distribution of ocean tides. Then follow two chapters on the mathematics of the problem and of its numerical approximation and solution. These chapters are more complete than customary treatments. For example, the question of whether the initial value problem with friction has a unique solution is investigated formally as a logically necessary preliminary to solving the problem by time stepping. A potentially important, although not yet fully realized, dividend of the more formal approach is that it provides the beginnings of a systematic theory of perturbations of the tidal problem, with the intent of understanding how inaccuracies in formulating a numerical model of ocean tides from real maps of ocean basins and bottom relief influence the accuracy of the subsequent calculations.

The following chapter, on tides in the world ocean, summarizes both historical and modern information on the global distribution of the M2 tide. Of particular interest is the discussion of numerical experiments by Kagan and his colleagues in which both the shape of the coasts and the bottom relief are altered. The form of the M2 tide appears to depend more on the shape of the oceans than on their bottom relief, but it is possible that the large degree of smoothing of the relief necessary in global tidal calculations has already greatly lessened the influence of relief on the calculations. Artificially isolating the major basins from one another by putting numerical barriers from South America, Africa, and Australia to Antarctica produces remarkably little change in the global pattern of tides.

Chapters on dissipation in a turbulent boundary layer, with details of a model due to Kagan and his associates, and on tidal internal waves complete the discussion.

On the whole, this book presents an accurate and self-contained account of tidal studies up to the date of original publication; it is the first account in English that adequately represents Russian work on ocean tides. A sequel by the same authors was published by Gidrometeorizdat, Leningrad, in 1983. The present English translation is thus somewhat behind the most recent developments, both in the U.S.S.R. and abroad, although acknowledgement of this fact is made in an appendix and an updated bibliography.

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Peoples and Resources in the Tropics

Adaptive Responses of Native Amazonians. RAYMOND B. HAMES and WILLIAM T. VICKERS, Eds. Academic Press, New York, 1983, xvi, 518 pp., illus. $49. Studies in Anthropology.

This book addresses the subject of an old debate in anthropology over the role (or roles) played by the Amazonian environment in the social-settlement systems of tropical South American groups. Earlier studies (in the 1950's and '60's) brought into question the agricultural potential of the forest; more recent studies center on the availability of game and other wild resources. In either case, anthropologists have dutifully aligned themselves into two camps.

Members of the wing that emphasizes environmental limitations argue that Amazonian soils are infertile, that game animals are sparse, that some kinds of rivers are poor in fish, or all of these. To cope with these constraints, Amazonian peoples live in relatively small settlements and may move residence often, maintain low densities, practice female infanticide, conserve resources through taboos, create buffer zones by constant warfare, or strengthen extra-village political alliances (and, presumably, also succumb to missionaries, accept food aid, adopt cash crops, and so on). The other, more optimistic camp views resources as somewhat more abundant and varied. Generally they agree that, under "normal" conditions (that is, where the people have not been reduced by disease, pushed into extremely unproductive lands, or enclosed in reservations), Amazonians are efficient producers and skillful predators.

The volume under review clearly falls into the optimistic camp. To secure reliable data on subsistence practices, the authors spent countless hours trekking with the "natives" for game, measuring their gardens, counting the fish they caught, weighing the crops they harvested, collecting soil samples, adding up proteins and calories, and subtracting time and energy expenditures. As a result, their essays are full of tables, graphs, and lists of species. Some of their viewpoints and conclusions would appear self-evident were it not that other researchers have advanced contrary opinions.

The book begins with a useful introduction by the editors. They discuss regional environmental differences, giving an overview of previous studies and intellectual positions and explaining new approaches and methodologies. The 14 essays that form the body of the volume are organized (somewhat artificially) under four headings. Within the group headed Cultivation, Johnson's essay on the Machiguenga (Urubamba's tributary dwellers of the Peruvian montaña) is particularly competent. Johnson painstakingly demonstrates that the Machiguenga are careful and skillful cultivators. He suggests that they maximize autonomy through overproduction rather than through reliance on extra-community patterns of reciprocity. For example, in 1972–73 an average household produced 13 million kilocalories of food energy but consumed less than 5 million. (Carneiro, on the other hand, in his essay on the Kuikuru, considers surpluses to be not overproduction but a necessary cushion against unexpected losses.) The importance of Johnson's essay resides in his recognition that there may be more ways than one for individuals to respond effectively to ecological constraints. This is also the main point of Hill and Moran's essay on the adaptive strategies of the Wakuénai people occupying an impoverished segment of the upper Rio Negro, in the Venezuelan Amazon.

To this reviewer, the most interesting data are to be found in the section on hunting and fishing. One of the issues the authors address concerns protein levels and the efficacy of traditional hunting technologies. According to Hill and Hawkes, the Aché of eastern Paraguay are efficient and get fairly good average meat yields (0.53 kilogram per man-hour with bow, 1.60 kilograms per man-hour with shotgun). But they work hard and employ a simple technology so that at the end they extract fewer calories from wild resources than they would were they to grow cultivated crops. The last point raises the question of why the Aché continue to hunt and gather. To this the authors respond that it is probably to escape their bellicose Guarani Indian neighbors, who are cultivators. Simplistic as this explanation may appear to be, it probably accounts for why many hunter-gatherers move around frequently.

In a comparison between shotguns, blowguns, and spears among the Waorani of eastern Ecuador, Yost and Kelley conclude that the shotgun is 1.22 times more efficient than the blowgun and spear combined (and 1.5 times more than the blowgun alone). This would strike one as not terribly surprising were it not for E. Ross's remark that "shotguns

have reduced the efficiency with which certain important animals—in particular, the terrestrial quadrupeds—can be killed" (*Current Anthropology*, March 1978). Be that as it may, the Waorani can be added to the list of groups among whom warfare and infanticide seem to have little to do with scarce resources.

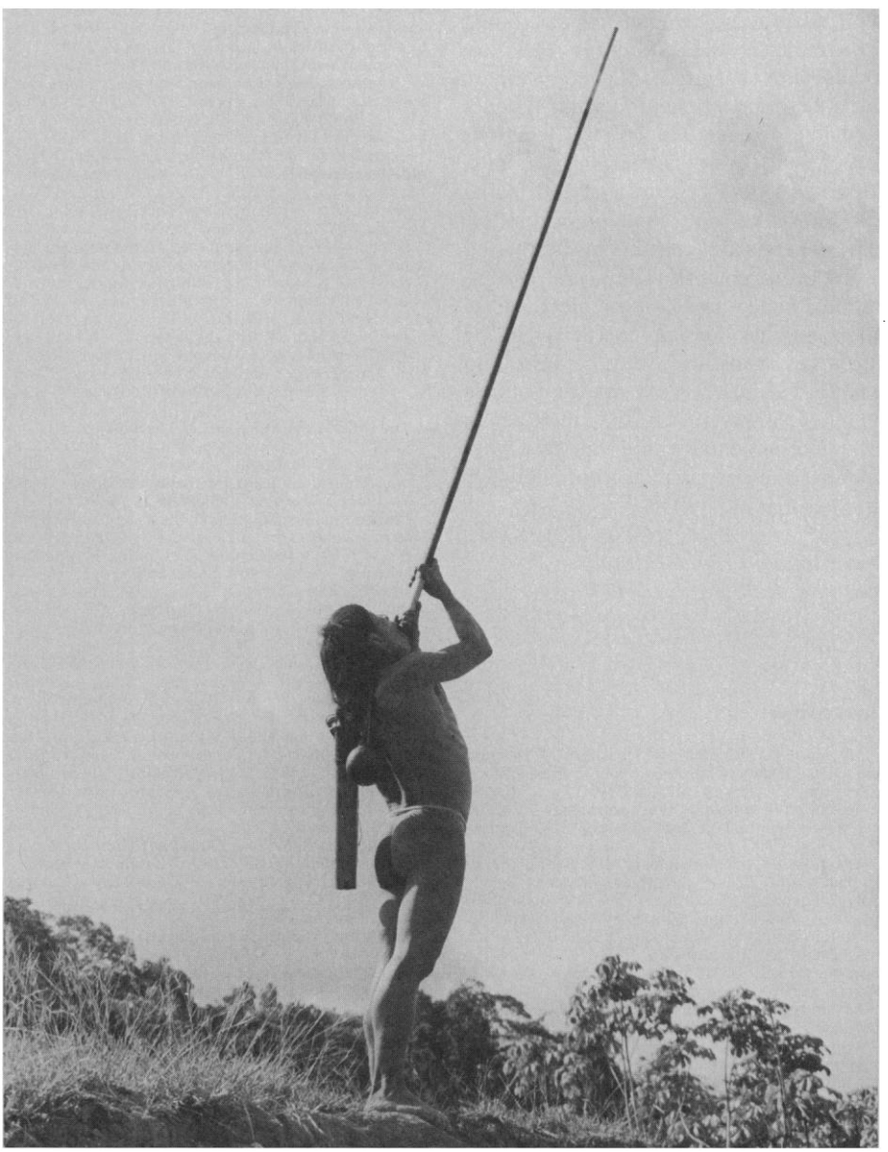
Applying the biological concept of patch modification, Stocks explores the fishing practices of the Cocamilla Indians living near a floodplain (*várzea*) lake in northeastern Peru. The Cocamilla actually fertilize a lake zone nearest the community with 44.5 metric tons of garbage and feces every year. This zone they use for fishing at times when the floodwaters are high. Are the Cocamilla "managing" their fish resources unconsciously?, the author asks. In puzzling over the connection between individuals' actions and their explications of them, Stocks himself seems unaware that he is employing a useful "habitus" or "praxis" model of behavior. Many features of social action seem particularly effective (read "adaptive") precisely because they are relatively unconscious or unmotivated; appropriate responses can be produced without hesitation or ambiguity. One can see how this might work in that part of the lake the Cocamilla call "with admirable simplicity, *Capichiru* (shit creek)."

In another sophisticated essay, Beckerman asks why the Bari of the Maracaibo basin continue to hunt at an average return of 100 grams of meat per man-hour when they can fish and get fourfold returns. The answer is simply that they hunt on the way to fishing spots, where they either fish or acquire valuable fishing information for future use. This embedding of patches raises the Bari's overall *M/T* (meat to time) ratio. On the subject of acquiring information, Beckerman himself is candid: he confesses to not having asked sufficient questions of the Bari concerning the reasons why (or why not) they go to fish or hunt in a particular spot on a particular day. He thus puts his finger on what is lacking in many studies concerned almost exclusively with quantifiable data.

This said, the next essay deals precisely with why two Jivaroan groups name and classify many animals accurately, yet only use (that is, eat) a few species. The Berlins perceptively suggest that animals may not only be good to eat, they may also be food for thought. And on the subject of food, the two essays on nutrition have much to say about diets, health, and the growth patterns of Amazonian peoples.

Three final essays discuss settlement patterns. Hames reminds us that settlement patterns can vary according to size, form, duration, and social relations; and settlements can be moved for a number of reasons (depletion of resources, warfare, deterioration of living conditions, disease, and so on). Therefore, he rightly insists, a settlement pattern is a series of compromises. Using the Yąnomamö of Venezuela as an example, he outlines their dilemma in compromising between living in small villages to conserve resources and living in big villages to defend themselves. In attributing Yąnomamö warfare not to competition over "natural" resources but to competition over women, Hames is employing this concept in the biologically correct way, as representing a mechanism for enhancing individual reproductive success.

The essay by Gross on the settlement patterns of four Central Brazilian groups contains few surprises for readers acquainted with his previous articles. He sticks to the idea that increased labor input into cultivation accompanies resource depletion and contributes to the low density and frequent moving of these groups. He justifiably insists on the necessity of using a region-wide, rather than a village-centered, framework for the investigation of resource potentials. But it is up to Vickers, in the final essay, to really demonstrate the theoretical necessity of specifying the exact parameters of a particular resource base. Thus, although cultivable land is not a major



Blowgunning of game as practiced by the Waorani of eastern Ecuador. "Most game is blowgunned at a near-vertical angle. As shots approach the horizontal, range and accuracy decrease significantly." [Photo by J. Yost, from Yost and Kelley's paper in *Adaptive Responses of Native Amazonians*]

limiting factor for the Siona-Secoya peoples of the San Pablo area in northeastern Ecuador, it is limiting for another branch of the same people living elsewhere.

This raises what is possibly the major weakness in an otherwise extremely useful volume. Several authors (Hill and Hawkes, Werner, Stocks, Beckerman, Gross, Vickers) use optimal foraging theory—a theory borrowed from biology to describe the workings out of natural selection—to "explain" (or to model or describe) the subsistence practices of Amazonian groups. Yet optimization theory is not without its problems. As West-Eberhard (*Quarterly Review of Biology*, Dec. 1979) clearly argues, this theory confuses the best "possible" alternative with the best "feasible" (of all available) alternatives; moreover, it assumes that optimization is synonymous with adaptation. Among tropical forest Amerindians, the resources that are available to each group depend on highly variable and contingent factors. What is available depends not only on what nature has to offer in the way of soils, waterways, and vegetational and faunal characteristics but, most important, it also depends on cultural attitudes and social arrangements. The social organizational factors and cultural mechanisms filtering what humans perceive to be resources transform what is best into what is feasible. To say that individuals adapt is simply to say that they act in an environmentally appropriate way; whether they always act "optimally" is another matter.

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