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THE ITALIAN ACTION PLAN FOR THE ENDANGERED EURASIAN OTTER *LUTRA LUTRA*

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ABSTRACT - Although recent evidence of the species recovery has been reported for many European countries, in Italy the Eurasian otter *Lutra lutra* is still considered endangered. Otter populations are confined to few river basins in the southern part of the peninsula and these are both geographically and genetically isolated from other European populations. This critical situation led the Italian Ministry of Environment to promote the production of an Action Plan for the otter in Italy, whose methods, aims and actions are briefly summarized.

*Key words***:** Eurasian otter, *Lutra lutra*, conservation, management, Italy

RIASSUNTO - Nonostante i segnali di recupero segnalati in molti paesi europei, la lontra *Lutra lutra* è ancora una delle specie più minacciate della fauna italiana, in virtù delle piccole dimensionino della popolazione e del suo isolamento , sia geografico, sia genetico, dal resto delle popolazioni europee. Sulla base di queste considerazioni il Ministero dell'Ambiente e della Tutela del territorio e del Mare ha recentemente promosso la realizzazione di un Piano d'Azione Nazionale per la Conservazione della Lontra, i cui contenuti, obiettivi, e azioni sono riassunti in questo lavoro.

*Parole chiave***:** Lontra euroasiatica, *Lutra lutra*, piano d'azione, Italia

INTRODUCTION

In the last four decades of the 20th century, the Eurasian otter *Lutra lutra* underwent a large, significant decline throughout much of Europe. Several factors have been suggested to explain this decline, including a reduction of food supply, pollutants, human persecution and the destruction of riparian vegetation. These factors played different roles in each European country, making it difficult to generalize conservation strategies at a continental level. Accordingly, the action plan for otter species produced by the IUCN-Otter Specialist Group (Foster-Turley *et al*. 1990) gives specific indications for the implementation of national action plans. The decrease in the concentration of harmful pollutants in the environment due to more stringent regulations and the enactment of legal protection have allowed otter populations to gradually recover since the 1980s in several European countries (Fig. 1). This positive trend led to downgrade the species from "Vulnerable" (Reuther and Hilton-Taylor, 2004) to "Near Threatened", at both global and European scale (IUCN, 2004, 2007). Despite this positive trend the species is still considered as "Endangered" in Italy (Boitani L., Genovesi P. and Rondinini C., in prep).

During the first half of the 20th century the otter was still widespread throughout Italy, but its distribution is now confined to the southern part of the peninsula. The residual population is relatively small (estimated at about 250 adult individuals surviving on 50 river catchments) and is both geographically and genetically isolated from other European populations (Prigioni *et al*., 2006a, 2007; Randi *et al*., 2003; Mucci *et al*. 2010). Moreover the population is divided in two isolated subpopulations: the larger occurring in Campania, Basilicata, Calabria and Puglia regions, while the smaller, only recently discovered nucleus, occurs in four river catchments of Molise and Abruzzo regions (Loy *et al*., 2004; Fusillo *et al*., 2004; Marcelli, 2006).

Recent expansion of the otter populations in Slovenia (Honigsfledt, pers. com.) and Austria (Kranz, pers. com.) let hypothesize the near colonization of the River Isonzo catchment (NE Italy).

Compared to other populations in Europe, that in e Italy is recovering rather slowly, with signs of the species expanding its range having only recently become evident (De Castro and Loy, 2007; Prigioni *et al*., 2007).

This critical situation led the Italian Ministry of Environment to promote the production of an Action Plan (AP hereafter) for the otter in Italy (Panzacchi *et al*., 2010). The efficacy of this tool depending on both its adherence to the local situation and capacity to involve stakeholders (Council of Europe, 1998). To achieve this, the Italian Ministry of Environment established two teams: the first team (TSB - Technical and Scientific Board) was charged with collecting data and drawing up the plan; the second, the Institutional Board (IB) was responsible for promoting the participation and involvement of all the territorial authorities within the current range of the otter (Regional and Provincial administrations, National and Regional parks, government environmental agencies, NGOs). The teams met periodically to share and

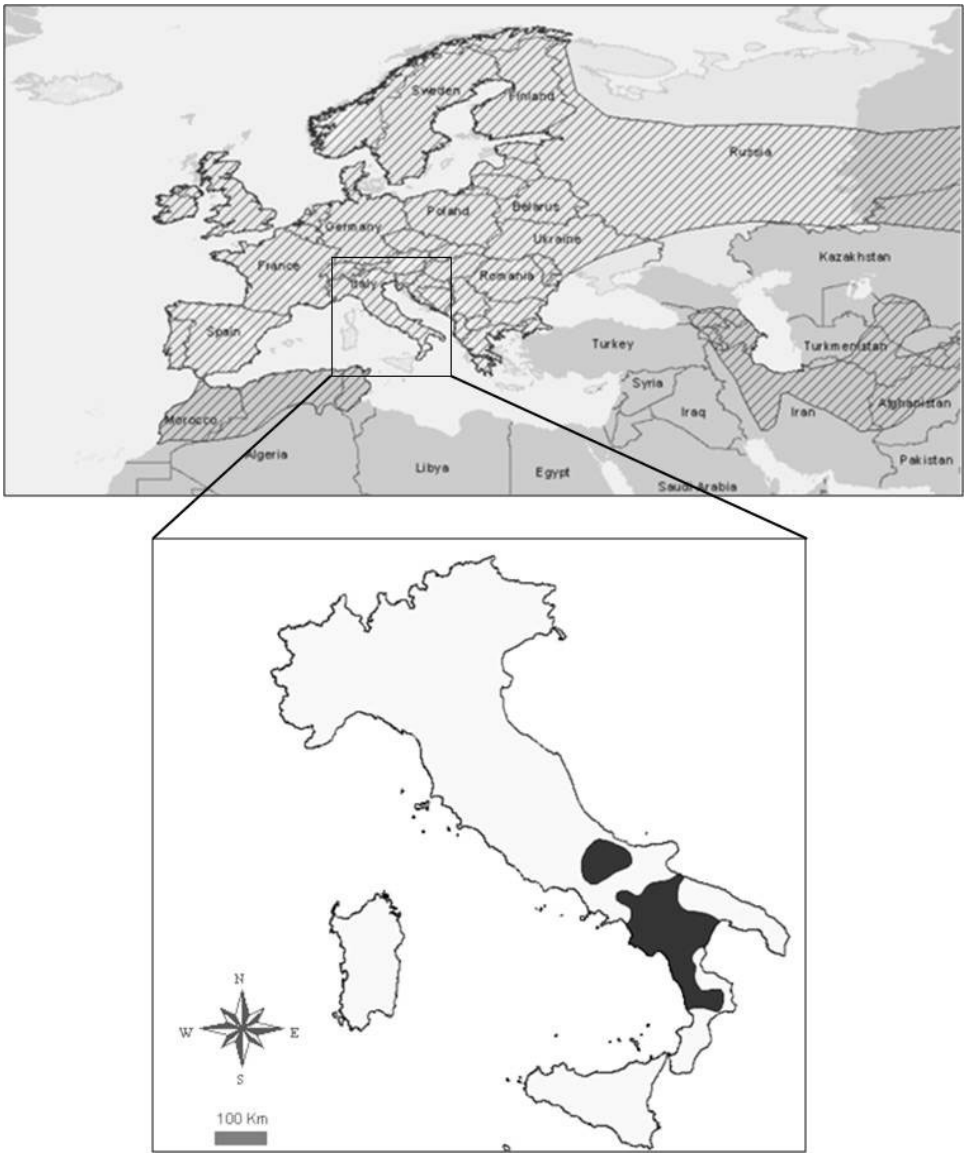

Figure 1 - Distribution of the otter in Europe (from European Mammal Assessment http://www.iucnredlist.org) and detail of the otter range in Italy.

discuss the different stages of the plan development. The plan represents an official document of the Italian government. To maximize and optimize the efficacy of the plan through a shared strategy of management, all institutions signed an official agreement.

The otter is considered a "flagship species", at the top of the fresh water food chain and strictly dependent on riparian vegetation cover (Lunnon and Reynolds, 1991; Bifolchi and Lodé, 2005), consequently the Action Plan was also conceived in the light of the key role of

otters in the conservation of aquatic ecosystems, these being among the most endangered habitats in Europe (Dudgeon *et al*., 2006).

A special effort was devoted to standardize methods, monitoring efforts and actions in conformity to the European conservation strategy. This aim was achieved by adapting the recommendations of the IUCN Otter Specialist Group for Europe (IUCN, 2004) to the Italian legal, economic, and social context. In these terms, we argue that it may represent an effective tool to enhance the protection and conservation of the otter in Europe.

BIOLOGY AND ECOLOGY OF ITALIAN OTTERS

The Eurasian otter is a solitary and territorial semi-aquatic carnivore distributed widely throughout Eurasia, where it inhabits streams, rivers, ponds, lakes and coastal areas. In Italy the species is confined mainly to the median course of the main rivers and their tributaries, rarely occurring in coastal areas (Panzacchi *et al*., 2010). The Eurasian otter is an opportunistic feeder and in Mediterranean freshwater bodies, its diet varies spatially and seasonally in relation to fish availability (Remonti *et al*., 2008, 2009).Whenever fish are scarce otters rely on alternative prey, most frequently amphibians and crustaceans (Ruiz-Olmo *et al*. 1989; Prigioni *et al*., 2006b; Fusillo, 2006; Smiroldo *et al*., 2009). As in the rest of Europe, the diet is dominated by cyprinids in lentic waters, mainly barbs (*Barbus* spp.), European chub (*Leuciscus cephalus*), and orange-fin roaches (*Rutilus rubilio*) (Prigioni *et al*., 1991, 2006b; Prigioni, 1997; Cannetiello *et al*. 2005; Fusillo, 2006) and trout (*Salmo trutta*) in mountain streams. Otters also prey upon alien species, such as largemouth bass (*Micropterus salmoides*), carp (*Cyprinus carpio*;), goldfish (*Carassius auratus*), catfish (*Ictalurus melas*) and red swamp crayfish (*Procambarus clarkii*), which sometimes may form the bulk of its diet (Prigioni *et al*. 2006b; Blanco Garrido *et al*., 2008; Loy *et al*., 2009).

The behavioural ecology of Italian otters has been little investigated. Radiotelemetric data on wild otters are available for only one male and one female from the Cilento National Park, while six animals (three females and three sterilized males) were experimentally released from an enclosure in the Maiella National Park. These data indicate that home range size varies between 36 - 44 km for males and 30 km for females (Mattei *et al*., 2005a, b, c, d; Fusillo, 2006; Quaglietta, com. pers.). A non-invasive genetic sampling carried out in the Pollino National Park yielded maximum values of 35 km and 21 km of river stretches (Prigioni *et al*., 2006c), each including the overlapping ranges of 4-6 different otters. The same study allowed an assessment of otter density, which, in the core area of the Italian otter population, ranged from 0.18 to 2.0 ind/km (Prigioni *et al*., 2006a). Variation in otter marking intensity at the periphery of the range suggested otter density is probably lower in these areas (Prigioni *et al*., 2006d, Fusillo *et al*., 2007).

The average distance covered in one night by females was 11 km and by males 15 km (Mattei *et al*., 2005b). All otters monitored in Italy were largely

nocturnal (80-100% of total activity was at night; Mattei *et al*., 2005c; Fusillo, 2006; Quaglietta, pers. com.). As in other temperate areas (Green *et al*., 1984; Rosoux and Libois, 1991; Jiménez and Palomo, 1998), during their diurnal inactive phase otters used a high number of resting sites (up to 50; Fusillo, 2006; Quaglietta, com. pers.). Brambles seem to be strongly selected as resting habitat, as reported for Portugal (Beja, 1996), whilst reed beds and tree roots are less important than reported for other countries (Green *et al*., 1984; Kruuk, 2006; Macdonald and Mason, 1983).

No data are available for wild otters breeding in Italy, while in captivity births tend to concentrate in October - December (Maiella N. P.; Mattei, personal observation).

Finally, recent studies reported that the otter population of southern Italy show only one mtDNA haplotype (Mucci *et al*., 2010) and are divergent from the other European ones probably as a consequence of recent isolation and bottleneck (Mucci *et al*., 2010), even if, lacking data on extinct north Italian populations, the genetic diversity of southern otters is difficult to interpret.

LEGAL PROTECTION

The Italian Action Plan has been devised to be accommodated into current international and national laws for the protection of biodiversity and endangered species. The Eurasian otter is strictly protected by the Bern Convention, is listed in annex I of the CITES convention and annexes II and IV of the EU Habitat Directive. It is also severely protected under the Italian law for the protection of wildlife (L.N. 157/1992, art. 2/1).

THREATS AND LIMITING FACTORS

Threats and limiting factors have been defined considering the specific characteristics of Mediterranean river basins and the Italian socioeconomic context. Each threat was examined for its relevance, effects and present trend (Tab. 1). Due to high human density in Italy, the species has been severely limited by anthropogenic factors. Main threats to otters were identified as the destruction of riparian vegetation along riverbanks, road casualties, illegal direct persecution, the scarcity of food resources (mainly fish), and seasonal variation in water availability. The online database on otter road casualties (http://www2.-units.it/~specieinvasive/) developed by L. Bonesi for the IUCN.SSC Otter Specialist Group, recorded 27 otters found dead between 1999 and 2008.

GOALS AND STRATEGY OF THE ITALIAN ACTION PLAN

Taking the current otter distribution in Italy, the species' main ecological requirements and all potential threats, the Action Plan identified the priority areas for intervention and main goals to be accomplished in the short, medium and long term, summarized in the Appendix. The latter group includes: the coordination of the institutions responsible for the application of the legal framework for the conservation of the otter (goals R: rules), reduction of mortality and disturbance, prevention of conflicts and impacts on human activities, preservation of the genetic identity

Table 1 - Main threats and limiting factors for the Eurasian otter in Italy.

Threat or limiting factor	Relevance in Italy
Shortage of feeding resources	Very high
Scarcity of water	Very high
Demographic and genetic stochasticity	Very high
Riparian habitat loss/destruction	High/Very high
Roads	High
Direct persecution and conflicts with man	High
Organoclorine pesticides	Probably high
Urbanization and human disturbance	Moderate/High
Dams	Moderate/High
Heavy metals	Moderate/High
PCBs	Probably moderate
Organic pollutants	Moderate
Gravel pit	Moderate

and integrity of populations, with an adequate genetic flow among populations (S: species), habitat restoration and conservation, primarily in the areas of current presence and those potentially connecting the isolated populations (H: habitat), systematic, continuous and coordinate monitoring of the goals and, eventually, updating of conservation strategies (M: monitoring), communication and dissemination strategies, training and involvement of stakeholders (I: information). Each category was subdivided in specific sub-goals, each to be achieved through specific actions (see Appendix). For each action, the institutional responsible, costs and time of accomplishment were defined. Actions were differently addressed to three categories of priority areas: river basins where otters actually occur (P), river basins that are crucial for the connection of isolated portions of the range (C), river basins where otters are likely to expand in the next future (E; Fig. 2). Within each priority area, maps of habitat suitability were produced, following a model produced by Ottaviani *et al*. (2009), to allow the identification of the specific areas of intervention.

As listed in the Appendix, for each action the following information were specified: list of interventions, scale (national, regional, or local), area of intervention (areas of occurrence, connection, or expansion), relevance of the action (high, medium, low), subjects in charge for action coordination, subjects in charge for action achievement, deadlines for both the start up and completion of the action, and estimated costs. Finally, the Action Plan contains a series of appendices providing protocols for: 1) data collection and recovery of wounded animals (also including the national website for reporting otters ca-

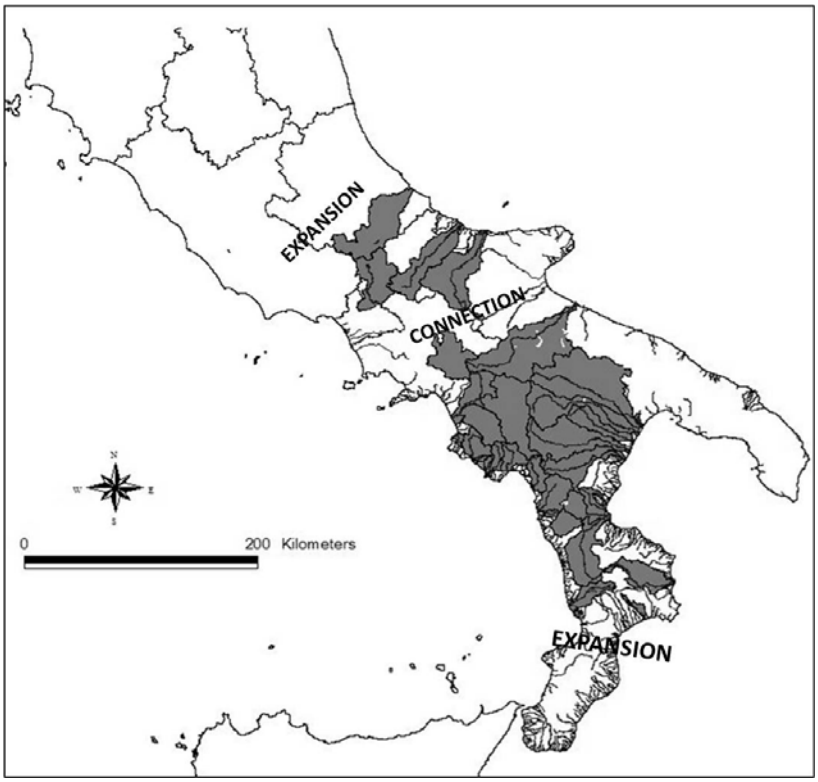

Figure 2 - Current otter distribution in Italy, showing the priority areas for the connection of isolated populations and future otter expansion.

sualties and carcasses http://www2.-units.it/~specieinvasive/); 2) necropsies, 3) captures, 4) captive breeding, 5) monitoring, 6) standard survey. Protocols were derived from those available in Europe, adapted to Italian laws and the relevant EU Directives. Particular attention was devoted to provide a protocol for standard surveys in accordance to IUCN –OSG recommendations (Reuther *et al*., 2000). The standard method was also revised in order to optimize monitoring efforts according to the obligations of both art. 17 of Habitat (92/43/CE) and Water Framework (2000/60/CE) Directives. The Action Plan also provides guidelines for non invasive genetic sampling, captive breeding and the conversion of captive breeding centres into recovery centres.

We hope that the effort devoted to adapt the conservation strategy for otters in Europe (IUCN, 2004) to the Italian legal, economic, and social context made the Italian AP an effective tool to enhance the protection and conservation of the otter throughout Europe.

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REFERENCES

Beja P.R. 1996. Temporal and spatial patterns of rest0site use by four female otters *Lutra lutra* along the south-west coast of Portugal. *Journal of Zoology*, 239: 741-753.

Bifolchi A. and Lodé T. 2005. Efficiency of conservation shortcuts: an investigation with otters as umbrella species. *Biological Conservation*, 126: 523-527.

Blanco-Garrido F., Prenda J. and Narvaez M. 2008. Eurasian otter (*Lutra lutra*) diet and prey selection in Mediterranean streams invaded by centrarchid fishes. *Biol. Invasions,* 10: 641–648.

Cannetiello M., Bruno E., Di Bello S., Ruocco M., Valore M. and Fulgione D. 2005. Ecological niche factor analysis in otter (*Lutra lutra*) population from Cilento and Vallo di Diano National Park (Italy). Proceedings of the European Otter Workshop, Padula (SA), Italy, 38 pp.

Council of Europe, 1998. Drafting and implementing action plans for threatened species. Environmental encounters, Council of Europe (ed), Strasbourg, 39: 104.

De Castro G., Loy A. 2007. Un nuovo censimento della lontra (*Lutra lutra*, Carnivora, Mammalia) nel fiume Sangro (Abruzzo): inizia la ricolonizzazione dell'Italia centrale? 68° Convegno Unione Zoologica Italiana, Lecce.

Dudgeon D., Arthington A.H., Gessner M.O., Kawabata Z.I., Knowler D.J., Leveque C., Naiman R.J., Prieur-Richard A.H., Soto D., Stiassny M.L.J. and Sullivan C.A. 2006. Freshwater biodiversity: importance, threats, status and conservation challenges. *Biol. Rev*., 81: 163-182.

Foster-Turley P., Macdonald S. and Mason C. 1990. Otters, an action plan for their conservation. IUCN, Gland, Switzerland, 126 pp.

Fusillo R. 2006. Risorse trofiche ed habitat della lontra (*Lutra lutra*) in Italia meridionale. Fattori di variazione ed analisi di selezione. Tesi di dottorato. Università di Roma "La Sapienza".

Fusillo R., Marcelli M. and Boitani L. 2004. Progetto di ricerca sulla ecologia della lontra nel Parco Nazionale del Cilento e Vallo di Diano. Relazione delle attività di ricerca 2003-2004. Università di Roma "La Sapienza", Parco Nazionale del Cilento e Vallo di Diano.

Fusillo R., Marcelli M. and Boitani L. 2007. Survey of an otter *Lutra lutra* population in southern Italy: site occupacy and influence of sampling season

on species detection. *Acta Theriologica,* 52(3): 251-260.

Green J., Green R. and Jefferies D.J. 1984. A radio-tracking survey of otters *Lutra lutra* (L. 1758) on a Perthshire river system. *Lutra*, 27: 85-145.

IUCN 2004. Recommendations and Results. IXth International Otter Colloquium. IUCN/SSC Otter Specialist Group, Frostburg, USA.

IUCN 2007. *Lutra lutra*. In: IUCN 2007. European Mammal Assessment, EMA. Website: http://ec.europa.eu/environment/nature/conservation/species/ema/

Jiménez J. and Palomo J.J. 1998. Utilización de refugios por la nutria en el río Bergantes (Cuenca del Ebro). *Galemys*, 10 (N.E.).

Kruuk H. 2006. Otters ecology, behaviour and conservation. Oxford University Press, 280 pp

Libois R. and Rosoux R. 1991. Écologie de la Loutre (*Lutra lutra*) dans le Marais Poitevin. II. Aperçu général du régime alimentaire. *Mammalia* 55: 35-47.

Loy A., Bucci L., Carranza M.L., De Castro G., Di Marzio P. and Reggiani G 2004. Survey and habitat evaluation for a peripheral population of the Eurasian otter in Italy. Otter Specialist Group Bulletin, 21A.

Loy A., De Castro G., Bianco P., Frezza V., Pansino S., Ruco V. and Reggiani G. 2009. Fine scale fish and otter (*Lutra lutra*) monitoring in the Ofanto river (southern Italy). Integrating marking frequencies, diet and resources availability. 2nd European Congress Conservation Biology, Prague, Book of Abstracts: 586.

Lunnon R.M. and Reynolds J.D. 1991. Distribution of the otter *Lutra lutra* in Ireland, and its value as an indicator of habitat quality. In: Jeffrey D.W. and Madden B. (eds.), Bioindicators and environmental management. Academic Press, London, 435-443.

Macdonald S.M. and Mason C.F. 1983. Some factors influencing the distribution of otters (*Lutra lutra*). *Mammal Rev*., 13: 1-10.

Marcelli M. 2006. Struttura spaziale e determinanti ecologici della distribuzione della lontra (*Lutra lutra* L.) in Italia. Sviluppo di modelli predittivi per l'inferenza ecologica e la conservazione. Tesi di Dottorato. Università di Roma "La Sapienza".

Mattei L., Antonucci A., Di Marzio M, Ronci D. and Biondi M. 2005c. Otter experimental release in Aterno-Pescara basin (Abruzzo): pattern of activity. Proceedings of the European Otter Workshop, Padula (SA), Italy, 38 pp.

Mattei L., Antonucci A., Di Marzio M., Ronci D. and Biondi M. 2005b. Otter experimental release in Aterno-Pescara basin (Abruzzo): home range and space use. Proceedings of the European Otter Workshop, Padula (SA), Italy, 38 pp.

Mattei L., Antonucci A., Di Marzio M., Ronci D. and Biondi M. 2005d. Otter experimental release in Aterno-Pescara basin (Abruzzo): resting sites structure and use. Proceedings of the European Otter Workshop, Padula (SA), Italy, 38 pp.

Mattei L., Antonucci A., Di Marzio M., Ronci D., Biondi M. and Zuccarini R. 2005a. Feasibility study and otter experimental release in Aterno-Pescara Basin (Abruzzo): results and problems. Proceedings of the European Otter Workshop, Padula (SA), Italy, 38 pp.

Mucci N., Arrendal J., Ansorge H., Bailey M., Bodner M., Delibes M., Ferrando A., Fournier P., Fournier C., Godoy J.A., Hajkova P., Hauer S., Heggberget T.M., Heidecke D., Kirjavainen H., Krueger H.H., Kvaloy K., Lafontaine L., Lanszki J., Lemarchand C., Liukko U.M., Loeschcke V., Ludwig G., Madsen A.B., Mercier L., Ozolins J., Paunovic M., Pertoldi C., Piriz A., Prigioni C., Santos-Reis M., Luis T.S., Stjernberg T., Schmid H., Suchentrunk F., Teubner J., Tornberg R., Zinke O.

and Randi E. 2010. Genetic diversity and landscape genetic structure of otter (*Lutra lutra*) populations in Europe. *Conserv. Genet*., DOI 10.1007/s-10592-010-0054-3.

Ottaviani D., Panzacchi M., Jona Lasinio G., Genovesi P. and Boitani L. 2009. Modelling semi-aquatic vertebrates' distribution at the drainage basin scale. The case of the otter *Lutra lutra* in Italy. *Ecological Modelling,* 220:111-121.

Panzacchi M., Genovesi P. and Loy A. 2010. Piano d'Azione Nazionale per la Conservazione della Lontra (*Lutra lutra*). Ministero dell'Ambiente e della Tutela del Territorio e del Mare - Istituto Superiore per la Protezione e la Ricerca Ambientale, 211 pp.

Prigioni C. 1997. La Lontra. Una vita silenziosa negli ambienti acquatici. Edagricole: Bologna, 171 pp.

Prigioni C., Balestrieri A. and Remonti L. 2007. Decline and recovery in otter (*Lutra lutra*) populations in Italy. *Mamm*al *Review*, 37 (1): 71-79.

Prigioni C., Balestrieri A., Remonti L., Gargaro A. and Priore G. 2006b. Diet of the Eurasian otter (*Lutra lutra*) in relation to freshwater habitats and alien fish species in southern Italy. *Ethology Ecology & Evolution*, 18: 307-320.

Prigioni C., Balestrieri A., Remonti L., Sgrosso S. and Priore G. 2006d. How many otters are there in Italy? *Hystrix, It. J. Mamm*., 17(1): 29-36.

Prigioni C., Pandolfi M., Grimod I., Fumagalli R., Santolini R., Arcà G., Montemurro F., Bonacoscia M. and Racana A. 1991. The otter in five Italian rivers- First report. In: Reuther C. and Röchert R. (eds.): Proceedings of the V International Otter Colloquium. *Habitat*, 6: 143-145.

Prigioni C., Remonti L. and Balestrieri A. 2006c. Otter *Lutra lutra* movements assessed by genotyped spraints in southern Italy. *Hystrix, It. J. Mamm*., 17(1): 91-96.

Prigioni C., Remonti L., Balestrieri A., Sgrosso S., Priore G., Mucci N., Randi E. 2006a. Estimation of otter (*Lutra lutra*) population size by fecal DNA typing in Southern Italy. *Journal of Mammalogy*, 87(5): 855–858.

Randi E., Davoli F., Pierpaoli M., Pertoldi C., Madsen A.B. and Loeschcke V. 2003. Genetic structure in otter (*Lutra lutra*) populations in Europe: implications for conservation. *Animal Conservation,* 6: 93-100.

Remonti L., Balestrieri A. and Prigioni C. 2008. Altitudinal gradient of Eurasian otter (*Lutra lutra*) food niche in Mediterranean habitats. *Can. J. Zool*., 87: 285-291.

Remonti L., Prigioni C., Balestrieri A., Sgrosso S. and Priore G. 2008. Trophic flexibility of the otter (*Lutra lutra*) in southern Italy. *Mamm. Biol*., 73: 293-302.

Reuther C. and Hilton-Taylor C. 2004. *Lutra lutra*. In: IUCN 2007. 2007 IUCN Red List of Threatened Species. Website: www.iucnredlist.org

Reuther C., Dolch D., Green R., Jahrl J., Jefferies D., Krekemeyer A., Kucerova M., Bo Madsen A., Romanowsky J., Roche K., Ruiz0Olmo J., Teubner J. and Trindade A. 2000. Surveying and monitoring distribution and population trends of the Eurasian Otter (*Lutra lutra*). *Habitat*, 12.

Rosoux R. and Libois R.M. 1991. Ecologie de la loutre (*Lutra lutra*) dans le Marais Poitevin: II Aperçu general du regime alimentaire. *Mammalia*, 55: 35-47.

Ruiz-Olmo J., Jordan G. and Gosalbez J. 1989. Alimentacion de la nutria (*Lutra lutra* L., 1758) en el Nordeste de la Penınsula Iberica. Doñana. *Acta Vertebrata*, 16: 227-237.

Smiroldo G., Balestrieri A., Remonti L. and Prigioni C. 2009. Seasonal and habitat-related variation of otter *Lutra lutra* diet in a Mediterranean river catchment (Italy). *Folia Zool*., 58(1): 87-97.

Appendix – Main objectives, sub objectives and actions required for the Italian Action Plan for the Eurasian otter to be successfully achieved.
Abbreviations. Subject: MATTM –Italian Ministry of Environment; ISPRA – National Environmental Agency, ARPA – Regional Environmental Agency, SS -Public institutions and private organizations who signed the AP agreement , CNR-IRSA – National Research Institute-Institute for Water Research, TSB: Technical and Scientific Board, IB: Institutional Board, MC- Management Committee, CFS-National Forestry Service, ASL – Local Health National Service. Scale: N -National, R -Regional; L: Local. Basin:P - current occurrence; C - important for subpopulation connection; E - future expansion; Priority: H – high, M - medium, L - low

Objectives R *(Rules):* Coordination of institutional subjects responsible for application of existing rules regarding on otter conservation, and for any integrations needed.

code	Specific Objective	Scale	Basin	Action	Priority	Time	Subject responsible	Institutional subject involved	Costs €/*1000
R1	Assure institutional support to the AP	N	-	Production, revision, approval, reception and adoption of the AP	H	2009	MATTM, ISPRA, SS	TSB, IB, State committee for regional affairs	0
R2	Promote coordination and organization of institutional subjectsresponsible for accomplicshment of the AP	N	-	*a)* Establishment of a Management Committee to coordinate and provide scientific and technical support to AP activities	H	Immediate	MATTM, ISPRA	TSB	2/year
		R/L	P, C (E)	*b)* Establishment of Working Groups for accomplishment of specific actions	H	Within first yr	SS	Reference organizations, MC	0
		N/R	P, C (E)	*c)* Guarantee funding for the AP	H	Within six months	MATTM, SS	Regional and Province administrations, Protected Areas	Do be defined
R3	Assure inclusion of otter conservation actions during application of actual regulation	***I. ENVIRONMENTAL IMPACT EVALUATION***							
		N/R/L	P, C, E	Being responsible for the inclusion of otter AP objectives in any Environmental Impact Assessments, Environmental Strategic Assessments, or Environmental Incidence Assessments	H	Immediate	MATTM	MATTM , Regional administrations, SS, MC	Routine
		II. DIRETTIVA ACQUE (2000/60/CEE)							
		N	P	Assure otter is considered in the decision making process within the *quality objectives* of Water Framework Directive 2000/60/CE	M	Within first yr	MATTM	CNR-IRSA, ISPRA, MC	Routine

		III. DIRETTIVA HABITAT (92/43/CEE)							
		L	P (C,E)	Integration of AP actions in management plans of Natura 2000 sites and eventual proposal for new sites in relation to otter occurrence	H	Within first yr	Regional administrations	MATTM	Routine
R3		***IV. NATIONAL FREMEWORK LAW ON PROTECTED AREAS (LN 394/91)***							
		R	P, C, E	*a)* Promote the adoption of management plans in National and Regional Parks	H	Within two yrs	Regional administrations, Protected Areas	Regional and Province administrations, MATTM, National Parks	Routine
				b) Promote the establishment of *Side Areas* and inclusion of AP objectives in defition of their regulation s					
		V. CONVENZIONE DI RAMSAR (1971)							
		N	P	Inclusion of the otter within biological indicators for identification of internationally relevant wetlands	L	Within two yrs	MATTM	MC	Routine

Objectives S *(Species)***:** Reduction of mortality rates and disturbance, prevention of conflicts with human activities, safeguard the genetic identity of populations and sustain adequate gene flow among populations.

S1	Reduction of casualties	L	P (C, E)	*a)* Minimize road casualties	H	Within two yrs	SS	Regional and Province administrations, Road agencies, CFS	Do be defined
				b) Minimize casualties due to fishing tools			SS	Province administrations, Stake holders associations (*i.e.* Fish farm , Anglers)	
S2	Prevention of conflicts with fish farms and anglers	R,L	P (C, E)	Define adequate measures of prevention, assessment and consider damage compensation	H	Within one yr	Regional administrations, Protected Areas	Stake holders associations (*i.e.* Fish farm, Anglers)	
S3	Prevention of risks related to captures of wild animals	L	P	Authorize captures only in exceptional cases, when they are necessary to achieve actions	H	Immediate	MATTM, ISPRA, Regional and Province administrations	Protected Areas, Research Institutions, Museums, CFS	0

S4	Preserve gentic identity and variabilità of Italian populations	L	P, C, E	H	Immediate	MATTM, SS	Captive breeding Centres	Do be defined
S5	Minimize disturbance in sensitive areas	L	P	H/L	Immediate	SS	Regional and Province administrations, Protected Areas, CFS, Stake holders associations (*i.e.* Fish farm, Anglers)	Routine

Objectives H *(Habitat)*: Restoring and preserving otter, with priority in areas of occurrence and corridors connecting isolated populations

code	Specific Objective	Scale	Basin	Action	Priority	Time	Subject responsible	Institutional subject involved	Costs €/*1000
H1	Assure planning of habitat conservation and restoring actions	R	P, C, E	Assure integration of AP objectives being considered in managment and planning tools of river basins (according to LN 183/1989, Dlgs 152/2006)	H	Within one yr	MATTM, Regional administrations	River District Authorities, competent Ministries	Routine
H2	Riestore and preserve riverine environment in AP priority areas	R,L	P, E, C	*a)* Preserve/restore riparian vegetation cover	H	Within one yr	SS	Regional and Province administrations, ISPRA, River District Authorities, CFS, Protected Areas	Do be defined
				b) Reduce impact agricultural and zootechnical practices on riparian vegetation belts					
				c) Adequate agricultural and zootechnical practices in riparian belts	M				
H3	Restore and preserve freshwater habitat in AP priority areas	R,L	P, E, C	*a)* Preserve/restore natural waterbeds	H	Within one yr	SS	Local administrations, River District Authorities, CFS, Land reclamation authority, Protected Areas	Do be defined
				b) Adequate water quality and flood throughout the year					

H4	Assure an adequate and constant availability of otter feeding resources, both fish and alternative preys	L	P, E, C	Restore freshwater ecosystems and promote a sustainable and rationale management of fishing and manipulation of fish fauna	H	Within one yr	SS	Regional and Province administrations, River District Authorities, CFS, Land reclamation authority, Protected Areas, Stake holders associations (*i.e.* Fish farm, Anglers)	Do be defined
H5	Assure an adequate gene flow among populations	R,L	C	*a)* Recover/protect relevant areas for gene flow within river basins	H	Within one yr	SS	Regional and Province administrations, Protected Areas, MATTM, Universities	Do be defined
				b) Recover/protect relevant areas for gene flow among river basins, specifically for isolated populations and for expanding areas					
		N	C	*c)* Identify and adequately manage areas for ecological and functional connection (DPR 357/97)	H	Within one yr	MATTM, SS	ISPRA, Universities	0

Objectives M ***(Monitoring)*****:** Collecting in a systematic, continuative and coordinated way data useful to accomplish, verify and update conservation strategies of the AP.

code	**Specific Objective**	**Scale**	**Basin**	**Action**	**Priority**	**Time**	**Subject responsible**	**Institutional subject involved**	**Costs €/*1000**
M1	Monitor otter distribution	N	P, C, E	*a)* Carry out a five year monitoring program at a national scale through standard survey techniques	H	Within one yr	MATTM	CDG, authorized personnel	Do be defined
		N	C, E	*b)* Notify and document any finding of otter occurrence outside current range during monitoring following obligations of Dlgs 152/2006	L	Within two yrs	MATTM, CDG	ISPRA, University of Molise, University of Pavia	15 - 20

M2	Monitor otter mortality	N	P	Promote a coordinated and centralized collection of data and information on dead or wounded otters	H	Within six months	University of Trieste, MATTM	Road Authority, CFS, ASL, Regional and Province administrations, Protected Areas, Regional Veterinary Service
M3	Monitor potential conflicts	N	P	Promote coordinated and centralized collection on damages to fish farms	H	Within two yrs	MATTM, MC	Stake holders associations (*i.e.* Fish farm, Anglers)
M4	Monitor otter habitat conservation status	N	P, C, E	Store and utilize data on quality of freshwater and riparian ecosystems collected following obligations of Dlgs 152/2006 related to otter habitat conservation	M	Within one yr	MATTM, MC	ISPRA
M5	Promote scientific research on priority subjects	N,L	P, C, E	Promote researches on priority subjects	M	Within one yr	MATTM, Ministry of Education and Scientific Research, SS	Universities, ISPRA, Protected Areas, Research Institutions, Museums

								Routine
								15-20
								Routine
								Do be defined

Objectives I ***(Information)*****:** Put into practice- realize an effective and transparent communication, train, and involve all active components of the society in the accomplishment of the AP.

code	**Specific Objective**	**Scale**	**Basin**	**Action**	**Priority**	**Time**	**Subject responsible**	**Institutional subject involved**	**Costs €/*1000**
I1	Promote dissemination and education	N	P, C, E	Promote and advertise the AP contents and related activities, including the involvement of mass media and the creation of a dedicated web site	H	Within one yr	MATTM, ISPRA, MC	SS, Media, Schools, Environmental organizations	30 - 40
I2	Promote active participation of stakeholder	R,L	P, C, E	Develop specific programs for accomplishment of AP actions through active involvement of stakeholders	H	Within one yr	MATTM, SS, MC		Do be defined