Scientific name	*Lithobates (Rana) catesbeianus*
Common name	North American bullfrog
Broad group	Vertebrate
Number of and countries wherein the species is currently established	7: BE, DE, GR, FR, IT, NL, UK
Risk Assessment Method	GB NNRA
Links	http://www.nonnativespecies.org/downloadDocument.cfm?id=56
1. Description (Taxonomy, invasion history, distribution range (native and introduced), geographic scope, socio-economic benefits)	Socio-economic benefits are limited to the harvest and trade of animals for food (legs eaten, sold as gourmet, but does not appear to be economically profitable and limited extent) and as pet (including for garden ponds). This species is farmed for food in some areas outside Europe, and small number of the European introductions were originally due to import for food (and subsequent escape from farms) (Adriaens *et al.*, 2013). Translocations into private wetlands as a pet or source of food are problematic (Albertini & Lanza, 1987, Yiming *et al.*, 2006). http://www.issg.org/database/species/ecology.asp?si=80&fr=1&sts=sss&lang=EN
5. Can broadly assess environmental impact with respect to biodiversity and ecosystem patterns and processes	The species may have a major impact on many species of threatened native amphibians due to the role as vector of the chytrid fungus, as predator, and as competitor (including sexual competition) From GISD: In the USA the bullfrog is known to prey on the following endangered amphibians: Amargosa Toad (*Anaxyrus nelsoni)*; California tiger salamander (*Ambystoma californiense*); Chiricahua leopard frog (*Lithobates chiricahuensis*); the California red-legged frog (*Rana draytonii*); and the Oregon spotted frog (*Rana pretiosa*) From IUCN Red List: Outside its native range, this species is considered a pest. It has been observed predating on native species in Puerto Rico, including on

	Leptodactylus albilabris, and is a potential predator of other native species throughout its introduced range. It is a possible vector of pathogens.
6. Can broadly assess environmental impact with respect to ecosystem services	Negative impact on native biodiversity, commercial fisheries, human enjoyment of wildlife following disruption of native biodiversity; possibly others including regulating services. Several field studies portray tadpoles as ''ecosystem engineers'' that alter the biomass, structure and composition of algal communities. High food intake (Pryor, 2003) and high population densities (up to thousands of individuals per m² (Pryor, 2003) suggest that tadpoles have considerable impact on nutrient cycling and primary production in freshwater ecosystems. http://www.issg.org/database/species/ecology.asp?si=80&fr=1&sts=sss&lang=EN
7. Broadly assesses adverse socio-economic impact	An attempt has been made to determine the cost to control of *R. catesbeiana* in Germany (Reinhardt *et al.*, 2003). In this country the presence of the bullfrog was limited to a few populations. However, the foreseen annual cost to implement control measures on only five ponds (mainly by means of electrofishing) is 270,000 euro. The total cost would rise to euro 4.4 billion (and obviously the ecological harm would likewise increase commensurately) in the event that this species spreads throughout Germany (Reinhardt *et al.*, 2003).
8. Includes status (threatened or protected) of species or habitat under threat	Very likely to have an impact on some protected amphibians via disease transmission, predation or competition. This could include amphibians listed on Annex IVa of the Habitats Directive (to say explicitly which species are at particular risk would take further analysis). Given that North American bullfrogs introduced into Europe have been found to prey on a wide range of taxa (notably invertebrates, amphibians, reptiles and mammals), it is possible that they could impact on these taxa via predation if introduced to a site supporting vulnerable populations. Unlikely to have a direct impact on protected habitats. The ability of the North American bullfrog to act as a vector for chytrid fungus is highly important. Infection prevalence was exceptionally high in Spain and Switzerland. In Spain, ongoing chytridiomycosis-driven declines of midwife toads (*Alytes obstetricans*) and salamanders (*Salamandra salamandra*) have been documented since 1997 and 1999, respectively (Fisher & Garner, 2007, Garner *et al.*, 2006). Most of European amphibians will be affected by chytrid fungus. According to GISD

	worldwide at least 512 species are affected by chytrid fungus (Red List assessed species 512: EX = 8; CR = 196; EN = 126; VU = 63; NT = 29; DD = 36; LC = 54). Introduced bullfrogs compete with endemic species (Hanselmann *et al.*, 2004). Unlike many other frogs, bullfrogs can coexist with predatory fish (Casper & Hendricks, 2005), giving bullfrogs a competitive advantage. Tadpoles of *L. catesbeianus* feed upon eggs and larvae of the endangered Razorback Sucker (*Xyrauchen texanus*) in laboratory conditions (Kraus, 2009), and their densities in artificial habitats can depress fish larvae recruitment (Kraus, 2009). http://www.issg.org/database/species/impact_info.asp?si=80&fr=1&sts=sss&lang=EN *Rana catesbeiana* consumes native frogs, salamanders, turtles, ducklings. It is important to note that additional introductions on alien sunfish can increase bullfrog tadpole survival, increasing the abundance of bullfrogs and their impacts. Impact on Red List assessed species 35: EX = 1; CR = 4; EN = 9; VU = 5; NT = 3; DD = 2; LC = 11 (from GISD 2014); *Allobates ranoides EN* *Alytes obstetricans LC* *Ambystoma velasci LC* *Anaxyrus californicus EN* *Anaxyrus nelsoni EN* *Ansonia inthanon DD* *Aromobates mayorgai EN* *Aromobates meridensis CR* *Atelopus carbonerensis CR* *Bolitoglossa spongai EN* *Bufo bufo LC* *Centrolene quindianum VU* *Crossodactylus schmidti NT* *Dendropsophus mathiassoni LC* *Dendropsophus meridensis EN* *Epipedobates espinosai DD*

	Erinna newcombi VU *Lithobates fisheri EX* *Lithobates onca EN* *Lithobates palmipes LC* *Lithobates pipiens LC* *Lithobates subaquavocalis CR* *Lithobates tarahumarae VU* *Lithobates vaillanti LC* *Opisthotropis kikuzatoi CR* *Pelophylax cretensis EN* *Rana aurora LC* *Rana boylii NT* *Rana pretiosa VU* *Rhaebo caeruleostictus EN* *Salamandra salamandra LC* *Spea hammondii NT* *Thamnophis atratus LC* *Thamnophis gigas VU* *Thamnophis rufipunctatus LC*
9. Includes possible effects of climate change in the foreseeable future	No data available for Europe only for South America (Nori *et al.*, 2011). Scenarios of future land-use suggest that suitability will remain similar in the next years (Ficetola *et al.*, 2010). It is likely that the risk of establishment and spread would increase as a result of climate change, if the latter caused higher summer temperatures and/or waterbodies having longer hydroperiods. Finally, the ongoing climatic changes at global scale can modify the suitability of some areas for bullfrog; for example, global warming can cause an expansion of suitable areas towards higher latitude (Ficetola *et al.*, 2007). http://www.issg.org/database/species/ecology.asp?si=80&fr=1&sts=sss&lang=EN
11. Documents information sources	**Adriaens T, Devisscher S, Louette G. 2013.** Risk analysis of American bullfrog *Lithobates catesbeianus* (Shaw). Risk analysis report of non-native organisms in Belgium. Rapporten van het Instituut voor Natuur- en Bosonderzoek 2013 (INBO.R.2013.41). Instituut voor Natuur- en Bosonderzoek, Brussel. **Albertini G, Lanza B. 1987.** *Rana catesbeiana* Shaw, 1802 in Italy. *Alytes* **6:** 117-129. **Casper G, Hendricks R. 2005.** *Rana catesbeiana* Shaw, 1802. American

	bullfrog. *Amphibian declines: the conservation status of United States species. University of California Press, Berkeley***:** 540-546. **Ficetola GF, Maiorano L, Falcucci A, Dendoncker N, Boitani L, PADOA‐SCHIOPPA E, Miaud C, Thuiller W. 2010.** Knowing the past to predict the future: land‐use change and the distribution of invasive bullfrogs. *Global Change Biology* **16:** 528-537. **Ficetola GF, Thuiller W, Miaud C. 2007.** Prediction and validation of the potential global distribution of a problematic alien invasive species—the American bullfrog. *Diversity and Distributions* **13:** 476-485. **Fisher MC, Garner TW. 2007.** The relationship between the emergence of *Batrachochytrium dendrobatidis*, the international trade in amphibians and introduced amphibian species. *Fungal Biology Reviews* **21:** 2-9. **Garner TW, Perkins MW, Govindarajulu P, Seglie D, Walker S, Cunningham AA, Fisher MC. 2006.** The emerging amphibian pathogen *Batrachochytrium dendrobatidis* globally infects introduced populations of the North American bullfrog, *Rana catesbeiana*. *Biology letters* **2:** 455-459. **Hanselmann R, Rodrıguez A, Lampo M, Fajardo-Ramos L, Alonso Aguirre A, Marm Kilpatrick A, Paul Rodríguez J, Daszak P. 2004.** Presence of an emerging pathogen of amphibians in introduced bullfrogs *Rana catesbeiana* in Venezuela. *Biological Conservation* **120:** 115-119. **Kraus F. 2009.** Global trends in alien reptiles and amphibians. *Aliens: The Invasive Species Bull* **28:** 13-18. **Nori J, Urbina-Cardona JN, Loyola RD, Lescano JN, Leynaud GC. 2011.** Climate change and American Bullfrog invasion: what could we expect in South America? *PloS one* **6:** e25718. **Pryor GS. 2003.** Growth rates and digestive abilities of bullfrog tadpoles (*Rana catesbeiana*) fed algal diets. *Journal of Herpetology***:** 560-566. **Reinhardt F, Herle M, Bastiansen F, Streit B. 2003.** *Economic impact of the spread of alien species in Germany*. Umweltbundesamt Berlin. **Yiming L, Zhengjun W, Duncan RP. 2006.** Why islands are easier to invade: human influences on bullfrog invasion in the Zhoushan archipelago and neighboring mainland China. *Oecologia* **148:** 129-136.
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Notes	The species is CITES-listed, to ensure a coherent legal framework and

	uniform rules on IAS at Union level, the listing of those IAS as IAS of Union concern should be considered as a matter of priority. In how many EU member states has this species been recorded? List them. 10: Austria; Belgium; Denmark; France; Germany; Greece; Italy; Netherlands; Spain; United Kingdom (Note: some records are historic and so it is possible that the species probably does not still occur in all of these MS). In how many EU member states has this species currently established populations? List them. Belgium, France, Italy, Netherlands, UK, Germany, Greece. In how many EU member states has this species shown signs of invasiveness? List them. UK, France, Italy, Netherlands In which EU Biogeographic areas could this species establish? See Ficetola et al. (2007 and 2010) In how many EU Member States could this species establish in the future [given current climate] (including those where it is already established)? List them. See above – potentially many MS, although establishment is more likely in central and southern countries. In how many EU member states could this species become invasive in the future [given current climate] (where it is not already established)? List them. See above – it could be invasive in many central and southern MS.
Outcome	Compliant