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Research determines fatty acid composition of 32 commonly eaten finfish, crustaceans, and mollusks.

Chemical and Nutritive Values of Several Fresh and Canned Finfish, Crustaceans, and Mollusks. Part II. Fatty Acid Composition

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ABSTRACT

This paper presents data on total fat and fatty acid composition of 32 commonly eaten finfish, crustaceans, and mollusks. Among these are two canned finfish, salmon, tuna in oil and tuna in brine; the other samples were raw.

INTRODUCTION

Although there have been a number of studies carried out on the fatty acids in fish, very little has been done on the edible flesh of common market fish in the United States. Ackman (1967) has reported on some species of both freshwater and marine fish of North America; Krzeczkowski, Tenney, and Hayes (1972) have reported on some of the mollusks; and Stansby and Hall (1967) have also done some work in the area of commercially important fish in the United States. Much of the other fatty acid data available at present covers fish components which are not edible portions—liver, roe, milt, etc.

The object of this study was to provide total fat and the fatty acid composition of commonly marketed finfish, both fresh and canned, crustaceans, and mollusks. Since this report is an interim report for fatty acids, the values for some of the fatty acids may change somewhat as more data are added to the compilation.

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ANALYTICAL PROCEDURE

Samples

The sampling technique is described by Zook et al.[1]

Total Fat

The total fat was determined on edible muscle by the method developed by Smith, Ambrose, and Knobl (1964).

Preparation of Esters

Methyl esters were prepared using the method of Gauglitz and Lehman (1963). Amounts of reactants were scaled down for use with smaller sample size, about 0.5 gram. The esters were separated and identified using Gelman's[2] ITLC silica gel chromatography media and ultraviolet light, then extracted from the media with petroleum ether. The petroleum ether was removed by vacuum distillation and the esters were analyzed by GLC.

[1] Zook, E., J. Powell, B. Hackley, J. Emerson, J. Brooker, and G. M. Knobl, Jr. Survey for selected heavy metal content of consumer available fish. In preparation.

Table 1.—Common and scientific names of the fish and shellfish used in this study.

Common name	Scientific name
Finfish	
Catfish	*Ictalurus punctatus*
Cod	*Gadus morhua*
Flounder, yellowtail	*Limanda ferriginea*
Haddock	*Melanogrammus aeglefinus*
Hake	*Merluccius productus*
Halibut	*Hippoglossus stenolepis*
Perch	*Sebastes marinus*
Pollock	*Pollachius virens*
Rockfish	*Sebastes* spp.
Snapper	*Lutjanus campechanus*
Whiting	*Merluccius bilinearis*
Canned	
Salmon	*Oncorhynchus nerka*
Tuna	*Thunnus albacares*
Crustaceans	
Blue crab	*Callinectes sapidus*
King crab	*Paralithodes camschatica*
Lobster, spiny	*Panulirus argus*
Shrimp, brown	*Penaeus aztecus*
Shrimp, Maine	*Pandalus borealis*
Shrimp, Mexican	Mixed species
Shrimp, white	*Penaeus setiferus*
Mollusks	
Clam, hard	*Mercenaria mercenaria*
Clam, soft	*Mya arenaria*
Clam, surf	*Spisula solidissima*
Oyster	*Crassostrea virginica*
Scallop, bay	*Pecten* sp.
Scallop, calico	*Argopecten gibbus*
Scallop, sea	*Placopecten magellanicus*

Chromatographic Conditions

The Hewlett-Packard 810 GC used was equipped with dual flame ionization detectors and an 8 ft × ¼ in pyrex column packed with 5 percent diethylene-glycol succinate on $^{80}/_{100}$ mesh Chromosorb W (HP).

The helium carrier gas flow rate was 60 ml/min; hydrogen flow rate, 45 ml/min; air flow rate, 300 ml/min; column temperature programmed from 140°C to 210°C at 1° per minute; detector temperature, 235°C; and injection temperature 285°C.

RESULTS AND DISCUSSIONS

Table 1 lists the common and scientific names of the finfish, fresh and canned, mollusks and crustaceans.

All 13 species of the fresh finfish

[2] Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

fall into the low fat classification, ranging from the low of 0.35 percent in the Icelandic cod to a high of 4.86 percent in the halibut. The tuna, canned in vegetable oil, contained the highest level of total fat. The one canned in brine was markedly lower. The canned salmon was the only finfish that falls in the category of high fat fish. The mollusks and crustaceans have low total fat contents. The total fat content levels found in Table 2 contain not only the fatty acids, but also steroids, phospholipids, triglycerides, and many other fat-like substances.

The fatty acid composition of the finfish is tabulated in Table 3. The range for each fatty acid is quite wide. The differences are due primarily to the physiological status of the fish. The diet and the age of the fish are also contributing factors. The data presented in Table 3 may be used to compare the composition of the various fish, but not to determine the actual amount of a certain fatty acid, since the composition of the total fat was not determined.

The percent of unsaturated fatty acids ranges from a low of 58 percent in wild catfish to a high of 81 percent in ocean perch. There is a significant difference between the cultured and wild catfish, probably caused by the differences in the diets of the fish.

As may be noted in Table 4, the tuna canned in oil contained more unsaturated fats than the one in brine, 88 percent and 79 percent respectively, which may have been due to the vegetable oil that was used in the processing.

On these limited data recorded in Table 5, there appears to be very little difference in the fatty acid composition of the different crustaceans. The saturated fatty acids ranged from a low of 15 percent in Maine shrimp to a high of 27.5 percent in the coastal white shrimp.

In Table 6 it may be observed that the mollusks tended to be a little higher in saturated fatty acids, 17.5 percent in sea scallops and 41.5 percent in Long Island oysters, than the crustaceans. Also the oysters and clams showed a higher percentage of non-identifiable fatty acids than the scallops.

Table 2.—Total fat content of finfish, fresh and canned, crustaceans and mollusks.

	Mean & standard error of mean	Range	Number of analyses
	Percent of sample		
Finfish			
Catfish, cultured	1.48 ± 0.18	1.10—2.61	10
Catfish, wild	1.80 ± 0.21	1.15—2.65	7
Cod, Icelandic	0.67 ± 0.06	0.35—0.96	10
Cod, domestic	0.65 ± 0.05	0.36—0.81	8
Flounder, yellowtail	1.20 ± 0.07	0.94—1.52	10
Haddock	0.65 ± 0.03	0.42—0.77	12
Hake, Pacific	1.48 ± 0.19	0.93—2.01	6
Halibut	2.33 ± 0.25	1.36—4.86	18
Perch, ocean	1.67 ± 0.09	0.99—2.32	20
Pollock	1.03 ± 0.04	0.94—1.13	5
Rockfish	1.38 ± 0.12	0.79—2.18	14
Snapper, red	1.19 ± 0.12	0.67—2.30	19
Whiting	3.80 ± 0.49	2.28—4.86	6
Canned finfish			
Salmon	6.73 ± 0.25	6.08—7.33	5
Tuna (in oil)	14.49 ± 0.65	12.28—15.72	6
Tuna (in brine)	1.38 ± 0.10	0.99—1.61	7
Crustaceans			
Crab, blue	1.88 ± 0.08	1.33—2.47	14
Crab, king			
body meat	1.27 ± 0.05	0.94—1.40	8
leg meat	1.73 ± 0.15	1.27—2.23	6
Lobster, spiny	1.20 ± 0.03	1.03—1.33	14
Shrimp, brown, Texas	1.19 ± 0.01	1.14—1.24	7
Shrimp, Maine	1.32 ± 0.08	1.05—1.60	8
Shrimp, Mexican	1.07 ± 0.03	0.80—1.24	18
Shrimp, white, Gulf	1.18 ± 0.02	1.00—1.36	20
Shrimp, white, So. Atl.	1.22 ± 0.03	1.08—1.34	8
Mollusks			
Clam, hard	0.38 ± 0.02	0.24—0.47	8
Clam, soft	2.18 ± 0.33	1.03—3.03	7
Clam, surf	0.88 ± 0.05	0.74—1.18	9
Oyster, Long Island	1.93 ± 0.11	1.64—2.54	10
Oyster, Chesapeake	1.57 ± 0.06	1.30—1.83	10
Scallop, bay	0.84 ± 0.02	0.75—0.90	12
Scallop, calico	0.89 ± 0.02	0.83—0.95	8
Scallop, sea	1.05 ± 0.02	0.95—1.11	6

SUMMARY

This paper presents the total fat and fatty acid composition of finfish, fresh and canned, crustaceans and mollusks.

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Table 3.—Fatty acid composition of raw finfish.

Acid: No. double bonds	Catfish, cultured	Catfish, wild	Cod, Icelandic	Cod, inshore (domestic)	Flounder, yellowtail	Haddock, inshore (domestic)	Hake, Pacific	Halibut	Perch, ocean	Pollock	Rockfish	Snapper, red	Whiting
	Percent total fatty acids												
14:0	[1]1.33 ± 0.23 [2]0.75 – 3.02	[1]3.04 ± 0.40 [2]2.03 – 3.84	[1]2.00 ± 0.74 [2]0.83 – 5.51	[1]2.60 ± 1.83 [2]0.43 – 11.72	[1]5.14 ± 0.95 [2]3.47 – 9.44	[1]1.78 ± 0.71 [2]0.75 – 5.19	[1]3.67 ± 1.23 [2]2.15 – 6.20	[1]2.83 ± 0.16 [2]1.85 – 3.89	[1]4.42 ± 0.38 [2]2.06 – 6.56	*0.73	1.91 ± 0.42 0.94 – 6.31	3.06 ± 0.65 1.01 – 10.54	4.97 ± 0.69 3.23 – 6.78
15:0	0.62 ± 0.09 0.41 – 1.19	1.03 ± 0.26 0.83 – 1.63	0.63 ± 0.19 0.32 – 1.50	0.69 ± 0.45 0.13 – 2.91	0.82 ± 0.18 0.32 – 1.38	0.51 ± 0.14 0.27 – 1.13	0.27 ± 0.11 0.07 – 0.45	0.31 ± 0.02 0.18 – 0.48	0.34 ± 0.02 0.20 – 0.44	*0.23	0.23 ± 0.03 0.16 – 0.49	0.71 ± 0.16 0.28 – 2.76	0.55 ± 0.04 0.46 – 0.68
16:0	10.51 ± 0.79 6.28 – 13.81	20.77 ± 3.66 10.45 – 26.65	14.86 ± 2.26 9.00 – 24.00	16.85 ± 2.80 12.35 – 30.24	16.22 ± 1.97 10.46 – 22.18	17.13 ± 2.91 7.48 – 26.50	13.05 ± 0.53 12.09 – 13.91	10.28 ± 0.76 6.50 – 19.14	8.43 ± 0.44 5.76 – 10.71	*11.12	11.57 ± 1.25 8.15 + 24.66	14.29 ± 1.20 8.38 – 19.66	15.04 ± 1.78 9.53 – 18.93
17:0	1.23 ± 0.10 0.83 – 1.61	1.48 ± 0.15 1.17 – 1.89	1.12 ± 0.09 0.82 – 1.35	1.10 ± 0.70 0.23 – 4.59	2.04 ± 0.27 1.21 – 3.15	1.38 ± 0.29 0.79 – 2.66	0.78 ± 0.08 0.67 – 0.93	0.83 ± 0.06 0.34 – 1.08	0.54 ± 0.05 0.36 – 1.02	*0.70	1.23 ± 0.18 0.54 – 2.20	1.44 ± 0.18 0.79 – 3.36	0.53 ± 0.04 0.42 – 0.65
18:0	5.43 ± 0.51 3.15 – 7.20	4.30 ± 1.05 2.19 – 7.16	10.94 ± 2.60 6.58 – 23.83	7.31 ± 1.68 5.00 – 15.65	7.36 ± 0.96 4.52 – 10.61	6.84 ± 1.43 2.72 – 11.09	2.37 ± 0.27 1.84 – 2.75	2.41 ± 0.33 1.37 – 5.73	2.32 ± 0.09 1.90 – 3.36	*5.67	3.66 ± 0.51 2.00 – 8.67	7.56 ± 0.81 3.28 – 12.20	2.61 ± 0.65 1.07 – 4.40
19:00	0.33 ± 0.08 0.00 – 0.78	—	0.11 ± 0.11 0.00 – 0.64	0.20 ± 0.05 0.00 – 0.34	0.79 ± 0.18 0.31 – 1.38	0.43 ± 0.15 0.00 – 0.84	1.50 ± 0.40 0.85 – 2.22	0.54 ± 0.06 0.00 – 0.82	0.28 ± 0.07 0.00 – 0.91	*0.29	0.54 ± 0.07 0.25 – 0.92	0.25 ± 0.07 0.00 – 0.64	0.64 ± 0.11 0.41 – 1.07
20:0	0.19 ± 0.10 0.00 – 0.69	2.86 ± 1.01 0.00 – 4.49	—	—	0.56 ± 0.21 0.00 – 1.38	0.14 ± 0.09 0.00 – 0.44	1.05 ± 0.06 0.95 – 1.15	0.32 ± 0.08 0.00 – 0.86	0.34 ± 0.08 0.00 – 0.78	*0.40	0.20 ± 0.06 0.00 – 0.43	0.23 ± 0.11 0.00 – 1.38	0.64 ± 0.27 0.00 – 1.29
24:0	0.26 ± 0.17 0.00 – 1.21	0.20 ± 0.20 0.00 – 0.80	0.84 ± 0.84 0.00 – 5.04	—	0.27 ± 0.27 0.00 – 1.64	0.05 ± 0.05 0.00 – 0.32	0.35 ± 0.35 0.00 – 1.05	0.80 ± 0.17 0.00 – 1.88	0.03 ± 0.03 0.00 – 0.49	—	0.23 ± 0.16 0.00 – 1.58	—	—
14:1	0.20 ± 0.05 0.06 – 0.52	0.81 ± 0.17 0.52 – 1.29	0.52 ± 0.27 0.20 – 1.33	0.08 ± 0.02 0.00 – 0.16	0.38 ± 0.09 0.09 – 0.66	0.25 ± 0.10 0.06 – 0.68	0.17 ± 0.04 0.12 – 0.26	0.16 ± 0.02 0.08 – 0.35	0.24 ± 0.00 0.11 – 0.45	*0.12	0.09 ± 0.01 0.06 – 0.17	0.21 ± 0.05 0.04 – 0.75	0.23 ± 0.04 0.11 – 0.33
15:1	0.18 ± 0.03 0.08 – 0.39	0.64 ± 0.14 0.28 – 0.88	0.46 ± 0.21 0.14 – 1.50	0.15 ± 0.02 0.09 – 0.23	0.35 ± 0.05 0.15 – 0.51	0.33 ± 0.19 0.00 – 1.26	0.10 ± 0.02 0.07 – 0.14	0.18 ± 0.03 0.09 – 0.44	0.16 ± 0.01 0.11 – 0.28	*0.10	0.13 ± 0.02 0.06 – 0.23	0.18 ± 0.03 0.03 – 0.44	0.17 ± 0.03 0.12 – 0.26
16:1	4.46 ± 0.48 3.22 – 6.53	7.38 ± 1.83 2.30 – 10.56	3.85 ± 1.18 1.28 – 9.56	2.99 ± 1.30 1.19 – 9.44	7.59 ± 0.84 4.91 – 9.66	3.27 ± 0.64 1.72 – 5.76	6.97 ± 1.19 5.49 – 9.33	8.05 ± 0.33 5.25 – 10.06	5.63 ± 0.91 2.96 – 14.79	*1.59	5.60 ± 0.57 3.26 – 10.67	5.51 ± 0.52 2.02 – 7.81	8.61 ± 0.34 7.71 – 9.38
17:1	0.09 ± 0.09 0.00 – 0.85	0.26 ± 0.26 0.00 – 1.05	0.30 ± 0.21 0.00 – 1.19	0.35 ± 0.08 0.00 – 0.55	0.81 ± 0.08 0.64 – 1.11	0.23 ± 0.18 0.00 – 1.09	0.57 ± 0.57 0.00 – 1.71	0.46 ± 0.09 0.00 – 0.86	0.41 ± 0.07 0.00 – 0.88	*0.29	0.28 ± 0.08 0.00 – 0.71	0.45 ± 0.12 0.00 – 1.35	0.54 ± 0.22 0.00 – 0.93
18:1ω9	12.63 ± 2.23 6.79 – 23.90	22.45 ± 6.37 3.58 – 31.64	13.20 ± 1.68 9.52 – 19.17	14.18 ± 2.53 3.62 – 31.64	11.11 ± 1.08 7.85 – 15.34	13.22 ± 4.31 9.87 – 25.99	12.22 ± 1.58 10.50 – 15.38	17.49 ± 1.00 11.13 – 27.69	13.15 ± 0.49 9.04 – 15.26	*8.88	15.91 ± 1.37 9.04 – 26.14	15.12 ± 0.88 9.87 – 23.96	16.79 ± 2.35 10.41 – 22.55
20:1	1.30 ± 0.37 0.00 – 3.23	1.14 ± 0.67 0.00 – 2.55	4.81 ± 1.39 0.00 – 10.35	3.13 ± 0.93 0.00 – 5.79	2.70 ± 0.34 1.62 – 3.47	1.74 ± 0.38 0.68 – 3.04	1.94 ± 0.39 1.24 – 2.57	6.06 ± 1.33 0.00 – 18.29	7.00 ± 1.37 0.00 – 14.92	*2.96	1.62 ± 0.30 0.00 – 3.79	1.89 ± 0.27 0.57 – 3.49	3.37 ± 0.72 1.66 – 4.99
22:1	0.04 ± 0.03 0.00 – 0.18	—	—	0.09 ± 0.09 0.00 – 0.52	0.08 ± 0.08 0.00 – 0.49	—	—	—	0.16 ± 0.11 0.00 – 1.45	*1.33	0.35 ± 0.13 0.00 – 1.16	—	0.45 ± 0.27 0.00 – 1.13
18:2ω9	2.25 ± 0.83 0.00 – 6.62	5.54 ± 1.30 1.89 – 7.80	2.25 ± 1.02 0.00 – 6.65	0.77 ± 0.19 0.00 – 1.32	0.46 ± 0.24 0.00 – 1.44	1.23 ± 0.40 0.00 – 2.98	1.64 ± 0.07 1.51 – 1.74	1.12 ± 0.07 0.68 – 1.49	1.23 ± 0.11 9.00 – 2.14	*0.94	1.40 ± 0.11 0.81 – 1.88	1.26 ± 0.18 0.39 – 2.50	1.74 ± 0.06 1.61 – 1.93
18:2ω6	0.54 ± 0.14 0.00 – 1.23	0.27 ± 0.27 0.00 – 1.07	0.24 ± 0.16 0.00 – 0.87	0.24 ± 0.05 0.00 – 0.38	0.54 ± 0.12 0.00 – 1.29	0.62 ± 0.27 0.00 – 1.83	0.44 ± 0.08 0.31 – 0.58	0.46 ± 0.04 0.23 – 0.82	0.35 ± 0.08 0.00 – 1.47	*0.21	0.33 ± 0.07 0.00 – 0.81	0.39 ± 0.05 0.00 – 0.77	0.39 ± 0.06 0.30 – 0.59
20:2ω9	0.33 ± 0.17 0.00 – 1.10	0.27 ± 0.27 0.00 – 1.08	0.14 ± 0.09 0.00 – 0.53	0.15 ± 0.08 0.00 – 0.39	0.92 ± 0.27 0.57 – 1.45	0.18 ± 0.09 0.00 – 0.46	0.38 ± 0.19 0.00 – 0.57	0.33 ± 0.05 0.00 – 0.66	0.20 ± 0.04 0.00 – 0.40	*0.48	0.17 ± 0.04 0.00 – 0.38	0.44 ± 0.08 0.00 – 1.05	0.32 ± 0.16 0.00 – 0.85
20:2ω6	0.67 ± 0.17 0.00 – 1.31	—	—	0.26 ± 0.10 0.00 – 0.58	0.64 ± 0.06 0.45 – 0.82	0.07 ± 0.07 0.00 – 0.43	0.22 ± 0.11 0.00 – 0.36	0.16 ± 0.04 0.00 – 0.50	0.13 ± 0.05 0.00 – 0.65	*0.85	0.07 ± 0.04 0.00 – 0.30	0.12 ± 0.05 0.00 – 0.45	0.09 ± 0.06 0.00 – 0.25
18:3ω3	1.16 ± 0.44 0.00 – 3.37	0.51 ± 0.31 0.00 – 1.24	0.72 ± 0.72 0.00 – 4.32	—	0.90 ± 0.41 0.00 – 2.08	0.52 ± 0.37 0.00 – 2.23	2.19 ± 1.35 0.00 – 5.18	3.45 ± 1.14 0.00 – 9.95	5.29 ± 1.56 0.00 – 13.42	—	1.12 ± 0.35 0.00 – 3.67	0.42 ± 0.25 0.00 – 2.66	3.87 ± 2.02 0.00 – 8.86
20:3ω9	0.24 ± 0.08 0.00 – 0.59	0.19 ± 0.19 0.00 – 0.77	0.08 ± 0.05 0.00 – 0.31	0.18 ± 0.08 0.00 – 0.44	0.34 ± 0.08 0.00 – 0.55	0.11 ± 0.05 0.00 – 0.24	0.33 ± 0.06 0.23 – 0.43	0.14 ± 0.03 0.00 – 0.28	0.07 ± 0.02 0.00 – 0.25	*0.21	0.10 ± 0.03 0.00 – 0.21	0.30 ± 0.05 0.00 – 0.76	0.11 ± 0.05 0.00 – 0.20
20:3ω6	0.06 ± 0.04 0.00 – 0.26	—	0.07 ± 0.07 0.00 – 0.44	0.06 ± 0.04 0.00 – 0.21	0.07 ± 0.04 0.00 – 0.25	0.04 ± 0.04 0.00 – 0.23	—	1.19 ± 0.39 0.00 – 4.27	0.06 ± 0.04 0.00 – 0.44	—	1.08 ± 0.61 0.00 – 6.00	0.08 ± 0.03 0.00 – 0.33	0.28 ± 0.17 0.00 – 0.72
20:4ω6 & 20:3ω3	5.68 ± 0.21 4.47 – 6.41	2.29 ± 0.75 1.05 – 4.29	6.04 ± 1.59 2.38 – 11.07	4.10 ± 0.97 0.00 – 6.71	2.93 ± 0.59 0.66 – 5.01	3.25 ± 0.47 1.68 – 4.61	1.89 ± 0.43 1.32 – 2.73	6.42 ± 0.47 3.22 – 9.84	14.95 ± 2.15 0.93 – 29.78	*2.33	2.39 ± 0.40 0.40 – 4.72	3.83 ± 0.34 1.52 – 7.49	7.17 ± 1.94 1.88 – 11.90

Table 3.—Fatty acid composition of raw finfish, continued.

Acid: No. double bonds	Catfish, cultured	Catfish, wild	Cod Icelandic	Cod, inshore (domestic)	Flounder, yellowtail	Haddock, inshore (domestic)	Hake, Pacific	Halibut	Perch, ocean	Pollock	Rockfish	Snapper, red	Whiting
	Percent total fatty acids												
18:4ω3	0.36 ± 0.03 0.27 – 0.53	4.02 ± 3.82 0.00 – 15.46	0.90 ± 0.46 0.00 – 2.74	0.17 ± 0.08 0.00 – 0.40	1.70 ± 0.63 0.91 – 4.80	0.48 ± 0.16 0.00 – 1.14	1.57 ± 0.89 0.00 – 3.09	1.89 ± 0.61 0.41 – 6.52	1.73 ± 0.66 0.31 – 8.67	*0.66	1.82 ± 0.75 0.17 – 7.62	0.83 ± 0.27 0.27 – 4.30	2.41 ± 0.70 1.11 – 4.31
20:4ω3	0.92 ± 0.15 0.46 – 1.72	0.19 ± 0.19 0.00 – 0.76	1.48 ± 0.48 0.00 – 2.72	0.52 ± 0.11 0.00 – 0.78	1.52 ± 0.35 0.85 – 3.21	1.89 ± 0.65 0.48 – 4.80	1.45 ± 0.28 0.95 – 1.91	0.79 ± 0.13 0.00 – 1.65	3.83 ± 1.77 0.00 – 17.3	*1.06	0.95 ± 0.27 0.00 – 2.73	0.82 ± 0.09 0.26 – 1.44	0.54 ± 0.23 0.00 – 1.11
22:4ω6	1.22 ± 0.07 0.96 – 1.57	3.65 ± 2.37 0.00 – 10.74	2.65 ± 0.55 1.55 – 4.74	1.11 ± 0.25 0.00 – 1.73	1.59 ± 0.24 1.13 – 2.75	1.76 ± 0.27 0.95 – 2.63	0.98 ± 0.20 0.59 – 1.21	2.27 ± 0.32 0.74 – 4.46	2.26 ± 0.25 0.64 – 3.28	*0.54	1.34 ± 0.15 0.63 – 1.96	2.00 ± 0.17 0.62 – 2.96	1.73 ± 0.05 0.81 – 1.81
20:5ω3	15.54 ± 2.73 7.31 – 24.28	0.73 ± 0.28 0.00 – 1.25	9.21 ± 2.55 1.39 – 16.24	8.32 ± 1.67 0.00 – 10.60	10.89 ± 2.56 1.29 – 19.61	9.62 ± 2.08 2.24 – 14.31	16.49 ± 1.76 13.11 – 19.02	3.14 ± 0.35 0.00 – 13.63	4.82 ± 0.26 2.50 – 6.30	*9.41	13.33 ± 1.12 4.58 – 18.51	4.68 ± 0.79 0.87 – 13.09	9.18 ± 2.26 5.14 – 17.44
22:5ω6	1.77 ± 0.20 1.27 – 2.81	— —	0.70 ± 0.28 0.00 – 1.60	0.89 ± 0.18 0.00 – 1.18	1.02 ± 0.25 0.00 – 1.95	1.80 ± 0.48 0.00 – 3.50	1.32 ± 0.26 0.82 – 1.69	1.27 ± 0.25 0.00 – 3.26	0.84 ± 0.19 0.00 – 1.24	*1.17	1.07 ± 0.21 0.00 – 2.40	2.63 ± 0.23 1.02 – 4.02	0.46 ± 0.20 0.00 – 0.91
22:5ω3	3.67 ± 0.48 2.04 – 5.91	3.69 ± 2.99 0.00 – 12.64	2.11 ± 0.66 0.00 – 5.04	1.57 ± 0.37 0.00 – 2.81	3.86 ± 0.71 1.59 – 5.82	2.21 ± 0.38 1.02 – 3.71	1.65 ± 0.17 1.33 – 1.93	3.62 ± 0.14 2.52 – 4.36	1.04 ± 0.07 0.53 – 1.76	*1.81	2.86 ± 0.23 1.81 – 4.13	3.76 ± 0.36 0.23 – 5.31	1.24 ± 0.24 0.64 – 2.08
22:6ω3	23.45 ± 3.05 9.55 – 35.86	4.65 ± 3.61 0.00 – 15.42	15.47 ± 5.04 2.63 – 36.38	28.59 ± 6.62 0.00 – 46.47	11.48 ± 3.47 1.86 – 24.76	24.74 ± 6.52 6.09 – 44.20	17.11 ± 5.39 8.57 – 27.08	15.01 ± 1.01 9.79 – 22.38	17.72 ± 1.32 6.64 – 27.22	*46.58	25.64 ± 2.74 19.13 – 38.37	23.90 ± 3.01 0.75 – 47.70	12.49 ± 2.79 7.97 – 22.99
Total Unknown	3.30 ± 0.50 1.86 – 6.87	7.76 ± 1.55 4.92 – 11.16	4.38 ± 2.59 1.06 – 17.16	3.39 ± 1.36 0.68 – 9.31	4.95 ± 1.18 1.31 – 7.83	3.89 ± 0.82 1.47 – 7.07	7.35 ± 1.98 3.41 – 9.63	2.21 ± 0.22 1.30 – 3.77	2.00 ± 0.14 1.16 – 3.23	*1.20	3.02 ± 0.77 1.14 – 9.49	2.96 ± 0.53 0.59 – 6.96	2.75 ± 0.28 2.08 – 3.48
No. of analyses	9	4	6	6	6	6	3	15	16	2	12	14	5

* Insufficient data available at present for a statistical analysis.
[1] Mean ± standard error of mean.
[2] Range of analytical values.

Table 4.—Fatty acid composition of canned finfish.

Acid: No. double bonds	Salmon, red (canned)	Tuna, yellowfin (canned in oil)	Tuna, yellowfin (canned in brine)
	Percent of total fatty acids		
14:0	[1]2.45 ± 0.31 [2]1.66 – 3.18	[1]0.42 ± 0.05 [2]0.28 – 0.59	[1]1.68 ± 0.59 [2]0.54 – 3.63
15:0	0.31 ± 0.02 0.26 – 0.37	0.14 ± 0.02 0.08 – 0.18	0.55 ± 0.14 0.25 – 0.98
16:0	8.50 ± 0.21 8.05 – 9.04	6.78 ± 0.28 5.93 – 7.67	9.30 ± 1.12 6.50 – 12.66
17:0	0.79 ± 0.05 0.67 – 0.91	0.42 ± 0.04 0.26 – 0.58	1.52 ± 0.28 0.82 – 2.42
18:0	1.28 ± 0.25 0.55 – 1.65	3.54 ± 0.21 2.89 – 4.31	4.79 ± 0.89 3.52 – 8.31
19:0	0.60 ± 0.04 0.53 – 0.64	— —	0.48 ± 0.02 0.42 – 0.55
20:0	0.79 ± 0.26 0.00 – 1.13	— —	0.18 ± 0.18 0.00 – 0.89
24:0	—	—	—
14:1	0.16 ± 0.01 0.14 – 0.19	0.02 ± 0.01 0.00 – 0.06	0.13 ± 0.03 0.06 – 0.21
15:1	0.09 ± 0.00 0.08 – 0.09	0.10 ± 0.02 0.05 – 0.19	0.13 ± 0.03 0.07 – 0.26
16:1	3.83 ± 0.35 3.20 – 4.81	1.06 ± 0.15 0.69 – 1.53	3.65 ± 0.92 1.54 – 5.90
17:1	0.39 ± 0.05 0.24 – 0.48	— —	— —
18:1ω9	12.29 ± 0.28 11.69 – 12.88	13.68 ± 0.42 11.82 – 14.93	9.68 ± 0.91 6.32 – 11.78
20:1	0.93 ± 0.58 0.00 – 14.85	1.93 ± 1.10 0.00 – 6.17	1.40 ± 0.18 0.89 – 1.93
22:1	0.65 ± 0.65 0.00 – 2.61	— —	— —
18:2ω9	2.06 ± 0.16 1.78 – 2.43	— —	1.69 ± 0.28 1.07 – 2.42
18:2ω6	0.39 ± 0.02 0.34 – 0.44	31.18 ± 1.28 27.53 – 34.52	0.39 ± 0.02 0.36 – 0.44
20:2ω9	0.16 ± 0.16 0.00 – 0.65	0.25 ± 0.08 0.00 – 0.51	0.32 ± 0.19 0.15 – 0.66
20:2ω6	0.42 ± 0.11 0.26 – 0.75	— —	0.24 ± 0.16 0.00 – 0.75
18:3ω3	6.75 ± 3.53 0.00 – 12.91	1.74 ± 1.11 0.00 – 5.23	0.63 ± 0.19 0.39 – 1.00
20:3ω9	0.33 ± 0.03 0.27 – 0.40	0.08 ± 0.05 0.00 – 0.24	0.37 ± 0.02 0.31 – 0.41
20:3ω6	0.54 ± 0.22 0.00 – 0.90	— —	0.49 ± 0.42 0.00 – 2.17
20:4ω6 & 20:3ω3	7.78 ± 3.89 1.04 – 14.87	3.71 ± 0.34 2.70 – 4.93	6.69 ± 1.55 3.58 – 11.49
18:4ω3	1.24 ± 0.69 0.55 – 2.62	1.93 ± 1.22 0.00 – 6.15	1.00 ± 0.16 0.56 – 1.38
20:4ω3	5.37 ± 3.14 0.00 – 11.91	0.51 ± 0.13 0.00 – 0.85	0.84 ± 0.13 0.61 – 1.31
22:4ω6	0.81 ± 0.07 0.72 – 1.01	0.72 ± 0.07 0.49 – 0.98	1.52 ± 0.41 0.89 – 3.10
20:5ω3	10.09 ± 0.33 9.14 – 10.70	4.56 ± 1.11 2.26 – 8.49	12.59 ± 1.11 10.88 – 16.97
22:5ω6	2.67 ± 0.35 1.65 – 3.18	1.97 ± 0.23 1.57 – 3.06	3.33 ± 0.08 3.05 – 3.48
22:5ω3	3.51 ± 0.16 3.17 – 3.92	1.16 ± 0.14 0.77 – 1.70	2.66 ± 0.22 2.14 – 3.18
22:6ω3	16.44 ± 1.66 14.31 – 21.36	23.26 ± 1.78 17.10 – 29.27	32.34 ± 7.02 14.26 – 49.55
Total Unknown	2.17 ± 0.74 1.31 – 4.39	0.84 ± 0.19 0.47 – 1.76	2.92 ± 0.55 1.45 – 3.90
No. of analyses	4	6	5

[1] Mean ± standard error of mean. [2] Range of analytical values.

Table 5.—Fatty acid composition of crustaceans.

Acid: No. double bonds	Crab, blue	Crab, king (body)	Crab, king (leg)	Lobster, spiny	Shrimp, brown	Shrimp, Maine	Shrimp, Mexican	Shrimp, white Gulf	Shrimp, white So. Atlantic
	Cooked				*Raw*				
	Percent of total fatty acids								
14:0	[1]1.37 ± 0.27 [2]0.59 – 3.45	[1]1.26 ± 0.18 [2]0.84 – 1.88	[1]2.34 ± 0.52 [2]1.59 – 3.34	[1]1.79 ± 0.25 [2]0.42 – 2.76	[1]1.79 ± 0.60 [2]1.17 – 3.58	[1]1.90 ± 0.26 [2]0.71 – 2.46	[1]1.30 ± 0.27 [2]0.62 – 4.35	[1]1.08 ± 0.09 [2]0.58 – 2.04	[1]1.38 ± 0.37 [2]0.71 – 2.52
15:0	0.53 ± 0.05 0.33 – 0.87	0.68 ± 0.13 0.39 – 1.07	0.96 ± 0.21 0.60 – 1.31	0.48 ± 0.06 0.33 – 0.97	1.15 ± 0.25 0.89 – 1.90	0.46 ± 0.04 0.31 – 0.55	0.74 ± 0.08 0.48 – 1.24	0.74 ± 0.03 0.51 – 0.99	0.74 ± 0.10 0.59 – 1.10
16:0	9.64 ± 0.91 4.19 – 14.68	9.91 ± 2.00 5.29 – 15.73	9.16 ± 0.74 7.91 – 10.48	7.59 ± 0.37 6.28 – 10.38	10.40 ± 1.14 7.71 – 12.81	10.13 ± 0.37 8.56 – 11.20	9.60 ± 0.75 5.25 – 15.17	11.86 ± 0.45 8.41 – 15.44	10.37 ± 1.58 7.43 – 16.26
17:00	1.24 ± 0.87 0.79 – 2.19	0.71 ± 0.12 0.30 – 1.01	0.90 ± 0.23 0.63 – 1.36	0.96 ± 0.05 0.71 – 1.30	2.35 ± 0.17 1.95 – 2.74	0.54 ± 0.07 0.34 – 0.80	1.86 ± 0.17 0.90 – 3.03	1.93 ± 0.11 1.36 – 2.88	1.32 ± 0.19 0.66 – 1.77
18:0	4.31 ± 0.48 1.83 – 6.58	1.47 ± 0.29 0.84 – 2.52	1.70 ± 0.26 1.19 – 2.07	6.62 ± 0.53 4.70 – 10.64	6.36 ± 0.96 4.17 – 8.81	1.05 ± 0.25 0.55 – 1.92	6.68 ± 1.02 0.40 – 16.78	9.37 ± 0.73 5.00 – 15.53	5.03 ± 1.10 1.77 – 7.18
19:0	0.21 ± 0.08 0.00 – 0.61	0.56 ± 0.19 0.00 – 1.16	0.66 ± 0.34 0.00 – 1.12	0.10 ± 0.04 0.00 – 0.32	0.74 ± 0.28 0.36 – 1.57	0.32 ± 0.07 0.00 – 0.55	0.32 ± 0.07 0.00 – 0.79	0.46 ± 0.06 0.00 – 0.74	0.46 ± 0.04 0.36 – 0.60
20:0	0.36 ± 0.21 0.00 – 1.80	0.73 ± 0.11 0.42 – 1.02	0.17 ± 0.17 0.00 – 0.52	0.01 ± 0.01 0.00 – 0.14	1.02 ± 0.28 0.65 – 1.84	0.58 ± 0.08 0.30 – 0.85	0.51 ± 0.26 0.00 – 3.50	0.20 ± 0.08 0.00 – 1.00	0.21 ± 0.16 0.00 – 0.81
24:0	0.17 ± 0.17 0.00 – 1.73	0.32 ± 0.32 0.00 – 1.58	— —	— —	— —	— —	— —	0.51 ± 0.18 0.00 – 1.77	0.17 ± 0.17 0.00 – 0.87
14:1	0.15 ± 0.04 0.07 – 0.43	0.28 ± 0.08 0.09 – 0.48	0.18 ± 0.13 0.00 – 0.43	0.05 ± 0.01 0.00 – 0.15	0.29 ± 0.12 0.17 – 0.64	0.25 ± 0.10 0.09 – 0.72	0.16 ± 0.02 0.10 – 0.27	0.14 ± 0.01 0.10 – 0.20	0.16 ± 0.03 0.11 – 0.26
15:1	0.25 ± 0.03 0.12 – 0.48	0.38 ± 0.09 0.13 – 0.65	0.05 ± 0.05 0.00 – 0.15	0.08 ± 0.01 0.00 – 0.17	0.45 ± 0.19 0.25 – 1.02	0.18 ± 0.03 0.12 – 0.25	0.21 ± 0.02 0.09 – 0.36	0.24 ± 0.01 0.14 – 0.34	0.22 ± 0.03 0.15 – 0.30
16:1	5.87 ± 0.40 4.53 – 8.06	3.66 ± 0.28 3.00 – 4.47	5.62 ± 0.77 4.58 – 7.12	4.63 ± 0.35 3.41 – 7.37	5.13 ± 2.01 0.56 – 10.34	6.56 ± 0.55 4.89 – 8.20	4.23 ± 0.42 0.38 – 6.29	5.10 ± 0.43 3.53 – 11.47	5.98 ± 0.46 5.06 – 7.26
17:1	0.16 ± 0.11 0.00 – 0.92	0.55 ± 0.16 0.00 – 0.87	0.24 ± 0.24 0.00 – 0.73	0.08 ± 0.05 0.00 – 0.51	— —	0.31 ± 0.14 0.00 – 0.66	0.29 ± 0.15 0.00 – 1.81	0.19 ± 0.07 0.00 – 0.90	0.39 ± 0.24 0.00 – 1.15
18:1ω9	10.87 ± 0.88 5.56 – 13.53	7.55 ± 1.21 5.55 – 12.02	9.74 ± 0.92 8.03 – 11.18	9.87 ± 0.61 7.46 – 11.59	7.42 ± 0.49 5.98 – 8.10	9.90 ± 1.25 7.13 – 15.20	10.15 ± 0.98 3.95 – 20.23	9.72 ± 0.35 7.24 – 13.30	8.54 ± 1.20 4.83 – 11.53
20:1	3.18 ± 0.54 0.91 – 5.39	0.66 ± 0.19 0.00 – 1.10	1.53 ± 0.82 0.00 – 2.78	1.06 ± 0.13 0.60 – 1.97	0.79 ± 0.26 0.00 – 1.11	0.69 ± 0.16 0.40 – 1.24	1.06 ± 0.20 0.62 – 3.07	1.49 ± 0.11 0.86 – 2.50	1.06 ± 0.20 0.56 – 1.57
22:1	— —	— —	— —	0.07 ± 0.05 0.00 – 0.52	— —	0.42 ± 0.26 0.00 – 1.29	0.03 ± 0.02 0.00 – 0.23	0.16 ± 0.06 0.00 – 0.64	— —
18:2ω9	1.77 ± 0.21 0.60 – 2.63	1.07 ± 0.17 0.80 – 1.71	1.77 ± 0.32 1.18 – 2.27	1.63 ± 0.37 0.00 – 2.94	1.64 ± 0.24 1.16 – 2.29	1.02 ± 0.09 0.79 – 1.46	2.51 ± 0.45 0.32 – 5.58	1.37 ± 0.11 0.40 – 1.96	1.37 ± 0.09 1.12 – 1.66
18:2ω6	0.61 ± 0.18 0.00 – 1.58	0.78 ± 0.12 0.50 – 1.14	0.33 ± 0.33 0.00 – 1.00	1.01 ± 0.35 0.00 – 2.71	0.41 ± 0.14 0.00 – 0.59	0.43 ± 0.06 0.35 – 0.72	0.63 ± 0.10 0.00 – 1.37	0.70 ± 0.06 0.46 – 1.43	0.59 ± 0.06 0.46 – 0.77
20:2ω9	0.49 ± 0.22 0.00 – 1.84	0.74 ± 0.08 0.55 – 0.90	— —	0.14 ± 0.10 0.00 – 0.86	— —	0.59 ± 0.41 0.00 – 2.63	0.63 ± 0.15 0.00 – 1.42	0.75 ± 0.14 0.00 – 1.62	0.55 ± 0.16 0.00 – 0.95
20:2ω6	1.18 ± 0.18 0.88 – 1.50	0.18 ± 0.18 0.00 – 0.92	0.26 ± 0.26 0.00 – 0.78	0.57 ± 0.15 0.00 – 1.31	0.93 ± 0.31 0.00 – 1.33	0.27 ± 0.09 0.00 – 0.66	0.40 ± 0.12 0.00 – 1.18	0.30 ± 0.12 0.00 – 1.47	0.47 ± 0.21 0.00 – 1.08
22:6ω3	19.88 ± 1.03 15.55 – 24.13	13.50 ± 1.50 9.76 – 17.98	13.53 ± 1.13 11.41 – 15.26	10.17 ± 0.49 7.15 – 12.21	17.27 ± 2.11 10.95 – 19.70	20.82 ± 1.56 14.73 – 25.11	18.71 ± 1.07 7.82 – 24.38	17.75 ± 0.79 12.64 – 23.74	18.18 ± 2.05 10.56 – 21.77
Total Unknown	3.70 ± 0.79 1.59 – 7.87	5.51 ± 0.76 2.83 – 6.89	3.15 ± 1.20 1.54 – 5.50	4.37 ± 0.86 0.86 – 10.49	3.27 ± 0.30 2.50 – 3.98	4.02 ± 1.94 1.00 – 13.66	3.32 ± 0.41 1.02 – 6.36	4.55 ± 0.66 1.02 – 9.90	2.83 ± 0.77 1.53 – 5.50
No. of analyses	10	5	3	11	4	6	14	18	5

[1] Mean ± standard error of mean. [2] Range of analytical values.

Table 6.—Fatty acid composition of raw mollusks.

Acid: No. double bonds	Clam, hard	Clam, soft	Clam, surf	Oyster (Long Island)	Oyster (Md.-Va.)	Scallop, bay	Scallop, calico	Scallop, sea
	Percent of total fatty acids							
14:0	[1]2.16 ± 0.41 [2]1.22 – 3.22	[1]2.19 ± 0.40 [2]1.00 – 2.64	[1]2.28 ± 0.39 [2]1.27 – 3.56	[1]8.13 ± 1.66 [2]3.93 – 13.84	[1]3.39 ± 0.50 [2]1.67 – 4.39	[1]2.45 ± 0.42 [2]1.28 – 4.03	[1]2.61 ± 0.60 [2]0.69 – 4.20	[1]3.16 ± 0.96 [2]2.13 – 5.09
15:0	1.38 ± 0.25 0.71 – 1.81	1.15 ± 0.12 0.80 – 1.31	1.07 ± 0.23 0.51 – 1.84	1.45 ± 0.24 0.80 – 1.97	0.91 ± 0.10 0.52 – 1.08	0.71 ± 0.11 0.38 – 1.07	0.71 ± 0.06 0.51 – 0.88	0.72 ± 0.08 0.56 – 0.85
16:0	8.78 ± 1.72 4.91 – 12.62	12.46 ± 3.60 4.85 – 20.98	8.26 ± 1.21 5.37 – 12.65	22.43 ± 2.99 12.64 – 30.31	18.31 ± 0.61 17.01 – 20.54	8.29 ± 0.75 5.30 – 10.11	10.63 ± 0.93 7.09 – 12.43	9.99 ± 2.54 5.52 – 14.32
17:0	1.92 ± 0.25 1.32 – 2.36	1.37 ± 0.26 0.79 – 1.94	1.39 ± 0.29 0.49 – 2.19	1.78 ± 0.21 1.45 – 2.61	1.29 ± 0.11 1.06 – 1.68	0.72 ± 0.11 0.37 – 1.00	0.76 ± 0.09 0.44 – 0.99	0.67 ± 0.14 0.40 – 0.87
18:0	4.08 ± 0.76 2.79 – 5.74	3.03 ± 0.63 1.87 – 4.33	2.87 ± 0.49 1.65 – 4.61	3.45 ± 0.43 2.20 – 4.73	1.92 ± 0.20 1.54 – 2.61	2.19 ± 0.49 1.15 – 4.31	2.62 ± 1.36 0.00 – 6.90	2.02 ± 0.49 1.07 – 2.70
19:0	0.74 ± 0.74 0.00 – 2.97	0.17 ± 0.17 0.00 – 0.69	0.10 ± 0.10 0.00 – 0.51	0.37 ± 0.15 0.00 – 0.64	0.57 ± 0.13 0.36 – 1.08	0.34 ± 0.21 0.00 – 1.15	0.19 ± 0.11 0.00 – 0.58	0.28 ± 0.14 0.00 – 0.44
20:0	2.70 ± 1.19 0.00 – 5.46	0.75 ± 0.44 0.00 – 1.67	0.07 ± 0.07 0.00 – 0.34	1.43 ± 0.13 1.11 – 1.86	1.72 ± 0.45 0.00 – 2.62	0.83 ± 0.17 0.05 – 1.26	0.19 ± 0.16 0.00 – 0.80	0.48 ± 0.32 0.00 – 1.09
24:0	— —	— —	2.28 ± 1.62 0.00 – 8.28	0.43 ± 0.43 0.00 – 2.17	— —	1.25 ± 0.59 0.00 – 3.34	2.42 ± 0.72 0.00 – 3.74	— —
14:1	1.12 ± 0.23 0.50 – 1.59	0.90 ± 0.22 0.25 – 1.18	0.81 ± 0.22 0.19 – 1.53	0.49 ± 0.11 0.23 – 0.88	0.45 ± 0.06 0.22 – 0.57	0.41 ± 0.12 0.04 – 0.73	0.17 ± 0.05 0.04 – 0.33	0.28 ± 0.08 0.19 – 0.45
15:1	1.44 ± 0.25 0.77 – 1.90	1.12 ± 0.25 0.39 – 1.48	0.94 ± 0.25 0.24 – 1.80	0.45 ± 0.13 0.22 – 0.89	0.30 ± 0.05 0.16 – 0.48	0.51 ± 0.12 0.09 – 0.81	0.15 ± 0.04 0.05 – 0.31	0.30 ± 0.09 0.19 – 0.47
16:1	3.07 ± 0.21 2.62 – 3.50	4.48 ± 1.01 2.72 – 7.22	3.06 ± 0.22 2.51 – 3.75	4.31 ± 0.41 3.22 – 5.43	2.83 ± 0.30 1.62 – 3.24	3.14 ± 0.24 2.34 – 4.13	2.14 ± 0.09 1.86 – 2.34	3.11 ± 1.43 1.58 – 5.97
17:1	3.06 ± 1.22 1.33 – 6.64	1.32 ± 0.34 0.48 – 2.01	0.74 ± 0.37 0.00 – 1.93	0.85 ± 0.14 0.58 – 1.22	0.67 ± 0.10 0.49 – 1.06	0.44 ± 0.20 0.00 – 0.91	1.96 ± 1.05 0.00 – 4.44	0.23 ± 0.11 0.00 – 0.37
18:1ω9	5.31 ± 1.65 3.42 – 10.25	6.22 ± 1.25 4.50 – 9.93	5.04 ± 1.04 3.04 – 8.73	4.63 ± 0.51 3.06 – 5.55	3.81 ± 0.16 3.43 – 4.36	3.70 ± 0.49 2.38 – 5.56	2.96 ± 0.40 1.53 – 3.98	3.34 ± 1.32 1.42 – 5.88
20:1	1.21 ± 0.71 0.00 – 2.77	1.10 ± 0.83 0.00 – 3.49	3.69 ± 0.81 0.67 – 5.53	2.39 ± 0.33 1.82 – 3.60	2.13 ± 0.41 1.31 – 3.51	2.89 ± 1.63 0.00 – 10.83	1.22 ± 0.23 0.47 – 1.92	1.51 ± 0.43 0.97 – 2.35
22:1	— —	0.68 ± 0.68 0.00 – 2.72	— —	— —	0.40 ± 0.40 0.00 – 1.98	0.19 ± 0.19 0.00 – 1.11	— —	— —
18:2ω9	2.75 ± 0.18 2.35 – 3.18	1.18 ± 0.41 0.00 – 1.78	0.99 ± 0.45 0.00 – 2.29	1.35 ± 0.14 0.95 – 1.76	2.13 ± 0.18 2.00 – 2.71	1.38 ± 0.51 0.00 – 3.73	0.69 ± 0.06 0.54 ± 0.89	0.84 ± 0.11 0.62 – 0.97
18:2ω6	0.75 ± 0.75 0.00 – 3.00	0.72 ± 0.49 0.00 – 2.09	1.85 ± 0.34 0.67 – 2.77	0.85 ± 0.16 0.56 – 1.33	0.59 ± 0.13 0.36 – 1.08	0.87 ± 0.14 0.35 – 1.38	0.51 ± 0.12 0.28 – 0.91	0.62 ± 0.14 0.45 – 0.89
20:2ω9	1.77 ± 0.70 0.00 – 3.34	1.13 ± 0.46 0.00 – 2.09	— —	0.32 ± 0.13 0.00 – 0.62	2.26 ± 0.66 0.55 – 4.23	0.54 ± 0.19 0.00 – 1.04	0.16 ± 0.10 0.00 – 0.40	0.73 ± 0.37 0.00 – 1.13
20:2ω6	0.55 ± 0.55 0.00 – 2.18	0.11 ± 0.11 0.00 – 0.42	0.42 ± 0.42 0.00 – 2.08	0.46 ± 0.05 0.37 – 0.55	0.53 ± 0.15 0.00 – 0.89	0.17 ± 0.11 0.00 – 0.57	0.35 ± 0.18 0.00 – 0.95	0.83 ± 0.05 0.72 – 0.89
18:3ω3	2.62 ± 0.36 1.96 – 3.38	1.40 ± 0.59 0.00 – 2.82	0.65 ± 0.49 0.00 – 2.55	2.57 ± 0.41 1.79 – 4.05	0.49 ± 0.49 0.00 – 2.45	0.92 ± 0.34 0.00 – 2.13	0.10 ± 0.10 0.00 – 0.52	0.58 ± 0.29 0.00 – 0.93
20:3ω9	0.99 ± 0.65 0.00 – 2.74	0.75 ± 0.62 0.00 – 2.58	1.24 ± 0.74 0.00 – 3.85	0.52 ± 0.20 0.00 – 1.20	0.39 ± 0.12 0.00 – 0.69	1.40 ± 0.54 0.59 – 4.07	0.49 ± 0.13 0.30 – 1.02	0.18 ± 0.18 0.00 – 0.53

Table 6.—Fatty acid composition of raw mollusks, continued.

Acid: No. double bonds	Clam, hard	Clam, soft	Clam, surf	Oyster (Long Island)	Oyster (Md.-Va.)	Scallop, bay	Scallop, calico	Scallop, sea
				Percent of total fatty acids				
20:3ω6	—	—	0.03 ± 0.03	0.16 ± 0.16	0.29 ± 0.14	0.38 ± 0.18	—	0.20 ± 0.20
	—	—	0.00 – 0.17	0.00 – 0.79	0.00 – 0.72	0.00 – 0.89	—	0.00 – 0.60
20:4ω6	3.99 ± 0.39	4.38 ± 0.88	4.22 ± 0.37	1.73 ± 0.20	2.12 ± 0.31	6.77 ± 3.10	6.82 ± 0.35	3.13 ± 0.24
20:3ω3	3.07 – 4.77	2.87 – 6.65	3.30 – 5.53	0.98 – 2.15	1.41 – 3.22	2.74 – 22.17	5.89 – 7.96	2.66 – 3.43
18:4ω3	4.62 ± 1.31	1.82 ± 1.04	2.67 ± 0.64	4.23 ± 0.96	5.83 ± 0.59	2.36 ± 0.64	1.45 ± 0.30	4.37 ± 0.92
	2.31 – 8.34	0.00 – 4.61	0.55 – 4.44	1.41 – 7.37	4.27 – 7.43	0.84 – 5.17	0.67 – 2.36	3.20 – 6.18
20:4ω3	3.51 ± 1.62	1.24 ± 0.54	2.81 ± 1.32	1.14 ± 0.26	1.55 ± 0.40	1.82 ± 0.92	0.74 ± 0.14	1.75 ± 0.12
	0.00 – 7.76	0.00 – 2.54	0.00 – 4.63	0.62 – 1.83	0.88 – 3.00	0.59 – 6.38	0.39 – 1.18	1.53 – 1.94
22:4ω6	5.61 ± 1.33	3.79 ± 0.92	5.98 ± 1.32	1.83 ± 0.35	1.76 ± 0.44	3.10 ± 0.84	2.26 ± 0.19	3.02 ± 0.31
	2.82 – 8.83	1.52 – 6.00	1.65 – 9.16	1.14 – 3.14	0.81 – 3.44	0.00 – 6.26	1.76 – 2.75	2.59 – 3.63
20:5ω3	4.45 ± 1.22	11.22 ± 5.57	11.41 ± 7.69	7.58 ± 1.87	12.17 ± 0.98	19.33 ± 4.81	21.73 ± 1.99	20.59 ± 5.26
	1.73 – 7.67	4.56 – 27.84	0.00 – 41.82	2.32 – 12.60	9.61 – 15.00	0.00 – 36.88	19.14 – 29.64	10.86 – 28.93
22:5ω6	—	0.50 ± 0.31	3.30 ± 2.02	0.54 ± 0.22	1.53 ± 0.33	1.92 ± 0.14	2.98 ± 0.19	1.89 ± 0.23
	—	0.00 – 1.27	0.00 – 10.04	0.00 – 1.02	0.54 – 2.49	1.23 – 2.15	2.36 – 3.42	1.46 – 2.23
22:5ω3	4.02 ± 1.02	3.88 ± 1.15	6.91 ± 1.84	1.56 ± 0.37	1.68 ± 0.44	3.90 ± 0.31	3.32 ± 0.23	2.48 ± 0.03
	1.37 – 6.34	1.50 – 7.68	2.05 – 11.19	0.94 – 3.02	0.56 – 3.21	2.90 – 4.71	2.80 – 4.03	2.44 – 2.54
22:6ω3	5.06 ± 1.24	13.35 ± 2.16	11.49 ± 2.05	5.17 ± 1.06	15.59 ± 1.63	21.55 ± 1.66	27.09 ± 2.07	27.52 ± 3.11
	1.48 – 7.06	9.13 – 17.38	5.49 – 17.94	1.81 – 7.46	10.89 – 18.93	14.37 – 26.21	19.59 – 30.97	21.53 – 31.95
Total Unknown	23.89 ± 4.28	17.15 ± 3.04	13.18 ± 4.30	17.36 ± 1.40	12.09 ± 1.72	5.54 ± 1.24	2.58 ± 1.65	5.17 ± 0.91
	16.04 – 36.09	8.78 – 23.19	2.41 – 26.72	13.63 – 20.92	8.16 – 17.96	0.72 – 9.47	0.33 – 9.04	3.57 – 6.73
No. of analyses	4	4	5	5	5	6	5	3

[1] Mean ± standard error of mean.
[2] Range of analytical values.

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