



**HÁSKÓLI  
ÍSLANDS**

Rannsóknasetur Háskóla Íslands á Snæfellsnesi



**NÁTTÚRUSTOFA  
VESTFJARÐA**

## NESTING ON THE VERGE:

# The impact of roads on nesting success of Eurasian Oystercatchers in Iceland

Funded by the Icelandic Road and Coastal Administration Research Fund



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## ABSTRACT

Roads are among the most widespread anthropogenic structures on Earth, imposing a range of direct and indirect impacts on wildlife through habitat fragmentation, vehicle collisions, and increased noise and disturbance. For some ground-nesting birds, roadside habitats present both risks and opportunities, and understanding their net effects remains particularly challenging in low-traffic rural landscapes.

This study examined how roads affected the nesting success of Eurasian oystercatchers (*Haematopus ostralegus*) in two regions of Iceland – Snæfellsnes and the Westfjords – during the 2025 breeding season. A total of 91 nests were monitored, and nest fate was analysed in relation to three road-related variables: distance from road edge, traffic volume, and posted speed limit.

No statistically significant relationships were found between road characteristics and nest survival in either region. However, subtle trends were observed for distance from road edge and traffic volume, with Snæfellsnes showing a tendency towards lower nest survival with increased road exposure – most notably a borderline significant effect of traffic volume ( $p = 0.052$ ) – while the Westfjords showed the opposite pattern. These contrasting regional trends suggest that road effects on oystercatchers may be shaped in conjunction with local ecological factors, such as predator communities and landscape context, rather than by road characteristics alone.

This report presents findings from the first year of an ongoing study. The results should be viewed as a baseline for future work, with continued monitoring expected to clarify the observed trends and deepen our understanding of how roads interact with oystercatcher breeding ecology in Iceland.

## INTRODUCTION

Roads are among the most widespread anthropogenic structures on earth, and their ecological footprint extends far beyond the road itself (Seiler, 2001). Across Europe alone, it is estimated that up to 194 million birds are killed by vehicle collisions annually (Grilo et al., 2020). Beyond direct mortality, roads can fundamentally alter the ecological landscape of surrounding areas through habitat fragmentation, changes in predator behaviour, and increased noise pollution (Kociolek et al., 2011; Batary & Baldi, 2004; Shannon et al., 2014). While these negative impacts are well documented, roads can simultaneously create new habitat opportunities for tolerant species that favour open, sparsely vegetated terrain (Laidlaw et al., 2020; Morelli et al., 2014) — giving roads a dual role as both habitat disruptor and creator that makes understanding their net effects on wildlife essential.

The Eurasian Oystercatcher (*Haematopus ostralegus*) is a common wader in Iceland, relying on both coastal and inland habitats for nesting, feeding, and roosting (van de Pol et al., 2014). In Iceland, oystercatchers have broadly adapted to breeding in human-made environments including rooftops, golf courses, parking lots, and roadsides (Skarphéðinsson et al., 2016; Authors' observation). Icelandic roads commonly feature gravelly or sparsely vegetated margins between the carriageway and adjacent fields or developed land - attractive nesting conditions for oystercatchers and other species (e.g., Common ringed plover *Charadrius hiaticula*) that prefer open, minimally vegetated terrain for breeding (Laidlaw et al., 2020). This preference has led to widespread observations of oystercatchers nesting along roadsides, particularly where gravel slopes mimic their natural nesting substrates (Rannsóknasetur Háskóla Íslands á Suðurlandi & Bobeková, unpublished data, 2020-2024). The high site fidelity of oystercatchers – returning to the same territories year after year even as surrounding conditions might change (Méndez et al., 2018) – means that changes within a territory, such as road development or increasing traffic volume, may have long-term consequences for local populations.

Despite the apparent appeal of road margins as nesting sites for this species, these habitats carry risks. Traffic disturbance, potentially higher presence of nest predators such as ravens and gulls attracted to roadkill (Pescador & Peris, 2007), and the direct nest destruction from roadside activities or mortalities from vehicle strikes are all concerns for roadside-nesting birds. Roads can also fragment oystercatcher territories, particularly where infrastructure follows shorelines closely, forcing birds to cross roads to access feeding areas and increasing their exposure to vehicle strikes (Carroll, 2020; Bobeková, 2022; Authors' observation, 2020–2024). Conversely, roadside habitats may offer some benefits for tolerant species, including reduced predation pressure in certain contexts, thermal benefits from warm road substrate, and elevated vantage points (Morelli et al., 2014).

These considerations are especially relevant given the conservation status of the species. The global oystercatcher population is classified as Near Threatened by BirdLife International (2025), and the Icelandic population has been elevated to Vulnerable following three decades of consistent declines at Western European wintering sites (van Roomen et al., 2015). Whether roadside nesting habitats support or undermine population viability — functioning as ecological sources or sinks (Pellissier et al., 2013) — remains poorly understood, and this knowledge gap hinders the development of effective mitigation measures.

This report presents findings from the first year of a study examining the nesting success of Eurasian oystercatchers breeding within 100 metres of roads in two distinct regions of Iceland: Snæfellsnes and the Westfjords. We analysed nest fate in each region in relation to three road-related variables — distance from road edge, traffic volume, and posted speed limit.

## METHOD

### Study Site

The study areas for this project were located in west and northwest Iceland, focused along two major road networks. The northwest Iceland study area was located in the Westfjords, and focussed nest monitoring on approximately 100 km of the coastal road network. This included, but was not limited to, the roads in Dýrafjörður (Routes 60 and 624), Öndarfjörður (Routes 60 and 64), and route 61 across Bolungarvík, Skutulsfjörður, Álftafjörður, and Hestfjörður (Figure 1-A). In west Iceland, nest monitoring was conducted along approximately 80 km of road along the northern coast of the Snæfellsnes Peninsula. Extending from Stykkishólmur in the east, to the boundary of the Snæfellsjökull National Park, near Hellissandur, in the west (Routes 54 and 574). This study area therefore covered a large amount of the southern shore of Breiðafjörður (Figure 1-B). Both regions are rural, and infrastructure development is largely limited to coastal areas due to geographical constraints. The Westfjords is Iceland's least trafficked region, however both regions experience increased road use in summer due to tourism.



**Figure 1.** Map of Iceland with study areas highlighted in red (Westfjords, NW. Iceland) and orange (Snæfellsnes, W. Iceland). Road networks monitored are highlighted in the respective colour of their region.

### Data Collection - Fieldwork

Data collection was carried out between April 24th and July 16th, 2025, encapsulating the full span of the oystercatcher nesting season in both regions and accounting for early and late breeders, as well as re-nesting attempts. In Iceland, breeding typically occurs between May and

June, with occasional nests found in April or July, and slight regional variations in timing (Rannsóknasetur Háskóla Íslands á Suðurlandi, unpublished data).

Nests were located by field observations conducted from a vehicle along the road network, and those found within  $\leq 100$  m of the road edge were included in the study. Upon locating nests, GPS coordinates were recorded using a handheld GPS unit (Garmin GPSMAP 64s in Snæfellsnes & Garmin GPSMAP 65s in the Westfjords), clutch size was noted, and eggs were floated to estimate incubation stage and predict hatching dates (Cramp & Simmons, 1983). Each nest was photographed to show the eggs and surrounding environment, with additional notes taken on the habitat features and nest substrate.

Each study area was visited approximately once per week throughout the breeding period to follow up on located nests and identify new nest locations. The presence of an incubating adult indicated that the nest was still active, and it was therefore only checked from a distance to avoid unnecessary disturbance – unless additional eggs were expected to have been laid since the previous visit, in which case the nest was approached and clutch size checked. If no adult was present, the nest was approached and examined to determine whether it remained active or had failed (predated, abandoned, destroyed, or otherwise lost). During these visits, egg additions or losses were recorded. Where nests had failed, the area continued to be visited weekly to monitor for re-nesting attempts. Pairs can re-nest up to three times during the breeding season if early clutches fail (van de Pol et al., 2014).

Using predicted hatch dates, nests were visited near the expected time of hatching to record the outcome and number of eggs successfully hatched, after which the nest was considered complete. Where the hatching event was not directly observed, small eggshell fragments in the nest cup were used as evidence of a successful hatch, supplemented where possible by observing family behaviour through a scope or binoculars. Oystercatcher families were not monitored beyond the hatching date. A final check of known nest sites and territories was carried out in late July following the final predicted hatching date, to ensure all nests had recorded outcomes.

## Data Collection – Desktop

Nests were mapped using QGIS 3.42.1 (QGIS.org, 2026). Distances between each nest and the nearest road edge were measured within the program. Average annual daily traffic (AADT) data from 2024 were obtained from the Icelandic Road and Coastal Administration (IRCA) database (Vegagerðin, 2024); at the time of preparation of this report, 2025 data were not yet published. As traffic patterns on these rural roads are unlikely to differ substantially between years, 2024 data were used as a proxy for the 2025 breeding season. Traffic volume categories used in descriptive analyses follow Vegagerðin's classification system. Posted speed limit data were determined for each road segment.

## Analysis

Nests located more than 100 metres from a road listed in the Icelandic Road and Coastal Administration (IRCA) database were removed from the sample, as were nests without a known fate outcome (hatched or failed). Nests for which road data (traffic volume or speed limit) were unavailable were also excluded. A total of 91 nests were included in the final analysis.

Nest fate (hatched = 1, failed = 0) was modelled as a binary response variable. We fitted separate generalised linear models (GLMs) with a binomial error distribution and a logit link function for each study region (Snæfellsnes and Westfjords), as the two regions differ substantially in characteristics and were not intended to be directly compared statistically. The two regions were analysed separately rather than pooled, as regional differences in oystercatcher breeding success across Iceland are well documented (Carroll, 2020; Carroll et al., 2023), and the road characteristics and landscape contexts of the two study areas differ substantially.

For each region, we fitted a null model (intercept only) and individual models for each road predictor: distance from road edge and average annual daily traffic (AADT). A full model including both predictors simultaneously was also fitted for each region.

Distance from road edge and average annual daily traffic were treated as continuous variables. Posted speed limit was treated as a categorical variable in descriptive analyses; however, small sample sizes in several speed limit categories prevented formal GLM modelling of this variable, and it is therefore reported descriptively only.

Model fit was assessed by comparing each predictor model against the null model using a likelihood ratio test (LRT), implemented via ANOVA with a chi-squared statistic. Statistical significance was assessed at the threshold of  $p < 0.05$ . Model fit was further assessed using the Akaike Information Criterion (AIC), with lower values indicating better model fit. All analyses were carried out in R (Version 4.5.3; R Core Team, 2026).

## RESULTS

### Nest Fate

In total, 91 nests with a known outcome were located within 100 m of roads and were monitored throughout the 2025 breeding season. Of the 91 nests, 57.1% were successful and 42.9% failed to hatch. 32 of these were in Snæfellsnes, where a success rate of 46.9%, and a failure of 53.1% were recorded. Of the remaining 59 nests in the Westfjords, 62.7% were successful, and 37.3% failed (Table 1).

**Table 1.** Nest fate outcomes for oystercatcher nests monitored within 100 m of listed roads in Snæfellsnes and the Westfjords during the 2025 breeding season.

	Total Nests	Successful	Failed
<b>Snæfellsnes</b>	32	15 (46.9%)	17 (53.1%)
<b>Westfjords</b>	59	37 (62.7%)	22 (37.3%)

### Distance From Road Edge

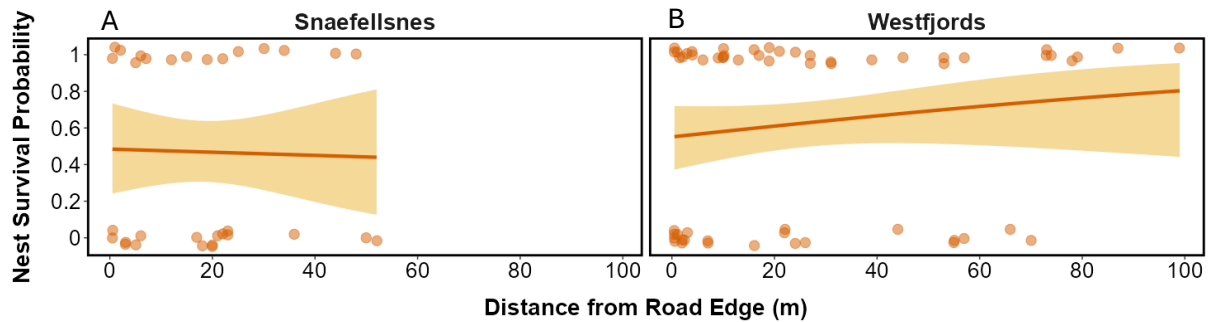
Oystercatcher nests in our sample ranged from 0.5 – 52 metres from the road edge in Snæfellsnes, while in the Westfjords this distance ranged from 0.5 – 99 metres (Table 2). Both distributions were right-skewed, with most nests clustered close to the road and a tail of nests further out. The median is therefore a more representative measure of typical nest distance in our sample than the mean, as it is less sensitive to the influence of distant outliers. The interquartile range (IQR) similarly provides a measure of spread that is unaffected by extreme values, and indicates that the central 50% of nests in Snæfellsnes were found between 5.0 and 23.5 metres from the road edge, compared to 3.5 - 49.0 metres in the Westfjords – suggesting a wider spread of nest distances in the Westfjords despite similar medians in both regions. It is important to note that these distributions are limited by our sampling methodology and may not fully reflect preference by oystercatchers for nesting at particular distances from roads; we do not use this data to draw conclusions about nest site selection.

**Table 2.** Descriptive statistics for nest distance from road edge in Snæfellsnes and the Westfjords.

	n	Min (m)	Max (m)	Mean (m)	Median (m)	SD (m)	IQR (m)
Snæfellsnes	32	0.5	52	18.5	18.5	15.4	5.0–23.5
Westfjords	59	0.5	99	27.3	19	27.5	3.5–49.0

Nest survival probability remained fairly constant across all distances in Snæfellsnes, with a very slight decreasing trend with increased distance from the road edge (Figure 2-A). This slight decrease was not statistically significant (Likelihood ratio test (LRT):  $\chi^2$ (df=1) = 0.022, p = 0.883) and is largely influenced by a single nest recorded at the furthest distance in the sample (52m), which failed. The smaller sample size in Snæfellsnes (n = 32) and the absence of nests beyond 52 metres from the road edge reduce the certainty of these results. Data from the Westfjords tell a slightly different story, with a slight increase in nest survival probability as distance from the road edge increases — from 0.554 for nests within 1 metre of the road edge to 0.764 for nests at

80 metres away from the road (Figure 2-B). The difference was not statistically significant (LRT:  $\chi^2(df=1) = 1.38, p = 0.240$ ). As in Snæfellsnes, limited data points at greater distances from the road edge contribute to increased uncertainty at the upper end of the range. AIC comparisons provided no evidence of improved model fit over the null for distance in either region (Snæfellsnes: 48.2 vs. null 46.2; Westfjords: 80.6 vs. null 79.9), consistent with the non-significant LRT results. Full AIC values for all models are reported in Appendix Table 1.



**Figure 2.** Probability of nest survival ( $y$ ) predicted by distance of nest from road edge ( $x$ ) in Snæfellsnes (**A**) and Westfjords (**B**), indicated with a logistic regression line with a 95% confidence interval.

Distance from road edge was treated as a continuous variable in these logistic regression models, which assume a smooth, consistent relationship across the full range of distances. Examining nest survival across distance categories (Table 3) shows a relationship that may not be strictly linear, particularly in Snæfellsnes where success rates fluctuate across distance categories, likely reflecting the small sample sizes within each category (especially over 50 metres with only one nest). In the Westfjords, the categorised data show a broadly consistent pattern with the regression model, with survival rates generally higher for nests further from the road edge. Given the sample sizes available, we did not have sufficient statistical power to model non-linear relationships formally.

**Table 3.** Nest survival rates by distance category from road edge in Snæfellsnes and the Westfjords.

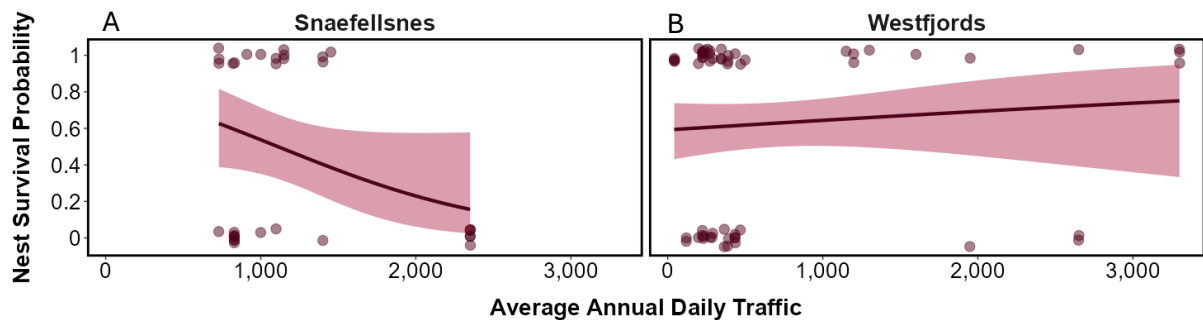
Distance from road edge (m)	Snæfellsnes n (% success)	Westfjords n (% success)
0–10	12 (50.0%)	24 (54.2%)
11–25	13 (38.5%)	12 (66.7%)
26–50	6 (66.7%)	8 (75.0%)
>50	1 (0.0%)*	15 (66.7%)

\*  $n=1$ ; percentage not meaningful due to small sample size.

## Traffic Volume

Average annual daily traffic on roads varied across each region, ranging from 501–1,000 cars per day on the quieter roads in Snæfellsnes to 2,001–3,000 on the more frequently used roads in the region. A different story is visible in the Westfjords, with the quietest road sections averaging fewer than 201 cars per day, while the busier sections saw an average of 3,001–5,000 cars per day across the course of the year (Table 4). Increased traffic volume on roads in Snæfellsnes was associated with a decrease in nest survival probability, from a predicted survival rate of

0.626 on roads averaging 730 cars per day to 0.156 on roads averaging 2,350 cars per day (Figure 3-A). This negative trend approached but did not reach statistical significance (LRT:  $\chi^2(df=1) = 3.77$ ,  $p = 0.052$ ). Notably, no nests along the busiest road sections in Snæfellsnes (2,001–3,000 vehicles per day,  $n=6$ ) were successful, though the small sample size limits interpretation of this result. Conversely, nest survival probability in the Westfjords showed a marginal increase along roads with higher traffic volume, from a predicted survival of 0.594 on roads averaging 42 cars per day to 0.751 on roads averaging 3,300 cars per day (Figure 3-B); this trend was not statistically significant (LRT:  $\chi^2(df=1) = 0.48$ ,  $p = 0.490$ ). It is also worth noting that the busiest road sections in both regions were located within urban areas, where additional factors beyond traffic volume may influence nest outcomes. In both regions, fewer nests were located alongside roads with high traffic volumes, thus increasing uncertainty in nest survival estimates for higher-usage roads. AIC comparisons indicated that the AADT model outperformed the null in Snæfellsnes (AADT: 44.5 vs. null: 46.2), consistent with the borderline significant LRT result, but not in the Westfjords (AADT: 81.5 vs. null: 79.9). Full AIC values for all models are reported in Appendix Table 1.



**Figure 3.** Probability of nest survival ( $y$ ) predicted by mean daily traffic ( $x$ ) in Snæfellsnes (**A**) and Westfjords (**B**), indicated with a logistic regression line with a 95% confidence interval.

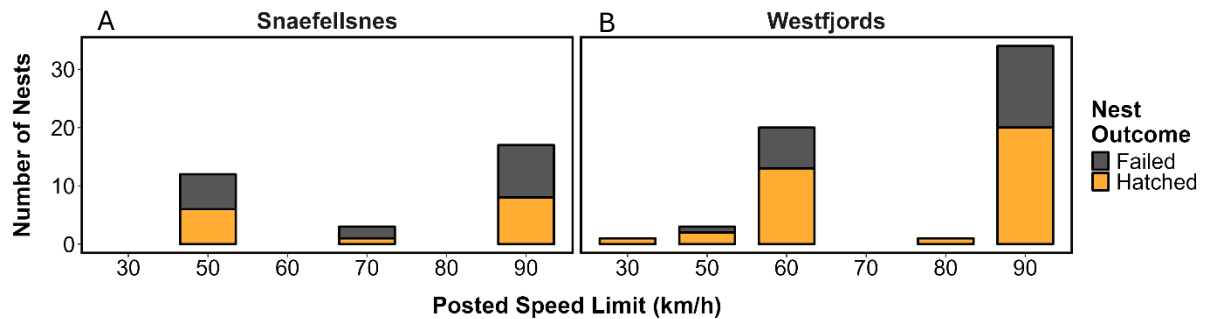
**Table 4.** Nest survival rates by average annual daily traffic category in Snæfellsnes and the Westfjords.

Traffic volume (AADT)	Snæfellsnes n (% success)	Westfjords n (% success)
<201	0	9 (66.7%)
201–500	0	37 (56.8%)
501–1,000	16 (43.8%)	0
1,001–2,000	10 (80.0%)	7 (85.7%)
2,001–3,000	6 (0.0%)	3 (33.3%)
3,001–5,000	0	3 (100.0%)

## Speed Limit

Most nests monitored in Snæfellsnes were found along 50 km/h and 90 km/h roads (Table 5), with similar success rates across both speed limits — 50.0% on 50 km/h roads and 47.1% on 90 km/h roads (Figure 4-A). The Westfjords also saw a majority of nests along 90 km/h roads, alongside a substantial number along 60 km/h roads (Table 5). Success rates were again similar across these two speed limits, with nests along 90 km/h roads successful 58.8% of the time and

65.0% along 60 km/h roads (Figure 4-B). The categorical nature of speed limit data and small sample sizes in several categories prevent formal statistical modelling of this variable. Nests along roads with lower or higher speed limits were too few to allow meaningful comparison across all categories in either region.



**Figure 4.** Number of hatched and failed nests (*y*) categorised by posted speed limit (*x*) in Snæfellsnes (A) and Westfjords (B).

**Table 5.** Nest survival rates by posted speed limit in Snæfellsnes and the Westfjords.

Speed limit (km/h)	Snæfellsnes n (% success)	Westfjords n (% success)
30	0	1 (100.0%)
50	12 (50.0%)	3 (66.7%)
60	0	20 (65.0%)
70	3 (33.3%)	0
80	0	1 (100.0%)
90	17 (47.1%)	34 (58.8%)

\*Percentages for categories with  $n \leq 3$  should be interpreted with caution due to small sample sizes.

## DISCUSSION

Road characteristics did not show statistically significant effects on oystercatcher nest survival in either study region during the 2025 breeding season. However, slight trends were observed for distance from road edge and traffic volume — in both cases, Snæfellsnes showed a tendency towards lower nest survival with increased road exposure, while the Westfjords showed the opposite pattern. In Snæfellsnes, traffic volume was the strongest predictor of nest survival, with the AADT model outperforming the null model in terms of AIC, and the likelihood ratio test approaching significance ( $p = 0.052$ ). These contrasting regional trends suggest that road characteristics alone are unlikely to be the primary driver of nest outcomes, and that landscape context — including factors such as terrain and vegetation type, whether nesting habitat is urban or rural, coastal or inland, and the composition of local predator communities — may interact differently with road disturbance across regions and warrants further investigation. It is also worth noting that oystercatcher breeding success is known to vary considerably between regions of Iceland (Carroll, 2020; Carroll et al., 2023), with the Westfjords generally outperforming other regions — the survival rates observed here (62.7% in the Westfjords vs. 46.9% in Snæfellsnes) are broadly consistent with this pattern, suggesting that regional differences in nest survival are not solely attributable to road effects.

### Distance from Road Edge

Distance of nests from the road edge did not have a statistically significant impact on nest survival probability in either region. Notably, when examining nest survival across distance categories, both regions showed a similar pattern with survival peaking at intermediate distances from the road edge (26–50 m; Snæfellsnes: 66.7%, Westfjords: 75.0%). This is broadly consistent with Dietz et al. (2013), who found that nest success in a migratory landbird was lowest both very close to and far from the road edge, attributing this to higher desertion rates near the road and higher predation rates at greater distances.

In Snæfellsnes, the apparent negative trend across the full distance range is largely an artefact of a single nest recorded beyond 50 m, which failed. The logistic regression model, which is less sensitive to this isolated data point, shows an essentially flat relationship between distance and survival probability across the Snæfellsnes range (predicted survival 0.480 at 1 m to 0.440 at 52 m). The two regions therefore show a more similar pattern than the overall trends initially suggest — both peaking at intermediate distances, with the Westfjords showing a clearer positive trend at greater distances where sample sizes are more adequate. Beyond 50 m, survival rates in the Westfjords levelled off (66.7%), while the Snæfellsnes sample contained only a single nest at this distance, limiting meaningful interpretation of this pattern. These findings suggest that distance from the road edge alone may be an incomplete proxy for disturbance, and that the relationship between nest proximity to roads and survival probability may be non-linear. With further data collected, it may become clearer whether this relationship is linear or non-linear in nature.

Nesting in close proximity to roads exposes adult oystercatchers to an elevated risk of vehicle collisions, with evidence of bird strikes observed near nest locations during monitoring for this study (Authors' observation). Loss or injury of one adult can increase the probability of nest abandonment or failure (Roche et al., 2010). Traffic noise is also a possible stressor that

increases with proximity to roads. Anthropogenic noise from traffic can inhibit species that rely on sound to detect threats such as predators, reducing fitness as time spent in alert behaviour increases (Shannon et al., 2014; Madadi et al., 2017), and Franks (2017) found specifically that Eurasian oystercatchers spend an increased amount of time alert at sites with high levels of anthropogenic noise. Reduced fitness of birds exposed to elevated anthropogenic disturbance has been documented more broadly across species (Slabbekoorn & Ripmeester, 2008; Dooling & Popper, 2016). However, proximity to roads may not disturb all species uniformly. While road traffic has been shown to have a consistent negative effect on breeding bird densities across a wide range of species and habitats, with densities on average 25% lower within road-effect zones (van Dijk et al., 2025), and several ground-nesting birds in lowland Iceland showing reduced densities within 200 m of low-traffic roads (Pálsdóttir et al., 2025), oystercatchers appear comparatively tolerant of road proximity. The oystercatchers in our sample, by definition, may represent those individuals that did not avoid nesting close to roads, and may therefore constitute a self-selected group of more road-tolerant birds or pairs with established roadside territories. Oystercatchers nesting close to roads in areas with long-established road networks may have become accustomed to vehicle traffic over time, reducing the direct disturbance effect of proximity, or may experience some perceived or real benefit from roadside locations that offsets the associated risks.

## Traffic Volume

Average annual daily traffic (AADT) did not have a statistically significant impact on nest survival probability in either region, though the effect in Snæfellsnes approached significance (LRT:  $\chi^2(df=1) = 3.77$ ,  $p = 0.052$ ) and warrants closer attention. In Snæfellsnes, a negative trend was observed between traffic volume and nest survival. A notable influence on this trend is that no nests located along the busiest road sections in the region (2,001–3,000 vehicles per day,  $n=6$ ) were successful. However, all six of those nests were located on the same stretch of beach within the harbour of Grundarfjörður, an urban area, and while all were within 25 metres of the road, it is possible that confounding factors beyond traffic volume were influencing nest fate in this location — including elevated disturbance from other sources, a weather event, and potentially higher predator presence typical of urban harbour sites, such as ravens, gulls, and mink.

In the Westfjords, the opposite trend was observed, with nest survival probability showing a marginal increase with higher traffic volume. This may partly be explained by the predator deterrent effect of high-traffic roads, whereby increased vehicle activity discourages predators from using roads as travel corridors or foraging areas (Pescador & Peris, 2007). However, roads also fragment habitat and create edges that predators may patrol opportunistically, increasing predation pressure on nearby nests (Kociolek et al., 2011; Batary & Baldi, 2004) — the balance between these opposing forces is therefore likely to vary depending on local predator communities and landscape context. The contrasting directions of the traffic volume effect between regions may reflect these differences — for example, predator pressure in urban harbour environments is likely to differ substantially from that in rural areas, and likewise between inland and coastal areas. Predator management practices such as fox control by farmers may further complicate regional comparisons and vary from fjord to fjord (Magnusdóttir et al., 2012; Morin, 2020). Additionally, higher traffic volume does not necessarily translate

uniformly into higher disturbance, as roads passing through areas of tourist interest may attract vehicles stopping or pulling off, creating localised disturbance pressure that is not captured by average daily traffic figures alone.

It is also worth noting that the traffic volume profiles of the two regions differed considerably. The Westfjords contained both the quietest road sections in the dataset (fewer than 201 vehicles per day) and the busiest (3,001–5,000 vehicles per day), yet the majority of nests were located on low-volume roads. Snæfellsnes, by contrast, occupied a middle range of traffic volumes (501–1,000, 1,001 – 2,000, & 2,001 – 3,000 vehicles per day), with nests more evenly distributed across the available range. This means that the two regions are not directly comparable in terms of traffic exposure.

## Speed Limit

The posted speed limit of road sections where nests were located did not appear to have a clear influence on nest survival in either region, with success rates broadly similar across all speed limit categories in both study areas. This consistency suggests that posted speed limit is not in itself a primary driver of nest fate. Field observations during this study support the idea that oystercatchers may respond to vehicle presence and behaviour rather than speed per se. Incubating adults were observed remaining on eggs when vehicles passed at 90 km/h, while the same individuals flushed when approached slowly or when vehicles stopped nearby (Authors' observation). This suggests that it is the unpredictability of vehicle behaviour — rather than speed alone — that triggers a disturbance response, which would explain why posted speed limit shows no clear relationship with nest survival in our data.

Nevertheless, speed limit should not be dismissed as irrelevant to nest survival, as it is directly related to traffic noise levels (Ware et al., 2015), which have documented implications for bird breeding success (Parris & Schneider, 2009; Halfwerk et al., 2012; Polak & Polak, 2024). The relationship between speed limit and nest survival may therefore operate indirectly through noise rather than through direct disturbance, and warrants consideration in conjunction with other road variables in future analyses with larger sample sizes.

## General Discussion

The results of this study raise several broader questions about oystercatcher nesting ecology in roadside environments that warrant further investigation. Nest habitat type and surrounding landscape characteristics were recorded during monitoring but were not formally analysed in this first year — as the dataset grows, these variables will be incorporated and may help explain some of the regional variation observed. The question of why some oystercatchers nest close to roads at all is also relevant context. Road verges in Iceland often offer exposed substrate with low vegetation cover that oystercatchers favour, and roads frequently run through coastal lowlands that oystercatchers would likely occupy regardless of road presence. It is possible that the presence of a road in some areas introduces suitable nesting habitat for oystercatchers that would not otherwise exist. The physical structure of the road may also limit available nesting space, concentrating nests closer to the edge than birds might otherwise select. It is also worth noting that roads are considerably quieter when nests are initiated in April and early May than later in the season when tourism peaks. However, given that oystercatchers typically return to the same territories year after year (van de Pol et al., 2014), many breeding individuals will have

prior experience of how road conditions change across the season — suggesting that roadside nesting in this species may reflect tolerance or habituation rather than a misjudgement of habitat quality.

It is also important to note that this study did not monitor oystercatcher families beyond hatching. The nesting period is only part of the story — once chicks hatch, they enter what may be an equally or more critical life stage in terms of road-related risk. Unlike incubating adults, which can remain stationary on the nest, mobile chicks must actively navigate their territory, and those in nests closest to the road or on the inland side of a coastal road may face frequent and dangerous road crossings to access foraging and roosting areas. Mumme et al. (2000) found that road mortality on roadside territories was high enough that breeder mortality exceeded yearling production, effectively making roadsides sink habitats for that species — a finding that underscores the importance of extending monitoring beyond the hatching date in future work.

## Limitations

This study represents a single breeding season and should be interpreted as a baseline rather than a definitive assessment. Results may reflect year-specific conditions, and the relatively modest sample size (n=91) limits statistical power, particularly for subcategories with few nests. Traffic volume data were based on annual averages, which likely underestimate summer exposure. Speed limit could not be formally modelled due to its categorical nature and small category sizes. Nest monitoring ceased at hatching, meaning road effects on chick survival remain unexamined. Natural disturbance events such as storms and high tides may also affect coastal nests independently of road effects. These limitations are acknowledged throughout the discussion, and the continuation of this study over multiple seasons will progressively address them.

## CONCLUSION

This report presents the first year of findings from an ongoing study into how roads affect oystercatcher nesting success in Iceland. While no statistically significant relationships were found between road characteristics and nest survival, subtle trends were observed — most notably a borderline effect of traffic volume in Snæfellsnes, and consistently opposite patterns between the two regions. These findings suggest that road effects on nesting oystercatchers may be shaped in conjunction with local ecological factors, such as predator communities and landscape context, rather than by road characteristics alone.

A single breeding season is not sufficient to draw firm conclusions, and the results presented here should be viewed as a baseline for future work. The monitoring system established across both regions provides a solid foundation, and this study is designed to continue in subsequent years. Extending the research over multiple years will help account for natural variations such as predator cycles and weather conditions. Additionally, expanding the study to other regions of Iceland would provide a more robust picture of roadside nesting behaviour across the country, and extending monitoring beyond hatching to include the period when chicks are dependent on movement around their territory with their parents will be an important next step in understanding the full impact of roads during the breeding season. With a greater understanding of the role that roads play in oystercatcher breeding ecology, this research has the potential to inform mitigation measures that support ground-nesting bird populations alongside the continued development of Iceland's transport infrastructure.

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## APPENDIX

**Appendix Table 1.** AIC values for generalised linear models of nest fate in relation to road predictors, fitted separately for each study region.

<b>Model</b>	<b>Snæfellsnes AIC</b>	<b>Westfjords AIC</b>
Null	46.2	79.9
Distance only	48.2	80.6
Traffic volume (AADT) only	44.5	81.5
Full model (distance + AADT)	46.5	82.4