

APPENDIX A

Bayesian removal model

A.1 Description of parameters, indices, and data

A.1.1 Parameters

$D_{t,j,k}$ – density at time period t , of species j , and stage-class k

$N_{h,i,j,k}$ – number of fish available for capture during pass h , at site i , of species j , and stage-class k

$p_{i,j,k}$ – capture probability at site i , of species j , and stage-class k

A.1.2 Indices

h – removal pass number ($h = 1, 2, 3$)

i – survey index ($i = 1, \dots, 28$)

j – species ($h = 1, \dots, 5$)

k – stage class ($k = 1, 2, 3$)

t – time period, pre- or post-disturbance ($t = 1, 2$)

A.1.3 Data

$c_{h,i,j,k}$ – catch during pass h , at site i , of species j , and stage-class k

A_i – site i area (length * width)

A.2 Model Description

Removal samples were used to estimate pre- or post-disturbance densities and site-specific capture probabilities for three stage-classes of each species using the Wyatt (2002)

Bayesian removal model. Removal sampling at each site occurred within a short period of time (<3 hours), and sampled reaches were closed by either natural blocks, such as steep cascades and riffles, or a block net. Thus, we considered fish populations to be closed to mortality and movement during sampling. The numbers of fish available to be captured in the first pass, $N_{1,i,j,k}$, were considered random draws from a Poisson distribution, with expected value equal to the area sampled times a pre- or post-disturbance density, $D_{t,j,k}$,

$$N_{1,i,j,k} \sim \text{Poisson}(D_{t,j,k} * A_i)$$

The number captured during the h th pass, $c_{h,i,j,k}$, was binomially distributed, with capture probability, $p_{i,j,k}$,

$$c_{h,i,j,k} \sim \text{Binomial}(p_{i,j,k}, N_{h,i,j,k}).$$

After capture, fish were removed without replacement. The number available for capture during all passes subsequent to the first was equal to the number previously available, minus the number previously caught,

$$N_{h,i,j,k} = N_{h-1,i,j,k} - c_{h-1,i,j,k}.$$

A.2.1 Priors

Density parameters were given uninformative priors ($D_{t,j,k} \sim \text{dgamma}(0.001, 0.001)$), and informative capture probability priors were developed from capture probability estimates listed

in Kwak et al. (2007), which used identical equipment and procedures to sample Puerto Rico stream fish assemblages. Hyperparameters for a beta prior distribution on p were estimated using Kwak et al. (2007) species-specific capture probability estimates as data and the `fitdist` package in R (R Development Core Team 2012, Table A1). OpenBUGS software (version 3.2.1; Lunn et al. 2009) was used to sample the posterior distribution of each parameter.

TABLE A1. Hyperparameters, α and β , fit to observations of electrofishing capture probability listed in Kwak et al. (2007).

Species	α	β
Bigmouth sleeper		
<i>(Gobiomorus dormitor)</i>	10.55	11.2
Mountain mullet		
<i>(Agonostomus monticola)</i>	5.89	5.23
Sirajo goby		
<i>(Sicydium spp.)</i>	9.93	18.02
Smallscaled spinycheek		
sleeper <i>(Eleotris perniger)</i>	23.55	26.64
American eel		
<i>(Anguilla rostrata)</i>	8.69	12.5

LITERATURE CITED

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