Bulletin of the Irish Biogeographical Society **No. 35** (2011)

2011 NATTERJACK TOAD (*EPIDALEA CALAMITA* LAURENTI, 1768) BREEDING HABITAT SURVEY, NORTH DINGLE PENINSULA, CO. KERRY, IRELAND

John Kelly Korky

Biology and Molecular Biology Department, Montclair State University, Montclair, New Jersey, 07043, U.S.A.

Abstract

Historic, natural natterjack toad (*Epidalea calamita* Laurenti) breeding sites on the north Dingle Peninsula, Co. Kerry, were surveyed in June 2011. Current habitat conditions and possible presence of toads were noted, and compared with the initial survey in 1997 by this author and others thereafter. The recent creation of new breeding ponds by the National Parks and Wildlife Service and their benefits are reviewed. Genetic data suggesting that the north Dingle toads share a common distant ancestor with those of southern Castlemaine Harbour are included. Comments on present taxonomic and systematic nomenclatural alternatives to designating the natterjack are offered.

Achomaireacht

I Mí an Mheithimh 2011 scrúdaíodh láithreáin síolraithe nádúrtha an chnádáin i dtuaisceart leithinis Chorca Dhuibhne, Contae Chiarraí. Tugadh faoi deara staid reatha na gnáthóige agus láithreacht fhéideartha na gcnádán agus cuireadh i gcomparáid iad leis an suirbhé tosaigh leis an údar seo agus le daoine eile ina dhiaidh sin. Déantar athbhreithniú ar chruthú deireanach na lochán nua, agus ar a mbuntáistí, ag an tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra. Cuirtear ar fáil sonraí géiniteacha a thugann le fios go roinneann cnádáin tuaisceart Chorca Dhuibhne sinsearach coiteann le cnádáin Loch na dTrí gCaol deisceartach. Déantar trácht ar mhalairtí ainmníochta tacsanomaíthí agus sistéamaí faoi láthair ar ainmniú an chnádáin.

Introduction

The natural breeding sites of the natterjack toad (*Epidalea calamita* Laurenti, 1768) between Fermoyle and Tullaree on the north Dingle Peninsula of Co. Kerry, were surveyed during the first week of June 2011 in the middle of the breeding season. These historic sites do not include the 90 more recent ponds dug by farmers under the National Parks and Wildlife Service (NPWS) REPS 4 Toads option programme, with aid in part from The Heritage Council. Sites were visited under NPWS licence since both toads and their habitat are protected under European and Irish statutes. Maps of sites are provided by Korky and Webb (1999), Beebee (2002), Bécart *et al*. (2007a, b), May and Beebee (2008, Fig. 1; 2010) and Aubry *et al*. (2010).

The presence of Ireland's only toad was first reported in 1805 at Callanfersey, Co. Kerry, south of Castlemaine harbour by Mackay (1836). Disjunct natural breeding sites encircle the harbour from Inch to Glenbeigh. Toads on the north Dingle Peninsula were only recognized in the late 1960's (Gresson and O'Dubhda, 1971). Speculation as to their origin focused for a time on a relatively recent anthropogenic translocation. This was proven unlikely by May and Beebee (2008, 2010) using microsatellite nuclear DNA analysis that suggested the north Dingle and Castlemaine toads were equally old and derived from a distant common ancestor, not from human transport northwards. This ancestor likely survived the last glacial maximum in a north European Lusitanian refugium and recolonized Ireland and part of England as ice receded and melt water raised the sea level isolating Ireland and England (Beebee and Rowe, 2000; Rowe *et al*., 2006). Given that the north Dingle toads have been present for perhaps centuries, it is curious indeed their presence was not reported before the 1960's in spite of vocalizations by their breeding choruses that can be heard at evening's onset over a kilometer and a half away.

Another consideration prior to the molecular findings, was the off chance that the Castlemaine toads had migrated on their own northwards over the dales of the Slieve Mish mountains. The probability of this event is virtually zero because of their short hind legs and the totally unsuitable habitat between the coasts. One can confirm this by following the road sign east of Inch marked "scenic route" Camp and traversing the single lane gravel road across the mountains with steep drops and free roaming sheep. Not for the faint hearted or toads!

Materials and methods

I first surveyed toad sites across Kerry in 1997 (Korky and Webb, 1999) for the primary purpose of netting larvae (= tadpoles) to document occurrence and analyze geographic variation by morphometric methods (Korky and Webb, 2001). Those samples were preserved in 10% formalin rendering them unfit for molecular analysis. I returned to Kerry localities in 2007 (Korky, 2008) to obtain tail tissue samples in drierite dessicant that could be used for molecular techniques. Some sites that yielded larvae in 1997 were dry in 2007, hence no samples were taken. North Dingle 2007 sites that were productive included: the Castlegregory golf course ponds at Stradbally; the Maharees slack No. 25 north of Lough Gill; and Tullaree ponds. I also collected water samples in 2011 at all north Dingle localities for subsequent analysis. Evidence of toad presence at a site could include: egg strings (spawn); larvae (tadpoles); metamorphosed toadlets; adults; calling adults heard but not seen; dead remains; adult tracks in sand.

Localities

The north Dingle sites are given from west to east along with their Irish grid map references in brackets.

Fermoyle (Q550122). The three ponds here are accessible by the Fermoyle strand road from the west or Kilcummin strand road from the east by driving on the strand to a midway point between the roads. Ponds lie just inland of the sea defence wall in a fenced pasture. The oldest pond has steep sides and depth of a meter at its centre, and is free of barrier vegetation. The other two lie in a pasture with a stream flowing east to west flooding the area with shallow water but overgrown by *Phragmites*. No evidence of toads was present. Adults were first found there in 1970 (Gresson and O'Dubhda, 1971), and the last spawn strings there were reported in 2004 (Bécart *et al*., 2007a). These authors suggested that the site of an estimated nine breeding adults was near extinction, and Marnell (pers. comm.) advises that no breeding has occurred there for years. My observations confirm the above. While there is adequate fresh water to breed in, reed clearance of the two more recent pond areas would be prudent, and if no resident toads appear, a reintroduction from the Stradbally source may be warranted.

Stradbally (Q592137). The Castlegregory Fishing and Golf Club boasts ideal breeding conditions for the toads in its eight or so ponds and drains although all are not equally utilized. The nine hole course was developed in 1989-1991 and Beebee (2002) reported that hundreds of adults, much spawn and tadpoles were present immediately afterwards in 1991. Bécart *et al*. (2007a) called this population the second largest in Kerry after the slacks of the Maharees. But the latter area faces severe annual dessication issues to be noted later here while Stradbally does not, making it a stable breeding and source site for reintroductions or translocations. I noted that as usual the two ponds closest to the ninth hole and the car park are a delight, loaded with spawn and tadpoles. Their sloping sides devoid of vegetation, warm shallow depth, and surrounding dunes for adults, result in abundance. Nearby drains to other ponds showed no signs of toads present. A deep, fenced pond with a submersible pump near work sheds also had no signs, reflecting habitat preference when choice is possible. Other ponds had few larvae or none perhaps due to steeper slopes.

Lough Gill (Q612500). Beebee (2002) reported that much spawn and tadpoles were present in the early 1970's. Bécart *et al*. (2007a) termed breeding here successful, with fluctuating water level due to a damaged sluice in the eastern end being the limiting factor for the survival of the egg strings. Many toadlets were also annually observed here over three years prior to 2007. I surveyed the entire northwest boundary adjoining the Castlegregory golf course and found no signs. I noted that the sheer drop into deep water protected by a rock wall made it unsuitable. It is the eastern end of Lough Gill, extending north of the pier, that is suitable and where spawn has been noted 4m from the shore in the reeds. My several surveys have not proven as positive. Wading north of the pier, I stirred up a calling adult which was not seen. It probably originated in the dunes north of the Lough. I have yet to see egg strings or tadpoles there including this year. I did flush out from among the reeds, a large probable trout that slithered to the deeper water. Since eggs, larvae, and adults are protected by bufotoxins, a group of noxious secretions making them unpalatable to predators, presumably this trout was not foraging. Successful breeding appears likely here along the extensive northeast shore.

The Maharee slacks (Q550122). Potentially with miles of dunes and slack areas north of

Lough Gill, it could host the largest Kerry toad population. But the reality is that dessication due to rainfall fluctuation and grazing animal water usage, annually plagues the slacks whose numbers may vary from several dozen to usually less than half that. The latter still may be breeding dead ends if they dry out after the spawn is laid or before the larvae metamorphose. Conditions across the area in this survey were hot and humid with dry ground conditions. The wind, exacerbating evaporation, resulted in many dried slack bottoms, moist mud and algal mats as I transected the dunes. Even slack No. 25 (Beebee, 2002), that was a meter deep in my 2007 survey, was 95% gone with the tadpoles densely crowded into the remaining shallow northern part. The reproductive success is unknown here without continued monitoring. Any mechanical digger deepening of productive slacks to enhance water retention should increase the reproductive success of this large region that appears in decline after repeated surveys.

Lough Naparka (Q623170). Considered virtually permanent (Beebee, 2002) and noted as site 1 (Bécart *et al*., 2007a, Fig. 6.3), this "lough" suffers the same plight of decline as the Maharee slacks in general due to the lack of water. My survey in 1997 showed that it was quite viable with visible adults peering from the dune burrows by day. There were abundant tadpoles for sampling in the shallow and warm water paralleling Tralee Bay. There was also a sloping margin lacking vegetation and even a dry rock wall for adult hibernation just west of the water. Subsequent visits (unpublished) turned up numerous tadpoles, but conditions were markedly poorer there in 2007 with it being 80% dry with emergent irises. There were no tadpoles, adults or any sign of toad activity. Now, 2011 was equally negative for any sign of natterjacks although a rim of shallow water was present along the eastern margin. Whether toads have survived here is unknown. Any mechanical deepening would enhance breeding success if toads were found to be still present. If not, it represents another possible reintroduction site.

Tullaree (Q636124). The eastern terminus of the Dingle metapopulation with toads being discovered there in 1983 (Beebee, 2002), several ponds were deepened in 1999 to extend the hydroperiod, and subsequently additionally scrape ponds were created (Shaw, 2006). I collected tadpoles in 2007 that were abundant. This survey encountered numerous calling adults at 17:30 hours. The ponds had abundant water and tadpoles. Water is not the limiting factor as the

surrounding fields are quite wet. Vegetational overgrowth is the densest that I have found at any survey site and it certainly impedes toad movement. Grass hummocks are knee-high, irises hip-high, and reeds shoulder-high, the latter two especially at the ponds. No grazing animals were present or any signs of the same although NPWS erected fencing in 2006 to encourage the grazing of horses. Frankly, such animals would be in peril under present conditions especially near the ponds. The vegetation issue at this site has to be addressed to allow the continuation of successful and long term breeding.

Discussion

Bécart *et al.* (2007b) provided a comprehensive overview of contemporary and potential future natterjack conservation issues. Generally, amphibian breeding success is all about water being present for spawn deposition and larval metamorphosis, all else being in order. As noted, the Maharee complex in particular suffered in recent years. Met Éireann online data show a mean annual rainfall at Valentia Observatory of 1430.2mm, but only 1331.7mm for 2010. Not a long term climatic trend, but notable. A query to Met Éireann found that there are no rainfall reporting stations co-inciding with any of the north Dingle sites for specific comparisons. As anecdotal as it may be, naturalists and farmers did remark how dry that the 2011 spring was generally countrywide. Suffice to say, water for breeding season was reduced as field conditions reflect. Remediation of drier conditions then would involve the widening and deepening with bank sloping of older sites as needed to retain the critical water. Unfortunately, no easy solution applies to the last two severe Irish winters that likely increased toad mortality, reducing adult numbers for reproduction.

New pond creation is the next conservation step forward, and as noted the REPS4 Toad option (see NPWS.ie website) is in place. Farmers in designated Kerry areas enter a five year agreement with compensation to have ponds dug on their property with specific maintenance conditions that I feel should be applied as stringently to the older sites as well. Some 90 new ponds have been dug to date, and as important, a team of freshwater biologists will monitor all the older and newer sites during the breeding season over the next two years (Marnell, pers.

comm.). This will afford the opportunity to evaluate the scheme's effect on population dynamics and conservation status in real time. The additional ponds will increase site interconnectivity of presently fragmented populations thereby increasing gene flow, decreasing inbreeding depression, increasing allelic richness, permitting source populations to bolster sink ones, and reducing the probability of local or wider extinction. This is important as loss of genetic diversity in amphibians has been shown to amplify synergistically the detrimental effects of environmental pollutants and pathogens (Allentoft and O'Brien, 2010).

A major component of pond maintenance is managing the vegetational succession or not, as Tullaree comes to mind. There I can only envision intensive, manual labour as the solution, grazing being perilous, and the hummocks and water table not facilitating field mowing. Natterjacks as habitat specialists prefer low vegetational growth for ease of movement within and between populations. Even toadlets, the dispersal stage, were experimentally shown to prefer low resistance vegetational environments (Stevens *et al*., 2006). Therefore it is critical that by pruduent grazing, mowing or both, the optimal habitat be maintained. Less vegetation will also reduce water loss through uptake and transpiration.

Taxonomic/systematic commentary

Are natterjacks *Epidalea calamita* or *Bufo calamita*, or *Epidalea* (formerly *Bufo*) *calamita*? All appear in the formal herpetological literature or naturalists' accounts. This is tantamount to asking, is the Kerry town Dingle or An Daingean or Daingean Uí Chúis? Highly contentious points of view pro and con follow. The generic name change of natterjacks from *Bufo* to *Epidalea* is based on publication of *The Amphibian Tree of Life* (Frost e*t al*., 2006). These authors determined that molecular data warranted resurrecting *Epidalea* from the species synonomy to reflect sufficient differences from other Eurasian bufonids. The change is maintained in the *Amphibian Species of the World* 5. 5 an Online Reference (Frost, 2011, see *http://research.amnh.org/vz/herpetology/amphibia/*), the author Frost cited in 2006 and 2011 being the same authority. Extensive discussion of the widespread name changes of biological taxa is way beyond the remit of this survey. Such changes based on different systematic philosophies have led to conflict and confusion in the formal literature and in public museum

displays. The basis of the ongoing problem is that there are overlapping codes of nomenclature in use (Hillis, 2007). The traditional *International Code of Zoological Nomenclature* or ICZN (see *http://www.nhm.ac.uk/hosted-sites/iczn/code/*), currently fourth edition posted 1 January 2000, is based on typology and priority, the use of a type specimen, the first published valid binomial, in a non-evolutionary framework to set the names of animal taxa to nomenclatural hierarchical levels. The first ICZN edition was published in 1905, with precedents dating to Linnaeus's tenth edition of *Systema Naturae*, 1 January 1758. The *PhyloCode*, alternatively, (see *http://www.ohio.edu/phylocode/*), uses phylogenetic determinations for taxa above the specific level within the 2006 *Amphibian Tree of Life* without ranking them. Cogent arguments, sometimes involving charges and countercharges of deceptions, for their dual useage or incompatability (Hillis and Wilcox, 2005; Hillis, 2007; Crother (ed.), 2008; Frost *et al*., 2009) are an ongoing work in progress. The resultant taxonomic instability is something that we will have to accept until it is resolved.

Acknowledgements

I am indebted to Ferdia Marnell of the NPWS for advice, comments, and licensing. Also to John Gillen, The City University of New York, who provided the Abstract in Irish and Jack Gaynor, Montclair State University, for assistance in map preparation and review of the manuscript. Gratitude for support is extended to Roger and Olivia Goodwillie, Lavistown, Co. Kilkenny and to Kirsten Monsen of Montclair State University for suggestions. This study was financed solely by the author and partly by the Faculty Scholarship Program of Montclair State University by released research time.

References

Allentoft, M. E. and O'Brien, J. (2010) Global amphibian declines, loss of genetic diversity and fitness: a review. *Diversity* **2**: 47-71.

Aubry, A., Bécart, E., Davenport, J. and Emmerson, M. C. (2010) Estimation of survival rate and extinction probability for stage-structured populations with overlapping life stages.

Population Ecology **52**: 437-450.

Bécart, E., Aubry, A. and Emmerson, M. (2007a) Monitoring the conservation status of natterjack toad (*Bufo calamita*) in Ireland, 2004-2006. *Irish Wildlife Manuals* **No. 31**.

Bécart, E., Aubry, A., Whelan, P. and Emmerson, M. (2007b) The natterjack toad *Bufo calamita* in Co. Kerry, Ireland: conservation status, current and foreseeable threats. *Irish Naturalists' Journal* **28**: 477-487.

Beebee, T. J. C. (2002) The natterjack toad *Bufo calamita* in Ireland: current status and conservation requirements. *Irish Wildlife Manuals* **No. 10**.

Beebee, T. J. C. and Rowe, G. (2000) Microsatellite analysis of *Bufo calamita* Laurenti populations: consequences of dispersal from a Pleistocene refugium. *Biological Journal of the Linnean Society* **69**: 367-381.

Crother, B. I. (ed.) (2008) Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. Sixth edition. *Herpetological Circular* **No. 37**: 1-94.

Frost, D. R., Grant, T., Faivovich, J., Bain, R. H., Haas, A., Haddad, C. F. B., de Sá, R. O., Channing, A., Wilkinson, M., Donnellan, S. C., Raxworthy, C. J., Campbell, J. A., Blotto, B. L., Moler, P., Drewes, R. C., Nussbaum, R. A., Lynch, J. D., Green, D. M. and Wheeler, W. C. (2006) The amphibian tree of life. *Bulletin of the American Museum of Natural History* **297**: 1-370.

Frost, D. R., McDiarmid, R. W. and Mendelson, J. R. (2009) Response to the Point Of View of Gregory B. Pauly, David M. Hillis, and David C. Cannatella, by the anuran subcommittee of the SSAR/HL/ASIH scientific and standard English names list. *Herpetologica* **65**: 136-153.

Gresson, R. A. R. and O'Dubhda, S. (1971) Natterjack toads (*Bufo calamita* Laur.) at Castlegregory and Fermoyle, Co. Kerry. *Irish Naturalists' Journal* **17**: 9-11.

Hillis, D. M. (2007) Constraints in naming parts of the Tree of Life. *Molecular Phylogenetics and Evolution* **42**: 331-338.

Hillis, D. M. and Wilcox, T. P. (2005) Phylogeny of New World true frogs (*Rana*). *Molecular*

Phylogenetics and Evolution **34**: 299-314.

Korky, J. K. (2008) Notes on the 2007 breeding season of the natterjack toad *Epidalea calamita* Laurenti (Anura: Bufonidae) in Ireland. *Bulletin of the Irish Biogeographical Society* **32**: 21-31.

Korky, J. K. and Webb, R. G. (1999) Resurvey, biogeography, and conservation of the natterjack toad *Bufo calamita* Laurenti (Anura: Bufonidae) in the Republic of Ireland. *Bulletin of the Irish Biogeographical Society* **23**: 2-52.

Korky, J. K. and Webb, R. G. (2001) Geographic variation in larvae of *Bufo calamita* Laurenti (Anura: Bufonidae) in the Republic of Ireland. *Bulletin of the Irish Biogeographical Society* **25**: 144-169.

Mackay, J. T. (1836) The natterjack toad (*Bufo rubeta*) occurs wild in Ireland. *Magazine of Natural History* **9**: 316-317.

May, S. and Beebeee, T. J. C. (2008) G*enetic analysis of Kerry natterjack toad (Bufo calamita) populations*. Report prepared for the National Parks and Wildlife Service June 2008.

May, S. and Beebee T. J. C. (2010) Recent introduction or ancient ancestry? Use of genetic evidence to investigate the origins of range edge populations in natterjack toads (*Bufo calamita*). *Conservation Genetics* **11**: 293-300.

Rowe, G., Harris, D. J. and Beebee T. J. C. (2006) Lusitania revisited: a phylogenetic analysis of the natterjack toad *Bufo calamita* across its entire biogeographical range. *Molecular Phylogenetics and Evolution* **39**: 335-346.

Stevens, V. M., Leboulengé É., Wesselingh, R. A. and Baguette, M. (2006) Quantifying functional connectivity: experimental assessment of boundary permeability for the natterjack toad (*Bufo calamita*). *Oecologia* **150**: 161-171.

Shaw, W. (2006) Conservation of natterjack toad (*Bufo calamita*) breeding habitats in County Kerry, Ireland. *Conservation Ecology* **165**: 619-629.

FIGURE 1. Distribution of *Epidalea calamita* Laurenti in Co. Kerry, 2007. Shaded areas = habitat with natterjacks present. Map after May and Beebee (2008).