

Asynchronous Serial Data Communication of the Humboldt Squid (*Dosidicus gigas*)

Abstract

The behaviors of the Humboldt Squid in the Sea of Cortez have been observed by many biologists. One noteworthy observation is that the Humboldt squid often work in large groups, perhaps as many as 1200 have been noted. It has been observed that the squid seem to operate in tandem with other squid of a larger group. This would suggest that some form of communication may exist for the Humboldt squid. Without sound emitting organs, use of some form of sonar can be excluded. The Humboldt squid has been observed to exhibit coloration changes while moving within a group of other Humboldt squid. The Humboldt squid are able to produce coloration changes through millions of chromatophores. By changing coloration in a predefined pattern, it would be possible to transmit information.

Introduction

Most cephalopods contain chromatophores, which enable the organism to change its pigmentation, or skin color. This color change has often been observed as a function of predator avoidance and in mating. The Humboldt Squid (*Dosidicus gigas*) however, does not display a behavior of pigmentation change that indicates a preservation mechanism such as, predator avoidance, nor does it suggest any form of mating. The Humboldt has been observed changing its coloration periodically during a food gathering operation while in large groups of other Humboldt squid. This raises the question; could this coloration change be some form of communication?

Communication Concept

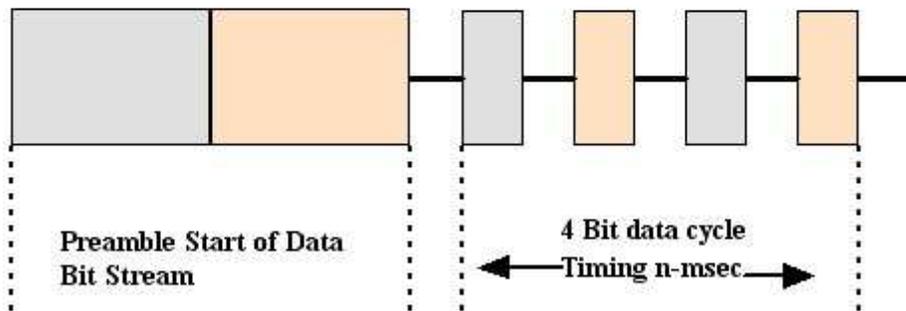
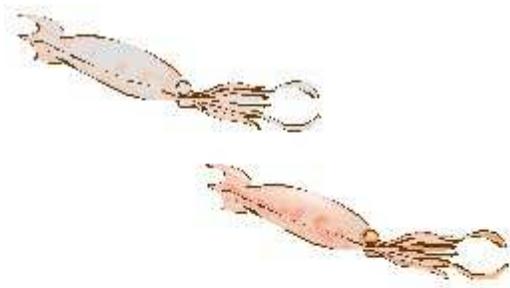
When considering chromatophore modulation as a form of communication, many questions are raised, and answers are required to support such a claim. The following paragraphs will attempt to address some of these questions.

- **Is alternating skin pigmentation a possible form of communication?**

Consider binary data transmission, often used in computer devices, this form of communication uses a series of pulses employing a form of On-Off-Keying to relay information. The on-keying can be considered a binary 1 or yes, the off-keying can represent a 0 or no. With a series of on-off keying, intelligible data can be conveyed. This can be compared to the binary number system, the value 1000 is equivalent to the decimal form of the number eight, and 1001 equals nine. Other possible forms of transmission are plausible, Morse code transmission for example. Here a series of long and short burst are used to convey data. Morse code can be considered binary as there are only dots and dashes, or 0's and 1's.

- **Initiation of a communication link**

Indeed the start/stop indicators for conveying serial transmission of data must be considered. Without a common timing source, start and stop of a serial data stream becomes problematic. Again, consider serial computer devices, the problem of asynchronous transmission is overcome by the transmission of preamble data streams that indicate that data is to follow. Often called start and stop bits. It is conceivable that cephalopods have mastered this form of data communication. See figure 1.



**Asynchronous Serial Data
Communication *Dosidicus gigus***

Figure 1

Indeed through a series of flashing colors at timed intervals, the Humboldt squid could in fact convey information such as, left/right signals, or even warn of impending danger.