

## ZOOL 567 - Topic Summary

Howling is an audible signal used by wolves to communicate with members of their pack, as well as wolves in distant packs, over extended distances (Harrington & Asa, 2003). The “lower pitched, harmonically simple sound” can be emitted by single wolves or simultaneously as a pack in what is known as a chorus howl (Harrington & Asa, 2003). Within packs, individuals use howling to locate packmates that have been divided from the group (Mazzini et al., 2013). Among packs, howling is used mainly for territory and resource defence (Harrington & Mech, 1979; Harrington & Mech, 1983).

Researchers interested in understanding the development of howls analyzed the variability of wolf howls audibly and visually through sonogram and spectrograph analysis (Theberge & Falls, 1967; Zaccaroni et al., 2012). To audibly observe howl variations, researchers listened to how howls of different individuals were different by ear (Theberge & Falls, 1967). To visually analyze howl variations, researchers recorded wolf howls using a microphone and recorder and then used computer software to generate visual diagrams depicting changes in pitch (Zaccaroni et al., 2012). They found that variation existed between howls of individuals as well as groups (Theberge & Falls, 1967; Zaccaroni et al., 2012). This suggests that acoustic differences may have developed in wolves so that they can identify one another, which is essential for locating isolated pack members and avoiding unfamiliar individuals nearby (Theberge & Falls, 1967; Harrington & Mech, 1979; Harrington & Asa, 2003). Acoustic differences could also be observed depending on whether a wolf was using howling for territory defence or locating a packmate (Watson et al., 2018). The genetic cause behind these individual howl variations remains unknown and requires further investigation, as these differences are currently being explained by a wolf’s personal preference in howl acoustics (Theberge & Falls, 1967; Zaccaroni et al., 2012).

To understand the ecology of howls, researchers observed behaviour changes in the receiver, such as movements from their original locations, and found that howling mediates interactions between wolves (Harrington & Mech, 1979; Harrington & Mech, 1983; Harrington, 1987; Palacios et al., 2015). In some instances, researchers used radio tracking to help monitor wolf movements (Harrington & Mech, 1983). Wolves typically reacted to howling by howling back to the caller or remaining silent (Harrington & Mech, 1979; Harrington & Mech, 1983). They found that the receiver would howl back to the caller to indicate that they were going to remain at their location, whereas the receiver would stay quiet if they were going to retreat (Harrington & Mech, 1979; Harrington & Mech, 1983). Wolves were more likely to respond when they were part of large groups (Ausband et al., 2020). This response to howling is critical in creating the territorial behaviour of wolves, as they were more likely to respond to the caller and remain at their location if there were defensible resources present (Harrington & Mech, 1979).

Researchers interested in understanding whether there was a hormonal mechanism that triggered howling in wolves observed changes in cortisol levels before and after howling (Mazzini et al., 2013). This was done by collecting saliva samples from wolves after they howled

in response to one of their pack members being separated from their group (Mazzini et al., 2013). Hormone levels only trigger howling behaviour in specific contexts (Mazzini et al., 2013). Cortisol levels only increased to trigger howling in wolves when high-ranked individuals were separated from the pack (Mazzini et al., 2013). Conversely, cortisol levels did not increase when individuals with whom the caller had affiliative relationships were separated (Mazzini et al., 2013). This suggests that, although stress may sometimes play a role in howling, it is not always a stress response (Mazzini et al., 2013). It remains unknown whether wolves cognitively trigger howling when an increase in cortisol does not act as the trigger (Mazzini et al., 2013). Furthermore, more research is needed to determine whether other hormones trigger howling in wolves (Mazzini et al., 2013).

## Bibliography

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