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A review of Post-Traumatic Stress Disorder in Animals

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Summary

Post-Traumatic Stress Disorder (PTSD) is a mental health condition that has been extensively documented in the field of human psychology (Lancaster et al., 2016; Mann et al., 2024). Since the mid-20th century, research on trauma has expanded to include its impact on non-human animals. Studies have identified trauma-related symptomology of psychological trauma in animals subjected to abuse, neglect, or exploitative living conditions, including animals used in laboratory experiments, as well as those bred or raised for human use (Lopresti-Goodman et al., 2015; Rizzolo et al., 2016). However, the notion that animals are capable of exhibiting signs of mental health disturbances is a comparatively new perspective that is only beginning to gain traction in scientific discourse.

This review explores PTSD in non-human animals, focusing on the manifestation of trauma-related symptoms as observed in various species, both captive and in the wild. Furthermore, the relative ecological, etiological, and phenomenological factors that lead to the development of trauma in animals will be explored. By examining the appearance of established behavioral and physiological PTSD symptoms, such as hypervigilance, avoidance, aggression, stereotypies, and altered stress levels, this review will highlight the parallels between human and animal PTSD. We will also explore the symptoms of Complex PTSD, which involves long exposure to trauma from a young age, in the context of animals. Finally, this review aims to contribute to the discourse on Trans-species Psychology, that is, the perspective that the biopsychosocial model of mental health applies across species, and in doing so, seeks to bridge the gap between human and non-human animals.

The present thesis, ultimately, aims to deepen our understanding of trauma in animals, explore possible pathways to recovery and intervention, advocate for improvement in our treatment of animals in various contexts, and identify avenues for future research and discussion for empirical exploration of mental health in the context of non-human animals.

Introduction

Post-traumatic stress Disorder (PTSD) is a severe mental condition diagnosed in humans characterized by experiences of intense psychological distress and hypervigilance, intrusive thoughts, avoidance, and emotional instability, among other symptoms (DSM-V, 2013; Cantor, 2009; Mann et al., 2024). While this phenomena has been recorded throughout human history, it was only recognized as a mental health diagnosis in 1980 in The Diagnostic and Statistical Manual of Mental Disorders (DSM-III, 236-239) PTSD symptoms in humans can develop through a single or prolonged exposure to events such as physical, mental or sexual assault at home or other areas; unexpected loss, accidents, injuries, war or natural disaster (Thakur et al., 2022).

Complex Post Traumatic Stress Disorder (C-PTSD) is a related disorder that may develop following exposure to an event or series of events of an extremely threatening or horrific nature, most commonly prolonged or repetitive events from which escape is difficult or impossible (ICD-11th edition, WHO 2019). A single or prolonged exposure to traumatic events such as torture, slavery, domestic violence, and repeated childhood physical or sexual abuse can lead to C-PTSD in humans.

In recent years, increasing evidence has shown that trauma-related dysregulation is not limited to humans. Various animal species, including elephants, chimpanzees, rodents, cetaceans, and livestock, are exposed to abuse, neglect, captivity, experimentation, social isolation, or other adverse experiences and evidence suggests that the exposure to trauma can produce long-lasting behavioral and physiological symptoms that closely parallel human PTSD (Overall, 2013; Bradshaw et al., 2019; Goswami et al., 2013; Marino et al., 2019). Many of these species display symptoms characteristic of PTSD, such as avoidance, withdrawal, hypervigilance, aggression, exaggerated stress response, along with impaired social and emotional regulation (Overall, 2013; Goswami et al., 2013; Rizzolo et al., 2016; Clegg et al., 2017). Many species also display species-specific stereotypies and self-injurious behaviors such as pacing, rocking, and over-grooming, which are recognized indicators of psychological distress (Weary et al., 2000; Lopresti-Goodman et al., 2015; Lutz et al., 2014).

Much of the literature has focused on animals as models for investigating the neurobiological mechanisms of trauma (Richter-Levin et al., 2019; Schöner et al., 2017). However, their own traumatic experiences and the welfare implications of experimentation have rarely been central to the aim of the research. Growing recognition of animal sentience, supported by legislative

changes, ethical discussions, and scientific research, has strengthened the argument that animals are sentient beings and possess mental, emotional, and social capacities relevant to trauma.

Jonathan Birch (2024) defines a sentient being as a “system with the capacity to have valenced experiences, such as experiences of pain and pleasure”. He argues that sentient beings require both “phenomenal consciousness”, which is subjective experience, along with “valence”, which is the property of “a conscious experience that feels bad or good to the subject”. Although scientific debates continue, particularly around the extent of sentience and consciousness that exists in animals, there is growing acceptance in international legal spaces, with countries and unions such as the European Union, France, New Zealand, and others explicitly recognizing animal sentience in their legislation. The recognition of sentience supports the theory of Trans-species psychology at its core.

Trans-species psychology is a field of psychology founded by Gay A. Bradshaw, hypothesizing that complex emotional and cognitive phenomena, such as fear, empathy, trauma, and grief, are not exclusive to humans but also occur in various animal species, including mammals, birds, and even some reptiles, in different ways (Bradshaw, 2017). This field integrates the behavioral, neurobiological, and environmental evidence, highlighting that traumatic experiences can result in an animal displaying PTSD- like symptoms in various species (Overall, 2013; Hance, 2017; Bradshaw et al., 2019; Marino et al., 2019). These manifestations of trauma across species suggest that there may be common neurobiological mechanisms underlying PTSD, and that we consider the social and environmental contexts when studying animal trauma.

This thesis reviews the evidence for PTSD-like symptoms in non-human animals by examining the trauma experienced by various species in different contexts and the behavioral and physiological manifestations of trauma in animals, and the relevance of Complex PTSD and the role of early-life stressors. It also evaluates Trans-species Psychology as a framework for understanding trauma as a cross-species phenomenon. Finally, this review highlights the ethical implications of captivity and the human use of animals, explores the therapeutic approaches to recovery and existing legislation, along with the limitations of current research. The aim is to contribute to a more comprehensive and trauma-informed understanding of animal welfare and to support further scientific and ethical integration of trauma research across species.

Post-Traumatic Stress Disorder (PTSD)

PTSD is a trauma-related psychiatric condition characterised by persistent disturbances in memory, emotion, and arousal following exposure to a traumatic event. In humans, the DSM-5 identifies four major symptom clusters, each capturing different aspects of the disorder's cognitive, emotional, and behavioural expression. This cluster-based framework provides a widely accepted foundation for understanding PTSD (Siddaway, 2024) and offers a useful lens for examining trauma manifestations across species.

1. **Intrusion symptoms:** recurrent and distressing memories, nightmares, and flashbacks; Distress at reminders of trauma and physiological reactions to trauma cues (sweating, hyperventilation, rapid heartbeat).
2. **Avoidance:** of trauma-related memories, thoughts, feelings, and external reminders (places, people, sounds, objects).
3. **Negative alteration in cognition and mood:** persistent negative beliefs, dissociative amnesia, emotionally numb, less interest in activities and interaction with others, inability to experience positive emotions.
4. **Alteration in arousal and reactivity:** irritability, aggression, reckless behaviour, hypervigilance, exaggerated startled response, concentration problems, irregular sleep.

2.1 Complex PTSD (C-PTSD)

According to a study by Cloitre et al. (2013), complex PTSD is more strongly predicted by chronic trauma and repeated exposure than by PTSD, and C-PTSD is linked to more impairment and disturbances in affect regulation, self-concept, and interpersonal functioning. In contrast to PTSD, which can arise from single-event traumas, the ICD-11 framework clearly distinguishes C-PTSD as arising from sustained, multiple traumas that frequently occur during childhood or other vulnerable periods.

In addition to the core PTSD symptoms, C-PTSD is characterized by the following features:

1. **Affect dysregulation:** emotional instability, chronic sadness, explosive anger.
2. **Negative Self-concept:** feelings of worthlessness, guilt, shame.
3. **Interpersonal difficulties:** difficulty trusting, maintaining relationships, and chronic loneliness.

These symptoms cause significant impairment in personal, family, social, educational, occupational, and other important areas of functioning (Cloitre et al., 2013).

2.2 Neurobiological mechanisms of trauma

PTSD manifests not only in behavior but also in alterations of the brain and stress-response systems. These neurobiological alterations provide a physiological basis for the core symptoms (McEwen et al., 2007; Sherin et al., 2011; Pitman et al., 2012). The key players are as follows:

A. Neuroendocrine

1. Hypothalamic-pituitary-adrenal axis: hypocortisolism and sustained and increased levels of corticotropin-releasing hormone (CRH).
 - Disinhibits CRH/Norepinephrine and upregulates stress response.
 - Drives abnormal stress encoding and fear processing.
 - Blunts adrenocorticotropin (ACTH) response to CRH stimulation.
 - Promotes hippocampal atrophy
2. Hypothalamic-pituitary-thyroid axis: increases subjective anxiety.

B. Neurochemical

1. Catecholamines: increased dopamine and norepinephrine levels.
 - Interferes with fear conditioning by the mesolimbic system
 - Increases arousal, startle response, encoding of fear memories, pulse, blood pressure, and response to memories.
2. Serotonin: disturbs the dynamic between the amygdala and the hippocampus.
 - Increases vigilance, startle, impulsivity, and memory intrusions.
3. Amino acids: decreased GABA and increased glutamate levels foster derealization and dissociation.
4. Peptides: upregulate stress response and foster numbing, stress-induced analgesia, and dissociation.

C. Neuroanatomic

1. Hippocampus: reduced volume and activity alter stress response and extinction.
2. Amygdala: increased activity promotes hypervigilance and impairs the discrimination of threat.

3. Cortex: reduced volume and decreased activation that dysregulates executive function, impairing the extinction of fear response.

These markers highlight how PTSD impairs individuals beyond the psychological symptoms. Heightened amygdala activity fosters hypervigilance, while dysregulation of the stress response system perpetuates anxiety and intrusive memories, disrupting social and relational functioning. These neural pathways have been observed across species and provide a foundation for examining the parallels between human and animal manifestations of trauma (Alexander et al., 2019; Xi et al., 2021)

Trauma in Animals

Although PTSD research has largely centered on humans or on animal models designed to explain human symptoms, evidence shows that non-human animals also experience trauma with lasting psychological, behavioral, and physiological effects. This section explores the contexts and environmental factors that contribute to PTSD-like symptoms across species.

3.1 Captivity and Human Entertainment

Animals held in facilities for human entertainment, such as zoos, circuses, and marine parks, often endure traumatic capture from the wild, prolonged captivity, forced training, repetitive performance routines, and isolation from their natural social groups, amongst other forms of abuse (Rizzolo et al., 2016; Carnahan, 2019; Vail et al., 2019; Hoffman, 2020). Additionally, animals in such conditions are often kept in small, confined spaces without regulated maintenance of their living spaces, artificial lighting, exposure to loud sounds, inappropriate temperatures and substrates, forced proximity to humans, reduced feeding opportunities, among other stressors (Morgan et al., 2007). They are also subjected to constant human presence, without opportunities to hide or retreat, leaving them in a state of prolonged stress with little regulation over the nature of their interactions with both staff and civilians (Fischer et al., 2019).

The organization PETA documented the impact of abuse in traveling circuses and zoos on tigers used for entertainment, who endured traumatic capture, harsh training, physical abuse, forced proximity to humans, and inadequate husbandry (sleep disturbance, malnutrition, improper breeding practices, unclean living areas) and repetitive performance routines. Most big cats, like tigers, are also solitary and need adequate space from other individuals, and all of them need private spaces that they can retreat to; however, due to the nature of traveling circuses, they are often kept in small trailers with two or more individuals with inadequate freedom of

movement. This abuse led to fearful gestures like hunching of the back, and lowering their head, anxiety, bowel incontinence, fainting during routines, and stereotypies such as pacing and spinning in the same place, along with defensive aggression to trainers and other cats, causing trainers to punish the animals with whips and jabs, further inducing trauma responses.

Marine animals – particularly orcas and dolphins– have been observed to have traumatic experiences and conditions in captivity such as being housed in unnatural and restrictive environments in restricted space (small and shallow tanks), with a lack of enrichments, loud or abruptive sounds, social group dynamics, improper breeding practices that lead to shorter lifespans with their deaths and general deterioration linked to viral, bacterial, fungal, and gastrointestinal diseases and a generally weakened immune system (Waples et al., 2002; Miller et al., 2018; Marino et al., 2019; RSPCA 2019; Fisher et al., 2019; Jacobs, 2020; Vail et al., 2020).

Wildlife research has also demonstrated that other animals, such as elephants exposed to poaching, translocation, and captivity, exhibit symptoms consistent with PTSD, most persistently in elephants that experienced premature maternal separation (Bradshaw et al. 2005, 2008; Poole et al 2008). Tenofsky in 2013 also observed that orphaned elephants had impaired social skills due to observing their mothers and herds undergo trauma and culling, along with experiencing trauma themselves, impairing decision-making abilities, such as being able to distinguish friend from foe and defensive responses to genuine threat, instead displaying erratic, atypical, or flat reactions to potential harm.

3.2 Laboratory Experimentation

Animals have been used in laboratory research for centuries, dating back to Galen (129–c. 200 CE), who performed systematic vivisections on live dogs and pigs to study anatomy and physiology. While animals often serve as models for investigating human neurobiology and physiology, the impact of these experimental experiences on the animals themselves is rarely considered of significant importance, and laboratory environments often expose animals to a range of stressors, including improper handling, restraint, housing instability, repeated and increased intensities of exposure to fear-inducing stimuli, invasive procedures, forced social isolation, and eventual euthanasia (Balcombe et al., 2004; Borghans et al., 2015; Klabukov et al., 2023; Philippe et al., 2023).

In social species such as primates and rodents, the isolation or removal of individuals from their social groups, especially at a young age, is particularly detrimental as this disrupts their natural behaviour, impairs social and emotional development, disrupted attachment behaviors

and causes long-term psychological distress, similar to the effects of such action on human beings (Lukkes et al., 2009; Cinini et al., 2014). Chen et al. (2025) found that social isolation had a significant effect on the chimpanzees that displayed trauma symptoms pre-rescue compared to those housed in social groups, and found that those that were housed earlier and longer showed a higher and more persistent stress response during rehabilitation.

Evidence has shown that laboratory animals also develop behavioral and physiological responses that parallel the manifestations of trauma in humans (Whitaker et al., 2014; Dunsmoor et al., 2022). Furthermore, housing instability, social isolation, and early-life maternal separation have a significant impact on rodents, leading to heightened anxiety and impaired fear extinction and social and emotional development that carries into adulthood (Borghans et al., 2015; Whitaker et al., 2014).

3.3 Abuse in Domestic Environments

Domestic animals, such as cats and dogs, are frequently exposed to traumatic experiences in human households and care environments, such as abuse, neglect, witnessing domestic violence, early maternal separation, and inadequate living conditions in breeding facilities that can lead to long term behavioral and physiological consequences (Poulsen et al., 2010, Lange, 2021; Stumpf et al., 2023). Unlike animals in captivity, laboratories, or farms, companion animals form strong bonds with their owners, which can intensify the psychological impact of mistreatment.

Often, these animals are bought or adopted at very young ages, stunting their social and emotional development, and experiencing early separation from their mother, exposure to abuse or neglect, resulting in long-term trauma-related behaviours. These behaviours are also seen in animals that have been reared in pet shops (Amat et al., 2015; Overall, 2013).

Animals exposed to trauma observed in shelters, veterinary clinics, and breeding facilities have also been known to have difficulty in forming social bonds with humans and other animals and express stress, anxiety, and depressive behaviours along with stereotypies, low postures, and coprophagy (Barrera et al., 2010; Dalla Villa et al., 2013).

The *Manual of Clinical Behavioral Medicine for dogs and cats* (Overall, 2013, pg 261) discusses the development of Canine-PTSD due to the exposure to severe or repeated traumatic events such as abuse, neglect, military service, natural disasters, or intensive confinement and affected dogs demonstrate an inability to eat, avoidance, fatigue, lethargy, and disinterest in activities, especially observed in working dogs. Gastrointestinal signs such as vomiting, diarrhea, and

weight loss, along with other symptoms, were also observed in 2016 by Drobny and Miller. In a systematic review, Salden et al. (2023) reported that Search-and-Rescue (SAR) dogs exhibited PTSD-like symptoms, along with gastrointestinal pathologies, fatigue, and persistent anxiety.

3.4 Trauma in farmed animals

Over the years, the mental, physical, and emotional suffering of farmed animals has gained attention in animal welfare discussions where emphasis is given to both the physical and psychological prevention of their exposure to trauma (Campbell, 2024; Niemiec et al., 2024). Farmed animals are one of the largest and yet most overlooked populations of the animal species exposed to chronic stress, abuse, inadequate housing and care, inhumane breeding practises, and traumatic experiences such as tail docking or castration without anesthesia or pain relief post operation due to industrial agricultural practices, and the welfare of farm animals is often ignored as they are primarily viewed as products used for food, labor, or other byproducts (Anomaly, 2015; Keefe 2022; Scialabba et al., 2022; Beaver et al., 2023). However, research suggests that farmed animals are capable of experiencing psychological distress, fear, and PTSD- like symptoms when subjected to abusive and neglectful environments, social disruption, and invasive procedures (Kona-Boun et al., 2020).

One common agricultural practice in farming systems is housing many animals in confined spaces together, such as crates for gestation in pigs, battery cages in hens, and veal crates for calves. Not only do these cages extremely limit physical movement and natural behavior, but they also cause stereotypies such as bar-biting, feather-plucking, and aggression. Farm animals are also constantly exposed to stressors like overcrowding, loud noises, witnessing invasive procedures, and abuse of other animals.

Another trauma experienced at farms is the early separation of the mother from their offspring. Dairy cows have been observed to vocalize intensely and show signs of distress and stereotypies when their calves are taken away shortly after birth (Weary et al., 2000). The disruption of the mother-offspring bond was also found to have long-term effects on the calves, showing more social deficits and being more fearful of their environments. Handling and slaughter practices also produce acute traumatic stress. Studies show that pigs and other cattle show signs of fear and distress in slaughter environments, and invasive procedures inflict extreme pain during the procedure and after, along with long-lasting sensitivity and chances of infections, potentially leaving the animal in a state of distress (Grandin, 1997).

3.5 Trauma in Wild animals

Wild animals are exposed to a range of trauma, such as natural disasters, predation, habitat loss due to human intervention, poaching and hunting activities, and exposure to environmental contamination. Unlike animals under the care of humans, the conditions under which wild animals are exposed to trauma are more difficult to control or limit, leading to chronic stress and long-term behavioural and physiological impact.

Fischer (2019) reported that wild animals held in short and long-term captivity displayed signs of chronic stress and had lower survival rates, and were unable to re-adapt to free living, with significantly abnormal Glucocorticoid levels, both during and after captivity. These animals were also observed to have short-term and long-term reproductive suppression, which is extremely indicative of their stress levels and potentially detrimental to their population viability.

For instance, elephants that survived poaching attempts and culling operations had exhibited an abnormal startle response, depression, unpredictable asocial behaviour, and aggression (Bradshaw et al., 2008), while Zanette et al. (2019) found that chickadee birds exposed only to predator cues showed PTSD-like signs along with reduced feeding, long-term behaviour change, and altered brain activity, suggesting that even the fear of predation can induce chronic psychological stress and PTSD-like symptoms.

Evidence also suggests that PTSD-like symptoms may also emerge in naturalistic settings; Zhao et al (2025), in a longitudinal study on the impact of heirarchy-based infanticide in communities of golden snub-nosed monkeys on mothers, found that during and after events of infanticide, mothers withdrew and reduced their social engagement with other members, especially the males, and increased their caregiving behaviours with more alarm-call responses. Due to the constant fear and stress associated with perceived threat, even in the absence of immediate danger or despite infant survival, mothers exhibited prolonged anxiety-like and PTSD-like symptoms. In contrast, mothers whose infants were killed showed behavioural recovery within approximately 30 days. These findings highlight a critical gap in current research, as the psychological effects of trauma in free-living wild species remain largely understudied compared to those in captive or domestic animals.

The recognition that animal species across captive, laboratory, domestic, agricultural, and wild contexts can exhibit PTSD-like symptoms highly suggests that they are sentient beings with

complex emotional lives and have the capacity to suffer from traumatic experiences, calling into question the ethical legitimacy of practices that expose them to trauma. Acknowledging animals as potential trauma victims challenges the justifications for their confinement and use in human entertainment and conservation settings, while recognizing the suffering that laboratory animals undergo strengthens the case for alternative research models and more humane experimental design. Likewise, acknowledging trauma responses in companion animals stresses their capacity for complex emotional suffering and strengthens emerging approaches that examine trauma across species boundaries. Similarly, recognizing trauma in farmed animals raises urgent ethical concerns regarding harmful agricultural practices, and acknowledging trauma in wild animals highlights the need to confront the impacts of poaching, hunting, environmental degradation, and human encroachment. Taken together, these findings necessitate a fundamental reevaluation of the human-animal relationship and the development of stronger welfare protections across species.

Manifestation of PTSD in Animals

While PTSD has not been formally recognized in non-human animals, research across various contexts suggests that animals that are exposed to trauma do exhibit PTSD-like symptoms, both on a behavioural and physiological level, including hyperarousal, emotion dysregulation, avoidance, and hypervigilance, amongst other symptoms (Bradshaw et al., 2005; Marino et al., 2019). Examining these manifestations of PTSD in animals allows us to better understand the condition and continuity of symptomatology across species.

4.1 Behavioral Symptomatology

Behavioural change is the most accessible marker of PTSD-like symptoms in animals and is often the key indication of chronic stress and trauma-related pathology (Whitaker et al., 2014; Xi et al., 2021).

Avoidant behaviour is a consistent feature of trauma studies in animals, paralleling the PTSD symptom cluster Avoidance, with animals avoiding people, places, and objects, along with social interactions associated with their traumatic experience. This behaviour has been observed in primates reacting to medical equipment or staff, big cats in entertainment avoiding trainers and their whips, and the audience or visitors, companion animals avoiding social interaction and environmental reminders of trauma, and farmed animals avoiding caretakers and objects used to

train them or in procedures and certain areas (Grandin, 1997; Morgan et al., 2007; Overall, 2013; Cinini et al., 2014; PETA). Rodents have also been observed to avoid traumatizing experiments and predator odours (Whitaker et al., 2014).

Many animal species exhibit signs consistent with cluster three of human PTSD, such as withdrawal from their social group and prosocial behaviour, a lack of interest in their surroundings and social and training activities, apathy, fatigue, lethargy, depressive-like states, and postures. Rodents and primates show trauma-related decreases in exploratory behaviour and a lack of interest in activities and surroundings, along with impaired learning and memory (Cantor, 2009; Lopresti-Goodman et al., 2015; Verbitsky et al., 2020). Negative alteration of mood and cognition has also been observed in wild species like golden snub-nosed monkeys, cetaceans that show a lack of interest in their training activities, elephants, as well as working and SAR dogs (Bradshaw et al., 2008; Overall, 2013; Clegg et al., 2017; Bradshaw et al., 2019; Salden et al., 2023; Zhao et al., 2025).

Paralleling Cluster 4 of PTSD symptomatology, Alterations in arousal and reactivity have been frequently reported, signifying emotional dysregulation. Elephants exposed to trauma have displayed high levels of aggression toward people and other members of their groups, and those exposed at a younger age or separated prematurely from their mothers show the most persistent symptoms (Tenofsky, 2013; Rizzolo et al., 2016). Hyperarousal symptoms such as irritability and exaggerated startle response have also been observed in primates and elephants, rodents, and pets (Borghans et al., 2015; Bradshaw et al., 2019; Verbitsky et al., 2020; Overall, 2013; Salden et al., 2023). Captive orcas have also shown unpredictable aggression toward their trainers and mates, causing fatal incidents in some cases (Marino et al., 2019). Hypervigilance has been documented in primates, elephants, rodents, pigs and other cattle in slaughterhouses (Bradshaw et al., 2019; Verbitsky et al., 2020; Grandin, 1997).

While stereotypies are not a part of PTSD symptomatology in humans, research suggests that self-soothing behaviours in humans, such as rocking, pacing, hair-pulling, etc., are done to regulate arousal typical of trauma survivors (Kearney et al., 2022; Boyer et al., 2022). In animals, stereotypies are extremely indicative signs of deep psychological distress; namely, pacing, rocking, hair-pulling, excessive self-grooming, circling, feather-plucking, self-clasping, etc., and can be considered a behavioral manifestation of PTSD-like symptoms specific to animals (Barrera et al., 2010; Bradshaw et al., 2019; Mason et al., 2007; Morgan et al., 2007; Weary et al., 2000).

Self-injurious behaviour is another potential manifestation of trauma specific to animals exhibiting PTSD-like symptoms. This behaviour has been reported in primates that engage in self-mutilative behaviors, i.e., biting, hitting, excessive scratching, etc. (Lutz et al., 2014; Lopresti-

Goodman et al., 2015). Orcas have been observed to bang into aquarium walls and gnaw on their teeth to the point of reaching the pulp, while elephants also exhibit similar behaviors under duress (Marino et al., 2019; Rizzolo et al., 2016).

4.2 Physiological Symptomatology

PTSD in animals seems to manifest in not only behavioral symptoms, but also through significant physiological manifestations that parallel those in human PTSD, and these alterations are observed due to the dysregulation of the neuroendocrine, autonomic, and immune systems following trauma exposure (Goswami et al., 2013; Whitaker et al., 2014; Verbitsky et al., 2020; Sanchís-Ollé et al., 2023).

A. Neuroendocrine Dysregulation

Repeated or Chronic exposure to trauma in animals leads to significant disruption of the HPA axis, comparable to the findings in human PTSD. Richter-Levin et al. (2019) emphasize that both rodent and primate PTSD models consistently showed alterations in glucocorticoid signaling, resulting in impaired stress response and a heightened susceptibility to subsequent stressors. Sanchís-Ollé et al., 2023 also showed that stressors such as immobilization provoke long-lasting neuroendocrine changes, including HPA axis sensitization and altered corticosterone responses, paralleling human PTSD. Similar dysregulation has been observed across species, including primates, canines, elephants, and cetaceans (Bradshaw et al., 2005, 2008; Lutz et al., 2014; Marino et al., 2019; Salden, 2023).

B. Autonomic Nervous System (ANS) Changes

Hyperarousal symptoms, such as hypervigilance and a heightened startle response, observed in humans have also been physiologically recorded in animals through increased nervous system activity. Pitman et al. (2012) discuss the impaired parasympathetic regulation in PTSD patients that has been observed in animal stress models, finding an increase in heart rate and blood pressure (Goswami et al., 2013; Koresh et al., 2016). Morgan and Tromborg in 2007 also observed that primates in isolation or in improper care showed altered vagal tone and sustained tachycardia.

C. Immune and inflammatory alterations

Chronic stress and trauma exposure also induce upregulated inflammatory pathways in both humans and animals, marked by elevated pro-inflammatory cytokines, as documented by Du et al. (2021) in humans with PTSD. Prolonged HPA axis activation and sympathetic overdrive increase the release of these cytokines, weakening the immune resilience and promoting susceptibility to infection (Lancaster et al., 2016; Mann et al., 2024). Rodent models of chronic stress show immune suppression followed by rebound hyperinflammation (Goswami et al., 2013), while captive animals such as dolphins and elephants exhibit elevated inflammatory indicators and increased vulnerability to disease when exposed to traumatic experiences (Rizzolo et al., 2016; Marino et al., 2019).

D. Neurological and Brain Structural Changes

Animal studies reveal trauma-induced alterations in the brain regions such as the amygdala, hippocampus, and prefrontal cortex, paralleling the neurological findings in human PTSD patients. Goswami et al., 2023, note diminished hippocampal volume and altered amygdala activity, both in humans and animals showing PTSD symptoms, supported by recorded hippocampal atrophy by Richter-Levin et al. (2019). According to Whitaker et al. (2014), chronic trauma exposure reduces neural plasticity with amygdala hyperactivation amplifying threat detection and hypervigilance, while prefrontal cortical hypoactivity compromises emotional regulation and disrupts the fear extinction circuitry in rodents. Such manifestations have also been observed in elephants and primates (Bradshaw et al., 2008; Rizzolo et al., 2016; Schöner et al., 2017).

E. Neurochemical and Electrophysical patterns

Research by Xi et al. (2021) highlights alterations in neurotransmitter levels and certain electroencephalographic patterns in rodent PTSD models that are consistent with those recorded in human PTSD patients, including altered GABA and glutamate levels. Goswami et al. (2013) and Whitaker et al. (2014) also recorded enhanced amygdala excitability and diminished hippocampal volume, correlating with anxiety-like and avoidance behaviours.

Taken together, the physiological symptomatology in animal PTSD parallels many of the hallmark features documented in human PTSD, strengthening the argument that humans and non-human species share a biophysical architecture of trauma (Goswami et al., 2013). Recognizing behavioral and physiological symptoms of trauma in animals not merely as maladaptive responses but as clinical indicators of severe psychological distress is essential for

both scientific and ethical reasons. This perspective also contributes to the development and understanding of trauma studies in animals, and acknowledging these markers underscores the profound welfare implications for animals subjected to captivity, farming practices, research procedures, and other trauma-inducing environments. Integrating these insights into animal care, management, and scientific methodology is critical for promoting more humane, evidence-based approaches to the treatment and prevention of trauma in non-human species.

Complex PTSD in animals

In the context of animal species, evidence suggests that trauma symptoms similar to C-PTSD in humans are observed when animals experience prolonged or early-life trauma (Goswami et al., 2013; Richter-Levin et al., 2019; Bradshaw et al., 2008, 2016; Marino et al., 2019; Carnahan, 2019). Various behavioural, physiological, and neurobiological alterations, ranging from hypervigilance and fear dysregulation, along with social withdrawal, aggression, and social impairment, indicate that animals may develop symptoms akin to C-PTSD in human patients (Cohen et al., 2012; Borghans et al., 2015; Bradshaw et al., 2008, 2016; Verbitsky et al., 2020).

5.1 Early Life Trauma and Long-Term Consequences

Early life experiences play a crucial role in shaping the neurological and behavioral development and responses of animals to stress (Lyons et al., 2010; Bondar et al., 2018; Campbell, 2024). Trauma during sensitive developmental periods, such as during infancy or adolescence, can have significant and lasting effects on emotional regulation, cognition, and social behaviour of an individual (De Bellis et al., 2014; Thomason et al., 2017). Studies in elephants and non-human primates demonstrate that individuals exposed to early life stressors, such as maternal separation, witnessing abuse, significant and prolonged abuse and neglect, produce hypervigilance, aggression, withdrawal, and social impairment, and an exaggerated startle response (Bradshaw et al., 2005; Rizzolo et al., 2016; Carnahan, 2019).

Rodents in laboratory settings are exposed to maternal and social separation and isolation, repeated early handling, and other traumas, leading to alterations in the HPA-axis, decreased neurocampal neurogenesis, and heightened stress and anxiety (Lukkes et al., 2009; Xi et al., 2021).

5.2 Maternal Separation, Social Isolation, and Developmental Trauma

Maternal separation, especially in social species such as rodent species, elephants, cetaceans, and primates, is one of the most documented and studied forms of early life trauma in animals and humans. In non-human primates, chimpanzees and other species that have been separated from their mothers and social groups either in infancy or for long-term isolation display profound behavioural alterations such as aggression, withdrawal, stereotypies, such as pacing, grooming, rocking, self-mutilation, impaired social cognition, and emotional dysregulation (Harlow et al., 1971; Lopresti-Goodman et al., 2015; Chen et al., 2025). Rodents that are subjected to post-weaning social isolation also display heightened anxiety, exaggerated startle responses, and disrupted hippocampal and amygdala circuits (Verbitsky et al., 2020).

These patterns of behaviour are consistent with the term “Developmental Trauma,” which involves the prolonged exposure to life-threatening or interpersonal trauma during sensitive infant and child developmental stages, and this trauma disrupts attachment, safety, and foundational emotional, cognitive, and behavioural capacities that contribute to C-PTSD in adulthood (Cruz et al., 2022). In cetaceans, for example, Marino et al. (2019) found that maternal separation and early life traumas result in behavioural alterations such as stereotypies, self-injury, social withdrawal, aggression towards tank mates and trainers, and failure to reproduce or properly care for offspring.

Overall, evidence across primates, elephants, cetaceans, and rodents indicates that significant early-life, prolonged, or relational trauma can produce long-lasting behavioural, physiological, and neurobiological alterations in animals that closely parallel human C-PTSD, including hypervigilance, emotional dysregulation, social impairment, and disrupted stress-response systems, pushing for the recognition of complex trauma as a cross-species phenomenon that has significant implications for animal welfare, developmental psychopathology, and broadens the understanding of trauma in animals.

Trans-species Psychology

Transpecies psychology is an emerging field of research that aims to bridge the gap between human and animal trauma by identifying and integrating the overlapping behavioral and physiological trauma and PTSD-like responses across species (Bradshaw & Watkins, 2017). This can be accomplished through the observation of parallels in evolutionarily grounded psychological mechanisms between humans and non-human animals (Goswami et al., 2013; Richter-Levin et al., 2019). For instance, research has established that, on a neurobiological level,

traumatic experiences seem to activate and impair the same core neural circuits of the brain in various species (Borghans et al., 2015; Overall, 2013; Verbitsky et al., 2020).

This lens attempts to place trauma as a translational neurobiological phenomenon rather than one based in language and communication, showing that trauma is rooted in shared behavioral and evolutionary mechanisms. and not necessarily in species-specific cognition. Bradshaw and Watkins (2017) suggest that the trauma of animals is generally disregarded as opposed to that of humans, due to the human capacity for linguistic expression through narratives, self-reports, and a shared understanding of irregular behaviour and trauma-response, while animals display their trauma-patterns through behavioural and physiological responses. Without language, their experiences are easily dismissed despite aligning with the neurobiological and behavioural markers of human PTSD and C-PTSD.

Ultimately, trans-species psychology is distinctive as it focuses on the individual history, social context, and the subjective experience of each animal, rather than treating them as biological models, and by reframing how trauma is understood across species. Through this lens, we may also encourage the reconsideration of human actions in relation to the vast populations of non-human species with which we share the planet.

6.1 Ethical implications

Recognizing trauma as a phenomenon that is expressed across species has profound implications for the future of ethical practices and the interaction of humans with animals. If we agree that animals can experience traumatic psychological suffering akin to human PTSD, then many human practices, such as captivity, abuse, and neglect in domestic environments, invasive research practices, entertainment, food and animal product industries, and inhumane wildlife control measures, must be abolished or re-assessed under a new framework that considers trauma.

The key ethical implications that should be considered are:

- 1) Animal welfare protocol:** this not only accounts for physical well-being but also includes the psychological welfare of the animals, taking their social needs and developmental requirements for the growth of a well-rounded, emotionally-regulated individual or group of individuals.

- 2) **Planning for captivity and breeding programs:** especially relevant for social species such as elephants, primates, and cetaceans, who are extremely affected when their social structure and individuals in their group suffer from disruption or traumatic experience.
- 3) **Wildlife management:** practices such as culling, relocation, capture, etc., that inflict community-wide psychological and physical trauma across species and ecosystems.
- 4) **Ethical Research:** must reconsider the use of stress-inducing experimentation that intends to traumatise the subjects by generating stress, fear, isolation, and disrupting social bonding.

6.2 Rethinking the role of animals in trauma research

Specifically in the context of trauma research, animals such as rodents and primates are used as animal models to simulate human psychological and medical phenomena and disorders, such as human PTSD (Balcombe et al., 2004; Borghans et al., 2015; Klabukov et al., 2023; Philippe et al., 2023). Rodent models, such as single prolonged stress, predator-based stress, electric shock programs, and various primate studies, have been critical in understanding trauma and trauma-related responses in human beings, along with the development of various therapies (Goswami et al., 2013; Cohen et al., 2012; Schöner et al., 2017; Verbitsky, 2020). Transpecies psychology challenges the use of animals in this research on scientific and ethical grounds.

Animal models, while crucial to current trauma research, have significant scientific limitations. While these models can test the effects of controlled exposure to traumatic stressors and allow for invasive procedures, not possible to test in humans, they can wrongly simplify the complexity of PTSD by only focusing on observable behaviours like hyperarousal and fear responses, but cannot consider other core clusters such as intrusion symptoms, which cannot be observed in animals along with their variance (Goswami et al., 2013; Cohen et al., 2012; Richter-Levin et al., 2019). Although such experiments can simulate neurobiological symptoms of trauma, they cannot capture the variance in individual experience or resilience of different subjects to stressors, which humans exhibit (Goswami et al., 2013). These limitations suggest that it is difficult to translate the findings from animal models to human PTSD and PTSD treatment.

Furthermore, it brings into question whether animals in these experiments, and so in general, can exhibit PTSD-like symptoms akin to humans; Is it still valid and humane, and necessary to subject them to these traumatic experiences? This is why there should be a reconsideration of the primary use of animal models for human trauma research, and to have a separate field of research that centers on the manifestation of trauma and PTSD in animals.

Recovery, Rehabilitation, and Welfare

While trauma in animals manifests behaviorally, physiologically, and causes neurobiological alterations, research across species shows that recovery is possible and that PTSD-like symptoms can be controlled and alleviated over time with appropriate therapies, rehabilitation strategies, and long-term focused welfare.

7.1 Therapeutic approaches in animals

Desensitization, behavioral enrichment, and human-animal bonding are some commonly used practices in animal trauma or PTSD recovery (Overall, 2013; Kapteijn et al., 2021; Verbitsky et al., 2020). Systematic desensitization and counterconditioning are widely used behavioural therapies for fear and trauma-related symptoms in animals (Overall, 2013). Desensitization involves gradual exposure of the animal to a lower level of the feared stimuli related to the trauma they experienced in a safe, controlled environment to reduce the fear response over time; while counterconditioning helps the animal associate the feared stimuli with positive experiences to change the animal's response to the stimulus in the future (Fitzsimmons, 2018; Dinwoodie et al., 2022). These methods are often used in combination with other therapies, medical intervention, and positive reinforcement to help the animal manage triggers and recover from trauma (Corridan 2024). Moreover, in 2020, the European Association of Zoos and Aquaria (EAZA) found that combining desensitization and habituation with positive reinforcement during training reduces stress and fear, improves cooperation, and ensures the welfare of elephants.

The provision of environmental and behavioural enrichment is very effective in mitigating trauma in non-human animals (Goswami 2013; Richter-levin et al., 2019). Environmental enrichment has been found to increase the resilience of rodents in response to traumatic stimuli and prevent stress-induced neurobiological and neurochemical changes in the prefrontal cortex and hippocampus (Seetharaman et al., 2016). In a study by Hendriksen et al. in 2010, provision of exercise and enrichment in the form of running wheels, tunnels, and novel objects after rats' exposure to trauma was found to promote resilience and have beneficial anxiolytic effects. The provision of enrichment was also found to benefit captive animals that expressed stereotypies related to trauma and stress (Mason et al., 2007). In 2008, Bradshaw et al. also noted that enriched naturalistic environments helped reduce abnormal behaviours and improve social interaction in elephants that were rescued from circuses and other traumatic backgrounds.

Human caregiving, gentle handling, and positive and consistent interactions can significantly reduce fear, stress hormone levels, and anxiety-like behaviours in animals, especially in the domestic and captive context (Bradshaw et al., in 2008 and 2014; Corridan et al., 2024). Corridan also highlighted the importance of understanding the adverse effects of early traumatic experiences, and empathetic and consistent “trauma-informed care”, tailored to the individual’s triggers and personal threshold, helps to prevent re-traumatization and to help the animal (dogs, in this case) recover from trauma, promoting emotional regulation and improved welfare. Lopresti-Goodman et al., in 2015 also note the need for building empathetic and trustful relationships with traumatized chimpanzees who were vulnerable and had no agency when previously interacting with humans in laboratories.

While behavioural therapies are central to trauma recovery and rehabilitation in animals, the addition of medical interventions such as selective serotonin reuptake inhibitors (SSRIs), tricyclic antidepressants (TCAs), and benzodiazepines can be used to help with HPA axis dysregulation and neurotransmitter imbalances, emotional regulation, or as calming and anti-anxiety agents, which can temper hyperarousal and facilitate social interaction (Goswami et al., 2013; Overall, 2013; Lopresti-Goodman et al., 2015; Richter-Levin et al., 2019).

7.2 Welfare legislation regarding trauma-informed care

Trauma-informed care and welfare policies are an increasing field of consideration, but at present, PTSD legislation for animals is largely absent. However, certain legislations do indirectly mandate the prevention of trauma and rehabilitation protocol by establishing welfare standards:

- 1) Legislation regarding animals in Captivity and Zoos:** The EU Zoo Directive (1999), along with standards from associations like the EAZA and AZA (Association of Zoos and Aquariums), requires social housing, appropriate care and enclosures, and provision of behavioral and environmental enrichment in captive populations.
- 2) Legislation regarding Laboratory Animals:** The EU Directive of 2010 mentions stress minimization, procedure refinement, and social housing among other protocols, as legal requirements, demonstrating the growing acknowledgement of the effects of, and prevention of, long-term psychological harm.
- 3) American Acts:** The Animal Welfare Act (AWA) has been amended several times since 1966, and covers pain and distress minimization, promotes the psychological well-being

of primates, and mentions environmental enrichment. The Marine Mammal Protection Act (MMPA, 1972) limits stressful capture and handling techniques, along with requiring human care standards for marine mammals due to psychological stress.

- 4) **India:** The Prevention of Cruelty to Animals Act of 1962, with its ongoing amendments, prohibits “causing unnecessary pain or suffering”, including psychological suffering. National animal boards and high courts recognize mental distress and social deprivation as cruelty in cases regarding elephants and other species’ welfare.
- 5) **South Africa:** The Animal Protection Act of 1962, along with several animal welfare codes, recognizes mental distress in several legal cases as “suffering”. There are also wildlife regulations in place that mandate the reduction of stress and fear responses in large mammals.

Future Direction For Research

8.1 Limitations of current research

The current research on trauma focused on animals is scarce, with a lack of standardized diagnostic criteria, studies with small sample sizes, and variability in animal models, and only a few species, such as elephants and non-human primates, have been studied (Verbitsky et al., 2020). Additionally, much of the neurobiological trauma research is focused on rodent animal trauma models, with less exploration on the neurochemical manifestations of trauma in large mammals and other social species, limiting the information we have currently and its translational relevance (Goswami et al., 2013; Richter-Levin et al., 2019). There is also a lack of integration of neurobiological, behavioral, and welfare-based research, leading to a disjointed understanding of how trauma manifests across species.

We must also consider the ethical implications of current research that restricts the induction of severe or chronic trauma to animals in laboratory settings, making it difficult to study real-world situations and the impact of traumatic experiences across species (Borghans et al., 2015).

8.2 Future direction in animal trauma recovery

Future research must prioritize the standardization of diagnostic frameworks for PTSD in animals and related trauma symptomatology. Expanding the research across species may help develop a deeper understanding of transspecies psychology and how PTSD manifests in different species. The role of early life and developmental trauma should be recognized and explored

further to prevent the development of PTSD or trauma-like symptoms in affected individuals, especially in the context of captive and farmed animals that are subjected to maternal separation, isolation, and the witnessing of their social members' traumatic experiences.

The recognition of PTSD in animals and focused research would also allow for further research on animal trauma prevention and recovery. It would also allow for more research on the pharmacological avenues that could be explored and combined with more effective behavioral therapies (Goswami et al., 2013; Richter-Levin et al., 2019).

An example of research that shows promise, according to Keptaijn et al., in 2021, is a non-invasive and non-pharmacological intervention called the Eye Movement Desensitization and Reprocessing (EMDR). The study states that while EMDR has shown successful PTSD and trauma recovery in adult humans, it requires a patient who can verbalize and communicate; however, with alterations, it was proven to be successful in pre-verbal children who could communicate using imagery and sensations rather than verbalization, hence it is argued that the method could be adjusted to apply to dogs exhibiting trauma symptoms after a traumatic event.

Progress in this field requires integrated research considering the clinical, ethological, neuroscience, pharmacological, and ethical aspects of PTSD. Integrating medical interventions such as neuroimaging, endocrinology, and the behavioral manifestations can highlight certain cross-species neurobiological pathways (Whitaker et al., 2014).

8.3 Recommendations for integrating animal PTSD in welfare discussion

PTSD should first be researched with a focus on animal species, both individually and then cross-species, with an integrated approach. It should then be formally recognized both in the scientific communities and in legislation, which can then be incorporated into future frameworks of animal welfare policies (Niemic et al., 2024). PTSD focused legislation and incorporation in acts such as EAZA and AWA could help mandate the social and environmental conditions animals must be housed in to prevent and mitigate the risk of acute and chronic psychological trauma. The formal recognition of PTSD in animals would also support the development of better recovery and rehabilitation programs, bridging the gap between trauma research and welfare practices.

Regular welfare assessments and screening should be conducted in affected or possibly affected individuals, incorporating validated behavioral and physiological markers of PTSD and trauma, along with the implementation of trauma-informed care protocols in clinical, captive, laboratory, farmed, and wildlife contexts. Increased funding is imperative for much-needed, expansive research into animal-focused psychological trauma disorders. Increasing public

awareness of the impact of traumatic practices and their impact on animals' social and emotional states can initiate discourse for ethical reform.

Ultimately, the integration of Animal PTSD into the scientific and ethical discourse of animal welfare will help to dismantle the narrow and physical well-being-focused welfare protocols and call for a more ethical and compassionate standard for animal welfare that emphasizes both the physical and psychological well-being of all animal species.

Conclusion

This thesis examined whether non-human animals can experience trauma, akin to Post Traumatic Stress Disorder and Complex PTSD in humans, and evaluated how trauma manifests across species in various contexts. Across the scientific literature evaluated, there is a consistent conclusion one can arrive at, that is, that animals that have been exposed to traumatic experiences such as abuse and neglect, captivity, invasive laboratory procedures, and other stressors, develop long-lasting and significant behavioral and physiological alterations that closely parallel the symptomatology exhibited in human PTSD. Hence, Trauma in animals is not a vague assumption, but rather a scientific, neurobiological, and physiological phenomenon with significant ethical and welfare implications across species.

A key finding is that trauma occurs in similar patterns across widely different species in different environments, be it captive animals, laboratory animals, companion pets, farmed species, and wildlife. Each species, when exposed to trauma, exhibits symptoms such as avoidance, hypervigilance, aggression, stereotypies, self-mutilation, withdrawal, exaggerated startle responses, and impaired social and emotional behavior, mirroring diagnostic criteria of human PTSD. There are also corroborating physiological manifestations of trauma, such as alterations in the HPA axis, dysregulation of cortisol, overactivation of the sympathetic pathways, immunological disturbance, and disrupted neuroplasticity that mirror the neurobiological manifestations of trauma-related disorders in humans.

Another aspect of my findings is the profound effect that maternal separation, early life stressors, and prolonged exposure to stress, impairing the social, emotional, and neurobiological development of animals consistent with human C-PTSD, and the symptoms associated with this disorder suggest that trauma in animals is not only behavioural, but can persist and cause long-term impairment of the neurobiological pathways and brain function.

Transpecies psychology is also found to be a relevant field of research that serves as a framework to understand trauma across species. Recognizing that humans and non-human animals share emotional capacities and responses to trauma raises an ethical dilemma about the treatment of animals and the reconsideration of practices that can expose them to traumatic events that must be analyzed through a trauma-informed perspective.

Finally, this review stresses the need for improved recovery, rehabilitation, and welfare protocols, emphasizing the impact of behavioral and environmental enrichment along with trauma-informed care, while acknowledging the limits of research and the need for further studies. Overall, this review maintains that recognizing trauma in animals is imperative to trauma studies and emphasizes the need for a compassionate and scientific approach to animal welfare.

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