

EU NON-NATIVE ORGANISM RISK ASSESSMENT SCHEME

Name of organism: *Nasua nasua*

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Risk Assessment Area: Europe

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EU CHAPPEAU	
QUESTION	RESPONSE
1. In how many EU member states has this species been recorded? List them.	UK and Spain. Coatis have been recorded out of captivity in England and Wales at least 10 times; 7 times between 1970 and May 2006 (Baker 2008) and 3 times in the Lake District between 2004 and 2006 (Baker, S., 2011.). This American carnivore has become naturalized and formed at least one stable breeding group in Majorca (Spain) (Mayol et al., 2009). Accidental escapes or intentional occur in the island of Majorca. At least 42 individuals have been captured in the Serra de Tramuntana Area, Majorca, from 2005-2014 (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government, pers comm.). Single escaped individuals were also recorded in the wild in Germany, indicating that the species is available as pet in other European countries as well.
2. In how many EU member states has this species currently established populations? List them.	Spain. There were earlier reproduction evidences but it was in 2009 when it was totally confirmed after capturing a few weeks old young with its mother (Mayol et al, 2009)
3. In how many EU member states has this species shown signs of invasiveness? List them.	Spain.
4. In which EU Biogeographic areas could this species establish?	Mediterranean area. It may survive cooler conditions as it has happened in UK Lake District during the winter period.
5. 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.	The species is currently established in Spain. It could probably also adapt to climatic condition present in Portugal, France, Italy and Greece. The species appears to have survived for some time out of captivity in the UK Lake District during the winter period.
6. In how many EU member states could this species become invasive in the future [given current climate] (where it is not already established)?	The species could become invasive in all Mediterranean EU countries.

SECTION A – Organism Information and Screening		
Stage 1. Organism Information	RESPONSE [chose one entry, delete all others]	COMMENT
1. Identify the organism. Is it clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?	<i>Nasua nasua</i> (Linnaeus, 1766) The name 'coati' is deemed to cover two very similar species of the genus <i>Nasua</i> : the Brown-nosed or Ring-tailed Coati (<i>Nasua nasua</i> Linnaeus, 1766) and the White-nosed Coati (<i>Nasua narica</i> Linnaeus, 1766) - Procyonidae - Carnivora - Mammal - Chordata - Animalia. The name Coatimundi is sometimes used to describe these species, this is based on the incorrect early assumption that the solitary males were a separate species. The third species in the genus, <i>Nasua nelsoni</i> is restricted to Cozumel Island, Mexico, is smaller than the other two species and not specifically included in this assessment.	Yes, this species can be adequately distinguished from other entities of the same rank. In ITIS (Integrated Taxonomic Information System) there are 13 subspecies: <i>Nasua nasua aricana</i> Vieira, 1945; <i>Nasua nasua boliviensis</i> Cabrera, 1956; <i>Nasua nasua candace</i> Thomas, 1912; <i>Nasua nasua cinerascens</i> Lönnberg, 1921; <i>Nasua nasua dorsalis</i> Gray, 1866; <i>Nasua nasua manium</i> Thomas, 1912; <i>Nasua nasua molaris</i> Merriam, 1902; <i>Nasua nasua montana</i> Tschundi, 1844; <i>Nasua nasua nasua</i> (Linnaeus, 1766); <i>Nasua nasua quichua</i> Thomas, 1901; <i>Nasua nasua solitaria</i> Schinz, 1823; <i>Nasua nasua spadicea</i> Olfers, 1818; <i>Nasua nasua vittata</i> Tschudi, 1844
2. If not a single taxonomic entity, can it be redefined? (if necessary use the response box to re-define the organism and carry on)	NA	
3. Does a relevant earlier risk assessment exist? (give details of any previous risk assessment)	Yes	A Risk Assessment has been conducted in UK and the result was that the species has low risk for UK conditions.
4. If there is an earlier risk assessment is it still entirely valid, or only partly valid?	No	It only considers a single country with different climate conditions to Mediterranean areas.

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<p>5. Where is the organism native?</p>	<p>Native Range: Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay and Venezuela (IUCN Global Invasive Species Database, 2012)</p>	
<p>6. What is the global distribution of the organism (excluding Europe)?</p>	<p><i>Nasua nasua</i> is broadly distributed in South America, ranging from Colombia and Venezuela in the north to Uruguay and northern Argentina in the south (UICN, 2008; Gompper and Decker, 1998). The species is absent from the Llano grasslands of Venezuela (UICN, 2008; Eisenberg, 1989).</p> <p>Introduced to Chilean Island of Robinson Crusoe after 1935 and had established a population of between 2,500 and 5,000 by 1976 (Lever, 1985). Introduced to Anchieta island just off the coast of Brazil in 1983 and have subsequently thrived (Bovendorp & Galetti 2007). Also introduced in Florida (Ferriter et al., 2006). In Majorca Island (Spain) a viable population is known (Mayol at al., 2009).</p>	
<p>7. What is the distribution of the organism in Europe?</p>	<p>Majorca (Spain)</p>	
<p>8. Is the organism known to be invasive (i.e. to threaten organisms, habitats or ecosystems) anywhere in the world?</p>	<p>Yes</p>	<p>Has devastated the vegetation and aviflora of Robinson Crusoe island in the Juan Fernandez archipelago off the coast of Chile (Lever 1985). Along with other nest predators it has been implicated in the absence of many bird species on Anchieta Island of the coast of Brazil (Galetti et al 2009) where it was introduced. The profile on the Invasive Alien Species by the IUCN Global Invasive Species Database is incomplete (2012)</p>

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		<p>and only in Chile through the Inter-American Biodiversity Information Network (I3N) (2009). The risk of South American coati (<i>Nasua nasua</i>) to Tasmania using the Bomford model (2008) has been assigned as “serious” threat category meaning that import should be restricted only to those licence holders approved for keeping serious threat species and only permanently castrated male animals will be approved for import (Tasmanian Government, 2015). The coati is listed on the Vertebrate Pest Committee of Australia as 2/Extreme, which means it is able to be kept in zoos or endorsed collections and it has an extreme threat rating (Feral 2007).</p>
<p>9. Describe any known socio-economic benefits of the organism in the risk assessment area.</p>	<p>Zoo, pet trade.</p>	<p>Possible small pet market.</p>

SECTION B – Detailed assessment			
PROBABILITY OF ENTRY			
<p>Important instructions:</p> <ul style="list-style-type: none"> • Entry is the introduction of an organism into Europe. Not to be confused with spread, the movement of an organism within Europe. • For organisms which are already present in Europe, only complete the entry section for current active pathways of entry or if relevant potential future pathways. The entry section need not be completed for organisms which have entered in the past and have no current pathways of entry. 			
QUESTION	RESPONSE [chose one entry, delete all others]	CONFIDENCE [chose one entry, delete all others]	COMMENT
<p>1.1. How many active pathways are relevant to the potential entry of this organism?</p> <p>(If there are no active pathways or potential future pathways respond N/A and move to the Establishment section)</p>	very few	low	<p>The species is already present in the Risk Assessment area with viable and spreading populations in Spain.</p> <p>However coati imports are banned in Spain (Act 630/2013, 2nd August, which regulates Invasive Alien Species Spanish Catalogue) the pathway for new introduction are still escapes from pet owners who bought them before this legislation, deliberate release from pet owners, deliberate introductions or illegal trading through internet.</p>
<p>1.2. List relevant pathways through which the organism could enter. Where possible give detail about the specific origins and end points of the pathways.</p> <p>For each pathway answer questions 1.3 to 1.10 (copy and paste additional rows at the end of this section as necessary).</p>	[Pet-trade]		<p>As this species is not banned in the rest of Member State Countries individual can be brought into the territory of Spain through the Pyrennes.</p> <p>The number of coatis kept by private owners is unknown but they are not thought, at present, to be held in large numbers, although they have been for sale before banning in 2011 and sales via the internet is not</p>

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			<p>fully controlled in the Risk Assessment Area.</p> <p>The origin of the established population in Majorca seems to be due to a single import of about eight individuals as pets, a decade earlier, which were located in a rural hotel, where an escape or release may have occurred (Mayol et al, 2009). Currently, the property no longer holds this species, even though there are at least five or six other animals in private collections in the island. Some of the individual established in nature are due to other isolated escapes. In any case, it should be noted that it is an animal which has been imported rarely into Majorca and has established at least one population, this demonstrates a high capacity to adapt and survive in the natural ecosystems of the island (Mayol et al, 2009).</p> <p>Some other animals are privately kept outside Majorca in the rest of the country. This animal, like other exotic pets, is still nowadays being illegally sold online in Spain.</p> <p>Natural populations could be the source of animals for an illegal trade of the species</p>
Pathway name:	[Pet-trade]		
<p>1.3. Is entry along this pathway intentional (e.g. the organism is imported for trade) or accidental (the organism is a contaminant of imported goods)?</p> <p>(If intentional, only answer questions 1.4, 1.9, 1.10, 1.11)</p>	intentional	low	<p>Import into Spain is banned since 2013 however it can be brought into Spain through the Pyrennes.</p> <p>Intentional release from individuals kept in private collections is also possible.</p>
1.4. How likely is it that large numbers of the organism will travel along this pathway from the point(s) of origin over the course of one year?	very unlikely	low	In any case, it should be noted that it is an animal which has been imported rarely into Majorca and has established at least one population, this demonstrates a

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Subnote: In your comment discuss how likely the organism is to get onto the pathway in the first place.			high capacity to adapt and survive in the natural ecosystems of the island (Mayol et al, 2009).
1.5. How likely is the organism to survive during passage along the pathway (excluding management practices that would kill the organism)? Subnote: In your comment consider whether the organism could multiply along the pathway.			
1.6. How likely is the organism to survive existing management practices during passage along the pathway?			
1.7. How likely is the organism to enter Europe undetected?			
1.8. How likely is the organism to arrive during the months of the year most appropriate for establishment?			
1.9. How likely is the organism to be able to transfer from the pathway to a suitable habitat or host?	very likely	high	The origin of the established population in Majorca seems to be due to a single import of about eight individuals as pets, a decade earlier, which were located in a rural hotel, where an escape or release may have occurred (Mayol et al, 2009). This means that natural populations can establish from few founders.
1.10. Estimate the overall likelihood of entry into Europe based on this pathway?	likely	high	The species is already present in Spain.
<i>End of pathway assessment, repeat as necessary.</i>			
1.11. Estimate the overall likelihood of entry into Europe based on all pathways (comment on the key issues that lead to this conclusion).	likely	high	The principal pathway for entry is escape or release from captivity. The origin of the pathway is considered to be the keeping of the animals in captivity but possible spreading from established population is also possible.

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			<p>Control actions are being carried out since 2005. It was found that there was already reproduction in 2006 so that the species should be present from before 2003 (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government, pers comm.). In 2014 there were no captures but in 2013 there were 10 animals withdrawn from nature (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government, pers comm.).</p> <p>Total captures confirmed since 2005 are:</p> <p>2005: 2 2006: 9 2007: 1 2008: 0 2009: 4 2010: no data 2011: 9 2012: 7 2013: 10 2014: 0</p>
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PROBABILITY OF ESTABLISHMENT			
<p>Important instructions:</p> <ul style="list-style-type: none"> For organisms which are already well established in Europe, only complete questions 1.15 and 1.21 then move onto the spread section. If uncertain, check with the Non-native Species Secretariat. 			
QUESTION	RESPONSE	CONFIDENCE	COMMENT
1.12. How likely is it that the organism will be able to establish in Europe based on the similarity between climatic conditions in Europe and the organism's current distribution?	very likely	very high	The species is already established in Spain (Mayol, 2009). As it is localized in Majorca, climatic condition in the Mediterranean area is considered suitable.
1.13. How likely is it that the organism will be able to establish in Europe based on the similarity between other abiotic conditions in Europe and the organism's current distribution?	very likely	high	Main factors for a medium sized terrestrial mammal are likely to be biotic and climatic. In Majorca, <i>Ceratonia siliqua</i> and some other fruits are part of their diet (Mayol, 2009). This species is distributed all along the Mediterranean area.
1.14. How likely is it that the organism will become established in protected conditions (in which the environment is artificially maintained, such as wildlife parks, glasshouses, aquaculture facilities, terraria, zoological gardens) in Europe? Subnote: gardens are not considered protected conditions	very likely	very high	The species is already keeps in wildlife parks, zoological gardens and some private collections.
1.15. How widespread are habitats or species necessary for the survival, development and multiplication of the organism in Europe?	widespread	very high	The species lives in Mediterranean forest (<i>Quercus</i> spp. and also). Woodland with dominant evergreen arborescent <i>Quercus</i> , e.g. <i>Quercus alnifolia</i> , <i>Quercus coccifera</i> , <i>Quercus ilex</i> , <i>Quercus rotundifolia</i> , <i>Quercus suber</i> (EUNIS habitat type (code G2.1). Other species as <i>Ceratonia siliqua</i> is also present. Within the European Union, the Mediterranean

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			Region encompasses seven Member States either partially (France, Portugal, Italy, Spain) or completely (Greece, Malta, Cyprus). The Mediterranean region occupies 20.6% of EU territory (EEA, 2008)
1.16. If the organism requires another species for critical stages in its life cycle then how likely is the organism to become associated with such species in Europe?	NA		
1.17. How likely is it that establishment will occur despite competition from existing species in Europe?	likely	high	Until a few decades ago wild carnivores in the Balearic Islands were reduced to two species of mustelids: <i>Mustela nivalis</i> Linnaeus, 1766 and <i>Martes martes</i> (Linnaeus, 1758) and a viverid, <i>Genetta genetta</i> (Linnaeus, 1758) (Alcover 1979). Furthermore to these three species feral domestic cats and small packs of feral dogs should cause conflicts with traditional island livestock. Nowadays, two new species joined the list of carnivorous mammals, coati (<i>Nasua nasua</i> (Linnaeus, 1766)) (Alvarez and Mayol 2007) which has naturalized relatively easily on the island of Majorca, and more recently some isolated observations of raccoon - <i>Procyon lotor</i> - (Linnaeus, 1758) (Pinya et al. 2009), resulting in a considerable increase in foreign species. In UK, there may be some competition from badgers (<i>Meles meles</i>) and foxes (<i>Vulpes vulpes</i>) both of which are omnivorous and a similar size but coati can be arboreal and are diurnal.
1.18. How likely is it that establishment will occur despite predators, parasites or pathogens already present in Europe?	very likely	high	Having in mind <i>Nasua nasua</i> size does not seem to exist possible predators in the island. There are no predators to full grown coatis in Majorca (Spain) Possible parasites have not prevented the

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			<p>establishment, nor the spread of the animals. Sizes of other mammals present in the island do not seem to be competitive enough.</p> <p>In UK, badgers (<i>Meles meles</i>) and foxes (<i>Vulpes vulpes</i>) are the only native species that might try and take the adults but the similar size with <i>Nasua nasua</i> (3.5 - 5.6 kg; Russell 1984) would make this unlikely. There could be predation of juveniles as they are born very poorly developed (100-180 gm; Russell 1984), are kept in nests in trees at first, joining female troops at 5-6 weeks old (Hass 2002).</p>
<p>1.19. How likely is the organism to establish despite existing management practices in Europe?</p>	<p>likely</p>	<p>high</p>	<p>At least 42 individuals have been captured in the Serra de Tramuntana Area, Majorca, from 2005-2014 (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government, pers comm).</p> <p>2005: 2 2006: 9 2007: 1 2008: 0 2009: 4 2010: no data 2011: 9 2012: 7 2013: 10 2014: 0</p> <p>The number of observations has been reduced, and the last confirmed breeding citation is from two years ago (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government, pers comm). Many warnings come from naturalists and hikers, most of them more aware of the</p>

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			<p>environmental problems than rural population or private owners (Mayol, 2009).</p> <p>Since 2010 Balearic Island Government have a specific unit (Wildlife Control Unit) which performs an intense tracking and capture of wildlife invasive species. Hence the greater number of captures.</p> <p>The most common direct control measure is trapping with life traps.</p>
1.20. How likely are management practices in Europe to facilitate establishment?			NA
1.21. How likely is it that biological properties of the organism would allow it to survive eradication campaigns in Europe?	likely	high	They are very elusive animals that are difficult to locate. Usually the specimens that we have been captured in Majorca have been located thanks to alerts (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government, pers comm).
1.22. How likely are the biological characteristics of the organism to facilitate its establishment?	likely	high	<p><i>Nasua nasua</i> is omnivorous, eating predominantly invertebrates and fruit (Gompper and Decker, 1998). The consumption of vertebrates has been noted, but is never common (Beisiegel, 2001; Bisbal, 1986; Gompper, 1996; Kaufmann, 1962; Russell, 1982; Schaller, 1983). It is essentially diurnal in its activities. Adult males are solitary, while females and immature males travel in groups up to 30 individuals (Crespo, 1982; Emmons, 1990; Schaller, 1983).</p> <p>Low ground habitats are preferred by the coati genus <i>Nasua</i>, which has been described as opportunistically omnivorous (Kaufmann, 1962; Kaufmann et al., 1976) because of its dietary composition: they eat diverse kinds of prey such as</p>

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			<p>insects, spiders, land crabs, snails, amphibians, rodents and a wide variety of fruits (Russell, 1982).</p> <p>Mayol et al. (2009) have found that in Majorca <i>Ceratonia siliqua</i> is part of their diet, and they have also been seen risen to fruit trees.</p> <p>Females spend 5-6 weeks in the nests and have 1-7 pups (but typically 3-4) which they then bring down to join the group (Beisiegel 2001, Favaron et al. 2014, Rodrigues da Paz et al. 2012, Russell 1981).</p> <p>The origin of the established population in Majorca seems to be due to a single import of about eight individuals as pets, a decade earlier, which were located in a rural hotel, where an escape or release may have occurred (Mayol et al, 2009). This means that natural populations can establish from few founders.</p>
<p>1.23. How likely is the capacity to spread of the organism to facilitate its establishment?</p>	<p>likely</p>	<p>high</p>	<p>Home ranges small in tropical forests (0.35 to 0.45 sq km) (Kaufmann 1962) but larger to the north of their range (to 22.4 sq km for troops and 10.7 sq km for solitary males (Haas 2002) which might be expected to be more similar to that in introduced suboptimum habitat.</p> <p>Clearly coati (<i>Nasua narica</i>) are capable of extensive movements such that dispersal of 10s of kilometres would not be unexpected (NatureServe 2009).</p> <p>Coatis can travel around 2kms a day so they can travel between islands of vegetation and to new areas quickly. In low lying deciduous forests the population density can be as low as 6.2 individuals per km² and in tall galley forests it usually is about 13 individuals per km² (IUCN 2008). Coatis can live in numerous types of environments, they have</p>

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			been found in; closed in, deciduous and evergreen forests, riverine gallery and cloud forests, rainforest, Gran Chaco, dry scrub forest and savannah. They can utilise primary or secondary forest and they can travel between vegetation islands in areas that have been logged, they are also very comfortable living in close proximity to humans and use human garbage as a source of food (Alves-Costa & Eterovick 2007, Beisiegel 2001, IUCN 2008, Gompper & Decker 1998).
1.24. How likely is the adaptability of the organism to facilitate its establishment?	likely	high	Coatis live in a wide range of habitats, Neotropical, deciduous forests, evergreen, old growth and secondary forests; they adapt well to anthropogenic influences and can become established in disturbed areas. They live in relatively stable temperature climates, minimum 3°C to maximum 29°C with an average of 18°C -20°C (Beisiegel 2001) Coatis thrive also in disturbed areas, they are able to adapt well to human influences and interact with humans (Alves-Costa & Eterovick 2007).
1.25. How likely is it that the organism could establish despite low genetic diversity in the founder population?	very likely	high	The origin of the established population in Majorca seems to be due to a single import of about eight individuals as pets, a decade earlier, which were located in a rural hotel, where an escape or release may have occurred (Mayol et al, 2009). This means that natural populations can establish from few founders.
1.26. Based on the history of invasion by this organism elsewhere in the world, how likely is to establish in Europe? (If possible, specify the instances in the comments box.)	likely	very high	Releasing captive coatis is thought to be behind the recent Majorca and Cambria UK populations.
1.27. If the organism does not establish, then how likely is it that transient populations will continue to occur?	moderately likely	medium	In UK there were a number of sightings of coati in the Lake District from 2004 to 2006. At least 3

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<p>Subnote: Red-eared Terrapin, a species which cannot reproduce in GB but is established because of continual release, is an example of a transient species.</p>			<p>animals were accounted for; one tranquilized in Lindale (2006), one shot near Barrow in Furness (2005), one captured in a chicken pen in Haverthwaite (2004) (Baker, S. (2011)).The origin is unconfirmed but they are all within 10km of the South Lakes Wild Animal Park, which had a large colony. Widely kept in captivity worldwide with ISIS members holding over 1100 (ISIS 2009). In addition to those killed or captured from the Lake District, coati have been recorded out of captivity in England and Wales at least 7 times between 1970 and May 2006 (Baker 2008) . Risk of new introduction will continue to remain if allowed trading as a pet.</p>
<p>1.28. Estimate the overall likelihood of establishment (mention any key issues in the comment box).</p>	<p>likely</p>	<p>high</p>	<p>The species already established in Majorca (Spain). It is included as a game species, raids have been organized, including training program of hunting dogs because although gregarious and diurnal, the coati is elusive (Salgado, 2015).</p>

PROBABILITY OF SPREAD			
Important notes: <ul style="list-style-type: none"> Spread is defined as the expansion of the geographical distribution of a pest within an area. 			
QUESTION	RESPONSE	CONFIDENCE	COMMENT
2.1. How important is the expected spread of this organism in Europe by natural means? (Please list and comment on the mechanisms for natural spread.)	minor	high	Records collected until now are located in islands (Majorca, UK). This could possible minimise spreading.
2.2. How important is the expected spread of this organism in Europe by human assistance? (Please list and comment on the mechanisms for human-assisted spread.)	moderate	high	The coati has become a semi-common pet in Europe but accidental or purposeful releases of coatis have been on the rise, releasing captive coatis is thought to be behind the recent Majorca and UK populations. Widely kept in captivity with zoos that are ISIS members holding over 1100 (ISIS 2009).
2.3. Within Europe, how difficult would it be to contain the organism?	with some difficulty	very high	This would depend on the area of spread. This animal is elusive so it is difficult to localize. In Majorca it seems to be controlled but since first record in 2005 the population still remains. The Majorca government has issued fliers alerting people to the coati and to call and report sightings of the pest. Majority of the records have been made thanks to these kind of alerts (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government, pers comm.). If a new population will establish in Mediterranean forest in the Iberian peninsula it will be more difficult to contain.
2.4. Based on the answers to questions on the potential for establishment and spread in Europe, define the area endangered by the organism.	[All Mediterranean countries]	high	See answers to questions 4 and 5 of EU CHAPPEAU

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2.5. What proportion (%) of the area/habitat suitable for establishment (i.e. those parts of Europe where the species could establish), if any, has already been colonised by the organism?	0-10	high	
2.6. What proportion (%) of the area/habitat suitable for establishment, if any, do you expect to have been invaded by the organism five years from now (including any current presence)?	0-10	low	Actual population is located in an island and control program is ongoing. Possible new introductions could happen from private owner releases. Measuring the area where records of the species have occurred suppose around 350 km ² (Conselleria d'Agricultura, Medi Ambient i Territori. Balearic Island Government data)
2.7. What other timeframe (in years) would be appropriate to estimate any significant further spread of the organism in Europe? (Please comment on why this timeframe is chosen.)	10	medium	Depending on the results of the control program and on the number of animals sold as pets.
2.8. In this timeframe what proportion (%) of the endangered area/habitat (including any currently occupied areas/habitats) is likely to have been invaded by this organism?	33-67	medium	Most of the records collected in Majorca (Spain) are located in Natura 2000 sites (ZEPA D'Alfàbia a Biniarroi: ES000044; LIC: Puig d'Alaró –Puig de S'Alcadena ES5310090; Cimals de la Serra ES5310027) and very close to some other sites. This animal is very elusive and very difficult to localize ,the management in these kind of habitat is complicated.
2.9. Estimate the overall potential for future spread for this organism in Europe (using the comment box to indicate any key issues).	slowly	high	They also present dispersal behaviour (Gompper, 1997; Alves-Costa, 1998; McFadden, 2004). However, their dispersal distance is usually small, with their home range including or being close to their birth area (Costa et al, 2009). This species spread from its actual nucleus in Majorca is very difficult but uncertainty is high due to possible new introductions from deliberate releases from private owners or private collection as it has happened in Majorca.



PROBABILITY OF IMPACT			
<p>Important instructions:</p> <ul style="list-style-type: none"> • When assessing potential future impacts, climate change should not be taken into account. This is done in later questions at the end of the assessment. • Where one type of impact may affect another (e.g. disease may also cause economic impact) the assessor should try to separate the effects (e.g. in this case note the economic impact of disease in the response and comments of the disease question, but do not include them in the economic section). • Note questions 2.10-2.14 relate to economic impact and 2.15-2.21 to environmental impact. Each set of questions starts with the impact elsewhere in the world, then considers impacts in Europe separating known impacts to date (i.e. past and current impacts) from potential future impacts. Key words are in bold for emphasis. 			
QUESTION	RESPONSE	CONFIDENCE	COMMENTS
2.10. How great is the economic loss caused by the organism within its existing geographic range, including the cost of any current management?	major	high	<p>May occasionally eat cultivated crops (Russell 1984) and experience in the UK shows they can predate domestic poultry (Baker, S., 2011). Other species of this gender, <i>Nasua narica</i>, produced losses on corn fields in Venezuela (Romero et al 2006). Losses from coatis were 7% on average, equivalent to 77kg · ha⁻¹. <i>Nasua narica</i> is considered an agricultural pest (Ibarra et al 2011)</p> <p><i>Nasua nasua</i>, among others, is one of the most cited species listed as nocive in São Martinho da Serra (Brasil) causing damages to plantations and breeding (Rodrigues et al., 2014)</p> <p>Conflicts between wildlife and agricultural production are a recurring theme nowadays.</p>
2.11. How great is the economic cost of the organism currently in Europe excluding management costs (include any past costs in your response)?	minor	medium	<p>We are not able to quantify the economic cost. Majorca population is located in the range mountain of Tramuntana. There have not been data of direct impact on orchard however they have been seen risen to fruit trees (Mayol, 2009). One possibility is that they find</p>

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			<p>enough food in natural areas not needing look for food near populated areas. Ferreira et al (2013) observations demonstrate that coatis can use alternative food resources that are abundant and close to the area they explore.</p> <p>In any case economic cost on ecosystems services is difficult to evaluate, but this species is located in Majorca in a Red Natura site.</p>
2.12. How great is the economic cost of the organism likely to be in the future in Europe excluding management costs?	moderate	low	Is difficult to know but possible new introductions may occur. They are able to impact on plantations and breeding in native area so depending in the area of introduction cost could be higher.
2.13. How great are the economic costs associated with managing this organism currently in Europe (include any past costs in your response)?	minor	medium	<p>According to the COFIB (Consortium for the Recovery of the Fauna of the Balearic Islands) from 2011 to 2014, 26 coatis were captured in Majorca. The total working days during that period for the coati are 200 to catch 26 coatis. Obtaining an index that tells us the number of catches taken by day of work ($26 \text{ coatis} / 200 \text{ wages} = 0.13$). The average cost of a working day of a wildlife control technician (average costs of different categories, wildlife technician, veterinarian ...), which includes part of the salary, the cost for the company, and costs associated, is of 125 euros /day. Which means that to capture those 26 coatis with 200 days of work (conducted during four years), we had to invest in staff approximately 25,000 euros? (6250 euros / year). This is about 1,000 euros per coati captured. To this it must be added the cost of vehicles, maintenance, diesel, capture material, crates, loops, and anesthesia medical supplies (used in control campaigns in many other species). Cost control per coati could be roughly estimated around 1500 euros.</p>
2.14. How great are the economic costs associated with managing this organism likely to be in the future in	minor	low	It will depend on establishment but based on data from question 2.13 they can be estimate as minor.

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Europe?			
2.15. How important is environmental harm caused by the organism within its existing geographic range excluding Europe?	major	medium	<p>In particular instances, such as its impact on seabirds following introduction to an island, it can cause a problem but over the vast majority of its range it does not cause environmental harm.</p> <p>Coatis have devastated the vegetation and aviflora of Robinson Crusoe island in the Juan Fernandez archipelago off the coast of Chile (Lever 1985). Along with other nest predators it has been implicated in the absence of many bird species on Anchieta Island of the coast of Brazil (Galetti et al 2009) where it was introduced. It is held responsible for the decline of native endemic birds in Juan Fernández Archipelago, including Juan Fernández petrel (<i>Pterodroma externa</i>), Cook's petrel (<i>Pterodroma cooki</i>), Kermadec petrel (<i>Pterodroma neglecta</i>), pink-footed shearwater (<i>Puffinus creatopus</i>), and flesh-footed shearwater (<i>Puffinus carneipes</i>) (Araya & Bernal 1995).</p> <p>Coatis pose a strong predation pressure on eggs and chicks of petrel in Juan Fernandez archipelago. They also are a risk due to erosion created by their burrowing habits and are a potential vector of tuberculosis (Project GEF, 2013-2016)</p> <p>The coati is listed on the Vertebrate Pest Committee of Australia as 2/Extreme, which means it is able to be kept in zoos or endorsed collections and it has an extreme threat rating (Feral 2007).</p>
2.16. How important is the impact of the organism on biodiversity (e.g. decline in native species, changes in native species communities, hybridisation) currently in Europe (include any past impact in your response)?	moderate	low	<p>Coatis are omnivores whose diet consists of small vertebrates, invertebrates, and fruit (Ferreira et al, 2013). Despite not having specific data in Majorca (Spain) it is sure they are feeding on same groups of species for example coleopteran or amphibians. Furthermore in Majorca the main focus is located in</p>

			<p>Natura 2000 sites (ZEPA D’Alfania a Biniarroi: ES000044; LIC: Puig d’Alaró –Puig de S’Alcadena ES5310090; Cimals de la Serra ES5310027) and very close to some other sites (LIC: Torre Picada ES5310084; Es Galatzó-s’Esclop ES5310008). For this reason taking into account there are no data but the species is established in protected areas at least a moderate impact should be assumed. <i>Alytes muletensis</i> classify as Vulnerable (IUCN 3.1) is distributed in similar areas as the coatis. This could be further threat to this species.</p>  <p><i>Alytes muletensis</i> distribution</p>  <p><i>Nasua nasua</i> records</p>
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<p>2.17. How important is the impact of the organism on biodiversity likely to be in the future in Europe?</p>	<p>moderate</p>	<p>medium</p>	<p>The species is arboreal and can eat birds and eggs, it also uses hollows in trees so could compete with birds for nest sites. Coatis also impact on seabird colonies in specific situations.</p> <p>It has devastated the vegetation and aviflora of Robinson Crusoe island in the Juan Fernandez archipelago off the coast of Chile (Lever 1985). Along with other nest predators it has been implicated in the absence of many bird species on Anchieta Island of the coast of Brazil (Galetti et al 2009) where it was introduced. It is held responsible for the decline of native endemic birds in Juan Fernández Archipelago, including Juan Fernández petrel (<i>Pterodroma externa</i>), Cook's petrel (<i>Pterodroma cooki</i>), Kermadec petrel (<i>Pterodroma neglecta</i>), pink-footed shearwater (<i>Puffinus creatopus</i>), and flesh-footed shearwater (<i>Puffinus carneipes</i>) (Araya & Bernal 1995).</p> <p>Coatis are a strong predation pressure on eggs and chicks of petrel in Juan Fernandez archipelago. They also are a risk due to erosion created by their burrowing habits and are a potential vector of tuberculosis (Project GEF, 2013-2016)</p> <p>Following these data future impact could be major in some locations as the islands and moderate in some other areas.</p>
<p>2.18. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic interactions), including losses to ecosystem services, caused by the organism currently in Europe (include any past impact in your response)?</p>	<p>moderate</p>	<p>low</p>	<p>No study on the specific diet in Majorca is available. Based on diet in its original?? range a potential impact on native fauna could be estimated.</p> <p>Impacts of invasive species on ecosystem services are substantial and typically negative. Invasives are having substantial, if not fully quantified, impacts on cultural services including aesthetic values, recreation, and tourism, in both riparian and upland areas (Eiswerth et al. 2005). Decreased biodiversity and species extinctions linked to invasive species threaten the</p>

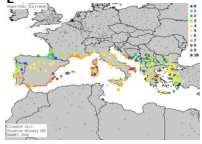
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			<p>continued delivery and quality of many ecosystem services.</p> <p>Also impacts on productivity losses (crops) can be considered as <i>N. narica</i> produces losses on different crops.</p> <p>From other data of this risk assessment it can be assumed that impact on ecosystem services would be provisioning of food (small, as it eats fruit from orchards) and regulating services (large, in that it is a carrier of pests and disease, and small, as its burrowing can cause soil erosion). It would have a moderate effect on habitat or supporting services as predation affects maintenance of genetic diversity.</p>
2.19. How important is alteration of ecosystem function (e.g. habitat change, nutrient cycling, trophic interactions), including losses to ecosystem services, caused by the organism likely to be in Europe in the future?	moderate	low	No study on the specific diet in Majorca is available. Based on diet in home range it could be estimate a potential impact on native fauna, endangered species loss, aesthetics, and productivity losses.
2.20. How important is decline in conservation status (e.g. sites of nature conservation value, WFD classification) caused by the organism currently in Europe?	major	medium	In Majorca the main focus is located in Natura 2000 sites (ZEPA D’Alfabia a Biniarroi: ES000044; LIC: Puig d’Alaró –Puig de S’Alcadena ES5310090; Cimals de la Serra ES5310027) and very close to some other sites (LIC: Torre Picada ES5310084; Es Galatzó-s’Esclop ES5310008).
2.21. How important is decline in conservation status (e.g. sites of nature conservation value, WFD classification) caused by the organism likely to be in the future in Europe?	high	medium	A decrease in the conservation status of Natura 2000 sites is expected is the spread of this species is not contained.
2.22. How important is it that genetic traits of the organism could be carried to other species, modifying their genetic nature and making their economic, environmental or social effects more serious?	NA		No native species is closely related to the coati, therefore no genetic transfer to the native biota is expected

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<p>2.23. How important is social, human health or other harm (not directly included in economic and environmental categories) caused by the organism within its existing geographic range?</p>	<p>major</p>	<p>medium</p>	<p>Bittner et al. (2010) report describes a coati attack on 2 children in their home. The children sustained deep scratches and bites. The animal may have injured the humans in a defensive strike, but motivation for attack was uncertain. Coati attacks may occur in places where there is interaction between these mammals and humans.</p> <p>Being pet trade the main pathway it seems to be a high risk for private owner with no capacities o keeping areas to maintain this species.</p> <p>Coatis (<i>Nasua nasua</i>) are able to adapt to different environments, including urban forests, and move between urbanized areas and native forests. This large distribution has led to an increase in their population within anthropic areas, which can subsequently facilitate the transmission of biological agents to domestic animals and human beings. In coatis, a variety of ticks vectors of pathogens, have been reported, including <i>Amblyomma cajennense</i> and <i>A. ovale</i>.</p> <p>There is a risk of transmission of zoonotic diseases to humans such as scabies, rabies, etc.</p>
<p>2.24. How important is the impact of the organism as food, a host, a symbiont or a vector for other damaging organisms (e.g. diseases)?</p>	<p>major</p>	<p>high</p>	<p>Coatis are susceptible to diseases common to carnivores such as: canine and feline distemper, parvo virus, hepatitis, leptospirosis and rabies and are also susceptible to a range of internal and external parasites, particularly mange (Australian Government 2009). Coatis have many parasites in the wild, tapeworms, kidney worms, ticks, fleas, lice, nematodes and acanthocephalan (hook worms passed on by crustaceans) (Gompper & Decker 1998, Milanelo et al. 2009, Rodrigues et al. 2006). They are known to carry other pathogens that both humans and animals can be subject to, such as mange, tuberculosis, canine distemper, feline panleukopaenia, toxoplasmosis,</p>

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			<p>dermatophytosis, histoplasmosis, and sporotrichosis. <i>Mycobacterium bovis</i> can cause tuberculosis in humans, air droplet transmission though very rare can be a public health issue (Murakami et al. 2012).</p> <p>Mesocarnivores that feed on both invertebrates and mammals, including the coati, a host that can be bioaccumulator of <i>T. cruzi</i> DTU's, seem to take place at the top of the <i>T. cruzi</i> transmission chain (Rocha et al, 2013).</p>
2.25. How important might other impacts not already covered by previous questions be resulting from introduction of the organism? (specify in the comment box)	minimal	low	Not known
2.26. How important are the expected impacts of the organism despite any natural control by other organisms, such as predators, parasites or pathogens that may already be present in Europe?	major	medium	<p>There are not many possible predators of these animals in many sites.</p> <p>Diseases did not prevent coati establishment in Majorca.</p>
2.27. Indicate any parts of Europe where economic, environmental and social impacts are particularly likely to occur (provide as much detail as possible).	<p>[</p>  <p>]</p>	high	<p>Spain.</p> <p>Countries in the Mediterranean biogeographic area if the species will be introduced.</p>

RISK SUMMARIES			
	RESPONSE	CONFIDENCE	COMMENT
Summarise Entry	likely	medium	The origin of the established population in Majorca seems to be due to a single import of about eight individuals as pets, a decade earlier, which were located in a rural hotel, where an escape or release may have occurred (Mayol et al, 2009). Currently, the property no longer holds this species, even though there are at least five or six other animals in private collections in the island. Some of the individual established in nature are due to other isolated escapes. In any case, it should be noted that it is an animal which has been imported rarely into Majorca and has established at least one population, this demonstrates a high capacity to adapt and survive in the natural ecosystems of the island (Mayol et al, 2009).
Summarise Establishment	very likely	high	The species is already established in Spain (Mayol, 2009). As it is localized in Majorca, climatic condition in the Mediterranean area is considered suitable.
Summarise Spread	moderately	low	The coati has become a semi-common pet in Europe but accidental or purposeful releases of coatis have been on the rise, releasing captive coatis is thought to be behind the recent Majorca and UK populations. Human releases are difficult to control. Spreading from actual population in Majorca seems more difficult.
Summarise Impact	moderate	medium	It has devastated the vegetation and aviflora of

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			<p>Robinson Crusoe island in the Juan Fernandez archipelago off the coast of Chile (Lever 1985). It has been implicated in the absence of many bird species on Anchieta Island of the coast of Brazil (Galetti et al 2009). The coati is held responsible for the decline of native endemic birds in Juan Fernández Archipelago, including Juan Fernández petrel (<i>Pterodroma externa</i>), Cook's petrel (<i>Pterodroma cooki</i>), Kermadec petrel (<i>Pterodroma neglecta</i>), pink-footed shearwater (<i>Puffinus creatopus</i>), and flesh-footed shearwater (<i>Puffinus carneipes</i>) (Araya & Bernal 1995).</p> <p>Coatis are a strong predation pressure on eggs and chicks of petrel in Juan Fernandez archipelago. They also are a risk due to erosion created by their burrowing habits and are a potential vector of tuberculosis (Project GEF, 2013-2016)</p> <p>The coati is listed on the Vertebrate Pest Committee of Australia as 2/Extreme, which means it is able to be kept in zoos or endorsed collections and it has an extreme threat rating (Feral 2007).</p> <p>Coatis are susceptible to diseases common to carnivores such as: canine and feline distemper, parvo virus, hepatitis, leptospirosis and rabies and are also susceptible to a range of internal and external parasites, particularly mange (Australian Government 2009).</p> <p><i>Nasua narica</i> is considered crop pest in its distribution area.</p> <p>More research is needed on this issue.</p>
Conclusion of the risk assessment	high	medium	The fact is this species is able to adapt to Mediterranean condition which supposes a risk.

ADDITIONAL QUESTIONS - CLIMATE CHANGE			
3.1. What aspects of climate change, if any, are most likely to affect the risk assessment for this organism?	[Temperature]	high	<p>The majority of the coati's native range is tropical or sub-tropical, between the tropics of Cancer and Capricorn, but they can be found at high altitudes within this area. They have not naturally expanded north or south from the more tropical areas in the Americas indicating that establishment in Europe could well be problematic. Despite high adaptability, it was stated that coatis are basically tropical woodland and forest animals whose distribution is limited by aridity, cold, unsuitable plant cover and food supply (Kaufmann et al., 1976). However, cold was not found to be a limiting factor due to good thermoregulatory capacities, at least for adult coatis (Chevillard-Hugot et al., 1980). Likely increased impact with climate change.</p> <p>Its establishment in Sierra de Tramuntana (Majorca Island) shows how this species can be established in areas with typical Mediterranean weather.</p> <p>The Serra de Tramuntana has a subhumid / humid mesomediterranean bioclimate with humid supramediterranean type in some places. In any case, it is a Mediterranean climate in all senses, with warm average temperatures and seasonal rainfall, dry season coinciding with the warm summer. The annual rainfall is 1,500 mm in high mountain areas. Most of the rainfall is concentrated in a few days, with heavy or very heavy rains in autumn and the whole year of low intensity.</p> <p>The average annual temperature is 16.6 ° C, with an average minimum temperature of 10.8°C and average maximum of 21,3°C.</p>
3.2. What is the likely timeframe for such changes?	20	medium	

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3.3. What aspects of the risk assessment are most likely to change as a result of climate change?	[Expansion; Impacts on biodiversity]	high	Heating should be provided to coatis held in captivity in any area that reaches less than 4°C, the main reason is the risk of frostbite of their tails (AZA 2010).
ADDITIONAL QUESTIONS - RESEARCH			
4.1. If there is any research that would significantly strengthen confidence in the risk assessment please summarise this here.	[impacts on ecosystem services]	medium	There are not direct studies on this issue and conclusions can be made from other impacts information.

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