

Status report on *Trachemys scripta elegans*: pet terrapin or Australia's pest turtle?

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ABSTRACT

Red-eared Sliders *Trachemys scripta elegans* have become the ubiquitous 'pet terrapin'. They are endemic to much of eastern United States of America and northern Mexico, and have been traded to the four corners of the world, mainly from the 'turtle farms' of Louisiana, predominantly for the pet industry. There has been sustained growth in the industry (which included turtles for the Asian food market) since its establishment. In many countries, escaped and released animals have formed the basis of feral populations and in some areas they appear to have had a major impact on the biodiversity of local waterways. There are now breeding populations within Australia, at least in New South Wales and Queensland. This paper reviews the current evidence for feral Red-eared Sliders populations in this country and the approach governments of Australia have taken to overcome the spread of this species and the associated threats to biodiversity.

Key words: Red-eared slider, feral, aquatic pest, tortoise, introduced pest, wetland degradation, pet trade

Introduction

Freshwater turtles are popular children's pets (Alderton 1986; Covington 1995; Roberts 1998; Connor 1992). Although some locally-sourced species may become established in the pet trade (eg. in Australia, the pet shop turtle, *Elusor macrurus*; Cann and Legler 1994), worldwide the most common 'pet terrapin' is the Red-eared Slider *Trachemys scripta elegans*. Millions of these turtles are exported annually from the United States of America (USA) for the pet trade (Alderton 1986; Hoover 2002) and, to a lesser extent, the Asian food market (Hoover 2002). As a consequence, they have become 'probably the most commonly kept reptile in the world' (Conner 1992).

Dynamics of the Red-eared Slider trade

Red-eared Sliders are endemic to much of eastern USA and northern Mexico. In the 1930s, a pet trade industry was initiated in Louisiana that was based on wild-harvested animals. This was replaced by on-farm production by the 1950s. A subsequent major expansion of the industry occurred in the 1960s when husbandry techniques developed for the Soft Shelled Turtle *Trionyx sinensis japonicus* culture were transferred to the culture of Red-eared Sliders (Wood 1991). As a consequence of these changes, by 1969 there were 75 producers with an annual output of 15 million turtles (Kuzenski 1976). The USA 'turtle farms' became the source of most hatchlings for the pet market worldwide (Roberts 1988) with Louisiana farmers responsible for 85 - 95% of world trade in pet baby turtles (Wood 1991).

Sustained growth was maintained in the industry thorough the mid-1980s and there was a rapid expansion in the 1990s (Hughes 2000). This resulted in turtles being now the largest group of reptile species exported from the USA. By 2002 this represented an export of approximately 10 million Red-eared Slider hatchlings annually for the pet and food trade industries (Hoover 2002).

The sustained increase in exports has occurred despite the pet trade being severely curtained in 1975 when a US Federal ban was placed on inter-state shipment and sale of hatchlings because a source of *Salmonella* and Arizona bacteria that infected humans was traced to pet terrapins (Kuzenski 1976). However, *Salmonella* disinfection methods were developed within a short time and export trade again expanded. Certified pet turtle sales reached three to four million in 1986 and exceeded eight million in 1996. Numbers of producers almost doubled, from 25 to 48, over same period (Hughes 2000).

Historically, most hatchling turtles were distributed to the European community (particularly the former Soviet Union) and Eastern Asia. In 1991, Wood estimated that the trade to Europe and the Far East was three to four million hatchlings annually and noted that these sales maintained the USA industry. More recently the trade with Europe has been curtailed with an import ban imposed by the European Economic Community in 1998 over ecological concerns. This has reduced demand for hatchlings throughout Western Europe (Lutz *et al.* 2003).

The supply of Red-eared Sliders to the Asian market has continued to increase. For example, exports from USA to China have trended upwards (4.65 million 1998, 4.71 million 1999, 7.5 million 2000; Lutz *et al.* 2003). Typically these hatchlings are reared as livestock for eventual slaughter for human consumption, rather than being sold for the pet trade (Lutz *et al.* 2003). Based on statistics obtained from the Endangered Species Import and Export Management Office of the Peoples Republic of China, about \$0.5M were traded and sold commercially each year between 1999 and 2002. While rearing of imported stock apparently represents a substantial portion of the total trade volume, it was also assumed that there is 'mass farming' in mainland China. In addition to this trade, Red-eared Sliders have also been raised and traded elsewhere in Asia (CITES 2003).

The Slider invasion

Red-eared Sliders have declined within their natural range due to pressure from unsustainable farming (Warwick 1986). Although limited data are available on the status, distribution and ecological impact of introduced populations (McCoid 1993; Ng *et al.* 1993), due to their flexible environmental requirements, feral populations have become established outside of their natural range within the USA (Connor 1992; Rose and Manning 1996) and in a wide range of habitats, in various other countries (eg. France, Dupré 1996, Cadi *et al.* 2004; Italy, Ferri and di Cerbo 1996, Luiselli *et al.* 1997; Spain, Silva and Blasco 1995; South Africa, Branch 1998; Israel, Branch 1998, Taiwan, Chen and Lue 1998; Thailand, Cambodia, Malaysia and Australia CITES 2003; Guam, McCoid 1993; Singapore, Ng *et al.* 1993; Southern Florida, Hutchinson 1992; Sweden, Nilson and Andren 1986; Japan, <http://homepage3.nifty.com/japrep/englishtop.htm>; New Zealand, Fieldman 2005). While sites that encompass these populations are listed on the invasive species data base, the list includes additional feral populations from elsewhere in the world (South East and Far East Asia, Europe [Poland, France, England, Cyprus]), the Caribbean, Israel, Bahrain, Mariana Islands, Guam and South Africa (ISSG 2005). These populations can vary between apparently relatively small populations (eg. Burgin 2006) and those that cover an extensive area. For example, in a review of *Turtles of Borneo and Peninsular Malaysia*, by Liat and Das, Levell (2000) suggested that the introduced Red-eared Slider was 'almost universally' present in the region. As a result of the establishment of exotic populations across so much of the world, *T. s. elegans* is listed on the Invasive Species Specialist Group (International Union of the Conservation of Nature) as 92 on the list of 100 'worst invasive species' (ISSG 2005).

Red-eared Sliders: the Australian context

Apart from their attractive appearance and distinctive facial markings, a major reason for their popularity as pets is their robustness. In the wild they are able to cope with a wide range of environmental conditions across the temperate regions of the world. They have become established in a large number of countries across the world including South Africa, the Mediterranean and much of East Asia (see above). These countries have similar climatic conditions to Australia (Burgin 2006).

As has occurred elsewhere in the world, Sliders have been imported into Australia for the pet trade and Asian food markets in Sydney's China Town (Stimson and Wells, pers. comm.). As with other countries, pet turtles have escaped within Australia, simply by accident or by deliberate release into the local wetland for all the usual reasons that families discard pets (Burgin 2006). This has resulted in the establishment of wild populations in at least two states (New South Wales, Burgin 2006; Queensland, O'Keeffe 2005).

Federal Government

Australia has among the strictest environmental protection laws in the world (<http://www.deh.gov.au/biodiversity/invasive/publications/too.html>). It is an offence to illegally possess imported exotic reptiles under the *Environment Protection and Biodiversity Conservation Act 1999*.

In May 2004, a moratorium on exotic reptiles (including Red-eared Sliders) was declared by the Minister for the Environment and Heritage. This included an eight week National Exotic Reptile Amnesty with exemption from prosecution during this period for those who forfeited animals being retained illegally. This project was conducted jointly with the Federal Government and all States and Territories. Now that the amnesty has lapsed, the keeping of such animals may incur Federal penalties of up to five years in prison and/or fine of up to \$110,000. These penalties are aimed at reducing the number of illegal exotic reptiles privately owned in Australia (Kemp 2004). This law provides the framework for State legislation.

Despite the Federal Government's recognition of the potential for Red-eared Sliders to become an environmental pest, their actual risk has not been formally assessed by the Commonwealth Department of Agriculture, Fisheries and Forestry (see Bomford 2003).

New South Wales

Amateur herpetologists have discussed sightings of Red-eared Sliders in New South Wales for more than 20 years and observations have been reproduced in a manuscript by Anthony Stimson and Richard Wells titled *A note on the Red eared Slider, Trachemys scripta elegans, 'feral' in the Sydney area* which was written for the Hawkesbury Herpetology Society Inc. It was reported that in 1985 a gravid female was found on the Everglades Golf Course (Woy Woy, Central Coast, NSW). It was collected and subsequently laid eggs at the nearby Australian Reptile Park. They also wrote that 'many specimens' had been observed on the Golf Course spanning a range of size classes which indicated that the collected female was part of a larger breeding population. The founding individuals were animals released by Eric Worrell (Australian Reptile Park) in the late 1950s. Wells and Wellington (pers. comm.) also stated that they had been observed in Centennial Park, Bicentennial Park, Lane Cove River, Mirrambeena Lakes, Manly Dam, Howes Creek, Wingello Creek and Nurranginee Reserve Ponds, with an unconfirmed sighting in Liverpool Weir. In his field guide of the Sydney Region, Griffiths (1997) provided information on Red-eared Sliders that supports the suggestion that they are present at sites including the Royal Botanic Gardens, Hacking River and Royal National Park. There have also been Red-eared Sliders found in backyards (eg. Anon. 2005a).

In Sydney sites, where the actual location where Red-eared Sliders were observed could be confirmed, were sampled in the late 1990s. They were only captured at one site. However, nets were generally only set for a few days and, therefore lack of capture does not confirm their absence from the site (Burgin 2006). More recently it has been shown that netting regimes need to cover at least five days, with high trap density to ensure reliable

sampling (O'Keeffe, pers. com.). My trapping effort is, therefore, considered marginal. The possible exception to this conclusion is the Lane Cove River where a year-long survey of turtles was undertaken as part of a student project. No Sliders were collected (Rosser 1997). In an equivalent study in the Upper Parramatta Catchment, Ross (2000) collected a single large individual. However, they have not been captured in turtle targeted surveys in impoundments elsewhere in North Western Sydney (eg. Dalem 1998, Burgin *et al.* 1999).

The site where Red-eared Sliders were found was Yeramba Lagoon (South Sydney) and sampling was extended at that site until the rapidly declining water levels during summer precluded further sampling (Burgin 2006). Upon finding Sliders, I immediately made this information available to the appropriate New South Wales government authorities, however, the implications of the find were not recognised. Indeed although I provided evidence that five of the six females captured had developing ovarian follicles (the other was immature) and there was evidence that they were laying eggs in the area, the data were ignored by government and dismissed by scientific reviewers as being of an inconsequential number. No follow up study has been commissioned.

The New South Wales Government response to the on-going sightings and evidence of at least one breeding population could probably be best described as having a 'watching brief'. The New South Wales Department of Primary Industries has a link to the Queensland Natural Resources, Mines and Water Pest Animals portal (<http://www.ricecrc.org/reader/pe-vp>) but there does not appear to be other material provided for public education/information through their web site. Despite this there are references to Red-eared Sliders in community forums. For example, in an article on the by-catch from a weed harvester in Glenbrook Lagoon (Western Sydney), it was commented that no Red-eared Sliders were found (www.bmcc.nsw.gov.au/download.cfm?f=B8FDE741-AE40-9F6C-B6D9A0A566D6C34D0).

Queensland

In an article titled *Invading Turtles* (Anon. 2004a), comment was made that 'the response by the Queensland Government to sliders found in that state stands in stark contrast to the disinterest and inactivity of the New South Wales Government'. However, arguably the most reputable Australian freshwater turtle expert reported to the Queensland National Parks and Wildlife Service some 15 years ago that a reptile enthusiast in the Caboolture area (north of Brisbane) was breeding and distributing Red-eared Sliders (Cann pers. com.). The Department declined to intervene because they were not native species. In January 2004, members of the public alerted the Queensland Department of Natural Resources, Mines and Water of the presence of Red-eared Sliders in the South Pine Shire, north of Brisbane (CALM 2004; DNRM 2005a).

Because of the potential major threat to native aquatic flora and fauna of Queensland, the government has declared *T. s. elegans* a Class 1 pest species under the *Land Protection (Pest and Stock Route Management) Regulation*

2003. Under the Act, Class 1 pests are those species with the potential to cause adverse economic, environmental or social impacts in Queensland. Under this category, it is illegal to introduce, feed, keep, supply or release Red-eared Sliders without a *Declared Pest Permit*. Non-compliance may result in charges and potentially fines of up to \$60,000. To date one Petrie resident (the individual that Mr John Cann informed the authorities about 15 years before, O'Keeffe, pers. com.) has been found guilty of keeping 22 animals and 27 eggs. He was fined \$5,000 (NRM 2005d; Murray 2005).

Additional reports of individuals and/or breeding populations were also confirmed from the general area (eg. NRM 2004a, 2004b; 2005b), together with reports of individual animals from as far away from the source as Bundaberg (van de Wetering 2005; NRM 2004b) and the Gold Coast. (NRM 2004b).

The Department of Natural Resources and Mines, who have responsibility for administration of the Act, have responded to the Red-eared Slider threat proactively. The process has included the establishment of a Task Force that included staff from the Department of Natural Resource and Management, together with representation from other relevant government bodies, local governments, the Queensland Museum and the Australian Quarantine and Inspection Service. Surveys were undertaken, together with permitted trapping to determine the extent of the incursion (2004b). By July 2005, 165 Sliders had been captured (NRM 2005c).

The Queensland government has also introduced an active community education program. For example on the Department's web page (<http://www.nrm.qld.gov.au>) there have been nine press releases, and a warning brochure that dealt specifically with Red-eared Sliders, between November 2004 and October 2005. Apart from engaging with the community to help in the removal of this feral species, the government has appointed a project officer (Scott O'Keeffe) and resources that include support staff. This team have introduced innovations to enhance capture of these animals that include development of a new trap type (DMR January 2005), turtle exclusion barriers and a 'sniffer dog' has been trained to find eggs and turtles (Townsend 2005). In 2006, the Taskforce hosted a regional workshop to encourage a networked approach to dealing with the problem.

Australian Capital Territory

Reports from the Australian Capital Territory (ACT) have been less frequent than in New South Wales and Queensland. A single Red-eared Slider was found in a Belconnen (Canberra) backyard (<http://www.abc.net.au/news/newsitems/200412/s1255687.htm>) and was considered to be an escaped pet. There have also been sightings in a wetland close to the Murrumbidgee River (<http://www.environment.act.gov.au/yourenvironmenthwp/pests/readearedsliderturtle>). Both these localities are in the head waters of the Murray River and thus if they were to become established there is the potential for them to spread throughout Murray Darling Basin (*cf.* rangelands, Norris *et al.* 2005).

In response to these sightings, a program of trapping and observational surveys were implemented, together with leaflet letter box drops in the general area, media releases (eg. Stanhope 2005) and a poster to support identification of the species (http://www.environment.act.gov.au/_data/assets/pdf_file/13580/redearedsliderturtleinformationposter.pdf).

Despite the substantial effort there have been no more confirmed sightings of Sliders (Anon. 2005b) although the media attention generated in the ACT prompted public education campaigns as distant as Perth (Kanck 2005).

Western Australia

Under Western Australian State legislation, administered by the departments of Agriculture and Conservation and Land Management, it is illegal to import or maintain Red-eared Sliders in captivity. Although recognised to have the potential to become a pest in the south-east of the State, there has been limited evidence that they are currently present in the wild. However, in response to media coverage in Queensland, there was a media release titled *Feral toads and turtles* by the Western Australian Department of Agriculture. People were encouraged to be vigilant and report any 'unusual animals' to the Department. The Queensland Government web address was included for information (Department of Agriculture 2004). As indicated above, the public education program was also further stimulated by a sighting in the Australian Capital Territory (Kanck 2005). A report of a suspicious turtle at Kewdale was received from the public in December 2005. With the assistance of the Queensland team, the animal was identified as a Red-eared Slider and captured (O'Keeffe, pers. com.).

Through the National Heritage Trust funds, a grant of \$103,260 was provided to the West Australian Department of Agriculture for a project to assess the risk posed by the import of two potential pests, the Red-eared Slider and an African bird (Truss 2005).

South Australia.

In South Australia Red-eared Sliders are considered to have a 'high pest potential' and, as such, proclaimed as a Class 3a animal under the *Animal and Plant Control (Agricultural Protection and Other Purposes) Act of 1986*. It is an offence to 'keep or possess, move, sell or release' the species without a permit. The Adelaide Zoo has such a permit for the purposes of public education (Holloway 2005). Along with other exotic species, there is information on Red-eared Sliders posted on the Department of Water, Land and Biodiversity Conservation website (www.dwlbc.sa.gov.au). There does not, however, appear to have been reports of the species outside of captivity.

Victoria.

There is reported evidence from Victoria that Red-eared Sliders may be present in local wetlands. During the Victorian amnesty, two Red-eared Sliders were surrendered and a billabong was drained in an attempt to retrieve a pair that the owners had released there (DPI 2004).

Victoria's Department of Sustainability and Environment have recovered Red-eared Sliders, together with a range of other North American species, from homes and shops of Melbourne (O'Connor 2005). Smugglers have also been caught. For example, one individual was found to have in their possession 12 Boa Constrictors and two Red-eared Sliders (Smith 2004). More recently an individual was jailed for possessing Corn Snakes, Green Tree Pythons and Red-eared Sliders (O'Conner 2005; Oakes 2006).

Northern Territory

There are no recorded sightings of Red-eared Sliders from the Northern Territory although there have been unsubstantiated reports that smuggling may occur (O'Keeffe, pers. com.). As fewer people reside in the Territory, compared to Sydney and Brisbane, it is likely that fewer animals are kept in the area and, therefore, there are fewer individuals available that could act as founders to support the establishment of feral population/s. Other factors such as the total number of people interested in natural history/science, relatively few permanent wetlands close to the urban population concentrations and presence of crocodiles, may inhibit or preclude observation of feral turtle populations if they were to exist.

The climatic conditions in the Northern Territory are not considered to be ideal for Red-eared Sliders, although there is evidence that they can adapt to a tropical environment (Mol and Moll 1990).

Tasmania

As with the Northern Territory, there are apparently no sightings of Red-eared Sliders in Tasmania. The relatively low human population, compared to the Sydney and Brisbane areas, may also result in fewer potential releases and observations of wild populations. However, evidence from New Zealand indicates that climatic conditions in the southern latitudes may not be conducive to survival of Red-eared Sliders in the wild. There appears to be inappropriate habitat for nesting and conditions may not be conducive to the development of viable eggs and/or hatchlings (Fieldman 1992, 2005) and healthy animals (Fieldman 1998, 2005). For example, reptiles that are not adapted to cooler climes require water temperatures above 18-20°C for active feeding (Ernst *et al.* 2004) and incubation temperatures need to be above 22.5°C or hatchlings are likely to be deformed or neurologically impaired (Ewert *et al.* 1991). Overall, it would appear that if there is anywhere in Australia with adequate standing waters where Red-eared Sliders may not establish feral populations it is Tasmania.

Conclusion

A comparison of the current range of Red-eared Sliders indicates that these turtles will survive within the environmental conditions that are typical of many environments within Australia. They are able to inhabit a wide range of impoundments and rivers, and this may include the saline reach of rivers and salt marshes (Lehrer 1990). They may also rapidly expand their range via over-land movement (Ernst *et al.* 1994) and there are indications that they will displace local species (Burgin 2006).

Populations could potentially be formed on even a single adult inseminated female since they can produce fertile offspring for up to five years after insemination. They are also capable of multiple clutching (2/3 clutches/season; Covington 1995) although in Queensland they are apparently restricted to a single clutch/year (Limpus pers. com.).

Red-eared Sliders continue to be held in captivity across Australia and it is relatively simply to source them (pers. obs.). Individual animals found urban gardens in several cities (eg. Canberra, Sydney, Maryborough, Gold Coast) indicate that pets continue to escape from captivity. Smuggling is another factor. For example, Australian Customs interrupted an attempt to smuggle five hatchlings through the Melbourne airport in January 2000 (Australian Customs Service 2000). In August 2005, they also caught a passenger entering Australia through Brisbane airport with 39 exotic species, including Slider turtles (Australian Customs Service 2005).

Norris *et al.* (2005) noted that *T. s. elegans* may invade the rangelands 'in the near future' and they considered that they would have a major impact on wetland habitats. This view is supported by risk assessment that revealed that the species possess an 'extreme risk to biodiversity' (Townsend 2005). Although based on a small number of sites where Sliders had been netted, O'Keeffe (2005) observed that where there were large numbers of Red-eared Sliders, no native turtles or

fish were present. This trend has also been noted overseas (Pendergrass 2002). In contrast, I found two species of native turtles in the one waterbody with a breeding population of Sliders in Sydney (Burgin 2006). This finding may not necessarily be contradictory to previous observations. In the early phase of invasion, naturally-occurring species may be able to co-occur, but overtime the native species may be displaced. Observations and discussion during a visit to wetlands from which O'Keeffe and his team collected turtles demonstrated that the density of turtles in the Southern Queensland wetlands was greater than the wetland where I sampled a breeding population in Southern Sydney. This supports the concept that in 1997 when the sampling, reported by Burgin (2006) was carried out, the Southern Sydney population was probably only in the early phase of establishment.

There is no doubt that Red-eared Sliders are established in, at least, south-eastern Queensland (O'Keeffe 2005) and in New South Wales (Burgin 2006) and there is a strong possibility that they will become established in other areas of Australia. In Europe and Asia, their ability to displace native turtles has been recognised (Pendergrass 2002). The only valid conclusion that can be drawn from the evidence to date is that the cute little 'penny turtle' that was the ubiquitous childhood pet has made the transition in yet another country from pet terrapin to pest Red-eared Slider.

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