**RESULTS**

**Data Collection**

From September 2, 2010, to December 2021, 2021, *N* = 11,239 reports were made to the Edmonton Urban Coyote project website. Of these, we removed *N* = 1,722 spam or duplicate reports, *N* = 256 reports that were outside of Edmonton city limits, and *N* = 127 reports from 2010 and 2011 because of limited reporting in these years. Coordinates were assigned to *N* = 3,366 reports (36.7%). The final dataset of classified reports included *N* = 9,134 unique and spatially explicit coyote reports between January 1, 2012, and December 31, 2021. The mean total repeatability of report classification was 92%, and the mean repeatability of report classification for coyote boldness or human concern categories were 84% and 96%, respectively.

**Reporting patterns**

Reports were widely distributed across the city but were unevenly spread across land cover types (χ24 = 1,564, P < 0.001, Figure 1). The abundance of reports in land cover types was greater than expected in residential (59.1%, *N =* 5,396), mowed grass (12.2%, *N =* 1,111), and natural land cover (10.9 %, *N =* 997) but not commercial (11.1%, *N*=1,016) or modified open (6.7%, *N*=614) based on their availability in the study area.

Reporting increased over the duration of the website’s availability, and was consistently higher in the breeding and dispersal seasons (Figure 2A). At a monthly scale, reporting was highest from October to March (69.9% of reports over 6 months) and lowest from April to September (30.1% of reports, Figure 2B). Reports were more common during the day than at night (Figure 2C).

Human activity was identified primarily as walking (19.1%), in home/yard (18.4%), or as driving (8.1%) but also as various outdoor activities (1.7%) and cycling (0.8%). Vulnerable individuals were either present or mentioned in reports as cats (1.9%), dogs (20.9%), or children (4.8%), and in some reports multiple of these were identified (3.2%). When dogs were present, they were mostly leashed (11.7%) but were often off-leash (9.4%), although in 78% of reports mentioning dogs they were in homes or yards, or their status could not be determined. The majority of reports involved a single coyote (59.4%), but some mentioned pairs (15.5%), groups of three (5.0%) or more than three (4.0%). A small number of reports identified coyote health as healthy (13.9%) or unhealthy (6.0%).

**Coyote boldness and human concern**

Coyote boldness could not be determined in the majority of reports (52.2%, *N* = 4,770) because these reports were sightings where no interaction occurred between humans and coyotes (Table 1). Coyote boldness categories avoidance and indifferent were most common at 11% (*N* = 993) and 16.9% (*N* = 1,532) of reports, respectively. Bold coyote behaviour (following, stalking or approaching people or pets) was reported in 7.5% (*N* = 682) of reports, and aggressive behaviour (chases, charges or physical contact) was identified in 3.6% (*N* = 333). Reports identifying physical contact between people and coyotes consisted mostly of dog attacks (*N* = 85), followed by cat depredations (*N* = 50), and only in one report did a coyotes contact a human trying to take a sled out of a child’s hands.

Human concern of coyotes was identified in a small subset of reports (11.6%, *N* = 1,060) and was predominantly of a negative perspective (7.9%, *N* = 718; Table 2). However, some reporters were not concerned about coyotes and expressed neutral (2.1%, *N* = 195) or positive (1.6%, *N* = 147) perspectives. Human concern and coyote boldness were significantly related (χ26 = 56.3, P < 0.001) with reports expressing negative perceptions of coyotes more likely to identify bold or aggressive behavior and those with positive perceptions reporting avoidance behavior (Appendix 2, Figure 5).

**Changes in boldness and concern over time**

There were apparent increases in coyote boldness and human concern of coyotes from 2012 to 2021 based on the distribution of classifiable reports within each variable (Figure 4). The percentage of reports indicating bold behaviour increased significantly while avoidance behaviour decreased, but indifferent and aggressive behaviour did not significantly change. Similarly, within the reports where human concern was determined there was an increase in negative perceptions of coyotes and a decrease in positive perceptions, but no change in neutral perceptions. The top AIC-selected ordinal regression models also indicated that both coyote boldness and human concern had increased significantly over the duration of report collection (see below, Figure 6).

**Ordinal regression**

Twenty ordinal regression models with coyote boldness as the response were within 2 AICc of the top model. These models included the variables year, coyote season, road distance decay, building density (within 200m), proportion of mowed (within 100m) and modified open (within 400m) land cover, and an interaction term between proportion of modified open land cover and coyote season (Appendix 3 Table 3). The top model indicated a significantly higher log odds likelihood of coyote boldness as year increased (ß = 0.29, 95% C.I. [0.22, 0.35]), during the pup rearing season (ß = 0.59, 95% C.I. [0.43, 0.76]), in areas with higher proportions of mowed land cover (ß = 0.089, 95% C.I. [0.023, 0.16]), and in areas with more modified open land cover during the pup rearing season (ß = 0.36, 95% C.I. [0.19, 0.52]; Figure 6). Lower coyote boldness was predicted by road distance decay (ß = -0.11, 95% C.I. [-0.18, -0.032]) and building density (ß = -0.13, 95% C.I. [-0.20, -0.05]). Several other variables and interaction terms appeared intermittently in the top models, but their effects were not significant (Appendix 3, Table 3).

For human concern there were also 20 models within 2 AICc of the top model (Appendix 3, Table 4). Only year and the proportion of residential land cover (within 800m) appeared in all the top models, but the interaction term between these residential and year appeared in 19 models and the proportion of modified open land cover (within 1600m) was in 18 of 20 models. Season appeared in 15 of the top models, and while several other variables were present their effects were non-significant. The top model indicated that the log odds of increased human concern of coyotes was predicted by increases in year (ß = 0.14, 95% C.I. [0.01, 0.27]), the proportion of residential (ß = 0.17, 95% C.I. [0.04, 0.3]) and modified open land cover (ß = 0.16, 95% C.I. [0.03, 0.3]), and the dispersal season (ß = 0.33, 95% C.I. [0.04, 0.62]; Figure 6). However, the interaction term between residential and year was negative, and while marginally non-significant in the top model (ß = -0.12, 95% C.I. [-0.25, 0.0019]) this indicates decreased human concern of coyotes in areas with more residential land cover over years.

**Contextual variables associated with boldness and concern**

Pearson’s χ2 tests of independence indicated that all contextual variables were significantly related to coyote boldness (Figure 5, Appendix 2, Table 4). Of the human activity categories, bold coyote behaviour was significantly more likely when walking (rij = 18.5, P < 0.001) and significantly less likely when cycling (rij = -3.37, P = 0.014), driving (rij = -10.1, P < 0.001), or in home/yard (rij = -7.26, P < 0.001). When reports mentioned cats there was a strong positive correlation with aggressive behaviour (rij = 16.4, P < 0.001), and dogs were significantly correlated with both bold (rij = 18.2, P < 0.001) and aggressive behaviour (rij = 8.76, P < 0.001). No significant correlations existed between coyote boldness and the presence or mention of children or multiple vulnerable individuals. Within reports that mentioned dogs, off-leash dogs were strongly correlated with aggressive coyote behaviour (rij = 7.08, P < 0.001), and negatively correlated with boldness (rij = -3.36, P = 0.009) or indifference (rij =-3.56, P = 0.004). Reports with only one coyote were negatively correlated with bold (rij = -4.76, P < 0.001) and aggressive behaviour (rij = -6.46, P < 0.001), and positively correlated with avoidance (rij = 7.06, P < 0.001). Bold coyote behaviour was significantly more prevalent in reports with two (rij = 3.07, P = 0.038) or three (rij = 3.49, P = 0.009) coyotes, and reports with more than three coyotes were significantly correlated with aggressive behaviour (rij = 3.13, P = 0.029). Healthy coyotes were significantly negatively correlated with boldness (rij = -5.98, P < 0.001) or aggressiveness (rij = -4.51, P < 0.001), and significantly positively correlated with avoidance (rij = 4.65, P < 0.001) and indifference (rij = 3.2, P = 0.015).

Human concern was significantly related to all contextual variables except dog leash status (Figure 5, Appendix 2, Table 4). When reporters were walking, they had greater concern of coyotes (rij = -3.72, P = 0.002) and when driving they had more positive (rij = 5.41, P < 0.001) and less negative (rij = -4.82, P < 0.001) perceptions. The presence or mention of dogs (rij = 5.08, P < 0.001), children (rij = 4.54, P < 0.001) or multiple vulnerable individuals (rij = 6.72, P < 0.001) were all strongly positively correlated to higher human concern as indicated by negative human perceptions. Lower human concern as indicated by positive coyote perceptions was more common in reports where no vulnerable individuals were mentioned (rij = 10.3, P < 0.001). Human concern was lower when only one coyote was reported as indicated by the positive correlation with positive (rij = 4.49, P < 0.001) and neutral perceptions (rij = 3.43, P = 0.009) and a negative correlation with negative perceptions (rij = -6.16, P < 0.001). Additionally, reports of healthy coyotes were significantly positively correlated with lower human concern (rij = 12.1, P < 0.001) and negatively related to negative human perceptions (rij = -10.6, P < 0.001).

Several relationships that may affect coyote boldness or human concern were also identified between contextual variables and both coyote season and land cover classes (Appendix 2, Figure 1,2). Reporters were more often walking (rij = 3.12, P = 0.031), cycling (rij = 3.08, P = 0.033) or engaging in another outdoor activity (rij = 5.19, P < 0.001) during the pup rearing season, and cats were also more commonly mentioned during this season (rij = 6.99, P < 0.001). Dogs, when present, were more commonly identified as leashed during the pup-rearing season (rij = 3.49, P = 0.004), and lone coyotes were more common (rij = 5.46, P < 0.001). During the breeding season reports more commonly included two (rij = 6.98, P < 0.001) or three (rij = 3.92, P = 0.001) coyotes. Coyote health was less likely to be unhealthy during the dispersal season (rij = -3.73, P = 0.002). Human activity varied substantially across land cover types and notably reporters were more often walking in mowed (rij = 8.73, P < 0.001) or natural (rij = 10.5, P < 0.001) areas. Reports mentioned cats more often in residential areas (rij = 7.93, P < 0.001) but dogs were more common in land cover types mowed (rij = 5.75, P < 0.001), modified open (rij = 3.78, P = 0.003) or natural (rij = 8.33, P < 0.001). In mowed areas, children (rij = 13.0, P < 0.001) or multiple vulnerable individuals (rij = 3.82, P = 0.002) were more commonly mentioned. Dogs were more often identified as off-leash in natural (rij = 9.24, P < 0.001) and modified open areas (rij = 3.21, P = 0.02). More than three coyotes were more commonly reported in modified open (rij = 6.22, P < 0.001) and mowed areas (rij = 3.29, P = 0.023), and reports of only one coyote were less frequent in mowed areas (rij = -3.67, P = 0.006). Coyotes were more frequently described as healthy in natural areas (rij = 7.25, P < 0.001) and less in modified open (rij = -3.04, P = 0.033) and residential areas (rij = -3.12, P = 0.028).

Several relationships that may affect coyote boldness or human concern were also identified between contextual variables and both coyote season and land cover classes (Appendix 2, Figure 1,2). Reporters were more often walking during the pup rearing season and when in mowed or natural land cover types. Cats were more commonly mentioned during the pup rearing season and in residential areas. Dogs were more frequent in mowed, modified open or natural land cover types and were more commonly identified as leashed during the pup rearing season but were most often off-leash in natural and modified open areas. Lone coyotes were more common in the pup rearing season, but pairs and trios occurred mostly in the breeding season. Greater numbers of coyotes were more common in modified open and mowed areas, and coyotes were less frequently described as healthy in modified open and residential areas.

As broad patterns in reporting, we found that reports of coyotes were more prevalent than expected in residential, mowed and natural areas (Figure 1), were least frequent during the pup rearing season and increased over time (Figure 2). We identified several spatial and temporal patterns in reporting and were able to identify contextual variables from many reports using the classification form (Figures 1, 2, 3). However, we stress that report distribution can be affected by several potential sources of bias including unequal reporting rates of residents due to socioeconomic factors (Wine et al., 2015), repeat reporters, uneven advertising of the reporting database across neighborhoods or over years, varying visibility of coyotes across seasons, time of day or land cover types due to differences in vegetative cover, human activity and daylight (Quinn, 1995, Poessel et al., 2013). Despite these limitations, the coyote report distribution can aid with the interpretation of our analyses of coyote boldness and human concern. While more reports than expected were from natural areas that provide good coyote habitat (Poessel et al., 2016, Murray et al., 2015b), residential and mowed areas also received high numbers of reports despite likely being used less frequently by coyotes, suggesting that coyotes in these areas are much more highly reported. As identified in other studies (Drake et al., 2021, Poessel et al., 2013, Lukasik and Alexander, 2011), reporting was substantially lower during the pup rearing season, which we attribute partially to greater vegetative cover during this period but also to coyotes denning away from edge habitat (Dodge and Kashian, 2013) and remaining closer to den sites during this period (Harrison and Gilbert, 1985). We found that coyote reporting increased over time, but we caution that this trend may be caused by changes in reporting database popularity rather than increased prevalence of coyotes or human-coyote interactions in Edmonton.