Dispersal and speciation of skinks among archipelagos in the tropical Pacific Ocean

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Summary

We examined the potential effects of geography on the distribution and speciation of skinks on tropical Pacific archipelagos. The entire tropical Pacific skink fauna was divided into continental (found also in continental areas), Pacific (endemic to the study area but found within more than one archipelago) and endemic (found within only one archipelago) species categories. The number and proportion of skinks within each species category were determined for each of the 27 archipelagos in the study area. Nine geographic variables reflecting archipelago size, isolation and elevation were estimated for each archipelago. Principal components analysis was used to reduce the nine variables to three uncorrelated composite variables that were interpreted as representing archipelago size, isolation and elevation. Numbers and proportions of skinks in each category within an archipelago were related to the composite geographic variables using multiple linear regression analysis. Archipelago size and isolation were important predictors of both skink diversity and endemism. Results were then compared to diversity and endemism of birds within the study area. Skinks showed an archipelago-wide level of endemism similar to that of birds. On an archipelago by archipelago basis, however, large differences between birds and skinks were evident. In particular, the New Caledonia skink fauna was much more endemic than that of birds. The bird faunas of Hawaii and the Marquesas were nearly completely endemic, while no endemic skinks occurred in these two archipelagos. These differences presumably reflect the relative dispersal powers of skinks and birds and, consequently, rates of colonization and speciation. Differences may also be due partly to morphological conservatism among isolated skink populations and the occurrence of cryptic species that have not yet been identified as separate species. The discovery of such cryptic species, however, is unlikely to increase the endemic skink fauna of Hawaii and other distant archipelagos to a level commensurate with that of birds. Differences in endemism between skinks and birds may also be due to unknown local ecological interactions.

Keywords: archipelagos; endemism; islands; skinks; speciation; species diversity; Pacific Ocean

Introduction

The vagility of organisms influences not only their ability to colonize remote areas but also their rate of evolution following successful colonization. Animals with poor dispersal powers are expected to have low rates of gene flow and, consequently, higher rates of speciation in populations far removed from other populations, such as on islands. Geographic features of islands are often correlated not only with species diversity but also with the level of endemism in island faunas (e.g. Mayr, 1965; Diamond, 1980; Williamson, 1981; Adler, 1992, 1994; Adler and Dudley, 1994). For instance, Mayr (1965) showed that higher rates of endemism are generally seen on remote islands (presumably due to reduced gene flow) and on large islands (presumably due to low extinction rates and greater population lifetimes).

Islands in the tropical Pacific Ocean offer an excellent system with which to examine the consequences of geography for speciation and to compare relative effects on taxa with different dispersal abilities. For example, both birds and butterflies are capable of actively dispersing long distances and have colonized virtually every archipelago and major island within the tropical Pacific. Rates of endemism are also high, but birds have a higher rate of endemism than butterflies despite better dispersal ability (Adler, 1992; Adler and Dudley, 1994). This rather surprising finding may be partly attributed to an additional constraint placed on butterflies to co-evolve with host plants required by larvae (Adler and Dudley, 1994), as well as inherent differences in potential evolutionary rates. Lizards, particularly skinks (Scincidae) and geckos (Gekkonidae), are also widely distributed on islands in the tropical Pacific. Diamond (1984) noted the much higher proportion of endemic lizards than birds in New Caledonia, presumably because of the lesser dispersal powers of skinks. In this report, we examine geographic correlates of skink species diversity and rates of endemism on all tropical Pacific archipelagos and compare the results with birds and butterflies.

Materials and methods

Study area

Included in this study were the 27 oceanic archipelagos and isolated islands in the tropical Pacific Ocean for which detailed herpetological data exist and from which skinks have been collected (Table 1). The study area was located between the Tropics of Cancer and Capricorn and from the Bismarcks east to Hawaii and the Pitcairn group. Landbridge islands such as the New Guinea satellite islands, islands of the Sunda Shelf and the Philippines were excluded. New Caledonia, although not strictly an oceanic island since it was at one time connected to Australia, was, nonetheless, included since its connection was much more ancient (approximately 50 000 000 years old; Raven and Axelrod, 1972) than landbridge connections to other islands (approximately 10 000 years old). Limits of the study area and archipelago definitions and numbers follow Adler (1992). Nauru, Banaba and the Line Islands, although included in Adler (1992), were excluded from the present report because of extremely poor herpetological collections from these islands.

Skink fauna

For each archipelago and isolated island, we compiled a list of all members of the family Scincidae, excluding those species known to have been introduced by Europeans. In compiling this list, we used a variety of published sources (see Table 1) and also examined 6535 specimen records from the California Academy of Sciences (C.C. Austin, personal observation). Taxonomic boundaries within the genus *Cryptoblepharus* are unclear. Fuhn (1969a, b) and Greer (1974) considered *Cryptoblepharus boutonii* to be a superspecies with approximately 36 'forms'. Mertens (1931) considered the 36 forms to all be subspecies of *C. boutonii*. We have followed Mertens' classification in this study, except we have considered *Cryptoblepharus novocaledonicus* as a distinct species. We then classified each skink species based upon its distribution and degree of endemism. Continental species were those species found on continental areas (Australia, New Guinea, and Asia) or on large landbridge islands outside of the study area (islands of the Sunda Shelf and the Philippines). Endemic species were confined to a single archipelago or isolated island within the study area, while Pacific species were endemic to the study area but were found within more than one archipelago. We considered *C. boutonii* as a widely distributed Pacific species rather than as a continental species.

For each archipelago and isolated island, we included nine geographic variables (total land area, area of the largest island, numbers of islands > 1000, 500 and 100 km^2, maximum elevation

and distances to the nearest continental area, nearest larger land mass, and nearest land mass) following Adler (1992).

Data analysis

We first constructed a species area power curve (log–log regression) for the entire skink fauna. In this regression, each archipelago and isolated island represented a single observation. We next searched for relationships between skink diversity and the other geographic variables. Since the geographic variables were highly intercorrelated, we used principal components analysis (PCA) to provide a smaller number of uncorrelated composite variables. Components with eigenvalues >1 were retained for further analysis. The number of skinks in each species category, area of largest island, total land area, elevation and the distance variables were log_{10}-transformed to reduce extreme variance. We performed linear regressions of species numbers in each species category with the composite geographic variables as independent variables. We constructed regression models of all combinations of the composite variables and selected the best model for each dependent variable. Islands that had no skink species in a particular species category were omitted from analysis.

We also calculated the proportion of species within each species category (continental, Pacific and endemic) and constructed linear regression models of all combinations of the composite geographic variables, again selecting the best model for each dependent variable. The proportion variables were arcsine transformed. Archipelagos with less than five species of skinks were omitted from this analysis.

Results

The entire skink fauna of the study area consists of 100 species in 23 genera (see the Appendix), with 66 species being endemic to a single island or archipelago and an additional 13 species being found only on islands within the study area. Nine genera are endemic to the study area, including *Caledoniscincus* (Vanuatu and New Caledonia), *Geomyersia* (Solomons and Bismarcks), *Geoscincus* (New Caledonia), *Graciliscincus* (New Caledonia), *Marmoroshpax* (New Caledonia), *Phoboscincus* (New Caledonia), *Sigalospes* (New Caledonia), *Tachygyia* (Tonga) and *Tropidoscincus* (New Caledonia).

The number of islands inhabited by each species of skink varies widely (see the Appendix). Eighty-seven species have highly restricted distributions (occurring within three archipelagos or fewer), while several species occur almost throughout the study area. Particularly noteworthy for their wide distributions are *Emoia cyanura* (24 archipelagos), *Lipinia noctua* (20 archipelagos), *C. boutonii* (19 archipelagos) and *Emoia impar* (16 archipelagos).

The number of species within an archipelago also varies widely, with the Bismarcks, Solomons and New Caledonia having at least twice as many species as any other archipelago (Table 1). Most archipelagos contain fewer than ten species of skinks. Hawaii is of particular interest in that it harbours only three species (none endemic), in stark contrast to the large, within-archipelago radiations of birds and several other groups of organisms that have occurred in that archipelago. By contrast, New Caledonia has not a single continental species and only two species that are found on other islands. The entire New Caledonian skink fauna is therefore endemic either to that island group or to Pacific islands. The Solomons also contain a highly endemic skink fauna. Endemic species are found on nine additional islands, but the level of endemism on these nine islands is low (<25%).

The species area regression yielded a highly significant relationship with an intercept of 0.02 and a slope of 0.27 (Fig. 1). PCA yielded three components with eigenvalues >1 that together

Table 1. Numbers of skink species on the 27 study archipelagos, with sources used in compiling the species lists

Number	Name	Total	Continental	Pacific	Endemic	References
1	Tuamotus	4	2	2	0	Burt and Burt (1932), Blanc *et al.* (1983), Ineich and Blanc (1989), Ineich and Zug (1991), CAS
2	Australs	4	2	2	0	Burt and Burt (1932), Zweifel (1979), Ineich and Blanc (1989), Ineich and Zug (1991), CAS
3	Cooks	6	2	4	0	Burt and Burt (1932), Bullivant and McCann (1974), Zweifel (1979), Crombie and Steadman (1986), Brown (1991), Ineich and Zug (1991), CAS
4	Marquesas	4	2	2	0	Burt and Burt (1932), Zweifel (1979), Ineich and Blanc (1989), Brown (1991), Ineich and Zug (1991), CAS
5	Pitcairns	3	2	1	0	Ineich and Blanc (1989), Gill (1993)
6	Societies	4	2	2	0	Burt and Burt (1932), Zweifel (1979), Blanc *et al.* (1983), Ineich and Blanc (1989), Brown (1991), Ineich and Zug (1991)
7	Niue	5	2	3	0	Zweifel (1979), Crombie and Steadman (1986), Brown (1991), Ineich and Zug (1991), Robert N. Fisher (personal communication)
8	Samoas	9	2	6	1	Burt and Burt (1932), Brown (1991), Ineich and Zug (1991), Zug (1991), Zweifel (1979), CAS
9	Wallis-Futuna	2	0	2	0	Brown (1991)
10	Tonga	9	2	6	1	Greer (1974), Zweifel (1979), Gibbons (1985), Gill (1990), Gill and Rinke (1990), Brown (1991), Ineich and Zug (1991), Zug (1991)
11	Fiji	11	3	5	3	Burt and Burt (1932), Zweifel (1979), Brown (1991), Ineich and Zug (1991), Zug (1991), CAS
12	Rotuma	5	1	4	0	Zug *et al.* (1989), Zug (1991)
13	Vanuatu	13	4	5	4	Burt and Burt (1932), Zweifel (1979), Brown (1991), Zug (1991), CAS

Number	Name	Total	Continental	Pacific	Endemic	References
14	New Caledonia	27	0	2	25	Bauer and Vindum (1990), Brown (1991), Ineich and Zug (1991), CAS
15	Santa Cruz	9	4	3	2	Burt and Burt (1932), McCoy (1980), McCoy and Webber (1984), Brown (1991), Ineich and Zug (1991)
16	Solomons	34	10	5	19	Burt and Burt (1932), Greer (1974), Greer and parker (1974), Zweifel (1979), McCoy (1980), Mys (1988), Brown (1991), Ineich and Zug (1991)
17	Bismarcks	40	19	5	6	Greer (1974), Zweifel (1979), Greer and Mys (1987), Mys (1988), Brown (1991), Ineich and Zug (1991), C.C. Austin (personal communication)
18	Palau	10	7	0	3	Brown and Fehlmann (1958), Greer (1974), Greer and Parker (1974), Zweifel (1979), Brown (1991), CAS
19	Carolines	12	7	4	1	Dryden and Taylor (1969), Zweifel (1979), Brown (1991), Ineich and Zug (1991), CAS
20	Marianas	5	3	1	1	Brown (1991), Ineich and Zug (1991), CAS
21	Marshalls	9	5	4	0	Brown (1991), Ineich and Zug (1991), CAS
24	Gilberts	2	0	2	0	Brown (1991), Ineich and Zug (1991), Robert N. Fisher (personal communication)
25	Ellice	3	1	2	0	Zweifel (1979), Brown (1991)
26	Phoenix	1	1	0	0	Burt and Burt (1932)
27	Tokelau	5	2	3	0	Burt and Burt (1932), Whitaker (1970), Zweifel (1979), Brown (1991)
29	Wake	1	0	1	0	Brown (1991), Ineich and Zug (1991)
30	Hawaii	3	2	1	0	Burt and Burt (1932), Greer (1974), McKeown (1978), Zweifel (1979), Ineich and Zug (1991)

CAS represents 6535 specimens in the California Academy of Sciences examined by C.C. Austin. Archipelago numbers are from Adler (1992).
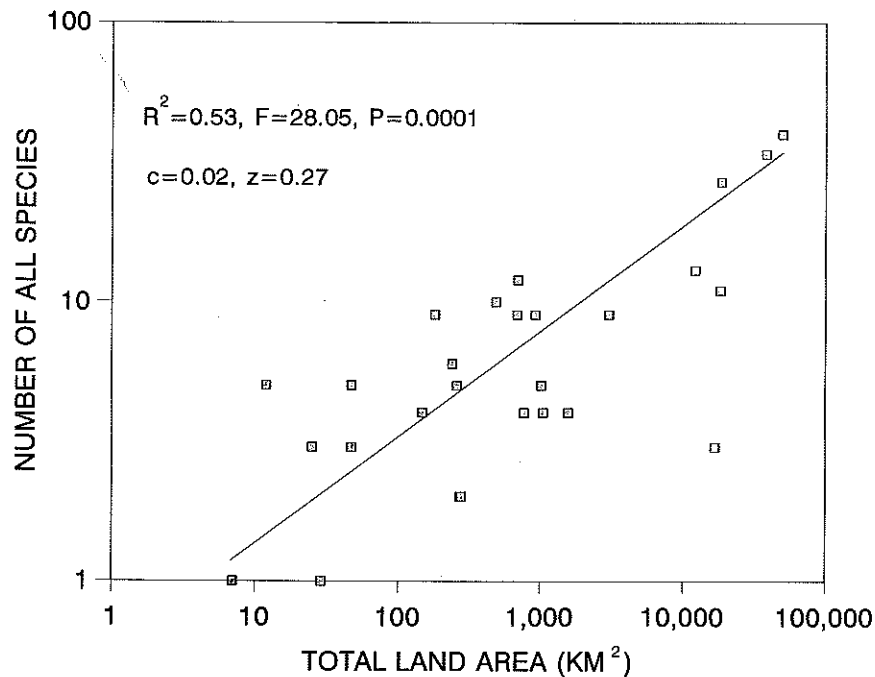
Figure 1. Species area relation for all skink species on 27 tropical Pacific archipelagos and isolated islands, where c is the intercept and z is the slope of the regression.

Table 2. Results of linear regression analysis of the $\log_{10}$ number of species and arcsine proportion of species in each species category versus the composite geographic variables

Category	n	Regression model	R^2	F	P
Number of species					
Total	27	0.76 + 0.30 (size) − 0.13 (isolation)	0.69	26.10	0.0001
Continental	23	0.43 + 0.21 (size)	0.44	16.36	0.0006
Pacific	25	0.42 + 0.10 (size) − 0.13 (isolation)	0.44	8.70	0.0016
Endemic	11	0.18 + 0.39 (size)	0.59	12.82	0.0059
Proportion of species					
Continental	16	No significant models			
Pacific	16	0.48 − 0.13 (size)	0.28	5.49	0.0344
Endemic	16	0.17 + 0.17 (size)	0.36	7.94	0.0137

Islands with no species in a particular category were deleted from the analysis of species numbers. n = number of islands included in a regression. Only the best regression model for each category is shown.

explained 88% of the total variance. These variables represented archipelago size (factor loadings on all five area variables > 0.85), isolation (factor loadings on distances to nearest land and nearest larger land > 0.85) and elevation (factor loading = 0.59). Regressions of numbers of species in the different species categories demonstrated the importance of both archipelago size and isolation in predicting skink diversity (Table 2). In particular, island size was important in

predicting skink diversity in all categories, while isolation was important in predicting total and Pacific skink diversity.

The proportion of species within each species category was also related to the composite geographic variables (Table 2). Archipelago size, however, was a more important predictor. Similar results were obtained when all islands were included in these regressions. The proportions of skinks in each species category were unrelated to any composite geographic variable when only islands with at least ten skink species were included in the regressions.

Discussion

In this report, we have not included all lizards but have focused solely on one family with similar life histories and presumably similar dispersal abilities. Four other families of lizards are represented on tropical Pacific islands, including Agamidae, Gekkonidae, Iguanidae, and Varanidae. Geckos are found in virtually every archipelago in the study area and, like the skinks, have undergone an impressive radiation in New Caledonia (Bauer and Vindum, 1990). Genetic work on three species of house geckos, however, suggests a pattern of very recent human-aided colonizations (Moritz *et al.*, 1993). At present, the extent of human-aided dispersal of geckos is too confused to permit their inclusion in this analysis. Including the other three families of lizards would add little to the present analysis since there are only four species.

Despite the extremely limited capacity of skinks for active overwater dispersal, these lizards have managed to colonize virtually every archipelago and isolated island in the tropical Pacific Ocean. While some human-aided dispersal is possible, genetic work on *Lipinia* sp., including the widespread *L. noctua*, suggests that at least some component of colonization by widespread species is not recent (Austin, 1995). No genetic work has been done on skinks from the more distant archipelagos and therefore we cannot presently rule out assisted colonizations throughout the entire study area. However, in the analysis of proportions of endemic species, results did not differ qualitatively between all islands in the study area and only those islands with at least five species of skinks (thereby eliminating from analysis the distant islands where human-aided colonizations were most likely).

To accomplish colonizations unassisted by humans, skinks must have relied primarily upon chance events of passive dispersal (i.e. rafting on floating debris) from Australia, New Guinea and Asia across vast distances and, secondarily, by using intervening islands as stepping stones to reach more distant islands. Because of the reliance on passive dispersal and chance colonizations, gene flow is no doubt much reduced. Thus, the Pacific island skink fauna is dominated numerically by endemic species, with 66% being endemic to a single archipelago and 89% being restricted solely to these islands. This level of endemism is very similar to that of birds, however, even though birds are capable of much more active dispersal. If all known species of birds are considered, including those known only from post-Pleistocene fossils, 66% are endemic to a single archipelago and 76% are endemic to the study area. The level of endemism in butterflies is statistically lower than that of birds. Thus, birds and skinks have similar levels of endemism, while endemism in butterflies is much lower. The similar levels of endemism for birds and skinks is at first puzzling. Even though birds have a much better dispersal mechanism (namely, powered flight) than skinks, selection for reduced dispersal on islands is apparently sufficient to greatly reduce gene flow among populations of birds in different archipelagos. This selection is presumably manifested first as a 'psychological' reluctance to leave an island (Diamond, 1984) and is sometimes followed by evolution towards flightlessness (as in many endemic species of flightless rails).

The number of skink species and the level of endemism within tropical Pacific archipelagos are

related to geography, with both area and isolation being important predictors. In a study of day geckos (*Phelsuma*) on Indian Ocean islands, Losos (1986) also notes that island size (and habitat diversity) and particularly isolation are important in predicting total gecko diversity. Archipelago size and isolation are also important predictors of bird and butterfly diversity and endemism on tropical Pacific archipelagos. Large island size apparently enhances endemism in all three taxa. Thus, the proportion of species within an archipelago's fauna that are endemic is best predicted by variables related to the number of large islands and to total land area.

Closer scrutiny of endemism on an archipelago by archipelago basis reveals larger differences between skinks and birds. First, as pointed out by Diamond (1984), New Caledonia has a highly endemic skink fauna (93% endemic to the archipelago and 100% endemic to the study area) while the bird fauna is only moderately endemic (including species known from subfossil remains, 33% are endemic to the archipelago and 47% are endemic to the study area). The skinks on New Caledonia are also of ancient origin (Bauer and Vindum, 1990). Of the 11 genera represented, six are endemic to the archipelago and another genus is endemic to the study area. By contrast, only three known birds are of relict origin. These birds represent two endemic families and only the kagu (*Rhynochetus jubatus*, family Rhynochetidae) is extant. Second, the highest levels of endemic birds are in the Hawaiian and Marquesas Islands (> 90 and 85% endemic, respectively). The only skinks present within these two remote archipelagos are wide-ranging continental and Pacific species. Thus, there has been no apparent speciation of skinks in these two archipelagos. Indeed, endemic skinks are not found beyond Tonga, Samoa, the Carolines and the Marianas.

What accounts for these striking differences in endemism between skinks and birds, particularly in New Caledonia and Hawaii? Because of the lesser dispersal powers of skinks relative to birds, skinks may have colonized the tropical Pacific region much more slowly than birds. Most of the endemic species are concentrated on the archipelagos nearest Australia and New Guinea (i.e. New Caledonia, the Bismarcks and the Solomons), presumably because these archipelagos were the first to be colonized. Indeed, much of New Caledonia's skink fauna may have been of relict origin when New Caledonia was connected to Australia. The skink faunas on the most distant archipelagos such as Hawaii and the Marquesas are no doubt of much more recent origin (and possibly human aided). The skinks on these distant archipelagos are almost exclusively continental or Pacific species and may not have had sufficient time to break up into complexes of morphologically distinct endemic species. By contrast, birds may have colonized the distant archipelagos more quickly and undergone much more extensive diversification, both among archipelagos and within archipelagos (i.e. inter- and intra-archipelago speciation; Diamond, 1977). Skinks have been able to undergo an impressive radiation within a single large island (New Caledonia). This continental speciation has not been possible for birds on islands in the study area smaller than New Guinea (Diamond, 1977). Endemic lizards may be able to persist longer than birds because of lower resource requirements, larger populations and lower extinction rates. Thus, given sufficient time large numbers of skinks may accumulate via speciation within a single island. Birds, however, may require a more substantial isolating barrier (i.e. open ocean) and a complex of isolated land masses to undergo extensive radiations within the study area.

It is possible that some of the widespread skink species are genetically differentiated among islands, but due to morphological conservatism we do not recognize such populations as morphologically distinct species (i.e. they may be cryptic species). For instance, morphologically similar populations of *L. noctua* show a large degree of genetic divergence (Austin, 1995). Other recent systematic work on skinks also suggests that morphological conservatism may be a common phenomenon in this group, thereby masking actual species diversity (Donnellan and Aplin, 1989; Donnellan and Hutchinson, 1990; Hutchinson *et al.*, 1990). Skink diversity and

endemism may therefore be underestimated, but it is unlikely that diversity and endemism on the distant archipelagos such as Hawaii will approach that of birds or that of skinks on New Caledonia.

Although reduced gene flow associated with isolation has long been thought to facilitate population differentiation (and appears to be important in speciation within the tropical Pacific), local ecological interactions may also be important (as suggested for tropical Pacific butterflies; Adler and Dudley, 1994). We conclude that comparative studies relating diversity and endemism of organisms with different dispersal powers to geographic features may provide valuable insight into processes of speciation. Such studies would be enhanced if coupled with pertinent genetic and ecological data.

Acknowledgements

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Appendix

List of skink species and their distributions within the study area. For status, c, continental, p, pacific and e, endemic. For distribution, numbers refer to archipelago numbers in Table 1.

Species	Status	Distribution
Caledoniscincus atropunctatus	p	13, 14
Caledoniscincus austrocaledonicus	e	14
Caledoniscincus festivus	e	14
Caledoniscincus orestes	e	14
Carlia fusca	c	17
Cryptoblepharus boutonii	c	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 16, 17, 18, 19, 20, 26, 27, 30
Cryptoblepharus novocaledonicus	e	14
Corucia zerbrata	e	16
Emoia adspersa	p	3, 8, 9, 25, 27
Emoia aneityumensis	e	13
Emoia arnoensis	p	19
Emoia atrocostata	c	13, 16, 17, 18, 19, 20, 21
Emoia bismarckensis	e	17
Emoia boettgeri	p	19, 21
Emoia caeruleocauda	c	11, 31, 15, 16, 17, 18, 19, 20, 21
Emoia campbelli	e	11
Emoia concolor	p	11, 12
Emoia cyanogaster	p	13, 15, 16, 17
Emoia cyanura	p	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 24, 25, 27, 29
Emoia erronan	e	13
Emoia flavigularis	e	16
Emoia impar	p	1, 2, 3, 4, 6, 7, 8, 10, 11, 13, 16, 17, 19, 21, 24, 30
Emoia isolata	e	16
Emoia jakati	c	17, 18, 19, 21
Emoia kordoana	c	17
Emoia lawesi	p	7, 8, 10
Emoia longicauda	c	17
Emoia loyaltiensis	e	14
Emoia maculata	e	16
Emoia mivarti	e	17
Emoia murphyi	p	8, 10
Emoia nigra	p	8, 10, 11, 12, 13, 15, 16, 17, 27
Emoia nigromarginata	e	13
Emoia pallidiceps	c	17
Emoia parkeri	e	11
Emoia ponapea	e	19
Emoia pseudocyanura	e	16
Emoia rennellensis	e	16
Emoia rufilabialis	e	15

Species	Status	Distribution
Emoia samoensis	e	8
Emoia sanfordi	e	13
Emoia schmidti	e	16
Emoia slevini	e	20
Emoia taumakoensis	e	15
Emoia trossula	p	3, 10, 11, 12
Eugongylus albofasiolatus	c	15, 16, 17, 18, 19, 21
Eugongylus rufescens	c	16, 17
Geomyersia coggeri	e	17
Geomyersia glabra	e	16
Geoscincus haraldmeieri	e	14
Graciliscincus shonae	e	14
Lamprolepis smaragdina	c	15, 16, 17, 18, 19, 21
Leiolopisma alazon	e	11
Leiolopisma greeri	e	14
Leiolopisma nigrofasciolatum	e	14
Leiolopisma steindachneri	e	14
Leiolopisma vovaecaledoniae	e	14
Leiolopisma sp. nov.	e	14
Lipinia leptosoma	e	18
Lipinia noctua	c	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 16, 17, 18, 19, 21, 25, 27, 30
Lipinia rouxi	e	17
Mabuya sp. no.	e	18
Marmoroshpax euryotis	e	14
Marmoroshpax tricolor	e	14
Nannoscincus gracilis	e	14
Nannoscincus greeri	e	14
Nannoscincus mariei	e	14
Nannoscincus rankini	e	14
Nannoscincus slevini	e	14
Phoboscincus bocourti	e	14
Phoboscincus garnieri	e	14
Prasinohaema virens	c	15, 16
Sigalospes deplanchei	e	14
Sphenomorphus bignelli	e	16
Sphenomorphus concinnatus	e	16
Sphenomorphus cranei	e	16
Sphenomorphus derooijae	c	17
Sphenomorphus fragosus	e	16
Sphenomorphus jobiensis	c	17
Sphenomorphus neuhaussi	c	17
Sphenomorphus pratti	c	17
Sphenomorphus scutatus	e	18
Sphenomorphus solomonis	c	16, 17
Sphenomorphus stickeli	c	17
Sphenomorphus tanneri	p	16, 17
Sphenomorphus taylori	e	16
Sphenomorphus transversus	e	16
Sphenomorphus undulatus	c	16

Species	Status	Distribution
Sphenomorphus woodfordi	e	16
Tachygyia microlepis	e	10
Tiliqua gigas	c	17
Tribolonotus annectens	e	17
Tribolonotus blanchardi	e	16
Tribolonotus brongersmai	e	17
Tribolonotus ponceleti	e	16
Tribolonotus pseudoponceleti	e	16
Tribolonotus schmidti	e	16
Tropidoscincus aubrianus	e	14
Tropidoscincus roehssii	e	14
Tropidoscincus variabilis	e	14