

Not to be cited without
permission of the author.¹

Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 84/73

Ne pas citer sans
autorisation des auteur¹

Comité scientifique consultatif des
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 84/73

An Analysis of the Scallop Meat Count Regulation

by

K. S. Naidu
Fisheries Research Branch
Department of Fisheries and Oceans
P.O. Box 5667
St. John's, Newfoundland A1C 5X1

¹ This series documents the scientific basis for fisheries management advice in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the Research Documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research Documents are produced in the official language in which they are provided to the Secretariat by the author.

¹ Cette série documente les bases scientifiques des conseils de gestion des pêches sur la côte atlantique du Canada. Comme telle, elle couvre les problèmes actuels selon les échéanciers voulus et les Documents de recherche qu'elle contient ne doivent pas être considérés comme des énoncés finals sur les sujets traités mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée par les auteurs dans le manuscrit envoyé au secrétariat.

ABSTRACT

Examination of individual commercial meat-weight frequencies from St. Pierre Bank points to little, if any, culling of sea scallops. Here, as elsewhere on the Atlantic seaboard, most sea scallops caught appear to be retained for shucking. Compliance with the meat-count Regulation in force is readily achieved through blending large meats with smaller ones, the latter frequently being predominant in the landed catch. This strategy facilitates the harvesting of considerable numbers of small scallops.

In a bracketed array including past, present and recommended levels of imposed meat counts for St. Pierre Bank it was found that small scallops invariably made greater contributions (by numbers and weights) to total catch than did meats whose individual weights exceeded minimum critical weights at those counts. At a 45 meat count per lb., for example, individual scallops under 10.1 g would be defined as failing to meet the minimum critical weight. As the Regulation was intended primarily for the protection of young scallops and delaying capture of those only recently recruited to improve yield per recruit, the meat count in its present form has not had the intended regulatory effect. Instead, it has resulted in a pattern of fishing, sometimes uneconomical, which allows considerable blending of meats, effectively bypassing the intent of the Regulation.

This paper proposes a revision to the Regulation to limit the small meat content in the catch. It does not eliminate the count, but rather strengthens the means of achieving its intent.

RESUME

Un examen des fréquences de poids de chairs individuelles de pétoncles géants capturés commercialement sur le banc de Saint-Pierre indique qu'il y a peu, si tant est qu'il y en ait, de triage des prises par taille. Ici comme ailleurs le long de la côte atlantique, la plupart des pétoncles géants capturés semblent être conservés pour écaillage. Il est facile de se conformer au règlement actuel: on n'a qu'à mélanger les grosses chairs avec les petites, ces dernières étant très souvent prédominantes dans les prises débarquées. Cette stratégie permet de récolter un nombre considérable de petits pétoncles.

En étudiant les comptages de chairs passés et présents imposés par règlement sur le banc de Saint-Pierre, on constate qu'invariablement, les pétoncles de petite taille contribuaient davantage aux débarquements (en nombre comme en poids) que les chairs de poids individuels supérieurs aux poids critiques minimaux correspondant à ces comptages. Par exemple, à un comptage de 45 chairs à la livre, les pétoncles individuels de moins de 10,1 g seraient considérés de taille inférieure au poids critique minimal. Comme le règlement a pour but principal de protéger les jeunes pétoncles et de retarder la capture des nouvelles recrues pour améliorer le rendement par recrue, le comptage, dans sa forme actuelle, n'a pas l'effet escompté. Il a plutôt donné naissance à un comportement, parfois non économique, de mélange des chairs qui, effectivement, contourne le règlement.

Nous proposons, dans le présent document, de limiter la teneur de chaque débarquement en petites chairs. Il n'est pas question d'éliminer les comptages mais plutôt de permettre au règlement de mieux réaliser son objectif.

INTRODUCTION

Recruitment variations, expended effort and yield-per-recruit (assuming steady state) orchestrate to establish catch and landing trends in any given fishery. Fishing regulations affecting fleet size, meat counts (number of meats to the pound), catch limits (per trip and per three-month period) affect temporal patterns in the fishery. While offshore scallop Regulations have been in place for some ten years, and variously implemented during that period, no attempt has been made to examine their impact, individually or collectively, on the total management of the resource. This document examines critically the intent, relative efficacy and overall success of one of these (meat counts) in the Atlantic offshore fishery with specific reference to St. Pierre Bank - a westward extension of the vast apron of shelf off Newfoundland, commonly called the Grand Banks of Newfoundland. The scallop fishery here is prosecuted exclusively by Maritimes-based vessels which traditionally fish the rich Georges Bank but make opportunistic excursions into other areas, including St. Pierre Bank.

MATERIALS AND METHODS

Scallop catches from St. Pierre Bank are generally discharged at Maritime ports. Sampling technicians are dispatched to perform individual meat-weight determinations. On one occasion meats were procured from boardings at sea by the Resource Management Division (Newfoundland Region) to check for possible meat-count violations. The meats were brought back to the laboratory for analysis. To date the fishery has been directed primarily at the larger sea or giant scallop, Placopecten magellanicus. Every effort was made to ensure purity of samples with respect to species composition. At-sea samples were shucked onboard in the presence of Fishery Officers. Port samples were furnished by the Master of the vessel who in each instance was forewarned of our requirements.

Three types of meat components (Fig. 1) occur in every bag of scallop meats landed, viz.

1. Muscle-on (posterior adductor muscle with both the large "quick" and small "slow" or "catch" fractions still attached).
2. Muscle-off (large "quick" fraction of the posterior adductor muscle only).
3. Bits and pieces (consisting primarily of separated or detached "slow" fractions from (2) as well as small torn bits and pieces).

Weights to the nearest tenth of a gram were determined separately for muscle-on and muscle-off. Subsamples were used to obtain data on the relative contributions to total weight by the two fractions to facilitate transformations from muscle-off to muscle-on. Individual meat-weight data allow the determination of proportions below and above minimum critical weights at varying meat-count levels.

At a 45 meat count per lb., for example, individual scallops under 10.1 g would theoretically fail to meet the critical weight requirement and would contribute to the number of small scallops in any given catch. Meats in excess of 10.2 g, however, would clearly meet the meat-count stipulation and would be considered acceptable. Average meat weight (g) for a given meat count is given by the formula:

$$\bar{x} = \frac{454}{\text{Number of meats/lb}} \quad (1 \text{ lb} = 454 \text{ g})$$

RESULTS

A total of nine offshore vessels fishing St. Pierre Bank was sampled over the two-year period. Proportions of "muscle-on" to "muscle-off" in the landed catch were highly variable (Table 1). In 1982, 54.5% of adductor muscles sampled were in the "muscle-on" condition, the remainder (45.5%) in the "off" condition. In 1983, this was reversed in favour of "muscle-off" (57.3% versus 42.7%). Combined overall distribution for the two years approached equinumerical representation of the two types of meat (48% vs. 52%).

Individual meat-weight distributions in 1982 and 1983 were tabulated separately for four levels of meat count (Tables 2 and 3). Percent contributions bracketed by critical weights at each level, were tabulated for muscle-on, muscle-off, adjusted muscle-on and for untransformed as-landed data. Percent frequency of small scallops and corresponding weight contributions to the landed catch in 1982 and 1983 are summarized in Table 4. For comparisons of theoretical yields, muscle-off weights were adjusted upwards to muscle-on by a factor in the range of 1.074 to 1.089, depending on the computed relationship between the two for any given boat at the time of landing. Regressions between muscle-on and muscle-off were linear (Fig. 2, Table 5), with no discernable correlation ($r^2 = 0.01$) of the ratio of the weights of quick to catch fractions with scallop size for both sea and Iceland scallops (Fig. 3). Mean as-landed adductor muscle weights were also examined by boat and year (Table 6) to determine the relative proportions of the two types of meat. It is clear that small scallop meats make significant contributions to the catch both numerically and in terms of total weight (Table 4, Fig. 4).

Relevant enforcement data for 1983 were also examined (Table 7). These were assembled by Resource Management personnel throughout the fishing season to determine if counts were violative. The data were made available to the author courtesy of the District Protection Office, Bridgewater, Nova Scotia. Not one of the 38 meat-count determinations from this source exceeded the 45/500 g stipulation (Table 7). It is difficult to reconcile average counts with the known presence in the catch of a large number (66% in 1983) of meats each weighing less than 11.1 g. This corresponds to the minimum critical weight below which a given meat would fail to meet the 45/500 g meat count requirement. A full 50% of the landed weight in 1983 is estimated to have come from small scallops, down from 63% in 1982 (Table 4).

DISCUSSION

Regulations affecting the Canadian offshore scallop fishery were developed primarily for the Georges Bank sea scallop fishery and date back to 1973 (Caddy and Jamieson 1977). In chronological order of introduction they may be summarized as follows:

<u>Date of Introduction</u>	<u>Specifics</u>
June 1973	Meat-count regulation first introduced. Maximum of 60 meats/lb in the landed catch.
May 1974	Meat count reduced to 50/lb.
June 1975	Meat count revised downward to 45/lb.
May 1976	Meat count further reduced to 40/lb. Remained at that level until May 1981.
15 March 1977	Trip quota of 30,000 lbs imposed. Maximum trip duration of 12 days, dock to dock. Maximum landed weight per boat per 4-month period set at 180,000 lb shucked meats.
May 1981	Modification of the meat count to 55 by allowing a temporary tolerance.
July 1982	Effective mid-July 1982 industry returned to the 40 meat count.
March 1983	35 meat count for sea scallops and 50 for Iceland scallops proposed for St. Pierre Bank. Resource managers subsequently modified this to a 45 count for both species (45/500 g).
June 1983	35 meat count (39/500 g) implemented for 4X and 5Ze. 45 meat count for areas east of 4X (i.e. 4V, 4W, 3P and 30). Count to apply for both sea and Iceland scallops. Under Regulation, all scallops are to meet the 39/500 g. 45/500 g (in eastern areas) is by policy.

Most important in terms of addressing total fishery yield and maximizing yield/recruit is the meat count, which specifies the number of meats allowed per unit weight. This is normally monitored by a Fishery Officer at the port of landing. By law, the meat count must be based on at least eight representative samples of scallops, each sample weighing not less than 500 g (1.10 lb). It is an average count with attendant difficulties. Normally a 10% tolerance is allowed over the maximum allowable count. Apparently this is an acknowledgement of the semi-quantitative nature of approximations to weights at sea (Barnes, pers. comm. 1982).

Until 28 October 1982 the meat-count Regulation was applicable to sea scallops only. The incidental presence of Iceland scallops on St. Pierre Bank (Naidu et al. 1983) made implementation of Regulations for that fishery almost impossible. Relevant portions of the Atlantic Fishery Regulations were therefore amended to make the Regulations applicable to Iceland scallops as well as sea scallops. Considerable culling of Iceland scallops occurs by those boats that retain them for shucking (Naidu et al. 1983; Naidu and Cahill 1984). Only the large ones (>80 mm) are shucked.

In 1983 CAFSAC Steering Committee recommended a sea scallop meat count of 30/lb. for St. Pierre Bank (CAFSAC Advisory Document 83/14, as for the Georges Bank fishery). However, DFO managers allowed removals at 45/500 g by permitting a tolerance greater than 10% for directed fisheries east of 4X (i.e. 4V, 4W, 3P, and 3O) because of the presence in the catch of Iceland scallops particularly on St. Pierre Bank.

Examination of frequency distributions of individual meat weights from St. Pierre Bank over the last two fishing seasons showed that the meat count was by and large ineffective in meeting the regulatory intent. In particular, it is difficult to reconcile biological sampling data with those obtained to determine if counts met regulatory requirements. At the 45 count in 1982, for example, only 32% of the total landed catch sampled (N = 4487) was made up of animals with meats in excess of 10.2 g (the critical weight required to meet the count if all scallops weighed exactly the same). In 1983, contributions from small scallops had dropped somewhat through growth increments in weight (Table 4). With the exception of one boat, frequency distributions of large versus small scallops for the five boats sampled were much the same for any given meat count. A large proportion of small scallops (91%, N = 2173) was recorded for one boat. For both recommended and implemented meat counts for the directed fishery on St. Pierre Bank, (30/lb and 45/500 g respectively) it is apparent that there are large numbers of small scallops in the landed catch. Average meat counts, however, meet the stipulated requirements and boats catching and landing such scallops are not in violation (Table 7).

This above analysis is not compromised by the accidental presence of Iceland scallops in the sampled meats. For comparable shell heights beyond 65 mm, Iceland scallops provide greater meat yield than do sea scallops (Naidu and Cahill 1984). In any case the Regulation applies for both species and the presence of Iceland scallops would only improve observed counts. Selective shucking of Iceland scallops, has already been mentioned.

It is clear that the offshore fleet has developed the necessary skill to "blend" meats with the result that the efficacy of the regulation must be questioned. In addition to maintaining minimal CPUEs, vessels also ensure that sufficient numbers of large meats are mixed in with smaller ones to conform to the stipulated meat count. Sampling methodology clearly favors the potential violator. In addition to the built-in tolerance there are elements to weight contributions that are not enumerated (scallop bits and pieces contribute to weight but not to counts). This invariably results in underestimating the meat-count. This has helped the systematic harvesting of small scallops which the Regulation was specifically intended to protect.

It is apparent that if the Regulations are to have the intended effect, critical re-examination of current practices is needed. Imposition of revised Regulations, particularly with regard to that affecting meat counts, to more effectively control growth overfishing could be applied. The meat-count stipulation may still be retained with the proviso that no more than a certain percentage of meats in the landed catch be made up of meats averaging less than the critical weight allowed by that meat count. Critical weights for 30, 35, 40 and 45 meat counts/lb would correspond to individual meat weights of 15.1, 12.9, 11.4 and 10.1 g respectively. The stipulation of an acceptable level of "small meat" content in the landed catch would better address the regulatory intent of the meat-count stipulation. Initially, a tolerance could be entertained, eg. no more than a fixed percentage of meats may be made up of meats whose average weight is less than 13.0 g (35 meat count). This modification to the current Regulation would better address the problem of growth overfishing as well as minimize recruitment overfishing in areas which may be dependent on recruitment pulses from without, as may be the case on St. Pierre Bank (Naidu and Anderson, 1984). Indirect fishing mortality of prerecruits may also be expected to be reduced (Naidu et al. 1982).

ACKNOWLEDGEMENTS

I wish to thank Mr. Robert Barnes, Field Protection Officer, Bridgewater, Nova Scotia for assistance with logistics of port sampling in Nova Scotia, for numerous discussions on the subject of meat counts, for providing the information on prosecutions, and for reading the original manuscript of this paper. Principal research support was provided by Messers F. M. Cahill and D. B. Lewis.

REFERENCES

- Caddy, J. F., and G. S. Jamieson. 1977. Assessment of Georges Bank (ICNAF Subdivision 5Ze) scallop stock, 1972-76 incorporated. CAFSAC Res. Doc. 77/32, 23 p.
- Naidu, K. S., and F. M. Cahill. 1984. Status and assessment of St. Pierre Bank scallop stocks 1982-83. CAFSAC Res. Doc. 84/69, 56p.
- Naidu, K. S., F. M. Cahill, and D. B. Lewis. 1982. Status and assessment of the Iceland scallop, Chlamys islandica in the northeastern Gulf of St. Lawrence. CAFSAC Res. Doc. 82/02, 66 p.
- Naidu, K. S., D. B. Lewis, and F. M. Cahill. 1983. St. Pierre Bank: An offshore scallop buffer zone. CAFSAC Res. Doc. 83/16, 48 p.
- Naidu, K. S., and J. T. Anderson. 1984. Aspects of scallop recruitment on St. Pierre Bank in relation to oceanography and implications for resource management. CAFSAC Res. Doc. 84/29, 15 p.

Table 1. Distribution of scallop adductor muscles landed as muscle-on versus muscle-off from St. Pierre Bank (see text for details).

Year	Vessel	N	Numbers		Percent	
			On	Off	On	Off
1982	1	1864	1026	838	55	45
	2	1779	959	820	54	46
Totals		3643	1985	1658	<u>54.5</u>	<u>45.5</u>
1983	3	613	287	326	47	53
	4	722	193	529	27	73
	5	488	310	178	64	36
	6	403	253	150	63	37
	7	2173	834	1339	38	62
Totals		4399	1877	2522	<u>42.7</u>	<u>57.3</u>
Overall totals		8042	3862	4180	48	52

Table 2. Individual scallop meat-weight frequency distribution at four meat count levels from the St. Pierre Bank fishery in 1982. Figures in parentheses are percentages.

Date	Vessel	Meat condition	Conversion factor	N	Meat Count/lb								Meat count/500 g		Notes
					30		35		40		45		45		
					<15.1 g	>15.2 g	<12.9 g	>13.0 g	<11.4 g	>11.5 g	<10.1 g	>10.2 g	<11.1 g	>11.2 g	
22 Sept. 1982	1	Muscle on	1.080	261	259 (99)	2 (1)	227 (87)	34 (13)	174 (67)	87 (33)	135 (52)	126 (48)	166 (64)	95 (36)	Samples for meat-count violations.
1 Oct. 1982	2	Muscle on		1,026	979 (95)	47 (5)	842 (82)	184 (18)	745 (73)	281 (27)	664 (65)	362 (35)	730 (71)	296 (29)	Giants only, port sample.
		Muscle off		838	820 (98)	18 (2)	771 (92)	67 (8)	702 (84)	136 (16)	648 (77)	190 (23)	690 (82)	148 (18)	
		Adjusted combined	1.088	1,864	1,776 (95)	88 (5)	1,566 (84)	298 (16)	1,412 (76)	452 (24)	1,269 (68)	595 (32)	1,380 (74)	484 (26)	
		As-landed		1,864	1,799 (97)	65 (3)	1,613 (87)	251 (13)	1,447 (78)	417 (22)	1,312 (70)	552 (30)	1,420 (76)	444 (24)	
2 Oct. 1982	3	Muscle on		14	-	-	-	-	-	-	-	-	-	-	Mixed, mostly giants, port sample.
		Muscle off		574	474 (83)	100 (17)	465 (81)	109 (19)	443 (77)	131 (23)	362 (63)	212 (37)	427 (74)	147 (26)	
		Adjusted combined	1.088	588	486 (83)	102 (17)	465 (79)	123 (21)	403 (69)	185 (31)	305 (52)	283 (48)	383 (65)	205 (35)	
Aug. 1982	4	Muscle on		959	891 (93)	68 (7)	843 (88)	116 (12)	703 (73)	256 (27)	584 (61)	375 (39)	671 (70)	288 (30)	Unknown, at-sea procurement of bag of meats.
		Muscle off		820	799 (97)	21 (3)	773 (94)	47 (6)	705 (86)	115 (14)	599 (73)	221 (27)	688 (84)	132 (16)	
		Adjusted combined	1.076	1,779	1,686 (95)	93 (5)	1,582 (89)	197 (11)	1,354 (76)	425 (24)	1,135 (64)	644 (36)	1,291 (73)	488 (27)	
		As-landed		1,779	1,690 (95)	89 (5)	1,616 (91)	163 (9)	1,408 (79)	371 (21)	1,183 (66)	596 (34)	1,359 (76)	420 (24)	
1982 Totals		Muscle on		2,246	2,129 (95)	117 (5)	1,912 (85)	334 (15)	1,622 (72)	624 (28)	1,383 (62)	863 (38)	1,567 (70)	679 (30)	1982 totals as-landed based on two vessels only.
		Muscle off		2,232	2,093 (94)	139 (6)	2,009 (90)	223 (10)	1,850 (83)	382 (17)	1,609 (72)	623 (28)	1,805 (81)	427 (19)	
		Adjusted combined		4,231	3,948 (93)	283 (7)	3,613 (85)	618 (15)	3,169 (75)	1,062 (25)	2,709 (64)	1,522 (36)	3,054 (72)	1,177 (28)	
		As-landed		3,643	3,489 (96)	154 (4)	3,229 (89)	414 (11)	2,855 (78)	788 (22)	2,495 (68)	1,148 (32)	2,779 (76)	864 (24)	

Table 3. Individual scallop meat-weight frequency distribution at four meat count levels from the St. Pierre Bank fishery in 1983. Figures in parentheses are percentages.

Date	Vessel	Meat condition	Conversion factor	N	Meat Count/lb								Meat count/500 g		Notes
					30		35		40		45		45		
					<15.1 g	>15.2 g	<12.9 g	>13.0 g	<11.4 g	>11.5 g	<10.1 g	>10.2 g	<11.1 g	>11.2 g	
3 May 1983	5	Muscle on		287	225 (78)	62 (22)	166 (58)	121 (42)	104 (36)	183 (64)	44 (15)	243 (85)	88 (31)	199 (69)	Giants only, port sample.
		Muscle off		326	274 (84)	52 (16)	232 (71)	94 (29)	179 (55)	147 (45)	110 (34)	216 (66)	164 (50)	162 (50)	
		Adjusted combined	1.076	613	475 (77)	138 (23)	365 (60)	248 (40)	244 (40)	369 (60)	110 (18)	503 (82)	210 (34)	403 (66)	
		As-landed		613	499 (81)	114 (19)	398 (65)	215 (35)	283 (46)	330 (54)	154 (25)	459 (75)	252 (41)	361 (59)	
3 May 1983	6	Muscle on		193	144 (75)	49 (25)	109 (56)	84 (44)	62 (32)	131 (68)	29 (15)	164 (85)	53 (27)	140 (73)	Giants only, port sample.
		Muscle off		529	420 (79)	109 (21)	320 (60)	209 (40)	208 (39)	321 (61)	113 (21)	416 (79)	184 (35)	345 (65)	
		Adjusted combined	1.074	722	532 (74)	190 (26)	364 (50)	358 (50)	213 (30)	509 (70)	96 (13)	626 (87)	181 (25)	541 (75)	
		As-landed		722	564 (78)	158 (22)	429 (59)	293 (41)	270 (37)	452 (63)	142 (20)	580 (80)	237 (33)	485 (67)	
21 May 1983	7	Muscle on		310	267 (86)	43 (14)	222 (72)	88 (28)	185 (60)	125 (40)	134 (43)	176 (57)	167 (54)	143 (46)	Mixed, port sample.
		Muscle off		178	159 (89)	19 (11)	137 (77)	41 (23)	103 (58)	75 (42)	74 (42)	104 (58)	97 (54)	81 (46)	
		Adjusted combined	1.070	488	417 (85)	71 (15)	342 (70)	146 (30)	274 (56)	214 (44)	190 (39)	298 (61)	248 (51)	240 (49)	
		As-landed		488	426 (87)	62 (13)	359 (74)	129 (26)	288 (59)	200 (41)	208 (43)	280 (57)	264 (54)	224 (46)	
21 May 1983	8	Muscle on		253	163 (64)	90 (36)	107 (42)	146 (58)	61 (24)	192 (76)	27 (11)	226 (89)	49 (19)	204 (81)	Mixed, port sample.
		Muscle off		150	110 (73)	40 (27)	76 (51)	74 (49)	50 (33)	100 (67)	33 (22)	117 (78)	45 (30)	105 (70)	
		Adjusted combined	1.074	403	259 (64)	144 (36)	171 (42)	232 (58)	97 (24)	306 (76)	45 (11)	358 (89)	82 (20)	321 (80)	
		As-landed		403	273 (68)	130 (32)	183 (45)	220 (55)	111 (28)	292 (72)	60 (15)	343 (85)	94 (23)	309 (77)	
2 Dec. 1983	9	Muscle on		834	813 (97)	21 (3)	792 (95)	42 (5)	768 (92)	66 (8)	719 (86)	115 (14)	761 (91)	73 (9)	Giants only, port sample.
		Muscle off		1,339	1,327 (99)	12 (1)	1,315 (98)	24 (2)	1,300 (97)	39 (3)	1,267 (95)	72 (5)	1,296 (97)	43 (3)	
		Adjusted combined	1.089	2,173	2,135 (98)	38 (2)	2,098 (97)	75 (3)	2,067 (95)	116 (5)	1,911 (88)	262 (12)	2,038 (94)	135 (6)	
		As-landed		2,173	2,140 (98)	33 (2)	2,107 (97)	66 (3)	2,068 (95)	105 (5)	1,986 (91)	187 (9)	2,057 (95)	116 (5)	
1983 totals		Muscle on		1,877	1,612 (86)	265 (14)	1,396 (74)	481 (26)	1,180 (63)	697 (37)	953 (51)	924 (49)	1,118 (60)	759 (40)	
		Muscle off		2,522	2,290 (91)	232 (9)	2,080 (82)	442 (18)	1,840 (73)	682 (27)	1,597 (63)	925 (37)	1,786 (71)	736 (29)	
		Adjusted combined		4,399	3,818 (87)	581 (13)	3,340 (76)	1,059 (24)	2,885 (66)	1,514 (34)	2,352 (53)	2,047 (47)	2,759 (63)	1,640 (37)	
		As-landed		4,399	3,902 (89)	497 (11)	3,476 (79)	923 (21)	3,020 (69)	1,379 (31)	2,550 (58)	1,849 (42)	2,904 (66)	1,495 (34)	

Table 4. Percent frequency of small scallops and corresponding weight contributions to the landed catch from St. Pierre Bank at four meat count levels.

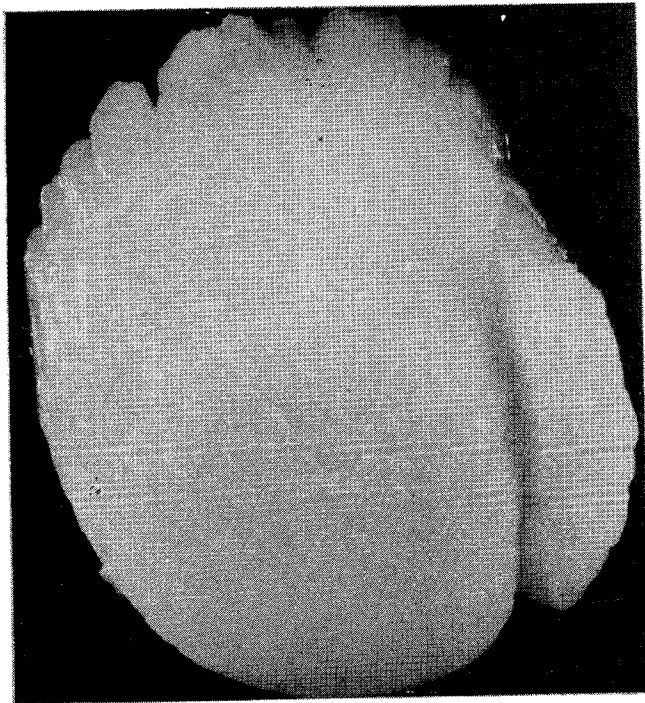
	Year	N	30 (≤ 15.1 g)	35 (≤ 12.9 g)	40 (≤ 11.4 g)	45 (≤ 10.1 g)	45/500 g (≤ 11.1 g)
Numbers	1982	3,643	96	89	78	68	76
	1983	4,399	89	79	69	58	66
Weights	1982	33,262 g	90	79	65	54	63
	1983	33,956 g	78	65	53	41	50

Table 5. Muscle-on/muscle-off regressions for scallops from St. Pierre Bank.

Date	Vessel	N	r ²	a	b
27 August 1982	F	524	1.00	0.10	1.06
22 September 1982	O	261	1.00	0.29	1.05
1 October 1982	P	78	0.99	0.23	1.06
4 May 1983	Q	60	1.00		1.07
21 May 1983	D	60	0.99	0.26	1.05
21 May 1983	R	60	1.00	0.09	1.08
2 December 1983	C	120	1.00	0.10	1.08

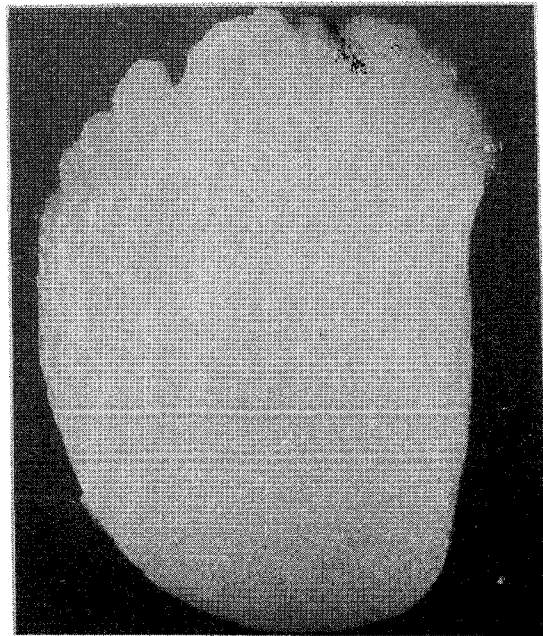
Table 6. Mean as-landed adductor muscle weights from the St. Pierre Bank fishery.

Date	Vessel	N	$\bar{x} \pm S.D.$
27 August 1982	F	1779	9.17 \pm 5.17
1 October 1982	P	1864	9.15 \pm 2.88
1982 Totals		3643	9.16
3 May 1983	D	614	12.39 \pm 3.20
3 May 1983	Q	720	12.88 \pm 3.35
21 May 1983	K	488	11.14 \pm 3.67
21 May 1983	R	403	16.30 \pm 9.63
2 December 1983	C	2173	7.42 \pm 2.68
1983 Totals		4398	10.23



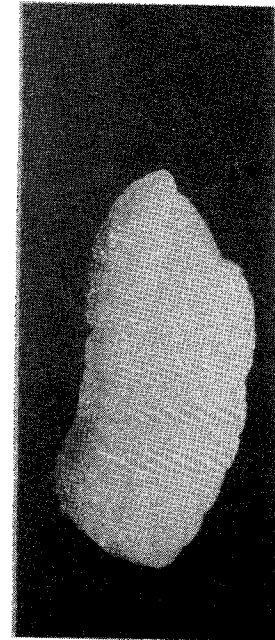
Posterior adductor muscle
(muscle-on)

=



quick muscle
(striated)
(muscle-off)

+



slow muscle
(smooth)

Fig. 1. The posterior adductor muscle of the sea scallop and its components.

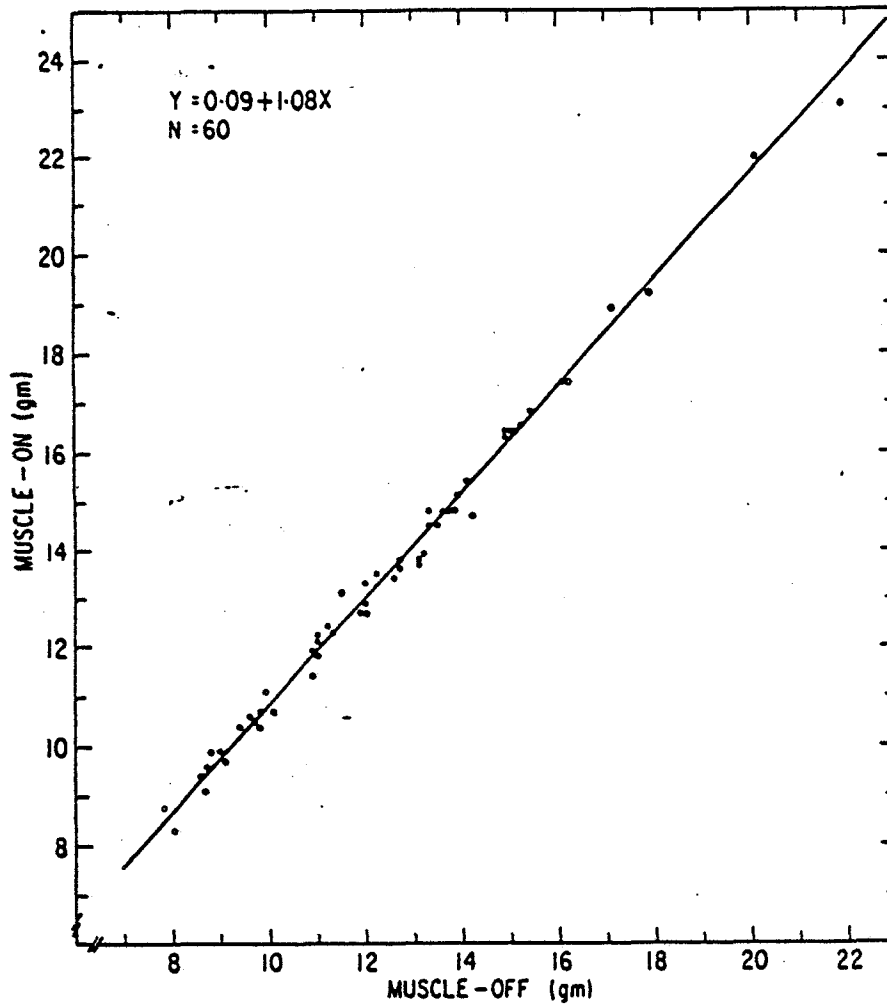


Fig. 2. Regression of adductor muscle weight (g, muscle-on) on adductor muscle weight (g, muscle-off) for St. Pierre Bank sea scallops.

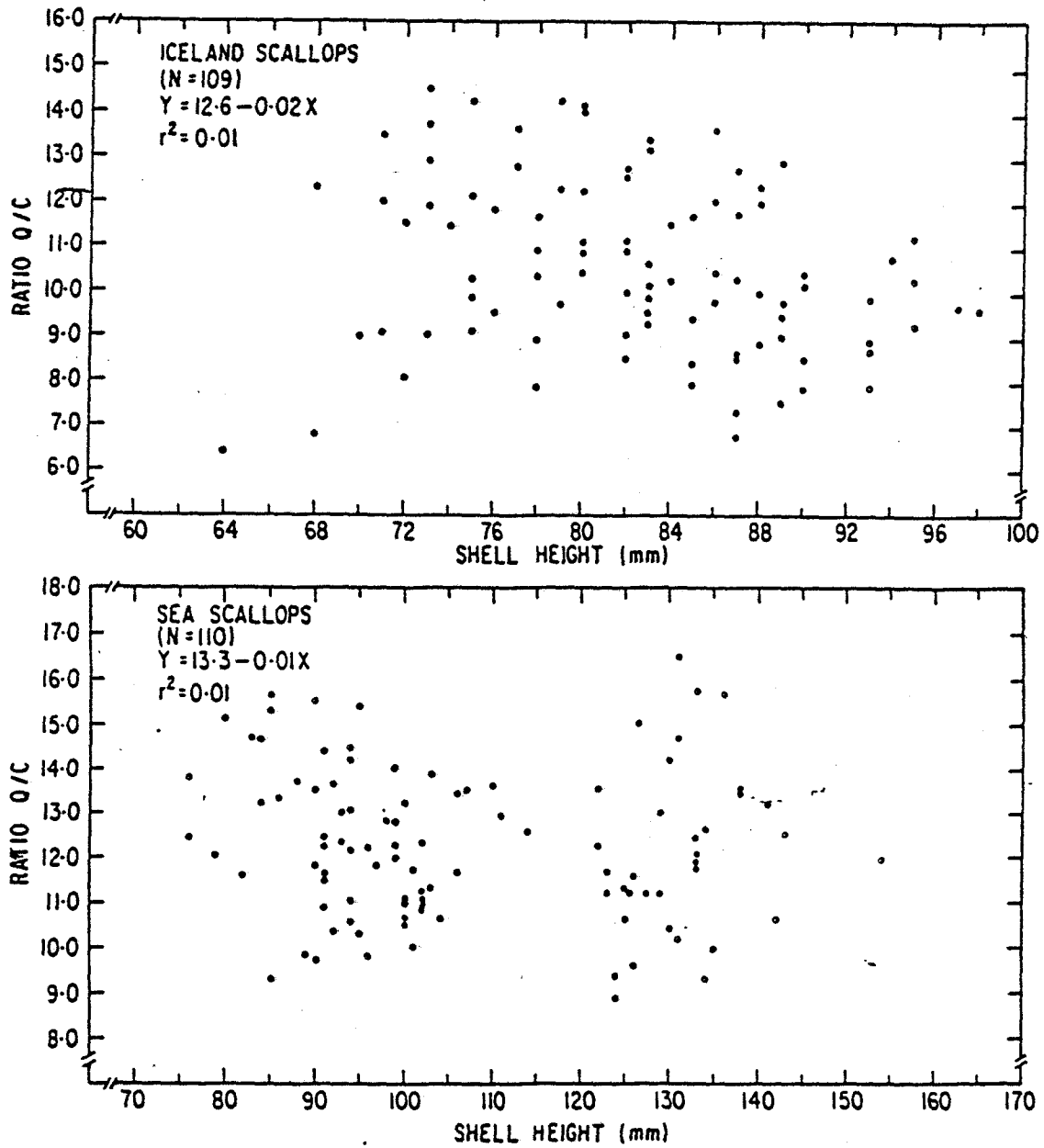


Fig. 3. Scatter diagram: Ratio of quick to catch fractions with shell height for sea and Iceland scallops from St. Pierre Bank.

Fig. 4. Small meat content of scallop catches from St. Pierre Bank, 1982-1983. Fine etched areas represent proportion of meats (by numbers) whose individual weights meet or exceed the minimum critical weight allowed by the count.

