



# DETAILED DISCUSSION BY GROUP



# Chordates



## Mammalia (mammals)



Mammals are a quite well known group, however estimates for the numbers of described species still vary considerably, ranging from 4,300 in *Biodiversity: the UK Action Plan* (Anon. 1994), through 4,630 (Groombridge and Jenkins 2002), 5,416 (IUCN 2004), 5,419 (Wilson and Reeder 2005) to 5,487 (IUCN 2009a). For the purposes of this report, I have accepted the figure of 5,487 which accords well with the most recent figures from The IUCN Red List of Threatened Species although Hilton-Taylor (pers. comm.<sup>17</sup>) suggests that there are several additional recently described species. Although I can find no estimate of the total estimated

number of species of mammals, based on the recent rate of description of new species, I estimate that it would be a little over 5,500 species.

Australian mammal species are quite well known and thus the number of described species is relatively stable at 386 in 48 families and 150 genera (ABRS 2009a) although this number has increased by eight since the last edition. There are also 246 accepted subspecies. Estimates for the number of species yet to be described in Australia is <1%; however, as noted previously, molecular studies may lead to some further splitting. Mammal species are well known, and endemism in Australia was given as 83% in the previous report (calculated from Walton 1988). The percent endemism has been revised to 87% following recalculations based on new species described since 1988.

There are 78 listed threatened species in Australia along with 42 subspecies, forms or populations including four undescribed subspecies (DEWHA 2009a). Of these, 20 species and seven subspecies are listed as Extinct in the Wild, two species and two subspecies as Critically Endangered, 25 species, six subspecies, one form and one population as Endangered and 31 species, 19 subspecies, and six races, forms or populations as Vulnerable.

World Descr./ Accepted min.	World Descr./ Accepted max.	World Descr./ Accepted	World Estimated	Australia Descr./ Accepted	Australia Percent.	Australia Estimated	Australia Endemic	World Threatened <sup>18</sup>	Australian Threatened	Australian Threatened as percentage of World Threatened
4,300	5,487	5,487	~5,500	386	7.0%	~390	87%	1,141 (~20.8%)	78 (20.2%)	6.8%

<sup>17</sup> pers. comm. Craig Hilton-Taylor, Manager The IUCN Red List of Threatened Species, IUCN, September 2008.

<sup>18</sup> Plus another 1.4% which are regarded as Extinct in the Wild (The IUCN Red List of Threatened Species, 2009b).

## Aves (birds)



Birds are also a well known group, and the estimate of the number of described species appears quite stable, varying from as low as 9,000 (Tangley 1997), through 9,750 (Groombridge and Jenkins 2002), 9,875 (BirdLife International 2005), 9,917 (IUCN 2004), 9,946 (Gaston and Blackburn 1997) to 9,990 (IUCN 2009b). I have accepted the figure of 9,990 which is consistent with the most recent figures from BirdLife International (2008) and IUCN (2009b). Total number of species of birds on earth is estimated at around 10,000 (BirdLife International 2004, 2008), although if one accepts the figure of 9,990 already described, this figure would appear a little low.

Australian species of birds are quite well known and thus the number of described extant species is stable at around 828 (Christidis and Boles 2008). An additional 13 species are listed by Christidis and Boles as Extinct in the Wild, and 27 as introduced. Because bird species are so well known, the number of Australian endemic species is also well known at 45% (DEH 2007). I have accepted the species numbers

of Christidis and Boles as cited and accepted by Birds Australia (2009)<sup>19</sup>. ABRS (2009a) gives a figure of 869 which must include the Extinct and Introduced species. Including vagrants on the mainland and island territories, we arrive at a figure approaching 900 species (Boles pers. comm. 2009).

There are 50 listed threatened bird species in Australia, and 81 listed subspecies (including one undescribed) (DEWHA 2009a). Of these, nine species and 14 subspecies are listed as Extinct in the Wild, three species and three subspecies as Critically Endangered, 16 species and 25 subspecies as Endangered, and 22 species and 39 subspecies as Vulnerable. Due to a rearrangement of taxonomy, a number of previously listed species now appear as subspecies in accordance with the taxonomy of Christidis and Boles (2008).

World Descr./ Accepted min.	World Descr./ Accepted max.	World Descr./ Accepted	World Estimate	Australia Descr./ Accepted	Australia Percent.	Australia Estimate	Australia Endemic	World Threatened <sup>20</sup>	Australia Threatened	Australian Threatened as percentage of World Threatened
9,000	9,990	9,990	>10,000	828	8.3%	~900	45%	1,222 (~12.2%)	50 (6%)	4.1%

19 *Birds Australia Checklist* (Birds Australia 2009) is derived from Christidis and Boles (2008). [http://www.birdsaustralia.com.au/images/stories/birds/checklist2008\\_sm.pdf](http://www.birdsaustralia.com.au/images/stories/birds/checklist2008_sm.pdf) [Accessed 13 March 2009].

20 The IUCN Red List of Threatened Species (2009b).



## Reptilia (reptiles)

Reptiles are also quite a well known group, however the estimate of the number of described species varies considerably, ranging from 6,300 (Tangley 1997), through 8,002 (Groombridge and Jenkins 2002), 8,163 (IUCN 2004), 8,300 (EMBL Reptile Database<sup>21</sup>) to 8,734 (TIGR 2009). I have accepted the figure of 8,734 from the TIGR Reptile Database (TIGR 2009), the figure also accepted in The IUCN Red List of Threatened Species (IUCN 2009b). This is an increase of over 400 species since the previous report. The figures include 168 amphisbaenians, 5,079 lizards, 3,149 snakes, 313 turtles, 23 crocodiles and two tuataras.

The only estimate I have received of the total number of species is from the coordinator of the EMBL Reptile Database<sup>22</sup>. He stated that the number of new species described each year was fairly constant at around 70 per year, and estimated the total number of species at around 10,000.

The number of Australian reptile species has increased considerably in recent years and since the previous report, from 633 (DEH 2001) through 869 (DEH 2007) to 917 (ABRS 2009a). This is an increase of 48 species since 2006. ABRS (2009a) also lists 189 described subspecies. Estimates for the number of species yet to be described in Australia is around 3.5% which takes the estimated number of species to around 950. Reptile species are well known and endemism is high, reported by Healey (2001) as round 89%. This figure is here revised to 93%.

There are 46 species and seven subspecies listed as threatened in Australia (DEWHA 2009a). The list includes two species listed as Critically Endangered, 11 species and three subspecies as Endangered and 33 species and four subspecies as Vulnerable.



World Descr./ Accepted min.	World Descr./ Accepted max	World Descr./ Accepted	World Estimate	Australia Descr./ Accepted	Australia Percent.	Australia Estimate	Australia Endemic	World Threatened <sup>23</sup>	Australia Threatened	Australian Threatened as percentage of World Threatened
6,300	8,734	8,734	~10,000	917	10.5%	~950	93%	423 (4.8%)	46 (5.0%)	10.9%

21 *EMBL Reptile Database* (Aug. 2005)—<http://www.embl-heidelberg.de/~uetz/>. [NB This link is no longer operating and is replaced by the *TIGR Reptile Database*, (TIGR 2009)].

22 pers. comm. Peter Uertz, Coordinator, *EMBL Reptile Database*, Aug. 2005.

23 The IUCN Red List of Threatened Species (2009b).

## Amphibia (frogs, etc)



Amphibia are also quite a well known group, however the number of undescribed species is quite large with more being discovered every year. The estimate of the number of described species varies from 4,950 (Groombridge and Jenkins 2002) through 5,743 (Frost 2004), 5,802 (*AmphibiaWeb* 2005), 6,347 (IUCN 2009b) to 6,515 (*AmphibiaWeb* 2009). I have accepted the figure of 6,515 which is consistent with the most recent figures from *AmphibiaWeb* which maintains an up-to-date estimate. A recent paper by Alain Dubois in the journal *Alytes* predicts that there will be about 15,000 species of Amphibia in total (Wake pers. comm.<sup>24</sup>). Recent molecular work has shown considerable divergences between populations of 'species' (Wells pers. comm.<sup>25</sup>) and thus new species are likely to be split off in the future resulting in further increases in numbers both nationally and globally.

Australian amphibian species are quite well known and thus the number of described species is stable at around 227—an increase of just 8 species since the previous report (Doughty

pers. comm.<sup>26</sup>). The estimate for the number of species yet to be described in Australia is around 1.5% (DEH 2007) which takes the estimated number of species to around 230. Amphibia are very well known and endemism is extremely high, given by as around 93% by Wong (1999) and DEH (2007). This figure is here revised to 94%.

There are 31 threatened species and one subspecies listed in Australia (DEWHA 2009a). Of these four are listed as Extinct, two Critically Endangered, 14 Endangered and 11 species and one subspecies as Vulnerable.

World Descr./ Accepted min.	World Descr./ Accepted max.	World Descr./ Accepted	World Estimate	Australia Descr./ Accepted	Australia Percent.	Australia Estimate	Australia Endemic	World Threatened <sup>27</sup>	Australia Threatened	Australian Threatened as percentage of World Threatened
4,950	6,515	6,515	~15,000	227	3.5%	~230	94%	1,905 (~29.2%)	31 (13.7%)	1.6%

<sup>24</sup> pers. comm. David B. Wake, University of California, Berkeley, May 2009.

<sup>25</sup> pers. comm. Alice Wells, Australian Biological Resources Study, Canberra, July 2009.

<sup>26</sup> pers. comm. Paul Doughty, Western Australian Museum, March 2009.

<sup>27</sup> The IUCN Red List of Threatened Species (2009b).



## Pisces (fishes including Chondrichthyes and Osteichthyes<sup>28</sup>)

Fish are a less well known group, and the estimate of the number of described species has varied considerably over time, ranging from 25,000 (Groombridge and Jenkins 2002), through 28,900 (*FishBase* 2005) up to the present estimate of 31,153 (*FishBase* 2009 based on Eschmeyer and Fricke 2009). I have accepted the figure of 31,153 which is consistent with the most recent figures from *FishBase* as of March 2009. Eschmeyer (pers. comm.<sup>29</sup>) estimated that in 2005 there were probably around 35,000 species in total but in 2009<sup>30</sup> he stated that over 400 species are currently published every year (Eschmeyer and Frong 2009) and that the total number of species would be close to 32,000. He estimated that there were probably around 40,000 species in total.

Australian species of fish are also reasonably well known, however the number of described species continues to climb, from 4,450–4,500 listed in the previous report (Chapman 2006) to 4,597 (Hoese *et al.* 2005, 2006) and recently to

4,696 with a further 200 species known but as yet unnamed, and this does not include some of the island territories such as Norfolk, Christmas and Cocos/Keeling which would add another approximately 300 species. The rate of growth over the past 40 years is around 50 species a year (Hoese pers. comm.<sup>31</sup>). The number of known species is therefore well over 4,900 and sure to be well above 5,000 before long. Estimates for the number of species yet to be described in Australia is around 15% which takes the estimated number of species to around 5,750.

Endemism in Australia is estimated to be 24% (Hoese *et al.* 2006). Approximately 47% of southern Australia's fishes are endemic to the region. In freshwater fishes endemism is high, given as 61% by Hoese *et al.* (2006). For all fishes in Australia these authors list 4,107 marine, 443 estuarine and 258 freshwater species.



There are 41 listed threatened fish species in Australia (three of which are undescribed). Two listed subspecies and two populations are also listed (DEWHA 2009a). One species is listed as Extinct in the Wild, one Critically Endangered, 17 Endangered, and 24 Vulnerable.

World Descr./ Accepted min.	World Descr./ Accepted max.	World Descr./ Accepted	World Estimate	Australia Descr./ Accepted	Australia Percent.	Australia Estimate	Australia Endemic	World Threatened <sup>32</sup>	Australia Threatened	Australian Threatened as percentage of World Threatened
25,000	31,153	31,153	~40,000	~5,000	16.0%	~5,750	24%	1,275 (4.1%)	41 (0.8%)	3.2%

28 Encompasses Superclass Pisces as used by ABRS (Hoese *et al.* 2007), and includes a range of paraphyletic groups as recognised by others.

29 pers. comm. Bill Eschmeyer, Catalogue of Fishes, California Academy of Sciences, August 2005.

30 pers. comm. Bill Eschmeyer, Catalogue of Fishes, California Academy of Sciences, May 2009.

31 pers. comm. Doug Hoese, Australian Museum, Sydney, March 2009.

32 The IUCN Red List of Threatened Species (2009b).

## Agnatha (hagfish, lampreys, slime eels)

*FishBase* (2009) lists 74 species of hagfish and 42 species of lamprey for the world. Hickman and Roberts (1994) gave a figure of 70 species for the combined groups. I have accepted the figure of 116 described species as cited by *FishBase*.

ABRS (ABRS 2009a) lists five Australian species in three genera with about another five species undescribed. Of the five species listed for Australia in *FishBase*, three are endemic to Australian waters and one other occurs only in Australian and New Zealand waters.

There are no species listed as threatened in Australia (DEWHA 2009a).

World Descr./ Accepted min.	World Descr./ Accepted max.	World Descr./ Accepted	World Estimate	Australia Descr./ Accepted	Australia Percent.	Australia Estimate	Australia Endemic	World Threatened <sup>33</sup>	Australia Threatened	Australian Threatened as percentage of World Threatened
70	116	116	unknown	5	4.3%	~10	60%	0	0	–

33 The IUCN Red List of Threatened Species (2009b).



## Cephalochordata (lancelets)

Very little information could be found on these animals. Three estimates were found, however, for the number of described species worldwide: 20 (McCauley n.dat.), 23 (Groombridge and Jenkins 2002) and 36 species (Ponder *et al.* 2002). The *Catalogue of Life* 2009 Checklist (Bisby *et al.* 2009) lists 33 accepted and one provisionally accepted species. I have accepted this figure.

ABRS (ABRS 2009a) lists eight Australian species in two genera, with about four being endemic (Richardson 1998).

There are no species listed as threatened in Australia (DEWHA 2009a).

World Descr./ Accepted min.	World Descr./ Accepted max.	World Descr./ Accepted	World Estimate	Australia Descr./ Accepted	Australia Percent.	Australia Estimate	Australia Endemic	World Threatened <sup>34</sup>	Australia Threatened	Australian Threatened as percentage of World Threatened
20	36	33	unknown	8	24.2%	~8	50%	0	0	–

34 The IUCN Red List of Threatened Species (2009b).

## Tunicata or Urochordata (sea squirts, doliolids, salps)

Estimates of the number of described tunicates in the world vary, with figures of 1,400–2,000 (Groombridge and Jenkins 2002), 2,000 (Hickman *et al.* 2004), 3,000 (Brusca and Brusca 2003), and 4,900 for Ascideacea alone (Bouchet 2006). Sanamyan (*pers. comm.*<sup>35</sup>) states that there are 2,590 ( $\pm 20$ ) described species of ascidian. In addition there are about 100 species of Thaliacea (Kott 2005) and 70 species of Appendicularia<sup>36</sup> making a total for the Subphylum of about 2,760 species.

The previous report listed 754 species for Australia (Chapman 2006). In 2006, this figure was updated to 757 (Kott 2006). About 50% of the Australian species are thought to be endemic.

There are no species listed as threatened in Australia (DEWHA 2009a).

World Descr./ Accepted min.	World Descr./ Accepted max.	World Descr./ Accepted	World Estimate	Australia Descr./ Accepted	Australia Percent.	Australia Estimate	Australia Endemic	World Threatened <sup>37</sup>	Australia Threatened	Australian Threatened as percentage of World Threatened
~1,400	>5,000	2,760	unknown	757	27.4%	~850	50%	–	0	–

<sup>35</sup> *pers. comm.* Karen Sanamyan, Kamchatka Branch of Pacific Institute of Geography, May 2009.

<sup>36</sup> MEER Database <http://www.meer.org/M20.htm> [Accessed 30 June 2009].

<sup>37</sup> The IUCN Red List of Threatened Species (2009b).

