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The ethnography and archaeology of African hunter-gatherers are so intertwined it is sometimes difficult to discern where one ends and the other begins. This close convergence of the observable and the inferential can be traced to the 1960s, when a series of systematic studies to document several living African hunter-gatherer societies coincided with early attempts to discern the behavioral inputs structuring the archaeological record of deep human history. The relationship was, for the most part, symbiotic. Pioneering ethnographic field campaigns in the savannas of southern and East Africa (Heinz 1972; Lee and DeVore 1976; Lee 1968, 1969, 1972, 1979; Silberbauer 1965, 1981; Tanaka 1969, 1976, 1980; Woodburn 1968) were, for example, largely catalyzed by the discovery of Early Pleistocene “living floors” at sites like Olduvai Gorge (Leakey 1971) and Kalambo Falls (Clark 1969, 1974a, 1974b). The now-classic ethnographies that resulted—of groups including the Ju/'hoansi, G/wi, G//ana, !Xóǀ, and Hadza—in turn fed directly into interpretive models for other major human origins projects (e.g., Isaac 1984). Paleolithic archaeologists even harnessed ethnographic research not conducted with an evolutionary bent. The adaptations of contemporary tropical foragers in central Africa (Turnbull 1961), for example, came to inform models of rainforest colonization during the Middle Pleistocene (Clark 1959). Similarly, most studies of Africa's more recent archaeological records of the Holocene and later Pleistocene, especially in southern Africa, have drawn

*Beyond the Shadow
of a Desert*

*Aquatic Resource Intensification
on the Roof of Southern Africa*

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heavily—and understandably—on its rich hunter-gatherer ethnographies, including considerations of mobility, aggregation–dispersal, domestic spatial organization, gender relations, *hxaro* gift-exchange, and shamanism (e.g., Hall and Binneman 1987; Lewis-Williams 1981, 1982; Parkington 1996; Parkington et al. 1992; Sampson 1988; Solomon 1992, 1994; Wadley 1987, 1998).

As a consequence, there is arguably no continent more susceptible to its own “ethnographic tyranny” (Wobst 1978). It is perhaps ironic, then, that analogies and inferences drawn from African hunter-gatherer ethnography have particularly severe limitations. A complex blend of historical contingency and resource structure has resulted in Africa’s forager societies being some of the world’s most encapsulated within, and entangled with, those of food producers. Binford (2001), for example, notes that, of all the continents, Africa has the highest percentage (65%) of hunter-gatherer groups whose economies were tied into those of neighboring food producers at the time of ethnographic documentation. The resulting changes to and dispersed distribution of African hunter-gatherer societies have profound implications for our ability to model past behaviors using ethnographic and ethnoarchaeological data, an issue whose contours were shaped during the Kalahari Debates of a quarter century ago (Schrire 1980, 1984; Solway and Lee 1990; Wilmsen 1989; Wilmsen and Denbow 1990). Moreover, Binford (2001) showed that strong relationships exist between *effective temperature* (ET) and a range of variables central to hunter-gatherer lifeways, including subsistence, settlement, mobility technology, and social and spatial organization (Kelly 1983, 1995, 2013; Oswalt 1976; Whitelaw 1991). Relative to other continents, ETs in present-day Africa are high, with all but a few regions exceeding 15.75°C. Across his global sample of 339 groups, Binford noted that foragers living in regions with comparable ETs subsist primarily on terrestrial plants, do not practice storage, and have no wealth differentiation or hierarchical ranking. They also typically have high residential mobility (Kelly 1983) and use relatively “simple” technologies (*sensu* Oswalt 1976). As far as the ethnographic record is concerned, therefore, Africa samples comparatively little latitudinally mediated diversity in hunter-gatherer lifeways.

These facts hinder the utility of the African ethnographic record as a prism for viewing the continent’s past. The marginalization of surviving hunter-gatherer groups to Africa’s ecological and sociopolitical fringes (Kent 1996) makes it certain that very different societal forms existed in the past, particularly in more productive environments. In relatively recent periods, rich, well-preserved archaeological records can mitigate this issue. Indeed, marked divergences between behaviors registered in such records and their ethnographic equivalents are often noted (for southern Africa, see Humphreys 2005;

Jerardino 1996, 2010; Sealy 2006; B. Stewart 2010, 2011). Much more challenging are the problems created in the temporal dimension, particularly across deep time. For example, it is now abundantly clear that Africa played host to our species' behavioral evolution (Barham and Mitchell 2008), and that this occurred during—and was at least partly fueled by—later Pleistocene climatic and environmental change (Jones and Stewart 2016). As many researchers have noted, the nature, scale, and pace of these changes have no parallels in the Holocene, including, of course, the ethnographic present. Beyond climatic flux, moreover, during the bulk of the later Pleistocene, Africa experienced ETs substantially lower than those of today. What forms did African hunter-gatherer societies take during periods of pronounced climatic instability or cooling—that is, when conditions differed most from those of the ethnographic present?

We address this question here by integrating later Pleistocene and Holocene paleoenvironmental and archaeological data to explore hunter-gatherer adaptive diversity in one of the continent's most temperate regions: the Maloti-Drakensberg Mountains of Lesotho (figure 6.1). Not only does this region fall well below Binford's "storage threshold" ($ET \leq 15.75^\circ\text{C}$), but, together with a strip of the interior Karoo dryland biome, it is also one of only two zones of the subcontinent with ETs approaching 12.75°C (figure 6.2). Binford's ethnographic data suggest that hunter-gatherers inhabiting regions with ETs colder than this latter value cannot rely on plants as their primary food base, but depend instead on terrestrial or aquatic animal resources, although only the latter represent a viable intensification option (Johnson 2014:15). If past episodes of climatic cooling pushed ETs in highland Lesotho below this "terrestrial plant dependence threshold" ($ET \leq 12.75^\circ\text{C}$), we anticipate expansions of subsistence regimes to incorporate greater quantities of freshwater fish at such times.

To explore this, we consider the fish assemblages from three archaeological sites: Sehonghong, Pitsaneng, and Likoaeng. Between them, they provide a history of highland fish exploitation over the past 30,000 years. We show that during glacial and stadial phases highland Lesotho sustained severe temperature depressions. At times, these shifts appear to have obliged humans to abandon the highland zone. At others our data make clear that people managed to adjust to ecological pressure by transforming their dietary base, with knock-on implications for settlement, technology, and perhaps sociopolitical structures. Cultural responses to highland Lesotho environments during such phases probably contrasted sharply with those developed by hunter-gatherer groups in the modern Kalahari from which many archaeologists derive behavioral models. Our analysis, therefore, furthers ongoing efforts (Pargeter et al. 2016) to move African hunter-gatherer archaeology beyond the shadow of the Kalahari Desert.

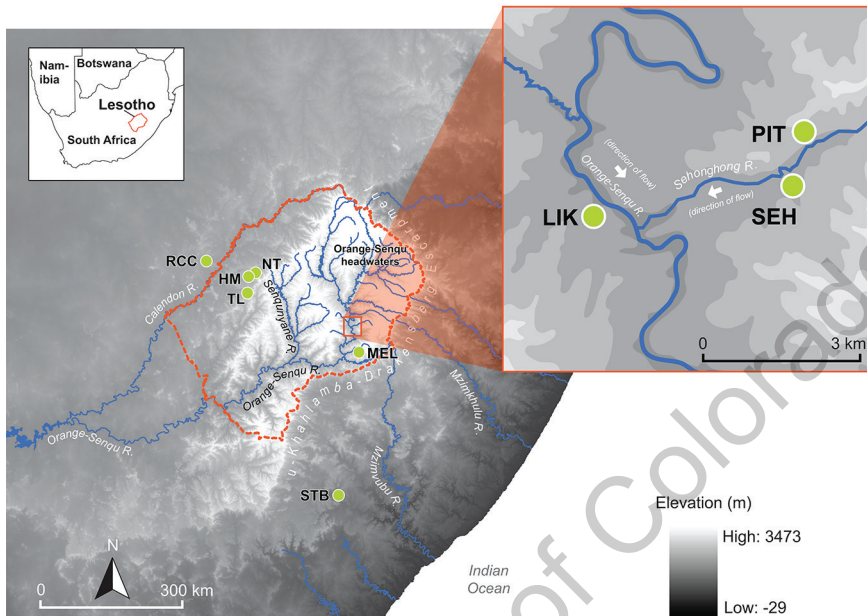


FIGURE 6.1. Map showing sites mentioned in the text: HM, Ha Makotoko; LIK, Likoeng; MEL, Melikane; NT, Ntloana Tsoana; PIT, Pitsaneng; RCC, Rose Cottage Cave; SEH, Sehonghong; STB, Strathalan B; TL, Tloutle.

THE MALOTI-DRAKENSBERG MOUNTAINS: LANDSCAPE, CLIMATE AND VEGETATION

The Maloti-Drakensberg Mountains lie in the far southeastern corner of Africa and extend for some 55,000 km² over most of Lesotho and adjacent parts of South Africa's KwaZulu-Natal and Eastern Cape Provinces (figure 6.1). The highest peaks exceed 3,000 masl with Thabana Ntlenyana (3,482 masl) Africa's tallest south of Mount Kilimanjaro. The mountain system is a roughly quadrangular-shaped massif composed of three sub-parallel ranges. Drakensberg Group flood basalts cap several Karoo Supergroup sedimentary strata. One of these—the Clarens Formation—outcrops as cliffs up to 150 m high within which hundreds of rockshelters and overhangs have formed, many containing archaeological sequences and rock art. Intense fluvial erosion of these geological strata has produced an intricate network of drainages that deeply dissect the landscape. This fluvial system represents the most productive catchment area for southernmost Africa's largest river, the Orange, known in Lesotho as the Senqu.

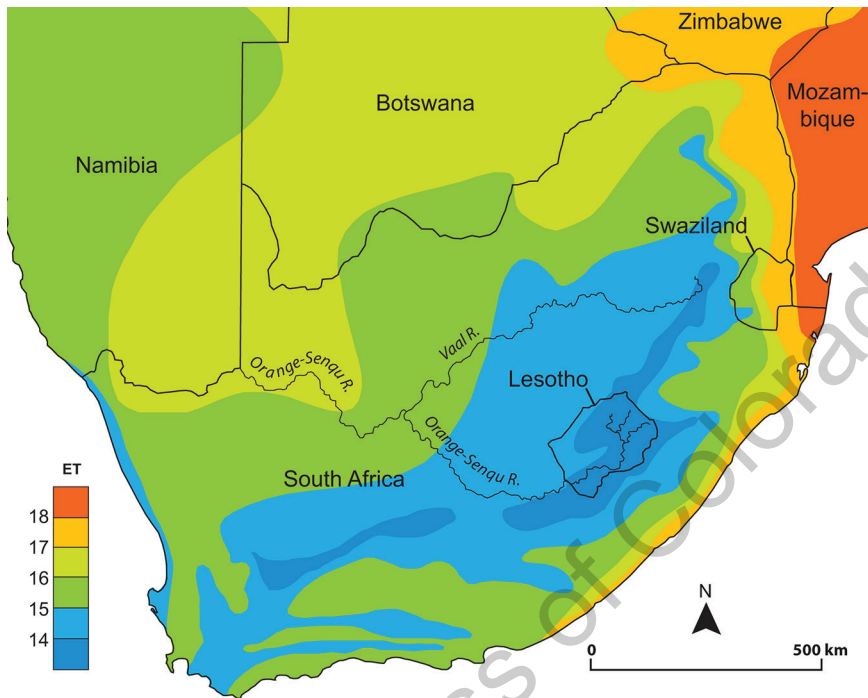


FIGURE 6.2. *Effective Temperature (ET) map of southern Africa (°C; modified after Stuckenberg 1969).*

The climate of the Maloti-Drakensberg Mountains is continental, with cold, dry winters and warm, humid summers. The region lies in southern Africa's summer rainfall zone and receives over 75 percent of its rainfall between October and March. Overall precipitation varies tremendously with altitude and locality, decreasing from north to south and from east to west because of the pronounced orographic rain-shadow cast by the uKhahlamba-Drakensberg Escarpment, which defines the eastern edge of the Mountains. Thus, while estimates of mean annual precipitation for the escarpment typically exceed 1,500 mm (Killick 1963; Schulze 1979), a mean of only 578 mm has been recorded in the upper Orange-Senqu Valley (Bawden and Carroll 1968). Temperatures also vary drastically by altitude, as well as seasonally and diurnally. Mean annual values range from ~15°C in lowland Lesotho to 6°C on the highest mountains (Grab 1994, 1997). The lowlands experience mean mid-summer maxima of 29°C and mid-winter minima 4.3°C, with respective values for the highlands of 17°C and -6.1°C (Grab and Nash 2010). Snow can

fall at any time, but especially between May and September, after which it may persist on southern slopes for up to six months. Frost is also widespread (~31 days per year in the lowlands to ~150 days in the highlands; Schulze 2008) and ground freezing is estimated to occur in the high Maloti-Drakensberg up to two hundred days per year (Grab 1997).

As might be expected, vegetation is also strongly differentiated by altitude. Mucina and Rutherford (2006) distinguish three main units in the Lesotho highlands: (1) Senqu Montane Shrubland, (2) Lesotho Highland Basalt Grassland, and (3) Drakensberg Afroalpine Heathland. Senqu Montane Shrubland is found along the Orange-Senqu Valley and its tributaries at ~1,600–1,900 masl. Effectively an eastern intrusion of lowland Lesotho taxa into the highlands along the Orange-Senqu corridor, this is a *Cymbopogon-Themedra-Eragrostis* C₄ grassland with numerous tree and evergreen shrub species. Lesotho Highland Basalt Grassland occurs between ~1,900 and 2,900 masl. This is a dense, subalpine, C₄-dominated *Themeda-Festuca* grassland with patchy shrublands dominated by *Passerina montana* (Mucina and Rutherford 2006). Due to its large altitudinal range (~1,000 m), it contains several altitude-specific vegetation belts. At lower elevations (~1,900–2,100 masl on south-facing [cooler] slopes, but reaching up to ~2700 masl on north-facing [warmer] slopes) grasses are dominated by *Themeda triandra*, a C₄ species that provides excellent pasture (Jacot Guillarmod 1971). However, above these ranges and extending to ~2,900 masl, *Themeda* gives way to shorter, less palatable C₃ *Festuca-Merxmullera* grasses. Although some ericaceous and composite taxa occur in this unit, trees are mostly absent. Above 2,900 masl, the Basalt Grassland gives way to Drakensberg Afroalpine Heathland, an afroalpine short shrubland with dwarf bushes and C₃ *Merxmullera*-dominated grasses (Killick 1978; Mucina and Rutherford 2006). Embedded within it, numerous alpine bogs help regulate the flow of rainwater into the Orange-Senqu river system (van Zinderen Bakker and Werger 1974).

THE FISH FAUNA OF THE ORANGE-SENQU RIVER

The rivers of highland Lesotho currently support seven indigenous fish species (Ambrose et al. 2000), all adapted to a fairly hostile riverine environment in which temperature, precipitation, food supply, shelter, and levels of predation can vary widely during the year (Arthington et al. 1999). Neither the chubbyhead barb (*Barbus anoplus*) nor the endemic Maloti minnow (*Pseudobarbus quathlam-bae*) is large enough to attract human interest and a third taxon, the sharptooth catfish or barbel (*Clarias gariepinus*), is currently only documented archaeologically in the most minimal numbers. A fourth, the rock catfish (*Austroglanis*

sclateri), is more in evidence, but it is three members of the Cyprinid family that dominate the samples we discuss: the largemouth yellowfish (*Labeobarbus kimberleyensis*), the smallmouth yellowfish (*Labeobarbus aeneus*), and the Orange River mudfish (*Labeo capensis*). Hobart (2003), Vinnicombe (2009), and Plug et al. (2010) discuss the procurement methods used to capture these species. These methods included angling with hooks and fish gorges, shooting with bow and arrow, spearing/harpooning, and trapping using baskets, weirs, and/or drag screens. The last two techniques (spearing/harpooning, typically from boats or rafts, and trapping) are depicted in surviving rock art in the region (figure 6.3).

It is impossible to estimate fish numbers in highland Lesotho before the onset of increased siltation brought about by human-induced soil erosion and overgrazing and of competition from invasive rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), but they must have been considerably higher than today. Archaeological data (Plug and Mitchell 2008b; Plug et al. 2010) support this insofar as they include cyprinids bigger than those recorded recently in highland Lesotho (Arthington et al. 1999) and—by some margin—the southern African angling records reported by Skelton (2001).

Although we do not discuss the ecology of the fish species caught by past hunter-gatherers in Lesotho in detail here for reasons of space, one observation is worth stressing. To an even greater degree than other cyprinids, *Labeo capensis* is noted for its capacity to put on fat before breeding (Baird and Fourie 1978). The combination of increased fat content with an important source of protein probably made these fish especially attractive to people able to intercept them during their spawning runs in spring/early summer, since not only are these events predictable in location and—in a more general sense—time, but this is a season when game animals are still in poor condition following winter and few plant foods are yet available. An extensive literature documents the importance of fat-rich foods in such environments, as well as the relevance of accessing aquatic resources (including freshwater fish) for coping with this situation (Speth 2010; K. Stewart 1994).

MALOTI-DRAKENSBERG PALEOENVIRONMENTS SINCE EARLY MIS 2

Our current understanding of Maloti-Drakensberg paleoenvironments is patchy. Here we synthesize our current state of knowledge as it relates to the period since the start of marine isotope stage (MIS) 2 (~25 ka), with the caveat that spatiotemporal gaps in our comprehension remain considerable. All the ¹⁴C dates and age estimates given have been calibrated using the most recent

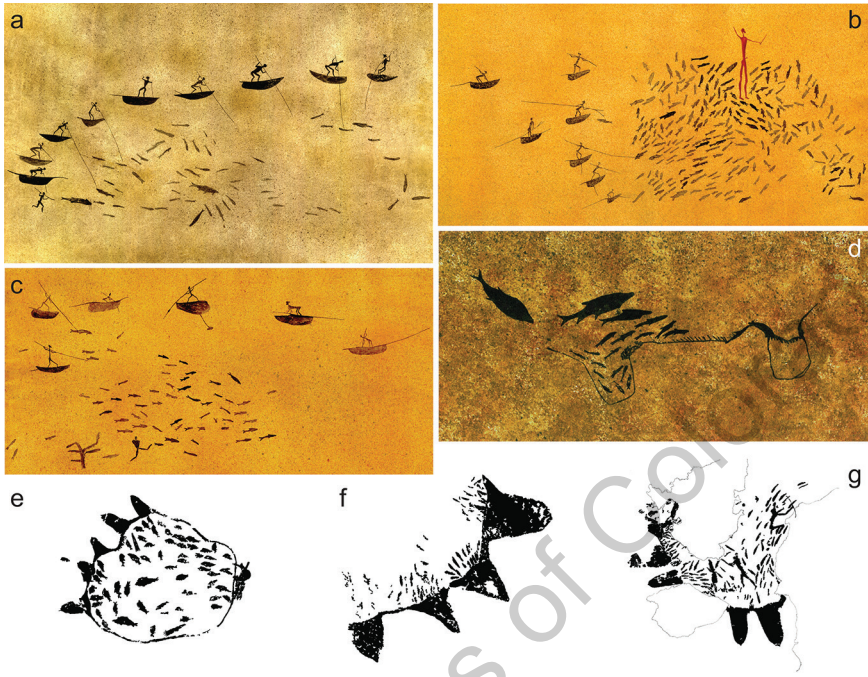


FIGURE 6.3. Fishing (a–c) and fish mass-capture (d–g) scenes depicted in Lesotho’s rock art. (a–d) After Vinnicombe (1976: figures 63, 206, 209; courtesy of the KwaZulu–Natal Museum); (e–g) after Smits (1967: figures 1–3).

versions of OxCal (4.2.4) and the southern hemisphere calibration curve (Hogg et al. 2013).

Our most detailed evidence comes from Sehonghong and another highland rockshelter, Melikane, located some 40 km to its south. Their sequences stretch from the late Holocene back to early MIS 3 (~57 ka) and early MIS 5a (~83–80 ka), respectively, though human occupation at each was highly discontinuous (Jacobs et al. 2008; B. Stewart et al. 2012). Both sites register an occupational pulse centered on ~25–24 ka, in the early stages of the Last Glacial Maximum (LGM). At Melikane, soil organic matter (SOM) $\delta^{13}\text{C}$, phytolith, and charcoal records suggest cooler conditions than had prevailed previously during early and mid-MIS 3. Grassland cover with a strong C_3 component most likely derived from alpine sour grasses is present, along with a low C_4 component. However, the C_4 taxa probably reflect lower $p\text{CO}_2$ levels during the onset of the LGM rather than warmer temperatures. This is because the

sediments from this level comprise anthropogenic materials mixed with colluvial sediments and host bedrock attrition materials derived from roof fall debris (B. Stewart et al. 2012). This supports the notion of colder and drier conditions, with material derived from landscape erosion as well as freeze-thaw and weathering processes. Moreover, tree cover is much reduced, with trees and shrubs likely to have been tightly restricted to deeper river corridors where there was sufficient shelter and surface water to support them. This is supported by the presence in the immediately pre-LGM faunal assemblages at Sehonghong of small antelope species that browse and/or require cover, indicating that riverine shrubs and bushes were still available in sufficient density (Plug and Mitchell 2008a). In addition, cold- and frost-tolerant taxa are present in the Melikane charcoal assemblage, including *Leucosidea sericea* and *Protea* sp. At Rose Cottage Cave in the Caledon Valley just beyond the Maloti Front Range to the west, late MIS 3 and early MIS 2 are also marked by the presence of *Protea* sp. along with *Leucosidea sericea* and other heathland species (Wadley et al. 1992). To the east, at a newly analyzed sedimentary exposure in the high Drakensberg, a major organic-poor gravel layer suggesting colluvial deposition under conditions of lowered temperatures and humidity is bracketed between ^{14}C dates of 27,410 and 23,055 cal BP (Grab and Mills 2011).

Humans abandoned Sehonghong and Melikane for the remainder of the LGM. Hiatuses at both sites begin ~24 ka, when conditions throughout the Maloti-Drakensberg seem to have deteriorated sharply. Geomorphological indications of periglacial conditions along the high uKhahlamba-Drakensberg Escarpment are extensive, accompanied by evidence at several locales of small niche (cirque) glaciers (Mills et al. 2009a, 2009b). Comparable evidence comes from the Eastern Cape Drakensberg immediately to the south of Lesotho (Lewis 2008) and here too people abandoned the area shortly after 24 ka (Opperman and Heydenrych 1990). People may have returned to this area only as late as 11.8 ka (Opperman 1987), but in both highland and lowland Lesotho sporadic human activity was underway long before this. At Ha Makotoko and Ntloana Tšoana, for example, in western Lesotho's Phuthiatsana Valley, occupation is evident at 15.1–13.5 ka (Mitchell and Arthur 2014), slightly later than its resumption at Rose Cottage Cave in the Caledon Valley immediately to the west (Wadley 1996). Perhaps preceded by one or more earlier, ephemeral visits (e.g., at 19.3–18.6 ka; Mitchell 1995), newly obtained dates from Sehonghong register human presence there between ~16.0 and ~15.0 ka, and again between ~14.8 and ~13.7 ka (Pargeter et al. 2017). The first of these occupational pulses coincides with a ~3‰ positive shift in SOM $\delta^{13}\text{C}$ at the site (to -19.8‰), suggesting a greater contribution of C_4 taxa under markedly

warmer temperatures relative to the previous (pre-LGM) occupation (Loftus et al. 2015). The subsequent pulse, however, records a negative shift (to -21.8‰), signaling a return to cooler temperatures. While Loftus et al. (2015) ascribed this cold reversal to the Younger Dryas (YD; $\sim 12.7\text{--}11.5$ ka) on the basis of previous dates from this portion of the Sehonghong sequence (Mitchell 1996a), the new chronology suggests that it more likely accords with the slightly earlier Antarctic Cold Reversal (ACR; $\sim 14.7\text{--}13.0$ ka). Interestingly, two of the seven ^{14}C dates for the above-mentioned high Drakensberg glacial moraines give ages of 14,700 and 13,820 cal BP (Mills et al. 2009a), indicating that some of these features likely formed during the ACR.

The YD itself may be registered slightly later in the Sehonghong sequence, since SOM $\delta^{13}\text{C}$ values (and thus temperatures) remain relatively depressed until ~ 11.0 ka. Thereafter, they increase once again by $\sim 3\text{‰}$ as temperatures warm into the mid-Holocene (Loftus et al. 2015). Higher temperatures, and probably higher rainfall too, are also signaled by increased numbers of small antelopes and ground game in Sehonghong's faunal assemblage by ~ 11.0 ka (Plug and Mitchell 2008a). More clearly than the Sehonghong sequence, multiple proxy records from western Lesotho and Rose Cottage Cave demonstrate sizable climatic oscillations across the Pleistocene-Holocene transition rather than a smooth, unidirectional sequence of change (Roberts et al. 2013 with references). In this they are broadly in line with similar evidence elsewhere in southern Africa (e.g., Abell and Plug 2000; Chase et al. 2011; Coetzee 1967; Quick et al. 2011; Scott and Lee Thorp 2004).

The higher temperatures that set in across the Maloti-Drakensberg ~ 9.5 ka have been argued to signal the start of the mid-Holocene altithermal (Smith et al. 2002). This phase of widespread warming between ~ 9 ka and ~ 4.5 ka is apparent in numerous archives throughout the subcontinent (Partridge et al. 1999). However, considerably more climatic variability exists within it than previously appreciated, particularly as regards moisture availability through time and space (e.g., Nash and Meadows 2012). The Maloti-Drakensberg likely witnessed fluctuations in both precipitation and temperature, even though records from the Lesotho highlands are poor at this time, compared to those along the Caledon and Phuthiatsana Valleys (e.g., Esterhuysen and Mitchell 1996; Smith et al. 2002). The onset of peat formation in the upper Mashai Valley to the northeast of Sehonghong ~ 8.2 ka (7280 ± 150 BP, Q-1165; Carter 1976) does, however, fit with other proxies, hinting at cooler, moister conditions around this time that may be local manifestations of the so-called 8200 cal yr BP event, a period of global-scale cooling triggered by mass glacial meltwater influx into the North Atlantic (Barber et al. 1999).

Thereafter, and beginning from at least ~ 7.5 ka, temperatures across the region appear to have remained relatively high until the start of the late Holocene Neoglacial (~ 3.5 ka), although moisture availability fluctuated. Dramatic habitat changes in the highlands that may have been associated with a warming climate are likely implicated in a major faunal turnover event registered at Sehonghong ~ 7 – 6 ka. While several medium and large grazing ungulates (springbok, *Antidorcas marsupialis*; bluebuck, *Hippotragus leucophaeus*; blesbok, *Damaliscus pygargus phillipsi*) that had been archaeologically present throughout the later Pleistocene disappear, others increase in frequency, among them the common reedbuck *Redunca arundinum*, which is restricted to this part of the site's sequence; its heavy water dependence signals a wetter landscape (Plug and Mitchell 2008a).

The later Holocene witnessed warm temperatures overall, punctuated by several cold reversals of variable duration and intensity. The longest such excursion was the Neoglacial, a period of widespread cooling and humidity registered across much of southern Africa, including the Maloti-Drakensberg region, between ~ 3.5 and 2.0 ka (Nash and Meadows 2012; but see Chase et al. 2009). A strong Neoglacial signature has been recorded at Likoeng ($1,725$ masl), an open-air site near Sehonghong, the fish assemblages from which we consider below. Here, phytoliths and SOM $\delta^{13}\text{C}$ values from strata dated between c. 3000 and 2180 cal BP (Layers XIV–XI) suggest a distinct habitat change from preceding or subsequent periods. Whereas the bulk of this later Holocene sequence is dominated by C_4 phytolith morphotypes (Panicoids and Chloridoids) and high $\delta^{13}\text{C}$ values indicative of warm temperatures not dissimilar to today, these third millennium BP layers register a switch to C_3 Pooid grass dominance and correspondingly low $\delta^{13}\text{C}$ values (Parker et al. 2011); charcoal data corroborate this (Mitchell et al. 2011). As mentioned above, today C_3 alpine grasslands occur in the high Maloti-Drakensberg at altitudes above $\sim 2,100$ masl. Their dominance in the area surrounding Likoeng thus indicates that, as with earlier cold events, the Neoglacial provoked a substantial lowering of vegetation belts in response to temperature depressions, in this case in the order of 2.5°C (Parker et al. 2011). The Neoglacial portion of the Likoeng sequence also contains the highest counts of phytoliths laid down under very wet conditions, suggesting substantially increased moisture availability at this time. This agrees well with evidence from the Eastern Cape Drakensberg, where humid conditions in this time range are indicated by the formation of paleosols and overbank deposits at Kilchurn (~ 3.2 – 2.3 ka), and gully erosion at Tiffindell (~ 2.8 – 2.7 ka) (Lewis 2005).

Over parts of the past two millennia the Maloti-Drakensberg region experienced some of the warmest temperatures of the Holocene. At Likoang, the cool, humid Neoglacial was followed from around 2100 cal BP by enhanced drying and warmth, evidenced respectively by higher frequencies of C_4 phytoliths and SOM $\delta^{13}C$ values consistent with a mixed C_3/C_4 grassland. This was followed some four centuries later by a shift to markedly warmer and drier conditions in the site's uppermost levels, dated 1615–1066 cal BP (Parker et al. 2011). During this final pulse of human occupation SOM $\delta^{13}C$ values are the highest in the Likoang sequence, indicating an upper Orange-Senqu Valley heavily dominated by C_4 taxa, with frequencies of arid-adapted Chloridoid (C_4) phytoliths also peaking and the lowest counts of Pooid (C_3) grass phytoliths, which had peaked in the Neoglacial.

This is not, however, to suggest that conditions in the Maloti-Drakensberg were uniform over the last 2 ka. Two of the later Holocene's sharpest climatic swings—the Medieval Warm Epoch (1390–650 cal BP) and the ensuing Little Ice Age (650–150 cal BP)—register at several regional proxy archives, including peat deposits at Tlaeng Pass in the high Drakensberg north of Sehonghong (Hanvey and Marker 1992), the pollen sequence at Craigrossie in the easternmost Free State (Scott 1989), and the SOM $\delta^{13}C$ values obtained from several open-air sampling locations near Sehonghong itself (Julia Lee-Thorp, personal communication 2016). The absence of zebra (*Equus quagga*) and extreme scarcity of black wildebeest (*Connochaetes gnou*) in archaeological faunas of the last two thousand years at Sehonghong, Likoang, Pitsaneng, and other highland sites also suggests a further impoverishment of the region's mammalian fauna, with roan antelope (*Hippotragus equinus*) too disappearing before the first literate observers arrived in the second half of the nineteenth century (Plug and Mitchell 2008a). Whether or not these losses were climatically instigated, they certainly imply a degree of ongoing ecological reorganization during the later Holocene.

In sum, far from the conventional picture of a cool, dry later Pleistocene and warm, wet Holocene, major changes in temperature and humidity are evident throughout the period under consideration. We wish to highlight the evidence presented above for at least three periods of sharply reduced temperatures during MIS 2 and the Holocene: ~24–18 ka (the LGM), 14.8–13.7 (the ACR), and ~3.5–2 ka (the Neoglacial). The paleoenvironmental evidence just summarized provides the requisite climatic backdrop against which we now frame and interpret the archaeological record of fishing in highland Lesotho.

THE ARCHAEOLOGY OF HIGHLAND FISH EXPLOITATION AND ITS CLIMATIC CORRELATES

Three archaeological sites are especially important to understanding the pre-history of fishing in highland Lesotho: Sehonghong, Pitsaneng, and Likoang (figure 6.1). Sehonghong is one of five sites originally excavated by Pat Carter in 1971 as part of his and Patricia Vinnicombe's pioneering research of the region (Carter 1978; Vinnicombe 1976). A large sandstone rockshelter (figure 6.4a) situated on the south side of the Sehonghong River, which flows into the Orange-Senqu about 3 km downstream, Sehonghong's sequence reaches back to early MIS 3 (Carter et al. 1988; Jacobs et al. 2008). Faunal remains, including fish, are variably well preserved throughout at least the upper 35,000 years of its sequence. Sehonghong has been excavated twice since 1971. In 1992 Mitchell investigated its Later Stone Age (LSA) deposits, including those dating to early in MIS 2 that appear to register a transition between Middle Stone Age (MSA) and LSA lithic technologies (Mitchell 1995). As already mentioned, the Pleistocene LSA and MSA/LSA transitional levels from Mitchell's excavation have recently been re-dated using AMS ^{14}C (Pargeter et al. 2017). In 2011, Stewart reopened Mitchell's trench to allow exploration of underlying MSA levels; this work continues. Approximately 1 km upstream from Sehonghong, Pitsaneng is a much smaller rockshelter (figure 6.4b) with a sequence that includes fish remains but is restricted to the second millennium AD (Hobart 2004). Likoang, located some 3 km to the northwest of Sehonghong on the west bank of the Orange-Senqu River, is a very different kind of site. Here, in 1995 and 1998, Mitchell explored a series of superimposed open-air occupations (figure 6.4c and d) dating to the late Holocene in which fish were exceptionally numerous and well preserved (Mitchell et al. 2011). The relevant radiometric dates for all three sites are listed in table 6.1.

Excavations at Sehonghong employed a 1.5-mm mesh (except in the uppermost layers, DC and SS, where a mesh of 3.0 mm was used) and those at the other two sites used a sieve with 2.0-mm mesh. All bone retrieved from Likoang, Pitsaneng, and the 1992 excavations at Sehonghong was analyzed by the same analyst, Ina Plug, at the Transvaal (now Ditsong) Museum, Pretoria, South Africa, using the comparative collections and procedures detailed elsewhere (Plug and Mitchell 2008b; Plug et al. 2010). All told, 14,333 identifiable specimens were recovered from Sehonghong, 918 from Pitsaneng, and 61,241 from Likoang. Collectively, this provides one of the largest concentrations of freshwater fish remains anywhere in sub-Saharan Africa. We are confident that the assemblages were accumulated by people, since many of the bones



FIGURE 6.4. Views of the primary sites discussed in this chapter: (a) looking southeast into Sehonghong Rockshelter from the Sehonghong River bank; (b) a view south into Pitsaneng Rockshelter, also from the Sehonghong River bank; Likoang (c) before excavation, looking west from the Orange-Senqu River bank, and (d) during excavation, looking north up the Orange-Senqu River in the winter dry season.

are burnt, none show any sign of gnawing or of carnivore digestive processes, and all occur in association with other residues of human activity, such as charcoal and lithic debitage. Leopards (*Panthera pardus*), water mongooses (*Atilax paludinosus*), and Cape clawless otters (*Aonyx capensis*) occur in the assemblages, but are rare. Only otters regularly eat fish, but they tend to do this in the water, and defecate along the water's edge, rarely moving as far from the riverbank as the Sehonghong or Likoang sites. These facts, and the virtual absence from the archaeological faunas of crabs, which dominate otter diets in the KwaZulu-Natal Drakensberg (Skinner and Chimimba 2005), reinforce our view that the fish remains we discuss are of human origin (Plug et al. 2010).

Tables 6.2 and 6.3 present the relative proportions of fish to mammalian Number of Identifiable Specimens (NISP) by layer for Sehonghong and Likoang. Figure 6.5 then graphs the frequencies of fish remains through the Sehonghong and Likoang sequences both as densities (NISP per cubic meter

TABLE 6.1. Published radiocarbon dates from Likoaeng, Pitsaneng, and Sehonghong from Marine Isotope Stages 1 and 2.

| Site | Stratigraphic context | Cultural association | Laboratory number | Date BP | Calibrated BP | Material | Reference |
|------------|--------------------------|----------------------|-------------------|--------------|---------------|-------------|---------------------------|
| Pitsaneng | Q ₂ , spit 3 | Ceramic Wilton | OXL-1314 | AD 1380 ± 60 | — | Pottery | Hobart (2004) |
| Pitsaneng | Burial | Ceramic Wilton | Pta-8360 | 810 ± 50 | 786 | Human bone | Hobart (2004) |
| Pitsaneng | M ₄ , spit 9 | Ceramic Wilton | Pta-8491 | 840 ± 40 | 773 | Charcoal | Hobart (2004) |
| Pitsaneng | M ₄ , spit 18 | Ceramic Wilton | OXL-1316 | AD 1140 ± 80 | — | Pottery | Hobart (2004) |
| Pitsaneng | Q ₂ , spit 7 | Ceramic Wilton | OXL-1315 | AD 1040 ± 90 | — | Pottery | Hobart (2004) |
| Sehonghong | DC | Ceramic Wilton | Wk-34785 | 1132 ± 25 | 1057 | Mammal bone | Horsburgh et al. (2016) |
| Sehonghong | DC | Ceramic Wilton | Wk-34786 | 1132 ± 25 | 1057 | Mammal bone | Horsburgh et al. (2016) |
| Sehonghong | DC | Ceramic Wilton | Wk-34784 | 1201 ± 25 | 1173 | Mammal bone | Horsburgh et al. (2016) |
| Sehonghong | GAP | Ceramic Wilton | Pta-6084 | 1240 ± 50 | 1265 | Charcoal | Mitchell and Vogel (1994) |
| Likoaeng | Layer I | Ceramic Wilton | GrA-23237 | 1285 ± 40 | 1269 | Sheep | Mitchell et al. (2011) |
| Likoaeng | Layer I | Ceramic Wilton | GrA-26831 | 1390 ± 30 | 1268 | Iron | Mitchell et al. (2011) |
| Likoaeng | Layer I | Ceramic Wilton | Pta-7877 | 1310 ± 80 | 1309 | Charcoal | Mitchell et al. (2011) |
| Sehonghong | Layer IX, unit 6 | Ceramic Wilton | Pta-885 | 1400 ± 50 | 1357 | Charcoal | Carter et al. (1988) |
| Sehonghong | GAP | Ceramic Wilton | Pta-6063 | 1710 ± 20 | 1691 | Charcoal | Mitchell and Vogel (1994) |
| Likoaeng | Layer III | Postclassic Wilton | Pta-7865 | 1830 ± 15 | 1784 | Charcoal | Mitchell et al. (2011) |
| Likoaeng | Layer III | Postclassic Wilton | Pta-7097 | 1850 ± 15 | 1811 | Charcoal | Mitchell et al. (2011) |
| Likoaeng | Layer V | Postclassic Wilton | Pta-7092 | 1850 ± 40 | 1834 | Charcoal | Mitchell et al. (2011) |

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TABLE 6.1—continued

| Site | Stratigraphic context | Cultural association | Laboratory number | Date BP | Calibrated BP | Material | Reference |
|------------|--------------------------------|----------------------|-------------------|-----------|---------------|-------------|---------------------------|
| Likoeng | Layer V | Postclassic Wilton | Pta-9048 | 2000 ± 70 | 2085 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer V | Postclassic Wilton | Pta-7870 | 2100 ± 80 | 2306 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer VIII/IX | Postclassic Wilton | Pta-7876 | 2020 ± 60 | 2091 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer VII/IX | Postclassic Wilton | Pta-7098 | 2060 ± 45 | 2096 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer XI | Postclassic Wilton | Pta-7101 | 2390 ± 60 | 2703 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer XIII | Postclassic Wilton | GrA-3236 | 2555 ± 45 | 2749 | Mammal bone | Mitchell et al. (2011) |
| Likoeng | Layer XIII | Postclassic Wilton | Pta-7093 | 2650 ± 60 | 2859 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer XIII | Postclassic Wilton | GrA-23239 | 2860 ± 45 | 3064 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer XIII | Postclassic Wilton | GrA-23233 | 2810 ± 45 | 2978 | Mammal bone | Mitchell et al. (2011) |
| Likoeng | Layer XV | Postclassic Wilton | GrA-23232 | 3355 ± 45 | 3687 | Charcoal | Mitchell et al. (2011) |
| Likoeng | Layer XVII | Postclassic Wilton | GrA-26178 | 2875 ± 35 | 3071 | Eland | Mitchell et al. (2011) |
| Likoeng | Layer XVII | Postclassic Wilton | GrA-13535 | 3110 ± 50 | 3395 | Charcoal | Mitchell et al. (2011) |
| Sehongsong | DC (displaced upward from GWA) | Wilton | Wk-34787 | 5870 ± 25 | 6736 | Mammal bone | Horsburgh et al. (2016) |
| Sehongsong | GWA | Classic Wilton | Pta-6154 | 5950 ± 70 | 6931 | Charcoal | Mitchell and Vogel (1994) |
| Sehongsong | Layer IX, unit 28 | Later Oakhurst | Q-3174 | 6870 ± 60 | 7818 | Charcoal | Carter et al. (1988) |
| Sehongsong | ALP | Later Oakhurst | Pta-6278 | 7990 ± 80 | 8297 | Charcoal | Mitchell and Vogel (1994) |
| Sehongsong | ALP | Later Oakhurst | Pta-6280 | 7090 ± 80 | 8007 | Charcoal | Mitchell and Vogel (1994) |
| Sehongsong | ALP | Later Oakhurst | Pta-6072 | 7210 ± 80 | 8173 | Charcoal | Mitchell and Vogel (1994) |

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TABLE 6.1—continued

| Site | Stratigraphic context | Cultural association | Laboratory number | Date BP | Calibrated BP | Material | Reference |
|------------|-----------------------|----------------------|-------------------|-------------|---------------|-----------|---------------------------|
| Sehonghong | ALP | Later Oakhurst | Pta-6o83 | 7010 ± 70 | 7942 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | SA | Oakhurst | Pta-6368 | 9280 ± 45 | 10550 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | SA | Oakhurst | Pta-6o57 | 9740 ± 140 | 11595 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | BARF | Robberg | Pta-6o65 | 11090 ± 230 | 13395 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | RF | Robberg | OxA-39742 | 12010 ± 50 | 14018 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | RF | Robberg | Pta-6282 | 12180 ± 110 | 14467 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | Layer IX, unit 39 | Robberg | Q-3175 | 12250 ± 300 | 15229 | Bulk bone | Carter et al. (1988) |
| Sehonghong | Layer IX, unit 42 | Robberg | Q-3176 | 12200 ± 250 | 15080 | Bulk bone | Carter et al. (1988) |
| Sehonghong | RF | Robberg | OxA-39741 | 12355 ± 50 | 14712 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | RF | Robberg | OxA-39740 | 12420 ± 50 | 14877 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | RBL | Robberg | Pta-6o62 | 12410 ± 45 | 14735 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | CLBRF | Robberg | Pta-6o58 | 12470 ± 100 | 15040 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | Layer IX, unit 48 | Robberg | Q-3174 | 12800 ± 250 | 15925 | Charcoal | Carter et al. (1988) |
| Sehonghong | RBL | Robberg | OxA-39739 | 12870 ± 55 | 15601 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | RBL | Robberg | OxA-39738 | 12960 ± 55 | 15725 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | Layer IX, unit 50 | Robberg | Pta-884 | 13000 ± 140 | 15948 | Charcoal | Carter et al. (1988) |
| Sehonghong | Layer IX, unit 52 | Robberg | Q-3172 | 13200 ± 150 | 16210 | Charcoal | Carter et al. (1988) |
| Sehonghong | BAS | Robberg | Pta-6o60 | 15700 ± 150 | 19298 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | Layer IX, unit 54 | Robberg | Q-1452 | 17820 ± 270 | 22246 | Charcoal | Carter et al. (1988) |
| Sehonghong | BAS | Robberg | Pta-6281 | 19400 ± 200 | 23853 | Charcoal | Mitchell and Vogel (1994) |

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TABLE 6.1—continued

| Site | Stratigraphic context | Cultural association | Laboratory number | Date BP | Calibrated BP | Material | Reference |
|------------|-----------------------|----------------------|-------------------|-------------|---------------|----------|---------------------------|
| Sehonghong | BAS | Robberg | Pta-6077 | 20200 ± 100 | 24495 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | BAS | Robberg | OxA-39736 | 20270 ± 100 | 24648 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | BAS | Robberg | OxA-39737 | 20600 ± 100 | 25178 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | Layer IX, unit 60 | Robberg | Pta-789 | 20900 ± 270 | 25735 | Charcoal | Carter et al. (1988) |
| Sehonghong | Layer IX, unit 72 | Robberg | Pta-918 | 19860 ± 220 | 24401 | Charcoal | Carter et al. (1988) |
| Sehonghong | Layer VII (MOS) | Transitional MSA/LSA | Pta-919 | 20240 ± 230 | 25015 | Charcoal | Carter et al. (1988) |
| Sehonghong | MOS | Transitional MSA/LSA | OxA-39735 | 20290 ± 90 | 24656 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | MOS | Transitional MSA/LSA | OxA-39734 | 20460 ± 100 | 25019 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | MOS | Transitional MSA/LSA | Pta-6059 | 20500 ± 230 | 25272 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | OS | Transitional MSA/LSA | OxA-39733 | 20100 ± 90 | 24420 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | RFS | Transitional MSA/LSA | Pta-6271 | 25100 ± 300 | 29890 | Charcoal | Mitchell and Vogel (1994) |
| Sehonghong | RFS | Transitional MSA/LSA | OxA-39731 | 25510 ± 150 | 30191 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | RFS | Transitional MSA/LSA | OxA-39730 | 25870 ± 160 | 30615 | Charcoal | Pargeter et al. (2017) |
| Sehonghong | RFS | Transitional MSA/LSA | Pta-6268 | 26000 ± 430 | 30983 | Charcoal | Mitchell and Vogel (1994) |

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TABLE 6.1—continued

| Site | Stratigraphic context | Cultural association | Laboratory number | Date BP | Calibrated BP | Material | Reference |
|------------|-----------------------|----------------------|-------------------|--------------|---------------|----------|-----------------------|
| Sehonghong | I 62 | MSA | OxA-27689 | 25330 ± 130 | 29706 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | I 63 | MSA | OxA-27690 | 28650 ± 200 | 33148 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | I 67 | MSA | OxA-27691 | 29120 ± 190 | 33737 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | I 69 | MSA | OxA-27692 | 29170 ± 190 | 33769 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | I 030 | MSA | OxA-27693 | 29200 ± 200 | 33801 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | I 031 | MSA | OxA-27694 | 28800 ± 190 | 33517 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | I 036 | MSA | OxA-27695 | 30910 ± 250 | 35332 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | I 037 | MSA | OxA-27696 | 31030 ± 250 | 35482 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | IIIA | MSA | OxA-27697 | 30710 ± 240 | 35063 | Charcoal | Lofthus et al. (2015) |
| Sehonghong | Layer V, unit 88 | MSA | Pta-787 | 30900 ± 550 | 35978 | Charcoal | Carter et al. (1988) |
| Sehonghong | Layer V, unit 93 | MSA | Pta-785 | 32150 ± 770 | 38315 | Charcoal | Carter et al. (1988) |
| Sehonghong | Layer IV | MSA | SEH4 | 31600 ± 1400 | — | Sediment | Jacobs et al. (2008) |
| Sehonghong | Layer III | MSA | SEH3 | 30300 ± 3400 | — | Sediment | Jacobs et al. (2008) |
| Sehonghong | Layer III | MSA | SEH2 | 46500 ± 2500 | — | Sediment | Jacobs et al. (2008) |
| Sehonghong | Layer II | MSA | SEH1 | 57600 ± 2300 | — | Sediment | Jacobs et al. (2008) |

Notes: All dates are conventional radiocarbon ages except for those prefixed by GrA-, OxA- and Wk. Dates prefixed by OXl- and SEH are OSL dates. Radiocarbon dates have been calibrated using OxCal 4.2.4 and SHCal 13 (Hogg et al. 2013) and are presented at 95% CIs.

of deposit) and as ratios of fish to mammals. The latter are expressed using a fish/mammal index similar to those advocated by Broughton (1994):

$$\Sigma \text{ NISP fish} / \Sigma (\text{NISP fish} + \text{NISP mammals})$$

Values approaching 1 or 0 indicate diets with higher relative contributions of fish or mammals, respectively. For Likoang we also present a large ungulate/fish index:

$$\Sigma \text{ NISP large ungulates} / \Sigma (\text{NISP large ungulates} + \text{NISP fish})$$

In this index, values approaching 1 or 0 respectively indicate diets with higher relative contributions of large ungulates or fish, with large ungulates defined as size class 3 or above (Brain 1981). Tables 6.4 and 6.5 break down Sehonghong and Likoang's fish NISPs and Minimum Number of Individuals (MNI) by taxon. Pitsaneng is treated as a single assemblage for this comparison and is presented in table 6.6 (NISPs only). Note that a precise count for the total number of unidentifiable fish remains does not exist for Likoang, but that they are estimated to be on the order of ~1.3 million (Plug et al. 2010:3114).

Both the density of fish remains and their abundance relative to mammals are low in the oldest layer sampled at Sehonghong (RFS), which is now dated to between 30,615 and 29,206 cal BP (figure 6.5; table 6.2). Both measures of fish prevalence then increase, peaking in BAS, the oldest layer assigned to the late Pleistocene Robberg Industry; associated AMS radiocarbon dates fall between 25,178 and 24,022 cal BP. Fish remains decline sharply in the succeeding RBL/CLBRF layer, which is now dated to 15,725–15,163 cal BP, but pick up again in the two youngest Robberg-associated layers, RF and BARF, which have dates of between 14,877 and 12,559 cal BP. Their density and relative abundance then decline sharply once more in the early and middle Holocene parts of the sequence (Layers SA, ALP, and GWA, 11,595–6537 cal BP) (figure 6.5; table 6.2). The period from 6537 to 1691 cal BP is not represented at Sehonghong, but its second half is present at Likoang, where the basal excavated deposits date to c. 3400–3000 cal BP. Fish are relatively unimportant in these lowest horizons, but increase dramatically from Layer XIV onward (c. 3000 cal BP) both in absolute terms and relative to the frequency with which mammal remains were introduced to the site (figure 6.5; table 6.3). Overlapping with the end of the Likoang sequence, Layer GAP (1691–980 cal BP) at Sehonghong also registers a high incidence of fish. However, they are very rare in the latter part of this time range at Likoang (i.e., in Layer I, that site's youngest occupation). For the last thousand years, fish numbers are again high at Sehonghong (though not as high as in GAP), but a lack of

stratigraphic resolution for these layers (DC/SS) precludes matching any part of them closely with the sample from Pitsaneng (Hobart 2004).

We have hypothesized that people will have intensified their use of fish during colder climatic episodes (after Binford 2001:368). On the whole our data appear to support this. For example, peaks of fishing activity occur in the Sehonghong sequence at 25,178 to 24,022 cal BP (Layer BAS) and between 14,877 and 12,559 cal BP (Layers RF and BARF) and at Likoaeng in layers dated to c. 3000–1749 cal BP (Layers XIV–VII/IX) (figure 6.5). The first of these episodes coincides with the LGM onset, the second with the ACR, which interrupted the last deglaciation (c. 14,700–13,000 cal BP) (Pedro et al. 2016), although its precise impact in southern Africa remains unclear (Chevalier and Chase 2015; Green et al. 2015; Pedro et al. 2016), and the third with the late Holocene Neoglacial (Parker et al. 2011). We suggest that enhanced fishing was part of a strategy to broaden diets as the descent of C₃-dominated alpine grasslands that today occur $\geq 2,100$ – $2,700$ masl reduced the abundance and availability of edible plants, as well as ungulate grazing capacity and biomass. Search costs for large game and edible plant foods would consequently have increased. A sharp decline in large ungulate hunting with the onset of the Neoglacial is especially apparent at Likoaeng (figure 6.5e). At the same time, higher winter snowfalls during these cold episodes would have generated greater spring/early summer river flow as snow melted (Mills et al. 2012), which should have benefited *Labeobarbus aeneus* and the size of its spawning runs. Conversely, during warmer periods immediately before the onset of the LGM and the ACR (represented at Sehonghong by Layers RFS and RBL/CLBRF respectively), in the early and middle Holocene (Sehonghong Layers SA, ALP, and GWA), and at the very base of the Likoaeng sequence (Layers XV–XVII) game and plant resources were probably more abundant and relatively little emphasis was placed upon fishing.

Our data do, however, show an interesting exception to this latter pattern. Whereas fishing declined as temperatures rose after the earlier two cold phases (LGM and ACR), this does not appear to have been the case following the Neoglacial at Likoaeng. There, the dietary emphasis on fish remained strong into the first millennium AD even if densities fell, before dropping off steeply in Likoaeng's uppermost stratum, Layer I (c. 1309–981 cal BP) (figure 6.5, table 6.3). The Neoglacial is not represented at Sehonghong, but the site's second highest stratum—Layer GAP (1691–980 cal BP)—overlaps with Likoaeng's immediately post-Neoglacial, first-millennium AD layers. Echoing the latter, Layer GAP contains the highest density and relative abundance of fish remains of the entire Sehonghong sequence (figure 6.5). We are

TABLE 6.2. Sehonghong and Pitsaneng: proportion of fish versus mammals, by layer, calculated using NISP

| <i>Age cal BP</i> | <i>Layer</i> | <i>NISP</i> | | <i>Percentage ratio fish/mammal</i> |
|-------------------|--------------|-------------|---------------|---|
| | | <i>Fish</i> | <i>Mammal</i> | |
| SEHONGHONG | | | | |
| ≤ 1200 | DC/SS | 5,489 | 910 | 86/14 |
| 1691–980 | GAP | 4,042 | 170 | 96/04 |
| 6931–6548 | GWA | 107 | 933 | 10/90 |
| 8297–7697 | ALP | 726 | 1,855 | 28/72 |
| 11,595–10,255 | SA | 442 | 1,190 | 27/73 |
| 13,395–12,559 | BARF | 78 | 72 | 52/48 |
| 14,877–13,744 | RF | 1,473 | 757 | 66/34 |
| 15,725–15,163 | RBL/CLBRF | 208 | 921 | 18/82 |
| 25,178–24,022 | BAS | 1,626 | 653 | 71/29 |
| 24,420–23,914 | OS | 76 | 104 | 42/58 |
| 25,019–24,058 | MOS | 63 | 142 | 31/69 |
| 30,615–29,206 | RFS | 3 | 40 | 07/93 |
| PITSANENG | | | | |
| | All contexts | 911 | 4,175 | 18/82 |

tempted to suggest that these fish-rich post-Neoglacial strata at Likoang and Sehonghong coincide with a cold, moist period indicated by the development of pronival ramparts in the high Drakensberg ¹⁴C-dated to 1702–1602 cal. BP (Grab and Mills 2011:183). However, testing this would require better chronological control in this part of these sequences than we currently possess. Poorly resolved stratigraphy in Sehonghong's uppermost and only slightly less fish-rich Layer DC/SS (≤ 1200 cal BP) also means that we cannot say whether and how many fish there relate to any putative Little Ice Age occupation of the site. Newly obtained radiocarbon dates for a DNA-analyzed mammalian bone from Layer DC do, however, point to at least one focused occupation very close in time to the tail end of that represented by GAP, between 1173 and 933 cal BP (Horsburgh et al. 2016). Pitsaneng presents similar dating difficulties, though we know that it was occupied during both the Little Ice Age and the preceding Medieval Warm Epoch (Hobart 2004). If these late Holocene episodes of enhanced fishing buck the trend described in this chapter by not correlating to colder climatic intervals, future research should

TABLE 6.3. Likoang: proportion of fish *versus* mammals, by layer, calculated using NISP

| Age cal BP | Layer | NISP | | Percentage ratio fish/mammal |
|------------|--------|--------|--------|---------------------------------|
| | | Fish | Mammal | |
| 1309-980 | I | 96 | 45 | 68/32 |
| | II | 308 | 3 | 99/01 |
| 1811-1615 | III | 5,510 | 293 | 95/05 |
| | IV | 58 | 8 | 88/12 |
| 2085-1610 | V | 7,548 | 108 | 99/01 |
| | VI | 2,727 | 78 | 97/03 |
| 2096-1749 | VII/IX | 21,660 | 575 | 97/03 |
| | X | 62 | 1 | 98/02 |
| 2703-2180 | XI | 2,683 | 297 | 90/10 |
| | XII | 41 | 17 | 71/29 |
| 3064-2382 | XIII | 19,138 | 910 | 95/05 |
| | XIV | 808 | 188 | 81/19 |
| 3687-3411 | XV | 162 | 117 | 58/42 |
| | XVI | 89 | 45 | 66/34 |
| 3395-2845 | XVII | 324 | 107 | 75/25 |

pursue alternative hypotheses for their occurrence, perhaps rooted in more widespread indications of population increase at this time (Mitchell 2002).

In addition to the intensity with which fish were procured, changes are also apparent in the relative frequency of different fish species over time and between sites. At Sehonghong *Labeobarbus aeneus* dominates every sample at a percentage NISP frequency of ≥ 80 percent, while *Austroglanis sclateri* and *Labeo capensis* oscillate between second and third position but become more common overall in the mid- and late Holocene (Layers GWA, GAP, and DC/SS). The pattern at Likoang is quite different: *Labeobarbus aeneus* is more common than *Labeo capensis* in the small samples from Layers XVII (NISP = 74) and XVI (NISP = 31), but these positions are reversed in Layers XV, XIV, and lower XIII. *Labeobarbus aeneus* is then again the most common taxon in the middle of Layer XIII, but declines thereafter and is present in only trace amounts in the remainder of the sequence, which is wholly dominated by *Labeo capensis*. *Austroglanis sclateri* is almost entirely absent at Likoang. *Labeobarbus kimberleyensis*, the largemouth yellowfish, registers a minimal presence in all but the smallest samples, but is almost wholly absent from

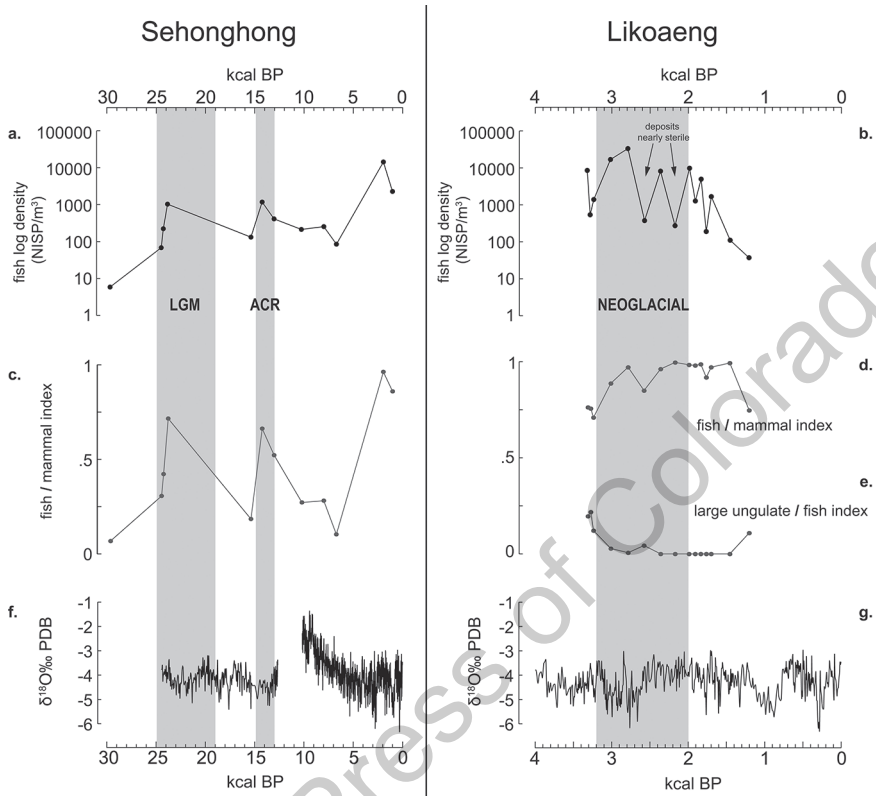


FIGURE 6.5. Fluctuations in the densities of fish remains at (a) Seohonghong and (b) Likoang, expressed as Number of Identifiable Specimens (NISP) per cubic meter of deposit, and fluctuations in fish:mammal ratios for (c) Seohonghong and (d) Likoang as well as (e) large ungulate:fish ratios for Likoang (where large ungulates are defined as size class 3 and above; Brain 1981). Also shown is the semicontinuous $\delta^{18}\text{O}$ speleothem record from Cold Air Cave (Makapansget Valley, South Africa; Holmgren et al. 2003) in (f) its full 25 kyr span and (g) only the past 4 kyr. The cold phases under discussion—the LGM, ACR and Neoglacial—are highlighted in gray.

Seohonghong, while *Clarias gariepinus*, the sharptooth catfish, is extremely rare at both sites. Pitsaneng most closely resembles Layers DC/SS at Seohonghong, with which it is broadly contemporary.

Some of these intersite differences likely reflect differences in the season at which fish were taken, in the permanency of river flow and other water

TABLE 6.4. NISP and MINI frequencies of the fish taxa present at Seohonghong (by layer).

| Taxon | DC/SS | GAP | GWA | ALP | SA | BARF | RF | RBL/ CLBRF | BAS | OS | MOS | RFS |
|--|--------------|--------------|------------|------------|------------|-----------|--------------|---------------|--------------|-----------|-----------|----------|
| NISP | | | | | | | | | | | | |
| <i>Labecobarbus kimberleyensis</i> | — | 1 | — | — | — | — | 16 | — | 4 | — | — | — |
| <i>Labecobarbus cf. kimberleyensis</i> | 1 | 11 | — | — | — | — | — | — | 1 | — | — | — |
| <i>Labecobarbus aeneus</i> | 1,645 | 1,316 | 22 | 226 | 84 | 11 | 449 | 31 | 233 | 31 | 16 | 1 |
| <i>Labecobarbus cf. aeneus</i> | — | — | — | — | — | — | — | — | 140 | — | — | — |
| <i>Labeo capensis</i> | 140 | 70 | 3 | 13 | 12 | — | 23 | — | 6 | 1 | — | — |
| <i>Labecobarbus/Labeco</i> | 1 | 2,515 | 48 | 472 | 345 | 56 | 974 | 166 | 1,218 | 44 | 46 | 2 |
| <i>Austroglanis sclateri</i> | 259 | 129 | 3 | 15 | 1 | — | 11 | 3 | 1 | — | 1 | — |
| <i>cf. Austroglanis sclateri</i> | 9 | — | — | — | — | — | — | 2 | — | — | — | — |
| <i>Claris gariepinus</i> | 2 | — | — | — | — | — | — | — | — | — | — | — |
| Not identified | 3,432 | — | 31 | — | — | 11 | — | 6 | 23 | — | — | — |
| Total | 5,489 | 4,042 | 107 | 726 | 442 | 78 | 1,473 | 208 | 1,626 | 76 | 63 | 3 |
| MINI | | | | | | | | | | | | |
| <i>Labecobarbus kimberleyensis</i> | — | 1 | — | — | — | — | 2 | — | 1 | — | — | — |
| <i>Labecobarbus cf. kimberleyensis</i> | 1 | 1 | — | — | — | — | — | — | 1 | — | — | — |
| <i>Labecobarbus aeneus</i> | 83 | 55 | 2 | 11 | 10 | 2 | 15 | 5 | 30 | 3 | 3 | 1 |

continued on next page

TABLE 6.4—continued

| Taxon | DC/SS | GAP | GWA | ALP | SA | BARF | RF | RBL/ | | OS | MOS | RFS |
|----------------------------------|------------|-----------|----------|-----------|-----------|----------|-----------|----------|-----------|----------|-----------|----------|
| | | | | | | | | CLBRF | BAS | | | |
| <i>Laebobarbus cf. aeneus</i> | — | — | — | — | — | — | — | — | 9 | — | — | — |
| <i>Laebo capensis</i> | 8 | 5 | 1 | 2 | 1 | — | 2 | — | 3 | 1 | — | — |
| <i>Laebobarbus/Laebo</i> | — | 17 | 3 | 4 | 6 | 3 | 8 | 3 | 22 | 2 | 6 | 1 |
| <i>Austroglanis sclateri</i> | 43 | 18 | 1 | 3 | 1 | — | 2 | 1 | 1 | — | 1 | — |
| cf. <i>Austroglanis sclateri</i> | — | — | — | — | — | — | — | — | — | — | — | — |
| <i>Claris gariepinus</i> | 1 | — | — | — | — | — | — | — | — | — | — | — |
| Not identified | 18 | — | — | — | — | — | — | — | — | — | — | — |
| Total | 154 | 97 | 7 | 20 | 18 | 5 | 29 | 9 | 67 | 6 | 10 | 2 |

Note: Columns are arranged in order from the youngest layer (DC/SS) at the left to the oldest (RFS) at the right.

TABLE 6.5. NISP and MNI frequencies of the fish taxa present at Likoaeng.

| Taxon | I | II | III | IV | V | VI | VII/IX | X | XI | XII | XIII | XIV | XV | XVI | XVII |
|---------------------------------------|---|----|-----|----|----|----|--------|---|----|-----|-------|-----|----|-----|------|
| NISP | | | | | | | | | | | | | | | |
| <i>Laebobarbus kimberleyensis</i> | — | 1 | 187 | 1 | 23 | 76 | 388 | — | 25 | 2 | 133 | 3 | — | 1 | — |
| <i>Laebobarbus cf. kimberleyensis</i> | — | — | 2 | — | 12 | 13 | 55 | — | — | — | 12 | — | — | — | — |
| <i>Laebobarbus aeneus</i> | — | — | 82 | 2 | 54 | 14 | 228 | — | 9 | — | 3,246 | 69 | 19 | 19 | 35 |
| <i>Laebobarbus cf. aeneus</i> | 1 | 5 | 5 | — | 20 | 25 | 36 | — | — | — | 11 | 2 | 1 | — | — |
| <i>Laebobarbus</i> spp. | 6 | — | 30 | 1 | 16 | 51 | 310 | — | 23 | 2 | 309 | 22 | 4 | — | — |

continued on next page

TABLE 6.5—continued

| Taxon | I | II | III | IV | V | VI | VIII/X | X | XI | XII | XIII | XIV | XV | XVI | XVII | |
|---|-----------|------------|--------------|-----------|--------------|--------------|---------------|-----------|--------------|-----------|------------|-----------|----------|----------|-----------|--|
| <i>Labeo capensis</i> | 33 | 93 | 2,203 | 28 | 3,531 | 965 | 9,486 | 23 | 783 | 14 | 2,974 | 196 | 51 | 11 | 31 | |
| <i>Labeoobarbus/Labeo</i> | 55 | 209 | 2,993 | 25 | 3,889 | 1,583 | 11,152 | 39 | 1,842 | 23 | 12,447 | 516 | 87 | 58 | 247 | |
| <i>Clarias gariepinus</i> | 1 | — | 8 | 1 | — | — | 2 | — | 1 | — | 5 | — | — | — | 8 | |
| <i>Austroglanis sclateri</i> | — | — | — | — | 2 | — | — | — | — | — | 1 | — | — | — | — | |
| cf. <i>Austroglanis sclateri</i> | — | — | — | — | 1 | — | 3 | — | — | — | — | — | — | — | — | |
| Total | 96 | 308 | 5,510 | 58 | 7,548 | 2,727 | 21,660 | 62 | 2,683 | 41 | — | — | — | — | — | |
| MNI | | | | | | | | | | | | | | | | |
| <i>Labeoobarbus kimberleyensis</i> | — | 1 | 9 | 1 | 3 | 4 | 20 | — | 3 | 1 | 9 | 1 | — | — | — | |
| <i>Labeoobarbus</i> cf. <i>kimberleyensis</i> | — | — | 0 | — | 1 | 0 | 1 | — | — | — | 2 | — | — | — | — | |
| <i>Labeoobarbus aeneus</i> | — | — | 5 | 1 | 6 | 3 | 12 | — | 2 | — | 178 | 6 | 2 | 3 | 4 | |
| <i>Labeoobarbus</i> cf. <i>aeneus</i> | 1 | 2 | 0 | — | 1 | 0 | 0 | — | — | — | 1 | 0 | 0 | — | — | |
| <i>Labeoobarbus</i> spp. | 1 | — | 0 | 1 | 1 | 3 | 6 | — | 2 | 0 | 6 | 1 | 2 | — | — | |
| <i>Labeo capensis</i> | 5 | 5 | 129 | 5 | 173 | 50 | 429 | 4 | 31 | 3 | 114 | 12 | 4 | 3 | 4 | |
| <i>Labeoobarbus/Labeo</i> | 1 | 1 | 9 | 0 | 9 | 12 | 10 | 1 | 2 | 0 | 26 | 7 | 1 | 1 | 8 | |
| <i>Clarias gariepinus</i> | 1 | — | 1 | 1 | — | — | 1 | — | 1 | — | 2 | — | — | — | 1 | |
| <i>Austroglanis sclateri</i> | — | — | — | — | 1 | — | — | — | — | — | 1 | — | — | — | — | |
| cf. <i>Austroglanis sclateri</i> | — | — | — | — | 1 | — | 2 | — | — | — | — | — | — | — | — | |
| Total | 9 | 9 | 153 | 9 | 196 | 72 | 481 | 5 | 41 | 4 | 339 | 27 | 9 | 8 | 17 | |

Note: Columns are arranged in order from the youngest layer (I) at the left to the oldest (XVII) at the right.

TABLE 6.6. Pitsaneng: NISP frequencies of fish taxa (after Hobart 2004). Note that MNI frequencies could not be calculated at this site because of small sample size and the interdependence of the excavated samples.

| <i>Taxon</i> | <i>NISP</i> |
|--|-------------|
| <i>Labeobarbus</i> cf. <i>kimberleyensis</i> | 3 |
| <i>Labeobarbus</i> cf. <i>aeneus</i> | 79 |
| <i>Labeobarbus</i> spp. | 137 |
| Cf. <i>Labeobarbus</i> | 1 |
| <i>Labeobarbus/Labeo</i> | 1 |
| Cf. <i>Labeo</i> sp. | 1 |
| Unidentified cyprinids | 483 |
| <i>Austroglanis sclateri</i> | 52 |
| <i>Austroglanis</i> sp. | 2 |
| Unidentified catfish | 9 |
| Unidentified fish | 150 |
| Total | 918 |

conditions between the Senqu River and its Sehonghong tributary (on which both Sehonghong and Pitsaneng lie), and perhaps also in changes in fishing strategy or in the overall role of fishing within broader subsistence–settlement decisions. The enhanced representation of *Austroglanis sclateri* at Sehonghong and Pitsaneng, for example, likely reflects its preference for side streams over larger rivers, even though it occurs at the confluence of the Sehonghong and Senqu Rivers today (Arthington et al. 2003). At Likoang, in contrast, the high presence of *Labeo capensis* probably derives from the opportunity provided by the shallow rapids adjacent to this site for intercepting it when it spawns in spring to midsummer, with a most probable focus in November (Plug et al. 2010:3117). *Labeobarbus aeneus*, on the other hand, breeds slightly later, with a peak in spawning activity in January (Nthimo 2000). At those times when it dominates at Likoang (middle and lower Layer XIII) the site was therefore likely occupied rather later in summer; the greater number of very small—and thus immature—individuals identifiable only as *Labeobarbus/Labeo* found in these levels and in Layer XIV supports this (Plug et al. 2010:3117). The more equal presence of both *Labeo capensis* and *Labeobarbus aeneus* toward the base of the Likoang sequence may instead indicate a more extended fishing season c. 3400–2800 cal BP stretching from October (when *Labeo capensis* begins to spawn) to February (when *Labeobarbus aeneus* ceases to do so) (Plug et al.

2010:3117). Conversely, whether or not the smallmouth yellowfish recovered at Sehonghong were obtained from the Sehonghong River itself and/or the main Senqu channel, the consistent dominance of this species across the past 30,000 years at this site suggests that fishing—and perhaps other aspects of the site’s occupation—were heavily focused on summer, rather than spring, as originally suggested by Carter (1978).

To explain why *Labeobarbus aeneus* was specifically targeted in preference to *Labeo capensis* during the occupation of Likoaeng Layers XIII and XIV we need to consider climate. As we have already noted, a range of paleoenvironmental evidence, including charcoal studies, phytolith samples, and SOM $\delta^{13}\text{C}$ analysis of the sediments from which they derive (Mitchell et al. 2011; Parker et al. 2011), indicates a pronounced shift toward a C_3 -dominated grassland and generally cooler, wetter conditions around 3000 cal BP, equivalent to a $\geq 400\text{-m}$ lowering of high-elevation alpine grassland and a likely minimum temperature depression of 2.5°C (Parker et al. 2011:208). *Labeobarbus aeneus* requires water temperatures of $18\text{--}21.5^\circ\text{C}$ for its eggs to incubate successfully, whereas *Labeo capensis* demands a temperature at the extreme upper end of this range (Arthington et al. 2003). The Neoglacial downturn registered by the Likoaeng sequence, and confirmed by multiple other data sets from the Maloti-Drakensberg Mountains (Lewis 2005, 2008; Rosen et al. 1999) and more broadly in southern Africa (Holmgren et al. 2003; Lee-Thorp et al. 2001) between 3200/2900 and 2400/2300 cal BP, may thus have favored the more cold-tolerant smallmouth yellowfish over the Orange River mudfish. In turn, this may have encouraged people to camp at Likoaeng later in the year when *Labeobarbus aeneus* migrated upstream past the site or spawned there on coarser gravel substrates in the main riverbed. At the same time, lower snowlines and thus increased flooding in spring/early summer may have enhanced the predictability and size of fish runs. When climatic conditions reversed and the Neoglacial came to an end we can expect that the constraints on *Labeo capensis* populations eased. As a result people shifted their exploitation focus toward it and an earlier point in the spring/summer, when the importance of fish as a substitute for other foods (especially those rich in fat) is likely to have been greater than later in the year.

These seasonal changes in site use serve to remind us that any understanding of fish exploitation must be situated within the broader context of hunter-gatherer settlement-subsistence strategies as a whole. With very few sites—especially smaller sites rather than large rockshelters—having yet been excavated in highland Lesotho and continuing difficulties in developing a robust chronology for open-air artifact scatters, we are still a long way from achieving this (Mitchell 1996b). Nevertheless, along with the likelihood that

fish were particularly favored as a resource when conditions became colder, we need to acknowledge that their relative predictability in space and time could also have made them attractive at other times, especially given the paucity of other fat- (or carbohydrate-) rich resources available in this environment in spring/early summer. This may have made fish an appealing resource focus around which people could aggregate for several weeks or even a couple of months for purposes that were as much as social as they were economic (Carter 1970; Wadley 1987). However, we currently lack additional evidence from the Lesotho highlands for enhanced exploitation of aquatic resources in a broader context of social intensification as proposed by Hall (1990, 2000) in the Fish River Basin of South Africa's Eastern Cape Province.

DISCUSSION

Climatic cooling appears to have affected highland Lesotho in complex ways, simultaneously impoverishing terrestrial plant and animal resources while improving conditions for certain taxa of freshwater fish. Although a detailed understanding of highland paleoenvironments remains elusive, it is self-evident from the topography of the Maloti-Drakensberg Mountains that people can more easily travel along the main river valleys rather than directly across the mountain ranges and uplands between them (Stewart et al. 2016). Preliminary analysis of the likely distribution of resources (edible and non-edible) of interest to hunter-gatherers in the greater Sehonghong area (Mitchell 1996b) has indicated the importance of river valleys and the immediately adjacent plateaus up to about 2,000 masl. In contrast, higher areas may have been only infrequently visited—to hunt, to collect flakeable rock or geophytes (plants with edible underground storage organs), or while passing through en route elsewhere. The overall distribution of archaeological sites supports this (Mitchell 1996b: table 6.4). Under Neoglacial conditions the extensive (≥ 400 m) depression of vegetation belts inferred at Likoang can only have reinforced this pattern, something surely even truer of stadial episodes in the Pleistocene. The downslope movement of nutrient-poor alpine grasses at such times would have thinned local populations of grazing ungulates, substantially raising search costs for human hunters. Increased snowfall in spring, autumn, and winter (Mills et al. 2012) may have further impeded ungulate grazing and browsing opportunities and human mobility. As Pat Carter (1976, 1978) presciently argued four decades ago, we can infer from this that human use of the Lesotho highlands under stadial conditions was substantially—and perhaps quite narrowly—focused along the Senqu Valley

and its lower tributaries relative to periods of greater warmth. People—and the plant, animal, and firewood resources on which they depended—will have become increasingly packed along these linear corridors as the attractions of using other parts of the landscape declined. Aquatic resources are predicted to have become more important in cool to cold environments under precisely such conditions (Binford 2001:368; Kelly 2013), and this is what our data show. The very restriction of fish to rivers will, moreover, have encouraged a degree of positive feedback here, and thus a yet more linear focus for human settlement and activity (Binford 2001:384).

In further support of this, we note other indications of people intensifying their use of river valley sites during cold phases. The Neoglacial levels at Likoaeng (Layers XV–XI) contain the highest densities of both lithic artifacts and bone of the sequence's four occupational pulses (Mitchell et al. 2011; Plug et al. 2003). At Sehonghong, Layer BAS, which dates to immediately before the LGM, sees a sharp increase in artifact densities relative to the underlying terminal MSA and transitional MSA/LSA strata (Mitchell 1994, 1995). When humans returned to the site after the height of the LGM, densities remain high. In contrast, higher-altitude zones of the Maloti–Drakensberg witness a complete absence of occupation at this time at Moshebi's Shelter and Ha Soloja in the Sehlabathebe Basin southeast of Sehonghong (Carter 1978). Excavations at sites on the South African side of the uKhahlamba–Drakensberg Escarpment have likewise failed to produce evidence of Pleistocene occupation (Mitchell 2009a). Conversely, Melikane, 40 km south of Sehonghong and, like it, situated on a tributary of the Senqu, *does* have evidence of occupation ~24,000 cal BP, contemporary with Layer BAS at Sehonghong, and again in the form of an as-yet-undated Robberg assemblage later in the Pleistocene (B. Stewart et al. 2012). Fish are, however, almost entirely absent here, a product perhaps of poor preservation, but also of this site's having been used principally in winter, when fish were probably less abundant and harder to catch (Carter 1978). Should archaeological deposits of Pleistocene age be located along the other major river system of highland Lesotho—the Senqunyane—where only very limited survey work and almost no excavation has yet taken place (Bousman 1988; Kaplan and Mitchell 2012), we predict that they too will show evidence for intensified use of fish coincident with the LGM, the ACR, and the late Holocene Neoglacial.

Regional dietary intensification and resultant shifts in settlement and demography can also be expected to have engendered changes to hunter-gatherer technologies. In addition to shifts in raw material procurement and reduction, the reconfiguration of highland groups into more packed, river valley–focused subsistence-settlement regimes could have impacted rates of technological

innovation. At Sehonghong, the immediately pre-LGM-aged Layer BAS (25,178 to 24,022 cal BP) correlates with the region's earliest full-blown LSA technocomplex—the microlithic, bladelet-rich Robberg Industry (Mitchell 1995). In fact, Layer BAS at Sehonghong is currently the oldest occurrence anywhere in southern Africa of Robberg technology, which then persists until the cessation of the second cold phase registered in the ACR-aged Layers RF and BARF (14,877 to 12,559 cal BP). Various ideas have been advanced to explain the Robberg's origins, uses, and spatial distribution (Binneman 1997; Binneman and Mitchell 1997; Deacon 1984a, 1984b; Mitchell 1988, 2002; Parkington 1984, 1990), review of which is beyond the scope of this chapter. Here we note only that the early onset of such a major technological reorganization in a highland context as regional environments responded to climatic deterioration in early MIS 2 is striking. Whether such innovations originated in the Maloti-Drakensberg and spread to other regions, were imported into the mountains from elsewhere in southern Africa, or arose independently in multiple locations must await better chronological resolution for relevant Robberg assemblages across the subcontinent, work on which we are currently engaged. But we suspect that the industry's multicomponent tools, for which standardized bladelets likely functioned as replaceable parts (Mitchell 2002:122), offered highland foragers enhanced reliability in the face of heightened search costs such as those suggested by our data. Such tools may have served as essential gear, in the Maloti-Drakensberg at least, for logistical (upland?) extraction forays by late Pleistocene foragers whose primary resource base had become constrained to the Orange-Senqu River valley and its principal tributaries.

Changes to the lithic repertoire are less evident during the Neoglacial at Likoang, but the sheer quantities of fish taken at this site may suggest innovations in other technologies—specifically the employment of mass-capture techniques. Without doubt, a variety of fishing techniques were practiced at the site, including angling and spearing or killing with bow and arrow, as suggested by a single bone hook and several fish crania bearing punctures consistent in diameter with bone points, respectively (Plug et al. 2010). Both techniques are also documented ethnohistorically (Vinnicombe 2009) and spearing—using both barbed spears and leisters—is, as we have indicated, depicted in local rock art (figure 6.3). We imagine that some fish were probably also caught by hand. However, a more efficient method of intercepting fish spawning runs would have been to use baskets and/or fences and drag screens, methods that are also depicted in the region's rock art, including a panel directly adjacent to Likoang itself (Challis et al. 2008:figure 10). Though difficult to test, the dramatic change in subsistence emphasis from terrestrial to aquatic

resources during the Neoglacial (Plug et al. 2003) may signal the development of new (or the reemployment of preexisting) mass-capture methods for maximizing fish returns during multiple, albeit brief, spawning runs (Arthington et al. 1999; Cambray 1985). Support for this comes from variation through the sequence in the size of fish taken, with the lower, Neoglacial-aged layers (particularly XIII and XIV) containing by far the highest number of small and very small individuals, many of which were immature (Plug et al. 2010). Although this may partly stem from the shift toward a more extended (spring to midsummer) occupation suggested by higher numbers of adult (spawning) *Labeobarbus aeneus* (Plug et al. 2010) that we discussed above, it could equally (also) reflect the more balanced age profile expected with nonselective mass capture, as argued for very similar changes in fish assemblages at LSA sequences in the Nile Valley (Sudan and Egypt) and northern Kenya (K. Stewart 1989:227–232).

The intensified use of aquatic resources during cold phases also raises the question of food storage. On the basis of his 339 ethnographic cases, Binford (2001) found that foragers living in regions with $ET < 15.25^{\circ}\text{C}$ are expected to practice food storage even at low densities, with investments in food storage increasing as ET reduces further and populations become more packed (Johnson 2014:15). Those living in areas with ETs of $< 12.75^{\circ}\text{C}$ are dependent on aquatic resources or, if unavailable, terrestrial animals, although in none of Binford's ethnographic cases was the latter a viable intensification option (Johnson 2014:15). Today, as mentioned above, the entirety of highland Lesotho has ETs below Binford's "storage threshold" (figure 6.2). While modeling past ETs is not currently possible, the evidence presented above for average annual temperature reductions of between -2.5°C (Neoglacial) and -5°C (later Pleistocene) makes it probable that these cold phases pushed the highlands below Binford's "terrestrial plant dependence threshold" as well. Our archaeological data support this; in cold phases the upper Orange-Senqu fluvial system appears to have offered foragers a good intensification option as terrestrial environments became more impoverished, plant and animal resources more costly to obtain, and people more tethered to deep river valleys. But did highland groups practice a delayed return economy? At Likoang, fishing ramps up in Layer XIV (c. 3000 cal. BP; NISP = 808) before increasing exponentially in the overlying Layer XIII (2978–2382 cal. BP), when fish remains (NISP = 19,138) massively outnumber those of mammalian fauna (NISP = 414). With such vast quantities, we may ask whether some or most of this meat was dried or smoked for later consumption in a leaner season (winter/early spring). Signs of fish being processed for storage are, however,

absent at Likoaeng; vertebrae and especially intermuscular bones, which typically remain embedded in fish removed from the site, are well represented, and features consistent with fish smoking or drying absent (Plug et al. 2010:3121). Rather than signaling storage, therefore, the immense quantities of fish at the site have been interpreted as supporting spring/summertime aggregations of hunter-gatherers (Plug et al. 2003, 2010).

How, then, did foragers overwinter in highland Lesotho's continental climate without food storage, considering its improbability according to Binford's ethnographic data? The obvious question becomes whether people *did* overwinter in the highlands (Carter 1978), particularly during stadial and Neoglacial phases of heightened cold such as those we have highlighted here. Although continental, Lesotho is situated on the eastern edge of this interior climatic regime. Unlike hunter-gatherers living at higher latitudes, foragers regularly based in the Maloti-Drakensberg therefore had the option of overwintering in much more equable environments, such as the lower-altitude thornveld/bushveld of the midland regions of the Eastern Cape Province or KwaZulu-Natal (Carter 1970). The latter is a temperate zone below 35° S latitude that Binford's (2001:257) ethnographic data suggest hunter-gatherers can readily inhabit without food storage. Moreover, if relatively packed, cold-phase foragers were obliged to abandon the highlands during winter, this would have negated the need for storage and limited the potential for sedentism, thereby offsetting two major factors that typically underpin the kind of labor rearrangements leading to sociopolitical inequalities and ranking (Arnold 1996; Kelly 2013). The Maloti-Drakensberg has produced no archaeological evidence for hereditary social or political ranking, save perhaps for the last few centuries when hunter-gatherers entered into diverse relations with food producers (Blundell 2004; Campbell 1987; Challis 2012; Dowson 1994). Unfortunately, however, a firm understanding of seasonal mobility in the wider region remains stubbornly elusive despite considerable effort (Carter 1970, 1978; Cable 1984; Opperman 1987) and the occurrence in highland sites of items of personal adornment originating from the Indian Ocean (Mitchell 1996c), the frequency of which, incidentally, increases during warmer (early and mid-Holocene) rather than cooler (LGM, ACR or Neoglacial) climatic phases. Resolving patterns of hunter-gatherer seasonal mobility across the wider region should be a major priority for future research.

Finally, what of our argument that highland Lesotho bears out Binford's (2001:368, 385) expectation that hunter-gatherers with an aquatic intensification option should enhance their use of such resources when diminished terrestrial food resources raise the cost of maintaining high mobility? This might

be countered by the fact that Lesotho is not alone in southern Africa in having produced evidence of late Pleistocene fishing activity, since Robbins et al. (1994, 2000) have documented a pulse of fish procurement focused on cichlids, most probably *Serranochromis* spp. and, more especially, sharp-tooth catfish (*Clarias gariepinus*) around 36–30 ka at White Paintings Shelter in the northwestern Kalahari (Robbins et al. 2012, 2016). The same authors have also shown that there is good evidence that fishing was important in this region during the Holocene (Robbins et al. 1998, 2000, 2009), while today and in the recent past Khoe-speaking Bushmen along Botswana's Botlele and Nata Rivers practice/have practiced delayed return economies focused on fishing with heavy investment in nets, traps, and weirs (Cashdan 1986). However, what is significant about the northwestern Kalahari—a notoriously semiarid part of southern Africa—is that these activities depend either on *unearned* water—that is, on the inflow of rain falling hundreds of kilometers to the north in the highlands of Angola—or on significantly wetter conditions locally. The poor preservation of bone at Melikane and the still incomplete nature of excavations of the Pleistocene sequence at Sehonghong currently preclude comparing Lesotho with Botswana for MIS 3, but there is no evidence at present that people focused on fish in the Kalahari during MIS 2, even though conditions there were significantly wetter on several occasions at this time (see Burrough 2016).

CONCLUSION

Integrating archaeological and paleoenvironmental data, we have argued in this chapter for a connection between phases of heightened hunter-gatherer exploitation of freshwater fish and proxy data indicative of reduced temperatures in southern Africa's Maloti-Drakensberg Mountains. Such correlations have recently become clear to us because of fresh proxy paleoenvironmental analyses and significant new bodies of radiometric dates. We concentrated on three archaeological sites with well-preserved fish remains—Sehonghong, Likoaeng, and Pitsaneng—and particularly on the former two because of their larger assemblages and longer sequences. Two spikes in the frequencies of fish remains at Sehonghong and a third at Likoaeng coincide respectively with the early LGM and ACR in the late Pleistocene, and the late Holocene Neoglacial. Estimates of average annual temperature reductions during these phases range from -2.5°C (Neoglacial) to -5°C (early LGM). Reductions of this magnitude would likely have pushed the region's ET below Binford's terrestrial plant dependence threshold of 12.75°C , negating plants as a primary subsistence base let alone a viable intensification option. Multiple proxy data

suggest that these cold phases triggered major descents of altitudinal vegetation belts, with nutrient-poor, C₃-dominated alpine grasses (that today live $\geq 2,100$ – $2,700$ masl, depending on aspect) descending hundreds of meters into the deeply incised Orange-Senqu fluvial system within which these sites are situated ($\sim 1,800$ masl). These shifts would have lowered the highlands' overall carrying capacity for browsing and grazing ungulates, making these highly ranked terrestrial resources more costly to procure. Highland hunter-gatherers appear to have responded by diversifying their subsistence base to include much higher quantities of riverine fish.

We hypothesized that foragers also reoriented their settlement systems toward more constricted, linearly structured arrangements along the upper Orange-Senqu Valley and its main tributaries, with forays into higher altitudes probably occurring on a more logistical basis. The heavier emphasis on fishing and higher costs of hunting may have encouraged adoption of more specialized, efficient, and reliable technologies in the form of mass fish-capture facilities (e.g., weirs, baskets, and drag screens) and multicomponent hunting tools (e.g., spears with replaceable microlithic barbs), respectively. Such technological innovations may have been assisted by the spatial redistribution of highland populations into more packed concentrations within these fluvial corridors. There is currently no evidence, however, that increased yields of aquatic resources—whether by dispatching individuals or mass capture—translated into the practice of food storage, as would be expected on an ethnographic basis (Binford 2001). One plausible alternative, particularly during cold phases, is that foragers negated the need for this by overwintering at lower altitudes across the uKhahlamba-Drakensberg Escarpment in the more temperate climatic regimes of the Eastern Cape and/or KwaZulu-Natal midlands. However, seasonal mobility in the region remains very poorly understood for the whole sweep of hunter-gatherer history. This, and the still uneven nature of archaeological coverage through time, are weaknesses that must be remedied before determining whether and when the region may have encouraged delayed return systems and, by extension, incipient sociopolitical inequalities.

We began by noting the pivotal importance of Kalahari Bushman ethnography not only for the interpretation of the southern African LSA, but also for broader archaeological investigations of past hunter-gatherer (and hominin) behavior. Using insights derived from Binford's (2001) global comparative study of hunter-gatherers within the framework of variation in ET we have shown that, in at least one instance, that of highland Lesotho, LSA hunter-gatherers not only engaged in subsistence activities that are difficult, if not impossible, to parallel in the Kalahari ethnographic record, but did so in ways

consistent with predictions derived from broader anthropological theory. This matters for at least two reasons. The first is because, despite several previous calls to “de-!Kung” the Later Stone Age (Parkington 1984; cf. Hall 1990; Humphreys 2005; Mitchell 2002) and explore a wider range of potentially relevant ethnographic comparanda, there has been little actual effort to do so, notwithstanding well-argued instances from coastal settings in the Western Cape Province for levels of sedentism and territoriality that cannot be matched by anthropological observations in the Kalahari (e.g., Jerardino 1996; Sealy 2006). Second, our choice of highland Lesotho adds weight to the realization that hunter-gatherer communities there did not remain unchanging over the past several thousand years (Mitchell 2009b; Pargeter et al. 2016) and to the caveat that this must be remembered when applying insights gleaned from late nineteenth/twentieth-century Maloti-Drakensberg Bushmen or their descendants to the explication and explanation of Bushman rock art (e.g., Lewis-Williams 2003). But above and beyond these specific contributions, we hope to have demonstrated that investigating southern Africa’s archaeological record against a well-established body of predictive, anthropologically informed theory about hunter-gatherer behavior (e.g., Binford 2001) provides a robust means of learning more about its Stone Age populations.

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this essay we learned with sadness of the murder on his family farm of Gavin Carter, Pat Carter and Patricia Vinnicombe's son, who was present with them during their 1971 excavations at Sehonghong. We hope that, at some point, South Africa will cease to experience mindless violence of this kind.

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