

**DEFENSIVE BEHAVIOR OF OSPREYS (*Pandion haliaetus*)
AT NATURAL AND ARTIFICIAL NEST SITES**

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Ospreys (*Pandion haliaetus*) are found nearly worldwide and are common year-round in Florida (Bierregaard et al. 2016, Solensky 2004). Osprey nests in natural substrates (trees) and on artificial substrates (poles) can be found throughout Florida, primarily around sources of water because this raptor's diet is almost exclusively composed of fish (Bierregaard et al. 2016). Ospreys use artificial nest sites such as channel markers, utility poles, and platforms as a supplement to or replacement for natural nest sites, which may no longer be available due to alterations in their environment, such as deforestation due to commercial development (Castellanos & Ortega-Rubio 1995, Bierregaard et al. 2016). Nests in trees often have more cover due to branches, but artificial nest substrates have no cover and this can allow the nest to be more susceptible to intruders.

Nest predation can be reduced by nest defense behaviors by adults (Montgomerie & Weatherhead 1988). Ospreys conduct nest defense behaviors not only to avoid predation, but also other birds who may take over the nest for their own (Bierregaard et al. 2016). Predation pressures that Ospreys are face include raccoons (*Procyon lotor*) and other birds such as eagles that steal their eggs or kill the nestlings (Ortega-Jimenez et al., 2011). Although Ospreys are one of the most-studied North American raptors, little is known about Osprey nest defense (Bierregaard et al. 2016). Signs of territorial defense in Ospreys include: sitting upright in the nest to show that they are alert, shaking wings, warning vocalizations, and aerial chases of the intruder (Bretagnolle & Thibault 1993, Bierregaard et al. 2016).

In this study, I used observations at nests to address the following question: Is there a difference in the types and frequencies of nest defense behaviors exhibited by Ospreys nesting in natural substrates and nesting on artificial substrates? I hypothesize that Ospreys nesting on artificial substrates will spend significantly more time defending their nests by comparing nest defense behaviors over a period of 1 h than Ospreys nesting in trees because there is more cover at and proximate to nests in trees due to surrounding branches. Meanwhile, nests on poles tend to lack cover and can be more easily accessed by intruders, such as predators. I also wished to quantify the most commonly displayed defensive behavior performed by Ospreys at both artificial and natural nest sites.

METHODS

During the months of January-May 2014, I conducted observations at five Osprey nests on poles and at five nests in trees near the Indian River Lagoon in Brevard County, Florida (Fig. 1, Table 1). The nests were randomly selected for this study, and their coordinates were determined by Google Earth. Nests were observed for 1 h total each. Each behavior was recorded after 1 min of observation during the hour in order to get a representation of nest defense behavior for a time budget. The behaviors were categorized into two types: nest defense and other behaviors.

Ospreys would Vocalize when another bird (typically another Osprey) was observed flying above the nest. Aerial Chases occurred when another Osprey landed on the nest or came near it, and one or both of the residents forced it away on the wing. I recorded Wing Shaking when an Osprey would shake its wings as a threatening gesture (Bretagnolle and Thibault 1993). Vigilance was defined as standing on the edge of the nest in an



Figure 1. Osprey nest sites on the Indian River Lagoon, Brevard County, Florida, January – May 2014. The squares show the nests on artificial substrates, and the stars show the nests on natural substrates.

alert posture. As in Bretagnolle and Thibault (1993), Ospreys sitting in the nest were considered to be resting; while a more vertical posture of the bird (standing on the edge of the nest) was considered to be Vigilant.

Due to the small sample of time collected for the behaviors, the nest defense behaviors analyzed were grouped into three types: Calling/Wing Shaking, Aerial Chases, and Edge.

Table 1. Osprey nest sites on the Indian River Lagoon, Brevard County, Florida, January – May 2104.

Nest site	Substrate type	Latitude	Longitude
Grills	Artificial	28°12'40.09"N	80°39'51.73"W
Chilly Spoons	Artificial	28°11'29.29"N	80°40'13.70"W
Captain Katanna's	Artificial	28°10'38.21"N	80°38'56.43"W
Post Rd/US 1, 7 Eleven	Artificial	28°10'20.40"N	80°38'51.66"W
Crab House 1	Artificial	28° 7'26.45"N	80°37'48.25"W
Elm Dr US 1, 1	Natural	28°10'30.35"N	80°38'51.36"W
Elm Dr US 1, 2	Natural	28°10'29.11"N	80°38'51.14"W
Elm Dr US 1, 3	Natural	28°10'25.85"N	80°38'48.87"W
Church	Natural	28°10'47.64"N	80°40'22.63"W
Suntree	Natural	28°13'26.59"N	80°40'40.53"W

Calling/Wing were the vocalizations and wing-shaking behaviors; these were combined because they tended to occur simultaneously. Edge referred to the vigilance of the Osprey as it would stand on the edge of the nest. Other behaviors included eating, flying, cleaning, and sitting in the nest without showing signs of aggression. Statistical analyses were conducted in RStudio (RStudio Team 2015). Shapiro-Wilk test and variances were unequal (Bartlett test of homogeneity of variance), and I used a Wilcoxon signed rank test to test for differences in the nest-defense behavior categories between the artificial- and natural-nest substrates.

RESULTS

There was no difference in the total territorial defense behaviors between natural and artificial nests (Fig. 2). However, I did find a difference in the total amount of time spent on nest-defense behaviors and other behaviors regardless of nest type ($W = 0$, $P < 0.01$). There was no difference in the amount of time spent on Calling/Wing Shaking and Edge (Fig. 2), or between Aerial Chase and Edge (Fig. 2), but there was a significant difference between the Calling/Wing Shaking and Aerial Chase (Fig. 2).

DISCUSSION

Although I expected that Ospreys nesting on poles would spend significantly more time on nest defense than Ospreys nesting in trees, the data do not support this

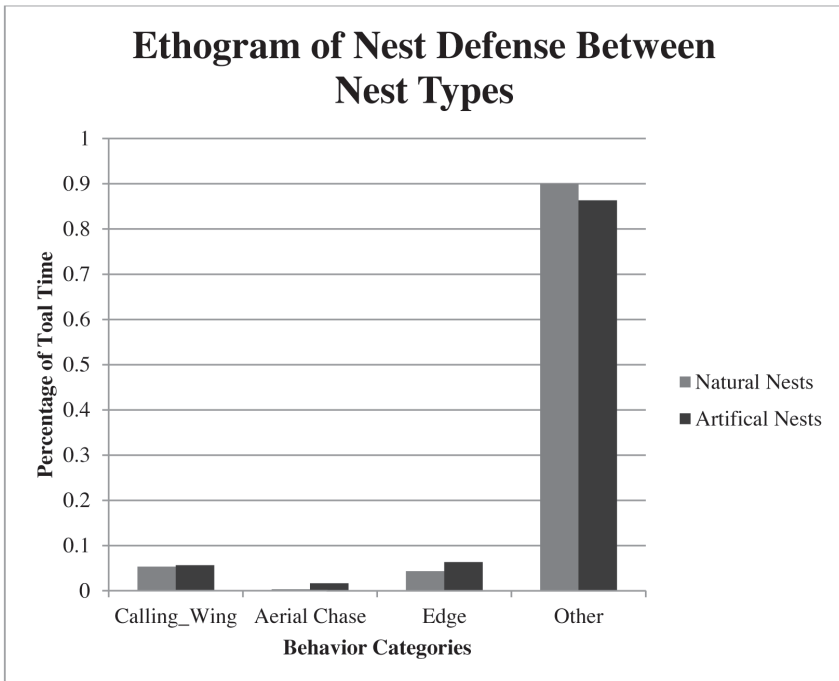


Figure 2. Ethogram of the behaviors observed at artificial and natural nest substrates, Indian River Lagoon, Brevard County, Florida, January – 2014.

hypothesis. Similar to results of Castellanos and Ortega-Rubio's (1995) study, artificial and natural nest substrates did not differ much in the display of nest defense behaviors. I did find a difference between the total time spent on nest defense and other behaviors for each nest type (artificial and natural substrate). My results showed that nest defense does not make up the majority of the Osprey's time, at least in this study area during this time. The location of artificial nest structures and their distance from one another may have an influence on Osprey nest defense behavior. However, the lack of a difference for nest defense behaviors between nest types indicates that Ospreys are tolerant of not just different environments, but urbanization as well as indicated by Bierregaard et al. (2016). Whether or not the nest was on an artificial or in a natural substrate did not negatively affect the Osprey by having the Osprey exert more energy in nest defense behaviors. Nest-defense behaviors are used by Ospreys to prevent intruders from entering their nests to take them over to prey on the contents (Bierregaard et al. 2002). More studies on the predation and interaction of Ospreys with intruders would be necessary in order to address if there is a difference in the rate of predation and intrusion between artificial and natural nest substrates, but based off this study and others (Castellanos & Ortega-Rubio 1995, Bierregaard et al. 2016) that have not shown a noticeable difference for nest defense behaviors between nest types, it could be that the act of intruding upon a nest and the predation of the nest is an act of opportunity and not necessarily a common occurrence.

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