

Rushton Woods Banding Station  
Northern Saw-whet Owl  
Fall Migration  
Summary Report  
2010-2021



RUSHTON WOODS  
Banding Station

*Program of Willistown Conservation Trust*

Prepared by

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Fall 2022

## Introduction

Willistown Conservation Trust (WCT) joined Project OwlNet as a collaborator in 2010 to study the migratory patterns of the Northern Saw-whet Owl (*Aegolius acadicus*), hereafter Saw-whet. Founded in 1994, Project OwlNet is a network of more than 120 independently run migratory banding stations following a standardized protocol to track the migratory movements of this small secretive owl (Figure 1). We are still learning about the migratory and wintering behavior of this small, secretive owl that breeds in boreal and mountainous forests of North America. Here we present twelve years of data collected at Rushton Woods Banding Station (RWBS) to provide a glimpse into the dynamic nature of Saw-whet populations and their migratory movements.



Northern Saw-whet Owl. Photo: WCT Staff

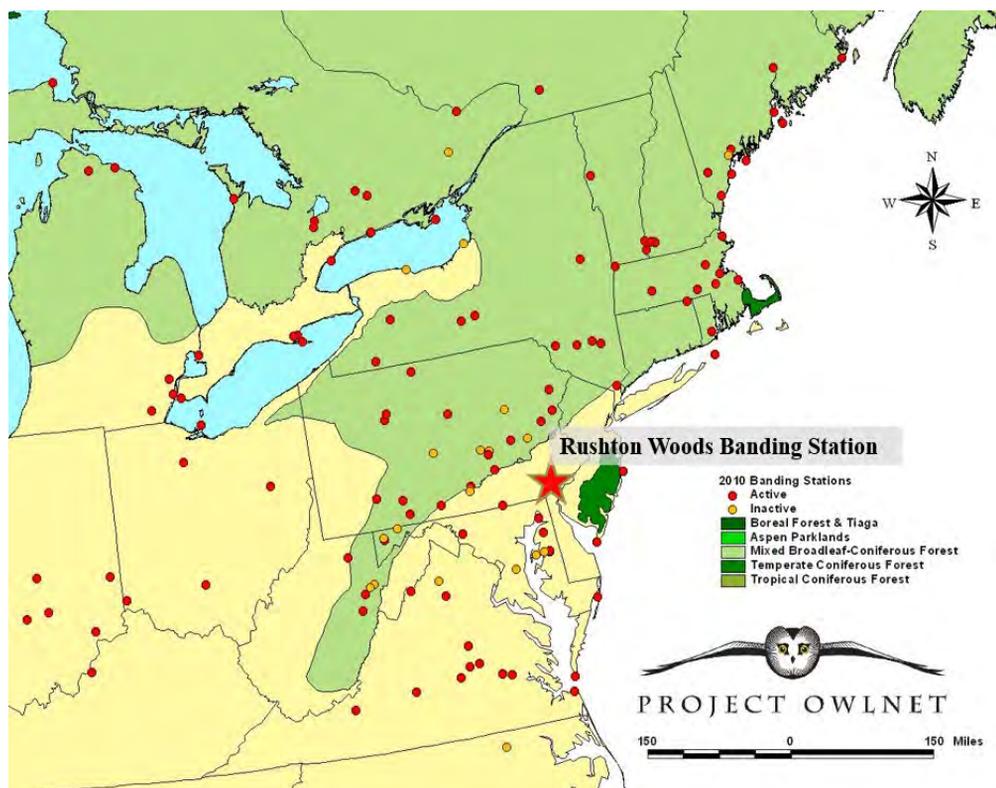


Figure 1. Map of Project OwlNet Stations in the northeastern US. Source: Projectowl.net.org



## Saw-whet Ecology

Saw-whets are a small owl, measuring around 8 inches in length and weighing 2.5oz (77.8g, male) to 3.4oz (95.4g, non-breeding female), which is about the size of an American Robin. Found in the boreal forests of Canada to the mountain ranges of southwestern Mexico, Saw-whets often breed in conifer woods, though can overwinter in a variety of habitats. Closer to us, they are known to breed along the Appalachian Mountain range, nesting in old woodpecker cavities. Common prey species include voles and white-footed mice. Saw-whet movements are complex, with the species sometimes being described as nomadic and exhibiting both resident and migratory behaviors that vary by sex and age. During fall migration, individuals from eastern populations will migrate as far south as Alabama and Georgia, before migrating back north in the spring to breeding grounds in New York and Canada (Weidensaul, 2015).

## Methods

Each fall starting in mid-October, banders at Rushton Woods Banding Station (RWBS) follow Project OwlNet methodology and set up five-six mist nets in a perpendicular array. Beginning at sunset, we continually play an audio recording of the male Saw-whet song for at least five hours to help attract the birds to the area. Nets are checked every 30 minutes, when owls are then carefully extracted and brought to the banding station to be processed. Each bird is given a uniquely numbered aluminum band placed on the right leg. Each bird is weighed and one wing is measured to determine sex, as the females are larger than males but look the same (Project OwlNet). Additionally, we record body condition, a beak measurement, and the specific net where the bird was caught. Birds are recorded as New (N) if they are captured and receive a band at our station; Foreign Recapture (FR) if the bird was originally banded at different banding station; or Local Recapture (LR) if the bird was caught with a band issued at our station either in the same year or in subsequent years.

## Banding Totals

After twelve years of banding during fall migration, 953 Saw-whet owls have been banded at RWBS, in addition to 30 foreign recaptures being catalogued (Table 1). The number of Saw-whets migrating south every year is influenced by prey abundance on the breeding grounds. Years with high rodent population increases the survival of Saw-whet fledglings, meaning more juveniles migrate in the fall (Côté et al., 2007). Looking across time, we can see how migration numbers at Rushton increase and then decrease the following year, likely due to fledgling survival (Figure 3). In addition to year-to-year fluctuations, Saw-whet populations exhibit cyclical peaks, or irruptions, where they migrate in unusually high numbers. Rushton experienced such irruption events in 2012 and 2018, when captures totals of new Saw-whets were 263 and 154, respectively.



Figure 2. Northern Saw-whet Owl.  
Photo: Celeste Sheehan



Table 1. Total number of Northern Saw-whet Owls (NSWO) banded at Rushton Woods Banding Station each year.

Year	New (N)	Foreign Recapture (FR)	Local Recapture (LR)	Total
2010	91	2	6	99
2011	34		7	41
2012	263	7	34	304
2013	30		11	41
2014	95	3	30	130
2015	20	1	10	31
2016	95	4	25	125
2017	12		4	16
2018	154	2	10	166
2019	20		4	24
2020	84	5	17	107
2021	55	6	24	85
Totals	953	30	182	1169

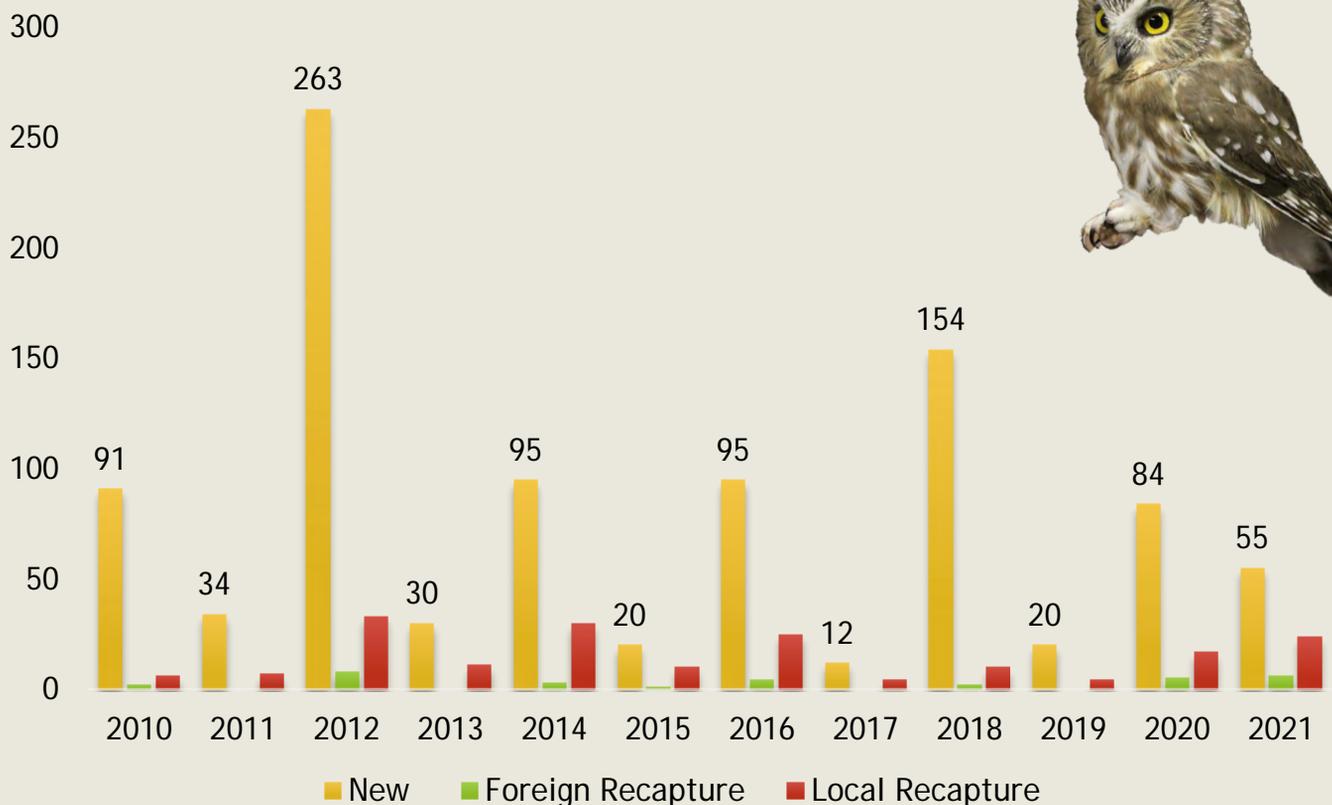


Figure 3. Total number of new, foreign recapture, and local recapture Saw-whet owls during fall migration from 2010 through 2021. Note that years 2012 and 2018 experienced irruptive migration events, with unusually high numbers.

## Capture Rates

Weather is one of many factors that influences how long we are out banding birds on a given night and the number of days within a season. Below you will see a table of how many nights we spent banding, total net hours and capture rates each year (Table 2). Capture rates, calculated as the number of birds captured per 100 net hours, is a way to compare the numbers of birds captured each year more accurately by controlling for the number of nets we have open at any time as well as the amount of time we spend banding each night (Figure 4).

Table 2. Total number of nights banding, net hours and capture rates per year at Rushton Woods Banding Station 2010-2021.

Year	Total # Nights	Total Net Hours	# New NSWO	Capture Rate (Birds/100net hours)
2010	18	487.5	91	18.67
2011	28	524	34	6.49
2012	37	1118.5	263	23.51
2013	40	1178.5	30	2.55
2014	35	1047.5	95	9.07
2015	33	1001.58	20	2.00
2016	31	1103.67	95	8.61
2017	27	778.05	12	1.54
2018	25	688.2	154	22.38
2019	22	536	20	3.73
2020	28	812.29	84	10.34
2021	22	633.5	55	8.68

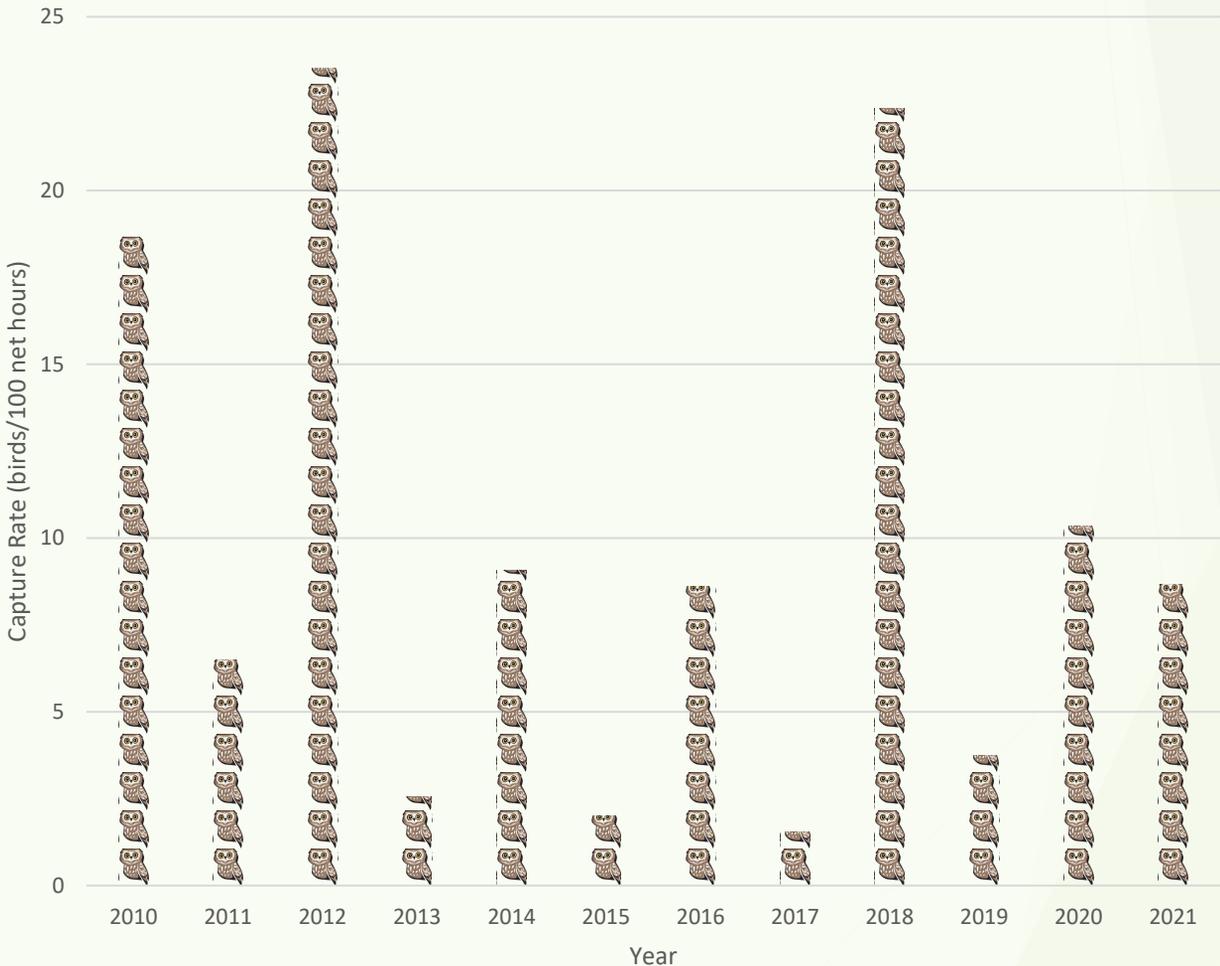


Figure 4. Rushton Woods Banding Station Saw-whet Owl capture rates per year 2010-2021.



## Nightly Captures and Weather Effects

The number of Saw-whets captured in a single night can vary due to environmental factors like wind, temperature, and moon phase. Figure 5 shows daily variation in Saw-whet captures across all years, with migration generally peaking in late October to early/mid-November. Nights with high captures often have strong northerly winds that help push migrating Saw-whets south, and have minimal moon illumination, making mist nets less visible and decreasing risk of predation by larger owl species (Frye, 2012).

Such northerly winds and hidden moons likely led to exceptionally high capture numbers on three special days at Rushton, highlighted in Figure 5.

- In 2016, a storm rolled in on the eve of Halloween, sending banders running for cover and closing nets early. To trick-or-treaters delight, the rain had stopped come morning, though northern wind gusts of up to 20 mph continued into the spooky night and brought in 27 Saw-whets, the highest catch of the 2016 season.
- On November 6, 2012, 37 Saw-whets were captured, likely brought in by two nights of high winds from the north, and a waning crescent moon that helped to keep mist nets hidden
- Nearly identical conditions were seen on Rushton's record day on November 8, 2018, where winds shifting from southwest to northwest carried in 79 Saw-whets.

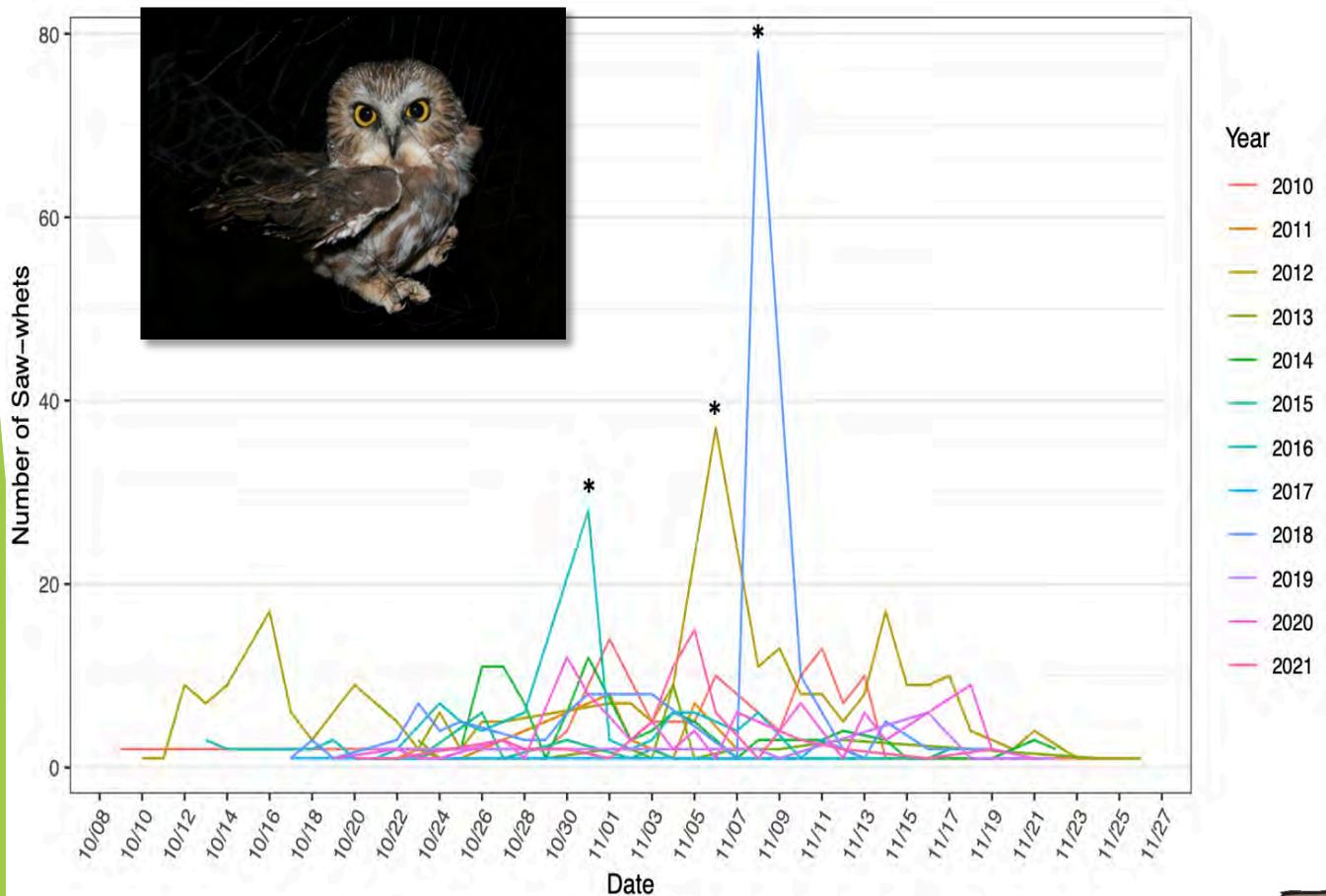
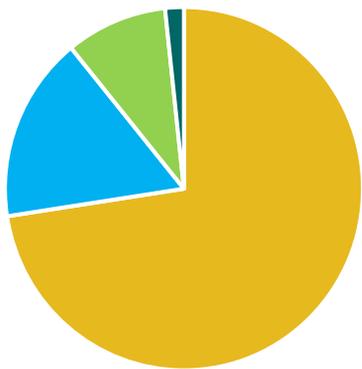


Figure 5. Nightly captures of new Saw-whet Owls during yearly fall migrations from 2010 through 2021. Nights of high captures denoted by \*.

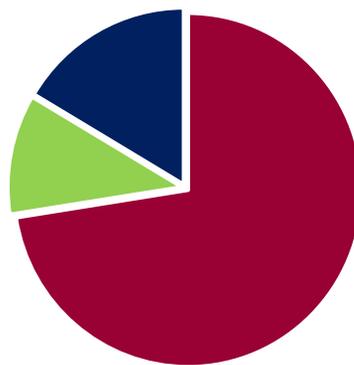
## Age and Sex Totals

Interestingly, not all Saw-whets migrate south in the fall. Long-term banding data indicates that young, or hatch-year (HY), and female Saw-whets tend to migrate further south in the fall, while adults (AHY) and males travel shorter distances, sometimes remaining in boreal forests during the winter (Beckett and Proudfoot, 2012; Weidensaul, 2015). Our data shows the same phenomenon, where 72% of Saw-whets captured are hatch-year (HY), and 73% are female (Figures 6 and 7).



■ HY ■ SY ■ ASY ■ AHY

*Figure 6. Percent of new Saw-whet captures by age class at Rushton Woods Banding Station 2010-2021. Age is recorded as Hatch-year (HY), Second-year (SY), After-second-year (ASY), and After-hatch-year (AHY)*



■ Female ■ Male ■ Unknown

*Figure 7. Percent of female, male and unknown Saw-whets captured at Rushton Woods Banding Station 2010-2021.*

*Figure 8.  
Banding a  
Saw-whet.  
Photo:  
Celeste  
Sheehan*



## Determining Sex

Male and female Saw-whets look identical or are sexually monomorphic, but, as in many raptor species, females are larger than males. This size dimorphism is difficult to visually observe since the difference is slight. Extensive research by Dave Brinker in 1997 (Project OwlNet), has provided us a way to determine sex using two metrics, wing chord and weight. Using this method, we have been able to sex 83% of the birds we have banded.



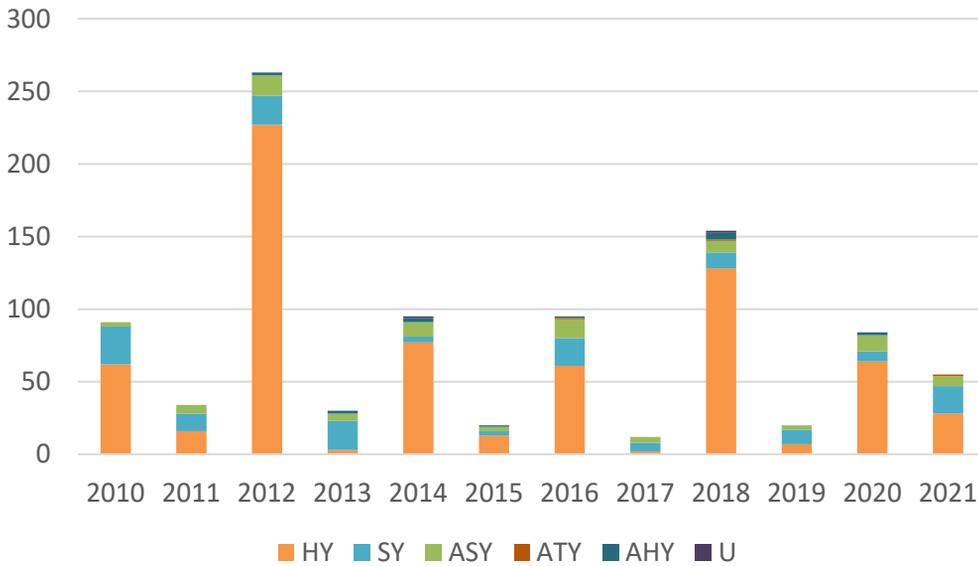


Figure 9. Total New Saw-whet Owls by Age Class per Year at Rushton Woods Banding Station 2010-2021.

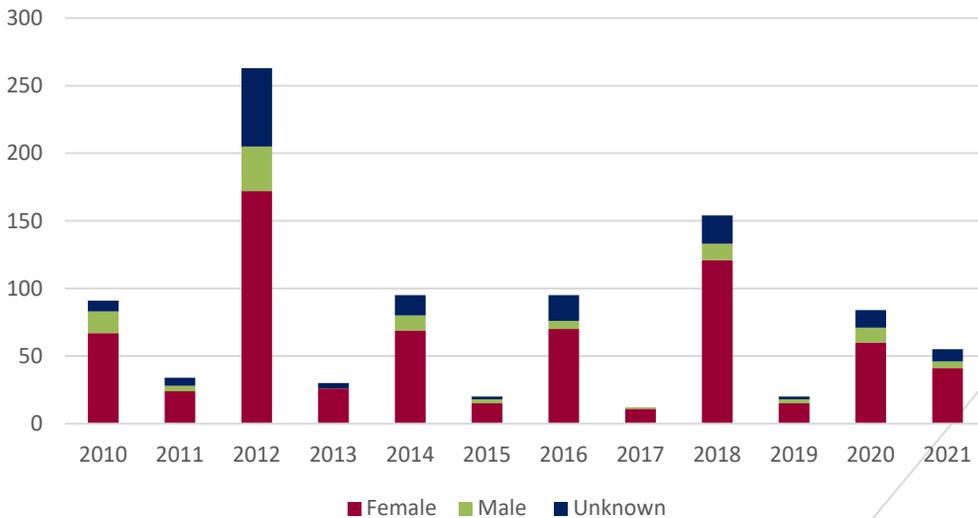


Figure 10. Total Female, Male and Unknown New NSWOW captured at Rushton Woods Banding Station 2010-2021.



## Determining Age

We can determine the age of these birds by the condition and appearance of their flight feathers. Saw-whets do not replace any flight feathers during their first molt in the fall, therefore all feathers will appear uniform. However, second-year (SY) and after-second-year (ASY) birds molt flight feathers in consistent patterns. Second-year (SY) birds replace outer primaries and inner secondaries, giving the appearance of fresh dark brown feathers sandwiching lighter brown, older feathers in the middle. After-second-year (ASY) birds will show three distinct generations of feathers when captured during fall migration, where you can see a pattern of three different aged chunks of flight feathers across the wing (Fig.11).

Interestingly, we can confirm the age of feathers under a black light. Some species of birds, such as owls and nighthawks, have porphyrins, a pigmentation, in the feathers. This is the same pigmentation used by birds to color their eggs. These pigments are faintly visible on the underside of the wing under normal light and freshly grown feathers with a hue of pink. However, in 1982, it was discovered that these pigments fluoresce a bright magenta under Ultraviolet (UV). These pigments also breakdown easily in sunlight, so we can easily observe different feather ages by the intensity of porphyrin fluorescence under UV light (Weidensaul et al, 2011) shown in Figure 11 where the newest feathers have the deepest pink coloration and older feathers that have not been replaced recently, the pink is more faded.



*Figure 11. The left photo shows three different age feathers of an after-second-year (ASY) bird from above. The photo on the right is the same wing seen from underneath and under UV light. Photo: WCT Staff.*

## Do Irruption Years Make a Difference?

Even though younger birds are the majority during migration, the ratio of HY to AHY Saw-whets that are captured can vary by year. During the irruption years of 2012 and 2018, nearly all individuals caught were HY, with only 16% of individuals aged as AHY. However, in non-irruptive years the age difference was less stark with up to 40% of individuals being AHY (Figure 12). The varying sex ratio indicates that irruptive years are related to high nest success in the boreal breeding grounds that leads to more hatch-years come migration.

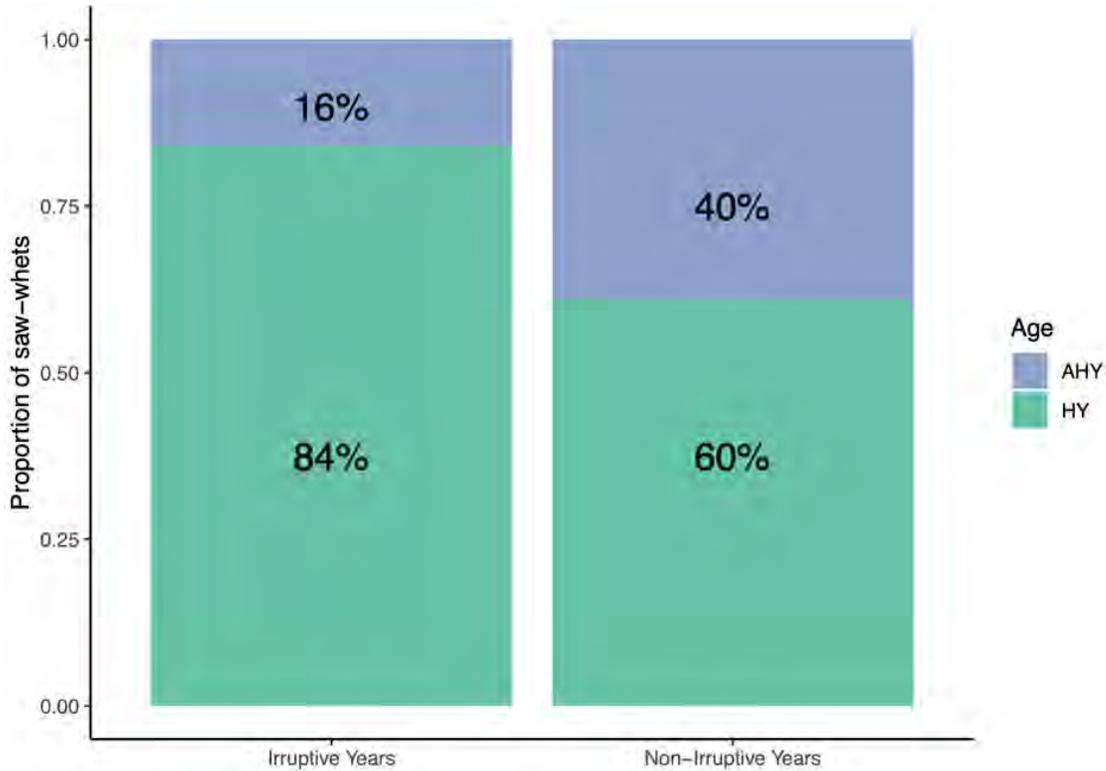


Figure 12. Age ratios of Saw-whets captured at Rushton Woods for irruptive and non-irruptive years. AHY includes all adults aged AHY (after-hatch year), SY (second year), ASY (after second year), TY (third year), ATY (after third year).



Photo: Celeste Sheehan



## Foreign Recaptures and Encounters

In addition to banding new Saw-whets each night, we occasionally capture owls that already have a band on their feathery legs! Thanks to the unique code on each band, we can determine where and when these birds were captured. In most cases, the band is one that we put on the bird in that same year, meaning it is a local recapture. However, when we catch a bird with an unfamiliar number, we enter the number in the central Bird Banding Laboratory database to determine where and when that bird was banded and record it as a foreign recapture. Figure 13 shows the locations (in blue) where 73 Saw-whets were originally banded and the recapture locations for each Saw-whet (in orange). Each bird will have one blue point and at least one orange point. We have caught 30 foreign recaptures from more than 18 other banding stations. Likewise, we have banded 47 birds that have been subsequently captured at more than 14 other banding stations or found elsewhere. Unfortunately, some of the orange points on the map are the locations where a bird was found dead, often struck by a vehicle. Thankfully, we can still identify these birds by the unique band number and record useful information on where and when the bird has traveled. This recapture data increases our understanding of movements of Saw-whets during migration.

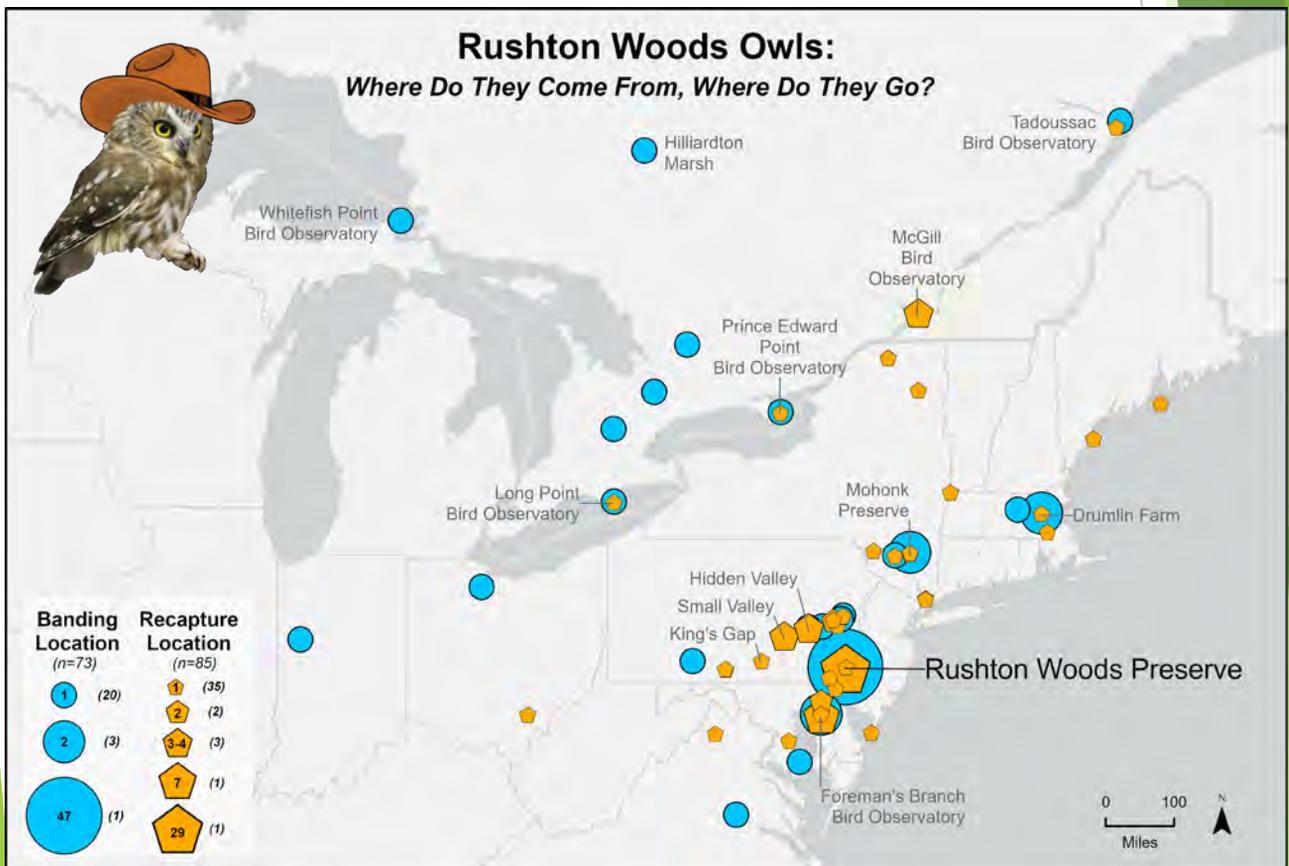


Figure 13. This map represents 73 Saw-whets captured at RWBS from 2010-2021; 47 birds were banded at RWBS and recaptured elsewhere later, and 26 birds were banded elsewhere and recaptured at RWBS. All blue points are a bird's original banding location, and all orange points are a location where a bird was recaptured. Each bird has one blue point and at least one orange point.



Foreign recapture data can give us an indication of location, direction, how fast the birds are moving, and in some cases, individual lifespan. Figure 14 highlights six individual Saw-whets that passed through Rushton.

- Most of our Saw-whets were recaptured within the same year or in the next year. For example, on October 11, 2012, a HY was banded at the Tadoussac Bird Observatory, Quebec. Then, one month later, on November 14, we caught the same bird at Rushton! That's 634 miles south-southwest in 34 days!
- There have been a few occasions where Saw-whets were captured years later. During the 2012 irruption year, we caught an adult female foreign recapture that we learned was originally banded in eastern Massachusetts in October 2007, making this bird at least five years old! The longevity record for Saw-whets is 10 years, which was a bird banded in Ontario as a HY in 2011 and recaptured at a banding station in Wisconsin in 2021 (BBL, 2022)
- Most of our Saw-whets are usually only recaptured at one other station. One exception over the years was a bird that was originally banded in Fergus, Ontario on October 17, 2020, then seven days later was captured just south at Long Point Bird Observatory and then again almost a month later southeast of Columbus, Ohio. Then a year later, the same bird was caught at Rushton on November 4, 2021, giving us four migration points for this bird over two years.
- While most of our foreign recaptures tend to travel from Quebec or Ontario, down through New York, until arriving in Pennsylvania, in 2021 we caught a bird that was originally banded in Indiana. This was the most western point we've documented a Rushton owl.
- Interestingly, twice our birds have been captured north of their original banding location. In October 31, 2011 a Saw-whet banded at Rushton was recaptured just six days later, 62 miles NW at Hidden Valley. Likewise, on November 4 a Saw-whet was banded a Forman's Branch Bird Observatory, then recaptured at Rushton, 60 miles NE just five days later.

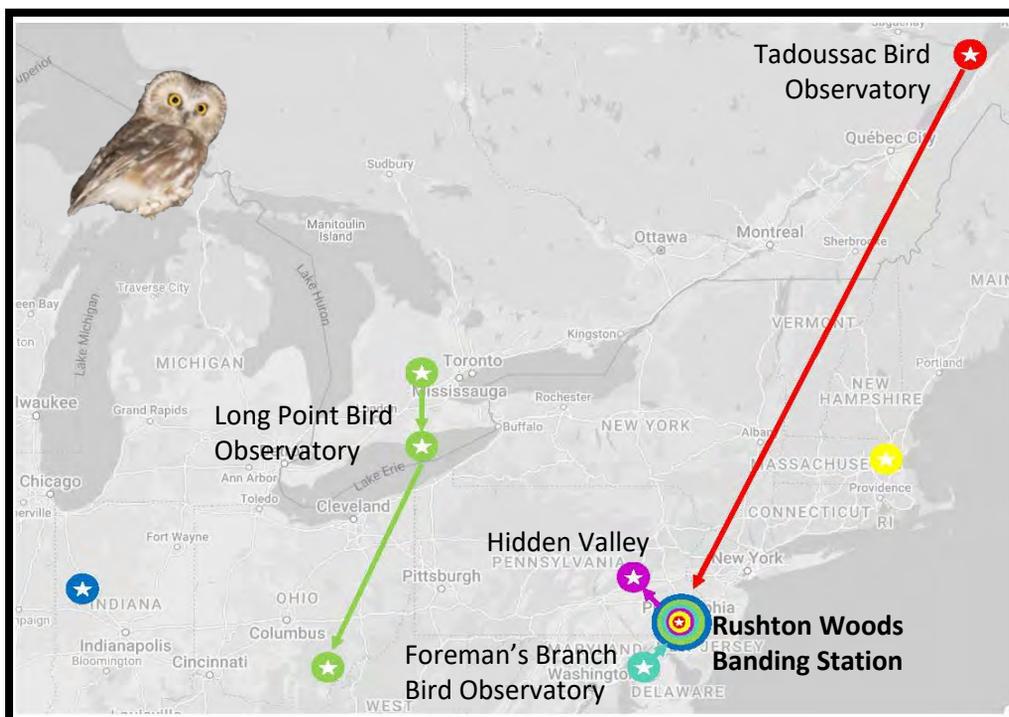


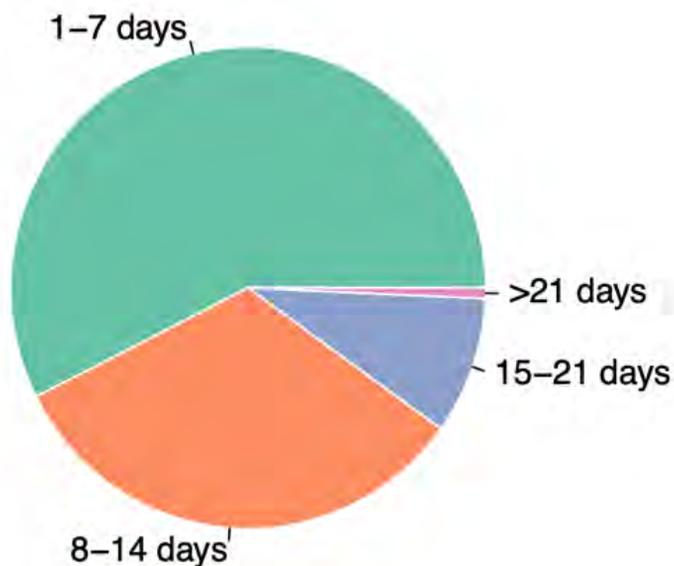
Figure 14. Six foreign recaptured Saw-whets at Rushton Woods Banding Station (RWBS) and their travels.



## How long do saw-whets stay near Rushton Woods?

Given the possible nomadic nature and unpredictable migration of Saw-whets, it is rare to recapture a banded individual at Rushton years later. Excitingly, in the irruptive migration of 2012, we recaptured a third-year female Saw-whet that was originally banded in 2010 as a hatch-year! While recaptures like this are unusual, it is common to have local recaptures that are captured multiple times within the same season. Local recaptures at Rushton are more common during non-irruptive years where 20% (n=107) of individuals were recaptured compared to irruptive years where only 8% (n=35) of individuals were recaptured. This suggests that probability of recapturing within the same season is density-dependent, meaning Saw-whets are less likely to stay for long when migration numbers are high likely due to resource competition (Whalen and Watts, 2002).

Recording local recaptures is useful in measuring how long Saw-whets stopover to rest and refuel before continuing their journey. Across all years, the average stopover duration of recaptured Saw-whets was 7 days, with some individuals staying for multiple weeks (Figure 15). In 2011 we recorded the longest stay of one Saw-whet at 29 days, potentially indicating that this individual remained at or near Rushton Woods throughout the winter. It is unknown how far a Saw-whet may hear the audio-lure we use; they may be flying over in migration, roosting right at Rushton, 1.5 miles away at Ridley Creek State Park, or in your own backyard! Regardless, this stopover data emphasizes the importance of preserving natural habitats for migratory species. Woodland sanctuaries like Rushton provide a haven for weary Saw-whets and are especially important in a landscape increasingly dominated by urban sprawl.



*Figure 15. Stopover length in days of recaptured Saw-whets near Rushton Woods Preserve.*



## A Woodland Sanctuary

While conservation efforts by Willistown Conservation Trust have created more open space and is in proximity to Ridley Creek State Park, the surrounding landscape is highly developed, and habitat is largely fragmented. It is surprising that an interior forest breeding owl can be found within a suburban area, especially one so close to the city of Philadelphia. However, Rushton capture rates, the number of Saw-whets caught per 100 net hours, are comparable to capture rates of three other partner stations in eastern Pennsylvania managed by Scott Weidensaul (Figure 16). These three partner sites, highlighted in the map in Figure 17, are characterized by large acres of woodland habitat, a stark contrast to the fragmented and developed landscape surrounding Rushton Woods. Despite this difference, our capture rates are not only similar but also show the same rising and falling population trends across the years.

Even though our area has fragmented habitat, Saw-whets are still utilizing our woodlands and backyards as migratory stopover sites and perhaps even as overwintering grounds. The presence of these amazing owls reminds us that our actions can impact vital habitat. It is important that we work to protect our nocturnal neighbors by keeping dense vegetation in our backyards for Saw-whets to roost, and by not putting out rodent poison to ensure they can feed safely during the winter. And just maybe, you too will hear the whistling *too-too-too* of a Saw-whet calling out at night.



*Photo: Blake Goll*



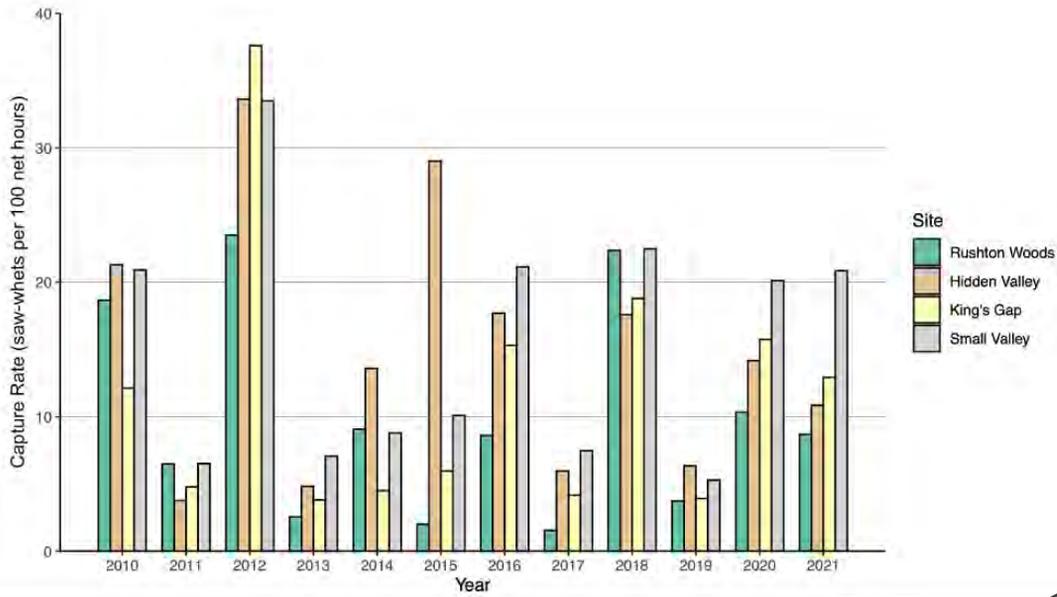


Figure 16. Comparison of capture rates of Saw-whet owls during fall migrations at four sites in eastern Pennsylvania from 2010 to 2021.

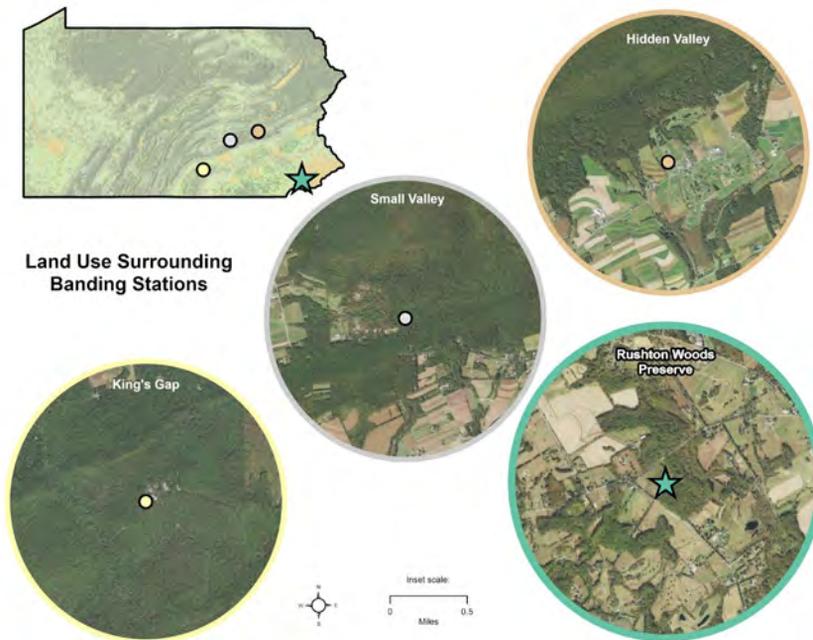


Figure 17. Map of RWBS (star) and three partner banding stations in eastern Pennsylvania. Location of banding stations are magnified to compare varying degrees of human development surrounding Saw-whet habitat.



## Other Owl Species Captured

Finally, although we target Saw-whet Owls, we also end up catching a few other nocturnal visitors. The Eastern Screech Owl (EASO) is a year-round resident in the eastern United States and is occasionally lured in by the call of the Saw-whet. We have captured 28 EASO since 2010, with only one captured more than once! EASO number 100527105, as his band reads, has visited our nets four times since 2013 making this bird at least six years old! We are serenaded by Great-horned Owls, and hear the occasional Barred Owl, but have only caught one other owl species, the Long-eared Owl, in 2012, though it was not banded. Figure 18 represents the owls other than Saw-whet that we have caught since 2010.



Eastern Screech Owl  
(*Megascops asio*)



Long-eared Owl  
(*Asio otus*)

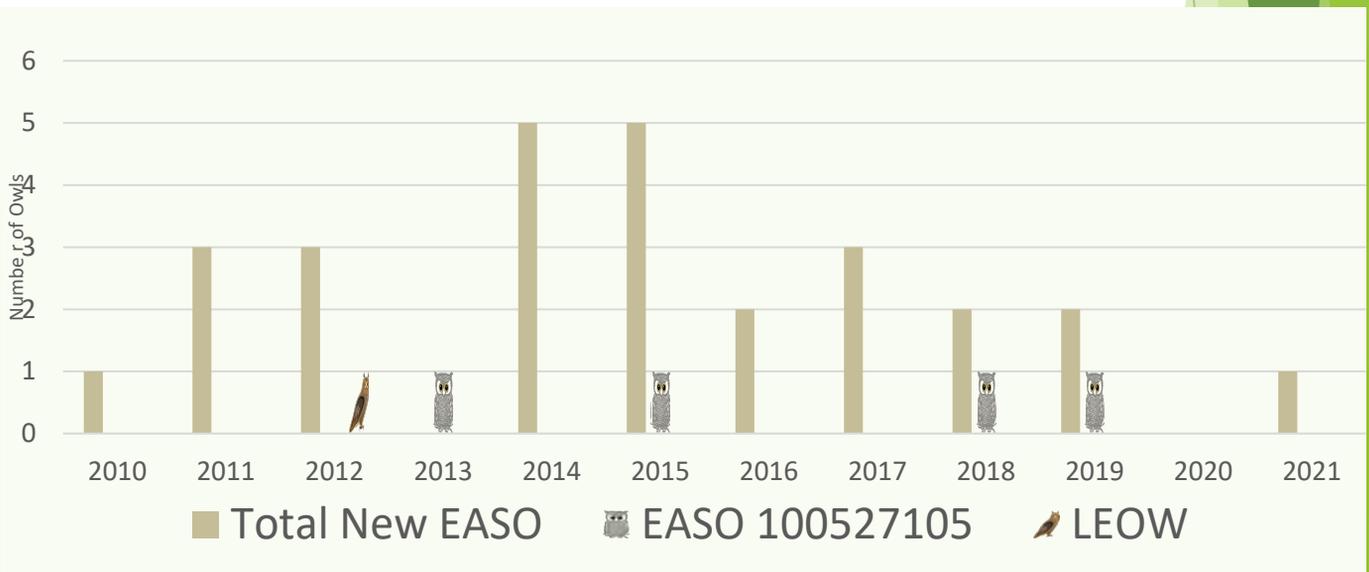


Figure 18. Total new Eastern Screech Owls (EASO), Long-eared Owl (LEOW) and the recaptures of one faithful Eastern Screech Owl at Rushton Woods Banding Station 2010-2021.



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