

Index

Page numbers for figures are in italics; for tables in bold

- abstraction, 128–129
- abundance/rarity, 102
- adaptations, natural selection, 43
- adaptive tracking, microbial species, 52
- adaptive zones, 27
- affirming the consequent, 9
- African great apes, 14, 30–34
- agamospecies, 17–18
- agriculture, 7
- algae, taxonomic codes, 88–89
- alien species, **104**
- alleles, 45
- allopatric speciation, 43, 44–45, 71
- alternatives to species, 123, 128–130, 136–137
 - clades, 123–124
 - classification, 27–28
 - LITUs/SNaRCs, 124–126
 - OTUs, 127–128
 - taxonomic instability, 127
- anagenesis, 38
- anatomy, 81–82
- animal emancipation, 119–120
- animal rights, 117, 118
- Animal Species and Their Evolution* (Cain), 8
- animals, taxonomic codes, 88–89
- apex predators, 97–98
- apomicts, 17–18, 53–54
- apomorphies, 22–23
- apple maggot (*Rhagoletis pomonella*), 44
- Arabian camel (*Camelus dromedarius*), 108
- arbitrariness, 17, 21
- Arctocephalus pusillus* (brown fur seal), 86, 87
- Aristotle, 57–58, 75, 78, 116
- asexual speciation, 50–56
- asexual species, 17–18
- asexuality, 54–56, 135
- Aspidozelis* spp. (whiptail lizards), 55, 55–56
- assisted colonisation, 108–109
- association hypothesis, 106–107
- Australia, introduced species, 108
- axiology, 10, 74, 113
- Babulus babulus* (water buffalo), 108
- Baker, Robert, 24–25
- Baldwin, James Mark, 48–49
- bananas, Cavendish, 54, 111

152 INDEX

- barcoding, DNA, 25–26, 90–92, 91, 93–94
- Bauhin, Casper, 59
- beetles, 15
- behavioural plasticity, 48
- Bellman's Theorem, 131
- binomials, 11, 12–13
- biodiversity, 114
 - conservation and repair, 107–112
 - extinctions, 96
 - human impact, 105–107, 120–121
 - importance of species, 97–100
 - measurement, 64, 136
 - phylogenies, 129
 - value, 103–105
- biofilms, 94
- Biological Species Concept, 15–18, 30–32, 69, 97
- biomedical research, 6
- birds, as dinosaurs and reptiles, 14
- book species vs. natural species, 89–90
- botanical classification, 70
- botany, 7
- boundaries, species, 89–93
- boundary markers, 5–6
- Bradley, Robert, 24–25
- Bradshaw, Karen, 119
- Brigandt, Ingo, 79, 81
- brown fur seal (*Arctocephalus pusillus*), 86, 87
- brumby (wild horse), 108
- Burke, Edmund, 95
- Cain, Arthur J. 8
- Camelus dromedarius* (Arabian camel), 108
- Candolle, Alphonse & Augustin, 62
- cane toad (*Rhinella marina*), 102–103
- canids, 1
- Canis dingo* (dingo), 103
- Canis latrans* (coyote), 1
- Canis lupus* (grey wolf), 1
- Canis rufus* (red wolf), 1, 2
- capitalism, 120–122
- Carson, Rachel, 118
- Castle, William, 68–69
- Cavendish bananas, 54, 111
- Chalmers, Robert, 61–62
- charismatic species effect, 115, 119, 136
- chimpanzee, 110–111
- chromosomes, speciation, 46
- chronospecies, 36, 39
- CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), 118
- clades/cladism, 13–14, 123–124, 125, 128
- cladistics *see* phylogenetic systematics
- cladogenesis, 38, 39
- cladograms, 22, 23, 125
- classification, 6–8, 11–14, 28–30; *see also* phylogenetic systematics; taxonomy
 - alternative views, 27–28; *see also* alternatives to species
 - evolutionary theory, 18–21
 - humans, 30–34
 - Linnaean, 50–51
 - molecular/genetic concepts, 24–27
 - number of species, 14–15
 - phylogenies, 21–24
 - reproduction, 15–18
- climate change, 111
- clusters, gene-space, 53
- common tern (*Sterna hirundo*), 89
- common wealth, 121
- community-based approach, taxonomy, 93–94
- concepts vs. definitions, 4–5
- conceptualism, 78, 79
- conjugation, genetic exchange, 51
- Conniff, Richard, 14–15
- consequential ethics, 117

- conservation, 24, 81–82, 97, 107
 ecology, 97
 ecosystem services, 114–115
 extantion (de-extinction), 109–110
 flagship species, 100
 focal species, 99–100
 indicator species, 98–99
 keystone species, 97–98
 rewilding, 108–109
 umbrella species, 99
 wildlife corridors, 110–112
- Consortium for the Barcode of Life, 90–92
- conspicuous, 43
- constructivism, 117
- Convention on International Trade in
 Endangered Species of Wild Fauna
 and Flora (CITES), 118
- conventional species concept, 29–30
- conventionalism, 78
- Cope, Edward Drinker, 71–72
- corals, 53–54
- core genes, 52
- corridors, 110–112
- coyote (*Canis latrans*), 1
- creationism, 9, 35–36
- crossbreeds, 19–20
- cultural perspectives, 132
- Cuvier, Baron Georges, 61
- Darwin, Charles, 9, 18, 29
 development theory, 35–36
 historical perspective, 62–66
 natural selection, 43, 68
Origin of Species, 71
 Strickland Committee, 67
- Darwin, Erasmus, 61–62
- Darwinism see evolutionary theory
- Dawkins, Richard, 49–50
- de Queiroz, Kevin, 20, 21
- deep ecology, 105, 114
- de-extinction, 109–110
- definitions
 vs. concepts, 4–5
 species, 73, 135
- Denisovans, 30–34
- deontic ethics, 117
- deoxyribonucleic acid see DNA
- derivations of terms, 11
- development theory, 72–73
- Devitt, Michael, 77
- Dewey, John, 132
- diagnostic monophyly, 123–124
- dichopatric speciation, 46–47
- dingo (*Canis dingo*), 103
- dinosaurs, 14
- The Diversity of Life* (Wilson), 105, 114
- DNA, 24, 72
 barcoding, 25–26, 90–92, 91, 93–94
 hybridisation, 25–26
 sequences, 26
- Dobzhansky, Theodosius, 18–19, 21,
 24–25
 allopatric speciation, 43–44
 species definition, 69
 ‘species problem’, 74
- Dürer, Albrecht, 67
- Echinometra* spp. (sea urchins), 16–17
- eco-evo-devo, 72–73
- ecological species, 27–28
- ecological niche fitness, 18
- ecology, 6, 62, 81–82
- economic perspectives, 7, 100–101
 ecosystem engineers, 98
 ecosystem services, 100–101, 105,
 114–115
- ecosystems, 108–109, 113
 stability, 102
- Ehrlich, Paul, 16–17
- eidos* (forms), 11, 57–58, 59, 75
- Eigen, Manfred, 53
- Eldredge, Niles, 39–40

154 INDEX

- Endangered Species Act (ESA), 1, 114, 118
 endogenous retroviral insertion, 51
Environmental Ethics: Theory in Practice (Sandler), 117
 episodic view, speciation, 39, 40
 epistemology/epistemic objects, 10, 78–80
 error theory, 117
Escherichia coli, 123
 essentialism, 8–9, 28, 70, 76–78, 135
 ethics, 117
 eucalyptus species, 27
 eugenics, 71–72
 Euler, Leonhard, 75
 evo-devo, 72–73
 evolutionary biology, 81–82
 evolutionary species concept, 18–19, 20, 33, 69
 evolutionary systematics, 20–21
 evolutionary theory, 8, 18–21, 35–36, 135
 evolutionary trees (phylogenies), 21–24, 38
 exploitation, 121
 extant, 109–110
 extinctions, 96, 106
 extracellular matrices, 94
- feature set, 8, 58, 76, 101–102
 fertile progeny, 16
 field guides, 81–82
 Filipchenko, Iuri'i, 35
 Fisher, R. A. 68–69
 fitness, hybrid progeny, 41
 fixed/non-fixed species, 63, 65
 flagship species, 100
Flora (Ray), 65–66
 focal species, 99–100
 forest elephant (*Loxodonta cyclotis*), 48
 form of life, 116
 forms (*eidos*), 57–58
- fossil fuels, 120–121
 fragmentation, habitat, 111
Frogs, Flies and Dandelions (Schilthuizen), 44–45
 functional version, biodiversity, 103
 functionalism, 15
 fungi, taxonomy, 88–89, 92–93
- Galtier, Nicholas, 93
 genera, 11
 General Lineage Concept, 21
 gene-space clusters, 53
 genetic compatibility, 18
 genetic exchange
 conjugation, 51
 thresholds, 17
 transduction, 51
 transformation, 51
 genetic homeostasis, 47
 genetic material, movement, 45
 genetic species concepts, 24–25
 genetic variance, 115
 genetics, 81–82; *see also* DNA
 Mendelian, 18, 26
 population, 26
 genomes, 24–25
 genomic sequencing, 25–26
 genus, origin of term, 58, 59
 genus–species pairing, 59
 Geoffroy, Étienne Saint-Hilaire, 61
 geographic view, speciation, 42
 Gesner, Conrad, 66
 Ghiselin, Michael, 75–76
 Goldschmidt, Richard, 76–77
 Goodall, Jane, 110–111
 gorillas, 24
 Gould, Stephen Jay, 39–40
 gradualist view, speciation, 36, 38, 39
 Grant, Robert, 61–62
 grasshoppers, 46
 ‘Great Chain of Being’, 3

- grey wolf (*Canis lupus*), 1
- Griffiths, Paul E. 77
- group selection, 49–50
- gulls (*Larus* spp.), 90
- habitat fragmentation, 111
- habitat rights, 117
- Haeckel, Ernst, 62
- Haldane, J. B. S. 15
- Hamlet* (Shakespeare), 116
- haplotypes/haplotype groups, 33–34
- Hardin, Garrett, 121
- Hebert, Paul, 90–92
- Hennig, Willi, 13, 22–23
- herring gull (*Larus argentatus*), 90
- Hewitt, C. Watson, 89–90
- HGT (horizontal genetic transfer), 56
- Historiae Animalium (Investigations into Animals)* (Gesner), 66
- historic monophyly, 123–124
- historical perspective, 57–62
- Darwin and successors, 62–66
 - modern issues, 72–73
 - morphology, 70–72
 - systematic biology, 66–69
- History of Plants* (Ray), 64–65
- holotypes, 86
- homeostasis, genetic, 47
- Homo ergaster*, 32, 33
- Homo rhodensisensis*, 33
- Homo sapiens*, 30–34
- homologies, 22, 128
- ‘hopeful monsters’, 76–77
- horizontal genetic transfer (HGT), 56
- Hoser, Raymond, 132–133
- Hull, David L. 55–56, 70, 76–77
- human/s
- balance with nature, 107
 - exceptionalism, 27
 - impact, biodiversity, 105–107
 - species, 30–34, 31
- human value vs. land ethic, 114–115
- Humboldt, Alexander von, 62
- Huxley, Julian, 27
- hybridisation, 1–3, 17, 19–20
- humans, 32
 - lowered fitness, 41
 - religious perspective, 64
 - whiptail lizards, 55, 55–56
- inbreeding depression, 111, 115
- indicator species, 98–99
- individual organisms, value, 116
- inductive reasoning, 85
- inherent worth, 116
- instrumental values, 115
- integrative taxonomy, 92–93, 123–124
- intelligence, 27
- interbreeding, 15, 16, 18–19, 135
- International Code of Botanical Nomenclature (ICBN), 67
- International Code of Nomenclature for algae, fungi and plants (ICN), 88–89
- International Code of Nomenclature of Prokaryotes (ICNP), 88–89
- International Code of Phylogenetic Nomenclature (PhyloCode), 21–22, 82, 88–89
- International Code of Virus Classification and Nomenclature (ICVCN), 88–89
- International Code of Zoological Nomenclature (ICZN), 67, 88–89, 132–133
- introgression, 1–2
- invasive species, 102–103, **104**
- ‘investigative kinds’, 79, 81
- isolation, subpopulations, 41
- ITIS (Integrated Taxonomic Information System), 82
- Johannsen, Wilhelm, 68–69
- Jordan, David Starr, 71

156 INDEX

- Jurassic Park* (film), 76
justice, 118–119
- keystone species, 97–98, 114
kinds, natural, 74–78, 136
- Lamarck, Jean Baptiste, 60–61
land ethic, vs. human value ethic,
113–114
Laridae, 89
Larus spp. (gulls), 90
last common ancestor (LCA), 14
lateral genetic transfer (LGT), 56
Latrielle, Pierre André, 70–71
least inclusive taxonomic units (LITUs),
124–126
lectotypes, 86–87
Leech, Tara, 99
Lenski, Richard, 123
Leopold, Aldo, 113–114
lesser black-backed gull (*Larus fuscus*), 90
lineages, 21, 27, 123–124, 125
Lamarck, 60–61
microbial species, 52
within-species, 33–34
Linnaeus, Carl, 11, 30–32
Linnaean Natural System, 59
single-character system, 70–71
Systema Naturae, 60, 66–67
LITUs (least inclusive taxonomic units),
124–126
Locke, John, 130
logical tradition, 70
Loxodonta cyclotis (forest elephant), 48
lumpers vs. splitters, 12–13
- macroevolution, 35
macromutationism, 68–69
mammoths, 109–110
marketing concepts, 100
mate recognition systems, 18
- Maupertuis, Pierre, 60
Mayden, Richard, 4–5
Maynard Smith, John, 131
Mayr, Ernst Walter
allopatric speciation, 43–44
Biological Species Concept, 16, 32,
97
modern synthesis, 8, 9
Morphological Species Concept, 28
ontology, 78
species complex, 90
species definition, 69
systematic biology, 68
meanings and definitions, 4–6
measurement, biodiversity, 82
megafauna, decline, 105–106
Mendelian genetics, 18, 26, 68–69,
127–128
metacommunities, 93–94
metaethics, 117
metaphysics, 10, 75–78
metapopulations, 21
microbial species, 52
microevolution, 35
migration, 40
Mill, John Stuart, 75
minimum viable population (MVP), 111
Mishler, Brent, 82, 124–125
misplaced concreteness, 129
modern synthesis, evolution/genetics,
43–44
molecular biology, 7, 72
molecular/genetic concepts, 24–27
monoculture, 107
monophyly, 22–23, 123–124
moral realism, 117
morphological species concept, 28,
70
morphology, 28–29, 30–32
museums, 6
mushroom identification, 7; see also fungi

- Naess, Arne, 114
 name bearers, 86
 names of species, 7–8
 National Parks, 113
 natural historical values, 115
 natural history, 3, 66
 natural kinds, 74–78, 136
 natural selection, 35, 43
 natural species vs. book species, 89–90
 naturalists, deaths, 14–15
 Neandertals, 30–34
 neo-Lamarckism, 8, 71–72
 neotypes, 86–87
 niche construction, 48–49
 Noah's Ark, 59–60, 64, 65–66
 nomenclature codes, 88–89
 nominal taxon, 88
 numerical systematics, 28–29
 numerical taxonomy, 127
- objective values, 115, 116
 online databases, 82
 ontology, 10, 75–78
 operational taxonomic units (OTUs),
 28–29, 127–128
 operationality, 16–17
 organism, history of term, 58
Origin of Species (Darwin), 71
 Owen, Richard, 22
- Packard, Alphaeus, 71–72
 Paine, Robert, 98
 palaeontology, 127–128, 129
 Pallas, Peter Simon, 62
 parapatric speciation, 45
 parasite-driven speciation, 49
 parent–progeny chains, 21
 parthenogens, 17–18, 54
 pattern recognition, human, 83
 peripatric speciation, 45
 phenetics, 127
- phenotypes, 26, 28, 115
 phenotypic plasticity, 48
 philosophical perspectives, 74, 80–83
 epistemic objects, 78–80
 natural kinds, 74–78
Philosophy of Science (journal), 74
 philosophy/philosophers, 10, 15
 PhyloCode, 21–22, 82, 88–89
 phylogenetic species concept, 23–24, 33
 phylogenetic systematics, 13, 22
 phylogenetic taxonomy, 88–89
 phylogenies, 21–24, 38
 Pigliucci, Massimo, 129
 pioneering species, 114
 pizza analogy, speciation, 47
 plants, taxonomic codes, 88–89
 plasticity, behavioural, 48
 Plato, 57
 Pleistocene rewilding, 109
 ploidy, 46
 polyphasic approach, 93
 polyploidy, 46, 53–54
 whiptail lizards, 55, 55–56
 polysemic terms, 123
 population genetics, 26, 40–41, 45
 post-modernism, 79
 'predictascope', 19–20
 primate rights, 118
 prokaryotes, taxonomic codes, 88–89
 property rights, 119
 Przewalski's horse, 109
 public relations, 100
 punctuated equilibrium (PE), 39–40
 punctuated view, speciation, 39, 40
- quasispecies, 17–18, 53
Quercus spp. 27
- races, human, 32
 rare species, 115
 rarity/abundance, 102

158 INDEX

- Rawls, John, 118–119
- Ray, Rev John, 58, 64–65
- realism, scientific, 79
- red wolf (*Canis rufus*), 1, 2
- Regan, Charles Tate, 29
- reification fallacy, 129
- relict populations, 111–112, 115
- religious perspective, 59–60, 64, 65
- repairing nature *see* conservation
- reproduction, 15–18
- reptiles, 14
- reticulation, 38, 56
- rewilding, 108–109
- Rhagoletis pomonella* (apple maggot), 44
- Rhinella marina* (cane toad), 102–103
- The Rhinoceros* (Dürer), 67
- rights, of non-human species, 114, 117–120
- ring species, 90
- Royal Society, 16
- Ruse, Michael, 76
- Rutherford, Ernst, 80–81
- sacred groves, 112
- saltationism, 68–69
- Sand County Almanac* (Leopold), 113–114
- Sandler, Ronald, 115, 116
- Schilthuizen, Menno, 44–45
- scientific method, 81
- sea urchins (*Echinometra* spp.), 16–17
- Seddon, Philip, 99
- The Selfish Gene* (Dawkins), 49–50
- sequence similarities, 25–26
- Shubin, Neil, 131–132
- signal transduction cascades, 94
- Sigwart, Julia, 84
- Silent Spring* (Carson), 118
- Simpson, George Gaylord, 8, 27
- Singer, Peter, 118
- single-celled organisms, 93–94
- single-character system, 70–71
- Smallest Named and Registered Clades (SNaRCs), 82, 124–125
- Smith, Sir James Edward, 67
- social construction, scientific ideas, 78–79
- spatial process, speciation, 40–41
- speciation, 2–3, 34, 35–36
 - allopatric, 43, 44–45
 - alternative types, 47–50
 - asexual, 50–56
 - chromosomes, 46
 - dichopatric, 46–47
 - genes, 26–27, 91–92
 - parapatric, 45
 - parasite-driven, 49
 - peripatric, 45
 - populations, ranges and migration, 41–45
 - process types, 37
 - spatial process, 40–41
 - stasipatric, 46, 47
 - sympatric, 43, 44–45
 - temporal process, 36–40
 - theory, 35
- species; *see also* alternatives to species
 - boundaries, 89–93
 - causes, 65
 - complex, 90
 - criteria, 19
 - fixed/non-fixed, 63, 65
 - importance, 1–3
 - names, 7–8
 - nominalism, 128
 - origin of term, 58
 - transformation, 61
- species concepts, 4–5, 9, 82, 133–134, 136; *see also* Biological Species Concept; Unified Species Concept
 - conventional, 29–30
 - evolutionary, 18–19, 20, 33, 69

- genetic, 24–25
- morphological, 28, 70
- phylogenetic, 23–24, 33
- surrogate, 97
- ‘species problem’, 68–69, 135
 - philosophical perspectives, 74
- speciesism, 118
- specimens, 84, 128
- Sphenodon punctatus* (tuatara), 115
- splitters vs. lumpers, 12–13
- stability, ecosystem, 102
- stakeholders, 105
- stasipatric speciation, 46, 47
- Sterna hirundo* (common tern), 89
- Strickland Committee, 67
- subaltern genus, 63
- subjective values, 115
- subspecies, 2–3
- surrogate species concepts, 97
- symbiosis, 102
- sympatric speciation, 43, 44–45, 71
- A System of Logic* (Mill), 75
- Systema Naturae* (Linnaeus), 60, 66–67
- systematic biology, 66–69, 83
- systematics *see* phylogenetic systematics; taxonomy
- Systematics and the Origin of Species from the Viewpoint of a Zoologist* (Mayr), 16
- taxonomy, 11–14, **12**, 21, 80–82, 84–85, 94–95
 - community-based approach, 93–94
 - integrative, 92–93
 - numerical, 127
 - species boundaries, 89–93
 - taxonomic codes, 88–89
 - taxonomic inflation, 24
 - types, 85–89
- telos, 116
- temporal process, speciation, 36–40
- terms, biological, 11, 58, **59**, 63
- terns, 89
- theory of Forms, 57
- Tragedy of the Commons, 121
- transduction, genetic exchange, 51
- transformation
 - genetic exchange, 51
 - species, 61
- Tree of Life database, 82
- Trémaux, Pierre, 71
- Trying Leviathan* (Burnett), 131
- tuatara (*Sphenodon punctatus*), 115
- Tversky, Amos, 101–102
- type specimens, 84, 86, 128
 - neotypes/lectotypes, 86–87
- type sub-taxon, 88
- type taxon, 87–88
- types, 85–89
- Tyrannosaurus rex*, 76
- umbrella species, 99
- understanding, 131–134
- Unified Species Concept, 21
- universals, philosophical, 75, 129
- users, 6–8
- value of species, 113–117
 - biodiversity, 103–105
 - capitalism, 120–122
 - rights, 117–120
- Van Valen, Leigh, 27
- Venn, John, 75
- Vénus Physique* (Maupertuis), 60
- Veron, John, 53–54
- The Vestiges of the Natural History of Creation* (Chalmers), 61–62
- virtue ethics, 117
- viruses, 51, 52–53, 88–89
- Wagner, Moritz, 43, 68, 71
- Walsh, Denis, 77

160 INDEX

- Warren, Charles, **104**
water buffalo (*Babulus babulus*), 108
weeds, 103
What Species Mean (Sigwart), 84
Whewell, William, 85
whiptail lizards (*Aspidoscelis* spp.), 55, 55–56
White, Lynn, 114–115, 120
White, Michael, J. D. 46
wilderness, 107
Wildlife as Property Owners (Bradshaw), 119
Wilkins, Bishop John, 65–66
Wilson, Edward O. 49–50, 96, 105, 107, 114
Wilson, Robert A. 77
Winsor, Mary P. 8–9
within-species lineages, 33–34
Wittgenstein, Ludwig, 129
wildlife corridors, 110–112
Wolbachia (single-celled parasite), 49
wolves, reintroduction, 108
Wright, Sewell, 44
Wynne-Edwards, Vero C. 49–50

Yeats, William, 94–95
Yellowstone, wolves, 108
Yosemite National Park, 113
Your Inner Fish (Shubin), 131–132

Zachos, Frank, 4–5
zoological classification, 70
zoos, 111–112