THE TUATARA, *SPHENODON PUNCTATUS* GRAY, ON ISLANDS WITH AND WITHOUT POPULATIONS OF THE POLYNESIAN RAT, *RATTUS EXULANS* (PEALE)

IAN G. CROOK

New Zealand Wildlife Service, Department of Internal Affairs, Wellington

SUMMARY: The results of a survey of the presence and populations of the tuatara (*Sphenodon punctatus*) and the Polynesian rat or kiore (*Rattus exulans*) on 35 islands off the New Zealand coast are presented and discussed. Tuataras were found on 23 of these, and on six they occur with kiore. The age distributions and densities of the tuatara populations suggest that decline because of failure of recruitment is occurring on seven — the six kiore-inhabited islands and one other. Seven more kiore-inhabited islands within island groups which otherwise support tuataras apparently lack any tuataras themselves. These findings strongly suggest that tuataras cannot persist in the presence of this rat.

INTRODUCTION

The tuatara (*Sphenodon punctatus* Gray) is now confined to islands in Cook Strait and off the north-east coast of the North Island of New Zealand between East and North Capes (Fig. 1). Previously it was more widely distributed; sub-fossil remains have been found in localities ". . . . ranging from North Cape at the tip of the North Island . . . to Bluff near the southernmost point of the South Island" (Dawbin 1962). It may also be dying out on some of the islands where it still occurs. The first part of a distribution survey has shown wide variations in abundance both of adults and young animals on different islands. On some, young animals are very uncommon or have not been found at all; on these same islands adults also tend to be less abundant. All islands, except one, where tuatara populations with these features have been found also support populations of the Polynesian rat or kiore *Rattus exulans* (Peale).

Each island in the survey was searched for tuataras and their sign during part of at least one day and one night* between the months of November and April. An additional visit was made to some islands in the Mercury Group in June. During daylight hours sloughed skins, faecal pellets, remains of dead animals and, to a limited extent, tuataras themselves were sought. A search was also made for young tuataras, which are often found under rocks and logs. Night searches for active tuataras and, where numbers warranted it, timed searches, provided indications of relative numbers. All tuataras caught were measured, the length from snout to vent being used as an index of age: the tuatara has a remarkably slow growth rate and measurable increments in length and weight occur during at least the first 50 years of life (Dawbin 1962).

Thirty-five islands from which tuataras have been reported, or which are in groups of islands where tuataras occur, (Falla 1960, Bell 1963) were examined (Table 1). Tuataras, or their sign, were found on 23 of these and kiore on 13. Both species were recorded on six, kiore alone on seven, tuataras alone on 17, and neither species was found on the remaining five.

TUATARAS ON KIORE-FREE ISLANDS

With one exception (Hongiora—Aldermen Group) tuataras were found to be common on islands without kiore, rates of capture varying from four to 22 per hour (Table 2). The main factors limiting rate of capture and total numbers caught were vegetation cover and size of the island. Cap-

* Night searches were not made on two minor stacks in the Aldermen group which support tuataras (see Table 2).

ture rates were comparatively low on some small islands and on those with thick, scrubby vegetation, as both these factors limited the amount of new ground that could be covered. However, on Hongiora only six tuataras were caught in over three hours, and the slow rate of capture was attributable only to the comparative rarity of the species. Sladden and Falla (1928) also noted tuataras to be less common on Hongiora than on other islands in the group. In addition, the smallest tuatara caught on Hongiora had a length from snout to vent of 230mm—a mature male (Table 2). On all other rat-free islands young tuataras were found, from hatchlings (50-54mm) upwards, and 524 of the total of 653 animals caught (80.2%) were smaller than 230mm (Fig. 2).

TABLE 1. *Comparison of Occurrence of Tuataras and Kiore on the Islands Examined.*

REGION	ISLAND/ISLAND GROUP	PRESENCE OF: TUATARAS	KIORE
Cook Strait	STEPHENS	present	—*
	TRIO GROUP		
	Main Trio	present	—
	North Trio	present	—
	South Trio	present	—
	THE BROTHERS GROUP		
	Lighthouse (North) Brother	present	—
	Main (South or Big) Brother	—†	—
East Cape to Cape Colville	MOTUNAU	present	—
	RURIMA ROCKS		
	Rurima	—†	present**
	Moutoki	present	—
	KAREWA	present	—
	ALDERMEN GROUP		
	Ruamahua Nui	present	—
	Ruamahua Iti	present	—
	Hongiora	present	—
	"Half"	present	—
	"Hernia"	present	—
	"North Stacks" (southern)	presumed present††	—
	Middle Chain Stack	presumed present††	—
	Middle Chain	—†	present**
	MERCURY GROUP		
	Green	present	—
	Middle	present	—
	Red Mercury	present	present**
	Double	—†	present**
	Stanley	—†	present**
	Korapuki	—	present**
Cape Colville North	CUVIER	present	present**
	HEN AND CHICKENS GROUP		
	Hen (Taranga)	present	present**
	Marotiri (Lady Alice)	present	present
	Coppermine	present	present
	Whatapuke	present	present
	Araara	—†	presumed present
	Mauitaha	—	present**
	Pupuha	—†	—
	"Middle Stack"	—†	—
	Muriwhenua, Wareware } North-west Chicken	—†	—
		—†	—

* Indicates presumed absence.

** Voucher specimens held by Ecology Division D.S.I.R.

† Presumption of absence based on one night of search.

†† Not visited at night. Presumption of presence based on sign.

TABLE 2. *Tuatara Populations on Islands With and Without Populations of Kiore.*

ISLAND	KIORE	TUATARAS					
		Number/ hour Search	Estimated Relative Abundance	Mean	Snout-vent length (mm) Range —	+	N
STEPHENS	Absent	20	common	202	53	289	237
TRIO GROUP							
Main Trio	Absent	14	common	201	103	261	41
North Trio	Absent	—	common	—	172	183	2
South Trio	Absent	—	common	—	110	220	6
THE BROTHERS GROUP							
Lighthouse Brother	Absent	22	common	198	133	260	54
MOTUNAU	Absent	8	common	194	135	244	81
RURIMA ROCKS							
Moutoki	Absent	8	common	187	157	216	45
KAREWA	Absent	5	common	194	135	244	28
ALDERMEN GROUP							
Ruamahua Nui	Absent	12	common	173	51	260	46
Ruamahua Iti	Absent	10	common	183	55	231	63
"Half"	Absent	4	common	—	95	212	8
"Hernia"	Absent	10	common	190	146	229	12
Hongiora	Absent	2	uncommon	—	230	285	6
"Nth. Stacks"	Absent	—	common*				
Middle Chain Stack	Absent	—	common*				
MERCURY GROUP							
Green	Absent	10	common	205	53	254	31
Middle	Absent	6	common	220	150	288	62
Red Mercury	Present	—	rare				
CUVIER	Present	—	rare				
HEN & CHICKENS GROUP							
Hen	Present	—	rare				
Marotiri	Present	6	common	236	190	273	68
Coppermine	Present	4	common	—	195	259	7
Whatapuke	Present	1	uncommon	246	181	302	52

*Island not visited at night; status of kiore and tuatara and relative abundance of tuatara inferred from sign.

This ratio of small to large tuataras varied considerably from one group of islands to another. On those in Cook Strait 73 percent (242 of a combined total of 332) were less than 230mm in snout-vent length. The ratio was similar for the Mercury Group (71%—64 of 90 animals less than 230mm), but on those of the Aldermen Group other than Hongiora and in the southern Bay of Plenty (Karewa, Motunau and Moutoki) it was much higher. Of the combined total of 231 tuataras caught on these islands, 218 (94%) were less than 230mm. This further emphasises the differences between the tuatara population of Hongiora and those of other islands in the vicinity.

The ratios of small to large animals found reflect the age distribution of the different tuatara populations. On Stephens Island, for example, both very young and mature animals are present and common, while the Aldermen Islands, excepting Hongiora, have large populations of young tuataras; animals over 230mm in snout-vent length are hard to find (Fig. 2). Hongiora on the other hand has few, if any, juveniles; but large animals are equally hard to find. This population has features similar to those on some kiore-inhabited islands.

TUATARAS ON KIORE-INHABITED ISLANDS

Tuataras are rare on three of the six islands where they have been found with kiore (i.e. Hen, Cuvier and Red Mercury). Mr D. V. Merton (pers. comm.) recorded only one or two adult tuataras on each of four, month-long visits to Hen Island between 1963 and 1968; and in more than five months on Cuvier between 1960 and 1969 tua-

FIGURE 1. *Locations of islands examined*: 1. *The Hen and Chickens Group*, 2. *Cuvier I.*, 3. *Mercury Group*, 4. *Aldermen Group*, 5. *Karewa I.*, 6. *Motunau I.*, 7. *Rurima Rocks*, 8. *Stephens I.*, 9. *Trio Group*, 10. *The Brothers Group*.

taras, except for the few living under lighthouse keeper's cottages, were rarely encountered. Young animals were not seen. Edgar (1962) reported one (about 12 inches (300mm) long and thought to be a female) from Red Mercury Island, and Merton (pers. comm.) has found one during about a month there since 1964. Neither the combined Wildlife Service — D.S.I.R. expeditions of June 1970 and November 1972 nor the Auckland University Field Club expedition of August 1971 (Towns 1972) recorded tuataras from Red Mercury, though they are common on two other islands in the group (Middle and Green—Table 2).

The seven islands with kiore on which tuataras have not been found may have similarly small numbers of them: alternatively, they may once have been present but are now extinct. None of these islands has been visited for as long as Hen, Cuvier and Red Mercury where, even during long visits, few tuataras were seen; and all are in groups which otherwise support tuataras. The best example of this is Middle Chain in the Aldermen Group. All the islands in this group which have been visited have tuataras and lack kiore except Middle Chain, where the opposite applies. Middle Chain is at the geographic centre of the group and less than 30m from the nearest tuatara island (Fig. 3).

On the three remaining islands with kiore populations (Marotiri or Lady Alice, Coppermine and Whatapuke—all in the Chickens Group) tuataras are relatively more common. On Marotiri and Coppermine rates of capture were within, but near the lower limit of , the range observed on rat-free islands. Whatapuke appears to support the lowest density of the three. Tuataras were classed as being uncommon there but sufficient were present for one to be caught during every hour of search (Table 2).

Of the 93 animals that have been measured on kiore-inhabited islands none was less than 180mm in snout-vent length and only three were less than 200mm. On islands without kiore 27.6 percent of the animals caught (180 of 653) were less than 180mm, and 352 (53.9%) were less than 200mm (Fig. 2). The failure to find small animals indicates very low rates of recruitment.

DISCUSSION

The annual increase in snout-vent length of young tuataras on Stephens Island is such that they probably reach 180mm during the first 20 years of life (Dr W. H. Dawbin *in litt.*, Crook and Moran, unpubl.). Therefore, in the recent past, some breeding has occurred on at least three kiore-inhabited islands — Marotiri, Coppermine and Whatapuke. Kiore, introduced by Maoris, have been on these and other islands where they occur with tuataras for undetermined but far longer

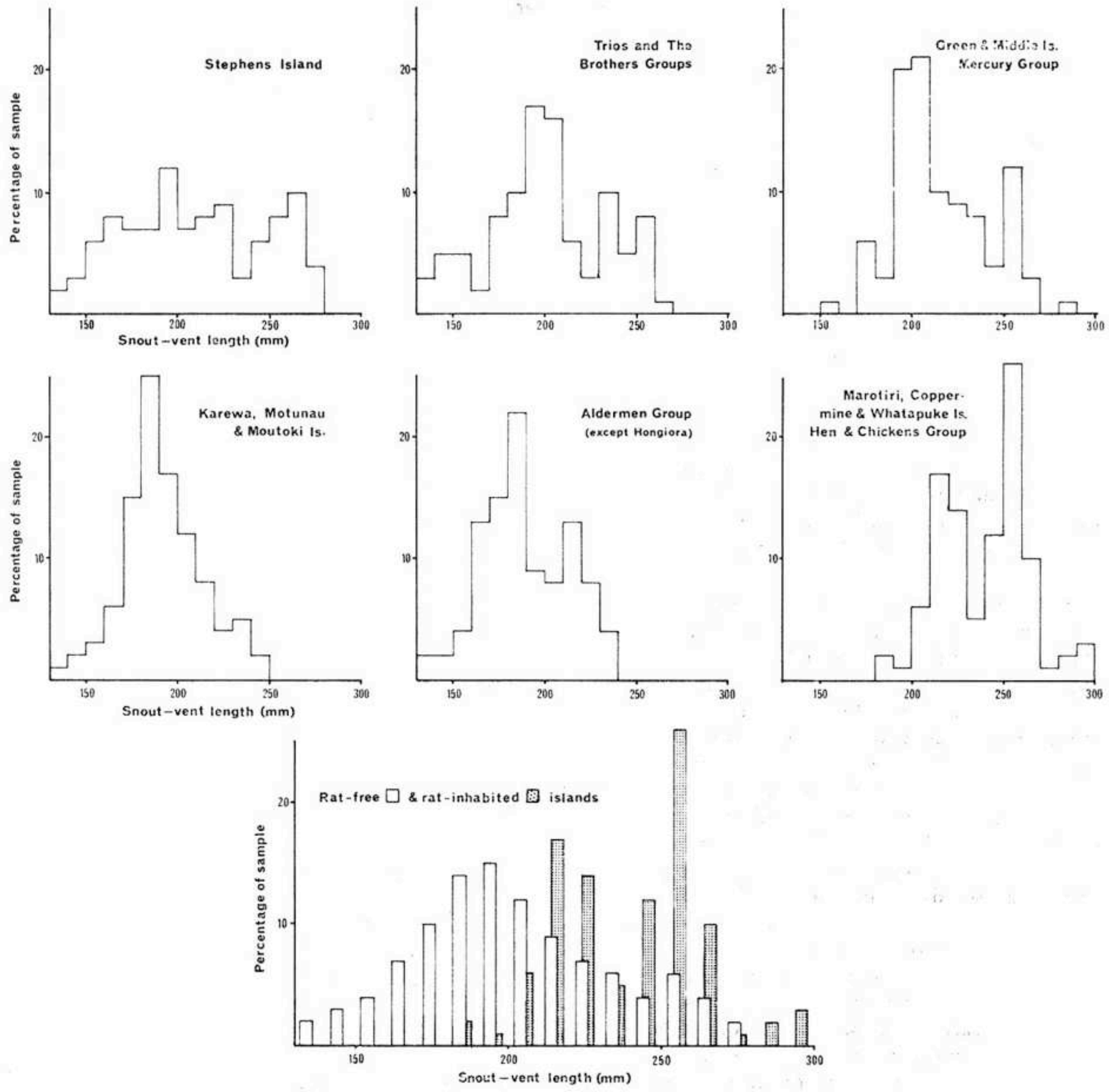

FIGURE 2. *Distributions of snout-vent lengths of tuataras larger than 130mm on the different groups of islands and comparison of lengths of tuataras on kiore-free and kiore-inhabited islands. (For sample sizes refer to Table 2.)*

periods than the lifespan of the youngest tuataras found there. Therefore tuataras can sometimes breed successfully in the presence of kiore and very young animals may occur even though surveys have, so far, failed to reveal them.

However, recruitment rates in tuatara popula-

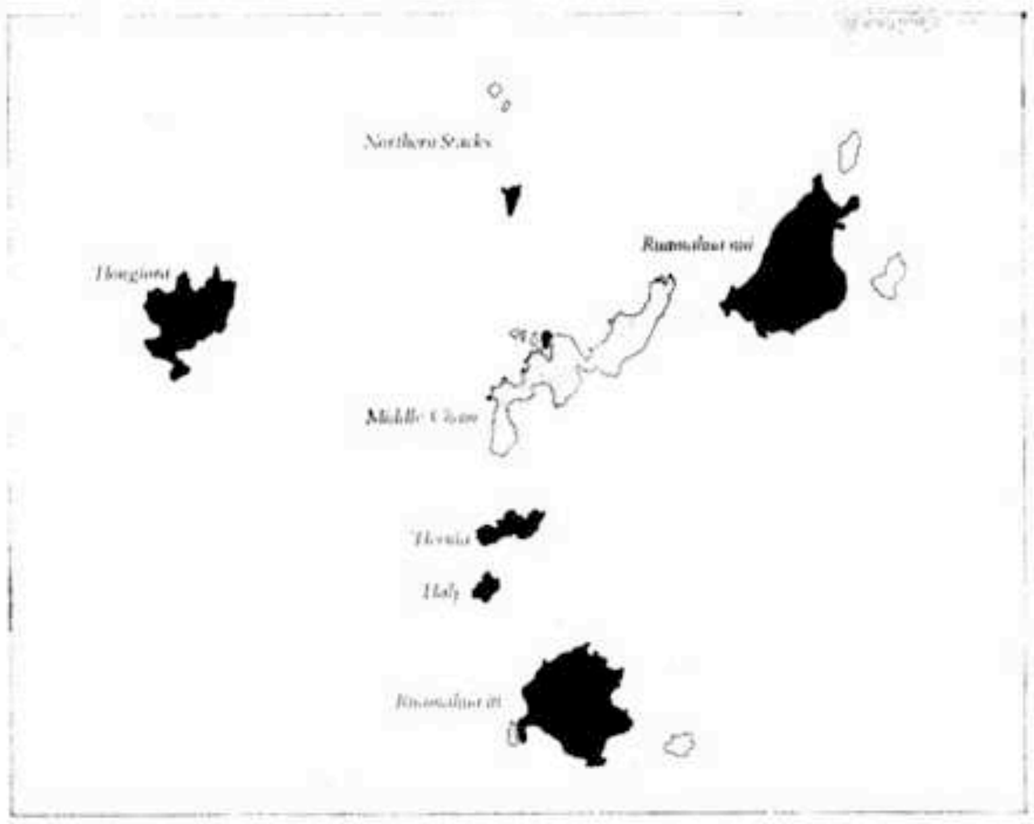

FIGURE 3. *Islands of the Aldermen Group showing Middle Chain (stippled), which apparently lacks tuataras but which is inhabited by kiore, in relation to the other islands visited (black) — which have tuataras but apparently lack kiore.*

tions are very much slower on islands with kiore than on those without, and rates insufficient to maintain their numbers would explain the apparently relict populations of Hen and Cuvier Islands. On islands like Red Mercury where, despite frequest visits, only two sightings have been made since 1961, and none have been seen in recent surveys, the tuatara could be nearing extinction.

This may also be so on some other of the islands where tuataras have not been found, especially those in close proximity to islands where they do occur; but islands lacking both species indicate that tuataras may be absent from some islands of an inhabited group for reasons other than those related to presence of kiore. Small populations with low recruitment rates are also to be found, though apparently rarely, on islands without kiore (e.g. Hongiora); and the low incidence of older animals on some islands further demonstrates that factors other than kiore may also be responsible for variations in population structure. Predation or habitat destruction by Maoris and, more recently, the collection of large numbers of tuataras, particularly on the smaller islands such as Karewa, could contribute to these differences.

However, failure to find a single island where kiore have established which also supports a clearly self-maintaining population of tuataras strongly suggests that the species cannot persist in the presence of this rat. Under these circumstances, variations in the stage which the decline has reached on the different kiore-inhabited islands may be the result of differences in the times of introduction of kiore. The Chicken Islands (Marotiri, Coppermine and Whatapuke) may have had kiore for a shorter time than Red Mercury, Cuvier and Hen Islands for example.

ACKNOWLEDGMENTS

Mr L. R. Morton (Wildlife Service) collected data presented here on Karewa and Motunau Islands and the Rurima Rocks. Mr Moran and Mr A. H. Whitaker (Ecology Division, D.S.I.R.) collected the data for the Chickens Islands. I am also indebted to Mr Whitaker, Dr I. A. E. Atkinson (Botany Division, D.S.I.R.) and other members of the Wildlife Service, particularly Mr D. V. Merton, for both ideas and criticisms as well as help in the field.

REFERENCES

BELL, B. D. 1963. List of New Zealand offshore islands and their wildlife status. Unpublished report, Wildlife Branch, Department of Internal Affairs, 1 July.

DAWBIN, W. H. 1962. The tuatara in its natural habitat. *Endeavour* 21: 16-24.

EDGAR, A. T. 1962. A visit to the Mercury Islands. *Notornis* 10: 1-15.

FALLA, R. A. 1960. The fauna of New Zealand. In: *A descriptive atlas of New Zealand*, A. H. McLintock Ed. R. E. Owen, Government Printer, Wellington.

SLADDEN, B.; FALLA, R. A. 1928. Alderman Islands. *New Zealand Journal of Science and Technology* 9: 282-290.

TOWNS, D. R. 1972. The reptiles of Red Mercury Island. *Tane* 18: 95-105.