

FINAL REPORTTESTING FISH FRESHNESS WITH A
GR TORRYMETERCOMMERCIAL APPLICATION

N.V. & J.H. RUELLO

Ruello & Associates Fisheries Consultants

62 Centennial Ave., Chatswood NSW 2067

SUMMARY: The aim of this study was to test the GR International Fish Freshness meter (Torrymeter) on Australian fish. The study included the following fish: sea mullet (Mugil cephalus), tiger flathead (Neoplatycephalus richardsoni), snapper (Chrysophrys auratus), gemfish (Rexea solandri) and shark. The results are presented in graphical form, and the practical application of the Torrymeter is discussed using the flathead as an example.

The GR Torrymeter can be used to measure fish freshness, however it is not sufficiently reliable for general use. It would appear that the GR Torrymeter can only be used by a highly trained operator and consequently this instrument has limited application in the Australian fishing industry.

Fish quality can best be determined (in the field) by sensory methods: specific guidelines for the major commercial species need to be prepared. A draft guideline on the spoilage pattern and a suggested grading for tiger flathead is shown at Appendix 1.

The fishing industry has long been seeking an objective test for fish quality. The electronic device developed at Torry Research Station, Aberdeen (Cheyne, 1975) and marketed by GR International Electronics Limited, Doman Road, Camberley, Surrey, U.K. would appear to be an answer.

OBJECTIVES: The objectives of the work described, were to collect Torrymeter scores on chilled fish and correlate these values with sensory assessment of the same fish. These results were analysed mathematically to determine the relationship between the Torrymeter score and the sensory score.

EXPERIMENTAL METHOD: Very fresh fish were purchased at the Sydney Fish Centre. Sixteen fish of each species were selected, as this is the minimum number of fish recommended by the GR Torrymeter manufacturer. Torrymeter scores were taken on individual fish and an average reading was automatically taken on the 16 also. The quality of the fish was assessed by sensory methods (sight, smell and touch) on a hedonic scale of 0 to 10. A hedonic score of 10 was given to fish in almost live condition and a score of 0 for completely rotten fish. The Torrymeter score and the sensory score were taken daily until the fish were in very poor condition. The 16 fish were iced as required to maintain a temperature of 0°C and stored in a commercial fish box held in a 2°C coolroom.

DETERMINATION OF SENSORY SCORE: Only sensory aspects of fish quality were used during the trials. The general appearance of the fish was examined, the raw odour, colour of the skin, springiness of the flesh, colour of the gills, presence or absence and colour of slime were noted. The hedonic score was determined after all these factors were

considered.

Experiments were repeated on the various species of fish at different times of the year to try to take account of fluctuations in fish quality.

RESULTS: There was considerable difficulty in obtaining an average reading from the one Torrymeter purchased. The machine was returned to the manufacturer in the U.K. for service and repairs. On its return its performance had improved but it often failed to give an average reading for several days in a row and consequently many experiments had to be aborted and much time was wasted.

The research work with shark was discontinued because the experiments showed that shark fillets discoloured badly long before spoilage problems were evident.

The results of the experiments with tiger flathead, snapper, mullet and gemfish are summarized in Figs 1, 2, 3 and 4. These graphs show that there was a linear relationship (significant at 5% level) between Torrymeter scores and the sensory score; similar results were obtained in preliminary experiments. The preliminary results were encouraging because it appeared that fish quality could reliably be estimated from Torrymeter readings. However, further studies showed that quite different Torrymeter scores were obtained on fish (of the same species) caught at different times of the year. This phenomenon is illustrated in Fig. 1 which shows data for flathead in October/November 1977, July 1978 and November 1978.

DISCUSSION OF RESULTS

Although the GR Torrymeter usually works and could be used to measure fish quality, there are many reasons why this machine has limited application in the Australian fishing industry:

Seasonal and Other Changes in Fish Quality - our research with flathead indicates that there are large seasonal differences in fish quality and Torrymeter readings, consequently the data obtained from the Torrymeter need to be interpreted by personnel with considerable practical experience or theoretical knowledge of fish quality changes.

Overseas work indicates that the quality and spoilage pattern of fish from different fishing grounds can also vary significantly, and similar observations have been reported by Australian fishermen.

It is evident that the quality and spoilage pattern of fish is a complex subject; this instrument cannot take account of these complexities.

Limited Use -- fish such as flathead may be unmarketable for reasons other than those due to spoilage. For example, flathead with broken bellies (known as "wingy" flathead) are unattractive and are unsaleable as whole fish and may be condemned at the Sydney Fish Market, although the flesh is generally good and saleable as fillets. "Wingy" flathead may give a high GR Torrymeter reading and be considered of satisfactory quality by an inexperienced operator.

The GR Torrymeter is calibrated to give an average reading

based on 16 fish. This means it would be impossible to use the GR Torrymeter to assess the quality of one box of large fish, such as a 30 kg box of gemfish, large snapper or large shark, or a 100 kg consignment of large tuna (3 or 4 fish), thus limiting the use of a GR Torrymeter to small-sized fish. Individual readings taken from less than 16 fish are considered by the manufacturer to be too inaccurate to be used to commercially assess fish quality.

CONCLUSIONS, RECOMMENDATIONS AND GENERAL DISCUSSION

A machine such as the GR Torrymeter would appear to be useful in processing factories, supermarkets or large fish shops where very often inexperienced staff are required to make decisions regarding fish quality. However, it would appear that inexperienced or poorly trained staff would have considerable difficulty interpreting the meter readings and using the machine wisely and safely. Good quality fish could be condemned by inexperienced staff or poor quality fish passed as acceptable. The business' financial resources could be better deployed by training staff to recognize quality or lack of quality and to interpret simple guidelines of quality for commercially important species instead of purchasing a rather expensive machine of limited use.

The GR Torrymeter cannot be recommended for fisheries inspectors on the market floor because (a) the Torrymeter and the data obtained are not reliable enough and (b) the Torrymeter readings are affected by seasonal and other changes in the fish. These changes (which are still poorly understood) mean that the Torrymeter results need to be interpreted with care. Thus the instrument cannot be used by untrained personnel. (c) the GR Torrymeter only measures spoilage as it produces changes in the dielectric properties of the skin of the fish, it cannot assess the many other factors (such as physical damage and appearance) that can determine the acceptability and saleability of fish, (d) GR Torrymeter average readings must be taken from 16 fish, which limits its use to small-size fish or small fish fillets.

For the same capital outlay the market/factory/retail shop staff could be trained to assess fish quality. Experienced, observant, trained staff will assess fish quality quicker and more reliably than this machine.

The assessment of fish quality on the wharf, market floor or retail shop can be assessed quickly and more reliably by trained staff using sensory methods.

One-day workshops at major fishing ports and fish marketing centres would be an inexpensive way to adequately train personnel in the spoilage pattern and sensory evaluation of fish. Such training will still be useful if and when a satisfactory and reliable fish quality meter is available for general use in the fishing industry.

The sensory assessment of fish is not understood by inexperienced or untrained staff. It is important to emphasize that a total sensory assessment involving smell, appearance and touch is required; under special circumstances it is worthwhile tasting the fish to determine just how fresh and marketable they are.

The sensory criteria used to assess fish quality should be related to the species in question. The criteria for mullet and flathead (usually sold as whole fish) must be different from that of snapper (sold as gilled and gutted fish). Completely different criteria again may be required for gemfish and shark because these species are usually retailed as fillets.

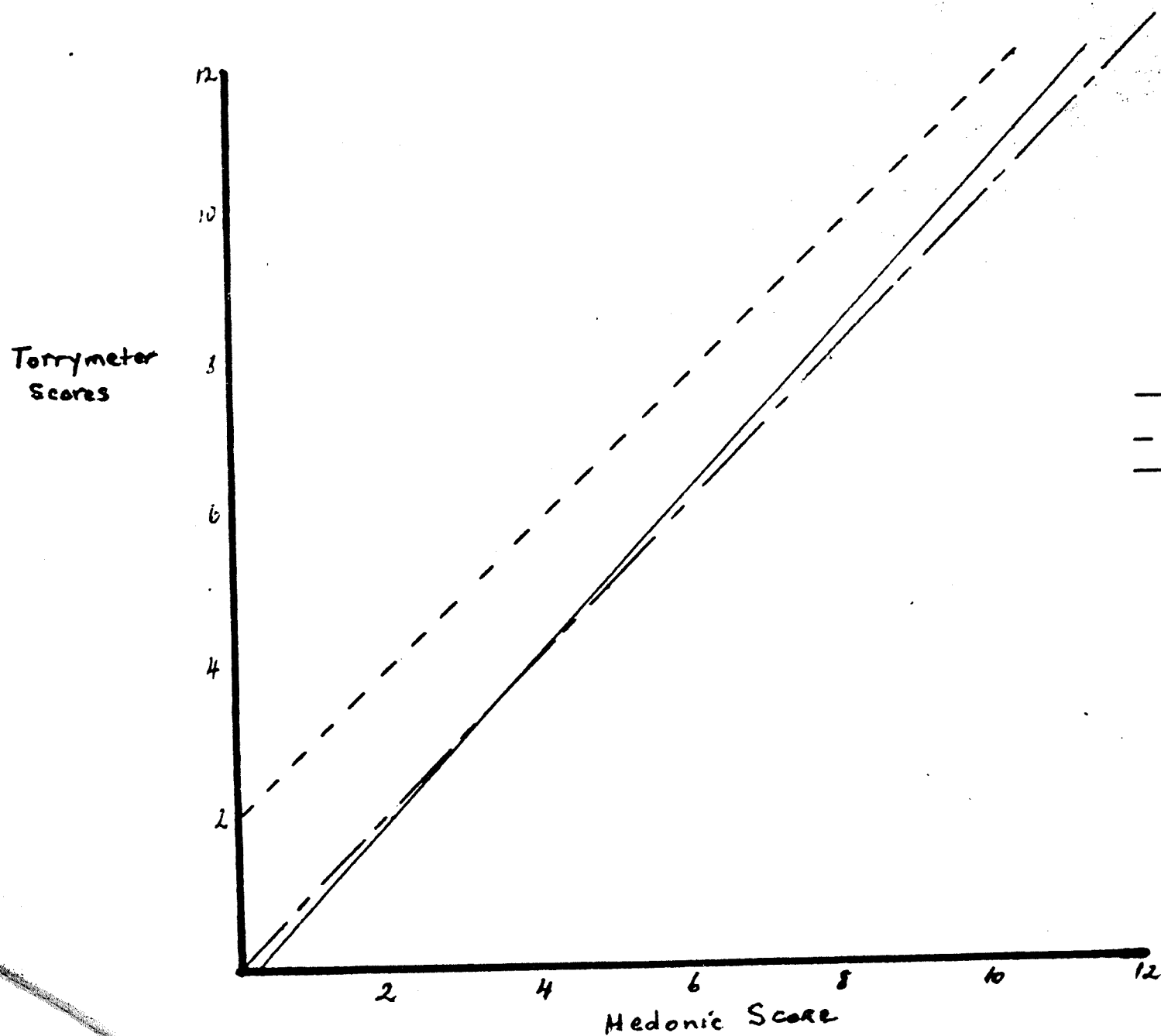
Quality assessment guidelines need to be prepared for major commercial species. These guidelines could be similar to the draft guidelines we have prepared for flathead (Appendix I) following our research on this species. Such guidelines could be used in any commercial situation - wharf, market floor, processing factory, supermarket or large retail fish shop.

We feel that the development of such guidelines would be most useful to the industry, for both new comers and "old hands" alike.

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Fig. 1



Relationship between
Torrymeter Scores and
Hedonic Scores for
Tiger Flathead

——— Oct/Nov 1977 (I)
----- Nov/Dec 1978 (II)
- . - . - JUNE 1978 (III)

$$\begin{aligned} \text{(I)} \quad y &= 0.9168 + 0.3232x \\ r &= 0.8594 \\ \text{(II)} \quad y &= 1.9377 + 0.9541x \\ r &= 0.9837 \\ \text{(III)} \quad y &= 0.0715 + 0.9940x \\ r &= 0.9045 \end{aligned}$$

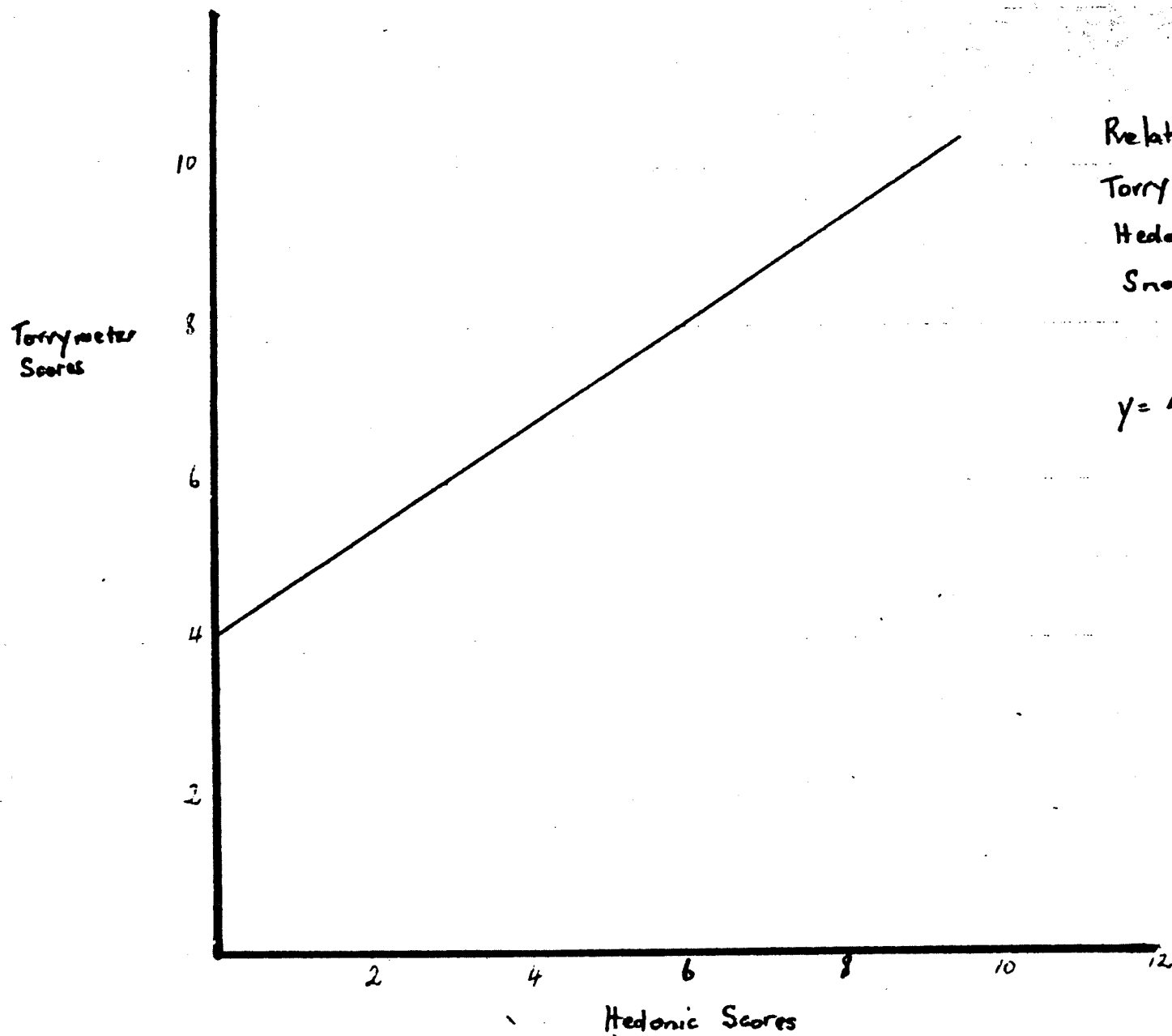
Appendix I

A draft description of the spoilage pattern observed in Tiger flathead and a suggested grading system.

- "A" Grade Fish: Fish clean smelling and covered with thick mucus.
Eyes convex and surrounded by yellow ring.
Upper side of fish has strong brown colour and most scales attached.
Gills bright red-brown colour and covered with thick slime.
Flesh firm and springy when touched.
-- Usually only 1 or 2 days old.
- "B" Grade Fish: Fish clean smelling and covered with thin mucus.
Eyes sinking in some fish and going cloudy.
Many fish losing strong brown colour and scales.
Gills on some fish more brown than red.
Brown stains evident on belly of some fish.
Flesh softening and losing springiness.
-- Usually 3 or 4 days old.
- "C" Grade Fish: No mucus on fish but some fish have offensive smell.
Eyes sunken and cloudy in most fish.
Most fish have pale colour and few scales.
Gills on most fish brown rather than red.
Most fish have brown stained belly and thin belly wall.
Flesh soft in most fish.
-- Usually about 7-8 days old.
- "D" Grade Fish: Almost all fish covered with thick slime and have offensive smell.
Eyes sunken and cloudy in almost all fish.
Almost all brown colour and scales lost from most fish.
Gills brown and smelly.
Belly on all fish stained brown, belly wall torn in some fish.
All fish with soft flesh and no springiness.
-- Usually more than 9 days old.

"A" and "B" Grade fish are suitable for general use,
"C" Grade fish are suitable for filleting only and "D" Grade fish are unfit for human consumption.

Fig. 2.



Relationship between
Torrymeter Scores and
Hedonic Scores for
Snapper

$$y = 4.5406 + 0.5973 X$$

$$r = 0.8845$$

Fig. 3

Relationship between Torrymeter Scores and Hedonic Scores for Sea Mullet

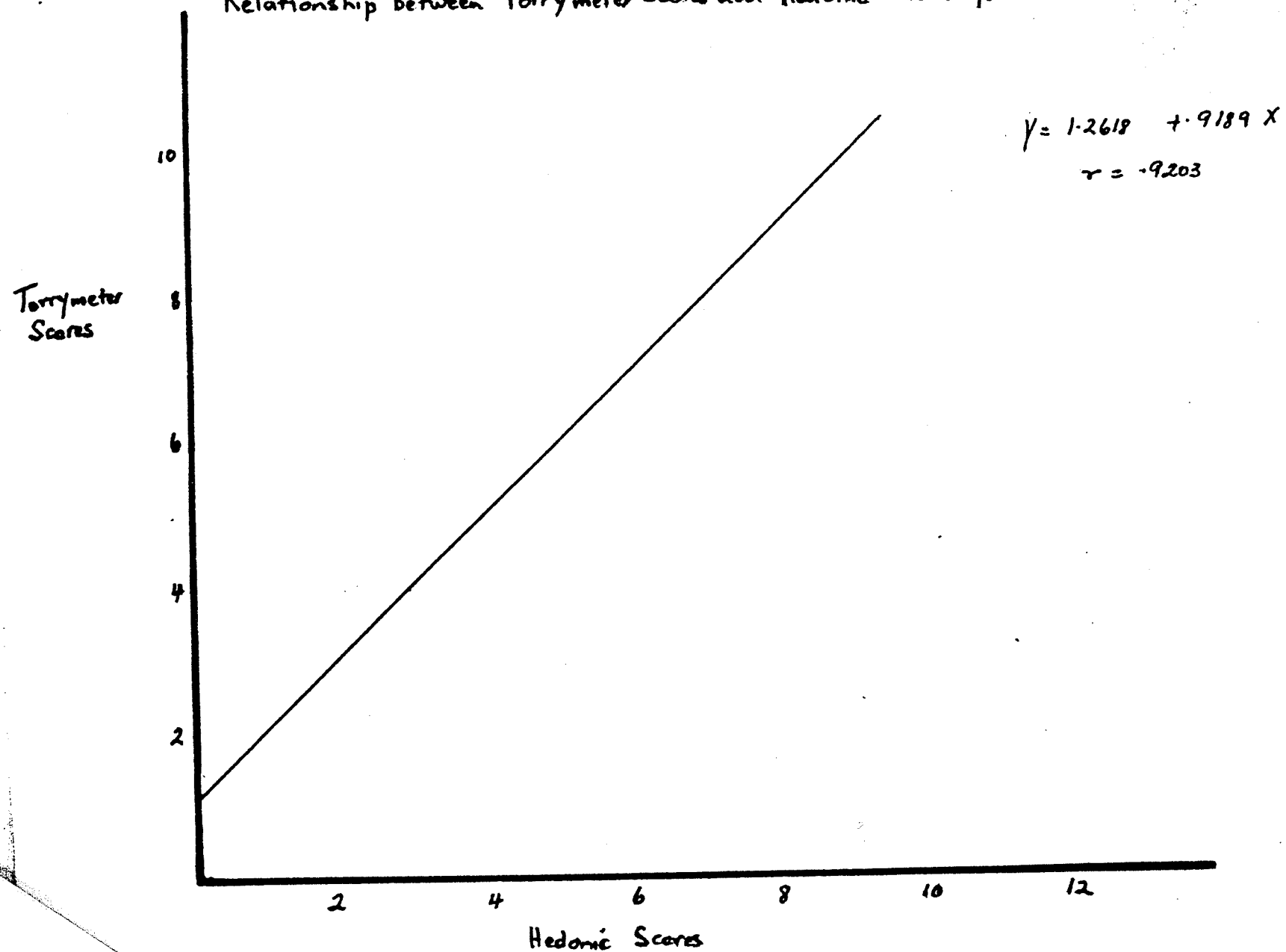


Fig. 4

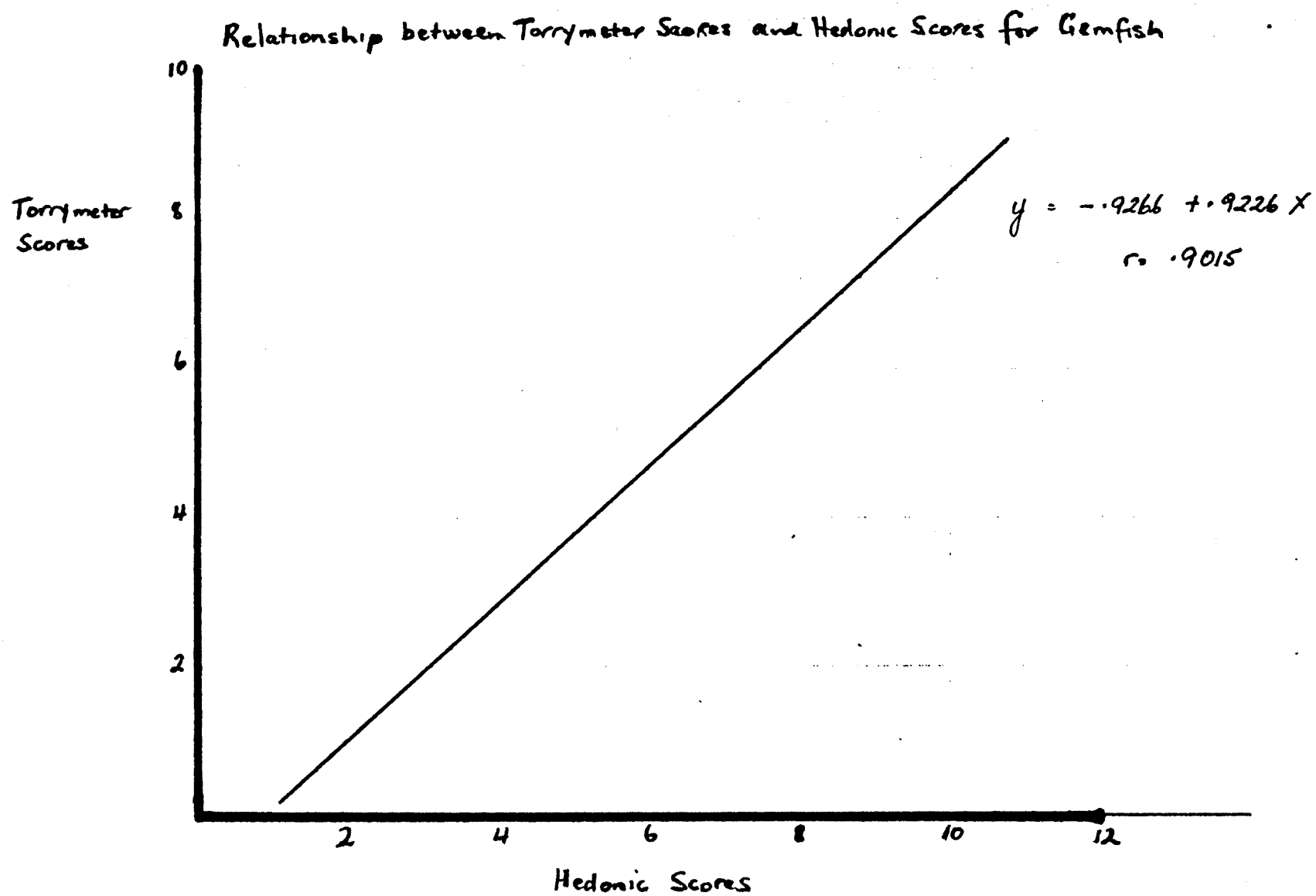


Fig. 5.

The G R International Fish Freshness Meter
(Torrrymeter) applied to a snapper.



Fig 6 missing in FIRTA report

Fig. 7.

Suggested Grading of Spoiling Flathead - (ventral view)

"A" grade fish in a very fresh condition; note the white skin of the belly; "C" grade fish suitable only for filleting; note the brown stains on the belly.

(yes, quite clearly.)

