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The welfare of fish

George K. Iwama*

Acadia University, Wolfville, Nova Scotia B4P 2R6, Canada

ABSTRACT: Our interactions with fish cover a wide range of activities including enjoying them as pets to consuming them as food. I propose that we confine the consideration of the welfare of fish to their physiology, and not join the discussion on whether fish can feel pain and suffering, as humans. A significant proportion of the papers on animal welfare center on whether non-human animals can feel pain, and suffer as humans. This is a question that never can be answered unequivocally. The premise of the present paper is that we have an ethical responsibility to respect the life and well-being of all organisms. Thus, we should concentrate on the behavioural, physiological, and cellular indicators of their well-being and attempt to minimize a state of stress in the animals that we have in our care or influence.

KEY WORDS: Fish · Stress · Welfare · Well-being · Pain

INTRODUCTION

The welfare of animals is a broad topic that has received increasing attention in the peer-reviewed literature in the past decade. While our understanding of the anatomical, physiological, and humoral components of pain in humans is increasing, the mechanisms underpinning those components are far from being fully known. The qualities that we associate with pain and hunger are related to physiological structures and processes, but they are also modified by factors such as experience, social elements, and individual variation. I will argue that it is impossible to conclude that fish or other animals share the experience we know as pain. Even if we unequivocally knew the mechanisms underlying those qualities, it would be speculation to claim that non-humans were sharing those same experiences. Nevertheless, we are often compelled to cross the divide between what is known about the experience of pain in humans and what non-humans must be experiencing. It may be an ethical imperative that compels us to do this, but it is my opinion that the humane treatment of animals does not require this.

This short commentary will address the 2 topics of pain and welfare separately. Pain will be addressed in the human context, as is only reasonable, and welfare will refer to the well-being of animals under our care or influence. While it is reasonable to consider that all organisms on earth are or can be within the scope of our influence, I will concentrate on those cases where our interactions are direct.

I do not address the platforms of the various animal-rights groups, lobbies, and special-interest groups. The motivations of such political and commercial groups are outside the scope of the present paper. It is my hope that we can keep these concepts distinct: (1) our pursuit of knowledge concerning the underpinnings of the experience of pain in humans, and (2) ethical considerations concerning the well-being of the organisms that we affect through our activities. I use the term 'well-being' and 'welfare' to mean the range of behavioural, physiological, and cellular conditions that are within the normal range for that organism. As in other animals these conditions vary temporally as well as change with age in fish. A valid definition of a stressed state in fish is the state when these conditions extend beyond this normal range. This state may occur in response to a range of potential stressors that are related to how we interact with fish. Fish serve as a valuable research model for a wide range of disciplines from evolutionary biology to medicine. We have fish as pets, inexpensive ones in small jars to very expensive

*Email: george.iwama@acadiau.ca

ornamental carp. We hunt them, grow them as a food, and catch them for sport in the oceans and freshwater bodies around the world. The aquaculture of fish and shellfish also is used to supplement natural stocks that are under pressure from sport and commercial fisheries. Through research our knowledge about the anatomy, physiology, and ethology of fish has aided us in defining environmental and procedural conditions that are normal and stressful for many species. We have learned that minimizing stress is not only important for research results, but also for the commercial value of the fish for consumption.

THE WELFARE OF FISH

The cellular and physiological responses to stressors in a large number of teleosts, or bony fishes, is well known. This has been reviewed in numerous papers (Basu et al. 2002, Iwama et al. 2005). Håstein et al. (2005) presents a comprehensive overview of the welfare consideration of aquatic animals under various biotic and abiotic conditions. Furthermore, the Canada Council on Animal Care (2005) provides assessment techniques for determining the condition of fish, and also specifies environmental conditions that should be met in order to maintain fish in a good or acceptable state. For example, water quality criteria for optimizing fish health are given for coldwater, warmwater, and marine fish species.

Like other vertebrates, fish undergo a series of biochemical and physiological changes in response to a wide range of biological and physical stressors. This response, known as the generalized stress response, has been categorized into the primary, secondary and tertiary responses. The initial or primary response, comprises a neuroendocrine response that includes the rapid release of stress hormones, catecholamines and cortisol, into the circulation. Catecholamines are released from the chromaffin tissue situated in the head (anterior) kidney of teleosts. Cortisol is released from the interrenal tissue, located in the head kidney, in response to several pituitary hormones, but most potently to the adrenocorticotrophic hormone, which also causes adrenaline release. The secondary response is made up of the biochemical and physiological effects associated with stress, and mediated by the stress hormones. The stress hormones activate a number of metabolic pathways that result in alterations in blood chemistry and haematology. Changes in plasma glucose concentration have been used commonly as an indicator of the secondary response to a wide range of stressors in fish. The tertiary response can reflect the changes in the whole animal and population in response to a stressor or a combination of stressors. Negative effects such as decreased reproductive capacity, immune function, and growth in individuals may affect community species abundance and diversity. Heat shock proteins (HSPs) respond to a wide range of physical and biological stressors (see Basu et al. 2002). While there is a constitutive production of these proteins when the animals are at rest to maintain cellular homeostasis, there can be a dramatic increase in message and protein content in the various classes of HSPs, including HSP70, HSP90 and the lower molecular weight HSPs in response to a wide range of abiotic and biological stressors.

SUBJECTIVITY

There is a somewhat arbitrary line we draw concerning the choice of organisms to which we extend our humanity, and thus our ethical consideration. It is not as simple as just including domesticated animals in this group, although this may represent the largest category. The fact that we have a hierarchy in this regard presents problems in an objective treatment of this issue. There is hardly any consistency in the regard we show for the animals we affect.

It is relatively easy for us to extend our emotional support for those pets that give us comfort and enjoyment in return. Our cherished pets, such as dogs, cats, fish and birds might be at the top of such a list. From this point onward the divergence in empathy towards organisms fans out broadly. Even within this group, there are many inconsistencies. Our interactions with dogs ranges from using them as work animals, using them in sport, such as greyhound racing, and consuming them as food. Fish are the third most popular domestic pet, but generally they are not held in the same high regard as dogs and cats with respect to welfare issues. This regard is reflected in the level of research, and thus knowledge, about their anatomy and physiology, and in veterinary care, and legal protection. However, when the monetary value of pet fish is high, such as in ornamental carp, the attention to welfare and the investments into care on an individual basis increase dramatically. Again, fish are kept as pets, as ornaments, are used in sport and consumed as a wild or farmed animal. Farmed animals, whether they are those traditionally raised on land or the relative newcomer, farmed fish, are fundamentally different from our pets, as they are in our care for the sole purpose of being killed for our consumption.

The regard and concern we have for animals is subject to the context in which that animal is found. I believe it is important for us to acknowledge the fact that the magnitude of that concern and care is dependent on the use of that animal and the cultural values

that influence our interactions with that animal. We must acknowledge that a fish at the end of a sport fishing line is under the most severe physiological stress, and is fighting for its life. We must accept that releasing the fish, only for it to be subject to the same stress by another angler is solely for our pleasure. We must be clear about the parameters we use to determine the value we place on the life and well-being of an organism. The behaviour of moving away from noxious factors has been used by some as an indication of fear or an indication of the complexity of sentient organisms; however, organisms as 'simple' as amoeba and paramecium also move away from noxious stimuli. While inconsistency and subjectivity characterize the respect we hold for the different animals that we influence, we have the responsibility to respect the life of all organisms we affect, and to think clearly about the issues relevant to this responsibility.

LOGIC AND ETHICS

It is unlikely that we will ever know if non-human organisms share the same experiences we have in pain, suffering, anxiety, and even hunger. It is a significant challenge even to know if we share the same feelings as other humans under identical physiological conditions.

The mechanisms underpinning the experience of pain and suffering in humans are not completely known. Without this knowledge, it is impossible for us to know if the physiological and humoral changes in non-humans in response to noxious stimuli might be the same experience that we have. It is my opinion that even if we shared identical neural structures and had the same behavioural and humoral responses to noxious stimuli as animals such as fish, we could never know unequivocally that pain and suffering as we know it exists in non-humans. In spite of this, discussions about welfare in animals generally overlook this lack of knowledge.

In theory, it is possible that we will one day know the chemical, anatomical, and physiological basis for our consciousness, or the sensations of pain and hunger. Equally, it is entirely possible that one day we may know if non-humans share those correlates with us. With that knowledge, however, would we be any further ahead than we are today with respect to knowing if fish and other animals share those experiences as we do and if this would affect our care for their welfare? It is my opinion that we would not be any further ahead at that point. It will always be conjecture, as it is between humans, as to whether the other is feeling pain, or suffering. However, we have an ethical imperative today to respect the life and welfare of all organisms that we affect. This will not change further with an increased understanding of if or how we might share similar experiences with them. We do not need evidence-based validation of this possibility of a shared experience to care for their well-being. It is our responsibility to act with the precaution that organisms show a stress response and we ought to inform ourselves in this regard so we can minimize the stresses imposed upon them through our interactions.

THE BASIS FOR PAIN

The neuroendocrine basis for pain in humans appears to depend on several variables. The existence of a neocortex appears to be associated with the sensation of pain, as does the humoral factor Substance P. There has been a strong tendency in the literature to link the anatomical, humoral, and physiological basis of pain in humans to the same experience in animals such as fish.

The work of Sneddon et al. (2003) showed the existence of nociceptors in rainbow trout *Oncorhynchus mykiss* that responded to mechanical, thermal, and chemical stimulation. Furthermore, trout that were injected with bee venom and acetic acid in the lips, where the nociceptors were found, had higher gill ventilation rates, took longer to resume normal feeding, and exhibited a rocking motion on the floor of the tank for about 1.5 h after injection. When these latter treatments were combined with morphine, an analgesic and narcotic in humans, these behavioural responses were reduced (Sneddon 2003). The authors concluded that these findings presented a sound basis for the existence of pain in fish.

In contrast, Rose (2002, 2007, this issue) argued, from an anatomical basis, that fish cannot experience fear nor have consciousness as we know it, because they lack the neocortex that is found in our brains. Rose (2002, 2007) presented a substantial discussion of the evidence supporting the hypothesis that the neocortex is the basis for our consciousness as well as for fear. Rose (2003) pointed out that anthropomorphic thinking and approaches undermined objective insights into the nature of non-human organisms. I am in full agreement with this view.

CONCLUDING REMARKS

I have separated the topics of whether fish can feel pain and suffer in our hands and the ethics of treating all organisms, including fish, with respect for their lives and well-being. While we will never know with certainty whether any organism feels the sensations of

pain, hunger, anxiety, and fear as we do, most of the fish and animal welfare literature is comprised of arguments about this issue, as if the basis for our respectful treatment of those organisms relied upon the outcome that fish are sentient organisms and that they experience pain as we do. We must be clear about the fact that we use fish for our purposes, and that their stress response can guide us as to how we can minimize stressful conditions in our interactions with them. If we are killing them for our consumption, we should do this as quickly and effectively as possible. I have referred to other documents that provide guidelines for the processes and environmental conditions that would provide the least stressful conditions for fish in our care or influence. Adhering to these guidelines is the best we can do; thus it is what we should do.

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