



# Yield Indices for Meat in Pre-processing of *Nemipterus japonicus* (Bloch, 1791)

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## Abstract

*Nemipterus japonicus* is preferred for production of surimi in India and in other Asian countries as the surimi produced from this fish is of high grade with white colour. The yield of processed or semi-processed product in processing of this fish is a subject of prime importance. An attempt was made to establish relationships between meat yield and quantity of raw material used for processing, for facilitating appropriate managerial decision in surimi industry. *Nemipterus japonicus* specimens collected for the study were grouped in three length groups and were processed further with straight as well as inclined cut dressing style. The weight of scale, fin, head, meat and bone were recorded for both the dressing styles, and belly flap weight was additionally recorded for the straight cut dressing style. Average meat yield increased as the fish grew while the head weight decreased. The highest average meat yield recorded in 15-21 cm length group for straight cut and inclined cut were 50.57% and 52.10% respectively. The highest average head weight was recorded in 5-10 cm length group for straight cut (29.38%) and inclined cut (37.24%) dressing styles. Scale and other waste did not show increasing or decreasing trends with growth of *N. japonicus*. Nomographs were developed to predict the meat yield for various length groups as well as for pooled length group for both straight and inclined cut dressing styles.

**Keywords:** *Nemipterus japonicus*, yield indices, surimi, nomograph, inclined cut, straight cut

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## Introduction

Threadfin breams being low cost fish have gained great demand in Indian surimi industry. Surimi produced from threadfin bream fetches higher price because of its whitish colour, low fat content, better gel strength and high myosin content. As *Nemipterus japonicus* is the major constituent of the threadfin breams used in the surimi processing industry it was selected for the present study. *N. japonicus* has been studied widely on various aspects like maturity, spawning and fecundity (Dan, 1977; Acharya, 1990), biology (Murty, 1984; Samuel, 1990; Raje, 2002; Manojkumar, 2004) and population dynamics (Vivekanandan & James, 1986; Zacharia, 1998). There have been no attempts to establish the quantitative meat yield and other body parts indices of this species, in spite of its significant contribution to marine fish landing and its large scale use in the surimi industry.

Surimi industry is capital-intensive and produces huge amount of waste consisting of scales, bones, fins, viscera, belly flaps and head portion. It is a well-known fact that the waste produced during the production of surimi can be used as raw material for other subsidiary industries such as pearl essence, poultry feed, shrimp feed and organic fertilizer. To make the industry profitable proper management right from the procurement of raw material to finished product is quite essential. Thus, an attempt was made to quantify the amount of meat as well as other waste material produced during surimi production on the basis of morphometric relationships, and nomographs were developed as ready reckoners for production managers in surimi industry.

## Materials and Methods

*Nemipterus japonicus* (Bloch, 1791) specimens were collected from Ratnagiri landing centre in

Maharashtra. The collected specimens ranged from 5.70 to 20.95 cm in total length and were aggregated into three groups *viz.*, 5-10, 10-15 and 15-21 cm. The total length (Vivekanandan & James, 1984) was recorded to a precision of 0.5 mm. After removal of excess water the total weight was recorded to the nearest of 0.1 mg on electronic balance. Beheading was done in two different dressing styles *viz.*, straight cut or inclined cut to record weight of head. A total of 143 specimens were dressed by straight cut (Fig. 1a) and 160 were dressed by inclined cut (Fig. 1b) dressing style. The weight of scales and the fins were recorded separately. Weight of viscera and belly flaps was recorded separately in the case of straight cut. The weight of meat and bones was also recorded separately after cutting the fish in two halves parallel to the centre bone. Weight of fins, gut, bones and belly flaps together formed the total waste in the case of straight cut dressing style, while weight of fins, gut and bones together formed the total waste in the case of inclined cut dressing style.

Indices for meat and different body parts were estimated by percentage analysis. ANOVA was applied to test the significance ( $p < 0.05$ ) of the average values of weight of meat and other waste material. Student-Newman-Keuls test was applied to test the significant differences in pairs of mean wherever significant difference in ANOVA was observed (Zar, 2005). Nomographs were constructed on total weight, meat weight, scale waste and total waste of *N. japonicus* separately for straight and inclined cut dressing styles for 5-10, 10-15, 15-21 cm length groups as well as separately for inclined and straight cut dressing styles after pooling grouped data.

## Results and Discussion

The estimated percentage meat yield, scale waste and total waste in *N. japonicus* according to dressing style and length groups are summarised in Table 1. The estimated percentage meat yield was less for straight cut dressing style (49.16%) than that for inclined cut dressing style (51.21%). The average meat yield was the highest in the largest length group. Meat yield in 15-21 cm length group was 50.57% for straight cut and 52.10% for inclined cut dressing style whereas, the lowest percentage of meat yield was recorded in the smallest length group in 5-10 cm and the estimated values of meat yield were 47.73% for straight and 49.86% for inclined cut dressing style. ANOVA revealed significant difference in the meat yield of various length groups ( $P < 0.05$ ), similarly t-test also revealed significant difference in the meat yield of the straight and inclined cut dressing styles ( $P < 0.05$ ). Therefore, the surimi industry can utilise fishes more than 15 cm to improve meat yield, which will also help in sustaining the fisheries of *N. japonicus* as the first spawning occurs at the size of 15.5 cm total length (Acharya & Dwivedi, 1981). Arroyo et al. (1976) while working on the milkfish also observed more meat yield (64.69%) in highest weight group (1001-1200 g) and minimum percentage of meat yield (53.69%) in the lowest weight group (1-200 g).

The head weight recorded in inclined cut dressing style was more than head weight recorded in straight cut dressing style, though most of the portion of gut and belly flaps were removed along with the head in inclined cut dressing style. The

Table 1. The percentage meat yield, head waste, scale and total waste  $\pm$  Standard Deviation for straight and inclined cut dressing styles of *N. japonicus* for different length groups

Body portion	Dressing style	Length groups			Pooled
		5-10 (cm)	10-15 (cm)	15-21 (cm)	
Meat yield	Straight cut	47.73 $\pm$ 2.39	48.72 $\pm$ 3.24	50.57 $\pm$ 2.37	49.16 $\pm$ 2.91
	Inclined cut	49.86 $\pm$ 2.20	51.37 $\pm$ 2.79	52.10 $\pm$ 2.98	51.21 $\pm$ 2.82
Head waste	Straight cut	29.38 $\pm$ 2.28	27.49 $\pm$ 2.50	26.22 $\pm$ 1.76	27.50 $\pm$ 2.43
	Inclined cut	37.24 $\pm$ 2.40	35.63 $\pm$ 2.39	34.27 $\pm$ 2.71	35.58 $\pm$ 2.74
Scale waste	Straight and inclined cut	4.78 $\pm$ 0.79	4.73 $\pm$ 0.56	4.98 $\pm$ 0.41	4.84 $\pm$ 0.60
Other wastes	Straight cut	17.91 $\pm$ 1.81	19.08 $\pm$ 2.04	18.25 $\pm$ 2.48	18.46 $\pm$ 2.21
	Inclined cut	8.29 $\pm$ 1.28	8.31 $\pm$ 1.16	8.69 $\pm$ 1.51	8.44 $\pm$ 1.34

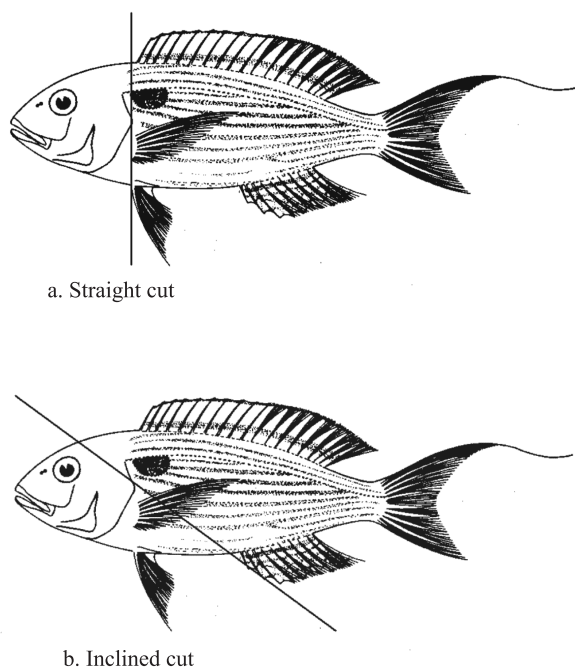


Fig. 1. Dressing styles

estimated percentages of head waste were 27.50 and 35.58% for straight and inclined cut dressing styles, respectively. The average head weight of *N. japonicus* decreased with increase in total weight and estimated average head weight for 5-10, 10-15 and 15-21 cm length groups were 29.38, 27.49 and 26.22% respectively for straight cut dressing style, while those were 37.24, 35.63 and 34.27% for inclined cut dressing style for 5-10, 10-15 and 15-21 cm length groups, respectively. The analysis of variance showed significant difference among all the three length groups for straight and inclined cut dressing styles ( $P < 0.05$ ). Arroyo et al. (1976) reported that average percentage head weight of milkfish decreased as total weight increased.

Scale weight of *N. japonicus* for various length groups did not show increasing or decreasing trend in relation to growth of fish. The estimated scale waste was 4.84% for both the dressing styles. The highest scale waste in *N. japonicus* was recorded in 15-21 cm length group (4.98%) whereas minimum was recorded in 10-15 cm length group (4.73%).

The waste in inclined cut dressing style (8.44%) was relatively less than that of straight cut dressing style (18.46%) as in inclined cut dressing style major portion of gut and belly flaps was removed with head and was accounted in head weight. Total waste

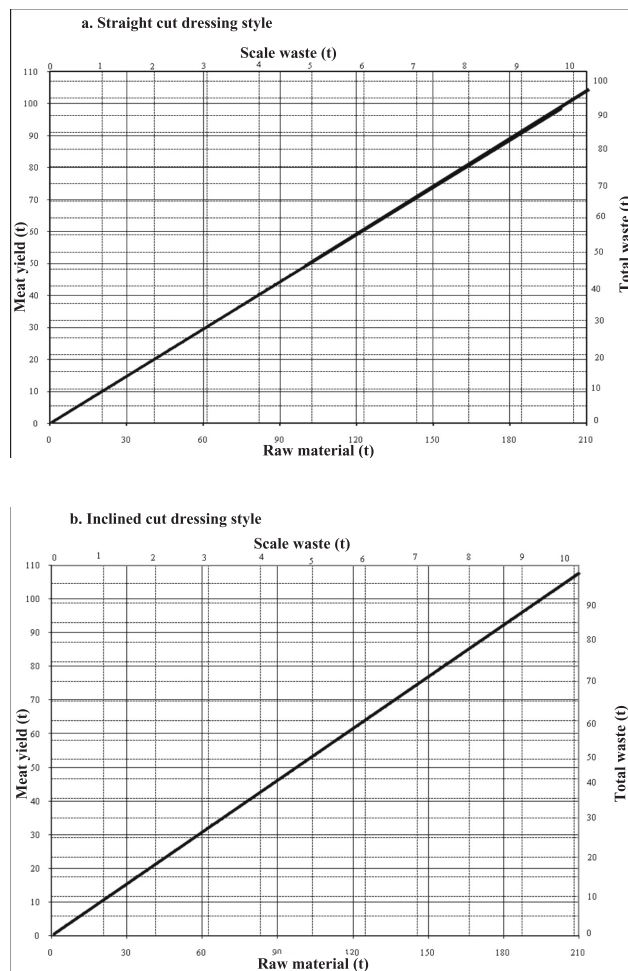


Fig. 2. Nomograph on raw material, meat yield and scale waste of *Nemipterus japonicus* - pooled data

showed increasing trend with size of fish in inclined cut dressing style whereas in straight cut dressing style total waste was maximum in 10-15 cm length group and thereafter it went on decreasing in larger length group. Arroyo et al. (1976) worked out dressing waste of milkfish separately for skin, bones, tail and entrails and reported that skin waste increased initially up to 600 g (fish weight) whereas bone weight and tail weight decreased up to 600 g. Entrails weight showed decreasing trend for all the weight groups with growth (Arroyo et al., 1976) and similar trend was observed in the present study also.

Nomography is a tool used to visualise the interrelationship between more than two variables in two-dimensional space. Nomographs were developed for meat yield, scale weight, head weight and total waste with respect to total weight on the basis

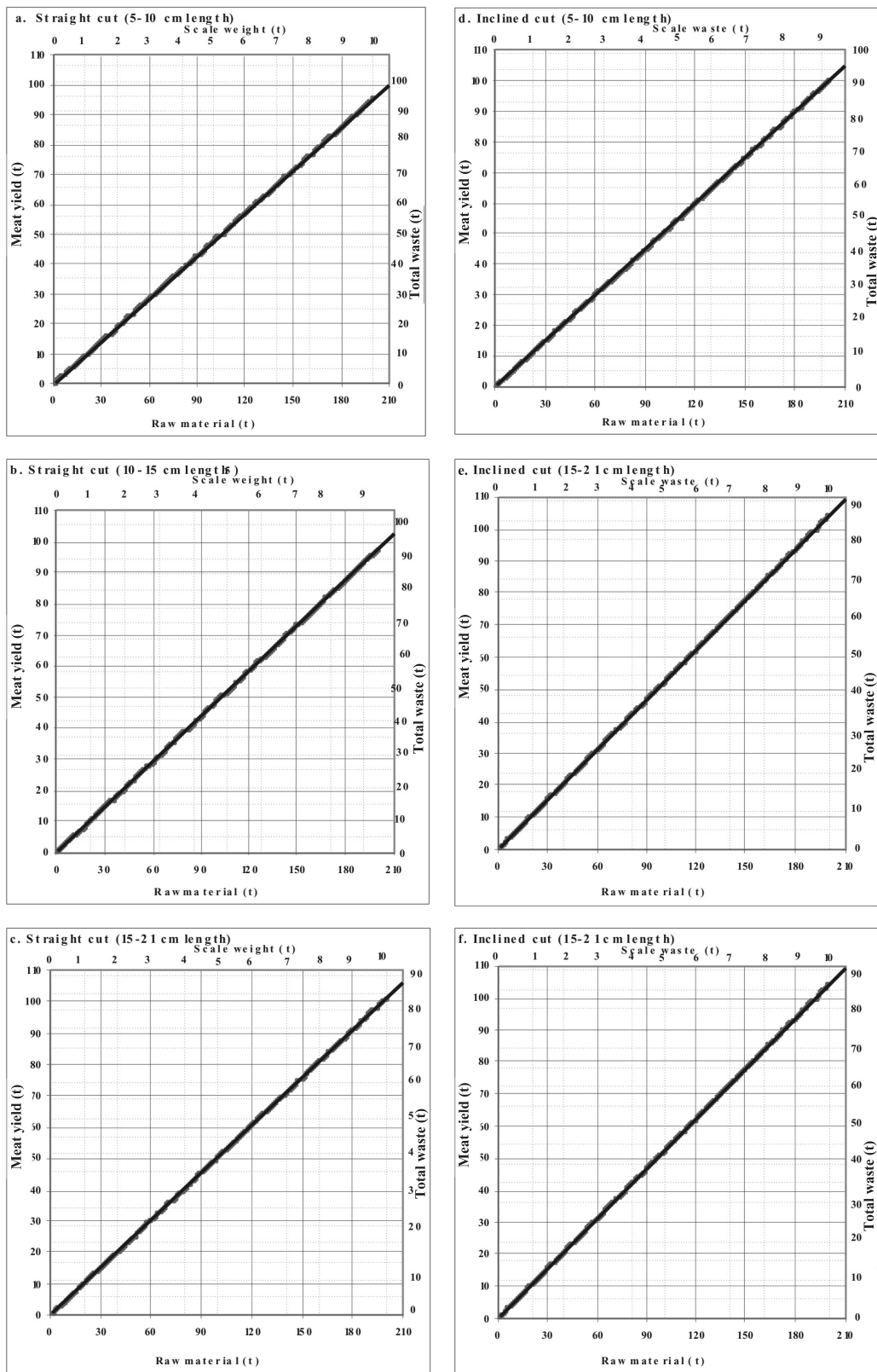


Fig. 3. Nomograph on raw material, meat yield and scale waste of *Nemipterus japonicus* for different length groups

of relationships established between them. These were plotted separately for pooled data of straight and inclined cut (Fig. 2. a & b) dressing styles as well as for each length group of both the dressing styles (Fig. 3. a, b, c, d, e & f). Nomographs were developed with a specific intention to help the processing managers of the surimi industry. Therefore, the scale is extrapolated to tonnes, as large quantity of material is processed in surimi industry.

The indices of meat and waste were developed for both the straight and inclined cut dressing styles. It was expected to get certain variations in indices due to size of fish. Therefore, indices were estimated separately for 5-10, 10-15 and 15-21 cm total length groups and common nomographs were also established since the fish was cut in the factory without segregation.

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