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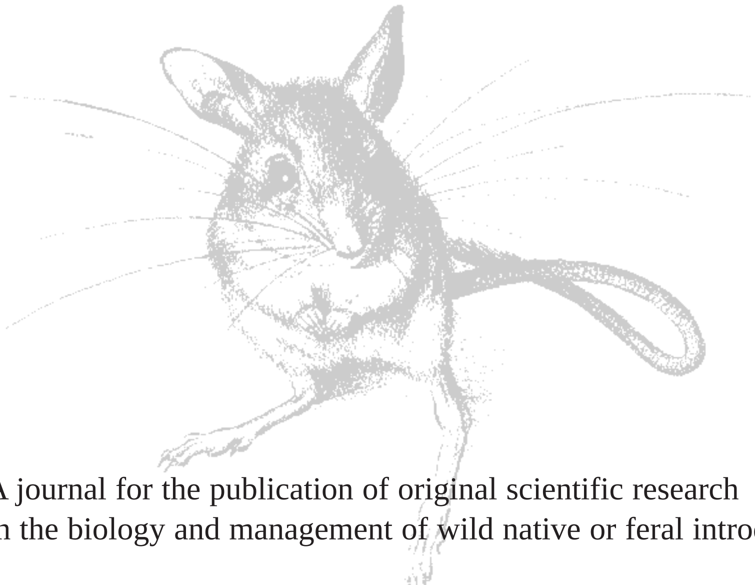

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Ecological traits of commercially harvested water monitors, *Varanus salvator*, in northern Sumatra

Richard Shine[A], *Ambariyanto*[A], *Peter S. Harlow*[A] *and Mumpuni*[B]

[A]School of Biological Sciences A08, The University of Sydney,
NSW 2006, Australia.
[B]Centre for Research in Biology, Museum of Zoology, LIPI,
Bogor 16122, Indonesia.

Abstract

An important step towards evaluating ecological sustainability of resource use is to understand the characteristics of that resource. Indonesian populations of the Asian water monitor (*Varanus salvator*) have been heavily exploited over several decades for the reptile skin industry. We visited two cities in northern Sumatra (Rantauprapat and Cikampak) to gather information on the sizes, sexes, reproductive status and food habits of harvested specimens. Data on 399 lizards showed that monitors in northern Sumatra are similar in most respects to those studied previously in southern Sumatra (Palembang), despite the considerable distance between the two areas and the significant difference in climates. Male water monitors mature at a smaller size than females, but grow to larger body sizes. Harvesting is concentrated on adult males, and adult plus juvenile females. Reproduction occurs year-round, but at a lower intensity in drier months (March and June). Females produce multiple clutches of 6–17 eggs each year. These lizards eat a wide variety of prey, including commensal vertebrates (e.g. rats, chickens) as well as invertebrates (e.g. insects, crabs). The numbers of stomach parasites (spirurid nematodes, *Tanqua tiara*) were higher in juvenile lizards than in adults, and varied between our two sampling sites. Our results suggest that water monitors exhibit relatively little morphological or ecological divergence over broad areas within Sumatra, hence simplifying the task of developing appropriate management systems for the commercial harvest.

Abstract (Bahasa Indonesia)

Langkah pertama yang perlu dilakukan dalam mengevaluasi pemanfaatan suatu sumberdaya yang berkesinambungan secara ekologis, adalah dengan memahami sifat-sifat dari sumberdaya tersebut. Kami mengunjungi dua lokasi di propinsi Sumatra Utara (Rantauprapat dan Cikampak) untuk mengumpulkan data-data tentang ukuran, jenis kelamin, tingkat kematangan (reproduksi) serta kebiasaan pakan dari biawak Asia (*Varanus salvator*) yang ditangkap dan dipotong untuk mensuplai industri kulit international. Berdasarkan data dari 399 hewan yang terkumpul, terlihat bahwa biawak dari Sumatra Utara dalam banyak hal sangat mirip dengan biawak dari palembang yang pernah kami teliti sebelumnya. Walaupun kedua tempat tersebut berjarak cukup jauh serta mempunyai perbedaan iklim pula. Biawak jantan akan mencapai tingkat dewasa pada ukuran yang lebih kecil dibanding dengan hewan betina, tetapi hewan jantan akan tumbuh lebih besar. Biawak yang tertangkap terutama adalah hewan jantan dewasa serta hewan betina baik yang sudah dewasa maupun belum. Proses reproduksi hewan ini terus berlangsung selama satu tahun, dengan intensitas yang menurun pada bulan-bulan kemarau (Maret–Juni) Hewan betina mampu mereproduksi banyak *clutch* dengan 6 hingga 17 telur per tahun. Jenis hewan yang dimangsa oleh biawak sangat beragam, termasuk vertebrata (misalnya kucing, tikus, ayam) dan invertebrata (misalnya serangga dan kepiting). Sedangkan jumlah parasit (cacing Nematoda) yang terdapat dalam perut lebih banyak ditemukan pada hewan yang berasal dari Cikampak dibanding dari Rantauprapat. Berdasarkan hasil-hasil tersebut dapat dikatakan bahwa hewan biawak mempunyai perbedaan morfologi dan ekologi yang relatif kecil di seluruh wilayah Sumatra, hal ini justru akan mempermudah dalam proses penyusunan sistem menejemen yang tepat untuk pemanfaatannya secara komersial.

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Introduction

In many parts of the world, the meat and/or skins of wild animals constitute important resources for human populations. Although consumptive use of wildlife has occurred over a very long period, recent decades have seen widespread changes in this interaction between man and nature. Increased numbers of humans have added to harvesting intensity, at the same time as anthropogenic degradation of habitats has reduced the ability of many animal species to withstand hunting pressure (e.g. Campbell *et al*. 1989; Green and King 1993). These rapid changes have raised widespread concern about the continued sustainability of many existing harvests, especially in the case of species involved in large-scale commercial trade (e.g. Campbell *et al*. 1989; Warwick *et al*. 1991). Although harvest quotas are often driven by social, political and economic pressures rather than biological information, a clear understanding of the biology of the exploited taxa can provide a useful basis not only to evaluate the sustainability of current harvesting practices, but also to suggest ways in which current practices might be modified to enhance sustainability (Fitzgerald *et al*. 1993; Webb 1995; Grigg 1995).

The skins of several species of large reptiles possess a high commercial value because they can be used for luxury leather items. This fact has stimulated considerable international trade in these items over several decades (Luxmoore and Groombridge 1990; Jenkins and Broad 1994). The squamate reptile taxon most heavily represented in the commercial leather trade worldwide is the Asian water monitor, *Varanus salvator*, an extremely large (to 2.5 m total length, 20 kg) semiaquatic varanid lizard widely distributed through south-east Asia (Gaulke 1991*b*). Recent surveys suggest that more than a million lizards of this species are taken from the wild every year to be killed and skinned, with the greatest numbers coming from Indonesia, especially Sumatra and Kalimantan (Luxmoore and Groombridge 1990; Jenkins and Broad 1994). Several authorities have expressed concern about depletion of wild populations of these monitors due to overcollecting (e.g. Gaulke 1992; Green and King 1993). There is wide agreement that we need more extensive data both on the biology of the monitors, and on the sizes, sexes and reproductive condition of the slaughtered animals, in order to evaluate sustainable levels of harvesting (Luxmoore and Groombridge 1990; Erdelen 1991).

This challenge is exacerbated by the broad geographic range of *V. salvator*. The species occurs in a diverse array of habitats and climates, and displays geographic variation in several aspects of morphology, ecology and reproductive biology (e.g. Gaulke 1989, 1991*b*). Thus, we need information from the particular areas from which the animals are harvested, because extrapolation from other sites may be misleading. For example, geographic variation in size at maturity in *V. salvator* caused Luxmoore and Groombridge (1990) to mistakenly infer that most harvested monitors were juveniles rather than adults (Shine *et al*. 1996). Two previous analyses of the commercial trade in Indonesian populations of *V. salvator* have been undertaken (Erdelen 1991; Shine *et al*. 1996), but both were based in southern Sumatra, near the city of Palembang. Because many monitors are also taken from northern Sumatra (Luxmoore and Groombridge 1990), we have examined harvested monitors from this area as well. The current paper describes the results from this work, and compares our data with those obtained from the southern populations. Although both harvesting areas are in Sumatra, they are separated by almost 800 km, are on opposite sides of the equator, and differ in climate (see below). Thus, before we can make general statements about sustainable levels of offtake of *V. salvator* in Indonesia, it is important to know whether or not the lizards from these two areas show similar morphological and ecological characteristics.

Methods

We visited slaughterhouses where lizards are brought to be killed and skinned, in two cities in northern Sumatra: Rantauprapat (2°05′N, 99°46′E) and Cikampak (1°43′N, 100°15′E), approximately 70 km apart. The lizards are collected over a broad area of northern Sumatra and transported alive to whichever commercial operator pays the best price (G. Saputra, personal communication); thus, some animals may have been transported a considerable distance from their place of capture. We could not reliably determine

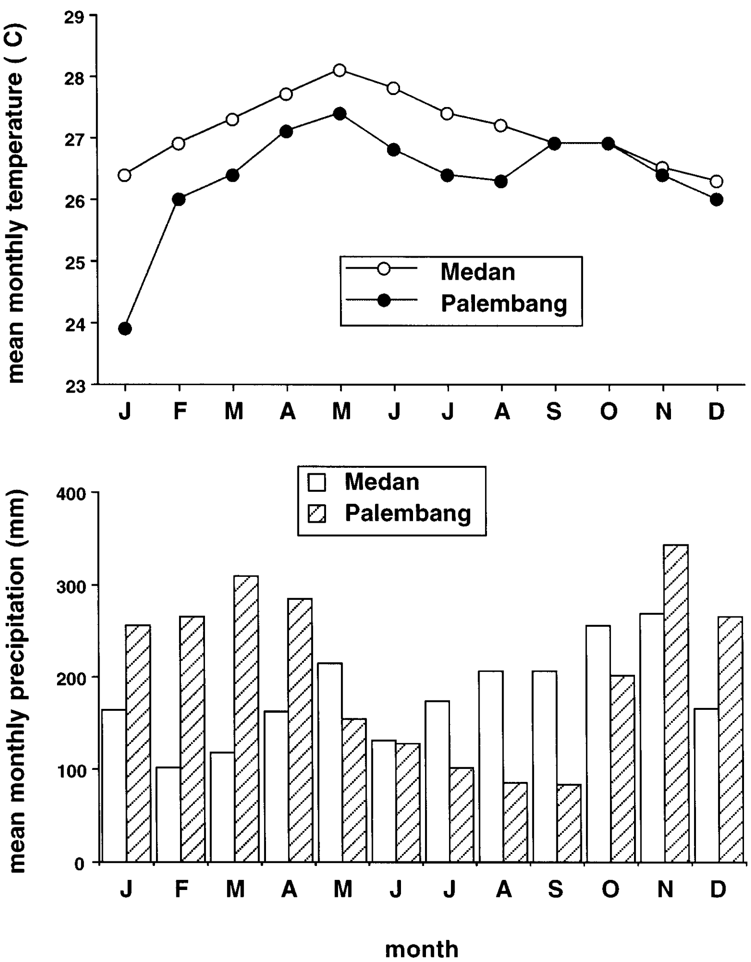

Fig. 1. Comparison of air temperatures and rainfall patterns at Palembang (southern Sumatra) and Medan Polonia (northern Sumatra). Climates are broadly similar, but more highly seasonal in Palembang. Data from Sukanto (1969).

the origin of most specimens. Water monitors are common throughout most of Sumatra (Whitten *et al.* 1984; Welch *et al.* 1990).

The climate in this area is characterised by consistently high mean temperatures, with little seasonal variation (Fig. 1). Rainfall is high (mean annual precipitation at Medan Polonia = 2174 mm: Sukanto 1969) and relatively uniform, but with two minor peaks in May and November (Fig. 1). Although the climate of Palembang (the site of our previous study, 2°59′S, 104°45′E) is broadly similar to that of northern Sumatra, the Palembang climate is more strongly seasonal both in temperatures (cooler in January–February: Fig. 1) and precipitation. The same two peak monsoon periods occur as at Medan Polonia, but at Palembang they are separated by a more pronounced dry season (Fig. 1).

We visited northern Sumatra four times. The trips were spread evenly over the entire year (March, June, August, December), to enable us to evaluate seasonal variation. Actual dates for each trip are shown in Table 1. On each trip we travelled to slaughterhouses in the two localities listed above, and examined freshly killed lizards prior to skinning. We recorded snout–vent length (SVL), tail length and body mass, and then examined the lizard's carcass after skinning to determine sex and reproductive condition (by direct inspection of the gonads). We removed, weighed and measured oviductal eggs, and counted and measured corpora lutea and vitellogenic ovarian follicles. The testes were measured, and their volumes calculated from these dimensions using the equation for an ellipsoid (James and Shine 1985). Any prey items in the alimentary tract were removed for later identification. We scored fat-body size on a four-point scale to provide an approximate index of energy stores. The stomachs of many lizards contained numerous large nematode worms (*Tanqua tiara*, Spirurida), and we also recorded the numbers of these parasites.

Data were analysed on a PowerMacintosh 6100/66 computer, using the software programs SuperAnova 1.11 and Statview 4.5 (AbacusConcepts 1991, 1995).

Results

We obtained information on a total of 399 water monitors killed for their skins. Below, we first analyse these data in terms of spatial (between-location) and temporal (among-trip) variation, since it is necessary to understand these influences before combining the data from locations and trips to provide an overall summary of morphological and ecological traits of the nothern Sumatran monitors.

Spatial variation

If the lizards from the two slaughterhouses differed significantly in characteristics such as size, sex ratio, or reproductive output, it would be meaningless to combine the datasets to provide overall averages. Our data show, however, that geographic variation at this level is relatively minor. One-factor ANOVA (with location as the factor) detected no significant differences among the two localities in mean SVL ($F_{1,397} = 3.71$, $P > 0.05$), mean body mass ($F_{1,386} = 3.52$, $P > 0.05$), mean fat-body score ($F_{1,396} = 0.57$, $P = 0.45$), mean clutch size ($F_{1,25} = 1.79$, $P = 0.19$), or mean egg size ($F_{1,6} = 0.54$, $P = 0.49$). Testis volume (combined for both testes) increased with male SVL, but testis volume relative to SVL did not differ among lizards from the two localities (one-factor ANCOVA with location as the factor, SVL as the covariate, and testis volume as the dependent variable: slopes homogeneous, location effect $F_{1,186} = 1.40$, $P = 0.24$). The sex ratios of lizards from the two areas differed, with relatively more males from Cikampak than from Rantauprapat (62 *v*. 45% male; $\chi^2 = 6.45$, d.f. = 1, $P < 0.02$). The only other variable that differed significantly among locations was the number of parasitic worms in the stomach: specimens from Cikampak were more heavily parasitised (mean = 10.6 worms per stomach) than were lizards from Rantauprapat (mean = 7.5; one-factor ANOVA, $F_{1,238} = 11.34$, $P < 0.001$).

Temporal variation

Table 1 provides information on the numbers of adult and juvenile lizards of each sex examined during each of our four trips at different times of the year. Overall, we detected no significant differences among trips in terms of the relative numbers of males *versus* females

Table 1. Numerical composition of the harvested monitors (*Varanus salvator*) in terms of their sexes and reproductive status (adult *v.* juvenile) on each of our four trips to northern Sumatra

Dates shown are actual span of dates when lizards were examined.

Trip #	Dates	Males		Females	
		Juvenile	Adult	Juvenile	Adult
1	23–26 August 1996	1	56	23	46
2	4–9 December 1996	0	11	4	14
3	26 February–6 March 1997	0	54	12	44
4	15–26 June 1997	2	65	18	49
Totals		3	186	57	153

(χ^2 = 1.77, d.f. = 3, P = 0.62) or adults *versus* juveniles (within males, χ^2 = 1.90, d.f. = 3, P = 0.59; within females, χ^2 = 2.49, d.f. = 3, P = 0.48). Similarly, one-factor ANOVAs (with trip # as the factor) detected relatively few differences among trips for mean values for most traits. Thus, we found no significant temporal variation in mean SVL ($F_{3,395}$ = 1.00, P = 0.39), mean body mass ($F_{3,384}$ = 1.83, P = 0.14), mean fat-body score ($F_{3,394}$ = 2.12, P = 0.10), mean clutch size ($F_{3,23}$ = 2.14, P = 0.12), mean egg mass ($F_{2,5}$ = 2.74, P = 0.16) or mean parasite numbers ($F_{1,238}$ = 0.78, P = 0.38).

However, our comparisons among trips revealed seasonality in reproductive cycles. Mean testis volume relative to SVL differed among lizards from the four trips (one-factor ANCOVA with trip # as the factor, SVL as the covariate, and testis volume as the dependent variable: slopes heterogeneous, $F_{3,178}$ = 7.69, P < 0.0001), because testes were much larger in adult males killed in August (mean = 3524.5 mm^3) than in males killed on the other three trips (all means < 2700 mm^3). Similarly, the proportions of adult females at different stages of the reproductive cycle differed among trips. The proportion of nonreproductive adult females was low (16 and 21%) in the August and December trips, but much higher (44 and 59%) in the March and June trips. These differences were greater than expected under the null hypothesis of equal proportions of nonreproductive animals through time (χ^2 = 20.66, d.f. = 3, P < 0.0001). Nonreproductive females examined in March and June did not have any corpora lutea on their ovaries, indicating that they had not bred for a considerable period.

Sexual dimorphism

We analysed patterns of sex dimorphism in size and shape, because such differences may influence the degree to which each sex is used for the skin trade. Dissections revealed that males mature at a smaller size than do females (approximately 40 *v.* 48 cm SVL), but that males attain larger maximum sizes (to 99 *v.* 71 cm). Thus, despite the fact that the largest 22 specimens in our sample were all males, mean adult SVLs actually did not differ between the two sexes (one-factor ANOVA, $F_{1,339}$ = 0.06, P = 0.81; see Fig. 2). If attention is restricted to the smallest and largest 10% of adult animals within each sex, however, the pattern is clear: males comprise both the smallest adults and the largest adults (one-factor ANOVAs: mean SVL for smallest 10% of adult males = 42.0 cm, for females = 49.8 cm, $F_{1,31}$ = 368.3, P < 0.0001; mean SVL for largest 10% of males = 82.1 cm, for females = 65.7 cm, $F_{1,31}$ = 64.37, P < 0.0001).

As well as differing in absolute size, male and female water monitors show subtle differences in overall shape: for example, males have longer tails than females at the same body length (one-factor ANCOVA with sex as the factor, SVL as the covariate, and tail length as the dependent variable: slopes $F_{1,361}$ = 6.12, P < 0.015) and are more heavy-bodied (one-factor ANCOVA with sex as the factor, SVL as the covariate, and ln mass as the dependent variable: slopes $F_{1,384}$ = 5.57, P < 0.02). However, we did not detect any significant differences between adult male and female monitors in mean fat-body scores ($F_{1,207}$ = 2.30, P = 0.13) or parasite numbers ($F_{1,207}$ = 0.78, P = 0.38).

Reproductive biology

As noted above, males mature at a relatively small size (40 cm SVL), and all males above that size were reproductively active (i.e. contained turgid testes and sperm-filled efferent ducts). Testis volumes increased with male body size, and were larger in August than in the other months for which samples were available.

Females also reproduce year-round, but the lower proportion of reproductive animals in mid-year trips suggests that reproductive activity is depressed in drier months (Fig. 1). Clutch sizes based on counts of vitellogenic follicles or oviductal eggs ranged from 6 to 17 eggs, and averaged 12.8 (s.d. = 3.6). Estimates based on corpora lutea averaged 12.3, with the same range as above (6 to 17 eggs). Clutch size increased strongly with maternal body size (Fig. 3; n = 27, r = 0.76, P < 0.0001). Oviductal eggs averaged 48.7 g in mass (s.d. = 10.9; range 31.8–63.3 g), with no apparent relationship between maternal SVL and mean egg mass (r^2 = 0.01, d.f. = 7, P = 0.81).

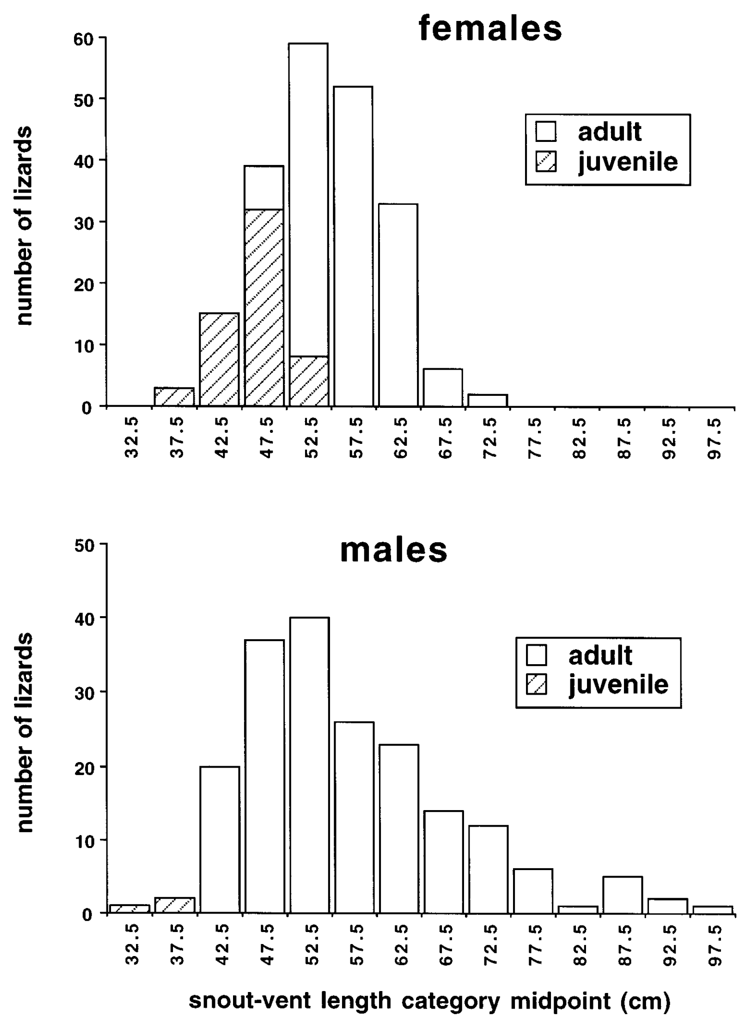

Fig. 2. Body-size distributions of the harvested monitors. Although mean snout–vent length was similar in the two sexes, differences in size at maturity mean that most of the males were adults whereas many of the females were juveniles.

During two of the trips (# 3 and 4), numbers of nonreproductive adult-size female lizards were high enough for us to compare the body sizes of reproductive *versus* nonreproductive animals. In both samples, larger animals were more likely to be reproductive (overall mean SVLs = 51.4 cm for nonreproductive females, 59.0 cm for reproductives; $F_{1,123} = 59.77$, $P < 0.0001$). This result may be due to a tendency for larger females to commence reproducing earlier within a season; or alternatively, because some females delay maturation until they attain sizes larger than 50 cm SVL. Because corpora lutea regress quite rapidly, we cannot estimate the full reproductive history of each female. However, samples from all four trips contained females that had definitely produced one clutch quite recently (based on fresh corpora lutea), and were embarking on vitellogenesis for another. Hence, we are confident that female water monitors in northern Sumatra often produce multiple clutches per year, probably in quick succession.

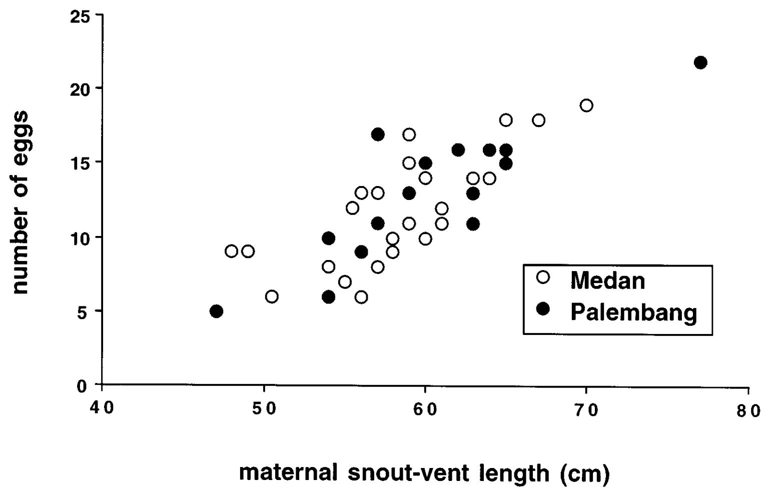

Fig. 3. Clutch sizes relative to maternal body size in water monitors from northern Sumatra (this study) and southern Sumatra (Palembang area, from Shine *et al.* 1996). Statistical analyses (in text) show that these regressions are not significantly different.

Parasites

Adult monitors had fewer parasites than did juveniles (means of 6.1 *v.* 8.5, $F_{1,238} = 4.32$, $P < 0.04$), but no other trends were apparent except for the higher parasite loads in Cikampak than in Rantauprapat (see above).

Table 2. Prey items identified from the alimentary tracts of dissected water monitors

All lizards contained only one prey type, except for two adult female specimens that contained (i) a rat and a bird; and (ii) insects and a crab

Prey type	Number of lizards containing that prey type: Juveniles	Adults
Invertebrates		
Crustacea (crabs)	0	2
Insecta	1	8
Arachnida (scorpions)	0	2
Vertebrates		
Reptiles		
Varanus salvator	0	1
Snakes	1	4
Birds	0	5
Mammals		
unidentified	2	5
Ricefield rat (*Rattus argentiventer*)	2	6
Wood rat (*R. tiomanicus*)	0	3
Civet (*Cynogale bennetti*)	0	1
Leopard cat (*Felis bengalensis*)	0	1

Dietary composition

Most stomachs were empty, presumably because of delays between the lizard's capture and its death. The 44 records of prey from the stomachs of dissected monitors comprised a diverse array of prey types, including crustaceans, arachnids, insects, reptiles, birds and mammals (Table 2). One monitor contained the foot of a conspecific lizard. Some of the largest prey items, from species that might be difficult for a lizard to overpower (e.g. leopard cat, civet), may well have been taken as carrion rather than as living prey. The data are too sparse to test the possibility of an ontogenetic shift in diet, but suggest that even juvenile monitors sometimes take quite large prey.

Discussion

The strongest and most surprising result to emerge from our analyses is that the water monitors of northern Sumatra are very similar to their southern Sumatran conspecifics in virtually every trait that we measured. Previous studies on geographic variation in wide-ranging lizard species have generally emphasised differences rather than similarities among populations; for example, comparisons between lizards from the seasonal *versus* aseasonal tropics have revealed major differences in attributes such as clutch sizes, egg sizes and reproductive frequencies (e.g. Barbault 1975; Rand 1982). Similarly, many reptiles display substantial differences in body size between nearby areas (e.g. Tinkle 1967; Forsman 1991; Auffenberg 1994), often accompanied by divergence in diets (e.g. in tropical Australian *Varanus mertensi* – Shine 1986; and see Losos and Greene 1988).

Given this evidence of intraspecific diversity, why do populations of Sumatran monitors on either side of the equator resemble each other so closely? The answer is likely to lie in the high vagility and broad habitat usage of *V. salvator* (Khan 1969; Erdelen 1991; Gaulke 1992). Populations of this species appear to be virtually continuous across lowland Sumatra, rather than divided into small fragmented populations that can follow different evolutionary trajectories in response to local environments. Thus, gene flow may prevent local adaptation. In keeping with this interpretation, strong geographic variation in morphology and ecology of *V. salvator* has been documented only in populations inhabiting small islands (e.g. in the Philippines – Gaulke 1991*b*; in the Togian Islands – Supriatna and Hedberg 1998).

Whatever its cause, the similarity between the monitors of Medan *versus* Palembang is very strong, and extends to patterns of harvesting (e.g. sex ratio of the culled lizards) as well as to the underlying biological attributes of the animals. Table 3 compares our samples of lizards from northern Sumatra (present study) *versus* southern Sumatra (Shine *et al*. 1996). The clear result is a strong similarity. For example, body size at maturity, mean adult size, and maximum body sizes in each sex are almost identical in the two populations (Table 3). Other aspects of sexual dimorphism are consistent also; for example, males in both populations have relatively longer tails, and are more heavy-bodied, than are females. Reproductive outputs in females (clutch sizes and egg sizes) are also similar (for mean egg mass, $F_{1,11} = 0.76$, $P = 0.40$), as is the relationship between clutch size and maternal body size (Fig. 3: one-factor ANCOVA with location as factor, maternal SVL as covariate and clutch size as the dependent variable: slopes homogeneous, intercepts $F_{1,33} = 0.22$, $P = 0.64$). In both populations, females as well as males are reproductive throughout the year, but with more intense activity at some times than at others. Our data do not allow us to compare the details of reproductive timing in the two systems. Given that the two areas experience different climates (Fig. 1), and that they lie on opposite sides of the equator, it would not be surprising to find that lizards from the two areas exhibited minor differences in the relative intensity of reproduction in particular months of the year. For example, Palembang males had larger testes in April than in October, whereas testes of the Medan lizards were at their maximum size in August. Dietary habits are very broad in both northern and southern Sumatra.

The dearth of significant differences between samples from Cikampak *versus* Rantauprapat also fits well with the similarity between the lizards from northern *versus* southern Sumatra. The

Table 3. Comparison between ecological traits of water monitors in two regions of Sumatra: the southern area near Palembang (data from Shine *et al*. 1996) and the northern part of the island (this study)

Trait	Palembang	Medan
Sample size	166	399
Snout–vent length (cm) at maturity in:		
Males	40	40
Females	47	48
Mean adult snout–vent length (cm) for:		
Males	56.6	56.9
Females	59.0	56.6
Maximum snout-vent length (cm) for:		
Males	91	99
Females	77	71
Mean clutch size	13.0	12.8
Mean egg mass (g)	53.5	48.7
Sex ratio in harvested lizards:		
% Male	49%	47%
% Juveniles among harvested lizards:		
Males	7%	2%
Females	45%	27%

most notable exception was for parasite loads, which were higher in Cikampak than Rantauprapat, and higher in juvenile lizards than in adults. The ontogenetic shift in this trait is particularly interesting, and may well reflect an ontogenetic shift in diets or habitat use. Such shifts have been described in many other lizard taxa, including varanids (e.g. Auffenberg 1981, 1994; Losos and Greene 1988). However, existing data on the diet of *V. salvator* provide no evidence of such a shift (Table 2, and see Gaulke 1991*a*). Alternatively, adult lizards may develop more effective immune responses to parasite infestation. Further work to clarify this issue would be of great interest.

Our study suggests that the commercial harvest of lizards occurs in a broadly similar way in northern Sumatra as in southern Sumatra, and that it is focussed on the same kinds of lizards (i.e. adult males and adult plus juvenile females). The general organisation of the trade also seems to be similar: local people catch the lizards opportunistically (often using baited noose-traps), and sell them to ‘middlemen’ who travel around the villages, or direct to the skinners.

Our data support the inference that harvesting occurs year-round, rather than being restricted to about half the year (Shine *et al*. 1996, *contra* Erdelen 1991). However, the numbers of lizards processed varied considerably among our four trips, and was particularly low on our second trip (Table 1). It is difficult to interpret this variation, although it has obvious significance for levels of offtake and their impact on the population. Possibilities include temporal variation in (i) lizard catchability (some tropical varanids become inactive for several months per year: Christian *et al*. 1995), or (ii) the time that people have available to hunt lizards due to seasonally-enforced agricultural activities (as occurs in the Javan harvest of cobras and ratsnakes: Boeadi *et al*. 1998), or (iii) economic viability of the skin trade. Skin-dealers have told us that the profit margin on lizard skins has declined markedly over recent years, because of falling demand in international markets. These fluctuations may affect the price paid to local hunters, and the numbers of lizards purchased by the dealers. Additional work would be required to test among these alternatives.

Despite these uncertainties, the main conclusion to emerge from our study is the strong similarity (both in general biology and harvesting patterns) of the lizards from northern *versus* southern Sumatra. This is an encouraging result, because it simplifies the challenging task of developing recommendations for sustainable levels of offtake (Webb 1995). Such plans may be able to deal with very large areas, rather than having to incorporate as-yet-unavailable information on lizard biology and harvesting patterns from many specific localities. More generally, we are encouraged to see that this attempt to repeat our initial Palembang study, with a larger sample size and in a different area, has strongly supported the conclusions from the earlier work (Table 3). This kind of study takes relatively little time, is fairly inexpensive, and does not require sophisticated equipment or expertise. Hence, it is well-suited to the scientific resources available in many developing countries. Continued work of this kind could provide valuable data from which to plan the long-term management of water monitor populations in south-east Asia.

Acknowledgments

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