

Comparison of Fish Freshness Assessment - Torrymeter vs. Sensory Evaluation

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1. Introduction

The aim of the study was to find out a correlation between the freshness quality by sensory evaluation and the Torrymeter measurements for New Zealand fish species.

2. Method

The freshness of fish was compared for the following fish species:

5 samples for each species of TAR, TRE, GUR, KAH and JDO

Total of 400 observations and measurements were obtained between 1.8.2019 and 10.9.2019 period.

The Long Line caught fish were sourced from Sanford vessels Carolyn Marie and Terpeena.

Fish freshness assessment was carried out on each fish by the above panelists. With the use of a Torrymeter, the freshness value was determined. The fish was examined to evaluate for the sensory attributes of appearance, smell, eye quality, skin quality, gills odour, gills colour, and the flesh firmness by quality assurance staff. The fish was stored with ice flakes and inside the chiller and the measurements and the evaluation was carried out daily until the fish was no longer edible.

2.1 Torrymeter

Torry fish freshness meter is a rapid and objective method for measuring the dielectric properties of fish skin and muscles. It is non-destructive and portable, allowing for use in field work. The Torrymeter was developed at Torry Research Station in Aberdeen, Scotland. Post-mortem degradation of tissue components alter the dielectric properties of fish skin and muscles in a systematic manner. The microscopic changes are related to the altering of sensory attributes during spoilage. The base of the instrument has 2 pairs of electrodes, the base is firmly place on the skin of the fish. An alternating current is then send through the fish, dielectric properties of the muscles tissues causes a change in phase angle of the return current. The resultant signal is converted to a value ranging from 0 to 16. A perfect fresh fish would show a score of 10 or more. Research shows a linear correlation was found between Torrymeter readings and the sensory attributes for common North Atlantic and Baltic fish species. Torrymeter values of the fish were measured by placing the base of the meter firmly on the fish so that it lay flat against the surface and parallel to the lateral line at a thick, fleshy part of the fish. Triplicate readings were obtained for each fish, followed by their total average. The Torrymeter scale starts from a value of 16 to 1, with any score below 4 being spoiled fish that is unfit for consumption, and scores of 10 and above to being of fresh quality.



Fig 1. Instrument in Portable and convenient case.

Fig 2. Measurements are taken on fish.



Fig 3. Base of the instrument showing 2 sets of electrodes

Fig 4. Face of the instrument



Fig. 5 The best position of the fish to measure freshness using the Torrymeter

2.2 Sensory Evaluation

Sensory evaluation involves using sense of sight, smell and touch. Sensory method is the primary method of evaluation used to measure the quality and freshness of fish as the same humans senses used by customers when they make objective judgement about the quality. Sensory evaluations generally require trained panelists to carry out. A problem that arise in sensory evaluation is fatigue, hence the panelists losing the ability to give reliable judgement.

Table 1 Sensory Evaluation Attributes Table

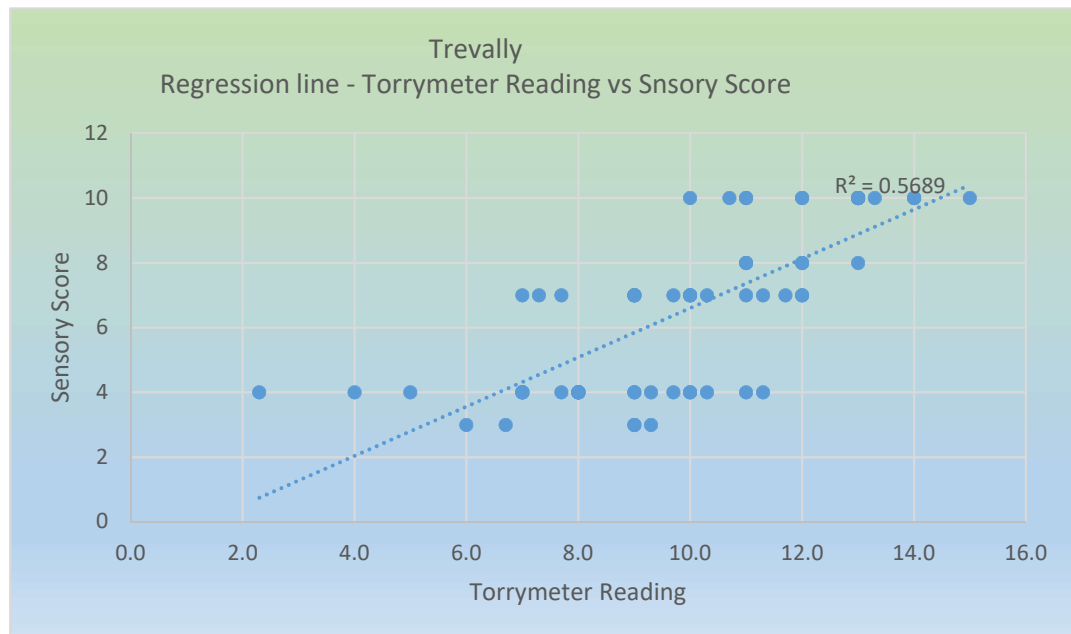
QUALITY RATING	EYES	SKIN	GILLS	FLESH	SENSORY SCORE
Excellent	Black pupil, translucent cornea	Bright luminous sheen Glossy transparent body slime	Bright pastel rose colour Fresh sea weedy odour	Translucent, firm and elastic texture	10
Very Good	Flattening slight graying of the pupil	Body slime, loss of sheen, no longer luminous	Buildup of slightly cloudy slime Musty earthy celery colour Slightly darker red	Translucent, firm and elastic texture	8,9
Good	Sunken eyes and general cloudiness of pupil	Continued loss of sheen Lateral lines less distinct	Slime on gills thickening Blood defusing on slime Briny, bready, malty odour Slightly darker red	Translucency lost Soft flesh with no elasticity	6,7
Average	Either flat and cloudy or swollen and bloodshot	Pale and dull looking	Bleached in patches, much more slime Dark maroon colour Strong stale celery odour	Waxy appearance Plasticine like, sticky flesh	4,5
Marginal	Either flat and cloudy or swollen and bloodshot	Pale and dull looking	Bleached in patches, much more slime Dark maroon colour Strong stale celery odour	Waxy appearance Plasticine like, sticky flesh	2,3
Poor	Sunken bloodshot or cloudy	Covered in yellow slime Continued loss of colour	Thick slime, brick red or pale dirt pink Little odour, turnipy, musty Will emit unpleasant odours if fish has not been stored correctly, Dark brown or pink	Considerable darkening or the flesh Very soft, mushy gapping flesh	1

2.3 Storage of Fish

Fish was stored in the chiller with ice during the trials. Temperatures during the storage was between 0 and 4° C. This was to ensure proper cold chain management throughout the procedure.

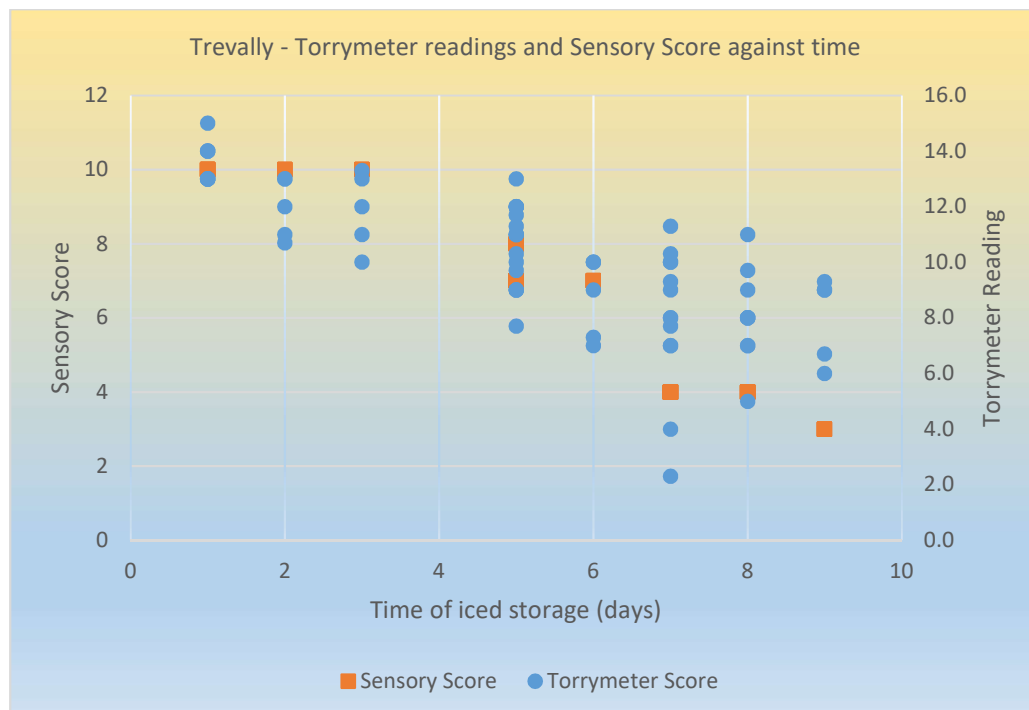
3.0 Results and Discussion

Chart 1



A linear correlation was found between Torrymeter readings and sensory attributes for Trevally are shown in Chart 1. The coefficient of correlation value (R – squared) of 0.5689 shows a good positive relationship between the two parameters used during the trials.

Chart 2



The Chart 2 shows changes of Torrymeter readings for whole Trevally sample over a period of 10 days in iced storage (Blue dots), a similar change was observed with the sensory evaluation for the same fish sample (Orange dots). Torrymeter values, thus indicating an apparently inferior product with time of storage. The mean torrymeter values of >10 will indicate very fresh fish, whereas a value of <6 will be indicative of marginal quality fish.

Very similar pattern of results obtained for the other 4 species of fish.

4.0 Conclusion

The Torrymeter offered a unique tool for indirectly measuring freshness quality of fish. Instrument readings were consistent with sensory assessment and provide a basis for estimating the freshness of fish, it is also fast and reliable and non-destructive method for assuring freshness.



Fresh Fish



Rotten Fish