Assessing attractability and palatability using AI

Eva Rondeau[1], Guillaume Le Reste[1]

[1]Halieutica

In recent years, feed palatability has emerged as a priority in shrimp aquaculture. As productivity remains a central objective for shrimp producers, fast and efficient feed consumption is critical to achieving consistent performance and profitability.

Shrimp will consume feed efficiently, maximizing intake while limiting waste, only when the feed is attractive enough to trigger feeding behavior. When feed lacks sufficient palatability, intake declines, resulting in slower growth, poorer feed conversion, and reduced farm profitability. Conversely, a growing body of research shows that the inclusion of feed attractants and palatability enhancers can significantly improve feed intake, growth performance, and feed efficiency in *P. vannamei*.

Feed formulation, therefore, plays a central role in driving palatability. Careful selection and optimization of raw materials, combined with the use of ingredients, allow the development of diets that are more attractive, more rapidly consumed, and better utilized by shrimp.

Despite its importance, accurately assessing palatability remains challenging. Traditional tools, such as feed-tray observations or pellet counts, are often subjective, time-consuming, and challenging to apply in commercial pond conditions. Emerging technologies, including video tracking, computer vision, and acoustic monitoring, are now opening new opportunities for more objective and precise evaluation of shrimp feeding behavior.

In this context, these recent technological advances make palatability measurement more objective and reliable, allowing nutritionist to integrate palatability as a key performance criterion in their formulation software.

Importance of palatability in modern feed formulation

The increasing use of alternative ingredients, driven by cost control and sustainability goals, has further reinforced the importance of palatability in formulation strategies. Plant-based proteins and new lipid sources can change feed attractability, potentially affecting feed acceptance if not properly balanced. Palatability optimization, therefore, becomes a challenge, allowing formulators to maintain feed intake and performance while adapting to evolving ingredient choices.

By enhancing palatability, nutritionists can promote faster feed detection, higher ingestion rates, and more uniform feeding, reducing feed losses and improving feed conversion ratios. Improved palatability also supports better water quality by limiting uneaten feed through faster feed intake, shortening the residence time of pellets in the water, which is particularly important in high-density and intensive production systems. This reduced exposure limits nutrient leaching and helps reduce pollution in rearing ponds.

Difficulties in accurately measuring palatability in shrimp

Assessing feed palatability in *Penaeus vannamei* remains challenging, even in labs. Traditional methods, such as counting uneaten pellets or manually observing feeding behavior, provide only rough estimates and are time-consuming and labor-intensive. They also mix up true palatability with environmental losses, making it hard to get accurate results.

Recent technological advances, such as video tracking and behavioral analysis tools, offer more precise ways to monitor shrimp feeding. These systems can track animal movements, time spent near feed, and feeding activity, providing valuable insights into how attractive a feed really is. They can also shed light on animal welfare in different situations.

However, in commercial pond conditions, these tools still face limitations. High-quality video and powerful

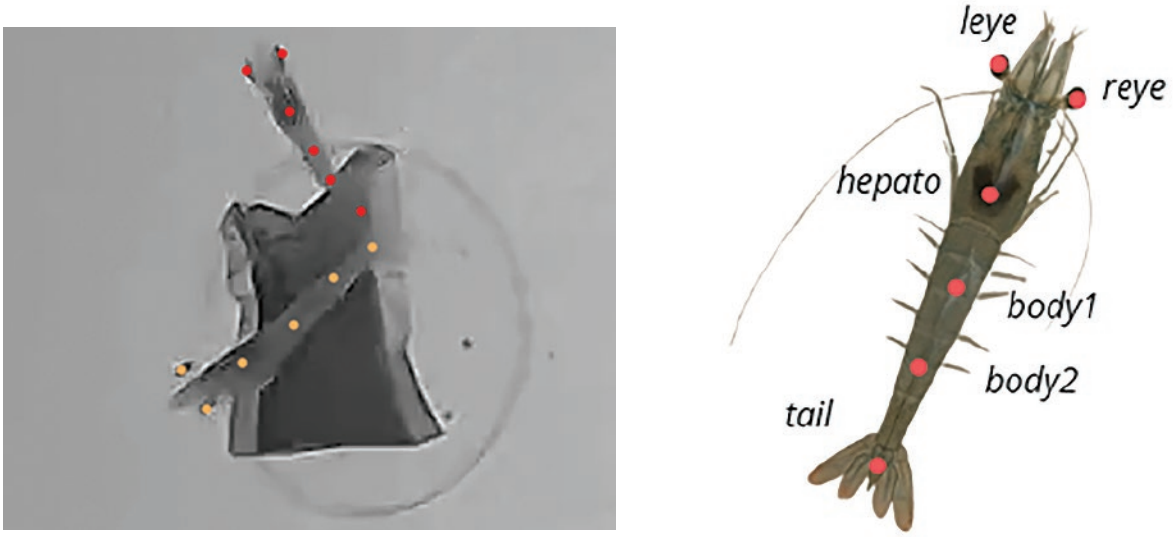

Figure 1. AI software point-of-interest detection during tracking analysis (left) and an example of shrimp anatomical labelling (right)

computers are often required, and corrections for errors can be time-consuming.

Artificial intelligence as a powerful tool

Artificial intelligence (AI), combined with video monitoring and acoustic sensors, is increasingly being explored to understand shrimp feeding and welfare. The main advantage of AI is its ability to automate observations, reduce human bias, and provide objective, reproducible data.

Despite its promise, applying AI in commercial shrimp systems is still challenging. Factors such as turbid water, poor lighting, overlapping shrimp, or background noise can reduce detection accuracy, making it challenging to capture all feeding activity. Some traditional metrics, such as how quickly shrimp approach feed or how long they stay near it, remain hard to measure consistently at the pond scale.

Still, recent advances in computer vision and AI-driven monitoring show strong potential to overcome these issues. By precisely tracking shrimp movements and feeding responses, these tools can help identify which feeds are most attractive and are consumed most efficiently, supporting better formulation.

Recognizing both the opportunities and current limitations, we developed VannamAI®, a software solution tailored to our experimental setup that enables more reliable, practical assessment of feed palatability.

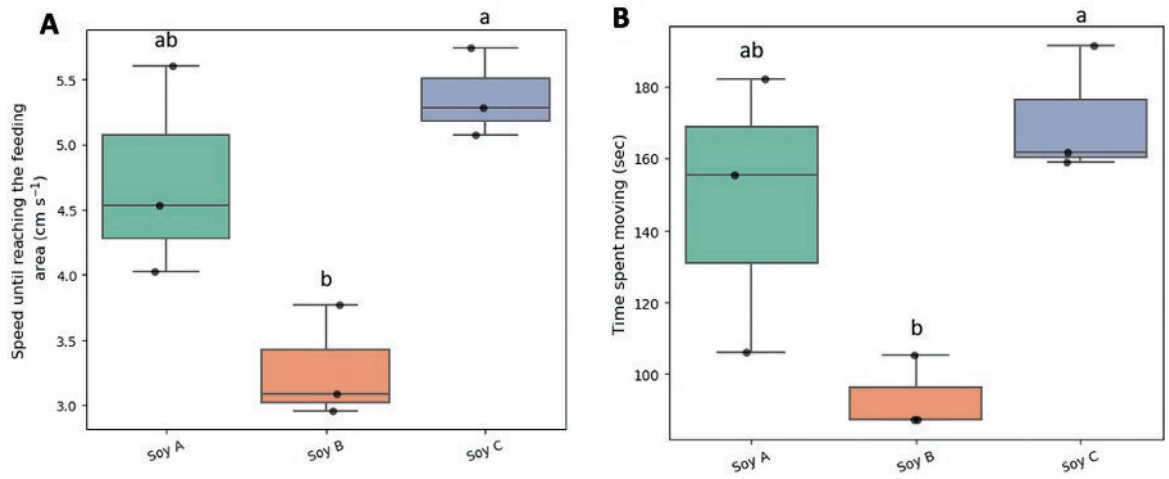

Figure 2. Two key parameters automatically tracked by VannamAI®: (A) Speed until reaching the feeding area, (B) total movement duration for three different soy-based feed formulation

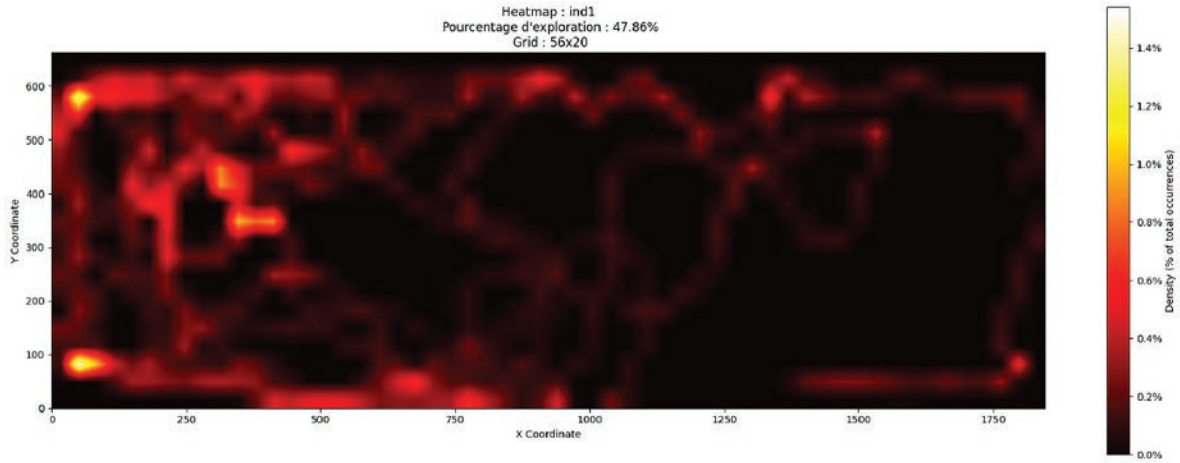

Figure 3. Heatmap showing the shrimp's most visited areas with the percentage of exploration

Proven results

Our custom software provides a clear and intuitive interface, allowing users to visualize shrimp behavior from video recordings. Key parameters can be monitored easily, including:

- Latency and speed to feed
- Time spent in the feeding area
- Number of times entering the feeding area
- Time spent moving
- Mean distance to the feeding area

Once the parameters are automatically calculated, the software generates table-based files, making it easy to perform statistical analysis and compare feed performance.

As an example, we tested three different soybean-based feed formulations. The software captured clear differences in shrimp behavior (Figure 2). Soy C triggered the fastest approach to the feeding area, compared to Soy B. Soy A showed moderate engagement (Figure 2A). The same results were observed for time spent moving, with Soy B being less active than Soy C (Figure 2B).

For each shrimp, as well as for the group overall, a heatmap is generated to show the areas they visit most. Figure 3 shows a shrimp mainly exploring the left side of the tank, where the feeding area is located.

Perspectives

This tool makes it possible to objectively characterize a large number of ingredients, additives, or complete feeds. This, in turn, would enable the development of formulation databases based on objective and comparable criteria for both attractability and palatability, facilitating feed formulation and ingredient selection.

Palatability and attractability are complementary aspects of shrimp feeding behavior. Sometimes, a feed may be less attractive initially, but once the shrimp start eating, it proves highly palatable. Conversely, a feed might be very attractive, attracting shrimp to it quickly, but they may eat only small amounts or spend little time feeding.

To fully capture the performance of a given additive, an ingredient or a feed, it would be useful to develop an integrated indicator that combines both attractability and palatability, providing a single measure of how effective a feed is in stimulating both approach and sustained consumption.

More information:

Guillaume Le Reste
CEO
Halieutica
E: contact@halieutica.net

Eva Rondeau
Scientific Manager
Halieutica