**Appendix 10. Calculating the probability of detecting northern pike with gillnetting efforts.**

Between 2005 and 2010, ADF&G conducted 12 removal experiments with northern pike populations on the Kenai Peninsula using similar sampling methods. Data collected from these experiments included catch and effort (in units of net-hours per surface acre) for sample and experiment Populations are assumed to be closed except for fish caught and the fishing is assumed to represent a Poisson process with a constant probability of capture for all individuals. Data was analyzed using a hierarchical version of Leslie’s regression method (Seber 1982):

where:

= the initial population size in experiment j

= average probability that a fish is captured with one unit of effort during experiment j,

The probabilities of capture for each experiment are assumed to come from a common distribution:

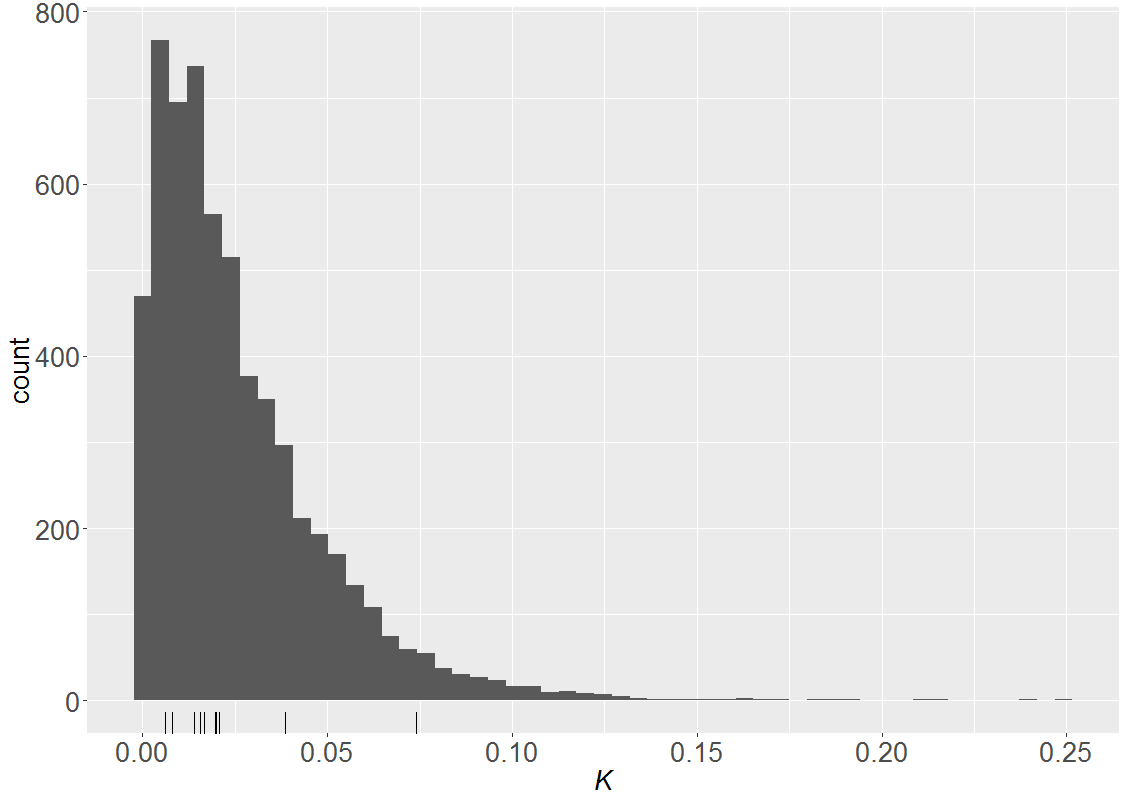
The analysis was conducted using the RJAGS package (Plumber 2013) within R (R Core Team 2016). Non-informative priors were used for all parameters. Although Leslie’s method is typically used to estimate the initial population size our interest was in the posterior and predictive distributions of for the purpose of estimating the probability of detecting small pike populations in future removal experiments.

Percentiles from the predictive distribution for the value of *K* in a new removal experiment are shown in Table 1 and the predictive distribution is shown in Figure 1.

**Table 1: Percentiles from the predictive distribution of *K*.**

|  |  |
| --- | --- |
| Percentile | predicted *K* |
| 5% | 0.001 |
| 10% | 0.003 |
| median | 0.019 |
| 90% | 0.055 |
| 95% | 0.073 |

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**Figure 1: Prediction distribution for *K, the average probability a fish is captured in a new removal experiment with one unit of effort. Tick marks along the x-axis show the median values for Kj, the average probability a fish is captured with one unit of effort in each of the previous removal experiments.***

Under the assumption that fishing represents a Poisson counting process, the probability of failing to detect a population of pike of size N as a function of net-hours per acre (E) is:

=

We will use the median value of K from Table 1 to calculate probabilities. The value of effort will be chosen based on logistical considerations such as the number of nets and technicians available.

**Table 2: Probability of failing to detect a population of 20 pike with various levels of netting effort.**

|  | **Net Densities** | | | |
| --- | --- | --- | --- | --- |
|  | **0.1nets/sa** | **0.25nets/sa** | **0.5nets/sa** | **0.75nets/sa** |
| **24 hours** | 0.391 | 0.096 | 0.009 | 0.001 |
| **48 hours** | 0.153 | 0.009 | 0.000 | 0.000 |
| **72 hours** | 0.060 | 0.001 | 0.000 | 0.000 |