Terrapins in South-east Yorkshire (VC61)

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Introduction

Various terrapin species are widely recorded as living wild throughout the UK (Langton *et al.*, 2011; Allain, 2019; Simpson, 2021). These non-native terrapins were kept as pets but released when they were no longer wanted. In prehistoric times, during several warm episodes in the Pleistocene and early Holocene, the European Pond Terrapin (also called the European Pond Tortoise or European Pond Turtle) *Emys orbicularis* inhabited southern Britain (Stuart, 1979; Sommer *et al.,* 2007). This animal died out as the climate cooled in the middle Holocene as recently as 6,000 years ago and it is now regarded as non-native in the UK.

Currently, the Pond Slider *Trachemys scripta* from central and southern USA is the most frequently recorded terrapin living wild in the UK (Langton *et al*., 2011.; Simpson, 2021). Two forms or morphs (typically referred to as subspecies) predominate in the UK: the Red-eared Slider/Terrapin *T.s. elegans* and the Yellow-bellied Slider *T. s. scripta.* Although different in their head markings, a recent genetic analysis, including mitochondrial and nuclear markers, detected no genetic differentiation between these morphs, therefore finding that a subspecific status is not merited genetically (Vamberger, *et al.*, 2020). However, for practical conservation purposes Vamberger *et al.* did not propose abandoning the well-established subspecies status of these two morphologically distinct Pond Sliders.

The Red-eared Slider used to be the main pet terrapin traded and released into the wild in the UK (Langton *et al*., *loc. cit.*). A trade ban on importation of Red-eared Sliders into the EU, introduced in 1997 (Council Regulation (EC) No 338/97), led to trade switching to other terrapin species (Langton *et al*., *loc. cit.*; Global Invasive Species Database, 2022). In the ongoing national terrapin survey, Turtle Tally UK, the Yellow-bellied Slider outnumbered the Red-eared Slider during the first two years of the survey, 2019-2020 (Simpson, *loc. cit.*). Other terrapins less commonly recorded as living wild in the UK include musk turtles *Sternotherus spp*, cooters *Pseudemys spp* and map turtles *Graptemys spp* (Langton *et al.*, *loc. cit.*; Allain, 2019; Internet ref. 1).

The Red-eared and Yellow-bellied Sliders, as well as the related Cumberland Slider (*T.s troostii*), were listed as invasive alien species of concern in the EU on 3rd August 2016 (Regulation (EU) No 1143/2014). In the EU, they are regarded as widespread and a serious threat to endangered populations of indigenous terrapins such as the European Pond Terrapin and the Mediterranean Pond Turtle *Mauremys leprosa*, because they compete for basking and nesting sites (European Commission, 2020). According to this EU report, pond sliders are also considered to have the ability to disturb aquatic habitats owing to their "voracious appetite" and to pose a "human health risk, being a possible reservoir for *Salmonella*". The EU Regulation was converted into UK law as *The Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2019* with accompanying guidance, e.g. for animal species in England and Wales (Internet ref 2). Under this law, these three slider terrapins can no longer be kept as pets (except any kept prior to 3 August 2016); other restrictions include a ban, with very limited exceptions, on importing these terrapins into the UK and a ban on releasing them into the environment. These terrapins are not, however, included in the *Invasive Alien Species (Enforcement and Permitting) Order 2019* (Internet ref. 3), which requires management plans to be put in place in England and Wales for widely spread species of EU concern. Presumably, for these slider terrapins, it is considered that the focus should be on reducing further introductions into the environment rather than controlling existing populations (see consultation on proposed management measures at Internet ref. 4).

In mainland Europe, competition between non-native and indigenous terrapins has been shown for basking sites (Cadi & Joly, 2003) and food (Balzani *et al*., 2016). Although this is not relevant in the UK, this situation could change if the European Pond Terrapin were the subject of an authorised re-introduction scheme. Another aspect that needs to be considered is the potential to negatively affect aquatic habitats and to pose a human health risk in the UK. These potential negative consequences are likely to be influenced particularly by the number of terrapins present and their distribution.

Despite evidence of the presence of terrapins throughout the UK, terrapin records are not routinely submitted to local recorders and they are likely to be under-recorded. A recent project used photographs submitted to Flickr to mine records of terrapins in the UK (Allain, 2019). In addition, Turtle Tally UK, a citizen science project (see Internet ref. 5), is currently aiming to cover recording gaps of terrapins in the UK by encouraging the general public and anglers to submit sightings via a dedicated website.

Terrapins were spotted in several lakes and other water bodies in and around Hull during our 2019-2020 dragonfly survey (Gómez & Shillaker, 2020) and during recent monitoring of the city's wildlife by AG (e.g. Internet ref. 6). In the first report on East Yorkshire terrapins, almost three decades ago, Kirk (1994) reported few sightings of terrapins living wild in East Yorkshire but none from Hull. Given this, we decided to produce an account of our findings in South-east Yorkshire (VC61), supplemented by sightings by other observers. This study complements the review by Colin Howes and John Newton (see p100 of this issue) of terrapins from much of the rest of Yorkshire and also the previously mentioned national terrapin survey (Turtle Tally UK). In addition, our study should provide useful background information for any assessment of the potential risks posed by terrapins to the environment and human health in Hull and East Yorkshire, especially in the light of predicted future climate change.

Methods

Terrapin records for VC61 up to the end of 2021 were obtained from several sources; three records from 2022 have also been mentioned because they provide relevant additional information. Our own sightings have been submitted to iRecord, where we also searched for further records. To be as inclusive as possible we searched iRecord for Emydidae, the family-level classification for most terrapin species. A few records were obtained from the NBN Atlas. We are not aware of any additional records held by the Yorkshire Naturalists' Union. In addition to general requests for information posted on social media, we individually approached local naturalists, The North and East Yorkshire Ecological Data Centre, the Pocklington Canal Amenity Society and a few Parish Councils with village ponds where terrapins had been sighted. Once a site had been identified to hold one or more terrapins, further internet searches were carried out to find if there were additional records and/or photographs which would help identify the species.

We generated a bar chart showing the seasonality of terrapin sightings using dates for all VC61 records of Emydidae submitted to iRecord from 2000 to 2021, a total of 52 records. It should be noted that many sightings obtained from other observers have not been entered onto iRecord, in particular because of a lack of sufficient information.

Identification of terrapins to species in the field poses some challenges (Conant & Collins, 1991; also see Discussion, p90). We typically spotted terrapins at some distance, viewed them through binoculars and took photographs. Available terrapin photographs by other observers were also examined. To help, we referred to a guidebook on North American reptiles (Conant & Collins, 1991), published papers (e.g. Langton *et al*., 2011; Baxter-Smith & Meek, 2012; Vamberger *et al.*, 2020) and online guidance (Internet refs. 7, 8). In many cases we sought confirmation of identification from Suzie Simpson of Turtle Tally UK; in some cases just the genus could be determined. No attempt was made by us to sex terrapins.

A six-figure, 100m x 100m, grid reference is provided for most sites (water bodies) with a terrapin record but it does not necessarily define the exact location of the sighting. Some sites are not well enough defined or cover too wide an area for a grid reference to be helpful. Exact dates were not available for all records as some were from memory, but we wanted to be as exhaustive as possible regarding sites where terrapins had been observed.

Results

Temporal and seasonal findings

The earliest reports of terrapins were from Pocklington Canal in the 1980s; it is unclear if the two 1980s reports refer to the same sighting. The earliest definite terrapin record is, however, from Brandesburton fishing pond no 3 in 1992 with sightings from a few other sites for the years up to 2009 (Table 1). The number of sites with sightings increased slightly in 2010-2014 (eight or nine sites) and then rose to 22 or 23 sites in 2015-2019, with 11 or 12 sites having terrapin records in 2020-2021. These latter included three sites at which terrapins had not been definitely recorded before. In total, terrapins were recorded at 32 (possibly 33) sites, of which 25 are known to have had terrapins during the period 2015-2021. At most sites only a single terrapin was seen. The sites at which more than one terrapin were seen during a visit in the period 2015 to 2021 are listed in Table 2.

Table 1. Number of VC61 sites with terrapin records, 1980s to 2021 mostly as 5-year intervals.

1980s	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	2020-21
1(2?)	4	1(2?)	2(5?)	2(4?)	8(9?)	22(23?)	11(12?)

Note: the higher value in brackets refers to uncertain or presumed site records.

Table 2. Sites at which more than one terrapin were seen during a visit in the period 2015-2021.

Site	Max. no. of terrapins seen on a visit	Comments
East Park lake	At least 8‡	Possibly as many as 20 (an estimate)
Pickering Park lake	7	Could be more
Humber Bridge Country Park pond	5 or 6	Now thought to be none
Kilnwick Percy Hall lake	3	3 seen in 2014, ‘several’ seen 2021
Paul Holme Strays, car park pond	3	3 seen in 2021
Beverley and Barmston drain (in Hull)	3	3 seen in 2021
Melton village pond	3	2 seen in 2019 & 2020, 1 seen in 2021
Walkington village pond	3	3 reported in 2007, 2 seen in 2021
Foredyke Green pond	2	2 reported by locals (date?), 1 seen in 2017

‡ 9 seen on 17 May 2022

Terrapins were seen during spring, summer and autumn with the first sighting on 9 March and the last on 19 October, which was an unusually warm day with an air temperature reaching about 19℃. Changes in the number of terrapin sightings per month based on iRecord data are shown in Figure 1, p85. Most sightings were recorded in May and June as well as in September, with a dip in the number of sightings in high summer.

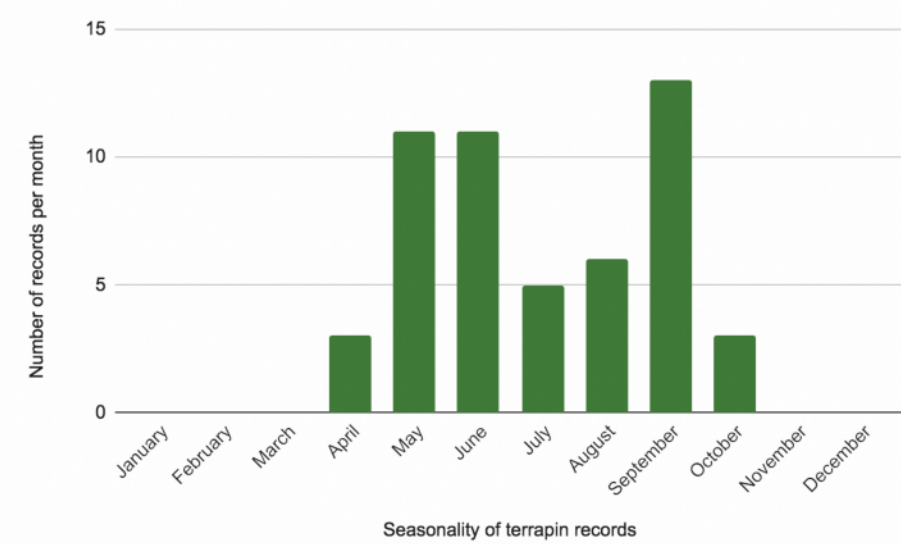

Figure 1. Seasonality of terrapin records in VC61 based on iRecord data (n= 52 records).
Note: a record is a sighting of one or more terrapins at a particular site on a particular day.
Hence the number of terrapins seen per month can be greater than the number of records.

Records for individual sites

Terrapin records were obtained for the following 32 sites: 10 in Hull and 22 in the rest of VC61; there is also a record for an unspecified location in Hull. The majority of sites (30) were water bodies and for 16 of these sites there were sightings in more than one year, suggesting the presence of at least one established resident terrapin.

Note: * Indicates sites with one or more records during the period 2015 to 2021

Hull sites

***Beverley and Barmston Drain** (TA093306): The drain, a Local Wildlife Site (LWS), is situated slightly to the west of the River Hull and follows the general course of the river through the city before draining into the river in the Sculcoates district. From 2019 to 2021, up to three terrapins have been seen by AG in the section of drain between Sculcoates Lane and Stepney Lane on six occasions between May and September. A favoured basking spot was a metal drainage pipe but they were also seen basking on an old nest of a Coot *Fulica atra* (Figure 2, p88) and on the shore. Two of the terrapins have been identified as Yellow-bellied Sliders. There is also a report in the Hull Daily Mail (April 2020) of walkers spotting terrapins in the drain near Beverley Road; a photograph shows a terrapin basking on the above-mentioned drainage pipe (Internet ref. 9).

Bransholme Reservoir (TA086339): The reservoir is designated a Site of Nature Conservation Interest (SNCI) by Hull City Council. Stuart Noble told AG that he had seen a terrapin there when doing bird counts c.2013. In addition, anecdotal reports of terrapins are mentioned in a habitat survey report by Black & Veatch Ltd (2011). This recommends that a strategy should be identified to prevent the release of any non-native reptiles (terrapins) into the wild.

***East Park, Ferens Boating Lake**: The park is a SNCI. There is a terrapin record on Twitter from 2014 with regular records in iRecord from 2017 to 2021; photographs are also available. The

number of individuals has been estimated to be “at least eight” (Simon Brebner pers. comm.), although a park ranger estimated that up to 20 could have been present in 2021; nine were seen by AG on 17 May 2022. Terrapins have been observed at several places around the lake where they use bankside branches, old Coots’ nests and fallen tree trunks for basking on the east or south sides of the islands. They have also been spotted by us basking at the water surface. A Yellow-bellied Slider, a Yellow-bellied X Red-eared Slider hybrid and two Cooters have been identified. Also, in July 2022, a Red-eared Slider was photographed basking on a fallen log. One Cooter had a distorted carapace which may have been the result of incorrect husbandry when kept as a pet. In both June 2020 and June 2021 a terrapin basking out of the water was noted to have a few scutes slightly separated from the rest of the carapace. This was considered to be nothing unusual and just part of the normal shedding of scutes. At least one melanistic individual with dark pigmentation of the eyes, skin and carapace was photographed. There is a recent report of someone catching a terrapin and apparently taking it home. No terrapins have been recorded in the adjacent Model Boating Pond.

***Foredyke Green pond** (TA100348): One terrapin was seen in the pond at this LWS in May 2017 and again later that summer (Jen Woollin pers. comm.). Locals have reported up to two large terrapins being present. AG paid several summertime visits to the pond from 2019-2021 when recording dragonflies but never saw a terrapin.

***Holderness Drain** (TA137318): This drain, a LWS, is on the eastern side of the city and takes water from the Yorkshire Wolds to the Humber Estuary. There is a single record from 2017 (Maggie Bruce pers. comm.).

***Noddle Hill Nature Reserve** (TA110349): This is a Hull City Council Local Nature Reserve (LNR). A terrapin was photographed in the main fishing lake in 2019 by AG. In September 2021, AG saw a Yellow-bellied Slider in the adjacent pond-dipping pond.

***Pearson Park lake** (TA084303): A young Red-eared Slider was photographed on a straw bale in the lake at this LWS in July 2006. Another young terrapin, a Slider hybrid, was seen in May 2012. There are also photographs of a Yellow-bellied Slider from May 2017 to May 2018. There have been no recent sightings in spite of regular visits to the park by AG. The likely source of one of these terrapins has been traced to a small pet bought in response to the Teenage Mutant Ninja Turtles TV series and then released into the lake after a few months, when its aquarium became smelly through lack of attention.

***Peter Pan boating lake** (TA055280): AG photographed a terrapin basking at the water surface in July 2019 and one was seen the following year by Chris Clarke (pers. comm.).

***Pickering Park lake:** The park is a LWS. Terrapins are thought to have been present in this large fishing lake for about 20 years with a few possibly released into the lake more recently. Although up to six or seven terrapins at a time were seen between September 2020 and July 2021 there are believed to be more terrapins in the lake. An angler using maggots as bait reported regularly catching terrapins, with up to nine caught on a single day. He noted a red area behind the eye and therefore concluded they were Red-eared Sliders. He has seen a variety of sizes with the largest having a carapace length of c.20cm. One terrapin recorded by AG on a visit in July 2021 was basking on an old bird's nest on the northernmost island. Both Red-eared Sliders (Figure 3, p88) and Yellow-bellied Sliders are present in the lake. A notable record is a Chinese Softshell Turtle *Pelodiscus sinensis* which is reported to have been caught

twice by anglers (including in 2021); one caught a few years ago (Figure 4, p88) was aggressive when handled and was released back into the lake (Ellis Hunter pers. comm.). A further species, a cooter, was identified from a photograph taken in March 2022.

*__Unspecified location__: the RSPCA reported that a Giant Musk Turtle (presumably a *Staurotypus* species) was found wandering in Hull in November 2020 (Internet ref. 10).

*__Willows Pond__ (TA126314): This Hull and District Anglers' Association pond is adjacent to the east end of the Boating Lake in East Park. A terrapin (there may be more than one) was seen regularly in 2021 (Derek Pye pers. comm.).

Other VC61 sites

***Beverley and Barmston Drain** (TA063381): A terrapin was seen in summer 2019 in the drain on Figham Common, by the bridge closest to Woodmansey (Andy Wilson pers. comm.).

Bishop Burton (SE990399): In July 2012, RS saw a terrapin, carapace c.15-20cm long, swimming under water in the small pond on The Green.

Brandesburton fishing lake (TA101474): This lake is called no. 3&4 pond by the Hull and District Anglers' Association. Kirk (1994) cites a report from 12 October 1992 in the Hull Daily Mail of a Red-eared Slider caught by an angler in no. 3 pond and that one had been caught two weeks previously. Kirk considered that a photograph accompanying the article appeared to confirm the identification.

***Filey**: A terrapin, of c.25cm length, was removed from one of the ponds at a caravan park in 2018 (Jen Woollin pers. comm.).

Filey Dams (TA107808): A terrapin is known to have been present at this Yorkshire Wildlife Trust Nature Reserve (YWT NR) but was subsequently removed (Sue Hull pers. comm.).

***Grindale Mere** (TA131711): Up to three terrapins were seen in June and August 2012 and in May 2016 by different observers at this large pond near Bridlington. A Red-eared Slider and two individuals that appear to be cooters were seen (Internet ref. 11).

*__High Eske Nature Reserve__ (TA052442): This is an Environment Agency Nature Reserve near Beverley. A Red-eared Slider is considered to have been present since about 1997 in a small 'borrow pit' pond due north of High Eske Lake and adjacent to YWT's Pulfin Bog Nature Reserve (Jon Traill pers. comm. and Internet ref. 12). It has been photographed basking on a log several times, including on a warm day in October 2014. The terrapin was recorded most recently in April 2021 (Internet ref. 13) and appears darkened with age.

***Humber Bridge Country Park** (TA018260)**:** This LNR is managed by East Riding of Yorkshire Council (ERYC). Five or six terrapins were seen on one occasion in 2016 (Gavin Paterson pers. comm.). It is presumed that they were spotted in the large permanent pond. The terrapins are thought to have been subsequently removed. There have been no reported sightings in 2020 or 2021.

*__Kilnwick Percy Hall Lake__ (SE824496): The Hall, which is near Pocklington, is home to the Madhyamaka Buddhist Centre. There are photographs on Flickr and Twitter of terrapins basking on logs between May 2013 and September 2021, which include three Red-eared Sliders (Internet ref. 14). A map turtle *Graptemys sp.* photographed in July 2020 had a rear scute

Figure 2 (left). Yellow-bellied Slider on old coot's nest in Beverley and Barmston Drain. Photo: Africa Gómez.

Figure 3 (right). Red-eared Slider beside Pickering Park lake. Photo: Africa Gómez.

Figure 4. Chinese Softshell Turtle caught by fisherman at Pickering Park lake. Photo: Ellis Hunter.

Figure 5. Communal basking beside East Park lake. Cooter in middle, probable Yellow-bellied Slider on left. Photo: Africa Gómez.

separated slightly from the carapace (Internet ref. 15). A photograph of possibly the same individual taken from a different angle in September 2021 shows a gap around one dorsal scute and another dorsal scute had lifted away from the carapace (Internet ref. 16). Both of these observations are considered to be evidence of the normal shedding of scutes.

Leconfield: Kirk (1994) mentions a report from August 1993 in the Hull Daily Mail of a Red-eared Slider being found in the middle of St Catherine's Drive, Driffield. This was considered to be an escaped pet. Note: St Catherine's Drive is in Leconfield, not in Driffield.

***Leven Canal**: The canal is a privately owned SSSI. A terrapin, probably a species of cooter, was videoed after being caught by a rod and line fisherman in June 2015 (Internet ref. 17).

***Mappleton beach**: a terrapin found on the beach in August 2017 was taken to a veterinary surgery (Maggie Bruce pers. comm.).

*__Melton village pond__ (SE972264): Three small terrapins appeared in the pond c.2016/2017 and subsequently grew much bigger (Rockett, 2021 and pers. comm.). A floating trap was installed in an attempt to catch them but this was unsuccessful. RS saw two terrapins swimming at the surface of the pond in May 2019 and May 2020. A single terrapin (carapace length estimated at c.20cm long) basking in reeds close to the water's edge was photographed by RS in September 2021; the animal appeared to be a Yellow-bellied Slider.

*__Paull Holme Strays__ (TA180251): There are reports of up to three terrapins being present in the car park pond of this YWT NR in 2020 and 2021 (see 19 June 2021 posting at Internet ref. 18), with a sighting of a single terrapin in August 2017. One terrapin has been identified as a Yellow-bellied Slider.

***Pocklington Canal:** Most of the canal has SSSI status; the small section in the vicinity of Hagg Bridge not notified as an SSSI has been designated a LWS by ERYC. Several terrapin sightings have been reported on Pocklington Canal Amenity Society's Facebook page in response to our request for information in August 2021. Terrapins are thought to have been present in Pocklington Canal since the 1980s (Alistair Anderson and Ian Vickers pers. comm.). Most reports have been of single individuals, although several have been seen in the past along the Bielby Arm and between Coates Lock and Sandhill Lock according to a report in the Hull Daily Mail (Kirk, 1994.). Kirk mentions several sightings near Coates Lock between 1993 and 1994; they were apparently claimed to be European Pond Terrapins (but this proposed identification has to be questioned in the absence of a photograph and any other reports of this terrapin in the area). The most recent record is of a terrapin spotted in 2020 between Bielby Swing Bridge and Walbut Lock. A number of people have apparently seen a terrapin along this stretch of canal, which was reported to have very little reed and waterweed growth. There are also sightings from the Melbourne stretch (possibly in the 1980s) supported by a photograph of a terrapin in a fisherman's keep net, as well as from near Hagg Bridge (c. 2002) and at Silburn Lock (c. 2011) (Pocklington Canal Amenity Society Archives; Pete Hinks pers. comm.; Marion Blockley, 2011).

***River Derwent** (on border of VC61 and VC62): A terrapin was seen basking on a log beside the River Derwent near Howsham by a canoeist in 2015; the sighting was probably in August or September (Internet ref. 19).

***Saltmarshe Delph** (SE774247): A terrapin, believed to be a Yellow-bellied Slider (no photograph seen), was first spotted in 2017 (Paul Adams pers. comm.) on this YWT NR. It was observed fairly often basking on a raft but there are no reports from 2021. There is no apparent evidence of it having negative effects on the Delph.

***Thwaite Hall lake** (TA053328): previously part of the Hull University estate in Cottingham. One terrapin, possibly noted in summer 2016, has been reported (Graham Sellers pers. comm.). Another, probably a Yellow-bellied Slider, was also seen in a ditch near the lake in September 2019 (Internet ref. 20).

***Tophill Low Nature Reserve** (TA071481): This is a Yorkshire Water NR near Hutton Cranswick. A probable Yellow-bellied Slider was present in South Lagoon at least from June 2015 (Internet ref. 12). No predation of chicks was observed and Little Grebe *Tachybaptus ruficollis* bred successfully in 2016. The terrapin was removed from the NR later that year (Internet ref. 21).

*__Walkington village pond__ (SE999371): This site has had a large number of terrapin sightings with several photographs on social media. Steve Dowler, who lives in the village and has taken

a particular interest in the pond, says that terrapins, which are still present, appeared in the pond about 20 years ago. Although he has never seen more than two at any one time, there is a report in April 2007 from another observer of three terrapins being present (see pictures of Walkington at Internet ref. 22). Steve provided the following interesting observations in 2021: "They were quite small when they first appeared and grew to their present size over the first 10 years, at which point they seemed to have reached maximum size. Initially they lived solitary lives with little observable interaction, however, for whatever reason, in the last two or three years they have sought out each other's company and can be seen together on their favourite log at the west end." The change in behaviour from solitary to social has been noted by another regular observer of the Walkington terrapins.

Steve Dowler also noted that: "They hibernate over winter and make their appearance around mid to late spring (depending on the temperature) and usually disappear around mid-September. With regard to interaction, they will happily 'sunbathe' alongside the ducks but are quite timid and will scurry back into the water if approached by humans. Over the years people have expressed an opinion that they should be removed from the pond as they eat the ducklings but I have never seen that happen and the rooks and a solitary seagull (which has visited during the breeding season for the last few years) are much more of a threat." There are several reports from 2021 of terrapins being present in the village pond. A number of photographs show them basking on a small log occupied by ducks with a Moorhen *Gallinula chloropus* nesting close by. The two terrapins present in 2021 are different species: one, a map turtle, is thought to be a Mississippi Map Turtle *Graptemys pseudogeographica khonii;* the other is a Yellow-bellied Slider. There is also a clear photograph of the map turtle basking beside the pond in 2007 (see pictures of Walkington at Internet ref. 22). In 2021 the first recorded terrapin sighting was on 9 March and the last on 19 October, which was an unusually warm day.

Wawne: A terrapin was seen in a farm dyke about 10 years ago (Rob Atkinson pers. comm.).

Wheldrake Ings NNR: There are records of four separate terrapin sightings on this YWT NR between September 1993 and May 2014 (Craig Ralston pers. comm.).

Discussion

Terrapin records were obtained for 32 (possibly 33) sites in VC61, 10 or 11 of which were in Hull. Most terrapin sightings were from ponds, lakes, canals and open drainage channels (dykes and drains), i.e. from still and slow-flowing water bodies. A large proportion of records were from sites considered important for wildlife conservation, i.e. SSSIs, NRs, LWSs/SNCIs. Other locations included lakes in urban parks and a few village ponds.

Recording and identification. Terrapins are mostly seen when they are basking out of the water, e.g. on a fallen branch. However, a terrapin can be present but out of sight when swimming under water or basking in a position hidden from view. Hence they can easily be under-recorded. We know of several instances in the last few years where a site with at least one terrapin has been regularly visited by us but no terrapin has been seen. In Hull, two lakes in public parks contained several 'large' terrapins: nine have been recorded in East Park Lake and seven were seen together in Pickering Park Lake (although more are thought to be present in both lakes).

As mentioned in the methods section, field identification of terrapins to species level can be challenging and many sightings have been recorded just as terrapins. However, we were able to determine that at least four species have been living wild in VC61. Two were fully identified (Pond Slider and Chinese Softshell Turtle). The presence of at least two others was based on the identification of two further genera (cooters and map turtles). One of the map turtles was probably a Mississippi Map Turtle. The sites at which these different types of terrapin were found are listed in Table 3. The Pond Slider, which included two subspecies and hybrids, was the most widespread and frequently identified terrapin recorded in VC61. There was also a report of a Giant Musk Turtle, which probably had been recently released or escaped, as well as reports, of questionable validity, of the European Pond Terrapin.

Table 3. Sites at which terrapin identification to genus or species has been possible.

Location	**Pond Slider** *Trachemys scripta*			**Cooter** *Pseudemys sp.*	**Map Turtle** *Graptemys sp.*	**Chinese Softshell Turtle** *Pelodiscus sinensis*
	Red-eared	Yellow-bellied	Hybrid			
Hull sites⧫						
Bev & B Drain*		●				
East Park	● (in 2022)	●	●	●		
Noddle Hill	o	●				
Pearson Park	●	●	●			
Pickering Park	●	●		● (in 2022)		●
Other VC61 sites‡						
Brandesburton	+					
Grindale Mere	●			o		
High Eske	●					
Kilnwick Percy	●				●	
Leconfield	+					
Leven				o		
Melton		o				
Paull Holme		●				
Saltmarshe		?				
Thwaite		o				
Tophill Low		o				
Walkington		●			#	

*Bev & B Drain = Beverley and Barmston Drain; ● = Definite ID; # = Probable Mississippi Map Turtle *Graptemys pseudogeographica khonii*; o = Probable ID; + = Reported by Kirk 1994; ? = No photograph to support reported ID; ⧫ A Giant Musk Turtle (presumably a *Staurotypus* species) was reported at an unspecified location in Hull; ‡ A report from the 1990s of European Pond Terrapins in Pocklington Canal is considered to be of questionable validity.

It is not surprising that many people who provided records would not be familiar with identifying terrapins, especially as differences between species can be quite subtle. Moreover, it is often not possible to get a clear view of a key feature in the field, e.g. the colour/shape of head markings, owing to the animal's position or the viewing distance, and some photographs were not of good enough quality. Identification is also hampered by individuals, particularly males, darkening with age (Conant & Collins, 1991) or individuals having non-standard features due to cross-breeding in captivity (Langton *et. al.,* 2011).

We have used iRecord to record our terrapin sightings and as one source of sightings by other people, although it has limitations for recording terrapins. In particular, it was not possible to record a sighting simply as a terrapin. If you entered the species name as 'terrapin' there were only four possible options: Red-eared Terrapin as species or subspecies, as well as European Pond Terrapin or Stripe-necked Terrapin *Mauremys caspica,* although the latter would seem to have been rarely found living in the wild in the UK. Terrapins could also be recorded on iRecord as Emydidae. In addition, it was possible to enter the species name as 'turtle' (the American name for a terrapin) and then select from a dropdown list which included Testudines (the reptile classification order for terrapins, turtles and tortoises) and a few freshwater 'turtles'. However, some terrapins known to have been living wild in the UK, notably map turtles, cooters and musk turtles, were not listed on iRecord. Owing to our initial inexperience in identifying terrapin species/genera and the limited options for recording terrapins on iRecord, some terrapin sightings have been reported incorrectly on iRecord as Red-eared Terrapin (as species or subspecies).

Years seen. There are reports of terrapins being released into the wild in the UK since Victorian times (Fitter, 1959). The earliest reports refer mainly to the European Pond Terrapin. In Hull and East Yorkshire, the earliest reports of terrapins living in the wild are thought to be from Pocklington Canal in the 1980s. The first definite VC61 terrapin record is, however, from a fishing pond at Brandesburton in 1992, with sightings from a few other sites up to 1994. These early VC61 records coincide approximately with the time when terrapins first became popular pets in the UK as a result of the Teenage Mutant Ninja Turtle craze. From 1995-2009 terrapin records continued to be only known from a few sites. The scarcity of reported terrapin sightings prior to 2009 is reflected by the observations of an active bird watcher who regularly visited the Noddle Hill area from 1987-2000 and East Park in the early 1990s but never saw a terrapin (Richard Broughton pers. comm.), and also by an apparent lack of terrapin records held by Hull City Council prior to the early 2000s (Jon Capel pers. comm.).

The number of sites with sightings increased slightly in 2010-2014 and then rose to 22-23 sites in 2015-2019. Despite this apparent recent increase in records, evidence suggesting the recent release of terrapins in VC61 is limited, e.g. the appearance of three small terrapins in Melton village pond in about 2016. The larger number of sites with terrapin records in more recent years is probably a result of increased recording by us (as we became more aware of their presence) and by other observers (associated with the popularity of digital photography and greater on-line recording opportunities) rather than to increased numbers of terrapins being released into the wild. Allain (2019) proposed a similar reason for the substantial increase in terrapin sightings reported on Flickr during the final years of his survey (2017-2018); he considered that this could have been due to more people using Flickr. Another possible factor contributing to the increase in terrapin sightings in recent years could be that as released

terrapins grew they became more noticeable, especially in large water bodies.

Terrapins are relatively long-lived. Red-eared Sliders can live for about 40 years (Global Invasive Species Database, 2022), although c.30 years is common (Harding, 1997), and the European Pond Terrapin has been known to live for up to 120 years in captivity (Stuart, 1979). It is therefore not surprising that at two sites, High Eske NR and Walkington village pond, there is evidence for one or more terrapins having been present for at least 20 years; terrapins are also thought to have been present in Pickering Park Lake for about 20 years. At High Eske the same Red-eared Slider is believed to have been present in a borrow pit pond since about 1997.

Seasonal activity. Terrapins were visible from March to October. During the colder months of the year they hibernate ('brumate' - dormant period for reptiles), normally under water (Ultsch, 1989) and have a number of physiological adaptations which allow this, including the ability to absorb oxygen from water through their vascularised cloaca and to tolerate hypoxic/anoxic conditions which can occur at the bottom of an iced-over pond (Ultsch, *loc. cit.*; Bronmark & Hansson, 2005; Litzgus, 2017).

Most VC61 sightings reported on iRecord were in May, June and September with a dip in the number of sightings in high summer. Although these data do not take account of other variables, e.g. the number, location or time of site visits, they do raise the possibility of seasonal differences in basking behaviour which might be worthy of further investigation. In eastern and central USA, sliders and cooters are reported to be seen basking in spring and autumn or at any time when it is not too hot or too cold (Conant & Collins, 1991). This is supported by observations on the Yellow-bellied Slider in the US state of Georgia where summer is a time of reduced basking activity compared to spring and autumn (Internet ref. 23). Our findings are, however, somewhat different to those of Allain (2019), who noted a peak in terrapin records in May but not September, and Howes & Newton (see p100 of this issue) who report the highest number of sightings in May, July and September.

Basking. Terrapins are particularly noticeable when basking on isolated logs or other structures at or near the water surface. Basking is a means of thermoregulation and is important for maintaining optimal metabolic activity, upregulating hormonal function during the nesting season, aiding digestion, facilitating vitamin D synthesis and controlling ectoparasites (see references in Dreslik & Kuhns, 2000; Jacobi & Kahl, 2021). Emydid terrapins are well-known for communal basking (Jacobi & Kahl, *loc. cit.*). We witnessed communal basking on numerous occasions and have photographs from various sites showing several terrapins basking close together on the same log or at the water surface. Communal basking can involve more than one terrapin species (Figure 5, p88). Also, an apparent change in behaviour from solitary to 'social' basking has been anecdotally reported for the map turtle and Yellow-bellied Slider in Walkington village pond. We noted that terrapins are wary and easily disturbed when basking, e.g. by an approaching person, causing the animals to slide off into the water. We also observed a basking terrapin return to the water following a sudden burst of loud bird calls and a Moorhen rushing through nearby vegetation.

Evidence of a benefit from communal basking comes from a study of Red-eared Sliders in Texas which suggested that basking in groups enabled better detection of predators (Jacobi & Kahl, *loc. cit.*). The anti-predator benefits of communal basking may be more limited in the UK where

adult Red-eared Sliders are considered to have “few natural enemies” (Aldridge *et al*., 2020), although these authors note that it is conceivable that hatchlings could be eaten by a number of predators e.g. by Grey Heron *Ardea cinerea* and corvids. The Otter *Lutra lutra,* however, has been shown to predate both juvenile and adult Mediterranean Pond Turtles in southern Spain (Clavero *et al*., 2005). In addition, communal basking could help to protect against unwelcome ‘attention’ by humans and dogs. Basking may also have a negative ecological effect. Terrapins sometimes bask on birds’ nests built at, or close to, the water surface. Hence it is possible that nesting by birds such as Moorhen, Coot and Great Crested Grebe *Podiceps cristatus* could be disrupted. However, we have only observed terrapins basking on ‘old nests’, i.e. those no longer used by birds.

Diet. Pond Sliders are widely-foraging, opportunistic omnivores consuming a variety of aquatic vegetation, invertebrates and, to a lesser extent, vertebrate food (Parmenter & Avery, 1990). Juveniles are reported to feed on a fairly balanced mix of plant and animal matter but as they grow plant material dominates. In a recent study this difference in diet was true for small and medium-sized Pond Sliders but the largest individuals were found to consume more animal than plant material (Works & Olson, 2018). Small fish, tadpoles and frogs can be actively pursued and captured but larger vertebrate food items are thought to usually result from feeding on carrion. Of the less-frequently recorded terrapins in the UK, the River Cooter *Pseudemys concinna* is primarily herbivorous; in contrast the Common Map Turtle *Graptemys geographica* is mainly carnivorous feeding on molluscs, crayfish and aquatic insects (Internet ref. 24). The Chinese Softshell Turtle is reported to be primarily carnivorous but a recent preliminary study in China concluded that it was omnivorous (Kong *et al.*, 2022).

Terrapins have not been observed feeding in VC61, although several have been caught by anglers using maggots, mussels or sweet corn as bait. Food resources at some sites must be suitable because at least two individuals are considered to have survived for about 20 years and terrapins released into Melton village pond grew considerably in a few years. In addition, obvious signs of poor health, e.g. the eye effects reported in pet sliders (Internet ref. 25), have not been noted at any site. Visitors to village ponds and urban lakes in VC61 often feed the ducks, particularly with bread. It is therefore notable that, in one London park, terrapins began feeding on bread thrown for the ducks (Langton *et al*., 2011).

Red-eared and Yellow-bellied Sliders can grow to a relatively large size (female carapace length up to c.30cm). However, being poikilothermic their energy requirements can be less than a similar-sized mammal. Hence in VC61 the ecological impact from terrapins feeding could be less than suggested by their body size. Ecological impact will be also influenced by several other factors including the number of terrapins and the size of the water body. For example, nine terrapins have been seen at the 16 acre lake in East Park and, although it has been suggested that as many as 20 may be present, it is difficult to imagine how they could have much of an impact on the ecology of such an extensive water body. However, as terrapins are large and non-native there is often a desire to remove them from ponds and lakes (this is not always successful, e.g. at Melton village pond). A commonly-stated concern is suspected predation on ducklings and other young waterfowl. We have not found any convincing evidence for this in the UK, although we are aware of anecdotal reports including some in the press (e.g. Barkham, 2007), and snapping turtles e.g. *Chelhydra serpentina*, which have been found in some UK water bodies, would be expected to predate waterfowl. Langton *et al*. (*loc.cit.*) consider that

the Red-eared Slider "has been wrongly accused in the press of attacking ducklings and other small wildlife (e.g. Yapp, 2004; Lloyd, 2005) often when other predators such as Northern Pike *Esox lucius* or the introduced Wels Catfish *Silurus glanis* are more likely to be responsible (e.g. Anon., 2005)". An observer at Walkington suspected that Rooks *Corvus frugilegus* and gulls were more of a threat than terrapins to ducklings on the village pond. However, predation by a Pond Slider on a duckling has been observed in Spain (Salerno & van den Burg, 2021) and a Red-winged Blackbird *Agelaius phoeniceus* which was struggling on the surface of a pond in North America was reported to have been attacked by up to three Pond Sliders (Lignon, 2007). The Colombian Slider *T. venustra callirostris (*previously classified as *T.s callirostris)* is also known to capture waterfowl by seizing their legs and pulling them under water (Pritchard & Trebbau, 1984; Cortes *et al*., 2021). Salerno & van den Burg commented that the chance of directly observing this type of predation is limited by the apparent speed of attack with the prey being dragged under the water.

Health and safety. Terrapins commonly carry *Salmonella* bacteria on the surface of their skin and carapace and outbreaks of *Salmonella* poisoning in humans have been linked to the keeping of pet terrapins in the USA (Internet ref. 26); associated cases of sepsis are also known (Nagano *et al*., 2006). A survey of pathogenic bacteria in free-living Red-eared Sliders in Spain found that 15% of the sliders sampled had *Salmonella* in their intestine or cloaca (Marin *et al.,* 2013). Therefore the risk to humans in the UK from the presence of terrapins in the environment needs to be considered, although the risk would be expected to be low unless terrapins were handled. It should be noted that Chinese Softshell Turtles can become aggressive and bite when handled (Park *et al*., 2006). In addition, non-native terrapins may carry diseases that infect native wildlife. For instance, pet terrapins rehoused at London Zoo suffered from an outbreak of the protozoan *Hexamita* which then created a concern for the zoo's bird collection (Langton & Herbert, 2011).

Breeding. We obtained no evidence for terrapins breeding in VC61. This was based only on casual observations but is consistent with observations from elsewhere in the UK. Notably, despite several reports of egg-laying associated with terrapins living in the wild in the UK (Bowley & Durkin, 1996; Langton *et al.*, 2011), there is little evidence for successful breeding leading to a sustainable or increasing population. The only apparent example of successful breeding is said to have involved the European Pond Terrapin in east Suffolk (Fitter, 1959); the original reports refer to releases and observations on the Mediterranean Pond Turtle (then called the Marsh Tortoise *Clemmys leprosa),* which occurred during the period 1889-1929 (Anon, 1931; Rope, 1934).

Current summer temperatures in the UK are considered to be too low to permit successful egg incubation. Data gathered by Rödder *et al.* (2009) from other studies suggest that an air temperature of c.26-32.5°C lasting for 60-130 days is required for successful incubation of Red-eared Slider eggs. However, as sex determination in this animal is temperature dependent (cooler temperature favouring males, warmer favouring females) a narrower temperature range (28.3-30.6°C) is required for a balanced sex ratio which would facilitate the establishment of a viable breeding population. It is notable that, although Red-eared Sliders have been widespread in mainland Europe for decades, evidence of successful breeding has only been found around the Mediterranean: in Spain (Perez-Santigosa *et al.*, 2008), France (Cadi *et al*., 2004), Italy (Foglini & Salvi, 2017) and Slovenia (Standfuss *et al*., 2016).

The future. The continued presence of terrapins in Hull and East Yorkshire will depend particularly on the balance of recruitment to, and loss from, the current population. Without further recruitment the population in VC61 will eventually die out. Recruitment will be affected by the following factors.

a) Successful breeding by terrapins living in the wild. Currently this is unlikely as it would require, in particular, much warmer summers and for a site to have both sexes of a species in reproductive condition.
b) Continued illegal release to the environment of unwanted pet terrapins (terrapins are still offered for sale as pets in the UK). All terrapins, including the European Pond Terrapin, are regarded as non-native in the UK. Hence, releasing any terrapin into the environment in the UK would be an offence under Section 14 of the Wildlife and Countryside Act 1981.
c) Possible authorised re-introduction of the European Pond Terrapin, which lived in southern Britain in prehistoric times. There have been re-introduction attempts in the UK in the past, with importing reported since Victorian times. Although there are several historical records of this terrapin in the UK there are few recent records (Fitter, 1959; Langton *et al*., 2011; Allain, 2019; Simpson, 2021). This is the most northerly-breeding Chelonian in the world and occurs in western Europe as far north as southern France (see map in Stuckas *et al*., 2014), although in eastern Europe it is present further north e.g. in Poland and Lithuania (Rybacki & Maciantowicz, 2008; Internet ref. 27). It is reported to favour shallow ponds that warm up quickly with plenty of plants in the littoral zone (Janiszewski *et al.*, 2014). These authors consider that the Eurasian Beaver *Castor fiber* creates suitable habitat for the terrapin. Hence the current re-introduction of the Eurasian Beaver into the UK might benefit any future authorised re-introduction of the European Pond Terrapin.

Loss from the terrapin population in VC61 could be due to:

a) Death from old age, poor health, disease or predation, or
b) Intentional removal of terrapins from water bodies because of concerns about the effect of a non-native species on the ecology of a site.

We intend to continue to record the presence of terrapins in VC61 and therefore would be grateful to receive details of any sightings, especially if photographs are available.

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