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AMERSHAM MEETING REPORT 2022 CONSERVATION, CAPTIVE BREEDING AND FIELDWORK

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Brief Introduction

The usual activities of the BHS have been somewhat disrupted in recent times. Due to the Covid pandemic there has been a significant gap in our face to face meetings programme during 2020-2021. However, in 2022 the BHS has managed to re-instate a full series of meetings throughout the year. In this publication we report on the most recent meeting, held in the town of Amersham (UK) on the 2nd of October 2022. This meeting was jointly held between the British Herpetological Society and the Thames and Chiltern Herpetological Group. The programme continued with the themes explored in previous meetings, with an emphasis on applied research in conservation, captive breeding, fieldwork and related subjects. Overall, there were eight presentations (four oral and four poster) covering a range of species. The presenters were (mostly) young people - postgraduate students or early-career scientists, explaining their research and ideas to a mixed-age audience. We hope that the summaries provided in this Report, which will be available free of charge from the BHS website (thebhs.org), will help to disseminate this important research to a much wider audience.

Sand Lizard (*Lacerta agilis)* Breeding and Reintroduction: Optimisation of Protocols

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The sand lizard (*Lacerta agilis)* is Britain's rarest lizard and a European Protected Species. Due to loss, degradation, and fragmentation of favoured dry heath and coastal dune habitat in the nineteenth and twentieth centuries, sand lizard populations in the country were left small and isolated. Reintroduction efforts over the last fifty years have utilised a captive breeding programme, now coordinated by the Amphibian and Reptile Conservation Trust, to return the species to its former range in areas of restored habitat. Conservation charity Marwell Wildlife, who owns and operates Marwell Zoo near Winchester, Hampshire, has been involved in the captive breeding programme for over thirty years, initially providing lizards for release at sites in the New Forest. Their involvement since has extended across southern England, within the range of the genetically distinct Dorset race. Marwell Zoo is home to an adult captive-breeding population of sand lizards that lives in a large naturalistic south-facing outdoor vivarium in a quiet, off-show area. This offers ample opportunities through sandy soils and heterogeneous vegetation structures for basking, sheltering, oviposition and brumation (Fig. 1). Sand lizards typically emerge post-winter in March/April, begin breeding in May and lay their eggs in June and July. Locations of the back-filled test burrows dug by females are noted before eggs are carefully excavated (Fig. 2) and artificially incubated until hatching 4-6 weeks later, in July and August (Fig. 3). In favourable spring and summer conditions, mature females often lay two clutches. Hatchlings are kept in smaller outdoor vivaria until release, typically in early autumn.

Fig. 1. Adult male sand lizard basking in vivarium at Marwell Zoo. (Photo: R. S. Gardner).

The vivaria are surrounded by an outer breezeblock and mesh enclosure with electric fencing to prevent avian and mammalian predation. The wild invertebrate food source is supplemented by vitamin-dusted black crickets of appropriate sizes for adult and hatchling lizards. During warm conditions, the vivaria are misted with rainwater. The captive breeding population undergoes late spring (adult) and pre-release (juvenile) health screening annually.

Sand lizards are a cryptic species and typically poor users of reptile refugia (also termed artificial cover objects), a common reptile survey tool; this raises challenges for monitoring in the field. During a PhD, joint-funded by Marwell Wildlife and University of Southampton, three cohorts of approximately 80 sand lizards were released at Eelmoor Marsh SSSI, Farnborough, annually between 2017 and 2019. Data were collected pre-, during, and post-release to inform and make recommendations for optimising longstanding reintroduction protocols (Fig. 4). The research assessed: spatiotemporal behaviour of sand lizards, considering microclimatic, microhabitat and for sand demographic factors; best survey protocols for sand lizards and the widespread native reptile assemblage, accounting for environmental conditions; and demographic and individual factors affecting post-release movement and survival of released lizards. Individual lizards, identifiable by unique dorsal ocelli patterns, were followed from hatching through to release and establishment at the site. Behavioural and morphometric data enabled individual differences to be incorporated into analyses, with broader demographic variables also considered, in relation to post-release survival and movement. Systematic surveys within the dry heath at Eelmoor Marsh during the reptile active season followed each release for a full year. Oviposition was observed in 2019 and a wild hatchling sighted in 2020. Research data are currently being prepared for publication. Monitoring and management continue at the site, ensuring open sandy areas and varied habitat structure to support persistence of the population into the future.

With thanks to: University of Southampton, Marwell Wildlife, QinetiQ, Amphibian and Reptile Conservation Trust, Natural England.

Fig. 2. Sand lizard egg clutch *in situ* during excavation at Marwell Zoo. (Photo: R. S. Gardner).

Fig. 3. Sand lizard hatchlings during transfer from incubation tub to rearing vivaria at Marwell Zoo. (Photo: R. S. Gardner).

Fig. 4. Data collection during first of three sand lizard releases at Eelmoor Marsh SSSI, in 2017. (Photo: Paul N. Drane).

Long-Term Population Ecology of Great Crested Newts (*Triturus cristatus*) on the University of Kent Campus

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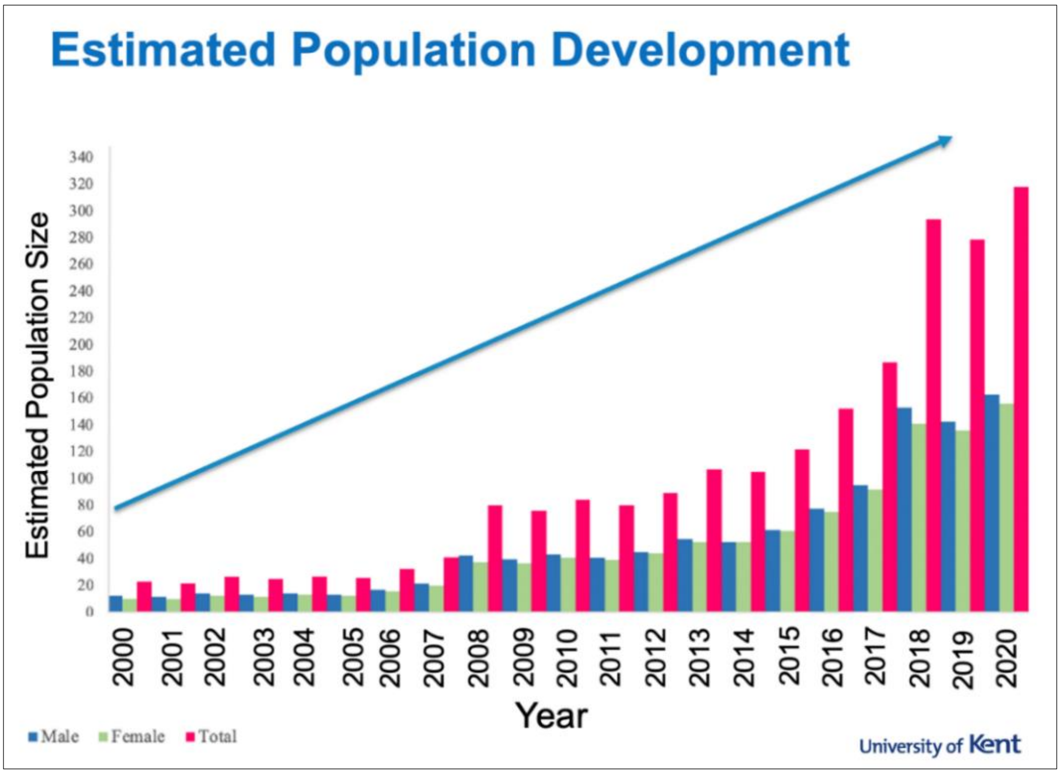
In the wake of anthropogenic development and encroachment into natural landscapes, global biodiversity has been substantially reduced in many regions, subsequently exacerbating extinction vulnerability of many taxa. In recent times there has been a 15% increase in rates of global biodiversity decline in vertebrates, and a further 20% of land-based habitat loss since 1900. Agricultural and urban expansion has intensified this, severely fragmenting ecosystems with various industries polluting the environment at an alarming rate. Synergistically, climate change continues to shift the distributions of species and influence seasonal breeding patterns. No other taxon is more at risk than the amphibians. The United Kingdom is an island ecosystem and particularly vulnerable to such pressures, which threaten species such as the great crested newt (*Triturus cristatus*). To understand and assess populations, long-term population ecology datasets, are pivotal. A 21 year-long encounter history was used to calculate survival, detectability, and population trends of *T. cristatus.* The study site comprised a pond system that has been colonized naturally by newts following the initial installation of four identical ponds in 1998. In 2008 a further four ponds were added to create a grid system of eight ponds, each measuring 1 m x 2 m and shelving to a deep end of 0.7 m. All of the ponds were trapped at weekly intervals for newts throughout the aquatic period. Data from local weather stations were used to explore population trends in relation to temperature from the year 2000 to 2020. Cormack-Jolly-Seber models suggested a higher rate of

Fig. 1. Identification of individual newts by belly pattern.

detectability of males than females. This may be due to the longer period of time that males spend in the water and their higher levels of activity, and females sometimes skipping breeding and not returning to the ponds. The annual survival of newts was high with some individuals living for 10 years or more, but survival did not differ between the sexes. Jolly-Seber population estimates indicated a growing great crested newt population that has exceeded 200 adults in recent years. The population trends were not clearly related to changing temperatures but other weather variables are worthy of further exploration. The ponds also contain populations of smooth and palmate newts. These populations have not increased in the same way as the great crested newts. Indeed, periodic pond desiccation which may reduce invertebrate predators may favour great crested newts over the smaller species, resulting in different population trends in between the species. This study has produced valuable insight into population dynamics at the University of Kent field site, building upon previous knowledge and updating the records of drivers to population proliferation.

Fig. 2. Preparation of newt for belly pattern photography.



Secretive Settlers: Behaviour and Genetics of the Introduced Aesculapian Snake in North Wales

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The Aesculapian snake (*Zamenis longissimus*) has been introduced twice to the UK: in London and in Colwyn Bay, North Wales. The Welsh population, introduced in the early 1970s, has been the focus of research by staff at Bangor University and the Welsh Mountain Zoo for many years. New information on the European origins of the UK Aesculapian snake populations is emerging from genetic evidence, which is similarly providing insight into the historical biogeography of this widespread species. The wild behaviour of snakes is difficult to study due to their secretive nature and infrequent activity patterns. As a result, the ecology of this species was largely a mystery. In 2021 and 2022, Aesculapian snakes were tracked using implanted radio transmitters as part of a study into their habitat selection and movement behaviours - a UK first. We radio tracked a total of 21 snakes between May-October in 2021 and 2022. Aesculapian snakes kept to individual home ranges and demonstrated variable movement patterns throughout the year in reaction to reproductive cues. There were also notable differences in the behaviour of males and females. Using radiotelemetry, we were able to record many behaviours previously not witnessed in this species in Wales including Aesculapian snakes kept to individual home ranges and demonstrated variable movement patterns throughout the year in reaction to reproductive cues. There were also notable mating, combat, and egg

Fig. 1. (Photo: Nathan Rusli).

laying events. It also allowed unique insight into the causes of mortality this species faces, with road collisions an expectedly common fate for wild snakes. Snakes did not use all habitats equally and demonstrated preferences within the small, introduced range in North Wales. Radiotelemetry has allowed unrivalled insight into the ecology of this mysterious introduced snake species.

Fig. 2. (Photo: Antonio Gandini).

Fig. 3. Tracking Aesculapian snakes using radiotelemetry on a North Wales hillside (Photo: Wolfgang Wüster).

Distribution of the Native and Naturalised Snake Species in the Maltese Archipelago

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Globally, numerous reptile species are at risk of extirpation due to human influence on natural landscapes. However, snakes remain poorly studied relative to other squamates, thus ascertaining population distributions is critical for their conservation. Malta has two native and two naturalised snake species, all of which are protected. Using a complementary methodology of citizen science and fieldwork, locality records were collated across the three main islands of the Maltese archipelago: Malta, Gozo, Comino, and the small islet of Cominotto. The western whip snake (*Hierophis viridiflavus*) was the most common, and the only species native to all islands, excluding Cominotto which reported no snake presence.
The European cat snake (*Telescopus fallax*) and the leopard snake (*Zamenis situla*) were always believed to be isolated to the island of Malta, but we provide the first report of individuals found on Gozo; however, this is likely due to accidental relocation via vehicles rather than natural dispersal.

Fig. 1. A juvenile western whip snake found in someone's courtyard, demonstrating they are regularly found in human domains. Photo: (Edward Camilleri).

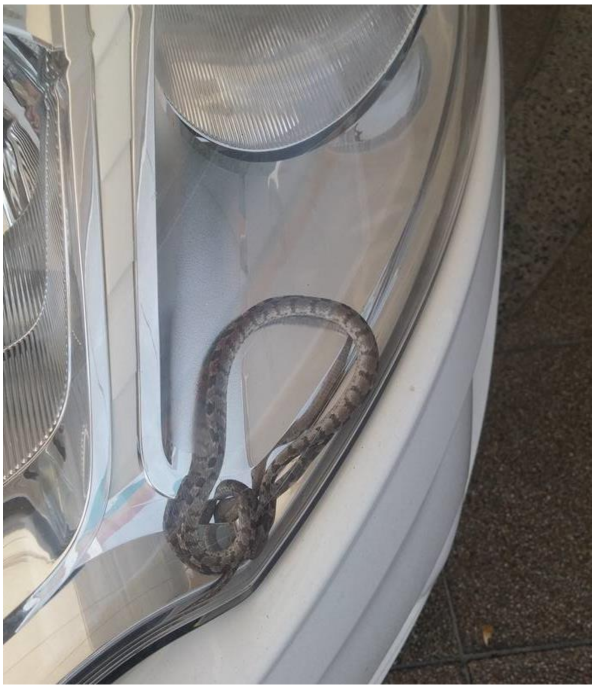

Fig. 2. A cat snake which has crawled into the headlight of a car, which we have theorised is how the leopard snake and cat snake specimens got to Gozo, via accidental relocation. Photo: (Annelise Camilleri).

Fig. 3. Algerian whip snake, the rarest species in Malta.

The Algerian whip snake (*Hemorrhois algirus*), the rarest of the four species, remains largely confined to the localities surrounding Floriana, its assumed original introduction site, whilst the leopard snake and cat snake, based on anecdotal information, have demonstrated a substantial shift into urban landscapes. The cat snake is also much more widely distributed than previous estimates and aids to the theory it may be a native species as the lack of previous reports may be a result of its cryptic and nocturnal behaviour. These data also provide the first accurate insight into the distribution of the elusive Algerian whip snake. The Maltese snake species show tendencies to use dry stone walls as hiding places, particularly the cat snake, which may be linked to the presence of prey. The leopard snake records were distributed significantly closer to streams than the other three resident species with evidence of use of artificial water sources in both urban and rural dwellings. Generalised Linear Modelling showed snake presence was influenced by elevation, average temperature, proximity to roads, and habitat type, with temperature and elevation likely being attributed to increased detectability. The collective influence of resource type and use across different habitats may therefore represent key factors in explaining presence and abundance in future research. In the wake of further habitat loss and fragmentation all species also require urgent intervention and improvements to urban planning to accommodate movements of terrestrial species.

Fig. 4. A leopard snake utilising the traditional Maltese rubble walls.
(Photo: Guido Bonnett).

Fig. 5. A cat snake seeking refuge in the traditional Maltese walls.
(Photo: Bastjan Azzopardi).

Fig. 6. Two male western whip snakes engaging in combat. (Photo: Bernard Farrugia).

The Adder (*Vipera berus*): Monitoring and Conservation Management of a Relict Population in Essex, UK

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For a long period, Epping Forest on the north-eastern edge of London was an important site where all four of the widespread British reptiles occurred, recognised in several pieces in the BHS Bulletin and Essex Naturalist in the 1960's. Epping Forest is largely mature woodland but significant parts are open meadow or heathland, which historically were maintained by traditional woodland practices such as pollarding and grazing by cattle. The result was open areas existing as a fluid mosaic of reptile habitats, ranging from highly suitable to unsuitable, such suitability being largely dependent on the vegetation structure and its regrowth since the last management intervention.

Unfortunately, populations of adders and viviparous lizards in particular have declined disastrously especially during the last 15 years in Epping Forest, despite increasing knowledge, public opinion, expert opinion and efforts to reverse this decline. In some cases, these species have not been seen on sites for over 10 years and are presumed to be locally extinct. However, examination of Google Earth images in 2017 of sites adjoining Epping Forest but outside the jurisdiction of the Forest led to the discovery of an 8 ha field on private land constituting excellent reptile habitat, where we were able to establish in 2019 that it held thriving populations of lizards and slow-worms, while adders and grass snakes occurred. The field rests on London Clay and slopes to the south/southeast. We have since used cover boards and visual encounter transects to try to ascertain reptile population distribution and status. We now have some understanding of the status of slow-worms (widespread and abundant throughout), viviparous lizards (widespread but with inconsistent estimates of numbers) and adders (apparently restricted to areas downslope with young bushes and trees constituting young but developing secondary woodland). During World War II, the field was used as allotments for food production and almost certainly had no reptile populations, or small and transient ones. It seems likely that the current reptile status resulted from movement of individuals from the nearest Epping Forest site, just 50m away and with no obstacle to reptile movement. Until the recent loss of populations in the Epping Forest site in question, it seems likely that there was a level of movement in both directions between the private field and Epping Forest. We have some evidence that this did occur. Our hope is that this site will become an important source of animals for re-introduction to the adjacent site in Epping Forest that held all four species until 2010 when the last adders were found there. Reptiles disappeared from this site at least in part due to inappropriate habitat management, although now the habitats on this site are in good condition for reptile survival. However, there are at least two issues in particular that need addressing. Firstly, while we have excellent relations with the estate manager of the private field, who is an enthusiastic conservationist, we have no control over its management or even its maintenance as a field – for this reason using it as a source of feedstock of reptiles in the longer term cannot be guaranteed, either by natural migration or by assisted translocation.

Fig. 1. A particularly fine pregnant female basking at the edge of a grass path, late July 2021.

Fig. 2. There have been several sightings of melanistic adders. This one was found at the end of March 2021 basking on the end of a bramble patch.

Secondly, stipulations by the Conservators of Epping Forest (Corporation of London), and by Natural England must be complied with before any translocation can be attempted, such as that the habitats of the recipient site must be suitable, and that the donor site populations can tolerate the removal of translocated individuals. Our concern in the longer term is that the purpose of the private field could change, at worst losing its status as any sort of wildlife haven, before compliance of the necessary stipulations for translocation has been achieved.

Fig. 3. Viviparous lizards are widespread in the open areas. We have the impression that the population is only modest.

Table 1. Total number each year of reptiles found on the private estate.

Year	Slow- worm	Viviparous lizard	Grass snake	Adder
2019	33	13		1
2020				1
2021	12	5		12
2022	80	8	3	6

Comparison of Scale Anomalies in Adder *Vipera berus* Populations Differing in Size and Levels of Habitat Fragmentation

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As studying drivers of population trends becomes more important for the survival of the species, so too will the identification and mapping of individuals over time. Population declines of threatened species are often detected only after the drivers of the declines are well-established yet difficult to identify, mitigate or reverse. Developing 'early warning system' measures that can be used as proxies to identify populations potentially in trouble may therefore have merit for devising early interventions to arrest declines. Deviations from abnormal scalation patterns in reptiles can potentially provide such a system for identifying environmental stressors. As reptiles show strong bilateral symmetry in scalation patterns they provide a good model for exploring the potential of deviations from symmetry in relation to potential environmental stress. We analysed adder head patterns from four declining populations in southern England that have been subject to differing degrees of environmental pressures. At all four sites photographs have been used to identify individuals for long-term population research. Nearly 1300 images were processed comprising 400 individual adders across the four sites. Based on previous studies, we focused on the apical, intercanthal and supraocular scales and scored these according to (1) asymmetry (different numbers of the same scale on either side of the head); and (2) fragmentation (clear but non-traumatic fracture lines splitting a single scale).

Fig. 1. Talbot Heath. A site containing about 37 ha of adder habitat but isolated by urban development.

Although all four populations contained some adders that showed evidence of scale asymmetry and fragmentation, these anomalies were lowest at Fackenden Down, a rural population occupying a continuous habitat of chalk grassland and scrub. The other three sites were fully or partially isolated and showed higher levels of asymmetry and fragmentation than Fackenden Down. In two cases (Turbary Common, Talbot Heath) the sites were completely surrounded by human development; in the third case (Kings Wood) the adder populations were small and confined to three small clearings within a wider mixed woodland system. It is unknown what mechanisms may generate these patterns, but they could be indicative of restricted genetic flow and potential inbreeding depression affecting morphology. Morphological abnormalities may therefore provide a proxy measure of potential drivers of population decline, although further genetic analyses are needed to confirm this.

Fig. 2. The most common scalation pattern, in descending order from the apex: **two** unfused apical scales (red), **five** intercanthals (blue) and **six**, three on each side, supraoculars (yellow).

Fig. 3. Female adder from Talbot Heath showing asymmetry in head scale patterns (Photo: N. Dobbs).

Observations on Behaviour and Enclosure Use by Zoo-Captive Reticulated Pythons (*Malayopython reticulatus*)

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The discussion of enclosure size for captive reptiles is one that has been ongoing for nearly as long as these animals have been kept as such, with modern keepers beginning to embrace a principle of ‘there is no maximum size’. However, a more recent debate centres on the concept of minimum enclosure sizes as a way to present a starting point for both zoos and private keepers. Past studies have demonstrated welfare benefits to larger enclosures, as well as to those outfitted with enrichment based on the species’ natural history. However, much of these have been focused on small-to-medium sized species, and primarily on colubrids, with little to no research focused on large boas and pythons.

The reticulated python (*Malayopython reticulatus*) has been popular in both zoo and private collections since the early 20th century, in part due to their large size, impressive appearance, and reports of alert, active dispositions. However, very little of their behaviour has been scientifically monitored, and while they are reputed to be more active than other giant pythons (*e.g. Python bivittatus*), the ways in which these animals utilise enclosure space has been left unstudied.

Utilising 24/7 security camera surveillance, this study investigated the behavioural repertoires and enclosure use of zoo-captive *M. reticulatus* with the aim of providing evidence of the ways in which the species interacts with the captive environment, allowing for better evaluation of the husbandry needs of captive individuals and the ways in which these can be met by keepers. The subjects included two 1.1 pairs, a 0.2 pair, and a singly-kept male spread across four institutions (Crocodiles of the World, Paradise Wildlife Park, West Midlands Safari Park, and ZSL London Zoo, respectively), all of whom were adults (14-21 years) exceeding 3.5m in length (3.95-5.5m).

The cameras were mounted in each enclosure (Fig.1) and set to record footage over 21 consecutive days, with data readings taken every 10 minutes, resulting in 144 behaviours and postures recorded for each snake per day, for a total of 1008 recordings per day. Data was analysed using the Spatial Partitioning Index (SPI), paired T-Tests, and Chi-Square Test of Independence to analyse zonation use and investigate the expression of differing postures as well as comparing active/inactive behaviour by both individuals and groups.

Fig. 1. The 360° camera mounted with protective cage at ZSL.

Findings showed that while the subjects were not significantly more inclined to engage in active behaviours or fully stretched out postures than not, all but one snake showed SPI numbers indicating even use of enclosure zones, with the arboreal zones showing higher usage than the combined terrestrial zones. This suggests that while enclosure size is important in maintaining these large snakes, it is at least as important that these enclosures are structured in complex ways, with enrichment and climbing opportunities. The findings of this study suggest that continued work in studying the behaviours of giant constrictors may lead to improvements in captive husbandry in both the institutional and private arena.

Fig. 2. Camera footage pythons 'Adrian' and 'Rocky' at Crocodiles of the World.

Fig. 3. Pythons ‘Nagini’ and ‘Two-Dot’ at West Midlands Safari Park.

Turtle Tally: Mapping the Distribution of Released Pet Terrapins in UK Waterbodies

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Freshwater turtles have not been native to the UK for approximately 9000 years. Although terrapins can be seen in local waterbodies throughout the country due to owners releasing when unable to keep any longer. In 2015, the EU regulation (1143/2014) on invasive alien (non-native) species came into force prohibiting *Trachemys spp.* from being rehomed, exchanged, sold, or bred. Evidence shows that they are highly invasive globally, yet there is little evidence on their impact or ability to thrive in the UK. In 2018, the National Centre for Reptile Welfare (NCRW) opened at Hadlow College providing well needed rehoming services to reptiles and amphibians. The centre has since received several thousand terrapins, primarily *Trachemys spp*. (see NCRW report). Their longevity and the inability for owners to house appropriately due to size results in numerous submissions. With Covid-19, loss of jobs and financial difficulties, this can only add to the issue of pet relinquishment. The Turtle Tally UK citizen science project collects data on captive and released welfare, it includes the local and national community to collect data on distribution and is investigating disease presence in captive and release animals. This collaboration, with many others, have established several sanctuaries to alleviate pet relinquishment but this alone is not enough. If appropriate rehoming facilities are not in place, an increase in released terrapins is more likely. Monitoring released terrapin distribution is important for future management and investigation of impacts.

Fig. 1.
An adult red-eared slider terrapin living in Eliot Pond at the University of Kent, Canterbury Campus.

Fig. 2. Rescue carried out by the Turtle Tally team during Summer 2022 due to a pond drying out in Ditchling.

Fig. 3. Welfare assessment data collection of both captive and released terrapins measuring body morphometrics.