

# Agonistic Behavior in *Betta splendens*

## Introduction to a Model Organism

Wild Siamese Fighting Fish (*Betta splendens*) are **sexually dimorphic**: males and females look different from one another. Males are more brightly colored than females (Figure 1). Because of their attractive colors and interesting behaviors, this species has a long history of artificial selection (particularly males) for mutant color morphs and very long fins and tails. Despite the domestic variety's showier appearance (Figure 2), its basic courtship and other **intraspecific** (i.e., between members of the same species) displays have remained relatively similar to those of its wild ancestors.



**Figure 1.** Wild type *Betta splendens* male (left) and female (right). The male is fanning his fins and tail in the beginnings of an agonistic (contest) display.



**Figure 2.** Artificially selected *Betta splendens* males showing mutant color morphs and fin morphologies. The fish in the upper lefthand corner and lower righthand corner are not displaying. All other fish shown are engaging in agonistic displays of varying intensity.

## **I. Natural History of the Siamese Fighting Fish**

*Betta splendens* (Actinopterygii, Perciformes, Osphronemidae) commonly known as the **Betta**, or **Siamese Fighting Fish\*** is native to tropical Southeast Asia including the northern Malay Peninsula, central and eastern Thailand, Cambodia, and southern Vietnam. They live and breed in rice paddies, shallow, stagnant ponds, and slow-moving streams (Figure 3), and are known for their ability to survive in rather fetid, oxygen-poor water by gulping air from the surface, when necessary. Interestingly, newly hatched *Betta splendens* rely on their gills for oxygen exchange. The species' ability to surface-breathe develops later.



**Figure 3.** Typical habitat for wild *Betta splendens*: slow-moving stream (left) rice paddy (center) wild Bettas *in situ* (right).

Adult males reach a total length of about 7cm, and females are slightly smaller. Cultivated Bettas have been artificially selected for many decades so that the domesticated males are characterized by colorful pigmentation and long, showy fins. Females are slightly smaller, less brightly colored, and have shorter fins than males. The domestic fish look quite different from their wild **conspecifics** (members of the same species).

Bettas are popular as aquarium fish because of their spectacular colors, and because they are relatively easy to keep and breed. They thrive comfortably in a volume as small as 3 gallons of water, and when living in an appropriate, warm, stress-free environment, will breed. Males build a nest of mucus-coated bubbles on the surface of the water, and as the eggs laid by the female hatch, he will carry each hatchling to the nest in his mouth and spit it into the nest. Hatchlings grow in relative safety in their bubble environment, guarded by the male.

**Every experienced aquarium hobbyist knows that only one male Betta can occupy an aquarium at a time.** The males are extremely aggressive towards males of their own species. When fighting, males will nip at each others fins until one of them is too tired and injured to continue. This usually takes long enough so both combatants' fins resemble rags by the time one fish concedes defeat by retreating.

**\* Common names should be capitalized, as they are proper nouns.**

The **Siamese Fighting Fish** (*Betta splendens*) is not the same as a **Siamese fighting fish**, which could be any fish born in Thailand (formerly Siam) that happens to be fighting.

## **II. *Betta splendens* External Anatomy**

In order to accurately describe and record *Betta* behavior, you will need to know the names of body parts your fish use to communicate with their conspecifics. Refer to Figure 4 for an overview of the general external anatomy of *Betta splendens* (which is very similar to that of any other bony fish).

Male and female Bettas use all their fins in their displays, as well as their opercula and the fleshy, membranous extensions beneath the opercula. Your team must decide in advance

- (1) what anatomical features you will monitor during fish displays
- (2) how you will quantify their use
- (3) what statistical test is most appropriate for analysis of your data set

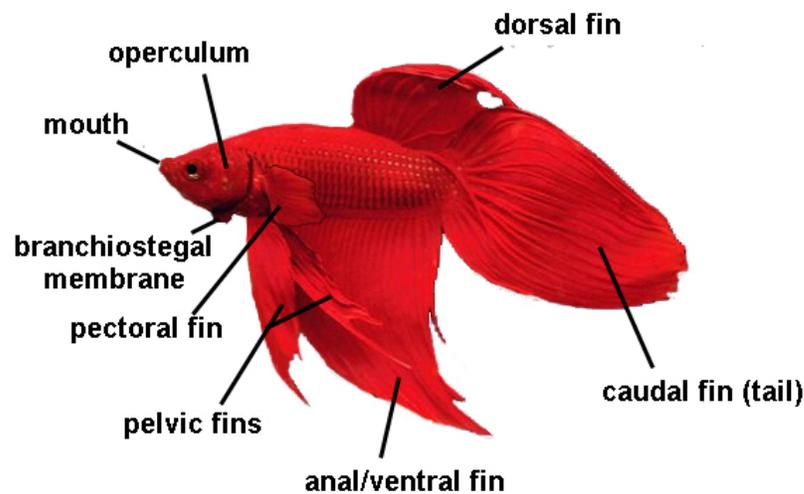


Figure 4. External anatomy of *Betta splendens*.

## **III. Agonistic Behavior in *Betta splendens***

**Agonistic** (from the Greek *agon*, meaning "contest") behavior in animals are defined as those associated with fighting. Behaviors exhibited during a contest, combat, attack, appeasement, or retreat are all agonistic behaviors. The term is often used to describe the display behaviors exhibited by male animals when they compete for mating opportunities with females.

Male Bettas may fight to claim territory, or to protect their eggs or offspring from rival males. Physical combat is invariably preceded by a display sometimes called "flaring." When stimulated by the sight of a rival male (the **releaser**), a male *Betta* will exhibit several types of genetically determined aggressive movements (**fixed action patterns**). The fish will spread his fins, shudder his body, extend his gill opercula and membranes, and generally appear much larger than his resting size. Bettas do not recognize themselves in a mirror, and will display to their reflections as aggressively as they might to another male.