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Probable Play Behavior in a Surgeonfish (*Naso vlamingii*)

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I report an observation of possible play behavior in an individual captive Vlaming's unicornfish (*Naso vlamingii*). The fish was documented performing locomotory interactions with the filtered stream of water from the return nozzle in its aquarium. Such behaviors conform to existing definitions of play behavior. Animal play is traditionally imagined to be restricted to mammals and birds, with research on this type of behavior remaining scarce within other animals. This finding thus expands upon the ubiquity of play in understudied vertebrate taxa.

Keywords: animal play, fish behavior, surgeonfish

サザナミトサカハギ（*Naso vlamingii*）で見られた遊びと推測される行動

飼育下のサザナミトサカハギ(*Naso vlamingii*)において、遊びと推測される行動を観察したので報告する。この魚は、水槽のリターンノズルから送られてくる濾過された水流に対して、運動に関連したインタラクションを行うことが記録された。このような行動は、既存の遊び行動の定義に合致する。動物の遊びはこれまで、哺乳類と鳥類に限られると考えられており、他の動物種におけるこのような遊び行動に関する研究はまだ少ない。この発見は遊び行動の普遍性を、脊椎動物の中でまだ研究が進んでいない分類群へと広げるものである。

キーワード：動物の遊び、魚類行動、ニザダイ科

Posible Comportamiento de Juego en Pez-unicornio de Vlaming (*Naso vlamingii*).

Reporto una observación de un posible comportamiento de juego en un pez-unicornio de Vlaming (*Naso vlamingii*) en cautiverio. Se documentó que el pez realizaba interacciones locomotoras con el chorro de agua filtrada de la boquilla de retorno de su acuario. Tales comportamientos se ajustan a las definiciones existentes de comportamiento de juego. Tradicionalmente se considera que el juego animal está restringido a los mamíferos y las aves, y la investigación sobre este tipo de comportamiento sigue siendo escasa en otros animales. Este hallazgo amplía así la ubicuidad del juego en taxones de vertebrados poco estudiados.

Palabras clave: juego animal, comportamiento de los peces, pez-unicornio de Vlaming

Recently there has been a marked increase in publications documenting play behavior in non-mammalian and non-bird animals, including reptiles (e.g., Barabanov et al., 2015; Burghardt, 2015; Burghardt et al., 1996; Dinets, 2015; Kane et al., 2019; Kramer & Burghardt, 1998), amphibians (e.g., Burghardt, 2015), fish (e.g., Burghardt et al., 2015; Eisenbeiser et al., 2022; Fagen, 2017), and several invertebrate taxa; bumblebees, spiders, and octopuses being notable examples (e.g., Galpayage Dona et al., 2022; Kuba et al., 2003, 2006; Mather & Anderson, 1999; Pruitt et al., 2012). The growth in this body of research appears to reflect a widespread prevalence of play behavior across distinct animal clades, but more observations are crucial for a deeper understanding of this matter.

Further complicating the issue are inconsistencies in how play behavior is defined. A historically popular example is that of Bekoff and Byers (1981), who defined it as "...all motor activity performed postnatally that appears to be purposeless, in which motor patterns from other contexts may often be used in modified forms and altered temporal sequencing" (p. 300). However, many other examples of behavior often appear purposeless (e.g., captive stereotyping), meaning this definition has been met with some scrutiny (Heinrich & Smokler, 1998). Fagen (1981) listed several other examples of play behavior that have informed later definitions. Miller (2017) has found 17 different behavioral criteria belonging to at least 16 distinct working definitions of play in the contemporary literature. The varying forms and functions of play add additional complexity to the issue.

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Play is usually considered to conform to one of three distinct types: locomotor-rotational, object, and social play (Fagen, 1981). Isolated locomotor play is individualistic, consisting of physical movement that may resemble exaggerated extensions of typical behavior (Graham & Burghardt, 2010). Locomotor play may be linked to exercise or ontogenetic practicing of adult behaviors.

Play associated with inanimate objects, either through manipulation or generalized playful interaction, is considered object play (Burghardt, 2005). Object play is distinct from tool use, which it may resemble in certain contexts. Social play must involve at least two individuals and often resembles a mild form of aggression. Such behavior may reaffirm or strengthen social bonds.

It should be noted that these different forms are not always mutually exclusive. For example, social play can involve locomotory processes (e.g., chasing) and object use (e.g., tug of war, prey manipulation). Such blending may make it difficult to classify play by type. Novel behavioral observations add further complexity, as they may lack existing frameworks for comparison. These widespread discrepancies display the need for a standardized model that researchers can rely on when categorizing specific behaviors. Such an approach has been taken by Burghardt (2012), who developed a set of five criteria that must all be satisfied for a behavior to be considered play:

"The first criterion for recognizing play is that the performance of the behavior is not fully functional in the form or context in which it is expressed; that is, it includes elements, or is directed toward stimuli, that do not contribute to current survival.

The second criterion for recognizing play is that the behavior is spontaneous, voluntary, intentional, pleasurable, rewarding, reinforcing, or autotelic ('done for its own sake').

The third criterion for recognizing play is that it differs from the 'serious' performance of ethotypic behavior structurally or temporally in at least one respect: it is incomplete (generally through inhibited or dropped final elements), exaggerated, awkward, or precocious; or it involves behavior patterns with modified form, sequencing, or targeting.

The fourth criterion for recognizing play is that the behavior is performed repeatedly in a similar, but not rigidly stereotyped, form during at least a portion of the animal's ontogeny.

The fifth criterion for recognizing play is that the behavior is initiated when an animal is adequately fed, healthy, and free from stress (e.g., predator threat, harsh microclimate, social instability), or intense competing systems (e.g., feeding, mating, predator avoidance). In other words, the animal is in a 'relaxed field'" (p. 9-18).

As this definition provides a set of formal criteria, it is particularly useful when describing novel observations of animal behavior that may represent play. Some authors, including Lillard (2014), consider it the premier model in this regard. As such, it is this definition that the following observations adhere to.

A lack of standardized definitions impacts several other subdisciplines within the behavioral sciences. For example, tool use has been found to have as many as 18 different definitions (Crain et al., 2013) and dozens of potential criteria (Bentley-Condit & Smith, 2010; St Amant & Horton, 2008). Such inconsistencies result in widespread confusion between authors, as well as reduced credibility of the field overall. By clearly stating what definitions were adhered to in their research, or by formalizing what is meant by behaviors like 'play' or 'tool use,' researchers can reduce discrediting the study of animal behavior.

Life History & Ecology

Here I describe possible examples of play in an individual Vlaming's unicornfish (*Naso vlamingii*), a planktivorous surgeonfish distributed throughout the Indo-Pacific (Myers, 1991). *N. vlamingii* is a monotypic unicornfish typically associated with coral reefs. The species is wide-ranging, found from the Eastern coast of Africa to the Galapagos Islands (Eschmeyer et al., 2024). Although ranked of least conservation concern, the species displays a decreasing population trend (Dominici-Arosemena et al., 2012). As many surgeonfish have important commercial value, both as a local food resource and in the international pet trade (Polunin & Roberts, 1993; Williams et al., 2009), this may explain apparent losses in abundance.

N. vlamingii is a member of the 'water-column feeder' surgeonfish guild; a functional role characterized by a reliance on suspended food particles (Tebbett et al., 2022). This unique ecological strategy has important implications for the trophic structure of reef food webs. While many surgeonfish are grazers or detritivores, water-column feeders lack many of the specializations for these niches, preying instead on zooplankton. This allows linkages between disparate habitats, as nutrients from pelagic zones are introduced to the reef system through surgeonfish feces. Cross-habitat connection potential is thus much higher in water-column feeding surgeonfish than in other marine fish families (Tebbett et al., 2022). Such traits warrant special consideration when discussing the behavior of *N. vlamingii.*

Method

Behavior was observed on five separate occasions in February of 2023, with 20 s of smartphone video obtained on the 21st of the month (see Supplementary Materials). The fish was housed in the marine display aquarium of Colorado State University's biology building. It was monitored from a chair approximately 20 ft away from the aquarium glass. None of the fish in the aquarium were visibly affected by my presence at this distance. Recording began after the fish began to exhibit the previously displayed behavior.

Figure 1

A Photo of the Fish in its Aquarium

Behavior was determined to be play based on its satisfying each of the five play criteria: (1) directed towards a stimulus unrelated to survival; (2) voluntary, pleasurable, or self-rewarding; (3) different structurally or temporally from related maintenance behavior; (4) expressed repeatedly during the animal's life span; and (5) initiated in a 'relaxed field' (environment suited for welfare) (Burghardt, 2012).

Examples of Play Behavior

The fish's actions consisted of locomotory interactions associated with the aquarium's return nozzles. These are fixed tubing elements of the aquarium's filtration system responsible for returning water to the tank and creating a circulating current. The play sequence began with the fish moving to the area of the aquarium lacking rock and coral. Directing itself toward a nozzle, it would rapidly accelerate at the flow of water, turning its body so that its sagittal plane was positioned perpendicular to the current. This resulted in an upward somersault, which propelled the fish toward its starting position at the bare end of the tank. At this point, the behavior would typically be repeated. Somersaulting sessions lasted anywhere from 10 s to a min.

This behavior may represent an intersection between locomotor-rotational and object play, as an object (i.e., the return nozzle) is partially responsible for the solitary locomotory activity. It is unlikely to represent self-cleaning or parasite removal, as fish typically seek out cleaning stations or scrapes for this (Barber, 2007; Grossman et al., 2009; Thompson & Meeuwig, 2022), both of which are available in the aquarium. At least five separate instances were witnessed over several weeks and appeared to occur in the absence of any obvious stimuli.

Incidentally, the curator of the aquarium has also reported behavior of a similar vein during feeding. She detailed periods of heightened excitement, during which the fish would accelerate in circles around the tank. The behavior described in her anecdote differs in form from the somersaulting, likely being some form of feeding response as often reported in other fish (Lall & Tibbetts, 2009). In contrast, the repeated looping behavior caught on video has no obvious function for survival or maintenance. There is no intraspecific competition or intimidation at work, as only one individual of *N. vlamingii* resides in the aquarium. Tankmates belong to various clades of non-aggressive reef fish, all of which are of significantly smaller size than *N. vlamingii*. The individual was well-fed, free of pathologies, and was maintained in an appropriate environment (Figure 1). Observations lasted a few min at sporadic intervals, ruling out pathological stereotyping and supporting interpretation as play. As the first documented example of play behavior in a surgeonfish species, this report provides an important supplement to existing fish play ethology.

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