CHAPTER 35

FRUITS, ANIMALS AND PEOPLE: HUNTING AND FISHING STRATEGIES OF THE WAYÃPI OF AMAZONIA

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INTRODUCTION

In studies of human ecology, the Amazon basin is often presented as a rather unattractive region for people (e.g. Meggers, 1971), where Amerindian populations somehow "optimize" their strategies for obtaining natural resources (Beckermann, 1983; Yost and Kelley, 1983; Balée, 1985; Sponsel and Loya, 1993, this volume). My own ethnographic experience, especially in the discourse of Amerindians, led me to wonder about the nature of this "optimization". It seems to me that if the Amerindians employ "optimal foraging strategies", then it should be possible to rank game animals in terms of the predictability of capturing them. Trying to rank game animals in this fashion leads us, as it did the Amerindians before us, to consider whether it is indeed possible to establish reliable strategies for hunting and fishing.

THE PEOPLE AND THEIR HABITAT

The Wayãpi are a Tupi-Gurani speaking people who live between 0°75' and 3°25'N, on the boundary between French Guiana and the federal territory of Amapá in Brazil. The Wayãpi are divided into three subgroups (Figure 35.1) totalling 835 people in 1990. The southern group lives on a 543 000 ha reserve, under the control of a government agency (the FUNAI), while the members of the two other, more northern, groups, are French citizens who live on state lands to which access is limited by order of the "Prefet" of French Guiana. The present study is concerned with the central subgroup (group 2 in Figure 35.1), which has the largest population.

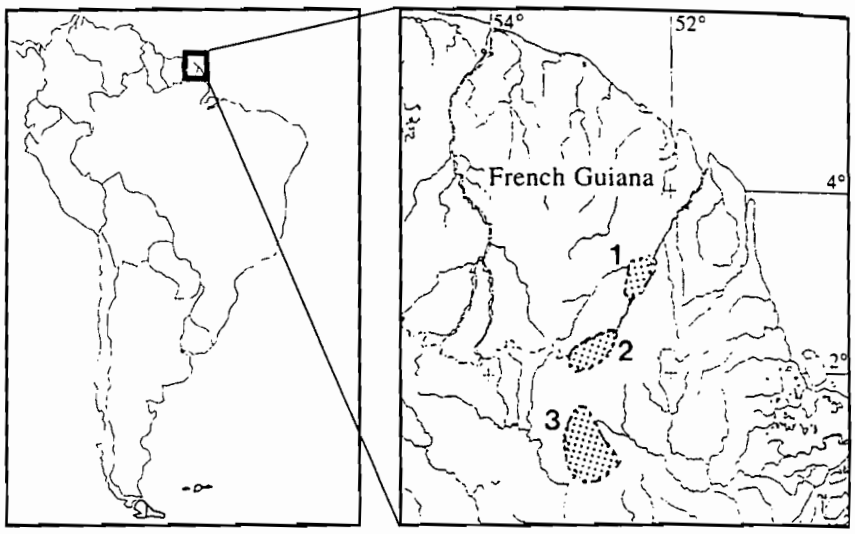

Figure 35.1 Location of the three Wayãpa subgroups (stippled areas), on the boundary between French Guiana and the federal territory of Amapá (Brazil)

The economic subsistence activites are classically categorized as slash-and-burn agriculture, hunting, fishing, and gathering. Hunting and fishing, pre-eminently male activities, are valued highly, and 70% of the men's working time is devoted to them.

The Wayãpi alternate one-day hunting or fishing trips with several-day expeditions based around crude campsites. These campsites are shifted a few kilometres, or even only a few hundred metres, when firewood runs out or the regrowth gets too thick.

The central group of the Wayãpi lives on an ancient granite plateau which has little relief but is sharply dissected. Annual rainfall varies between 2 200 and 2 500 mm, with a major dry season from July to September and a minor dry season in March. The vegetation is dense, *terra firme* rain forest. Its species composition varies considerably according to altitude, streambeds and, in part, differences in the drainage of the soil. Watercourses are numerous, and the principal rivers, such as the Oiapoque and the Ipisi, have many rapids. The swampy depressions of the forest are mainly covered by stands of the palm *Euterpe oleracea*.

The valley of the upper Oiapoque, where the villagers of this study live, is considered by its inhabitants as very favourable for growing and finding food, even if they feel that its watercourses are too narrow and have too few rapids and bays for really ideal fishing. These Amerindians are the only people living there; they use a territory of 770 km^2 of which 96.2 % is "primary" forest and 3.8 % shows varying evident degrees of human disturbance.

METHODS

This investigation combined four quantitative and qualitative studies. First a quantitative survey was carried out in 1976 and 1977 of the total yield from men's hunting and fishing and part of their harvest from gathering over a complete annual cycle, during which 29 hunters were supplying a community of 125 people. As the literature offers conflicting figures, I recorded the average weight of animals captured for each species. The largest number of species are products gathered from the forest, although they weigh the least. A great many of these products are eaten directly when gathered, which leads to a bias in my own estimates, and probably has caused other observers to underestimate the amount of food gathered from the forest. Hames' (1983) statement that, on average, only 6–7% of the diet of Amazonian peoples consists of gathered products probably reflects such underestimates.

A second study was based on interviews started in 1979, and continued from 1980 to 1990 as opportunities arose, about the behaviour of each species of animal sought by the Wayãpi and the hunting strategies used. Third, data on flowering and fruiting were collected, as the study progressed, from botanical and ethnobotanical investigations carried out by a group of researchers between 1974 and 1990 (including 3 000 herbarium specimens deposited at the ORSTOM herbarium in Cayenne and the herbarium of the Museum National d'Histoire Naturelle in Paris (see Sabatier, 1983). Fourth, a study of frugivorous animals (see Emmons and Feer, 1990; Roosmalen, 1985) undertaken at various intervals between 1974 and 1980, was combined with extensive observations of their stomach contents.

In an earlier paper (P. Grenand, 1980), I described the hunting, fishing and gathering techniques of the Wayãpi in detail. Here, I will confine myself to recalling that between 1970 and 1982, the bow was progressively replaced by the shotgun, although the Wayãpi still use the bow to hunt fish in shallow water and to lie in wait for birds. The quantity, variety and precision of the results have enabled an assessment of the extent to which the hunting and fishing strategies of the Wayãpi reflect the functioning of their ecosystem.

RESULTS

The year's total yield from hunting, fishing and gathering registered by our survey, was 14.3 tons fresh weight, excluding reptile eggs, crabs, insect larvae and various kinds of honey. At the time of our survey, the population to be fed comprised 125 people, of which only 25% were over 15 years old. The proportions of protein derived from different animal groups shows striking seasonal variation (Figure 35.2) explained below. Experience suggests that the total harvest of animal protein varies little from year to year,

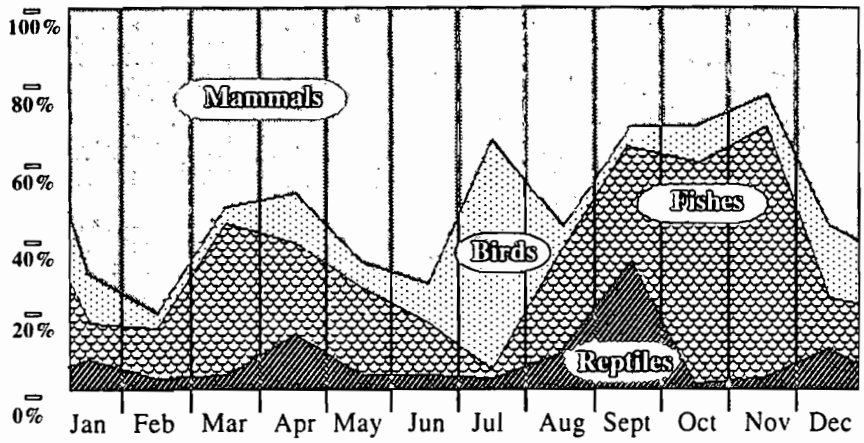

Figure 35.2 Monthly variation of the sources of animal protein, as cumulative percentages of total animal food obtained

and that other results are in line with those of our survey, where 52% of animal protein came from mammals, 28% from fish, 13% from birds and 7% from reptiles. This very high yield of animal protein arises from four different approaches: optimization (both simple and complex), "semi-optimization" and chance encounters.

Optimization

Optimization among the Wayãpi involves the relative predictability of captures, which is strictly related to aspects of the ecology and behaviour of the animals concerned. It takes into account the factor or factors that will concentrate the desired species at a given place or a given time.

Simple optimization

Fruiting, primarily of trees and woody vines, plays an important role in attracting concentrations of most species of animals, making it easy to predict the results of hunting, fishing and even the collecting of honey (Table 35.1).

It is clear that only a very detailed knowledge of the links between the timings of fruiting, leaf flush and flowering in different species of plants and the ecology and behaviour of animals permits the Wayãpi to hunt so successfully.

Two rather different examples, the agouti (*Dasyprocta agouti*), a mammal, and the pacou (*Myleus pacu*, Myletinae), a fish, can be taken for il-

Table 35.1 Hunting and fishing strategies among the Wayãpi. and the total weight obtained during one year by 29 men (in a community of 125 persons)

Characterization	Relation to the ecosystem	Species[a]	Weight (kg)	
Optimization	Simple opportunism: Fruiting, flowering or leaf flush of one or several species	Spider monkey	M	
		Howler monkey	M	
		Agouti	M	
		Acouchy	M	
		Guan	B	
		Tinamous	B	
		Wood quail	B	4 846
		Agami	B	
		Parrots	B	
		Macaws	B	
		Yellow-footed tortoise	R	
		Myletinae	F	
		Melipona bees	I	
	Complex opportunism: one or two other, predictable biological or climatic factors	Paca	M	
		Sloth	M	
		Black curassow	B	
		Leporinus	F	
		Pseudobrachyplatystoma fasciatum	F	3 518
		Erythrinidae	F	
		Procholidus	F	
		Iguana	R	
		Reptile eggs		
Semi-optimization	Fruiting or other climatic or biological factors associated with greater hunting effort (number of trips, distance covered)	Capuchin monkey	M	
		Red brocket deer	M	
		Agami	B	
		Cayman	R	1 819
		Phrynops tortoise	R	
		Ageneiosus	F	
Chance	Hunting effort (tracking, visual and auditory acuity; distance convered). Magico-religious practices.	White-lipped peccary	M	
		Collared peccary	M	3 376
		Brown brocket deer	M	
		Tapir	M	

[a] M: mammal; B: bird; R: reptile; F: fish; I: insect

lustrative purposes. These two animals are of moderate size (4.35 kg for the agouti and 1.25 kg for the pacou). Both foods are highly prized by the Wayãpi. I have observed agoutis eating the products of 57 plant species, and the pacou eating 19 species. Some 61% of all the agoutis caught are captured during what are considered to be favourable periods. This figure is rather low because this animal is more or less equally easy to kill all year, so the

"favourable" periods are times when the most agoutis are caught. The effort devoted to hunting agoutis is adjusted according to the success in capturing less predictable game. Although agoutis are a typical example of what one could call supplemental game, a genuine optimal strategy is involved in hunting them.

The pacou fish illustrates a different kind of simple optimization. Some 96% of the captures of this fish are concentrated during two restricted, well-defined times of year when water levels are highest and lowest. This optimization is governed by the flocking of these fish to feed on one or two plant species during these periods: the Amerindians take full advantage of the resulting concentrations of pacou.

Complex optimization

Optimization can similarly be attained by taking into account several ecological factors, either simultaneously or spread out over the year. Once again, the time of fruiting is involved, but so are other factors such as variation in water levels, variation in the amount of rainfall or sunshine, mating or nesting seasons etc.

The example of the black currasow, *Crax elector* seems to be particularly illustrative. Hunting this large (2.76 kg) game bird, the bird most sought after by the Wayãpi, is based on two strategies. The first is to catch the birds during the season of mating, nesting, or feeding the young, when they are quite vulnerable; 58% of the captures of this species occur during the reproductive period which lasts from October to January. The second strategy is to catch them when they concentrate to eat their favourite fruits, in April and May; 22% of these captures occur during this period. Hunting pressure on these birds is relaxed at other times of the year, except during August in certain years, when *Guarea kunthiana* (Meliaceae) are bearing fruit late.

Semi-optimization

Semi-optimization is based both on taking advantage of predictable opportunities and benefitting from lucky chances. Here, results are less predictable, because the Wayãpi consider that their knowledge of events in the forest is less capable of predicting, or predicts less exactly, the locations or activities of the animals concerned.

A good example is provided by the red brocket deer (*Mazama americana*). The Wayãpi try to define favourable seasons for hunting this animal, which plays an essential role in their diet, providing 15% of the total weight of animals consumed. These favourable seasons are in November, January,

April and May. In November, the red brockets eat the fallen flowers of *Passiflora laurifolia*, *Lecythis corrugata*, *Tabebuia serratifolia* and *Pachira aquaticum*; in January they eat the young manioc shoots in new clearings, and in April and May they eat fallen fruits of many species (13 in April, 12 in May). Surveys of hunting yields show that in November not many red brockets were caught, that in January red brockets were caught in primary forest, and that the number of red brockets caught in April and May was slightly lower than the average monthly catches for this species! In short, the red brocket does not seem to concentrate on a particular kind of food during the rainy season (December to July) which makes finding it a chancy but not entirely unpredictable affair, because the hunter can take into account a large number of food items which might attract the deer. In January, they visit new clearings without fail early each morning, thus increasing their chances of finding a red brocket.

Another example is that of the capuchin monkey (*Cebus apella*). It illustrates a quite different type of semi-optimization. Like the agouti, the capuchin monkey is an abundant supplemental game animal of modest size (3 kg). Capuchins eat an impressive variety of plant foods (74 species), preferring fruits of the genus *Inga*. This diverse diet gives little help to the hunters in knowing where to look for them, but other indicators, such as the calls of monkey troops or fresh traces of their feeding, such as fruit cast to the ground or half-eaten, are vastly more effective guides. The hunting survey shows that capuchins are killed all year round, with, however, three maxima; one in April, another in July (sometimes June) and the third in December and January. All three of these are important fruiting periods.

In short, semi-optimization yields a respectable number of captures. To compensate for bad luck, the Wayãpi hunt over long distances or fish specific sites, which permits them to visit a large number of sites where the desired animals are presumed to be eating. An increased hunting and fishing effort is compensates for the effects of chance.

Chance

Game animals in this category are considered so essential by the Wayãpi that they go to some trouble to palliate the effects of chance. The time taken, and the distance travelled, are greatest for this category of game (although the red brocket would also fall into this category if these were its only criteria). However, other kinds of effort are also devoted to hunting such animals. Families or villages may cooperate to look for tracks. Individuals or families may use various forms of magic: they may prepare hunting charms from various kinds of plants, such as the rhizomes of Araceae (P. Grenand *et al.*, 1987); they may paint or scar their bodies to propitiate the

hunt, they respect taboos of hunting or diet, in particular those related to the births of the hunter's children (F. Grenand, 1985). Finally, individuals or groups may seek the assistance of the shaman in the most critical cases.

The aim is no longer trying to discover what ripe fruits are available for these animals, but rather trying to learn where these animals have been, where they are going, where they are hiding, why they are no longer in the hunting territory. In other words, the issue is trying to restore lost contact between the animals and their hunters.

The collared peccary (*Tayassu tajacu*), chosen to illustrate game animals located by chance, is, together with the white-lipped peccary, one of the animals most eagerly sought by the Wayãpi. For this reason, it seems appropriate to treat these two animals jointly. During the survey year, they provided 3 376 kg of undressed meat, 45% of the total weight of the year's catch of mammals. Nevertheless, the total catch of peccaries, especially of white-lipped peccaries, varies greatly from one year to the next. The yearly catch of white-lipped peccaries can fall below 1 000 kg. It is worth noting that collared peccaries live in small bands which occupy smaller territories than do bands of white-lipped peccaries, which contain many individuals and wander over immense areas, making it more difficult to predict their whereabouts.

Although the Wayãpi can point to 35 species of nuts and hard fruits eaten by each of these two species of peccary, they also know that these animals eat the roots and rhizomes of various Marantaceae, Cyclanthaceae, and Araceae all year round. These roots and rhizomes are to be found everywhere in humid areas, which enhances the dispersal of these animals over an immense area. As for the fruits and nuts in their diet, peccaries often eat them when quite rotten, so they are not obliged to congregate under particular trees when they are bearing fruit, but instead, can wander about at leisure.

On the other hand, the Wayãpi suggest two factors which can attract peccaries: first, the massive fall of fruit of the oil palm *Euterpe oleracea* and of various species of Sapotaceae betweeen May and July; and, second, the habit of peccaries to search during the driest months, mid-September to November, for pockets of nuts fallen from palms and various species of Caryocaceae, and the tough pods of various Leguminosae, which have become buried in the mud and sand of the streambeds and forest pools. Experience shows that these factors act over so wide an area that they are of little use, although it is easier to find bands of collared peccaries than groups of white-lipped peccaries. On the other hand, the rarety of encounters with white-lipped peccaries is compensated for by the high yield when they are encountered: 50 individuals were killed in one extraordinary episode observed in 1975. In short, the peccary example demonstrates well the role played by uncertainty in hunting such highly prized game. Coping with such uncertainty leads to cultural practices to which a study in human ecology such as the one described here cannot entirely do justice.

DISCUSSION AND CONCLUSIONS

Optimization unquestionably dominates the hunting-fishing strategy, accounting for 62% of the annual yield from hunting and fishing. Nonetheless, 13% of the yield results from "semi-optimal" strategies where chance plays a distinct role, and 25% of the yield is decidedly subject to chance (Figure 35.3).

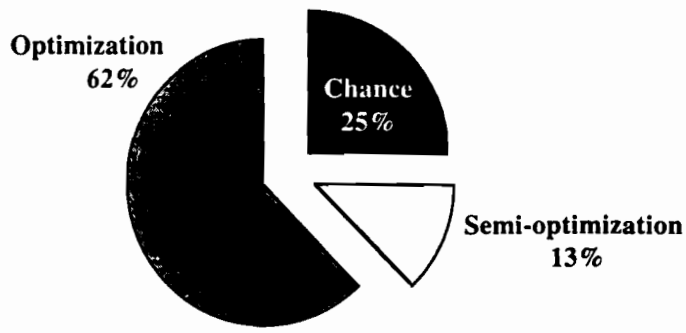

Figure 35.3 The Wayãpi hunting and fishing strategies

This said, our anthropological studies among the Wayãpi (P. Grenand, 1980, 1982; F. Grenand, 1982) suggest that the Wayãpi's representations of their environment are founded on the chance aspect of hunting, the aspect which yields the smallest weight of the catch, but that which is the important part ideologically. This representation involves, amongst other things: treating the hunt as a war; endowing the set of animal species, and to a lesser extent, plant species, with a supernatural master (*-ya*) to explain the oscillations between the abundance and rarity of food in the forest; and elaborating taboos around the birth of children, because of the dangers of hunting for human society.

In contrast, the plant world is invariably viewed either as neutral or as a mediator between man, on the one hand, and the animals and the spirits of the forest on the other. Maximizing the success of hunting and fishing according to when different food-bearing plants are flowering and fruiting provides an appropriate justification for such a view. Thus the apparent contradiction between high hunting-yields and worry about the environment's reliability is much attenuated. The opposition and complementarity between flora and fauna provides another illustration of the dichotomizing thought apparently so typical of Amerindians (Lévi-Strauss, 1991). This ecological clarification of the classical nature/culture dichotomy deserves to be tested by a large-scale comparison of the Amerindian societies of Amazonia, in order to help resolve other debates besides those concerning optimal foraging strategies.

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