2022 Eastern Loggerhead Shrike Recovery Program - Summary Report

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1.0 HIGHLIGHTS FROM THE 2022 FIELD SEASON

Wild population

22 wild pairs (15 in Napanee, 7 in Carden)
45 wild young fledged (28 in Napanee, 17 in Carden)
7 single bird (4 in Carden, 2 in Napanee, 1 in Quebec)
14% of bird detected in the wild were captive-origin
29% of wild fledglings from pairs with at least one captive-origin bird

Captive population

28 initial pairs, 4 repairing attempts
19 pairs fledged young
66 fledglings survived to release or retention (22 died during the field season)
12 fledglings retained
54 fledglings released, 9 with radio tags

Status of the captive population (as of December 7, 2022)

70 birds in captivity
67 breeding adults
1 retired female (2010 HY bird at Toronto Zoo)
1 unreleasable non-breeding bird
2 hand-reared education birds (2014HY bird at Toronto Zoo, 2020HY bird at Smithsonian Conservation Biology Institute)

2.0 COVID-19 PROGRAM IMPACTS

The Loggerhead Shrike (LOSH) Recovery Program generally returned to typical operation this year. Field staffing was at pre-pandemic levels, the volunteer Adopt-A-Site program was reinstated in full, and conservation breeding activities are also starting to ramp back up. The largest impact that still remains is likely in staffing levels at partner facilities, which have not yet fully recovered at all locations. Travel is also still somewhat limited, as program personnel have varying levels of comfort around indoor public events. Most meetings this year have offered hybrid in-person/virtual options that have allowed all staff to attend, but this may change if more in-person-only events return.

3.0 WILD POPULATION

3.1 Monitoring

Twenty-two pairs of Loggerhead Shrike (LOSH) were confirmed in Eastern Canada this season: 15 in Napanee, and 7 in Carden (Fig. 1). There was one additional sighting of an adult with a fledgling near Meaford in July, which was reported second-hand through a program volunteer, but this report was never confirmed by field staff so is not being included in population counts.

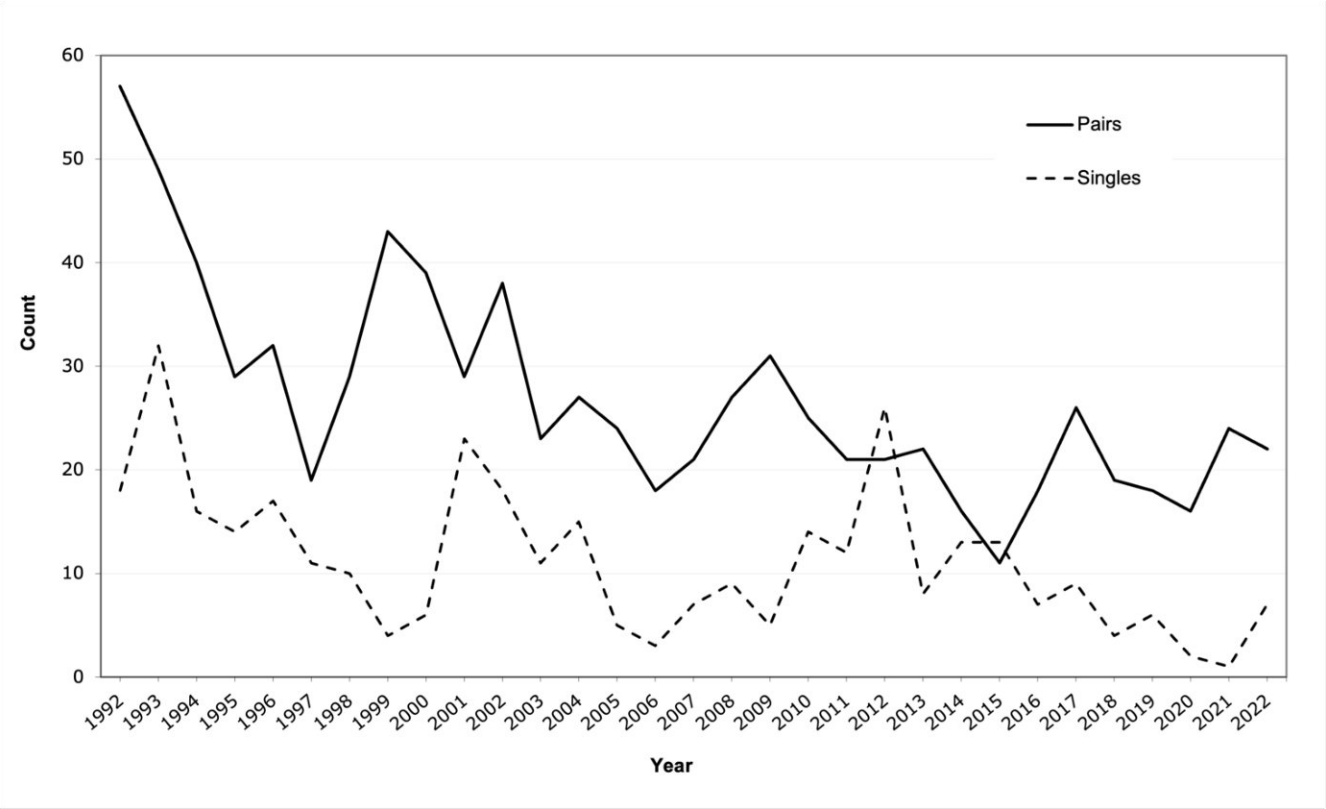

Figure 1. Number of LOSH pairs and single birds in eastern Canada

Counts in each core remained relatively stable this year, with Napanee increasing by one and Carden decreasing by two. Excluding the possible breeding near Meaford, there were no confirmed reports of pairs outside of the two main cores this year. However, there was a single bird reported on eBird in the Lower Saint-Lawrence region in May, so the spectre of unknown breeding locations in Quebec looms this season.

All pairs observed in Carden this year fledged young, though one pair had a failed first attempt and was successful on their second nest. Napanee numbers were markedly lower, with only nine pairs (60%) with confirmed fledglings. Of the remainder, one pair failed to fledge any young, and the other five pairs had unknown outcomes. The dearth of data for the “outcome unknown” pairs can be attributed to a lack of site access (two pairs), birds disappearing before outcomes were confirmed (two sites), and an inability to monitor because of unfriendly landowners (one site).

Nest success rates were high in Carden (89% of observed nests fledging young), but slightly tempered in Napanee (75% in 2022 compared to 90% in 2021). Determining causes of nest failures is always challenging in the absence of direct observation, but American Crows (*Corvus brachyrhynchos*) nesting in close proximity to two of those nests is considered a likely contributor. There was also another instance of an entangled fledgling in Napanee this year, which we last observed in 2019 when an entangled nestling had to be brought in to captivity due to its injuries. Unfortunately the entangled juvenile found this year was already dead at the time of discovery; as in 2019 this juvenile was caught in anthropogenic waste—bailing twine in this case—that had been incorporated during nest building. This was the only juvenile observed for this pair, and no birds were seen on this site after the carcass was removed, so it was counted as a failure.

The 16 successful pairs in Ontario had a total of 45 fledglings observed (28 in Napanee, 17 in Carden), with an average of 2.81 fledglings per successful nest. As with most years, the observed fledgling count is likely an underestimate, as some pairs nested on sites that were inaccessible to field staff, making detailed observations difficult. Further, some family groups were located after the young had already fledged, and fledgling counts tend to decrease with time after leaving the nest as the young get more mobile, thus more difficult to detect. There were no double-broods this year, though one pair in each core had a second (successful) nesting attempt after their first clutch failed.

In addition to breeding pairs, seven single birds were confirmed in Ontario this year: four in Carden, one in Napanee, and one in Quebec (reported on eBird). Only one of these birds had a band combination that allowed definite identification, so this count was largely determined by timing and location of sightings and may be an underestimate.

Using conservative counts of confirmed pairs and single birds, the LOSH population in eastern Canada this year was 51 adults.

3.1.1 Returning captive-bred birds

Seven captive-released birds were confirmed returning to Ontario breeding grounds this year (Table 1), and made up 14% of the population of adult shrike in eastern Canada. Six of these birds had confirmed breeding with wild mates, producing at least 13 fledglings (29% of all wild juveniles seen in Ontario), though that count is likely an underestimate as one adult was found with a single juvenile after fledging so there may have been more young with the other adult, which was never observed.

Two of the returning birds were confirmed as 2021-releases (5% return rate), two were a 2019-release birds that were seen breeding on the same sites in 2021, and two were 2018-releases. At least one of the 2018 birds had not yet been seen in Ontario, which brings the cumulative return rate for that cohort to 8.5%. The other 2018 bird had only a partial band combination observed, so while we can be certain of its release date, no further details could be confirmed.

One other captive-origin bird was seen, but with only a partial band combination we cannot determine year or location with certainty.

Table 1. Captive-bred birds observed in 2022

Core	Band combination	Hatch year	Hatch site[1]	Release site	Sex	Paired?	Breeding outcome
Carden	LB/SI (L)	2021	Unk	Unk	M	Y	2 fledglings
	SI/LG:OR/GY	2019	MRC	Carden	F	Y	4 fledglings
Napanee	LB/SI:OR/OR	2021	TZ	Napanee	M	Y	1 fledgling[2]
	LG/SI:DB/DG	2019	MRC	Napanee	M	Y	2 fledglings
	SI/DB:DB/WH	2018	ALS	Napanee	M	Y	Unknown[3]
	DB/SI:Unk[4]	2018	Unk	Unk	Unk	Y	Failed
	SI/?:?/OR[4]	Unk	Unk	Unk	M	Y	4 fledglings

[1] ALS = African Lion Safari; MRC = Mountsberg Raptor Center; TZ.= Toronto Zoo

[2] Adult an 1 juvenile found after fledging, so likely an undercount for the nest

[3] Staff unable to monitor due to an unfriendly landowner, so outcome unknown

[4] Full band combination never determined, so no details on provenance

3.1.2 Nest checks

Eleven nests were checked this year (six in Carden, five in Napanee; Table 2). All nest checks were completed by Area Biologists, using smart phones to take video that could be later examined to document contents and age nestlings. Typical adult behaviour was observed at all nests immediately following checks; however, one nest (Car84C-1) was inactive at the nest monitoring visit (see *3.1.3 Nest Failures* for details)

Table 2. Nest checks

Core	Patch ID	Date of 1st check	No. eggs	Date of 2nd check	No. nestlings	Age of nestlings
Carden	Car36D	N/A	-	31 May	5-6[1]	13-15 d
	Car36G	N/A	-	31 May	4 + 2 eggs	1-2 d
	Car84C-1	31 May	5	13 Jun	1 + 3 eggs	2-3 d
	Car84C-1.2	10 Aug	0[2]	N/A	-	
	Car88A	30 May	6	13 Jun	2	11-13 d
	Car98B	N/A	-	31 May	4	1-2 d
Napanee	Nap179E	N/A	-	2 Jun	6	13 d
	Nap221A	N/A	-	2 Jun	4	11 d
	Nap221B	N/A	-	2 Jun	N/A[3]	N/A
	Nap176H	N/A	-	2 Jun	6	7 d
	Nap179C	3 Jun	6	16 Jun	3 + 1 egg	10 d

[1] Observed from approx. 15m away from nest on approach, ready to fledge, so nest check was aborted

[2] Empty damaged nest, though may have occurred after fledging as FY seen later in August

[3] Nest was too high to see in; no counts possible

3.1.3 Nest failures

Four nest failures were observed this season: three in Napanee and one in Carden. Two of the failures in Napanee occurred on sites to which staff did not have access, so it was not possible to examine the nests directly. Both of these sites had families of American Crows frequenting the nest area, and in one case there was a crow nest less than 10 m from the LOSH nest tree, and the adults were often seen mobbing the crows. No depredation was observed, but the presence of the crows is suspected to be a contributor to both of these failures.

The third failure in Napanee was at a site where a fledgling was found dead, entangled in bailing twine (see Section 3.1.4). A predator camera had been placed at this nest, but it was shifted by cattle after deployment, so no images of the nest were captured around the time of failure. While it is possible other young may have fledged, no other young were observed in this breeding territory in follow-up monitoring, so the nest was assumed failed.

The failure in Carden occurred at a nest that had been checked to get egg and nestling counts (Car84C-1), and at the last check had one nestling and three unhatched eggs. Both adults were seen returning to the nest immediately after the nest check, and on the nest day during a follow-up visit, but at the next monitoring visit (June 16) there was no further activity at the nest. The nest was approached to discern nest status, and only two eggs that remained. It was decided to leave the eggs for another two days to be sure there was no further activity at the nest, and they were ultimately collected on June 21. The eggs were candled using cellphone flashlights and shown to be infertile, and one of these eggs was about 1/3 larger than the other. No damage to the nest nor any remnants of eggshells or chicks were present.

3.1.4 Plastics found in nests

Plastics continue to be a threat in the Napanee core, and all six nests that were inspected at the end of the season had bailing twine incorporated during construction. Conversely, none of the nests inspected in Carden included anthropogenic wastes.

Bailing twine led to another juvenile death this year in Napanee, as an entangled fledgling was found dead at the start of July (see Section 3.1.3). As a discrete problem, anthropogenic waste has a fairly clear solution: clean up the waste. This idea is going to be brought to the regional working group (the Napanee Plain Joint Initiative) at the next meeting, with the goal of developing a “community cleanup” initiative for the region.

3.2 Banding

Six wild LOSH were trapped and banded this year, four in Napanee by Amy Chabot, and two by Hazel Wheeler, one each in Carden and Napanee. All of these birds were adults in breeding pairs. Band combinations were partitioned this year such that Napanee birds received SI/DG as part of their four-colour combination, and Carden birds received DG/SI. Regular behaviour was observed on all territories the day after trapping activities.

Following all trapping, 37% of the observed adult LOSH population was confirmed banded, 49% unbanded, and 13% with unknown band status. The distribution of banded birds continues to skew heavily towards Napanee, with 84% of all banded birds observed in that core, with Carden remaining largely unbanded. Additional trapping trips were made to Carden this year, but were ultimately unsuccessful. Effort will continue to be focused on Carden next year to increase the proportion of banded individuals in that population.

Band status was not confirmed this year for seven individuals. Three of these (2 in Carden, 1 in Napanee) were birds that were not directly observed; however, three single adults were found with recently fledged young, so the other members of those breeding pairs were assumed. All remaining unknown birds were in Napanee: two were a pair that was observed once by field staff, but were on a site to which there was no access so further observation was limited; one was a member of a pair that was reported early in the season on eBird, but was never directly observed by field staff; and one was part of a pair that was only observed two times in June before they disappeared.

3.3 Development and critical habitat

3.3.1 Post-construction monitoring agreement with BluEarth Renewables

This year marked the fourth year of a five-year agreement with BluEarth whereby WPC would conduct surveys of two Loyalist Solar Project Generation Sites (SGS), and four Habitat Enhancement Sites (HES) to assess if and how LOSH use these SGS, and the areas in and around the generation site infrastructure. Intensive surveys of SGS use ended in 2021, so this year was just surveys and monitoring of birds on HES or around SGS.

All but one of the four HES established for this project are on sites with long histories of LOSH activity, so it is no surprise that breeding again occurred on two of these sites (WPC patches Nap220C and Nap221B). A pair also successfully bred on the property surrounding Solar Generation Site D (on Nap221A) in the same general area where nests have been found the past three years. Though birds had also nested near Solar Generation Site B and were regularly seen using site infrastructure from 2019 through 2021, no birds were observed in this area this year.

Full details of all activities related the Loyalist Solar Project can be found in the *Loyalist Solar Project – Post-construction Monitoring, Year 2022 Report*, available upon request.

3.3.2 Surveys and research with Kingston Solar

This was the first year of a new agreement with Kingston Solar LP whereby WPC would conduct surveys of two Habitat Enhancement Sites (HES) that had been established to meet requirements of an Overall Benefit Permit associated with a solar Sol-luce Kingston Solar PV Energy Project in the Napanee core. This new agreement was reached in 2021 to ensure that both HES had five consecutive years of surveys, and both were maintained as suitable habitat for LOSH over that time.

One of the HES (on Nugent Rd, near the Napanee release site) underwent some habitat restoration over the winter to improve the site's suitability for LOSH breeding, so 2022 was the first of five years of surveys to occur on this site. This work was led by Kurt Hennige, an independent contractor in the Napanee region with extensive knowledge of LOSH, and involved clearing dense areas of red cedars to make the habitat more open. The work appeared to be very successful, as this year field staff observed several grassland species-at-risk that had not been seen previously, including Barn Swallow (*Hirundo rustica*; threatened), Eastern Meadowlark (*Sturnella magna*; threatened), Grasshopper Sparrow (*Ammodramus savannarum*; special concern), and Bobolink (*Dolichonyx oryzivorus*; threatened). A LOSH was also seen twice on this site (June 29 and Aug 17). The June sighting was brief, but there was no behaviour observed that suggested it was part of a breeding pair. The August sighting was a hatch-year bird, and given it was seen in the same location as the first sighting, it is being conservatively counted as the same individual.

No birds were seen on the other HES, which has been maintained as suitable habitat through grazing so will have one more year of surveys to meet the five-year requirement.

Full details of survey work ca be found in the *Kingston Solar – Loggerhead Shrike surveys on Habitat Enhancement Sites, 2022 Report*, available upon request.

Kingston Solar's permit also required them to fund research that would "contribute towards filling a knowledge gap for Loggerhead Shrike that is relevant for the protection and recovery of the species in Ontario". Details of this research can be found in Section 8.1.1.

3.3.3 Surveys on Deseronto Road TNPI Station

WPC was subcontracted in May 2022 by Dillon Consulting Ltd., to conduct LOSH surveys on the Deseronto Road Trans-Northern Pipelines Inc. (TNPI) Station site. This was a small (approximately 3.3 ha) site in the southwest region of the Napanee core, and while it was near some mapped LOSH habitat patches, there was little suitable habitat present. Surveys occurred from May through August, but no LOSH were found. This small contract generated $4K of revenue for the program.

Full details of survey work can be found in *2022 TNPI Cut-out Program: Loggerhead Shrike Survey and Monitoring at 560 Deseronto Rd*, available upon request

4.0 CAPTIVE POPULATION

4.1 Status of the captive population

As of December 7 there were 70 birds in the captive population at partner facilities in both Canada and the U.S. Sixty-six of these birds are considered breeding stock, two are education/exhibit birds, one is

a retired female (HY 2010) and one is a non-releasable non-breeding adult, retained from the 2019 breeding season. The current breeding stock includes: 47 birds that are 5 years or younger (HY 2017-2022), and 19 birds that are 6-10 years old (HY 2012-2016).

4.2 Activities at partner facilities

4.2.1 Captive breeding summary

Twenty-eight original pairs and 4 re-pairs were given the opportunity to rear young across partner facilities. Nineteen of these pairs produced 66 young that survived to release or retention (Fig. 2). Fifty-four of these young were released into the wild (34 in Carden, 20 in Napanee), and 15 young were retained to rebalance losses sustained in the off-season; however, 4 of those retained juveniles died from various injuries and illness (see Section 4.3.2).

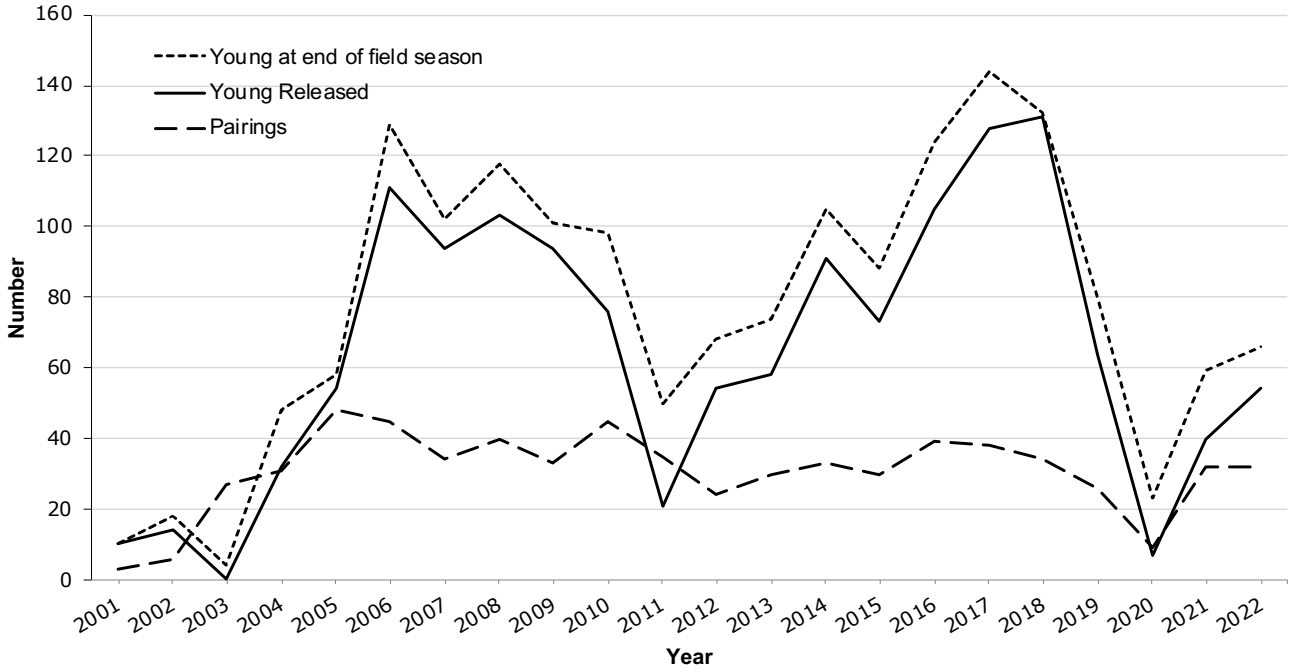

Figure 2. Captive LOSH pairings, young surviving to end of season, and young released

4.2.2 Breeding facility results and wintering status

***African Lion Safari (ALS; Cambridge ON)*:** 8 of 11 original pairings and 1 of 3 re-pairings fledged 43 young this year (26 from 1st clutches and 17 from 2nd clutches). Seven of these successful pairings were first-time pairs. Twenty-seven of these fledglings were released (12 in Napanee, 15 in Carden), 4 were retained, 12 died before release, and one was found dead after release (see Section 4.3.2). The re-pairings made over the course of the season were due to due to observed aggression (2) and lack of interest (1). Two of these re-pairs involved the same male (studbook ID 3028), who was aggressive to his first two potential mates, but appeared to be compatible with the third female. The pair laid eggs but the clutch was not fertile. ALS currently houses 26 breeding birds.

***Toronto Zoo (TZ; Toronto ON)*:** 4 of 6 original pairings fledged 19 young (17 from 1st clutches, 2 from 2nd clutches); 9 were released (4 in Carden, 5 in Napanee), and 5 were retained. Five fledglings died before the end of the season (see Section 4.3.2). One re-pairing was made due to lack of interest. One pair successfully and laid two clutches (one with 5 eggs and another with 2), both of which

hatched but disappeared completely before fledging. An ermine was seen on Toronto Zoo grounds in September; it is suspected that these clutches may have fallen prey to this or a similar predator. Toronto Zoo is currently housing 17 breeding birds, one retiree, and one education bird on display.

***Smithsonian Conservation Biology Institute (SCBI; Front Royal VA)*:** 6 of 9 pairs fledged 26 young (18 from 1st clutches, 8 from 2nd clutches); 18 were released (15 in Carden, 3 in Napanee), and 3 were retained. Five fledglings died before the end of the season (see Section 4.3.2). Of the three pairings that failed, one was due to the female dying (see Section 4.3.1), one pair showed mutual aggression, and one never successfully initiated a clutch. The latter was a pair that laid a clutch of three eggs in 2021 but abandoned them soon thereafter; staff were hopeful the pair would be more successful this year, but they were not. Breeding was cut short at SCBI this year due to construction taking place near the shrike holdings. As such, most pairs were not able to raise a second clutch, which significantly impacted the number of offspring produced for the season. SCBI is currently housing 16 breeding birds and one hand-reared education bird.

***Nashville Zoo at Grassmere (NZG; Nashville TN)*:** 0 of 2 original pairings fledged young this year. One pair laid a clutch of 3 eggs late in the season after delayed courtship signs were observed. The eggs were found in several shards on June 17th; staff do not know if the nest was depredated or if the pair destroyed the clutch. The other pair had to be separated due to observed aggression and could not be re-paired with birds from SCBI as there was insufficient time to complete a transfer and quarantine before the breeding cut-off date. Nashville Zoo is currently housing 7 breeding birds.

4.2.3 Non-breeding facility status

Carolina Raptor Centre (CRC; Huntersville NC): 'Pierce'– the hand-reared education bird raised at Mountsberg Raptor Centre– has been an education ambassador at CRC since January 2020. Unfortunately he was found dead in his enclosure in early spring, with no clear cause of death. There are currently no plans to replace him at CRC.

4.3 Mortality

4.3.1 Adult deaths

We had 10 adult deaths in the captive population this year (as of December 7). One additional death occurred in 2021 after the Recovery Team report was distributed. Eight of these deaths occurred at Ontario facilities and four occurred at a U.S. facility. Details of those deaths are as follows:

ALS (4 deaths): A hatch-year female went missing in Dec 2021, after the Recovery Team report was completed. No body was found after a thorough inspection of the enclosure, though staff did find a hole tunneling under the inside portion of the enclosure so this bird was assumed depredated.

There were four deaths at ALS in 2022, including a 16-y/o male that died from a pulmonary hemorrhage in January. Oddly, this bird was found stargazing on the ground of his enclosure days prior to his death, but this clinical symptom didn't align with his primary cause of death. The reporting pathologist suggested the clinical signs could indicate trauma, an unknown toxin, or a metabolic or nutritional imbalance. Other deaths were a 9-y/o female that died of unknown causes in July (necropsy was not possible due to the state of the carcass), and a 1-y/o female that died from head trauma in August. The 9-y/o female had a history of Vitamin A-related issues and has never been a successful breeder.

SCBI (3 deaths): Two 8-y/o birds (one male and one female) were noted to have severe plaque build-up in their nares at SCBI this year. The issue in the male was found during a routine health check in January and this bird died under anesthesia during a follow-up exam. The female died in-hand during a follow-up exam for chronic beak hyper-keratinisation in July. Necropsies for both of these individuals showed severe parasitic infection with *Calodium* spp. (formerly *Capillaria*), with the plaque build-up a downstream symptom of these infections. Eggs of this parasite, which can be encountered in the enclosure substrate, are resistant to many commonly used disinfectants, so best management is through controlling the local environment (e.g. careful management of enclosure substrates/removing earthworms that can be vectors), and through treatment if worms are already present in the birds. Management of parasites will be a discussion topic for the captive subcommittee during the off-season.

One other bird—an 11-y/o female—died this year due to suspected cage-mate aggression when they were introduced in March. There was some light aggression when the female and male were first introduced, but it subsided quickly and no further conflicts were observed. However, this female was found dead during morning rounds six days after pair introductions, with visible wounds implicating the male.

TZ (3 deaths)**:** A 3-y/o male was found weak and uncoordinated during morning rounds mid-February, and staff opted to euthanize given an extremely poor prognosis; necropsy results are pending. The second death was a 7-y/o female died on August 23rd; no details have yet been received. Finally, a 1-y/o male disappeared in September, and the same morning an ermine was seen near the shrike holdings, so depredation is suspected.

CRC (1 death): 'Pierce' was found dead in his enclosure in March. There were no significant findings during the necropsy and cause of death remains unknown.

4.3.2 Fledgling deaths

There were 22 fledgling deaths this year that occurred prior to release or retention, and 1 in the post-season at its overwintering facility. This amounts to a 25% within-season mortality rate, a percentage not seen since 2010 and 2011 (when mortality rates were 24% and 40% respectively; Fig. 3). Where cause of death was possible to discern, deaths were attributed to the following causes:

- Parasitic infection (*Calodium* spp.; 4 at SCBI)
- Pulmonary infection (1 at TZ)
- Predation (disappeared post-fledge; 2 at TZ)
- Head trauma (1 at TZ)
- Accidental entanglement (1 from ALS at Napanee field site; detailed below)
- Euthanised due to severe leg injury, cause of which was unknown (1 from ALS at Napanee field site)

An additional 12 fledglings (1 at TZ, 1 at SCBI, 10 at ALS) died of unknown causes; preliminary necropsies have been completed for three of these birds, but cause of death remains open. The majority of these birds died before even being handled, but two birds (from ALS) presented with poor flight, poor body/feather condition, and a dirty vent. These birds were part of a second clutch, the first of which all presented with the same symptoms, though they all improved to the point that they were deemed releasable. Some sort of parasitic infection is suspected, as was seen at SCBI, but final necropsy results with histological information will hopefully help clarify cause of death in these cases.

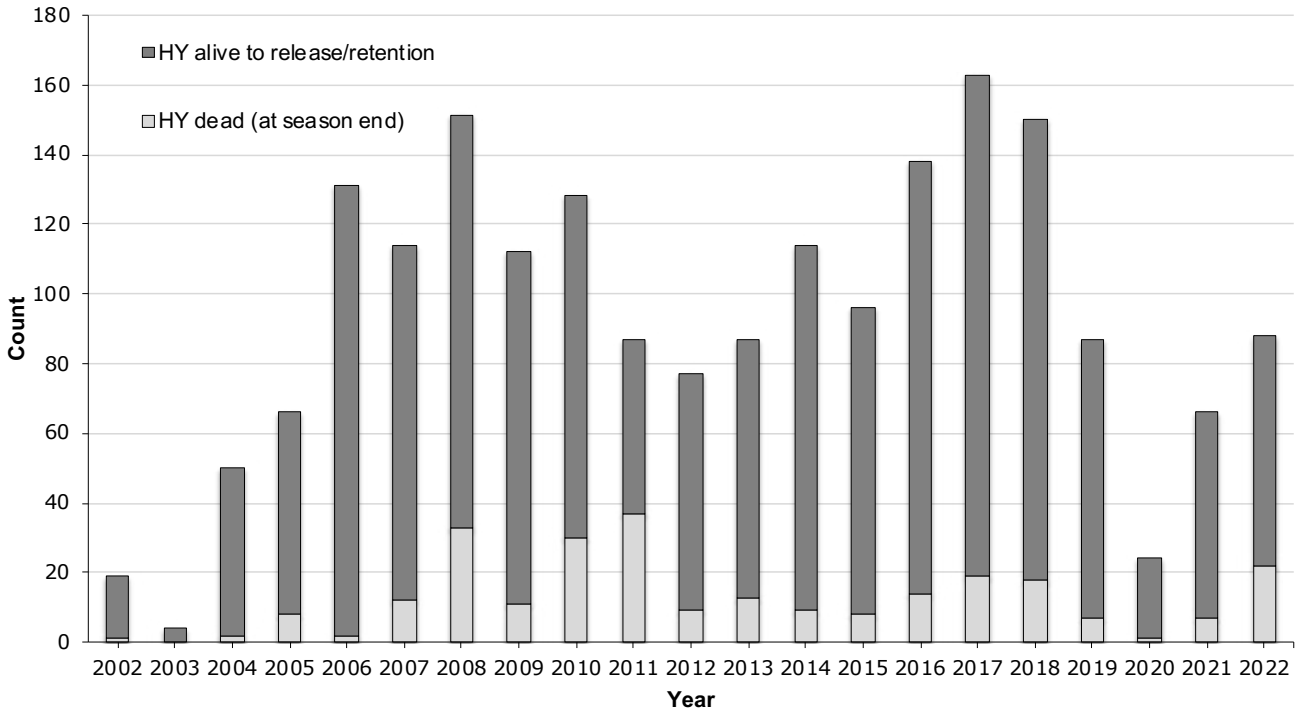

Figure 3. Annual number of fledglings produced that died or survived to release or retention

It is notable that all the fledglings that died at SCBI from parasitic infections were dewormed before dying in care; discussions on a modified HY deworming protocol and/or management of environmental conditions will take place at the captive subcommittee meeting during the off-season.

The depredation of two fledglings at TZ, along with the disappearance of seven chicks from another nest enclosure (see Section 4.2.2), is a worrying development, as weasels have had severe impacts on captive holdings in past. A weasel was seen around the TZ shrike holdings in September, but it has not been seen since. The winter TZ shrike enclosures are built off an old barn that is somewhat porous to predators; however, plans are in place to build a new pod, which will go a long way to assuaging further fears of weasel activity (see Section 4.6.3).

This year saw a novel cause of death in a juvenile that died from injuries sustained when it became entangled by its radio tag antenna prior to release. A small bead of glue at the end of the radio antenna, used to prevent fraying, had gotten lodged in some barbed wire in the release enclosure and the bird had wrapped itself around the wire in an attempt to get free. Field staff freed the bird immediately upon discovery, and it was transferred to Sandy Pines Wildlife Rehabilitation Centre where radiographs showed two broken femurs. Sandy Pines staff were hopeful the fractures would heal after a week of splinting, cage rest and pain management, but at reassessment there was extensive nerve damage and little/no improvement to both legs, so the bird was euthanized.

An inquiry into the radio tag antennas commenced immediately after the incident, and tag manufacturers (Lotek Inc.) responded quickly, confirming that the glue bead could be removed without impacting tag function, and that they would be looking into their manufacturing process. As of this year, 100 radio tags have been deployed on captive-bred juvenile LOSH and this is the only observed occurrence of this type of incident. However, in the interest of decreasing any chance of

entanglement, either during captivity or once they are released, all future radio tags will be inspected and glue beads carefully removed to prevent reoccurrence of such an incident.

One additional a hatch-year female died from head trauma at ALS in October. This was a bird that was fitted with a radio tag in August as part of migratory urge research project (see Section 8.2.2), but presented with weak flight a few days prior to death.

4.4 Pre-release processing

4.4.1 Banding

Sixty-four captive juvenile shrikes received stainless steel bands this season (54 released young, 5 retained young, 4 young that died before release). Released birds that received colour-bands were given a combination that included either DG/SI (41 birds) or SI/DG (7 birds) on the left leg to identify them as a 2022 release bird. Five birds were not given colour bands on their right legs due to old injuries or abrasions, and two birds received only SI on left, one due to an abducted left leg, and one due to a colour band intolerance. Birds released with radio tags (9 individuals; see Section 4.4.2) were banded with the year combination on their left leg only if they received a size 1D band (5 birds), or only a SI on left if they took a size 2 (4 birds).

Young at SCBI received colour-band identifiers only for transfer across the border since SCBI staff were not permitted to apply stainless steel bands. WPC personnel applied SI bands to the SCBI young once they were transferred to field sites for release.

4.4.2 Radio tags

Nine birds were released with radio tags on the Motus network this season (two in Napanee, seven in Carden) using the same nylon-coated elastic cord harness attachment technique used since 2015. Five additional tags were applied to birds in Napanee, but four were removed before release (reasons: tag malfunction, non-active tag, decrease in bird weight, and entanglement – see Section 4.3.2), and one had fallen off between application and pre-release check. Two additional tags were applied to birds in Carden, but one bird removed its tag, and the other bird was found dead in its enclosure. All tags applied were purchased in 2022, and have a 10-month battery life.

4.5 Non-fatal injuries and incidents

4.5.1 Band-related injuries

Two fledglings that were given size 2 bands showed minor abrasions on their halluces at pre-release checks (Fig. 4); both measured well above a size 1D band (tarsus widths 3.63 and 3.71) and both were over 90 days old at the time of banding. The program has seen tarsus widths shrink as birds age, so staff have delayed the application of size 2 bands as a consequence, but these individuals were well past an age where their tarsus widths would have changed if banding was delayed by a week in the field. Both minor abrasions were treated with saline at pre-release checks and both band combinations were changed from DG/SI to SI/DG to displace the weight of the SI bands on the halluces (two other siblings of the same age and similar tarsus widths were given DG/SI and had no abrasions at pre-release checks). It is recommended that going forward, any birds that receive size 2 bands have their colour band applied underneath the SI prevent these injuries.

Figure 4. Minor abrasions to hallux caused by a size 2 band

4.5.2 Transport-related injuries

Transport crates were retrofitted last year following several injuries in carriers that were constructed with a smaller-gauge mesh than had been used in past. All wooden crates used by SCBI this year had the original mesh size (¼ inch); however, several juveniles again sustained dents to their maxillae, and moderate to severe breaks to their tips (Fig. 5). It is suspected that birds get their beaks caught in the mesh and are unable to get free without some breakage, and clearly both mesh sizes are potentially a problem.

It has been recommended that SCBI crates be refitted with a screen-door-type mesh with very small openings that would hopefully prevent damage/injury, or that the transport crate design be reimagined to remove materials in which birds are prone to getting beaks or nails caught. Additionally, it appears that birds are able to see through the shade cloth that is meant to function as a visual barrier on existing SCBI crates, so it has been recommended that crates be retrofitted with a thicker cloth for next season to help manage stress.

Figure 5. Injuries sustained by juveniles transported in SCBI crates: broken maxilla tips (moderate - left; severe - center), and dented maxillae (right).

4.6 Population management

Andrea Morgan (African Lion Safari) continued in her role of acting studbook keeper in 2022, and Colleen Lynch (Consulting Population Biologist with the Population Management Centre) was once again contracted by WPC to produce a Breeding and Transfer Plan for the season, including release prioritization and repairing recommendations throughout the breeding season. Jane Spero has access to the studbook and was able to assist Andrea with HY acquisitions from the breeding season earlier this fall.

4.6.1 Program capacity

Excluding holdings for education/outreach birds, holding capacity across all project partners heading into 2023 (including onboarding Parc Omega and the National Aviary; see section 4.6.3) will be 82 birds.

4.6.2 Highly Pathogenic Avian Influenza

A new subtype of Highly Pathogenic Avian Influenza (HPAI; H5N1) was introduced across North America in the spring which had some slight impacts on the program. Some recommended breeding pairs were not able to be put together as they involved an exchange of birds between African Lion Safari and Toronto Zoo. These transfers were not able to take place due to a general precautionary decision from Toronto Zoo to cease any new bird intakes, and also due to African Lion Safari's proximity to Waterloo region, where a commercial flock had tested positive for HPAI.

Some other biosecurity measures were put in place, including field staff having dedicated footwear for use inside the enclosures, increased enclosure cleaning between release groups, and increased cleaning of banding equipment for both wild and captive birds. Overall, the HPAI outbreak was mercifully uneventful for the LOSH program.

4.6.3 New partner facilities

Two new breeding partners are joining the LOSH program this fall: the National Aviary (Pittsburgh, PA) and Parc Omega (Montebello, QC). Granby Zoo (Granby, QC) has also shown interest in coming on as a partner and connected with WPC just before the pandemic, but decided against building infrastructure and taking on breeding pairs until there is greater need for increased capacity in the captive breeding population. After discussions with LOSH program staff and Granby Zoo staff earlier this year it was decided that onboarding one Quebec facility at a time was more feasible financially and logistically. WPC will focus on onboarding Parc Omega with breeding pairs this fall; efforts will be made to add Granby Zoo as a breeding facility once Parc Omega is established.

Parc Omega is a CAZA-accredited drive-through safari park in Quebec, similar in concept to African Lion Safari, but with a focus on North American wildlife. Parc Omega staff visited shrike holdings at African Lion Safari in November of last year and are nearing the end of constructing a pod in time to house one or two pairs over the winter. WPC staff performed a site visit in November, but the enclosures have had several construction delays so were not yet complete. The site itself looks very promising, and work will continue in to the winter, to be ready for next spring.

The National Aviary has constructed specialized enclosures for shrikes following dimension recommendations listed in the LOSH Husbandry Manual and will be taking on a breeding pair from SCBI in November.

4.6.4 Developments at existing partner facilities

Toronto Zoo secured $30K in funding for upgrades related to the shrike conservation breeding program in the fall of 2021 and plan to use the funding to build a shrike pod using schematics from African Lion Safari. Though construction is not yet underway, a location for the pod has been selected within Toronto Zoo grounds near the cheetah breeding compound. This location is not accessible to the public (compared to existing shrike enclosures which are directly beside trail heads into Rouge Park) and is very quiet and relatively isolated.

African Lion Safari has all the components to erect a Motus tower on site; however, the receiver is currently being used for migratory urge research (see Section 8.2.2), so will not be operational until that research is complete.

4.6.5 Napanee release cage construction

Plans were developed in 2019 to increase the number of release enclosures at the Napanee field site from two to four, using funding supplied by the Nashville Zoo at Grassmere (USD$5000) and African Lion Safari (USD$8891). The intention was to erect the enclosures in Napanee this spring with the assistance of Nature Conservancy of Canada volunteers, but due to inflated lumber costs and the government's recommendations for social distancing at the time panel construction has been delayed until the fall of 2022. Materials for enclosure panels will be purchased by the end of this calendar year and panel construction will be completed by African Lion Safari staff or sub-contracted staff by spring 2023.

5.0 PUBLIC EDUCATION AND OUTREACH

5.1 Public presentations

The LOSH program was the subject of five virtual presentations this year (Table 3). All presentations were well received with excellent feedback from collaborators and those in attendance.

Table 3. Presentations delivered in 2022

Date	Host	Staff	Attendees	Description
Jan 17	Hamilton Naturalists' Club	Jane	83	1.5 hr presentation on LOSH Recovery Program Updates to Hamilton Naturalists' Club and the public
Jan 26	OVC Environmental Club	Hazel	15	45 min lunchtime presentation to the OVC Environmental Club
Apr 8	McMaster University	Hazel	27	Guest lecture for a 4th year Conservation Biology class at McMaster (taught by Leanne Grieves)
Apr 13	Holy Trinity School	Jane	100	20 min presentation on recovery program to Holy Trinity lower classes
May 17	Toronto and Region Conservation Authority	Jane	50	Hour-long presentation on the ELOSH Recovery Program with TRCA

5.3 Media and Events

LOSH program staff participated in three events this year:

1) Wildlife-at-Risk Video Series Release Party (Apr 2) – This virtual event was the first airing of a series of five videos created by staff at Sandy Pines Wildlife Rehabilitation Centre (SPWC), highlighting conservation in the region. One of the videos, focusing on birds, included an interview with Hazel Wheeler that took place at the Napanee field site in 2021. Hazel participated in a Q&A session after the airing of the bird video, and the audience of 35 people was very engaged. A link to the video is included below.
2) Spring Birding Festival, Colonel Sam Smith Park (May 28) - The event was very well attended and the program's tent was ideally situated for a high volume of foot traffic (where three walking paths converged). Approximately 500 people interacted with staff and many expressed interest in donating.
3) Lakehead University class site visit (Aug 31) – An upper-year Environmental Sustainability Field Class (Instructor: Chase Moser) visited the Carden field site for a tour led by Hazel Wheeler. The tour took approximately 1.5 hours, and included an explanation of the LOSH Recovery Program, a look at the feed shed, and scope-views of captive juveniles that were to be released the following day. The class was approximately 20 people, and many students expressed interest in applying to field positions in coming years.

The LOSH Recovery Program was mentioned in the following media pieces:

- Wildlife-at-Risk Episode 4: Bird's Eye Views (YouTube, April 2) – One of a series of videos made by SPWC about wildlife-at-risk in the Napanee region; features footage of LOSH release site and interview with Hazel Wheeler https://youtu.be/MTRO5jcKKuQ
- "The return of one eastern loggerhead shrike songbird a cause for celebration at the Toronto Zoo" (Toronto Zoo, July 13)– Article about a returned TZ shrike in Napanee; WPC mentioned as coordinator of the recovery program https://www.thestar.com/local-toronto-scarborough/opinion/2022/07/13/the-return-of-one-eastern-loggerhead-shrike-songbird-a-cause-for-celebration-at-the-toronto-zoo.html
- "You can't catch a wild shrike twice": CAZA facilities work together to repopulate a Canadian migratory songbird (CAZA Newsletter, Oct 1)– Article about the LOSH program; WPC mentioned. Promoting Amy and Jess' talk about LOSH and the One Plan Approach at the upcoming CAZA conference https://files.constantcontact.com/e38ed0d0801/0975ebbe-9e6a-48c8-94ed-06230f1bfc0e.pdf
- Animalogic World of Birds (YouTube, Nov 18) – Episode of the Animalogic web series focused on shrikes. Some WPC footage used, and the release program is mentioned at the end https://www.youtube.com/watch?v=D-KVv4n9wZM

6.0 HABITAT STEWARDSHIP

Four habitat stewardship projects will be completed before spring 2023:

1) Vegetation management on Lafarge property (Car36G; 127 ha) – Though this site has been a successful breeding territory for the past six years, suitable habitat areas (and available grazing areas) are shrinking due to encroaching hawthorns. This concern was brought to WPC by Susan Winter, who runs her cattle on the property. Lafarge has allowed Winter to put her

annual lease towards clearing, which will be the match for WPC funds contributed to the project. Hawthorns will be thinned throughout approximately 60 ha of the property, leaving a density of 1-3 trees per acre (including all past nest trees). The total budget for this project is $12K (with $8K coming from Winter), and the contractor will continue through the property until his labour costs reach that ceiling.

2) Vegetation management on Nap219F (15 ha) – this private property, which has hosted breeding LOSH for the past six years, is becoming overgrown with prickly ash. This project will clear the large area of prickly ash, along with other small encroaching shrubs that are decreasing the amount of grazing area and shrike habitat, using a rotary mower.

3) Fencing on the Napanee Plain Alvar Nature Reserve (Nap179C/D/E; 105 ha) – There was an incomplete fence on the southern border of the NCC Napanee Plain Alvar Nature Reserve, through with cattle would sometimes escape on to a neighbouring property. This project will see the southern fence rebuilt with existing cedar rail from an old fence line that is no longer used in the middle of the property. This site hosts the Napanee field release site, and is one of the most frequently used wild nesting sites in the region.

4) Fencing on the Boese property (50 ha) – this project, that would have seen fencing installed around his 50-ha property to recommence grazing and control vegetation, was started in 2021, but as it could not be completed over the winter, it had to be paused during this field season. This project will be completed this winter. The Boese property is not a mapped habitat patch, but had a successful breeding pair in 2021, another pair nesting just across the road in 2017, and is within 500m of other nesting territories. A single bird was seen on this property this year, but breeding was never confirmed.

7.0 PROGRAM PERSONNEL

This year had the typical teams of two in the Carden and Napanee cores to carry out regular program activities. An additional Research Biologist was hired in November 2021 to complete work related to the Kingston Solar-funded habitat research (see Section 8.1.1); this contract runs to the end of 2022.

Conservation Breeding Coordinator, Jane Spero, surprised us all by making two new humans in October. She will be going on maternity leave in November, with plans to return in approximately one year. Rather than hiring someone to cover her position, which would involve a long on-boarding process, Hazel Wheeler and Jessica Steiner will be taking on captive population responsibilities, and a new position was created that would support all program activities, and also continue work related to the Kingston Solar research project. Interviews are planned for late November, with the position starting in the new year.

8.0 RESEARCH

8.1 New projects

8.1.1 Kingston Solar

WPC was contracted to complete a research project developed to meet, in-part, the requirements of an Overall Benefit Permit associated with a solar Sol-luce Kingston Solar PV Energy Project in the Napanee core. The goal of the proposed research was to ground-truth the results of the species

distribution model (SDM) developed by Dr. Amy Chabot (African Lion Safari) and Dr. Stephen Spear (The Wilds, OH) that predicted the occurrence of LOSH based on habitat characteristics. The SDM was developed using mapping layers, but lacked any input from finer-scale microhabitat characteristics, and so this research would quantify those finer-scale elements through in-person habitat assessments.

Field work for this research was completed this year, and involved visiting a random selection of points of varying predicted quality to determine the accuracy of the model, and to collect data on finer-scale habitat characteristics (e.g. presence of perches, impaling sites, nest trees, etc.) that were not included in available mapping layers. Data was collected at 485 sites from Manitoulin Island to the Smiths Falls region, with analyses currently underway. This project will continue in 2023, with the goal of creating an updated SDM, identifying priority areas for stewardship, and starting a stakeholder analysis for those regions.

Full details of this research can be found in the proposal, *Identification of priority stewardship areas and required actions for Loggerhead Shrike Recovery in Ontario*, available upon request

8.2 Ongoing projects

8.2.1 Identification of wintering grounds and migratory routes

Nine birds were released with radio tags on the Motus network this season, the results of which will be reported in 2023. Of the 12 birds released with tags in 2021, 3 were detected on Motus stations away from their release sites (an additional 4 were only detected on the Napanee tower). of those birds were just detected at the Napanee release site tower. Three birds, released in Carden, were picked up on the tower at the Pickering nuclear plant, and one birds, released in Napanee, was picked up on six towers east along the Lake Ontario shore to Bowmanville. No U.S. detections have yet been posted for any of these birds.

8.2.2 Migratory urge study

The impact of environmental versus genetic factors on the expression of migratory urge in Loggerhead Shrike is the focus of research by PhD student Alisa Samuelson at Queen's University. Radio-tagging work in 2021 at African Lion Safari showed evidence of a significant increase in nocturnal movement of captive birds from September into October. Data collection expanded this year, with 16 birds tagged at two facilities (8 each at SCBI and ALS) this summer, and additional tagging planned at other facilities in 2023 to reach desired sample sizes. Movement data will be compared with environmental and genetic analyses (through collaboration with Dr. Kristen Ruegg) to determine the influence of each of these factors on migratory behaviour in captive shrike.

8.2.3 Retrospective analysis of mortalities and necropsies in captive population

A small retrospective study on mortalities in the captive population began in 2021 by Dr. Jordan Foxx (veterinary intern at Ontario Veterinary College) and supervised by Dr. Christopher Dutton (OVC). This analysis is of particular interest given recent cases involving plaque buildup in nares (see Section 4.3.1, SCBI); results will hopefully shed some light on these and similar mortalities seen in earlier years. Dr. Foxx and LOSH program staff spent the spring following up on outstanding necropsy results within the captive population; work was delayed over the breeding season but will resume this fall.

8.2.5 Diet analysis and food preference study

A formal analysis into the diets of the captive shrike population has been of interest since the 2019 captive subcommittee meeting. Despite many false starts and delays due to pandemic-related communication and staffing challenges, newly-hired Toronto Zoo nutritionists remain eager to participate once time allows. Additionally, Ginger Elliott (African Lion Safari) is hoping to use existing blood samples to validate an assay to assess Vitamin A levels. This would be of particular use given several hypovitaminosis A cases that have been seen in some breeding facilities. A metabarcoding methodology has been developed in collaboration with Queen's University using fecal samples from captive birds, and additional methods will be explored further at African Lion Safari this year; data collection with existing video capture equipment will hopefully commence once staff have time to commit to the project.

8.2.6 Genomic tools for species conservation and management

Several genomic tools are available for use in the management of the conservation-breeding colony of Loggerhead Shrike, including Single Nucleotide Polymorphic (SNP) markers, Major Histocompatibility Complex (MHC) markers and a high-quality genome, fully annotated to chromosome level. The following work relating to these topics was completed this year:

- Jordan Rutherford (Queen's University) successfully defended her BSc Honours thesis: Mechanisms contributing to the maintenance of MHC-I polymorphisms in the Eastern Loggerhead Shrike (*Lanius ludovicianus migrans*). Rutherford found different mechanisms of selection operating on MHC diversity, based on sex, where greater fitness (represented by survivorship and lifetime fledgling production) conferred by higher MHC diversity in males, and lower diversity in females.
- SNP data filtering is complete, and some basic metrics derived from the data (e.g. heterozygosity rates), but phenotype data is required to move ahead with the analyses (e.g. lifetime reproductive success). WPC will work with Amy Chabot, who is overseeing this research, to compile these data in the coming year.
- DNA extraction and library preparation of feathers collected over a broad range of subspecies and populations (both migratory and non-migratory) began in 2021 in collaboration with Dr. Kristen Ruegg. Genomic assays will be completed by early 2023, with high coverage (6-8x) data (i.e. each individuals genome is 6 to 8 'reads' of single nucleotides from across the whole genome) from a known-phenotype partially migratory population (Indiana), which will be used to determine if genetic differences are leading to different phenotypes. Low coverage (2-3x) data will then be assessed for a larger subset of individuals from a broader geographic area, and will include multiple sedentary, obligate, and partially-migratory populations. Low coverage data will be used to assess gene regions of interest based on results of high coverage analyses, and also be used as the basis of a new genoscape, to replace the now-defunct microsatellite-based genoscape, for which the technology is no longer available to run the full suite of markers to distinguish subspecies.

8.2.7 Quantitative genetic techniques for species conservation and management

Dominique Charland (Queen's University) successfully defended her BSc Honours thesis: Measuring unintentional selection in a captive breeding program for the Eastern Loggerhead Shrike (*Lanius ludovicianus migrans*). Charland found evidence of selection in four analysed traits—mass, tarsus width, tarsus length, and wing length—that could be causing phenotypic change in the captive

population. Changes in these traits are not necessarily negatively affecting survival, but the potential for them to be maladaptive should be considered. This thesis is currently being prepared for publication.

8.3 Manuscripts

The following manuscript was published this year:

- Sauve, D., J. Hudecki, J. Steiner, H. Wheeler, and A. Chabot. 2022. Improving species conservation plans under IUCN's One Plan Approach using quantitative genetic methods. Peer Community Journal 2: e50.

The following manuscript has been accepted for publication:

- Geldhart, E.A., H. Wheeler, L-A. Howes, S. Mackenzie. In press. Impacts of tracking devices on birds: A review. North American Bird Bander.

9.0 PARTNERSHIPS AND COLLABORATION

9.1 Loggerhead Shrike Working Group

The 8th annual LOSH Working Group (WG) meeting occurred on November 14-18, and was a hybrid virtual/in-person event hosted by the Nashville Zoo at Grassmere. Jessica Steiner attended in-person, and Hazel Wheeler attended virtually. Topics covered include: a review of regional threat assessments (led by Wheeler and Steiner), Recovering America's Wildlife Act (RAWA) funding and actions, review and revision of the PVA model developed for the LOSH Species Conservation Planning Process (SCP; see Section 9.3), and a discussion on WG representation at upcoming international conferences/meetings.

Monthly Working Group calls were largely suspended this year as precedence was again given to work related to the LOSH SCP.

9.2 Building regional capacity

Regional working groups were again inactive this year owing to the ongoing COVID-19 pandemic. WPC staff continue to hold the position of co-chair of the Napanee Plain Joint Initiative (NPJI) along with Amanda Tracey of the Nature Conservancy of Canada (NCC), and WPC also remains engaged in the Carden community through a strong partnership with the Couchiching Conservancy, and participation in the Carden Forum (when the event occurs).

9.3 Species Conservation Planning for Loggerhead Shrike

The Species Conservation Planning (SCP) process for Loggerhead Shrike (formerly the Population and Habitat Viability Assessment) continues to progress as a slow pace. Milestones from this year include:

- Threat assessment updated to follow the scheme developed in the MFFP Standardized Classification of Threats to Biodiversity (https://conservationstandards.org/wp-content/uploads/sites/3/2021/08/Standardized-classification-threats-English-Full.pdf)
- Ontario PVA data compilation completed, and used to build an initial population model

- Ontario model presented to the technical group at a workshop in January, to demonstrate how their data will be used; requests sent out for regional data
- Available data for metapopulation model collected from all regions by end of summer

Much of the LOSH Working Group meeting in November was dedicated to discussion of parameter estimates to model all the populations that are included in the SCP (see *2021 Eastern Loggerhead Shrike Recovery Program – Summary Report; Fig 9* for map). Ontario is in a unique situation as we have many years of detailed monitoring data to derive those estimates with high confidence, but without comparable data sets in other regions much is left to speculation. To fill these gaps, Ontario will likely be used as a base, with parameters modified based on opinions of regional experts.

The regional threat assessment, completed after the first SCP workshop, was also revisited at this meeting, with discussion of how threats may impact the various LOSH populations, and thus impact parameter estimates. Available trend data sources (eBird, Breeding Bird Survey, Christmas Bird Count) will be considered to help calibrate the model, to ensure it reflects the reality of observed LOSH population dynamics.

At the end of 2021, the anticipated timeline placed the model development over this summer, the final workshop in August 2022, and a final report drafted by the end of the year. This timeline proved impractical, however, as is required researchers to be available to work on their data over the summer field season, which is a busy time for all. This timelines is therefore going to be shifted again, but new targets have not yet been set. The planning committee will be setting a new timeline in the new year.

10.0 PROGRAM FUNDING

WPC implemented the recovery program this year with funding from the following sources:

- Species at Risk Stewardship Program ($92.9K; Final year of a 3-year agreement)
- one field position)
- Kingston Solar LP ($10K for survey [Year 1 of a 5-year agreement]; $74.8K for research)
- BluEarth Renewables ($9,750; Year 4 of a 5-year post-construction monitoring agreement)
- Dillon Consulting Ltd. ($4K)
- Colleges and Institutes Canada Career Launcher Internship ($14.9 to subsidize one field position)
- Employment and Social Development Canada – Canada Summer Jobs ($4.6K to subsidize
- Private donors ($40K)
- Private foundations ($10K)