Supporting Information for Frontiers of Biogeography

The Paradox of Anthropogenic Enrichment: Homogenization and Downsizing of Insular Mammals

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Table S1

Title. Species lists of 37 oceanic islands and Madagascar with occurrence data.

Legenda: b= species extinct before hominids ('natural extinctions'); ae= species extinct after early hominid arrival; as = species extinct after Homo sapiens arrival; p = native species present today; i = introduced species. Single-island endemic species are noted in bold.

Note regarding the use of palaeontological data

This study relies mostly on palaeontological data, supplemented with molecular data from extant species. The fossil record is inevitably incomplete due to reasons of taphonomy and population dynamics. However, factors like 1) having hard parts (teeth, skeletons), 2) high population numbers and 3) the presence suitable sediments (e.g., cave sediments, river valleys, marshes) increase the preservation changes dramatically. Regarding the first factor, all mammals meet this requirement. As to the second factor, for most island endemic species and study islands, this is the case. Due to higher population numbers of the few species on any oceanic island, the fossil record of mammal species on islands is more complete than that on the continents. Regarding the third factor, islands without such sediments were necessarily excluded from our analysis. Taken all three together, the sufficient completeness of the insular fossil record is confirmed by our estimates of changes in species numbers and endemicity, which are globally consistent over 37 islands. Instead, if the fossil record would have been less complete, this would likely have systematically biased the estimates towards well-studied systems. Furthermore, although fossils of small mammal species are easier overlooked because of their size, their remains are accumulated in vast amounts by birds of prey such as owls beneath their roosting sites in caves. Thus, if a preservation bias on body size would have been present in our dataset, this would have been directed towards missing out on larger species rather than smaller species, so our estimate of downsizing nature remains conservative. From a methodological viewpoint, missing species irrespective their size would only lower the total number of extinctions and should be equally distributed over the stages (pre-hominid, after early hominid, and after modern hominid arrival) without change in the distinctiveness between the stages.

Wallacea

Species	Flores	Luzon	Mindanao	Mindoro	Negros	Timor
Batomys cagayanensis		ae				
Bubalus sp.		ae				
Celebochoerus cagayanensis		ae				
Elephas beyeri		ae				
Nesorhinos philippinensis		ae				
Stegodon florensis insularis	ae					
Stegodon luzonensis		ae				
Stegodon mindanensis			ae			
Bubalus cebuensis					as	
Carpomys dakal		as				
Coryphomys buehleri						as
Coryphomys musseri						as
Crateromys ballik		as				
Crateromys heaneyi					as	
Crocidura panayensis					as	
Mahoney's genus A						as
Mahoney's genus B						as
Muridae genus C						as
Papagomys theodorverhoeveni						as
Spelaeomys florensis						as
Homo luzonensis		as				
Abditomys latidens		p				
Apomys abrae		p				
Apomys aurorae		p				
Apomys banahao		p				
Apomys brownorum		p				
Apomys datae		p				
Apomys gracilirostris				p		
Apomys hylocoetes			p			
Apomys insignis			p			
Apomys iridensis		p				
Apomys littoralis			p			
Apomys magnus		p				
Apomys microdon		p				
Apomys minganensis		p				
Apomys musculus		p		p		
Apomys sacobianus		p				
Apomys sierrae		p				
Apomys zambalensis		p				
Archboldomys kalinga		p				
Archboldomys luzonensis		p				
Archboldomys maximus		p				
Archboldomys musseri		p				
Batomys dentatus		p				
Batomys granti		p				
Batomys hamiguitan			p			
Batomys salomonseni			p			
Batomys uragon		p				
Bubalus mindorensis				p		
Bullimus bagobus			p			
Bullimus luzonicus		p				
Carlito syrichta			p			

Carpomys melanurus		p				
Carpomys phaeurus		p				
Chrotomys gonzalesi		p				
Chrotomys mindorensis		p		p		
Chrotomys silaceus		p				
Chrotomys whiteheadi		p				
Crateromys schadenbergi		p				
Crocidura beatus			p			
Crocidura grandis			p			
Crocidura grayi		p		p		
Crocidura negrina					p	
Crocidura tenuis						p
Crunomys fallax		p				
Crunomys melanius			p			
Crunomys suncoides			p			
Cynocephalus volans			p			
Exilisciurus concinnus			p			
Komodomys rintjanus	p					
Limnomys bryophilus			p			
Limnomys sibuanus			p			
Musseromys anacuao		p				
Musseromys beneficus		p				
Musseromys gulantang		p				
Musseromys inopinatus		p				
Papagomys armandvillei	p					
Paulamys naso	p					
Petinomys crinitus			p			
Phloemys cumingi		p				
Phloemys pallidus		p				
Podogymnura truei			p			
Rattus everetti		p	p	p	p	
Rattus hainaldi	p					
Rattus timorensis						p
Rhynchomys banahao		p				
Rhynchomys isarogensis		p				
Rhynchomus soricoides		p				
Rhynchomys tapulao		p				
Rusa alfredi					p	
Rusa marianna		p	p	p		
Soricomys kalinga		p				
Soricomys leonardoccoi		p				
Soricomys montanus		p				
Soricomys musseri		p				
Suncus mertensi	p					
Sundasciurus philippinensis			p			
Sus cebifrons					p	
Sus oliveri				p		
Sus philippensis		p	p			
Tarsomys apoensis			p			
Tarsomys echinatus			p			
Tryphomys adjustus		p				
Urogale everetti			p			
Callosciurus finlaysoni		i				
Crocidura maxi	i					i

Hystrix javanica	i					
Macaca fascicularis	i	i	i	i	i	i
Mus caroli	i					
Mus musculus	i	i				i
Paradoxurus hermaphroditus	i	i	i	i	i	i
Phalanger orientalis						i
Prionailurus bengalensis rabori					i	
Rattus argentiventer	i	i	i	i		i
Rattus exulans	i	i	i	i	i	i
Rattus nitidus		i				
Rattus norvegicus		i	i	i	i	
Rattus rattus/tanezumi	i	i	i	i	i	i
Rusa timorensis	i					i
Suncus murinus		i	i	i	i	i
Sus celebensis	i					i
Sus scrofa	i					i
Viverra tangalunga		i	i	i	i	

Note

Negros includes Panay in LP

Macronesia

Species	Fuerteventura	Gran Canaria	Tenerife
Malpaisomys insularis	as		
Canariomys tamarani		as	
Crocidura canariensis	p		
Atelerix algirus	i		i
Atlantoxerus getulus	i		
Capra aegagrus	i	i	
Capra hircus	i	i	
Cuniculus oryctolagus	i	i	i
Felis catus			i
Mus musculus	i	i	i
Ovis orientalis			i
Rattus norvegicus	i	i	i
Rattus rattus	i	i	i
Suncus etruscus			i

Note

The separate islands of Lanzarote and Fuerteventura were joined together as recently as the late Pleistocene; this large, former island is called Mahan in Fernández-Palacios et al. 2011 in JoB

Pacific isolates

	Galápagos		Central Ryukyu Islands				Channel Islands
Species	Isabela	Santa Cruz	Amami	Kume	Okinawa	Tokuno	Santa Rosae
***Megaroyzomys* sp. 1**	b						
***Nesoryzomys* sp. 2**	b						
***Nesoryzomys* sp. 3**	b						
Megaoryzomys curioi		as					
Nesoryzomys darwini		as					
Nesoryzomys indefessus		as					
Cervus astylodon					as	as	
***Muntiacus* new sp.**					as		
Mammuthus exilis							as
Peromyscus nesodytes							as
Microtus miguelensis							as
Sorex ornatus							as
Crocidura orii			p			p	
Crocidura watasei			p		p		
Diplothrix legata			p		p	p	
Pentalagus furnessi			p			p	
Tokudaia muennincki					p		
Tokudaia osimensis			p				
Tokudaia tokunoshimensis						p	
Urocyon littoralis							p
Capra hircus	i	i					
Cervus elaphus							i
Cervus nippon keramae					i		
Felis catus						i	
Herpestes javanicus			i		i		
Mus caroli					i		
Mus musculus	i	i	i	i	i	i	
Mustela itatsi			i		i		
Odocoileus hemionus							i
Peromyscus maniculatus							i
Rattus rattus	i	i	i	i	i	i	
Rattus norvegicus		i		i	i		
Reithrodontomys megalotis							i
Spilogale gracilis							i
Suncus murinus riukiuanus			i	i	i	i	
Sus scrofa	i	i	i		i	i	i

Notes

Alternative names / spelling: Isabela =Albemarle, Santa Cruz =Indefatigable, Amami =Amamioshima, Kume =Kumejima, Okinawa = Okinawajima, Tokuno = Tokunoshima

Ie and Kume were connected to Okinawa during the Pleistocene, hence their shared species.

Santa Rosae included (until Holocene) Santa Cruz and San Miguel

Sorex ornatus went extinct in the historical period

wild swine on Santa Rosa: Von Bloeker 1965; archaeological deposits Ryukyu Islands

Kerama Islands are part of Okinawa in LP and LGM

Maeda et al. 2019: free-ranging cats on Tokunoshima

Introduced species for Ryukyu are from the database NIES Invasive Species of Japan, https://www.nies.go.jp/biodiversity/invasive/index_en.html

Mediterranean Islands

Species	Crete	Cyprus	Karpathos	Majorca (=Mallorca)	Naxos	Sardinia	Sicily	Tilos
Algarolutra majori						b		
Enhydrictis galictoides						b		
Megalenhydris barbaricina						b		
Palaeoloxodon aff. creutzburgi			b					
Candiacervus cerigensis			b					
Candiacervus pigadiensis			b					
Sardolutra ichnusae						b		
Candiacervus cretensis	ae							
Candiacervus devosi	ae							
Candiacervus dorothensis	ae							
Candiacervus listeri	ae							
Candiacervus major	ae							
Candiacervus rethymnensis	ae							
Candiacervus reumeri	ae							
Candiacervus ropalophorus	ae							
Crocidura sp.					ae			
Lutrogale cretensis	ae							
Mammuthus lamarmorae						ae		
Palaeoloxodon creutzburgi	ae							
Palaeoloxodon lomolinoi					ae			
Asoriculus corsicanus						as		
Asoriculus similis						as		
Cynotherium sardous						as		
Genetta plesictoides		as						
Hippopotamus minor		as						
Microtus henseli						as		
Mus minotaurus	as							
Palaeoloxodon tiliensis								as
Praemegaceros cazioti						as		
Prolagus sardus						as		
Rhagamys orthodon						as		
Bos primigenius siciliae							as	
Cervus elaphus siciliae							as	
Equus hydruntinus							as	
Sus scrofa (native, extinction, followed by Neolithic introduction)							as	
Canis lupus cristaldii							as	
Apodemus mystacinus					p			
Apodemus sylvaticus dichrurus							p	
Crocidura sicula							p	
Crocidura zimmermanni	p							
Erinaceus europaeus consolei							p	
Felis silvestris							p	
Glis glis							p	
Lepus corsicanus							p	
Martes martes							p	
Microtus savii nebrodensis							p	
Mus cypriacus		p						
Muscardinus avellanarius							p	
Mustela nivalis							p	
Suncus etruscus							p	
Vulpes vulpes							p	
Acomys cahirinus	i	i						
Apodemus mystacinus rhodius	i		i					i
Apodemus sylvaticus	i			i		i		
Atelerix algirus				**i**				
Capra aegagrus	i	i		i				
Cervus elaphus						**i**		
Crocidura leucodon			**i**					
Crocidura pachyura						**i**		
Crocidura suaveolens	i	i			i			i
Eliomys quercinus	i			i		i		
Erinaceus europaeus						**i**		
Erinaceus roumanicus	i		i		i			i
Felis sylvestris	i					i		
Genetta genetta				**i**				
Glis glis	i					i		

Hemiechinus auritus		**i**						
Hystrix cristata							**i**	
Lepus capensis						**i**		
Lepus europaeus	i	i	i		i			
Lepus granatensis				**i**				
Martes foina	i		i		i			
Martes martes				i		i		
Meles meles	**i**							
Mus musculus	i	i	i	i	i	i	i	i
Mus spretus				**i**				
Mustela nivalis	i			i		i		
Mustela putorius						**i**		
Oryctolagus cuniculus	i		i	i		i	i	
Ovis orientalis		i				i		
Rattus norvegicus	i			i		i	i	
Rattus rattus	i	i	i	i	i	i	i	i
Suncus etruscus	i					i		
Sus scrofa	i	i				i	i	
Vulpes vulpes	i	i				i		

Caribbean Archipelago

Species	Anguilla	Antigua	Barbados	Bonaire	Cuba	Curaçao	Hispaniola	Jamaica	Martinique	Puerto Rico	Saint Kitts	Saint Lucia	Saint Vincent
Acratocnus ye							b						
Clidomys osborni								b					
Parocnus serus							b						
Xaymaca fulvopulvis								b					
Antillothrix bernensis							as						
Boromys offella					as								
Boromys torrei					as								
Brotomys contractus							as						
Brotomys voratus							as						
Elasmodontomys obliquus										as			
Geocapromys columbianus					as								
Geocapromys pleistocenicus					as								
Heteropsomys insulans										as			
Hexolobodon phenax							as						
Hexolobodon sp.							as						
Isolobodon montanus							as						
Isolobodon portoricensis							as			as			
Megalocnus rodens					as								
Megalomys desmarestii									as				
Megalomys luciae												as	
Megalomys sp. 2	as												
Nesophontes edithae										as			
Nesophontes hypomicrus							as						
Nesophontes micrus					as								
Nesophontes paramicrus							as						
Nesophontes zamicrus							as						
Oligoryzomys victus													as
Oryzomys antillarum								as					
Oryzomys curasoae						as							
Oryzomys georginae			as										
Antillomys rayi		as											
Parocnus browni					as								
Pennatomys nivalis											as		
Plagiodontia ipnaeum							as						
Quemisia gravis							as						
Rhizoplagiodontia lemkei							as						
Solenodon marcanoi							as						
Xenothrix mcgregori								as					
Acratocnus antillensis					as								
Acratocnus odontrigonus										as			
Capromys latus					as								
Insulacebus toussaintiana							as						
Megalomys audreyae		as											
Mesocapromys barbouri					as								
Mesocapromys beatrizae					as								
Mesocapromys gracilis					as								
Mesocapromys kraglievichi					as								
Mesocapromys minimus					as								
Neocnus comes							as						
Neocnus dousman							as						
Neocnus gliriformis					as								
Neocnus major					as								
Neocnus toupiti							as						
Nesophontes major					as								
Paralouatta varonai					as								
Plagiodontia spelaeum							as						
Puertoricomys corozalus										as			
Solenodon arredondoi					as								
Tainiotherium valei										as			
Capromys pilorides					p								
Geocapromys brownii								p					
Isolobodon portoricensis							p			p			
Mesocapromys nanus					p								
Mysateles melanurus					p								
Mysateles prehensilis					p								
Plagiodontia aedium							p						
Solenodon cubanus					p								
Solenodon paradoxus							p						
Bos taurus							i						
Capra hircus	i			i		i	i						
Cercopithecus aethiops			i								i		
Cuniculus paca					i								
Dasyprocta leporina		i	i						i		i	i	i
Dasyprocta mexicana					i								
Dasyprocta punctata					i								
Didelphis marsupialis									i			i	i
Felis catus	i						i						i
Herpestes javanicus		i	i		i		i	i	i	i	i	i	i

Lepus europaeus			i									
Macaca mulatta										i		
Mus musculus	i	i		i	i	i	i	i	i	i	i	i
Odocoileus virginianus					i	i						
Oryctolagus cuniculus					i		i	i				
Procyon lotor									i			
Rattus norvegicus	i	i	i		i	i	i	i	i	i		
Rattus rattus	i	i	i	i	i	i	i	i	i	i	i	i
Saimiri sciureus										i		
Sus scrofa					i		i	i		i		
Pecari tajacu=Tayassu tajacu					i							
Tayassu tajacu					i							

Note

No extinctions recorded for the Caribbean in earliest period = 'after early hominids' because these islands were not colonized by early hominids.

Species	Madagascar
Archaeolemur edwardsi	b
Megaladapis grandidieri	b
Megaladapis madagascariensis	b
Archaeoindris fontoynontii	as
Archaeolemur majori	as
Babakotia radofilai	as
Brachytarsomys mahajambaensis	as
Cryptoprocta spelea	as
Daubentonia robusta	as
Hadropithecus stenognathus	as
Hippopotamus lemerlei	as
Hippopotamus madagascariensis	as
Hypogeomys australis	as
Megaladapis edwardsi	as
Mesopropithecus dolichobrachion	as
Mesopropithecus globiceps	as
Mesopropithecus pithecoides	as
Microgale macpheei	as
Nesomys narindaensis	as
Pachylemur insignis	as
Pachylemur jullyi	as
Palaeopropithecus ingens	as
Palaeopropithecus kelyus	as
Palaeopropithecus maximus	as
Plesiorycteropus germainepetterae	as
Plesiorycteropus madagascariensis	as
Allocebus trichotis	p
Avahi betsileo	p
Avahi cleesei	p
Avahi laniger	p
Avahi meridionalis	p
Avahi mooreorum	p
Avahi occidentalis	p
Avahi peyrierasi	p
Avahi ramanantsoavanai	p
Avahi unicolor	p
Brachytarsomys albicauda	p
Brachytarsomys villosa	p
Brachyuromys betsileoensis	p
Brachyuromys ramirohitra	p
Cheirogaleus andysabini	p
Cheirogaleus crossleyi	p
Cheirogaleus grovesi	p
Cheirogaleus lavasoensis	p
Cheirogaleus major	p
Cheirogaleus medius	p
Cheirogaleus minusculus	p
Cheirogaleus shethi	p
Cheirogaleus sibreei	p
Cheirogaleus thomasi	p
Cryptoprocta ferox	p

Daubentonia madagascariensis	p
Echinops telfairi	p
Eliurus antsingy	p
Eliurus carletoni	p
Eliurus danieli	p
Eliurus ellermani	p
Eliurus grandidieri	p
Eliurus majori	p
Eliurus minor	p
Eliurus myoxinus	p
Eliurus penicillatus	p
Eliurus petteri	p
Eliurus tanala	p
Eliurus tsingimbato	p
Eliurus webbi	p
Eulemur albifrons	p
Eulemur cinereiceps	p
Eulemur collaris	p
Eulemur coronatus	p
Eulemur flavifrons	p
Eulemur fulvus	p
Eulemur macaco	p
Eulemur mongoz	p
Eulemur rubriventer	p
Eulemur rufifrons	p
Eulemur rufus	p
Eulemur sanfordi	p
Eupleres goudotii	p
Fossa fossana	p
Galidia elegans	p
Galidictis fasciata	p
Geogale aurita	p
Gymnuromys roberti	p
Hapalemur alaotrensis	p
Hapalemur aureus	p
Hapalemur griseus	p
Hapalemur meridionalis	p
Hapalemur occidentalis	p
Hemicentetes nigriceps	p
Hemicentetes semispinosus	p
Hypogeomys antimena	p
Indri indri	p
Lemur catta	p
Lepilemur aeeclis	p
Lepilemur ahmansonorum	p
Lepilemur ankaranensis	p
Lepilemur betsileo	p
Lepilemur dorsalis	p
Lepilemur edwardsi	p
Lepilemur fleuretae	p
Lepilemur grewcockorum	p
Lepilemur hollandorum	p

Lepilemur hubbardorum	p
Lepilemur jamesorum	p
Lepilemur leucopus	p
Lepilemur microdon	p
Lepilemur milanoii	p
Lepilemur mittermeieri	p
Lepilemur mustelinus	p
Lepilemur otto	p
Lepilemur petteri	p
Lepilemur randrianasoloi	p
Lepilemur ruficaudatus	p
Lepilemur sahamalazensis	p
Lepilemur scottorum	p
Lepilemur seali	p
Lepilemur septentrionalis	p
Lepilemur tymerlachsonorum	p
Lepilemur wrightae	p
Macrotarsomys bastardi	p
Macrotarsomys ingens	p
Macrotarsomys petteri	p
Microcebus arnholdi	p
Microcebus berthae	p
Microcebus bongolavensis	p
Microcebus boraha	p
Microcebus danfossi	p
Microcebus ganzhorni	p
Microcebus gerpi	p
Microcebus griseorufus	p
Microcebus jollyae	p
Microcebus jonahi	p
Microcebus lehilahytsara	p
Microcebus macarthurii	p
Microcebus mamiratra	p
Microcebus manitatra	p
Microcebus margotmarshae	p
Microcebus marohita	p
Microcebus mittermeieri	p
Microcebus murinus	p
Microcebus myoxinus	p
Microcebus ravelobensis	p
Microcebus rufus	p
Microcebus sambiranensis	p
Microcebus simmonsi	p
Microcebus tanosi	p
Microcebus tavaratra	p
Microgale brevicaudata	p
Microgale cowani	p
Microgale drouhardi	p
Microgale dryas	p
Microgale fotsifotsy	p
Microgale gracilis	p
Microgale grandidieri	p

Microgale gymnorhyncha	p
Microgale jenkinsae	p
Microgale jobihely	p
Microgale longicaudata	p
Microgale majori	p
Microgale mergulus	p
Microgale monticola	p
Microgale nasoloi	p
Microgale parvula	p
Microgale principula	p
Microgale pusilla	p
Microgale soricoides	p
Microgale taiva	p
Microgale thomasi	p
Mirza coquereli	p
Mirza zaza	p
Monticolomys koopmani	p
Mungotictis decemlineata	p
Nesogale dobsoni	p
Nesogale talazaci	p
Nesomys audeberti	p
Nesomys lambertoni	p
Nesomys rufus	p
Oryzorictes hova	p
Oryzorictes tetradactylus	p
Phaner electromontis	p
Phaner furcifer	p
Phaner pallescens	p
Phaner parienti	p
Prolemur simus	p
Propithecus candidus	p
Propithecus coquereli	p
Propithecus coronatus	p
Propithecus deckenii	p
Propithecus diadema	p
Propithecus edwardsi	p
Propithecus perrieri	p
Propithecus tattersalli	p
Propithecus verreauxi	p
Salanoia concolor	p
Setifer setosus	p
Tenrec ecaudatus	p
Varecia rubra	p
Varecia variegata	p
Voalavo antsahabensis	p
Voalavo gymnocaudus	p
Felis silvestris	i
Mus musculus gentilulus	i
Potamochoerus larvatus	i
Rattus norvegicus	i
Rattus rattus	i
Suncus etruscus	i

Suncus murinus	i
Viverricula indica	i

Note

Synonym for Suncus etruscus is Suncus madagascariensis