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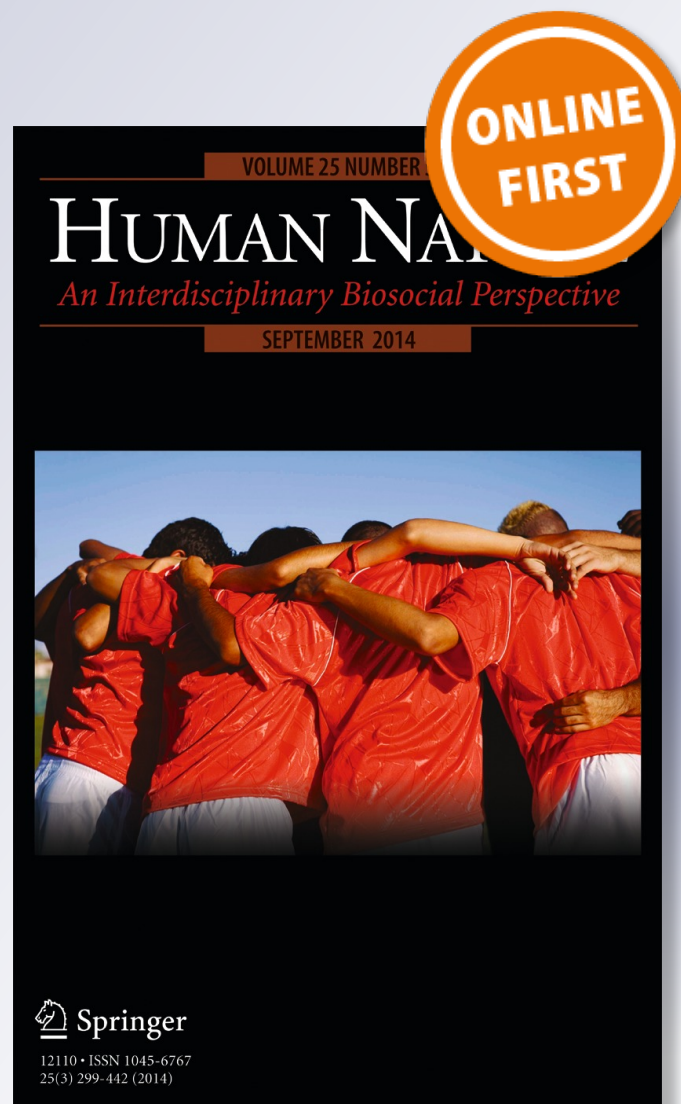
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More Lessons from the Hadza about Men's Work

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Abstract Unlike other primate males, men invest substantial effort in producing food that is consumed by others. The Hunting Hypothesis proposes this pattern evolved in early *Homo* when ancestral mothers began relying on their mates' hunting to provision dependent offspring. Evidence for this idea comes from hunter-gatherer ethnography, but data we collected in the 1980s among East African Hadza do not support it. There, men targeted big game to the near exclusion of other prey even though they were rarely successful and most of the meat went to others, at significant opportunity cost to their own families. Based on Hadza data collected more recently, Wood and Marlowe contest our position, affirming the standard view of men's foraging as family provisioning. Here we compare the two studies, identify similarities, and show that emphasis on big game results in collective benefits that would not be supplied if men foraged mainly to provision their own households. Male status competition remains a likely explanation for Hadza focus on big game, with implications for hypotheses about the deeper past.

Keywords Paternal provisioning · Hunting Hypothesis · Show-off Hypothesis · Collective goods · Men's strategies · Human evolution

In their recent paper in *Human Nature*, Brian Wood and Frank Marlowe (2013) challenge our contention that Hadza men's big game hunting is suboptimal with respect to the goal of feeding their wives and children. Their argument is that Hadza men bring more food, more often, to their families than they do to the families of any other man. We do not dispute this. Instead, our question is whether men could do *better* in regard to the goal of feeding their wives and children by targeting a broader array of available resources; and if so, why do they do otherwise? We reconsider Wood and Marlowe's

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data with respect to those questions. After a brief review of the research settings, objectives, and data collection practices of the two research groups, we evaluate the results of these studies as they pertain to Hadza men's foraging goals, their focus on big game hunting, their relative lack of attention to small game, and patterns in the distribution of meat they acquire. We conclude that Wood and Marlowe's data *do not refute, but in fact support* our argument that Hadza men's hunting practices are less consistent with the goal of provisioning the hunter's own family than a broader prey selection strategy would be. We underline the implication that men supply more meat to the community because they do not prioritize meat for their own families. We review our own findings and features of Wood and Marlowe's report that are inconsistent with the Risk Reduction Reciprocity Hypothesis to justify our characterization of this community benefit as a collective good. Although Hadza hunters could bring more meat to their own households by regularly pursuing small animals when they encounter them, there would be much less meat for all if they did that—less for all if men's goal was delivery of the most meat to their own families. Competition for social standing may help account for the focus on big game we all observe. The broader implication is that public, rather than family-related, goals may have been the main force behind the archaeologically documented Plio-Pleistocene emergence of big game hunting and aggressive scavenging in our lineage.

Background

Because relevant reports have appeared in many different venues over the course of the past several decades, we begin by reminding readers of key elements of the ethnographic context for this work. The Hadza are a genetically and linguistically distinct population of about 1,000 hunter-gatherers living in savanna woodlands around Lake Eyasi, northern Tanzania (Blurton Jones et al. 1992, 1996; Marlowe 2010; Sands 1998; Tishkoff et al. 2007). They have been known to Westerners for more than a century (Baumann 1894), and have been the subjects of increasing anthropological interest over the past thirty years, partly as a function of the insights they can provide for arguments about human evolution (e.g., Bunn 2001; O'Connell et al. 1999). When first observed by Europeans, Hadza had their current homeland largely to themselves, but since the late 1950s they have been subjected to significant interference in the form of government- and mission-sponsored settlement schemes, incursions by farmers and pastoralists, and heightened interest on the part of tourists. Still, several hundred Hadza have continued to practice full- or nearly full-time hunting and gathering right to the present, particularly in the 600–800 km² area known as Tli'ika.

Three studies among the Hadza are important to this discussion: Woodburn (1968a, b, 1979, 1982, 1998) fieldwork in the late 1950s and early 1960s; our own in the mid-to late 1980s, mainly in Tli'ika; and Marlowe's project (later including Wood) from 1995 intermittently through the present, also in Tli'ika but in other parts of Hadza country as well.

All of us have reported that full-time foraging in this region takes roughly the following form. Hadza operate in small, relatively mobile groups of 25–75, variable in composition, organized in nuclear families and other household types. Their annual round can be thought of in terms of two seasons, broadly defined: the “late dry”

(September–October) and the “wet/early dry” (November–August). In the late dry, local groups are concentrated around a limited number of reliable water sources. Men hunt with bow and arrow by ambush at night near water and on daytime walks in areas where big game are likely to be encountered. Women forage daily for tubers and fruit. In the wet/early dry, when water is more widely available, people are usually found in smaller, more widely distributed camps. Men continue to practice encounter hunting; women still target tubers and fruit. Married couples (sometimes accompanied by their children) and mixed gender groups of unmarried young adults and teenagers also pursue the honey of *Apis mellifera*. Foraging tactics year-round are sensitive to differences in food availability; specific types and quantities of resources taken vary at intra-seasonal through longer-term time scales.

Woodburn’s research focused on issues of importance to cultural anthropologists of the time, notably group size and composition, resource use, and kinship and social organization. Few quantitative data were produced as a result, but Woodburn’s qualitative observations on foraging are important in this discussion because his main goal was descriptive. Our group’s work and that of the Wood/Marlowe team have been organized in terms of the theoretical framework of behavioral ecology. Both projects have emphasized the collection of quantitative data on time allocation, foraging, and food sharing, and on variation across all three relative to an actor’s gender, age, and marital and reproductive status, all in the context of immediate ecological circumstances. Routine data collection techniques in both studies have included regular censuses, intra-camp activity scans, extra-camp focal-person follows, tallies of the types and weights of resources collected, and systematic observations on food sharing. Differences in research questions and data reporting practices make direct comparison of our respective results sometimes difficult to follow. Readers should be prepared.

Issues

Key questions here concern patterns in men’s time allocation, foraging practices, and the distribution of foods they obtain as a result, especially as they involve large animal prey. Conventional wisdom has long held that nuclear families among hunter-gatherers are units of common economic and reproductive interest. Men’s big game hunting is seen to be aimed at provisioning their wives and offspring (e.g., Flinn et al. 2007; Hill 1982; Kaplan et al. 2000; Lancaster and Lancaster 1983; Lovejoy 1981; Marlowe 2005; Washburn and Lancaster 1968; cf. Zilhmann 2013). With husbands/fathers providing a valuable resource that women cannot acquire as readily on their own, women can reduce their food-related workload and potentially bear more children who will enjoy a better chance of reaching reproductive age. Archaeological data are read by many to show that big game hunting and related food-sharing dates to, and is largely responsible for, the emergence of the genus *Homo* (e.g., Bunn 2007; Isaac 1978). Data on the Hadza are important to this idea because they hunt big game in an environment similar to those in which *Homo* evolved, in a place that has revealed archaeological evidence of large animal carcass acquisition by early Pleistocene hominins. In principle, understanding Hadza men’s hunting practices should help interpret those archaeological data and aid assessment of the broader argument they are taken to support.

Results of our work among the Hadza challenge the argument that family provisioning is the goal of men’s foraging. While men were seen to focus almost exclusively

on big game hunting and scavenging over 256 days of observation (1985–1986, 1988) at nine residential base camps in Tli'ika, the prospects for success on any given day were very low and the bulk of the meat that any man obtained went to other men's families rather than to his own (Hawkes et al. 1991, 2001a, b). Observations on women's foraging showed that tuber and fruit collecting were far more reliable food sources (Hawkes et al. 1989, 1995, 1997), yet men rarely collected either other than to satisfy their own immediate hunger. Experimental data collected in 1990 further indicated that men could produce more meat for their families, more consistently, by hunting and trapping small game in addition to pursuing larger prey, yet men rarely did either and often ate whatever they acquired in these ways themselves rather than sharing it with others (Hawkes et al. 1991).

Woodburn's (1968a:51–54) observations in the late 1950s are consistent with these findings:

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 . . . gather vegetable food only for their own needs and normally bring none back to camp.

A man on his own [away from camp] will normally light a fire, cook, and eat on the spot any small animal he kills.

. . . meat is widely distributed and rapidly consumed. . . . To eat meat slowly, to preserve it and store it would be largely wasted effort: other people would simply demand meat when their own was finished and it would be wrong to refuse them.

Woodburn's descriptions, our own day-to-day impressions, and analysis of our quantitative data led us to suspect that a goal other than family provisioning governed men's resource choice. We inferred that the ways in which a hunter's reputation for success in pursuit of large animal prey contributed to others' assessment of his virtues as a desirable ally (or dangerous competitor) made payoffs for maintaining or improving social standing relative to other men outweigh those associated with family provisioning (e.g. Hawkes 1992a, b, 1993a, b, 1996; Hawkes and Bliege Bird 2002; see also Barclay 2013; Bliege Bird and Smith 2005; Roberts 1998; Smith and Bliege Bird 2000).

Wood and Marlowe (2013) present what initially seems a different picture, based on information about foods brought home by Hadza men over 216 days of observation in seven residential camps monitored between 2005 and 2009. They seek to make two points: (1) that Hadza men routinely carry back a wider array of resources than either we or Woodburn reported and (2) that a man's family consistently receives a larger share of this "take" than do any others in the camp. Data marshaled in support of these points lead them to conclude that Hadza men's hunting is indeed aimed at provisioning their own families. We agree that Hadza men treat their wives and children differently than they do those of other men. But their resource choices and the pattern of sharing these entail are suboptimal provisioning strategies under the conditions in which Hadza

men currently operate. Here we reanalyze the data provided by Wood and Marlowe to demonstrate that considerations other than family provisioning must be invoked to account for their behavior, and the substantial consequences for community consumption have direct implications for hypotheses about the evolution of our lineage.

Hadza Men's Foraging

As indicated above, our findings on this topic are consistent with Woodburn's earlier impressions. They also match up well in some, but not all, respects with those reported by Wood and Marlowe (2013: Tables 1, 4, S1, S4). And they have very different implications than the latter propose.

Men in our study camps hunted every day and took 71 large animals—species with average adult body weights ≥ 40 kg—over 2,072 hunter-days; Wood and Marlowe report 46 large animals taken over 2,297 hunter-days (Table 1). The year-round probability of capture on any day for the average hunter in our sample was 3.4% (29 hunter-days/carcass); in Wood and Marlowe's, 2% (50 hunter-days/carcass). Broken down by season: the average daily capture rate in the late dry, when both ambush and encounter hunting are practiced, was 3.9% in our sample (16 hunter-days/carcass), 4.7% (13 hunter-days/carcass) in Wood and Marlowe's. For the wet and early dry seasons, when "encounter" is the only big-game hunting option, the daily success rate for the average hunter in our sample is 2.6% (39 hunter-days/carcass); in Wood and Marlowe's, an order of magnitude lower: 0.4% (241 hunter-days/carcass). The best return rate across all thirteen seasonal samples is one large carcass every two hunter-weeks (approximated in late dry seasons in both our sample and Wood and Marlowe's). The worst, in Wood and Marlowe's sample of 561 hunter-days at camp 3, is one every 18 hunter-months; the next worst, at Wood and Marlowe's camp 2, is zero over 340 days. In these two lowest-capture samples combined, *the data show just one successful carcass acquisition over the equivalent of two-and-a-half hunter-years*. The implications for family provisioning are obvious: big game hunting in this setting is very risky, a poor strategy for feeding mates and offspring.

The picture with respect to plant foods and honey is incomplete but very different. Wood and Marlowe report that men carried fruit back to camp once every 9–90 hunter-days across six camps in their seven-camp sample; at the seventh they brought no fruit home at all in a sample of 69 hunter-days. The overall average carry-home rate across all seven camps is once every 14 hunter-days. Average package weight per carry-home event varied from 1.3 to 3.9 kg, the overall mean is 2.4 kg. No seasonal pattern is apparent in either measure. We have not tallied carry-home rates or weights for our 2,072 hunter-day sample, but we would be surprised if our overall mean carry-home rate for fruit were higher than about once per hunter-month—half of Wood and Marlowe's observed rate. By comparison, women during our study periods carried home 4–6 kg of berries almost every day when fruit was in season (e.g., Hawkes et al. 1995).

With respect to tubers, the difference between men's and women's collecting practices is even more extreme. Wood and Marlowe report just one occasion on which a man brought home a single tuber; no other tuber collecting incidents, let alone carry-home events, are reported. Our data show that women collected tubers (specifically *Vigna frutescens*) almost every day in the dry season, and often in the wet, at rates of

Table 1 Locations, seasons, observation days & big game captures

Camp ID	Region	Observation days	Hunter-days observed	Large carcasses ^a acquired	Hunter-days/carcass
Hawkes et al.—late dry seasons ^b					
1	Tli'ika	47	470	30	16
4	Tli'ika	44	440	13	34
5	Tli'ika	43	430	9	48
Total		34	1,340	52	26
Wood & Marlowe—late dry seasons					
1	W Eyasi	23	345	27	13
5	Tli'ika	36	436	11	40
7	Han!abi	11.5	69	2	35
Total		70.5	850	40	21
Hawkes et al.—wet & early dry seasons					
2	Tli'ika	61	366	8	46
3	Tli'ika	36	216	5	43
6	Tli'ika	25	150	6	25
Total		122	732	19	39
Wood & Marlowe—wet & early dry seasons					
2	Tli'ika	32	340	0	>340
3	Tli'ika	51	561	1	561
4	NE Eyasi	38	456	2	228
6	Tli'ika	22.5	90	3	30
Total		143.5	1,447	6	241

Source: Big-game hunting and aggressive scavenging returns reported by Hawkes et al. (1991) for 1985–1988 and Wood and Marlowe's (2013: Tables 1 & S1) for 2007–2009

^a See O'Connell et al. 1988 for treatment of prey size classes

^b In contrast to Wood and Marlowe's (2013: Tables 1, 4) seasonal breakdown, ours is based on whether or not men practice ambush hunting, a tactic pursued only in the late dry

roughly 2 kg/hr, amassed quantities of up to 10 kg or more per collector; consumed substantial portions of those totals at or near the collecting site; fed the preteen children and grandchildren who accompanied them; and carried several kilos each back to camp to feed other youngsters as well as their husbands.

Our sense of the overall pattern here is similar to that conveyed in the Woodburn quotes above: men in both our studies rarely carried vegetable products home. By comparison, women on average targeted one or another of these resources nearly every day, never failed to acquire substantial quantities when they did, and rarely failed to bring home multiples of the quantities reported by Wood and Marlowe for men. Measured acquisition rates for men (e.g., Hawkes et al. 1995:693, Table 6) show that they could do even better than women on all counts, but they rarely chose to do so, either in our study or in Wood and Marlowe's.

Honey presents a somewhat more complex picture. Wood and Marlowe report carry-home rates of one honey parcel every 1.3–21.8 hunter-days across the seven camps: on

average, one parcel every 7.5 hunter-days across the overall sample. Average parcel weights ranged from 0.8 to 2.9 kg; the overall mean was 1.2 kg. Carry-home rates are seasonally patterned: one event every 3.3 hunter-days in the wet/early dry; one every 12.7 hunter-days in the late dry. Average carry-home weights in both seasonal sets are just over 1 kg, although the overall amounts arriving in camp are nearly four times higher in the wet/early dry. We have not analyzed our own honey-collection data in detail, but it is our impression that the carry-home frequencies are similar both seasonally and overall to those reported by Wood and Marlowe, that late dry season carry-home parcel sizes are also similar, but that our mean wet/early dry carry-home sizes are markedly larger than Wood and Marlowe's—not uncommonly >10 kg (Hawkes et al. 1997:555, 2001b:688).

Leaving honey aside, it is our sense that men could do much better with respect to the goal of family provisioning if they collected plant foods more assiduously *in addition to* big game hunting. Although the fruit and tuber packages women collect are much smaller than large animal carcasses, foraging women never fail to acquire plant food when they want to. Nevertheless, in our observations as well as Woodburn's, men generally collected plant food only for themselves and seldom carried any back to camp. The carry-home frequencies for tubers and fruit reported by Wood and Marlowe—rarely and once every hunter-fortnight, respectively—are consistent with those we saw.

Small Game Procurement

Comparing plant foods with animals involves complications. Edible parts of animals are mostly protein and fat, and many (though not all) plant foods are mostly carbohydrates. If macronutrient differences are important, a calorie of animal food will have a different value than a calorie of plant food. This complication does not arise in small versus large game comparisons: all are made of meat. Since there are always more small animals available for capture than large ones, we assumed that including the former in the targeted array would yield more frequent captures; and we did on occasion see small animals carried back to base camps. These observations prompted further exploration of the household income potentially available from pursuing small-bodied prey, defined here as those with adult weights no greater than about 5 kg.

Since pursuing small animals requires a trade-off with continuing to search for encounters with big ones, we exclude nighttime ambush and focus on the daytime alternatives. In our sample, the overall daily success rate for daytime big-game encounter hunting is 2.2%—one large carcass taken every 46 hunter-days, or 3.17 kg/hunter-day (Table 2, lines 3–5). (The success rate is probably an order of magnitude lower in Wood and Marlowe's sample but cannot be calculated precisely from the data they present.) Our estimates of returns available from small game come from two sources (Table 2). One is our 1985–1988 sample of day-long follows of one or two men each (75 hunter-days total) on which encounters, pursuits, and successful captures of animal prey, both large and small, were recorded. Small game were usually seen several times a day but were rarely pursued in other than the most casual fashion—often not at all. Fourteen were taken, “ten of [which] were immature hornbills snatched from the nest as the hunter walked by” (Hawkes et al. 1991:244), for an average capture probability per hunter-day of 5/75, or 6.7% (Table 2, line 7).

Table 2 Hunting success rates

	Hawkes et al. 1991, 2001b	Wood and Marlowe 2013
Large animals		
<i>Year-round acquisition rate</i>		
1. Prey taken/hunter-day (daily success rate)	71/2,076 (3.4%) ^a	46/2,297 (2.0%) Table S1
2. Hunter-days/acquisition	29	50
<i>Encounter-hunting acquisition rate</i>		
3. Prey taken/hunter-day (daily rate)	45/2,076 (2.2%) ^a	
4. Hunter-days/acquisition	46	
5. Live wt acq (mean) kg/ hunting-day	3.17 ^a	
6. Live wt acq (mean) kg/ hunting-hr @4.1 h/day	0.78 ^{b,c}	(see line 22)
Small animals		
<i>Non-experimental follow acquisition rate</i>		
7. Days prey taken/hunter-days (daily rate)	5/75 (6.7%) ^d	
8. Hunter-days/acquisition	15	
<i>Carry home rate</i>		
9. Prey returned/hunter-day (daily rate)		183/2,297 (8.0%) Table S1
10. Hunter days/prey item carried home		12–13
<i>Small animal acquisition experiment</i>		
11. Small animals encountered/hunter-day (mean)	164/28 (5.9) ^e	
12. Small animals taken/hunter-day (mean rate)	12/28 (42.8%) ^e	
13. Small animals taken/encounter (mean rate)	12/164 (7.3%) ^e	
14. Small animals mean kg/experimental hunting-day	0.41 ^e	
15. Small animals mean kg post encounter	0.23 – >1.55 ^e	
16. Small animals snared/snaring-day (mean)	17/14 (1.2) ^f	
17. Small animals snared kg/snaring-day (mean)	0.78 ^f	
18. Large animals encountered/hunter-day (mean)	19/28 (0.7) ^e	
19. Large animals taken/hunter-day (mean rate)	0/28 (<3.6%) ^e	
20. Large animals taken/encounter (mean rate)	0/19 (<5.3%) ^e	
Tissue returned to camp (kg)		
21. Mean/hunter-day—large animals		1.9 Table S1
22. Mean/hunter-hr—large animals assuming our observed 4.1 h/day ^c		0.46
23. Mean/hunter-day—small animals		0.1 Table S1

^a Hawkes et al. 1991:245, Tables 1 & 2

^b Hawkes et al. 2001b:686

^c Using time allocation data from Hawkes et al. 1997

^d Hawkes et al. 1991:244

^e Hawkes et al. 1991:246

^f Hawkes et al. 1991:246–247

Our second source is a hunting experiment aimed at better quantifying the possible payoffs for including small animals more consistently in the targeted array (Table 2; see details in Hawkes et al. 1991:245–247). That experiment covered 102 hunter-days in the wet season of 1990 when men were given daily rations and a wage to take as many small animals as possible. Observations included 28 focal hunter-days on which all encounters and pursuit times were recorded. In the course of these focal-follows, large animals were pursued 19 times but never taken. Small animals were pursued 164 times, on 12 occasions successfully (Table 2, line 11, 13). The daily capture rate for encounter hunting small animals (12 taken over 28 focal hunter-days) is 43% (Table 2, line 12), six-fold higher than the 7% recorded in our non-experimental follows. Hunters also set snares, although their attention was inconstant and signs indicated that leopards and other consumers were often the beneficiaries. Still, 17 small animals were successfully taken by snare over 14 hunter-days (Table 2, line 16), for a rate of 1.2 prey per day, roughly three times higher than the success rate for the small prey encounter hunting experiment.

Because we were interested in comparing the income rates a man could earn for his household by targeting various prey types, we used our time allocation records (Hawkes et al. 1997) to transform average big game daily success rates into expected live weight (kg) per hunter-hour (Table 2). That way we could compare the payoffs hunters chose when they passed up encounters with small animals to continue the hunt for larger ones. For big animals the “pre-sharing” encounter hunting return rate was 0.78 kg/h (Table 2, line 6)—3.17 kg/day divided by 4.1 hunting hours/day (Hawkes et al. 1997:556, 2001a: Table 4). Our household sharing data (see below) indicated that hunters’ household shares of big animals averaged 10% or less of their live weight. That makes the expected household income rate 10% of the pre-sharing 0.78 kg/h, (Table 2, line 6) or about 0.08 kg/h (Table 3, line 18). Measured return rates for small animals on encounter ranged from 0.23 to >1.55 kg/h (Table 2, line 15). Assuming that men could usually retain small prey entirely for themselves and their families, we counted the whole animal as household income. By these calculations, men were often choosing a mean household income rate more than *an order of magnitude lower* than that available for small game when they passed up such prey to continue searching for large animals instead.

The Consequences for All

The consequence of their choice is that they supply much more meat to others than they would if they aimed to maximize their delivery of meat to their own households. To see whether the good fortune of bystanders is a happy side effect, we explored the frequency dependent consequences of that repeated choice by representing it as an evolutionary game (Maynard Smith 1982). Table 4 shows a much simpler payoff matrix than the one we used in Hawkes et al. 1991 (p. 248). Yet it incorporates the dependence of how much meat a model hunter’s household is likely to get on both what a hunter captures himself and what the other men do. Here a focal hunter’s choice of whether or not to pursue a small animal is represented by the rows. The expectation for his household depends on which he chooses and the choices of the other men. For modeling simplicity we assume that the others either all pursue small game on

Table 3 Meat sharing

	Hawkes et al. 1991, 2001a, b	Wood and Marlowe 2013
Large animals		
1. Prey live wt sharing sample (mean kg)	288 ^a	
<i>Hunter's household shares</i>		
2. Primary share (mean kg)	17 ^a	35.5 (p. 298)
3. Prey w/ live wt <180 kg (mean kg)	2.3 ^a	
4. Prey w/ live wt >180 kg (mean kg)	29.9 ^a	
5. Est. fraction of live wt at time acquired (%)	10 ^b	
6. Est. fraction of wt to all men's households (%)	25 ^a	
7. Est. fraction of wt. to all households (%)		42 (p. 296)
8. Est. fraction consumed in hunter's household (%)		18 (Table S4)
<i>Other household shares</i>		
9. Primary share (mean kg)	13.5 ^a	7.6 (p. 298)
10. Prey w/ live wt <180 kg (mean kg)	2.5 ^a	
11. Prey w/ live wt >180 kg (mean kg)	16.7 ^a	
12. Est. fraction of wt to all men's households (%)	15.5 ^a	
13. Est. fraction of wt to all households (%)		11 (p. 296)
Small animals		
<i>Hunter's household consumed</i> (% of total prey wt)		
14. Observed		47 (p. 299)
15. Assumed	100 ^c	
Household (hh) income rate		
<i>Large animals encounter</i> (mean kg/hunter-day)		
16. If 10% of 3.17 kg/day acquisition to own hh	0.32	
17. If 18% of 1.9 kg/day to camp consumed in own hh		0.34
<i>Large animals</i> (mean kg/hunter-hour)		
18. Assuming previous kg/day & 4.1 hunter hours/day	0.08	0.08
<i>Small animal experiment data</i> (mean kg/hunter-day)		
19. Assuming all consumed in hunter's hh	0.41 ^d	
20. If 47% consumed in hunter's hh		0.19
<i>Post-encounter hh income rate, small animals</i> (kg/hr)		
21. Assuming all consumed in hunter's hh	0.23→1.55 ^d	
22. If 47% consumed in hunter's hh		0.11→0.73

^a Calculated from Hawkes et al. 2001a: Appendix

^b Hawkes et al. 2001a: 124, 2001b:686

^c Hawkes et al. 1991:248, 2001b:686

^d Hawkes et al. 1991:246–247

encounter or all pass them by and continue to search for bigger animals. The entries in the cells show the expected rate of meat, measured in kg/h, for each row's household when the others are making the choice indicated by the column.

Table 4 Expected hourly household income based on our data: passing or pursuing small game^a

	Five others continue searching for bigger animals & pass up small game	Five others pursue small game
Panel A		
Pass small game encounter & continue searching for big game ^b	10% of own big game rate plus 10% of the big game rates of each of the five others	10% of own big game rate
Pursue small game on encounter	100% of own small game rate plus 10% of the big game rates of each of the five others	100% of own small game rate
Panel B		
Pass small game encounter & continue searching for big game	0.468 kg/hr	0.078 kg/hr
Pursue small game on encounter	0.620 kg/hr	0.230 kg/hr

Expected household income, assuming data reported in Hawkes et al. 1991. Both a man's own choice and what the other men do determine how much meat comes to his household. Here this interdependence is simplified by assuming all others do the same thing. Entries in the cells are the expected immediate income rate to the focal hunter if he makes the choice indicated in the row, when the other five men make the choice represented in the column

^a Assuming six co-resident hunters, hunter's household gets 10% of big game (Table 3, line 5), 100% of small animals (Table 3, line 15), and the *lowest* post encounter return rate for small game measured in the small game experiment (Table 2, line 15)

^b Table 2, line 6

Panel A shows how the entries in the cells are calculated. Panel B gives the resulting numerical values. This payoff matrix has the familiar form of a prisoner's dilemma. The entries in the left column are higher than those on the right, but the entries in the bottom row are higher than those on the top. A hunter's household will always do better if the other men pass up small animals and continue to search for big ones. But his own household will do better, no matter what the others do, if he pursues the small animals. This is so even though we have assumed here the small animals encountered are the ones with the lowest post-encounter return rate of those measured in the small game experiment.

Note that these expected hourly rates ignore the failure risk, averaging away the problem of days of no captures that is especially acute for large game. That crucial issue aside, our observations show that hunters would maximize their average household meat income by widening the suite of prey types they pursued to include small animals. We concluded that "Even if neighbors made claims on small animals, a man who pursued them and kept less than half of the *lowest-return* small prey type would still earn a greater nutritional benefit for his own household than he would get from specializing in big game" (Hawkes et al. 2001b:686, emphasis in original).

Wood and Marlowe's Observations on Small Game

Wood and Marlowe ask, “Did Hadza hunters generally ignore small game and specialize in hunting large game?” They say no to both, *but that conclusion cannot be reached from the data they report*. Their account covers only food brought to camp, not the amount actually encountered, pursued, and captured. Prey brought to camp is not an *acquisition* rate. As they say, their number “*underestimates* the amount of small game killed because hunters sometimes ate such prey before returning to camp” (Wood and Marlowe 2013:309, emphasis in original). It may also underestimate the number of captures brought home because, as Marlowe says elsewhere, “When it comes to food . . . it simply must be shared with anyone who sees it” (2010:215; see also Woodburn 1968a:53). Small animals might sometimes have been carried into shelters without drawing the camp-wide notice attendant on summoning the researchers, their notebooks, video camera, and scales.

Still, we can use their data on arrivals in camp to consider whether men in their sample aim their small game hunting at household provisioning. Wood and Marlowe counted 183 small animals brought into camp over the 2,297 hunter-days, representing a delivery to camp on 8% of hunter-days, or about one small animal every 12–13 hunter-days on average (Table 2, line 9). They suggest that “the lower rate of acquisition [*sic*] . . . relative to the [Hawkes et al. 1991] small game hunting experiment is expected since the men we observed were not induced to hunt as much small game as possible” (2013:296). Our analysis, summarized above, was the basis for concluding that a goal of family provisioning would provide that inducement. That the men Wood and Marlowe observed did not hunt as much small game as possible echoes our characterization of Hadza hunters as big game specialists.

Large Game Sharing: Is It Risk Reduction Reciprocity?

As noted above, big game capture rates are very low in all accounts of Hadza hunting. But while our observations of big game meat sharing are similar to Woodburn's, Wood and Marlowe's initially appear to be different, and as they say, the differences are “challenging to interpret” (Wood and Marlowe 2013:310). Part of the contrast involves differences in the questions being addressed and the data collected to answer them. Our 2001a Hadza meat sharing paper reported the distribution of shares to men's households from 20 large animals to test predictions from the Risk Reduction Reciprocity Hypothesis (Trivers 1971; Winterhalder 1986), long favored as an explanation for the wide sharing of meat from big animals commonly observed among ethnographically known foragers. If Hadza hunters are “storing meat in their neighbors' bellies,” then shares that others receive from a hunter's kill represent debts they will later repay. If so, then all the big game meat eaten by members of a hunter's household, including that initially acquired by other men, could be counted as income earned from the hunter's own big game hunting. Marlowe (2010:251) has registered his impression that this may be at least partly the case among the Hadza, saying, “reciprocity may account for some sharing; my anecdotal observations suggest that the best hunters tend to give other good hunters portions of their kills first.”

Our definite contrary sense was that hunters were not considered owners of the meat from the carcasses they acquired and did not control its distribution. If we are right, the

distribution is not risk reduction reciprocity and the shares claimed by others cannot count as family income. Wood and Marlowe (2013) open their paper with a Hadza man's report that adds other possibilities. Hunters, the Hadza man says, are expected to keep special parts of the animals they kill, and some men keep even more. "Women are the ones who share meat" (p. 281).

Our observations in the 1980s were similar to reports from Woodburn, who said:

The *people's meat* [our emphasis] is widely distributed among all the men, women and children of the camp unit—maybe twenty-five to thirty people. There are several stages of sharing. The meat is first shared at the kill site among the men, women and children who have gone out to carry the meat. Back at camp it is then shared again with those who remained behind. . . . As soon as one set of people in the camp finish their meat, gentle pressures are brought to bear on those who have any left to share again (1998:52).

We saw many make claims on "the people's meat"—often quite insistently—not as repayments due but instead simply demanding, "Where's mine?" In our (2001a) meat sharing paper we reported our impressions and their consistency with Blurton Jones's (1984, 1987) Tolerated Theft Model in which food is widely distributed because the cost of refusing others' claims can be too high to pay. Nevertheless we checked our inferences with quantitative analyses of the 20 large animal distributions we measured and found support for Woodburn's (1998) explicit surmise that "sharing is not exchange." Using weights of meat—edible tissue only—that arrived at the household of the hunter credited with the kill and at other hunters' households and predictions extracted from the simplest exchange hypothesis, we found no evidence that hunters repaid meat they got from another's kill with subsequent shares from their own (see Hawkes et al. 2001a for details of the findings and analysis).

Disputing this analysis, Michael Gurven (2004:551) proposed that getting shares was more contingent on supplying them in our data than in any other case he analyzed (his Table 2). This resulted from ignoring confounds, as we explained in our reply (Hawkes et al. 2010) to Gurven and Hill (2009), who had reaffirmed Gurven's (2004) finding. Because camp compositions changed, we observed some men on more days than others. Those observed more days were both more likely to be seen on a successful day and also more likely to be seen getting shares from the kills of others within our observation window. Men also varied in their big game hunting success rates, and even if all claimed equal shares, the more successful hunters will get shares from each other's kills more often just because their successes are more frequent. Failure to control these confounds gives correlations that appear to be evidence for exchange, but are not.

Wood and Marlowe's Question: Why the Differences in Household Share Size?

Wood and Marlowe do not address the exchange issue. Instead they ask, "Did hunters only keep a small fraction of their large game kills, or were men able to control distributions of the large game they killed to their household's advantage?" (Wood and Marlowe 2013:296). In both their data set and ours, meat distributions were measured on only some of the large carcasses that contribute to tallies of hunting

capture rates. Since they were tallied in different ways, directed toward different questions, and reported differently in each case, comparisons are complex.

Our 20-carass sample included 15 hunter's household shares (one share to each successful hunter's household)—not all carcasses were acquired by resident men—and 98 shares to the households of other men, all tallied in terms of meat weight. We excluded inedible parts because we were testing predictions from the hypothesis that sharers were “storing meat in their neighbors’ bellies.” Hunter's household share sizes varied with size of prey (Table 3 here). For animals with mean live weights *less than* 180 kg (impala and mid-sized antelope), hunter's shares averaged 2.3 kg ($n=7$; the maximum share size was 5.5 kg). Shares to other men's households averaged about the same, 2.5 kg ($n=27$). In contrast, for prey *heavier than* 180 kg (zebra, larger antelope, buffalo and giraffe), hunter's shares averaged 29.9 kg ($n=8$; maximum 50 kg) while the mean for other men's households was 16.7 kg ($n=71$), a notable difference. Because the estimated average carcass weight of the 20 animals in our sample was 288 kg (2001a:121), and hunter's shares averaged about one tenth of the biggest carcasses, we used this (29.9/288) as the basis for our estimate that a hunter could (optimistically) expect about 10% of the live weight of a large kill as household income (2001a:124, 2001b:686).

Wood and Marlowe's Fig. 3 plots hunters' households' and average receiving households' share weights against carcass weights. The difference between hunter's and average receivers' primary share is proportionately much larger, nearly twice the difference (their Fig. 2) we reported for the very biggest animals (Table 3, lines 4 and 11). Inclusion of shares to all household types in their receiver average may account for this (see below) since we only reported shares to men's households. But the much larger proportion that hunters retained in their primary distributions, an average 42% share, is *nearly double the maximum* we saw (Wood and Marlowe 2013: Figs. 2 and 3).

One reason for this difference may be the metrics. We were interested in the fraction of live weight so we could estimate the household income rates from overall kilograms of carcasses acquired from large game scavenging and hunting (e.g., Hawkes et al. 2001a:124, 2001b:686). In contrast, Wood and Marlowe focused on what was brought to camp. Their Table S1 lists average package weight for the large game brought to each camp with means and standard deviations that encompass the distribution of carcass weights displayed in their Fig. 3. Loads brought to camp exclude anything eaten at the kill, taken from there to locations other than the hunter's camp, or left at the kill unconsumed.

Considering that possible source of the difference, we can come closer to Wood and Marlowe's tally by using our published record to calculate individual hunter's household shares as proportions of the total weighed at all hunters' households. Doing so, the average share at the households of men not credited with the kill is 15.5% while the fraction to households of men credited with the kill averages 25%. Calculated this way, our dataset includes three hunter's household fractions that are greater than Wood and Marlowe's 42% overall hunter's household average. In short, the difference between the two data sets in proportion retained by the hunter is reduced. Still, in the aggregate, *counting all in-camp sharing incidents regardless of prey size*, hunter's shares of animal tissue brought to camp in Wood and Marlowe's tally are on average substantially larger than in ours.

We see at least three possible explanations.

Skins Wood and Marlowe counted impala and kudu skins, which they describe as “choice cuts” (p. 302) and components of the shares hunters kept (p. 313) “because they make ideal sleeping and working surfaces, and their leather is particularly good for clothing and other tool manufacture” (p. 302). In our experience, skins from impala and certain larger antelope (including kudu) did usually go to the hunter’s household, but given our focus on edible portions we did not count them in our analyses. Wood and Marlowe’s 36-animal share-sample includes 26 impala and kudu, with the skins of 21 (16 impala, 5 kudu) distributed as household shares (p. 302). In impala, skin represents ~6% of total live weight, (Karen Lupo, personal communication based on analysis of five carcasses). On a 40- to 50-kg adult animal (a common estimate for impala), that amounts to an average of 2.7 kg. If the same ratios are typical of a 150 kg kudu, that represents 9 kg. In our sample of impala shares, the addition of a skin to the hunter’s take would more than double his average share by weight, significantly reducing the difference between our share sample and Wood and Marlowe’s. Including kudu in the tally would substantially reduce the difference for prey with mean live weights less than 180 kg, which make up the bulk of their sample (Wood and Marlowe 2013: Figs. 1 and 3). If they also included heads, which often go to the hunter’s household and have substantial fractions of inedible tissue, that would likely account for any remaining differences from our household share weights of edible tissue only.

Varying Social Pressure on Sharing Our sample showed that hunters retained a larger fraction of meat from animals with mean live weights greater than 180 kg, a pattern we might have attributed to the cost of claiming more than others (as in Blurton Jone’s (1984, 1987) Tolerated Theft Model). Hunters could get more of the total in these cases because there was more for all, reducing the incentive of other claimants to press for even more. We noted that residents of other camps are attracted by news of an unusually large kill, usually identified by the name of the successful hunter, and soon arrive to “help eat the meat.” Successful hunters arguably prepared themselves to meet these claims. Similar considerations may well apply with respect to the Wood and Marlowe sample. They report that “visitors often appeared and requested shares from camp residents after the initial distribution in camp had taken place” (p. 393). Since they “adjusted the household shares of those donors accordingly,” the difference between their primary distributions of 42% to hunters’ households and the estimated 18% consumed there (our Table 3, lines 7 & 8) must reflect mostly distributions to other resident households. Their analysis of share values will have been heavily affected (perhaps essentially determined) by data from their Camp 1, where successful large carcass acquisitions averaged more than one per observation-day. Under these circumstances, successful hunters might claim disproportionately large shares for the reasons just indicated. Pertinent here is their note on Camp 1, indicating “many visitors” (Wood and Marlowe 2013: Table 1) and correspondingly high pressure for distribution of shares after the initial in-camp distribution.

Wood and Marlowe also report “meat drying” at this same camp (2013: Table 1), the only one of their seven at which this practice is noted. This recalls our observations at a camp occupied in September–October 1985, where hunters took 30 large animals in 47 days, there were many visitors, and meat was dried for trade with agricultural settlements. This was the highest success rate for any of our 1985–1986 base camps (Table 1 here; Hawkes et al. 2001b:678) and the only one in which meat was dried.

Drying for trade increases the value of meat—the question is whether that makes it more valuable to the hunter and hence more worth defending. As Wood and Marlowe suggest, the increased benefit should also apply to recipients; therefore, if we apply Tolerated Theft strictly, there should be no tendency for a hunter to keep more. This is something that cannot be resolved on the basis of data published thus far.

Wood and Marlowe do consider the possible effects of both more claimants (larger camp sizes) and surfeits of meat on the social pressure for shares. They regressed the number of resident households on hunter's share, found no association, and say,

It is surprising that producers were not giving away larger fractions of carcasses in larger camps, as would be expected if sharing was largely driven by social pressure. Before investigating this matter further, it is important to note that the largest camp in our dataset (camp 1) also experienced the most successful large game hunting (one large game kill per 12.8 person days, shown in Table S1). Perhaps because more meat arrived in this camp than others, the social demands on producers to share were reduced, allowing them to retain more meat for their own households (2013:298).

Twenty-seven large animals were killed during their 23 observation days at camp 1, an average of 1.2 animals each observation day. Their average weight (delivered to camp) was 89.8 ± 154.8 kg, for a total of 2425.7 kg (their Table S1). That camp had 63 residents (their Table 1), making the average ration of meat 1.7 kg, about 2,500 kcal per resident for each day of the entire 23-day observation period (their Table S1). The standard deviation of 154.8 kg for the average large game package weight (their Table S1) indicates some packages about three times the mean, making caloric rations sometimes multiples of that average.

Wood and Marlowe do investigate possible effects of surplus by testing “whether food scarcity influenced sharing depth [the fraction kept by hunters] of large game with multiple linear regression, using the per capita food kcal brought into camp in the 24 h prior to each large game distribution.” They found the “variation in meat supply to camps did not account for variation in sharing depth.” This, they suggest, is because

Even in camps where large game hunting was relatively successful, meat scarcity was the prevailing condition when kills were made. The per-capita supply of meat in the 24 h prior to each large game distribution in our sample only ranged from 1 to 329 kcal/person/day (median=49) (2013:298).

This maximum is less than one seventh the 2,500 kcal/person/day that we calculated above to be the *daily per capita average* their totals show for camp 1.

Camp 1 with its glut of meat was observed in the late dry season. In the late dry season camp where we saw the unusually high success rates mentioned above, people complained of digestive discomfort from “eating too much meat.” That was also the only season in which children lost weight (Hawkes et al. 2001b:687–688). John Speth (2010) has synthesized his own findings and a wide range of other data demonstrating the nutritional perils of eating large rations of lean (in this situation, late dry season) meat, perils that might additionally reduce the social pressure for shares.

Household Size A third possible reason for the difference in hunter's vs. receiving households' share weights is variation in household size. We would expect pressure for household shares to be greater for larger households. Wood and Marlowe indicate the average household size in each camp, but we do not know whether the households of men who were more successful as hunters were larger than average. We do know from their Fig. 12 and Table S4 that the seven best hunters were responsible for an average of 15,845 large animal kcals/day delivered to camp. Since a total of 6,143,063 large animal kcals arrived over the study period of 216 days (their Tables 1 and S1), the average was 28,841 kcals per day. So the seven best hunters (of the 63 men they observed; their Table 2) were responsible for 55% of the total while the seven median hunters contributed only 3.5%, and the seven poorest, just 0.4%. Whether or not the households of less successful hunters were smaller than those of the more successful, some of the non-nuclear-family "receiving households" likely were. If so, any tendency for household size to affect the strength of claims would make the average hunter's household share weights larger than those of recipient households.

Does Family Provisioning Explain Hadza Men's Work?

Humans form pair bonds, and men routinely acquire food later eaten by women and children. This can seem to make paternal provisioning the self-evident payoff for men's work. Even phylogenetic analyses that counter the Hunting Hypothesis by finding mate guarding the most likely impetus for the *initial* evolution of pair bonds in our lineage still concur with the inference that resource acquisition among ethnographically observed hunters is aimed at the goal of household provisioning (e.g., Chapais 2008, 2011). But the bases for challenging that proposition are equally simple. We emphasize two of them. First, most of the big game meat that anyone eats is from prey captured by other men—not themselves or their own husband or father. Wood and Marlowe's estimate of the average fraction of big game meat brought to camp that is actually consumed in the producer's household is 18% (Table 3, line 8). That means that on average 82% of the big game meat that arrived in camp was eaten outside the hunter's own household. If these were percentages of the parts of the animal that arrived in camp rather than of the entire animal (parts of which as indicated above are often eaten at the kill, transported to a camp other than the successful hunter's, or simply left behind), then that 18% would fall further toward our estimate of 10%.

If Wood and Marlowe are right that hunter's households get more meat, the point remains that far and away the lion's share of big animal meat does not go to the hunter's family. The converse also holds: most of the meat from large animals that families eat (an average of 82% implied by Wood and Marlowe's estimate) does not come from the hunting effort of the man of the family.

The Risk Reduction Reciprocity Hypothesis proposes that meat a man gets from others' captures is repayment for shares they got from a previous capture he made. If so, all the meat a household consumes *is* income from his work. Although our evaluation of predictions drawn from that hypothesis (Hawkes et al. 2001a) found none were supported, Wood and Marlowe do not investigate this question of exchange and report hunters (or their wives) controlling meat distributions. Aside from contrary impressions about control of distributions, there are other reasons to be skeptical that

recipient shares come as repayments. These include the rarity of big animal captures, making the problem of account keeping especially tricky. In addition, shifting Hadza camp compositions (e.g., Woodburn 1968b; Marlowe 2005, 2010) mean that a man who was “owed a share” may be elsewhere and unable to collect. Wood and Marlowe report an average of 10 men per camp (their Table 1), which means that less than one sixth (10/63) of the men in their sample camped together at any one time. Although they report visitors from other camps, and we found this especially common with very large kills, most of their big animals are smaller (2013:310) than the size that usually drew visitors during our observations. Finally, the extreme variation in hunter’s big game successes—even the median seven hunters supplying only 3.5% of the big animal calories—means a very few men were suppliers while most were perpetually “in arrears.” That by itself seems refutation of Risk Reduction Reciprocity, providing a tantalizing opportunity to investigate the relative share sizes received by so many non-suppliers.

If not Risk Reduction Reciprocity, it is still possible that the meat men are supplying to others is a mutualistic outcome, with each man doing what is best to provision his own family and this collective benefit being a lucky consequence. If hunting large animals while ignoring many other provisioning opportunities is the best way for a hunter to provision his family, then the substantial benefit to others is a fortunate positive externality.

The payoff matrix in Table 4 shows why we argued otherwise in 1991. With the acquisition rates we measured and our sharing estimates, men aiming to maximize the meat available for their households should always choose small game pursuits over continued specialization in big game. Our small game experiment, conducted in the same location that we collected hunting data and where Wood and Marlowe collected much of theirs, showed that hunters aiming to maximize mean rates of gain for their household should always pursue small animals on encounter. We reached that conclusion assuming hunter’s household income rate was 10% of their big game acquisition rate but their household would keep all of the small animals (Table 4). Does that conclusion still hold with the size of hunters’ shares estimated by Wood and Marlowe?

If a hunter is expecting Wood and Marlowe’s big game acquisition rate of 1.9 kg/day (Table 2, line 21), with 18% (Table 3, line 8) to be consumed by his household, then a hunter’s anticipated daily household income is 0.34 kg/day from big game. Assuming our encounter hunting time allocation estimate (4.1 h/day), this equals 0.083 kg/h (Table 3, line 18). If hunters expect to keep only 47% (Table 3, line 14) of small animals for their own household consumption, this drops the range of household income rates for pursuing small prey to about half their post-encounter return rates; hence, 0.11 to >0.73 kg/h (Table 3, line 22). Since these are higher than a hunter’s expected rate of 0.083 kg/h for continuing the search for large game (Table 3, line 18), he would raise his household income by pursuing the small animals.

The frequency-dependent consequences are shown in Table 5. As in Table 4, the rate of meat that will be delivered to a hunter’s own household (kg/h) depends both on his own choice and what the other men do. Table 5 assumes Wood and Marlowe’s average camp size, big game capture rates, and meat sharing estimates. As in Table 4, this game has the structure of a prisoner’s dilemma. Any hunter’s household does better if the other men pass up small animals and specialize in big game. The values in the left column are higher than those on the right. But the values in the bottom row are higher

Table 5 Expected hourly household income based on Wood and Marlowe (2013): passing or pursuing small game^a

	Nine others continue searching for big animals & pass up small game	Nine others pursue small game
Panel A		
Pass small game encounter & continue searching for big game ^b	18% of own big game rate plus 11% of the big game rates of each of the nine others	18% of own big game rate plus 1/9 of 53% of the small game of each of the nine others
Pursue small game on encounter	47% of own small game rate plus 11% of the big game rates of each of the nine others	47% of own small game rate plus 1/9 of 53% of the small game of each of the nine others
Panel B		
Pass small game encounter & continue searching for big game	0.463 kg/hr	0.205 kg/hr
Pursue small game on encounter	0.488 kg/hr	0.230 kg/hr

The game is set up here as in Table 4 but now we assume ten hunters (the average of Wood & Marlowe's camps), that each hunter's household gets the fraction reported by Wood and Marlowe (2013) of his own big and small game, and also one ninth of the big and small game brought by each of the other hunters that is not consumed in that successful hunter's own household. Note that this assumption ignores other household types that likely got some of the small animals, and substantially increases the benefit to men's households from the small game hunting of other men

^a Assuming there are 10 co-resident hunters, the successful hunter's household consumes 18% of his big game packages (Table 3, line 8), 47% of his small animals (Table 3, line 14), 11% of the other hunter's big game captures (Table 3, line 13), and 1/9 of the small game that goes outside the hunter's own household (1/9 of 53%). We also assume here the *lowest* post encounter return rate for small game measured in the small game experiment (Table 2, line 15)

^b Table 2, line 21

than those on top. No matter what the others do, each hunter aiming to provide the most for his own household should *always pursue smaller prey on encounter when expected post-encounter acquisition rates are at least 0.23 kg/h*—the *lowest* post-encounter rate we measured in the small game hunting experiment. *This holds even if they keep nearly twice as much of large and only half as much of small game as we estimated.*

The expectations used in the preceding calculations are averages. They highlight evidence that Hadza men's foraging priority is not family provisioning while ignoring a second important issue—the risk of failure. People, children especially, need to eat every day. Wood and Marlow itemize this most important feature of men's food deliveries to their respective households: the average number of days between those deliveries (their Table S1). For every resource type but honey and small game in camp 7, at least a week went by on average between days a man returned home with some of it. The duration of empty hunter-days is most extreme for big game. The cross-camp average number of hunter-days between kills given in their Table S1 (151) excludes the stretch of 340 hunter-days in camp 2 where no large animals were killed or scavenged. Honey is the resource men most frequently brought home in this data set: on average, 7.5 man-days between deliveries. These are relatively small packages, averaging 1.2 kg each. None are like the

loads an order of magnitude bigger carried home when families foraged together specifically for honey in some seasons in the 1980s (Hawkes et al. 1997, 2001b). The average number of days between fruit deliveries in their Table S1 tally is 29.2, again excluding the camp (7) where men brought no fruit home in the course of 69 forager-days.

Collective vs. Private Goods: The Essential Question

Wood and Marlowe report that Hadza men brought more meat on average to their wives and children than to any of their neighbors. This is an important challenge to our previous assessment that hunter's households did not usually get larger shares of big animals. While this is a notable difference, we find substantial similarities overall between their findings and ours. Both datasets show that households other than the hunter's benefit from a man's big game hunting; and, within the limits of our combined data sets, men would bring more to their own households—but less for the collective—if they regularly pursued small game.

We underline the importance of distinguishing between (1) questions about whether and in what ways men treat their own wives and offspring differently from other women and children and (2) the question toward which our work was directed and which they recognize (Wood and Marlowe 2013:282) as a key evolutionary issue: whether men's foraging is aimed mainly at family provisioning. This latter question has special force owing to the long-standing assumption that paternal provisioning produced the social organization and life history of our lineage (e.g., Flinn et al. 2007; Kaplan et al. 2000, 2010; Lancaster and Lancaster 1983; Washburn and Lancaster 1968).

The patterns we find in Wood and Marlowe's data are the same features of hunters' resource acquisition that stimulated development of the Show-off Hypothesis (Hawkes 1990, 1991) in the first place. That alternative, which Wood and Marlowe argue their data refute, was initially based on findings among the foraging Ache of eastern Paraguay, where detailed monitoring (Kaplan et al. 1984; Kaplan and Hill 1985) showed that hunting successes were unpredictable, and that when a hunter succeeded, most of the meat went to consumers outside his own nuclear family. Blurton Jones's (1984, 1987) Tolerated Theft Model can explain wide distributions of resources that come seldom, unpredictably, and in large, divisible packages. The *cost of not sharing* them is too high to pay. If that helps explain the sharing, it raises the question why hunters allocate effort to resources especially subject to such pressures instead of to smaller, more predictable alternatives that, under less sharing pressure, could be directed to their own families. The Show-off Hypothesis proposed that social reputation rather than family nutrition goals might help explain the resource choices of foraging men (Hawkes 1990, 1991, 1992a, b, 1993a, 1996; Hawkes and Bliege Bird 2002).

Marlowe (2010):251–252) says he “avoided the term *tolerated theft* [because] when it comes to food, one does not need to steal because it simply must be shared with anyone who sees it.” We agree, as he notes (2010:232), that Blurton Jones's (1984, 1987) model does not assume private property and the label “theft” can be misleading. Marlowe suggests “that Hadza take food to camp to feed their households, but once there, others often get some because scrounging is tolerated.” We doubt Hadza men are ever as surprised as Marlowe's surmise suggests. “[C]onstant demands to share”

(Marlowe 2010:252) are a part of everyday daily life well known to all Hadza from earliest childhood. Nevertheless, men spend hours each day seeking to acquire resources they know will go mostly to others, bypassing alternatives they could capture more often, and with larger fractions expected for their own households.

In spite of unresolved issues, Wood and Marlowe's observations show that men brought food for their households infrequently, as we have and as Woodburn—with no dog in this fight—reported before us. Wood and Marlowe's record for large game hunting in particular shows capture rates even lower than ours, and while they saw heavier hunter's household shares than we did in some situations, like us they also saw most of the meat go to others.

In our 1991 paper we emphasized the collective action problem this poses for Hadza meat consumption. The total amount of meat available for all is greater because men hunt big game. If individual hunters aimed to maximize their own family income, they would undersupply this public good—the “people's meat.” As modeled in both Tables 4 and 5, each man could increase the frequency and amount of meat for his own household by always pursuing small animals instead of preferentially searching for bigger ones. Increasing small game pursuits would mean less time searching for big game. Hunters would consequently acquire fewer large animals and there would be less meat for all.

In Wood and Marlowe's study, hunters brought 5,037,312 kcal from big game to consumers outside their own household (82% [their Table S4] of the total 6,143,063 large game kcal [their Table S1]). Our small game experiment suggested that hunters seeking to bring as much small game home as possible could get 0.41 kg/day. Using that estimate combined with Wood & Marlowe's calculation of an average 1,813 kcal/kg for small game (their Table S1) would give hunters a potential 743 kcal/hunter-day for taking advantage of most small game opportunities. With those numbers, the potential total for their 2,297 hunter-days, if all pursued most small game, would be 1,707,772 kcal. If 53% of that went to other households (their Table S4), the total others got from their work would be 905,119 kcal over their study days. That is less than one fifth of the total that Wood and Marlowe saw hunters actually supply to others.

Supply of “the people's meat” is the important public consequence that follows from men *not* choosing resources that would maximize delivery to their own households. Instead of foraging mainly to bring food to their families, Hadza men devote substantial effort to supplying what are clearly collective goods. Why do they do it? The importance of hunting reputations for men's social standing has been widely noted (e.g., Wiessner 1996). Those general patterns alone suggest considering the benefits of social status payoffs for hunting among the Hadza (Hawkes 1992a, b, 1993a, b; Hawkes and Bliege Bird 2002). In this specific case, as Wood and Marlowe (2013:311) report, “successful hunting and subsequent sharing can bring Hadza men respect and prestige. Hunting plays an important role in how Hadza men establish their reputations as skilled and mature social actors in their communities.”

Hadza hunters spend time acquiring food that is mostly consumed by others—other men, as well as women and children who are not their wives and offspring. This economic productivity distinguishes men from all other primate males. We have argued that it is the consequence of competition for relative standing among men that pervades a broad diversity of human social activities and can be a magnet to participation in novel endeavors (Coxworth 2013). Cultural anthropologists continue to recognize the

central role of competition among men in shaping social structures across a wide array of human societies (e.g., Rodseth 2012). Characterizing men's hunting as the outcome of an efficient division of family labor obscures the likely evolutionary importance of male status competition throughout our lineage. Findings such as those reported by Wood and Marlowe, as analyzed here, are opportunities to see that paternal provisioning is not the primary aim of men's work among the hunter-gatherers. More meat for all is a consequence of other priorities. Status competition among men may always have been the crucial spur to the economic productivity that is one of the distinctive features of our species. Its expression in big animal hunting and scavenging provides a way to identify it archaeologically in the deeper past, ultimately linking it to the evolution of genus *Homo* (O'Connell et al. 2002).

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