

Index

A

Abundance, estimation, [17](#)
Acoustic sampling, [7](#), [275](#)
 BUGS implementation, [278](#)
 ~~other types, 279~~
 secr implementation, [278](#)
 signal strength model, [276](#)
Activity center
 binomial point process model, [130](#)
 in BUGS, [146](#)
 concept, [16](#)
 conditional intensity and, [135](#)
 ~~defined, 41, 128~~
 direct linkage to density, [17](#)
 in distance sampling, [133](#)
 individual location, [429](#)
 initial values of, [143](#)
 location of, [161](#), [163](#), [169](#)
 in MCMC, [164](#)
 ~~in probability mass function, 135~~
 in SCR model, [134](#)
 in space usage, [135](#)
 in state space, [131](#), [140](#), [160](#)
 ~~multi-color spatial plot, 163~~
 non-uniformity of, [160](#)
 two-dimensional spatial coordinate, [127](#)
 uniform distribution, [165](#)
 unobserved random variable, [128–129](#)
 in WinBUGS, [159](#), [161](#)
 ~~of wolverine map, 166~~
Adaptive rejection sampling, [450](#)
ArcGIS, [465–466](#)
Akaike Information Criterion (AIC), [55](#), [184](#)
 ~~Bayesian model, 228~~
 likelihood methods, [223](#)
 model selection in, [202](#), [218](#), [224](#)
 secr package, [206](#), [220](#), [226](#)
 ~~sex-specific density, 227~~
Alternative movement model, [396](#)
American shad
 Cormack-Jolly-Seber (CJS) models, [419](#), [423](#)
 SCR issues, [426](#)
 stream flow, [430](#)
Animal movement, [287](#)
 see also Trap spacing
 ~~1-A protocol, 392~~
Area search, [385](#), [390](#), [392](#)
Avian mist-netting example, [264](#)

B

Basic capture-recapture method, [532](#)
Bayesian analyses, [33](#), [50](#), [436](#), [511](#), [534–535](#)
 ~~Akaike Information Criterion (AIC), 228~~
 Bayes' rule, [50](#)
 BUGS language for, [60](#)
 ~~checking, 80~~
 confidence intervals, [68](#)
 indicator variable, [231](#)
 inference principles, [52](#)
 in JAGS, [204](#)
 MCMC methods, [63](#)
 posterior inference, [54](#)
 prior distributions, [53](#)
 selection, [80](#)
 small sample inference, [55](#)
Bayesian inference, [436](#)
 sampling variance, [149](#)
Behavioral response
 in animal studies, [102](#)
 BUGS code for, [212](#)
 ~~contamination of, 139~~
 covariate effect, [207](#)
 encounter probability, [209–210](#)
 local or global, [212](#), [220](#)
 ~~probability changes in, 102~~
 to trapping, [102](#), [211](#)
Bernoulli distributions, [29](#), [452](#)
 encounter probability, [249](#)
 M_0 model, [105](#)
 observation model, [254](#)
 ~~Poisson model, 252~~
 prior distribution, [83](#)
 probability distributions, [29](#)
 Probability mass function (PMF), [29](#)
 SCR0, [169](#)
Binomial distributions, [452](#)
 M_0 model, [103](#)
 notation, [27](#)
 ~~Poisson integrated likelihood, 196~~
 probability mass function (PMF), [23](#), [28–29](#), [37](#)
 ~~R code, 25~~
Binomial GLMs
 parameter estimation, [77](#)
Binomial integrated likelihood, [196](#)
Binomial observation model, [127](#)
 ~~data augmentation, 145~~
Binomial point process model, [130](#)

Binomial probability mass function, 23
 Binomial regression
 waterfowl banding data, 79
 Bivariate normal distribution, 33, 136
 Black bears
 SCR + RSF model, study on, 360
 space usage, 362
 convex hull, 9
 standard approach, 12
 BUGS implementation
 Stratified populations, 373
 Buffering, 9

C

Camera trapping, 5
 historical overview, 5
 ~~drum bear study, 8~~
 encounter probability, 8
 ~~non-spatial, inadequacy, 11~~
 ~~population studies in, 4~~
 for sampling methods, 13
 ~~Canada goose resightings, 511~~
 Capture-recapture methods, 529
 Categorical distributions, 30
 Closed population models, 14
 data augmentation (DA), 92–93
 Closed capture-recapture model M_h , 451
 Collared individuals, 521
 C++, ~~computational speed using, 470~~
 Conditional distribution, 37, 455, 457
 constructing rules, 59
 M_0 model, 91
 Markov chain Monte Carlo (MCMC), 59
 Metropolis-Hastings algorithm, 59
 Conditional likelihood, 183
 in closed population model, 91
 full likelihood, 183
 SCR model, 300
 Convex hull
 buffering, 9
 density estimation, 9
 trapping array, 13
 Cormack-Jolly-Seber (CJS) models, 418
 Cost-weighted paths
 calculation, 338
 computation, 337–338
 defined, 335, 340
 R code, 338
 in SCR model, 336
 Counter detector, in *secr* package, 258
 Covariate effects

in density, 311
 in encounter probability models, 207, 250
 landscape structure, 353
 in standard GLM or GLMM, 207
see also Individual covariate model

D

Data augmentation, (DA)
 ~~in all-zero rows, 94~~
 in closed population models, 92–93
 formal development, 97
 heuristic motivation, 94
 joint likelihood using, 110
 model-based analysis, 110
 M_h model, 105
 in M_0 model, 95
 occupancy parameter, 94
 posterior mass of, 120
 remarks on, 97
 sampling model, 118
 ~~under a Uniform(0, M), 121~~
 unknown N , 144
 in **WinBugs**, 146
 zero-inflated model, 95, 110
 Data format
 ~~for number of traps, 155~~
 three-dimensional, 155
 two-dimensional, 141
 Data structure
 formatting, 141
 manipulating, 141
 sampling design and, 126
~~Demographic composition, 500~~
 ~~survival, 413~~
 Density estimation
 ~~Argentina jaguar study, 326~~
 ~~canopy height, 324–325, 327~~
 covariate, using, 303, 311
 data simulation, 318
 intensity parameter, 327
 ~~of invariance, 116, 122~~
 in M_0 model, 102
 parameter estimation, 321
 posterior mean, 329
 probability function, 316
 ~~R code, 328~~
 SCR definition of, 312
 sex specificity, 329
 ~~value expectation, 316~~
 Density maps
 effective sample area, 181

- individual prediction, 169
 - Wolverine analysis, 166
- DENSITY-Program, 173, 189
- Detection function
 - behavioral response, 254
 - conditional probability, 251
 - in covariate influence, 109
 - data collection, 279
 - in distance sampling, 117–118
 - in indicator variable, 235
 - individual, 110
 - models, 191
 - non-, 276
 - probability, 276
 - proximity in, 275
 - signal strength, 277
 - time trend, 269
- Detector dogs, 400
- DIC model selection, 229
 - wolverian data, 229
- Discrete habitat mask, 160
 - coarseness, evaluation, 161
- Dispersal dynamics
 - individual location, 428
 - in population ecology, 430
- Distance sampling, 30, 41, 44, 383, 386, 392
 - desert tortoise example, 120
 - in hierarchical model, 119–120
 - latent variability, 129
 - in SCR model, 117, 119, 122
- DNA sampling, 6
- Distribution of individuals, 531

E

- Ecological distance
 - Bayesian analysis, 343
 - density covariate, 349
 - likelihood analysis, 342
 - SCR simulation, 339
 - stochastic, 22
- Effective sample area, 199
 - density mapping, 181
- Effective sample size, 460
- Efford's formulation, 15
- Efford's possum trapping data, 272
- Encounter data file, 153
- Encounter device types, 191
- Encounter modeling
 - fisher study, 394
 - mountain lions, 393
- Encounter probability

- Bayesian analysis, 204
- Bernoulli process, 249
- binary observation, 252
 - cautionary note, 254
- covariate model, 207, 250
 - date, impact on, 208
- Gaussian model, 202, 253, 260
- individual covariate, 213
- multinomial model, 271
- signal strength model, 276
- space usage, 252
 - time, impact on, 208
- trapping interval, 271
- trap-specific covariate, 210
- Envelope function, 450
- Euclidean distance
 - in activity centers, 333
 - cost-weight distance, 338
 - encounter probability and, 334
 - estimate parameter, 347
 - in MLE model, 343
 - least-cost path model, 336, 342
 - mis-specified model, 343, 345, 349
 - in SCR model, 340
 - shortcomings, 334
- Explicit movement models, 536

F

- Fitness model
 - components, 237
 - in encounter probability, 219
 - individual trap frequencies, 241–242
 - occupancy dynamics, 245
- Fixed search path
 - alternative movement models, 396
 - design 1, 384
 - encounter probability, 385
 - intensity model, 395

G

- Gaussian kernel, 519
 - G bins, defined, 30
- Gelman-Rubin diagnostics, 463
- Generalized linear (mixed) models (GL(M)Ms)
 - binomial, 84
 - in applied statistics, 48
 - in Bayesian framework, 63
- Generalized linear models (GLMs)
 - binomial, 49, 77, 79
 - components, 48

- in exponential family, 48
- in SCR, 48
- Poisson, 69, 71, 75
- random effects, 49
- ~~Geographical analysis, 336, 345~~
- Gibbs sampling, 57, 59, [438](#)
- in MCMC methods, 57
- MH sampling vs., [445](#)
- ~~R-code, 440~~
- [Goodness-of fit, 55, 80, 82](#)
- evaluation, 236
- in SCR, 184
- wolverine data, 243
- ~~Google Scholar citations, 532~~
- ~~Google Scholar search, 529~~
- Gregarious species, 535
- Group structure
 - in data augmentation, 376
 - mean model, 374
 - multi-catch model, 369–370
 - no encountered individuals, 373
 - single parameter, 374

H

- Habitat mask, [187, 199–200](#)
- Habitat selection
 - space usage, 354
 - landscape simulation, 364, 367
 - non-uniform distribution, 311
 - spatial variation, 316
- Hard plot boundaries, 390
- [Heterogeneity model, 103, 106](#)
- Hierarchical modeling
 - defined, 40
 - examples of, 41
 - random variables, 21
 - statistical analysis, 37
 - statistical inference and, 40
- [Home range center](#)
 - definition, 128
 - ~~exhibit behavior, 16~~
 - implied model, 149
 - space usage model, 135
 - see also* Activity center
- Homogeneous point process, 523
 - [spatial randomness, 312](#)

I

- Imperfect identification, [534](#)
- Indicators variable

- detection function, 235
- wolverine data, 233
- Individual covariate model [1](#)
 - capture location, 110
 - data augmentation, 92
 - distance sampling, 87
 - extension, 114
 - ~~Fort drum bear study, 111~~
 - heterogeneity model, 103
 - ~~home range center, 115~~
 - in SCR, 109, 117
- Individual heterogeneity
 - defined, 201
 - detection probability, 216
 - for home range size, 202
 - incorporation methods, 220
 - see also* M_h model
- Inhomogeneous point-process, [525](#)
 - density model, 326
 - discrete space, 324
 - ~~estimation parameters, 318~~
 - fitting model, 322
 - in SCR model, 314
 - [intensity parameters, 315](#)
 - Poisson model, 312
 - spatial variation, 311, 319
- Integrated likelihood
 - construction, [177](#)
 - marginal distribution, 174
 - MLE estimators, 173–174
 - Poisson method, 195–197
 - in SCR models, 179–180
 - ~~simulated data, 175~~
 - under data augmentation, 183
- [Irregular patches, 345](#)

J

- JAGS, [467, 510](#)
 - Bayesian analysis in, 60
 - ecological introduction to, 60
 - ~~simulation analysis, 388~~
 - summary command for, 68
- Joint distribution, [37](#)
- Jolly-Seber model, 406, 413
 - data augmentation, 409
 - spatial, 413

L

- [Landscape connectivity](#)
 - geographical analysis, 345

- in SCR models, 333–334, 339
- Landscape structure
 - ~~‘A’ protocol, 354–355~~
 - covariate model, 353
 - ~~defined, 354~~
 - discrete model, 366
 - home range on, 361
 - resource selection, 364
 - simulated example, 356, 364
 - space configuration, 354, 367
- Langevin algorithm, 444
- Least-cost path
 - in BUGS, 343
 - computation, 347
 - covariate matrix, 340
 - ~~defined, 333, 335~~
 - encounter probability, 334
 - home range, 335
 - in MLE model, 342
 - ~~R code, 338~~
 - SCR example, 342
- Lincoln-Petersen estimator, 502–503
 - of abundance, 534–535
- Live-trapping study, 500

M

- Marginal distribution, 37
- Marginal likelihood
 - binomial form, 195
 - calculation, 187
 - conditional elements, 178
 - ~~grid information on, 176~~
 - individual encounter and, 174
 - point process density, 196
- Markov chain Monte Carlo (MCMC)
 - algorithm, 60, 72, 82, 508
 - in Bayesian analysis, 60, 63
 - ~~binomial encounter process, 457~~
 - building own algorithm, 435
 - closed capture-recapture model M_h , 451
 - ~~in conditional distribution, 59~~
 - convergence analysis, 65
 - ~~ecology application, 47~~
 - manipulating state-space, 463
 - ~~parallel computing, 467~~
 - ~~parameter estimation, 68~~
 - posterior distributions, 56, 436
 - ~~R code, 65~~
 - in SCR models, 57, 454
 - ~~using C++, 470~~
 - in WinBUGS, 64, 67

- Marked individuals
 - homogeneous point process, 523
 - imperfect identification of, 514
 - ~~information, 516~~
 - inhomogeneous point processes, 525
 - known number of, 501
 - ~~known number of, 506~~
 - locations of home ranges of, 504
 - spatial distribution of, 505
 - unknown number of, 501–502
- Markov random fields, 533
- ~~MARK program, 503~~
- Mark-resight models, 499
- M_b model
 - global trap response, 220
 - in non-spatial capture-recapture, 201
- Mean maximum distance moved (MMDM)
 - home range radius, 101
- Metropolis-Hastings algorithm
 - ~~conditional distributions and, 59, 520~~
- Metropolis-Hastings (MH) sampling, 443
 - vs. Gibbs sampling, 445
 - ~~R code to run, 445~~
 - ~~time series plots, 445~~
- Metropolis-within-Gibbs, 446
- M_h model
 - analysis, 105
 - ~~Fort drum data, 106~~
 - ~~as non-spatial capture-recapture, 201~~
 - random effect, 216
 - SCR, relevance to, 216
- Misidentification, 534
- MLE with known N , 173
- MLE with unknown N , 179
- M_0 model
 - binomial observation, 103
 - in black bear study, 98
 - in Bernoulli, 105
 - in BUGS, 95
 - capture-recapture assumptions, 90
 - closed population model, 88
 - conditional distribution, 91
 - occupancy type, 98
- Modeling territoriality, 533
- Model selection
 - in AIC, 218, 220
 - in Bayesian, 83
 - issues, 80
 - ~~in prior distribution, 83~~
 - in SCR model, 84
 - statistical ecology, 55
 - ~~variable indicators, 65~~
- ~~Modeling movement~~

~~population dynamics, 428~~
 Model output
 commands, 463
 ~~Gibbs sampling, 438~~
 ~~Metropolis-Hastings sampling, 443~~
 ~~Metropolis-within-Gibbs, 446~~
 posterior density plots, 459
 rejection and slice sampling, 450
 serial autocorrelation and effective
 sample size, 460
 summary results, 462
 time series plots, 459
 Movement model
 alternatives, 396
 auto-regression, 397
 data simulation, 395
 encounter frequency, 383
 open population, 399
 outcomes, 388
 Moving activity centers, 526
 Multi-catch device, 249, 258–259, 280
 Multi-catch independent multinomial
 model, 535–536
 Multi-session models
 BUGS language, 382
 data augmentation, 369–370
 landscape variation, 382
 multi-catch observation, 377
 other approaches, 376
 ~~R code, 369–370~~
 ~~secr analysis, 377~~
 sex effects on, 220, 369–370
 Multi-state model
 ~~apparent survival, 420~~
 ~~issues, 423~~
 ~~random parameters, 421~~
 spatial states, 403, 423
 ~~technical transition, 421~~
 Multinomial abundance models
 stratified populations, 371
 Multinomial distributions, 30
 Multinomial model
 density estimators, 271
 encounter devices, 258
 in Gaussian methods, 260
 ~~JAGS using, 249~~
 in single-catch trap, 271
 resource selection, 260
 in WinBugs, 260
 Multiple
 ~~distinct sample group, 369~~
 ~~space sample, 381~~

M_x model
 density invariance, 116

N

Non-spatial capture-recapture, 87, 534–535
 Non-spatial mark-resight models, 503, 507 514–515
 NOREMARK ~~program~~, 503
 Normal distribution, 436
 Notation
 ~~binomial distribution, 27~~
 BUGS language, 23
 ~~in hierarchical modeling, 21, 40~~
 ~~issues, 22~~
 ~~of R code, 21, 43~~
 ~~uniform point process, 32~~
 Numerical integration
 fitting parameters, 195
 integration grid spacing, 186
 R code, 182

O

Observation model
 alternative methods, 249
 in Bernoulli, 254
 in Poisson, 250
 JAGS, using, 249
 multinomial distribution, 249, 271
 single catch trap, 270
 Observed point processes, 318
 OpenBUGS, 435
 Open populations
 apparent survival, 405
 ~~dispersal, 399~~
 ~~issues, 409~~
 ~~model, 511~~
 ~~movements, 399~~
 recruitment, 408
 Optima design
 ~~calculation, 302~~
 detector configuration, 293
 ~~issues, 294~~
 in SCR model, 287, 297
 swapping algorithm, 300–301
 trap spacing, 289, 303, 307
 Ordinary capture-recapture models
 Efford's formulation, 11, 15
 encounter probability
 N , estimation, 109, 292, 364
 non-spatial, 12

- point process, 15
- technical problems, 17–18
- ~~Ovenbird data~~
- ~~reanalysis, 378~~
- ▲Ovenbird mist-netting study, 410, 414

P

- Parallel computing, 467
- Parameter estimation
 - in maximum likelihood estimates (MLEs), 36
 - statistical inference, 34
- Partial information designs, 399
- Photographic survey, 533–534
- Point process aggregation, 15
- Point process model
 - binomial, 130
 - state-space, 131
 - for homogeneous point process, 523
 - for inhomogeneous point processes, 525
 - ~~bin counts, 240~~
- Poisson distribution, 31, 69
- Poisson GLMs, 69
 - ~~bird survey, example, 69~~
 - ~~PoisGLMM(), 449~~
 - in WinBUGs, 71
 - ▲random effects, 75
- Poisson integrated likelihood
 - binomial form of, 196
 - development, 195
- Poisson model
 - ~~in Bernoulli, 252~~
 - in BUGS, 254
 - data simulation, 255
 - encounter probability, 249, 507, 515
 - GLMM, 449
 - multinomial relationship, 263
 - regression, 452
 - in SCR, 250
 - in *secr*, 266
 - space usage, 251
 - ~~trap specific, 263~~
 - wolverine camera, 257
 - zero-inflated, 255
- ▲Population dynamics
 - animal movement, 405
 - ~~overview, 404~~
- ▲Posterior distribution, 438–439, 441
 - Bayesian inference, 52
 - ▲~~conditionality, 57~~
 - ~~defined, 52~~
 - ~~density plots, 459~~
 - ~~discrepancy measures, 82~~
 - ~~inference of, 54, 55~~
 - ▲mass of, 75
 - MCMC simulation, 56, 65, 68, 436
 - ~~MH algorithm, 60~~
 - parameter estimation, 54, 83
 - ~~plots of, 441~~
- ▲Prior distribution
 - ~~Bayes' rule for, 52–53, 64, 83~~
 - choices, 63
 - conjugates, 58
 - ~~in Bernoulli, 83~~
 - ~~MCMC algorithm, 67~~
 - ~~parameter estimation, 54~~
 - ~~WinBUGS parameter, 73~~
- ▲Probability density function (PDF), 22
 - resource selection, 25
 - see also* Probability mass function (PMF)
- Probability distributions
 - Bernoulli, 29
 - binomial, 27
 - ~~commonly used, 27~~
 - different notations for, 22
 - hierarchical model, 40
 - properties, 24–25
 - random variable, 21, 22
- Probability mass function (PMF)
 - Bernoulli distribution and, 29
 - binomial ~~return~~, 23, 28–29, 37
 - ~~defined, 23~~
 - issues, 22
 - parameters, 22, 37
 - properties, 24
 - random variable values, 23
- Proposal distribution, 443
 - random walk, 443
- Proximity detector
 - density estimators, 249
 - in signal strength, 275

R

- ~~Raccoons, 521~~
- ~~R-code~~
 - ~~beta distribution, 33~~
 - ~~binomial distribution, 25~~
 - ~~binomial pmf returns, 23~~
 - ~~data analysis, using, 21~~
 - ~~data simulation, 261~~
 - ~~dbinom function, 28~~

- ~~declaration-deat, 31~~
- ~~dnorm function, 33~~
- ~~joint distribution, 37~~
- ~~marginal distribution, 38–39~~
- ~~non-negligible probabilities, 23~~
- ~~normal distribution, 24~~
- ~~Poisson outcomes, 35~~
- ~~resource selection, 25~~
- ~~in SCR model, 43~~
- ~~uniform distribution, 32~~
- ~~uniform search model, 397~~
- Radio-tagged individuals, 502–503
- Random effect
 - in Bayesian analysis, 84
 - ~~in GLM, 49~~
 - in GLMMs, 47, 49
 - in hierarchical models, 83
 - in MCMC, 47
 - in Poisson GLM, 75
 - in **WinBUGS** model, 61, 84
- Random sample assumption, 504
- Random variable
 - defined, 21, 25
- Random walk proposal distribution, 443
- ~~readShapeSpatial(), 466~~
- ~~Recall Bayes' theorem, 436~~
- Recruitment
 - data augmentation, 409
 - ~~degenerate, 410~~
 - JS model, 406, 413, 416
 - ~~in open population, 408~~
 - ~~sampling perspectives, 404~~
 - time dependent, 412
- Regular capture-recapture models, 501–502
- Rejection sampling, 319, 450
- Resighting techniques, 501
- Resource selection
 - encounter probability, 354, 359
 - in Poisson model, 358
 - in SCR model, 353
 - mis-specification, 364
 - population estimate, 354
 - second-order scale, 361
 - telemetry data, 364, 366
- Resource selection function (RSF)
 - independence assumption, 365
- S**
- Sample size
 - encounter probability, 290
 - estimation parameters, 289, 307
 - generation techniques, 285
 - in conditional probability, 297
 - in SCR model, 292
 - spatial problems, 281
 - trap clusters, 302–303
- Sampling design, 126
 - focal population vs. state-space, 284
 - model based, 282
 - population closure, 304
 - ~~space vs individual, 283~~
- Sampling methods
 - ~~latent heterogeneity, 12~~
 - non-invasive, 13
- Sampling techniques, 529
- Scenario analysis, 281–282
- ~~SCR framework~~
 - ~~assumptions of, 535~~
 - ~~misidentification in, 535~~
- SCR0
 - Bayesian analysis of, 131
 - Bernoulli model, 169
 - BUGS** analysis, 125
 - fitting model, 156–157, 142
 - home range area, 149
 - ~~multiple detections, 126~~
 - ~~R function, 161~~
 - statistical assumptions, 151
 - ~~in WinBugs, 146~~
- SCR models
 - activity center, ~~character~~, 298
 - applications, 376
 - Bayesian analysis, 149
 - binomial encounter process, 457
 - characterization, 41
 - conditional likelihood, 300
 - construct full conditionals, 455
 - continued development of, 532
 - core assumption, 151
 - data simulation, 262–263
 - distance sampling, 133
 - effective sample area, 169
 - encounter probability, 296
 - ~~fixed array trap, 44~~
 - ~~identify, 454–455~~
 - independence assumption, 365
 - integration, 359
 - model M_h , 133
 - optimal criteria for, 297
 - Poisson observation model, 299
 - population closure, 305
 - sex-specific encounter, 290
 - ~~spacing aspect, 291~~
 - study design, 285
- Search-encounter designs

- fixed path, 384–385
- methods, 7
- total hazard, 386
- uniform intensity, 385
- secr* package, 189
 - additional capabilities, 197
 - analysis, 192
 - covariate models, 199
 - density mapping, 199
 - encounter device, 191
 - in likelihood analysis, 195, 218
 - multi-session model, 196
 - ovenbird data, 266
 - population closure test, 199
 - sex specificity, 266
 - state-space buffer, 198
- Serial autocorrelation, 460
- Sex specificity
 - effects, 220
 - uncaptured individuals, 183
 - multi-session models, 369–370
 - secr* package, 266
- Single-catch trap, 535
 - ~~inference system, 271~~
 - multiple sample session, 265
 - observation model, 270
- Slice sampling, 450
- Small sample inference
 - Bayesian analysis, 55
- SMR model. *See* Spatial mark-resight model
- Space usage model, 354
 - empirical analysis, 137
 - home range center, 135
 - Poisson distribution, 358
 - ~~understanding, 139~~
- Spatial capture-recapture (SCR) methods
 - in animal population, 5
 - ~~in bears, 5~~
 - characterization, 9
 - construction of, 14
 - defined, 4
 - density estimation, 5
 - ecological theories and, 18
 - historical context, 12
 - inference formalization, 15
 - ~~in lions, 5~~
 - non-spatial aspects, 8, 11
 - technical problems, resolving, 3–4
 - ~~in tigers, 5~~
 - traditional, 18
- Spatial Capture-Recapture Odyssey, 533
 - ~~combining data from surveys, 533~~
 - ~~explicit movement models, 536~~
 - ~~gregarious species, 535~~
 - ~~misidentification, 534~~
 - ~~model fit and selection, 536~~
 - ~~modeling territoriality, 533~~
 - ~~single-catch traps, 535~~
- Spatial design
 - construction, 307
 - formal analysis, 281
 - issues, 282, 294, 300
 - model-based, 293
 - optimization criteria, 300
 - temporal aspects, 303
- Spatial distribution, 500
- Spatial mark-resight (SMR) model, 500
 - ~~for Canada geese in North Carolina, 514~~
 - hybrids of, 500
 - ~~homogeneous point process, 523~~
 - imperfect identification of marked individuals, 514
 - ~~implementing, 507~~
 - ~~individual capture histories, 503~~
 - inhomogeneous point processes, 525
 - ~~information, marked and unmarked individuals, 516~~
 - ~~known number of marked individuals posterior distributions from, 522~~
 - ~~raccoons on outer banks of North Carolina, 521~~
 - random sample assumption, 504
 - resighting techniques, 501
 - ~~short history, 502~~
 - telemetry data, incorporating, 518
- Spatial randomness, 311–312
 - homogeneous point process and, 312
 - observation model, 241
 - uniform distribution, 238
- Spatial sampling
 - in SCR model, 283
 - issues, 281, 303
 - trap location, 283
- State-space ~~concept, 16~~
 - ~~camera trapping, 302~~
 - ~~manipulating, 463~~
 - ~~size sensitivity, 240~~
- State-space model
 - invariance, 132
 - point process, 131
 - prescribing, 132
- Stationary distribution, 441
- Statistical inference
 - fundamentals of, 21
 - hierarchical models and, 40
 - parameter estimation and, 34
 - role in probability laws, 22

Stratified populations

- BUGS implementation, 373
- data simulation, 375
- hierarchical model, 371
- multinomial abundance models, 371
- ~~prototype, 370~~
- in SCR model, 369

Strauss model, 532

Survival

- affecting factors, 403
- American shad, 419, 426
- Cormack-Jolly-Seber (CJS) models, 418, 421
- ~~defined, 405~~
- demographic parameters, 413
- vs emigration, 405
- in spatial model, 404
- ~~JS model, 406~~
- ~~non-spatial version, 426~~
- in open population, 408
- ~~parameters, 408~~
- ~~posterior mean, 416~~
- ~~spatial multi-session model (S-MS), 410~~
- ~~week probability, 420~~

T

Telemetry data

- activity centers, 355
- ~~on black bear study, 360~~
- ~~estimation parameters, 362, 364~~
- ~~raccoons on outer banks of North Carolina, 521~~
- resource selection model, 353
- RSF model, 366
- SCR model, 354, 365
- space sampling, 356, 359

Temporal dependence

- multi-session formulation, 379

Temporary emigration, 13, 382

- ~~SCR models and, 13~~

Time series plots, 459

Total hazard,

- encounter model, 386–387, 392

Trap arrangement, 293

Trap spacing

- ~~array size, 287~~
- ~~home range factors, 285–286~~
- movement estimates, 286, 289
- ~~sensitivity analysis, 281~~
- study design, 285, 291

Trap-specific covariate

- encounter probability models, 210, 515

U

Uniform distribution, 32

Uniform intensity

- design 2, 395
- search-encounter designs, 385

Unmarked individuals

- estimated number of, 507
- information, 516

Unstructured spatial surveys, 392

UTM polygon, 467

W

WinBUGS, 435–436, 462–463, 467

- fitting model, 156
- in linear regression, 61
- in markov chain Monte Carlo (MCMC)-, 64, 67
- ~~in prior distribution, 73~~
- in random effect, 61, 84

Wolverine analysis

- camera trapping, 162, 184
- density map, 166
- space usage, 159
- ~~summary, 158~~

Z

Zero-inflated, Poisson model, 255

~~Zero-truncated distribution, 511~~