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**THE SMALL INDIAN MONGOOSE *HERPESTES*
AUROPUNCTATUS (HODGSON 1836) IN THE BALKANS**

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THE SMALL INDIAN MONGOOSE *HERPESTES AUROPUNCTATUS* (HODGSON 1836) IN THE BALKANS

Background

The Mediterranean basin to which the Balkans and the Adriatic sea belong is regarded as a one of the biodiversity hotspots especially where Reptiles and Amphibians are concerned (Myers, N. et al. 2000) with several endemic species and subspecies so should be a conservation priority for Europe. The Balkans is not only important for herpetofauna but for many other taxa and has a book dedicated to it (Griffiths, H. I. et al. 2004). Chapter 10 of the book concerns the herpetofauna giving details of the number of endemic species for specific areas (Džukić & Kalezić 2004) the so called “Adriatic triangle” which covers Montenegro and adjacent Albania & Croatia having 10 endemic species. A recent checklist and bibliography has been produced for Croatia (Jelić 2014). Any invasive alien predator becoming widespread in this region may have dire consequences for its herpetological biodiversity.

The Small Indian Mongoose has been successfully introduced into many areas around the World especially on islands for biological control of pest and unwanted species especially snakes but is now considered to be one of the worst invasive animals appearing on the I.U.C.N.’s worst 100 invasive species list (I.U.C.N. 2000). Island species with no experience of predatory mammals have been badly affected with some species of herpetofauna having become extinct (Honneger, R. E. 1981). At least 64 islands around the World have this mongoose on them and they have been eradicated from 6 islands. Until recently most of the scientific research on the mongoose has been carried out in the tropical areas where it has been introduced so some data is missing or may not be correct for populations along the Adriatic coast with its Mediterranean climate.

Classification and recent DNA work.

The mongoose in the Adriatic has had numerous scientific names in the literature including *Mungo mungo*, *Mungo mungo*, *Herpestes mungo*, *Herpestes griseus*, *H. ichneumon*, *H. edwardsii* and *H. javanicus*. Examining museum specimens and taking skull measurements (Tvrtković & Kryštufek 1990) came to the conclusion that the species involved is *Herpestes auropunctatus*. More recently (Veron et al 2006) (Thulin et al 2006) using DNA from a range of specimens in the wild in the natural range have also found this to be correct, they have also checked all the introduced populations and found them also to be this species. This certainly is in agreement with the well documented history of the locality of founder stock.

Range in the wild

The Small Indian Mongoose is native to the Middle East across to South East Asia, it has also been introduced to islands in the Caribbean, Hawaiian islands, Fiji, Mauritius and some Japanese islands as well as on the mainland of N.E. South America. Many of these introductions were as far back as 1866. The reason for some of the introductions was for the control of rats in sugar cane plantations whilst others especially the later ones were for the control of venomous snakes with their introduction in 1979 to the Japanese island of Amami for the control of the Habu *Trimeresurus flavoviridis* (Yamada 2002). The introduction that concerns European ecologists, especially herpetologists, is one that started in 1910 on some islands in the Adriatic Sea. The first island was Mljet which was apparently known as “Snake Island”. 7 females and 4 males were imported from India and introduced in 1910, the reason was to control the Sand Viper or Poskok *Vipera ammodytes*.

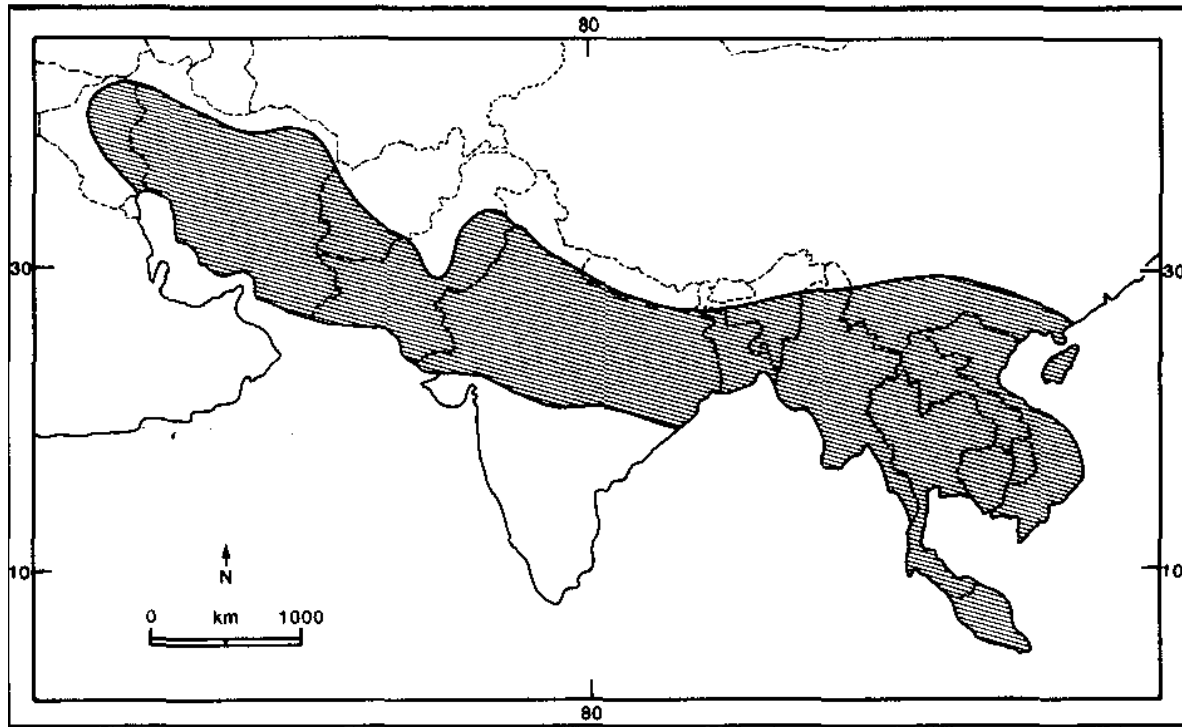


Fig 1. Range of *H.auropunctatus* in the wild, From Nellis 1989.

The Northern most part of the distribution is in N. Iraq which is a lot further south than the Balkans especially the Adriatic islands and coast but the maritime climate has aided its survival. Temperatures less than 0°C severely stress it (Nellis & Everard, 1983, Nellis & McManus, 1974) so the most northerly distribution predicted corresponds with the January 10°C isotherm.

No hibernation is known and the animals are active throughout the year but any colonisation to continental areas this far north with very cold winters would certainly kill them.

Introductions

These were mentioned in the paper by Tvrtković & Kryštufek 1990 unless otherwise referenced. The numbers refer to the positions on the two maps Fig 2. For the northern part of the Adriatic and Fig 3. For the southern part.

(1) 1910 Mljet 7 ♂ 4 ♀ introduced. Purchased in India by the Austro-Hungarian Imperial & Royal Ministry of Agriculture. Released 26.08.1910. 5 Days later one specimen was seen 17 km away.

(2) 1921-7 Pelješac Peninsula on Mainland, various sites. The statement in (Hays & Conant 2007) where they state it apparently died out after 1936 referring to (Tvrtković & Kryštufek 1990) is incorrect as the latter paper states they were frequent.

(3) 1921-7 Korčula Very frequent at present. In 2014 well over 30 mongoose were seen by 2 Croatian herpetologists on a 10 day visit and commented it was the worst place they had visited for herpetofauna just a few snakes seen(Lauš,B. pers.comm.)

(4) 1926 Brač Did not seem to colonise Brač no recent data in 1936.

(5) 1950's Škrda (Barun,Simberloff & Budinski 2008) A small uninhabited island off Pag.

(6) 1970 Hvar

(7) Introduction date unknown. Čiovo. Connected to mainland at Trogir by a small bridge. First reported to be common in 1991. History unknown.

(8) Introduction date unknown. Vicinity of Mostar (Bosnia-Herzegovina) 1990 (T & K 1990), 2006, winter of 2007-8 individuals seen. (B, S & B 2008) also along coast to south of Pelješac peninsula

(9) Introduction date unknown. Koprava, an islet just of the north coast of Mljet. (Budinski pers. Comm.) in (Barun et al 2011) No other information



Fig 2. Map of the Northern Adriatic sites.

(10) Island of Golem Grad less than 1km² Lake Prespa Macedonia. Origin and fate unknown, area does have cold winters. Small area, climate and original stock may have been responsible for lack of success.

The majority of the populations along the Adriatic have remained isolated on islands for 90-100 years but the Pelješac Peninsula is on the mainland and very little dispersal has been noted for this time period, some animals have been found to the south of the Pelješac Peninsula but it is not known if that is where they originated or if they are from the introduction close to Mostar. The recent paper (Ćirović et al 2011) maps the localities in S. Croatia & Montenegro in the past 25 years with a lack of evidence or history of introductions is far more worrying.

(11) 1988 Rose, Tip of Luštica peninsula was the first sighting in Montenegro

(12) 1990 Njivice. Sighting Croatian/Montenegro border

(13) 1997 Šasko Lake, Montenegro close to Albania which is a long way from the first two sightings approximately 115 km. There have been a lot of sightings on the Luštica peninsula and in the (14)Tivat area close by and then down the valley to (15)Jaz beach and onto Budva in the decade starting in 2000, only 4 records are known from the area from Budva down to Albania which is 70 km long. So far in Montenegro and on the Croatian mainland the distribution does appear to be limited to area with an altitude of less than 300m, even Mostar which is away from the coast in Bosnia-Herzegovina is only 56m a.s.l. and at this point the Neretva river with the influence of the valley providing temperatures similar to the coast so that Mediterranean species are found much further inland at this point. One cannot rely on this situation remaining the same, Lake Skadar or Scutari in Montenegro with international bird interest and then onto the area around Podgorica which itself is only 48 m a.s.l. and usually above 0C in January looks well within its range.



Fig 3. Map of the Southern Adriatic sites

In Nepal the mongoose can persist at over 2000m as in Hawaii near the peak of Haleakala on Maui in Hawaii so could move through the mountains in summer and reach more favourable climatic conditions inland at far lower altitudes. It is well known that many invasive species remain limited in distribution for many years then suddenly disperse over a much wider area, the reason for which cannot be explained, the control of the mongoose must be carried out in the Balkans before this can happen if it has not already happened in the last 30 years. If it does get across the river Bojana into Albania then a low altitude coastal route is easily available to Greece with the climate becoming more favourable as it moves south.

Food

The original description of the feeding behaviour of the species was that it was a carnivore but with more information it is now known to be extremely omnivorous and able to survive on a variety of foods, it is extremely adaptable animal so the diet may change with the habitat it is inhabiting and at different times of the year when certain foods become available or in larger quantities. The majority of early feeding studies have been carried out on the populations that had been introduced into the tropics. On Fiji (Gorman 1975) when examining scats found a huge variety of food, invertebrates, vertebrates and plant material which was dependent on the various habitats that they were found in from 100% littoral crabs in mangrove forests to 71% of scats in lowland rainforest containing lizards, in Sugar cane plantations Rats were found in 96% of scats, the reason for the majority of introductions of *H.a.* was to control this introduced pest. On Korčula a winter study (Cavallini & Serafini 1995) found that the diet was mainly vertebrates other than reptiles 46% by volume and plant material 43% by volume, this locality is probably close to the northern most limit of distribution and in Winter many invertebrates and the reptiles and amphibians are not to be found to be active or even present in an adult stage. There have been numerous sightings along the Adriatic around human habitation where chickens are taken as are grapes from the vineyards, they are also known to scavenge from waste bins and they are numerous around rubbish tips which would provide them with waste food as well as a higher density of rats, mice and some insects that also there to feed on discarded food. This supply is similar through the year and not really affected by the seasons, which allows the populations to become quite dense. One of the reasons they have been introduced is that they kill and eat snakes, they are quite good at this and feeding on lizards and amphibians in the tropics but also on the Adriatic islands. Various reptiles were found in the stomachs of mongoose captured (Barun, Simberloff & Budinski *et al* 2010).

H. auropunctatus are also known to predate marine turtle nests eating both the eggs and hatchling turtles on many of the islands where turtles breed (Nellis & Small 1983). The mongoose is usually a solitary feeder but in the case of nests groups will feed together most probably learning from each other, some beaches had been recorded where there was no predation of nests whereas on other beaches every nest was destroyed. In the Balkans the problem with Sea Turtle nests will only occur in Greece but there is a possibility that there may be predation on freshwater turtle nests where the eggs are far closer to the surface although so far nothing has been seen, or most probably has not been looked for as freshwater turtles are much smaller and can lay unobserved in much smaller areas. In Croatia and Montenegro the Balkan Turtle *Mauremys rivulata* is an endangered species, the Montenegrin Ecologists Society have a project on at the moment mapping it's distribution and do have some concern about mongoose predation and turtle nests, whilst out surveying 2 weeks ago at Šasko lake close to the Albanian border a mongoose was seen (Iković, V. 2015 personal comm.), this is a site that mongoose were first recorded in 1997 (Ćirović et al 2011) which is a long way 100 km. from the main population close to Tivat and almost certainly a separate introduction.

Behaviour

The mongoose is diurnal and can often be seen moving around in the day, the karst habitat with scrubby maquis suits it well as does areas of dry stone walls and small overgrown fields. It has been reported as avoiding water (Nellis & Everard 1983) whilst elsewhere it has been seen removing fish from nets and scats often contain littoral crabs and fish showing that it is an adaptable species and also able to learn in new situations. There is no hibernation and is active all year round a change in diet is probably necessary in the Adriatic when certain food animals hibernate.

Reproduction

The mongoose is known to breed from February to Early September, gestation is approximately 49 days and females typically have 2 young but can have up to 5 (Lelo 2007). The young first leave the den for short excursions at 4 weeks and may follow the female on hunting trips at 6 weeks, they are mature in 1 year (Nellis 1989).

Predators

It is known that Eagle Owls *Bubo bubo* feed on the mongoose as remains have been found in their pellets on Mljet (Tvrtković & Krystufek, 1990), this is not totally expected as the owls are mainly nocturnal and mongoose diurnal but obviously they must overlap some of the time.

The Beech or Stone Marten *Martes foina* is found on the mainland and on the islands but has evolved alongside the herpetofauna, so although it is a predator that does feed on reptiles as part of its diet has evolved with all the other components of the ecosystem to maintain a balance with no extinctions occurring due to it being present. It is mainly nocturnal but can sometimes be seen out during the day but nothing like as much as the mongoose. There does not seem to be any predation on mongoose by the Marten.

Losses of reptile populations

The decrease in any population due to an invasive alien is usually anecdotal until the population is almost gone and then some scientific evidence is sought, quite often it is then too late. Snakes are described as rare on Mljet a personal observation (Tvrtković & Kryštufek, 1990) and *Vipera ammodytes* absent. A recent study on the herpetofauna of Mljet over 3 years (Jelić, Budinski & Lauš, 2012) found no *V. ammodytes* although a single specimen was reportedly seen in 2008 near Nerezni dol. Several snake species particularly *Hierophis gemonensis* and *Elaphe quatorlineata* were found to be uncommon, more so than on other islands where mongoose are not found *Natrix natrix* and *Lacerta trilineata* were not found at all. The authors recommend that a plan for eradication be set up as soon as possible, or at least a plan for the reduction of the number of small Indian Mongoose on the island to reduce the pressure on the indigenous fauna. A study comparing the abundance of herpetofauna on 3 islands with mongoose with 3

islands where they were absent, the islands were all of a similar size found that on the islands with mongoose, reptiles and some amphibians were less abundant and some species were not found and were possibly extinct. On Mljet *Vipera ammodytes*, *Elaphe quatuorlineata*, *Hierophis gemonensis*, *Telescopus fallax* and *Bufo viridis* were not found despite having records previously. On Korčula *Lacerta trilineata*, *T. fallax*, *E. quatuorlineata*, *V. ammodytes* and *Natrix natrix* were also now absent. On Hvar *Dalmatolacerta oxycephala*, *Natrix natrix* and *Hyla arborea* were absent (Barun, Simeberloff & Budinska 2010). Another study by students from Slovenia who went on field trips over 11 years to various sites in the Western Balkans including Korčula and Mljet also came up with similar results (Žagar, A. et al, 2013). On Hvar which has been the most recent introduction the locals have been controlling the mongoose for many years and it is noticeable that this island shows the least species absent. It is not noted where on the islands the transects were made but (Bird. 2000 pers. obs.) found numerous *D. oxycephala* in the Jelsa to Stari Grad area. There is always the possibility that some of these species were just not found on the survey period especially with the snakes which are often difficult to find but when all of these are taken together it does seem that certain species are no longer present or in such small numbers that a population is no longer viable. (Bird 2000 pers. obs.) noticed the lack of road killed herpetofauna on the island of Hvar around Jelsa in 2000, not from a lack of reptiles being present although very few snakes were seen, but probably that the mongoose were finding them and removing them before they became a valid herpetological sighting. A German Botanist/herbalist living on Hvar and running guided walking tours commented that he now sees only about 30 % of the reptiles that he formerly saw and that *Vipera ammodytes* was now only present on the top of the mountainous ridge running along the centre of the island. (Bird. 2005. Pers. obs.) also found a lack of *Natrix* species along the water filled ditches behind Jaz beach, Montenegro in 2005 when compared with 1998 also a total lack of *Dalmatolacerta oxycephala* on the walls of culverts at the side of a zig-zag road coming from Budva to the Tivat road over the hillside whereas everyone had several individuals in 1998.

Examples of similar problems elsewhere

There are records of certain species of medium sized lizards becoming extinct on islands in the West Indies since the introduction of the mongoose such as the Giant Galliwasp *Celectus occidus* (Lewis) and *Ameiva polops* on St Croix (Barun, Simberloff & Budinski 2010) whereas it is still extant on smaller island where mongoose are not present. These species would be the equivalent of the Green Lizards *Lacerta trilineata* and *L. viridis* along the Adriatic. The Antigua racer *Alsophis antiguae* from Antigua, the Martinique clelia snake *Liophis cursor* from Martinique, and the Santa Lucia groundsnake *L. ornatus* from St. Lucia (Hays & Conant 2007) these would be the equivalent of the snakes that seem to be very rare or extinct on the islands of the Adriatic now.

Methods of Eradication

The methods that have been used have been 1. Live trapping; 2. Kill trapping; 3. Poison bait:- all have been successful but they do have their own benefits or problems.

1. Live trapping is very labour intensive with traps having to be set out by hand and then checked daily for captures or closed down. The animals captured then have to be killed humanely usually by gas, lethal injection or shooting, the benefit of this method is that any animal that is not a mongoose is caught it can be released unharmed. On the island of Amami, Japan where the original introduction was 1979 trapping with cage traps and wooden box traps using fish sausage as bait were used. The estimate of the population was 5-10,000 individuals in 1999 with an annual growth rate of 30%. 3886 mongoose were trapped in the 1st year, 12-22 trappers were involved in the 1st year and a total of U.S.\$50,000 was spent directly on the island (Yamada 2002)
2. Kill traps have been used and tested in Hawaii using the DOC 250 kill trap which conformed to National Animal Welfare Advisory committee (NAWAC) humane guidelines (Peters et al 2011). It is not known if this American standard would be suitable for use in Europe. The traps are set in wooden boxes and the entrance has to be made to suit the non capture of larger animals. These do not have to be checked daily for animal welfare reasons and only to remove carcasses and reset the trap.

3. Poison baits. It has been found that Mongoose are highly susceptible to Diphacinone, an anticoagulant toxin, LD50 0.2 mg/kg B.W. and is currently the toxin of choice. On Hawaii in 1998 a trial was started using Fish flavoured Diphacinone bait blocks placed in a 4 inch diameter 2 ft long ABS plastic pipes. Each pipe was fixed to the ground and had 8 x 2 ounce blocks of 0.005% diphacinone placed in the centre. Dead animals were found in burrows or in dense cover so unlikely to be found and eaten by a scavenger. The design of bait stations could avoid removal of bait by rats or other animals. The bait is relatively cheap, is easy to use and less labour intensive than traps which have to be checked and/or reset (Smith *et al* 2000), (Barun et al, 2011) states that poisoning is illegal in Croatia but does not say if this is a blanket ban or only if carried out by non-qualified workers or certain poisons, this may require a change in the law or special permission and should be checked in each country.

It would probably be best to use all 3 methods if this at all possible or at least the kill traps and poison bait.

When poisoning or trapping stopped, the population recovered quickly, in Grenada in 9 months the average density dropped from 7.4 to 2.5 and control stopped, within 6 months the population recovered (Everard & Everard in Barun et al 2011). In the past where locals are used to be the trappers and paid on a price per tail, many people start off and make quite a lot of money over the first few years, when the numbers caught become very low it then becomes uneconomical for most people to carry on and make a living so they then stop and the population recovers. There have been attempts at eradication on islands which have worked totally whereas others have failed. It is not easy to ascertain exactly why this is. In some cases control campaigns were stopped before trapping was producing negative results for a long enough period. As populations decrease and density becomes very low capture by traps does become much harder. If left the population will then rise and get back to the original levels. Whatever method is used it must be continued until there is a complete removal, poisoned bait left down for many years would probably suit this better as it is far less labour intensive and cheaper. Reproduction rates are much greater in the tropics so the Adriatic situation should be a lot easier with numbers not being able to build up again as quickly.

In some of the literature for Croatia the word hunting is used, in the U.K. this term is used only for shooting or with the use of dogs or ferrets. The term in Croatia does seem also to refer to the use of traps or poison which in the U.K. would put the control method in the realm of a person who would be described as a pest controller or a trapper, it is not certain if any mongoose are shot or what animals the hunting organisations do actually kill on the islands and all the methods they employ. There does not seem to be any information in the literature as to the amount of trapping or hunting that has occurred on the islands and just that it does occur, no numbers of traps used or animals killed or the length of time that control was carried out. (Frović, A. 2000) in the paper on the 90th anniversary of the introduction on Mljet states in the English summary “*Its excessive numbers had disturbed the relations among other wild animal species to such an extent that its legal protection was abolished in 1949. So far the attempts to decrease the mongoose population to an acceptable number has not given any positive results*”. As in all other literature no details are given but this is the 1st time Mljet seems to have been mentioned for any type of control and this does seem to have gone back many years.

It has been seen in a study in the West Indies (Lewis 2011) that trapping does work to lower the mongoose population with 7 mongoose captured per 100 trap days in 1997 whereas in 1998 it was only 0.25 animals/100 trap days, the 2nd year it was mostly males caught so these were ones re-colonizing from surrounding non trapped areas. It was found however that the Iguana population doubled after the control method was initiated

The species that would be endangered from poison bait would be the Stone Marten and if pipe could not be used of a size that stops them from reaching the bait but still allows mongoose to take it the pipe could be closed at dusk and opened at dawn. The most appropriate time of the year for control would be the winter especially around human habitation and on rubbish tip sites when natural food is at a minimum

and such sites are important for the mongoose. Čiovo apparently does not have *Martes foina* so there is no problem on that island.

Other Implications

As well as the implications to biodiversity there have also been cases of impact on agriculture. On Amami Island, Japan the cost has been \$110,000 in 1997, \$100,000 in 1998 and \$80,000 in 1999. Control was being carried out by local trappers over this period solely to reduce crop damage (Yamada 2002) In Croatia damage to wildfowl has caused hunting organisations to try to exterminate mongoose but probably not enough effort has been put in to have any real effect. Vegetables, figs, grapes and poultry have also been damaged so local trapping has probably just been around fields to catch individual animals but on Hvar such large areas of uncultivated maquis are perfect habitat for mongoose between villages and does make the localised trapping almost pointless from the point of view of eradication. If there is damage to commercial agriculture in the Balkans then agreement with the government department dealing with this to share the planning and cost may be an ideal way to go.

Legislation

Scalera, R (2011) has produced a National strategy on Invasive species in Croatia for the Croatian government that mentions the mongoose and notes that it is the oldest known I.A.S. problem dating back to 1910, it is not known if this has been accepted or not but mention is made of the present legislation

In Croatia the law that deals with Invasive Alien species is:

Nature Protection Act (Official Journal 70/05, 139/08), Article 91:

“(1) It shall be forbidden to introduce alien wild taxa into nature on the territory of the Republic of Croatia and into ecological systems which they do not populate naturally.” (Scalera 2011)

This has many other parts but basically this is the section that makes it illegal to introduce any mongoose to anywhere in Croatia.

The only mention that I have been able to find in the other literature on mongoose is “It is illegal to introduce mongoose to an uncolonised island in Croatia” (Barun, Simberloff & Budinski, 2008).

The family Herpestidae is mentioned in Table 15. Diversity of Mammals (Radović, 2000) but unfortunately is marked in the column of a protected species which hopefully is a mistake and should be followed up. A publication on hunting issued by the Croatian National Tourist Board mentions the Mongoose as small game but unfortunately has mistakenly identified it as the Egyptian Mongoose *Herpestes ichneumon* (Obratov, 2010). Running parallel with legislation outlawing introductions there must also be education for the general public and school children showing the importance of the Adriatic region for endemic species and how this must be preserved for future generations. The dangers of introducing alien species with examples must be taught with the implications for biodiversity as well as possible financial implications in damage to agriculture and the cost of eradication programs. Locals should want to preserve their areas and not destroy them with illegal introductions of destructive species. In the past some of the translocations from Mljet to other islands have been official but more recently they have not been and many stories as to how they were introduced have been heard mostly without evidence. One thing that has to be certain is that someone has had to catch up a number of animals where they are fairly numerous and then take them to a new locality, this is more likely to be persons who live in the original locality as they will have more knowledge and experience with the species, it is these people that must be informed of their wrong doing and perhaps employed in any eradication program. All countries around the Mediterranean must persevere to change the perception of snakes as being dangerous and something that should be killed when seen instead of an important part of the ecosystem.

A note by (Gjurašić & Benić, 2014) University of Dubrovnik mentions that research in the History and Economics field is to be carried out on Mljet in response to new laws on Environmental Protection and Nature Conservation that were adopted in 2013 relating to the Strategy and Action Plan for the

Conservation of Biological and Landscape Diversity (2008). It also states that a mongoose controlling system in Southeast Europe was introduced as recommended by Bern Convention Recommendation No. 140. There is a worrying statement that little or none has been written about the mongoose's negative impact which from the literature here is incorrect as numerous papers have mentioned the problem recently. The plan does seem to be to write a paper on the opinions of the local inhabitants and inquire about the attempts to repair the damage that has been caused. Obviously one must get the locals on board for any program of control but one would have thought that in the literature there is enough expertise and information to hand from experts around the World to put resources into starting to tackle the problem on the ground in a practical way especially on the mainland. Time may be running out to halt the spread of this invasive species.

Contacts

There does seem to be a list of contacts, which one cannot copy, on the East and South Europe network for Alien species but does give contacts for all the countries involved. Obviously the papers that are in the bibliography are by workers in the particular field either on the mongoose or Herpetologists and mostly for the Adriatic are fairly recent and contact details can be found on the various papers.

http://www.esenias.org/index.php?option=com_content&view=article&id=73&Itemid=82

Council of Europe countries

“The Former Yugoslav Republic of Macedonia”, **Croatia**, Slovenia, **Bosnia-Herzegovina**, Serbia, **Montenegro**, **Albania**, **Greece** are all members. So therefore party to the Recommendation No. 140 (2009) of the Standing Committee on the European Strategy on Invasive Alien Species Mongoose. The countries that would have the favourable climate at the moment and need to worry are in red.

There was no mention of any legislation or work being carried out on control of the Small Indian Mongoose on any of the National reports on Reptiles & Amphibians so far received for 2015.

Future work

From the past history it is clear that some introductions have been carried out without any approval, hopefully none would ever be given now, but it is only when someone visits an Island and sees Mongoose that the introduction is known about. It may be a good idea for some sort of systematic search of all the islands to check that they are all clear. It is clear that the mainland now has Mongoose in Montenegro, Croatia and Bosnia-Herzegovina, some localities are known but if control is to be carried out detailed surveys have to be made of the areas where they are known to map out the extent of the range and plan the eradication across the whole area, it is pointless leaving small pockets to survive and then recover and start spreading again.

Parasites & diseases

In 1950 in Puerto Rico it was found to be an important vector of the rabies virus, also in Hawaii. They can also carry *Leptospira* which causes Leptospirosis also known as Weil's disease in humans if bitten or urine of an infected animal gets into a cut, many species of native small mammal can also carry this. They also can be the host for the roundworm *Trichinella spiralis* which could be transferred to humans via pork from pigs that may scavenge on any infected dead mongoose (Lever 1994).

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