CERCA's Tree Swallow Project, a Pleasing Success Story

Dr. Goetz Schuerholz, Chair CERCA

In 2016 CERCA volunteers produced 50 nest boxes for cavity breeding Tree Swallows kick-starting a highly successful swallow habitat enhancement project in the Cowichan-Koksilah Estuary. 15 boxes were donated to the BC Conservation Foundation to be used at the Providence Farm meadows.

Introduction and Approach

Grave concerns about dwindling swallow populations worldwide and locally triggered CERCA's project on habitat enhancement of cavity-breeding Tree Swallows in the Cowichan Estuary. Caused by the alarming disappearance of old-growth trees from the Cowichan Estuary which provided prime habitat for cavity breeding Tree Swallows in the past, CERCA decided to focus on providing nesting facilities as a key habitat requisite for this species.

In 2016 the project started with the construction of 50 nest boxes, of which 36 were placed on old pilings lining the South Fork of the Cowichan River parallel to the old CN railroad bed. Some were hung on abandoned hydro poles along CERCA's self-guided nature trail. Swallow activities at the numbered nest boxes were monitored by CERCA volunteers from May to the end of August twice weekly for 3 hours for the first two consecutive years. This allowed for proper species identification during nest building, and for observations on nest box selection, occupation, feeding behaviour after successful hatching of the eggs, and for observations of fledglings leaving their nest.

By late August and shortly before swallows left for their winter quarters all nest boxes were checked and cleaned. Data recorded for each nest box included successful occupancy (i.e. finished and used nest), unfinished nests, number of clutches, number of un-hatched eggs, and the number of dead fledglings/adults.

As of 2018 monitoring was confined to a post-breeding nest count and box cleaning which provided useful information on successful nest occupancy, and estimates of overall juvenile survival.

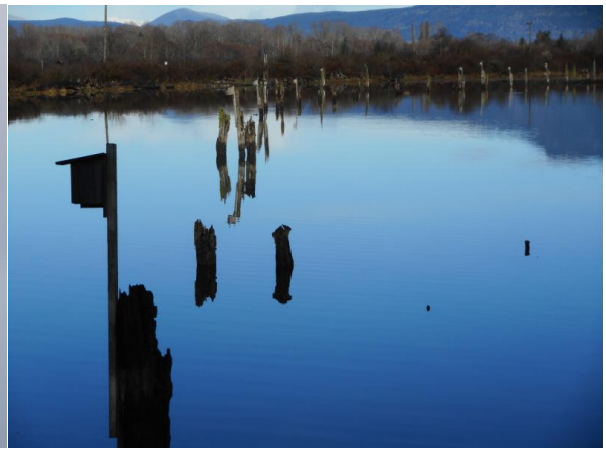
Swallow nests proved to be lined with various amounts of feathers from many species. Quality material for nest construction in the estuary is plentiful and readily available from over-wintering waterfowl, herons, and resident geese and swans.



Cleaning the boxes attached to the old pilings along the South Fork of the Cowichan River is only possible at low tide. Several boxes have disappeared during the past seven years, very likely due to rotten pilings broken off at high tide and boxes being washed away into the sea.



Nests covered with feces are a true sign of a successful clutch. Reasons for un-hatched eggs, dead fledglings, and the occasional dead adult could be manifold and are difficult to identify.



Clustered boxes hung on a trial basis on abandoned hydro-poles showed a high occupancy rate throughout the past seven years, contrary to the common belief that Tree Swallows don't like to breed close to each other!

Unfortunately, the nest boxes attached to the abandoned hydro poles in 2016 could not be checked and cleaned in 2023 as done in previous years. It has become too dangerous to climb the ladder leaning against the rotting poles.

In 2019 CERCA member Wes Heinrichs constructed 27 additional bird houses hung along the fence at Blackly's Farm bordering the dike trail extending to the spit of the Western Forest Products mill pond.

In 2020 Wes Heinrichs (left photo) constructed 24 additional nest boxes. They were attached to the fence posts lining the gradually recovering salt marsh adjacent to CERCA's self-guided nature trail. After diking in the late 1800s the former salt marsh was used as cattle pasture until recently.

RESULTS

Cowichan River South Fork (Nature Trail)

Results for the nest boxes along the South Fork of the Cowichan River and hydro poles along the abandoned CN rail bed are shown in Table 1. The lowest overall occupancy rate of the seven years recorded at this location was 64% in 2016. This may be attributed to the boxes appearing for the first time at this location and having been hung in late March, shortly after the spring arrival of Tree Swallows. The high occupancy rate of the same boxes in the following year -- 90% of the 40 boxes occupied and five producing two clutches-- may partly be explained by the same birds returning for a second breeding season at this location and by birds bred in the previous year being already familiar with the area.

The 2018 occupancy rate of 79% at this location is considered 'high'. The surprisingly high number of dead fledglings and un-hatched eggs found in some boxes may support the hypothesis of impacts of climate change on migratory birds as reported already from research in Europe. The unusually early spring of 2018 (i.e., 14 days earlier than average) may explain the unusually early return of the migratory swallows (14 days earlier than usual), an earlier breeding season, egg production, hatching, and rearing of fledglings. By the time the eggs hatched, there may not have been sufficient food sources available, a time too early in the spring for the full development of insects, the primary food source for this insectivorous species.

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Table1: N. Trail

YEAR	2016	2017	2018	2019	2020	2021	2022	2023
Number of boxes	**36**	**40**	**33**	**41**	**43**	**39**	**39**	**35**
# boxes empty	13	4	7	5	3	15	5	6
# incomplete nests	4	1	2	0	0	2	2	4
1 nest/box	23	36	26	36	35	24	32	25
2 nests/box	0	5	2	0	5	0	1	2
# boxes with bodies	3	1	6	1	2	10	4	7
# boxes with eggs	1	7	3	1	8	4	6	3
% occupied	**64**	**90**	**79**	**88**	**95**	**38**	**85**	**71**

The years 2019 and 2020 started with a 'normal' spring phenology, and a 'normal' time of Tree Swallow arrival by mid-March. Both summers were characterized by average temperatures with occasional precipitation, providing optimum framework conditions for a highly successful breeding and juvenile survival seasons. In 2020 the nest box occupancy reached a peak of 95%. Five boxes supported two clutches. The juvenile survival rate appeared very high.

This was followed by an extremely dry summer of 2021 with record-breaking temperatures, two extended 'heat domes', and months without any rain. This undoubtedly was the reason for the low nest box occupancy of 38% and the extremely high fledgling mortality. 25 dead bodies of fully feathered juvenile birds were found in 10 of the 39 nest boxes, compared to two boxes with a total of four dead birds and eight nests with a total of eleven un-hatched eggs in 2020.

Dehydration of fledglings in over-heated nest boxes for extended periods combined with a chronic food shortage is likely responsible for this high mortality. Temperatures during the heat domes reached 40 degrees during the day with little cooling down during the night. Adults trying to feed their young under such extreme conditions may have been equally stressed by the high temperatures. The poor conditions may also have been exacerbated by adults not finding sufficient prey to feed their young with insect populations also down as a result of the heat. In 2021 only 39 boxes were found at this site compared to 43 in the previous year.

With an 85% occupancy rate the 2022 season appeared relatively normal but showed a high number of dead fledglings and un-hatched eggs compared to previous years. The occupied boxes showed completed nests, feces, and other indicators of successful hatching. Five boxes were empty and two with unfinished nests. Two boxes were found with two dead fledglings each, one box with three and another one with one dead. Five nests had one un-hatched egg, and another two. Of the four hydro-poles with eight boxes total, four boxes were successfully occupied, two were empty, and two had unfinished nests. 2022 started with an unusually wet and late spring followed by a relatively normal summer. It may therefore be assumed that major prey species of swallows were available at the right time after hatching, contributing to a significant population increase after a successful breeding season.

In 2023 the occupancy rate dropped to 71%. The very high number of dead fledglings found in seven of the 25 boxes gives reason for concern. Whether the very dry summer contributed to the high mortality is speculative.

According to the literature nesting boxes for Tree Swallows should be placed some distance apart from each other since this species is not known to be a typical colony breeder such as Purple Martins for example. To test this theory several boxes were hung clustered on three hydro poles along CERCA's self-guided Nature Trail. In 2016 Purple Martins were the first to check out the clustered boxes but did not stay. Shortly after, both Violet-green Swallows and Tree Swallows inspected the boxes with Tree Swallows finally occupying most boxes and successfully producing clutches in the following years.

Blackly Farm Site

Encouraged by the positive results of the nest boxes hung along the Cowichan River South Fork between 2016 and 2019 it was decided to expand the project in 2019. The 27 new nest boxes were attached to the fence posts adjacent to the dike trail encircling the open meadows of the farm in early March of 2019 shortly before the swallows' arrival. With a southern exposure, all boxes face 50 acres of open hay fields. The meadows were created after diking this former salt marsh in the 1800s. Operated as a dairy farm until 2021, it now is used for hay and corn production by its new owner.

The results of the nest box monitoring are presented in Table 2. The findings after the first breeding season at this location were rather disappointing. Only three of the 27 boxes were successfully occupied. Four boxes showed incomplete nests. It should be noted that this site did not offer suitable nesting facilities for cavity breeding Tree Swallows before the nest boxes were

provided. This is believed to be the reason for the very poor results during the first breeding season on this site. The 2022 results were equally disappointing with only six boxes occupied. All six nest boxes were swarming with ants when cleaned, as well as a few of the un-occupied boxes. This raises the question whether ants' invasion during and after nest construction could be one of the reasons for the low occupancy rate. Although the nest boxes face the open meadows on one side Scotch broom and blackberry growing along the dike reach right up to the boxes on the other side. It was also noted that by mid-summer heavy growth of canary grass growing along the fence had reached the boxes, acting as a possible additional deterrent.

Table 2: Blackly

YEAR				**2019**	**2020**	**2021**	**2022**	**2023**
Number of boxes				**27**	**27**	**27**	**27**	**27**
# boxes empty				20	22	17	18	13
# incomplete nests				4	1	2	3	3
1 nest/box				3	5	9	6	11
2 nests/box				0	0	1	0	0
# boxes with bodies				0	1	2	1	1
# boxes with eggs				0	1	2	0	0
% occupied				**11**	**18**	**33**	**22**	**37**

The gradual increase of nest box occupancy from 11% in 2019 to 37 % in 2023 may be explained by the return of birds bred at this location choosing the site they are familiar with. Although the successful nest box occupancy increased to 33% during the 2021 extreme "heat dome" season the failure of four complete clutches should be noted. In one nest four and in a second nest five dead fledglings were found, and two nests with un-hatched eggs, three in one and four in another. Again this may have been related to the two extreme heat waves, the first early in the season causing nests with eggs to be abandoned, the second with fledglings possibly dying of dehydration and starvation. In 2022 and 2023 the meadow in front of the boxes was converted into a corn field, boxing in the fence-line and nest boxes on both sides. Since the corn growth did not start until well into the onset of the breeding season, it may not have affected the bird activity as much as expected. The nest occupancy of 37% with only one nest found with two dead fledglings and none with un-hatched eggs may suggest a high juvenile survival rate.

Due to the comparatively low success rate at this location during the first years, it has been suggested to move the boxes to a more open location in the estuary. However, this decision will be postponed pending the 2024 results.

<u>Heritage Site</u>

In 2020 a third location was added to the project seemingly offering a prime Tree Swallow habitat. 24 north-facing nest boxes were attached to fence posts bordering the 25-acre meadow parallel to CERCA's self-guided nature trail. The meadow which constitutes an alienated former

salt marsh was used as cattle pasture until 2020. It currently is in the process of reverting to a salt marsh. The four years monitoring results are shown in Table 3.

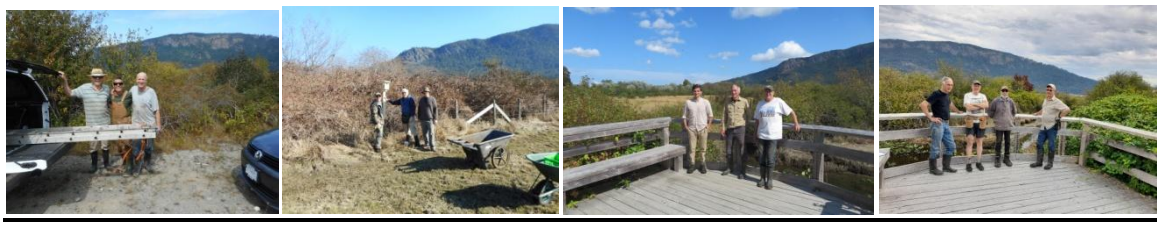
Although considered a prime location with all boxes facing the open meadow/salt marsh expected to provide a rich insect life, the results for the first years were discouraging. Only three successfully occupied boxes with all clutches successfully raised were encountered during the first season in 2020, followed by a marginal increase to eight of the 24 boxes by 2022 with all clutches raised successfully. The pattern of the 2021 heat domes described for the other two locations was echoed at this site. Although seven of the 24 boxes were occupied, three contained full clutches of dead fledglings and one with un-hatched eggs. The reason(s) for the high mortality appear similar to those described for the other two locations: dehydration and starvation.

Table 3: Heritage

YEAR					**2020**	**2021**	**2022**	**2023**
Number of boxes					**24**	**23**	**23**	**23**
# boxes empty					21	16	15	2
# incomplete nests					1	0	0	5
1 nest/box					3	7	8	15
2 nests/box					0	0	0	0
# boxes with bodies					0	3	0	3
# boxes with eggs					0	1	1	2
% occupied					**12**	**30**	**35**	**65**

The low occupancy rate of boxes during the first three years remains a puzzle. When first selecting this site it was assumed that the open meadow/salt marsh with a presumably rich insect life would offer prime Tree Swallow habitat provided sufficient nesting facilities were available. As described for the Blackly Farm, both sites face open meadows, but also both have a dense shrub cover behind the boxes which may provide predators of swallows with quality cover, therefore possibly acting as a deterrent.

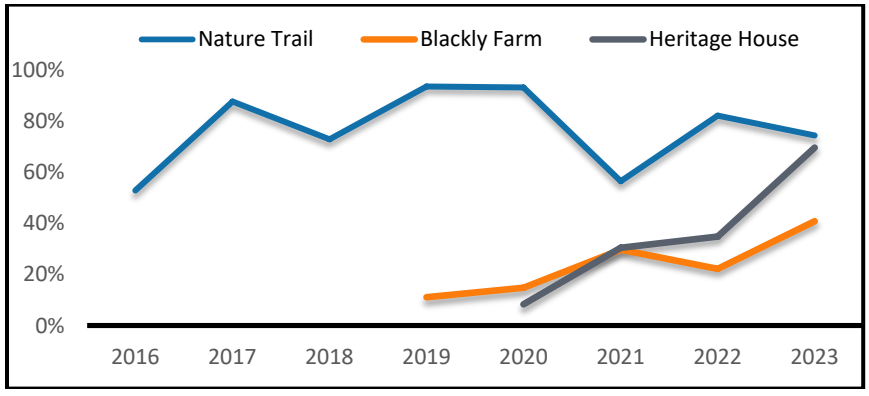
Based on the poor results of three years in a row it was considered to move the nest boxes into more open terrain, pending the results of 2023 which surprisingly showed a dramatic increase of up to 65% occupancy rate compared to previous years. A few dead fledglings were found in three of the 15 occupied boxes and some un-hatched eggs in another two. In view of the high occupancy rate in 2023 the boxes remained at their current location. It will be interesting to see what happens in 2024.



Summary

The Line Graph in Figure 1 compares the percentage of nest boxes successfully occupied for the three locations in the estuary. Monitoring records started at the nature trail in 2016. In 2019 nest boxes were added at the Blackly Farm with more boxes hung at the Heritage House location in 2020. The line graph clearly shows a peak box occupancy at the Nature Trail along the South Fork of the Cowichan River the years of 2017, 2019, and 2020. The dramatic drop in nest box occupancy during 2021 coincides with weather extremes during the breeding seasons as described before.

Figure 1: Comparison of nest box occupancy rate for the three sites



The low occupancy rate during the first season as noted for nest boxes at the Nature Trail is echoed by the first year of boxes placed at the other two locations. It appears to take time for swallows to get used to new nesting facilities. Except for the Blackly Farm site, the second-year occupancy was already

significantly higher. Although the 2021 low occupancy rate was reported for the Nature Trail boxes, the same was not reflected by boxes from the other two locations. However, the large number of dead fledglings and un-hatched eggs found in boxes at all three locations appears to be linked to the two heat domes during the 2021 breeding season as described before. The noticeable increase in successful box occupancy in 2023 at the Heritage House and Blackly Farm locations may hopefully be a promising sign for an increase in box occupancy in the coming years.

The number of nest boxes with dead bodies and un-hatched eggs peaked at all three locations in 2021. A second peak in both the number of dead bodies and un-hatched eggs reported for the Nature Trail boxes in 2018 may have been related to weather extremes as described before: an unusually early spring causing an unusually early arrival of swallows, and an earlier than usual breeding season not being in sync with insect development at the right time. This may have led to food shortages with starvation of fledglings as the prime mortality factor and abandonment of nests with a full clutch of eggs.

Figure 2: Number of nest boxes with dead bodies

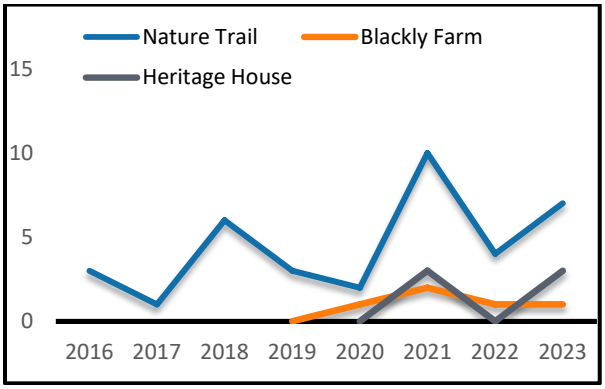
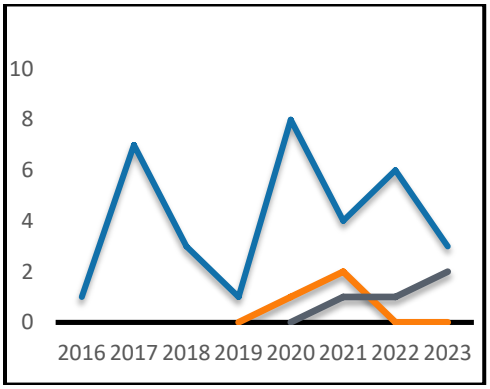


Figure 3: Nest boxes with un-hatched eggs

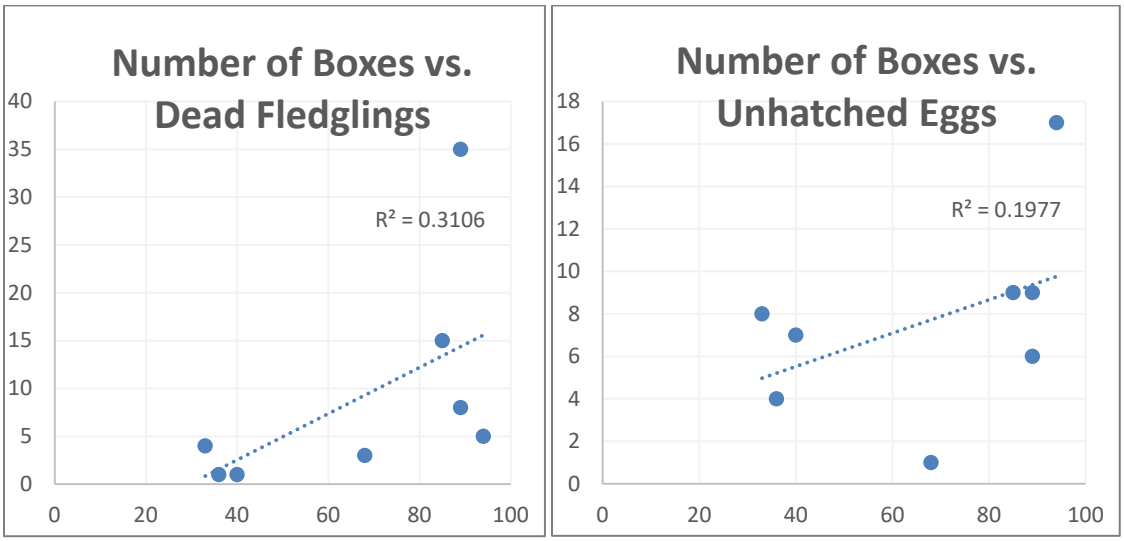


In order to assess whether the number of dead fledglings and un-hatched eggs is related to the number of boxes the correlation coefficient was calculated. The results show that the correlation coefficient for the number of boxes related to the number of dead fledglings was 0.55727681 showing a strong positive correlation, and for the number of boxes related to the number of un-hatched eggs 0.33358148 reflecting a moderate positive correlation. The correlation coefficients are interpreted as shown in Table 5. The trend line is presented in Figure 4.

Table 5: Interpretation of coefficient results

Correlation coefficient	Correlation strength	Correlation type
-.7 to -1	Very strong	Negative
-.5 to -.7	Strong	Negative
-.3 to -.5	Moderate	Negative
0 to -.3	Weak	Negative
0	None	Zero
0 to .3	Weak	Positive
.3 to .5	Moderate	Positive
.5 to .7	Strong	Positive
.7 to 1	Very strong	Positive

Figure 4: Scatter plot graphs of correlation coefficients



The R^2 in the scatter plot graphs is the Coefficient of Determination. This value indicates how well the trend-line corresponds to the data fit. The outliers constitute the 35 dead fledglings for 2021.

Conclusions and Recommendations

Based on the data recorded for the past seven years it may safely be concluded that this swallow habitat enhancement project has been a success, significantly enhancing the Tree Swallow population of Cowichan Bay. The total number of completed nests reported for the three sites from 2016 to 2023 was 304 as shown in Table 6. Conclusive indicators of producing one complete clutch were found for approximately 250 boxes. Considering that on average a Tree Swallow pair produces 4 to 5 eggs per nest, the total number of successfully hatched eggs amounts to 1000 to 1250. Since no dead birds or un-hatched eggs were found in the 250 of the 304 boxes it may safely be assumed that most fledglings of the 250 nests survived. Considering a juvenile survival rate of approximately 60%, the project added at least 600 mature birds to the Tree Swallow population of Cowichan Bay during the past seven years.

Table 6: Number of completed nests by year and location

Year	2016	2017	2018	2019	2020	2021	2022	2023	Sum
Nature Trail	23	36	26	36	35	24	32	25	237
Blackly Farm				3	5	9	6	11	34
Heritage Site					3	7	8	15	33
Overall Sum	23	36	26	39	43	40	46	51	304

Based on the overall success of this project CERCA will continue nest box monitoring in 2024.