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CHEMICAL COMPOSITION OF MEAT AND SENSORY QUALITY OF CANNED MEAT AND FROZEN MEAT FROM HARP SEAL (PHOCA GROENLANDICA) IN MOLTING AND PRE-MOLTING CONDITON

by

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ABSTRACT

Botta, J.R., E. Arsenault, H.A. Ryan, and N. Shouse. 1982. Chemical composition of meat and sensory quality of canned meat and frozen meat from harp seal (Phoca groenlandica) in molting and pre-molting condition. Can. Tech. Rep. Fish. Aquat. Sci. 1053:iv + 18 p.

Meat, of different carcass cuts, from molting and pre-molting seals of different ages was chemically analyzed. Portions of each cut of meat were: (a) canned with seasoning; (b) canned without seasoning; and (c) frozen prior to being assessed by a sensory evaluation panel. The ash, fat and protein content of meat from molting harp seal was not significantly different than that of pre-molting animals. However, moisture content of meat from molting animals was significantly higher than that from pre-molting seals, while carbohydrate level was significantly lower. Regardless of the manner of processing, judges preferred meat from molting seal. The greatest effect was with meat canned without seasoning and the least effect was with frozen meat. Both the age of the seal and the type of carcass cut influenced the effect of molting on the sensory quality of the meat.

Key Words: canned, composition, frozen, harp seal, meat, molting, Phoca groenlandica, pre-molting, quality.

RÉSUMÉ

Botta, J.R., E. Arsenault, H.A. Ryan, and N. Shouse. 1982. Chemical composition of meat and sensory quality of canned meat and frozen meat from harp seal (Phoca groenlandica) in molting and pre-molting condition. Can. Tech. Rep. Fish. Aquat. Sci. 1053: iv +18 p.

La composition de la chair de différentes coupes de phoques avant et en mues, a été chimiquement analysée. La chair mise en conserve, avec et sans assaisonnement ou congelée, évaluée par des juges par évaluation sensorielle. Le contenu des cendres, gras et protéines dans la chair de phoque en mue ne fut pas significativement différente de la chair de phoque avant la mue. Le taux d'humidité fut significativement plus élevé dans la chair de phoque en mue que dans la chair de phoque avant le mue, alors que pour le contenu en glucides ce fut l'inverse. Indépendamment de la méthode de traitement, les juges préféraient les phoques en mue. La différence fut plus grande pour la chair mise en conserve sans assaisonnement alors que la différence a été moins pour la chair congelée. L'âge des phoques et le type de coupe influèncerent l'effet de la mue sur la qualité sensorielle de la chair.

INTRODUCTION

Harp seals are traditionally hunted in the Newfoundland area until mid-May. However, beginning in early April and continuing for approximately 4 to 6 weeks, seals 1-year old and older shed their hair, reduce feeding substantially and hence lose up to 20% of their blubber (D. Bowen, Department of Fisheries and Oceans, Research and Resource Services, St. John's, Nfld; Pers. Comm.). Consequently, during this molting season, harp seals are emaciated and in general appear of inferior quality when compared to animals caught during February and March. In recent years, there has been considerable effort by the Inspection and Technology Branch to improve the quality of seal meat available for human consumption (F. Slade, Department of Fisheries and Oceans, Inspection and Technology Branch, St. John's, Nfld; Pers. Comm.), and substantial discussion regarding the suitability of meat from molting seal for human consumption has resulted (D. White, Department of Fisheries and Oceans, Inspection and Technology Branch, St. John's, Nfld; Pers. Comm.).

Consequently, it was decided to investigate the chemical composition and sensory quality of meat from harp seals in pre-molting and molting condition.

MATERIALS AND METHODS

RAW MATERIALS

Bedlamers and old harps in pre-molting condition were shot on February 25 and 26, March 27 and 28, 1981, in the Southern Labrador area (NAFO Div. 2J); molting seals were shot on April 30 and May 4, 1981, in the Straits of Belle Isle (NAFO Div. 4R).

All animals were immediately bled and shortly thereafter, eviscerated, skinned, washed in seawater, placed inside heavy-duty plastic bags and stored in ice until butchered six days later. The sex of each carcass was determined prior to evisceration and the age was determined by counting, under polarized light, the dentinal annuli of thinly sectioned (approximately 100 μ thick) canine teeth (Fisher 1954). All carcasses were butchered into the various cuts shown in Fig. 1. The flank, flipper and rump were retained, the surface fat trimmed off and the excess blood removed by cool water rinses. The trimmed and rinsed cuts were then divided and treated as described below.

One quarter of the flank, flipper or rump was immediately plate frozen, then individually vacuum packaged using a CDL model 212 vacuum sealing machine and stored at -40°C (-40°F) for subsequent sensory evaluation. The vacuum, seal and cool settings were 2, 2, and 1.5, respectively; and during packaging, the vacuum level reached 71.3 cm (28.0 in) of mercury.

One quarter of the flank, flipper, or rump was individually trimmed of meat of which 225 g (0.5 lb) was placed in a one-half-pound capacity cylindrical can, then vacuum sealed and thermally processed.

One quarter of the flank, flipper, or rump was individually trimmed of meat, of which 225 g was placed in a one-half-pound capacity cylindrical can with approximately 10 g(0.35 oz) of chopped onion and 3.5 g (0.12 oz) salt, vacuum sealed and thermally processed. All cans were processed at 115.5°C (240°F) for 80 min, the lowest initial temperature of the products was 18.3°C (65°F) giving a total $F_{(o)}$ value of 7.4.

One quarter of the flank, flipper or rump was individually trimmed of meat which was passed three times through a meat grinder with 7 mm diameter holes, transferred to a 450 ml (15.8 oz) capacity plastic tub with a tight-fitting lid, then frozen and stored at -30°C (-22°F). Moisture determination of each sample was initiated within three days of its being frozen.

CHEMICAL ANALYSIS

Moisture content was determined by placing 30-60 g (1.1-2.1 oz) of ground seal meat into a pre-weighed glass dish, maintaining the sample in a 100°C (212°F) hot-air oven for two days and then reweighing it. The determination was repeated if the difference between duplicate samples was more than 1.0%. The dried sample was immediately passed through a mill containing a 20 mesh screen, promptly transferred to a plastic vial with a screw cap and stored for further analysis.

Crude fat, crude protein and ash content of the dried samples were determined using methods described by AOAC (1975). Total carbohydrate was determined by subtraction.

SENSORY ANALYSIS

All canned seal (canned plain or canned with onion and salt added) was individually emptied into an aluminum tray covered with aluminum foil and baked in a conventional oven at 177°C (350°F) for 15 min.

All frozen samples previously cut into 19 cm x 5 cm x 10 cm (7.5 in x 2 in x 4 in) size units were removed from -40°C, individually placed in an aluminum tray, covered with aluminum foil and baked in a conventional oven at 232°C (450°F) for 100 min.

Once cooked, all samples were immediately placed in pre-warmed labelled glass petri dishes and placed on an electric warming tray.

Except for the 3-year-old combinations, each age x cut treatment combination was presented to three different panels of eight judges and evaluated using a triangle test (Table 1). The 3-year-old combinations

were presented to one panel of eight judges. At any one session, each judge was presented with three samples (two from seal in pre-molting condition and one from seal in molting condition, or two from seal in molting condition and one from seal in pre-molting condition) all from seal of the same sex, age and cut but from separate carcasses. They were then asked to choose which sample was different from the other two. All samples were evaluated within 15 minutes and all sessions were completed by August 1, 1981.

STATISTICAL ANALYSIS

The variation in the chemical data was analyzed by considering the effects of condition, individual seals, and carcass cuts. The seals formed a random sample from populations of harp seals in molting and pre-molting condition. In the analysis of variance design, seals were nested within condition and both carcass cut and condition were considered fixed effects. If the analysis indicated a significant ($P \leq 0.05$) difference among carcass cuts, the Studentized Range Test (Snedecor and Cochran 1980) was conducted to determine differences within this main effect.

Since the triangle test is based on the assumption that if there is no detectable difference, the "different" sample will be selected by chance one-third of the time, the results of the present sensory evaluations were analyzed by comparison with tabulated values (Larmond 1977).

Unless otherwise stated, "significant" means significant at the 5% level (i.e. the probability of the difference occuring by chance alone is 5%).

RESULTS AND DISCUSSION

CHEMICAL COMPOSITION

Condition (molting or pre-molting) of the seal did not significantly affect ash, fat or protein contents but the 73.73% moisture content of molting seal was significantly (at the 1% level) greater than the 72.95% moisture content of seal in pre-molting condition (Table 2). The 0.66% total carbohydrate content of the molting seal was significantly (at the 5% level only) lower than the 1.07% carbohydrate content of seal in pre-molting condition. However, the ash, carbohydrate, fat, moisture and protein contents did significantly differ among individual seals.

The carbohydrate, fat, moisture and protein contents, but not the ash content, varied significantly with carcass cut (Table 2). The 1.07% carbohydrate content of the flank was significantly greater than the 0.66% carbohydrate content of the flipper but not significantly greater than the 0.84% content of the rump (Table 2). Also, the amount of carbohydrate contained in the flipper was not significantly different from that of the rump (Table 2). The 1.10% fat content of the flipper was significantly greater than the 0.60% fat content of the flank, but significantly less than the 1.74% fat content of the rump (Table 2). The 72.24% moisture content of the flipper was significantly greater than the 73.27% moisture

content of rump which in turn was significantly greater than the 72.52% moisture content of the flank (Table 2). The flank also contained 24.66% protein which was significantly greater than the 23.01% and 22.81% protein of the rump and flipper, respectively, which did not significantly differ from each other (Table 2).

SENSORY QUALITY

Harp seal meat canned plain without seasoning

With each age group and each type of cut, there was a significant difference between samples from harp seal in molting and pre-molting condition (Table 3). With regard to 1- and 2-year-old seal, only a slight plurality of judges, who correctly identified the different sample, favored samples from seal in molting condition; in the case of older seal, particularly those 4 years and older, a large majority of judges favored samples from seals in molting condition (Table 3). The number of judges who had no preference was considerable when the younger seal were evaluated, but modest with older seal.

When carcass cuts were considered, a majority of judges, who correctly identified the different sample, favored flank, flipper and rump from seal in molting condition; a modest minority preferred samples from seal in pre-molting condition or had no preference (Table 3).

In general, when a judge correctly identified the different sample, the magnitude of difference between the duplicate and different samples was assessed as slight to moderate. A preference for a particular sample was usually based largely on flavor and texture. The samples from seal in pre-molting condition were often tougher than those from seal in molting condition. Appearance and odor were usually not dominant factors influencing sample preference.

A large majority of all samples correctly identified were rated acceptable (Table 4). However, substantially fewer samples from seals in pre-molting condition than from seals in molting condition were rated acceptable (Table 4).

Harp seal meat canned with onions and salt added

There was a significant difference between samples from seal in molting and pre-molting condition for seal 1-3 years old but not for seal 4 years old and older (Table 5). Similarly, when carcass cuts were considered, rump, but not flank and flipper from molting seal significantly differed from those from pre-molting seal (Table 5). Although the condition of the seal significantly affected the sensory quality of certain cuts and age groups, the magnitude of difference was generally assessed as only slight to moderate.

Among the ages that were significantly affected by the condition of the seal, the judges' preferences were not consistant (Table 5). In the case of samples from 1-year-old seal, preference was evenly divided between molting and pre-molting seal and the number of judges having no preference was very modest (Table 5). In regard to samples from 2-year-old seal, a substantial majority of judges preferred samples from seals in molting condition; with 3-year-old seal, a slight majority of judges preferred samples from seal in pre-molting condition.

An appreciable majority of judges, who correctly identified the different sample, favored rump from seals in molting condition to that from seal in pre-molting condition. Flavor and texture rather than odor or appearance were the major reasons for preferring a particular sample. Samples from seal in molting condition were often slightly more moist and tender than samples from seal in pre-molting condition.

The vast majority of all samples correctly identified were rated accetpable (Table 6). The samples from molting and pre-molting seal did not consistantly differ in acceptability.

Harp seal meat frozen prior to cooking

The condition of harp seal significantly affected the sensory quality of seal 2 years old but not that of the other ages studied (Table 7). Like seal meat canned with onions and salt added, rump, but not flank and flipper, from seal in molting condition signficantly differed from that in pre-molting condition (Table 7).

In the case of samples from 2-year-old seal, a large majority of judges who correctly identified the different sample, favored samples from seal in molting condition, and only a modest minority favored samples from seal in pre-molting condition or had no preference (Table 7). Regarding rump, a large minority of judges favored samples from seal in molting condition, a similar number had no preference, and a smaller minority preferred samples from seal in pre-molting condition (Table 7). Thus, with rump frozen prior to cooking, the condition of the seal did not conclusively affect the judges' preference.

Flavor and texture, but not appearance and odor, were important factors affecting the judges' preference for a specific sample. In general, when a significant difference existed the samples from seal in pre-molting condition were drier and tougher than those from seal in molting condition.

Although the majority of samples from 1-year-old seal were not acceptable, a substantial majority of samples from all other age groups and all types of cuts were rated acceptable (Table 8). Except for the samples from seal 3 years old, noticeably fewer samples from seal in pre-molting condition than from seal in molting condition were rated acceptable (Table 8).

GENERAL DISCUSSION

Comparing the present results with those previously reported for seal in pre-molting condition (Botta et al. 1982), the fat and protein contents are very similar; the moisture content of pre-molting seal is similar; the moisture content of molting seal is slightly higher, and ash contents of seal in both molting and pre-molting condition are noticeably lower (Table 2). The manner in which carcass cut affected ash, fat and protein contents is very similar to that already observed; however, the effect of carcass cut on moisture content is slightly different from that previously reported (Table 2 and Botta et al. 1982). In the present study, all three cuts significantly differed in moisture content; in the former, flipper was significantly different from the other two cuts in this respect.

In general, the chemical composition of harp seal in both molting and pre-molting condition is comparable to or better than that reported for fish and for domesticated terrestrial animals (Paul and Southgate 1978). However, it is very interesting to note that all of the chemical variables differed significantly among individual seals.

Statistically, molting of the harp seal significantly increased moisture content but, as the mean moisture content of seal in pre-molting condition was only 0.78 percentage points less (Table 2), this difference may not be of practical importance. However, particularly with the seal meat canned with salt and onions added, there were numerous comments that the meat from pre-molting seal was drier, and texture was a major factor concerning preference. In general, the judges preferred the molting samples which had a significantly greater moisture content.

Likewise, statistically, molting of seal significantly decreased total carbohydrate content of the meat, but the mean carbohydrate content of seal in pre-molting condition was only 0.41 percentage points greater (Table 2) suggesting that the practical importance is questionable. With domesticated terrestrial animals, a decrease in the level of glycogen (the major carbohydrate in meat) causes a decrease in the acidity of the meat which, in turn, may increase both the capacity of the meat to bind water and its tenderness (Paul 1972; Lawrie 1974). Although the acidity of the meat was not measured during the present study, molting of the seal caused a significant decrease in the carbohydrate (including glycogen) content of the meat, an improvement in water binding capacity (as evidenced by the judges' comments and significantly greater moisture content), and an increase in tenderness (as evidenced by the judges' comments).

Concerning general acceptability, the meat canned with salt and onions added was clearly the most acceptable and the meat frozen prior to cooking the least acceptable (Tables 4, 6 and 8). In addition, the condition of the seal affected the acceptability of the meat when it was frozen or canned plain, but not when canned with onions and salt added, presently the most common form of commercial preservation (Tables 4, 6 and 8). This substantiates a previously-stated observation that flavor, as well as texture, was an important factor regarding acceptability. The relatively low acceptability of the samples that had been frozen may have been at least partially due to the rapid thawing/cooking prior to sensory evaluation. This may also partially account for the fewer differences observed with the samples which had been frozen (Table 7).

It should be stressed that as regards sensory evaluation, the only difference between the odd and duplicate samples was the condition (molting or pre-molting) of the seal prior to killing. All samples (at any one sensory evaluation session) were of the same cut, were from seal of the same age, sex and post mortem age, and were handled/processed in an identical manner.

Although the data regarding 3-year-old seal are included in this report, it should be interpreted somewhat cautiously as the number of seals studied was very small. However, except for the fact that meat of 3-year-old seal in pre-molting condition (canned with salt and onions added) was preferred to that from seal in molting condition, the results followed the general trends observed with the other three age groups (Tables 3-8).

Similarly, although the results regarding preference and acceptability were reported and discussed in detail, it must be remembered that these data resulted from secondary questions and should be interpreted more cautiously than those resulting from the primary question, i.e. is there a difference? However, it should be noted that both preference and acceptability data were relatively consistent.

It should be stressed that these results were obtained in a laboratory study conducted under well-defined conditions. Under commerical conditions, the results will not necessarily be the same. In addition, it should be remembered that the sensory quality was evaluated not by a consumer panel or through test marketing, but by a laboratory panel whose assessment will not necessarily agree with that of the general public. Consequently, the report should be viewed as an intermediate one.

CONCLUSIONS

A laboratory study designed to investigate the suitability of meat from harp seal in molting condition for human consumption was conducted.

When the chemical composition of meat from seal in molting condition was compared to that of meat (similar carcass cut) from seal (similar age and sex) in pre-molting condition handled in an identical manner: (1) the ash, fat and protein contents were not significantly different; (2) the moisture content was significantly greater in meat from molting seal; and (3) the carbohydrate content was significantly less in meat from molting seal.

When the sensory quality of meat from seal in molting condition was compared to that of meat from seal in pre-molting condition: (1) meat, from molting seal, canned without seasoning was different and superior according to preference as well as the number of samples rated acceptable; (2) meat, from molting seal, canned with salt and onions added was moderately different and slightly preferable; and (3) meat, from molting seal, frozen prior to cooking was only slightly different and very slightly superior. Only when the meat was canned without seasoning did age of the seal and type of carcass cut not affect the difference between molting and pre-molting seals.

Meat from seal in pre-molting condition, particularly when canned, was quite acceptable.

Consequently, the present laboratory study indicated that meat from seal in molting condition is different from and slightly superior to meat from seal in pre-molting condition and certainly suitable for human consumption.

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REFERENCES

AOAC, 1975. Official Methods of Analysis, 12th Ed. Association of Official Analytical Chemists, Washington, D.C. 1094 p.

Botta, J.R., E. Arsenault, and H.A. Ryan. 1982. Effect of sex, age and carcass cut on composition of harp seal (Phoca groenlandica) meat. Can. Inst. Food Sci. and Technol. J. 15:(In Press).

Fisher, H.D. 1954. Studies on reproduction in harp seal, Phoca groenlandica (erxleben), in the Northeast Atlantic. Ph.D. Thesis, McGill University, Montreal, Que.

Larmond, E. 1977. Laboratory methods for sensory evaluation of food. Research Branch, Canada Department of Agriculture, Ottawa, ON. Publication 1637, 74 p.

Lawrie, R.A. 1974. Meat science. Pergamon Press, Toronto, ON. p. 322-323.

Paul, P.C. 1972. Meat. In: Food theory and applications. P.C. Paul and H.H. Palmer (ed.) p. 335-494. John Wiley & Sons Inc., New York, NY.

Paul, A.A., and D.A.T. Southgate. 1978. McCance and Widdowson's the composition of foods. Her Majesty's Stationery Office, London, England, 418 p.

Snedecor, G.W. and W.G. Cochran. 1980. Statistical methods. 7th Ed., Iowa State University Press, Ames, IA, p. 234-237.

Table 1. Form used to evaluate sensory quality of harp seal meat.

NAME _____ DATE _____

PRODUCT _____

Two of these three samples are identical, the third is different.

1. Evaluate the samples in order indicated and identify the different sample.

Code	Check different sample
_____	_____
_____	_____
_____	_____

2. Indicate the degree of difference between the duplicate samples and the different sample.

   Slight _____

   Moderate _____

   Much _____

   Extreme

3. Is the different sample acceptable? _____
   Are the duplicate samples acceptable? _____

4. Is the different samples more acceptable? _____
   Are the duplicate samples more acceptable? _____

5. Is the difference related to:

   Appearance _____
   Flavor _____
   Odor _____
   Texture _____

6. Comments:

Table 2. Condition and carcass cut means, including standard deviation, and results of Studentized Range Test[1].

Condition	Ash content (%)	Fat content (%)	Moisture content (%)	Protein content (%)	Total carbohydrate content[4] (%)
Molting[2]	1.17[a]	1.07[a]	73.73[a]	23.38[a]	0.66[a]
Pre-molting	1.14[a]	1.23[a]	72.95[b]	23.61[a]	1.07[b]
Carcass cut					
Flank[3]	1.15[a]	0.60[a]	72.52[a]	24.66[a]	1.08[a]
Flipper[3]	1.18[a]	0.10[b]	74.24[b]	22.81[b]	0.66[b]
Rump[3]	1.13[a]	1.74[c]	73.27[c]	23.01[b]	0.84[ab]

[1] Means not sharing the same letter are significantly different (at the 5% level) from each other

[2] n = 42

[3] n = 28

[4] Total carbohydrate content was determined by subtraction.

Table 3. Results of sensory evaluation triangle test using meat from harp seal in molting and pre-molting condition canned plain without seasoning.

Treatment	n^a	Number of correct identifications	Preference		
			Samples from seals in molting condition	Samples from seals in pre-molting condition	None
Age:					
One year	72	34*	14	8	12
Two years	72	36**	16	10	10
Three years	24	21***	12	6	3
Four years and over	72	34*	25	6	3
Total	240	125***	67	30	28
Cuts:					
Flank	80	51***	27	13	11
Flipper	80	36*	19	8	9
Rump	80	38**	21	9	8
Total	240	125***	67	30	28

n^a = number of observations per treatment

* Significant at the 5% level

** Significant at the 1% level

*** Significant at the 0.1% level

Table 4. Acceptability of correctly-identified sets of harp seal, seal meat canned plain without seasoning.[1]

Treatment	Percentage of correctly-identified sets	
	Samples from seals in molting condition	Samples from seals in pre-molting condition
Age:		
One year	82.4	70.6
Two years	88.9	83.3
Three years	90.5	76.2
Four years and over	97.1	76.5
Total	89.6	76.8
Cut:		
Flank	88.2	70.6
Flipper	88.9	80.6
Rump	92.1	81.6
Total	89.6	76.8

[1] Based on answers to question 3 of sensory evaluation form.

Table 5. Results of sensory evaluation triangle test using meat from harp seal in molting and pre-molting condition canned with onions and salt added.

Treatment	n[a]	Number correct identifications	Preference		
			Samples from seals in molting condition	Samples from seals in pre-molting condition	None
Age:					
One year	72	35**	16	15	4
Two years	72	32*	21	9	2
Three years	24	16***	6	9	1
Four years and over	72	25[n.s.]	16	6	3
Total	240	108***	59	39	10
Cut:					
Flank	80	34[n.s.]	21	10	3
Flipper	80	34[n.s.]	15	15	4
Rump	80	40**	23	14	3
Total	240	108***	59	39	10

n[a] = number of observations per treatment

* = significant at the 5% level

** = significant at the 1% level

*** = significant at the 0.1% level

n.s. = not significant at the 5% level

Table 6. Acceptability of correctly identified sets of harp seal meat canned with onions and salt added[1].

Treatment	Percentage of correctly identified sets	
	Samples from seals in molting condition	Samples from seals in pre-molting condition
Age:		
One year	88.6	85.7
Two years	90.6	100.0
Three years	100.0	100.0
Four years and over	92.0	92.0
Total	93.5	91.7
Cuts:		
Flank	88.2	100.0
Flipper	94.1	82.4
Rump	92.5	97.5
Total	93.5	91.7

[1] Based on answers to question 3 of sensory evaluation form.

Table 7. Results of sensory evaluation triangle test using frozen meat from harp seal in molting and pre-molting condition.

Treatment	n^a	Number of correct identifications	Preference: Samples from seals in molting condition	Preference: Samples from seals in pre-molting condition	Preference: None
Age:					
One year	72	$25^{n.s.}$	9	8	8
Two years	72	37**	25	6	6
Three years	24	$11^{n.s.}$	8	2	1
Four years and over	72	$23^{n.s.}$	7	9	7
Total	240	96*	49	25	22
Cut:					
Flank	80	$33^{n.s.}$	18	11	4
Flipper	80	$27^{n.s.}$	17	5	5
Rump	80	36*	14	9	13
Total	240	96*	49	25	22

n^a = number of observations per treatment

* = significant at the 5% level

** = significant at the 1% level

n.s. = not significant at the 5% level

Table 8. Acceptability of correctly-identified sets of harp seal meat frozen prior to cooking.[1]

Treatment	Percentage of correctly-identified sets	
	Samples from seals in molting condition	Samples from seals in pre-molting condition
Age:		
One year	44.0	40.0
Two years	86.5	70.3
Three years	72.7	72.7
Four years and over	73.9	69.6
Total	70.8	62.5
Cuts:		
Flank	81.8	66.7
Flipper	63.0	59.3
Rump	66.7	61.1
Total	70.1	62.5

[1] Based on answers to question 3 of sensory evaluation form.

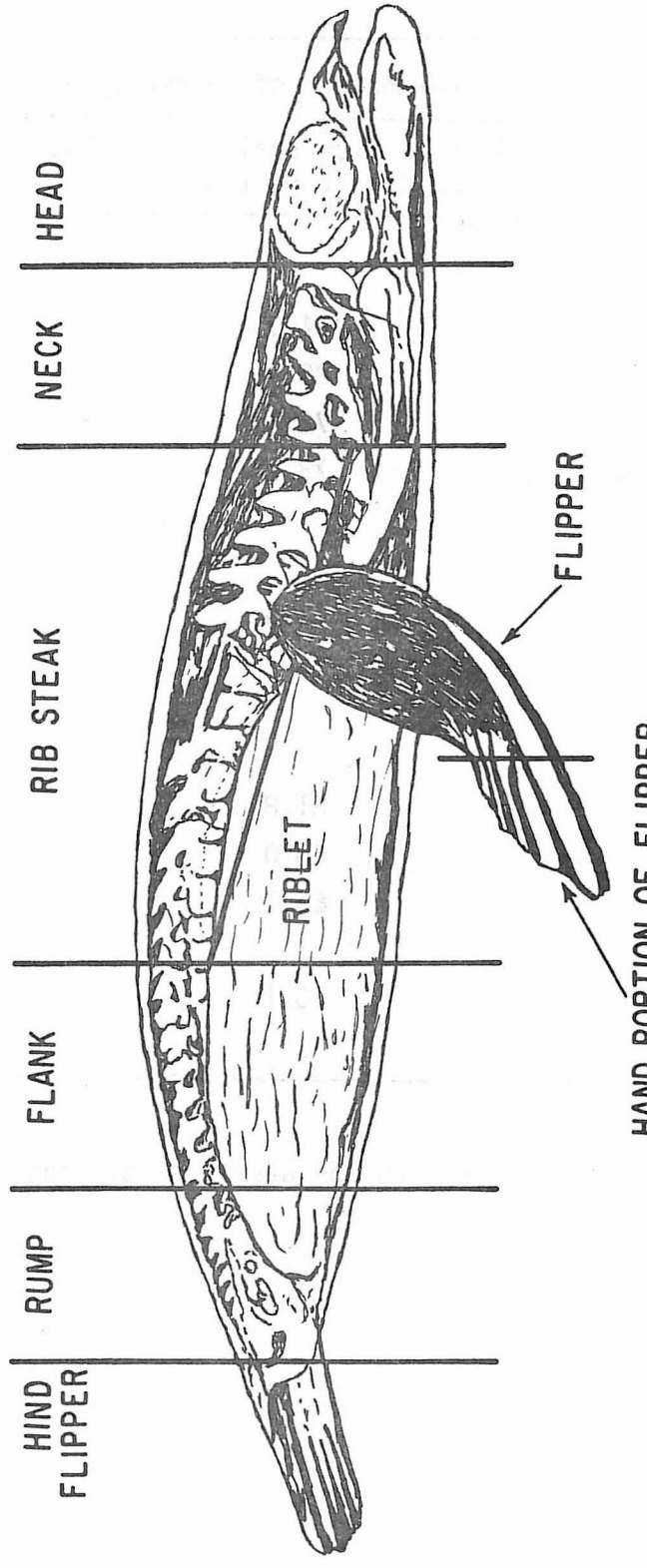

Fig. 1. Carcass cuts of the harp seal (Phoca groenlandica).