The Harmful Effects of Captivity and Chronic Stress on the Well-being of Orcas

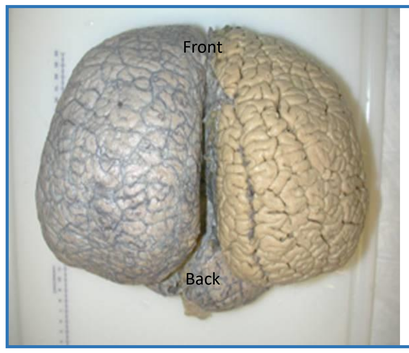
L Marino,[a] NA Rose,[b] IN Visser,[c] H Rally,[d] H Ferdowsian,[e] V Slootsky[f]

[a] Whale Sanctuary Project, Marinolori@outlook.com, [b] Animal Welfare Institute, naomi@awionline.org, [c] Orca Research Trust, ingrid@orca.org.nz, [d] Foundation to Support Animal Protection, heatherrally@gmail.com, [e] University of New Mexico School of Medicine, hopeferdowsian@gmail.com, [f] Mid Atlantic Permanente Medical Group, veronica_Slootsky@yahoo.com

ID #813

Characteristics of Orcas

Large and complex brains



Two and a half times larger than expected for body size (EQ = 2.5)

More cortical surface area than human brain

Largest cerebrum relative to whole brain mass among mammals

Elaborated in areas linking emotion with thought, communication and social awareness

Highly sensitive/complex acoustic capacities

Long distance travel and deep diving

Routinely swim tens of km/day In a straight line

Can dive to > 200 m depth several times a day

When not foraging or hunting, often traveling by swimming in a consistent direction at a steady pace and frequently engage in synchronized dives

Strong emotional and social bonds

Lifelong family bonds

Prolonged close mother-child bonds

Food sharing/turn-taking

Epimeletic behavior (care-giving) and standing by

Grieving for dead Infants and other conspecifics

Complex social networks and traditions

Complex social networks based on acoustics

Long juvenile period/learning

Cultural traditions (e.g., dialects, foraging)

Matrilineal with post-reproductive lifespans

Orca Welfare at Marine Parks

Survivorship and Longevity

While survivorship in US facilities has improved over time, survival to sexual maturity and reproductive senescence remains poor compared to healthy free-ranging orcas.

The mean life expectancy for free-ranging orcas is 46 years for females and 31 years for males. Females live an estimated maximum of 80 to 90 years and males an estimated maximum of 60 to 70 years.

No captive-born orcas at SeaWorld have yet exceeded 35 years of age.

Causes of Death in Captive Orcas

US records chart a history of disturbing causes of death, especially from opportunistic infections.

Fungal, viral and bacterial pneumonia
Yeast infections
Gastric ulceration
Encephalitis and Meningitis
Bacteremia

Abnormal Behaviors

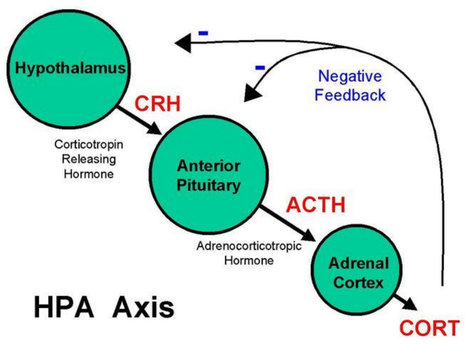
Stereotypies – circling, jaw clapping, grinding teeth
Self-mutilation – most common is dental grinding, leading to destruction of teeth and systemic infection risk
Hyper-aggression – towards conspecifics and humans
Poor parenting
Depression/Failure to thrive

The Association Between Stress, Disorder, and Death

What is Stress?

Stress is an organism's response to a situation that forces a deviation from homeostasis, which involves a correction through physiological and psychological mechanisms.

The HPA axis and its effects are highly conserved across mammals.



The Ability to Cope With Stress Depends upon Several Factors

Allostatic load – the discrepancy between homeostasis and the stress of the situation
Evolutionary History and Adaptations
Acute versus chronic stress
Overall health and behavioral coping mechanisms

"The type, magnitude and duration of a stress response have a cost to the animal… when stressors are chronic or severe, the accumulated costs associated with the response(s) become an allostatic overload, which can contribute to physiological dysfunction and increase the probability of disease and other pathologies" (p.464; Atkinson et al., 2015).

Shared Effects of Chronic Stress on Orcas and Other Mammals

Orcas and other cetaceans share brain mechanisms involved in mounting a stress response with other mammals and adhere to the classic HPA model.

The long list of emotional, psychophysiological, and behavioral changes associated with these neurological responses to stress, in humans and other mammals, includes:

- increased anxiety
- posttraumatic stress disorder
- cognitive impairment
- depression
- mood dysregulation
- changes in brain connectivity patterns

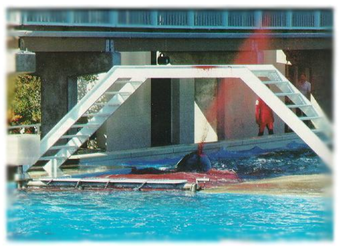
Salient Contributors to Chronic Stress in Captive Orcas

Artificial Social Groups

Captive orcas are deprived of natural social networks of family and pod members, and forced to live in artificial groupings of mixed ecotypes and species.

Mothers and calves are often separated, perpetuating aberrant psychological development and dysfunction through generations.

Confinement



Abundant evidence shows that confinement of wide-ranging species causes severe chronic stress, abnormal brain development, psychological deficits and increased infant mortality.

Typical tank sizes prevent both the physiological conditioning necessary for good health and the ability to disperse during conflict.

Boredom

Boredom is a deeply unpleasant state arising from the monotony of living in a largely featureless and predictable environment, a situation that characterizes life in concrete tanks.

Chronic boredom is expressed as listlessness, irritability, and self-stimulatory behaviors (stereotypies) – all common in captive orcas.

Sensory Disturbance

Much of the acoustic input orcas are adapted to processing is altered by living in captivity.

Studies show evidence of acoustic stress when captive cetaceans are regularly exposed to human-caused sources of loud noise, including fireworks and construction.

Loss of Autonomy

As self-aware complex mammals, orcas suffer from the inability to exercise choice about what happens to them in captivity.

Conclusions

We have provided empirical support for the argument that the morbidity and mortality of orcas in captive facilities is likely to be attributable to acute, severe, and chronic stress and its association with immune dysfunction, disease, and disorder. Given this evidence, the ethical ramifications of keeping orcas in captivity should be critically evaluated by society and regulators, and the industry should adapt accordingly.

Acknowledgements

The authors wish to thank Annika Fritsch for her help with the Supplemental Material, Tracy Cooper for her assistance with sourcing papers, and Dr. James Griffith of the George Washington University Department of Psychiatry and Behavioral Sciences

References

Please refer to https://doi.org/10.1016/j.jveb.2019.05.005 for references and full paper