EVALUATION OF A COMMERCIAL INFRARED FISH COUNTER (CALITRI TECHNOLOGY FC12) FOR COUNTING DELTA SMELT *Hypomesus transpacificus*

Jody Wong, Bhavika Maddineni, and Tien-Chieh Hung*
Dept. of Biological and Agricultural Engineering, University of California, Davis
*Corresponding author: Tien- Chieh Hung. Email: thung@ucdavis.edu

Introduction

For many aquaculture facilities, keeping accurate population counts is critical to success. As fish counting machines are more efficient for quantifying fish compared to manual methods, they are often used in fish farms and similar operations. Most counters are designed for larger fish and are less accurate with smaller species. Smaller fish may also be more susceptible to stress and related complications. Therefore, implementing a fish counter in a facility's regular practices should be species and size appropriate. To that end, as there is limited literature on the health impacts of counting machines on small and sensitive species of fish, the effects of using a counting machine to quantify Delta Smelt (Hypomesus transpacificus) were examined.

Methods

Figure 1. An FC12 Fry Counter (Calitri Technology, Walcourt, Belgium) was used for the study. The device was connected to a white loading tank with its central fish absorber removed and set up for manual operation.

- Cultured adult Delta Smelt ≥180 days post hatch were used.
  - Fish were reared in 1.5 m diameter, 1,100 L tanks at 12°C.
- 4 groups of about 300 fish each were counted using the FC12 into experimental tanks & maintained for 72 hours.
  - Injury assessments conducted 24 hours post-transfer.
  - Tanks assessed daily for mortalities.
- Post-counter states of fish were compared to the post-netting (manual) and pre-experiment data from Tsai et al. (2025)

Figure 2. Top view of the FC12's loading tank

- A minimum flow rate of 4.3 m3/hr was provided to the loading tank during operation.
- Fish poured into loading tank from 18.9L buckets with 6L water and at approx. 150 fish per bucket.
- Average pour time 31s per bucket.
- 20 fish were sampled live from each group.
- Injury severity was scored with discrete values (Table 1).

Table 1. Injury Level Criteria

Injury Level	Description
0	No injuries observed.
1	Minor injuries, with no expected long-term or ill effects.
2	Moderate injuries, thought to possibly impede regular function, though resulting mortality was not expected.
3	Major injuries, expected to both greatly impede regular function and likely cause mortality.

Results

Table 2. Counter Performance

	FC12 Count	Actual Number	Relative Count (%)
Trial 1	312	271	115.1 %
Trial 2	234	233	100.4 %
Trial 3	314	306	102.6 %
Trial 4	243	244	99.6 %
Average			104.7 ± 7.2 %

- 1103 fish counted by FC12 over 4 trials with a relative count of 104.7%
- 13 total mortalities observed over a period of 3 days.
- No injuries were observed on 70% of sampled fish.

Table 3. Number of fish scored at each discrete injury severity level

	Injury Severity			
	0	**1**	**2**	**3**
Pre-Experiment (N = 30)	21	7	1	1
Manual (N = 60)	44	11	5	0
Counter (N = 80)	56	24	0	0

- Two main types of injury were observed: split fin (separation of adjacent fin ray of any length) and fraying (ends of fins missing).
- All observed injuries were non-lethal.
- Only 3 fish displayed more than 1 injury.

Figure 3. Anesthetized Delta Smelt with a split right pectoral fin and a split left dorsal fin. Both of these fins were considered a minor-level injury.

Conclusion

While counter performance in regards to accuracy overestimated on average compared to manual counting, the overall performance was within acceptable ranges for its intended use. Injury assessment results indicated that adult Delta Smelt counted by machine were not significantly more likely to be injured or to be injured more severely than when counted by hand netting. Further testing may be done to evaluate performance when using younger fish, to more thoroughly define appropriate parameters for practical use in aquaculture settings.

Acknowledgements

We are grateful to Luke Ellison for his role in facilitating the trials and the staff as a whole at the FCCL for all their hard work with fish care. We also thank Yi-Jiun Jean Tsai for sharing with us her data and Ya-Chi Yang for her assistance with the injury assessments.