cation. In these cases the descriptions offered by the informants have been regarded as adequate to match local taxa against biological names.

In Table 2 all mammals apparently to be found in the Nuaulu area at the present time have been included. Many have, of course, been introduced by man during the historical period and do not reflect the kind of discontinuities in species diversity generally of interest to zoologists concerned with problems of dispersion and evolution. The numbers of unambiguously introduced animals are given in parentheses. However, some species which were quite probably introduced have now become accepted as part of the 'natural' fauna. These are included in the main figures. This group includes the common mouse (*Mus musculus*), certain rats (*Rattus norvegicus* and the commensal *R. rattus*), deer (*Cervus timorensis*) the pig (*Sus scrofa* and *S. verrucosus*) and at least two species of civet (*Viverra tangalunga* and *Paradoxurus hermaphroditus*). In deciding the appropriate allocation for species of this kind I have relied upon Laurie and Hill (1954). For the purposes of establishing a contemporary indigenous inventory the list should include both natural and introduced forms. While it may not represent the range of animals of interest to the evolutionary taxonomist, it is the operational reference group of concern to the local population.

In comparing the lists for definitely recorded genera and species on Seram as a whole with the equivalent lists for the Nuaulu area in particular (Tables 1 and 2), it will be noticed that for lizards, snakes, marsupials, bats (Chiroptera), even-toed ungulates (Artiodactyla) and rodents the number of genera and species recorded for the Nuaulu area is less than the number for Seram as a whole, in some cases strikingly so. It may be that some species are actually unrepresented in the Nuaulu area, or that provenances given in the older literature and museum collections are doubtful, while older and poorly-known species often turn out to be only subspecies or varieties. For these and other reasons - including the very arbitrariness of the species concept - competent zoologists are justifiably circumspect in the reliance they attach to 'number clues' to evolution and dispersion obtained through quantifying taxa (Darlington 1957:31-2). However, these things are unlikely to explain satisfactorily wide discrepancies, as in the case of bats. In this and other cases it is probably simply that collections have been insufficiently exhaustive. Animals in niches only rarely visited by the Nuaulu are unlikely to come to light during the course of fieldwork, and some species present in the area may well be unknown to informants. There is, for example, the Seram Island bandicoot (*Rhynochomeles prattorum*) which occurs in the upper limits of the Nuaulu exploitative environment, above an altitude of 1000 metres. Although it is known to and hunted by the mountain villagers of the Manusela area, from where it was first recorded, it is unknown to the

Nuaulu. I was only convinced of this after repeated enquiries during three stretches of fieldwork.[5]

The next two columns in Table 2 contain the number of Nuaulu primary and terminal taxa. Here again any error is likely to involve an under-specification rather than over-specification. It might be argued, following on my insistence on lumping both native and introduced species together, that the real inventory should include not only animals within the Nuaulu area, but those met with when travelling outside Seram (for example monkeys), those known to them but never seen (such as elephants and tigers) and even animals whose existence is only mythical. In a sense this is true. Indeed, in some cases it is quite artificial to separate out some animals from spirits, which may be perceived as a single continuum of beings. While recognizing this, I have purposely limited the present exercise (for both theoretical and practical reasons) to the relationship between the local fauna defined scientifically and the indigenous terminology which is broadly equivalent to it.

Over-Differentiation and Under-Differentiation

The final column in Table 2 consists of an index of differentiation, as an indicator of the relationship between the number of biological species in the area and the number of Nuaulu terminal taxa. The index is obtained by dividing the number of indigenous terminal taxa by the number of species equivalents. The result is then expressed in tenths as + or - 1. For example, the ratio 16/20 (Snakes) = 1.25 = +3, or the ratio 8/7 (amphibians) = 0.87 = -1. Figures greater than +5 or less than -5 are regarded as significantly over- or under-differentiated.

Now, it is important not to claim too much for this index. It is simply adopted as a convenient and succinct means of expressing folk differentiation of the biological world. It must be acknowledged, for example, that being dependent on a single ratio it takes no account of the number of categories and species involved. Thus, the ratio 1:2 can have the same value as 100:200. While the latter is very likely to represent consistent over-differentiation of some significance, the same index for the former ratio might be accounted for very easily by individual informant variation and error, or even error on the part of the ethnographer. Clearly, the implications of the index with respect to larger groups are generally more significant than for groups involving only one or two species. It is therefore of some importance to bear such points in mind, not to draw hasty conclusions from misleading arithmetic, and to treat the index with the caution it deserves.

Accepting all that has just been said, the Nuaulu appear to under-differentiate two groups - amphibians and bats - and

then only slightly (-1 and -2 respectively). Four groups - turtles, crocodiles, insectivores and perissodactyls - have values of zero indicating a general reflection of biological diversity in terms of local names, but the last three of these groups are represented by single species only - the crocodile, the shrew *Suncus murinus* and the introduced horse. Six groups are over-differentiated - lizards, snakes, marsupials, carnivores, artiodactyls and rodents. Of these lizards and marsupials are significantly over-differentiated (+6/+7, and +10 respectively), although it should be noted that marsupials are represented by only two biological species. More on this in a moment. In terms of classes, amphibians are marginally under-differentiated, mammals are marginally over-differentiated and reptiles are markedly over-differentiated.

Part of the variation in the values for these indices may be explained simply in terms of inadequate data, the conduct of fieldwork (Bulmer 1974:86) and artifacts introduced by quantification. This is particularly the case where we are dealing with groups where the relations between biological species and local taxa are derived from small numbers. Error of this kind may be involved in the case of Nuaulu rodents. With the other low figure groups we can be reasonably sure that both the number of biological species and local taxa reflect the true situation. This is because the biological record is sound, and because the animals involved are either introduced species (horses, dogs, cattle, cats) or otherwise morphologically distinctive (pigs, deer, crocodiles, turtles and marsupials).

On the other hand groups for which a discrepancy between the number of species in the Nuaulu area and Seram as a whole indicates that more species might be found (bats, lizards, snakes) might very well give rather different indices were they to be computed using revised figures based on a thorough and systematic collection of specimens. Having said this I think we can nevertheless conclude that the values for lizards and snakes indicate over-differentiation, while the remainder indicate a broad correlation between numbers of biological species and indigenous terminal taxa.

Apart from that due to error and inadequate fieldwork, there is of course genuine deviation from zero values. This may be accounted for in a number of ways. In the case of marsupials it is simply due to the fact that the named terminal taxa represent two sexually dimorphic cuscus species (*Phalanger orientalis* and *P. maculatus*). Cuscus are important both economically and ritually and thus over-differentiation is consonant with their utility. Moreover, one sex of one species (*maramakinete* = *P. orientalis* ♂) is employed totemically and is therefore prohibited food for certain clans. The four-fold classification and selection of only one taxon for totemic purposes may in this instance be in part a response to apparently

contradictory (although related) values attached to a single genus - subsistence utility and symbolic usage (Ellen 1972:226-7, 1975:203-11).

Lizards and snakes, however, are also over-differentiated and these are of no particular utilitarian value. At the risk of putting a cat among a few pigeons, I would suggest that here the answer would appear to lie rather with the fact that while both groups are diverse they have no immediate social values which would require them to be differentiated accurately and extensively, except perhaps for the purpose of separating dangerous from harmless types. The proliferation of terms is as much to do with *an absence of consensus* as with any utilitarian value which they might possess, either together or singly. It seems that what might be associated with utility more than the simple proliferation of names in a given domain is the consistency and accuracy with which these are applied. In the Nuaulu case labels are available and applied to reptile and snake taxa simply to identify them, but within reasonable limits the accuracy of the identification in a conventional biological sense is not important. The terms are used as loose labels to attach to animals with which people are interacting daily but peripherally in an economic sense, such as polymorphic skinks and to a lesser extent frogs. They are used to describe individual animals rather than to identify folk species with recognizable and discrete boundaries. The terms are sometimes used relatively, as in A is to B (labels) as x is to y (observed animal), rather than A = x and B = y. What may be labelled *poso noho kunie* ('yellow skink': usually *Mabuya multifasciata*) in contrast to another labelled *p. ai totu kopuwe* ('rotting tree leaf skink': usually *Carlia fusca*) may in contrast to a lighter coloured individual of *M. multifasciata* be spoken of as *p. noho metene* ('black skink'). In this sense we are not so much dealing with equivalences as relationships.

This kind of relative identification is valuable quite simply because it brings order to an otherwise apparently chaotic faunal universe. Its immediate aim is the creation of cultural system in nature so as to comprehend it, rather than because the elements involved have direct social values. This is also partially true of much western biological taxonomy, systematics and nomenclature. Even here though taxonomic science has its historical roots firmly in the personal and practical Aristotelian criteria and the tincture categories of the middle ages, while so-called 'pure' bourgeois scientific knowledge has always been accorded its own ideological value.

Another source of proliferation in terms for marsupials, lizards and snakes is in partial or imperfect synonymy. It could be argued that this is involved in the kinds of discriminations just described, since there is an overlap in the application of terms for particular animals. If *p. n. kunie* and

and *p. n. metene* are both used to refer to *M. multifasciata*, and that in different contexts the same label might be applied to the same individual, then the terms are being used synonymously. This is despite the fact that the semantic overlap is only partial and that in other contexts they may be contrasted. In perfect synonomy - which (as I have already mentioned) has been rejected as a source of further names in the tabulated lists - terms are identical in sense and usage and are consistently applied to a single taxon. There are a number of synonyms applied to cuscus taxa, but these are not perfect since they are making classificatory discriminations not made by the normatively applied term.

Thus *mara-kokowe* of an intermediate hue are sometimes labelled *mara-makioi*, referring to their mixed (reddish-brown, yellow-brown) coloration. Sometimes animals of indeterminate taxa are labelled provisionally as *mara-putie* or *mara-metene*, referring respectively to specimens of a white or darkish hue, while members of *mara-kokowe* and *mara-sina* showing a rufous suffusion (typical of the breeding season) are at times termed *mara-hehue*.

But these terms, like distinctions such as *mara-koko-putie/mara-koko-msinai* or terms applied to different phases of development are not acting as synonyms so much as descriptions of varient individuals. They certainly cannot be granted the status of terminal taxa. With snakes and lizards the situation is not as clear cut. Here both perfect and imperfect synonymy exist, but to complicate matters terms which may be applied to the same biological species on different occasions act as if they were true terminal taxa. It is therefore difficult to distinguish the perceived synonymy of the informant from the objective synonymy of the observer.

While it is quite possible to list Nuaulu terminal taxa for lizards and snakes and match them against their equivalents or near-equivalent biological species, it is equally instructive from the point of view of understanding the mechanism of classification to see names for animals as a pool of terms associated with certain ideal characteristics which can be matched against the diversity of reptilian fauna as and when seems appropriate. Since nature is ultimately a continuity made discontinuous by taxonomic science on the basis of certain selected criteria, it makes no difference whether the discontinuous elements are greater or less than the biologically distinguished number. Thus for the Nuaulu it makes little difference whether the distinctions between terminal taxa are based on mating populations or more superficial and loose criteria such as relative colour or size.

There is also an artifact in combining Nuaulu and biological categories which may explain the apparent overdifferen-

tiation of some groups. This is that the differentiation index for an order or class may simply be a reflection of significant overdifferentiation in one of its component lower taxa, while other taxa within the order may have near zero values or even be under-differentiated. For example, it is the significant over-differentiation of snakes and lizards which colours the overall picture for reptiles.

Among snakes some groups are under-differentiated, such as worm snakes, which are collectively termed *teke-tuamana* and not further sub-divided. As to explaining the overdifferentiation, in at least one case it is due to the representation of two developmental phases of the same snake *Dendralaphis pictus* as different terminal taxa. This is not because Nuaulu are insufficiently perceptive to recognize that, in this case, *teke tam niane* is simply an immature *teke-soata*, but because in terms of the criteria adopted for segregating terminal taxa the former actually does change into the latter. Freshwater and marine snakes are probably overdifferentiated on the grounds that they represent secondary food sources, although turtles, pythons and monitors are also important foods but have zero value. Here intraspecific variation may be less than among the water snakes. Among lizards, both *Varanus indicus* and *Hydrosaurus amboinensis* are sexually dimorphic and this is recognized by the existence of four terminal taxa for each of these two species which are both related in Nuaulu classificatory and mythic thought. The same is true for *Riopa (Eugongylus) rufescens (nopa hanai/nopai ina)*. Other over-differentiation in these two groups can be explained by proliferation of terms applied to species commonly seen around the village and gardens. Under-differentiation is found for unknown and unimportant species in areas distant from settlement locations, rare species being lumped together in a common taxon or incorporated in a taxon in which the type of species is relatively common. As the proportion of species present in inhabited and frequently visited areas is high compared with less frequently visited areas the index is pushed correspondingly higher.

Finally, in this connexion, a word on symbolism. I had not intended to say a great deal about the relationship of symbolic uses to differentiation of animal inventories, but since I am billed as culminating a series of lectures on the subject of natural symbols, I suppose I ought to. Clearly an understanding of classification systems is a necessary pre-condition for the adequate interpretation of symbolic systems. It is so because the material world - in this case discontinuities in the range, diversity and availability of fauna - sets the outer limits for the selection of natural symbols. This operates in the same way that the materiality of the human body structures the selection of anatomical semiotica (Ellen 1975). Despite this I am not at all convinced that one can demonstrate a consistent tendency either to over- or under-differentiate those

segments of classificatory systems which are symbolically important. Sometimes the relationship between overdifferentiation and symbolic usage is clear, as in the case of the marsupial cuscus which I have described in detail elsewhere. However, while the relationship is mutually self-enforcing there is no evidence that I know of to suggest that either symbolic usage tends to the making of greater discriminations among the animal species so-used or that the animals that are taxonomically subdivided naturally tend to become adopted as symbols. Rather, symbols arise for a variety of historical reasons which may or may not correspond to their contemporary function. Given the association between an animal and symbolic context, the possibilities for altering, refining or involuting the meaning of the symbol will be exploited. This may involve breaking-down an animal category into further categories, or the glossing over of variation which in other contexts might be regarded as taxonomically significant. The former process is exemplified among the Nuaulu in the case of the cuscus, the latter in the grouping of cassowary, pig and deer into a single category (Ellen 1972, 1975).

It is clear for a number of reasons - methodological, technical and ethnographic - that it is (a) difficult to measure differentiation, and (b) having measured it to explain it simply. In their influential paper 'Folk taxonomies and biological classification' (1966), Berlin, Breedlove and Raven seem to be implying the contrary, at least for the plant names they recorded for the Tzeltal of the Mexican province of Chiapas. A sample of 200 Tzeltal specific plant names were sorted into a matrix on the basis of degree of differentiation (under-differentiation, one-to-one correspondence and overdifferentiation) and in terms of 'cultural significance' (low, moderate and high). In this way they were able to demonstrate that there was a strong 'positive correlation between cultural significance and degree of lexical differentiation' (1969 (1966):62). This is in conformity with the Nida-Conklin hypothesis which states that the elaboration of terminologies (or portions of terminologies) is directly proportional to their cultural importance (Conklin 1962:132, see also Frake 1961:121). Unfortunately, the authors provide no discussion of the practical and methodological issues encountered in arriving at their results (Bulmer 1970). I have attempted to perform the same operation for the total number of Nuaulu terminal taxa in Table 3, and in so doing have met a number of problems which Berlin and his associates fail to mention, while the pattern of statistics is also rather different. Quite apart from any *a priori* uncertainties, these results suggest that the confidence to be placed in such a simple-minded grouping of the data must be rather limited.

Now, in as much as there is a strong null correlation between high cultural significance and under-differentiation the Nida-Conklin hypothesis is conformed with. But in all

other respects the data runs contrary to what Berlin, Breedlove and Raven propose. I am willing to concede that this might be accounted for in part in terms of the criteria adopted in assigning taxa to cells in a matrix. From what I have said at length regarding the reasons for variation in the Nuaulu differentiation index, it will be evident that the possible cultural factors involved are considerable. Consequently I find it no easy task to rank terms according to a simple threefold classification of degree of 'cultural significance'. The authors of the article in question appear to adopt material utility as an appropriate criterion (use values embodied in food, drugs, firewood and so on), and indeed this might work well for Tzeltal plant names. But when considering Nuaulu animal taxa we cannot be so confident in our assignations. Take, for example, the category *tekepatona* (*Python reticulatus*). In terms of nutritional and material utility this might be regarded as of moderate significance: it is eaten with some regularity (appearing towards the bottom of consumption charts compiled during fieldwork), while its skin has traditional technical uses and is exchanged with outsiders for trade goods. On the other hand it is also of considerable symbolic significance for those clans for whom it is a totem. In fact as a totem it is *proscribed* as food for such clans. Thus, symbolic importance is inversely correlated with its use by such clans as food. There are similar problems of assignation for many other Nuaulu amphibian, reptile and mammalian taxa; for example species recognized as of potential food or other material value, but nevertheless seldom collected.

The problems of classification by differentiation are equally apparent, and have already been mentioned: the broad categories used by Berlin, Breedlove and Raven take no account of degree of differentiation. Under-differentiation might involve from two to twenty (or more) biological species being represented by a single local category. The same is conversely true of over-differentiation. Thus, significant variation is *not distinguished from that which might conceivably be due to* errors on the part of both informant and ethnographer. Moreover, in view of the fact that names are not always applied consistently it might be concluded that the task of measuring over- and under-differentiation with respect to biological species is an impossible one. Certainly, it would be difficult to produce neat tabulated data on taxa to applied groups and divisions of species for the Nuaulu in the way that has been managed for the Tzeltal (Berlin, Breedlove and Raven 1966:174).

Conclusions

This paper has been primarily concerned with exploring the proposition that a restricted fauna on the island of Seram (which may be held to be generally typical of Wallacea as a whole) is reflected in concomitantly limited inventories for the classification of animals. The evidence suggests that such a

TABLE 3

Relationship between degree of lexical differentiation and 'cultural significance' of 82 Nuaulu terminal taxa for animals.

	Under-differentiation	One-to-one correspondence	Over-differentiation
Low cultural significance	6	18	26
Moderate cultural significance	-	6	8
High cultural significance	-	8	6

hypothesis is generally valid for the vertebrate groups considered. Consistent with this is the fact that adjacent areas with a higher species diversity index for various groups compared to the Moluccas also correspond with a greater extensiveness in local inventories. This is the case for categories applied to frogs by the Kalam of the New Guinea highlands (Bulmer and Tyler 1968).[6]

The confirmation of this ethnographic hypothesis in turn suggests that, despite the fact that we have disposed of the naive assumption of the equivalence of zoological species and folk taxa (Bulmer 1975:24), *in general* local taxonomies for vertebrates among subsistence hunters, collectors and cultivators reflect actual species diversity. In particular the Nuaulu data seems to imply that restricted faunas *naturally* limit ethnozoological inventories. The fewer the biological species present the shorter the inventories.

Now, all this might seem very straightforward and obvious except that it contradicts the Nida-Conklin hypothesis, as well as certain simplistic theories of the social construction of reality (Bulmer 1970).[7] It seems that the extensiveness of inventories reflects cultural significance in only a partial way, applying unevenly to different groups. The question of the cultural elaboration or simplification of natural discontinuities is a much more complicated matter.

Specifically, it seems that discrepancies between scientific and indigenous inventories and classifications tend to increase as we progressively ascend taxonomic hierarchies. Even at the level of biological orders and below it is seldom possible to attribute proliferation or condensation to a single cause. At the generic level this is much less likely to be the case, as the various examples cited above indicate. Symbolic value, other semiotic usages (such as signs of seasonal change, omens and the like), material utility in its widest sense, natural specific and sub-specific diversity, frequency of encounter, morphology, distribution and population sizes of different species are all relevant factors which will affect the differentiation index either way. For example, over- and under-differentiation may equally reflect the degree of endemism of particular species or genera. Endemism engenders both these processes by providing large numbers of essentially similar animals. Where morphological differences between species are greater there is a higher probability that scientific and local taxa will coincide. Moreover, proliferation of terms is not itself necessarily indicative of social value, nor paucity of its absence. Consistency in the application of terms to taxa may be as good an indicator as degree of differentiation, as may the structure of a classification (levels of hierarchy and other forms of complexity) and nomenclature (number of uninomials to binomials: Bulmer 1975:22).

Because the Nida-Conklin hypothesis applies only in a complicated and partial way, in a logical, developmental (and perhaps even an evolutionary) sense it represents a secondary accretion, although with substantial feedback implications. That in the last instance overall complexity in ethnozoological inventories will reflect the existential diversity of fauna measured by conventional biological methods, confirms the view that what is in the end at stake is the very propensity and impetus of the human mind to classify forms at all (Bulmer 1975:12-3, Lévi-Strauss 1962:8). Lexical inventories (like their non-verbal counterparts) are essentially a means of apprehending and ordering nature, thus facilitating perception and the use of information about the environment so as to produce, reproduce and perpetuate the species.

NOTES

1. The fieldwork among the Nuaulu was undertaken in 1969-71, 1973 and 1975 under the auspices of the *Lembaga Ilmu Pengetahuan* (the Indonesian Academy of Sciences), and funded at different times by the Social Science Research Council, the London-Cornell Project for East and Southeast Asia, the Central Research Fund of the University of London and the Hayter Travel Awards Scheme. I am grateful to Mr J.I. Menzies of the University of Papua New Guinea (who accompanied me to the field for the 1975 season) and Mr A.F. Stimson of the reptile section of the British Museum (Natural History) for supplying information and checking parts of the manuscript.

2. The eastern limit of the subtraction-transition zone lies just west of Australia and New Guinea but includes certain small and closely associated islands: the Aru (and possibly Kei) islands, Salawati, Batanta, Waigeo (and possibly Misol) west of the Vogelkop (Mayr 1944). See also fig. 9.

3. If a number of species is plotted against lateral distance as we move through the archipelago, the decline in the number of Oriental species is more-or-less inversely proportional to the number of Australian species. The point (p) where the graphs intersect represents the area of maximum overlap. Here the species diversity index is to be read as twice ($2p$) the value indicated on the x axis. The diversity index in Wallacea never seems to exceed that of the zones on either side, and the less the overlap the less the diversity index. There is therefore a close relationship between transition and species diversity:

(See diagram overleaf)