

The Reptiles of Sapwuahfik Atoll, Federated States of Micronesia

DONALD W. BUDEN

*Division of Natural Science and Mathematics
College of Micronesia P.O. Box 159
Kolonia, Pohnpei, Federated States of Micronesia 96941
e-mail: don_buden@comfsm.fm*

Abstract—Two species of marine turtle (*Chelonia mydas* and *Eretmochelys imbricata*) and 12 lizards (five geckos and seven skinks) comprise the herpetofauna of Sapwuahfik Atoll, Micronesia. None is endemic and most are widespread in the tropical Pacific; all occur on Pohnpei, the nearest high island. *Emoia impar*, *Lamprolepis smaragdina*, and *Lepidodactylus lugubris* are the most abundant and widespread species, each occurring on at least nine of the ten islands. All the lizard species occur in *Cocos* forest, the predominant habitat, but they exhibit differences in perch sites and habitat preferences. A ban on the hunting of all turtles was recently effected after two separate incidents of turtle poisoning (chelonitoxication), both involving *Eretmochelys imbricata*.

Introduction

Sapwuahfik Atoll is one of many far-flung, seldom-visited, and biologically poorly known groups of islands in the tropical Pacific; its biota has never been surveyed systematically. The present study provides information on occurrence, patterns of distribution, and habitat preferences of the reptiles of Sapwuahfik, and it is based largely on my observations along with the 252 specimens I collected during 28 May-1 July 1998. An additional 18 specimens of lizards representing three species were collected on the main island (Ngatik) by Jens Vindum on 4 February 1986 and deposited in the California Academy of Sciences (CAS 159714-159731).

Study Area

Sapwuahfik (formerly Ngatik) Atoll is a part of the Federated States of Micronesia, in the Eastern Caroline Islands. It is under administration of Pohnpei, the nearest high island, about 160 km to the northeast (Fig. 1). The atoll is about 21.0 km long (east to west) and up to 9.5 km wide, with a land area of about 1.6 km² distributed among ten low-lying, coralline islands. A deepwater channel near the center of the southern perimeter provides the only passage for boats into and out of the lagoon; interisland channels are shallow and easily waded at low tide. Ngatik, the largest and the only permanently settled island, is at the extreme western end of the atoll. The nine other islands are 20 m to 3.8 km apart from each

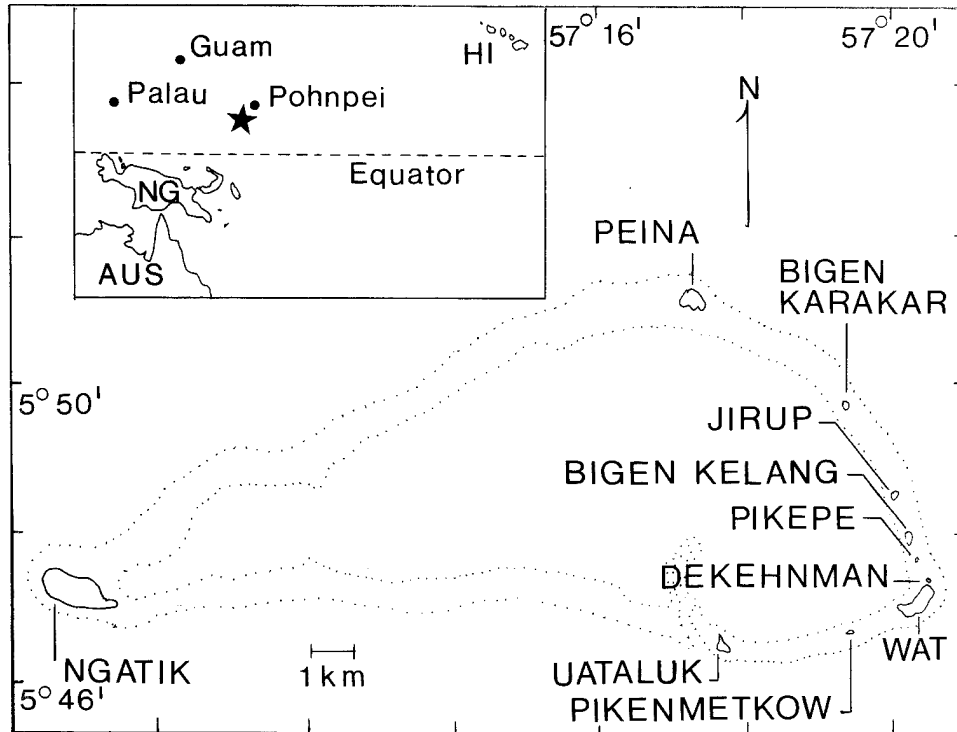


Figure 1.—Location map for Sapwuahfik Atoll; AUS = Australia, NG = New Guinea, HI = Hawai'i.

other on the eastern side. They are uninhabited or inhabited only intermittently by visitors from Ngatik, mainly to harvest coconuts, tend taro patches, feed free-ranging chickens and pigs, or just as a respite from crowded conditions on the main island. Thatch houses, some augmented with sheet metal and lumber, and in various states of upkeep are on Peina (3), Bigen Karakar (1, uninhabited for the past two years), Jirup (2), Bigen Kelang (2, plus one ship's cabin salvaged from a wreck and used as living quarters), Wat (3), and Uataluk (1). No more than 12 people were living on these islands at any time during my visit.

Archeological investigations are lacking and the time of colonization by aboriginals is unknown. However, the first documented encounters with Europeans were visits by trading ships during the early 1800s, mainly to obtain turtle shell, pearl shell, and *bêche-de-mer* (sea cucumbers) (Poyer 1993). The "Ngatik Massacre" occurred in 1837 when all but one of the men on the island were killed or escaped during raids by the crew of the trader Lamdon over a cache of turtle shell. The atoll was subsequently resettled by immigrants from Pohnpei, Kiribati, the Mortlock Islands, Europe, and the United States (Poyer 1993). The 1994 FSM national census recorded 603 residents (221 under the age of ten) domiciled on Ngatik (Office of Planning and Statistics 1996).

Cocos nucifera (coconut) is the dominant tree species atoll-wide, and *Cocos* forest extends directly to sandy or rocky beaches or is bordered by a narrow, discontinuous band of coastal thicket comprised largely of *Tournefortia* and *Scaevola* shrubs and trees. Breadfruit (*Artocarpus altilis*) is scattered among the coconut in the interior of the larger islands, as are *Pandanus* trees. Other forest tree species include *Allophylus timorensis*, *Barringtonia asiatica*, *Calophyllum inophyllum*, *Cordia subcordata*, *Ficus* spp., *Guettarda speciosa*, *Hernandia nymphaeifolia*, *Intsia bijuga*, *Morinda citrifolia*, *Neisosperma oppositifolia*, *Pisonia grandis*, *Premna serratifolia*, and *Terminalia samoensis*. Mosses and ferns grow epiphytically and contribute also to ground cover, along with grasses, sedges, and other herbs. The physiognomy of the understory varies among the islands according to the recency and degree of human activity and foraging of pigs. Rainfall averages about 410 cm/year (Anthony 1996) but drought stress was evident in the number of dead and withered epiphytes, especially along the windward shores, almost certainly a result of the 1997/98 El Niño.

Methods

The status of lizard populations was assessed by transect counts and timed surveys in different habitats presented as encounters per unit time or distance, and supplemented by incidental observations throughout the study period. Terms of abundance are: common (at least 30 sightings per day under optimum conditions), fairly common (10-30/day), uncommon (up to 10/day), and scarce (no more than 5/day, and unrecorded on some days). Place names are from Bryan (1971) with orthographic emendations provided by local residents; alternative names abound—e.g., Poyer (1993) recorded nine variants of the name Ngatik and five alternative names for the atoll. Distances were estimated using a 1:25,000 scale photomosaic aerial survey map (Pohnpei State Land Commission 1985), and island areas were measured by superimposing a grid and counting the number of enclosed units (1,600/km²) for each island, estimating fractions thereof. The 252 specimens I collected were deposited in the Bishop Museum (Honolulu), College of Micronesia (Pohnpei), Museum of Comparative Zoology (Harvard University), California Academy of Sciences (San Francisco), and National Museum of Natural History, Smithsonian Institution (Washington, D.C.)

Species Accounts

Chelonia mydas.—The green turtle occurs in small numbers in Sapwuahfik lagoon, where it has been frequently hunted for food. Herring (1986) was told it no longer nested at Sapwuahfik, but local fishermen told me green turtles still occasionally nest on some of the eastern islands. Sablan (in Pritchard 1981) observed two during an underwater survey in September 1973. I saw no live turtles during my visit but examined the carapace of one that was caught in early

June 1998; it measured 43 cm in a straight line distance from the midpoint of the nuchal notch to the posteriormost edge of the shell.

Eretmochelys imbricata.—Local residents told Herring (1986) that hawksbill turtles no longer nested on the atoll but did so in the past. During summer 1998, however, residents told me that hawksbills, though much less common than green turtles, occasionally nest on the eastern islands. *E. imbricata* apparently has always been less common than *C. mydas* at Sapwuahfik, at least in historical times. Regarding the large cache of tortoise shell that precipitated the “Ngatik Massacre” in 1837 (see Poyer 1993), Reisner (1996) stated “most of it was worthless green turtle shell, only 20-25 lbs [of 130-140] being the valuable hawksbill shell.”

About 50-60 islanders became ill and three died after eating meat from hawksbill turtles in two separate incidents about six months apart in 1997. According to the local nurse, Mercy Norman, and others present during both incidents, the very young, the elderly, and females in general were the most seriously affected. Symptoms often persisted for several days and included nausea, weakness, lethargy, numbness, and an inability to speak. The islanders distinguish two kinds of hawksbill turtle—the Sapwake, which has the characteristically brightly colored, variegated shell, and the Sirkitol, which is dark (melanistic?), and the form implicated in both cases of poisoning. The two turtles involved in the poisonings were both caught outside the reef.

Halstead (1970) and Silas & Fernando (1984) reported numerous cases of chelonitoxication attributed to *E. imbricata* and other sea turtle species worldwide. According to Limpus (1987), the etiology of the poison is unknown but “the majority of researchers are of the opinion that [it]...is derived from poisonous marine algae or invertebrates eaten by the turtles.” Meylan (1988) found that sponges are a favored food item of *E. imbricata*, and suggested that a “possible link between...potentially toxic sponge metabolites and the sporadic mass fatalities of humans caused by consumption of hawksbill meat deserves further study.” Some Sapwuahfik islanders were concerned that the poisonings may be attributed in some way to a long-line fishing vessel that permanently ran aground and scoured a large area of the reef several years ago. However, I was told that all fishes are safe to eat and that ciguatera poisoning does not occur.

Bustard (1972) reported that “the hawksbill is seldom eaten in northern Australia because the flesh of some populations is known to be poisonous at least at certain times of year [and]...in the New Guinea region a number of deaths have resulted from eating this turtle’s flesh.” Harrison (1991) admonished all visitors to the Indo-Pacific area to avoid eating turtle meat unless it is indicated safe by local residents, as the poisonings from this region are especially virulent. Turtle poisoning is apparently rare in the eastern Caroline Islands, as many Pohnpeians I interviewed (including local fishermen and staff at Pohnpei Marine Resources Division) were unaware of it. Bentzen (1949: 68) mentioned in passing that hawksbill turtles are eaten on Mokil Atoll (174 km southeast of Pohnpei) in spite of their being poisonous in some seasons. In the wake of the two serious incidents

Table 1.—Status and relative abundance of lizards on Sapwuahfik Atoll during summer 1998.

Species	Incidence ^a	Status ^b	Maximum Encounter Rate		
			Per Hour	Island	Habitat ^c
Geckos					
<i>Gehyra mutilata</i>	40%	UC-C	40	Ngatik	edificarian
<i>Gehyra oceanica</i>	70%	C	19	Bigen Kelang	palm leaf axils
<i>Lepidodactylus lugubris</i>	100%	C	68	Peina	<i>Scaevola</i> bushes
<i>Nactus pelagicus</i>	50%	UC-FC	6	Bigen Kelang	tree trunks
<i>Perochirus ateles</i>	30%	FC	20	Pikepe	palm leaf axils
Skinks					
<i>Emoia boettgeri</i>	50%	FC-C	30	Uataluk	forest floor
<i>Emoia cyanura</i>	70%	C	116	Peina	forest floor
<i>Emoia impar</i>	90%	C	132	Pikepe	forest floor
<i>Emoia jakati</i>	10%	C ^d	17	Ngatik	forest floor
<i>Eugongylus albofasciolatus</i>	30%	S	0 ^e		
<i>Lamprolepis smaragdina</i>	100%	FC-C	78	Wat	tree trunks
<i>Lipinia noctua</i>	20%	S	1	Jirup	palm leaf axils

^a The number of islands on which the species has been recorded as a percent of the ten total.

^b C = common, FC = fairly common, UC = uncommon, S = scarce.

^c At night for *Gehyra mutilata*, *Lepidodactylus lugubris*, and *Nactus pelagicus*; in daylight for all others.

^d Ngatik only, unrecorded elsewhere.

^e Recorded during incidental observations but not during census counts.

of poisoning at Sapwuahfik, the Municipal Government banned the hunting of all turtles throughout the region.

Gehyra mutilata.—The stump-toed gecko is common in areas of human habitation, being most numerous on the walls of buildings in the settlement on the main island (Table 1). I encountered it only rarely in vegetation on the more remote islands.

Gehyra oceanica.—The oceanic gecko is common in trees, shrubs, and edificarian sites throughout the atoll (Table 2), being unrecorded only on the three smallest islands (Table 3).

Lepidodactylus lugubris.—The mourning gecko is common atoll-wide and recorded on all the islands. Many were observed probing their snouts into the bases of *Scaevola* blossoms at night, imbibing fluids and/or feeding on small insects. I often observed *L. lugubris* also in buildings, but less frequently in the forest, mainly under loose bark on dead trees.

Nactus pelagicus.—The rock gecko is uncommon to locally fairly common, being recorded on five of the ten islands (Table 3). It usually occurs low on tree

Table 2.—Habitat distribution (percent frequency) of 252 lizards collected on Sapwuahfik Atoll during summer 1998.

Species	Habitat ^a						
	FOF	TTR	PLA	GRA	SCV	STR	EDI
Geckos							
<i>Gehyra mutilata</i>		26.7	3.3				70.0
<i>Gehyra oceanica</i>		29.4	41.2		5.9		23.5
<i>Lepidodactylus lugubris</i>		1.8	3.5		66.6	3.5	24.6
<i>Nactus pelagicus</i>		63.6				18.2	18.2
<i>Perochirus ateles</i>		15.0	60.0		10.0		15.0
Skinks							
<i>Emoia boettgeri</i>	90.0	10.0					
<i>Emoia cyanura</i>	63.0					37.0	
<i>Emoia impar</i>	79.1	2.3	2.3			16.3	
<i>Emoia jakati</i>	100.0						
<i>Eugongylus albofasciolatus</i>	33.3			50.0			16.7
<i>Lamprolepis smaragdina</i>	6.7	93.3					
<i>Lipinia noctua</i>			100.0				

FOF = forest floor in daylight, TTR = tree trunks in daylight (for skinks) and at night (for geckos), and including one *Gehyra mutilata* and two *Perochirus ateles* under loose bark, and two *Lamprolepis smaragdina* on palm petioles, PLA = palm leaf axils in daylight, GRA = grassy and weedy areas in daylight, SCV = *Scaevola* bushes at night, STR = strand, including sparsely vegetated sand strand in daylight (10 *E. cyanura*, 7 *E. impar*), and coral rubble at the forest edge at night (2 *L. lugubris*, and 4 *N. pelagicus*), EDI = edificarian sites at night.

trunks or on rocky ground, especially coral rubble at the forest edge. I also occasionally observed it on stone and cement walls of buildings on the main island.

Perochirus ateles.—The Micronesian gecko usually is common where it occurs, but is known from only three islands (Table 3). It was most frequently encountered in palm leaf axils, but one colony was well-established with numerous adults and young in the thatch and wood house where I stayed on Bigen Kelang. I also observed many young (including neonates) on Pikepe during the last week of June 1998.

Emoia boettgeri.—Boettger's skink is fairly common on the forest floor (less numerous on tree trunks and shrubs) on the four largest islands (Ngatik, Peina, Wat, Uataluk). It is present also on Dekehnman, which is one of the smallest islands, but separated from Wat only by a very narrow channel, with a dry land connection during the lowest tides. *E. boettgeri* is most numerous in the forest in shaded areas with dappled sunlight, and in disturbed areas where ground cover is sparse, especially where pigs have been rooting.

Emoia cyanura.—The bronze-tailed copper-striped skink is widespread and common in open, sunny areas within the forest, as well as in grassy or weedy

Table 3.—Distribution by island of 252 specimens and sight records (SR) of lizards obtained on Sapwuahfik Atoll during summer 1998.

Species	Island ^a									
	NGA	PEI	BKA	JIR	BKE	PIK	DEK	WAT	PKM	UAT
Geckos										
<i>Gehyra mutilata</i>	22	3	1					4		
<i>Gehyra oceanica</i>	5	2	1	2	1			5		1
<i>Lepidodactylus</i>										
<i>lugubris</i>	19	6	4	5	7	1	1	8	3	3
<i>Nactus pelagicus</i>	12	3			4		2	1		
<i>Perochirus ateles</i>					8	9				3
Skinks										
<i>Emoia boettgeri</i>	3	2					1	2		2
<i>Emoia cyanura</i>	10	4	1	3	5			2		2
<i>Emoia impar</i>	7	2	10	3	5	8		2	4	2
<i>Emoia jakati</i>	4									
<i>Eugongylus</i>										
<i>albofasciolatus</i>	3							1		2
<i>Lamprolepis</i>										
<i>smaragdina</i>	1	2	2	2	2	2	1	1	1	1
<i>Lipinia noctua</i>				1						SR

^a NGA = Ngatik, PEI = Peina, BKA = Bigen Karakar, JIR = Jirup, BKE = Bigen Kelang, PIK = Pikepe, DEK = Dekehman, WAT = Wat, PKM = Pikenmetkow, UAT = Uataluk.

areas (including sand strand), and in sparse vegetation in the vicinity of human habitation. It is the second most common lizard on the atoll behind *E. impar*, and it is largely terrestrial but will frequently climb trees to avoid capture.

Emoia impar.—The blue-tailed copper-striped skink is the most abundant lizard on the atoll, with encounter rates of up to 132/hour. It is most numerous in well-shaded, *Cocos* forest, usually on the ground and low in the vegetation, but frequently climbing trees to avoid capture. Its absence only on Dekehman probably is real and not an artifact of sampling as the island was visited on four different days without any sightings, whereas the presence of *E. impar* on all other islands was quickly determined during initial visits. Its absence on Dekehman is somewhat surprising in view of the close proximity of that island to Wat, (where *E. impar* is abundant), being separated by a very narrow channel and with a dry land connection during the lowest tides.

The distinctly blue-colored tail with greenish gloss at the base readily distinguishes most examples of *E. impar* from the otherwise very similar *E. cyanura*.

However, *E. impar* are more variable in coloration and pattern on Sapwuahfik than on any other island in the eastern Caroline group that I have visited, including Pohnpei and its lagoon islands, and Mokil, Pingelap, Ant, Pakin, Oroluk, and Kapingamarangi atolls. The dorsum is usually dark brown or black with three narrow (one or two scale rows wide), pale gold longitudinal stripes extending from the head to the base of the tail. The mid-dorsal stripe extends from the tip of the snout and merges gradually with the characteristically blue tail, the base of which has a distinctly greenish sheen. In some, the blue is restricted to a 1-2 cm-wide band near the middle of the tail, and in others the tail is bronze-colored or brown throughout. The venter is usually pale gray or off-white, and often faintly washed with pale salmon or orange. Others lack stripes and are more or less brown throughout. In life (and at least on Sapwuahfik), these alineate, dark morphs of *E. impar* (identification confirmed by G. Zug) have a shiny, copper-colored dorsum contrasting with dark brown sides, and grading to a sooty brown venter. A dark brown spadelike mark (with apex directed anteriorly) is invariably present on the occiput, and the tail ranges from brown to dull grayish blue.

Striped individuals with brown tails or with very little blue on the tail were most numerous on Pikepe (about 5-10% of the population), but they accounted for probably less than 1% of the population atoll-wide. Pikepe is one of only two islands where *E. impar* does not appear to coexist with its sibling species, *E. cyanura*, the other being Pikenmetkow. But the frequency of brown-tailed individuals on Pikenmetkow is no greater than it is on most of the other islands. I have seen brown-tailed variants of *E. impar* in small numbers on many islands in the eastern Carolines, but have not previously encountered the dark (unicolored) morph, which on Sapwuahfik is nearly confined to Bigen Karakar, comprising about 1-5% of the population; I saw only one elsewhere (specimen collected on Bigen Kelang). The dark morph, although scarce in the eastern Carolines (pers. obs.) occurs widely although spottily in the Pacific (G. Zug, pers. comm.), and comprises about 5-10% of the Polynesian population of *E. impar* (Ineich & Zug 1991).

Emoia jakati.—The Jakati skink is common on the main island, Ngatik, especially in sparsely vegetated areas along the edges of footpaths and where leaf litter and other debris has accumulated adjacent to residences. It is unrecorded elsewhere on the atoll.

Eugongylus albofasciolatus.—The reclusive litter skink is scarce to uncommon and recorded on only three islands (Table 3). It usually is seen on the forest floor, often near dense patches of grasses or weeds, among piles of rocks or coconut husks, or near the root bases of toppled trees, all in areas that often facilitate rapid subterranean escape. I observed two (in two separate incidents) feeding on the meat of an open and discarded coconut, and several that I collected on Sapwuahfik and other atolls of Pohnpei State had regurgitated coconut when first captured.

Lamprolepis smaragdina.—The green tree skink is fairly common to common on all the islands, usually occurring on tree trunks and rarely on the ground.

The greatest concentration was alongside a footpath through coconut forest extending the length of Wat on the lagoonside—38 counted over a distance of about 900 m in 30 min (= 42/km, 78/hr). Of the 34 atoll-wide for which I recorded dorsal coloration, 12 (35%) were gray, 10 (29%) were green, 7 (21%) were brown, and 5 (15 %) were an intermediate shade between green and brown or gray. The distribution of color variants appeared to differ among islands but was not assessed quantitatively. The gray-type was especially numerous on Bigen Kelang and Wat, but of the eight *L. smaragdina* I observed together one time on Bigen Karakar, six were green, one was brown, and the other was yellowish brown. I had not encountered the gray variant previously during my surveys of lizards on Pohnpei, its lagoon islands, and many outlying atolls, including Mokil, Pingelap, Ant, Pakin, Oroluk, and Kapingamarangi.

Lipinia noctua.—The moth skink is the least common among the lizards on Sapwuahfik Atoll. I saw only three (and collected one)—two on Jirup and one on Uataluk, all in palm leaf axils. All three bore a pale nuchal spot.

Discussion

The herpetofauna of Sapwuahfik consists of two species of marine turtles and 12 species of lizard (5 geckos, 7 skinks). The green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*) both are scarce to uncommon and less numerous now than in the past, probably because of overhunting. The recent ban on hunting turtles as a public health measure following two incidents of chelonitoxication doubtless will also benefit the turtles.

No lizard species is endemic to Sapwuahfik; all are widespread in Micronesia (occurring on at least two major groups of islands) or they are more broadly distributed in Oceania (Bauer 1994, Adler et al. 1995, Fisher 1997). The number of species on each island is correlated with island size (Table 4, Fig. 2), although on a global scale all the islands may be considered small as the total land area is less than 2 km². The three smallest islands each have 3-4 species, the four intermediate-sized islands have 6-9, and the three largest have 8-10. Four of the 12 species occur on at least 70% of the islands, three others occur on 40–60% of the islands, and the remaining five occur on 10 to 30%. *Emoia impar*, *Lamprolepis smaragdina*, and *Lepidodactylus lugubris* are the most abundant, occurring on all the islands with the exception of the absence of *E. impar* on Dekehrman. *Lipinia noctua* and *Perochirus ateles* are the least common, each being recorded on no more than three islands, none of them Ngatik. Whether their absence on Ngatik, the largest island, is real or an artifact of sampling is unknown. There does not appear to be any obvious pattern of competitive exclusion among species, although *Perochirus ateles* is known only on those islands where *Gehyra mutilata* is unrecorded.

The species are distributed in a mosaic pattern of different combinations, probably resulting from random human-assisted, island-to-island colonizations, mainly from Ngatik, the current and historically unofficial port of entry and

Table 4.—Number of lizard species recorded on Sapwuahfik Atoll islands during incidental observations and timed census counts in summer 1998.

Island	Area		Days ^a	Survey Time (min) and Habitat ^b					
	(km ²)	Species		FOF ^c	TTd ^c	TTn	PLA	SCA	EDI
Ngatik	0.906	10	7	50	50	260		70	115
Peina	0.206	8	4	40	40	185	155	45	30
Bigen Karakar	0.025	7	3	15	15	65	90	60	15
Jirup	0.023	6	2	25	25	30	80	60	15
Bigen Kelang	0.047	8	10	20	20	55	25	25	10
Pikepe	0.009	4	1	30	30	75	15	25	
Dekehnman	0.009	4	1	10	10	40	10	15	
Wat	0.281	9	4	105	105	100	130	35	25
Pikenmetkow	0.006	3	2	10	10	20	30	40	
Uataluk	0.039	9	2	25	25	85	90	30	

^a Approximate number of 6-12-hour observation days, but not necessarily the number of calendar days; e.g. Pikepe was visited briefly on 31 May and on 12, 19, and 26 June, and Dekehnman likewise on 15, 16, 17, and 19 June, with the total amount of time equating to no more than one observation day on each island.

^b FOF = forest floor in daylight, TTd = tree trunks in daylight, TTn = tree trunks at night, PLA = palm leaf axils in daylight, SCA = *Scaevola* bushes at night, EDI = edificarian sites at night.

^c Daytime surveys of forest floor and tree trunks were completed together, with survey times treated as duplicate.

location of the only permanent settlement. Ngatik has the largest number of species (10), and hosts the only known population of *Emoia jakati*, possibly a recent introduction from Pohnpei via cargo boarded on the government supply ship. The provenance and mode of dispersal of the lizards on Sapwuahfik is uncertain. There is no evidence to indicate that any species has been deliberately introduced, but Crombie & Steadman (1987) suggest that human-assisted transport probably accounts for nearly all lizards on remote Pacific Islands. On the other hand, Fisher (1997) stated natural dispersal among Pacific Island lizards may be more prevalent than previously thought, based on interpretations of recent studies on genetic variation.

Many Sapwuahfik islanders demonstrate a practical knowledge of local plants and animals used for food and medicine, but lizards do not feature significantly in their economy and they have only four names to cover the 12 species: didmwerek [teet-morek] = all geckos, lamwer [lammer] = all skinks excluding *Eugongylus* and *Lamprolepis*, kiiel [kee-el] = *Eugongylus albofasciolatus*, and liseiseipaihni [say-say-pinee] = *Lamprolepis smaragdina*. None of the lizard species on Sapwuahfik seem threatened or endangered by current levels of human activity although an airstrip now under construction may increase the frequency of visits from outside the atoll and the potential for introducing exotic species.

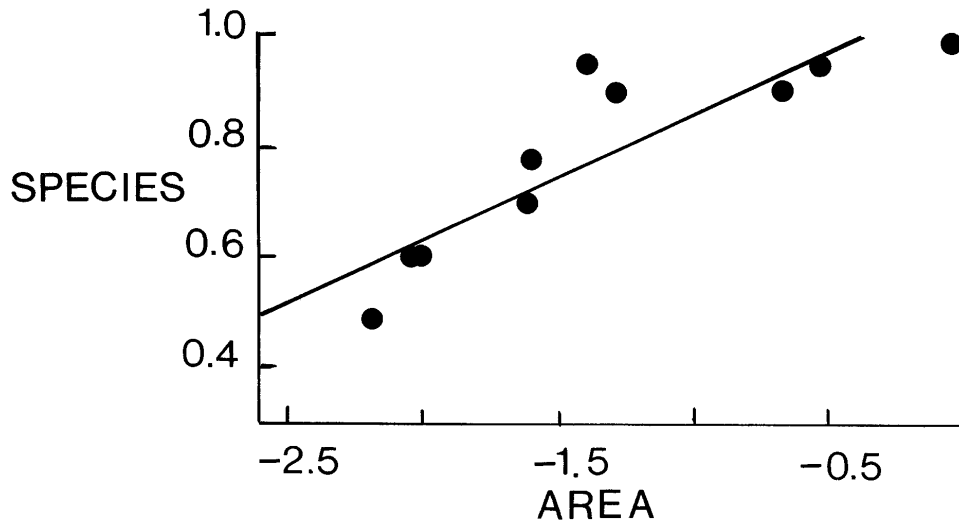


Figure 2.—Log-transformed species/area (km²) relationship for lizards on Sapwuahfik Atoll islands; $Y = 1.086 + 0.221(X)$, $r = 0.877$, $P < 0.01$.

Acknowledgments

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