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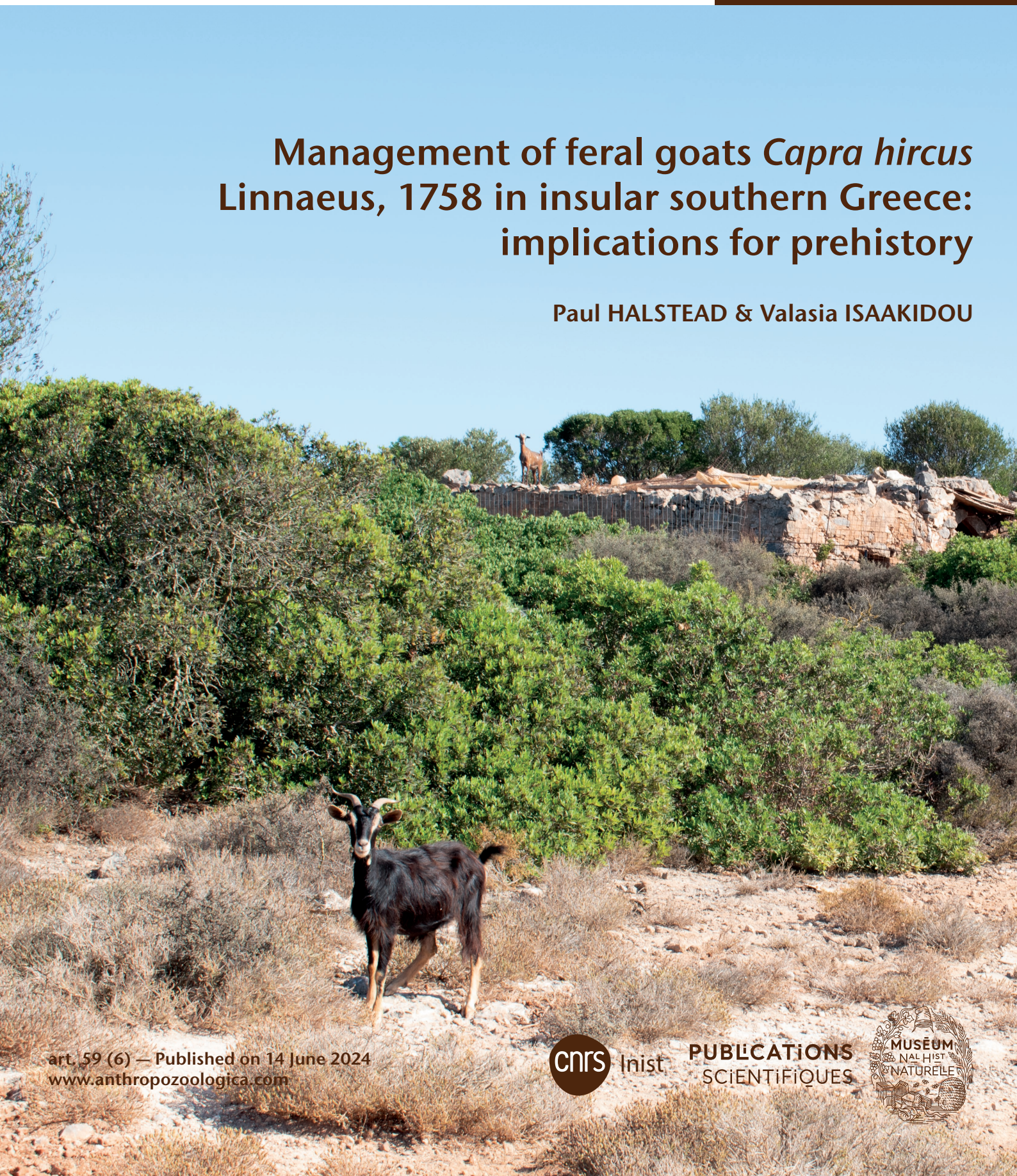
Management of feral goats *Capra hircus* Linnaeus, 1758 in insular southern Greece: implications for prehistory

Paul HALSTEAD & Valasia ISAAKIDOU



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Couverture / *Cover:*
Sur Cythère, les chèvres sauvages *Capra hircus* L. occupaient initialement les parties rocheuses et peu végétalisées du paysage, mais dernièrement, avec l'abandon généralisé des cultures, elles ont étendu leur aire de répartition à des zones où le fourrage est plus riche. Crédit photo : Valasia Isaakidou. / *On Kythera feral goats* Capra hircus *L. initially occupied rocky and sparsely vegetated parts of the landscape but latterly, with the widespread abandonment of cultivation, have expanded their range to areas with richer forage. Photo credit: Valasia Isaakidou.*

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Management of feral goats *Capra hircus* Linnaeus, 1758 in insular southern Greece: implications for prehistory

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ABSTRACT
Populations of feral goats *Capra hircus* Linnaeus, 1758, descended from escaped or released domesticates, are widespread in the islands of Greece. Although they behave like truly wild goats, many of these animals belong to someone and are exploited by their owner(s) primarily as a source of low-cost but high-value meat. While poachers also kill some of these animals for domestic consumption, many owners capture larger groups alive in traps or drives and then release most females but retain most males for sale to urban butchers. Apart from the status of many feral goats as private property, the distinction between such animals and nearby domestic herds is often obscured by the escape or release of domesticates, by the capture and taming of feral individuals, and by the provision of water and perhaps fodder to discourage feral groups from dispersing. Using information from interviews with herders and trappers, supplemented by first-hand observations, we first describe the formation, behaviour and management of recent feral goat populations on the southern Greek islands of Crete, Kythera and Proti. Although the radical changes in rural demography and land use of recent decades have facilitated the expansion of feral goat populations, the mass capture of these animals by trapping or driving is clearly not a recent innovation. We then discuss possible lessons from these observations for the formation of feral populations and for the management of wild, feral and domestic goats in prehistory.

KEY WORDS
Private ownership, trapping, driving, prehistoric Mediterranean.

RÉSUMÉ
La gestion des chèvres férales Capra hircus *Linnaeus, 1758 en Grèce méridionale insulaire : implications pour la préhistoire.*
Des populations de chèvres férales *Capra hircus* Linnaeus, 1758, issues d'animaux domestiques échappés ou libérés, sont répandues dans les îles grecques. Bien qu'ils se comportent comme de véritables chèvres sauvages, beaucoup de ces animaux appartiennent à quelqu'un et sont utilisées par leur(s) propriétaire(s) principalement comme source de viande peu coûteuse mais de grande valeur. Alors que les braconniers tuent eux aussi quelques animaux pour la consommation domestique, de nombreux propriétaires capturent de grands groupes d'animaux vivants dans des pièges ou lors de chasses en battue, puis relâchent la plupart des femelles et conservent la plupart des mâles pour les vendre à des bouchers urbains. Outre le fait que

beaucoup de chèvres férales sont des biens privés, la distinction entre ces animaux et ceux des troupeaux domestiques voisins est souvent masquée par la fuite ou la remise en liberté d'animaux domestiques, par la capture et l'apprivoisement des individus féraux, et par l'approvisionnement en eau et peut-être en fourrage afin d'empêcher la dispersion des troupeaux féraux. À partir des renseignements collectés lors des interviews avec des éleveurs et des trappeurs, complétés par des observations directes, nous décrivons d'abord la formation, le comportement et la gestion des populations récentes de chèvres férales sur les îles de Crète, Cythère et Próti en Grèce méridionale. Bien que les mutations profondes survenues dans la démographie et l'exploitation du territoire rural durant les dernières décennies aient facilité l'expansion des populations de chèvres férales, la capture en masse de ces animaux par piégeage ou en battue n'est manifestement pas une innovation récente. Pour conclure, nous discutons des leçons qui peuvent être tirées de ces observations concernant la formation des populations férales et la gestion des chèvres sauvages, férales et domestiques pendant la préhistoire.

MOTS CLÉS
Propriété privée, piégeage, chasse en battue, Méditerranée préhistorique.

INTRODUCTION

The apparently long-established extant populations of feral goats *Capra hircus* Linnaeus, 1758 on western Crete (*agrímia*) and Mallorca have attracted considerable scholarly attention, both as distinctive components of insular Mediterranean biogeography and as potential guides to the appearance, biology and behaviour of early domestic goats (e.g., Groves 1989; Masseti 2009a). While interbreeding with domestic relatives is a recognized threat to the survival of genetically distinct feral populations, the ebb and flow of goats between domestic and feral status is far more widespread than has often been appreciated. We draw on personal observations and interviews with herders, trappers and hunters between 2014 and 2022 on the southern Greek islands of Crete, Kythera and Proti (Fig. 1) to explore how goats in the recent past have escaped or been released from closely managed herds, were then exploited for meat, and were occasionally reintegrated with domestic stock. We do so with the ultimate aim of shedding light on how anthropogenic introductions to Mediterranean islands formed feral populations and how insular goats may have been exploited (with and without domestication) in the distant past. One respect in which the feral animals on which we report are of particular interest to those studying past human-animal relations is that, in contrast to the "wilder" and better-known Cretan *agrímia* (e.g., Plumakis 2001), they were widely recognized as private property.

GEOGRAPHICAL AND HISTORICAL CONTEXT

Crete, Kythera and Proti all fell in recent centuries under Venetian rule, a point to which we return in passing below, but in other respects are very different. Crete covers approximately 8000 km^2 and has a series of mountain massifs rising above 1000 m: from west to east, the Lefká Óri or White Mountains, Psilorítis or Ída, Asteroúsia, Lasíthi or Díkti, and Thriptí. Of the three islands, it is the most distant (*c.* 300 km) from the great urban market of Athens and its port Piraeus on the Greek mainland, but towns on the north coast of Crete provided local urban markets throughout the 20th century. Kythera covers about 280 km^2 and reaches up to *c.* 500 m above sea level. It lies just 14 km off the southern tip of the Greek mainland, but *c.* 200 km from the Athens-Piraeus conurbation (with poorer maritime connections than Crete), while the largest on-island concentration of consumers was the administrative centre of Khora with just several hundred inhabitants. Proti covers only 3 km^2, rises to less than 200 m and lies just 1200 m off the western coast of the southern Greek mainland, whence it enjoys relatively easy access by road to a few small market towns.

On Crete, extensive cereal agriculture was widely abandoned in the latter decades of the 20th century, but sheep and goat husbandry still thrives, facilitated by the fencing off as enclosed pasture of large areas of former fields and rough grazing. On Kythera too, field crops have largely been abandoned in recent decades, but animal husbandry has also declined, handicapped *inter alia* by limited local demand and the lack of an on-island slaughterhouse. Proti, in the first half of the 20th century, provided a seasonal home to a few families of herders, who also planted small gardens, but is now uninhabited.

TERMINOLOGY: "WILD" AND "FERAL"

In modern Greek, the words "goat" (e.g., *aíga*, *gídi*) and "wild" (*ágria*, *ágrio*) are coupled in a range of contexts from the biologically wild and taxonomically distinct chamois (*Rupicapra rupicapra* Linnaeus, 1758) of central and northern mainland Greece (Ondrias 1965: 124; Papaioannou & Kati 2007), through the long-established feral goats (*agrímia*) of Crete (Husband *et al.* 1986; Geskos 2009) and their more recent feral counterparts discussed here, to domestic goats of unimproved breed. On Proti and Kythera, the feral goat populations are commonly described as "wild", to distinguish them from "tame" goats under closer human control, but on Proti (and in most, if not all, cases on Kythera) they have been beyond close human control for only a few decades. On Crete, a distinction is commonly drawn among feral goats between the long established *agrímia*, more widespread

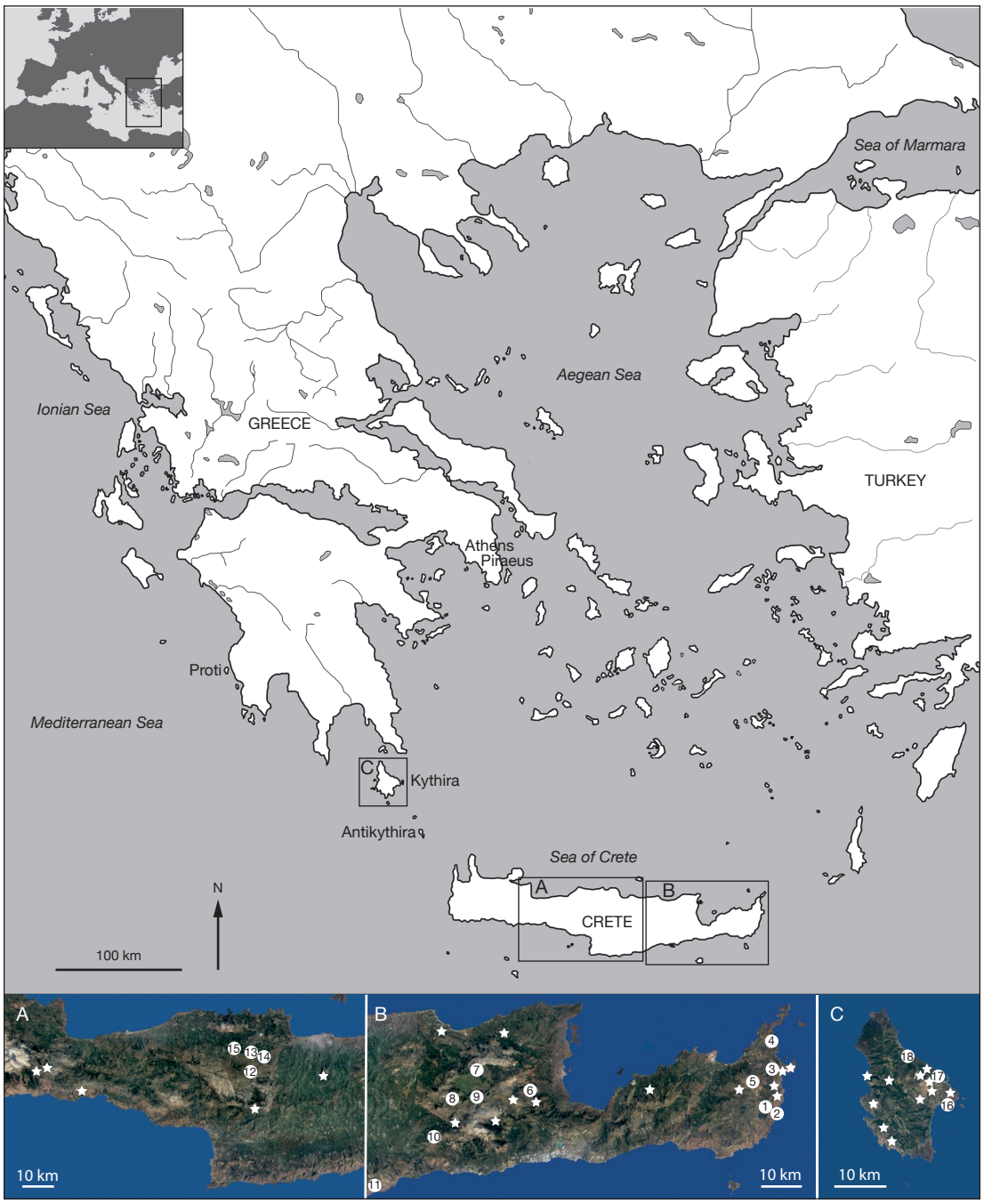

FIG. 1. — Map of Greece showing location of modern feral goat *Capra hircus* Linnaeus, 1758 populations studied by observation or interview with owner: **A**, **B**, named locations on Crete: **1**, Ano Zakros; **2**, Kato Zakros; **3**, Palaikastro; **4**, Toplou monastery; **5**, Xirolimni; **6**, Kritsa; **7**, Tzermiado; **8**, Psychro; **9**, Ag Georgios; **10**, Martha; **11**, Akhendrias; **12**, Anogia; **13**, Sisarkha; **14**, Gonies; **15**, Axos; **C**, named locations on Kythera: **16**, Avlemonas; **17**, Diakofti; **18**, Kakia Langada; other named locations: Antikythera, Proti; *****, locations not mentioned by name in the text. Credits: Google Earth - Data SIO, NOAA, U.S. Navy, NGA, GEBCO Landsat / Copernicus (A-C).

in the 19th century but now restricted to the southwestern mountains and off-shore reserves, and the extant *fouriárika*, *matsária* and *vetsária* of western, central and eastern Crete, respectively. While the former closely resemble the southwest Asian wild goat *Capra aegagrus* Erxleben, 1777 in phenotype (e.g., Masseti 2009b), if not genotype (Bar-Gal *et al.* 2002; Horwitz & Bar-Gal 2006), and are relatively isolated reproductively (Geskos 2009: 3), the latter usually resemble and are closely related to domestic goats in the same locality (for a similar contrast among Mallorcan feral goats, see Seguí *et al.* 2005). In contrast with "wild" *agrímia*, Cretans sometimes refer to the *fouriárika*/*matsária*/*vetsária* as "semi-wild" (*imiágria*), a distinction which less reflects differences of behaviour (Husband & Davis 1984) than the fact that the former belong to no one, while the latter are commonly regarded as private property. The Cretan distinction between "wild" and "semi-wild" feral goats thus essentially matches that drawn by Ingold (1986: 113) between animals that, in cultural rather

than biological terms, are "wild" (i.e. belong to nobody) and those that are "domestic" (i.e. belong to somebody). For the sake of clarity, we hereafter use the term *agrímia* to refer to the animals known by that name on Crete and "feral goats" to refer to those animals on Crete, Kythera and Proti that normally avoid human contact, but are recently descended from or interbred with local domestic herds and are widely considered private property. We follow our informants in using the term "wild" (i.e. Greek *ágria*/*ágrio*) more broadly to refer to animals that avoid human contact and control.

THE ORIGINS AND ANTIQUITY OF FERAL GOAT POPULATIONS ON PROTI, KYTHERA AND CRETE

The recent origins of the feral populations are clearest for Proti, the smallest island. From the early 19th century, a small group of pastoralist families used the island as winter pasture for a thousand or more sheep and goats with which they returned in summer to their home village in the mountains of Arcadia on the adjacent mainland. From the mid-1940s, they abandoned seasonal transhumance, leaving the animals on Proti year-round with two members of each family to water, milk and shear them. As the active herders grew older, however, and the next generation was unwilling to follow this arduous lifestyle, they gave up animal husbandry altogether. Our informant was the last to do so, at the end of the last century: he disposed of his sheep, which he considered unable to fend for themselves without shearing, and stopped milking his goats, which he left to run free on the island as a source of meat. Although he delivers water and, rarely, fodder to the goats and still considers them his private property, they had "turned wild" within five or six years.

On Kythera, informants in their 70s to 90s drew on first-hand participant experience to describe populations of "wild goats" established by at least the mid-20th century on rocky and largely uncultivated terrain bordering the island's western and northeastern shores. Both populations were formed by individuals that escaped or were abandoned from domestic herds, later reinforced by mass releases, and were largely acknowledged as belonging to the parent herd's owner(s), who sometimes provided water in summer. Over subsequent decades, feral numbers have suffered local setbacks from bushfires and subsequent measures to aid recovery of vegetation and have also declined where the provision of water ceased, but overall their range has expanded as cultivation and herding retreated and there are now groups without a recognized owner. Unplanned escapes became more frequent as herders grew old and unable to round up errant individuals but were also more likely from the biggest and thus most loosely managed herds. For example, a regular visitor in the 1930s to a domestic herd of 400 or more ("the biggest on Kythera") on the northeastern hill range recalls that the owner penned the goats at night and monitored their daytime movements from a high vantage point, dispatching a herder to round them up if they strayed towards fields or gardens. By the 1950s, however, when he was too old for milking and cheese-making, his sons exploited the herd only for meat and, with reduced human contact, fewer and fewer goats returned voluntarily to the pen. Escapes were easier to prevent from the more modest herds, of up to 100 head, that ranged closer to nucleated villages and cultivated land and so were under constant supervision. One relatively large herd of 100-200 head ranged mainly across uncultivated land in the hills of western Kythera but was penned every night and, although a few adult females left to give birth in nearby caves, they returned later with their newborn kid(s).

At least two local feral populations have been created in recent decades when an entire domestic herd was sold for slaughter, except for a few individuals in poor condition which were released and went on to flourish and multiply. Some mass-releases also occurred in response to the owner's conflicting commitments or advancing years. For example, at the coastal hamlet of Diakofti in the 1950s, the owner of 100-150 domestic goats left for military service and returned to find that several animals had escaped, forming two feral groups on high ground south and north of the settlement. In the 1960s, finding sheep more profitable and convenient, he let his remaining domestic goats run wild and then, around 1980, sold both feral groups to two different owners of similar animals along the northeast coast. The sales involved very approximate estimates of numbers of animals but underline the status of Kytheran feral goats as alienable private property. They also illustrate how groups of such animals were not only formed through escapes from closer "domestic" management but were sometimes proactively created or acquired for low-input meat-production. On neighbouring Antikythera, a merchant seaman working abroad bought and released on his own land a handful of feral females so that he could hunt their male offspring on his annual leave.

On Crete, existing feral goats include both long-established groups (spanning several human generations, to the limits of family oral histories) and more recent recruits, with the latter again drawn from both many small-scale escapes and a few mass releases or abandonments. On the Psiloritis massif, one group of feral goats occupying a ravine above the village of Sisarkha is descended from a domestic herd inherited a few years ago by a man not involved in animal husbandry who caught and slaughtered what he could and let the rest run wild. On a smaller scale, herders in Gonies and Axos describe how the odd animal often stayed behind when they moved the herd between summer pasture on Psiloritis and winter grazing lower down, especially if poor weather encouraged the goat to seek shelter and discouraged the herder from searching. Many such stragglers rejoined the herd a few days later without human intervention and, in his youth, one Gonies informant searched out any that did not, but now in his 70s he is less able to do so. He has recently given up milking his goats, managing them just for meat, and, with less frequent and less close contact, the goats are freer and keener to escape. He still visits them daily, providing fodder in winter and water in summer, but an animal that eats from his hand from September to March may, after 10-15 days without feeding, not come near him. The fencing of pasture has also

Fig. 2. — Typical feral goat *Capra hircus* Linnaeus, 1758 habitat: cliffs and caves above Kato Zakros, eastern Crete. Photo credit: Valasia Isaakidou.

Fig. 3. — Feral goats *Capra hircus* Linnaeus, 1758 browsing above Gonies on mid-slopes of Mt Psiloritis, central Crete. Photo credit: Valasia Isaakidou.

sharply reduced human contact with livestock. In the 1970s, four brothers from Anogia enclosed 400 domestic goats in an area of rough winter pasture, dissected by ravines, on the north coast of Crete. They continued milking the animals, but out of season visited them only once a month instead of herding them on a daily basis year-round. Year on year, 30-40 goats left the managed herd until they decided to milk only their more tractable sheep and let all the goats go feral to be exploited just for meat.

On Crete, therefore, as on Kythera, the number and range of feral goats have expanded since the 1970s, as the enclosure of pasture, the trend from many small to few big herds, and management of some herds for meat alone reduced contact with herders. Some (ex-)herders who first "acquired" feral goats during this period insist that such escapees are a recent phenomenon, resulting from the changes in domestic management, while milder winters are also said – plausibly enough – to have reduced mortality in recent decades among feral animals occupying higher altitudes. In each of the mountain ranges visited, however, some of the oldest interviewees recalled feral goats from their youth and in many cases had also heard of them from their fathers and grandfathers. Feral goats were thus evidently encountered and pursued on Crete from at least the late 19th or early 20th century, wherever cliffs and ravines provided terrain favourable for their escape and avoidance of recapture. Moreover, the etymology of the regional Cretan names for these animals (in each case, as distinct from the "wilder" *agrímia*) suggests their presence a few centuries earlier under Venetian rule (early 13th to mid-17th centuries AD): the west Cretan term, *fouriárika*, is of plainly Italian origin (meaning "wild"; Mavrakakis 1948: 38, 67), as also probably are the central and east Cretan alternatives (the former, *matsária*, referring to escapees' tendency to form a small, close-knit kin-group or *mátson*/*mazzo*; the latter, *vetsária*, perhaps an eastern dialect variant of the same term; Xanthoudidis 1918: 272, n. 3, 4). The Venetian elite on Crete were keen hunters and evidently pursued such goats (Papadopoli 2017: 163, 273, n. 170r) as well as the more impressive *agrímia* (Siakotos 2007: 169, n. 7; 173), while reports of *agrími* carcasses from the White Mountains, delivered in bulk to the city of Candia, imply mass capture – whether by trapping or driving (Papadopoli 2017: 105, 240, 241, n. 83v). Intriguingly, on Kythera, the term for one of the traditional methods of capturing feral goats en masse is of similar origin (see section "How, where and when to catch feral goats") and may again date back to the Venetian occupation, although here this ended at the end of the 18th century. That feral goat populations (regarded as ancestral to modern *agrímia*) existed on Crete several millennia earlier, in the Bronze Age or even Neolithic, has also been suggested on the basis of iconographical and textual evidence from the later Bronze Age (e.g., Vanschoonwinkel 1996; Palmer 2014; Isaakidou & Halstead 2021) and zooarchaeological (biometric) data from the Neolithic (Isaakidou 2005).

COMPOSITION, ETHOLOGY AND ECOLOGY OF FERAL GOAT POPULATIONS

The term by which feral goats are known in central (*matsária*) and perhaps western (*vetsária*) Crete refers to their tendency to form small groups of related females ("grandmother, daughters and granddaughters") that occupy particular localities (*piánoun tópo*) in the landscape (also Dunbar *et al.* 1990; Seguí *et al.* 2005: 141). Our informants report that male kids initially stay with their mothers but separate from them during the rut (also Husband & Davis 1984: 419; Paragkamián 1994; Shackleton & Shank 1984: 504) and from their second year move away (perhaps returning later if not intercepted by hunters). The attachment of females to preferred locations is such that, by common consent, herders can recognize their "own" feral goats on the basis both of where they are sighted and of "family resemblance" to their domestic goats. For example, at Tzermiado in the Lasithi Mountains, we met a young herder who had just caught a feral kid near the range of the family's domestic herd; his suspicion that the kid was one of their own was confirmed by his grandfather, who indicated the domestic doe it was descended from.

Fig. 4. — The last resting place of an elderly feral goat *Capra hircus* Linnaeus, 1758 with a broken jaw in a rock-cut "cave" (previously used as a shelter for domestic goats and sheep) on eastern Kythera. Remains of feral goats, especially adult females and newborn kids, can also be found in many abandoned rural out-buildings. Photo credit: Valasia Isaakidou.

Fig. 5. — On Kythera feral goats *Capra hircus* Linnaeus, 1758 initially occupied rocky and sparsely vegetated parts of the landscape but latterly, with the widespread abandonment of cultivation, have expanded their range to areas with richer forage. Photo credit: Valasia Isaakidou.

As with the *agrímia* immortalized in traditional Cretan song ("in the precipices we live, the steep peaks are our winter quarters, the caves in the mountain are our ancestral home"; http://www.kretakultur.dk/english/folklore/music/rizitika.htm, last consultation on 14 March 2024), the classic haunts of the feral goats we studied are (where available) cliffs, ravines and caves (Figs 2-4). This difficult terrain afforded refuge to feral goats in a landscape once busy with herders and farmers, but increasingly – especially on Kythera – they are expanding onto previously cultivated land and using abandoned farm-buildings in place of caves to shelter from insects and heat in summer and to hide newborn kids (Fig. 5). Their diet comprises forbs, dwarf shrubs (e.g., thyme) and woody (mainly evergreen) shrubs/trees in varying proportions, occasionally and contentiously supplemented by raiding gardens, vineyards and fruit trees. Informants identified the spring burst of new growth on evergreen oaks (Fig. 6) and the like as the best season and late summer, when herbaceous vegetation has dried up, as the worst.

Kidding is more dispersed through the year than in domestic herds (in which it is often artificially compressed by segregation of breeding males), but concentrated between October-November and March-April and thus broadly timed to exploit the seasonal rhythm of available browse/graze (also Husband & Davis 1984: 417). The females mostly give birth from their second year, but some become pregnant in their first year and tend to produce the later kids of each annual crop (into June, July or even August, although late kids are also said to be more frequent in bad years). Does tend to hide their newborn kids (often two, occasionally more) in caves, bushes and abandoned buildings and allow them to suckle for between 2-3 and 5-6 months. The kids are usually said to grow more slowly than their fodder-fed domestic counterparts, but conversely tend to be killed 2-3 months older (at least than domestic kids from a dairy herd) and to have suckled longer and so may provide larger carcasses. The three islands under consideration lack large terrestrial predators, other than humans (see section "The development of feral goat populations"), but kids are vulnerable to birds of prey and crows, the latter pecking out eyes and tongues from live newborn animals. The main source of natural deaths, other than old age and periodic malnutrition, is regarded as cyclical infestations by ticks that may cause heavy mortality every second or third year (also Paragkamián 1994: 12). The same problem afflicts domestic goats (e.g., Dimanopoulou *et al.* 2017), although these are inspected and treated by herders (e.g., Xanthoudidis 1918: 305; Mavrakakis 1948: 73), as occasionally are managed feral goats.

OWNERSHIP OF FERAL GOATS

Those claiming ownership of feral goats (as of their domestic counterparts) hope to benefit from their sale or consumption, but may also be held responsible for their raiding of fields and gardens. They may seek to avoid both losses to poachers and disputes over damage to crops by rounding up errant individuals and by providing water (and, latterly, also very small amounts of fodder) to encourage the animals not to stray. The oversight of feral goats is generally much lighter-touch than the husbandry of a domestic herd, however, and so it is harder for the owner either to monopolise their consumption or to prevent them from causing damage, while an unfavourable balance between these benefits and costs is not infrequently cited as the rationale for abandoning their management. Nonetheless, as with domestic herds, some owners may take extreme measures to enforce their proprietorial rights. For example, a few decades ago, one now deceased herder/trapper on Kythera, finding the carcass of one of his feral goats hidden under firewood on a donkey, beat up and severely injured the accompanying poacher.

That feral goats are the private property of a particular individual is widely signalled by clipping their ears in the owner's distinctive pattern (Fig. 7) or, occasionally, by their enclosure on land for which he (rarely she) has legal or customary use rights. Owners and their near neighbours recognize many

Fig. 6. — The fresh growth on evergreen oak (*Quercus ilex* L.) bushes (Kythera, spring 2018) is particularly sought out by feral goats *Capra hircus* Linnaeus, 1758. Photo credit: Valasia Isaakidou.

Fig. 7. — Trapped feral goats *Capra hircus* Linnaeus, 1758 on Crete with ears clipped (red circles) to mark ownership. Photo credit: Valasia Isaakidou.

other feral goats as private property, however, even in the absence of clipped ears or enclosure, on the basis of their physical appearance (and thus genealogy) or their occupation of an area of land (close to that) to which the owner has use rights. Where a feral goat is found is a more reliable guide to ownership in the case of females and their young, which typically adhere to particular localities, than of adult males, that tend to roam in search of mates and so are more likely to encounter hunters who do not know (or ignore) to whom they belong. Place may thus indicate to whom a feral goat belongs, but the case of Kythera, where most recent feral goats have occupied uncultivated land in public ownership (https://www.eghorios.gr/periousia/gi/, last consultation on 16 April 2024), suggests that location is not the basis of such claims. On the contrary, informant accounts from Crete, Proti, Kythera and also Antikythera clearly imply that ownership is determined by an animal's life history and genealogy. Ownership of feral goats is usually claimed on the basis of their descent or escape from the owner's domestic herd or of purchase from someone with such a claim. Those with such a "genealogical" claim to a group of feral goats may also cite their provision of water and perhaps fodder as further evidence of ownership, although such active husbandry seems also to be used as a means of asserting rights to unclaimed (or claimed but stray) animals. Finally, unclaimed feral animals that a herder tames and incorporates in a domestic herd are also treated as his private property.

HUNTING AND TRAPPING OF FERAL GOATS

Informants describe a range of more or less widespread methods of taking feral goats, which we present under four partly overlapping headings:

– hunting with guns and/or dogs;
– catching in "natural" traps;
– driving;
– catching in artificial traps.

In concluding this section, we discuss the contexts of use of different methods.

Hunting with guns and/or dogs

Today feral goats are widely hunted with guns, but shooting, unless by a good marksman close enough to achieve a bullet to the head, tends to spoil part of the carcass and so is more typical of those (mainly "poachers") hunting for the pot or sport than of owners undertaking systematic exploitation for meat (for a counter-case from Cyprus, see Hadjikoumis 2017: 133). On Kythera, the two feral herds above Diakofti were sold partly because, after a lifetime of rearing animals, the owner disliked shooting them, but owners do resort to guns, especially when other methods are impracticable or fail. Dogs may be used with guns, whether to frighten goats into open ground or to keep them at bay while the hunter approaches. They are also used on their own, immobilizing the prey by seizing its hind limb, but this tends (like shooting) to damage the carcass and is considered wasteful. In Axos, one informant previously had a skilled dog that immobilized goats without damaging the meaty upper limb, but his current dogs make a mess of carcasses (as recently, when they helped intercept a group of feral goats that would otherwise have been killed by someone else because they were moving into the territory of a neighbouring village).

Catching in "natural" traps

Sometimes goats on steep cliffs descend to ledges from which they cannot return without a herder's help (Xanthoudidis 1918: 276). At Psychro in the Lasithi Mountains, a retired herder recalls how he and some then-young friends scrambled down to such ledges to kill marooned feral goats, sometimes carrying wine to feast on them *in situ*. Goats could also be driven deliberately into such natural topographic traps, as at Gonies on Psiloritis, where a now deceased hunter sometimes used his dog to corner individual feral goats, taking advantage of their habit of seeking refuge on a rocky outcrop or ledge. He would then climb up and hook them from below with his herder's crook or lasso them from above with a rope. In summer, when plagued by flies, goats often take refuge at midday in caves, where hunters approaching silently may catch unawares a handful of animals, as informants described for Toplou Monastery in eastern Crete,

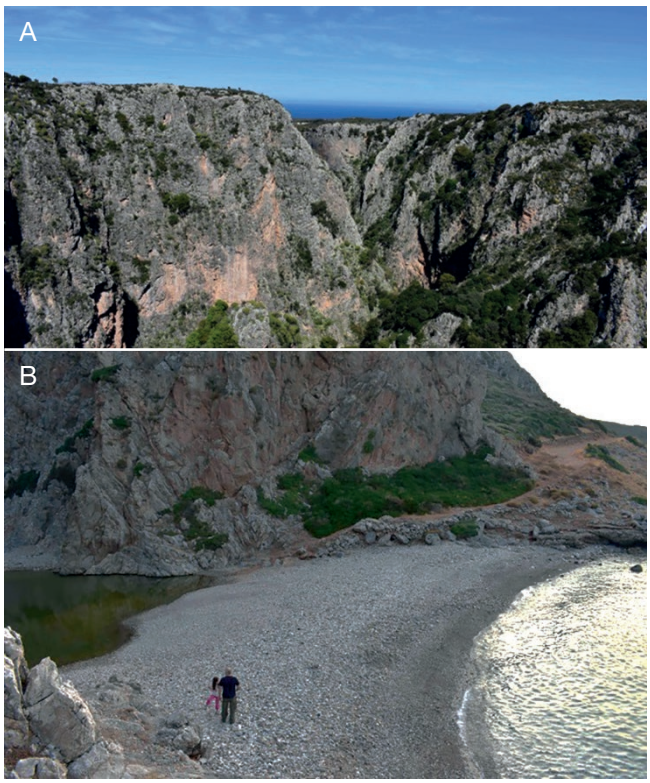

Fig. 8. — Kakia Langada gorge, Kythera: **A**, the inland origin of the gorge viewed from medieval Paliochora – drivers on the high ground to left and right ushered the goats (*Capra hircus* Linnaeus, 1758) down the gorge towards the sea; **B**, the mouth of the gorge – the goats were trapped on the storm beach between the sea, the steep walls of the gorge and the muddy pool in the bottom of the gorge. Photo credit: Valasia Isaakidou.

where coastal caves were reached by boat, at Gonies in central Crete, and on Kythera. On Kythera, abandoned field houses are now similarly used by feral goats as mid-day shelters and hiding places for new-born kids and so are monitored from afar by persons interested in killing or catching an animal or two. Once located, a young kid is easily taken but an adult may require pursuit and, by common agreement, will be caught if given no chance to stop and urinate, but otherwise will escape. A tactic reported in eastern Crete for running down a feral goat was to pursue it onto terrain with which it was not familiar, so greatly reducing its chances of escape.

Driving

In both central (Gonies) and eastern Crete (Xirolimni on the plateau between Sitia and Palaikastro; Ag. Georgios on Lasithi; and Martha on the southwest slopes of Lasithi), informants owning both domestic and feral goats describe driving the former to mix with the latter, which then found it difficult to extricate themselves and ended up in the same pen as the domesticates. Each such drive seems to have resulted in capture of a handful of animals, which in some cases were fairly recent escapees from the domestic herd.

Drives were also undertaken just by teams of men. In eastern Crete, one informant had, in his youth, used his fleetness of foot to outrun his quarry on the rocky slopes between

Fig. 9. — A medium-sized (*c.* 50m^2) purpose-built trap on Kythera with water trough, scattered remnants of hay, and dry-stone entrance ramp to right. Photo credit: Valasia Isaakidou.

Palaikastro and Zakros where teams encircled areas thought to be occupied by many feral goats. Drives on Kythera, on both the northeastern and western hill-ranges, began with 5-20 beaters at wide intervals who gradually maneuvered any feral goats caught between them towards a natural or artificially constructed funnel. In the latter case, they took advantage of existing field walls, sometimes raised in height by a cap of brushwood, while near the coast the sea served as an effective barrier on one side into which goats fled only as a last resort. Here too, while drives began sedately, agile young men were needed for the final phase of capture. Particularly striking were drives on the northeastern range that began around the abandoned medieval capital of Paliokhora and ushered the goats down the Kakia Langada gorge to the sea (Fig. 8A-B). At its seaward end, behind a pebble storm-beach, a shallow pool filled the space between the sheer sides of the gorge and this the goats avoided because they became stuck in its muddy bottom. With the pool behind, the sea in front and cliffs on either side, the goats were driven onto the beach. Here some jumped into the sea and drowned or were fished out by their pursuers, but most tried to escape through the narrow gaps on either side between cliff and sea, where other drivers lay in wait behind uprooted bushes. The number of animals captured by such drives depended on how many were within the area encircled and the extent to which, in their final stages, the constraints of terrain and efforts of drivers prevented escape. Participants on Kythera recall catching on a single drive as many as 100 goats on the northeastern and up to 30-40 on the western hills.

Catching in artificial traps

Traps for feral goats were small enclosures (we have seen purpose-built examples as small as 3 m by 3 m and as large as 10 m by 15 m), while use was also made of larger pens constructed to manage domestic livestock. Recently built traps use mass-produced metal fencing (Figs 9; 10), sometimes taking advantage of a convenient rock face on one side, but older examples had walls of dry-stone or cut brushwood and one informant had seen a trap made of "woven" lentisk bushes in west Crete. However constructed, the trap has a gate (occasionally two), normally left open to accustom the animals

Fig. 10. — Feral goats *Capra hircus* Linnaeus, 1758 caught in a small trap with dry-stone entrance ramp, Mt Psiloritis, Crete. Photo credit: Valasia Isaakidou.

to entering, and an alternative means of entry (an external ramp of rubble or wood, or an overhanging rock) for when the gate is closed to catch goats. Once the gate is closed, there is no internal ramp to facilitate escape over the enclosure fence or wall, 1.20-2.50 m high and often capped with cut brushwood sloping inwards. Adult males can jump over the lower fences/walls (we witnessed two do so with ease from an otherwise effective trap on Kythera) and try to scramble over taller barriers or demolish them with their horns. Low barriers are more effective if a trap is narrow or has an inner fence/wall, preventing animals from developing momentum in escape bids, but some traps only catch kids and females. Some owners maintain multiple traps, as each is visited only by goats from the home range(s) in which it is located.

The trap on Proti is closed by remote control from a mobile phone, to reduce the number of boat trips from the mainland, but most owners visit their traps to close the gate manually and then return, usually the following morning, to see what they have caught. Indeed most owners make multiple advance visits to leave bait so the goats become accustomed to entering the trap. Traps are usually baited with water, but sometimes also (or even instead) with fodder. By common consent, water is the most effective bait, but only at the height of summer (usually July-August) and when there are no other sources; one Kytheran herder recalls a neighbour placing a scarecrow at an unenclosed spring to divert the goats to his trap. Even in mid-summer, however, as some Kytheran owners report,

Fig. 11. — Feral goats *Capra hircus* Linnaeus, 1758 drinking (more or less fresh) water on the shoreline at Avlemonas, Kythera: nos. **1**-**2** from rock pools above sea-level and no. **3** from the sea. Photo credit: Valasia Isaakidou.

on days with a breeze the goats may not drink, while some appear to drink seawater (Fig. 11), albeit at least sometimes favouring spots where underwater springs ensure low salinity. Fodder is a less certain magnet than water, but, depending on the availability of natural pasture, may attract animals outside (especially after) mid-summer. Traditionally, leafy branches were offered but nowadays a little maize or grassy hay may be spared in the hope that "something sweet" proves tempting, although some feral animals reportedly refuse such fodder

even in captivity. Reported captures in traps on Crete and Kythera range from single individuals to several dozen per attempt and, cumulatively over one mid-summer, might amount to as many as a few hundred from a single feral population. For example, the owner of 200 adult feral goats enclosed in maquis and garrigue near Palaikastro, eastern Crete, reckons to catch something like 150-175 kids between late July and mid-August, while water traps in an enclosure on the north coast of central Crete, containing perhaps 500 feral goats (as well as tame sheep), are said to yield 300-400 young males per year.

HOW, WHERE AND WHEN TO CATCH FERAL GOATS

Although some apparent regional variation in methods of capture may be a fortuitous result of which informants we met, the potential for driving depends somewhat on local terrain and the efficacy of traps greatly on the local availability (in the home-range of each group of goats) of alternative water sources. On Kythera, we have not heard references to driving with the aid of domestic goats, but very few recent owners of feral goats have also maintained a nearby domestic herd.

Temporally, on both Crete and Kythera, there is a clear trend over the last few decades to increasing use of traps (facilitated by availability of metal fencing and of off-road vehicles able to transport water and captured animals) and decreasing recourse to driving by humans (consistent with scarcity of fit, under-employed young men in the countryside). Several current practitioners with traps built of metal fencing maintain that this method of capture dates back no more than half a century, but Xanthoudidis (1918: 277) describes brushwood traps from the early 20th century in western Crete and some elderly informants around east Cretan Palaikastro inherited dry-stone traps that date back at least to the late 19th century. As for the antiquity of driving with teams of humans, villagers on Venetian Crete were at times required to serve as drivers for elite hunts, at least of *agrímia* (Siakotos 2007: 169, n. 8; 173). On Kythera the term *kátsa*, plainly derived from Italian *caccia* and, probably more specifically from Venetian *cazza* (Boério 1856: 155), was used for this method of catching feral goats and someone driving was known as a *katsatóros*/*katsadóros* (Venetian *cazzadòr*). On Kythera too, therefore, the practice may date back at least to the period of Venetian rule (13th-18th centuries AD), although some elderly informants report that *kátsa* and *katsatóros*/*katsadóros* may also describe the pursuit of hares and the fast-running dogs used for this purpose, respectively.

In terms of seasonality, several informants claim to avoid catching the animals in winter, when the does are pregnant, but the goats are anyway in best condition during spring and summer, after the new evergreen browse emerges. As noted above, traps are usually baited with water only at the height of summer (from Easter onwards in the very dry far east of Crete), whereas they may be baited with fodder at any time of year but this is generally ineffective unless browse is scarce (most likely in late summer and winter). On Kythera, one long-retired *katsatóros* reckons that drives caught fewer animals in hot conditions, when goats sought to get cooler on high ground, than in lower temperatures, when they opted for warmth near the sea, but drives did take place in summer: for example, in Anogia, central Crete, we hear of a drive in the summer heat when a young runner collapsed and was (wrongly) feared dead. On both Crete and Kythera, some owners sold significant numbers of kids at Easter – too early in the year for water-baited traps and so caught with fodder-baited traps or by driving.

MASS CAPTURES AND SELECTIVE CULLING

While pursuit with hunting rifles and/or dogs may target individual feral goats, the usual end-product of a successful hunt is a small number of dead animals. The same is broadly true where animals (other than new-born kids) are taken in what we have labelled "natural" traps. Conversely, driving and trapping capture live animals, sometimes in large numbers, and so offer much greater opportunities for selective culling.

Approaches to culling of animals captured alive vary considerably, depending on factors of both supply and demand. At one extreme, a few practitioners claimed to kill whatever they caught, sometimes with the justification that animals released might be recaptured, and killed, by someone else. The mid-20th century herders of Toplou did this when raiding the caves where the animals sheltered by day, but the monastery's feral goats numbered about a thousand, leaving little incentive for more conservative culling. At the other extreme, some trappers on Kythera only killed animals of an age/size and number for which they already had a customer (one boat-load sent to Athens a few decades ago without a pre-agreed buyer was an expensive mistake). The most common strategy was to kill all young males (mostly first-year, plus a few second-year) large enough to be worth eating, but to release females with future reproductive potential (at least those of healthy appearance and conformation suitable for suckling young) and any late-born, underweight male kids (for recapture in their second year); to mark ownership of those released, the captor often first clipped their ears in his distinctive pattern. Some informants slaughtered elderly females, but others released them to die naturally. Even male kids of ideal weight for eating might be released for breeding if considered particularly handsome and, for the same reason, one informant culled "ugly" does. Additionally, the animals captured and thus available for slaughter might be a sub-set of the local population: outside the mating season, does and young live apart from adult males and so might be trapped separately; and the larger bucks sometimes escape from traps, so that only does and young are taken. Lastly, slaughtering decisions also depend on the perceived balance between local population size and carrying capacity: to increase numbers, all first-year females may be released; and to reduce numbers, for example if feral animals are competing for pasture with the domestic herd or causing arguments and court cases over damage to crops, many female kids may be slaughtered. Such

decisions are informed both by the frequency of sightings of feral goats in the landscape and by the number and condition of those captured in traps and drives. One Kytheran owner, concerned that he may have taken too many young females in the previous year, baited his trap in late summer with fresh hay with the intention simply of acquiring more reliable information on population size and age/sex structure and thus on the scope for sustainable culling in the upcoming year(s).

Animals selected for consumption were sometimes slaughtered on the spot: herders from the Toplou monastery did so outside the coastal caves, butchering the carcasses and discarding heads, feet and innards before removing the meat in their back-packs; those who supplied Venetian Candia with *agrímia* had also dry-roasted the dressed and split carcasses (Papadopoli 2017: 105), thus extending their "shelf-life"; and on Kythera the odd feral goat was slaughtered to provide a feast for the *katsatóri* after a drive. More often, especially if caught in large numbers, goats were removed alive. In eastern Crete, our fleet-footed informant recalls leading captured goats, attached in pairs to a long rope by a noose round the neck, or carrying them trussed in threes, one on each side with a third over his shoulders, or even loading 12 on a donkey, suspended in pairs by their feet between the cross-struts of a metal "ladder". He found removing the goats over land even harder than chasing them down until he hit on the idea of mobilizing an uncle with a small boat to carry the trussed goats, up to 120 at a time, along the coast to the quay at Palaikastro. On Kythera, captives from traps were carried overland by pack-animals or the drivers themselves, while those caught in drives ending at or near the sea were loaded onto a small boat. Most of these animals were then loaded, *via* one of the island's coastal settlements or directly, onto a larger vessel for shipment to the slaughterhouses in Piraeus. Those destined for local consumption might be corralled and slaughtered piecemeal to avoid outstripping demand.

The meat of these "wild" goats is widely considered much superior to that of herded livestock, in terms of both taste and healthiness, so a feral kid is a welcome addition to the table of a poacher, owner or paying customer. Owners may also accrue significant symbolic capital in providing several such animals to family weddings or religious festivals, while those who capture large numbers supply butchers and restaurants both locally and further afield. For example, those organizing the more successful drives and trappings on Kythera used to ship dozens of feral goats to Kalamata on the adjacent southern mainland or to the Athens-Piraeus metropolis. In eastern Crete, while large-scale trapping or driving between Palaikastro and Zakros likewise supplied urban butchers, the Toplou monastery required large numbers of its own feral goats at Christmas, Easter and the mid-August Dormition of the Virgin Mary, both for on-site consumption and as gifts to other institutions.

Most of the animals retained for consumption are young kids, with meat suitable for roasting, but there is also demand for a few big males to be stewed in a cauldron, typically in tomato sauce on Kythera or with rice for wedding feasts on Crete. Because entire males have a strong scent, some owners castrate them, as kids or adults, in the latter case waiting a few months for them to "put on new meat" before attempting recapture. In the past, however, some owners slaughtered entire adult males "despite their smell" or did so outside the breeding season when the smell was less strong. Such big males are the hardest to catch by driving or trapping, because they have the height and strength to overcome quite high barriers, and the owner of one trap often ensures timely recapture by shooting. One Kytheran *katsatóros* ended up in hospital after losing the struggle to load a large, trussed buck onto a boat.

TAMING AND RE-DOMESTICATION

As well as exploiting feral goats as a low-maintenance source of high-value meat, many herders have attempted, with variable success, to (re-)integrate feral animals into domestic herds. Motives for such "re-domestication" vary. First, some herders attempt this to maintain domestic numbers. A few decades ago, when most domestic herds were considerably smaller than today and more herders were young, it was normal to track down, recover and reintegrate errant animals, although, as we heard at Kritsa on Lasithi and at Gonies on Psiloritis, any that fled repeatedly were slaughtered. Similarly, at the Toplou monastery some decades ago, hired herders who lost a domestic goat had to replace it from the large local pool of feral animals. Secondly, some herders tamed feral goats to increase their domestic herd, in recent years with the added incentive of *per capita* subsidies paid on the latter. Thirdly, capture and taming of feral animals was a means for a young man without capital to start a domestic herd. One informant's great-grandfather did this on the western slopes of Lasithi in the late 19th century and, by doing so, also proved himself worthy of a share of his father's livestock when the latter retired. Similarly, a now retired herder at Ano Zakros in southeast Crete started a domestic herd by enclosing and feeding 50 of the feral goats that he previously trapped for their kids. He milked the tamed females ("why enclose them just for meat"), but his stated motivation for taming was to avoid litigation over the feral goats' depredations while using state subsidies on his resulting domestic herd to cover the costs of enclosure. Fourthly, others tame individual animals, female or male, to improve the quality (practical or aesthetic) of their domestic stock. Feral animals are widely considered more resilient than domesticates to disease and harsh conditions and one owner of both even believes them capable of removing ticks unaided. One herder tamed them because he considers their milk of superior quality to that of domestic goats, but feral animals may also be selected (like their domestic "cousins") for breeding because they are particularly handsome – "you never slaughter a good-looking animal" according to an owner of tame and feral goats in Axos. Lastly, some herders try taming feral animals simply to test their skill in this challenge.

Approaches to taming are very variable. At one extreme, a herder on Kythera sometimes finds a kid one or two days old in the bushes, abandoned by its mother perhaps during a close encounter with a vehicle, from which she had fled with only the larger of her twin offspring. Some such female

"orphans" he bottle-feeds and incorporates into his domestic herd, where they stand out as particularly tame. Each year they produce a kid for slaughter, after which he milks them with the does born to domestic mothers, but he cannot bear to slaughter the animal that he has reared by hand "like a house-cat". A herder near Martha on the southwest slopes of Lasithi has similar success with orphan feral kids fostered by his domestic sheep. At the other extreme, some herders at Tzermiado on Lasithi and Akhentrias on Asterousia leave out fodder (traditionally leafy branches) somewhere accessible to both domestic and feral goats, to entice the latter to join the domestic herd – as sometimes happens. Between these extremes of high- and low-input taming, many herders have taken feral goats caught in drives or traps and enclosed them, often together with fully domestic animals, in the hope that time and regular feeding will heal the trauma of captivity. Sometimes this works, but some new recruits refuse to eat and so die in captivity or appear to become tame but escape when allowed outside the pen (a problem noted also in antiquity; Brulé 1998: 17). Perhaps surprisingly, feral does are occasionally milked independently of attempts at taming. A herder near Gonies recently trapped a doe with full udders and, as he had slaughtered her kid, he milked her (onto the ground, to be lapped up by his dog) to prevent mastitis. Conversely, a group of herders near Palaikastro occasionally milked feral does and used their milk in cheese making.

While some informants claim regular success in taming feral goats, others are convinced that, sooner or later, such animals revert to life outside human control. Can these conflicting views be reconciled? Age at capture is, unsurprisingly, significant: several informants note that feral kids are more easily tamed than adults, with particular success reported for bottle- and foster-fed abandoned/orphan kids. Many herders also, again very plausibly, argue that some feral goats are more amenable to re-domestication than others, just as some domesticates seem particularly determined to turn feral. Some informants further attribute such differences to parentage, claiming that offspring of a feral father are more likely to flee domestication than those of a domestic sire, although paternity of kids is presumably sometimes uncertain. Another factor may be the length of time since a feral captive or its ancestors escaped from a domestic herd. Feral does live in small matrilineal groups, while herders sometimes report that domestic does drive out unrelated females. Animals with several generations of feral ancestry may be less welcome in the domestic herd, therefore, and more drawn to kin in the "wild", than the offspring of recent escapees. On a shorter timescale, recent escapees may be less wary of human contact than those that have lived free for several years, as is implied by herders' descriptions of successfully driving domestic goats to mix with and reintegrate the former. It also seems inevitable that the more closely herders manage their domestic herd, the more successful they will be not only in limiting escapes of domestic goats but also in retaining feral captives. In general, domestic goats are now managed less closely than a few decades ago: fewer pastoralists look after larger herds; fencing obviates the need to supervise browsing; and some herds are no longer milked. Consistent with this, while most elderly informants (active before widespread enclosure) regard taming as eminently feasible, most young herders take the opposite view.

Another important consideration is the closeness of control that herders seek to establish. On the rocky slopes overlooking Kato Zakros in eastern Crete, where feral goats now approach tourists for biscuits and chocolate, a local resident was recently asked to extricate one of these animals from the back seat of a hired car where it was resting after a snack. Some of these animals are habituated to people, but are not in any other sense domesticated. On the northeastern hills of Kythera, by providing water and scattering a little maize (enough to attract rather than sustain them), an elderly herder likewise accustomed an abandoned group of feral goats to his presence and discouraged them from dispersing, making it easier to locate and catch any kids he wished to cull (Fig. 12). He exploited the animals within their chosen range, however, without attempting to confine them or alter their movements. The lines between domestic and feral goats are further blurred by a final example from eastern Crete. In the hills immediately south of Palaikastro, until about 1980, four families kept domestic sheep and goats. As soon as the milking season ended in summer, the female goats withdrew in small groups to their habitual home ranges where they remained until they were rounded up with their next crop of offspring. At this juncture, most male kids were removed for slaughter, some female kids (for breeding) and underweight male kids (for later slaughter) were ear-clipped and released, and the adult does were retained for milking. There were also 30-40 "semi-wild" goats living on the roughest local terrain that did not mix with their tame conspecifics, other than when an adult male mated domestic does. The "semi-wild" goats were also periodically rounded up to cull their kids, after which some of the does "in search of their young" joined the tame goats in their pen where they too were milked for as long as they stayed. This very loose control had been maintained since the mid-19th century, according to what elderly relatives told our informant during his youth. He attributes its stability to the lack of nearby cliffs and ravines steep enough for the goats to evade the periodic round-ups, to which we might add that the herders again exploited the "semi-wild" kids without seeking to manipulate the ranging behaviour of their mothers.

DISCUSSION: IMPLICATIONS FOR THE FORMATION AND EXPLOITATION OF GOAT POPULATIONS IN THE DISTANT PAST

Recent exploitation of southern Greek feral goats is of interest both intrinsically, as a culturally and ecologically significant phenomenon that has largely evaded scholarly attention, and as a potential source of insight into human-goat relationships in the distant past. We focus here on the development of feral goat populations and past human exploitation of feral, wild, and also domestic goats, but leave aside the early Postglacial domestication of goats as a topic deserving fuller treatment elsewhere.

Fig. 12. — Water and a little fodder provided to feral goats *Capra hircus* Linnaeus, 1758 on Agia Moni, Kythera, by their owner makes them more approachable and facilitates capture of kids for consumption. Photo credit: Valasia Isaakidou.

The development of feral goat populations

The feral goat populations of the Mediterranean islands are descended from animals originally introduced by people (e.g., Groves 1989; Vigne 1999; Masseti 2009b), but did this involve deliberate release for hunting (cf. "kinegetization"; Vigne 1999: 313) or escape from controlled domestic herds? The modern populations described above highlight contingent circumstances favouring one or other of these processes. Most extant feral goat populations in Greece were apparently founded by individuals that escaped from domestic herds, especially where these ranged close to rough terrain relatively inaccessible to human herders or hunters, but variation in the management of domestic goats also played a formative role. Domestic goats in continuous close human contact through regular milking (also Roffet-Salque *et al.* 2018: 127) and penning are much less inclined or able to escape than those reared only for meat and left to forage more freely. Moreover, for practical reasons, close contact tends to be associated with small herds, while owners of large herds are more likely to lose escaping animals and also have less incentive and less available labour to retrieve escapees. Other extant populations originated very recently in deliberate releases that took advantage of the islands' lack of large terrestrial predators and of progressive human abandonment of the rural landscape, but a few decades ago, when widespread fields and gardens were a magnet for any uncontrolled livestock, free-ranging goats would have been vulnerable to third parties seeking to prevent crop raiding or to acquire "free" meat. For the latter reason, feral goats on uninhabited offshore Mediterranean islets are arguably more likely to have escaped from domestic animals transferred there for seasonal pasture, a widespread (Gizicki *et al.* 2018) and long-established (e.g., Chandezon 2003: 302) practice, than to have been released by passing sailors hoping to establish a future supply of fresh meat (Masseti 1998: 13; 2009b: 152). On some inhabited Mediterranean islands, feral populations may have formed from unintended escapes long after the arrival of domestic progenitors, while deliberate releases were more likely to succeed during periods of sparse human population, including (but not only) the time of the earliest visitors or settlers. In either case, the introduction of domestic progenitors to these islands was not a sufficient precondition for the development of feral populations (as opposed to the escape of the odd individual; Davidson 1989; Gron 2023). Indeed, both available zooarchaeological evidence (Vigne 1999) and the cranial capacities of extant feral goats and sheep suggest that such populations became isolated from their controlled counterparts at various stages of the latter's biological domestication (Groves 1989).

Evidence for when, and thus perhaps how, insular feral goat populations developed suggests a contrast between Cyprus and the Aegean. On Cyprus between around 10 000 and 8000 BCE, early human visitors or colonists introduced pigs, then cattle and goats, and finally sheep and fallow deer (Vigne *et al.* 2011). Pigs, goats and fallow deer were likely released intentionally, given indications that they were initially hunted: for pigs, numerous arrowheads and an age profile including many elderly individuals at Pre-Pottery Neolithic A Klimonas (Vigne *et al.* 2012: 8447, 8448); and for goats and deer, anatomical representation at Pre-Pottery Neolithic B Shillourokambos suggesting butchery, and thus slaughter, at a distance from the site, whereas sheep and cattle were butchered nearby and thus arguably herded (Vigne *et al.* 2011: S262, S263, fig. 2; 2016) or conceivably driven/trapped and captured alive.

In the Aegean, early insular introductions of pigs have been reported in Mesolithic (ninth millennium BCE) levels at Maroulas on Kythnos and Cyclops Cave on Youra, although their chronological status is not beyond question (Trantalidou 2014).

At Maroulas, the Mesolithic levels are shallow and include bones of sheep and goats regarded as later intrusions (Trantalidou 2010: 163, 164). At Cyclops Cave, however, while direct 14C dating assigns goat bones from "Mesolithic" levels to the seventh millennium BCE/Early Neolithic (Masseti 2009b: 142; Trantalidou 2011: 56), pigs are concentrated in the lowest levels and more heavily mineralised than the rest of the assemblage (Trantalidou 2003: 146) and so seem more securely dated. At both sites the pigs are relatively small-sized, compatible with intrusions from later deposits, but identification of the mt-Y2 haplogroup in ancient mtDNA analysis of a Youra specimen, directly C14-dated to the Mesolithic (Frantz *et al.* 2019: suppl. text, table S1), suggests descent from local mainland wild boar that underwent size reduction following isolation by rising postglacial sea-levels. If so, any Mesolithic pigs on Youra and Kythnos would not represent anthropogenic introductions.

The earliest secure occurrence of the "farmyard" species is at Initial Neolithic (seventh millennium BCE) Knossos on Crete, where available evidence for anatomical representation suggests nearby slaughter of goats, sheep, cattle and pigs, while biometric data offer no hint of the possible existence of separate populations of herded and feral goats before the later Neolithic/late sixth-fifth millennia BCE (Isaakidou 2005). In this case, stable carbon and nitrogen isotope analysis of bones of all four common farmyard species suggests herded confinement on nearby, intensively cultivated land in the earlier Neolithic, with subsequent expansion into the wider landscape especially in the later Bronze Age (second millennium BCE) (Isaakidou *et al.* 2022). On Crete, fallow deer is not securely attested until the later Bronze Age and, in contrast with Cyprus, stable isotope analysis at Knossos suggests initial enclosure on cultivated land, followed by the release or escape of some individuals into the wider landscape (Isaakidou *et al.* 2022).

Elsewhere in the insular Aegean, Neolithisation apparently began rather later, usually in the fifth and fourth millennia BCE (Broodbank 1999), and quite widely involved introduction of fallow deer as well as sheep, goats, cattle and pigs (Halstead 1987; Yannouli & Trantalidou 1999). On Rhodes, close to the Anatolian mainland, the presence of all five species, probably as anthropogenic introductions (Simaiakis *et al.* 2017), is first evident in fifth millennium BCE levels at Kalythies Cave, although the small size of the fallow deer here suggests a long-established insular population that had undergone size diminution. In any event, anatomical representation at Kalythies implies nearby slaughter and thus herding or driving/trapping of the four "farmyard" species, but distant slaughter and selective transport of hunted fallow deer carcasses (Halstead & Jones 1987). At Zas Cave on Naxos, in the central Aegean, sheep, goats, cattle and pigs are present in Late and Final Neolithic levels (fifth-fourth millennia BCE) and, judging by anatomical representation, were herded or driven/trapped for nearby slaughter (Halstead 1996; in prep.). Fallow deer were lacking in the Neolithic levels, however, despite their presence at Late Neolithic Saliagos (Bökönyi 1971) on the nearby islet of Antiparos (Evans & Renfrew 1968), perhaps indicating that this species was only introduced to part of the Antiparos-Paros-Naxos group of islands to facilitate its hunting or trapping.

Early hunting and herding (or perhaps driving/trapping) of introduced fauna on Cyprus and in the Aegean have been identified on diverse grounds and in each case the available evidence may not represent the earliest phase of their on-island human exploitation. Taking the available evidence at face value, however, why might hunting of goats have preceded their herding in Cyprus, but not in the Aegean islands, even though the heavily broken terrain of Crete and many of the smaller Aegean islands is far better suited than the gentler topography of Cyprus to the development of feral goat populations by escape from controlled herds? This apparent puzzle perhaps supports the formation of the early feral goat population in Cyprus by release rather than escape of domestic animals (Vigne *et al.* 2016) introduced from mainland southwest Asia, where there is evidence for herded goats by this date (Peters *et al.* 2005: 111, 112). Whether by release or escape, the introduction to Cyprus of goats predated the development on the adjacent Levantine mainland, and subsequent rapid diffusion westwards across the Mediterranean, of an integrated mixed agropastoral "package" that was apparently accompanied by household-level organization of much subsistence activity (Bogaard & Isaakidou 2010) and control of the fruits of that activity (Flannery 1972; Halstead 2019; Isaakidou *et al.* 2022: 25). The recent release of herded goats (or acceptance of their escape) on southern Greek islands was facilitated by several factors that enabled the erstwhile herder to maintain preferential access to the newly free-range animals: rural depopulation and a consequent scarcity of potential "poachers"; legal or informal tenure of the land occupied by the goats; and ear-clipping to signal private ownership. The release of goats for hunting may have been less attractive to early farming households on the Aegean islands than to Pre-Pottery Neolithic groups on Cyprus if the latter maintained more strongly collective rights to foraged resources.

Human exploitation of feral and wild goats

Although milking is not entirely unknown, feral goats in the Greek islands were exploited in the recent past primarily for their meat and secondarily, as a by-product thereof, for their hides. For Late Bronze Age (second millennium BCE) Crete, documents in the Linear B script from the palace at Knossos indicate use of a broader range of carcass products. Document C(2) 7064 lists male and female "wild" goats, presumably destined for slaughter at Knossos (Palmer 2014: 394, 395) and thus potentially for the table. The Mc series records requisitioning from multiple locations of four commodities derived from apparently "wild" goats: horns, presumably male (given the small size of female horns); the unidentified *142, listed by weight in direct proportion to the number of horns and so probably taken from the same carcasses; females (unspecified whether dead or alive); and perhaps males (again dead or alive unspecified, but more numerous than the females). The contextual associations of the Mc series suggest use as military raw materials at least for the horns (perhaps for making composite bows) and for *142 (e.g., Baumbach 1971).

Iconographic representations from Bronze Age Crete include several examples of individual goats hunted with weapons and/or dogs (e.g., Bloedow 2003), while one such depiction, of a dog holding a goat at bay on a rocky ledge, recalls the detailed understanding of feral goat behaviour that underpins much recent hunting (Isaakidou & Halstead 2021: 57). A few representations may also depict trapping of groups of live goats (Isaakidou & Halstead 2021: 57, 58). Less ambiguously, the few hundred goat carcasses represented by the Mc series of Linear B texts are more plausibly attributed to mass capture than individual stalking, with larger numbers of males than females compatible with capture of live animals and selective release of females (Isaakidou & Halstead 2021: 58).

Further afield, and despite arguments to the contrary (Holzer *et al.* 2010: 815), the modern Greek data indicate that wild goats or ibex should be considered potential targets of the "kite" traps found widely across the Near East, although only the smallest examples (e.g., in the southern Negev/Sinai; Zeder *et al.* 2013) could plausibly have been constructed with this prey species in mind, given the typically modest size and limited mobility of wild goat social groups (Shackleton & Shank 1984).

Despite the small size of recent feral goat social groups in the islands of Greece and the commensurately modest dimensions of built traps (and of the natural or artificial *cul-de-sacs* in which drives terminated), mass capture was normally undertaken to provision major commensal events or for sale, with the larger catches directed to urban butchers rather than local rural consumers. Consistent with this, the Linear B documents from Late Bronze Age Crete, recording centrally administered procurement and distribution of resources, imply mass capture of feral goats for the benefit of the ruling elite. Many Near Eastern "kites" are far larger than their recent Greek counterparts and in some regions were built in contiguous chains (e.g., Bar-Oz *et al.* 2011a), encouraging the widespread view that they were designed to capture vast migrating herds, especially of the Persian gazelle *Gazella subgutturosa* (Güldenstädt, 1780) (e.g., Helms & Betts 1987; Legge & Rowley-Conwy 1987; Holzer *et al.* 2010; cf. Martin 1998; Zeder & Bar-Oz 2014; Chahoud *et al.* 2015). Because associated portable material culture is sparse, the chronology of their construction and use is uncertain (Barge *et al.* 2020: 197), with proposed dates for Near Eastern examples ranging from the eighth millennium (Pre-Pottery Neolithic; e.g., Helms & Betts 1987; Betts 2014; Wasse 2019: 273; Abu-Azizeh *et al.* 2021) to the fourth-third millennium BCE or later (post-Neolithic; e.g., Echallier & Braemer 1995; Holzer *et al.* 2010; Bar-Oz *et al.* 2011a). If the size of the larger enclosures (≤ 1-5 h; Bar-Oz & Nadel 2013: 4) indeed indicates mass capture, a post-Neolithic date is compatible with the kites, like recent insular Greek traps, provisioning urban consumers, as inferred from osteological evidence for bulk processing of gazelle carcasses at fourth millennium BCE Tell Kuran in northeast Syria (Bar-Oz *et al.* 2011b). If an earlier date is accepted, Pre-Pottery Neolithic B "mega-sites" occupied by incipient farmer-foragers also potentially represented quite large concentrations of consumers (e.g., Bogaard & Isaakidou 2010; Wasse 2019: 274), but associated projectile points (Helms & Betts 1987) imply that captured animals left Neolithic kites dead rather than alive, so carcasses should have been consumed or processed for transport nearby, generating significant quantities of cultural material (cf. Quigg 1997). At Pre-Pottery Neolithic B and Late Neolithic Dhuweila 1 (Martin 1998), however, an occupation site associated with a kite, faunal remains, while dominated by gazelle, include indications of deaths in both spring and winter, that do not suggest hunting of migratory herds, and fairly complete anatomical representation and sparse butchery traces, that do not imply processing of carcasses for consumption elsewhere. Alternatively, and more consistent with the Dhuweila 1 faunal data, guide walls of at least some larger Near Eastern kites might have channelled modest numbers of non-migratory gazelle into enclosures intended not to trap large herds for rapid mass killing, but to provide a few days' forage for a small number of animals destined for staggered slaughter and consumption.

Human exploitation of domestic goats

Recent practice in the Greek islands included fairly frequent taming of feral goats variously to establish, expand or improve a domestic herd. Coupled with frequent escapes of herded animals, this contributed to the mutual genetic exchanges between feral and herded groups that enabled herders to recognize feral animals as their own from physical resemblance to their domesticates. This in turn suggests that biometric discrimination between ancient feral and domestic populations may be difficult or impossible, much as Vigne (2013: 125) has noted that backcrossing between wild and domestic lineages in mainland southwest Asia may have delayed the skeletal expression of domestication.

Recent exploitation of feral goats may also shed light on the husbandry goals of ancient domesticates. Domestic goats which are not milked are particularly prone to escape from human control, while both herders and trappers have identified the trapping of feral goats as a method of producing meat that, in present-day island landscapes with limited risks of their raiding crops or being killed by third parties, is less costly in human labour and supplementary foddering than the herding of domestic goats. The potential for managing feral goats in this manner was much more restricted a few decades ago, when these insular landscapes were more densely populated and more heavily cultivated. Favourable conditions may also have prevailed in the earlier Neolithic on Crete when available evidence implies very sparse settlement (Tomkins 2008) and mortality data from Knossos suggest management of domestic goats that prioritized production of meat rather than milk (Isaakidou 2006). Available stable-isotope evidence for diet, however, suggests that the earlier Neolithic goats at Knossos were confined to cultivated land near the settlement and so were closely controlled with few opportunities to escape, in contrast with their use of more distant pasture, apparently including rough browse, in the Bronze Age. Several factors may have contributed to the close control of earlier Neolithic goats. First, domestic animals must have been few in number, if closely associated with intensively cultivated garden plots (Isaakidou *et al.* 2022), and goats were only a minor

component of total livestock. Secondly, it has been argued, from variability in faunal $\delta^{13}C$ and $\delta^{15}N$ values, that early Knossian livestock were enclosed or tethered on the cultivation plots of individual households and so were managed in very small numbers. Thirdly, on mainland Greece mortality data for Neolithic sheep and also, judging from modest samples, goats and cattle conformed to a "meat" management strategy (e.g., Halstead 1996: 28, table 1; Halstead & Isaakidou 2013), but lipid residues from ceramics indicate that one or more of these three domestic ruminant species was milked (Whelton *et al.* 2018). Analysis of lipid residues has not been undertaken for Neolithic Knossos, but the mainland data demonstrate that "meat mortality" is not incompatible with the exploitation of both milk from breeding females and carcass products, after death, from both adult females and their mainly younger male offspring (Isaakidou 2006).

CONCLUSIONS

The islands of Greece are home to numerous populations of feral goats, many of which are regarded as private property and are exploited more or less systematically by their owners, primarily for meat but also for new recruits (mostly infants) to more closely managed herds. The goats are exploited for meat both by hunting individual animals, typically for immediate consumption, and by use of drives or traps (baited usually with water, sometimes with fodder) to capture groups of live animals to supply urban butchers, religious festivals and major social occasions such as wedding feasts. Successful driving, trapping and taming all draw on participants' understanding of feral goat ecology and ethology, which is in turn based partly on personal experience and partly on knowledge passed on by older relatives and work-partners. Prowess in these activities is often recalled with pride or described with admiration, while for some the desire to test or prove their skill provides an incentive to attempt taming of captive animals. Management of privately owned feral goats is fairly light-touch: water and perhaps fodder may be provided to discourage dispersal and to encourage visits to traps, while animals captured alive are usually subject to more or less selective culling (typically, slaughter of young and adult males and release of young and adult females) in order to maintain a sustainable population and perhaps also to improve the quality, both practical and aesthetic, of breeding stock. While the feeding and social behaviour of these feral animals recalls that of wild goats, they resemble herded domesticates in belonging to someone (Ingold 1986), in being subject to more or less systematic, selective culling, and sometimes in being provided with water and even fodder. As such, they may be instructive for understanding human relations with wild, feral and domestic goats in the distant past. Here we have discussed some possible implications of recent feral goat management for the formation of insular feral populations (by deliberate release or escape of founder individuals), for prehistoric driving and trapping of wild/feral goats and other herd ungulates, and for the rearing of domestic goats for meat or milk.

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