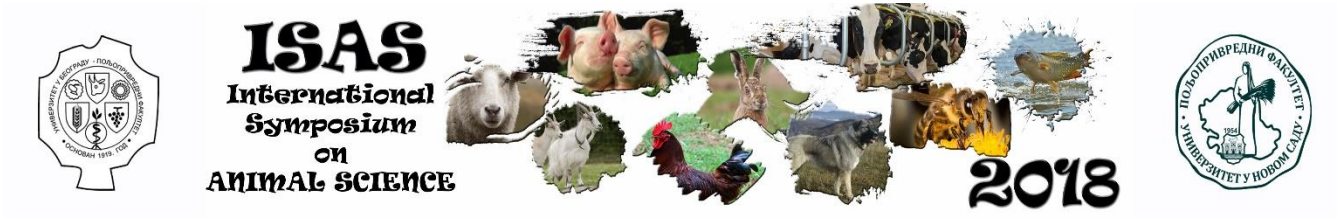

INTERNATIONAL SYMPOSIUM ON ANIMAL SCIENCE 2018

22th - 23th November 2018, Belgrade-Zemun, Serbia

TRAFFIC-RELATED MORTALITY OF WILD UNGULATES AND LARGE CARNIVORES IN SLOVENIA: SITUATION AND MITIGATION MEASURES

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ROAD-KILL OF UNGULATES IN SLOVENIA

(F+C+M: fallow deer + chamois + mouflon) (source: information system *Oslis, 2018*)

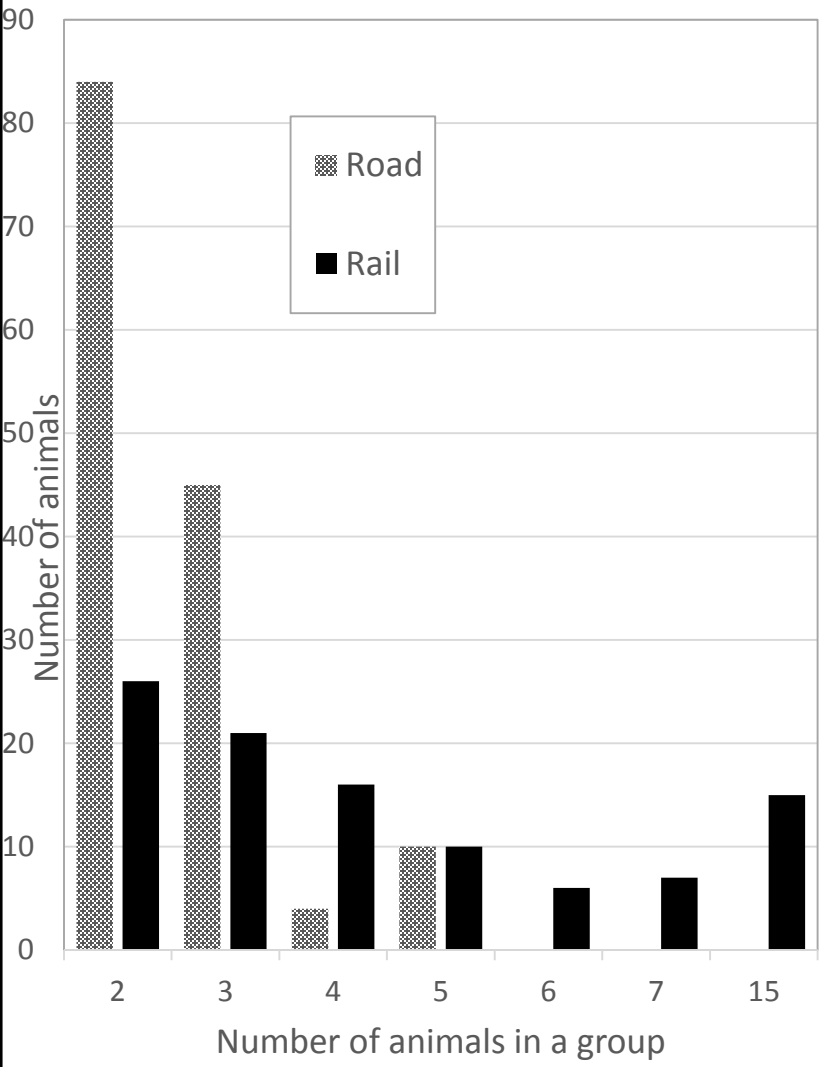
Year	**Roe deer**	Red deer	Wild boar	F+C+M	**Σroads**
2010	**5,901**	133	100	24	**6,158**
2011	**5,493**	140	86	16	**5,735**
2012	**5,420**	142	143	10	**5,715**
2013	**5,484**	136	75	13	**5,708**
2014	**5,138**	127	102	14	**5,381**
2015	**4,963**	161	93	12	**5,292**
2016	**4,582**	135	111	16	**4,844**
2017	**5,042**	171	118	9	**5,349**
2018 (21.11.)	**4,244**	134	84	24 (11c)	**4,486**

RAILWAY-KILL OF UNGULATES IN SLOVENIA

(F+C+M: fallow deer + chamois + mouflon) (source: *Oslis, 2018*)

Year	**Roe deer**	Red deer	Wild boar	F+C+M	**Σroads**
2010	**185**	51	9	1	**246**
2011	**103**	37	15	5	**160**
2012	**121**	44	29	0	**194**
2013	**163**	54	15	3	**235**
2014	**103**	56	19	0	**178**
2015	**102**	42	36	1	**184**
2016	**88**	38	23	2	**151**
2017	**112**	42	27	2	**183**
2018 (21.11.)	**136**	41	11	5	**193**

Massive traffic-kill of large wild boar groups



Railway-kill of **15 individuals** in a single collision in August 2007.

TRAFFIC-KILL OF SOME CARNIVORES

Road-kill + railway-kill (source: *Oslis, 2018*)

Year	**Brown bear**	Wolf	Lynx	Wildcat	Jackal
2010	**3 + 5**	0 + 1	0	6	0
2011	**6 + 7** ♥	1	0	2	0
2012	**12 + 11**	1	0	8	2
2013	**3 + 4** ♥	2	0	6	1
2014	**12 + 9**	1	0	5	0
2015	**9 + 5**	1	0	5	5
2016	**5 + 4** ♥	2	1	1	6
2017	**10 + 8**	1	0	3	8
2018 (21.11.)	**3 + 5** ♥	4 + 1	0	2	10 + 2

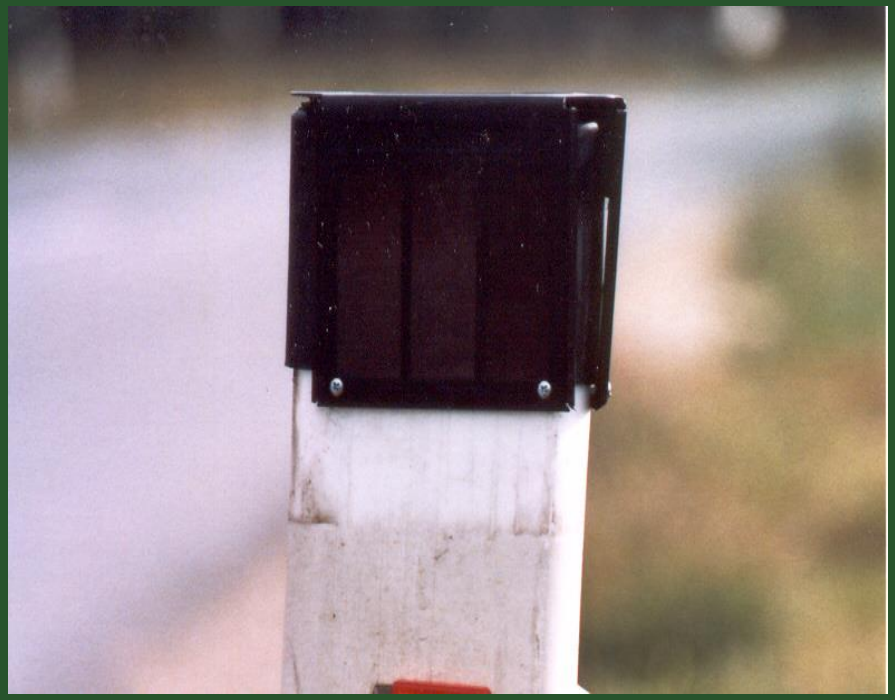
… the road-kill would be even much higher without mitigation measures ➔ for example, all highways in Slovenia are fenced …

... and not only with classic mesh (solid) fences!

OPTIONS FOR MITIGATION

MONITORING OF THE EFFECTIVENESS OF ACOUSTIC DETERRENTS IN THE PERIOD 2006-2013

- In the period 2006 – 2013, monitoring of the effectiveness of acoustic deterrents was performed at >120 very problematic Slovene road sections (>80 km in total).
- Beside temporal comparison with comparable periods in the past (before and after implementation), effect of acoustic deterrents on deer behavior was assessed also by filming by using IR-cameras.

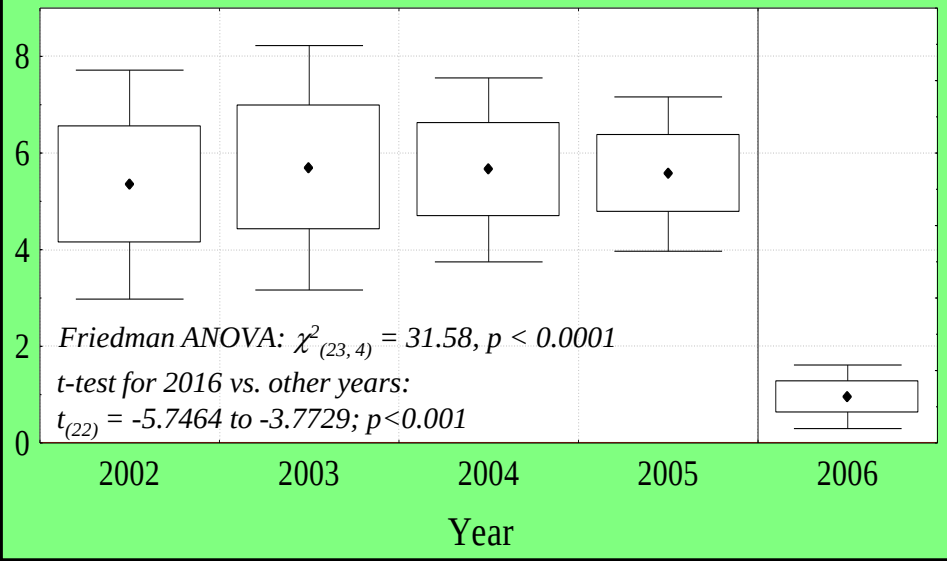


Effectiveness of acoustic deterrents in 2006:

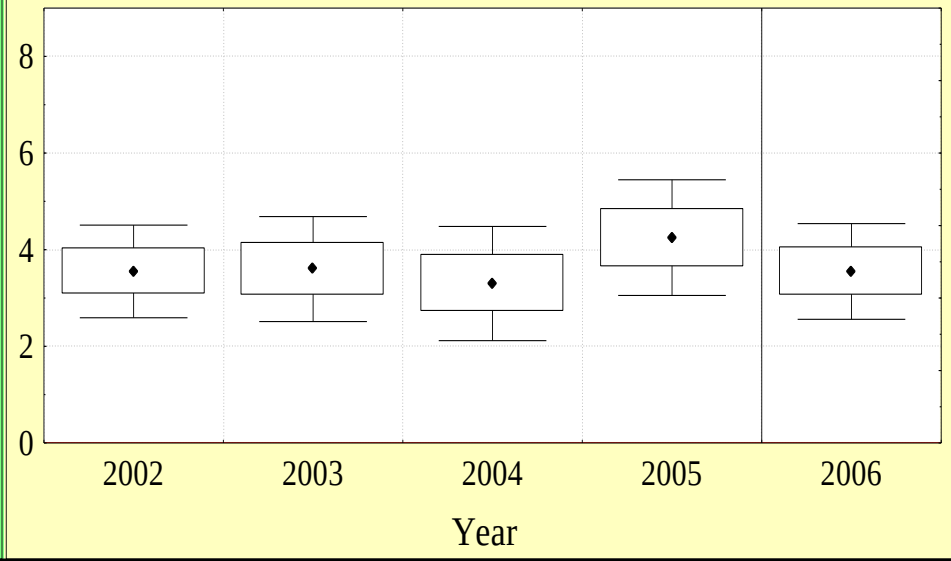
Number of road-killed deer before and after implementation of acoustic deterrents – pooled data across 23 tested road sections.

Section	Year 2006	Year 2005	Year 2004	Year 2003	Year 2002	Sum 02-05	Mean 02-05	D-2005	D-mean	K-2005	K-mean
Tested	22	128	130	131	123	512	128	-106	-106	0.17	0.17
Control	71	85	66	72	71	294	73.5	-14	-2.5	0.84	0.97
Adjacent	39	50	54	63	54	221	55.3	-11	-16.3	0.78	0.71

Tested (protected) road sections



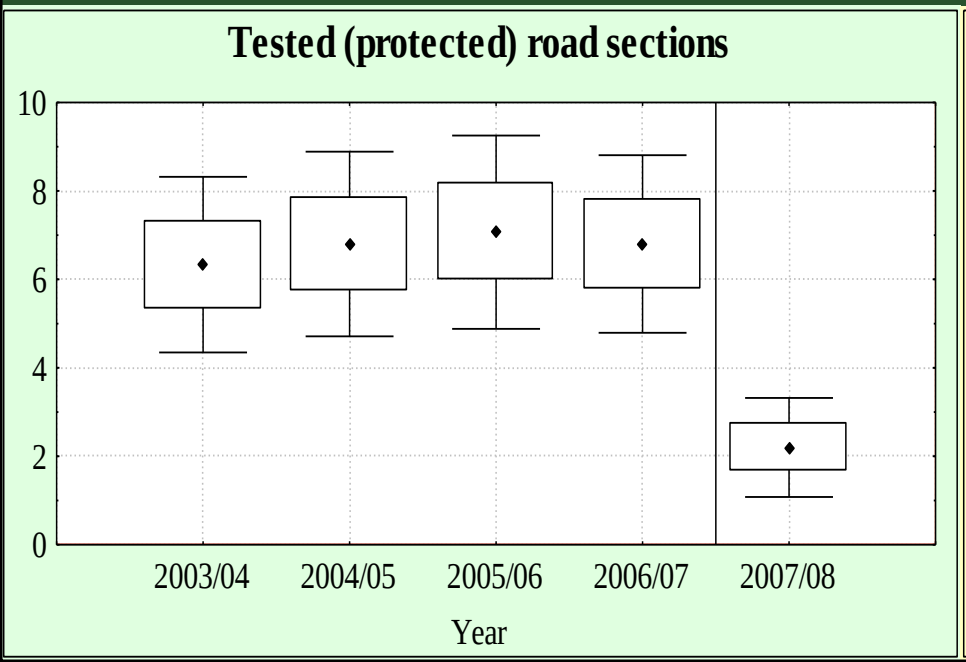
Control road sections

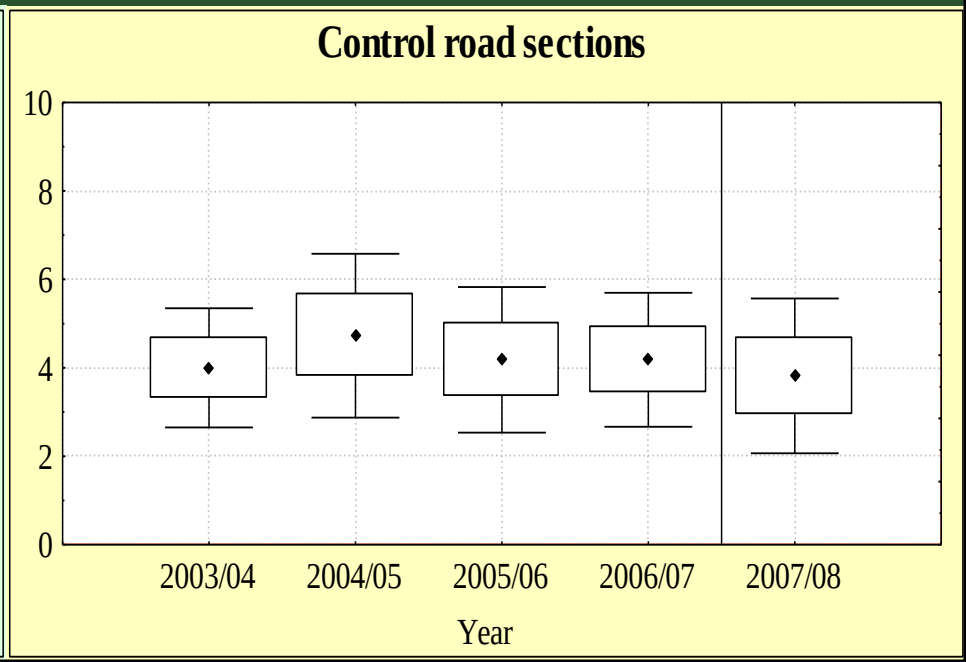


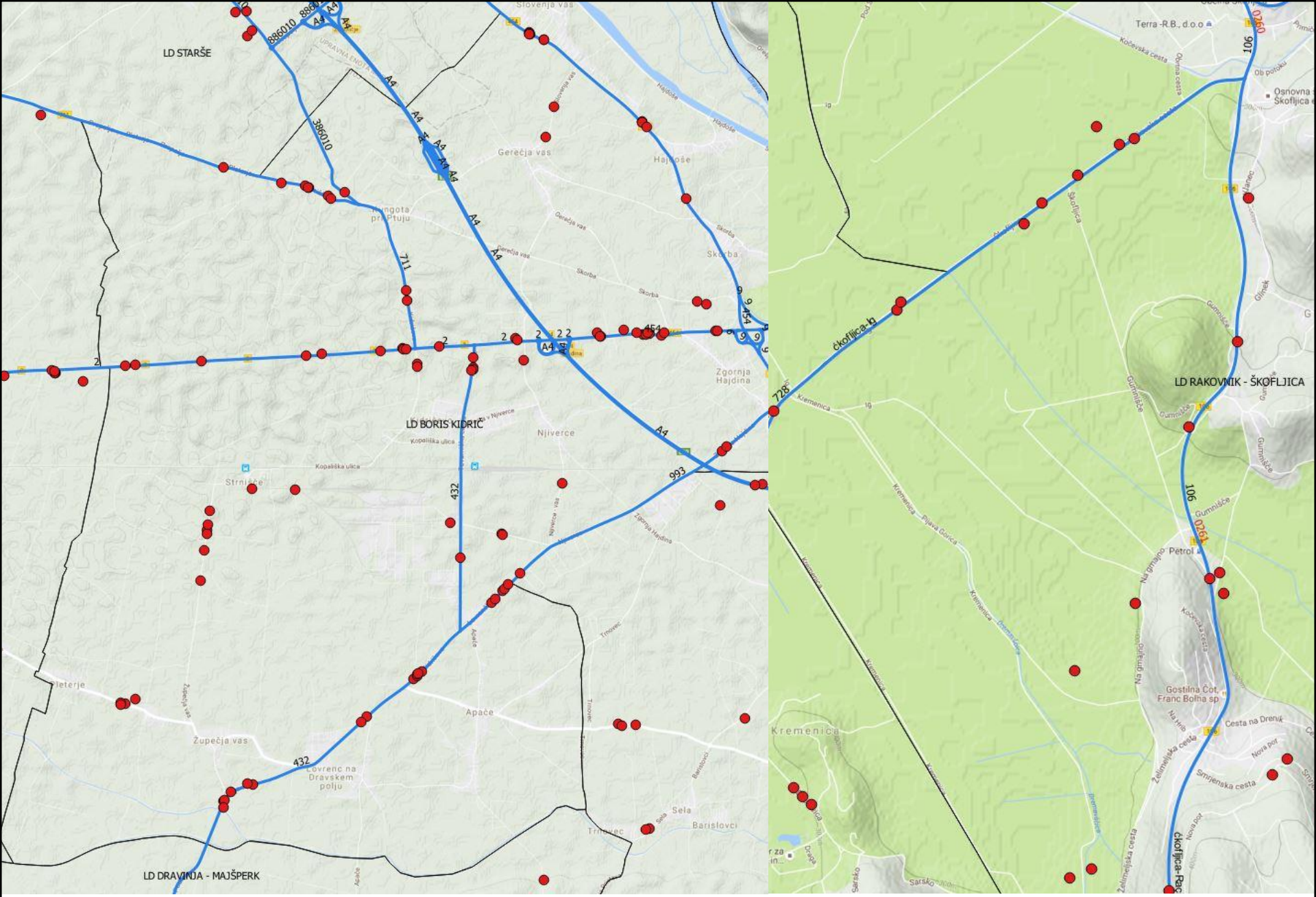
Effectiveness of acoustic deterrents in the period 2007/08:

Number of road-killed ungulates before and after implementation of acoustic deterrents – pooled data across 15 road sections for the period 10.8.2007 – 30.6.2008.

Sections	Year 2008	Year 2007	Year 2006	Year 2005	Year 2004	Sum 04-07	Mean 04-07	D-2007	D-mean	K-2007	K-man
Tested	33	102	106	102	95	405	101	-69	-68	0.32	0.33
Control	42	46	46	52	44	188	47	-4	-5	0.91	0.89
Adjacent	23	15	17	21	18	71	18	8	5	1.53	1.30

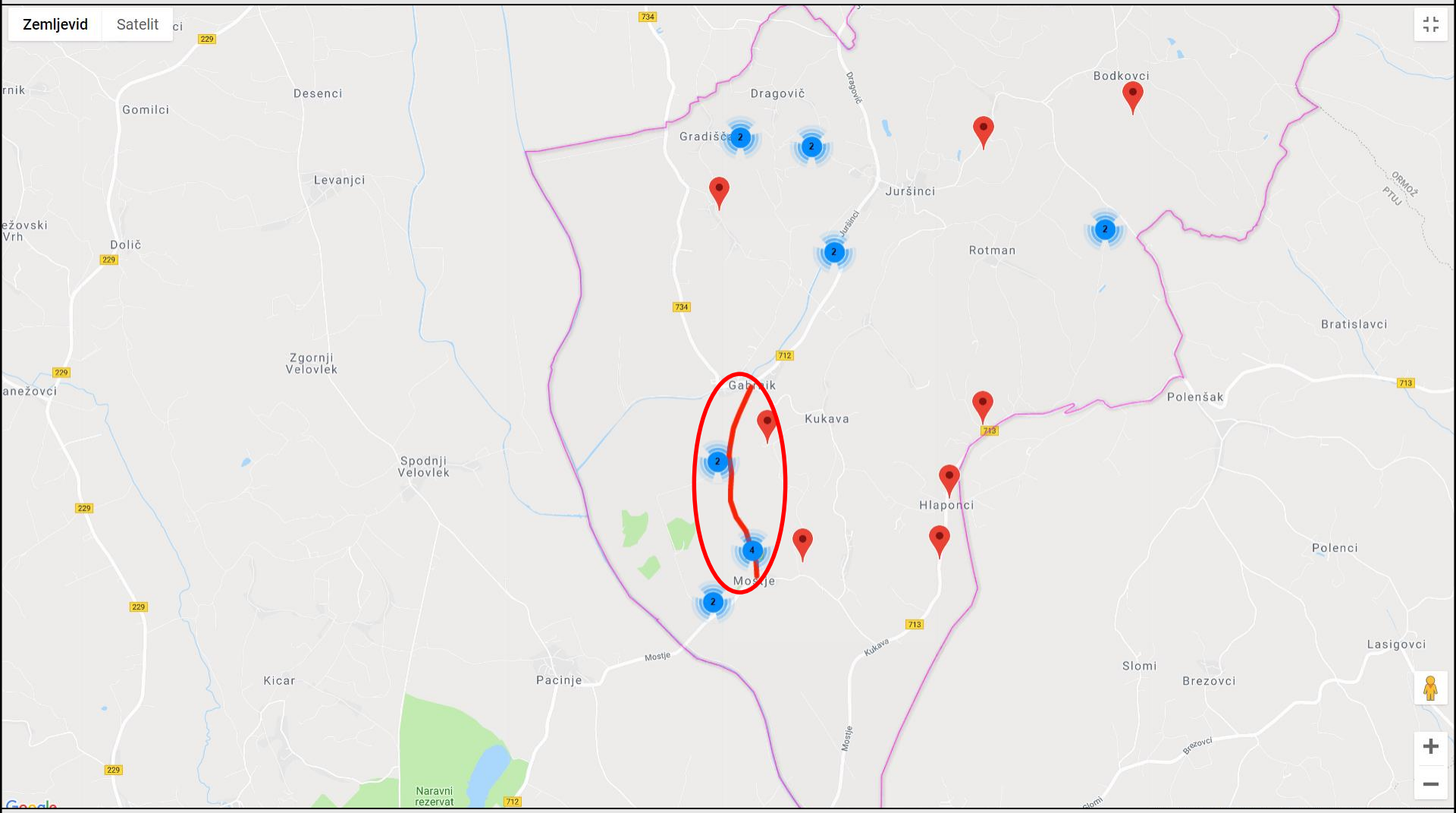






Road-kill, since 2015 ➔ <u>in a very high spatial resolution</u> (by providing coordinates) **➔** enabling both reasonable decisions and cost-effective monitoring.

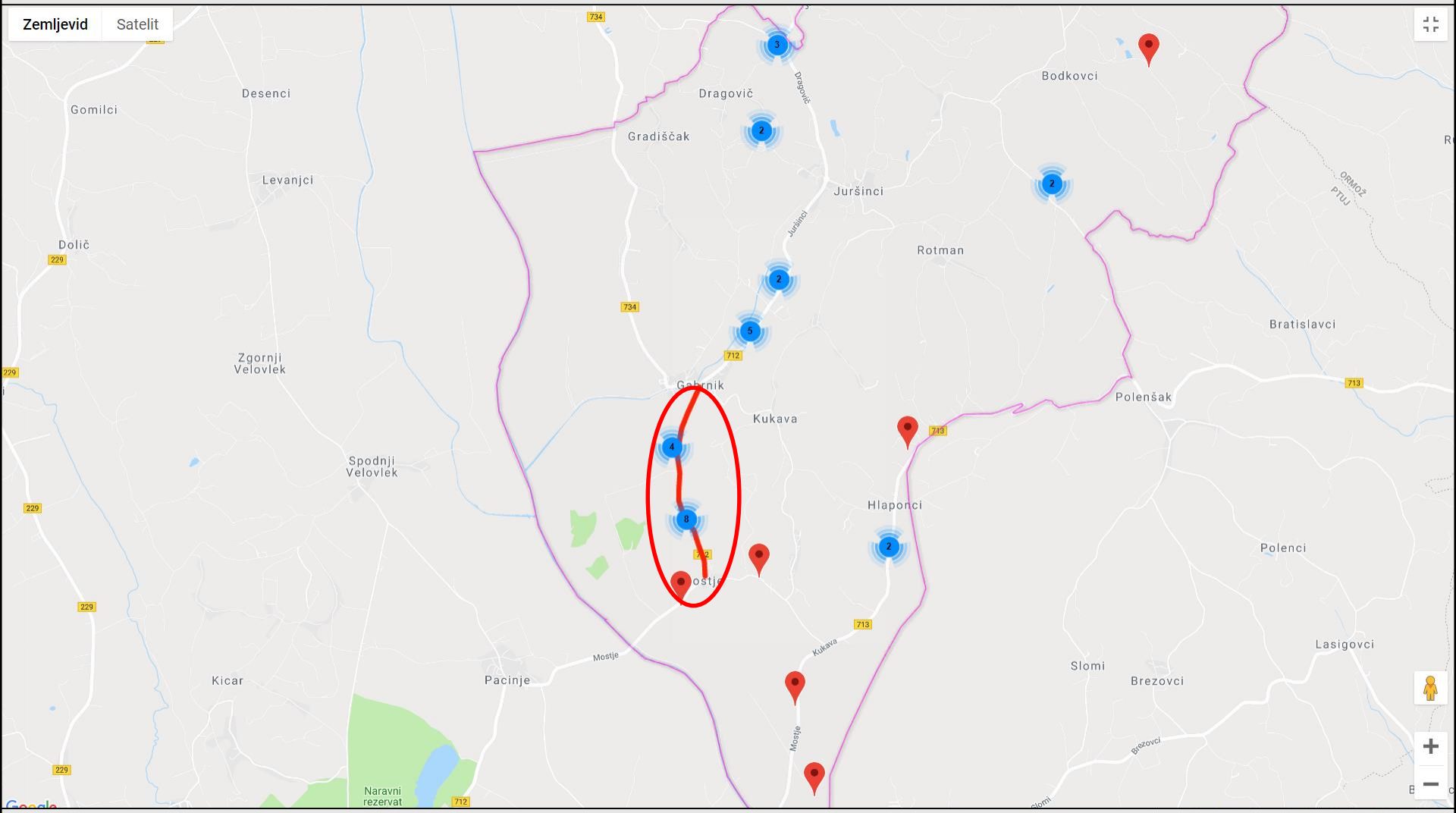
BEFORE IMPLEMENTATION OF ACOUSTIC DETERRENTS



Case report 1: Hunting ground Juršinci, north-eastern Slovenia

(road-kill of roe deer: 1 Jan – 31 Oct 2015)

BEFORE IMPLEMENTATION OF ACOUSTIC DETERRENTS



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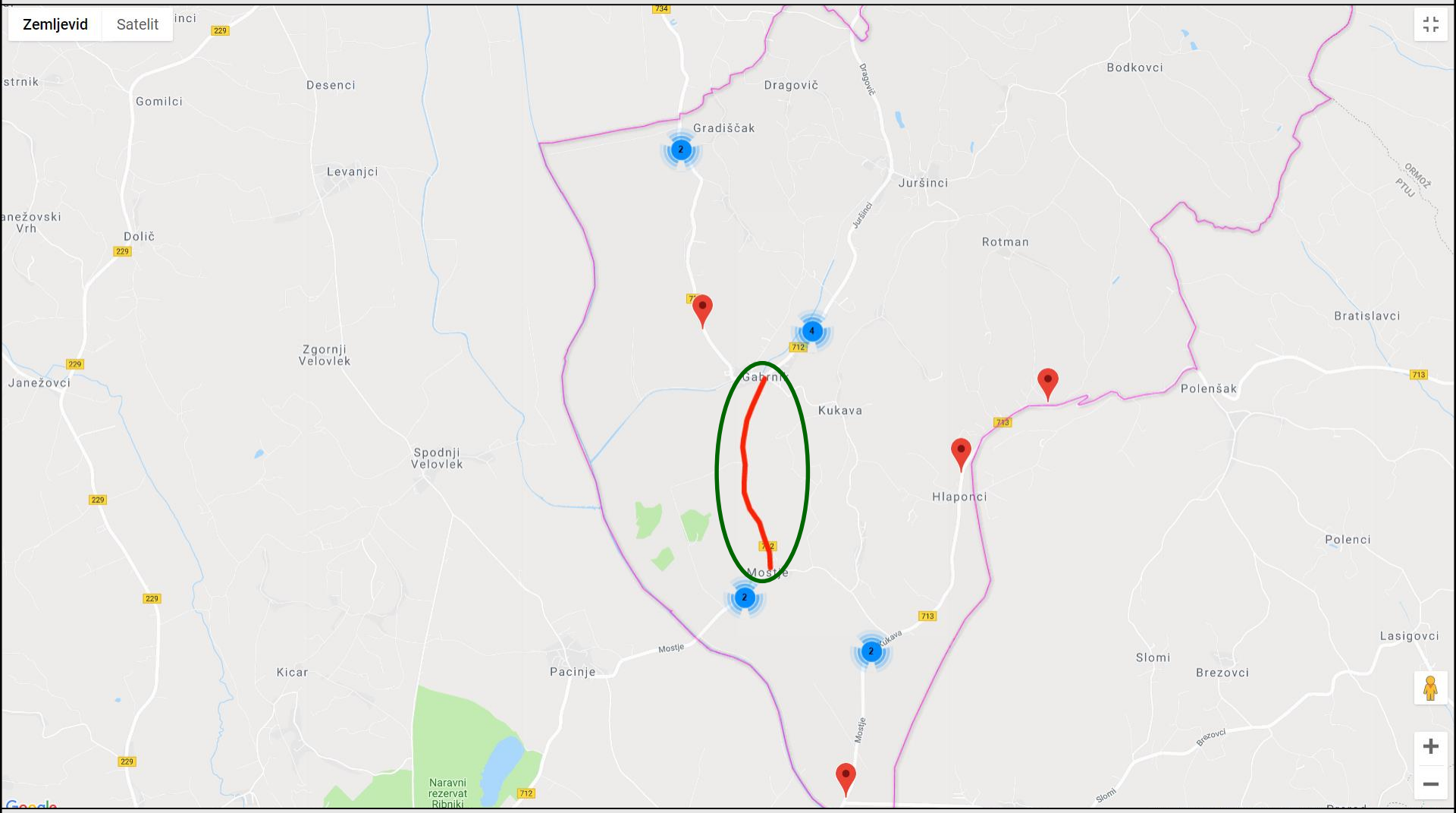
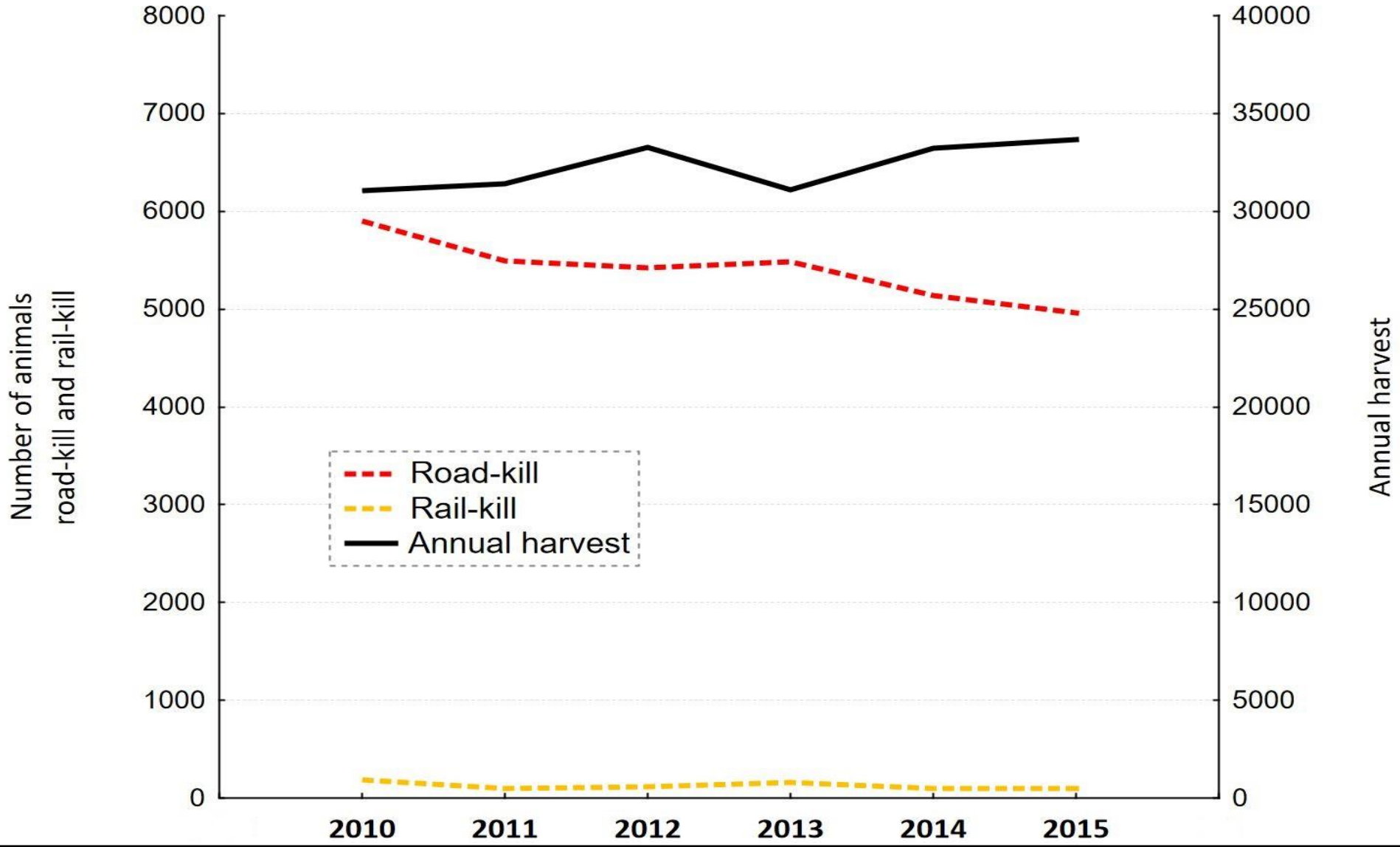


Case report 1: Hunting ground Juršinci, north-eastern Slovenia

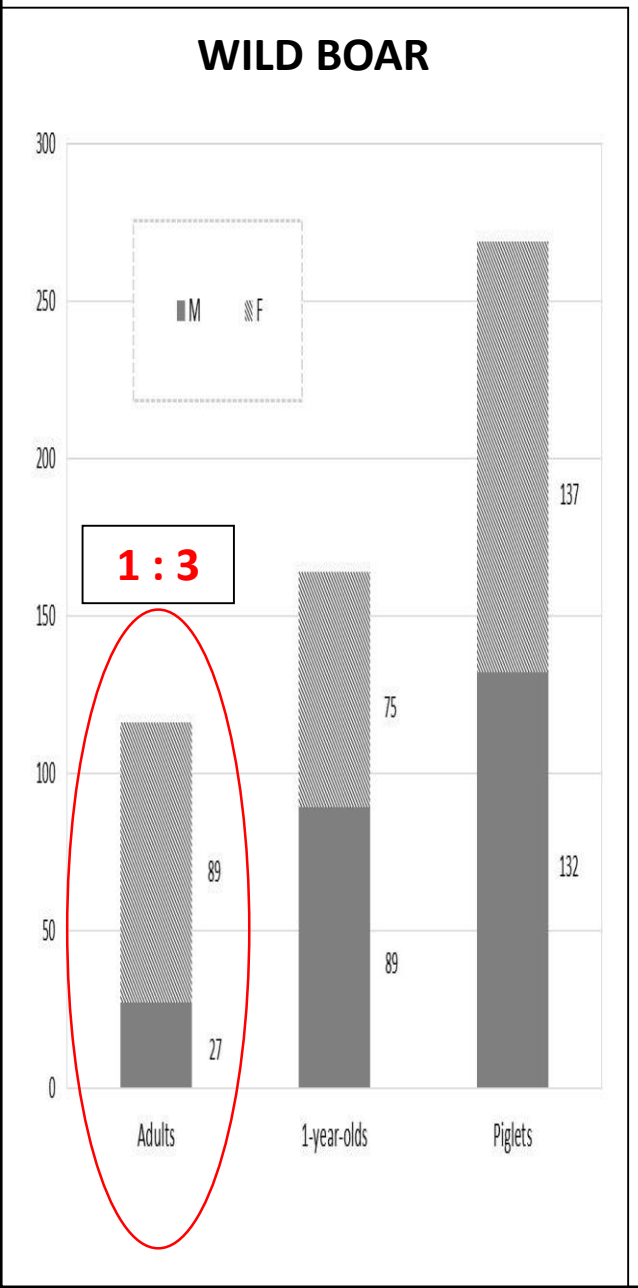
(road-kill of roe deer: 1 Jan – 31 Oct 2018)

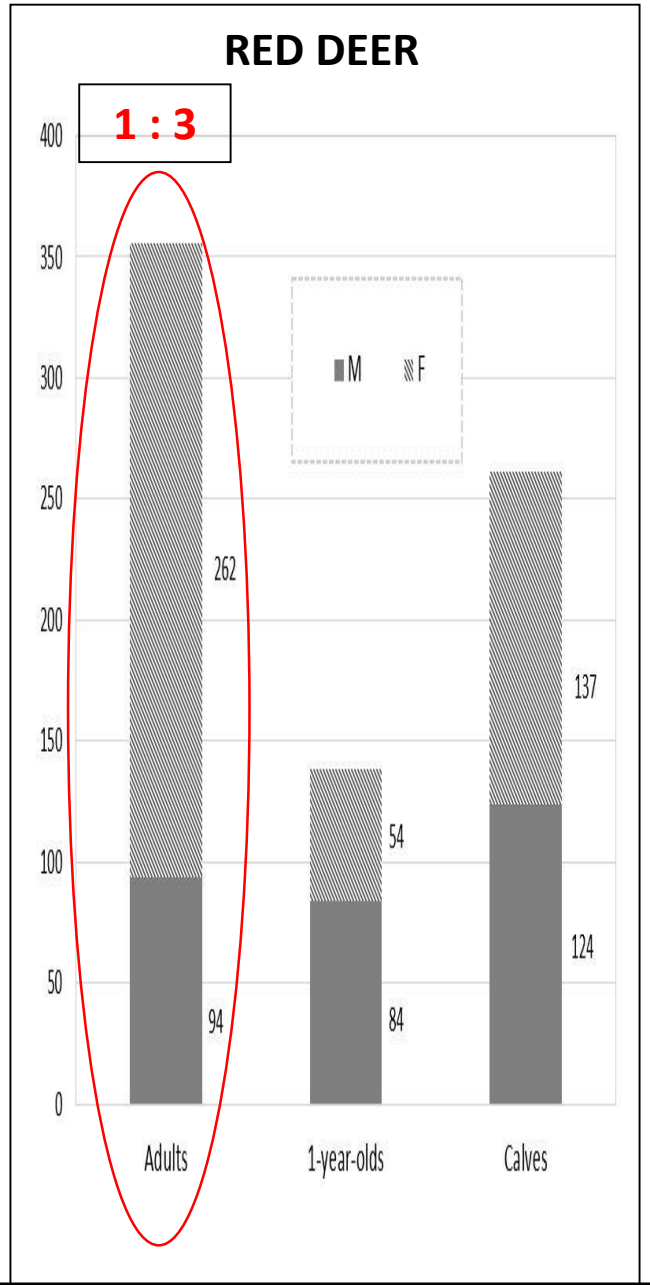
Do/can we affect number of UVC by population management?

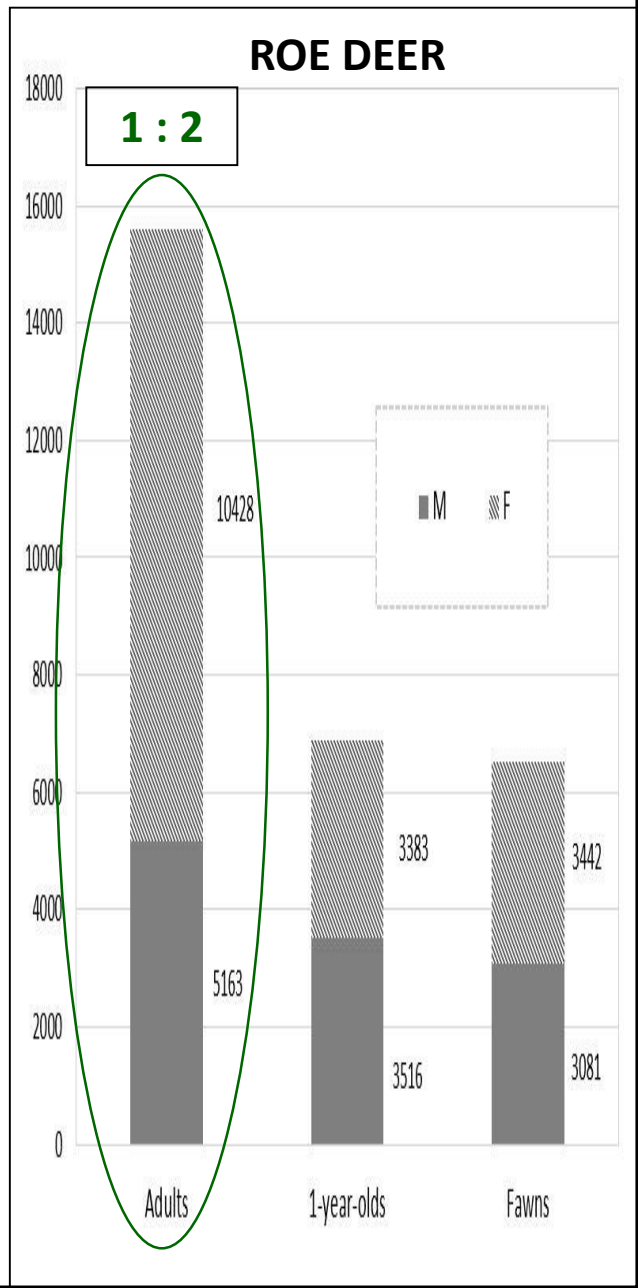
Annual harvest rate, road-kill and railway-kill of ROE DEER



Demographic structure of road-mortality (2011-2016)







Total mortality and road-kill of roe deer in Slovenia, in hunting grounds managed by hunting clubs (2008–2015)

ADULTS

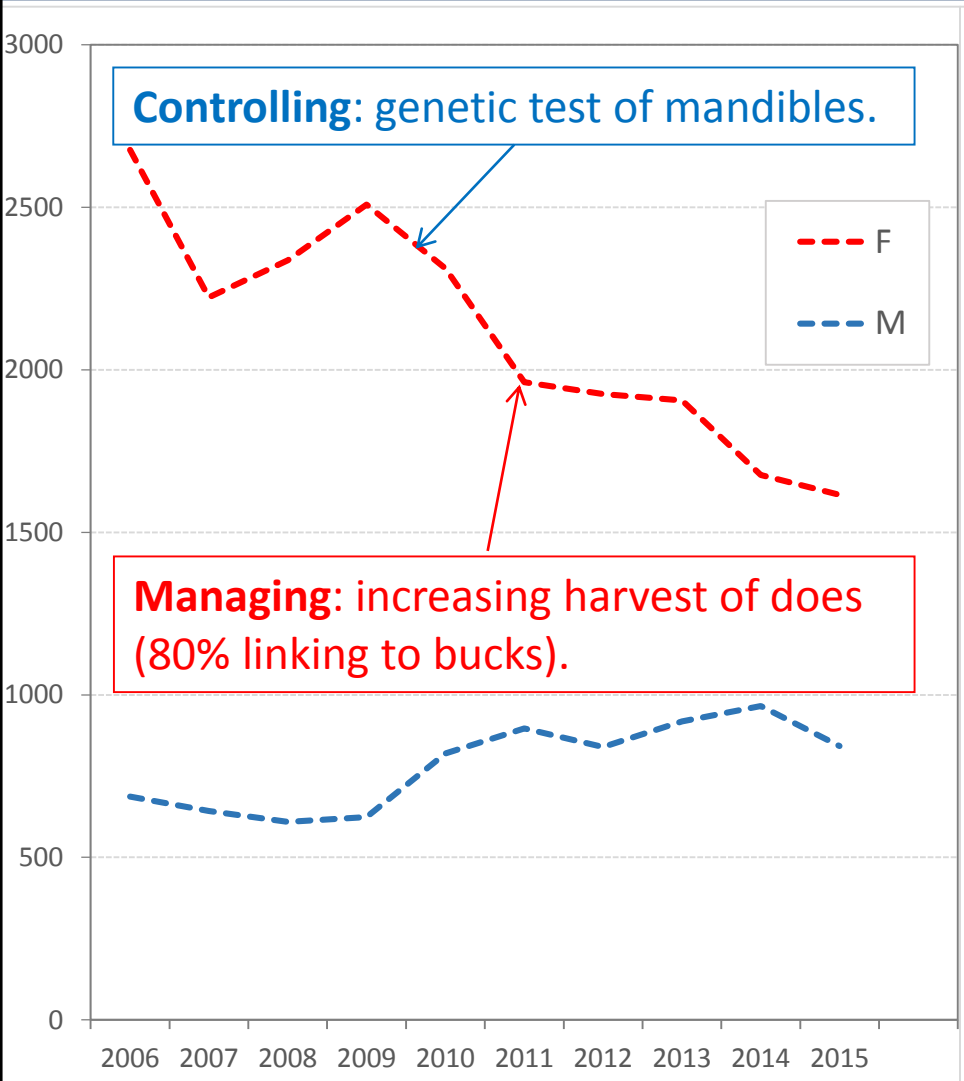
Year	Bucks			Does			Ratio of road-kill does : bucks
	mortality	road-kill	% of road-kill	mortality	road-kill	% of road-kill	
2008	8,101	611	**7.5%**	8,187	2,346	**28.7%**	**3.84**
2009	8,362	623	**7.5%**	8,346	2,506	**30.0%**	**4.02**
2010	8,169	817	**10.0%**	8,185	2,309	**28.2%**	**2.83**
2011	8,160	897	**11.0%**	7,668	1,962	**25.6%**	**2.19**
2012	8,203	840	**10.2%**	8,122	1,924	**23.7%**	**2.29**
2013	8,055	916	**11.4%**	8,458	1,904	**22.5%**	**2.08**
2014	8,310	966	**11.6%**	8,393	1,677	**20.0%**	**1.74**
2015	8,263	843	**10.2%**	8,472	1,616	**19.1%**	**1.92**

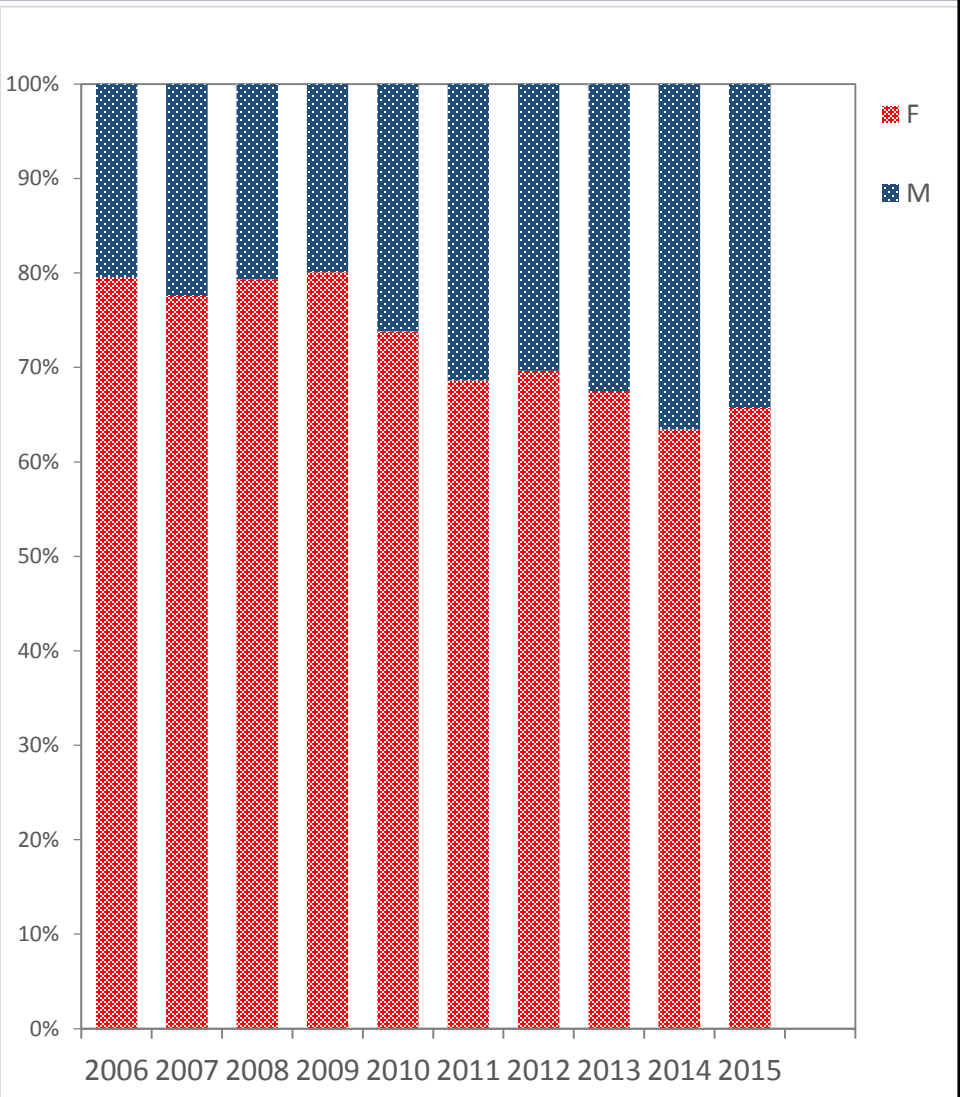
Road-kill of roe deer in Slovenia, in hunting grounds managed by hunting clubs (2008–2015)

FAWNS and YEARLINGS

Year	FAWNS			YEARLINGS		
	Females (F)	Males (M)	Ratio F : M	Females (F)	Males (M)	Ratio F : M
2008	636	542	**1.17**	701	490	**1.43**
2009	611	599	**1.02**	763	517	**1.48**
2010	700	603	**1.16**	668	566	**1.18**
2011	679	601	**1.13**	578	551	**1.05**
2012	608	583	**1.04**	591	656	**0.90**
2013	653	598	**1.09**	598	585	**1.02**
2014	565	536	**1.05**	559	605	**0.92**
2015	627	502	**1.25**	586	582	**1.01**

Temporal changes in road-mortality of ADULT roe deer





All Slovene hunting grounds, managed by hunting clubs (2006-2015)
(females: N = 21,145; males: N = 7,847)

CONCLUSIONS with PERSPECTIVES

Yes, we probably can! ➔ to reduce the number of ungulate-vehicle collisions ➔ either by using effective mitigation measures or by proper management of populations.

Knowledge on several aspects and performance of UVC is essential for taking adequate decisions.






Participants of study

EUROPEAN ANALYSIS OF UNGULATE-VEHICLE COLLISIONS

- no participants
- complete data
- data from part of country
- will send data
- insufficient data

0 250 500 km

CDV - Transport Research Centre
gis@cdv.cz
Last update: 03.09.2018

CONCLUSIONS with PERSPECTIVES

Reducing the number of UVC can also be achieved by enabling safe crossings for animals ➔ however, very expensive green bridges are not always needed.

In the moment in Slovenia ➔ **upgrading of database (by developing system for on-line registration *in situ*) and large-scale implementation of deer warning reflectors and acoustic deterrents** ➔ >370 km of state roads, all highway entrances.

CRP project V4-1825:

Game species in urban environment, on roads and other non-hunting areas: problems, challenges and solutions

Many thanks!

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA KMETIJSTVO, GOZDARSTVO IN PREHRANO

Javna agencija
za raziskovalno dejavnost
Republike Slovenije