Index

2019–20 fire season 34	state agency responses to support biodiversity recovery
fire weather during 12–13	299–311
timing, ignitions, spread and severity 13-16	summary 9
2019–20 wildfires	summary of exposure of species and ecological
Australian Government response to 285–98, 333, 338,	communities 270
392–4, 411	time period 4–5, 10
as catalyst for change 467–70	what we learnt from biodiversity management, policy
and climate change 12–13, 16, 456, 467, 469	and operations 377–88
consequences for sites important for biodiversity and other World Heritage values 3, 33–47	and wildlife welfare 343–56
conservation NGOs immediate and longer-term	Abyss Project 85
responses 313–26	Acacia
constraints on assessment of impacts and	covenyi 121
implementation of responses 297–8	flavescens 122
emerging trends in decline and recovery in Australian	penninervis var. longiracemosa 122
plant species 111–24	spp. 102, 105
emissions 16	active restoration of species 124
environmental impact 1–2	aerial food drops 222, 323
estimating the number of wild animals affected by	aerial shooting of feral ungulates 230, 238
154–64	Agamidae 185, 186
ex situ responses 357–72	agricultural losses from fires 17–18
extent of area burnt 4, 5, 17, 34, 93, 112, 269, 270, 300	Agrotis infusa see Bogong moth
global comparisons 16–17	algal blooms 63, 85, 87
government inquiries following 2–3, 389–402	Allocasuarina
human and economic costs 1, 17–18	mycorrhizas 129
impact on aquatic systems 59–75	verticillata see drooping she-oak
impact on birds 196–207	alpine ash forest (Eucalyptus delegatensis) 99–102, 124
impact of disease and weeds on vascular plants and	integrated ecosystem monitoring 414–15
communities 243–52	logging and fire 256
impact on ecological communities 92–108	alpine bog ecological communities, Victoria, aerial surveys 40'
impact on forestry 255–65	alpine bog skink (<i>Pseudemoia cryodoma</i>) 186, 293
impact on frogs 162, 167–78	alpine she-oak skink (<i>Cyclodomorphus praealtus</i>) 186, 191
impact on Indigenous cultural values 23, 0	192, 293
impact on Indigenous cultural values 23–9	Alpine Sphagnum Bogs and Associated Fens 96, 97 Amalosia lesueurii see velvet gecko
impact on invertebrates 141–51 impact on lizards and snakes 182–93	Amanita xanthocephala 131, 133
impact on marine species and ecosystems 78–89	Ambassis agassizzi see olive perchlet
impact on native mammals 158–61, 211–23	amphibians
impact on soils and soil processes 49–56	numbers rescued 351
monitoring impacts and recovery 404–15	see also frogs
NRM responses to biodiversity loss and recovery	Andebbia pachythrix 134
329–42	Androcalva rosea 118–19
personal reflections 442–56	animal welfare see wildlife welfare
precursors, characteristics and implications for the	animals
future 9–18	numbers impacted by the fires 154-64, 323, 347, 466
Preliminary Analysis Area 4, 5	response to fire 277–8
recommendations 457–64	see also introduced animals; invertebrates; specific
response to 2–3	animals, e.g. frogs
review of actions to support recovery of biodiversity	Antarctic beech (Nothofagus moorei) 129
374-6	Antechinus
review of impacts on biodiversity 269-72	argentus 324
	-

```
arktos 213
                                                              Australian Google Earth Engine Burnt Area Map (AUS
    mimetes 216
                                                                 GEEBAM) dataset 37, 131, 297
    stuartii 213, 216
                                                              Australian Government response to 2019–20 wildfires
Anthochaera phrygia see regent honeyeater
                                                                 285 - 98
                                                                 conclusions and key implications 297-8
Antichiropus sp. see keeled millipede
                                                                 consultation and collaboration with state/territory
ants 54
Anzia minor 134
                                                                     conservation agencies and others 285, 287, 289, 294
Apis mellifera see feral honey bee
                                                                 data and information 296-7
aquariums 362, 363, 364
                                                                 establishes Royal Commission into National Natural
aquatic ecosystems
                                                                     Disaster Arrangements 286, 287, 296, 392-4
    conclusions and recommendations 74-5
                                                                 funding support 2, 195, 285, 287-8, 375-6
    degradation and exploitation 469
                                                                 independent advisory panel established 285, 287,
    how fires impact 60-4, 237-8
                                                                     288-9, 293
    improving management in fire-prone regions 71-4
                                                                 Indigenous Fire and Land Management workshops
    physical impacts of fires 61-2
                                                                     program 294-5
                                                                 Phase 1 and 2 bushfire recovery programs 411
    preventing wildfires: identifying and mitigating drivers
                                                                 priority listings for ecological communities, plants and
    wildfire effects 59-75
                                                                     animals 286, 293-4, 296
                                                                 regional recovery planning and implementation 290-4
aquatic fauna
    emergency conservation efforts 68-71
                                                                 supports Threatened Species Scientific Committee
    impacts from 2019-20 wildfires 65-8
                                                                     286, 295-6
    mortality following wildfires 65
                                                                 Wildlife and Habitat Bushfire Recovery investment
                                                                     fund 289, 333, 338
    predicting the species at most risk 65-8
    preparedness: improving protection, building
                                                              Australian Government's Threatened Species Strategy 72,
       resilience, minimising other stressors and gaining
                                                              Australian plant species
       knowledge 72-4
    recovery: overcoming the impacts to ecosystems and
                                                                 assessing multiple species by focussing on ecological
       species 74
                                                                     communities 121-2
    response: emergency management to mitigate 74
                                                                 extent of area burnt in 2019-20 wildfires 112
    wildfire effects 59-75
                                                                 fire ephemerals emerge, increasing population size and
aquatic macroinvertebrates 83
Aquatic Root Mat Community in Caves of the Swan
                                                                 new populations discovered as part of post-fire field
    Coastal Plain 96
                                                                     surveys 117-18
aquatic sedimentation risk model 65
                                                                 post-fire vulnerability assessments 113-17
aquatic species
                                                                 recommendations: pre-fire actions; during fire; post-
    fire impacts on 61-4
                                                                     fire actions 124
    physiological tolerances of 63-4
                                                                 recruitment following fires 111
Araujia sericifera see moth vine
                                                                 response to fire 123
arboreal marsupials 160
                                                                 tales of unburnt species 120-1
arboreal tree frogs, habitat refuges during wildfire 170, 174
                                                                 trends in decline and recovery after 2019-20 wildfires
Archontophoenix cunninghamiana see bangalow palm
Arctocephalus pusillus doriferus see Australian fur seal
                                                                 vulnerability to introduced herbivore impacts post-fire
Armillaria root rot 245
                                                                     229
Arthrotaxis cupressoides see pencil pine
                                                              Australian Research Data Commons 297
ash deposition
                                                              Australian Seed Bank Partnership 365, 367, 368
    on the fire ground 51–2
                                                              Australian vegetation groups, proportion burnt 93
    into marine environments 85, 86
                                                              Australian Wildlife and Nature Recovery Fund 323, 325,
    into streams 63, 64, 237
Assa 175, 177
                                                              Australian Wildlife Conservancy (AWC) 314, 318–20, 321
    darlingtoni 167, 169, 176
                                                              Austropuccinia psidii see myrtle rust
    wollumbin 170, 171, 174
Atelomastix tigrina see tiger millipede
                                                              Baloon Cave, Carnarvon Gorge 25-6, 27
atmospheric instability 12-13
                                                              bangalow palm (Archontophoenix cunninghamiana) 339
Australia
                                                              Banksia
                                                                 integrifolia woodlands 122
    Indigenous Protected Areas 34, 35
    Key Biodiversity Areas (KBAs) 34
                                                                 montana 102
    National Reserve System 34
                                                                 montana, wildfire effects 116-17
                                                              Banksia montana mealybug (Pseudococcus markharveyi),
Australian Capital Territory
    extent of area burnt 300, 304
                                                                 likely extinction 142, 146-8, 269, 424, 444, 466
    response to support biodiversity recovery 304-5
                                                              barred galaxias (Galaxias fuscus) 451
    wildfire impacts on aquatic ecosystems 61-2
                                                              Baudin's black-cockatoo (Zanda baudinii) 43
Australian Convict Sites 41
                                                              bees see feral honey bee; native bees
Australian ecosystems, evolutionary history with fire 183
                                                              Bellinger River snapping turtle (Myuchelys georgesi) 304,
Australian fur seal (Arctocephalus pusillus doriferus) 86
```

Bendethera shrublands, NSW 121 NRM responses to 328-42 Bendethera wattle (Acacia covenyi) 121 regional scale recovery planning and management Bertmainius colonus 444 biodiversity review of actions to support 374-7 ad hoc status of planning and protection of 2-3 state agency responses to support 299-311 common features of wildfire impacts 271 Victoria 397 conclusions and recommendations 46-7 biological legacies after fire, logging impairing 259 BirdLife Australia 158, 198, 309, 314-16 consequences of fire impact on soils 53-5 conservation opportunities following wildfires 271-2 eastern bristle bird and eastern ground parrot critical gaps in knowledge 297 monitoring and recovery projects 407-8 fire impacts 1, 393, 466 birds identify and protect significant sites 461 broad context for impact and recovery 204-6 Key Biodiversity Areas wildfire impacts 42-4, 45-6 citizen science observations 408 knowledge gaps and uncertainties impacting 419-23 conclusion and recommendations 206-7 listing assessment for Key Threatening Process 'Fire expert-elicited estimates of the benefits of current regimes that cause biodiversity decline' 296 management after fire 205, 206 national overview of extent and severity of impact of habitat protection/management, post-fire environment wildfires 287 204-5, 206-7 and prescribed burning 277-8, 279 individual responses to fire 205 protected areas wildfire impacts 37-9, 45-6 Kangaroo Island, response to fire 196-203, 316 review of wildfire impacts 269-72 long-term monitoring 201-2 summary of exposure of species and ecological mortality 83, 159, 161-2, 197-8, 200-1, 204 communities to the 2019-20 wildfires 270 nest box provision to boost recovery 202, 205, 206, 207 World Heritage listings wildfire impacts 39-42, 45-6 numbers present within 2019–20 wildlife impact areas biodiversity agency representatives, embedded in disaster planning and fire control operations 462 numbers rescued 351 biodiversity assets population density estimates 158, 198-9 protection 6, 245, 392-3, 395 in post-fire landscapes 197 spatial information 389, 397 post-fire recovery, Nadgee Nature Reserve 203-4 biodiversity conservation 33, 295, 308, 311, 389, 393, 398 post-fire reductions in species persistence, Victoria uncertainty and data deficiencies clouding 417-27 161 - 2smoke inhalation 83 biodiversity decline 111-24, 296, 466 biodiversity impacts 286, 287, 290, 297, 305, 378, 405, 427 species difference in response to fire 202 assessment in government inquiries 389, 397, 402 threat from fire relative to other threats 201 common features 271 wildfire impacts 196-207 biodiversity information 306, 397 black bean (Castanospermum australe) 25 data deficiencies and uncertainty 417-27 black-faced monarch (Monarcha melanopsis) 425, 426 Black Saturday fires of 2009 17, 274, 275, 451, 465 enhance the evidence base 460 biodiversity loss 3 Black Summer fire season 4-5, 10, 18 factors driving 466-7 environmental precursors 10-12 fire weather 12-13 NRM responses to 328-42 biodiversity management, data deficiencies and timing, ignitions, spread and severity 13-16 uncertainty clouding 417-27 black-tailed antechinus (Antechinus arktos) 213 conclusions and recommendations 427 blackfish (Gadopsis bispinosus) 66, 70 incorporating uncertainty to support decisions 425-7 blackthorn (Bursaria spinosa) 121 synthesis of key knowledge gaps 419-23 Blue Mountains swamps 97 types of data deficiencies and uncertainties 418 Blue Mountains tree frog (Litoria citropa) 162, 172 when does uncertainty matter? 423-5 Blue Mountains water skink (Eulamprus leuraensis) 186, biodiversity management, policy and operations, what we 188, 192 learnt from the 2019-20 wildfires 377-88 Bogong moth (Agrotis infusa) 144, 359, 449 conclusions and recommendations 387-8 bogs, Australian Capital Territory 97-9 fire operations: protection of conservation assets Booroolong frog (Litoria booroolongensis) 162, 177, 332 377-8, 382-7, 388 Boronia imlayensis 120 interviewee key messages 378-87 Bos taurus see feral cattle preparedness: pre-fire planning for conservation assets botanic gardens 358, 362, 363, 365 377, 379-82, 387-8 bracelet honey-myrtle (Melaleuca armillaris) 121 biodiversity monitoring 3 broad-headed snake (Hoplocephalus bungaroides) 186, camera traps for 411-12 enhance and implement long-term programs 460-1 broad-toothed rat (Mastacomys fuscus) 98, 161, 216, 304, biodiversity protection 392-3, 463 biodiversity recovery 3-4, 467 brown antechinus (Antechinus stuartii) 213, 216 conservation NGOs immediate and long-term brown gerygone (Gerygone mouki) 218 responses 313-26 brush-tailed rock-wallaby (Petrogale penicillata) 213, 234, funding support 287-8, 398

```
aerial food drops 222, 323
                                                             Coeranoscincus reticulatus see three-toed snake-tooth
Budj Bim Cultural Landscape, wildfire effects 40, 41
building resilience 469
                                                             coir log damming 99
Bulburin National Park 324
                                                             collaboration 27, 294, 303, 305, 313-14, 322, 326, 328,
                                                                 331-4, 341, 355, 367, 371, 374-5, 393
Bureau of Biodiversity, need for 160, 163
Burramys parvus see mountain pygmy-possum
                                                             collembola 54
Burrin Burrin Reserve fire, NSW 317, 318
                                                             Colubridae 185, 186
Bursaria spinosa see blackthorn
                                                             Commersonia
Bush Heritage Australia 314, 316-18
                                                                 breviseta 119
Bushfire Data Commons 297
                                                                 pannosa 119
                                                                 prostrata 119, 120
Cacatua sanguinea see little corella
                                                                 rugosa 120
                                                             community engagement, ex situ conservation 368-9
Calamanthus cautus halmaturina see Kangaroo Island shy
   heathwren
                                                             community groups, for post-fire interventions 124
                                                             community recovery based on nature-based recovery
Calcarsynotaxus benrobertsi 444
Callistemon megalongensis see Megalong Valley bottlebrush
                                                                 programs 372, 398, 452, 468
                                                             Conondale spiny crayfish (Euastacus hystricosus) 64
Callitris oblonga see pygmy cypress pine
Callocephalon fimbriatum (gang-gang cockatoo) 293, 316,
                                                             conservation assets
                                                                 fire operations: protection of conservation assets
   425, 426
Calyptorhynchus
                                                                     377-8, 382-7, 388
                                                                 preparedness: pre-fire planning 377, 379-82, 387-8
   lathami 161, 162, 408
   lathami halmaturinus 197, 199-203, 205-6, 334-6,
                                                             conservation decisions, consequences of, and remedies for
       340,446-7
                                                                 data deficiencies and uncertainty in 417-27
   lathami lathami 293
                                                             conservation NGOs
                                                                 immediate and longer-term responses to 2019-20
camera trap monitoring 321, 411-12, 414
                                                                     wildfires 313-26
canker fungi 245
                                                                 recommendations 326
canopy die-back in forests 10, 11, 12
                                                             conservation opportunities following wildfires 271-2
Cape Arid National Park 234, 309
Capra hircus see feral goat
                                                                 see also ex situ conservation
                                                             control programs
captive-breeding programs 221, 359
                                                                 introduced herbivores 230, 238
carbon storage, and prescribed burning 278
Carnaby's black-cockatoo (Zanda latirostris) 43
                                                                 introduced terrestrial predators 221-2, 234-5, 238,
                                                                     321-2, 337, 375
carp (Cyprinus carpio) 237
Carphodactylidae 185, 186
                                                             controlled burning see prescribed burning
                                                             Cool Temperate Rainforest (CTR) fungal community 137,
Castanospermum australe see black bean
Casuarina equisetifolia subsp. incana woodlands 122
                                                             coordination between agencies 124, 462
Ceratopetalum apetalum see coachwood
Cervus spp. 228, 229, 230
                                                             Coronidium telfordii 120
   unicolor 229
                                                             Cortinarius
chemical soil processes, fire effects 52-3
                                                                 argyrionus 134
Cherax quadricarinatus see redclaw crayfish
                                                                 tubercularis 134
                                                             Country
Chlamydosaurus kingii see frill-necked lizard
                                                                 Black Summer wildfires impact on 24-6, 437
citizen scientists
   lead post-fire reconnaissance surveys 408
                                                                 and cultural burning 28, 435, 438, 439
                                                                 Indigenous Australians stewardship of 24, 27-8, 29,
   value in understanding fire's impact on frogs 173-4,
                                                                     330, 340, 437-9, 458-9, 468-9
                                                                 Indigenous groups lack of access to their 435-6, 459
Climacteris erythrops see red-browed treecreeper
                                                             COVID-19 pandemic 17, 18
climate change 7, 19, 397
   and 2019-20 wildfires 12-13, 16, 456, 467, 469
                                                                 impacts 79, 163, 173, 288, 318, 336, 337, 369, 370, 452
   impact on warm temperate rainforests 106-7
                                                             Cresponea ancistrosporelloides 134
                                                             Crinia signifera 174, 176
   increased FFDI and atmospheric instability 12-13
                                                             crown fires 257, 258
   mitigation 458
   planning for 207, 320, 325
                                                             cryopreservation 362
   and prescribed burning 278-9, 281
                                                             cultural burning see Indigenous cultural burning
                                                             Cyclodomorphus praealtus see alpine she-oak skink
   and wildfires 10
                                                             Cyphanthera scabrella 120
Climate Change Adaptation Strategy, AWC properties
                                                             Cyprinus carpio see carp
clover glycine (Glycine latroeana), restoring to Lobethal
                                                             Cyttaria
   Bushland Park 367-8
                                                                 gunnii 133
                                                                 septentrionalis 129
coachwood (Ceratopetalum apetalum) 105
coastal vegetation
   incineration and habitat destruction 81, 82, 84
                                                             Darwinia spp. see mountain bells
   post-fire changes 83-4
                                                             Darwinian shortfall 420, 422
cod (Maccullochella) 66,70
                                                             Dasyornis brachypterus see eastern bristlebird
```

```
Dasyurus
                                                              empowering Indigenous leadership and participation in
    maculatus 161, 233
                                                                 wildfire recovery, cultural burning and land
    maculatus maculatus 293
                                                                 management 430-40
data deficiencies and uncertainty in biodiversity
                                                              Entoloma ravinense 135-6
                                                              Environment Protection and Biodiversity Conservation Act
    conservation decisions 417-27
                                                                 1999 34, 72, 93, 169, 186, 188, 216, 246, 285, 301, 393,
deer (Cervus spp.) 228, 229, 230
Department of Agriculture, Water and the Environment
                                                                 394, 426, 433
                                                             Environmental Defenders Office 325
    (Cwth) 285-6, 296
    national overview of severity of impact of wildfires on
                                                              environmental disasters, capacity building to respond to 7
       biodiversity 287
                                                              environmental precursors, 2019-20 wildfires 10-12
    seven priority areas for regional scale biodiversity
                                                              Eolophus roseicapillus see galah
       recovery planning and management 290, 291
                                                              epigeal fungi 134
devil's fig (Solanum chrysotrichum) 339
                                                              Equus caballus see feral horse
diamond python (Morelia spilota spilota) 408
                                                              erosion rates following wildfires 53, 55
Dictyopharidae bug 445
                                                              estuarine habitat, wildfire impacts 85
                                                              estuarine waters, wildfire smoke settling in 87-8
Diplodactylidae 184, 185
disease-fire interactions 243-9, 251
                                                             Euastacus
Dodonaea viscosa subsp. burmanniana 122
                                                                 hystricosus 64
donations to help recovery 7, 345, 368-9, 376, 462
                                                                 rieki 304
drooping she-oak (Allocasuarina verticillata) 202, 335
                                                                 spinichelatus 73-4
drought 10, 11, 467
                                                                 suttoni 66
Drysdalia rhodogaster see mustard-bellied snake
                                                                 valentulus 64
duration, size and severity of larger fire events 13-14
                                                                 see also spiny crayfish
during fire 123-4
                                                              eucalypts
dwarf kerrawang (Commersonia prostrata) 119
                                                                 resprouters 277
                                                                 'seeders' 124, 261, 277
                                                              Eucalyptus
eastern bristlebird (Dasyornis brachypterus) 197, 201,
                                                                 cladocalyx 135-6
    206, 293, 374
    aspects that contributed to targeted protection 382
                                                                 delegatensis 99-102, 124
                                                                 forest 129, 137
    coordinated monitoring and recovery planning 407-8
                                                                 gomphocephala 250
    post-fire recovery at Nadgee Nature Reserve, NSW
                                                                 nova-anglica 96
                                                                 pauciflora 102
    re-establishment 205
eastern ground parrot (Pezoporus wallicus wallicus) 201
                                                                 regnans 99, 124, 204
                                                             Eulamprus
    coordinated monitoring and recovery planning
                                                                 kosciuskoi/leuraensis species complex, within-
       407 - 8
                                                                     species diversity 189-90
    post-fire recovery at Nadgee Nature Reserve, NSW
                                                                 leuraensis 186, 188, 192
       2.03 - 4
Eastern Stirling Range Montane Heath and Thicket
                                                              Euphrasia bella see Lamington eyebright
                                                              European rabbit (Oryctolagus cuniculus) 229
    Phytophthora impact 102-3
                                                              ex situ conservation 74, 123, 136, 138, 289, 357-72, 424
    wildfire effects 96, 102-3, 247, 309
                                                                 commonalities and differences for Australian animals
ecological communities
                                                                     and plants 361-3
    assessing multiple species by focussing on 121-2
                                                                 community engagement 368-9
    categorisation of fire-related threats 95
                                                                 conclusions and recommendations 369, 371-2
    changed or inappropriate fire regimes detrimental
                                                                 constraints 362, 370
       impacts 94
    characteristics 93
                                                                 implications for ex situ management 371
    conclusions and recommendations 107-8
    impacts of 2019-20 wildfires 96-107
                                                                 key findings 369, 370-1
    post-fire vulnerability assessment 94-107
                                                                 as long-term approach 371
                                                                 PACES tool 426
    threatened 93-4, 95, 96-7, 103, 107
                                                                 post-fire action 363-4
    wildfire effects 92-108
                                                                 potential benefits 358-9
economic cost of fires 1, 18
                                                                 prioritisation 370, 371
ecosystem processes, fungi role 128-9
                                                                 priority animal species 363-4, 365
ecosystem risk forecasting 396
ectomycorrhizal fungi 129, 130, 137
                                                                 priority plant species 364-8
                                                                 Wollemi pine 366-7
Egernia roomi see Kaputar rock skink
Eidothea hardeniana see Nightcap oak
                                                                 see also insurance populations; translocation
                                                              ex situ facilities 358, 360
Elapidae 184
                                                              ex situ germplasm collections 123, 251, 358, 362, 363, 367
elemental responses to fire 52-3
                                                              existing pre-fire planning tools: their benefits, limitations,
emergency conservation efforts, aquatic fauna 68-71
                                                                 and suggested improvements 379-80
emergency management 2, 319-20
                                                              expert elicitation
emergency post-fire ecological surveys 320
emissions 16
                                                                 aquatic species 66
```

```
birds 200
                                                               First Nations see Traditional Owners
    lizards 191-2
                                                               fish see freshwater fish; introduced fish; marine species and
extent of area burnt 4, 5, 17, 34, 93, 112, 269, 270, 300
                                                                  ecosystems
extinction deficit shortfall 421, 422
                                                               Fitzroy Falls and associated hydrobasin KBA 43
extinctions 2, 269
                                                               flame robin (Petroica phoenicea) 204
    invertebrates 142, 146-8, 269, 424, 444-5, 466
                                                               floods 7
    preventing 447-9
                                                               flying-foxes 159
                                                               forest fire danger, metrics 11-12
    squamates 183
Eyes on Recovery: camera trap partnership 411-12
                                                               Forest Fire Danger Index (FFDI) 12-13
                                                               forest integrity, and wildfire intensity 45-6
Felis catus see feral cat
                                                               forestry
                                                                  interacting and compounding impacts of fire in the
feral cat (Felis catus)
    effect on native species pre- and post-fire 230-3
                                                                      2019-20 wildfires 255-65
    control programs 234-5, 238, 321-2, 337, 375
                                                                  management policies and practices 264-5
                                                               forests
    number of mammals and birds killed by 466
                                                                  cessation of industrial logging from native forests
    post-fire change in abundance on Kangaroo Island
                                                                      255-6, 264
       233-4, 321-2, 337
                                                                  impact of 2019-20 wildfires on 256
    small mammal predation post-fire 232
    use of fire scars in the weeks post-fire 232
                                                                  lack of congruence between impacts of logging and fire
feral cattle (Bos taurus) 230
                                                                  logging and fire, conceptual model 264
feral goat (Capra hircus) 230
                                                                  logging pre-fire and proneness to high-severity wildfire
feral honey bee (Apis mellifera) 235-6
feral horse (Equus caballus) 228, 229
feral pig (Sus scrofa) 228, 229, 230
                                                                  post-fire ('salvage') logging has negative impacts 255,
                                                                      256, 260-2, 265
fine fuel in a forest 11-12
                                                                  prescribed burning in 273-81
                                                                  recommendations 264-5
    in the Australian landscape 1
                                                               freshwater crayfish
    as quintessential element in Indigenous Australian
       communities 24
                                                                  emergency conservation efforts 69
                                                                  post-fire persistence 162
fire-adapted vegetation communities 170
                                                                  see also spiny crayfish
    frogs occurrence in 170, 171-2, 173, 175, 177-8
                                                              freshwater fish
    habitat refuges 175
                                                                  emergency conservation efforts 68-71, 332, 334, 451
fire-affected communities, recovery 18
fire behaviour, climate and weather as dominant drivers of
                                                                  introduced, and fire 236-8, 272
                                                                  mortality 65
    255, 256, 263
                                                                  post-fire persistence 162
fire-derived emissions 16
                                                                  proportion of range at risk from sedimentation 66-7
fire ephemerals, emergence, increasing population size and
                                                                  recovery outlook 74
    extent 118-20
fire extent mapping 297
                                                                  recreational fish stocking policy 237, 238
fire-fighting retardants and foams, impact on fauna 64, 86
                                                                  species most at risk 65-8
                                                                  wildfire effects 60, 63, 64
fire operations: protection of conservation assets during
                                                               freshwater mussels 69, 162
    the 2019-20 fires 377-8, 382-7, 388, 462
    what didn't work 384-7
                                                               Friends of the Western Ground Parrot 309
    what worked? 382-4
                                                               frill-necked lizard (Chlamydosaurus kingii) 183
                                                               FrogID (citizen science project) 173-4, 178, 408
fire regimes
                                                               frogs
    altered, as threat to squamates 183
                                                                  adaptive traits to survive fire 169-70
    species adaptation to 183
                                                                  conclusions and recommendations 177-8
fire risk forecasting 123
fire-sensitive vegetation communities 170
                                                                  ecological group 176
                                                                  inferring fire impacts on 169-70
    enhance fire management and planning for 461-2
                                                                  numbers present within 2019-20 wildlife impact areas
    frogs occurrence in 170, 173, 175
    habitat refuges 175-6
                                                                  occurrence in fire-sensitive and fire-adapted vegetation
fire severity 14-16
    and forest integrity 45-6
                                                                      communities 170-6, 177-8
                                                                  population density estimates 158
    impact on aquatic fauna 65
                                                                  post-fire reductions in species persistence, Victoria
    impact on frogs 168-9
    impact on squamates 189, 191
    impact on warm temperate rainforests in Victoria
                                                                  previous studies on impacts of fire on 168-9
                                                                  refuges during wildfire 170, 174, 175-6
                                                                  threatened species and wildfire 177
    logging and elevated flammability 262, 263
                                                                  value of citizen science in understanding fire's impact
    and pre-fire logging of forests 256, 257-9
fire severity mapping 65, 94, 158, 188, 301
                                                                  vegetation preference, refuge types, and ecological
fire suppression for flora conservation 124
fire weather during the 2019-20 fire season 12-13
                                                                      group 176-7
```

wildfire effects 167-78	Gondwanan spiders 444
frozen zoos 358, 362	Gospers Mountain Fire 14, 41, 42
fuel management plans 123	government inquiries following 2019–20 wildfires 2–3,
fuel reduction burning see prescribed burning	389-402
fungal communities	2020 Royal Commission into Natural Disaster
fire intensity and frequency effects 130	Arrangements 286, 287, 296, 392-4, 399-400
persistence post-fire 130	conclusions and recommendations 399-402
fungi	state inquiries 389, 394–400
alternative strategies for determining fire impact 137–8	summary of recommendations or observations across all the inquiries 399–400
conclusions and recommendations 137-8	Great Western Woodlands, WA 24, 308
conservation status 129	Greater Blue Mountains Area 25, 34
fire effects 127-8, 129-38	wildfire effects 40, 41-2
fire overlap analysis and constraints 132-6, 137	Greater Blue Mountains KBA 43
role in ecosystems 128–9	greater glider (Petauroides volans) 160, 161, 216-17, 293,
species within Preliminary Analysis Area 132, 133-4	318, 407
threats to 129	green and golden bell frog (Litoria aurea) 162, 171
what are they? 128-9	green carpenter bee (<i>Xylocopa aeratus</i>) 149
fungi repository data 131-2	greenhouse gas emissions 16
future-proofing Australia 325	Greening Australia 325
	Grevillea
Gadopsis 66, 70	bemboka 120
bispinosus 62, 237, 304	guthrieana 409
galah (Eolophus roseicapillus) 336	Gymnobelideus leadbeateri see Leadbeater's possum
Galaxias	grey-headed flying-fox (Pteropus poliocephalus) 213, 283
emergency conservation efforts 69–71, 451	ground frogs, habitat refuges during wildfire 170, 174
fuscus 451	ground orchids 115–16, 409
olidus 64	Gunditjmara People 26
post-fire persistence 162, 407	Guthega skink (<i>Liopholis guthega</i>) 293
sp. nov. 'Cann' 68	Guthrie's grevillea (Grevillea guthrieana) 409
sp. nov. 'Yalmy' 68, 269	1.151
Galerina lurida 134	habitat destruction 82, 469
gambusia (Gambusia holbrooki) 237	Hakea eriantha 121
Gambusia holbrooki see gambusia	Harrisoniascincus zia see rainforest cool-skink
gang-gang cockatoo (Callocephalon fimbriatum) 293, 316, 425, 426	Hastings River mouse (<i>Pseudomys oralis</i>) 213, 407 hazard reduction burns 51, 274–5, 278, 281
Gekkonidae 185, 186	health impacts from fires 17
genetic diversity 363	Healthy Land and Water (HLW), post-fire recovery
Geocrinia 175, 176	strategies of rainforest flora 338-9
alba 168	heat stress 159, 160, 204
lutea 168, 176	heath goanna (Varanus rosenbergi) 321
vitellina 168, 176	heatwaves 10
germination trials 365, 367	Heleioporus
Gerygone mouki see brown gerygone	australiacus australiacus 177
Gibraltar Range KBA 42, 43	a. flavopunctatus 167, 172, 173, 177
Gintarasia megalophthalma 133, 134	herbivores, introduced, pressure on native species after fire
Gliophorus graminicolor 133	228–30, 238
glossy black-cockatoo (Calyptorhynchus lathami) 161, 162,	heterotrophs 128
408	high conservation value areas, wildfire impacts 33–47
see also Kangaroo Island glossy black-cockatoo	Hoplocephalus bungaroides see broad-headed snake
Glycine latroeana see clover glycine	honey bees, feral, affect on native biota 235–6, 238
goannas (<i>Varanus</i>) spp. 232–3 golden-tipped bat (<i>Phoniscus papuensis</i>), fire effects	house mouse (Mus musculus) 228
218–19, 408	houses destroyed by fires 17 human cost of fires 1, 17–18
Gondwana Rainforests of Australia World Heritage Area	human-nature recovery loop 451–2
25, 34, 168	Hutchinsonian shortfall 421, 422
2019–20 wildfire effects 41, 103–5, 337–8	hydrophobicity 52
bioregion and environmental conditions 103–4	Hypocreopsis amplectens 129
bird community diversity post-fire 197	Hypotrachyna subpustulifera 134
frog species in 170	1.) por working one processing in 101
learning from pre-existing monitoring 409	IDEA protocol 425
Queensland sections 302, 337–8	ignition sources 13
regeneration following fires 105	incineration of coastal vegetation 81, 82, 84
0	11011011011011011011011011011011011

```
control after 2019-20 wildfires 221-2, 234-5, 238
Indigenous cultural burning, fire management and land
   management practices 10, 28, 275-6, 281, 318, 394,
                                                                 effect on native species pre- and post-fires 230-4
                                                                 future research and management on control 235
   399, 431, 453, 469
   conclusions and recommendations 438-9
                                                                 see also feral cats; red fox
   cultural burning and biocultural landscape
                                                             invertebrates
       management 436-7
                                                                 aquatic see aquatic macroinvertebrates; spiny crayfish
   differences from non-Indigenous fire practitioner
                                                                 conclusion and recommendations 150-1
       understandings 436, 437
                                                                 digitisation of locational information 297
   empowering Indigenous leadership 430-40
                                                                 extinctions caused by 2019-20 wildfires 142, 146-8,
   lack of government arrangements to support
                                                                     269, 424, 444
       Indigenous engagement 435
                                                                 impediments to conservation 142-4
   lack of necessary legal protections over cultural
                                                                 introduced: honey bee 235-6
       burning 435
                                                                 in litter, south-eastern rainforests 412-13
   support for 458-9
                                                                 monitoring programs and management actions
   workshops program 294, 295, 435
                                                                     148-50, 412-13
                                                                 number of species impacted by fire 145-6, 158
   see also Country
Indigenous cultural heritage
                                                                 numbers in Australia 142
   koalas as culturally significant species 433-4
                                                                 population density estimates lacking 158
   safeguards 27-8
                                                                 in Preliminary Analysis Area 144, 145
   wildfire impacts on 24-6, 432-4
                                                                 soil, fire effects 54-5
Indigenous cultural values
                                                                 wildfire effects 141-2, 143-51, 444-5
   fire role 23-4
                                                             Isoodon obesulus obesulus see southern brown bandicoot
   recommendations 28-9
                                                             IUCN, critical role of ex situ conservation interventions
   response from the Aboriginal community to wildfires
                                                                 357, 358-9
                                                             IUCN Red List of Ecosystems 93, 102
                                                             IUCN Red List of Threatened Species
   spiritual and ceremonial significance of fire 24
   and stewardship of Country 24, 27-8, 29, 330, 340,
                                                                 Australian fungi 129, 135
       437-9, 458-9, 468-9
                                                                 birds 196, 199-200
   upside to fires 26
                                                                 freshwater fish and crayfish 65, 69
   wildfire impacts on 23-9
                                                                 frogs 169, 170
Indigenous Fire and Land Management workshops
                                                                 reptiles 186, 188
   program 294
   objectives and intended outcomes 294-5
                                                             Jerrawangala KBA 42, 43
Indigenous people
   empowering leadership and participation in wildfire
                                                             kangaroo apple (Solanum aviculare) 106
       recovery, cultural burning and land management
                                                             Kangaroo Island
                                                                 birds, response to catastrophic fire 196-203, 315
   Traditional Ecological Knowledge missing from
                                                                 camera trap monitoring 321, 411-12
       decision making 423, 427
                                                                 cat exclusion fence to protect KI dunnarts 319-20, 321
Indigenous Protected Areas 34
                                                                 cat impacts on refuge populations of native mammals
Indigenous ranger groups 435, 436
                                                                    232
Indigenous Traditional Agriculture Knowledge Hub 325
                                                                 emergency management 319-20
Indonesian peat fires (1997-98) 17
                                                                 fauna recovery 334-7
Innovate to Regenerate Challenge 325
                                                                 feral cat control 234, 321-2, 337, 375
instream barriers 237, 272
                                                                 feral pig eradication 230, 238, 322
insurance populations 75, 123, 221, 288, 302, 304, 360,
                                                                 green carpenter bee (Xylocopa aeratus) on 149
   364, 367, 451, 459
                                                                 impact of fires 307
integrated ecosystem monitoring, alpine ash forests
                                                                 landscape in the aftermath of 2019-20 wildfires 4
                                                                 post-fire change in feral cut abundance 233–4, 321–2
introduced animals, effect on native plants and animals
                                                                 power of community 450-1
   after fire 228-38
                                                                 recovery actions 307-8
introduced fish
                                                                 Western River Refuge 322
   and fire 236-7
                                                                 woodland bird community 202
   future research and management 237, 238
                                                             Kangaroo Island assassin spider (Zephyrarchaea austini)
   prevention of re-expansion using instream barriers
                                                                 144, 445
       237, 272
                                                             Kangaroo Island dunnart (Sminthopsis griseoventer aitkeni)
   recreational fish stocking policy 237, 238
                                                                 211-13, 216, 222, 234, 319-23, 336-7, 375, 411, 450
introduced herbivores
                                                             Kangaroo Island echidna (Tachyglossus aculeatus
   conceptual model of response to extensive fire 229
                                                                 multiaculeatus) 216, 321
   control programs after 2019-20 wildfires 230, 238
                                                             Kangaroo Island glossy black-cockatoo (Calyptorhynchus
   future research and management 230
                                                                 lathami halmaturinus) 197, 199-203, 205-6, 334-6,
   pressure on native species after fire 228-9
                                                                 340,446-7
introduced invertebrates: honey bee 235-6, 238
                                                             Kangaroo Island KBA 43
introduced terrestrial predators
                                                             Kangaroo Island Land for Wildlife 234, 314, 319, 321-3
```

Kangaroo Island micro trapdoor spider (Moggridgea	citropa 162, 172
rainbowi) 445, 446	daviesae 172, 177
Kangaroo Island shy heathwren (Calamanthus cautus	dentata 162
halmaturina) 201, 202	ewingi 169, 175
Kangaroo Island southern emu-wren (<i>Stipiturus</i>	kroombitensis 167, 171, 177
malachurus halmaturinus) 196, 199–200, 202, 321,	littlejohni 167, 169, 172, 173, 175, 177
425, 426	nudidigata 162
Kangaroo Island waters, potential long-term threats from	olongburensis 171
wildfires in 86–7 Kangaroo Island western whinbird (Peanhades nigracularis	paraewingi 169
Kangaroo Island western whipbird (<i>Psophodes nigrogularis</i>	phyllochroa 172 piperata 171
lashmari) 201, 202, 206 Kangaroo Island white-eared honeyeater (Nesoptilotis	raniformis 171, 177
leucotis thomasi) 201, 202	rubella sp. group 176
kangaroos, rescue efforts 212, 351	spenceri 162, 167, 169, 172, 173, 177, 407
Kaputar rock skink (<i>Egernia roomi</i>) 188, 191, 192	subglandulosa 172
Kardomia prominens 120	watsoni 167, 169, 172, 173, 175, 177
Kate's leaf-tailed gecko (Saltuarius kateae) 186-7, 188, 191	litter-associated fungi 130
keeled millipede (Antichiropus sp.) 445	litter invertebrates, south-eastern rainforests 413–14
Keferstein's tree frog (Litoria dentata) 162	little corella (Cacatua sanguinea) 336
Key Biodiversity Areas (KBAs) 34	lizards 183, 185–7, 191–2
patterns of fire 45-6	Lobethal Bushland Park, SA, clover glycine restoration
wildfire impacts 42-4	367-8
K'gari (Fraser Island), wildfire effects 34, 41, 121-2	logging
knowledge gaps and uncertainties impacting biodiversity	and increased flammability 262, 263
419–23	industrial, cessation to reduce stressors in forest
koala (Phascolarctos cinereus) 25, 216, 221, 320, 351	ecosystems 255–6, 264
animal welfare and rehabilitation efforts 221	in native forests, and fire, conceptual model 264
cost of intensive care 349	post-fire ('salvage') 255, 256, 260–2, 264, 265
as culturally significant species to Indigenous peoples	on steep slopes and 'downstreaming' effects 259–60
433-4	long sun skink (<i>Lampropholis elongata</i>) 191, 192
mortality 396	long-footed potoroo (Potorous longipes) 213, 216, 221,
post-fire surveys, northern NSW 324	232, 234, 320 long posed bandicoot, 216
post-release monitoring protocol 347–8 progressive digital necrosis 347	long-nosed bandicoot 216 long-nosed potoroo (<i>Potorous tridactylus</i>) 104, 320
rescue efforts and post-fire recovery 212	south-eastern mainland subspecies (<i>Potorous</i>
species recovery funding 288, 294	tridactylus tridactylus) 216, 293, 407
wildfire effects 142, 143, 155, 156, 219–20, 396	south-eastern mainland subspecies (<i>Potorous</i>
(maine enecto 112, 110, 100, 100, 21) 20, 0) 0	tridactylus trisculatus) 216
Laccocephalum 129	long-term species monitoring 163, 178, 460-1
Lake Condah, Victoria 26	birds 201-2
Lamington eyebright (Euphrasia bella) 120-1	reptiles 190, 192, 193
Lamington National Park 39, 337, 338	Lophostemon confertus open forests 122
Lampropholis elongata see long sun skink	lowland subtropical rainforest 96
land clearing 469	strategies to restore 337-40
landscape protection, and climate-ready restoration 324-5	
lantana (Lantana camara) 339	McArthur Forest Fire Danger Index (FDI) 12-13
Lantana camara see lantana	Maccullochella 66, 70
Leadbeater's possum (Gymnobelideus leadbeateri) 221	macquariensis 332
leaf-green tree frogs (Litoria nudidigita) 162	Macquaria australasica see Macquarie perch
leaf-tailed geckos (Saltuarius spp.) 191	Macquarie perch (Macquaria australasica) 70, 451
leaky weirs 99	rescue in Mannus Creek 70–1, 332, 334
Lechriodus fletcheri 175, 176	macropods, numbers rescued 351
Leptomeria ellytes community, collapse post-fire 250	Main Range National Park 337
Leucogaster meridionalis 134	mainland dusky antechinus (<i>Antechinus mimetes</i>) 216
lichens 129, 134	Mallacoota fires 83, 198, 325, 453
lilly pilly (Syzygium smithii) 106	mammals
Linnodynastes 176 Linnean shortfall 420, 422	broad context for impact and recovery 220–1
Linospadix monostachyos see walking stick palm	captive-breeding programs 221 conclusions and recommendations 223
Liopholis guthega see Guthega skink	expert elicitation of population losses 213–16
Litoria	management responses 221–3
aurea 162, 171	nest boxes provision 222
booroolongensis 162, 177, 332	numbers present within 2019–20 wildlife impact areas
castanea 171	159–60, 213

```
numbers rescued 351
                                                             monitoring impacts and recovery 404-15
   on-ground surveys 216-17, 218-20
                                                                 camera traps for biodiversity monitoring 411-12
   population declines in burnt areas 216-17, 218-20
                                                                collection of biodiversity data in key vegetation types
   population density estimates 158, 213
                                                                 conclusions and recommendations 415
   post-fire reductions in species persistence, Victoria
                                                                 focused on species abundance or occupancy 413, 414
   predator control programs 221-2
                                                                integrated ecosystem monitoring 414-15
   spatial overlap with fire to estimate impacts 213,
                                                                invertebrate monitoring 148-50, 412-13
                                                                lack of baseline monitoring data for most species 404,
   wildfire impacts 211-23
                                                                    405 - 6
mangroves 84
                                                                lack of investment in monitoring by Australian
Manning River helmeted turtle (Myuchelys purvisi) 304
                                                                    agencies and organisations 405, 411
Maratus sarahae see peacock spider
                                                                learning from pre-existing monitoring 409-11
marine species and ecosystems
                                                                looking forward: opportunities to improve monitoring
   conclusions and recommendations 89
                                                                    and preparedness 411-15
   mortality 85-6
                                                                MERIT tool use 411
   nature and full extent of wildfire impacts largely
                                                                 post-fire reconnaissance surveys 404, 406-9
                                                             montane ash forests
       unknown 79
                                                                Central Highlands of Victoria 262
   summary of possible impacts 80
   wildfire impacts on 78-89
                                                                 wildfire effects 99-102
marine systems, mechanisms of wildfire impacts 81-8
                                                             montane spiny crayfish (Euastacus rieki) 304
   death and injury from incineration, smoke inhalation
                                                             Morelia spilota spilota see diamond python
       and radiant heat 81-4
                                                             mortality rate estimates 65, 157-60, 162-3
   run-off laden with ash, debris, nutrients, metals and
                                                                birds 83, 159, 161-2, 197-8, 200-1, 204
       chemicals 85-7
                                                                freshwater fish and crayfish 65, 162, 237
   wildfire smoke settling in estuarine and offshore waters
                                                                marine species 85-6
Martin's toadlet (Uperoleia martini) 162
                                                                native mammals 161, 213-17, 218-20
masked owl (Tyto novaehollandiae) 162
                                                                 wildlife 157-60
Mastacomys fuscus see broad-toothed rat
                                                                Wildlife populations, Victoria 160-2
mean monthly FFDI 12-13
                                                             moth vine (Araujia sericifera) 339
media
                                                             Mount Barney National Park 337
   impacts on welfare of rescued wildlife 353-4
                                                             Mount Lofty Ranges, SA 307
   interest in effects of fires on wildlife 156-7, 212
                                                             mountain ash forest (Eucalyptus regnans) 99, 124, 204
megafires, definition 1
                                                                Central Highlands of Victoria 262
Megalong Valley bottlebrush (Callistemon megalongensis)
                                                                logging and fire 256, 262
    120
                                                             mountain bells (Darwinia spp.) 103
Melaleuca
                                                             mountain dryandra (Banksia montana) 102
   armillaris 121
                                                             mountain frog (Philoria kundagungan) 409
   quinquenervia floodplain woodlands, fire and
                                                             mountain galaxias (Galaxias olidus) 64
       myrtle rust 248-9
                                                             mountain pygmy-possum (Burramys parvus) 221
mental health issues 17
                                                                 protecting and preparing for future emergencies
Menura novaehollandiae see superb lyrebird
                                                                    359 - 60
MERIT tool 411
                                                                supplementary feeding with nutrient-rich biscuits 222,
Metacrinia 175
                                                                    359-60, 469
Metcalfe's greenhood (Pterostylis metcalfei)
                                                             movement shortfall 420, 422
   weed invasion effects 116
                                                             Muldoon (eel) trap complex 26
   wildfire effects 115-16, 409
                                                             multiregional species interventions and strategic
microbial communities 55
                                                                investments 293-4
Millennium Seed Bank, Royal Botanic Gardens, Kew, UK
                                                             Murray and Riverina NRM regions
                                                                 ecological impact of wildfires 331-4
Minister for the Environment
                                                                key lessons and insights 333-4
   appoints Threatened Species Scientific Committee
                                                                landscape-scale plan, positive outcomes 332-3
       286, 295-6
                                                             Mus musculus see house mouse
                                                             mustard-bellied snake (Drysdalia rhodogaster) 188
   emergency consultative roundtables 285, 287
   establishes Wildlife and Threatened Species Bushfire
                                                             mycorrhiza 129
       Recovery Expert Panel 287
                                                             Myobatrachus 175
Mixophyes
                                                             Myoporum floribundum see slender myoporum
   balbus 172, 173, 177
                                                             Myriophyllum sp. see water milfoil
   fasciolatus 172
                                                             myrtle rust (Austropuccinia psidii) 243
   fleayi 170, 171, 176
                                                                impact on native plant communities 244
Moggridgea rainbowi see Kangaroo Island micro trapdoor
                                                                impacts magnified by fire events 245-6, 247-9
                                                                recommendations 251
Monarcha melanopsis see black-faced monarch
                                                             Myuchelys georgesi see Bellinger River snapping turtle
```

```
Myuchelys purvisi see Manning River helmeted turtle
                                                             Notomacropus parma see parma wallaby
                                                             nutrient runoff 63, 85
                                                             nutrients in smoke, and offshore algal blooms 87
Nadgee Nature Reserve, NSW, post-fire recovery of
    eastern bristlebirds and ground parrots 203-4
                                                             Nuytsland Nature Reserve wildfire 309
Nadgee to Mallacoota Inlet KBA 43
Namadgi National Park, ACT 27, 304, 305, 382-3, 407
                                                             'obligate seeders' 124, 261
nation-wide severity map 188
                                                             OceanWatch Australia survey of wildfire impacts on
National Bushfire Recovery Agency 286
                                                                 marine wildlife, habitats and water quality, and socio-
National Bushfire Recovery Fund 285, 287-8
                                                                 economic consequences 81-3, 85
National Environment Science Program 307
                                                             offshore waters, wildfire smoke settling in 87-8
   Threatened Species Recovery Hub 288, 296
                                                             Olearia sp. Henrys Creek 120
National Indicative Aggregated Fire Extent Dataset
                                                             olive perchlet (Ambassis agassizzi) 64
   (NIAFED) 157, 186, 297
                                                             Oncorhynchus mykiss (rainbow trout) see trout
national parks, wildfire effects 37, 39
                                                             orchids, fire effects 115-16, 409
native bees, fire impacts 408-9
                                                             Ornithorhynchus anatinus see platypus
native mammals see mammals
                                                             Orroral Valley wildfire, ACT 61-2, 304, 305
native plants
                                                             Oryctolagus cuniculus see European rabbit
   and animals, effect of introduced animals on post-fire
                                                             our future 465-70
                                                             Outstanding Universal Values 25
       227 - 38
   compounding impacts of disease and weeds post-fire
       243 - 52
                                                             PACES tool 426
native predators, increased competition for prey post-fire
                                                             palm grass (Setaria palmifolia) 339
                                                             Palmgrove KBA 43
natural resource management (NRM) organisations
                                                             parma wallaby (Notomacropus parma) 213, 216
   conclusions and recommendations 340-1
                                                             Passiflora subpeltata see white passionflower
   ecological impact of wildfires in Murray and Riverina
                                                             peacock spider (Maratus sarahae) 444
       NRM regions 331-4
                                                             peatland ecological communities 96-7
   fauna recovery on Kangaroo Island 334-7
                                                             pencil pine (Arthrotaxis cupressoides) 129
   partnerships with First Nations communities 330, 340
                                                             per- and polyfluoroalkyl substances (PFAS) 86
   regions prioritised for wildfire recovery 330
                                                             Perissopmeros darwini 444
   responses to biodiversity loss and recovery 328-42
                                                             permanent collaborative national body focused on
   role and funding 329-30
                                                                 planning, policy and management for biodiversity in
   strategies to restore Critically Endangered lowland
                                                                 relation to fire 463
       subtropical rainforest 337-40
                                                             personal reflections of 2019-20 wildfires 442-56
Natural Temperate Grassland of the South Eastern
                                                             Petauroides volans see greater glider
   Highlands 96
                                                             Petaurus australis see yellow-bellied glider
nature-led community recovery 372, 398, 452, 468
                                                             Petrogale penicillata see brush-tailed rock-wallaby
Nesoptilotis leucotis thomasi see Kangaroo Island white-
                                                             petroglyphs 25
   eared honeyeater
                                                             Petroica phoenicea see flame robin
nest boxes 202, 205, 206, 207, 222, 335-6
                                                             Pezoporus
New England Peppermint (Eucalyptus nova-anglica)
                                                                 wallicus flaviventris 199, 234, 309, 316, 407
   Grassy Woodlands 96
                                                                 wallicus wallicus 201
New Holland mouse (Pseudomys novaehollandiae) 216,
                                                             Phascolarctos cinereus see koala
   407
                                                             Philoria 175, 177
New South Wales
                                                                 frosti 170
   extent of area burnt 300, 302, 394
                                                                 knowlesi 170, 171, 172, 176, 177
   inquiry into 2019-20 wildfires 389, 394-6, 399-400
                                                                 kundagungan 170, 176, 177, 409
   post-fire reconnaissance surveys 407
                                                                 pughi 168, 172, 174, 176, 177
   response to support biodiversity recovery 302-4
                                                                 richmondensis 170, 409
   Saving our Species (SOS) monitoring, evaluation and
                                                                 sphagnicolus 170, 172, 176
       reporting program 302-4, 407, 409-10
                                                             Phoniscus papuensis see golden-tipped bat
New South Wales Bushfire Inquiry 389, 394-6
                                                             phosphite fungicide to reduce Phytophthora impact 247,
New Zealand, smoke from 2019-20 wildfires recorded in
                                                                 309
                                                             physical soil processes, fire effects 50-2
Newnes Plateau shrub swamps 96-7
                                                             Phytophthora cinnamomi 243
NGOs see conservation NGOs
                                                                 and fire interaction, Stirling Range National Park
Ngunnawal Traditional Owners 318
                                                                     247 - 8,309
Nightcap oak (Eidothea hardeniana) 104
                                                                 impact on native plant communities 244
Ninox strenua see powerful owl
                                                                 Kangaroo Island 321, 322
nitrogen-fixing plants 53
                                                                 phosphite fungicide effectiveness 247, 309
northern corroboree frog (Pseudophryne pengilleyi) 97
                                                                 in Wollemi pine 114
Nothofagus moorei see Antarctic beech
                                                             Phytophthora dieback 243, 245
Nothofagus, ectomycorrhizal fungi associated with 129,
                                                                 Eastern Stirling Range 102, 103, 309
   130, 137
                                                                 impacts magnified by fire events 245-7
```

recommendations 251	see also Indigenous cultural burning
Stirling Range dryandra 117	Prestonian shortfall 421, 422
phytoplankton 87	prioritisation of assets for protection 395–6
plant louse (<i>Trioza barrettae</i>) 445	see also biodiversity assets
platypus (Ornithorhynchus anatinus) 65, 159, 213, 216, 293	prioritised communities and species 370, 371, 431 animals, <i>ex situ</i> actions 363–4, 365
Poirot shortfall 421, 422	aquatic fauna 66–8, 237
poison baiting 221-2, 234	Finalised Priority Assessment Lists 296
population viability analysis 164	key resources necessary for survival of 163
post-fire actions 124, 163	plants, ex situ actions 364–8
post-fire herbivory, by introduced animals 228-9	Queensland 301, 302
post-fire monitoring and recovery 404-15	Saving our Species program, NSW 302-4, 407, 409-10
post-fire reconnaissance surveys 404, 406-9	and species groups for interventions 286, 293-4, 296
across states 406–7	squamates 186, 187, 189-90
NGO, institutional species experts and citizen	to support recovery of diversity after fire 463-4
scientists led 408-9	propagation, restoration and translocation of plants in
number of surveys 406	botanic gardens 365
post-fire ('salvage') logging 255–6, 260–2, 264, 265	property, prescribed burning and wildfire risk to 275–6,
post-fire sampling 3, 106, 144, 182, 211, 407	280
post-fire surveys 320	protected areas
birds, Kangaroo Island 316	extent and severity of wildfires 37–8
importance for locating fire-ephemeral species 118–20	patterns of fire 45–6
koalas 324	in Victoria, impacts and consequences for
mammals 216–17, 218–20	management 39 wildfire effects 37–9
marine wildlife 81–3, 85 new populations discovered 117–18	Pseudemoia cryodoma see alpine bog skink
see also post-fire reconnaissance surveys	Pseudococcus markharveyi see Banksia montana mealybug
post-fire vulnerability assessments	Pseudomys
ecological communities 94–107	fumeus 218
iconic plant species 113–17	novaehollandiae 216, 407
'Potential Ecological Impact' (PEI) mapping 302	oralis 213, 407
Potorous	Pseudophryne
longipes 213, 216, 221, 232, 234, 320	corroboree 173, 177, 304
tridactylus 104, 320	pengilleyi 97, 167, 173, 177
tridactylus tridactylus 216, 293, 407	Psophodes
tridactylus trisulcatus 216	nigrogularis lashmari 201, 202, 206
powerful owl (Ninox strenua) 162	nigrogularis oberon 44
pre-existing monitoring, learning from 409-11	Pteropus poliocephalus see grey-headed flying-fox
pre-fire actions 123	Pterostylis metcalfei see Metcalfe's greenhood
pre-fire logging 255, 257–60	pygmy bluetongue lizard (Tiliqua adelaidensis) 183
pre-fire planning for conservation assets 377, 379–81,	pygmy cypress pine (Callitris oblonga) 409–10
387–8	Pygopodidae 185, 186
predator control programs 221–2, 234–5, 238, 309, 407	pyrocumulonimbus (pyroCb) storms 14
Preliminary Analysis Area (PAA) 131	Pythonidae 185, 186
fungal species within 132, 133–4	
invertebrates in 144, 145	Queensland
preparedness: pre-fire planning for conservation assets	extent of area burnt 300
377, 387–8 what didn't work 380–1	post-fire reconnaissance surveys 407
what worked 379–80	response to support biodiversity recovery 300–2
prescribed burning	quokka (Setonix brachyurus) 43, 103
and biodiversity 277–8, 279	andianthant 92 94
and carbon storage 278	radiant heat 83, 84 rainfall deciles, 2019 11
characteristics, impact and effects 273–81	rainforest cool-skink (<i>Harrisoniascincus zia</i>) 191
and climate change 278-9, 281	rainforests
effectiveness 394–5, 399	fire severity 16
how much of a problem is it? 279-80	see also Gondwana Rainforests of Australia World
knowledge gaps 280–1	Heritage Area; south-eastern rainforests; warm
recommendations 281	temperate rainforests in Victoria
risk-based strategy 274	rapid assessment of impacts of 2019–20 wildfires, on
what is it? 274-5	reptiles 187–8, 193
what we learnt from 2019-20 wildfires 278	rapid assessment of population fitness, frogs 178
and wildfire risk to property 275-6, 280	rapid flora assessments 365, 367

Rattus lutreolus see swamp rat	scar trees 24, 25
Raunkiaeran shortfall 421, 422	Scincidae 184, 185
recommendations 457–64	Scottsdale Reserve fire, NSW 317–18
list of 458–64	seagrass meadows 84
schematic diagram of 458	sediment removal 53
summary, from government inquiries 399–400	sediment slugs 86, 237
see also under specific topics, e.g. ex situ conservation	sedimentation
reconnaissance surveys see post-fire reconnaissance	effects on aquatic ecosystems 63, 64, 66–7, 237, 269
surveys	effects on marine ecosystems 85–6
red fox (Vulpes vulpes)	seed banks 358, 362, 365, 367–8
affect on native species pre- and post-fire 230–3	seed collecting 309, 365, 367
control programs 234–5	seed germination, fire-induced 53
red-browed treecreeper (Climacteris erythrops) 316	'seeders' 124, 261, 277
redclaw crayfish (<i>Cherax quadricarinatus</i>) 64	sequestrate fungi 130, 134
refuges used by frogs during wildfire 170, 174–6, 178	Sericornis citreogularis see yellow-throated scrubwren
Regenerate Australia 325	Setaria palmifolia see palm grass
regent honeyeater (Anthochaera phrygia) 201, 304, 316,	Setonix brachyurus see quokka
320	Siberian boreal forest fires of 2019 and 2020 17
regional recovery planning and implementation ('the	silver-headed antechinus (Antechinus argentus) 324
Regional Fund') 290	slender myoporum (Myoporum floribundum), new
co-design workshop investments 290-3	populations discovered 117–18, 423
multiregional species interventions and strategic	small crayfish (Euastacus spinichelatus) 73-4
investments 293–4	Sminthopsis griseoventer aitkeni see Kangaroo Island
planning tools used in workshops 291	dunnart
regional fire metrics and priority management themes	smoke from prescribed burns 276
292	smoke from wildfires
seven priority areas 290	as cause of algal bloom in South Pacific 87-8
reptiles	and sense of hopelessness 449
long-term monitoring 190, 192, 193	settling in estuarine and offshore waters 87-8
numbers present within 2019-20 wildlife impact areas	smoke inhalation 159, 160
159	by air-breathing marine animals 87
numbers rescued 351	by birds 83
population density estimates 158	by mammal species 218, 222
wildfire effects 182-93	smoky mouse (Pseudomys fumeus) 218
see also lizards; snakes; squamates	snakes 183, 185-6, 188, 190-1
rescued wildlife see wildlife welfare	snow gum (Eucalyptus pauciflora) 102
reseeding programs 124	social media, impacts on welfare of rescued wildlife 353-4
Reserve Values Protection Planning (RVPP) process,	socio-economic impacts 82–3
Tasmania 306–7	soil arthropods 54
resprouters 277	soil biological communities, fire effects 53–5, 56
Rhytididae snail 444	soil erosion 53, 55
Richmond mountain frog (Philoria richmondensis) 409	soil fungal communities, fire effects 130
riparian vegetation, impact of burning, radiant heat and	soil microbial communities 55
loss of shade 83	soil nitrogen 52, 53
Roccellinastrum flavescens 129	soil nutrients 52–3
rock art 24, 25–6, 27	soil organic carbon 52
rodents, introduced 229	soil organic matter 51, 52–3, 130
Royal Commission into National Natural Disaster	soil phosphorus 52–3
Arrangements (2020) 286, 287, 296, 392–4, 400–1, 468	soil surface 50–2
have the previous inquiries worked? 390–2	soil temperature 51
key findings 392–4, 463	soils and soil processes
number of inquiries and recurrent themes since 1927	chemical processes 52–3
390	conclusions and recommendations 55–6
runoff 53, 63, 84	fire consequences for biodiversity 53–5
	outflows: runoff and sediment 53
Salmo trutta (brown trout) see trout	physical processes 50–2
Saltuarius spp. 191	wildfire effects 49–56 Solanum
kateae 186-7, 188, 191	aviculare 106
'salvage logging' 255, 256, 260–2, 264, 265	chrysotrichum 339
sambar deer (<i>Cervus unicolor</i>) 229 'Sarsfield Snaps' post-fire photography project 452, 453	soot 25, 26
Saving our Species priority species program, NSW 302–4,	sooty owl (Tyto tenebricosa) 161
407, 409–10	South Australia
TU/, TU/=1U	oouth rustium

cultural burning

State Controller Wildlife 306

```
role in planning, management and research 427
                                                                 lowland subtropical rainforest 339
   see also Country; Indigenous headings
                                                                 post-fire in threatened ecological communities of the
transformer weeds 339
                                                                     Swan Coastal Plain 250
translocation 39, 73, 117, 147-8, 193, 251, 289, 309, 332,
                                                             weeping boobialla see slender myoporum
   360-2, 365, 367, 371, 384, 424
                                                             Werrikimbe KBA 42, 43
                                                             Western Australia
trapping 234
Trioza barrettae see plant louse
                                                                 extent of area burnt 300, 308
trout cod (Maccullochella macquariensis) 332
                                                                 response to support biodiversity recovery 308-9
trout (Oncorhynchus mykiss, Salmo trutta) 237, 238
                                                                 Stirling Range, wildfire effects 24, 96, 102-3, 116-17,
tuart (Eucalyptus gomphocephala) woodlands, Swan
                                                                     246-7,309
   Coastal Plain, weed invasion post-fire 250
                                                             Western Australian Seed Centre 309
                                                             western Bassian thrush (Zoothera lunulata halmaturina)
turtles 159, 183
two-spined blackfish (Gadopsis bispinosus) 62, 237, 304
                                                                 201, 202
Type I and II errors 423-4
                                                             western ground parrot (Pezoporus wallicus flaviventris)
Typhlopidae 185, 186
                                                                 199, 234, 309, 316, 407
                                                             western whipbird (Psophodes nigrogularis oberon) 44
Tvto
   novaehollandiae 162
                                                             white passionflower (Passiflora subpeltata) 339
   tenebricosa 161
                                                             wilderness areas, wildfire effects 37
                                                             wildfire recovery
Ulladulla to Merimbula KBA 43
                                                                 empowering Indigenous leadership and participation
unburnt species, tales of 120-1
                                                                 as long-term proposition and requires long-term
unburnt vegetation 16, 269
uncertainty and data deficiencies in biodiversity
                                                                     funding 464
   conservation decisions 417-27
                                                                 nature-led community recovery programs 372, 398,
   incorporating uncertainty to support decisions 425-7
                                                                 NRM regions prioritised for 330
   when does uncertainty matter? 423-5
                                                                 signs of hope 455-6
Uperoleia 176
                                                             wildfires
   mahonyi 171
   martini 162
                                                                 enhance capability to evaluate and mitigate severe fire
Upland Basalt Eucalypt Forests of the Sydney Basin
                                                                     risks and to suppress 459
   Bioregion 96
upland bogs in the Australian Capital Territory, wildfire
                                                                 impact on biodiversity 3
                                                                 risk to property from prescribed burning 275-6, 280
   effects 97-9
                                                                 see also 2019-20 wildfires
                                                             wildlife
Varanidae 185, 186
                                                                 conclusions and recommendations 163-4
Varanus rosenbergi see heath goanna
                                                                 media interests in effects of fires on 156-7
Varroa mite 235
                                                                 mortality rate estimates 157-60, 162-3
velvet gecko (Amalosia lesueurii) 191
                                                                 numbers affected by 2019-20 wildfires 154-64
vertebrate animals, number affected by 2019-20 wildfires
                                                                 population density estimates affected by fires 156,
   154-64, 323
                                                                     158 - 9
Victoria
                                                                 population loss, Victoria 160-2
   alpine ash and mountain ash forests 99-102, 124, 256,
                                                                 reductions in numbers since fires 160-3
                                                                 supplementary feeding 352-3, 359-60, 469
   biodiversity data collection in key vegetation types 412
                                                             Wildlife and Habitat Bushfire Recovery investment fund
   extent of area burnt 300, 305
                                                                 289, 333, 338
   inquiry into 2019-20 wildfires 389, 396-401, 468
                                                             Wildlife and Habitat Bushfire Recovery Taskforce (SA)
   post-fire reconnaissance surveys 406-7
   post-fire reductions in species persistence 160-2
                                                             wildlife recovery agency 371
   response to support biodiversity recovery 305-6
                                                             wildlife recovery fund 2, 285, 287-8, 295, 371
   warm temperate rainforests 105-7
                                                             wildlife refuges, identifying 320
Victorian Post Wildfire Indigenous Heritage Survey 432
                                                             Wildlife and Threatened Species Bushfire Recovery Expert
Vulpes vulpes see red fox
                                                                 Panel 287, 288-9, 293, 295, 296, 314, 315-16
                                                             wildlife welfare 221, 343-56
walking stick palm (Linospadix monostachyos) 339
                                                                 animal welfare-based decision making during 2019-20
Wallacean shortfall 420, 422
                                                                     wildfires 347-9, 350
warm temperate rainforests in Victoria 105-7
                                                                 appointment of Class 2 Controller - Wildlife, in
Warrumbungles National Park fires 52, 53, 54
                                                                     Victoria 398
water milfoil (Myriophyllum sp.) 62
                                                                 conclusions and recommendations 354-5
water quality
                                                                 and costs of veterinary and rehabilitation care 349
   freshwater environment, fire effects 63
                                                                 ethical considerations 352
   marine environment, fire effects 82
                                                                 Five Domains model 344, 346
weed invasion 244-5, 469
                                                                 and the human dimension 345
   control recommendations 251-2
                                                                 husbandry needs of wild animal patients 349
   following fire 243, 245, 249-50
```

media and social media impacts on welfare of rescued wildlife 353-4 prognostic thresholds, survivorship and euthanasia risk factors associated with wildfires 344-5, 346 species presented 349-51 and use of supplementary feeding 352-3, 359-60, 468 what is it? 343-4 Wollemi pine (Wollemia nobilis) active fire management 114 addressing the threats to 366-7, 374 assets that contributed to targeted protection 382 ex situ conservation 366 fire effects 114-15 protection 395 Wollemia nobilis see Wollemi pine Wollombi Valley 319, 320 woodlands, fire severity 17 World Heritage listings 34, 37 patterns of fire 45-6 wildfire effects 39-42

WWF-Australia 156, 157, 314, 323-6

Eyes on Recovery: camera trap partnership 411–12

Xylocopa aeratus see green carpenter bee

Yalgorup National Park, weed invasion post-fire 250 Yalmy galaxias 68, 269 yellow-bellied glider (Petaurus australis) 160, 161, 216-17, 293, 407 yellow-throated scrubwren (Sericornis citreogularis) 218

Yourka Reserve fire, far north Queensland 316-17 Zanda baudinii (Baudin's black-cockatoo) 43 latirostris (Carnaby's black-cockatoo) 43 Zephyrarchaea austini (Kangaroo Island assassin spider) 144, 445 robinsi 444 Zoo and Aquarium Association Australasia (ZAA) 363, zoos 358, 360, 361, 362, 363, 364 Zoothera lunulata halmaturina see western Bassian thrush