

## Exercise – K-Pass Removal

Answer the following questions with R code by creating (*and editing if you make a mistake*) an R script and iteratively running the code in RStudio.

1. In one reach of the Little Stawamus Creek (British Columbia), Decker *et al.* (1999) had the following removals of Coho Salmon (*Oncorhynchus kisutch*) in three passes – 107, 62, and 17. Use this information to estimate the initial population size (with the Carle-Strub method) as well as the probability of capture (with appropriate 95% confidence intervals).

```
> d <- c(107,62,17)
> res <- removal(d,type="CarleStrub")
> summary(res)
```

The Carle & Strub's K-Pass Removal Method method was used.

	Estimate	Std. Error
No	203.0000	7.44209
p	0.5586	0.04639

```
> confint(res)
      95% LCI  95% UCI
No 188.4138 217.5862
p   0.4676  0.6495
```

The initial population is estimated to be between 188 and 218. The probability of capture is between 0.468 and 0.649.

2. Schnute (1983) recorded the number of Brook Trout (*Salvelinus fontinalis*) removed in passes in two streams in the the Nashwaak Experimental Watersheds Project (Canada) on multiple dates. The data are recorded in **BrookTroutNEWP.csv**. Use this information to estimate the initial population size (with the Zippin method) and probability of capture (with appropriate 95% confidence intervals) for each stream, section, and date combination.

```
> setwd("C:/aaaWork/Web/fishR/courses/Vermont2014/CourseMaterial/Exercises/")
> d <- read.csv("Data/BrookTroutNEWP.csv",header=TRUE)
> res <- apply(d[,4:7],MARGIN=1,FUN=removal,just.ests=TRUE,type="Zippin")
> res <- data.frame(t(res))
> res <- cbind(d[,1:3],res)
> res <- within(res,{
  No.LCI <- No-1.96*No.se
  No.UCI <- No+1.96*No.se
})
> res
```

	stream	section	date	No	p	No.se	p.se	No.UCI	No.LCI
1	UNM	2	Jul-74	91	0.4339	5.6953	0.06374	102.16	79.84
2	UNM	3	Jul-74	115	0.4526	5.6847	0.05524	126.14	103.86
3	UNM	4	Jul-74	72	0.5932	1.8389	0.05840	75.60	68.40
4	UNM	2	Jul-76	124	0.6949	1.1811	0.03928	126.32	121.68
5	UNM	3	Jul-76	76	0.5873	1.9641	0.05725	79.85	72.15
6	UNM	4	Jul-76	57	0.8028	0.3062	0.04925	57.60	56.40
7	UNM	2	Oct-75	97	0.5439	2.9357	0.05343	102.75	91.25
8	HAY	4	Jul-74	47	0.5294	2.2396	0.07815	51.39	42.61
9	HAY	1	Jul-76	46	0.7302	0.5433	0.06152	47.06	44.94
10	HAY	2	Jul-76	89	0.6423	1.4672	0.04951	91.88	86.12
11	HAY	3	Jul-76	56	0.3810	6.2960	0.08793	68.34	43.66
12	HAY	4	Jul-76	81	0.5571	2.4646	0.05752	85.83	76.17
13	HAY	6	Jul-76	59	0.6042	1.5484	0.06367	62.03	55.97
14	HAY	2	Oct-74	44	0.4824	2.9146	0.08579	49.71	38.29
15	HAY	4	Oct-74	45	0.5789	1.5960	0.07515	48.13	41.87
16	HAY	3	Oct-74	68	0.7391	0.6125	0.04997	69.20	66.80