

## Index

- 16S rRNA, 82
- abortion, 184
- Adolf Friedrichs's *Angolan colobus*.  
 See *Colobus angolensis ruwenzorii*
- Africa  
 hunting, 359, 384
- African colobines, 18  
 morphology, 26  
 phylogeny, 37  
 research actions, 385–389
- age at sexual maturity, 177
- aggression, female, 254–255, 264
- agriculture, xiv, 226–227, 333, 365,  
 375–376, 380
- agriculture, shifting, 356
- agriculture, slash-and-burn. See  
 agriculture, shifting
- agroecosystems  
 Africa, 375–377
- air pollution, 180
- alarm calls, 138, 152, 221, 240
- alliances, male-male, 151
- all-male band, 196, 285
- all-male group, 215, 217, 241
- all-male unit (AMU), 172, 295
- allomothering, 123, 145, 178, 197,  
 236
- allonursing, 178
- altitudinal range  
 African colobines, 352
- altitudinal ranging, 169
- Angolan colobus*. See *Colobus angolensis*
- Annamese langur*. See  
*Trachypithecus margarita*
- anthrax, 377, 382
- antipredator behavior, 194
- aquaculture, 333
- area of occupancy, 354
- ashy red colobus. See *Ptilocolobus tephrosceles*
- associations, polyspecific, 115–116,  
 124, 151, 238, 374
- bachelor group. See all-male group
- bachelor males, 171
- bachelor threat, 305
- band, 294
- banded langur. See *Presbytis femoralis*
- behavioural flexibility  
 African colobines, 359
- Bengal sacred langur. See  
*Semnopithecus entellus*
- between-group encounters, 151,  
 154–155, 280–281, 283
- bezoar stones, 332
- biodiversity, xiv, 337, 393
- biofuels, 333
- biogeography, 388  
 African colobines, 343–354
- biomass, colobine, 102–103, 316,  
 318
- birth rate, 103, 121, 259, 261
- birth synchrony, 142
- black colobus. See *Colobus satanas*
- black langur. See *Trachypithecus ebenus*
- black snub-nosed monkey. See  
*Rhinopithecus strykeri*
- black Sumatran langur. See  
*Presbytis sumatrana*
- black-and-white colobus, 118, See  
 Colobus
- black-and-white langur. See  
*Presbytis bicolor*
- black-and-white snub-nosed  
 monkey. See *Rhinopithecus bieti*
- black-crested Sumatran langur. See  
*Presbytis melalophos*
- black-shanked douc. See *Pygathrix nigripes*
- body mass, 17, 28, 147, 180, 199
- body size  
 African colobines, 358
- bonds, cross-sex, 297
- bonds, female-female, 297
- bonds, male-male, 120
- Boonratana, Ramesh, 158, 160
- Borries, Carola, 188, 247
- brain size, 308
- bushmeat, xiv, 126, 144, 155, 184,  
 312, 367–368, See also  
 hunting
- C. guereza*, 314
- caeco-colon, 75
- camera traps, 205
- capped langur. See *Trachypithecus pileatus*
- captive breeding, 340  
 African colobines, 385
- captivity, 75, 79, 86–87, 89–90,  
 92–93, 177, 340, 356, 368,  
 395
- carbohydrates, 162
- Cat Ba langur. See *Trachypithecus poliocephalus*
- Cat Ba Langur Conservation Project,  
 247
- caves, 237–238
- Cercopithecidae, 32
- cercopithecines, 26, 31, 42, 110,  
 116, 124, 287, 320
- Cercopithecoides, 18–23, 25, 30
- Chamba sacred langur. See  
*Semnopithecus ajax*
- chamber, quadri-partite, 64
- chamber, tri-partite, 64
- Chapman, Colin, 131, 313
- chewing, 61, 65, 71, 73, 77
- chimpanzees, 123
- Chinese medicine, traditional, 184
- civil unrest, 335
- climate  
 African colobines, 352
- climate change, xiv, 98, 107, 110,  
 125, 180, 230, 312, 336, 353,  
 366, 398  
 Africa, 372–375  
 effect on food quality, 373
- clitoris, 110
- coalitions, 121, 283, 288

## 498 Index

- coalitions, female, 183, 251, 255, 266
- Cody/Altmann hypothesis, 304
- coercion, 175
- cognition, 308, 397–398
- collective action, 181, 184, 299, 305
- collective action problem, 262, 280, 290
- Colobinae, 1, 17, 29
- colobine habitats, status of, 327–328
- Colobini, 4, 32
- Colobus
- activity patterns, 136
  - alarm calls, 138
  - birth seasonality, 141
  - birth synchrony, 142
  - climate, 133
  - diet, 133–135
    - nutritional composition, 135
  - directions for future research, 396
  - dispersal, 140–141
  - forest loss, 364–365
  - future research directions, 142–144
  - gestation length, 141
  - group composition, 139
  - group size, 139
  - group size, influences on, 139
  - habitat, 132–133
  - home range size, 357
  - hunting
    - by humans, 369
  - infant handling, 142
  - interbirth interval, 141
  - mating system, 140
  - natal coats, 142
  - niche separation, 143
  - phylogeny, 32–33
  - predation, 138–139
  - range use, 136–138
  - research efforts, 130–132
  - sexual behavior and reproduction, 142
  - social organization, 139–141
  - taxonomy, 5
  - taxonomy and distribution, 128–130
- Colobus angolensis*
- activity patterns, 136
  - copulatory behavior, 141
  - diet, 134
    - diet, effect of anthropogenic disturbance on, 135
  - dispersal, 140
  - distribution, 128
  - forest fragmentation, 143
  - phylogeny, 37
  - predation, 138
  - range use, 136
  - taxonomy, 5
- Colobus angolensis palliatus*
- diet, 95
    - nutritional composition, 99
- Colobus angolensis ruwenzorii*
- competition
    - within-group scramble (WGS), 273
  - diet, 274
    - nutritional composition, 102
  - dispersal, 282
  - grooming, 282
  - logging, 364
  - male infant care, 142
  - multilevel society, 139
  - social organization, 276
    - fission-fusion, 300
    - multilevel society, 295
  - supergroups, 139
- Colobus caudatus*, 129, 343
- climate change, 375
- Colobus Conservation initiative*, 384
- Colobus guereza*, 17
- climate change, 375
  - competition
    - between-group contest (BGC), 280
    - within-group scramble (WGS), 276
  - copulatory behavior, 141
  - diet, 95–97, 134, 315
    - effect of anthropogenic disturbance on, 135
    - geophagy, 105
    - nutritional composition, 98, 104–105
  - dispersal, 140, 282
  - distribution, 129
  - dominance hierarchy, 279
  - forest fragmentation, 143
  - group size, 315
  - hunting by chimpanzees, 370
  - microbiome, 89
  - microwear, 25
  - phylogeny, 37
  - predation, 138
  - range use, 137
  - reintroduction, 385
- Colobus guereza gallarum*, 143, 352, 391
- Colobus guereza percivali*, 143, 375, 388
- Colobus pelts*, hunting for, 369
- Colobus polykomos*
- activity patterns, 136
  - competition
    - between-group contest (BGC), 280
    - within-group contest (WGC), 278
  - copulatory behavior, 141
  - diet, 95, 133
    - energy, 103
  - dispersal, 140, 282
  - distribution, 129
  - dominance hierarchy, female, 279
  - home range size, 137
  - phylogeny, 37
  - predation, 138
- Colobus satanas*
- copulatory behavior, 141
  - diet, 133
    - food selection, 100
    - nutritional composition, 99, 104
  - dispersal, 140, 282
  - distribution, 129
  - ecology, 144
  - hunting
    - by humans, 367–368
  - phylogeny, 37
  - range use, 137
  - taxonomy, 5
- Colobus vellerosus*
- competition
    - between-group contest (BGC), 281
    - within-group contest (WGC), 279
    - within-group scramble (WGS), 275
  - copulatory behavior, 141
  - diet, 95, 133, 135

- dispersal, 140, 282  
 distribution, 129  
 dominance hierarchy, female, 279  
 forest fragmentation, 144  
 home range size, 137  
 hunting taboo, 383  
 infanticide, 285  
 microbiota, 86  
 phylogeny, 37  
 predation, 138  
 socioecology, 285–287  
 taxonomy, 5
- colon, 231  
 community ecology, 398  
 community forest associations, 382  
 competition, 119  
 among females, 179, 183  
 among kin, 150  
 between-group contest (BGC),  
 250–251, 259, 261–262,  
 264–265, 269, 271, 280–282,  
 286–287, 289  
 contest, 176, 181–182, 233, 253,  
 271  
 food, 2, 103, 120, 136, 140, 145,  
 149, 152, 182, 213, 217, 256  
 for mates, 181  
 interspecific, 320–321  
 intraspecific, 319  
 male–male, 141, 147  
 resource, 182, 245  
 scramble, 120, 166, 173, 182, 233,  
 241, 250–251, 259  
 sperm, 121, 154, 243, 396  
 within-group contest (WGC), 250,  
 252, 259–260, 264–265, 271,  
 278–280, 286–287  
 within-group scramble (WGS),  
 250, 259–261, 264–265,  
 268–269, 271, 283, 286–287,  
 290, 302  
 effects on foraging effort,  
 275–277  
 fitness costs, 277–278
- connectivity, 381  
 conservation, xiv, 75, 376  
 African colobines, 380–385  
 Asian colobines, 324–341  
 conservation actions  
 African colobines, 389–390  
 conservation by tradition, 382–384  
 conservation education, 384–385  
 conservation measures  
 Asian colobines, 336–340  
 conservation planning  
 Asian colobines, 339–340, 398  
 conservation status, 47, 109  
 African colobines, 354–356,  
 398  
 Asian colobines, 324–325  
 conservation success  
 African colobines, 390–392  
 conservation threats, 75, 91, 108,  
 125, 128  
 African colobines, 354, 360–380  
 Asian colobines, 330–336, 398  
 conservation, community-based,  
 339  
 consortship, 121, 141, 153  
 copulation, 122, 141, 153, 155,  
 178  
 calls, 122  
 extra-group, 153, 184, 299  
 extra-pair, 308  
 copulation calls, 116, 141  
 copulation solicitation, 153, 218,  
 243  
 corridors, 125  
 cortisol, 115  
 crest, 46  
 Critically Endangered, 325, 332,  
 360  
 crop foraging. *See* crop raiding  
 crop raiding, 125–126, 335, 339  
 African colobines, 376–377  
 cross-marked langur. *See* *Presbytis*  
*chrysomelas*  
 cryptic appearance  
 African colobines, 359  
 cryptic behaviour  
 African colobines, 359  
 crypticity, 151–152, 154  
 cyclone, 318–319
- daily path length, 138, 154, 168,  
 193, 210  
 daily travel distance, 167  
 daily travel distances. *See* daily path  
 length  
 dams, 334–335  
 day range, 314. *See* daily path length  
 daylight length, 205
- defence, 295  
 against predators by males, 115,  
 120, 149  
 of resources by males, 181, 214,  
 262, 280–282, 287, 289,  
 292  
 of the home range, 290  
 defensibility index, 211  
 deforestation, xiv, 337, 363  
 Asia, 248  
 Delacour's langur. *See*  
*Trachypithecus delacouri*  
 dental eruption, 61  
 dental morphology, 394  
 dentition, 21, 44, 54–55, 61  
 cercopithecines, 44  
 detoxification, 69, 81, 94, 106–107,  
 113, 126
- diarrhea, 87–88  
 diet, 45, 94–97  
 bamboo shoots, 162–163  
 bark, 112, 191, 232  
 charcoal, 96, 106, 113  
 cultivated food, 191  
 energy, 103, 162  
 metabolizable energy, 103  
 Eucalyptus, 105, 137  
 fallback food, 164  
 flowers, 99, 163–165, 232, 315  
 food selectivity, 150  
 fungi, 213  
 gums, 232  
 immature leaves. *See* diet: young  
 leaves  
 insects, 164–165. *See* diet:  
 invertebrates  
 inter-annual variation, 134  
 invertebrates, 194, 233  
 leaf buds, 101, 163  
 lianas, 95, 274  
 lichen, 179, 277, 295, 301, 315  
 lichens, 96, 134, 162–163  
 mature leaves, 95, 97, 102, 114,  
 134, 162–163, 208, 232, 252,  
 274, 277, 303, 316, 356  
 moss, 164  
 nutritional composition, 97, 233  
 African colobines, 97–100  
 Asian colobines, 100–101  
 ripe fruit, 81, 252, 275  
 roots, 191, 232

## 500 Index

- diet (cont.)  
 seasonal variation in, 233, 274  
 seeds, 95, 133, 150, 162–163,  
 191, 208, 210, 231–232, 274  
 strategy, 97  
 swamp plants, 137  
 toughness, mechanical, 165  
 underground storage organs, 162,  
 191  
 unripe fruit, 81, 164, 208, 252  
 urine consumption, 105  
 variation, 96  
 vertebrates, 165  
 water plants, 105  
 young leaves, 95–97, 99–100,  
 134, 150, 162–165, 192, 232,  
 252, 274, 295, 315
- diet composition, 89, 191
- dietary diversity  
 African colobines, 356
- dietary flexibility, 274
- dietary overlap  
 between species, 320
- digesta  
 mixing, 71, 75  
 retention time, 62–63, 70, 79,  
 231  
 washing, 71, 77
- digestion gases, 69
- digestive folivore hypothesis,  
 61–62, 65
- digestive physiology, 395
- Dipterocarp, 318
- disaster, environmental, 318–319
- disease, 86–87, 89, 93, 107, 126,  
 322
- disease risk, 303
- disease, anthroozoonotic, 123
- disease, zoonotic, 123, 334, 361, 376
- diseases  
 African colobines, 377–379
- dispersal, 29, 140, 217  
 both sexes, 118, 176, 241  
 female, 118, 124, 140, 149, 174,  
 181, 195, 217–218, 251,  
 256–257, 269, 272, 279,  
 282–283, 285–286, 289, 299,  
 308  
 secondary, 257  
 female-biased, 108, 118  
 juvenile, 150  
 male, 149, 173–174, 195, 215,  
 241, 285, 299  
 male-biased, 140  
 out of Africa, 30  
 parallel transfers, 282
- dispersal-egalitarian, 183
- distribution, 5, 7, 10, 23, 26, 32,  
 193, 340, 388
- DNA, 38–39
- DNA barcodes, microbial, 78
- DNA sequences, 32  
 Colobinae, 32
- DNA, nuclear, 32
- Dolichopithecus, 26–28
- dominance, 242
- dominance hierarchy, 175, 183, 241,  
 271
- dominance hierarchy, female, 195,  
 254–256, 278–280, 287  
 age-inversed, 254–255, 260
- dominance hierarchy, male, 196
- dominance relations  
 despotic, 251, 254, 264  
 egalitarian, 217, 241, 251, 255  
 nepotistic, 251, 257
- drinking, 105, 113, 213, 234
- drought, 334, 336
- dusky langur. *See Trachypithecus  
 obscurus*
- eagle, 240
- eagles, 138
- East Javan langur. *See  
 Trachypithecus auratus*
- Ebola, 377
- eclectic feeders, 191
- Ecological Constraints Model, 275
- ecological flexibility  
 African colobines, 358
- ecological zones, 327
- ecotourism. *See* tourism
- education and awareness, 339
- El Niño, 334, 336
- elephants, 364
- enamel, 44, 46, 147
- endemism, 327
- energy balance, 277
- energy maximising strategy, 235
- energy production, 335
- energy, non-protein, 99
- estrogenic compounds, 113
- Europe, 25–26, 31
- extinction, 125, 327, 368
- extinction risk, 354  
 African colobines, 360  
 predictors of, 355–356
- extirpation, 387
- faecal nitrogen, 76, 113
- faecal particle size, 73
- fallback food, 102, 139, 162–163, 179
- Fashing, Peter, 131
- fat deposition, 180
- fatty acids, short-chain, 79
- feeding deterrents, 101
- female defence polygyny, 280
- female-mimicry hypothesis, 147
- fermentation, 94, 231
- fermentation, foregut, 64, 94, 136,  
 147
- fermentation, forestomach, 69, 231
- fiber, 162–164, 191, 277, 316
- fiber, faecal, 76
- fire  
 Africa, 379–380
- fission-fusion, 119, 172, 182, 295,  
 300
- fitness, female, 259, 261, 265
- flagship species, 339, 380–381
- fleeing, 222
- folivore paradox, 250–251, 259,  
 262, 264–269, 272, 283–287
- folivory, 15, 23, 31, 66, 77, 79, 95,  
 147, 208, 230–231, 234, 274,  
 315
- food choice, 96
- food distribution, 252
- food distribution, clumped, 168,  
 172, 182, 278
- food distribution, patchy, 275, 277
- food preferences, 106, 191
- food quality, 252
- food selection, 94, 99, 101, 103,  
 105–106
- food selectivity, 79, 163, 191, 252
- foraging effort, 259–260, 265,  
 268–269
- foraging strategy, 165
- foraging theory, 191
- foregut, 78, 81–82, 88–89, 94
- forest  
 alpine, 156

- bamboo, 229, 329, 344  
 beach, 208  
 coral rag, 133  
 deciduous, 329  
 dipterocarp, 161, 329  
 dry, 133, 327  
 fir, 160  
 flooded, 330, 333  
 gallery, 132, 139, 148, 374  
 high altitude, 208  
 highland, 330  
 karst. *See* forest:limestone  
 limestone, 161, 227, 327, 329  
 mangrove, 133, 161, 330, 344  
 mixed deciduous broadleaf and conifer, 160  
 moist deciduous, 229, 327, 329  
 montane, 133, 190, 202, 208, 277, 375  
 nipah, 161  
 peat swamp, 167, 208, 210  
 pine, 161  
 primary, 100, 132, 229  
 riparian, 353, 364, 366  
 riverine, 148, 167, 208  
 secondary, 132, 148, 208, 362, 364–365  
 subalpine, 160, 229, 375  
 subtropical humid, 327  
 teak, 208, 210, 329  
 tropical dry, 329  
 forest composition, xiv, 96, 318  
 forest cover  
 Africa, 362  
 forest degradation, susceptibility to, 356–358  
 forest fires, 184  
 forest fragmentation. *See* fragmentation  
 forest loss, 352, 356, 360  
 African colobines, 362–364  
 susceptibility to, 356–358  
 forestomach anatomy, 64–67  
 fragmentation, 125, 135, 143, 229, 236, 249, 333, 336–337, 364, 396  
 susceptibility to, 356–358  
*François's langur. See* *Trachypithecus francoisi*  
 frugivore paradox, 268  
 gastric acidosis, 87  
 gastric mill, 61, 65  
 gastrointestinal (GI) tract, 78, 231  
 gastro-intestinal disorders, 75  
 gastrointestinal distress, 87, 89, 395  
*Pygathrix nemaeus*, 88  
 gene flow, 125  
 genetics, 41  
 genomes, 43  
 geographic range  
 African colobines, 353  
 geographic range size  
 African colobines, 358  
 geophagy, 105, 165, 213, 234, 395  
 Germain's langur. *See* *Trachypithecus germaini*  
 gestation length, 176, 242  
 golden langur. *See* *Trachypithecus geei*  
 golden snub-nosed monkey. *See* *Rhinopithecus roxellana*  
 granivory, 133, 210  
 gray langur. *See* *Semnopithecus*  
 gray snub-nosed monkey. *See* *Rhinopithecus brelichi*  
 grey snub-nosed monkey. *See* *Rhinopithecus brelichi*  
 grey-shanked douc. *See* *Pygathrix cinerea*  
 grooming, 175, 195, 282  
 group composition, 300  
 group fissioning, 240  
 group size  
 African colobines, 357–358  
 Grueter, Cyril, 157  
 guenons, 151  
 guereza. *See* *Colobus guereza*  
 Guizhou snub-nosed monkey. *See* *Rhinopithecus brelichi*  
 gut anatomy, 80–81  
 gut microbes, 362  
 gut morphology, 60  
 habitat, 161  
 habitat disturbance, 90, 171  
 habitat fragmentation. *See* fragmentation  
 habitat heterogeneity, 180  
 habitat loss, 312  
 habitat productivity, 166, 180  
 habitat quality, 229, 235, 242, 245, 275  
 Hanuman langur. *See* *Semnopithecus*  
 Hatinh langur. *See* *Trachypithecus hatinhensis*  
 health, 91  
 hemoparasites, 379  
 herding, 297  
 heterogeneity hypothesis, 303  
 hired gun, 280  
 home range, 314  
 home range overlap, 154, 167, 169, 280  
 home range size  
 African colobines, 358  
 Hose's langur. *See* *Presbytis hosei*  
 Hrđy, Sarah, 196  
 human evolution, 197  
 human population growth, 361–362  
 hunting  
 by chimpanzees, xiv, 80, 114, 116, 122, 369–372, 377, *See also* predation  
 by humans, xiv, 107–108, 116, 123–126, 129, 170, 184, 220, 312, 338, 352–353, 356, 358–360, 382  
 Africa, 366–369  
 Asia, 331–332  
 hurricane, 319  
 husbandry, 75–76  
 hybridization, 33, 37, 187  
 inactivity, 136  
 incisor morphology, 48–53, 57–59  
 incisor row length, 45  
 Indo-Burma, 225, 324  
 Indo-Burmese region. *See* Indo-Burma  
 Indochinese grey langur. *See* *Trachypithecus crepusculus*  
 infant care, by males, 178  
 infant carrying  
 in mouth, 146, 152  
 infant handling, 142, 151, 174, 178, 219, 236, 297  
 infanticide, 139–140, 154, 175, 183, 196–197, 250–251, 262–263, 266, 269, 272, 278, 283–287, 289–290, 308

## 502 Index

- infanticide (cont.)  
 counter-strategies, 263, 286  
 sexual selection hypothesis, 285
- ingestive folivore hypothesis, 61, 65
- insectivory, 191
- interbirth interval, 122, 176, 195, 244–245
- intergroup encounters. *See*  
 between-group encounters
- intergroup relations, 142
- interspecies associations, 170
- IUCN Red List of Threatened Species, 226, 324, 354
- Javan langur. *See* *Presbytis comata*
- Kanagawapithecus*, 28
- king colobus. *See* *Colobus polykomos*
- kinship, 282
- Kirkpatrick, Craig, 157
- Koenig, Andreas, 188, 247
- Korstjens, Amanda, 132
- Kuseracolobus, 18, 20, 25
- lactational amenorrhea, 245
- langurs  
 phylogeny, 35–37  
 taxonomy, 6
- Laos langur. *See* *Trachypithecus laotum*
- lasers, parallel, 113
- leaf-eating. *See* folivory
- leguminous trees, 318
- Libypithecus*, 20
- life history, 219
- lignin, 162
- lipids, 163
- Lippold, Lois, 159
- logging, 135, 139, 184, 226, 332, 364–365
- Long, Yongcheng, 157
- loud call, 154, 173, 213–214, 359
- lutungs. *See* *Trachypithecus*
- macronutrients, 94, 96
- Malabar sacred langur. *See*  
*Semnopithecus hypoleucos*
- male influxes, 140
- malfermentation, 75
- mangroves, 160–161, 207–208
- maroon langur. *See* *Presbytis rubicunda*
- mastication, 45
- masturbation, 243
- mate choice, female, 257
- mate guarding, 121, 153–154
- Matsuda, Ikki, 131, 160
- mechanical properties of foods, 60
- medicinal properties of plants, 124
- Mesopithecus*, 17, 25–27, 29–30, 36
- mesquite, 366
- metagenomics, 204
- methanogenesis, 74
- microbial diversity, foregut, 74
- microbial transplantation, 92
- microbiome, 69, 76, 78, 80, 82, 127, 395  
 African colobines, 80  
 dysbiosis, 93
- microbiome, forestomach, 73–75  
*Nasalis larvatus*, 74
- microbiome, gut  
 colobines, 81–87  
 conservayion applications, 90–92  
 dysbiosis, 87–90
- microbiota, 78
- microbiota, gut, 304
- Microcolobus*, 15–18, 20, 26, 29–30
- micronutrients, 105–106, 395
- Miller's grizzled langur. *See*  
*Presbytis canicrus*
- minerals, 105–106, 165, 234
- mining, 335
- Miocene, 13–20, 23, 25–26, 28–31, 34, 36, 394
- mitochondrial DNA, 32–33, 38, 42
- mitred langur. *See* *Presbytis mitrata*
- mobbing, 222, 239
- model for human evolution, 143
- modular society. *See* multilevel society
- molar  
 crest, 13, 44, 49, 55  
 cusp, 15, 17, 21, 44, 46, 49, 54, 60, 147, 230
- molar morphology, 19, 21, 24, 29, 49, 52–54, 60–61
- molar surface area, 44
- monogamy, 214, 218
- monophyletic, 156
- monotypic, 146, 155
- monsoon, 190, 205, 230
- mortality  
 infant, 246
- mortality, infant, 176
- multilevel society, 139, 142, 160, 171, 277, 293–311, 397  
 bachelor threat, 305  
 between-unit interactions, 297  
 cognition, 308  
 competition  
 for mates, 306  
 dispersal, 299  
 evolution, 300–305  
 fission-fusion, 300  
 infanticide risk, 308  
 inter-band encounters, 299  
 predation hypothesis, 304  
 sexual selection, 306–308  
 social bonds, 297  
 social organization, 293, 297  
 troop, 299  
 vocal complexity, 310
- multi-male groups, 153
- multi-male units, 172
- mutualism, 181
- Myanmar snub-nosed monkey. *See*  
*Rhinopithecus strykeri*
- Myanmarcolobus, 28
- Nasalis larvatus*  
 activity patterns, 166  
 aggression, female, 255  
 climate, 162  
 copulation, 178  
 diet, 95, 164  
 nutritional composition, 105, 165  
 dispersal, 174  
 distribution, 157  
 habitat, 161  
 hunting  
 by humans, 184  
 microbiome, gut, 90  
 nose size, 307  
 nose, function of, 175  
 phylogeny, 42  
 predation, 170  
 range use, 167–168  
 research efforts, 159

- riverine refuging, 159, 169  
 rumination, 66  
 seasonality, birth, 178  
 sexual swelling, 178  
 sleeping sites, 169  
 social interactions, 176  
 social organization, 171  
 taxonomy, 11  
 threats, 184  
 natal coat, 142, 146, 218  
 Natuna Islands langur. *See Presbytis natunae*  
 Nepal sacred langur. *See Semnopithecus schistaceus*  
 niche separation, 143, 170, 396  
 Nilgiri langur. *See Semnopithecus johnii*, *See Semnopithecus johnii*  
 nutrient balancing, 135, 179  
 nutrients, fecal, 76  
 nutritional balance, 106  
 nutritional composition, 75  
 nutritional ecology, 94, 395  
 nutritional geometry, 100, 106  
 Oates, John, 130, 149, 189  
 odd-nosed colobines  
   activity patterns, 165–167  
   all-male units, 172  
   allomothering, 178  
   between-group interactions, 173  
   conservation status, 184–185  
   daily travel distance, 167  
   diet, 162–165, 180  
   directions for future research, 396  
   dispersal, 173–174, 181  
   distribution, 156–157  
   feeding competition, 182  
   gestation length, 176  
   grooming, 175  
   habitat and climate, 160–162  
   home range size, 167  
   phylogeny, 40–41  
   population density, 167  
   predation, 170–171  
   range use, 167–170, 180  
   reproduction and sexual behaviour, 176–179  
   research efforts, 157–160  
   social dynamics, 181  
   social interactions and social dynamics, 174–176  
   social organization, 171–173, 180  
   taxonomy, 6–7  
 odd-nosed monkeys. *See* odd-nosed colobines  
 oil palm, 339  
 oil palm plantations, 333, 381  
 olive colobus. *See Procolobus verus*  
 one-male unit (OMU), 171–172, 195, 294  
 one-male units (OMU), 171  
 ornamentation, 306  
 Pagai langur. *See Presbytis potenziani*  
 pairs, 171  
 paleobiogeography, 31  
 pale-thighed langur. *See Presbytis siamensis*  
 Paracolobus, 18–20, 23, 25  
 Parapresbytis, 28  
 parasites, 123, 194  
   African colobines, 377–379  
   nematodes, 194  
   Rotavirus, 194  
   ticks, 195  
   whipworm, 124, 194  
 parasites, gastrointestinal  
   African colobines, 378–379  
 parasitism, 278  
 particle sorting mechanism, 69  
 Passive Acoustic Monitoring, 127  
 patch depletion, 252, 276–277, 303, 319  
 peat swamps, 161  
 Phayre's langur. *See Trachypithecus phayrei*  
 phenolics, 107  
 philopatry, male, 108  
 phylogenetic constraints, 248  
 Phylogenetic Species Concept, 3  
 phylogeny  
   African colobines, 37  
   Colobus, 32–33  
   langurs, 35–37, 203–204  
   *Nasalis larvatus*, 42  
   odd-nosed colobines, 40–41  
   Presbytis, 33, 37–38  
   Pygathrix, 42  
   Rhinopithecus, 41–42  
   Semnopithecus, 33, 40  
   *Simias concolor*, 42  
   Trachypithecus, 33, 38–40  
 phylogeography, 33–37  
   Presbytis, 37–38  
 pig-tailed langur. *See Simias concolor*  
 Piliocolobus, 108  
   activity patterns, 113–114  
   aggression and affiliation, intra-group, 120  
   alarm calls, 116  
   allomothering, 123  
   anti-predation strategies, 115–117  
   associations, poly-specific, 116–117  
   birth rates, 121  
   bite force, 113  
   bonds, male-male, 120  
   climate, 110–111  
   coalitions, 121  
   cohesiveness and bonding, 120–121  
   conservation, 124–127  
   Conservation Action Plan, 112, 343, 366, 384–385  
   consortship, 121  
   copulation calls, 122  
   crop raiding, 125  
   diet, 274  
     food selection, 112  
   directions for future research, 396  
   diseases and parasites, 123–124  
   dispersal, 118, 282  
   distribution, 110  
   feeding ecology, 112–113  
   fission-fusion, 119  
   forest loss, 365–366  
   grooming, 120  
   group size, 117  
   habitat, 110  
   home range size, 357  
   hunting  
     by humans, 367  
   hunting by chimpanzees, 371  
   inter-birth interval, 122  
   inter-group relationships, 119–120

## 504 Index

- Ptilocolobus* (cont.)  
 leaf quality, 113  
 mate guarding, 121  
 mating systems, reproduction and sexual behaviour, 121–123  
 morphology, 109–110  
 phylogeny, 37  
 predation, 114–115  
 range use, 114  
 research efforts, 111–112  
 scramble competition, 120  
 seasonality  
   birth, 122  
   mating, 122  
 seed dispersal, 113  
 sexual interactions, 121  
 sexual swelling, 109, 121, 123  
 social organization, 117–119  
 solitary, 118  
 taxonomy, 5–6, 108  
 vigilance, 116
- Ptilocolobus badius*  
 locomotion, 109
- Ptilocolobus badius temminckii*. *See* *Ptilocolobus temminckii*
- Ptilocolobus ellioti*  
 conservation, 126
- Ptilocolobus epieni*  
 conservation, 125  
 forest loss, 365
- Ptilocolobus gordonorum*  
 conservation, 125
- Ptilocolobus kirkii*  
 competition  
   between-group contest (BGC), 281  
 conservation, 124  
 diet, 96  
 dispersal, 283  
 reintroduction, 385
- Ptilocolobus langi*  
 conservation, 126  
 epidemic, 378
- Ptilocolobus pennantii*  
 hunting  
   by humans, 368
- Ptilocolobus preussi*  
 conservation, 126  
 conservation threats, 381  
 diet  
   nutritional composition, 99  
   hunting  
     by humans, 368
- Ptilocolobus rufomitratu*  
 conservation, 124  
 diet  
   nutritional composition, 104  
 forest loss, 366
- Ptilocolobus temminckii*  
 climate change, 374  
 conservation, 124  
 dispersal, 283  
 dominance hierarchy, 278
- Ptilocolobus tephrosceles*  
 competition  
   within-group scramble (WGS), 276  
 diet, 95, 97, 315  
   nutritional composition, 97–98  
 dominance hierarchy, 278  
 forest loss, 365  
 group size, 315  
 hunting  
   by chimpanzees, 370  
   hunting by chimpanzees, 370
- Ptilocolobus waldroni*  
 extinction, 360
- plant secondary compounds, 69, 104–105, 151
- plant secondary metabolites, 79, 81, 97, 395
- plant toxins, 231
- planted forest, 132
- play behavior, 192
- playback, 138, 170
- Pleistocene, 19–20, 25, 28
- Pliocene, 18, 20, 23, 25–26, 28
- Plio-Pleistocene, 18, 20–25, 29
- poaching. *See* *alo* hunting. *See also* hunting
- policing, 176, 297
- pollution, 335
- Popa langur. *See* *Trachypithecus popa*
- population density, 123, 154, 167, 193, 229, 252, 313–315
- population dynamics, 320, 397
- population ecology, 313
- posture, 192
- posture, resting, 69
- praesaccus, 60–61, 64–66, 81
- prebiotics, 92
- predation, 198, 321–322  
 Asiatic golden cat, 220  
 birds of prey, 170, 240  
 chimpanzee, 114–115, 138, 295, 300, 321  
 clouded leopard, 220  
 crocodile, 114  
 crowned eagle, 114–115, 138, 321, 372  
 dhole, 220  
 dog, 114, 124, 126, 194, 220, 239, 376  
 gaval, 170  
 golden jackal, 220, 238  
 hyena, 114  
 leopard, 114–116, 138, 170, 194, 220, 238–239, 321, 372  
 lion, 138  
 marbled cat, 238  
 python, 170, 239  
 raptor, 194, 220, 238  
 snake, 114  
 tiger, 220, 238–239
- predation avoidance, 152, 238
- predation risk, 284, 290
- praesaccus. *See* praesaccus
- Presbytini, 4, 32
- Presbytis, 218–220  
 activity budget, 213  
 climate and habitat, 205–208  
 daily path length, 210  
 defensibility index, 212  
 diet and feeding ecology, 208–209  
 directions for future research, 397  
 dispersal, 217–218  
 distribution, 200–202  
 fossils, 28  
 group size, 215  
 hunting, by humans, 220  
 life history, 219  
 neonatal coat colour, 218  
 phylogeny, 33, 37–38  
 phylogeography, 37–38  
 predation and anti-predator behaviour, 220–223  
 range use, 210–213  
 research efforts, 204–205  
 seasonality, reproductive, 219  
 sleeping sites, 222  
 taxonomy, 7–8  
 taxonomy and phylogeny, 203



- terrestriality, 213  
 vocal behaviour, 213–214
- Presbytis comata*  
 diet, 208
- Presbytis femoralis*  
 taxonomy, 203
- Presbytis frontata*  
 anti-predator strategy, 222  
 habitat use, 212  
 population density, 213
- Presbytis melalophos*  
 diet  
   nutritional composition, 104
- Presbytis rubicunda*  
 diet, 96, 210  
   nutritional composition, 100, 104  
 habitat use, 212  
 home range size, 210  
 population density, 212
- Presbytis thomasi*  
 aggression, female, 255, 259  
 all-male group, 217  
 dispersal, 218  
   female, 256  
 food competition, 265  
 group formation, 218
- Preuss's red colobus. *See* *Ptilocolobus preussi*
- proboscis monkey. *See* *Nasalis larvatus*
- Procolobus, 108  
 activity patterns and behavior, 151  
 associations, polyspecific, 151–152  
 diet, 150–151  
 directions for future research, 396  
 dispersal  
   female, 149  
   juvenile, 150  
   male, 150  
 field studies, 148–149  
 geographic distribution, 148  
 gestation time, 153  
 group size, 149  
 habitat, 148  
 home range size, 357  
 infant carrying, 152–153  
 interbirth interval, 153  
 intergroup interactions, 155  
 microbiome, 89  
 range size and defence, 154  
 reproductive behaviour, 153–154  
 sexual swelling, 146, 149  
 social organization & dispersal patterns, 149–150  
 swelling, sexual, 153  
 taxonomy, 5  
 vocalizations, 154–155
- Procolobus gordonorum*  
 microbiome, 90
- Procolobus verus*  
 diet, 95  
   nutritional composition, 104  
 dispersal, 283  
 morphology, 146–147  
 sexual dimorphism, 146
- Procolobus waldronae*  
 extinction, 312  
 promiscuity, 140  
 prostration, 243  
 protected areas  
   Africa, 381–382  
 protected areas, management of, 336–337  
 protection laws, enforcement and enactment of, 338  
 protein, 162–164, 191, 274, 277, 316  
 protein, available, 99  
 protein-to-fiber ratio, 79, 101–103, 112, 118, 233, 315–318, 336  
 provisioning, 195  
 purple-faced langur. *See* *Semnopithecus vetulus*
- Pygathrix*  
 activity patterns, 166  
 climate, 161  
 dispersal, 174  
 distribution, 157  
 fission-fusion, 172  
 group size, 171  
 home range overlap, 169  
 phylogeny, 42  
 range use, 168  
 sleeping sites, 169  
 taxonomy, 11  
 weaning, 177
- Pygathrix cinerea*  
 diet, 164  
 habitat, 161  
 research efforts, 159
- Pygathrix nemaesus*  
 activity patterns, 166  
 diet, 163  
 habitat, 161  
 inter-band encounters, 173  
 interspecies associations, 170  
 microbiome, 87  
 microbiota, 86  
 research efforts, 159  
 vocalizations, 181
- Pygathrix nigripes*  
 diet, 163  
 habitat, 161  
 research efforts, 159
- rainforest, tropical, 329  
 random walk, 193  
 range use, seasonal variation in, 137  
 reconciliation, 176, 217, 255  
 red colobus. *See* *Ptilocolobus*  
 red-shanked douc. *See* *Pygathrix nemaesus*  
 reforestation, 337  
 regurgitation, 66  
 reintroduction, 340  
 remastication, 66  
 reproductive suppression, 141  
 resource defence polygyny, 280  
 restoration, 337
- Rhinocolobus*, 18, 23–25, 27  
*Rhinopithecus*, 298  
 altitudinal ranging, 169  
 climate, 160  
 competition  
   within-group scramble (WGS), 302  
 copulation initiation, 178  
 daily path length, 168  
 distribution, 156  
 distribution, historical, 160  
 dominance hierarchy, female, 176  
 fission-fusion, 172  
 fossils, 28  
 grooming, 175  
 group size, 171  
 infanticide, 183  
 inter-band encounters, 173

506 Index

- Rhinopithecus (cont.)  
 mortality, infant, 176  
 phylogeny, 41–42  
 policing, 176  
 predation, 170  
 reconciliation, 176  
 relationships among females, 183  
 seasonality, reproductive, 177  
 social interactions, 174, 176  
 taxonomy, 10–11  
 time budget, 165  
 weaning, 177
- Rhinopithecus avunculus*  
 diet, 163  
 habitat, 161  
 research efforts, 158
- Rhinopithecus bieti*  
 activity patterns, 166  
 aggression, female, 255  
 altitudinal ranging, 169  
 contest competition, 182  
 diet, 96, 162, 179  
   nutritional composition, 104, 162  
 dispersal, 174  
 dominance hierarchy, 183  
 habitat, 160  
 infanticide, 175  
 lip redness, 307  
 microbiome, 82  
 niche divergence, 170  
 range use, 168  
 research efforts, 157  
 sleeping sites, 169
- Rhinopithecus brelichi*  
 diet, 163  
 fission-fusion, 300  
 habitat, 160  
 microbiota, 88  
 research efforts, 158
- Rhinopithecus roxellana*  
 aggression, female, 255  
 between-group conflict, 262  
 diet, 162  
   nutritional composition, 100, 104, 162  
 dispersal, 173  
   female, 257  
 dominance hierarchy, 175  
 habitat, 160  
   home range overlap, 169  
 infanticide, 175  
 microbiome, 82  
 microbiota, 88  
 range use, 168  
 research efforts, 158  
 takeovers, 175  
 tenure length, 175
- Rhinopithecus strykeri*, 3  
 diet, 163  
 habitat, 161  
 research efforts, 158
- riverine refuging, 159, 169  
 roar, 138, 359  
 rubber plantations, 190, 208, 333  
 ruminants, 81  
 rumination, 66  
 Rwenzori Angolan colobus. *See Colobus angolensis ruwenzorii*  
 Rwenzori black-and-white colobus. *See Colobus angolensis ruwenzorii*
- Sabah grizzled langur. *See Presbytis sabana*  
 sacred forests, 383  
 sagittal crest, 20  
 sale of primates, 338  
 salivary glands, 231  
 salt licks, 234  
 same-sex mounts, 243  
 seasonality  
   birth, 122, 141  
   in food availability, 252  
   mating, 122  
   reproductive, 153, 177, 219, 244, 266  
 secondary forest, 229  
 seed destroyers, 46, 59  
 seed dispersal, 398  
 Selangor silvery langur. *See Trachypithecus selangorensis*  
 semi-nomadic lifestyle, 136  
 semi-nomadism, 357  
 Semnopithecus, 26  
   activity patterns, 192–193  
   all-male band, 196  
   allomothering, 197  
   antipredator behavior, 194  
   climate, 190  
   diet and feeding ecology, 190–192  
   directions for future research, 396  
   dispersal, 195  
   distribution, 186–187  
   dominance hierarchy, female, 195, 254–255  
   dominance hierarchy, male, 196  
   fitness, female, 261  
   food competition, 264–265  
   fossils, 28  
   habitat, 190  
   infanticide, 196–197  
   life history, 195  
   microbiome, 91  
   parasites, 194  
   phylogeny, 33, 40  
   predation, 193–195  
   range use, 193  
   social organization and behaviour, 195–197  
   takeover, 196  
   taxonomy, 10
- Semnopithecus entellus*  
 diet, 95–96, 191  
 distribution, 186–187  
 range use, 193  
 research efforts, 188–189  
 terrestriality, 194
- Semnopithecus johnii*  
 activity patterns, 192  
 diet, 191  
 distribution, 187  
 range use, 193  
 research efforts, 189
- Semnopithecus vetulus*  
 activity patterns, 192  
 diet, 191  
 distribution, 187  
 range use, 193  
 research efforts, 189–190
- sensory ecology, 198  
 sentinels, 151  
 sex ratio, 171, 176, 266  
 sexual dimorphism, 147, 306  
 sexual interactions, 121  
 sexual maturity, 242  
 sexual selection, 160  
 sexual selection hypothesis, 196

- Shan State langur. *See*  
*Trachypithecus melamera*  
 shola, 190  
 short-chain fatty acids, 69  
 Shortridge's langur. *See*  
*Trachypithecus shortridgei*  
 Siberut langur. *See* *Presbytis siberu*  
 Sichuan snub-nosed monkeys. *See*  
*Rhinopithecus roxellana*  
 Sicotte, Pascale, 132, 285  
 sieving analysis, 73  
 silvered langur. *See* *Trachypithecus*  
*cristatus*  
 smakobu. *See* *Simias concolor*  
 Simian Immunodeficiency Virus  
 (SIV), 147  
 Simias  
 taxonomy, 11  
 Simias concolor  
 activity patterns, 166  
 climate, 161  
 diet, 164  
 dispersal, 174  
 distribution, 157  
 habitat, 161  
 home range overlap, 169  
 hunting of, 170  
 intergroup encounters, 173  
 loud calls, 173  
 phylogeny, 42  
 range use, 167  
 research efforts, 159  
 seasonality, reproductive, 177  
 social organization, 171  
 sympatry, 170  
 sleeping sites, 169, 222, 237,  
 240  
 social dynamics, 181  
 social knowledge, 309  
 socio-ecological model, 250,  
 256–257, 261, 264  
 socio-ecological models, 271  
 sodium, 105, 137, 395  
 soil eating. *See* geophagy  
 solitaries, 196  
 sperm competition, 243  
 stress, 120, 125  
 Sundaland, 199–200, 205, 325  
 supergroup, 295  
 surilis. *See* *Presbytis*  
 swamp forest, 133  
 swamps, 161  
 swelling, perineal, 109, 141, 146  
 swelling, sexual, 108, 146–147, 149,  
 153, 178  
 sympatry, 31, 200, 396  
 between colobine taxa, 351–352  
 Presbytis and *Trachypithecus*,  
 199–200  
 systems model, 139  
 taboos, 382  
 takeover, 175, 196, 217, 240, 245,  
 266, 285  
 Tana River red colobus. *See*  
*Piliocolobus rufomitatus*  
 tannins, 103–104, 107, 162, 191,  
 231, 233  
 taxonomy  
 African colobines, 342–343  
 Colobus, 5  
 langurs, 6, 203–204  
 Nasalis, 11  
 odd-nosed colobines, 6–7  
 Piliocolobus, 5–6  
 Presbytis, 7–8  
 Procolobus, 5  
 Pygathrix, 11  
 Rhinopithecus, 10–11  
 Semnopithecus, 10  
 Simias, 11  
 Trachypithecus, 8–10  
 Teichroeb, Julie, 131  
 Temminck's red colobus. *See*  
*Piliocolobus temminckii*  
 temperature extremes, 353  
 Tenasserim langur. *See*  
*Trachypithecus barbei*  
 tenure length, 175  
 Terai sacred langur. *See*  
*Semnopithecus hector*  
 terrestriality, 194, 213  
 territoriality, 236  
 testis size, 243  
 thermoregulation, 238  
 Thomas's langur. *See* *Presbytis*  
*thomasi*  
 time constraints, 263  
 time-budget model, 113  
 Tonkin snub-nosed monkey. *See*  
*Rhinopithecus avunculus*  
 tourism, 334, 339  
*Trachypithecus phayrei*  
 diet, 233  
*Trachypithecus*, 218  
 activity budget, 213  
 activity patterns, 234–236  
 seasonal variation in, 235  
 variation between age and sex  
 classes, 235  
 all-male groups, 241  
 climate, 230  
 climate and habitat, 205–208  
 climate change, 230  
 daily path length, 210  
 defensibility index, 212  
 diet, 210–213  
 diet and feeding ecology,  
 208–209, 230–234  
 directions for future research, 397  
 dispersal, 217–218, 241  
 distribution, 201–202, 226–230  
 drinking, 234  
 fossils, 28  
 geophagy, 234  
 group size, 215, 241  
 hunting  
 by humans, 220  
 infant mortality, 246  
 interbirth interval, 244–245  
 life history, 219  
 neonatal coat colour, 218  
 phylogeny, 33, 38–40  
 predation, 238–240  
 predation and anti-predator  
 behaviour, 220–223  
 range use, 236–238  
 reproduction and sexual  
 behaviour, 218–220,  
 242–246  
 research efforts, 204–205,  
 246–247  
 same-sex mounts, 243  
 seasonality, reproductive, 219, 244  
 sexual maturity, 242  
 sleeping sites, 222, 237  
 social organisation, 240–242  
 taxonomy, 8–10  
 taxonomy and phylogeny, 203  
 terrestriality, 213, 237  
 vocal behaviour, 213–214  
 weaning, 245  
*Trachypithecus auratus*

## 508 Index

- Trachypithecus auratus* (cont.)  
 altitudinal range, 202, 207  
 diet, 208  
   nutritional composition, 104  
 group size, 215  
 home range size, 210
- Trachypithecus crepusculus*  
 dispersal, 241  
 microbiome, 86  
 predation, 238
- Trachypithecus delacouri*  
 activity patterns, 236  
 diet, 96  
   nutritional composition, 233  
 hunting by humans, 332
- Trachypithecus francoisi*  
 activity patterns, 235  
 diet, 95, 232–233  
 dispersal, 241
- Trachypithecus germaini*  
 diet, 95
- Trachypithecus leucocephalus*  
 activity patterns, 235  
 dispersal, 241
- Trachypithecus margarita*  
 diet, 232
- Trachypithecus mauritius*  
 taxonomy and phylogeny, 203
- Trachypithecus obscurus*  
 home range size, 210
- Trachypithecus phayrei*  
 activity patterns, 235
- Trachypithecus pileatus*  
 diet, 95, 232  
 predation, 238
- Trachypithecus poliocephalus*  
 hunting by humans, 332
- Trachypithecus popa*, 3
- Trachypithecus selangorensis*  
 taxonomy and phylogeny, 203
- traditional medicine, 331–332, 369
- trans-boundary conservation, 340
- translocation, 124  
   African colobines, 385
- transportation networks, 334
- Treponema pallidum*, 124
- tubercle, lingual, 52, 58
- tufted grey langur. *See*  
   *Semnopithecus priam*
- twins, 219
- Udzungwa red colobus. *See*  
   *Ptilocolobus gordonorum*
- urbanization, 334
- vigilance, 194, 240
- viruses, 377
- vocal complexity, 310
- vocalizations, 181
- weaning, 177, 245
- West Javan langur. *See*  
   *Trachypithecus mauritius*
- white-fronted langur. *See* *Presbytis frontata*
- white-headed langur. *See*  
   *Trachypithecus leucocephalus*
- white-thighed colobus. *See* *Colobus vellerosus*
- World's 25 Most Endangered Primates, The, 355
- Yeager, Carey, 160
- Yunnan snub-nosed monkey. *See*  
   *Rhinopithecus bieti*
- Zanzibar red colobus. *See*  
   *Ptilocolobus kirkii*