Hadza Men's Follows, 1985–1986: Data and Implications for Ideas About Ancestral Male Foraging Effort in Human Evolution

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ABSTRACT

Paternal provisioning via big game hunting and scavenging is central to many arguments about early human evolution. Data from East African Hadza challenge these widely held ideas. Here we report direct observations by the Utah/UCLA research group on Hadza men's foraging drawn from 570 hours of out-of-camp follows on focal men, September 1985–August 1986, all in a setting similar in some ways to those in which early humans evolved. Large ungulates were pursued frequently but few were acquired. When taken, parts were consumed widely within and between local groups, with no evidence of advantages in consumption for successful hunters' children. Focal men targeted smaller, more reliably acquired prey far less often, earning total weights of about 1% of those from big game. Nearly all were eaten by focal men themselves during follows. Focal men and their companions also took large quantities of *Apis mellifera* honey in some seasons. More than half was consumed by focal men and other party members while away from camp. Much of the rest was set aside for trade. Both practices limited its consumption by focal men's children. Men's foraging is not consistent with the goal of paternal provisioning in these data nor in our broader experience with Hadza foragers. An alternative model of early human evolution based on life history-related changes in mating-age sex ratios, driven by senior females' foraging productivity and its implications for ancestral males' foraging, fits better with both our Hadza observations and the paleoanthropological record.

INTRODUCTION

For decades conventional anthropological wisdom has held that ancestral hominin big game hunting and related paternal provisioning led to the emergence of genus *Homo* (e.g., Alger et al. 2020; Alvarado et al. 2015; Gavrilets 2012; Hill 1982; Isaac 1978; Kaplan et al. 2000; Lancaster and Lancaster 1983; Lovejoy 1981; Oxford and Geary 2019; Washburn and Lancaster 1968). Archaeological evidence for the consumption of large ungulates by some Early Pleistocene hominins is widely seen to support this idea (Bunn 2007; Isaac 1978). But that evidence does not speak for itself. It does not tell how often or how reliably hominins acquired those prey in real time, what was consumed, by whom, or why—all key elements of the paternal provisioning argument. Reference to the behavior of modern people living in similar environments and hunting big game provides essential perspective on these issues.

Data on Tanzanian Hadza are crucial here. As pedestrian hunters using relatively simple technology in an East African savanna woodland, Hadza men confront foraging opportunities and constraints similar in some respects to those of the Early Pleistocene. Large ungulates have at times been locally abundant; large carnivores preying on those ungulates have provided scavenging opportunities.

Based on data gathered from 1985–1990, our Utah/UCLA research group (Hawkes et al. 1991, 2001a, 2001b, 2018) has shown that Hadza hunters did not take large ungulates reliably enough to consistently support young children. Their own households did not generally get disproportionately large shares of those prey, and men largely

ignored small game and plant foods that could have met daily family provisioning needs more effectively. Despite high failure rates, Hadza men consistently pursued big game far more assiduously than most other resources. These observations indicate that paternal provisioning was not Hadza men's primary goal (Hawkes 1993; Hawkes et al. 1991; O'Connell et al. 1999, 2002). Though less comprehensively quantified, reports by James Woodburn (1964, 1968) from the late 1950s and early 1960s are consistent with these observations.

This empirical challenge to paternal provisioning arguments has led us to formulate a different model of Hadza men's foraging goals and their evolutionary history (see Hawkes et al. 2018; O'Connell and Hawkes 2023 for recent summaries). Like the hunting hypothesis, it identifies large-scale changes in Plio-Pleistocene East African climate and environment as crucial to the evolution of early humans. But it differs in highlighting the importance of ancestral senior females' foraging and food sharing practices, their effects on post-menopausal longevity and mating-age sex ratios, and the implications for ancestral male mating effort. We find that Hadza men's big game hunting and its evolutionary antecedents are better seen as mating rather than parenting effort. Similar opportunities and constraints likely applied to early humans.

Here we review a sizable mid-1980s Hadza data set not previously published that details relevant observations. Tallied across two semi-seasonal subsets, it includes observations on 73 out-of-camp forays covering 570 focal man-hours (h) and nearly 1200 total man-h. These data enrich our description of Hadza men's foraging in the mid-1980s, marked as it is by a strong emphasis on big game hunting, a parallel lack of concern with small game and other resources apart from honey, and a pattern of consuming most of the items collected, other than big game meat, at or near the point of acquisition. The case for reliable paternal provisioning in this data set and those we and Woodburn have reported elsewhere, especially as it involves subteen children, is unsupported. If paternal provisioning of nutritionally dependent children in this age set were a common practice, let alone central to their survivorship, we should see evidence for it in these data, but we do not (see Discussion). We identify the implications of these observations for arguments about the role of men's big game hunting and paternal provisioning in human evolution and briefly outline our alternative hypothesis.

METHODS

SETTING AND STUDY POPULATION

Hadza are a population of about a thousand central-place foragers living near Lake Eyasi, northern Tanzania. They are defined as a group by their common language, Hadzane. They have been known to Europeans since the late 19th Century (Baumann 1984). Comprehensive anthropological fieldwork among them has been reported by Kohl-Larsen (1958), Woodburn (1968), Blurton Jones (2016), Hawkes et al. (2018), and members of the late Frank Marlowe's research group (2010).

Observations detailed here were recorded during 1985–1986 in the 600–800km^2 region south of Lake Eyasi known as Tli'ika (Figure 1). The climate there is warm and dry. Annual temperatures range from 13–35^{o}C; rainfall averages 300–600mm, most of it falling in the November-May wet season. The defining terrain feature is a 10km wide, 40km long, WSW/ENE-trending ridge that rises 300–500m above the Eyasi and Yaeda basins to the north and south, respectively. Vegetation on the ridge itself is *Acacia-Commiphora* woodland; the adjacent lowlands are grassland and wetland. Large-bodied ungulates were seen often at this time; lion, leopard, and spotted hyena were also present. Small game, including smaller carnivores were numerous and diverse. Plant foods attractive to humans included geophytes and fruit. Several types of honey were also available. Water sources were widespread during the wet season but more restricted in the dry, especially in its later stages (see Supplementary Material for details).

The study population included the 200–300 Hadza then living in Tli'ika, mainly along the ridgeline. Members were usually distributed among 6–10 short-term camps, the number, sizes, and locations of which varied with resource availability. Throughout the study period, their subsistence was based almost entirely on wild resources—big game meat, honey, fruit, and geophytes. Maize and millet were acquired in trade from Iraqw and Isanzu people living several hours' walk to the south and west, but the quantities involved were small. Total contribution to Hadza diets in Tli'ika at this time was estimated at <5%. Durable items (metal pots, cloth, and clothing) were obtained from these same sources, from people passing through Tli'ika, or from Mangola to the northeast. Apart from a few Datoga pastoral camps in low lying areas to the north, where Hadza often foraged, non-Hadza presence was infrequent and fleeting.

Fieldwork began 7 September 1985 and ended 30 August 1986. Adult Hadza participants in the overall project gave verbal approval for the research to JOC and KH in camp-wide meetings at the onset of each multi-month field session (September 1985-January 1986; March-August 1986).

FOCAL MEN

From September 1985 through early August 1986, Hawkes and O'Connell lived with groups of 35–75 Hadza in a series of six base camps, collecting information on occupants' time allocation, foraging, and food sharing, mainly via frequent daytime scans of in-camp activity and focal-person follows away from camp (Blurton Jones 1989, 2016; Blurton Jones et al. 2005a, 2005b; Hawkes et al. 1989, 1995, 1997, 2001a, 2001b, 2018; O'Connell et al. 1988a, 1988b, 1990).

Of particular interest here are data on fifteen men and teenaged boys monitored on focal follows. These data are presented in detail in Supplementary Material. Table 1 lists subject code names, the code numbers assigned in Blurton Jones' (2016: 71–78) demographic analysis, their estimated ages, marital statuses, household sizes, numbers of

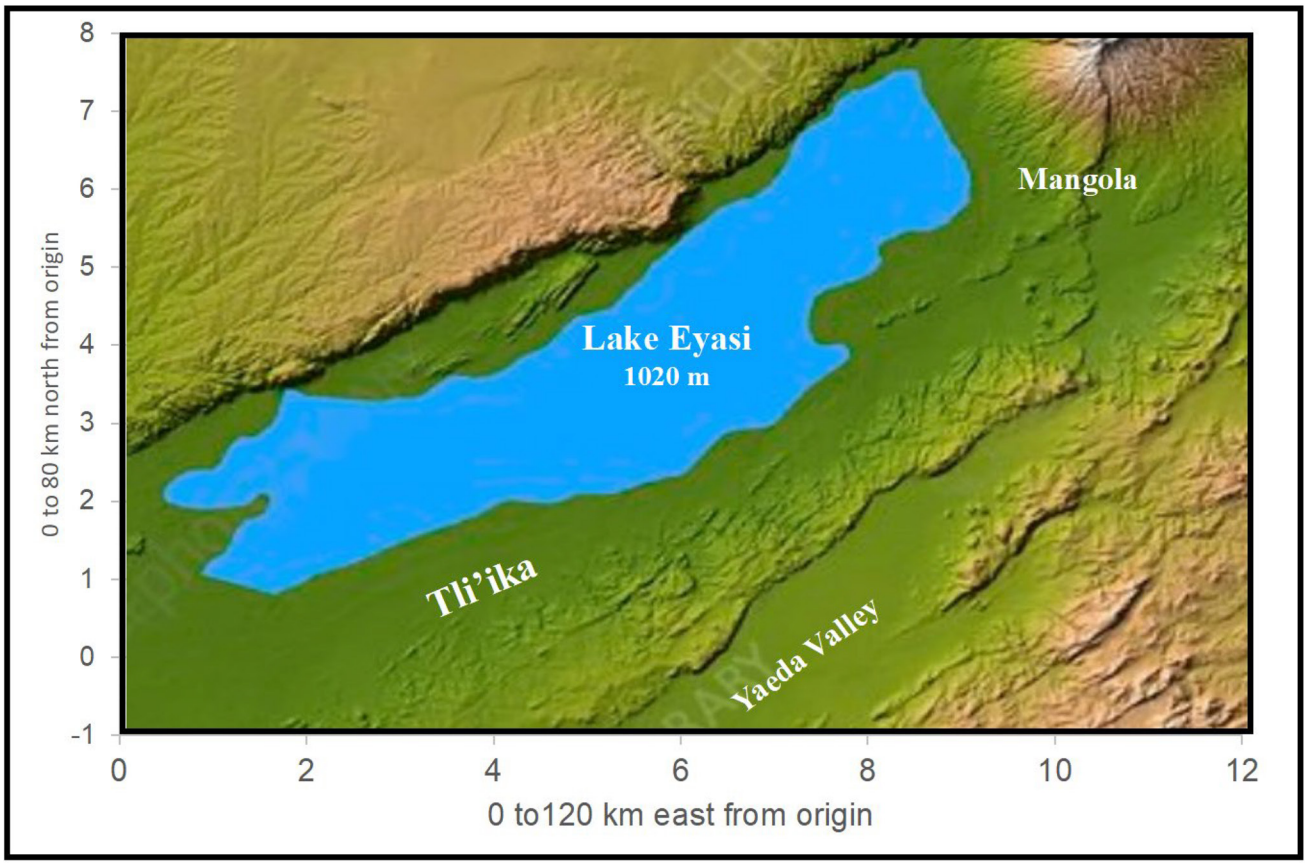

Figure 1. Satellite-based image of Hadza country showing major terrain features and localities named in text (source: NASA-JPL [https://d2pn8kiwq2w21t.cloudfront.net/original_images/jpegPIA04959.jpg]).

co-resident sub-teen children, and numbers of follows per season. Figure 2 shows the distribution of follows by focal men's age and season. Most focal men were adults aged 26–57 years (y); two (Mch, DS) were in their mid-teens, one (ROM) was about age 70. All the adults were married, most had subteen children living with them. Thirty-three follows were conducted in late dry seasons (September-October 1985, July-August 1986), 40 in the wet and early dry seasons (November 1985-June 1986).

Follows were initiated when a potential focal man was seen leaving camp, identified by the equipment he carried as likely to be away for some time. JOC asked and obtained permission to accompany him, record-keeping began and continued until the focal man returned to base. Sometimes focal men operated alone, more often with others. Variation in follow frequency by individual depended on who was present in camp and how active they were as foragers. Individual H was co-resident with KH and JOC throughout the study period; no other focal man was. All but one of those followed were active hunters. BSp is the exception—he rarely hunted, enjoyed limited success when he did (Hawkes et al. 2001a), and was low ranked as a hunter by women participants in Blurton Jones' (2016) reproductive history interviews.

This protocol produced activity records for focal men and others on 73 trips away from camp—570 h for focal men, 612 h for adult men who came along with them. Data collected included the identities of all individuals accompanying focal men, routes followed, potential prey seen, time spent in search, pursuit, ambush, and processing, quantities taken, and whether foods were consumed more or less immediately or carried back to camp. Details on resource acquisition and estimates of quantities taken are presented in Supplementary Material. Additional data on men's extra-camp activities were recorded on 37 trips to retrieve large animals killed or scavenged by camp residents and others. These data are reported elsewhere (O'Connell et al. 1988a, 1988b, 1990, 1992) and referenced here only on background.

SEASONS

Data are grouped by season. These are identified here as *late dry* (LD, July-October) versus *wet and early dry* (WED, November-June). This departs from the standard savanna wet-dry season distinction defined by rainfall. It is based instead on observed patterns in resource availability and hunters' acquisition tactics.

TIME ALLOCATION AND RETURNS

Tables 2 and 4 below show dates of focal follows (late dry vs. wet and early dry), the duration of each follow, identities of focal men, their primary goal on the follow, times

TABLE 1. DATA ON FOCAL MEN (FM) FOLLOWED, TLI'IKA, 1985–1986.

Code name	NBJ ID	Age (y)	Status	Hsld size	Co-resident subteens	Follows by season LD	WED	Total
H	2233	50	M	5(6)	-	6	7	13
Mgs	2221	48	M	4(5)	1	4	8	12
Drk	2121	45	M	8	3	4	6	10
LM	2264	34	M	6(9)	1	7	2	9
R	2125	26	M	4	1	-	5	5
EY	2421	41	M	5	1	2	3	5
BM	2161	28	M*	n/a	-	4	-	4
BH	2368	57	M	2(6–9)	(2)	2	2	4
HE	2333	37	M	5	3	-	3	3
Mch	2187	14	S	n/a	-	2	1	3
DS	2189	15	S	n/a	-	-	1	1
BlS	2406	40	M	5	1	1	-	1
BSp	2265	42	M	5(6)	2	-	1	1
Oz	2321	55	M	4(5)	1	-	1	1
ROM	2134	70	M	2	-	1	-	1

Code names are those used in KH/JOC field notes and Supplementary Material. **NBJ ID** are individual code numbers assigned in Blurton Jones' (2016) demographic study. **FM ages** are derived from years of birth estimated in NBJ study. **Marital status**: M—married; M*—married, family not present; S—single. **Household size**: unbracketed numbers represent individuals who usually slept in the same shelter; bracketed numbers are those who slept elsewhere but often joined FM's household for meals; n/a marks individuals who usually slept in a single men's shelter and ate in a married man's household. **Number of weaned subteens** (<12 y) are those associated with each FM's household. **Numbers of follows** are those carried out with each man as the primary focus, grouped by season (LD=late dry, WED=wet and early dry) and totaled.

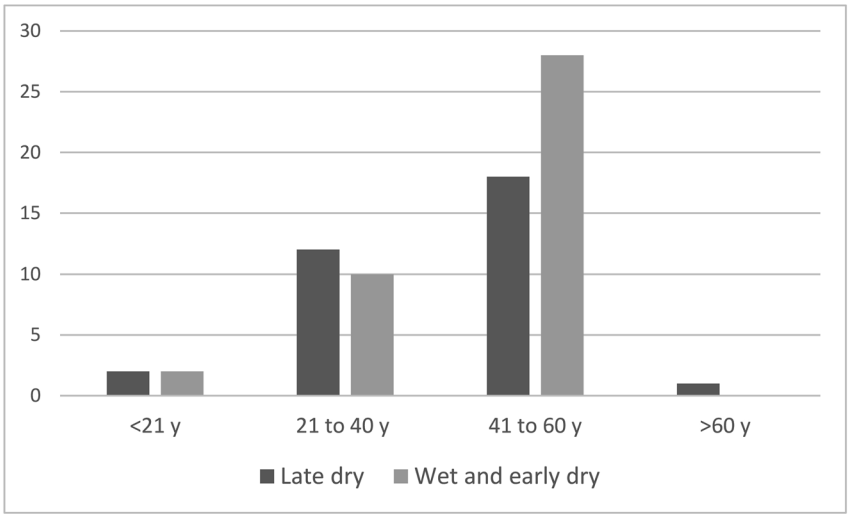

Figure 2. Focal men (FM, n=73) grouped by age and season.

invested in search, ambush, and pursuit, and numbers of people accompanying the focal man, grouped by age and sex. Tables 3 and 5 below (also divided by season) show encounters with prey, times invested in pursuit and outcomes by prey type, as well as weights of items collected. More information can be found in Supplementary Material, Tables S1-S2 and related notes.

Descriptive Terms

Those used here follow conventions of the classic prey or diet breadth model (Stephens and Krebs 1986).

Search includes time spent walking through areas where prey or tracks were likely to be sighted and on trips accompanying women targeting their preferred resources. It does not include time spent on pursuit of individual prey, resting, socializing while visiting, personal maintenance, or traveling after dark (1900 h). It was our strong impression that most of the time tallied as search was aimed at identifying opportunities to pursue big game or *Apis* honey. Small game and plant foods were rarely primary targets. They were generally ignored by focal men even when sighted unless they were close at hand and even then, not assiduously. Our sense that these encounters were pursued less often than they might have been is reinforced by the fact that small game were identified far more often in our 1990 experimental follows, when focal men operating over the same terrain as in 1985–1986 were asked to pursue all small game they saw (Hawkes et al. 1991).

Prey encountered. All animal prey seen were recorded as encountered. Plant foods and honey were marked as encountered if focal men or other members of the party pursued them. Numbers cited for these resources are underestimates of their actual encounter rates since JOC often did not recognize them in the absence of pursuit.

Pursuit includes all time spent acting on encounters with prey. For mobile prey this means pausing to decide whether to go after it, following it, shooting one or more arrows at it, then following it after an apparent hit, either immediately or after a pause (not counted as pursuit) to allow time, sometimes overnight, for the shot to have an effect. It also includes moving quickly to kills made by lions or leopards and driving them off. Note that time spent processing kills for immediate consumption or transport is also counted as pursuit. For honey and plant foods, pursuit includes time spent acting on an encounter, synonymous with a sighting. For *Apis honey*, it includes time spent preparing any *ad hoc* equipment (specialized axe hafts, climbing pegs, smoke sticks) needed to breach the hive and calm the bees. Eating at acquisition was counted as pursuit. Otherwise, counting time as pursuit stopped when it became apparent that continued effort would be unsuccessful or inordinately costly.

Ambush is defined as sitting in a blind, usually stone-walled and thorn brush-lined, adjacent to a frequently used game trail or overlooking a late dry season water source. It includes time spent establishing or improving a blind. We count time spent in ambush separately from search and pursuit. Small game or plant foods might be pursued if nearby, but this is ancillary to the main purpose of the ambush.

Other includes activities not directly related to resource acquisition, e.g., resting, socializing while visiting, equipment repair, or personal maintenance. Time spent traveling after dark is not counted here.

RESULTS

LATE DRY SEASONS

These are defined by the beginning and end of ambush hunting, a practice that takes advantage of the limited availability of surface waters and related concentration of large game around them in the late dry season. In this sample, focal men pursuing this practice operated from three base camps, one (Tsipitibe) occupied in September-October 1985, the other two (Dubenkela, Mbea C) serially in July-August 1986. The 1985 camp was monitored over 47 days, the 1986 camps over 24 days. Camp populations usually numbered about 50–60. Generally present at each (grouped by sleeping locations) were 8–9 nuclear families, 1–3 sets of senior women, 1–2 single mothers with one young child each, and one set each of unmarried men and older girls.

General Observations

Based on our overall observations (not on focal follows alone) we found that men devoted most of their late dry season time out of camp to ambush and encounter hunting (Hawkes et al. 1997). As noted above, they established small blinds immediately overlooking water points and along nearby game trails (O'Connell et al. 1988a, 1992) and manned them intermittently, day or night, depending on big game traffic nearby as assessed by tracks and night-time animal calls. Groups of 3–4 hunters often used multiple blinds located within a few tens of meters of one another to improve their chances of hitting a target. Multiple ambush points increase the number of potential encounters; a missed bow shot by a focal man might force an animal into bowshot range of another hunter; similarly, that other hunter's miss might create a shot opportunity for the focal man. Men also monitored the presence of large predators and any scavenging opportunities they created (O'Connell et al. 1988b). Hunting opportunities were identified and where possible acted upon during daylight walks up to ten km away from camp. Meanwhile women foraged in large groups for geophytes, baobab, or berries (Hawkes et al. 1989, 1995, 1997). Children, including subteens, routinely accompanied these groups. One, sometimes as many as three men and/or older teenaged boys also went along to provide protection from interference by pastoralists, and in the case of berries to feed themselves.

Focal Follow Data

More precise data on men's out-of-camp activities were gathered over 278 h on 33 late dry season follows involving ten focal men (Table 2, Figure 3; Supporting Material Table S1 and notes). Total party membership across all late dry follows was 97, including 33 focal men and 64 others.

TABLE 2. MEN'S LATE DRY SEASON FOLLOWS, 1985–1986: PARTY COMPOSITIONS, TIMES, DISTANCES, GOALS.

Follow	Date	FM	Dist. (km)	Times (h) Total	Search	Pursuit	Blind	Other	Goal	Others AdM	AdF	TnM	TnF
LD-1	10-Sep-85	BM	2.0	12.4	0.9	0.1	11.2	0.3	ambush-n	-	-	-	-
LD-2	11-Sep-85	BM	2.5	2.1	1.1	0.1	-	0.9	visit	-	-	-	-
LD-3	12-Sep-85	BM	2.5	12.6	1.0	-	11.7	-	ambush-n	-	-	-	-
LD-4	15-Sep-85	H	6.1	3.9	2.7	-	-	1.2	encounter	-	-	-	-
LD-5	15-Sep-85	BM	5.8	21.0	2.5	2.9	14.2	1.3	ambush-n	-	-	-	-
LD-6	20-Sep-85	BH	1.7	17.3	1.3	1.4	14.6	-	ambush-n	1	-	-	-
LD-7	23-Sep-85	H	1.7	6.4	0.6	-	3.2	2.7	ambush-d	5	-	-	-
LD-8	20-Sep-85	BH	1.7	17.3	1.3	1.4	14.6	-	ambush-n	1	-	-	-
LD-9	11-Oct-85	Mch	2.5	1.0	0.7	0.4	-	-	encounter	-	-	1	-
LD-10	11-Oct-85	LM	2.5	11.0	0.5	2.0	-	8.5	encounter	-	-	-	-
LD-11	12-Oct-85	LM	3.3	7.5	1.8	0.1	3.5	2.1	ambush-d	-	-	-	-
LD-12	12-Oct-85	EY	3.8	14.9	1.7	-	13.3	-	ambush-n	-	-	1	-
LD-13	13-Oct-85	Mch	0.8	3.3	0.3	3.0	-	-	encounter	-	-	5	-
LD-14	15-Oct-95	BH	5.0	9.9	1.8	0.4	-	7.7	w/women	-	2	-	-
LD-15	17-Oct-85	LM	4.2	15.3	1.6	-	13.5	0.1	ambush-n	-	-	1	-
LD-16	20-Oct-85	H	1.7	4.8	0.7	-	-	4.0	w/woman	-	1	1	-
LD-17	22-Oct-85	LM	1.7	6.9	4.0	2.7	-	0.3	w/woman	-	1	-	-
LD-18	23-Oct-85	BlS	4.2	10.8	0.8	8.1	-	2.0	tracking	2	-	3	-
LD-19	25-Oct-85	H	4.2	3.4	2.3	-	-	1.1	visit	1	-	-	-
LD-20	25-Oct-85	LM	3.0	15.3	1.2	-	14.0	-	ambush-n	-	-	1	-

TABLE 2. MEN'S LATE DRY SEASON FOLLOWS, 1985–1986: PARTY COMPOSITIONS, TIMES, DISTANCES, GOALS (continued).

Follow	Date	FM	Dist.	Times (h)					Goal	Others			
			(km)	Total	Search	Pursuit	Blind	Other		AdM	AdF	TnM	TnF
LD-21	27-Oct-85	LM	4.1	18.1	3.3	1.3	12.9	0.7	ambush-n	-	-	1	-
LD-22	30-Oct-85	LM	3.3	17.7	1.3	2.4	13.3	0.7	ambush-n	1	-	-	-
LD-23	2-Jul-86	H	7.1	18.8	1.6	-	16.2	1.1	ambush-n	1	-	-	-
LD-24	3-Jul-86	EY	7.1	5.0	2.2	1.0	-	1.8	w/woman	-	1	-	-
LD-25	4-Jul-86	Mgs	6.7	2.8	2.2	0.4	-	0.2	encounter	-	-	-	-
LD-26	5-Jul-86	Mgs	6.7	3.2	2.6	0.2	-	0.3	encounter	-	-	-	-
LD-27	6-Jul-86	Drk	7.1	5.6	4.5	0.1	-	1.0	encounter	-	-	-	-
LD-28	9-Jul-86	Drk	5.0	6.5	2.6	3.6	-	0.2	tracking	4	-	6	-
LD-29	12-Jul-86	Mgs	6.7	5.3	3.9	0.7	-	0.6	encounter	-	-	-	-
LD-30	13-Jul-86	Drk	3.6	2.5	0.8	1.8	-	-	retrieve	4	4	5	1
LD-31	15-Jul-86	Mgs	3.1	1.7	1.3	0.2	-	0.1	tracking	6	-	-	-
LD-32	4-Aug-86	Drk	8.0	4.4	2.6	1.2	-	0.6	encounter	-	-	-	-
LD-33	8-Aug-86	ROM	6.8	2.9	1.6	1.0	-	0.3	tracking	-	-	4	-
Totals			136	278	59	35	142	43		26	9	29	1
Means/follow			4.1	8.4	1.8	1.1	11.8	1.3		0.8	0.3	0.9	-

Follow identification numbers: LD 1–25 originated at Tsipitibe camp, LD 26–31 at Dubenkela, LD 32–33 at Mbea C. **Date** on which follow began. **Focal man's** code name. **Distance** in km traveled away from base, determined by the time at which FM turned back toward camp, converted to distance at five km/hr. Absolute distance away may be greater in some cases**. Total** follow time (h). **Search** time (h). G: **Pursuit** time (h). **Blind**—time spent in ambush (h). Time spent in **other** activities (h). FM's primary **goal**, either as stipulated by FM or inferred from his behavior on the follow. Ambush-n and -d are night and daytime ambush, respectively; visit indicates walk to a nearby Hadza camp; encounter means a daylight walk in search of large animal prey; tracking means pursuit of an animal thought to have been wounded; w/woman or women means the party mainly pursed women's foraging opportunities. **Others** are additional members of follow party, AdM—adult male, AdF—adult female, TnM—boy aged 12–18 y, TnG—girl aged 12–18 y.

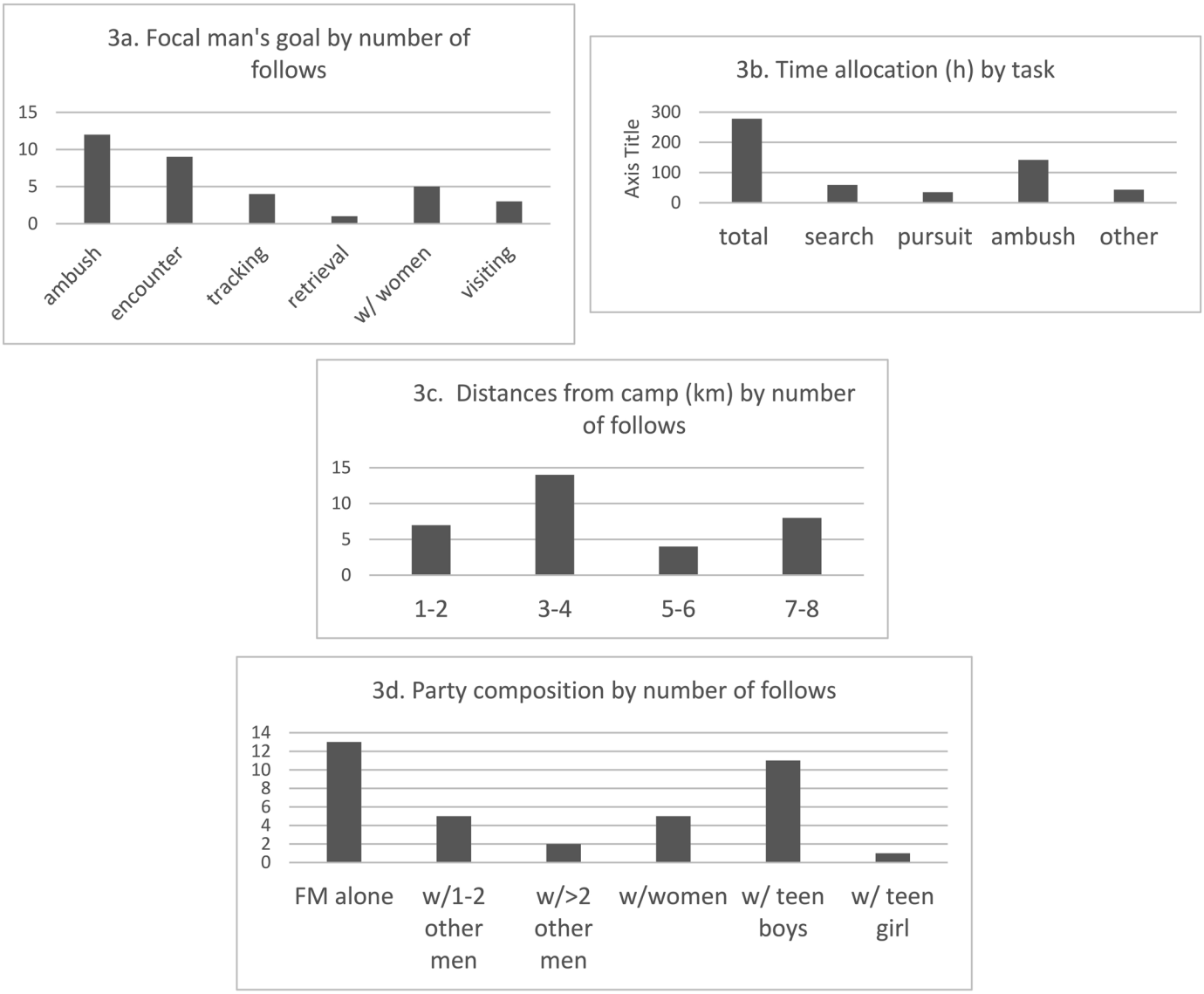

Figure 3. Late dry season follows (n=33). Data from Table 2.

Follow durations ranged from 1.0–21.0 h (mean 8.4). Search times ranged from 0.3–4.5 h (mean 1.8, total 58.7). Pursuit times (including carcass preparation for transport) ranged from 0–8.1 h (mean 1.1, total 35.1). Times spent in ambush blinds ranged from 3.2–16.1 h (mean 11.8, total 141.6). Time devoted to other activities, mainly resting and personal maintenance, varied from 0–8.5 h (mean 1.3, total 43.0). Especially long "other" tallies involved acting as security on women's foraging parties or guarding large carcasses while waiting for carrying parties to arrive. Most follows covered areas fewer than five km from base; twelve went 5–8 km out (overall mean 4.1 km).

Focal men operated alone on thirteen follows, with 1–2 other men on five follows, with larger, all-male groups on two. Teen boys were involved on eleven follows, a teen girl on one. Focal men worked with their wives three times, twice with their wives and one or more other women. All five of these parties included nursing mothers and infants. On 26 of 33 follows (79%), men were focused on big game in some combination of day- or night-time ambush (two and ten follows, respectively), day-time encounter hunting (nine), tracking wounded prey (four), or carcass retrieval (one). This represented 85% of total time allocation on these forays. With one exception these were all-male parties. Four of the five parties where women were involved targeted *Trigona* honey, geophytes, and/or baobab. Focal men took honey and roots; women roots and baobab. On one of the four, the focal man and his wife took *Apis* honey although it was generally unavailable in these seasons. On the fifth, women were involved in carcass retrieval. Three visits to other camps were also recorded. Subteen children (other than nurslings) were not present on any of these follows. As indicated above, carcass retrieval incidents unconnected with focal follows are not included here. They showed a similar range of variation in party composition, but exploitation of other food types was limited.

TABLE 3. MEN'S LATE DRY SEASON FOLLOWS, 1985–1986: PREY ENCOUNTERED, PURSUED, RESULTS.

Part A

	Encounter	Follow	Pursuit	Pursuit time (min)	Pursuit time (h)	Hit/Lost	Kill	Scav.	Wt (kg)
Bushbuck	1	1	1	5	0.1	-	-	-	-
Eland	2	1	-	-	-	-	-	-	-
Giraffe	6	4	2	484	8.1	-	1	-	450
Greater kudu	2	1	-	-	-	-	-	-	-
Hartebeest	12	3	-	-	-	-	-	-	-
Hyena	2	1	1	1	-	1	-	-	-
Impala	102	16	16	427	7.1	2	1	-	25
Lion	1	1	1	14	0.2	1	-	-	-
Warthog	3	2	1	8	0.1	-	-	-	-
Wildebeest	7	2	2	62	1	1	-	-	-
Zebra	35	9	10	573	9.6	1	1	1	220
large mammal	2	2	2	4	0.1	-	-	-	-
Total	**175**	**25**	**36**	**1578**	**26**	**6**	**3**	**1**	**695**
Baboon	70	3	1	2	<0.1	-	-	-	-
Dik-dik	6	4	3	3	<0.1	-	-	-	-
Guinea fowl	7	4	6	65	1.1	-	1	-	1
Mongoose	2	1	1	13	0.2	1	-	-	-
small mammal	2	2	1	2	<0.1	-	-	-	-
small bird	2	2	2	24	0.4	-	-	-	-
Total	**89**	**11**	**14**	**109**	**1.7**	**1**	**1**	**-**	**1**

Details on prey encountered, pursued and results are shown in Table 3 and Figure 4. Large animals (n>175; 59% impala, 20% zebra) were encountered on 25 follows—an average one every 1.6 follow-h overall. Thirty-six were pursued and in some cases taken and processed at the kill on 21 follows over a total of about 26 h. Two animals were acquired by ambush, one on encounter, one was seized from a lion kill. At least six others were hit with arrows but lost. An estimated 695kg of edible tissue were taken as a result, well over half of it from the single giraffe kill.

Eighty-nine small animals were encountered on eleven follows, about one every three follow-h overall. This is a low estimate: JOC was not aware of all visual contacts made by focal men. Fourteen were pursued over a total of 109 min, most for <2 min. Nearly all were lost. One guinea fowl was taken, cooked, and eaten by the focal man. Handling the bird accounted for the high pursuit time. Five *Apis* hives were tapped over a total of about an hour. Four were found to be dry, one yielded about two kg of honey, most of which was eaten on the spot by the focal man and his wife. Thirty-two *Trigona ruspolii* (*kanoa*) nests were sampled on seven follows. Twenty-five yielded small amounts of honey totaling an estimated 1.2kg, all eaten immediately by the focal man and one other person in the party. An estimated 50g of *T. erythra* (*n!ateko*) honey was taken and consumed on one follow. Baobab, *//ekwa* roots, and bird eggs were collected by women on five follows; some eaten on the spot, some returned to base. Focal men took baobab on six of nine encounters on six follows. They collected a total of c. 50kg shelled, most of which was processed and carried to base by other party members. Women party members collected baobab more frequently (see Supplementary Material Table S1 and notes for details). Focal men pursued and collected *//ekwa* on four of nine encounters. Roughly half the overall weight was cooked and eaten straightaway, the rest carried to base by women. As with baobab, women party members pursued and collected this resource more frequently. *Mpilipe* berries were encountered and eaten at least once by focal men and others on three follows; none were carried to base.

TABLE 3. MEN'S LATE DRY SEASON FOLLOWS, 1985–1986: PREY ENCOUNTERED, PURSUED, RESULTS (continued).

Part B

	Encounter	Follow	Pursuit	Pursuit time (min)	Pursuit time (h)	Acq'd	Wt (kg)
Apis honey	5	4	5	63	1.1	1	2
Kanoa honey	32	7	32	82	1.4	25	1.2
N!ateko honey	1	1	1	7	0.1	1	<0.1
Total	**38**	**9**	**38**	**152**	**2.6**	**27**	**3.2**
Baobab fruit	9	6	6	205	3.4	6	50
Mpilipe berries	5	3	5	14	0.2	5	0.3
Total	**14**	**9**	**11**	**219**	**3.6**	**11**	**50.3**
//ekwa root	9	6	4	>54	1	4	>3.7
Total	**9**	**6**	**4**	**>54**	**1**	**4**	**>3.7**

Part A covers mammals and birds: large (wt. >40kg), small (<40kg). **Encounter** means direct visual contact; tracks and other indicators are not counted. **Follows** are those on which encounters with indicated prey types were noted. **Pursuit** began when FM paused after sighting potential prey. **Pursuit time** was that invested, measured in minutes (min) and hours (h), whether successful or not. **Hit/lost**: FM's bow shot hit prey, which was lost after further pursuit; **Kill**: prey acquired by FM's bow shot; **Scav**: edible tissue was obtained from a kill made by another predator. **Wt (kg)**: estimated amount of edible tissue acquired (60% of mean adult live weights reported by Coe et al. (1976) minus amounts from scavenged prey lost to initial predators.
Part B covers honey, fruit and geophytes pursued by FM. **Encounter** refers to a single hive or set of closely spaced plant foods. It is an underestimate: not all encounters were identified by JOC or brought to his attention by FM. **Follows** are those on which encounters with indicated prey types were noted. **Pursuit** refers to the number of times FM tried to acquire the resource after encountering it. **Pursuit time** is that which FM invested in an attempt whether successful or not. **Acquired** means the number of times the resource was obtained from a single hive or a closely spaced set of plant foods. **Weight** refers to the amount taken by the FM alone or in the case of *Apis* honey in collaboration with other party members.
See Supporting Material Table S1 notes for additional data on other party members' encounters, pursuits, and acquisitions.

WET AND EARLY DRY SEASONS

The rains began in early November and continued intermittently through mid-May. Large animals were dispersed but began concentrating around persistent water sources in early July. Berries and *Apis* honey were generally available through early June but were encountered less often thereafter. Focal men operated from four sequentially occupied camps, two in November-December 1985 (Mugendeda, Mbea A, monitored serially over 37 days) and two in March-June 1986 (Mbea B, Dubenkela, monitored over 50 days). Camp populations numbered about 35–50. Generally present at each were 6–8 nuclear families, 1–3 sets of senior women, 1–3 single mothers with one young child each, and 1–2 sets each of unmarried men and older girls; essentially the same sizes and compositions as recorded in the late dry season.

General Observations

Overall, women in large groups collected berries and geophytes every day or so. As in the late dry season, they were usually accompanied by several men and/or older boys. Senior women also collected geophytes on foraging bouts late in the afternoons closer to base. Men devoted most of their time out of camp to *Apis* honey collecting and encounter hunting. They abandoned ambush hunting in November but began again in July. Encounter hunts partly intended to identify favorable ambush locations were part of this effort. As the country dried out, men set fires to clear vegetation and improve tracking conditions.

Focal Follow Data

Detailed data were gathered for twelve focal men over about 292 h on 40 wet and early dry season follows (Table 4,

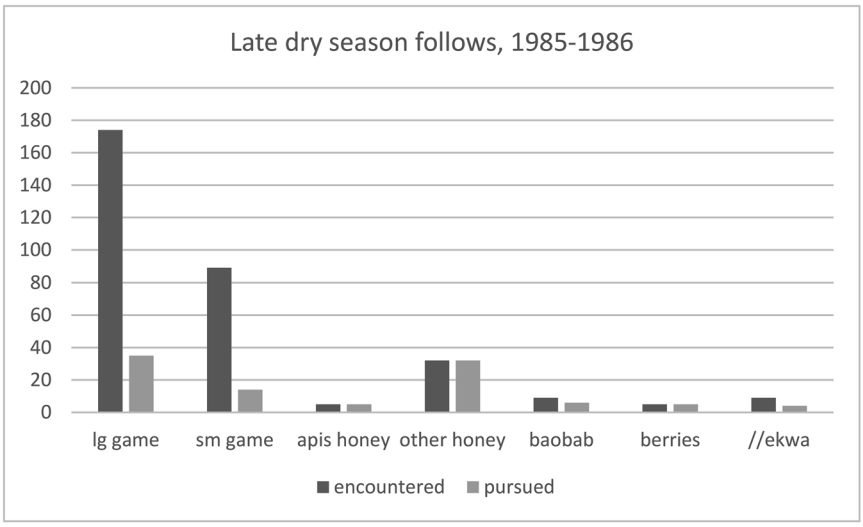

Figure 4. Late dry seasons: total numbers of resources encountered and pursued. Data from Table 3.

Figure 5; Supplementary Material Table S2 and notes). Total party membership across all wet/early dry follows numbered 202—40 FM, 162 others. Follow durations ranged from 1.5–14.1 h (mean 7.3); trips reached 0.2–20.8km out (mean 8.1km). Sixteen were >10km out; eleven of these were related to *Apis* honey collecting, the other five to encounter hunting, tracking wounded game, or inter-camp visiting. Search times ranged from 0.2–7.2 h (mean 3.4, total 138); pursuit times from 0.0–8.7 h (mean 2.4, total 95). Focal men operated alone on five follows, with 1–2 other men on two. They worked with 1–4 adult women on 21 follows, with large, mixed adult parties (12–15 members) on three. Focal men's wives were among the women on all 24 of these forays. Teenaged boys were present on 21 follows, teen girls on six. Nursing women and infants were involved on 24 follows, a subteen girl on one.

Large animals (n>222; 43% giraffe, 33% impala) were encountered on 23 follows—on average more than one every 1.3 h overall (Table 5, Figure 6). They were the primary focus on nine follows (daylight encounter hunting, tracking wounded prey). Men and boys made up the party on eight of these, women were involved on just one (see Table 4). Thirty-three large animals were pursued by focal men on nineteen follows over a total of about eighteen hours. One eland was taken for an estimated edible yield of 205kg. Ten kg were retrieved from a dead, heavily fly-blown elephant. Five giraffe and one greater kudu were hit by arrows and tracked but lost. Dried meat was obtained on four of six visits to other camps and carried back to the focal man's base.

Apis honey was the primary target on 21 follows, also taken on another eight. Women and teen boys were involved in nearly all follows where this resource was the main objective. Focal men tapped 134 *Apis* hives across 70 h on 29 follows. One hundred six yielded an estimated total of 326kg of honey, the rest were dry. One hundred eighty kg were eaten immediately, the rest taken to base. There, 30–60 kg were set aside for trade, most during the May-June late wet/early dry transition. Most of the rest was eaten by focal men's households, proportionately less when party size was larger.

At least 80 small mammals, birds, and bird eggs were encountered on fifteen follows; 22 were pursued by focal men on eleven follows over a total of about 121 min; eleven were taken, mostly small birds. All were eaten on the follows, mostly by FM. About 65% percent of one focal man's small prey pursuit, handling, and consumption time were spent on a single set of three bat-eared foxes. Other small prey were pursued and acquired by women and teenaged girls (see Supplementary Material Table S2 notes). Some were eaten on the spot; the rest were carried to camp, perhaps to share with others. Twenty-five *kanoa* nests were tapped by focal men on thirteen follows over a total of about 2.4 h. Twenty-four yielded honey. All taken by focal men (est. five kg total) was eaten immediately on acquisition. *N!ateko* honey was encountered and taken three times over a total of 71 min yielding c. 2.0kg, also eaten immediately, some by focal men.

//ekwa were encountered on at least six follows and pursued by women on all six over a total of more than five hours. They took fifteen kg on three follows, cooked, and ate half at the point of acquisition and carried the rest to base. A focal man dug once for ten min; collected, cooked, and ate on the spot the one kg he gathered.

Baobab pods were seen on the ground at least eight times on four follows and collected on two by the focal men. Women shelled the focal men's take to produce two kg of pith and seeds, then carried it to base. Women themselves collected similar numbers of pods on three other follows and carried all home. Berries were eaten at least 33 times on eleven follows over at least 2.5 follow-h, all in small quantities, all consumed as acquired. Focal men took part in most of these collecting bouts, probably eating about 1.5kg overall.

TABLE 4. MEN'S WET AND EARLY DRY SEASON FOLLOWS, 1985–1986: PARTY COMPOSITIONS, TIMES, DISTANCES, GOALS.

Follow	Date	FM	Dist.	Times (h)				Goal	Others			
			(km)	Total	Search	Pursuit	Other		AdM	AdF	TnM	TnF
EW-1	26-Nov-85	LM	3.5	5.4	3.6	1.4	0.4	*Apis* honey	-	1	-	-
EW-2	29-Nov-85	H	0.2	4.5	0.2	3.8	0.5	*Apis* honey	7	-	6	-
EW-3	30-Nov-85	R	5.9	10.1	5.3	4.4	0.4	*Apis* honey	2	-	-	-
EW-4	2-Dec-85	EY	11.4	6.5	3.8	2.2	0.5	*Apis* honey	-	1	1	-
EW-5	4-Dec-85	BH	2.0	9.4	2.6	2.1	4.7	w/women	-	2	-	-
EW-6	5-Dec-85	LM	2.6	2.0	1.0	0.2	0.8	w/woman	-	1	-	-
EW-7	6-Dec-85	DS	10.3	14.1	3.3	8.7	2.1	*Apis* honey	-	-	3	1
EW-8	8-Dec-85	EY	19.2	14.1	6.9	3.0	4.2	*Apis* honey	1	1	-	-
EW-9	24-Dec-85	H	3.3	3.7	1.4	2.0	0.3	tracking	3	-	1	-
EW-10	26-Dec-85	H	11.5	10.7	5.6	1.4	3.6	visit	1	3	-	-
EW-11	27-Dec-85	BH	4.0	5.5	1.7	3.7	0.1	*Apis* honey	2	4	2	-
EW-12	29-Dec-85	EY	8.7	7.3	3.0	3.9	0.4	tracking	5	10	2	-
EW-13	2-Jan-86	H	1.7	5.0	0.9	0.0	4.1	visit	-	-	-	-
EW-14	3-Jan-86	BSp	2.4	1.5	0.9	0.5	0.1	*Apis* honey	-	1	-	-
LW-1	23-Mar-86	HE	4.0	7.8	4.2	2.2	1.4	tracking	2	-	3	-
LW-2	24-Mar-86	R	13.8	10.3	5.2	3.1	2.0	*Apis* honey	-	-	1	-
LW-3	25-Mar-86	HE	4.2	4.5	1.5	2.3	0.7	tracking	1	-	-	-
LW-4	28-Mar-86	Drk	14.5	9.7	5.3	2.7	1.7	encounter	1	-	1	-
LW-5	29-Mar-86	Mgs	10.8	8.8	4.2	2.9	1.8	tracking	3	-	5	-
LW-6	15-Apr-86	Mgs	5.0	4.3	2.3	0.9	1.1	w/women	-	4	-	1
LW-7	16-Apr-86	Mgs	15.0	10.8	6.4	0.3	4.0	visit	2	-	1	-
LW-8	18-Apr-86	Drk	20.8	11.1	7.0	2.8	1.3	*Apis* honey	-	1	3	-
LW-9	19-Apr-86	H	11.3	9.4	3.9	0.9	4.6	visit	9	3	-	-
LW-10	21-Apr-86	Drk	6.3	3.8	3.1	0.1	0.6	encounter	-	-	-	-

TABLE 4. MEN'S WET AND EARLY DRY SEASON FOLLOWS, 1985–1986: PARTY COMPOSITIONS, TIMES, DISTANCES, GOALS (continued).

Follow	Date	FM	Dist.	Times (h)				Goal	Others			
			(km)	Total	Search	Pursuit	Other		AdM	AdF	TnM	TnF
LW-11	22-Apr-86	Drk	15.0	12.4	6.2	4.3	1.9	*Apis* honey	-	1	1	-
LW-12	26-Apr-86	Mgs	18.1	11.0	7.2	2.2	1.6	*Apis* honey	1	2	2	-
LW-13	29-Apr-86	HE	3.5	3.2	0.6	2.4	0.2	tracking	4	-	2	-
LW-14	18-May-86	Drk	5.0	4.3	1.4	2.9	0.0	encounter	-	-	-	-
LW-15	19-May-86	Mgs	6.0	5.2	2.6	2.5	0.1	*Apis* honey	-	2	-	1
ED-1	20-May-86	Mgs	3.3	2.8	1.1	1.2	0.5	*Apis* honey	-	1	-	1
ED-2	21-May-86	Mgs	3.6	3.4	2.2	0.3	0.9	visit	-	-	-	-
ED-3	22-May-86	H	7.5	8.2	3.0	0.0	5.2	visit	3	4	-	-
ED-4	24-May-86	Oz	6.6	5.7	2.8	2.6	0.3	*Apis* honey	-	1	1	-
ED-5	26-May-86	H	5.8	3.5	2.6	0.0	0.9	visit	-	-	-	-
ED-6	30-May-86	Mch	2.3	5.5	3.0	2.4	0.1	*Apis* honey	-	-	1	-
ED-7	30-May-86	Mgs	2.3	4.6	0.3	3.9	0.4	*Apis* honey	-	1	2	-
ED-8	4-Jun-86	R	10.2	10.0	3.8	5.5	0.7	*Apis* honey	6	6	1	2
ED-9	5-Jun-86	R	14.5	11.3	6.0	4.0	1.2	*Apis* honey	1	1	-	2
ED-10	6-Jun-86	R	14.3	10.0	5.1	4.3	0.6	*Apis* honey	1	4	2	-
ED-11	8-Jun-86	Drk	14.5	10.6	6.5	1.4	2.7	*Apis* honey	1	1	1	-
Totals			325	292	138	95	59		56	56	42	8
Means/follow			8.1	7.3	3.4	2.4	1.5		1.4	1.4	1.1	0.2

Follow identification numbers: EW 1–8 and EW 13–14 originated at Mugendeda camp, EW 9–12 at Mbea A camp, LW 1–15 at Mbea B camp; ED 1–11 at Dubenkela camp. **Date** on which follow began. **Focal man's** code name. **Distance** in km traveled away from base, determined by the time at which FM turned toward home, converted to distance at five km/hr. Absolute distance away may be greater in some cases. **Total** follow time (h). **Search** time (h). Time spent walking after dark generally not counted as search (see Supplementary Material for details). **Pursuit** time (h). Time spent in **other** activities (h). FM's primary **goal** as stipulated by FM or inferred from his behavior on the follow. *Apis* honey marks follows where that was the main target. This resource was taken on other follows but not as the primary focus of the trip. Visit indicates walk to a nearby Hadza camp; encounter means a daylight walk in search of large animal prey; tracking means pursuit of an animal thought to have been wounded; w/woman or women means the party mainly pursued women's foraging opportunities. **Others** are additional members of follow party, AdM—adult male, AdF—adult female, TnM—boy aged 12–18 y, TnF—girl aged 12–18 y.

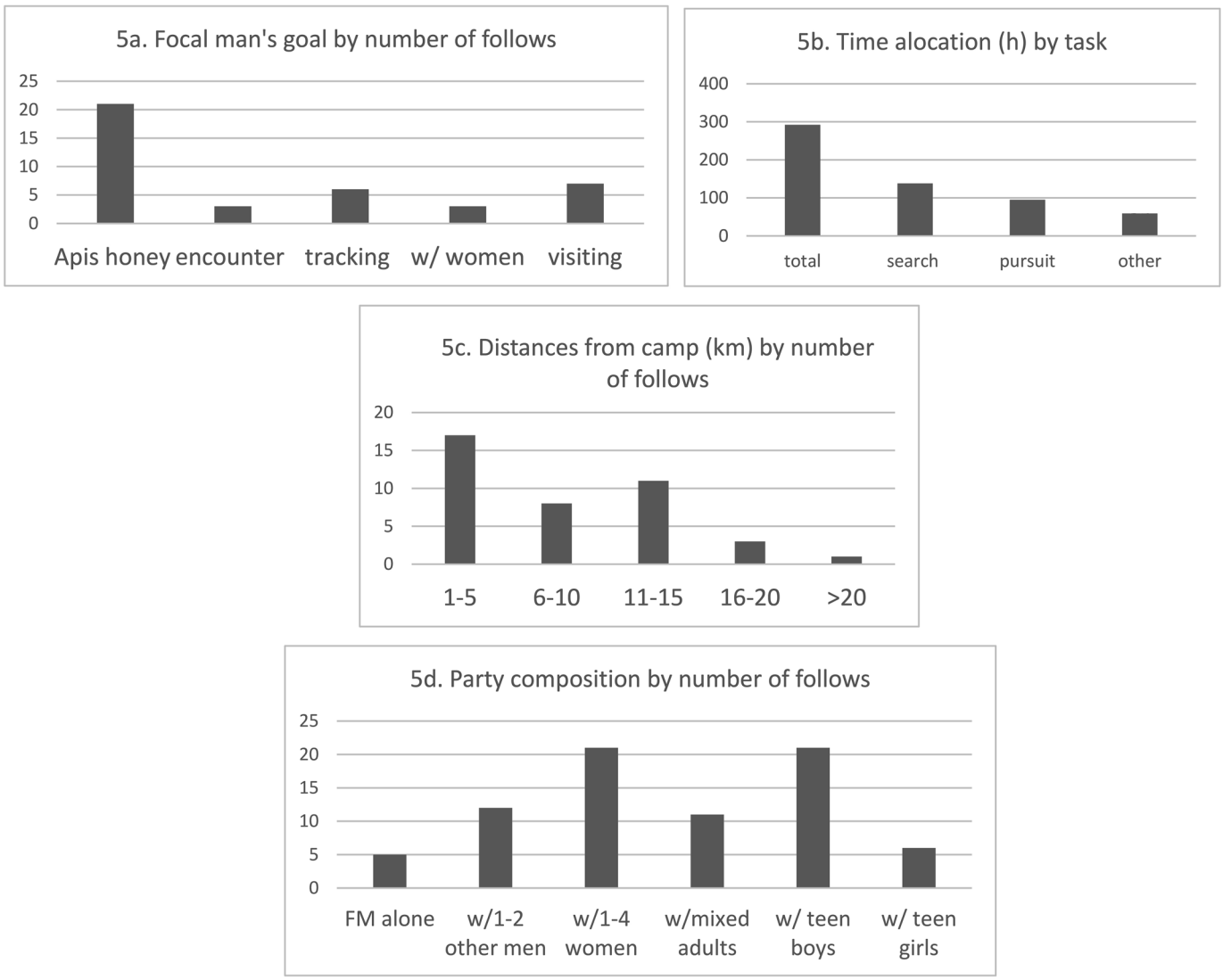

Figure 5. Wet and early dry season follows (n=40). Data from Table 4: a) focal men's goals; b) time allocation (h); c) estimated minimum distance away from camp (km); d) party composition.

ADDITIONAL OBSERVATIONS ON RESOURCE ACQUISITION AND DISPOSITION

As noted, women carried *//ekwa* and baobab collected by focal men back to camp on several follows. All was consumed in focal men's households. This was also true in our broader 1985–1986 experience—men or their companions occasionally brought resources collected by men to base where they were consumed by members of the collectors' households but not often with others (Hawkes et al. 1991). Also as noted, small game collected by focal men were seldom returned to base—nearly all were consumed at the point of acquisition as were all the berries focal men themselves collected. Small game brought home arrived without camp-wide notice. This mirrors the pattern seen elsewhere in the 1985–1986 study period (Hawkes et al. 1991, 2001a). Women and girls accompanying focal men took baobab, berries, small birds, and bird eggs on several follows. Detailed observations on their disposition were not always possible. Some of these items were eaten on the spot, some were returned to base.

As described elsewhere (Bunn et al. 1988; Hawkes et al. 1991, 2001a; Monahan 1998; O'Connell et al. 1988a, 1990) large carcasses, including all those acquired on focal follows reported here, were dismembered for transport at kill sites. Long bone marrow from bovids and giraffe was extracted and consumed in the process as were the brain and marrow cavity contents of zebra skulls and jaws (ca. 55% of 46 cases in the overall 1985–1988 carcass processing and transport sample). High proportions of giraffe marrow, perhaps half of what was acquired from this taxon overall, were carried to base in metal pots or leather wallets. Flesh was often eaten at kill sites; the amounts involved were sometimes significant (>10kg per incident). Children, including subteens made up about 15% of parties recruited to move carcass parts to base (O'Connell et al. 1988a, 1990) but overall had no unusually close relationships with men who made the kills. In other words, children of successful hunt-

TABLE 5. MEN'S WET AND EARLY DRY SEASON FOLLOWS, 1985–1986: PREY ENCOUNTERED, PURSUED, RESULTS.

Part A

	Encounter	Follow	Pursuit	Pursuit time (min)	Pursuit time (h)	Hit/Lost	Kill	Scav.	Wt (kg)
Eland	3	3	2	221	3.7	-	1	-	205
Elephant	1	1	1	10	0.2	-	-	1	10
Gazelle	20	1	-	-	-	-	-	-	-
Giraffe	94	9	13	644	10.7	5	-	-	-
Greater kudu	1	1	1	145	2.4	1	-	-	-
Hartebeest	8	2	1	1	<0.1	-	-	-	-
Impala	75	13	12	40	0.7	-	-	-	-
Leopard	1	1	1	1	<0.1	-	-	-	-
Warthog	5	2	1	5	0.1	-	-	-	-
Wildebeest	1	1	-	-	-	-	-	-	-
Zebra	13	4	1	2	<0.1	-	-	-	-
Total	**222**	**23**	**33**	**1069**	**17.8**	**6**	**1**	**1**	**215**
Baboon	20	1	-	-	-	-	-	-	-
Bat-eared fox	3	1	3	63	1.1	-	2	-	2
Bustard	1	1	-	-	-	-	-	-	-
Dik-dik	6	5	2	2	<0.1	-	-	-	-
Guinea fowl	22	3	3	4	<0.1	-	-	-	-
Hornbill	12	4	8	7	0.1	-	8	-	1
Hyrax	1	1	1	5	0.1	-	-	-	-
Mongoose	1	1	1	12	0.2	-	1	-	1
bird eggs	6	2	-	-	-	-	-	-	-
turtle	1	1	-	-	-	-	-	-	-
small mammal	1	1	1	1	<0.1	-	-	-	-
small bird	7	5	3	27	0.4	-	-	-	-
Total	**81**	**15**	**22**	**121**	**2.0**	**-**	**11**	**-**	**4**

ers did not enjoy special access to meat or marrow in these situations. Nutrient-rich organ meats (*epeme*) were always reserved for adult men and usually eaten at secluded locations just outside camp, off limits to women and children.

Adults claimed shares of flesh and grease-rich bones either at the kill as hunters, members of carrying parties, or when parts reached base. The successful hunter sometimes influenced the distribution at the kill but did not manage it. His own household usually did not receive a greater than average share. Exceptions involved prey with estimated body weights >180kg. In these cases (15 of 20 recorded), eight resident men were credited with the acquisitions. Those hunters' households retained an average 29.9kg, more than twice the mean weight of tissue in 38 shares (mean 13.5kg) assigned to co-resident non-acquirer hunters' households. In our opinion this pattern anticipates the need to satisfy claims made by residents of other camps drawn that day or the next by news of an especially large kill (Hawkes et al. 2001a). Four follows in focal data reported above as visits to other camps (32/EW-10, 35/EW-13, 43/LW-7, 54/ED-3) clearly had that purpose—focal men and as many as a dozen adult companions from our camp visiting other sites to share in unusually large amounts of meat, either eating it at those sites or carrying it back to their homes. On occasion, successful hunters sequestered parts of their kills for trade. Our late dry season 1985 data document meat being carried off to farming communities several hours walk away, but do not provide comprehensive information on connections with specific households.

Data on *Apis* honey present a more complex picture. Figure 7 (data from Table 6) shows total amounts collected on 28 wet and early dry season follows. Five gaps in the sequence (13–22 December, 6 January–22 March, 1–12 April, 1–17 May, 13–30 June) indicate periods when KH and JOC were absent from the field. The overall distribution shows two periods (26 November–3 January, 18 April–8 June) in which *Apis* honey was procured in large amounts. These coincide with the regional short and long rains, respec-

TABLE 5. MEN'S WET AND EARLY DRY SEASON FOLLOWS, 1985–1986: PREY ENCOUNTERED, PURSUED, RESULTS (continued).

Part B

	Encounter	Follow	Pursuit	Pursuit time (min)	Pursuit time (h)	Acq'd	Wt (kg)
Apis honey	137	29	134	4201	70	106	326
Kanoa honey	31	16	25	106	1.8	24	5
N!ateko honey	3	3	3	71	1.2	2	2
Total	**171**	**30**	**162**	**4378**	**73**	**132**	**333**
Baobab	8	4	2	16	0.3	2	2
Kongolobe berries	26	9	26	124	2.1	26	1.2
Undushibe berries	6	4	6	24	0.4	6	0.3
non-id berry	1	1	-	-	-	-	-
Total	**40**	**14**	**34**	**164**	**2.7**	**34**	**3.5**
//ekwa root	9	7	1	11	0.2	1	1
Total	**9**	**7**	**1**	**11**	**0.2**	**1**	**1**

Part A covers mammals and birds: large (wt. >40kg), small (<40kg). **Encounter** means direct visual contact; tracks and other indicators are not counted. **Follows** are those on which encounters with indicated prey types were noted. Pursuit began when FM paused after sighting potential prey. **Pursuit time** was that invested, measured in minutes (min) and hours (h), whether successful or not. **Hit/lost**: FM's bow shot hit prey, which was lost after further pursuit; **Kill**: prey acquired by FM's bow shot; **Scav**: edible tissue was obtained from a kill made by another predator. **Wt (kg***)*: estimated amount of edible tissue acquired (60% of mean adult live weights reported by Coe et al. (1976). Weight for elephant is what FM removed from the fly-blown carcass.

Part B covers honey, fruit and geophytes pursued by FM. **Encounter** refers to a single hive or set of closely spaced plant foods. It is an underestimate: not all encounters were identified by JOC or brought to his attention by FM. **Follows** are those on which encounters with indicated prey types were noted. **Pursuit** refers to the number of times FM tried to acquire the resource after encountering it. **Pursuit time** is that which FM invested in the attempt whether successful or not. **Acquired** means the number of times the resource was obtained from a single hive or a closely spaced set of plant foods. **Weight** refers to the amount taken by the FM alone or in the case of *Apis* honey in collaboration with other party members.

See Supporting Material Table S2 notes for additional data on other party members' encounters, pursuits, and acquisitions.

tively, marking peaks in honey production. Amounts procured per follow during each interval were highly variable: 1–31kg (mean 11±9) in the earlier one, 1–53kg (mean 14±4) in the latter. Amounts procured per hive across the total sample were also highly variable: 0–33 kg (mean 3±4).

Note the shift in proportions of *Apis* eaten as acquired versus carried back to base. During the November-January interval, significant amounts were brought home only when the total weight taken was well above the mean of twelve kg per follow. Estimated weights eaten in the field were sometimes substantial—on four follows estimated averages of 3–5kg consumed per party member were recorded. Overall, only about 15% of the 129kg collected on eleven follows was carried home, usually by women or a teen companion. From mid-April on, the pattern was reversed. Nearly 70% of the 186kg collected was brought to base. Estimated weights consumed in the field generally averaged <1.5kg/party member.

Trading opportunities account for at least part of this difference, perhaps most of it. In late May, Datoga men, usually in pairs, began visiting our camp and others looking to exchange cash, cloth, and metal pots for honey. Our sense was that few transactions were completed but some may have taken place out of sight or while we were away on follows. Toward the end of the month, the layout of our camp changed as family households moved their shelters further from nearest neighbors, roughly doubling the average distances between them, a shift that limited opportunities to monitor amounts of honey carried by foraging parties that returned after dark. At the end of the month, senior

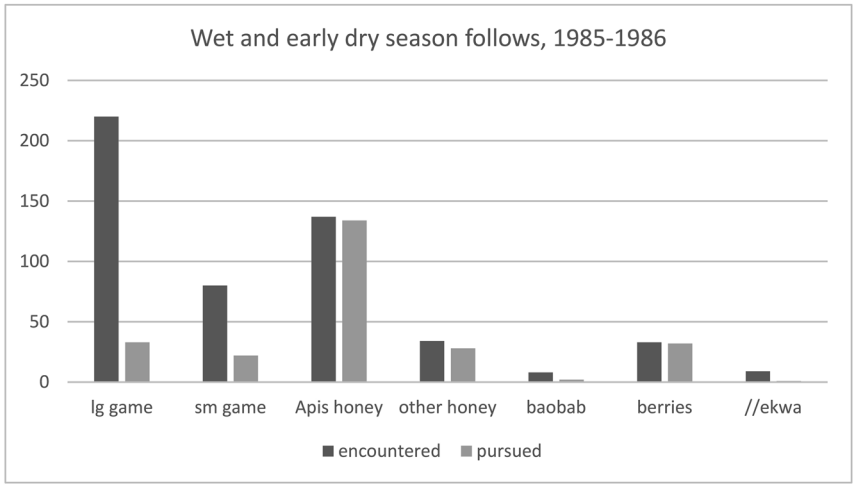

Figure 6. Wet and early dry seasons: total numbers of resources encountered and pursued. Data from Table 5.

Hadza men approached JOC about the possibility of temporarily stashing honey-filled drums in the project Land Rover, stores that were ultimately taken on foot to Iraqw mead-makers in Yaeda in exchange for maize or mead itself. At least 30kg of *Apis* honey, possibly up to 60kg were carried off from our study camp by residents in the first half of June. We do not doubt that more honey was eaten in camp during the early dry season than before but reckon that trade drew off a significant portion of the overall take during these several weeks.

SUMMARY OF 1985–1986 FOLLOW DATA

Figure 8 shows differences in party composition, foraging time, and objectives in late dry vs. wet/early dry season follows. Late dry season follows were marked by smaller party sizes, including more than a third where focal men operated alone. Follows were overwhelmingly large-game related—26 of 33 total follows (79%), 60% of total follow time (large game pursuit plus ambush), 74% of total pursuit time. All follows operated within 10km of base. Big game were closely tied to limited water sources during this season; so were the Hadza.

Wet and early dry season follow parties were larger and more diverse in membership. Big game hunting-related trips made up less than quarter of all those undertaken and only 18% of total pursuit time. *Apis* honey collecting was the main activity on 55% of all wet and early dry season follows, ancillary on another 18%, accounting for 73% of total pursuit time. Greater representation of non-focal men, women, and teenagers reflects the opportunity to consume honey as it was acquired or to claim shares for transport back to base. Forty percent of all wet/early dry follows traveled 10km or more from camp; most of these were *Apis* honey collecting-oriented, underlining its impor-

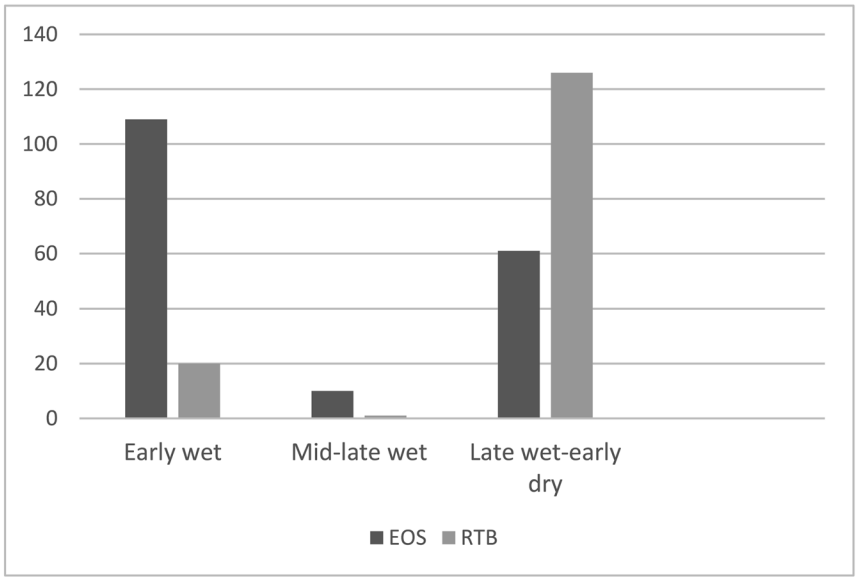

Figure 7. Variation in weights (kg) of Apis honey eaten on site (EOS) versus returned to base (RTB). Data from Table 6.

TABLE 6. WEIGHTS OF *APIS* HONEY TAKEN BY SEASON AND CONSUMED AT ACQUISITION VS. THOSE CARRIED TO BASE, WET AND EARLY DRY SEASONS, 1985–1986.

Follow	Date	Party size	Weight collected (kg)	EOS (kg)	RTB (kg)
EW-1	26-Nov-85	2	4.4	4.4	-
EW-2	29-Nov-85	14	15	14	1
EW-3	30-Nov-85	3	14.6	11.8	2.8
EW-4	2-Dec-85	3	10	10	-
EW-5	4-Dec-85	3	3.4	3.4	-
EW-7	6-Dec-85	5	30.6	24.6	6
EW-8	8-Dec-85	3	17.5	14.5	3
EW-10	26-Dec-85	5	8	8	-
EW-11	27-Dec-85	9	20.3	13.8	6.5
EW-12	29-Dec-85	18	4	4	-
EW-14	3-Jan-86	2	1.2	0.6	0.6
Subtotal			**129**	**109.1**	**19.9**
LW-1	23-Mar-86	6	2.8	2.8	-
LW-2	24-Mar-86	2	5.9	5.3	0.6
LW-4	28-Mar-86	3	2	2	-
LW-5	29-Mar-86	9	0	-	-
Subtotal			**10.7**	**10.1**	**0.6**
LW-8	18-Apr-86	5	8.2	7.4	0.8
LW-11	22-Apr-86	3	23.7	5	18.7
LW-12	26-Apr-86	6	25.4	9.8	15.6
LW-15	19-May-86	4	12.5	6.5	6
ED-1	20-May-86	3	3	2.2	0.8
ED-2	21-May-86	1	0.2	0.2	-
ED-4	24-May-86	3	17.7	1.2	16.5
ED-6	30-May-86	2	1	1	-
ED-7	30-May-86	4	11.3	3.7	7.6
ED-8	4-Jun-86	16	53.1	5.5	47.6
ED-9	5-Jun-86	5	14.3	5	9.3
ED-10	6-Jun-86	8	7.3	7	0.3
ED-11	8-Jun-86	4	8.5	6	2.5
Subtotal			**186.2**	**60.5**	**125.7**
Total			**325.9**	**179.7**	**146.2**

Follow and **date** as in previous tables; **party size** is the total number of individuals involved in the follow; **total collected** is the estimated weight (kg) taken from all hives tapped on the follow; **EOS** is the estimated weight consumed by party members at or near the point of acquisition; **RTB** is the estimated weight returned to base.

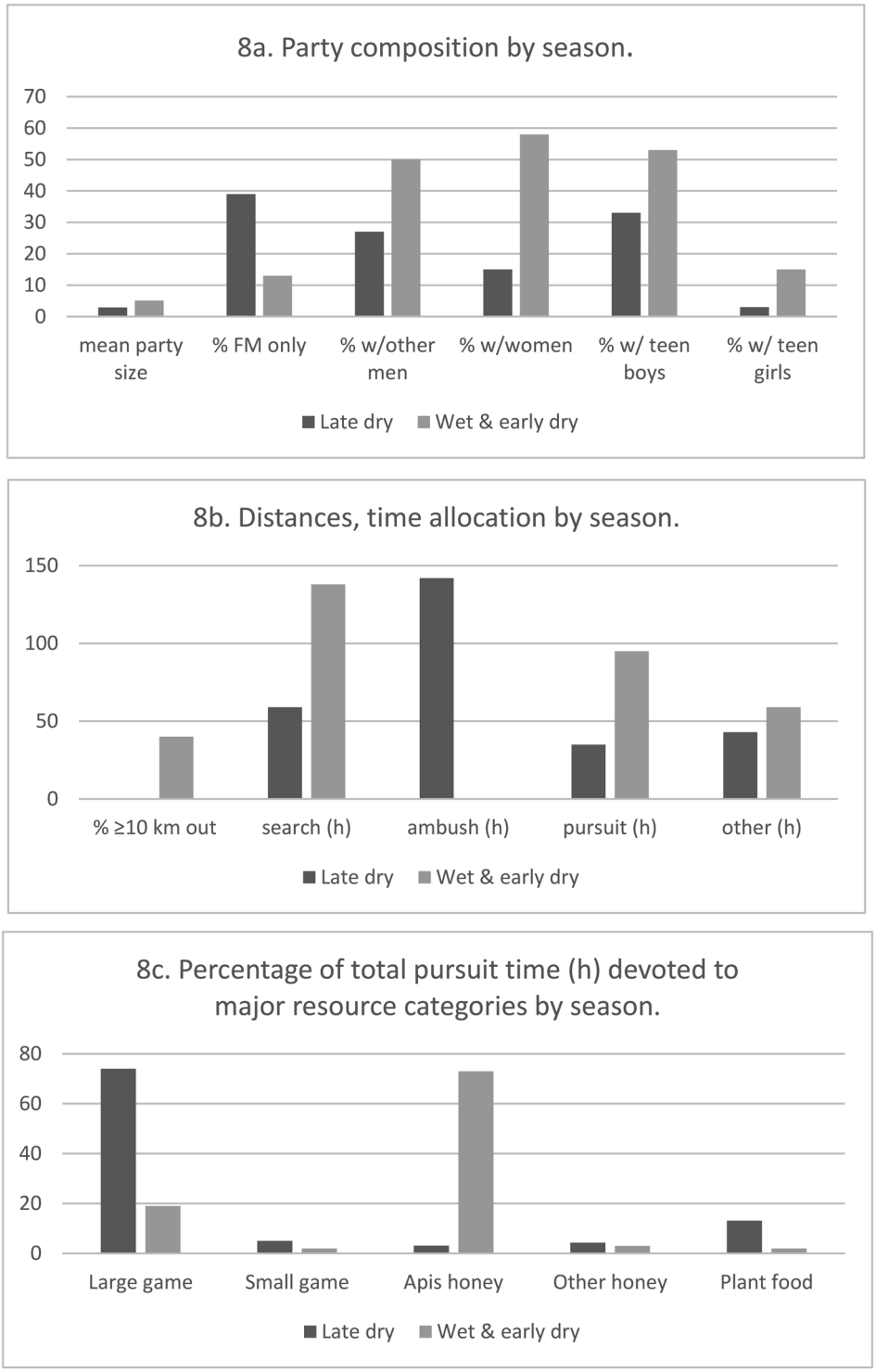

Figure 8. Summary of data on party compositions, times, distances, and goals; late dry vs. wet and early dry seasons, 1985–1986: a) seasonal contrast in number of follows, mean party size, percentage of follows with indicated party compositions; b) seasonal contrast in percentage of follows with indicated minimum distances from camp ≥10km and with times (h) devoted to search, ambush, and pursuit, respectively; c) seasonal contrast in percentage of total pursuit time devoted to major resource categories.

tance at this time. Across the overall sample, attention to small game, non-Apis honey, and plant foods measured by pursuit time was very limited, more common in the late dry season, less so in the wet and early dry season.

COMPARISON WITH PREVIOUS UTAH/UCLA REPORTS

Data presented here do not contradict but differ in detail from those reported by the Utah/UCLA research group

elsewhere (Hawkes et al. 1997, 2001b). Key points of contrast are these.

Sample subdivision. Previous presentations identified seven "seasonal" sets in the 1985–1986 study period, each defined by the occupation of a particular Hadza camp. Here that same study period is divided into just two sets, defined by differences in resource availability and hunters' acquisition tactics, each set including data from several camps.

Data collection protocols. Previous reports on time allocation were based on daylight time budgets constructed from scans of in-camp activity, focal follows on men and women out of camp, and on daily summaries of camp residents' activities. Data on men's follows were briefly summarized in those reports; here they are presented in detail. Scan data are referenced for background only; our focus is almost exclusively on men's follows.

Focal men. Earlier studies covered a larger sample (fourteen married men, eleven adolescent boys) including some who were on average less active, less successful hunters than the fifteen reported here. Earlier studies also incorporated data from the late dry 1988 and early wet 1989 seasons. Reference to study periods other than 1985–1986 has been more limited here.

Time. Hawkes et al. (1997, 2001b) reported an average of four h/day on food acquisition; here we cite an overall figure of about eight h/day. In-camp scans were the framework for estimating men's time allocation to daily activities in the samples reported by Hawkes et al. (1997, 2001b). At random time-points throughout the twelve daylight hours the location and activity of every individual in camp was observed "instantaneously." Residents' activities when they were absent at a scan time-point were later added to the record from other information sources (Hawkes et al. 2001b). The sample presented here is based on direct observations of out-of-camp activity. Better, more successful Hadza hunters spend more time hunting (Hawkes et al. 2001b: 685). More attention to the latter on focal follows here contributes to the "time away" difference between our reports. Also, as Woodburn noted, "men wander off into the bush individually for a while almost every day to satisfy their hunger" (1968: 51). Such absences would have been caught in the scans and contributed to both the shorter average time away from camp and the lower average party size.

Party composition. Hawkes et al. (1997, 2001b) reported that men usually operated alone or in pairs, consistent with Woodburn's accounts. Here we show a more diverse pattern, men operating alone on only about a quarter of recorded follows. The difference may reflect a trade-off between 1) the advantages of having an experienced male partner in search, pursuit, and acquisition of large prey and in defense of any such prey taken from aggressive lions and hyenas, and 2) those associated with being solo when big game-related success is relatively low and more effort is given to small game acquisition, the products of which can then be consumed immediately or carried back to base without the need to share with a partner. This trade-off should make better hunters draw more company when expected encounter rates with big animals are higher. It should also make our account and Woodburn's more alike. Instead, our party compositions are more diverse. Perhaps preparation for longer forays drew more attention from potential companions and as a follow opportunity, while shorter absences from camp, those captured in our scans and noted by Woodburn during his fieldwork, did not.

Attention to *Apis* honey. Our concern with the implications of our data for arguments about the role of big game hunting and paternal provisioning in Pleistocene past led us to focus our earlier treatment of Hadza data accordingly. Big game have been central to all arguments in the literature about provisioning. We noted (Hawkes et al. 1997, 2001b) that honey collecting parties were "often composed of nuclear family members" but did not make this a major issue. We now provide an important modification of that statement. Where women and children were present, they almost always included members of the focal man's nuclear family *but never all members of that family*. Subteen children were conspicuously absent on these outings, even though they were often present on women's plant collecting trips. The absence of subteens on men's follows where much was consumed at the site of acquisition is inconsistent with paternal provisioning (see also below).

DISCUSSION

At issue for us has been identifying and evaluating the foraging choices Hadza men make as knowledgeable hunters in ecological circumstances broadly comparable to some of those in which our genus evolved. To the extent the opportunities and trade-offs they face parallel those confronted by ancestral hunters, their strategies can help us evaluate the proposed catalytic role of big game hunting in the early stages of human evolution. Hunting to provision mates and offspring is widely held to have prompted relatively exclusive mating arrangements, a sexual division of labor in subsistence, extended provisioning of overlapping offspring after weaning, and the evolution of human life histories. In all these ways, humans differ from other great apes including chimpanzees, patterns among whom are assumed to have been shared with our most recent common ancestors (Alger et al. 2020; Silk and Rosenbaum 2022).

Many favored explanations for the emergence of the human pattern are versions of the hunting/paternal provisioning hypothesis. Their basic form is familiar. The Mio-Pliocene spread of African savannas increased the availability of large-bodied ungulates. Ancestral hominin males began to pursue those ungulates and brought the proceeds to certain females in exchange for exclusive sexual access. This allowed those females to reduce their foraging effort, shorten their birth intervals, handle the overlapping dependents, and bear more offspring for the successful hunter. Extended provisioning let those offspring remain dependent longer, mature later, develop larger brains, and for the juvenile males among them devote more time to the improvement of hunting-related skills. Paternal provisioning is central to this hypothesis.

The argument was grounded initially on the unique-

ness of modern human pair bonding, men's big game hunting, and purported family provisioning relative to other primates (Washburn and Lancaster 1968). In recent decades it has come to depend heavily on the hominin fossil record, archaeological evidence of early human hunting and aggressive scavenging, and on continuing, widely shared assumptions about modern hunter-gatherers. The fossil record shows that genus *Homo* first appeared in East Africa 2.8–2.4 million years ago (Kimbel et al. 1996; Prat et al. 2005; Suwa et al. 1996; Villmoare et al. 2015). The earliest undisputed evidence of hominin big game hunting and aggressive scavenging dates to 2.6–1.8 Ma (Barr et al. 2022; Pobiner 2020; Thompson et al. 2019). Assumptions about men's hunting and family provisioning in traditional foraging societies support the notion of a causal relationship underlying this coincidence. This has been a dominant theme in the paleoanthropological literature of the last 50 years (Alger et al. 2020; Alvarado et al. 2015; Gavrilets 2012; Hill 1982; Isaac 1978; Kaplan et al. 2000; Lancaster and Lancaster 1983; Lovejoy 1981; Oxford and Geary 2019; Washburn and Lancaster 1968).

A major problem with this model is that ethnographic support for paternal provisioning via big game hunting, specifically in Africa, is very limited. Hadza present an appropriate reference point. As noted above, they live in an East African habitat broadly similar, though not identical (Faith et al. 2019) to those in which genus *Homo* first evolved. Large ungulates and carnivores are/were prominent in both situations. Hadza have practiced full-time hunting and gathering with traditional tools throughout the century and a half that Europeans have known them. They have long been identified as big game hunters and see themselves in those terms. Based on fieldwork in the late 1950s and early 1960s, James Woodburn (1968: 52) said this:

> "Although vegetable foods form the bulk of their diet, the Hadza attach very little value to them. They think of themselves and describe themselves as hunters."

Returns from their efforts in this realm can sometimes be impressive. In 1985–1986, we recorded 56 large carcasses acquired by hunting and aggressive scavenging over 188 days of observations in base camps in which we resided (Hawkes et al. 1991). This represented an estimated total of about 4200kg of edible tissue, or an average of about 0.5kg per camp resident per day. But that average obscures the limitations of big game meat as a source of family support. Measured on a day-to-day basis, this resource was unreliable. Records of that same 188-day sample show one long period—28 May–10 July 1986, 43 consecutive days—during which no big game meat was acquired by any of the 8–10 active hunters living in those camps (data from our own observations supplemented by independent reports from two men covering our 13–30 June absence). Over a 43-day observation period in late dry season 1988, we saw the same pattern of unreliability—nine large animals taken for an average of about 0.6kg per camp resident per day, but with "no-kill" stretches by any hunters in the camps where we were living of fourteen and seventeen consecutive days. The 73 focal follow sample reported above shows the same thing—four large animals over 33 follow-days in the late dry season, an average of one every eight follow-days, but in the wet and early dry season, just two over 40 follow-days, an average of one every three follow-weeks. These numbers do not reflect reliable paternal provisioning, or for that matter reliable provisioning of camps by hunters as a group. As Woodburn (1968: 54) reported:

> "Hunting, even by a skilled hunter . . . is always an unpredictable pursuit. . . . Perhaps as many as half of the adult men may fail to kill even one large animal a year."

Men in our follow sample did not fill these shortfalls by acquiring other readily available resources in quantity. They collected baobab infrequently, roots rarely. They ate berries and *Trigona* honey to feed themselves, with no attempt to share beyond those present at collection points. They pursued small game occasionally but capture rates were low—one guinea fowl over 278 follow-hours in the late dry season, twelve small mammals and birds over 292 follow-hours in the wet and early dry season. The total small game take was ca. 10kg of edible tissue over 570 focal follow-hours and 1182 follow-hours for all adult men in follow parties. Recall that subteen children, the most nutritionally dependent individuals in this population, were seldom present on these forays and rarely shared in what was gathered by focal and other men. Instead, they were supported by what they themselves gathered near camp, by what they collected or were fed on forays with women, and by what women brought home from those forays (Blurton Jones 1989; Hawkes et al. 1989, 1995, 1997). If paternal provisioning were important to these children's welfare, we would have expected to 1) see them frequently accompanying their fathers on foraging trips, thus being in position to share immediately in whatever prey was taken, and/or 2) see their fathers more often pursuing resources that they encountered frequently, could capture readily, could hold and defend from other claimants, and could carry home to feed those children (see Hawkes et al. 1991 for additional details). Neither of these expectations is met in this data set.

Apis honey is a partial exception. It was taken in sizable amounts when available but evidence for sharing with children is mixed. On follows reported here, most of that take was consumed in the field by collecting parties and much of the rest was sent off in trade. Collectors' subteen children shared in some of this resource at base camps but its contribution to their diets was seasonal-only and irregular. This observation counters Marlowe's (2003) suggestion that honey rather than big game meat was the critical resource provided by men to their subteen children. Those children certainly ate honey taken by their fathers but did not do so routinely either in the sample reported here or in our broader mid/late 1980s experience.

Big game meat was the main outlier in this situation. In both our follow sample and other records (O'Connell et al. 1988a, 1988b, 1990 1992), it was always brought to camp in quantity when taken and widely shared with residents and visitors from other camps. But with limited exceptions, it was not distributed in ways that favored the successful hunter's own family (Hawkes et al. 1988a, 2014; Stibbard-Hawkes 2020). Even where a hunter's household took relatively large amounts in the initial distribution of a large kill (Wood and Marlowe 2013: 304–305), it has not been shown that his household members ate more as a result. In our experience, adult visitors from other camps took advantage of any such bonanzas within 24 h.

As we have observed elsewhere, most of the big game meat a Hadza hunter takes goes to consumers outside his own family, while most of the meat that family eats comes from other hunters' kills. Blurton Jones (2016: 301–304, 425–428, 447) has shown that better hunters have more children not because those children enjoy higher survivorship rates due to their fathers' hunting success, but because better hunters marry a younger wife when the previous one approached menopause and marry more quickly after losing a wife. The importance of women's role in keeping children fed could motivate women to welcome the protection that a husband's mating claim provided against interference from other men (Blurton Jones et al. 2000: 81–82). The observation that children of better hunters gain more weight (Hill et al. 1993) likely reflects their mothers' foraging skills—better hunters generally marry and have children with more productive women foragers (Hawkes et al. 2001a, 2001b).

Note that in the late dry season 1985 study period, 6–8 men in our camp took 31 large animals over 47 observation days for an estimated yield of >1.0kg per camp resident per day, the highest seasonal return recorded during our 1985–1990 fieldwork. Yet children in that camp on average lost weight, the only time in our fieldwork this outcome was recorded. A high level of protein consumption may have been responsible (Speth 1989). Again, none of this points to effective paternal provisioning.

The pattern of out-of-camp activity shown in our work fits well with most other accounts of Hadza men's foraging, including their practice of eating while away from camp much of what they have collected. Woodburn (1968: 51–54) said this:

> "Men … gather vegetable food only for their own needs and normally bring none back to camp.
>
> The men … satisfy their hunger at the place where the food is obtained. A man on his own [away from camp] will normally light a fire, cook, and eat on the spot any small animal he kills, and only after he is satisfied will he bring meat back to camp and, even there, a small animal is as likely to be eaten by the men as by the women and children ..."

Writing on the results of a large sample of focal men's follows recorded 2001–2013, Collette Berbesque and other members of the Marlowe group (2016: 285) said this:

> "Hadza men's foraging is driven by the goals of getting enough calories to eat and *potentially* to provision their families. … Men take advantage of a suite of high-quality foods – especially honey – and this strategy allows them to both feed themselves and pursue riskier food types that have higher chances of failure upon pursuit … Hadza men (and perhaps any solitary foragers) bring the spoils of their foraging back to camp … *only after they have already eaten most (if not all), of what they need*" (emphases added).

By riskier food types, Berbesque et al. (2016) clearly mean big game. As they say, although this resource feeds families, it does not do so reliably. Other foods that could serve this end more effectively were either ignored or taken mainly to satisfy a hunter's immediate hunger. Again, the case in any of these data for the reliable day-to-day provisioning that dependent juveniles require is unsupported.

This view has been challenged by Brian Wood and Frank Marlowe (2013, 2014). Despite their co-authorship on the Berbesque et al. paper (2016), they maintain that men not only favor the collection of small game, honey, and certain plant foods but also routinely carry these items back to base. They go on to question the empirical support for our own characterization of Hadza men's behavior, especially as presented by Hawkes et al. (1991, 2001a, 2001b):

> "We suggest again that Hawkes et al. should publish their data describing all the foods men encountered, pursued, acquired, and brought to their households *if these data exist*" (Wood and Marlowe 2014: 629) (emphasis added).

These data have now been provided, allowing us to address the Wood/Marlowe critique at length, an exercise to be conducted elsewhere. Here we simply note that Wood and Marlowe report data from 2006–2013 indicating that Hadza men returned small game and other foods to base to share with their households more often than we observed. This may reflect the sharp changes in men's foraging opportunities created by a doubling of non-Hadza populations, their continuing encroachment on Hadza territory, and the corresponding decline in large animal numbers across the region of interest during the twenty-year gap between our respective observations. Differences in data collection routines may also be involved. Whatever the reason, the Wood/Marlowe claim is an outlier relative to the data reported by Woodburn (1968), Berbesque et al. (2016), and in the presentation at hand. It does not refute those observations nor our reading of their implications. Again, more on this elsewhere.

One further point. We assume for the sake of argument that patterns in resource availability during our Hadza fieldwork were enough like those prevalent in the same part of the world early in the evolution of genus *Homo* to

justify useful comparison. Developing that comparison in detail is beyond the scope of this discussion. Nevertheless, we note and briefly react to two cautionary observations offered by colleagues and reviewers. First, the weapons Hadza use to take large animal prey—heavy bows and metal-tipped poisoned arrows—are relatively recent, Late Pleistocene inventions. They were not available to human hunters in the Early Pleistocene, probably limiting their ability to take big game as effectively as do the Hadza. Second, large ungulates and their predators were apparently more abundant and more diverse in those early East African settings than they were at any time in the 20th C (Faith et al. 2019). This may have meant more opportunities to acquire large carcasses by hunting or scavenging, but may also have meant more, possibly more dangerous competition from large carnivores for those carcasses. The East African archaeological record, especially from ca. 2.0 Ma onward shows that early humans could take large ungulates in complete or nearly complete condition by hunting and/or competitive scavenging (e.g., O'Connell et al. 2002). How they managed to accomplish this is not clear, though spearing or rock throwing in combination with "swarming" or "mobbing" (i.e., multiparty attack) are possibilities. Reliability of acquisition under these circumstances is not yet controlled but we suspect it was no better than reported in our 1985–1988 fieldwork or by Woodburn (1968). If so, then the same constraints on paternal provisioning applied in the distant past. As we said, more on this elsewhere.

Back to the main issue. Challenging the paternal investment model in the Hadza case begs an obvious question about the rationale for hunters' choices, specifically for those apparent in Woodburn's accounts and our 1985–1986 data. If not paternal investment, what is the goal of men's heavy investment in big game hunting? Elsewhere we have developed an argument in favor of mating effort (Coxworth et al. 2015; Loo et al. 2017). Key points are these. Male-biased sex ratios in the fertile ages of modern humans make persistent mate guarding more effective than the multiple mating strategies of other living hominids. Women's ability to bear children spans about 30 years, generally ending at about age 45. Since female fertility ends at about the same age in other living hominids (Emery Thompson et al. 2007; Hawkes and Smith 2010, Wood et al. 2023) but they age faster and rarely outlive their cycling years, we assume that shared age at menopause is the ancestral condition. As increased postmenopausal longevity evolved in genus *Homo* (O'Connell et al. 2002; O'Connell and Hawkes 2023), older age structures came to include increasing fractions of both post-fertile females as well as old males still in the paternity competition (e.g., Blurton Jones 2016: 132; Hawkes et al. 2020). Men's ability to conceive lasts at least 20 years longer than females, an increase of more than 60%. Unlike most mammals (including chimpanzees) where the sex ratio in the fertile ages is female-biased, in modern humans the pattern is reversed—more fertile-age men competing for relatively fewer fertile-age women. As in other taxa, that shift favors an increase in mate guarding (Coxworth et al. 2015; Loo et al. 2021; Schacht and Bell 2016).

Success in that gambit turns on men's level of respect for one another's claims on mates. In the Hadza case and others like it, this depends in part on men's big game hunting reputations. A successful hunter provides a highly valued public good in which all community members share. The keys to that success include not only the ability to kill large animal prey but also to acquire through aggressive scavenging kills made by other predators. This makes the successful hunter not only a favored ally but a potentially dangerous adversary, worthy of deference in many situations, including his claims on a mate (Woodburn 1979). That deference may account for women's stated preferences (Marlowe 2004).

All of this is ultimately a function of extended postmenopausal longevity, a pattern nearly unique to humans that establishes male bias in mating-age sex ratios in the first place. The shift to increased longevity may be detected in the hominin fossil record using cranial capacity as a proxy. That is justified by the tight regularity in neurodevelopmental events across placental mammals in which final brain size depends directly on the duration of development (Finlay and Uchiyama 2017; Hawkes and Finlay 2018). If so, fossil data on variation in estimated brain size (Du et al. 2018) indicate that the life history shift began with early *Homo* (O'Connell and Hawkes 2023). Older age structures meant older, still-fertile males competing for paternities, reversing the male preference for older mating partners in our closest living relatives (Muller et al. 2006) to the human male preference for younger ones (Muller et al. 2020). With the male-biased sex ratio in the fertile ages making mate guarding the strategy that wins most paternities, pair bonds create social arrangements that resemble nuclear families but with a very different underpinning (Coxworth et al. 2015). Evidence of interest in big game hunting and scavenging, indicated from early *Homo* onward (Barr et al. 2022), read here as mating rather than paternal investment, fits the expected pattern. To the degree the life history changes spring from senior female subsidies for dependent juveniles (Blurton Jones 2016; Hawkes et al. 1997, 1998; Kim et al. 2012, 2014, 2019; O'Connell et al. 2002), it makes the basic social unit in genus *Homo* a multigenerational set of closely related females, a common pattern among humans in the present (Sear 2016). Ancestral males making claims on the fertile-age figures in that set formed nuclear family-like subunits.

CONCLUSION

The appeal of the hunting/paternal provisioning hypothesis for the origin of genus *Homo* lies not only in claims that it accounts for differences between us and the other great apes, but also in the broad coincidence between the earliest dates for that taxon and archaeological evidence of big game hunting and scavenging. But that coincidence is not self-explanatory; it needs an argument consistent with natural selection. For advocates of the hunting hypothesis, that is provided by widely shared assumptions about men's role in provisioning offspring among modern hunter-gatherers. Some of what Hadza men acquire is con-

sumed by others, especially parts of big animals—a benefit for all, including women and children. We have certainly seen warm relationships between Hadza men and children but that does not make them paternal provisioners (Blurton Jones 2016: 416–436). The hunting hypothesis holds that hunters provided their children with a reliable, differential, roughly day-to-day intake from this source that raised the survivorship of their own offspring compared to those of non-provisioners. That differential was required for selection to increase the frequency of paternal provisioning in subsequent generations (Hawkes 2004). As documented here and elsewhere, notably in Woodburn's (1968) work, there is no evidence that it is or has been the norm among the Hadza. A counter hypothesis has been developed elsewhere, one that links senior women's foraging and food sharing with the evolution of human life histories and connects hominin big game hunting and its archaeological consequences with mating advantages rather than paternal provisioning (Hawkes et al. 2018; O'Connell and Hawkes 2023). Contrary to conventional wisdom, sexual selection and mate guarding rather than a model of nuclear families as units of common interest are brought to the fore.

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DATA AVAILABILITY STATEMENT

All data newly reported here are presented in detail in Supplementary Material. Questions can be handled in correspondence with oconnell@anthro.utah.edu.

WORK EFFORT

All authors contributed to conceptualization, analysis, and writing. O'Connell collected the follow data and organized the Supplementary Material.

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Supplement 1: Hadza Men's Follows, 1985–1986: Data and Implications for Ideas About Ancestral Male Foraging Effort in Human Evolution

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SUPPLEMENT 1
This file includes: additional text, references, and Supplementary Tables S1–S2.

Common English, Scientific, and Hadza Names For Resources Mentioned In This Paper

Large-bodied fauna		
bush elephant	*Loxodonta africana*	*bek'au*
giraffe	*Giraffa camelopardalis*	*tsokwonako*
cape buffalo	*Syncerus caffer*	*nakomako*
common eland	*Tragelaphus oryx*	*komati*
plains zebra	*Equus quagga*	*dongoako*
greater kudu	*Tragelaphus strepsiceros*	*!namako*
blue wildebeest	*Connocaetes taurinus*	*bisoko*
hartebeest	*Alcelaphus buselaphus*	*!eleako*
bushbuck	*Tragelaphus scriptus*	*tsimangana*
impala	*Aepycerus melampus*	*popoako*
common warthog	*Phacochoerus africanus*	*kwahi*
lion	*Panthera leo*	*seseme*
leopard	*P. pardus*	*janjai*
spotted hyena	*Crocuta crocuta*	*udzameko*
Small-bodied fauna		
olive baboon	*Papio anubis*	*ne'e'ko*
Kirk's dik-dik	*Madoqua kirkii*	*gewedako*
bat-eared fox	*Otocyon megalotis*	*bililiko*
rock hyrax	*Procavia capensis*	*ch'abako*
dwarf mongoose	*Helopgale parvula*	[not available]
helmeted Guinea fowl	*Numida meleagris*	*ch'aako*
hornbill	*Trockus* sp.	[not available]
Honey		
honey bee	*Apis mellifera*	*ba'alako*
stingless bee	*Trigona* spp.	*kanoa, n!ateko*
Fruit		
baobab	*Adansonia digitata*	*n//obabe*
mallow raisin	*Grewia villosa*	*kongolobe*
sandpaper raisin	*Grewia flavescens*	*mbilipe*
[not available]	*G. similis*	*ngwilabe*
long leaf cordia	*Cordia gharaf*	*undushibe*
toothbrush fruit	*Salvadora persica*	*tafabe*
Geophyte		
[not available]	*Vigna frutescens*	*//ekwa*

Notes on resource acquisition and disposition

Large game were defined by average adult body weights >40kg. Pursued whenever possible, they were shot with poisoned arrows or seized from kills made by lions or leopards. Small game weighed <40kg. They too were taken with bow and arrow, the latter never poisoned. Snares for small game were occasionally used during the study period, once in connection with follows in this sample by focal man H. Use of looped steel cables to trap large game on trails was observed twice while on follows, once in late dry 1985 by non-Hadza men from a settlement several hours away, once in late dry 1986 by focal man H. Some meat and marrow from large animals were eaten by Hadza at kills but carcass size meant most was left to be carried to camp to share with others there (Hawkes et al. 2001a; O'Connell et al. 1988, 1990; see also Bunn et al. 1988; Monahan 1998). Small game taken by FM were nearly always consumed on the spot. Women and girls accompanying focal men collected small animals, birds, and their eggs, sometimes eating them immediately, sometimes bringing them back to base.

Honey of *Apis mellifera* was a focus of attention throughout the 1985–1986 wet season and into the following early dry. Acquisition was aided by honey guides (*Indicator* spp., Wood et al. 2014), small birds that directed hunters' attention to active hives. Hives were usually encountered in baobab trees, sometimes up to 10m above ground. FM or male companions, including teens reached them by climbing on wooden pegs driven into the tree trunk, calming the bees with smoke, and pulling out the honey and brood-rich

comb. The process was contentious when calming was ineffective, dangerous if the climber fell. *Apis* hives were also found and tapped closer to ground in acacias and abandoned termite mounds. Smoke was used in these cases as well. Highly variable amounts of honey, brood, and comb (sometimes >10kg per hive) were acquired in the process and often eaten on the spot by focal men and their companions. Amounts brought to camp were also highly variable. Honey of stingless bees (*Trigona* spp.) was acquired in all seasons from nests near ground level. Focal men opened these nests with axes and drew out the honey, always in small amounts, and consumed it immediately, sometimes but not always sharing it with their companions. It was never carried to camp on these follows, seldom to our knowledge at other times during 1985–1986 fieldwork.

Berries (*Grewia spp.*, *Cordia gharaf*, *Salvadora persica*) were taken at various times, mainly in the wet and early dry. They were never a prime target for FM but were eaten occasionally as encountered while searching for other foods. They were never carried back to base by focal or other adult male party members, rarely and only in small quantities (<1kg/follow) by one or another of their female companions. As reported elsewhere, berries were taken routinely by women's foraging parties, especially in the wet, often in large quantities, some eaten at the point of acquisition but with sizable loads always carried to camp by women and girls (Hawkes et al. 1995, 1997).

Men collected baobab (*Adansonia digitata*) pods intermittently throughout the year. On follows reported here, pods were sometimes cracked on acquisition and the contents mixed with water to dissolve the pith surrounding the seeds inside. The resulting sweet, slightly acidic drink was quickly drunk, and the seeds usually discarded. At other times, FM carried the pods to camp. Women accompanying FM usually shelled the pods they and FM had collected, dissolved some of the pith for immediate consumption, then brought the rest including all the seeds home for further processing.

Geophytes were a main food source for Hadza throughout the study period (Hawkes et al. 1989, 1995, 1997). One (*Vigna frutescens*, *//ekwa*) was taken on five follows by focal men themselves, more often by their women companions. Men's take was mostly cooked and eaten on the spot. Only once was a portion carried to base. Women's take on FM follows was sometimes cooked and eaten at the acquisition point but was generally brought home, cooked or not. As reported elsewhere, women took *//ekwa* and other geophytes on female-organized forays throughout the year (Hawkes et al. 1989, 1995, 1997; Vincent 1985). They cooked and ate some in the bush and typically brought large quantities back to base to share with others including their children. The term *fallback food*, applied by some reporters based on post-1995 observations (e.g., Marlowe and Berbesque 2009) does not apply to the role these resources played during our fieldwork. They were day-to-day staples.

Resource Weights

Developing data on resource weights acquired was often difficult. Geophytes were the exception: subjects routinely set aside whatever they dug until a collecting bout was finished. Amounts gathered could then be weighed with portable spring scales.

Data on all other resources are accurate but less precise. Figures listed for big game were derived from average adult weights reported by Coe et al. (1976), adjusted somewhat if the animal was unusually large or small, reduced by 40% for an estimate of edible tissue content, and further reduced for giraffe and eland by the estimated flesh weights left uneaten at the kill. Where scavenging was involved, further adjustments were made for the estimated weight of tissue lost to the initial predator. Most large carcasses listed here were recovered intact, the one taken by aggressive scavenging essentially so. The sole exception was a subadult elephant speared by pastoralists, badly flyblown when Hadza encountered it. On one follow an estimated 10kg of meat from this animal were carried to base. Meat from the same animal was sometimes acquired by FM on visits to other Hadza camps.

For smaller game, we used the mean adult weights reported by Wood and Marlowe (2014). Baobab pod counts were readily tabulated, but their edible content varied with pod size. Where pods were processed at collection points, it was possible to establish an approximate average weight of edible content per pod (0.2kg of pith and seed each). We applied this value to all pods collected unless an actual weight was tallied. As indicated above, berries and *Trigona* honey were generally eaten as collected, always so by FM. Establishing precise weights consumed at each collection point might have been possible but attempting to do so routinely would have disrupted collectors' work. We reckon that most *Trigona* nests produced 50–100g of honey and applied this estimate throughout our analyses. Elsewhere we and others have developed estimates of berry weights collected, either by assuming standard values per handful gathered, then counting handfuls collected (Berbesque et al. 2016), or by measuring the rate at which a given weight could be collected, then applying it as a constant across the total time spent collecting (Hawkes et al. 1995). We use the latter method here, assuming an average estimated collection rate of 1kg/h for all berries.

Estimating weights of *Apis* honey collected was more problematic. Where small amounts were extracted from a hive, with nothing eaten in the process, it was possible to weigh the total take once collection was finished. But where amounts were large, with both the collector and bystanders feeding on the take while the work was in progress, quantification became difficult. In these situations, JOC estimated by eye the total volume of honey extracted, then converted that value to a weight at the ratio of one kg per liter based on several cases in which it was possible to pair a volume estimate with a weight. No matter how accurate they were, estimates were compromised in that the ratio of honey to waxy comb varied and because some of the take was made up of brood. The latter fraction was sometimes consumed on the spot, sometimes discarded, rarely carried to base. Estimating the amounts abandoned further complicated

quantification. Our *Apis* honey weight estimates are accurate enough to support useful discussion, but as with all other resources formal statistical analysis should be pursued with caution.

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SUPPLEMENTARY MATERIAL TABLE S1 (All data in Table S1 pertain to FM only. Resources acquired by other party members are reported in additional notes below.)

Follow	Date	FM	Others	Type	Times out/back	Distance out (min)	Duration (min)	Search (min)	Blind (min)	Other (min)	Potential prey seen (n)	Pursuit (min)	Success Y/n	EOS (kg)	RTB (kg)
LD-1	10-Sep-85	BM	none	ambush-n	1838/0700	25	742	52	669	15	impala	6	n	-	-
LD-2	11-Sep-85	BM	none	visit	1025/1230	30	125	65	-	53	tree resin	7	**Y**	taste	-
LD-3	12-Sep-85	BM	none	ambush-n	1815/0653	30	758	58	700	-	none	-	-	-	-
LD-4	15-Sep-85	H	none	encounter	0730/1121	74	231	162	-	69	hartebeest (8-10)	-	-	-	-
											impala (4-5)	-	-	-	-
LD-5	15-Sep-85	BM	none	ambush-n	1550/1350	70	1260	148	851	77	wildebeest (6-8)	1	n	-	-
											impala (2)	109	n	-	-
											mongoose (2)	13	n	-	-
											guinea fowl	60	**Y**	1.25	-
											guinea fowl (2)	1	n	-	-
LD-6	20-Sep-85	BH	AdM: 1	ambush-n	1600/0915	20	1035	79	875	-	zebra	1	n	-	-
											impala (15)	73	n	-	-
											impala (10)	2	n	-	-
											apis honey	5	n	-	
LD-7	23-Sep-85	H	AdM: 5	ambush-d	0735/1400	20	385	35	190	160	epeme meat	2	**Y**	some	-
											impala	-	**-**	-	-
											impala (5)	1	n	-	-
											impala (11)	19	n	-	-

											baboon (est. 25)	-	-	-	-
LD-8	26-Sep-85	H	none	visit	1345/1735	20	230	40	-	190	none	-	-	-	-
Absent from field 30 Sep-9 Oct															
LD-9	11-Oct-85	Mch	TnM: 1	encounter	0947/1047	30	61	39	-	-	non-id antelope	3	n	-	-
											kanoa honey (5 nests)	19	**Y**	0.5	-
LD-10	11-Oct-85	LM	none	encounter	0700/1800	30	660	30	-	510	zebra/scavenged	120	**Y**	some	100
LD-11	12-Oct-85	LM	none	ambush-d	0820/1548	40	448	109	207	127	bushbuck	5	n	-	-
											//ekwa root	-	-	-	-
LD-12	12-Oct-85	EY	TnM: 1	ambush-n	1624/0720	50	896	101	795	-	zebra (nn)	-	-	-	-
											impala (nn)	-	-	-	-
											//ekwa root	-	**-**	-	-
LD-13	13-Oct-85	Mch	TnM: 5	encounter	0955/1315	10	200	20	-	-	impala	180	**Y**	some	25
LD-14	15-Oct-85	BH	AdF: 2	w/women	0740/1736	60	596	107	-	464	impala	2	n	-	-
											small bird	23	n	-	-
											baobab fruit	-	-	-	-
											//ekwa root	-	-	-	-
LD-15	17-Oct-85	LM	TnM: 1	ambush-n	1645/0800	50	915	98	812	5	zebra (12)	-	-	-	-
											zebra (nn)	-	-	-	-
											zebra (nn)	-	-	-	-
											hartebeest	-	-	-	-
											impala (4)	-	-	-	-

LD-16	20-Oct-85	H	AdF: 1	w/woman	1130/1615	20	285	43	-	241	impala (nn)	-	-	-	-
			TnM: 1								kanoa	1	n	-	-
											//ekwa root	-	-	-	-
LD-17	22-Oct-85	LM	AdF: 1	w/woman	0828/1523	20	415	238	-	15	kanoa (10, serial)	28	**Y**	1.0	-
											kanoa	2	n	-	-
											kanoa	2	n	-	-
											kanoa	2	n	-	-
											kanoa	2	n	-	-
											kanoa	2	n	-	-
											kanoa	2	n	-	-
											baobab fruit	18	**Y**	-	5.0
											baobab	77	**Y**	-	9.0
											baobab	25	**Y**	-	2.0
											baobab	2	**Y**	-	2.0
LD-18	23-Oct-85	BlS	AdM: 2	tracking	0810/1900	50	650	46	-	120	giraffe	480	**Y**	some	400
			TnM: 3								kanoa honey (2)	4	**Y**	0.1	-
LD-19	25-Oct-85	H	AdM: 1	visit	0815/1140	50	205	140	-	65	epeme	-	-	-	-
LD-20	25-Oct-85	LM	TnM: 1	ambush-n	1645/0800	35	915	73	840	-	impala	2	n	-	-
											small mammal	-	-	-	-
LD-21	27-Oct-85	LM	TnM: 1	ambush-n	1705/1110	50	1085	200	771	39	non-id large mammal	1	n	-	-
											wildebeest	61	n	-	-
											small mammal	2	n	-	-
											baobab fruit	-	-	-	-
											kanoa honey	1	**Y**	0.1	-
											kanoa	1	**Y**	0.1	-

											kanoa	2	**Y**	0.1	-
											kanoa	2	**Y**	0.1	-
											kanoa	1	**Y**	0.1	-
											kanoa	4	**Y**	0.1	-
LD-22	30-Oct-85	LM	AdM: 1	ambush-n	1705/1045	40	1060	75	799	43	zebra	126	n	-	-
											zebra	1	n	-	-
											scav. opp.	16	n	-	-
LD-23	2-Jul-86	H	AdM: 1	ambush-n	1220/0710	85	1130	95	969	66	baobab fruit	-	**-**	-	-
LD-24	3-Jul-86	EY	AdF: 1	w/woman	0725/1223	85	298	133	-	105	hartebeest [3]	-	-	-	-
											impala	4	n	-	-
											guinea fowl	1	n	-	-
											mpilipe berries	2	**Y**	0.1	-
											//ekwa root	8	**Y**	0.5	-
											//ekwa	27	**Y**	0.9	1.7
											//ekwa	18	**Y**	0.6	-
											//ekwa	1	**n**	-	-
65/LD-25	4-Jul-86	Mgs	none	encounter	1545/1830	80	165	129	-	13	impala	-	-	-	-
											impala [4-5]	10	n	-	-
											impala (3-4)	1	n	-	-
											impala	3	n	-	-
											warthog	8	n	-	-
											dik-dik	1	n	-	-
LD-26	5-Jul-86	Mgs	none	encounter	1445/1755	80	190	156	-	20	impala [5-8]	-	-	-	-
											impala [3]	10	n	-	-
											impala [3]	-	-	-	-
											dik-dik	-	-	-	-
											mpilipe berries	4	**Y**	taste	-

LD-27	6-Jul-86	Drk	none	encounter	0802/1336	85	333	269	-	59	giraffe [2]	-	-	-	-
											greater kudu [2]	-	-	-	-
											baboon [est. 20]	2	n	-	-
											guinea fowl	1	n	-	-
											guinea fowl	1	n	-	-
											small bird	1	-	-	-
LD-28	9-Jul-86	Drk	AdM: 4	tracking	0710/1338	60	388	156	-	12	zebra	115	n	-	-
			TnM: 6								baobab fruit	61	**Y**	0.0	25
											kanoa honey	6	**Y**	taste	-
											n!ateko honey	7	**Y**	0.05	-
											apis honey	12	n	-	-
											apis	19	**Y**	taste	-
											//ekwa	-	**-**	-	-
LD-29	12-Jul-86	Mgs	none	encounter	0730/1246	80	316	236	-	36	giraffe [2]	-	-	-	-
											eland [2]	-	-	-	-
											impala [>20]	2	n	-	-
											warthog [2]	-	-	-	-
											dik-dik [3]	1	n	-	-
											baboon [est. 25]	-	-	-	-
											guinea fowl	1	n	-	-
											baobab	22	**Y**	1.4	5.6
											apis honey	17	n	-	-
											kanoa honey	1	**Y**	taste	-
LD-30	13-Jul-86	Drk	AdM: 4	retrieve	1330/1558	43	148	45	-	-	zebra	93	**Y**	10	120
			AdF:4								apis honey	10	**Y**	1.5	0.5
			TnM:5												
			TnF:1												

LD-31	15-Jul-86	Mgs	AdM: 6	tracking	1225/1405	37	100	78	-	8	lion	14	n	-	-
Absent from field 16 Jul-2 Aug															
LD-32	4-Aug-86	Drk	none	encounter	0734/1158	96	264	155	-	35	giraffe	4	n	-	-
											zebra	2	n	-	-
											zebra [8]	24	n	-	-
											zebra scavenging opp	40	n	-	-
											hyena [2]	1	n	-	-
											impala	3	n	-	-
											dik-dik	1	n	-	-
LD-33	8-Aug-86	ROM	TnM: 4	tracking	1112/1405	78	173	98	-	16	zebra	51	n	-	-
											mpilipe berries	3	**Y**	snack	-
											mpilipe	3	**Y**	snack	-
											mpilipe	2	**Y**	snack	-

Columns

A: Follow identification numbers, 1985-86 late dry seasons. LD 1-22 originated at Tsipitibe camp, LD 23-31 at Dubenkela, LD 32-33 at Mbea C.

B: Day on which the follow started; overnight follows sometimes continued well into the next day.

C: Focal man's (FM) code name.

D: Additional members of follow party, AdM – adult male, AdF – adult female, TnM – boy aged 12-18 y, TnG - girl 12-18 y.

E: Ambush-n and -d are night and daytime ambush, respectively; visit indicates walk to nearby Hadza camp; encounter means daylight walk in search of large animal prey; tracking means pursuit of an animal thought to have been wounded; w/woman or women means FM was accompanying woman/women pursuing their own foraging targets.

F: Start/finish follow times on the day follow began and where relevant the day following. Overnight ambush times include encounters on the following day.

G: Distance out is time elapsed in minutes from point at which FM turned back toward camp. Conversion to distance at twelve min/km.

H: Duration of follow in minutes.

I: Search time in minutes. Does not include pursuit, resting, personal maintenance or inter-camp visiting.

J: Time spent in or around blind in minutes.

K: Time spent visiting, resting, on equipment repair or personal maintenance.

L: Potential prey seen are tallied one sighting (individual or group) per line. Number in parentheses is number of prey spotted at one time. No number means one only; nn means more than one, counted as two in encounter tallies. Number of prey encountered at night is an estimate.

M: Time spent in pursuit of one target prey in minutes, including field processing of carcasses acquired. Dash (-) means no pursuit was undertaken. "dk" means don't know.

N: Success indicates whether target was acquired, (Y) or no (n).

O-P: EOS means target acquired was eaten on site, i.e., at or near point of acquisition; RTB means it was returned to base. Numbers indicate prey weight in kg. "Some," "snack", "taste" mean a small quantity of the resource was collected and immediately eaten.

Supplementary Material, Table S1 Notes

LD-2: Tree resin. Taxon unidentified. Consumed because of its refreshing taste.

LD-5: Impala was hit with poisoned arrow, tracked for nearly 2 h before pursuit was abandoned.

LD-6: Impala was shot from blind at nightfall, tracked that night for 30 min, again for 43 min the following morning before carcass remains, ravaged by hyena(s), were discovered.

LD-7: FM and companion joined men met on follow, sat on spot overlooking water point, rested for nearly 3 h and ate *epeme* (men's meat) collected from a non-Hadza men's camp nearby, then sat in and around a blind for another 3 h. During the latter interval, non-FM in party pursued two impala for one and nineteen min, respectively but without success.

LD-8: FM was followed to a location where *epeme* was being consumed. Stayed c. 3 h.

LD-9: *Kanoa* honey was collected from five nests over 19 min total. All eaten at points of acquisition. One small antelope was pursued by FM w/o success. Follow was terminated by encounter w/ scavenged zebra. Shifted focus to new FM on that kill.

LD-10: FM on encounter hunt seized a zebra in near-complete condition from a lion kill, then processed meat for transport at point of acquisition. Some meat was consumed at kill by FM and by others who passed by while processing was in progress. Total processing and consumption time by FM c. 2 h. FM spent remaining time resting, casually eating. Most edible tissue was RTB by FM and passers-by.

LD-11: Hadza-set snares were encountered along a stream channel north of base. After sitting in blind for >3 h and taking two unsuccessful shots at bushbuck over water, FM turned back to toward base, then paused for >2 h near women's *//ekwa* collecting party, ate roots obtained from women, tended his nursling child while mother dug roots.

LD-12: Small number of *//ekwa* tubers were collected and cooked by FM's teen son, then shared with FM at blind.

LD-13: Teen boy and companions shot, pursued, acquired, and processed impala; some meat and marrow was eaten at kill, most was carried back to base.

LD-14: FM accompanied women's collecting party, sat while women took *//ekwa*, bird eggs and baobab. While sitting, FM shot several arrows at a small bird: no hits, no serious pursuit.

LD-15: Five sets of ungulates passed the blind in night; no shots possible.

LD-16: FM accompanied spouse and subteen son on *//ekwa* collecting trip. Spouse dug and cooked *//ekwa* tubers, shared them with FM and son; FM tended nursling while mother was digging. Total 5.5 kg *//ekwa* over 138 min; 5.0 EOS, 0.5 RTB.

LD-17: FM tapped 15 *kanoa* nests, collected c. 1 kg total from ten. Contents of most were consumed by FM, remaining five nests were dry. FM and wife collected and shelled 80 baobab pods, took 16-18 kg seeds and pith to base.

LD-18: Giraffe shot at night from ambush was tracked >2 h the following morning by FM, two other men, and three sons of the men. All collected and ate *kanoa* encountered while tracking. Little consumption of meat on the kill; some neck meat abandoned. Men spent several hours processing the carcass for transport, meat RTB.

LD-19: FM and companion visited a nearby Hadza camp, ate *epeme* while there, then searched for potential prey further afield. They took salt and meat from two Hadza boys who had acquired them from a European hunter's camp.

LD-21: FM shot wildebeest from a blind, tracked it for 61 min but abandoned pursuit. Also shot one large and one small mammal. No pursuit on either. Baobab pods (n=23, 25 min elapsed) were collected, shelled by FM's son, 0.5 kg EOS, 1.5 kg RTB.

LD-22: FM shot a zebra from ambush, tracked it the following morning c. 2 h before abandoning pursuit. Also pursued possible scavenging opportunity, signaled by falling birds, for sixteen min.

LD-23: FM and AdM companion established a blind on watercourse; buffalo tracks were seen nearby. Steel cable snare was set on trackway. Baobab was collected by FM's companion, shelled, mixed with water (10 min, 1 kg shelled). Drink was consumed, seeds discarded. Lion and elephant were heard in the night nearby.

LD-24: FM and spouse returning to base from one night in blind. On route, they collected *mbilipe* berries for 2 and 8 min, respectively. FM ate all that he gathered; spouse consumed an equal amount but carried c. 300 g to base. Spouse also collected 2.3 kg *//ekwa* over 67 min and bought all to base. FM and spouse jointly spent 6 min on unsuccessful *//ekwa* pursuits. FM collected and cooked 3.8 kg *//ekwa* on three encounters over 53 min. He and spouse ate 2 kg at collection point, carried 1.8 kg to base.

LD-25: FM assessed evidence of ungulate prey around persistent water sources in a stream channel. Ambush anticipated in coming days.

LD-26: Reconnaissance near water sources in anticipation of ambush.

LD-27: FM encountered two Hadza men who had shot and killed a hyrax and were cooking it. Meat was shared with FM. Multiple large and small game encounters on route back to base. Limited opportunities for pursuit.

LD-28: FM shot at and hit a zebra the previous day, tracked it this day with help from four adult men and six teen boys. One adult male member of party dug unsuccessfully for *//ekwa*. One *n!ateko* nest was sampled for honey. One hundred twenty-six baobab pods (c. 25 kg shelled) were collected by the party as a whole and carried intact to base. Two *Apis* hives were sampled: one was dry, one yielded only a taste for 1-2 collectors.

LD-29: Solo hunter encountered multiple potential animal prey, pursued three briefly with no success. Sampled *Apis* hive - no success; procured a taste of *kanoa* honey. Sampled *ngwilabe* berries in passing. Collected 35 baobab pods (7 kg seed and pith shelled); processed and consumed 1.4 kg for pith, brought 5.6 kg to base.

LD-30: Zebra hit by FM arrow was located and processed for transport by tracking party. Some on-site meat consumption. FM and spouse sampled one *Apis* hive, collected 2 kg honey and comb, consumed 1.5 kg, brought 0.5 kg to base.

LD-31: Lion reportedly bow-shot by FM who recruited a tracking party. Search abandoned after just 14 min. Not clear why.

LD-32: Solo hunter encountered multiple potential large animal prey, pursued five unsuccessfully. Forty minutes of follow were devoted to investigating circling birds suggesting a scavenging opportunity. Found remains of a zebra killed and largely consumed by lions, then further ravaged by hyenas that were driven off by FM on his arrival. No edible tissue recovered.

LD-33: FM and four teenage boys tracked a zebra hit earlier by FM. No success. Party snacked three times on *mpilipe* berries. Each boy also collected 2-4 baobab pods, ate small quantities of pith.

SUPPLEMENTARY MATERIAL TABLE S2 (All data in Table S2 pertain to FM only. Resources acquired by other party members are reported in notes below.).

Follow	Date	FM	Others	Type	Times out/back	Distance out (min)	Duration (min)	Search (min)	Other (min)	Potential prey seen (n)	Pursuit (min)	Success Y/n	EOS [kg]	RTB [kg]
EW-1	26-Nov-85	LM	AdF:1	*Apis* honey	0745/1307	42	322	217	23	impala	1	-	-	-
										turtle	-	-	-	-
										kanoa honey	6	**Y**	some	-
										kanoa	3	**Y**	some	-
										apis haft prep	36	-	-	-
										apis honey	35	**Y**	4.4	-
										apis	1	n	-	-
EW-2	29-Nov-85	H	AdM: 6 TnM: 5-7	*Apis* honey	1000/1430	5	270	10	35	apis honey	225	**Y**	14.0	1.0
EW-3	30-Nov-85	R	AdM: 2	*Apis* honey	0720/1725	71	605	305	25	impala	1	n	-	-
										impala	-	-	-	-
										mongoose	12	**Y**	1.0	-
										bat ear fox pups (2)	63	**Y**	6.0	-

											bat ear fox adult	-	-	-	-
											kanoa honey	1	**Y**	some	-
											apis honey	15	**Y**	2.0	-
											apis	25	**Y**	1.0	-
											apis	25	**Y**	2.0	-
											apis	32	**Y**	1.2	-
											apis	10	**Y**	0.8	-
											apis	30	**Y**	2.0	-
											apis	53	**Y**	2.3	2.3
											apis	8	**Y**	0.5	0.5
26/EW-4	2-Dec-85	EY	AdF: 1	*Apis* honey	0723/1355	137	392	228	31		wildebeest	-	-	-	-
			TnM: 1								zebra	-	-	-	-
											impala	-	-	-	-
											impala	5	n	-	-
											impala	2	n	-	-
											//ekwa root	-	-	-	-
											kanoa honey	8	**Y**	some	-
											kanoa	-	-	-	-
											kanoa	4	**Y**	some	-
											apis honey	18	**Y**	2.0	-
											apis	10	**Y**	2.5	-
											apis	53	**Y**	2.0	-
											apis	19	**Y**	1.0	-
											apis	10	**Y**	2.5	-
											apis	4	n	-	-

EW-5	4-Dec-85	BH	AdF:2	w/women	0751/1713	24	562	154	280	impala	5	n	-	-
				Apis honey						non-id sm. bird	25	**Y**	-	-
				kanoa honey						//ekwa root	-	**-**	-	-
										//ekwa	-	**-**	-	-
										baobab	-	**-**	-	-
										kanoa honey	6	n	-	-
										kanoa	4	**Y**	some	-
										kanoa	1	**Y**	some	-
										kanoa	10	**Y**	some	-
										kanoa	3	**Y**	some	-
										apis honey	2	n	-	-
										apis	72	**Y**	3.4	-
EW--6	5-Dec-85	LM	AdF: 1	*//ekwa*	0840/1041	32	121	60	49	//ekwa root	-	**-**	-	-
										undushibe berry	12	**Y**	some	-
EW-7	6-Dec-85	DS	TnM:3	*Apis* honey	0655/2059	124	844	200	125	kanoa honey	1	**Y**	some	-
			TnF: 1							kanoa	1	**Y**	some	-
										apis honey	15	**n**	-	-
										apis	2	**n**	-	-
										apis	52	**Y**	2.0	-
										apis	225	**Y**	13.6	3.0
										apis	86	**Y**	1.0	2.0
										apis	137	**Y**	8.0	1.0
EW-8	8-Dec-85	EY	AdF: 1	*Apis* honey	0725/2130	230	845	411	252	impala (2)	-	-	-	**-**

			AdM: 1							impala	-	-	-	-
										hornbill	-	-	-	-
										kanoa honey	1	**Y**	some	1.0
										apis honey	14	**Y**	3.0	-
										apis	53	**Y**	1.5	-
										apis	13	**Y**	5.0	-
										apis	82	**Y**	4.0	-
										apis	17	**Y**	1.0	3.0
EW-9	24-Dec-85	H	AdM:3	tracking	0725/1107	40	222	84	20	giraffe	63	n	-	-
			TnM: 1	*Apis* honey						apis honey	10	**Y**	dk	-
										apis	2	**Y**	dk	-
										apis	43	**Y**	dk	-
EW-10	26-Dec-85	H	AdM: 1	visit	0750/1830	138	640	337	217	baboon troop (20)	-	-	-	-
			AdF: 3	*Apis* honey						zebra (6)	2	n	-	-
										dry elephant meat	1	**Y**	some	-
										kanoa honey	1	**Y**	some	-
										apis honey	25	**Y**	2.0	-
										apis	15	**Y**	1.5	-
										apis	24	**Y**	2.5	-
										apis	19	**Y**	2.0	-
EW-11	27-Dec-85	BH	AdM: 2	*Apis* honey	0950/1518	48	328	102	3	elephant scav	10	**Y**	0.0	10.0
			AdM: 4							apis honey	7	**Y**	1.0	-
			TnM: 2							apis	13	**Y**	4.0	-

										apis	37	**Y**	2.8	-
										apis	69	**Y**	1.0	-
										apis	50	**Y**	4.0	6.0
										apis	27	**Y**	0.5	0.5
										apis	10	**Y**	0.5	-
EW-12	29-Dec-85	EY	AdM: 6	tracking	0712/1430	104	438	177	25	eland	211	**Y**	30	175
			AdF:10	*Apis* honey						apis honey	15	**Y**	1.0	-
			TnM: 2							apis	dk	**Y**	dk	-
										apis	10	**Y**	3.0	-
EW-13	2-Jan-86	H	none	visit	1050/1550	20	300	55	245	dried meat	-	**Y**	dk	5.0
EW-14	3-Jan-86	BSp	AdF: 1	*Apis* honey	0958/1126	29	88	56	3	apis honey	29	**Y**	0.6	0.6
										//ekwa root	-	**-**	-	-
Absent from field 4 Jan - 22 Mar														
LW-1	23-Mar-86	HE	AdM: 2	tracking	0803/1549	48	466	251	82	giraffe [3]	-	-	-	-
			TnM: 3	*Apis* honey						giraffe	40	n	-	-
										giraffe [3-5]	28	n	-	-
										impala	-	-	-	-
										dik-dik	-	-	-	-
										kongolobe berry	2	Y	some	-
										kongolobe	2	Y	some	-
										kongolobe	3	Y	some	-

											apis honey	1	n	-	-
											apis	17	Y	2.1	-
											apis	15	Y	0.5	-
											apis	25	y	0.2	-
LW-2	24-Mar-86	R	TnM: 1	*Apis* honey	0828/1845	165	617	312	117	hartebeest [>3]	1	n	-	-
										impala	1	n	-	-
										sm. mammal	1	n	-	-
										sm. bird	-	-	-	-
										kongolobe berry	3	Y	some	-
										kongolobe	3	Y	some	-
										kongolobe	4	Y	some	-
										kongolobe	2	Y	some	-
										kanoa honey	2	Y	some	-
										kanoa	4	Y	some	-
										kanoa	13	Y	some	-
										kanoa	5	Y	some	-
										apis honey	4	n	-	-
										apis	19	Y	0.2	-
										apis	4	n	-	-
										apis	14	Y	0.3	-
										apis	17	Y	0.4	-
										apis	1	n	-	-
										apis	29	Y	1.2	-
										apis	26	Y	2.5	-
										apis	29	Y	0.7	0.6
										apis (6x)*	6	n	-	-

LW-3	25-Mar-86	HE	AdM: 1	tracking	0738/1205	50	267	87	41	giraffe	134	n	-	-
										kongolobe berry	5	Y	some	-
LW-4	28-Mar-86	Drk	AdM: 1	encounter	0736/1714	174	579	316	103	giraffe [22]	88	n	-	-
			TnM: 1							giraffe [25]	7	n	-	-
										zebra [3]	-	-	-	-
										zebra	-	-	-	-
										impala [3]	2	n	-	-
										impala [30]	-	-	-	-
										warthog	-	-	-	-
										leopard	1	n	-	-
										hornbill	1	Y	1.0	-
										ngwilabe berry	4	Y	some	-
										kongolobe berry	1	Y	some	-
										kanoa honey	10	Y	some	-
										apis honey	8	n	-	-
										apis	-	-	-	-
										apis	18	Y	1.2	-
										apis	21	Y	0.8	-
LW-5	29-Mar-86	Mgs	AdM: 3	tracking & pursuit	0730/1618	130	528	249	107	giraffe [nn]	19	n	-	-
										giraffe	80	n	-	-
										giraffe [2]	-	-	-	-
										giraffe	1	n	-	-
										giraffe [2]	8	n	-	-
										impala [10]	1	n	-	-

										impala [3]	-	-	-	-
										impala [nn]	1	n	-	-
										sm. bustard	-	-	-	-
										kongolobe berry	5	Y	some	-
										kanoa honey	2	Y	some	-
										n!ateko honey	55	Y	1.0	-
										apis honey	-	-	-	-
LW-6	15-Apr-86	Mgs	AdF: 4	w/women	0840/1300	60	260	137	67	dik dik [2]	1	n	-	-
										//ekwa root	11	Y	1.0	-
										undushibe berry	3	Y	some	-
										kongolobe berry	2	Y	some	-
										kongolobe	2	Y	some	-
										kongolobe	5	Y	some	-
										kongolobe	2	Y	some	-
										kongolobe	2	Y	some	-
										kongolobe	2	Y	some	-
										kongolobe	1	Y	some	-
										kongolobe	15	Y	some	-
										kongolobe	2	Y	some	-
										kongolobe	7	Y	some	-
										kongolobe	1	Y	some	-
LW-7	16-Apr-86	Mgs	AdM: 2	visit	0730/1815	180	645	385	240	impala	15	n	-	-
			TnM: 1							dry zebra meat	-	-	-	4.0
										undushibe berry	1	Y	some	1.0
										undushibe	2	Y	some	-

										kongolobe berry	1	Y	some	-
										kanoa honey	1	Y	some	-
LW-8	18-Apr-86	Drk	AdF: 1	*Apis* honey	0710/1816	250	665	418	76	giraffe [15-20]	-	-	-	-
			TnM: 3							zebra [2]	-	-	-	-
										impala [nn]	-	-	-	-
										hornbill [2]	-	-	-	-
										hornbill	-	-	-	-
										baobab	14	**Y**	0.0	1.0
										kongolobe berry	2	**Y**	some	-
										kanoa honey	3	**Y**	0.3	0.1
										kanoa	8	**Y**	some	-
										kanoa	7	**Y**	some	-
										apis honey	9	n	-	-
										apis	3	**Y**	0.5	-
										apis	10	**Y**	0.4	-
										apis	42	**Y**	0.5	-
										apis	13	**Y**	1.5	-
										apis	13	**n**	-	-
										apis	21	**Y**	2.5	-
										apis	21	**Y**	2.0	0.8
										apis	5	n	-	-
LW-9	19-Apr-86	H	AdM: 9	visit	0730/1655	135	565	235	275	warthog [4-5]	5	n	-	-
			AdF: 3							kongolobe berry	15	**Y**	some	-
										kongolobe	10	**Y**	some	-
										kongolobe	25	**Y**	some	-

LW-10	21-Apr-86	Drk	none	encounter	1458/1844	75	226	183	36	giraffe [2]	-	-	-	-
										impala [10-15]	2	n	-	-
										impala	4	n	-	-
										dik-dik	-	-	-	-
										sm birds [nn]	1	n	-	-
LW-11	22-Apr-86	Drk	AdF: 1	*Apis* honey	0735/2000	180	745	374	115	gazelle [20]	-	-	-	-
			TnM: 1							hyrax	5	n	-	-
										sm birds [2]	-	-	-	-
										kanoa honey	-	-	-	-
										apis honey	27	**Y**	0.5	-
										apis	27	**Y**	1.5	-
										apis	36	**Y**	2.0	0.3
										apis	54	**Y**	1.0	4.0
					-					apis	15	**Y**	-	0.3
										apis	15	**Y**	-	0.5
										apis	18	**Y**	-	2.6
										apis	46	**Y**	-	7.0
										apis	13	**Y**	-	4.0
LW-12	26-Apr-86	Mgs	AdM: 1	*Apis* honey	0740/1837	217	657	430	93	hornbill [2]	5	**Y**	dk	dk
			AdF: 2							hornbill [5}	1	**Y**	dk	dk
			TnM: 2							n!ateko honey	1	**Y**	some	-
										apis honey	12	**Y**	1.2	0.4
										apis	22	**Y**	2.8	0.6

										apis	22	**Y**	4.6	-
										apis	28	**Y**	0.4	3.6
										apis	43	**Y**	0.8	11.0
LW-13	29-Apr-85	HE	AdM: 4 TnM: 2	tracking	0725/1034	42	189	34	10	greater kudu	145	n	-	-
LW-14	18-May-86	Drk	none	encounter	0830/1250	60	260	86	0	giraffe [4]	110	n	-	-
										giraffe [5]	64	n	-	-
										giraffe [2]	-	-	-	-
LW-15	19-May-86	Mgs	AdF: 2 TnF: 1	*Apis* honey	0912/1426	90	314	155	0	//ekwa root	-	-	-	-
										//ekwa	-	-	-	-
										baobab	-	-	-	-
										baobab	-	-	-	-
										baobab	2	**Y**	1.0	-
										apis honey	51	**Y**	1.0	2.0
										apis	60	**Y**	3.5	-
										apis	39	**Y**	2.0	4.0
ED-1	20-May-86	Mgs	AdF: 1 TnF: 1	*Apis* honey	1415/1703	40	168	68	30	apis honey	40	**Y**	1.4	-
										apis	27	**Y**	0.8	0.8
										apis	3	n	-	-
ED-2	21-May-86	Mgs	none	visit	0810/1131	43	201	129	53	sm bird	1	n	-	-

				Apis honey						apis honey	19	**Y**	0.2	-
ED-3	22-May-86	H	AdM: 3	visit	0710/1520	90	490	180	310	eland	-	-	-	-
			AdF: 4							dik-dik	-	-	-	-
										giraffe meat	-	-	dk	dk
ED-4	24-May-86	Oz	AdF: 1	*Apis* honey	0758/1338	79	340	166	18	apis honey	16	**Y**	0.8	-
			TnM: 1							apis	139	**Y**	0.4	16.5
										apis	1	**n**	-	-
ED-5	28-May-86	H	none	visit	0709/1039	70	210	155	55	none	-	-	-	-
ED-6	30-May-86	Mch	TnM: 1	*Apis* honey	0915/1446	27	331	179	5	apis honey	59	n	-	-
										apis	55	**Y**	0.5	-
										apis	33	**Y**	0.5	-
										kanoa	1	**Y**	some	-
ED-7	30-May-86	Mgs	AdF: 1	*Apis* honey	1530/2007	27	277	17	27	apis honey	6	**Y**	0.1	-
			TnM: 2							apis	16	n	-	-
										apis	211	**Y**	3.6	7.6
Absent from field 31 May - 3 Jun														
ED-8	4-Jun-86	R	AdM: 6	*Apis* honey	0732/1732	122	600	225	46	guinea fowl [20]	1	n	-	-

			AdF: 6							apis honey	108	**Y**	2.5	11.0
			TnM: 1							apis	96	**Y**	3.0	2.5
			TnF: 2							apis	19	**Y**	-	1.6
										apis	105	**Y**	-	32.5
ED-9	5-Jun-86	R	AdM: 1	*Apis* honey	0743/1900	175	677	361	74	dik-dik	1	n	-	-
			AdF: 1							guinea fowl	1	n	-	-
			TnF: 2							bird egg	-	**-**	-	-
										bird egg	-	**-**	-	-
										apis honey	51	**Y**	2.0	0.5
										apis	28	**Y**	0.6	0.6
										apis	1	**n**	-	-
										apis	34	**Y**	1.3	1.3
										apis	2	n	-	-
										apis	11	**Y**	-	1.5
										apis	10	n	-	-
										apis	70	**Y**	-	4.0
										apis	18	**Y**	1.1	1.1
										apis	15	**Y**	-	0.3
ED-10	7-Jun-86	R	AdM: 1	*Apis* honey	0800/1758	172	598	309	34	//ekwa	-	**-**	-	-
			AdF: 4							baobab	-	**-**	-	-
			TnM: 2							baobab	-	**-**	-	-
										baobab	-	**-**	-	-
										berries	-	**-**	-	-
										n!ateko honey	15	**Y**	0.5	-
										kanoa honey	-	**-**	-	-

										apis honey	26	**Y**	0.4	-
										apis	17	**Y**	0.4	-
										apis	11	**Y**	1.5	-
										apis	14	**Y**	1.4	-
										apis	13	**Y**	1.0	-
										apis	67	**Y**	0.9	-
										apis	24	n	-	-
										apis	17	**n**	-	-
										apis	51	Y	1.4	0.3
ED-11	8-Jun-86	Drk	AdF: 1	*Apis* honey	0745/1822	175	637	390	162	giraffe	-	-	-	-
			AdM: 1							giraffe	2	n	-	-
			TnM: 1							eland	10	n	-	-
										hartbeest	-	-	-	-
										hartbeest [3]	-	-	-	-
						-				impala	-	-	-	-
										guinea fowl	2	n	-	-
										bird eggs [2]	-	**-**	-	-
										bird eggs [2]	-	**-**	-	-
										//ekwa root	-	-	-	-
										undushibe berry	4	**Y**	some	-
										undushibe	2	**Y**	some	-
										kanoa honey	-	**-**	-	-
										kanoa	-	**-**	-	-
										kanoa	-	**-**	-	-
										apis honey	-	**-**	-	-
										apis	42	**Y**	6.0	2.0
										apis	23	**Y**	-	0.5

Columns

A: Sequence numbers, 1985-86 wet and early dry seasons. EW 1-8, EW 13-14 originated at Mugendeda camp, EW 9-12 at Mbea A; LW 1-15 at Mbea B; ED 1-11 at Dubenkela.

B: Day on which the follow started.

C: Focal man's (FM) code name.

D: Additional members of follow party: AdM – adult male, AdF – adult female, TnM – boy aged 12-18 y, TnF: girl 12-18 y.

E: Visit indicates walk to nearby Hadza camp; encounter means a daylight walk in search of large animal prey; tracking means pursuit of an animal thought to have been wounded; w/woman or women means FM was accompanying woman/women pursuing their own foraging targets.

F: Start/finish follow times on the day follow began.

G: Distance out is time elapsed in minutes from point at which FM turned back toward camp. Converted to distance at 12 min/km.

H: Duration of follow in minutes.

I: Search time in minutes. Does not include pursuit, resting, personal maintenance, inter-camp visiting, or (with one exception) time after dark (1900 h).

J: Potential prey seen are tallied one sighting per line. Number in parentheses is number of prey seen at one time. No number means one only; nn means more than one, counted as two in encounter tallies.

K: Time spent in pursuit of one target prey in minutes, including field processing of carcasses acquired. Dash (-) means no pursuit was undertaken. "dk" means don't know.

L: Success indicates whether the target was acquired, yes (Y) or no (n).

M-N: EOS means target acquired was eaten on site, i.e., at or near the point of acquisition; RTB means it was returned to base. Numbers indicate estimated prey weight in kg. "Some" means a small quantity of resource was collected and immediately eaten. "dk" means the value is unrecorded.

Supplementary Material, Table S2 Notes

EW-1 Turtle was collected by AdF and carried to base. FM spent 36 min preparing special haft for his axe, a practice occasionally followed in connection with *Apis* honey collection.

EW-2 Group of men and boys spent nearly 4 h collecting and eating honey from one large *Apis* hive 200 m from camp. Women were present nearby but did not join in. About 95% of total was EOS by party members at the point of acquisition; balance was RTB.

EW-3: Time spent cooking and eating mongoose not recorded; likely c. ten min.

EW-4: Woman collected and cooked 2 kg *//ekwa*. With others she consumed half at acquisition. Teen/M spent 9 min taking kanoa. All honey EOS or nearby.

EW-5: FM collected *kanoa* honey w/ some help from wife; wife and the other adult woman collected and processed *//ekwa* and baobab. Birds were not seriously pursued: resting FM took repeated arrow shots at one without success, collected another and passed it to women. Otherwise, FM rested while watching women dig and cook roots. Over 175 min, they collected and cooked 9.2 kg *//ekwa;* 7.0 kg EOS, 2.2 kg RTB. Time on *//ekwa* includes total effort by both women. Two baobab pods were taken by one woman, shelled, mixed w/ water (8 min) and the drink given to infant.

EW-6: Woman collected 4.1 kg *//ekwa* in 45 min, carried all to base.

EW-7: Rest time is underestimated. Last 2 h of follow were completed in darkness, counted as "other," not search time.

EW-8: Woman collected and carried home one hornbill and small unidentified bird. Last 2.5 h of follow completed in darkness. Ten min spent in pursuit of dik-dik, aided by flashlight, otherwise not counted as search time. Tracks of giraffe, eland, elephant were noted during the day.

EW-9: Giraffe shot the day before was tracked intermittently for 1 h but lost. All *Apis* honey collected from three hives EOS; amounts acquired were not recorded.

EW-10: 0ne kg dried elephant meat from scavenged kill was acquired at the camp FM et al. visited. One AdM took *kanoa*, shared w/ one AdW. One AdM took one shot at zebra, missed; 2 min elapsed in process.

EW-11: About 10 kg meat were taken from dead, fly-blown elephant.

EW-12: Eland shot previous day was tracked and the carcass recovered intact; est. 210 kg edible meat obtained, 30 kg EOS. Some meat left at kill. Search for, collection and consumption of *Apis* honey continued while tracking was in progress.

EW-13: FM ate some meat at camp he visited, brought 5 kg dried eland meat back to home camp.

EW-14: FM spouse collected 1 kg *//ekwa*, cooked and eaten by FM.

LW-1: Outbound, party tracked giraffe that FM shot the evening before; track was lost after 40 min follow; 28 min spent on unsuccessful pursuit of second giraffe; *kongolobe* berries and *Apis* honey were collected. *Kongolobe* EOS, Apis honey eaten while on return to base. Non-FM pursued dik-dik 1 min w/o success.

LW-2: Five *Apis* hives tapped were dry. Stops for *kongolobe* were undercounted. TeenM took bow shot at non-id bird, missed.

LW-3: FM et al. tracked giraffe shot previous evening; track lost after 134 min.

LW-4: FM conducted long stalk on giraffe that was hit with arrow and lost. Stops for *kongolob*e were undercounted. Non-FM pursued for 1 min leopard encountered in close cover but lost; also pursued *Apis* c. 25 min, took 1 kg, EOS.

LW-5: FM on 80 min stalk; giraffe was hit but lost. Non-FM collected, cooked, and ate a small bustard (est. wt 5.0 kg); also took *Apis* and *kanoa* honey, times/weights not recorded.

LW-6: FM collected 1 kg *//ekwa*, cooked and consumed it at collection site. FM generally sat while women collected *//ekwa*; weight not tallied. Women also collected *kongolobe* frequently.

LW-7: Dry zebra meat was obtained at camp FM et al. visited, carried back to base.

LW-8: Three hornbills were collected by woman and one teen boy; one *kanoa* honey was taken by the woman. Baobab taken by FM were shelled by woman and carried to base.

LW-11: Small birds (2 min, 0.5 kg) and one *kanoa* honey were taken by adult woman, all EOS. Time after dark (1900) counted as "other." Three-four kg of *Apis* honey were left at collection points for lack of carry-off capacity.

LW-13: Greater kudu shot by FM the day before was tracked >2 h this day and lost.

LW-14: Two giraffe tracked for 110 and 64 min, respectively. Not clear if either had been shot/hit. Searches ended when tracks were lost.

LW-15 AdW dug 7 min for *//ekwa*, no luck; 6 min at another spot yielded <1.0 kg. AdW and TnF stopped twice for baobab pods, 7 min total yielded eight pods. All //ekwa and baobab EOS.

ED-3: Intercamp visit. Giraffe meat was eaten there; some also RTB.

ED-6: One h attempt to take single *Apis* hive was abandoned without success; bees too aggressive.

ED-7: FM and others revisited *Apis* hive abandoned earlier this day; nearly 4 h effort gained 11.2 kg comb and honey despite aggressive defense by bees. Travel to camp after dark counted as "other," not search.

ED-8: Party of sixteen brought many containers to transport *Apis* honey to base, most of it intended for trade.

ED-9: Bird eggs were collected, EOS by teen girl. As above many containers brought to carry honey to base, at least some for trade.

ED-10: *//ekwa* and baobab were collected by women; 0.7 kg *//ekwa* eaten as acquired, 8.1 kg baobab were shelled and carried to base. Unrecorded berries were taken by all party members, eaten as collected. *N!ateko* honey collected by FM and shared with others. As above, many containers were brought along but only a small amount of honey was RTB.

ED-11: One hartebeest, one impala pursued by teen boy for 1 and 2 min, respectively; neither taken. Two bird eggs, unidentified roots, two *kanoa*, some *undushibe* taken by FM spouse and teen boy, all EOS. FM took *undishibe*, times/amounts not recorded. One Apis hive was taken by non-FM and teen boy: 2.5 kg, 39 min, all EOS by all. Several landscape fires were set by FM and other AdM.