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## Life and Behaviour of Wolves: Croatia research update

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# Life and Behaviour of Wolves

Professor Josip Kusak presented jointly collated research – entitled “Spatio-temporal distribution of activity and space-use among wolves, ungulates and humans in Croatia” – at the 2013 International Wolf Symposium in Duluth, Minnesota, USA. His research collaborator, Pete Haswell, summarises their ten years’ work.

## Wolf distribution

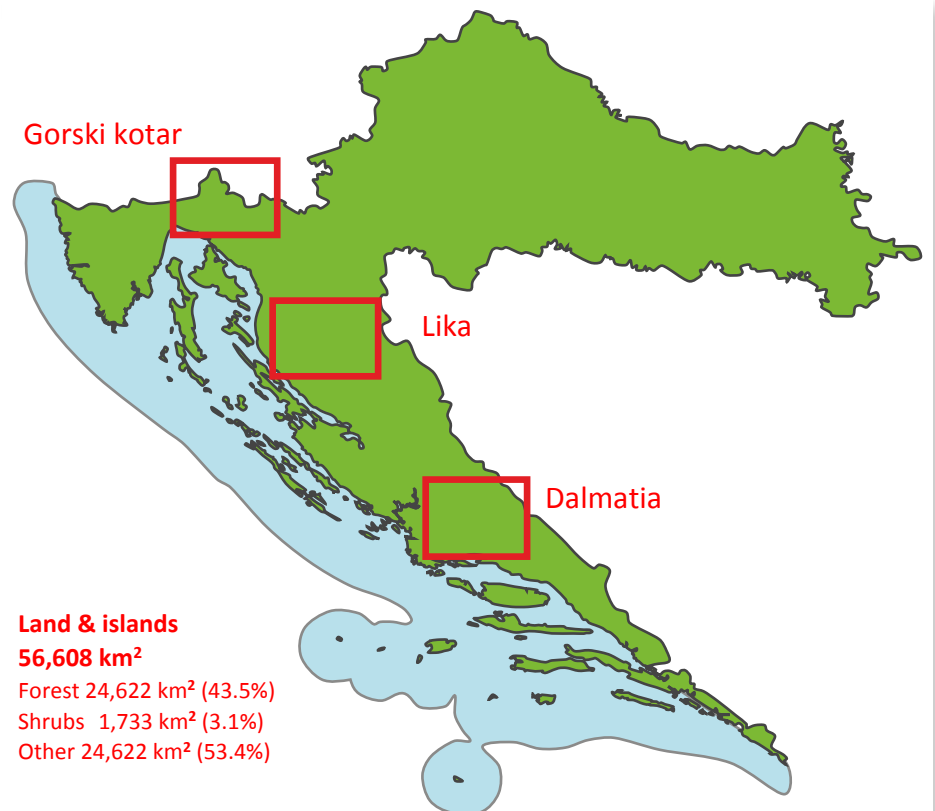
In Croatia wolves generally inhabit three connected yet distinct geographic regions. Gorski kotar is the most mountainous zone and is highly forested (60-70%) with wild ungulates being the predominant wolf prey. The Lika region with the Velebit mountains is less forested, with higher sheep numbers than Gorski kotar. Sheep predation is relatively low, with wild prey making up the bulk of wolf diet. Dalmatia, with its poor Mediterranean vegetation and rocky countryside, contains the highest human population of the three areas. Only hare and wild boar are present as wild prey, sheep density is high and wolf diet consists of 86% livestock. General attitudes towards wolves become less positive as you move north-west to south-east.

## Tracking collars

We examined motion-sensor activity data from 15 wolves fitted with Vectronic GPS Plus collars in the three different regions of Croatia, collecting 1,048,272 activity readings during 3,743 days of tracking between 2003 and 2013. Twelve wolves were tracked in Gorski Kotar, six of each gender. Two female wolves were tracked in Northern Velebit and one in Dalmatia.

In all areas, wolves were generally most active (more than 50% of the time) during one prolonged period centred about the nighttime with a spike of activity in the very early hours of the morning. Wolves were less active during the afternoon, possibly when it is hottest and humans are most active. However, the cause of this pattern needs further investigation.

We observed some regional variation in activity patterns. Wolves in Gorski kotar used dawn and daytime more than wolves from other regions. Wolves in



Dalmatia and Lika were more active at night. We need to track more wolves in Dalmatia and Lika to ascertain how significant the regional variances are, but results suggest that wolves may adapt their use of time dependent on the influences of local environment.

For management purposes it is useful to understand general or dominant patterns of how wolves in a given area use the time niche. However, one thing that became increasingly clear from our analysis is that wolf activity patterns are highly variable. Even when looking at wolves tracked within a similar locality, some wolves are more active than others, some more active during the day (diurnal) and others more nocturnal. Levels of activity also fluctuated

throughout the year. Wolves in all areas showed an increase in activity during June, suggesting some common denominator may cause this phenomenon. Varying levels of activity during different months of the year were accompanied by a variation in the predominant temporal patterns during the course of the day. If we take for example the June activity peak exhibited by wolves from Gorski kotar, we found that these wolves became significantly more active during the day than in any other month of the year and more active at dawn than in comparison to all months except April. Whether this change in behaviour is caused by an increase in food availability because of deer fawn birth, a need to feed wolf

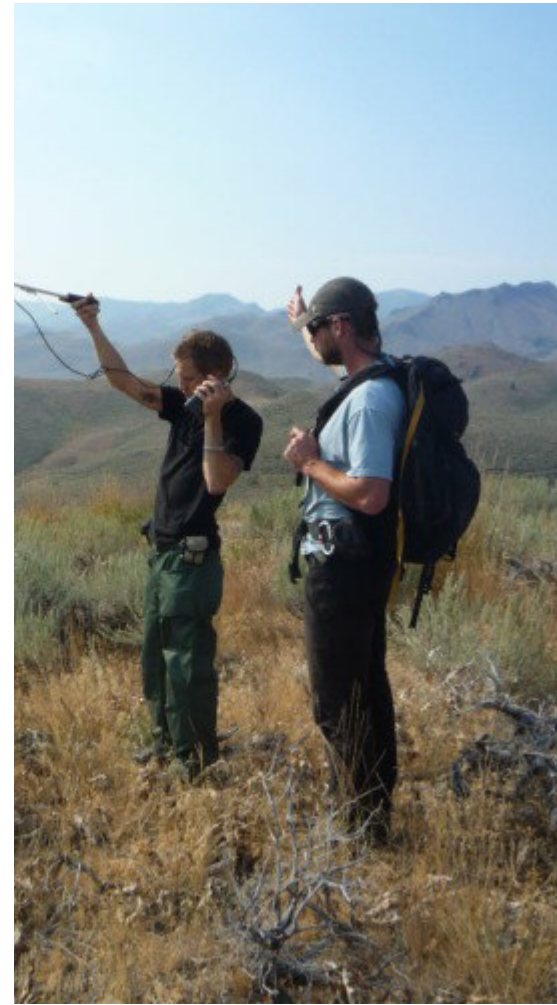
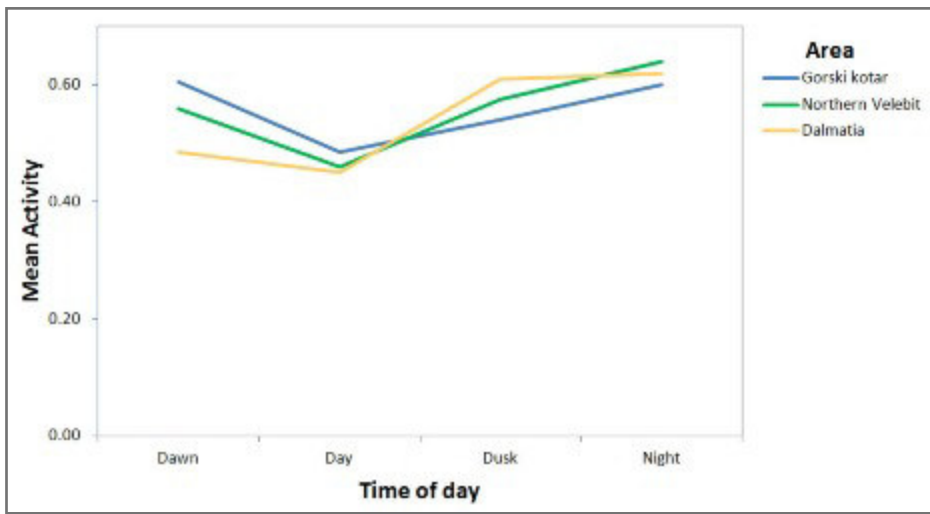
# s: Croatia research update

cubs born in late May or whether it is caused by human disturbance in the summer months, is an interesting question.

We found gender differences in how wolves use time. We found males in Gorski kotar to be less active than females. Females and males showed a similar spike in activity during June and a decrease in activity over the summer. Patterns during the rest of the year were, however, different, particularly in

March. Female activity remained high but male activity was significantly lower than in any other month. It could be that males need to recuperate in March after the high energy demands of the breeding season.

Activity patterns are not easily classified as strictly nocturnal, crepuscular or diurnal. It is clear that wolves exhibit a great deal of flexibility and adaptability in their use of the time niche.



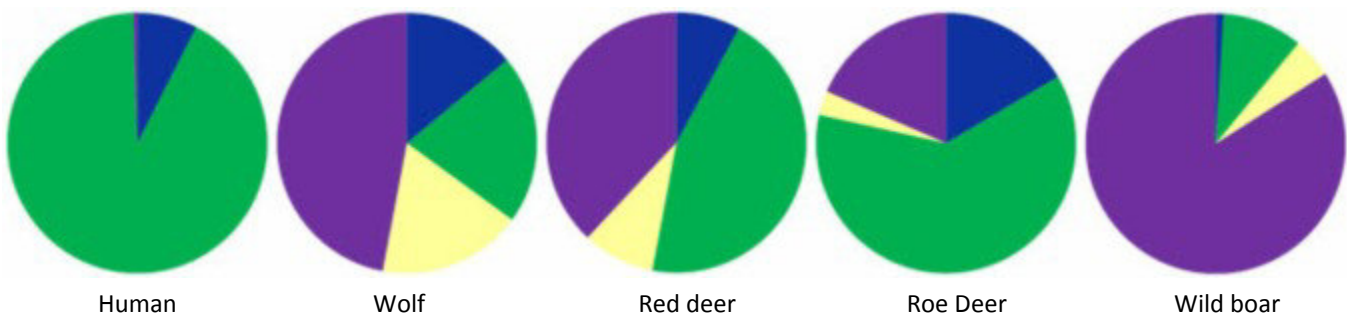
## Camera Traps

In Gorski kotar, over a period of 3,310.2 camera trap days in 2011 and 2012, motion-activated cameras recorded 2,021 observations that were used to examine spatio-temporal activity patterns of wolves (4% of observations used), their prey species, red deer, roe deer, wild boar (64.9%) and humans (31.1%). Camera traps were positioned at 50 sites over an area covering 400sq km in Gorski kotar. Eight site-types were studied: main forest roads, secondary forest roads, tertiary forest roads (with differences in surface material and vegetation cover defining road type), logging roads, mountaineering trails, animal trails, forest and forest house.

The number of observations at a site-type was divided by the number of camera trap days at that site-type. This way data between site-types (forest road main, forest road secondary, animal trail etc...) that had been studied for different lengths of time could be compared fairly.

Time of day:

■ Dawn ■ Day ■ Dusk ■ Night



# ◀ Life and Behaviour of Wolves: Croatia research update

An interesting question from our analysis is whether roe deer are so active during the day to maximise foraging success from feeding stations operated by humans or, alternatively, to avoid lynx. Some interesting questions arise when looking at wild boar too. Does similar time use in wild boar suggest a lack of predation pressure and avoidance of wolves? And, do wild boar avoid persecution from people during the daytime and dawn?

Wolves were observed most during the night but least at dawn. Which is interesting, considering that motion sensor data from wolves in the area suggests they are second most active during dawn. It could be that dawn activity may not involve great locational movement. Dawn activity could occur in locations not covered by cameras such as resting sites and gets missed by

camera traps, which are more likely to capture animals on the move. It might appear that wolves compromise their temporal behaviour in order to avoid humans while also maximising opportunities for hunting success. Ungulates do not necessarily avoid their predators in time, possibly due to the foraging requirements of an herbivorous diet.

The use of space and time in combination however, becomes important for predator avoidance.

Wolves were observed most during the night at places where humans were absent and prey species were observed frequently. Nine out of the 11 space-times where wolves were observed had fewer human observations. Four of these also had high prey observations. During the day in two places (main and secondary forest roads) where humans

are most active, wolves are still sometimes seen, as are prey species; red deer were mostly observed on animal trails where humans were rarely observed and wolves were not seen at all, this space-time saw more observations of red deer than any other. Observations were also high on logging roads during the day where humans were observed less. When humans were the dominant daytime land user on main and secondary forest roads as well as mountaineering trails, deer were observed less. More data collection and statistical tests are required. Initial observations suggest the possibility of a spatio-temporal predator-prey dynamic where wolves' pursuit of prey is offset against avoidance of humans. Large herbivores use what space-times they can, while attempting to avoid both wolves and humans.

## The Future

As well as continued studies on how animals use space and time, I plan to examine how the ecology of fear between wolves and other species is affected by local conditions, with one of the key conditions being intensity of human presence. I plan to examine how large herbivores, as well as smaller carnivores, perceive risk of predation or harassment from wolves. How these species forage in risky and safe environments as well as how they alter their behaviour in relation to predation risk. Hopefully this will provide a better understanding of the behaviourally mediated ecosystem services wolves provide and how these services are affected by local conditions.

Pete Haswell, BSc Hons Environmental Science (Biodiversity and Conservation), works at Bangor University  
<http://conservation.bangor.ac.uk/PeteHaswell.php.en> and is collaborating with Professor Josip Kusak on a project the UKWCT supports in Croatia.

You can read more about his work on his website:  
<http://petehaswellwolfresearch.wordpress.com/>



## Wolves of a Feather: painter Kym Anderson and her unusual canvases

Kym Anderson has a remarkable talent: she paints beautifully detailed wolves onto feathers. Not simply wolves but any animal or object your heart may desire. On many mediums, including fabric. But the feathers are the most remarkable: the brushstrokes are fine and minutely observed. I have held one in my hand and marvelled at the patience it must have taken to work on such a medium. In a world where we buy so many mass-produced goods, this is an incredibly affordable way to own a real work of art, as

well as to wear your dog/cat or horse on your sleeve! Feathers are obtained from suppliers in the UK and these are the stages that Kym goes through to produce her pieces, where she:

- Selects a good quality strong feather, preferably turkey or sometimes pheasant.
- Makes sure the feather and feather shaft is clean
- Uses a very fine paintbrush – one with as few brush hairs as possible
- Paints directly onto the feather, working with the feather fibres, not against

- 'Stays' with an acrylic fixative so the painting will never come off.
- Turns the work into a writing pen or a framed and mounted display

Kym Anderson (also known as Kym Easterbrook) has for more than 20 years focused on canvas, ceramics, textile based painting and hand-painted t-shirt creations.

You can buy Kym's wolf-painted feathers and t-shirts from our shop. See pages 30 and 31.

[www.kymspaintedshirts.com](http://www.kymspaintedshirts.com)