

*Comments/Reflections***Birds using artificial plants as nesting material**

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Abstract

Here we present the first cases of birds using artificial plants as nest material. We report our findings for the common coot (*Fulica atra*) from Leiden, the Netherlands, in 2019. This is the first population of freshwater birds studied for its use of anthropogenic nest materials, and together with another report from the same year, the earliest case of an entire bird population with plastic in all nests. We also report the first artificial plants used as nesting material by birds, and discuss the implications of their usage as such.

Keywords

Anthropocene, bird nest, canals, common coot, plastic pollution.

1. Introduction

We have entered the Anthropocene, a new geological period defined by human impacts (Crutzen & Stoermer, 2000). A starting point for the Anthropocene is the 1950s, which marked the onset of the mass-production of human-made substances, such as plastics (Zalasiewicz et al., 2016; Ludwig

& Steffen, 2017). Plastic plays an important role in the Anthropocene (Corcoran et al., 2017) as the global production has increased rapidly over the last 70 years (Thompson et al., 2009; Geyer et al., 2017). When plastic started to be produced for the masses, so began the aesthetic problem of plastic as litter (Barnes et al., 2009). However, the accumulation of plastic waste in our environment also has major consequences for wildlife (Bergmann et al., 2015). Birds like fulmars and albatrosses, dying of starvation due to a build-up of plastics in their stomachs, are prominent examples of such effects (Azzarello & van Vleet, 1987; van Franeker & Law, 2015; Rapp et al., 2017). Entanglement of animals is another environmental impact of plastic waste (Ryan, 2018). Some birds actively surround themselves with plastic, as they use plastic for the construction of their nests; a recent review on this referred to 24 species that at that time were known to do so (Jagiello et al., 2019). This increases the risk of entanglement for both the parents and chicks (Montevicchi, 2008; Votier et al., 2011; Ryan, 2018). As seen in e.g., Darwin's finches (*Geospiza fuliginosa*), artificial nest material may result in fatalities of nestlings (Theodosopoulos & Gotanda, 2018). The more anthropogenic material used in bird nests, the higher the chances of entanglement, with often lethal consequences (Townsend & Barker, 2014).

Most studies on artificial nesting material concern sea-birds (34 cases) and, to a lesser extent, land birds (17 cases). However, studies on artificial nest material in the nests of freshwater birds are lacking (Jagiello et al., 2019) and are thus presented as a knowledge gap (Blettler et al., 2018). A recent study on the greater thornbird (*Phacellodomus ruber*) which lives near riverbanks and constructs nests with plastic, is the only example of a peri-aquatic bird (Blettler et al., 2020), but plastic in nests of true waterfowl have not yet been reported.

One true freshwater bird that often uses plastic as nesting material, is the common coot (*Fulica atra*). The Netherlands has, together with Hungary and Poland, the highest abundance of common coots in Europe (SOVON, 2002). These birds are one of the most common birds in Dutch canals (Daalder, 2017). Originally, long before the introduction of plastics, common coots constructed their nests from plant material. According to the first descriptions of a Dutch common coot nest from Nozeman & Sepp (1770), mainly rushes (*Bolboschoenus*, *Eleocharis*, *Juncus*, *Luzula*, *Scirpus*, *Schoenoplectus*) and common reed (*Phragmites australis*) were used. As many Dutch historical city centers lack natural vegetated banks, water birds can only

construct their nests with partly submerged water plants such as yellow water-lily (*Nuphar lutea*) and European white water lily (*Nymphaea alba*), or with twigs from alder (*Alnus*), ash (*Fraxinus*), and willow (*Salix*) growing along the canals.

Apart from these few natural options, plastic litter is widely available in Dutch canals (Rambonnet et al., 2020; Tasseront et al., 2020; Hiemstra et al., 2021), and common coots have begun to use such litter as nesting material. We discovered that one particular type of plastic items may end up in coot nests because they are potentially mistaken by the coots for genuinely natural items, namely: plastic fake plants.

Artificial flowers, first made from silk, originated in China but reached Europe in the 12th century (Travers, 2020). Over the past decade, plastic plants seem to have increased in popularity with producers and consumers, as both the diversity of available ‘species’ broadened and superficial similarity improved (Wood, 2019). Prices range from less than one euro to hundreds of euros for just one specimen. According to ‘Nearly Natural’, a company selling fake plants: “The artificial foliage industry flowered (literally!) into a multi-billion-dollar business” (Green, 2020). However, their products also end up as litter. The magnitude of this problem may be unclear, especially when surrounded by real plants, as artificial ones are well camouflaged, and thus not easily recognized (Figure 1). Here, we study the incorporation of artificial plants into nests of the common coot.

2. Methods

After the breeding season of 2019, twelve nests were collected from the historical city centre of Leiden, The Netherlands. All nests were collected from the canals by canoe. Coots preferably make nests on floating platforms, bridge pillars, or boats, which makes the nests easy to collect. When no substrate is available, the nest base is built up from the bottom of the canal with large twigs (Daalder, 2017). If this was the case, only the top part that stuck out of the water was collected. The nests were kept for at least a week in a freezer at -20°C to kill parasites like red mites (*Dermanyssus gallinae*), which are abundant in urban nests (Cafiero et al., 2013). Nest construction items were divided into the categories ‘natural’ and ‘artificial’ (Wang et al., 2010). Artificial plant items were easily recognized because they had maintained their striking green appearance, whereas all the natural plant material



Figure 1. Artificial leaf of a juvenile Swiss cheese plant (*Monstera deliciosa*) meant as a placemat but found as litter, camouflaged among real yellow water-lily (*Nuphar lutea*) leaves in the canals of Leiden, the Netherlands. Collected during a Plastic Spotter canal clean-up on 19 July 2020. Photo by Auke-Florian Hiemstra.

at the time of dissection had withered and lost its original colour. Among these 12 nests, two cases were found of artificial plant incorporation. During the 2020 breeding season, an abandoned common coot nest yielded another case — further sparking our interest in this odd behaviour. To identify the artificial plants found in the common coot nests and to trace back their producers, the artificial plant sections of three local garden centres were visited. For some fake plants, no matching items could be found. These artificial plants were tentatively identified using Google image search. Producers were traced by information provided on the accompanying labels at the garden centre or on the internet.

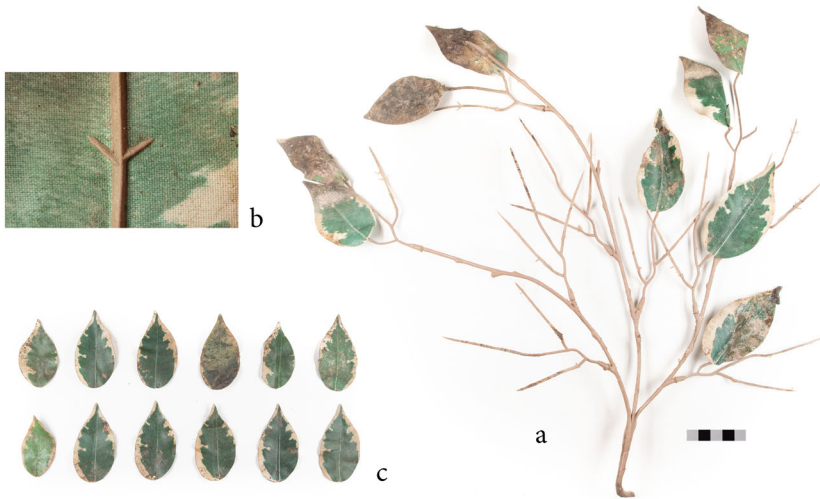


Figure 2. (a) Weeping fig (*Ficus benjamina*) imitation by Mica Decorations, found in a common coot nest in the city centre of Leiden, The Netherlands in August 2019. (b) Close-up of artificial secondary veins. (c) Close-up of loose leaves (Hiemstra 1, L3991784). Scale bar = 5 cm.

3. Results

The most common types of artificial nest material found in common coot nests were food packaging, cigarette pack foil, and straws. The 12 nests consisted on average of 29.3% artificial material (1634/5579). Some nests were even constructed with more plastic than natural items. Among the plastic material were several artificial plants. As far as we are aware, these are the first plastic plants recovered and reported from bird nests.

The first artificial plant (Figure 2) was found in a common coot nest on the Zuidsingel in Leiden, the Netherlands (52.160083°N, 4.502250°E) in August 2019. Plastic branches were already seen sticking out of the nest while the common coot was breeding. When the chicks had left the nest, the artificial branch was collected by us and incorporated in the national herbarium collection of Naturalis Biodiversity Center (Hiemstra 1, L3991784). Just nine artificial leaves were counted on the plastic twigs, but an additional twelve loose plastic leaves were found during dissection of the nest. The leaves most likely came detached during their incorporation into the nest, when common coots not only position items into place with their beaks, but also stamp with their feet on the nest (Boer, 1974), and possibly rupture plastics into multiple

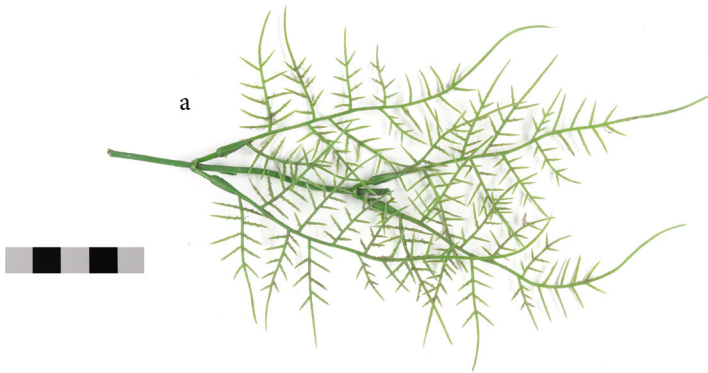


Figure 3. Part of a Ferny asparagus (*Asparagus*) imitation found in a common coot nest in the city centre of Leiden, The Netherlands in August 2019 (Hiemstra 2, L3991785). Scale bar = 5 cm.

pieces with their sharp nails. This fake plant could be identified as an imitation of the weeping fig (*Ficus benjamina*). It closely resembled the starlight cultivar with white variegation on the edges of the leaves, and is referred to as “Ficus ‘Natasja’” by the producer Mica Decorations (Intratuin, 2020).

The second artificial plant (Figure 3) was discovered during the dissection of a common coot nest from Oranjegracht in Leiden, the Netherlands (52.157667°N, 4.499694°E), in August 2019. This specimen was also incorporated in the herbarium collection of Naturalis Biodiversity Center (Hiemstra 2, L3991785). As the twig was broken off on both sides, it appears to be the middle section of a previously larger specimen. Based on the presence of multiple tiny leaf-like structures, it could be identified as an imitation of ferny asparagus (*Asparagus*) (Floristik24, 2020). The artificial plant is referred to as “Faux Asparagus, Plumosus”, referring to the horticultural cultivars of *Asparagus plumosus* Baker (Atlas, 2020; Bol, 2020).

The third artificial plant (Figure 4) was recovered from a nest first seen in April 2020, located on the Beestenmarkt, Leiden, the Netherlands (52.162222°N, 4.485444°E). The nest was built in a car tyre, attached to the side of the canal as a boat fender. Although there were eggs on the nest, the common coots abandoned the nest, as it partly fell apart. The recovered fake plant was identified as an imitation of a carnation (*Dianthus*). This specimen was also incorporated in the herbarium collection of Naturalis Biodiversity Center (Hiemstra 3, L3991786). The 30-cm-long artificial white flower is

produced by IKEA and referred to as ‘SMYCKA’ on their website (IKEA, 2020).

4. Discussion

In 2019, all nests of the common coots breeding in the historical city centre of Leiden, the Netherlands, contained plastic ($N = 12$). In the review on artificial items in bird nests by Jagiello et al. (2019), all studied populations still contained a certain proportion of ‘all-natural’ nests. In 2019, however, artificial items were found in all the nests of the greater thornbirds (*Phacellodomus ruber*) studied by Blettler et al. (2020) and the here presented population of common coots. The year 2019 thus seems to be the first year in which complete bird populations were found — both in the old and the new world — for which all nests contained plastic. However, the question remains whether artificial plants encountered in nests are there because they were interpreted by the birds as natural items because of their similarity to real plants.

There are various hypotheses explaining why birds may build with plastic (Jagiello et al., 2019). Plastics may be used simply as a back-up material when natural materials are scarce or absent (Witteveen et al., 2017). However, plastics may also be specifically favoured over natural materials as they come with certain benefits. Plastic may strengthen the structure, be easier to build with, and their striking colours could make it easier to find, thereby reducing search costs for nesting material and resulting in an increased building speed (Antczak, 2010). The incorporation of cigarette butts with plastic filters and nicotine remains may help to repel parasites (Suárez-Rodríguez et



Figure 4. (a) Carnation (*Dianthus*) imitation by IKEA, found in a common coot nest in the city centre of Leiden, The Netherlands in April 2020. (b) Close-up of flower (Hiemstra 3, L3991786). Scale bar = 5 cm.

al., 2013). Moreover, plastic decorations can increase mating success (Madden, 2003) or have a signalling function (Sergio et al., 2011). In the case of artificial plants, however, plastic may be used simply because it resembles natural nesting material.

We have seen indications of this in an earlier study on American crows (*Corvus brachyrhynchos*). These birds are known to use ‘synthetic twine, string, and rope’ in their nests and, as suggested by Townsend & Barker (2014), may do so as these resemble their preferred natural nesting materials like vines, grasses, or strips of bark. Also, great grey shrikes (*Lanius excubitor*) use plastic strings in their nests, which resemble the long hairs from horses which are traditionally used by this species (Antczak et al., 2010). Likewise, thrushes (Turdidae), old world flycatchers (Muscicapidae), and finches (Fringillidae) use anthropogenic string and coir in their nests that resemble fibrous roots and grass (Biddle et al., 2018). In these studies, artificial objects became incorporated into nests, apparently because they share physical features with natural items, although there have been no direct tests of this assumption, as noted by Reynolds et al. (2019). As plastic plants are especially designed to imitate the natural world, they may be even more convincing mimics, thus likely to be chosen as building materials.

The fake *Ficus* that was used as nesting material by the common coots, for instance, was described by the manufacturer as “indistinguishable from the real thing” (Intratuin, 2020). IKEA referred to their fake *Dianthus* as “so real that you can almost smell them” (IKEA, 2020). Potential buyers who are not yet persuaded by these clearly biased advertisement slogans, may be lured by the availability of special perfumes to give artificial plants a natural smell, like a fresh pine smell for fake Christmas trees (Braeburn, 2019).

In 1775, Marie Antoinette was presented an artificial rose that was so perfect, that it reputedly caused her to faint (Burns, 2007). Nowadays, however, imperfections are incorporated in the design to improve the resemblance with real plants. The “Two Week Vacation” model with both slightly browning leaves and substantial wilting, for instance, adds to the illusion of a real plant (SBFP, 2020). As the accompanying website states: “Who would ever doubt a slightly browning plant?” (SBFP, 2020) (the brown marks on the artificial weeping fig and the carnation (*Dianthus*) imitation collected in the common coot nests depicted in Figs 2 and 4 are, however, stains left by bird faeces).

Resemblance to the original appears to be a selling point in the artificial plant industry. This also leads to viral news articles like “Woman ‘heartbroken’ to discover she’s been watering a fake plant for two years” (Besanville,

2020), “Thoughtful lad has been watering his girlfriend’s plant for months — only to find out it’s fake” (Hawken, 2019) and “Woman tells husband to water her plants after she passes away. Years later he discovers they’re plastic” (Independent, 2018). It should be noted nevertheless, that there may be a difference between human and avian vision and perception.

Many artificial items, intentionally or not, will indeed be indistinguishable from the real thing — at least for animals. Circa 80% of the foamed plastic debris washed ashore on the Dutch coast has peck marks from birds that presumably mistake polystyrene foam for cuttlebones or other food (Cadée, 2002). When seabirds have more specialized diets, they are less likely to confuse plastic with prey, unless their specialization resembles a certain type of plastic (Ryan, 1987). Birds foraging on worms commonly ingest rubber bands, of which shape and colour resemble prey such as earthworms (*Lumbricidae*) (Henry et al., 2012). Consequently, rubber bands collected as nest material by white storks (*Ciconia ciconia*) are often eaten by their chicks, as the young may have a lower ability to discriminate between artificial and natural items (Henry et al., 2012).

The artificial plants described in this study may have been picked by common coots either randomly or preferentially as they resemble real plants. Artificial plants are only very rarely found as litter in the Leiden canals during clean-ups (Rambonnet et al., 2020; Tasseron et al., 2020; pers. obs.), thus finding a density as reported here in nests is remarkable, and may suggest preferential selection. Although the present report admittedly is anecdotal, it is (following De Waal, 2016: 45) a starting point for further studies into this intriguing behaviour; in fact, we have recently begun a national citizen science project on the use of plastic in nests of the common coot in the Netherlands (www.meerkoetnest.nl).

The use of plastic in birds’ nests may also be the consequence of too little natural nest material available. A study carried out with black-faced spoonbills (*Platalea minor*) demonstrated that the introduction of more natural nesting material decreased the amount of plastic incorporated into their nests (Lee et al., 2015). The specific use of plastic plants may suggest there is a shortage of natural material, and a tendency to include plants anyway, fake or real. The relation between the number of plastic items in common coot nests, and the amount of natural vegetation surrounding the nest, will be further studied as part of the citizen science project.

Our study describes the first cases of wild birds using artificial plants as a nesting material, making these common coot nests illustrative examples of bird nests from the Anthropocene. The inclusion of plastic in nests will be a behaviour which may only increase as the amount of plastic in the environment continues to increase.

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