the owls may have been scatter-hoarding mice in locations other than the adjacent box, presumably in trees. The results, although difficult to place in context, clearly indicates that food caching happens during the nonbreeding season as shown before by Phelan [57] and Cope & Barber [58].

Megascops kennicottii

In Idaho, USA, during winter, Western Screech Owls cached small mammals and small birds—sometimes decapitated—for later consumption [23].

Megascops trichopsis

In North America, Whiskered Screech Owls stockpile excess food in the nest. Similar to Eastern Screech Owls, they may place live Blind Snakes *Rena dulcis* in the nest with the owlets to help clean the interior of the nest hole. The snakes consume fly larvae emerging from decomposing prey carcasses stored in the nest [61].

Micrathene whitneyi

In USA, Ligon [62] observed excess uneaten food items at Elf Owl nest sites, particularly an accumulation of invertebrates. If an Elf Owl encounters an abundance of mice or lizards, it will often cache them in a cavity for later consumption [23].

Ninox connivens, Ninox rufa and Ninox strenua

Reversed sexual size dimorphism is a widespread phenomenon among owls, characterized by females being larger than males. However, some Australian *Ninox* owls appear to deviate from this typical pattern by having large-bodied species in which males are larger—for example, the Barking Owl, Rufous Owl, and Powerful Owl [63]. These large-bodied species exhibit a distinctive prey-holding behavior in which breeding males hunt large prey at night and retain the carcass at their daytime roost for display, without consuming it [64]. This represents a quite distinct and unusual form of prey caching. The behavior is hypothesized to favor larger males by simultaneously advertising their quality (e.g., territoriality and predatory skills) to females and establishing dominance over rival males [64,65].

Otus scops

In this regard, the Eurasian Scops Owl does not behave like a typical owl. Balázs Jusztin (pers. comm.) has never observed this species caching food in Hungary. When a male brings prey to the nest and offers it to a small chick that is unable or unwilling to swallow it, the prey dropped on the nest floor is never retrieved by the young. Only the parents may do so; if they do not, some prey may remain at the bottom of the nest (cf. [66], photo p. 132), and intact insects can later be found among the nest remains. Balázs also never found food caches in nest boxes not used for breeding, possibly because insect prey do not remain suitable for long-term storage.

Strix aluco

In cold weather, food may be stored in a tree hole [67], but during very severe winters, Tawny Owls are prone to high mortality [68,69]. In captivity, Tawny Owls are meticulous in caching uneaten prey in a hiding place. Often, after a short interval, the owl will return to inspect the cache, seemingly to confirm that the prey is still there or to memorise its location. It will subsequently return only when it becomes hungry again [25].

Strix nebulosa

In Canada, prey has been stored at the nest [70] and is sometimes cached in nearby trees [71]. In Sweden, Höglund and Lansgren [72] recorded excess uneaten food items (*Microtus* voles) at only one Great Grey Owl nest out of 19.

Strix rufipes

In Chile, Rufous-legged Owl males transfer prey to the female either inside or at the entrance of the nest cavity, and if the male brings excess prey, it is stored inside the nest for later consumption [73].

Strix uralensis

Uneaten food is stockpiled at the nest. For example, in Asikkala, Finland, Jussila [74] recorded two voles and two mice at a nest on 9 May 1972, when it contained one egg and one nearly hatched chick.

Strix varia

Angell [23] described how his captive Barred Owl would cache uneaten parts of a rat when not hungry. This behaviour is likely normal in the wild as well, although it is seldom recorded, perhaps partly due to the owl's aggressive behaviour at the nest.

Surnia ulula

In Alaska, while Northern Hawk Owl female incubates and broods, all caching and food retrieval is conducted by male. Generally, caches food during breeding more often after young leave nest and all sizes of prey are cached, usually at least 3 m above ground on spruce boughs [75]. Also in Alaska, Ritchie [76] recorded 11 caching incidents by nesting Northern Hawk Owl. He suggested that caching of food helps define duties by the pair, and reduces potential conflicts at nest site. Storing food at locations away from the nest will reduce conspicuousness and facilitate nest sanitation.

In Canada, Northern Hawk Owls were observed regularly caching prey at relatively prominent visual sites, suggesting an ability to use landmarks for retrieval. Such visual features—including dead trees, conspicuous tree cavities, and sites concealed in the snow next to a prominent pole—may facilitate recovery of stored prey [77]. Sub-freezing temperatures and snow can preserve cached prey for extended periods [78].

In Finland, Northern Hawk Owls take advantage of long daylight hours and cache surplus prey near nest site. Stored preys are used for intensive feeding of young and help account for rapid growth. Prey stores act also as buffer during food shortages [79].

In Norway, differently from Alaska, a male cached an equal amount of prey before and after egg-laying, incubation, and hatching [80].

Prey caching appears to be a common behaviour in wintering Northern Hawk Owls. In an experiment in Minnesota, USA, four Northern Hawk Owls were observed caching 93% of the prey items presented to them [81]. The strategy of caching prey allows the owls to take advantage of temporary increases in prey abundance and may aid survival during periods of food shortage or adverse weather [78].

Also in Minnesota, Schaefer et al. [81] offered a recently road-killed Red Crossbill *Loxia curvirostra* to a Northern Hawk Owl. The carcass was placed in the middle of the road,

and the owl soon retrieved it. It was not observed whether the owl consumed the entire carcass or cached all or part of it, as the authors assumed [81]. This is a typical example in which carrion-eating and caching behaviour are difficult to distinguish.

In the USA, several records of Northern Hawk Owls caching prey in captivity exist. Collins [2] observed an adult female caching partially eaten Old World rats *Rattus* spp., Cotton rats *Sigmodon* spp., and two Florida mice *Podomys floridanus* by pressing them against the baseboard of a nearby wall. The second mouse was partially eaten two hours later and was then cached again against the base of the perch. The remains of both mice were consumed six and a half hours later on the same day.

Tyto alba

In June 1967, an unmated male Western Barn Owl cached a freshly killed Short-tailed Field Vole *Microtus agrestis* and a Meadow Pipit *Anthus pratensis* on the window-sill of an old house in which the owl was roosting [25]. Outside the breeding season, this owl almost always consumes prey where it is caught or on a nearby perch, without engaging in further hunting until hungry again. In captivity, Western Barn Owls also stockpiled excess food, although some stored items were later left untouched [25].

During the breeding season, large amounts of excess food are often stockpiled at the nest. In Germany, Kaus [82] calculated ca. 80 small mammals stockpiled in the Western Barn Owl nest. Everett [1] published an illustrative photograph of British naturalist, Graham Dangerfield at a Western Barn Owl nest in the UK containing three eggs, three newly hatched young, three apparently intact rats, a partly eaten medium-sized bird, and other small prey remains.

Tyto furcata

Kaufman [3] conducted feeding experiments with captive American Barn Owls and noted that the owls killed all 165 live mice offered, but consumed only 51, plus parts of 13 additional mice, and stockpiled 86% of the uneaten prey. From this, he concluded that wild owls probably kill more prey than they consume when prey densities are high at any time of the year. Reese [83] observed wild owls stockpiling prey at a nest in the Chesapeake region. Wallace [84] further confirmed that American Barn Owls stockpile prey in the wild, recording large numbers of surplus animals—namely 80 and 189 mice.

Owls Exhibiting Cannibalistic Behaviour

No matter how alien it may seem to us, the truth is that only the fittest owlets survive; any weakling or a bird unable to look after itself is at risk of being eaten [1].

Ingram [85] suggested that nestling cannibalism in Short-eared Owls has definite survival value during periods of food scarcity. Höglund and Lansgren [72], after studying the Great Grey Owl, argued that Ingram's emphasis on cannibalism is misleading and potentially misunderstood. They maintained that it is not cannibalism per se, but rather the reduction of the brood that is important. Furthermore, in Great Grey Owls, "fracticide" is by no means a consistent occurrence. In cases of food shortage, the weakest nestling is doomed even without interference from larger siblings [72].

Below, we summarise, species by species, the known observations of cannibalism. These often support Ingram's findings more than those of Höglund and Lansgren, although the occurrence and nature of cannibalism vary greatly among species.

Aegolius funereus

The overall mean clutch size in Finland has been 5.71, of which an average of 4.95 young hatched per nest. Rarely do all hatched young survive to fledging; in Finland, the average number fledged is only 2.91. Thus, on average, 13% of eggs fail to hatch, and 41% of hatched young do not fledge [21]. Depending on food availability, the size discrepancy among owlets hatched at one- or two-day intervals can lead to a certain amount of cannibalism, further increasing the size advantage of the first-born.

In Northern Europe, 77 eaten young were identified in pellet and food store studies out of 45,268 prey items, while in Central Europe, 57 were recorded out of 35,834 prey [21]. These correspond to percentages of 0.17% and 0.16%, suggesting that the occurrence of cannibalism is broadly similar in Northern and Central Europe (Table 1). However, pellet studies may underestimate the actual number of young eaten.

In Germany, Saemann [86] provided a general statement of cannibalism in Tengmalm's Owl: food scarcity can lead females to consume weak or dead nestlings, while older, stronger owlets may eat their weaker nest mates.

In Alaska, USA, siblicide and cannibalism in Boreal Owls have been recorded using nest box cameras. In one nest box, three separate incidents were filmed, with only a single nestling surviving to fledging. In another box, the youngest owlet was eaten by all four remaining siblings, which survived and fledged [87]. The authors concluded that the heightened aggression was caused by food deficiency and noted that, over the last four field seasons, 69 of 168 nestlings (41%) perished prior to fledging. Interestingly, this is exactly the same percentage reported from Finland [21].

Asio flammeus

Depending on food availability, the youngest nestlings often do not survive; the strongest young may eat the weakest to ensure that at least some of the brood survive [88].

In Canada, near Theodore, Saskatchewan, Stuart Houston [89] reported a striking example of possible parental cannibalism in an adult Short-eared Owl. One parent was killed by electrocution on 4 June 1960, leaving six apparently healthy young in the nest. The surviving adult fed the three smallest owlets to the three oldest, effectively achieving brood reduction within the feeding capacity of the lone parent [89].

In Finland, in 1969, an area of 20 km² contained 40 nesting pairs of Short-eared Owls, which laid an average of 7.3 eggs per nest, of which 4.7 owlets fledged. From these 40 breeding territories, approximately 300 pellets were analysed, and 602 prey items were identified [90]. Based on this material, the total food consumption of the population between 15 April and 31 July, while the owls remained in the area, was estimated. Daily food consumption was calculated at 80 g per owl, resulting in a total requirement of 1,499 kg for the owl population.

The prey composition was estimated as follows: voles 42,075; shrews 4,241; mice and rats 2,706; squirrels 87; weasels 87; small birds 690; and, most importantly for this study, 85 owlets were cannibalised during the breeding season. Although the number of cannibalised young appears high, it corresponds with observations that at least 1–3 young disappeared from each nest during breeding [90].

Some authors have questioned cannibalism in this species, suggesting that the disappearance of owlets may be due to their tendency to leave the nest early and hide a short distance away

[91]. In addition to evidence from pellets in Finland, there is a direct observation by Mr James Alder of Ponteland, Newcastle-upon-Tyne, in England. From a hide, he observed how the larger nestlings—out of five, two of which had previously disappeared—became restless. One of the larger owlets reached out and pulled at the head of a smaller nestling. The aggressor then picked it up and attempted to swallow it head first. After interference by the observer, the larger owlet dropped the nestling, but a few minutes later it again reached out and picked it up by the head. This time, it successfully swallowed the smaller owlet, leaving only its feet visible from the beak of the killer. The observer concluded that a similar event must have occurred the previous year with this same owl, when the number of nestlings inexplicably fell from six to three [92].

Ingram [85] suggested that this species stockpiles additional food near the nest, within reach of the older owlets. He proposed that this strategy prevents the older nestlings from attacking their younger siblings when food is abundant, while still allowing aggression—and even cannibalism—to function effectively in brood reduction during periods of food scarcity [92].

In the US, five nestlings from two nests were reported to be eaten by siblings, but it was not known if the young were already dead before eaten by nest mates [93].

Asio otus

Since eggs are laid at intervals of about 48 hours, the youngest nestlings hatch when their siblings are already relatively large. If food availability is poor, there is a significant risk that they will be eaten by the older nestlings [94].

Studies of nesting-time food in Europe revealed cannibalism in 31 cases out of 62,009 prey items (Table 1). In Finland, nests contained 3–8 eggs, with an average of 5.1 (N = 17), but only two young per nest survived to fledging [95].

In Germany, the number of dead nestlings of Long-eared Owls increases sharply when the *Microtus* vole population collapses [96]. In the UK, more than half the successful nests lost at least one young in a total of 58 nests [97].

Athene cunicularia

In Kansas, USA, a feeding Burrowing Owl was flushed from a dead conspecific [98]. Feathers from the breast and belly of the dead owl were scattered around in the short grass. The headless carcass appeared to be no more than a day old. Robinson did not speculate on the cause of the death, but noted that another instance of cannibalism by Burrowing Owls had been reported by Bent [17].

Athene noctua

In southern Spain, a female Little Owl was observed carrying a large item in her claws (Andrés M. Domínguez, pers. comm.). Although it initially appeared to be a rat, it was in fact a young Little Owl from another family nesting approximately 250 metres away. The female then began to pluck her prey to feed one of her own nestlings, followed by the others. (**Photos 2 and 3)**

In Switzerland, Juillard [34] did not use the term "cannibalism" but noted that 20 of 60 nestlings in his study died as a result of either being killed or eaten by adult owls or siblings. The cause of death was recorded as either predation or unknown disease. Overall nestling mortality in Switzerland was 18%, slightly lower than in Germany (20%: [99] 22%: [100]) and higher than in the UK (13%: [101]).

Photo 2. *A Little Owl Athene noctua has killed a large young one from a neighbour pair nest in southern Spain. Arcos de la Frontera, Spain, June. Photo: Andrés M. Domínguez*

Photo 3. *A living young Little Owl waits for the female to serve the meat of the killed young one from another nest nearby. Spain, June. Photo: Andrés M. Domínguez*

Bubo bubo

If we compare the number of eggs with the number of fledged young, on average one egg or owlet is lost, even in successful nests. The last-hatched chick is often considerably smaller than the first-born and may fall victim to its siblings, who—with assistance from the female—show no hesitation in consuming it if food is scarce [102].

In Europe, in the well identified pellet studies 155 juv. Eurasian Eagle Owls were eaten among 181,975 prey items: 15 in Czechia, 3 in Finland, 12 in Germany, 66 in Norway and 59 in Slovakia (Table 1).

In Finland, the percentage of cannibalism is approximately 0.4%, considerably higher than in Czechia, Germany, Norway, or Slovakia (Table 1). However, the lowest percentages are recorded in the largest datasets, highlighting the limited value of such percentages as absolute indicators. This is shown clearly by Suchý [103] who studied particularly the causes of nestling failures of the Eurasian Eagle Owl in the Jeseníky Mountains (Czech Republic) in 1955-2000. In that study, the loss of 33 young (40.2%) out of 82 were caused by the female Eurasian Eagle Owl, which killed the young in the event of short food supply. Six young were proven to be fed to remaining young (7.3%) [103].

Table 1. *Cannibalism in well identified owl diets based on pellets. * = Vertebrates only and ** = Bird prey only*

Country	Eaten nestlings in %	Total prey items	Reference(s)
Eurasian Eagle Owl Bubo bubo			
Czech Republic	0.11	14,070	Obuch 2024
Finland	0.43	697	März 1936, Grönlund & Mikkola 1974
Germany	0.22	5,443*	Uttenförfer 1952
Norway	0.12	55,599	Obuch 2024
Slovakia	0.06	106,166	Obuch 2024
Total	**0.09**	**181,975**	As above
Tawny Owl Strix aluco			
Czech Republic	0.13	17,433	Obuch 2011
Finland	0.46	656	Itämies & Mikkola 1972, Kuhlman & Koskela 1980
Germany	0.01	53,624*	Uttendörfer 1952
Jordan	2.7	259	Obuch 2011
Norway	0.11	27,396	Obuch 2011
Slovakia	0.06	225,441	Obuch 2011
Total	0.06	324,809	As above
Great Grey Owl Strix nebulosa			
Finland	0.11	2,735	Mikkola 1973, 1976
Sweden	0.15	1,977	Höglund & Lansgren 1968
Total	0.13	4,712	As above
Ural Owl Strix uralensis			
Finland	0.43	462	Mikkola & Jussila 1974, Kunttu 1978
Slovakia	0.05	2,134	Obuch et al. 2013
Total	0.12	2,596	As above
Northern Hawk Owl Surnia ulula			
Finland	0.39	773	Mikkola 1972, Hublin & Mikkola 1976
Norway	0.19	525	Hagen 1952
Total	0.31	1,298	As above
Eurasian Pygmy Owl Glaucidium passerinum			
Czech Republic	0.3	1,011	Klaus et al. 1982 Mikusek et al. 2001
Germany	0.53	380	Klaus et al. 1965 Schönn 1978
Poland	0.08	1,232	Mikusek et al. 2001
Total	0.23	2,623	As above
Western Barn Owl Tyto alba			
Germany	0.01	67.528*	Uttendörfer 1952
Hungary	0.02	5,888**	Schmidt 1972
Slovakia	0.02	51,934	Obuch 2024
The Netherlands	0.07	1,390	Hoekstra 1975
Total	0.01	126,740	As above
Long-eared Owl Asio otus			
Finland	0.64	4,663	Grönlund & Mikkola 1977, Mikkola 1977, Korpimäki 1992
Germany	0.002	57,346*	Uttendörfer 1952
Total	0.05	62,009	As above
Tengmalm's Owl Aegolius funereus			
Central Europe	0.16	35,834	Korpimäki & Hakkarainen 2012
Northern Europe	0.17	45,268	Korpimäki & Hakkarainen 2012
Total	**0.17**	**81,102**	As above

In Germany, poor food availability in eastern Brandenburg often led to the cannibalism of Eurasian Eagle Owl nestlings near their nest sites [104].

In Russia, Southern Altai, a Eurasian Eagle Owl nest was examined on 10 May 1982, containing three downy nestlings. One chick was pecked to death by the female, and its flesh was fed to the remaining young. The authors attributed this instance of cannibalism to the presumed death of the male of that pair [105].

In Spain, cannibalism of young Eurasian Eagle Owls by adults from neighbouring nests has also been observed, and it does not appear to be directly linked to food scarcity. Penteriani & Delgado [51] found the remains of at least one of two ringed nestlings in the nest of a neighbouring pair breeding only 250 m from the original nest.

In Switzerland, of 72 Eurasian Eagle Owl nestlings, 15 died at the nest. Of these, five deaths were due to cannibalism: one chick was consumed by the parents, and four were eaten by their siblings [106].

Bubo scandiacus

In Finland, interesting instances of cannibalism have been reported from Snowy Owl nests. The female may temporarily remove a dead nestling, only to return it later and feed it to the remaining young. This behaviour appears to prevent the living owlets from understanding that they are consuming a sibling [107].

In the Wrangel Island, Russia, Menyushina [108] wrote that nestling mortality was due to both food shortage and cold weather, even under otherwise good feeding conditions. No direct cannibalism in the form of weak nestling killing was observed. However, dead nestlings were sometimes used by the female to feed the surviving young. Menyushina also noted, as reported in Finland, that on at least one occasion the female cached the carcass of a dead nestling for two days before feeding it to the others.

In the UK, Martin [109] stated, without providing references, that cannibalism has not been recorded in Snowy Owls. However, on Fetlar Island, Shetland, Tulloch [110] observed a Snowy Owl nest containing seven eggs on 14 June 1967, of which five young reached the fledging stage. The nearly fledged nestlings competed strongly for food, but no casualties occurred. Tulloch [111] described another Snowy Owl nest in 1968 with six eggs, of which only the first three fledged normally. The fourth chick was nearly dead on 24 June and died four days later, despite being kept indoors for two days. The fifth nestling survived only three days before being found bruised and scratched. The fate of the sixth egg was unclear; by 26 June, it was no longer present, either as an egg or hatchling. The size disparity among the last three nestlings may have prevented them from successfully competing with the older siblings, although surplus food was always available in the nest.

In later years, Tulloch [112] reported two additional incidents in 1973 and 1974 in which Snowy Owl chicks died and were either consumed by the female or used as food for the remaining brood. These observations suggest that female Snowy Owls may reduce brood size when food availability suddenly declines.

In Alaska, USA, during the summer of 1924, Murie [113] was surprised to observe high mortality among Snowy Owl nestlings. Most broods, initially numbering seven or eight, were reduced to four or five, with some being further decimated. However, the term "cannibalism" was not used at that time. In 2015, Weidensaul noted that siblicide—which is common among many raptors—is rarer in Snowy Owls, as even nestlings only two or three weeks old quickly disperse from the nest scrape to hide in the low tundra vegetation.

Bubo virginianus

In southwestern Yukon, Canada, Rohner [114] studied the integration of young Great Horned Owls—so-called "floaters"—into the territorial breeding population between 1988 and 1993. He reported four cases in which Great Horned Owls were believed to have been killed by other adults. Fatal fighting may occur when a substantial portion of a contestant's lifetime reproductive success is at stake [115].

In the USA, Austin & Holt [116] noted that, during periods of food shortage in the nesting season, adult Great Horned Owls from one territory may begin feeding on young owls from neighbouring territories, or even on their own offspring.

In Idaho, USA, conspecific scavenging has been observed during winter [117]. Weidensaul [39] concluded that siblicide is rare but can occur when prey is scarce.

Glaucidium passerinum

In Czechia, Germany and Poland, six nestlings were cannibalised by the female in the studied Eurasian Pygmy Owl nests (Table 1). In Germany, the cause was believed to be food shortage, as only one young successfully fledged from that nest where remains of the two young were found in the pellets of the female [118].

Ketupa lactea

In Africa, although two eggs are typically laid, only one young is normally reared. The elder chick may kill the younger, although this has not been documented, or the loss may result from starvation [119].

Ninox strenua

Infanticide combined with cannibalism has been documented as a rare event in Powerful Owls in Australia. In one case in1995, Powerful Owls successfully hatched at least one egg, but the young failed to fledge in suburban Melbourne. On 11 September 1995, clumps of broken wing feathers from juvenile Powerful Owls were collected among fresh pellets [120]. The ingestion of offspring by a parent had not previously been reported in Australia. The owls did not appear to suffer from food shortage or nestling competition.

Human disturbance near the nest tree was considered a potential factor in the suspected case of cannibalism, as a walking trail ran within 10 m of the nest and roosts. Groups of 15–30 people used the boardwalk simultaneously, and on two occasions the adult male dropped its prey during the day. The extent to which this disturbance adversely affected the pair's breeding attempts or contributed to cannibalism in the 1995 season remains unknown (cf. [25] in *Tyto alba*). However, the successful fledging of two owlets in 1997 at a less disturbed site nearby suggests that disturbance may have influenced the breeding failures in 1995 and 1996 [120].

The situation differed markedly at a Powerful Owl nest in Sarsfield, which was located within forest and rarely visited by humans. Food shortage has been associated with a second case of cannibalism [121]. The authors found the remains of a recently consumed nestling near an active nest—at a feeding perch frequently used by the breeding pair and beneath the long-term roost of the adult male. Given the placement of the nestling remains at two sites regularly used by the adults, it appears

likely that an adult consumed the nestling, constituting a case of cannibalism.

A third suspected instance of cannibalism is reported by Hollingsworth & Bilney [121], when partial remains of a nestling Powerful Owl were detected within a nest by Ed McNabb and Jim Greenwood. No further details were provided, so it is unclear whether the adults cannibalised the nestling following infanticide or consumed it after it had already died.

Otus scops

Koenig [122] reported the first case of cannibalism in Eurasian Scops Owls. Malle & Probst [66] also documented one young being eaten by its parents in Austria in 2008. In Hungary, nestbox cameras recorded two separate occasions on which a female owl fed a deceased chick to the remaining nestlings [123].

Strix aluco

In Finland, the largest nestling of a Tawny Owl brood was observed eating two smaller siblings during the 1966 breeding season in Rauma. In other years (1958–1969), no cannibalism was recorded in a sample of 500 prey items [124]. Kuhlman & Koskela [125] reported one Tawny Owl chick—either consumed by an adult or a sibling—in a sample of 156 prey items. That nestling had already been ringed, and the ring was recovered in a pellet at the nest.

In Germany, it was noted that any unusual behaviour can trigger aggression in the larger nestlings, sometimes causing them to kill or consume their siblings. Werner Haller [126] observed a young Tawny Owl grasping and eating a fallen, wriggling sibling at the nest. Uttendörfer [127] recorded only four cases of nestling cannibalism in Tawny Owls (Table 1). Wendland [128] identified approximately 0.1% of Tawny Owl juveniles as having been eaten in a sample of 13,359 prey items from Grunewald, collected between 1952 and 1971.

Obuch [129] found 203 juv. Tawny Owls among the 270,529 prey items: 22 in Czechia, 7 in Jordan, 29 in Norway and 145 in Slovakia (Table 1). Across six countries, the proportion of Tawny Owl nestlings eaten was highest in Jordan (2.7%), followed by Finland (0.46%). In the Czech Republic, Germany, and Norway, the percentage was roughly 0.1%, while Slovakia had the lowest incidence at 0.06%. This pattern reflects the influence of sample size: the highest proportion occurs in the smallest prey sample, and the lowest in the largest, demonstrating the limited value of these percentages for direct comparisons.

In the UK, Lack [130] observed that siblicide maximises the reproductive output of Tawny Owl parents. During years of abundant prey, adult owls can provide enough food for all nestlings. In years of poor food availability, mortality among the weaker young reduces wastage of resources, thereby maximising the parents' overall reproductive success. A similar mechanism has been reported for Tawny Owls by Southern [131]. Approximately 25% of hatched chicks died of starvation before fledging, either during their first week of life or at two to three weeks of age, when they were under the additional strain of growing feathers. Interestingly, none of these dead nestlings left any trace in the UK pellet studies. However, the UK is the only country where cannibalism has been witnessed between two adult Tawny Owls on 14 May 1995 [132]. He saw Tawny Owl eating another fully grown conspecies, and noted that the blood was fresh, when the owl flew off from the victim.

Martin [133] concluded more openly, that if Tawny Owl female assesses there is not enough prey animals in the environment to sustain the chicks that it has reared, the female may well return to the nest and feed one of the nestlings – probably the smallest and/or less developed young – to the others.

In the Netherlands, Van Veen [134] did not observe any aggressive behaviour, either between Tawny Owl parents or between parents and nestlings, across ten breeding cases. The deaths of the youngest nestlings (1984, 1985, 1991) and of the youngest and next youngest (1986) were always due to starvation, preceded by a visible lag in development and activity. On at least two occasions, adult owls showed no hesitation in picking up dead nestlings and feeding them to the remaining young. However, Van Veen [134] emphasises that consuming a previously dead individual, including conspecifics, should be considered scavenging rather than cannibalism [135]. In our terminology, this behaviour is still regarded as conspecific scavenging, a form of cannibalism [10].

Strix nebulosa

In Canada, an apparent case of cannibalism was reported from Alberta [136]. An adult Great Grey Owl was observed perched atop the still-warm carcass of another partially eaten Great Grey Owl. It was suspected that the owl had attacked a weakened or dying conspecific. Roadkill was considered unlikely, as the nearby road had been closed to public traffic due to possible avalanches. McNicholl [135] cited Fisher's [136] observation to support his critical view on the use of the term "cannibalism" when the observer has not confirmed killing. He argued that the consumption of one adult Great Grey Owl by another was more likely scavenging of an already dead bird. This case again highlights the sensitivity of the term "cannibalism" for many scientists.

In Finland, a food study of the Great Grey Owl revealed cannibalism in one nest out of 23, encompassing 2,464 prey items [137]. Following these published results, nest studies in Konnevesi between 8 and 14 June 1972 showed that the smallest of four chicks had been eaten when weighing approximately 120 g, while the oldest chick at that time weighed just over 500 g. In a second nest, the youngest chick was also later found to have been eaten, with remains detected in the pellet—representing the third confirmed case of cannibalism in Finland [138].

Also in Finland, it was observed that a female Great Grey Owl removed a dead chick from the nest, but after a while returned it and fed it to the remaining young [107]. Exactly similar behaviour has been noted in Snowy Owl nests in Finland and Russia. In the case of the Snowy Owl, this was interpreted as an attempt by the female to prevent the surviving chicks from realising that they were consuming a sibling.

In Sweden, in three closely monitored nests, the four smallest nestlings died at the age of 10–14 days, having lagged behind in development from birth [72]. Remains of three of these nestlings were found in pellets, confirming cannibalism (Table 1).

Strix uralensis

It appears fairly unusual for more than one or two, and at most three, Ural Owl nestlings to be successfully reared [139]. Given the asynchronous hatching strategy, it is therefore not surprising that remains of young Ural Owls have occasionally been found in the species' pellets.

In Finland, Ural Owl pellets from Päijät-Häme contained two young owl among 462 prey items, i.e. 0.43% (Table 1). Although Pietiäinen [140] makes no mention of cannibalism in his work, the statistics he provides on juvenile mortality in Ural Owl nests suggest that the practice must be relatively common in this species. He determined the hatching success of 1,126 eggs,

which produced 881 young. Of these hatched young, thirty-eight (4.3%) died in the nest. The year 1986 was particularly bad, with 22 nestlings lost; in these broods, the youngest owlets succumbed in competition with their older siblings.

Pietiäinen does not use the term "cannibalism," and Saurola [141] notes that even hungry siblings will not attack or consume smaller siblings unless they are already motionless on the nest floor. Only dead owlets become food for the others. If this is correct, Ural Owl adults and their siblings differ in this respect from most other owls.

In Russia, Leningrad (now Saint Petersburg) Region, researchers appear less hesitant to discuss cannibalism than those in Finland and Sweden. Malchevskiy & Pukinskiy [142] reported that, out of three nests initially containing three owlets each, in two cases one chick disappeared by the third day, and in one nest, a nestling at nine days of age was eaten by the female, as evidenced by remains found in her pellet. Across 14 nests, four had only one nestling reach one month of age, while ten nests had two chicks survive.

Volkov [143] studied Ural Owls in the Irkutsk Region. In one nest containing five eggs, by 2 June 1984 only three nestlings were alive. The fourth owlet had been partially eaten at two weeks of age, as judged by the development of its primaries, and the remains of the fifth young were not found.

In Slovakia, the diet of Ural Owls has been studied far less than that of other owls [144]. Interestingly, out of 2,134 prey items, only one case of a young being eaten was recorded as evidence of cannibalism (Table 1). This instance came from a mountain nest, where a single owlet was found among 137 prey items.

In Sweden, Lundberg [145] similarly noted that, once hatched, Ural Owl nestlings very rarely die during the nestling period. Of 189 hatched young, only five (2.7%) died in the nest, but there was no mention of any being eaten.

One factor that could help explain the apparent rarity of cannibalism in Ural Owls is their highly varied diet, in contrast with many other owl species that depend heavily on a single prey species or a small group of voles. On the other hand, the availability of food in Ural Owl territories has a profound effect on the number of pairs that attempt to breed. In years of low prey abundance, only around 10% of pairs lay eggs, and breeding is usually limited to the most experienced adults [146]. This may partly account for the relatively low mortality of nestlings, although further study is needed to clarify this relationship.

Strix varia

In Vermont, USA, on 14 December 2014, a Barred Owl was observed perched on the carcass of another Barred Owl, which it began to pluck and consume. Only the chest and abdomen had been eaten, while the rest of the body remained intact. The observer interpreted this as a possible case of predation on a conspecific, leading to scavenging cannibalism [147]. In the same paper, Mark Alexander reported witnessing a Barred Owl attack and consume another Barred Owl at his bird feeder on 10 March 2015.

On 15 March 2015, a commenter in Williston, North Dakota, USA, observed a larger Barred Owl (possibly female) carrying a smaller Barred Owl (possibly male) in its talons. The larger owl eventually dropped its prey, which was missing one wing and the head. Decapitation is typical in cannibalised prey [25]. Although these events do not definitively prove deliberate killing, they demonstrate that Barred Owls are opportunistic foragers and, when the opportunity arises, will consume conspecifics [147].

Perhaps even more surprisingly, Graves & Niemi [148] reported an observation of a Barred Owl carrying the carcass of a Great Grey Owl, a species considerably larger than the Barred Owl. The authors noted that the Great Grey Owl appeared to have been killed recently, as indicated by the absence of rigor mortis, and argued that the evidence at the scene was consistent with predation by the Barred Owl. This observation further supports the previous reports of cannibalism and predatory behaviour, rather than mere scavenging.

Surnia ulula

Little-studied Northern Hawk Owl pellets have revealed three instances of the species consuming their own young: two in Finland and one in Norway (Table 1). In Lapland, one nestling was killed and eaten [149], and another in Kuopio, Central Finland [150]. At least in Kuopio in 1976, the poor food situation likely explains the observed cannibalism. Birds made up 48% of the diet and voles 52%, indicating a severe shortage of voles; under normal conditions, voles constitute over 96% of the diet and birds only 1.2% [151].

Tyto alba

In France, Baudvin & Jouaire [152] reported that cannibalism was the principal cause of nestling mortality in Western Barn Owls. Their study, conducted between 1971 and 1995, showed that from 3,881 fledged young 161 young (2.6%) were certainly cannibalized and 860 additional young (14%) were believed to be consumed by their siblings. Cannibalism arose primarily from a lack of food, caused by various factors alone or in combination: the male being in poor physical condition, insufficient prey abundance, or unfavourable climatic conditions limiting hunting success for two out of three days. If any of these conditions were happening, cannibalism became an alternative solution. Baudvin [153] also noted that clutch size had little influence on the risk of cannibalism. This is unsurprising, as larger broods were most common during peak vole years, when food abundance reduced the occurrence of cannibalism.

In Germany, Wendland [96] observed the premature death of hatched young in Western Barn Owls but noted that the number of cases was too small to draw any generally valid conclusions. Later, Mebs & Scherzinger [154] clarified that cannibalism is not uncommon in Western Barn Owls in Germany. Uttendörfer [127] also reported six instances of nestling cannibalism in this species (Table 1).

In Slovakia, Barn Owls were recorded eating nine of their own young out of a total of 51,934 prey items (Table 1). The percentage is very low, 0.02%. As noted in the Bubo bubo and Strix aluco sections, such percentages must be interpreted cautiously. Owl nestlings have softer bones and highly acidic stomachs, which means that the remains of cannibalised siblings may be easily overlooked in dietary studies.

In the Netherlands, cannibalism by Western Barn Owls, specifically feeding on conspecifics, has been reported at least once in Amsterdam [155]. Hoekstra [156] reported two further cases: in the first, the remains of a young owlet were found beneath the male's roosting site; in the second, the skull, some bones, and feathers of a young owl were found in a pellet, based on a study of 260 pellets collected at a nest in Bruinehaar, Vriezenveen, Overijssel (Table 1).

In the UK, literature studies on Western Barn Owl cannibalism often focus on the potential link between human disturbance and the disappearance of nestlings. Bunn et al. [25] noted that

"it is far more likely that the adults have eaten their young after disturbance, ultimately ejecting their remains in pellets which are cast elsewhere." These authors also questioned claims that the female eats some of her young during food shortages to reduce pressure on the remainder, suggesting instead that the nestlings probably die of starvation or other causes before being consumed by the adult. However, the BBC *Springwatch* programme in 2007 provided direct evidence: a mini TV camera in a Barn Owl nest box captured the eldest nestling calmly approaching the smallest, alive but only a few days old, picking it up by the head, and promptly swallowing it—a clear case of cannibalism. Such behaviour appears to be fairly frequent, for instance in Suffolk [9].

Separately Shawyer [157] concluded that cannibalism within Western Barn Owl broods can be associated with the food stresses brought by heavy raifall or high atmospheric pressure and thunderclaps. Heavy rainfall can also reduce overall breeding success, especially in September and October.

Tyto furcata

In Texas, USA, one or both adult American Barn Owls presumably killed and consumed one of their offspring during a period of food scarcity [158].

In Brazil, two larger young killed and ate two smaller nestlings as seen in the nest video of the American Barn Owl in Rio de Janeiro. This cannibalism occurred due to the dispute for food among the chicks, not because lack of food. The larger owlet repeatedly pecked the head of the smaller young until dilacerating it. This happened when the female brought a rat to feed the chicks. The same behaviour occurred with the second of the smaller chicks a few days later, both cannibalistic killings occurring during the night [159].

Tyto javanica

In Australia, cannibalism among sibling Eastern Barn Owls has been recorded during periods of food scarcity [160,161], and similar behaviour occurs among siblings of other *Tyto* and *Ninox* species, in which the older and stronger owlets kill and consume the younger and weaker ones when the food supply suddenly fails [161].

In Malaysia, overall nestling mortality in 36 Eastern Barn Owl nests was 18.8% [162]. One female was observed attempting to eat a dead chick, but no remains of chicks were found in 2,839 pellets or among 3,530 identified prey items. It was suggested that the bones of young chicks are fully digested and leave no hard parts [162], which may partly explain why evidence of cannibalism is so rarely recorded in pellet studies.

Tyto longimembris

In the Philippines, Eastern Grass Owl (subspecies *amauronota*) Amadon & Jewett [163] explained the loss of one of the two fledgings with cannibalism, either that the lost young was eaten by the surviving nestling or the female.

Carrion-feeding

Historically, owls have been regarded as predators specialising in live prey, typically small vertebrates and invertebrates, and any observations of scavenging were considered anomalous [164]. Traditionally, because of their predominantly nocturnal habits, dietary information was inferred primarily from pellet analysis, while scavenging behaviour was rarely observed. However, the increasing use of passive infrared camera traps, often baited with carcasses—including road-killed animals—has revealed that a growing number of owl species engage in scavenging behaviour worldwide. Here, we summarise all known records of carrion-feeding in owls on a species-by-species basis:

Aegolius acadicus

In North America, Bent [17] reported second-hand that a Northern Saw-whet Owl fed on a Snowshoe Hare *Lepus americanus*; however, direct evidence of scavenging was not confirmed. At Long Point, Ontario, Canada, a Northern Saw-whet Owl was observed on 31 October 2005 perched on the head of a dead Surf Scoter *Melanitta perspicillata* on a beach. The owl was clearly feeding on the carcass, representing a previously unrecorded behaviour [165]. This observation constitutes the first confirmed record of scavenging in this species.

Aegolius funereus

In Canada, the Boreal Owl is among the species known to scavenge fresh meat used as bait in traps set for furbearing mammals. Several documented cases exist. During the winter of 1980–1981, north of Farrell Creek, a Boreal Owl was discovered with the back of its skull crushed. Another Boreal Owl was captured by a Lynx *Lynx* sp trap on 27 February 1984 at the confluence of Black Creek and the Beaton River [166]. Boyd [165] also cites Bent [17] regarding suspected scavenging by Boreal Owls in North America, although no further details were provided.

Asio otus

In Germany, the presence of a small bone fragment—possibly from a Roe Deer *Capreolus capreolus*—found in a Long-eared Owl pellet suggests scavenging [167].

In southern Tuscany, Italy, four fragments of Crested Porcupine *Hystrix cristata* and a jaw fragment of a marten *Martes* sp. were reported in the diet of the Long-eared Owl [168]. Dental analysis indicated that the marten was an adult. The size and defensive capabilities of both mammals strongly indicate scavenging rather than predation. Although the Long-eared Owl is a specialist predator of *Microtus* voles [169], it may broaden its trophic niche under adverse conditions, such as deep snow or low winter temperatures, including the consumption of carrion. In Poland, Long-eared Owl diet list included a Pig *Sus* sp. carrion, not known if domestic or wild [170]. In The Netherlands, Hedgehog *Erinaceus europaeus* quills and hairs were found in Long-eared Owl pellets [171], though it remains uncertain whether these had been scavenged, as in the case of the Little Owl described by Schreuder [172].

Athene cunicularia

In Montana, USA, remote cameras were used to monitor scavengers consuming shot Ground Squirrels *Urocitellus* sp. and Black-tailed Prairie Dogs *Cynomys ludovicianus* at eight sites [173]. At least five mammal and nine bird species were observed scavenging the carcasses. Burrowing Owls were the rarest scavengers, feeding on only 2.5% of carcasses, although they appeared at 7.5% of sites. This study represents the first documented evidence of scavenging in this species.

Athene noctua

In Belgium, Little Owls were observed feeding on road-killed European Hedgehogs *Erinaceus europaeus* [174].

In France, a Little Owl was observed feeding on a dead adult domestic chicken *Gallus gallus domesticus* [175].

In Germany, bones of a juvenile wild rabbit *Oryctolagus cuniculus* were identified in a pellet ; the remains were presumably taken from carrion. The same is likely true for the remains of a domestic pigeon *Columba livia domestica* [176].

In Switzerland, Juillard [34] photographed, on 6 February 1979, an adult Common Buzzard *Buteo buteo* stored in small pieces in a Little Owl nestbox; this prey was most likely of carrion origin.

In The Netherlands, Schreuder [172] reported hedgehog spines in Little Owl pellets, noting that some individuals remove the skin from already dead hedgehogs before consuming the flesh.

In the UK, pellets collected at Seaford in 1936 over two consecutive weeks contained hedgehog claws and bones, indicating the use of carrion [177]. However, as this carrion represented only a minor component of the diet in this large food study, it was concluded that Little Owls use carrion only sparingly [178].

Bubo africanus

In the Cape Province, South Africa, a pair of Spotted Eagle Owls died after feeding on a poisoned Springhare *Pedetes capensis* used as jackal bait [179]. In Hermanus, South Africa, two Spotted Eagle Owls were observed feeding at night on freshly dead mullet *Mugil cephalus* left on a harbour quay [180]. Carrion in the form of roadkill is also likely consumed, although direct confirmation is limited [181]. Kemp & Calburn [55] noted that carrion is not disregarded as a food source by this species. Indeed, one Spotted Eagle Owl was observed with a Rufous-cheeked Nightjar *Caprimulgus ruficollis*, which may have been a road casualty [181].

Bubo bubo

In Austria and the Netherlands, Eurasian Eagle-Owls have been observed scavenging Roe Deer *Capreolus capreolus* carcasses [182,183].

In Bulgaria, scavenging events involved sheep and goats (*Ovis aries* and *Capra hircus*), Fallow Deer *Dama dama*, and domestic pigs *Sus scrofa* [184].

In Finland, historical records report many Eurasian Eagle-Owls caught in baited traps after being attracted by fresh meat [185]. Until 1951, trappers received a bounty ranging from 44 (1841) to 90 (1937) Finnish Marks for each Eurasian Eagle-Owl killed [186].

In Germany, bone remains of juvenile Roe Deer were discovered in pellets [176], and feeding on a fresh Wild Boar *Sus scrofa* carcass has been observed [187]. Wickl & Bezzel [188] also noted that "Carrion-eating could be demonstrated in the Eurasian Eagle Owl on Roe Deer, Brown Hare *Lepus europaeus*, and Domestic Cat." Bone fragments from young Roe Deer and Brown/European hares were likewise reported in pellets by Görner [189], who added that their sharply cut edges indicate injuries caused by lawn-mowing machines. Scherzinger & Mebs [190] reported prey remains of deer (*Cervidae* spp.) and Alpine Chamois *Rupicapra rupicapra*.

In Spain, multiple records document scavenging on bovids, rabbits, and domestic chickens, with evidence suggesting regular consumption of farm chicken carcasses in parts of the Ebro River Valley [191-193]. Remains of two chickens were found in pellets from territory A (n = 193), while remains of 12 chickens were identified in pellets from owls breeding in territory B (n = 606). The dead chickens originated from three intensive breeding farms located in a village close to the nesting areas of pairs A and B [192].

Bubo c. capensis

In South Africa, Cape Eagle Owls consume small carnivores such as mongooses *Mungos mungo* and genets *Genetta genetta*, some of which may themselves be attracted to carcasses near nests and subsequently be preyed upon [55]. This indirect use of carrion-associated prey highlights the complexity of trophic interactions and warrants further study.

Bubo c. mackinderi

In Kenya, a Mackinder's Eagle Owl (often lumped with the previous species) was observed feeding on a freshly road-killed rabbit (Paul Murithi & Darcy Ogada, pers. comm., 17 Dec. 2025). Ogada & Kibuthu [194] documented five Mackinder's Eagle Owls killed after feeding on poisoned carcasses, representing half of all known causes of mortality.

Bubo magellanicus

In the Andean temperate forest of the La Araucanía region, a Magellanic Horned Owl was observed consuming a Southern Lapwing *Vanellus chilensis*. The authors considered scavenging a likely explanation [195]. Thus far, this is the only record of carrion-eating by Chilean owls [196].

Bubo scandiacus

Across the Arctic and sub-Arctic, Snowy Owls readily consume carrion, including walrus, seals, Arctic Foxes *Vulpes lagopus*, and animals caught in traps [197]. Scherzinger & Mebs [190] added carcasses of horses *Equus* spp. and cattle *Bovini* spp. to this list. Also in the Arctic, Snowy Owls have been observed scavenging whale (*Cetacea*) and dolphin (*Delphinidae*) carcasses and, on one occasion, were seen defending a carcass from a Turkey Vulture *Cathartes aura* on the U.S. Atlantic coast [39].

In Finland, Snowy Owls are known to steal trap-killed Willow Grouse *Lagopus lagopus* and Ptarmigan *Lagopus mutus* [141]. In both Finland and Russia, scavenging of Reindeer *Rangifer tarandus* has been documented [198,199].

In Alaska, USA, during a period of low Brown Lemming *Lemmus trimucronatus alascensis* populations, a Snowy Owl either killed an injured female King Eider *Somateria spectabilis* or pursued it until it died from the combined effects of Eskimo hunters' gunshot wounds and exertion. By late April 1950, the owl had stripped most of the flesh from the carcass [200]. About a month later, another Snowy Owl began a systematic patrol along a single-wire antenna because one or more Red Phalaropes *Phalaropus fulicarius* struck the wire and were killed or seriously injured. The owl quickly consumed any phalarope injured severely enough to impair its flight. The author never observed the owl attempting to capture an uninjured phalarope, nor patrolling the wire when lemmings were again numerous in 1952 [200].

In Oregon, USA, at Newport, a Snowy Owl was observed scavenging a cormorant *Phalacrocorax* sp. and body parts from two Cassin's Auklets *Ptychoramphus aleuticus*, presumably scavenged from the beach [201].

In Siberia, trapping with leghold traps and exposed bait for Arctic Foxes has caused the deaths of uncounted numbers of Snowy Owls [39].

Bubo virginianus

In Brazil, a possible Great Horned Owl scavenging event involved a Molina's Hog-nosed Skunk *Conepatus chinga* [202].

In Canada, this owl was confirmed scavenging a road killed domestic cat *Felis cattus* carcass [203]. Numerous additional cases involve owls attracted to traps or carrion, particularly during winter [166,197].

In north-eastern California, USA, Tui chub *Siphateles bicolor*

and Tahoe sucker *Catostomus tahoensis* bones and scales were found in Great Horned Owl pellets, possibly scavenged from nearby shorelines where dead fish often washed up [39]. Also in the USA, camera traps have documented scavenging of birds, Black-tailed Deer *Odocoileus hemionus columbianus* and Eastern Cottontail *Sylvilagus floridanus* [11,39,204,205].

Glaucidium perlatum

In South Africa, Kemp & Calburn [55] reported an occasional carrion consumption of the Pearl-spotted Owlet.

Ketupa ketupu

In Asia, the Malay Fish Owl has been reported feeding on carrion, including a dead crocodile *Crocodylinae* sp. and the remains of a Sunda Stink Badger *Mydaus javanensis* in Java, Indonesia [206].

Ketupa lactea

In Botswana, a pair of Milky Eagle Owls were observed feeding on a seven-foot long Cobra *Naja anchietae*, which was believed to be carrion [207]. Also in Botswana, a Secretarybird *Sagittarius serpentarius* was recorded as prey of the Milky Eagle Owl. Given the large size of this bird, Pitman & Adamson [207] considered this a case of carrion consumption.

In South Africa, this species regularly consumes carrion such as hares and snakes killed on roads at night [181]. In one instance, an observer accidentally ran over a Springhare *Pedetes capensis* and later returned to find a Milky Eagle Owl feeding on the carcass [181]. This species' diet has also included animals larger than those it is likely able to kill, such as adult Common Duiker *Sylvicapra grimmia*, which are presumed to have been scavenged [181]. Although road-killed carrion represents an occasional food source, Milky Eagle Owls are only rarely killed by traffic [180].

Prey remains collected in De Hoop Nature Reserve, Cape Province, South Africa, included a cranial bone of an adult Grysbok *Raphicerus melanotis*, almost certainly obtained as carrion [208]. Kemp & Calburn [55] further confirmed that Milky Eagle-Owls feed regularly on carrion.

In Tanzania, a two-foot road killed snake was wrested from a Milky Eagle Owl (Sir Hugh Elliot in [207]).

Ketupa nipalensis

The Spot-bellied Eagle Owl has been recorded scavenging on larger kills, but this is rare, probably because it is outcompeted (and also threatened) by mammals at night [209]. Baker [210] reported how he once disturbed Spot-bellied Eagle Owl scavenging the remains of a Tiger *Panthera tigris* and on another occasion feeding on the reamains of a dead goat *Carpa hircus*.

Ketupa zeylonensis

In India, a historic record describes a pair of Brown Fish Owls feeding on a decomposing crocodile *Crocodylinae* sp. carcass (C.M. Inglish in [210]). In Rajasthan, India, this owl was photographed while feeding on a juvenile Mugger Crocodile *Crocodylus palustris*, though whether the crocodile was captured alive or found as carrion remains unknown [211]. In Periyar Tiger Reserve, Kerala, a Brown Fish Owl was captured by camera traps scavenging an Asian Elephant *Elephas maximus* carcass in 2019 [212].

Megascops kennicottii

In California, USA, a Western Screech-Owl was observed feeding on a road-killed Virginia Opossum *Didelphis virginiana* [213].

Ninox strenua

In Western Victoria, Australia, it has been proposed that there is the possibility of a Powerful Owl scavenging on a dead sheep *Ovis aries* [214]. Also, in Bundeena, a small urban settlement in southern Sydney, there is another possible case of scavenging on an electrocuted Grey-headed Flying-fox *Pteropus poliocephalus* by one adult Powerful Owl, which was itself electrocuted on the overhead powerline in 2004 [215].

Strix aluco

Across Eurasia, the Tawny Owl shows a clear tendency to consume carrion, including fish washed ashore and animals or birds found dead in fields or caught in traps. This behaviour is considered one of the adaptations that enables the species to persist year-round within a restricted territory [197].

In Finland, the diet of the Tawny Owl included the remains of one Mountain Hare *Lepus timidus* out of 83 prey items. As the only large prey recorded, it was considered evidence of carrion-feeding [216].

In Germany, Beekers et al. [187] observed a Tawny Owl feeding on a fresh Roe Deer carcass.

In Hungary, a Tawny Owl pair breeding near the fishponds at Lillafüred was observed from spring 1958 onward regularly visiting a fish farm to feed on dead trout *Salmo trutta* left on the pond shore. The owls also collected trout carcasses floating on the water surface, consuming them on perches or delivering them to nestlings at a site known to have been occupied for 31 years. During more than five decades of observation, the author never recorded Tawny Owls capturing or consuming live trout from the breeding ponds [217]. Interestingly, Räber [27] concluded from captivity experiments that Tawny Owls caught fish in the water, but never when the fish were dead.

In Italy, a Tawny Owl was observed feeding on a coypu *Myocastor coypus* carcass near an oxbow lake of the Adda River in January 2017; the prey was most likely a roadkill. In December 2021, another coypu carcass was monitored using a camera trap in Massimbona. A Tawny Owl was recorded feeding on the carcass on at least three occasions before dogs removed it from the camera's field of view [218].

In Poland, a Tawny Owl was observed scavenging an unidentified ungulate *Ungulata* sp. carcass [219].

In the UK, two pellets collected from a nest in Lincolnshire consisted entirely of lamb's wool, indicating that the adult owl had been feeding on a carcass [220]. In Kielder, Northhumberland, several Tawny Owl pellets were studied and one contained a number of teeth in a section of lower mandible, from a young Roe Deer *Capreolus capreolus*. Charleton [221] presumed the owl being near starvation to bother with part of a carcase so lacking in flesh.

A local UK gamekeeper reported that Tawny Owls were repeatedly found in traps baited for rats with rabbit viscera [133]. A trail camera at Nant Brain in Mid Wales recorded a Tawny Owl on the ground next to a road-killed male Mallard *Anas platyrhynchos* on 5 May 2017. Unfortunately, the video clip was too short to determine whether the owl had been eating the duck or was attracted to the carcass for secondary prey items such as beetles and Wood Mouse *Apodemus flavicollis* seen in the footage [222].

The same authors obtained clear evidence of scavenging at Nant Brain when a Tawny Owl pellet collected on 23 June 2017 contained the rings of seven dead Pied Flycatcher *Ficedula*

hypoleuca chicks. These chicks had been removed from a nest box and left on the ground on 14 June for local scavengers such as Red Fox *Vulpes vulpes*, Badger *Meles meles*, and Polecat *Mustela putorius*. On this occasion, however, the Tawny Owl arrived before the mammalian scavengers [222].

To obtain high-quality photographs, Eric and David Hosking trained Tawny Owls to come to dead prey placed out at regular times each night in Buckinghamshire [223]. Similarly, Arnold [224] maintained a raptor feeding table in Worcestershire, UK, using road-killed carcasses primarily to attract Common Buzzards *Buteo buteo*. However, a Tawny Owl soon began frequenting the feeding site and appeared to remember the location as a reliable food source. Arnold (pers. comm.) repeated the experiment in 2019 and, again, after a few days a Tawny Owl began visiting the carrion; it was thought that this could have been the same individual as in 2013. Underwood [225] observed a Tawny Owl feeding on Pheasant *Phasianus colchicus* carrion on a road at Great Barton on 23 April 2017. Based on these and other UK observations, Martin [133] concluded that British Tawny Owls are among the most regular carrion eaters within the owl family.

Strix nebulosa

In Canada, an individual Great Grey Owl was reported feeding on fat and remnants of flesh from a butchered Moose *Alces alces* carcass in a yard near a house in southeastern Manitoba in March 1974 [226].

Some Great Grey Owls observed feeding on Snowshoe Hares *Lepus americanus* and other large prey may in fact have been scavenging road-killed animals [226]. Nero also documented several reports of owls feeding on Snowshoe Hares caught in snares, although it was often unclear whether the owl had killed a struggling hare or was feeding on an already dead animal. One trapper, Robert Stitt, reported finding a Great Grey Owl with a hare completely removed from a snare; the owl was unable to fly with the heavy carcass and remained reluctant to leave despite the trapper's approach. Stitt also observed another Great Grey Owl near a pile of American Marten *Martes americana* carcasses partially buried in snow, with one or two carcasses displaced slightly from the pile. Based on wing marks in the snow, it was presumed that the owl had just begun scavenging. The ability to exploit carrion may help Great Grey Owls persist during periods of prey scarcity [226].

Feeding at traps, however, carries substantial risks. North of Farrell Creek, a Great Grey Owl was found frozen in early January 1982 with wings outstretched and both feet caught in a meat-baited leghold trap [166]. In the Lac du Bonnet area of Manitoba, a Great Grey Owl was filmed perched on the carcass of a conspecific during the winter irruption of 2004–2005 (Jim Duncan, pers. comm.).

In Finland, a Great Grey Owl was observed in Porvoo in 1981 feeding on a domestic cat, a case suspected to involve scavenging, although no remains were detected in pellets [227]. The Great Grey Owl appears incapable of switching to larger prey when rodents and shrews are scarce. This is often fatal, as shown by the numerous individuals found starving or dead during winters of poor food supply. During the mass invasion of 1980/81, two Great Grey Owls were observed eating fat (from a domestic pig) put out for tits in Jyväskylä, Central Finland, as a desperate measure to avoid starvation (S. Ojala in [228]).

In Norway, H.M.S. Blair [229] dissected a female Great Grey Owl that had remains of a Blue Hare *Lepus timidus* in its stomach. This was most likely carrion, based on recent food studies in Finland in which Mountain Hare (the current name for the species) found in a female owl's stomach was confirmed to be scavenged [230].

In the USA, a Great Grey Owl was documented scavenging an ungulate *Ungulata* sp. carcass killed by a Grey Wolf *Canis lupus* [231].

Strix uralensis

In Finland, during a poor vole year in 1995, a female Ural Owl incubated four eggs of Goldeneye *Bucephala clangula* and ultimately scavenged the dead young, which were not strong enough to leave the nest box [141].

In Slovenia, evidence of scavenging by Ural Owls has been documented at two different carcasses: a European Roe Deer *Capreolus capreolus* killed by a Eurasian Lynx *Lynx lynx*, and a Red Deer *Cervus elaphus* killed by a Grey Wolf [232,233].

In a controlled camera-trap study in Slovenia, Allen et al. [11] placed an adult European Roe Deer carcass at a hunting site characterized by mixed forest and moderate understorey at 18:20 h on 13 May 2014. At 03:05 h on 22 May 2014, a Ural Owl landed near the carcass and began feeding on an exposed thigh. The owl fed intermittently for approximately three minutes before departing. On 23 May 2014, a Brown Bear *Ursus arctos* located the carcass and removed it from the site [11].

Strix varia

In Canada, north of Farrell Creek, a Barred Owl was found dead with its chest crushed in a meat-baited trap sometime in February 1981, indicating attempted scavenging at carrion-baited traps [166].

In the USA, an early account from Massachusetts reported, without details, that Barred Owls consume carrion [234]. On 12 February 2005, Graves & Niemi [148] observed a Barred Owl carrying a Great Grey Owl in St. Louis County, Minnesota. The authors suggested that the Great Grey Owl may have been injured or killed by a vehicle collision and subsequently plucked and eaten by the Barred Owl. However, as no evidence of a vehicle strike was found, the alternative possibility—though considered unlikely—that the Barred Owl had killed its close relative could not be excluded.

In North Carolina, a Barred Owl was photographed feeding on the carcass of an Eastern Grey Squirrel *Sciurus carolinensis*. The owl returned to the carcass on multiple nights, although visits were brief [235]. In another North Carolina study, a Barred Owl was recorded feeding on the badly decomposed rib cage of a road-killed White-tailed Deer *Odocoileus virginianus* at camera-trap sites established for mammals [235]. An additional anecdotal observation documented a Barred Owl feeding on a roadside carcass in North Carolina (Halley Buckanoff in [235]).

In northern Georgia, Myers & Bender [236] reported 11 separate visits by a Barred Owl to a single rabbit carcass over four consecutive nights during the breeding season. Across the southeastern USA, researchers deployed more than 700 carcasses in forested landscapes occupied by Barred Owls, yet only three scavenging events were recorded by camera traps. This suggests that scavenging is a relatively rare feeding behaviour in this region [236].

In Wisconsin, on 29 January 2017 at 17:55 h, Allen et al. [11] placed a Northern Raccoon *Procyon lotor* carcass in a hardwood forest with moderate understorey. Approximately 1.5 hours later, a Barred Owl landed near the carcass and began feeding,

doing so intermittently for 22 minutes before departing [11].

In Minnesota, at least three different Barred Owls visited White-tailed Deer *Odocoileus virginianus* gut piles provided by hunters during 2018 and 2019. Camera-trap images showed Barred Owls feeding directly on gut piles as well as capturing rodents that were also scavenging at the site [236]. This historically novel food subsidy also attracted Bobcats *Lynx rufus*, which both preyed upon rodents and scavenged the gut piles themselves. Kapfer et al. [235] referred to this phenomenon as a "two-for-one meal," whereby the sounds of scavenging rodents may facilitate the detection of gut piles by nocturnal predators.

Surnia ulula

In Canada, Duncan & Duncan [238] found that Northern Hawk Owls only rarely failed to take small rodent carcasses when offered. Also in Canada, a Northern Hawk Owl returned 25 times to a *Lynx canadensis* carcass, with the longest visit lasting more than three hours [239].

In Finland, Sámi people in Lapland have long disliked—and at times killed—Northern Hawk Owls because the owls feed on trap-killed Willow Grouse and ptarmigans before the trapper can collect the catch [141].

In the USA, Henderson (in [240]) assumed that portions of Snowshoe Hare *Lepus americanus* and Sharp-tailed Grouse *Tympanuchus phasianellus* found with Northern Hawk Owls were remains from kills made by larger predators. In Minnesota, Ruffed Grouse *Bonasa umbellus* remains were present in some Northern Hawk Owl pellets, which the author considered evidence of scavenging [241]. Scherzinger & Mebs [190] supplemented this Northern Hawk Owl's scavenging list with moose and deer carcasses.

Tyto alba

The Western Barn Owl is the best-studied owl species in the world, yet only two cases of carrion feeding have been documented to date.

In Scotland, Dunsire & Dunsire [242] reported a Barn Owl perched on a freshly dead European Hedgehog at 23:00 on 30 July 1977 on a minor road near Carrington in Midlothian. The authors caused the owl to fly off before it was able to begin feeding from the hedgehog's underside.

Also in Scotland, in December 2010, a Feral Pigeon *Columba livia* was found as a fresh roadkill that a Barn Owl apparently intended to scavenge. However, the owl was dazzled by headlights and was itself struck by a passing vehicle. When found, the owl was still alive but died 20 minutes later [243]. Post-mortem examination showed that the sub-adult male was in poor condition, weighing only 280 g. The region had been experiencing severe winter weather since late November. Upon encountering the dead pigeon, the owl was likely close to starvation, and the vehicle collision ended the event before it had time to feed on the fat-rich roadkill.

Carrion feeding appears to be highly unusual in this species and may occur only under extreme conditions [243].

Food sharing

Food sharing among siblings is a little-known interaction reported for the American Barn Owl [244] and for the Western Barn Owl by Bunn & Warburton [245], Epple [246], and Bühler [247]. In Utah, instead of eating all prey items it received, the largest nestling offered intact prey to its siblings. The first four shared prey items were *Microtus* voles, which the oldest owlet carried to one or another of the smallest siblings while uttering the rapid twittering described by Bunn et al. [25] as the food-offering call. The fifth prey item, a juvenile Pocket Gopher *Thomomys talpoides*, was offered to all younger owlets but was not accepted by any of them. All four nestlings in the brood fledged by 15 June [244].

Previous European observations of food sharing closely match those described above. Slightly larger young Western Barn Owls have been observed feeding younger siblings that were begging for food (e.g. [247]). Bunn & Warburton [245] wrote: "Rarely, the older owlets will actually feed the younger ones. In 1971, a 58-day-old chick, the second oldest of a brood of four, was seen to feed the youngest, aged 52 days, after receiving a vole from the female." They also noted that in another Western Barn Owl family studied the same year, one chick not yet old enough to leave the nest was fed regularly by the two oldest nestlings. After the two oldest began spending time away from the nest, the remaining two members of the brood of five fed the youngest after receiving food from their parents.

Juvenile barn owls seemingly rarely quarrel or fight over food [197] and do not guard food for later use once satiated. Food sharing could have survival value for younger members of large broods, or it may simply represent storing food in "living containers" as a hedge against future food shortages, as Bruce Colvin suggested [244]. Food sharing by juvenile barn owls differs markedly from the siblicide widely reported in the species. It has also been proposed that food shortage through sibling competition could force some degree of food sharing among nestlings [248]. However, food sharing accompanied by reduced growth rate suggests that such behaviour is ineffective when nest predation risk is high.

Marti [244] speculated that food sharing may represent early development of food presentation behaviour, as juveniles less than a year old must provide food to females during initial pair formation and continue doing so through incubation and brooding. In this light, food sharing by owlets may simply be an early manifestation of a behaviour important to their future reproductive success.

Owls stealing food from other birds or mammals

Kleptoparasitism, defined biologically as one species stealing food from another, is generally considered uncommon in owls, yet it does occur. Brown [249] suggested that kleptoparasitic behaviour may develop from carrion-feeding habits, meaning that some observations classified as scavenging may in fact represent kleptoparasitism. Marti [250] argued that kleptoparasitism is so rare in owls that it scarcely warrants discussion. To demonstrate that this behaviour is more widespread than previously assumed, we present below a list of all known cases of owl-related kleptoparasitism:

Asio flammeus

Occasionally, Northern Harriers *Circus hudsonius* and Short-eared Owls *Asio flammeus* harass one another until one drops its prey, allowing it to be stolen. Most often, harriers are the aggressors, pirating prey from owls. Angell [23] writes: "On one occasion I followed a Short-eared Owl that had just snatched a vole from a patch of grasses lining the edge of a slough. As it rose up and headed for a drift log to consume its catch, a Northern Harrier veered undetected in its direction, did a half-barrel roll, [and] snatched the vole from the owl's grasp." Lynch [40] described a case from Alberta in which a Short-eared Owl attacked a male Northern Harrier; the harrier landed shortly afterward and retained its vole.

Photo 4. *First attack of the male Pallid Harrier Circus macrourus was not enough to Short-eared Owl Asio flammeus to lose its prey in Nurmo, Finland. Photo: Ville Palokoski*

In Finland, Ville Palokoski (pers.comm.) studied a pair of Pallied Harriers *Circus macrourus* in Nurmo 2024. May 1, Short-eared Owl captured a vole from the obvious territory of the male Pallid Harrier, which immediately attacked the owl. Second heavy attack was enough for the owl to give up the vole for the Pallid Harrier. Nevertheless, Ville Palokoski felt that the Short-eared Owls and the Pallied Harriers are normally very tolerant to the extent that they will often share the same hunting grounds without any noticeable adverse consequences. (**Photo 4)**

Korpimäki [251] considered both inter- and intraspecific food piracy to be rare, having observed it only once in his Finnish study area. On 16 May 1982, he saw a Short-eared Owl carrying a vole in its talons. A Kestrel *Falco tinnunculus* chased the owl and struck it repeatedly. After three attacks, the owl took shelter in tall vegetation and retained its prey. Later, the author found a whole Common Vole *Microtus arvalis* that was still warm. The kestrel, having failed to secure the prey, returned hungry to the roof of a barn from which it had launched the attacks. As Short-eared Owls appear to capture voles more efficiently at low densities than kestrels, it is advantageous for kestrels to attempt to rob them.

Food piracy between kestrels and Short-eared Owls has been published eight times: once in Finland [251], twice in Sweden [252,253], and five times in the UK [102,254-257]. In three of the five UK cases, the kestrel obtained the prey, although in one instance it lost the prey again to four Hooded Crows *Corvus corone cornix*, which forced it to drop the item [255]. The same author also observed Hen Harriers *Circus cyaneus* robbing both Short-eared Owls and Kestrels.

Dickson [258] described a triangular kleptoparasitic interaction involving a Short-eared Owl, a kestrel, and a Hen Harrier. On 21 July 1968 in Scotland, a Short-eared Owl was chasing a Meadow Pipit *Anthus pratensis*. A kestrel and a Hen Harrier were also interested in the pipit. The owl began fighting with the harrier, allowing the kestrel to seize the pipit and fly off.

In the USA, a Short-eared Owl was seen robbing prey from a Northern Harrier [259], but more commonly Short-eared Owls lose prey to both Hen Harriers and Northern Harriers: at least 12 times in the UK [260] and in the USA [40,261,262]. In the Netherlands, Hen Harriers have robbed Short-eared Owls of prey at least twice, and a male Montagu's Harrier *Circus pygargus* once after a prolonged pursuit [263]. Schipper also noted additional observations from colleagues who frequently saw Hen Harriers stealing prey from Montagu's Harriers, kestrels, and Short-eared Owls.

Kleptoparasitism involving predatory mammals is less common. On 17 November 1974 at Needs Oar, Hampshire, UK, a Stoat *Mustela erminea* was observed carrying a small mammal when a Short-eared Owl suddenly appeared and dived at it. The stoat dropped its prey and reared up defensively, but the owl snatched the prey and flew off [264].

Athene noctua

A Little Owl was obtaining easy prey during grain threshing in Cambridge on 12 March 1947, but a Kestrel saw the opportunity and attacked the owl four times, ultimately relieving it of its mouse [36].

Bubo scandiacus

Kleptoparasitism by Snowy Owls upon Short-eared Owls may be the most frequent interspecific interaction between two potential food competitors [53]. The authors observed these two species in Alberta, Canada, for more than 130 hours between November 1977 and March 1978. Snowy Owls often ignored Short-eared Owls unless the latter appeared to have captured prey, which triggered a piracy response. Only one successful theft was witnessed. Short-eared Owls typically responded to Snowy Owl presence by mobbing the larger owl; on one occasion, mobbing by a single Short-eared Owl attracted three conspecifics to join briefly [53]. Such group attacks could potentially force a Snowy Owl to drop its prey, although this was not observed.

Also in Alberta, a Snowy Owl was seen watching a Gyrfalcon *Falco rusticolus* feed on its kill, a Mallard *Anas platyrhynchos*. After the falcon departed, the owl scavenged—or more accurately, stole—the remains of the duck [265].

In Massachusetts, USA, a Snowy Owl successfully pirated prey from a Northern Harrier [266]. The Snowy Owl left its perch and flew directly at the hawk, which was carrying a small rodent. Approaching from below, the owl rolled onto its back and grabbed for the prey, causing it to fall to the ground. The owl followed the falling prey while the hawk circled overhead calling before flying off. The Snowy Owl then fed on the rodent on the ground [266].

A second example of kleptoparasitism involving a predatory mammal comes from Wrangel Island, where Snowy Owls stole lemmings from Arctic Foxes *Vulpes lagopus* during periods of deep snow [267]. When snow cover made lemmings difficult to catch, the owls shadowed hunting foxes closely. As soon as a fox caught a lemming, the owl would swoop in and attack with its talons. Dr. Irina Menyushina described the behaviour: "To escape, the Arctic Fox would jump and run, making sharp turns; if this was unsuccessful, the fox would drop the prey and lunge at the owl with open jaws. That was the moment the owl was waiting for; it would dive past the fox, snatch up the lemming and fly away. Sometimes, foxes chased owls in such situations, but always without success."

Glaucidium perlatum

In Kenya, a Pearl-spotted Owlet repeatedly robbed a pair of Wood Hoopoes *Phoeniculus purpureus* of food deliveries to their nest. The owlet, much smaller than the Wood Hoopoe, waited on a perch 15–20 ft from the nest until the hoopoe arrived with food, then attacked and made off with the prey. This piracy was repeated, but the owlet had to take the Wood

Hoopoe by surprise in order to succeed [249]. Similar behaviour was reported in South Africa [55].

Ketupa lactea

In Kenya, at Lake Naivasha, a juvenile Milky Eagle Owl consumed a fish dropped by an African Fish Eagle *Ichthyophaga vocifer* [207]. This case is better classified as kleptoparasitism than carrion-feeding. Again in Kenya, video footage taken by Stratton Hatfield documented a Milky Eagle Owl scavenging from an unidentified kill of a Martial Eagle *Polemaetus bellicosus* (Shiv Kapila & Darcy Ogada, pers. comm., 17 Dec 2025). The footage shows the owl repeatedly looking upward toward the eagle, apparently aware of the risk of retaliation, making this a clear case of kleptoparasitism rather than simple scavenging. Despite the substantial size difference between the two raptors (maximum body mass approximately 3.1 kg for the owl versus 4.7 kg for the eagle), the owl boldly appropriated the prey.

Lophostrix cristata

Kleptoparasitism is so rarely observed that we include here a recent case involving the relatively uncommon and poorly studied Crested Owl. In lowland rainforest at La Terronera, Corcovado National Park, Costa Rica, an Ornate Hawk-Eagle *Spizaetus ornatus* captured a Crested Owl with apparent ease. Upon noticing observers, the eagle released its prey. At that moment, a Common Black Hawk *Buteogallus anthracinus*, which had been following the event, attempted to steal the owl from the Ornate Hawk-Eagle. The eagle, however, attacked the Black Hawk aggressively and regained possession of the dead owl. In this instance, the Crested Owl was the victim of kleptoparasitism between two larger raptors [268].

Ninox novaeseelandiae

A possible food-robbing attempt was recorded in Australia when an Eastern Barn Owl was delivering prey and was suddenly attacked from above and behind by a Southern Boobook. A brief flurry occurred between the airborne birds, ending when they flew off in separate directions [269].

Tyto alba

In the UK, Kestrels have been observed several occasions rolling over in flight and snatching a small mammal from a flying Western Barn Owl. [270] saw an owl which was carrying a vole, Kestrel passed below the owl, rolled on its back and seized the prey in both talons. The owl was losing height, while carrying the vole and the falcon with one foot. The the wildly flapping Kestrel broke loose with the vole and flew off. The second case is given by Dunn [271] in which the Western Barn Owl was carrying a small rodent towards a barn. Kestrel attacked the owl from behind, and grabbed the prey. It appeared "back-pedalling" frantically to get the rodent from the owl. However, the owl disappeared with the prey and the Kestrel into the barn. Outcome of fight was unclear but later the falcon got a new chance when the owl after three trials caught a large rodent and mantled it in the grass. Within seconds, the Kestrel appeared from nowhere, and landed on the owl's back. The fight started and both birds rolled over in the grass, and at the end Kestrel took the prey and flew off over the valley. The exhausted owl rested a little in the grass with its beak open and wings spread, and soon resumed hunting. When the owl got a new vole, it swallowed it as quickly as possible, like being afraid of a new kleptoparasitic attack. Shawyer [157] gives one case in which a Kestrel try to take a vole from the talons of an owl heading towards its nest. This attack was violent and the owl fell tumbling into a bramble bush and had to be helped out. And he adds that this example was not an isolated occurrence of piracy, and that there are more reports of Western Barn Owls and Kestrels attempting to remove hard-won prey from one another when the temptation arrises.

Discussion

Cannibalism—defined as the consumption of a conspecific—is an important aspect of predator ecology. Although cannibalism has been documented opportunistically for more than a century, its true frequency and distribution remain poorly understood [10]. Many owls hatch asynchronously, with up to two weeks between the first- and last-hatched nestlings [102]. Several hypotheses have been proposed to explain the evolutionary advantage of asynchronous hatching. Lack's [272] 'brood reduction hypothesis' suggests that asynchrony is a parental strategy for coping with unpredictable food supplies. It ensures that the oldest nestlings have a competitive advantage in years of low prey availability, while the youngest—unable to compete—are effectively eliminated, reducing the brood to a size that the available food supply can support. Consequently, nestling survival in asynchronously hatching species varies greatly from year to year. One mechanism for achieving brood reduction is sibling aggression [273], which may result in the death—and occasionally the consumption—of the weakest individuals [85] [274].

McNicholl [135] noted that the term *cannibalism* has two meanings: (1) eating the flesh of a conspecific, dead or alive, and (2) killing and subsequently eating a conspecific. He recommended using the term *scavenging* for cases in which an animal eats an already dead member of its own species. He compared this distinction to the 1972 Andean airplane crash, in which survivors consumed the bodies of deceased compatriots to avoid starvation [275]. To avoid such duality, the term *conspecific scavenging* is now widely regarded as a form of cannibalism [10].

Bunn et al. [25] proposed that cannibalism in owls is largely a by-product of stress—whether caused by prey shortages, severe weather, or disturbance at the nest. They never observed an adult killing an owlet to feed it to the remaining young, but acknowledged that adults might eat an already dead owlet, or that an older nestling might kill and consume a younger sibling, especially after another nestling had already died. Only under extreme stress, they suggested, would an adult kill and eat an owlet or kill it and remove it from the nest.

Most examples in our review indicate that cannibalism occurs fairly frequently in broods of many owl species. Cannibalism is sometimes—but not always—associated with food scarcity and occurs in all well-studied owl species. In nests, younger hatchlings are sometimes killed and eaten by older siblings, or a parent may kill the youngest offspring and feed them to the others. When a nestling behaves abnormally or remains motionless—often due to undernourishment—it may be perceived as prey, triggering cannibalism [197].

Kumar [29] raised an interesting point: in species with strong sexual size dimorphism, males might be more prone to cannibalism, and the larger size of females may help protect the young from male aggression. This pattern is not evident in our material, as sex was unknown in most cannibalism cases. Only in the Barred Owl was a larger individual (presumably a female) seen carrying a smaller victim (presumably a male) in Williston [147].

Carrion consumption may be advantageous for owls, either systematically or opportunistically, especially as carrion availability is likely to increase due to rising numbers of roadkills and electrocution events [276]. However, both sources also pose significant mortality risks when scavenging occurs near roads or high-voltage power lines. Scavenging represents a potentially important feeding behaviour that contributes to a more complete understanding of ecological processes and trophic relationships. Although our current knowledge of carrion feeding in owls is incomplete, the relatively few documented cases worldwide suggest that scavenging is uncommon. Pellet analyses cannot distinguish scavenged prey from hunted prey, making field observations essential. The use of camera traps to rigorously test and quantify carrion-feeding behaviour in owls is therefore strongly recommended, particularly in South America, Asia, and Australia, where scavenging has so far been documented in only six species.

Caching appears to be an important survival mechanism for owls inhabiting winter climates and arid environments. Díaz Ruiz et al. [193] and Myers & Bender [236] concluded that carrion consumption and scavenging are uncommon behaviours in owls. Winter prey caching allows owls to exploit temporary increases in prey availability and may enhance survival during periods of food scarcity or adverse weather [81]. Young et al. [26] proposed that food caching may also reduce the incidence of kleptoparasitism, at least in the case of Short-eared Owls kleptoparasitized by various Harriers in Europe and North America.

Two hypotheses have been proposed to explain why uneaten prey is sometimes found in or near nests. Under the 'insurance hypothesis', parents store food as a buffer against temporary shortages caused by adverse weather [16,277], especially when the energetic cost of capturing surplus prey is low [278]. Under the 'feeding-time hypothesis', Roulin [49] proposed that food stores allow offspring to eat when parents are unable to forage. Because digestion time in Barn Owls is approximately 2.25 hours [279] and pellet production requires about 6.5 hours [280], food stores allow nestlings to spread meals more evenly over 24 hours. The sight of a vole and the predictability of an imminent meal can also induce pellet ejection [25].

To determine whether these two hypotheses are mutually exclusive or complementary, further controlled studies are needed, particularly those combining behavioural observations with energetic modelling.

Supplementary-feeding studies show that test owls and captive owls are routinely fed dead prey, suggesting that scavenging may represent only a minor behavioural shift from caching. However, carrion consumption appears comparatively rare in the wild [222], and many long-term studies involving numerous carcasses have failed to document owls scavenging [11]. Further research is required to determine the true frequency of scavenging and to assess its ecological significance.

Kleptoparasitism refers to the stealing of already procured food by individuals of one species from individuals of another. We consider food stealing to be one of several feeding interactions. Interestingly, raptor piracy often occurs in a characteristic manner: the hawk or owl approaches from below, rolls onto its back, and quickly grabs the prey from the other bird. Such agility may facilitate the emergence of kleptoparasitism as a persistent behavioural pattern between certain species [281].

Conclusion

Lyons & Moshier [15] and Korpimäki [16] listed food caching for nine owl species, but our review increases this number to **30 owl species** known to cache surplus prey. These include **14 species from North America**, **10 from Europe**, **1 from Africa**, **1 from Asia**, **3 from Australia** and **3 from South America**. Three species—the Boreal Owl, Great Grey Owl, and Short-eared Owl—store food in both Europe and North America.

Cannibalism has long been known in owls, yet its true frequency and distribution remain unclear [10]. In this review, we document **21 owl species** in which cannibalism has been observed: **8 from North America**, **11 from Europe**, **1 from Africa**, **3 from Asia**, and **2 from Australia**. Four species (Boreal Owl, Great Grey Owl, Short-eared Owl, Snowy Owl) exhibit cannibalism in both Europe and North America, two species (Eurasian Eagle Owl and Ural Owl) do so in both Europe and Asia, and one (American Barn Owl) both in North and South America. The number of known cannibalistic species is likely to increase substantially with the growing use of nest cameras. The reluctance to report cannibalism should also diminish, as understanding its causes and frequency is essential for assessing its ecological significance. Distasteful as cannibalism may seem, it is neither wrong nor unusual in ecological terms, despite the moral labels sometimes attached to it.

Prior to this review, carrion consumption had been documented for 15 owl species [11]. We now document **25 species**, including **9 from North America**, **9 from Europe**, **5 from Africa**, **3 from Asia**, 2 **from South America**, and **1 from Australia**. Three species (Snowy Owl, Great Grey Owl, Northern Hawk Owl) scavenge in both Europe and North America, and one species (Great Horned Owl) does so in both North and South America.

Food sharing among siblings remains a little-known behaviour, so far reported only in the world's best-studied barn owls, but it is likely to be discovered in additional species with further research.

Food piracy in owls is uncommon, but not so rare as to be dismissed. Brockmann & Barnard [281] listed four owl species known to engage in kleptoparasitism. Our review documents **8 owl species** involved in stealing—or losing—prey to other birds or mammals.

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