XV.—CONTRIBUTIONS TO THE KNOWLEDGE OF THE CHEMICAL COMPOSITION AND NUTRITIVE VALUES OF AMERICAN FOOD-FISHES AND INVERTEBRATES.

By W. O. ATWATER, Ph. D.,

Professor of Chemistry, Wesleyan University, Middletown, Conn.

The report of the Commissioner of Fish and Fisheries for 1880 contained a preliminary "report of progress" of an investigation of the subject named as title of this article. The investigation has since been prosecuted as time and circumstances allowed, so that a considerable amount of material has accumulated. It is my aim to collate and prepare this for publication as soon as may be. Meanwhile, at the request of the editor, I state here a few of the results of that branch of the research which has to do more particularly with the nutritive values of the fish and invertebrates.

The investigation embraces—

I. Chemical analyses of the flesh of American food-fishes and invertebrates.

II. Experiments upon the digestibility of the flesh of fish.

III. Studies of the constitution of the flesh of fish.

I. *Chemical analyses of the flesh of the American food-fishes and invertebrates.*

The larger part of the results obtained in the chemical analyses are of interest chiefly in their bearing upon the nutritive values of the materials. A not inconsiderable portion of the work done in connection with the analyses has, nevertheless, like the study of the constitution of the flesh, been of a decidedly theoretical tendency. Indeed, I can see no reason why I should not frankly say that, so far as my own connection with the investigations is concerned my chief interest in it has been that of the biological chemist, a sentiment which I think is warranted, if by no higher considerations, by the very simple fact that in the present condition of human knowledge and progress the most abstract research is a condition of the best practical results. The investigation in its present status includes the chemical analyses of—

(*a*) Flesh of fish	118 specimens of	51 species.
(*b*) Flesh, &c., of invertebrates	64 specimens of	11 species.
Total food-fishes and invertebrates.	182 specimens of	62 species.

Along with these a parallel series of analyses of meats, dairy products, and other food materials, animal and vegetable, have been undertaken, at the instance of the United States National Museum, to furnish data for illustrating and explaining its food-collection. These analyses, though not specifically a part of the investigation herewith reported, form a most important supplement to it, because of the great desirability of data for comparisons of fish with other foods. The number of analyses of the latter kind already made is 90. These, with the 182 of food-fishes and invertebrates, give a general idea of the amounts of nutritive substances in our more common foods. Of course, an at all complete and satisfactory knowledge of the subject will require the prosecution in much more detail of the work of which these analyses represent only the beginning.

II. *Experiments upon the digestibility of the flesh of fish.*

The importance of studying the digestibility of the flesh of fish led me to improve the occasion of a stay in Munich, Germany, to conduct a series of experiments upon this subject. In this I was very materially aided by Professor von Voit, who courteously placed the needed room and appliances in the physiological laboratory of the University at my disposal, and rendered material assistance by his counsel.

The general outcome of the experiments may be expressed in a few words. The proportions of the nutrients digested were tested in a series of experiments with a healthy man and with a dog. The man digested some 98 per cent. of the protein of the fish and nearly the same proportion from meat (lean beef). That is to say, the digestion of the protein of both meat and fish was nearly complete. Essentially the same results were obtained for the other nutritive ingredients. The experiments with the dog gave practically like results with both kinds of food.

Regarding the ease and rapidity of the digestion of fish, the experimental evidence is as yet insufficient for exact conclusions. The investigations thus far made upon the constitution of the ingredients of the flesh, as well as those upon artificial digestion, indicate no great difference between the fish and the leaner meats, as lean beef, and imply that both would be very readily digested. In brief, the experimental facts at hand do not indicate any decided difference in digestibility between fish and the leaner meats. Both belong to the more readily and completely digestible foods.

III. *Studies of the chemical constitution of the proximate ingredients of the flesh of fish.*

It was my fortune to spend some months in Heidelberg, where Professor Kühne, of the University, kindly offered me the facilities of the physiological laboratory under his charge, and added his own valuable assistance in the prosecution of an inquiry into the constitution of

some of the albuminoid compounds of the flesh of fish as compared with those of mammals. This included with other matters the experiments upon artificial digestion above referred to. I have not yet been able to complete the investigation. The results obtained, however, point to a very great similarity between the flesh of our food-fishes and that of the domestic animals we use for food. I hope to be able to continue the inquiry and to present its results hereafter.

The present report includes only the analyses of fish and invertebrates, referred to above as already completed, and such brief explanations as its purpose, that of a record of the chief statistical facts in the form of a report of progress, seems to require.

The details of the chemical analyses have been performed, for the most part, by my assistant, Mr. C. D. Woods, with the aid of Mr. E. B. Voorhees, to whose skill and faithfulness I am happy to bear testimony.

In the report referred to above I had the pleasure of acknowledging contributions of one hundred dollars each from Mr. A. R. Crittenden of Middletown, Conn., and Mr. E. G. Blackford, Fish Commissioner of the State of New York, to which latter gentleman, as well as to Mr. G. H. Shaffer, of the firm of Dorlan & Shaffer, of New York, thanks are due not only for a very large number of the specimens of fish and invertebrates, but also for collateral information of no little value. It is a source of no little gratification to be permitted to add that Mr. F. B. Thurber, of New York, has generously contributed $500 toward the expenses of the analyses of foods, other than fish, just mentioned, and that a still larger sum has been furnished by the liberality of Hon. J. W. Alsop, M. D., of Middletown, Conn., in aid of researches in the laboratory, a considerable portion of which has been used in defraying the cost of the studies in the chemistry of fish. These with some other gifts from private sources have, with a larger amount appropriated to the purpose through the courtesy of Prof. S. F. Baird, Secretary of the Smithsonian Institution and United States Commissioner of Fish and Fisheries, defrayed the incidental expenses of the investigation for assistants, materials, &c., and thus rendered it possible.

ANALYSES OF FISH.

Tables I to X, herewith, contain a *résumé* of the analyses of the flesh of 99 specimens of fish, and of 19 samples of prepared fish-foods, making 118 specimens belonging to 51 species of American food-fishes. They give, however, only such of the data as are most important in their direct bearing upon the food values. The further details, which include descriptions of specimens, the composition of the water-free as well as the fresh substance, and numerous determinations of organic and inorganic constituents not mentioned here, will, I trust, be published elsewhere in the near future.

The methods employed in preparing the materials for analysis and

in the analytical determinations have been described in the preliminary report* above referred to, and in less detail in the *Berichte der Deutschen chemischen Gesellschaft*, xvi, 1883, s. 1839. It will therefore suffice here to refer to them very briefly.

Separation of edible portion (flesh) from refuse (bones, skins, entrails, spawn, &c.).—The sample, as received at the laboratory, was weighed, the edible portion, "flesh," was then separated from the refuse, and both were weighed. There was always a slight loss in cleaning, due, evidently, to evaporation and to slimy and fatty matters and small fragments of the tissues that adhered to the hands and to the utensils used in preparing the sample. Perfect separation of the flesh from the other tissues was difficult, but the loss resulting from this was small, so that, though the figures obtained for edible portion represent somewhat less than was actually in the sample, yet the amount thus wasted was doubtless scarcely more than would be left unconsumed at an ordinary table. The reasons for rejecting the skins, which generally has considerable nutritive value, were that its chemical constitution is different from that of the flesh, and that, so far as we have observed in this country, it is not ordinarily eaten. With the closer domestic economy that increased density of population must bring, people will doubtless become more careful hereafter to utilize such materials.

Water, and water-free substance.—The material is carefully sampled and partially dried at 95° centigrade, or thereabouts, generally in a current of hydrogen, then finally ground and the drying completed in hydrogen. The residue, after removal of all the water, is called water-free substance.

Nitrogen, albuminoids.—The nitrogen is determined by the soda-lime method. The results of a not inconsiderable amount of labor devoted to the study of the conditions under which this method yields correct results have been partially and briefly recapitulated in the accounts above referred to. We have come to believe that with proper precautions extremely accurate determinations may be made with soda-lime but that great care is needed to insure them.

It is customary to compute the albuminoids or protein by multiplying the nitrogen by 6.25. In our analyses this factor has in general been very nearly correct. The subject, however, demands extensive discussion, for which this is not the proper place. I have thought it more to the present purpose to state the percentages of nitrogen, and instead of giving the protein as calculated by multiplying these by 6.25, or any other factor, to estimate the albuminoids by difference. That is to say, the remainder, left after subtracting the sum of ether extract and ash from the water-free substance, or the sum of water, ether extract, and ash from the fresh substance, is taken as the percentage of albuminoids. This is, of course, not absolutely correct, but it is more

* Report of the U. S. Commission of Fish and Fisheries for 1880, Washington, 1883. Appendix D, pp. 242–248.

nearly so than the product of nitrogen by 6.25 would be, and in fact varies but very little from the exact truth. For that matter the protein, as ordinarily estimated, would be so near the truth as to make the variations of but little practical importance as regards the nutritive values. In the analyses of fresh fish there were no cases in which the sum of water, protein (N × 6.25), fat, and ash fell below 99, and but three in which it rose above 101 per cent. In the dried fish the variations were of course wider.

Fats; ether extract.—The figures for fats denote the amounts dissolved out by ether and properly denominated ether extract. In the extraction, which is conducted by use of the apparatus described by Johnson,* we find it advisable to repeat the extraction with fresh flasks until weighing of the latter shows no considerable amount of extract rather than to depend upon evaporation of the percolating ether upon a watch-glass or any other ocular test. The extract is freed from ether by heating at 95° C. in a current of hydrogen. I think that the extract, as determined in this way, in the flesh of fish, represents very closely the actual amount of fat.

Mineral matters; ash.—The ash is determined in the usual way by carbonizing, extracting with water, incinerating, adding water-extract, drying, and incinerating again.

TABLES OF ANALYSIS OF FISH.

The tables show the percentages of water, water-free substance, nitrogen, albuminoids estimated by difference, as above explained, and ash or mineral matters in the flesh—*i. e.*, edible portion of the fish. The number of specimens analyzed of each kind is shown in the first column. Where more than one specimen was analyzed the average is given, and in case the differences were marked the maximum and minimum percentage of each constituent is stated.

Table V gives the composition of the fish, as found in the markets, including both the refuse, bone, skin, entrails, &c., and the edible portion. Some of the specimens were entire, others dressed, as indicated in the table by the terms "whole," "entrails removed," &c.

From the purely economic standpoint this table is the more interesting one since it represents the composition of the fish as ordinarily sold, and thus shows the amounts of nutritive materials which people ordinarily receive in return for the money invested. Further statements regarding the economical bearings of the figures in the tables will be given beyond.

ANALYSES OF INVERTEBRATES.

Table VI herewith recapitulates the principal results of the analyses of 64 specimens of invertebrates (two of vertebrates) belonging to 11 species. As the variations in the composition of different specimens of

*Am. Jour. Sci. [3], 1877, 190.

the same species are very wide, a fact especially noticeable in the oysters; and as this is a matter of no little economic interest, I give the results of individual analyses as well as the averages.

It will be observed that with oysters, clams, &c., the composition of both the flesh (so-called "solids") and the liquid portion of the shell contents is given. Other tables have been prepared stating the proportions of flesh and liquids in the edible portion, proportions of edible portion and refuse (shells, &c.) in whole specimens, and numerous other details; but on account of their bulkiness are not inserted here. In the last columns of Table VI, however, under the heading "In whole sample," are given the percentages of total edible portion and of total water-free substance in the specimens as received for analysis. Thus, in the last column but two, we have the weight of total edible portion (which includes both flesh and liquids in the oysters, clams, and mussels) in 100 parts of each specimen. The percentage of refuse, shells, &c., may be found by subtracting the total edible portion in each case from 100. The last column but one gives the percentage of water-free substance (actual nutrients) in each case. This subtracted from the total edible portion will show the percentage of water in the latter.

As the data of Tables IV and V express the facts only incompletely, I have selected from other tabular statements that have been prepared for future publication, Tables I, II, III, and IV, which show the results of the analyses of fish more fully, as explained in the appendix, in which several of the larger tables are placed for convenience.

While, as said above, I do not deem this exposition of the more practical results of the investigation the proper place for discussing its theoretical aspects, I trust it may not be out of place to speak in somewhat greater length of the relations of the amounts of nitrogen to the amounts of the nitrogen compounds than was done in describing the methods of analysis.

It was there stated that the amounts of protein, as computed by multiplying the nitrogen by 6.25, differed in some cases very materially from the amounts as computed by subtracting the sum of the ether extract and ash from the whole water-free substance. Or, to put it in another way, the sum of the percentages of ash, ether extract, and protein thus computed, in water-free substance, varied considerably from 100, in several cases. This is illustrated by the following figures from Table I, which include all those in which the sum of these percentages in water-free substances varies 2 per cent. or more from 100. The variations in the flesh are, of course, less.

Sum of Protein ($N \times 6.25$) ether extract, ash and water in flesh of fish.

Laboratory number.	Name.	Protein + ether extract + ash in water-free substance.	Protein + ether extract + ash + water in fresh.
40	Spent land-locked salmon	97.01	99.34
41	....do	98.00	99.59
7	Striped bass	102.03	100.43
47	Herring	102.07	100.66
250	Sheepshead	102.08	100.43
229	Haddock	102.16	100.38
22	Flounder	102.19	100.32
45	Masquallonge	102.20	100.52
48	Sheepshead	102.33	100.65
30	Mackerel	102.37	100.61
39	Mackerel	102.39	100.87
18	Whitefish	102.87	100.87
271	Red grouper	102.94	100.62
3	Cod	103.03	100.52
250	Haddock	103.08	100.56
23	Smelt	103.09	100.62
257	Pike perch	103.23	100.62
253	Flounder	103.41	100.52
228	Cod	103.55	100.58
206	Rock cod	103.70	100.73
79	Desiccated cod	104.02	103.41
243	Cod	104.22	100.72
242	Red snapper	104.53	100.95
251	Sea bass	105.04	101.09
11	Cod	106.87	101.14
34	Salt cod	107.08	103.70
25	Salt cod	109.03	104.12
37	Desiccated salt cod	109.06	104.19
247	Skate	116.01	102.85

A more satisfactory way of getting at this matter is the usual one of dividing the total amount of nitrogenous matter by the amount of nitrogen and obtaining as quotient what may be termed the *nitrogen factor* of the protein, the amount of protein being simply the sum of the nitrogenous compounds, determined either directly, or, as in the present case, by difference. If the protein contains 16 per cent. of nitrogen the nitrogen factor is $100 \div 16 = 6.25$. If the percentage of nitrogen is larger, the nitrogen factor is smaller, and *vice versa*.

I have improved the occasion of analyzing the flesh of other animals referred to in the introduction to this article to compute the nitrogen factors for protein in those as well as in the fish. Some of the results are stated in the following table. Only the fresh (not the preserved) fish are included.

Nitrogen factors of protein in flesh of fish and other animals.

No. of specimens analyzed.	Kind of flesh.	Nitrogen factor. Maximum.	Minimum.	Average.
	FLESH OF FISH.			
2	Land-locked salmon, spent (*Salmo salar* subsp. *sebago*)	6.51	6.40	6.45
2	Salmon, spent (*Salmo salar*)	6.32	6.28	6.30
1	Pollock (*Pollachius carbonarius*)			6.26
2	Yellow perch (*Perca fluviatilis*)	6.28	6.18	6.23
3	Porgy (*Stenotomus argyrops*)	6.25	6.20	6.23
1	Cusk (*Brosmius brosme*)			6.23
1	Lamprey eel (*Petromyzon marinus ?*)			6.23
1	Pickerel (*Esox lucius*)			6.23
2	Pickerel (*Esox reticulatus*)	6.24	6.20	6.22
1	Buffalo-fish (*Myxostoma celata*)			6.21
1	Cisco (*Argyrosomus tullibee*)			6.20
1	Hake (*Phycis chuss*)			6.20
1	Mullet (*Mugil albula*)			6.20
1	Pike perch (*Stizostedium vitreum*)			6.20
1	Alewife (*Pomolobus vernalis*)			6.19
2	Black bass (*Micropterus pallidus*)	6.19	6.19	6.19
1	Butter-fish (*Poronotus triacanthus*)			6.19
2	Pompano (*Trachynotus carolinus*)	6.20	6.18	6.19
1	Sturgeon (*Acipenser sturio*)			6.19
1	Tomcod (*Microgadus tomcodus*)			6.19
2	Eel (*Anguilla rostrata*)	6.20	6.15	6.18
1	Red bass (*Sciænops ocellatus*)			6.17
6	Striped bass (*Roccus lineatus*)	6.20	6.11	6.17
4	Blackfish (*Tautoga onitis*)	6.19	6.13	6.17
3	Halibut (*Hippoglossus americanus*)	6.24	6.12	6.17
2	White perch (*Morone americana*)	6.20	6.14	6.17
2	Smelt (*Osmerus mordax*)	6.31	6.02	6.17
1	King Fish (*Menticirrus nebulosus*)			6.16
7	Shad (*Alosa sapidissima*)	6.21	6.11	6.16
3	Brook trout (*Salvelinus fontinalis*)	6.19	6.13	6.16
3	Salmon (*Salmo salar*)	6.17	6.13	6.14
2	Salmon trout (*Oristivomer namaycush*)	6.15	6.14	6.14
2	Flounder (*Paralichthys dentatus*)	6.17	6.10	6.13
1	Mascalonge (*Esox nobilior*)			6.13
6	Mackerel (*Scomber scombrus*)	6.24	5.97	6.13
1	Weakfish (*Cynoscion regalis*)			6.13
1	Bluefish (*Pomatomus saltatrix*)			6.12
4	Haddock (*Melanogrammus æglefinus*)	6.19	6.05	6.12
2	Grouper (*Epinephelus morio*)	6.17	6.06	6.11
1	Spanish mackerel (*Cybium maculatum*)			6.11
2	Sheepshead (*Archosargus probatocephalus*)	6.11	6.05	6.08
2	Red snapper (*Lutjanus blackfordii*)	6.13	5.95	6.04
1	Herring (*Clupea harengus*)			6.04
1	Pike perch (*Stizostedium canadensis*)			6.03
1	Flounder (*Pseudopleuronectes americanus*)			6.02
1	Whitefish (*Coregonus clupeiformis*)			6.01
5	Cod (*Gadus morrhua*)	6.05	5.81	5.97
1	Skate (*Raia* —— *?*)			5.27
	Average, 47 species96 specimens	6.51	5.27	6.14
	FLESH OF OTHER ANIMALS.			
28	Beef, flesh from different parts of body	6.41	6.02	6.21
8	Mutton, flesh from different parts of body	6.49	6.26	6.33
1	Pork			6.25
1	Turkey, white muscle } of same animal			6.22
1	Turkey, dark muscle }			5.78
1	Chicken, entire flesh of one animal			6.02

Were it not for the especial care observed in the analyses, of which more complete descriptions of methods and analytical details will, I trust, be given in a future report, I should be inclined to question the accuracy of some of the above figures for percentages of nitrogen. In every analysis the determinations were made in duplicate, and in a number where the results were out of the usual line, the determinations were

repeated. Thus, in the flesh of the skate, in which the nitrogen factor is the smallest of all, the two regular nitrogen determinations gave, respectively, 16.28 and 16.29 per cent. in the water-free flesh. These figures were so large that the analysis was repeated, with 16.30 per cent. as the result. It is worth noting that the flesh of a number of specimens of preserved fish gave results similar to those for the flesh of the fresh fish in the table. Thus a specimen of desiccated flesh of cod gave 5.98 as the nitrogen factor, a number identical with the average of the specimens of the fresh cod. The figures for the salted fish are, however, more variable, a circumstance which I am unable to explain.

The small nitrogen factors in the skate, cod and some other specimens are of no little interest. That of cod, 5.97, corresponds to 16.75 per cent. of nitrogen, and that of skate, 5.27, to 18.95 per cent. of nitrogen in the protein. These facts may point to decided peculiarities in the constituents of the flesh, particularly in the case of the skate.

RECAPITULATION OF THE ANALYSES OF FISH.

As the large Tables I to VI (at the end of this article) are somewhat bulky and inconvenient for perusal, I give some of the more important details of the percentages of nutritive and other ingredients of the specimens of fish, invertebrates, etc., in Tables VII and X which follow and will explain themselves. It will be borne in mind that the figures are computed from Table II, in which the protein is estimated by difference.

TABLE VII.—*Composition of flesh (edible portion, freed from bone, skin, shells, and other refuse) of food-fishes and invertebrates, etc., arranged in order, from those with the largest to those with the smallest percentages of nutrients.*

No. of specimens analyzed.	Kinds of food-fishes, invertebrates, etc.	Salt.	Water.	Water-free substance (nutrients).	Nutrients.			
					Protein.	Fats.	Carbohydrates.	Mineral matters.
	FRESH FISH.							
3	Salmon (*Salmo salar*)	.....	63.2	36.8	22.6	12.9	.....	1.8
1	Spanish mackerel (*Cybium maculatum*)	.....	68.1	31.9	21.0	9.4	.....	1.5
1	Herring (*Clupea harengus*)	.....	69.0	31.0	18.5	11.0	.....	1.5
2	Salmon trout, "Mackinaw trout" (*Cristivomer namaycush*).	.....	69.1	30.9	18.3	11.3	.....	1.3
1	Whitefish (*Coregonus clupeiformis*)	.....	69.8	30.2	22.1	6.5	.....	1.6
1	Butterfish (*Poronotus triacanthus*)	.....	70.0	30.0	17.9	11.0	.....	1.1
	Shad (*Alosa sapidissima*), very fat	.....	65.2	34.8	19.7	13.6	.....	1.5
7	Shad (*Alosa sapidissima*), rather lean	.....	72.0	28.0	20.0	6.5	.....	1.5
1	Shad (*Alosa sapidissima*), average	.....	70.6	29.4	18.6	9.5	.....	1.3
2	Lamprey eel (*Petromyzon marinus*)	.....	71.1	28.9	14.9	13.3	.....	0.7
2	Eel, salt-water (*Anguilla rostrata*)	.....	71.6	28.4	18.3	9.1	.....	1.0
1	Pompano (*Trachynotus carolinus*)	.....	72.8	27.2	18.7	7.5	.....	1.0
	Alewife (*Pomolobus vernalis*)	.....	73.0	27.0	19.5	6.0	.....	1.5
	Mackerel (*Scomber scombrus*), very fat	.....	64.0	36.0	18.2	16.3	.....	1.5
6	Mackerel (*Scomber scombrus*), rather lean	.....	75.4	24.6	19.1	4.2	.....	1.3
1	Mackerel *Scomber scombrus*), average	.....	73.4	26.6	18.3	7.0	.....	1.3
3	Mullet (*Mugil albula*)	.....	74.9	25.1	19.3	4.6	.....	1.2
	Porgy (*Stenotomus argyrops*)	.....	75.0	25.0	18.5	5.1	.....	1.4
	Halibut (*Hippoglossus americanus*), very fat	.....	70.1	29.9	18.2	10.6	.....	1.1
	Halibut (*Hippoglossus americanus*), rather lean	.....	79.2	20.8	17.5	2.2	.....	1.1
8	Halibut (*Hippoglossus americanus*), average	.....	75.4	24.6	18.3	5.2	.....	1.1

TABLE VII.—*Composition of flesh of food-fishes, &c.*—Continued.

No. of specimens analyzed.	Kinds of food-fishes, invertebrates, etc.	Salt.	Water.	Water-free substance (nutrients).	Nutrients.			
					Protein.	Fats.	Carbohydrates.	Mineral matters.
	FRESH FISH—Continued.							
2	Sheepshead (*Archosargus probatocephalus*)	....	75.5	24.5	19.6	3.7	.....	1.2
2	White perch (*Morone americana*)	.....	75.7	24.3	19.0	4.1	.....	1.2
1	Pollock (*Pollachius carbonarius*)	.....	76.0	24.0	21.7	0.8	.....	1.5
1	Cisco (*Argyrosomus tullibee*)	.....	76.1	23.9	19.1	3.5	.....	1.3
1	Mascalonge (*Esox nobilior*)	.....	76.3	23.7	19.6	2.5	.....	1.6
2	Black bass (*Micropterus pallidus*)	.....	76.7	23.3	20.4	1.7	.....	1.2
6	Striped bass (*Roccus lineatus*)	.....	77.7	22.3	18.3	2.8	.....	1.2
3	Brook trout (*Salvelinus fontinalis*)	.....	77.7	22.3	19.0	2.1	.....	1.2
1	Bluefish (*Pomatomus saltatrix*)	.....	78.5	21.5	19.0	1.2	.....	1.3
1	Buffalo-fish (*Myxostoma celata*)	.....	78.6	21.4	17.9	2.3	.....	1.2
2	Red snapper (*Lutjanus blackfordii*)	....	78.6	21.4	18.8	1.2	.....	1.3
1	Sturgeon (*Acipenser sturio*)	.....	78.7	21.3	18.0	1.9	.....	1.4
1	Weakfish (*Cynoscion regalis*)	.....	79.0	21.0	17.4	2.4	.....	1.2
4	Blackfish (*Tautoga onitis*)	.....	79.1	20.9	18.5	1.3	.....	1.1
2	Smelt (*Osmerus mordax*)	.....	79.2	20.8	17.3	1.8	.....	1.7
1	Kingfish (*Menticirrus nebulosus*)	.....	79.2	20.8	18.6	1.0	.....	1.2
2	Yellow perch (*Perca fluviatilis*)	.....	79.2	20.8	18.8	0.8	.....	1.2
1	Sea bass (*Centropristis atrarius*)	.....	79.3	20.7	18.8	0.5	.....	1.4
2	Grouper (*Epinephelus morio*)	.....	79.4	20.6	18.8	0.6	.....	1.2
2	Pickerel (*Esox reticulatus*)	.....	79.7	20.3	18.6	0.5	.....	1.2
1	Pike perch (*Stizostedium vitreum*)	.....	79.7	20.3	18.4	0.5	.....	1.4
1	Pickerel (*Esox lucius*)	.....	79.8	20.2	19.6	0.6	.....	1.0
1	Pike perch (*Stizostedium canadensis*)	.....	80.9	19.1	17.2	0.8	.....	1.1
1	Tomcod (*Microgadus tomcodus*)	.....	81.5	18.5	17.1	0.4	.....	1.0
1	Red bass (*Sciænops ocellatus*)	.....	81.6	18.4	16.7	0.5	.....	1.2
4	Haddock (*Melanogrammus æglefinus*)	.....	81.7	18.3	16.8	0.3	.....	1.2
1	Cusk (*Brosmius brosme*)	.....	82.0	18.0	16.9	0.2	.....	0.9
1	Skate (*Raia?*)	.....	82.1	17.9	15.3	1.4	.....	1.2
5	Cod (*Gadus morrhua*)	.....	82.6	17.4	15.8	0.4	.....	1.2
1	Hake (*Phycis chuss*)	.....	83.1	16.9	15.2	0.7	.....	1.0
2	Flounder (*Paralichthys dentatus*)	.....	84.2	15.8	13.8	0.7	.....	1.3
1	Flounder (*Pseudopleuronectes americanus*)	.....	84.4	15.6	14.0	0.4	.....	1.2
	ROE.							
1	Shad roe	.....	71.2	28.8	23.5	3.8	.....	1.5
	SPENT FISH.							
2	Salmon (*Salmo salar*)	.....	76.7	23.3	18.6	3.6	.....	1.1
2	Land-locked salmon (*Salmo salar* subsp. *sebago*)	.....	78.5	21.5	17.3	3.0	.....	1.2
	PRESERVED FISH.							
	Dried.							
1	Desiccated cod, dried flesh (*Gadus morrhua*)	2.9	15.3	81.8	74.5	1.9	.....	5.4
	Salted.							
1	Salt mackerel (*Scomber scombrus*)	10.6	42.2	47.2	22.0	22.6	.....	2.6
	Salted and dried.							
1	Desiccated cod, dried flesh (*Gadus morrhua*)	6.6	11.6	81.8	71.7	4.9	.....	5.2
1	Cod, boned (*Gadus morrhua*)	19.1	54.4	26.5	22.1	0.3	.....	4.1
2	Cod (*Gadus morrhua*)	20.6	53.6	25.8	21.4	0.3	.....	4.1
	Salted, smoked, and dried.							
1	Herring (*Clupea harengus*)	11.7	34.5	53.8	36.5	15.8	.....	1.5
2	Halibut (*Hippoglossus americanus*)	13.0	49.4	37.6	20.5	15.0	.....	2.1
1	Haddock, "Findon haddie" (*Melanogrammus æglefinus*).	2.1	72.5	25.4	23.7	0.2	.....	1.5
	Canned.							
1	Tunny, "Horse mackerel" (*Orcynus secundo-dorsalis?*).	9.5	43.2	47.3	16.9	27.9	.....	2.5
2	Salt mackerel (*Scomber scombrus*)	10.3	43.4	46.3	17.3	26.4	.....	2.6
1	Sardines (*Clupea pilchardus?*)	.....	56.4	43.6	25.3	12.7	.....	5.6

TABLE VII.—*Composition of flesh of food-fishes, &c.*—Continued.

No. of specimens analyzed.	Kinds of food-fishes, invertebrates, etc.	Salt.	Water.	Water-free substance (nutrients).	Nutrients.			
					Protein.	Fats.	Carbohydrates.	Mineral matters.
	PRESERVED FISH—Continued.							
	Canned—Continued.							
3	Salmon (*Onoorhynchus chouicha*)	1.3	59.9	38.8	19.4	18.0	.....	1.4
1	Mackerel (*Scomber scombrus*)	1.9	68.2	29.9	19.9	8.7	.....	1.3
1	"Findon haddie," smoked haddock (*Melanogrammus æglefinus*).	5.6	68.7	25.7	21.7	2.3	.....	1.7
	Shell-fish, &c.							
	Oysters (*Ostrea virginiana*), shell contents, poorest.[1]	.....	91.5	8.5	4.5	0.0	1.7	1.7
	Oysters (*Ostrea virginiana*), shell contents, richest.[1]	.....	85.3	14.7	6.2	1.3	5.0	2.2
34	Oysters (*Ostrea virginiana*), shell contents, average.[1]	.....	87.3	12.7	6.0	1.2	3.5	2.0
4	Oysters (*Ostrea virginiana*), "solids"[2]	.....	87.2	12.8	6.3	1.6	4.0	0.9
4	Long clams (*Mya arenaria*), shell contents	.....	85.9	14.1	8.5	1.0	2.0	2.6
1	Round clams (*Venus mercenaria*), shell contents	.....	86.2	13.8	6.6	0.4	4.2	2.6
1	Mussels (*Mytilus edulis*), shell contents	.....	84.2	15.8	8.7	1.1	4.1	1.9
2	Scallops (*Pecten irradians*) edible portion (muscle)	.....	80.3	19.7	14.7	0.2	3.4	1.4
4	Lobster (*Homarus americanus*), shell contents	.....	81.8	18.2	14.7	1.8	0.0	1.7
1	Crabs (*Ballinectes hastatus*), shell contents	.....	77.1	22.9	16.6	2.0	1.2	3.1
1	Crayfish, shell contents	.....	81.2	18.8	16.0	0.5	1.0	1.3
1	Terrapin shell contents	.....	74.5	25.5	21.0	3.5	.....	1.0
1	Green turtle (*Chelonia mydas*), shell contents	.....	79.8	20.2	18.5	0.5	.....	1.2
	Canned.							
3	Oysters (*Ostrea virginiana*)	.....	85.2	14.8	7.4	2.1	4.0	1.3
1	Long clams (*Mya arenaria*)	.....	84.5	15.5	9.1	1.3	2.8	2.3
1	Round clams (*Venus mercenaria*)	.....	82.9	17.1	9.6	0.7	3.1	3.7
2	Lobster (*Homarus americanus*)	.....	77.8	22.2	18.0	1.1	0.0	2.5
2	Crabs (*Ballinectes hastatus*)	.....	80.0	20.0	15.9	1.5	0.7	1.9

[1] In respect to percentage of nutrients, with no reference to flavor.

[2] Shell contents as commonly sold, including whole of flesh and part of liquids.

PROPORTIONS OF FLESH IN THE BODIES OF THE SPECIMENS OF FISH.

As was stated in the description of the methods of analysis, the specimens were received for analysis in the forms in which they are ordinarily sold in the markets—some whole, others dressed. They were weighed as received, and the flesh, thereupon, separated from the skin, bones and other organs as perfectly as could conveniently be done. The flesh and the refuse matter thus separated were each weighed and their percentages computed with results as set forth in Tables V and VIII. More or less of the flesh adhered to the skin and bones; but the quantities thus neglected were extremely small in proportion to the whole amount, and the figures in the tables are practically correct. The flesh, except in the fatter specimens, consisted mainly of muscular tissue. The proportions in the specimens of entire (not dressed) fish are recapitulated in Table VIII.

TABLE VIII.—*Percentages of flesh in specimens of entire fish, arranged in order from those with the highest to those with the lowest proportions of flesh.*

Kinds of fish.	No. of specimens analyzed.	Percentages of flesh.		
		Maximum.	Minimum.	Average.
FRESH FISH.				
Spanish mackerel (*Cybium maculatum*)	1			65.4
Salmon (*Salmo salar*)	2	62.5	60.5	61.5
Smelt (*Osmerus mordax*)	2	65.2	51.0	58.1
Pickerel (*Esox lucius*)	1			57.3
Cisco (*Argyrosomus tullibee*)	1			57.3
Butter-fish (*Poronotus triacanthus*)	1			57.2
Spent salmon (*Salmo salar*)	2	56.5	56.2	56.4
Mackerel (*Scomber scombrus*)	5	66.2	48.2	55.4
Pompano (*Trachynotus carolinus*)	2	57.6	51.4	54.5
Lamprey eel (*Petromyzon marinus?*)	1			54.2
Herring (*Clupea harengus*)	1			54.0
Pickerel (*Esox reticulatus*)	2	54.6	51.8	53.0
Spent land-locked salmon (*Salmo salar* subsp. *sebago*)	2	53.8	51.6	52.7
Brook trout (*Salvelinus fontinalis*)	3	54.8	49.9	51.9
Muscalonge (*Esox nobilior*)	1			50.8
Alewife (*Pomolobus vernalis*)	1			50.6
Shad (*Alosa sapidissima*)	7	55.6	41.2	49.9
Weakfish (*Cynoscion regalis*)	1			48.1
Cod (*Gadus morrhua*)	2	51.5	43.5	47.5
Whitefish (*Coregonus clupeiformis*)	1			46.5
Black bass (*Micropterus pallidus*)	2	46.4	44.0	45.2
Striped bass (*Roccus lineatus*)	5	51.4	42.9	45.1
Sea bass (*Centropristis atrarius*)	1			43.9
Flounder (*Pseudopleuronectes americanus*)	1			43.8
Salmon trout (*Cristivomer namaycush*)	1			43.7
Kingfish (*Menticirrus nebulosus*)	1			43.4
Pike perch (*Stizostedium vitreum*)	1			42.8
Mullet (*Mugil albula*)	1			42.1
Tomcod (*Microgadus tomcodus*)	1			40.1
Porgy (*Stenotomus argyrops*)	3	42.7	34.9	40.0
Blackfish (*Tautoga onitis*)	2	43.8	35.9	39.8
White perch (*Morone americana*)	2	38.2	36.8	37.5
Yellow perch (*Perca fluviatilis*)	1			37.3
Pike perch (*Stizostedium canadensis*)	1			36.8
Red bass (*Sciænops ocellatus*)	1			36.5
Sheepshead (*Archosargus probatocephalus*)	1			34.0
Flounder (*Paralichthys dentatus*)	1			33.2

Thus the largest percentage of flesh was in the Spanish mackerel, 65.4, and the smallest in the flounder, 33.2, per cent. I shall refer to these figures again.

The variations in the composition of the flesh are as wide as those of the amounts of flesh in the whole animal, as appears from Table IX, which follows:

TABLE IX.—*Percentage of water-free substance (nutrients) in flesh of fish, arranged in order from those with the highest to those with the lowest proportion of water-free substance.*

Kinds of fish.	No. of specimens analyzed.	Percentages of water-free substance in flesh.		
		Maximum.	Minimum.	Average.
FRESH FISH.				
Salmon	3	33.97	32.85	33.32
Spanish mackerel	1			31.00
Herring	1			30.97
Salmon trout	2	31.22	30.50	30.86
Whitefish	1			30.17
Butter-fish	1			29.98
Shad	7	34.75	26.44	29.38

TABLE IX.—*Percentage of water-free substance, &c.*—Continued.

Kinds of fish.	No. of specimens analyzed.	Percentages of water-free substance in flesh.		
		Maximum.	Minimum.	Average.
FRESH FISH—Continued.				
Lamprey eel	1			28.88
Eel, salt-water	2	30.20	26.60	28.40
Pompano	2	32.62	21.82	27.22
Alewife	1			27.04
Mackerel	6	35.99	21.33	26.63
Mullet	1			25.13
Porgy	3	28.02	20.32	25.01
Halibut	3	29.87	20.85	24.58
Sheepshead	2	27.99	20.92	24.45
White perch	2	24.36	24.23	24.29
Pollock	1			23.98
Cisco	1			23.85
Mascalonge	1			23.74
Black bass	2	25.18	21.30	23.29
Spent salmon	2	24.78	21.80	23.26
Striped bass	6	24.24	20.27	22.29
Brook trout	3	24.22	20.16	22.28
Bluefish	1			21.54
Spent land-locked salmon	2	22.12	20.80	21.46
Buffalo fish	1			21.44
Red snapper	2	22.66	20.19	21.42
Weakfish	1			21.03
Blackfish	4	23.05	18.64	20.90
Smelt	2	21.84	19.84	20.84
Kingfish	1			20.79
Yellow perch	2	21.93	19.57	20.75
Sea bass	1			20.08
Grouper	2	21.04	20.15	20.60
Pickerel	2	20.48	20.16	20.32
Pike perch	1			20.26
Pickerel	1			20.21
Pike perch	1			19.15
Tomcod	1			18.45
Red bass	1			18.44
Haddock	4	19.70	17.44	18.81
Cusk	1			17.99
Skate	1			17.85
Cod	5	19.20	16.52	17.36
Hake	1			16.89
Flounder	2	16.63	14.96	15.79
Flounder	1			15.65
ROE.				
Shad roe	1			28.75
PRESERVED FISH.				
Cod, boned, steam-dried, and ground	1			81.87
Cod, boned, steam-dried, and ground (salted)	1			81.87
Herring, salted, smoked, and dried	1			53.79
Tunny, "Horse mackerel," canned	1			47.33
Mackerel, salted	1			47.21
Mackerel, salted, canned	2	47.33	45.22	46.27
Sardines	1			43.63
Salmon, canned	3	42.04	33.61	38.81
Halibut, salted, smoked, and dried	2	39.43	35.89	37.66
Mackerel, canned	1			29.59
Cod, salted and dried (boned)	1			26.52
Cod, salted and dried	2	26.24	25.43	25.84
Canned "Findon haddie," smoked haddock	1			25.68
Haddock, "Findon haddie," salted, smoked, and dried	1			25.38

CLASSIFICATION OF FISH BY THEIR COMPOSITION.

On the basis of the figures of Tables VII, VIII, and IX, I have attempted a classification of the specimens of fish by their content of (1) flesh, (2) water-free substance in flesh, and (3) water and fats. With the following figures, the classifications will need no further explanation. Where more than one specimen was analyzed the averages of the

analyses are used. Of course a satisfactory classification would require many more analyses. Nevertheless these figures may be assumed to give a tolerably fair idea of the relative composition of the fish, or at least, an approximation that may serve until more complete data are obtained. Accordingly the order of the kinds in each of the four following groups must be regarded as by no means fixed, since further analyses would very likely give averages varying more or less from the results here tabulated.

CLASSIFICATION OF SPECIMENS OF FISH BY AMOUNTS OF FLESH (CHIEFLY MUSCULAR TISSUE) IN THE BODY, OR, IN OTHER WORDS, BY THE RATIO OF THE WEIGHT OF THE FLESH TO THE SUM OF WEIGHTS OF THE OTHER TISSUES.

SPECIMENS CONTAINING OVER 60 PER CENT. OF FLESH.

No. of specimens analyzed.	Kind of fish.	Flesh.	No. of specimens analyzed.	Kind of fish.	Flesh.
		Per cent.			*Per cent.*
1	Spanish mackerel	65.4	2	Salmon	61.5

SPECIMENS CONTAINING BETWEEN 60 AND 50 PER CENT. OF FLESH.

2	Smelt	58.1	1	Lamprey eel	54.2
1	Pickerel[1]	57.3	1	Herring	54.0
1	Cisco	57.3	2	Pickerel[2]	53.0
1	Butterfish	57.2	2	Spent land-locked salmon	52.7
2	Spent salmon	56.4	3	Brook trout	51.9
5	Mackerel	55.4	1	Mascalonge	50.8
2	Pompano	54.5	1	Alewife	50.6

SPECIMENS CONTAINING BETWEEN 50 AND 40 PER CENT., INCLUSIVE, OF FLESH.

7	Shad	49.9	1	Flounder[3]	43.8
1	Weakfish	48.1	1	Salmon trout	43.7
2	Cod	47.5	1	Kingfish	43.4
1	Whitefish	46.5	1	Pike perch[4]	42.8
2	Black bass	45.2	1	Mullet	42.1
5	Striped bass	45.1	1	Tom-cod	40.1
1	Sea bass	43.9	3	Porgy	40.0

SPECIMENS CONTAINING BETWEEN 40 AND 30 PER CENT. OF FLESH.

2	Blackfish	39.8	1	Red bass	36.5
2	White perch	37.5	1	Sheepshead	34.0
1	Yellow perch	37.3	1	Flounder[5]	33.2
1	Pike perch[5]	30.8			

[1] *Esox lucius.*
[2] *Esox reticulatus.*
[3] *Pseudopleuronectes americanus.*
[4] *Stizostedium vitreum.*
[5] *Stizostedium canadense.*
[6] *Paralichthys dentatus.*

CLASSIFICATION OF SPECIMENS OF FISH BY AMOUNTS OF WATER-FREE SUBSTANCE IN THE FLESH.

The kinds of fish analyzed are grouped below on the basis of the percentages of water-free substance in the flesh. The specimens are ranged in order from those with the largest to those with the smallest amounts of water-free substance. Of course those with the most water-free substance have the least water, and vice versa. Hence, the first in this arrangement have the lowest percentages of water, while the last are the most watery.

SPECIMENS CONTAINING OVER 30 PER CENT. OF WATER-FREE SUBSTANCE.

No. of specimens analyzed.	Kind of fish.	Water-free.	No. of specimens analyzed.	Kind of fish.	Water-free.
		Per cent.			*Per cent.*
8	Maine salmon	36.8	1	Herring	31.0
1	California salmon[1]	35.5	2	Salmon trout	30.9
1	Spanish mackerel	31.9	1	Whitefish	30.2

SPECIMENS CONTAINING FROM 30 TO 25 PER CENT. OF WATER-FREE SUBSTANCE.

1	Butterfish	30.0	1	Alewife	27.0
7	Shad	29.4	6	Mackerel	26.6
1	Lamprey eel	28.9	1	Mullet	25.1
3	Eel, salt-water	28.4	8	Porgy	25.0
2	Pompano	27.2			

SPECIMENS CONTAINING BETWEEN 25 AND 20 PER CENT. OF WATER-FREE SUBSTANCE.

8	Halibut	24.6	2	Red snapper	21.4
2	Sheepshead	24.5	1	Sturgeon[1]	21.3
2	White perch	24.3	1	Weakfish	21.0
1	Pollock	24.0	4	Blackfish	20.9
1	Cisco	23.9	2	Smelt	20.8
1	Muscalonge	23.7	1	Kingfish	20.8
2	Black bass	23.3	2	Yellow perch	20.8
2	Spent salmon	23.3	1	Sea bass	20.7
6	Striped bass	22.3	2	Grouper	20.6
8	Brook trout	22.3	2	Pickerel[2]	20.3
1	Bluefish	21.5	1	Pike perch[3]	20.3
2	Spent land-locked salmon	21.5	1	Pickerel[4]	20.2
1	Buffalo fish	21.4			

SPECIMENS CONTAINING BETWEEN 20 AND 15 PER CENT. OF WATER-FREE SUBSTANCE.

1	Pike perch[5]	19.1	1	Skate	17.9
1	Tomcod	18.5	5	Cod	17.4
1	Red bass	18.4	1	Hake	16.9
4	Haddock	18.3	2	Flounder[6]	15.3
1	Cusk	18.0	1	Flounder[7]	15.6

[1] The specimen contained only a section of the body, and not the whole body or the whole of the edible portion of a fish, as was the case with the other specimens.
[2] *Esox reticulatus.* [3] *Stizostedium vitreum.* [4] *Esox lucius.* [5] *Stizostedium canadensis.* [6] *Paralichthys dentatus.* [7] *Pseudopleuronectes americanus.*

PERCENTAGES OF FATS AND WATER IN FLESH OF SPECIMENS OF FISH OF DIFFERENT SPECIES.

It is interesting to observe the connection between the proportions of water and those of fat in the flesh of the fish. In the tissues of fish, as of other animals, as is well known, an increase of fat is generally accompanied by a decrease of water. This is strikingly the case in the flesh of the fish analyzed, as is shown in the following classification, in which the specimens are grouped on the basis of their percentages of fats (ether extract), in order commencing with the fattest and ending with the leanest specimens. Where more than one specimen was analyzed the average figures are given, as in the preceding classifications.

SPECIMENS CONTAINING OVER 5 PER CENT. OF FATS.

No. of specimens analyzed.	Kinds of fish.	Water.	Fats.	No. of specimens analyzed.	Kinds of fish.	Water.	Fats.
		Per cent.	*Per cent.*			*Per cent.*	*Per cent.*
1	Lamprey eel	71.1	13.3	2	Eel, salt-water	71.6	9.1
3	Salmon	63.2	12.9	2	Pompano	72.8	7.5
2	Salmon trout	69.1	11.3	6	Mackerel	73.4	7.0
1	Butter-fish	70.0	11.0	1	Whitefish	69.8	6.5
1	Herring	69.0	11.0	1	Alewife	73.0	6.0
7	Shad	70.0	9.5	8	Halibut	75.4	5.2
1	Spanish mackerel	68.1	9.4	2	Porgy	75.0	5.1

SPECIMENS CONTAINING BETWEEN 5 AND 2 PER CENT. OF FATS.

1	Mullet	74.9	4.6	1	Mascalonge	76.3	2.5
2	White perch	75.7	4.1	1	Weakfish	79.0	2.4
2	Sheepshead	75.5	3.7	1	Buffalo-fish	78.6	2.3
1	Cisco	76.2	3.5	3	Brook trout	77.7	2.1
0	Striped bass	77.7	2.8				

SPECIMENS CONTAINING LESS THAN 2, THE MAJORITY LESS THAN 1, PER CENT. OF FATS.

2	Smelt	79.2	1.8	2	Grouper	79.4	0.6
2	Black bass	76.7	1.7	1	Pickerel [3]	79.8	0.6
1	Skate	82.1	1.4	1	Sea bass	79.3	0.5
4	Blackfish	70.1	1.3	1	Pike perch [4]	79.7	0.5
1	Bluefish	78.5	1.2	2	Pickerel [5]	79.7	0.5
2	Red snapper	78.6	1.2	1	Red bass	81.6	0.5
1	Kingfish	79.2	1.0	1	Tomcod	81.5	0.4
1	Pollock	76.0	0.8	5	Cod	82.0	0.4
2	Yellow perch	79.3	0.8	1	Flounder [6]	84.3	0.4
1	Pike perch [1]	80.8	0.8	4	Haddock	81.7	0.3
1	Hake	83.1	0.7	1	Cusk	82.0	0.2
2	Flounder [2]	84.2	0.7				

[1] *Stizostedium canadensis.*
[2] *Paralichthys dentatus.*
[3] *Esox lucius.*
[4] *Stizostedium vitreum.*
[5] *Esox reticulatus.*
[6] *Pseudopleuronectes americanus.*

From these figures the general decrease of the water with the increase of fat is very apparent, though not perfectly regular. This might seem to be due simply to replacement of the water by fat in the tissues. It will be worth while to inquire whether this assumption is borne out by the analyses. To answer this question we should compare different

analyses of flesh of the same species, and see in how far the principle holds good, in other words, whether the protein remains constant, or nearly so, and whether the fat increases at the expense of the water or the water at the expense of the fat.

The following figures include all the cases in which two or more analyses were made of flesh containing in any case over 3 per cent of fats:

Percentages of fats, water, and protein in flesh of fish, different specimens of same species.

Kind of fish.	Number.	Fats.	Water.	Protein.
		Per cent.	*Per cent.*	*Per cent.*
Salmon (*Salmo salar*)	*280	13.1	61.0	24.5
	†279	13.0	61.4	24.2
	14	12.5	67.1	19.2
Spent salmon	*85	4.4	75.3	19.2
	†86	2.8	78.2	17.8
Salmon trout (*Cristivomer namayoush*)	17	12.5	68.8	17.3
	255	10.2	60.5	19.1
Shad (*Alosa sapidissima*)	10	13.6	65.3	19.7
	6	10.8	69.7	18.3
	212	10.2	71.0	17.8
	32	10.1	70.7	17.8
	245	8.1	72.1	18.2
	249	7.0	73.0	18.0
	221	6.5	72.0	20.0
Eel, salt-water (*Anguilla rostrata*)	4	10.8	69.8	18.9
	217	7.9	73.4	17.6
Pompano (*Trachynotus carolinus*)	234	13.5	67.4	18.1
	263	1.6	78.2	19.2
Mackerel (*Scomber scombrus*)	39	16.3	64.0	18.2
	18	7.0	74.3	17.5
	30	6.9	74.1	17.4
	230	5.9	73.7	19.2
	261	4.2	75.4	19.1
	8	2.2	78.7	18.1
Halibut (*Hippoglossus americanus*)	9	10.6	70.1	18.2
	211	2.8	77.0	19.4
	1	2.2	79.2	17.5
Porgy (*Stenotomus argyrops*)	31	7.9	72.0	18.8
	262	6.0	73.3	19.3
	15	1.5	70.7	17.5
White perch (*Morone americana*)	44	5.6	75.6	17.6
	46	2.5	75.8	20.4
Sheepshead (*Archosargus probatocephalus*)	48	6.7	72.0	20.2
	250	0.7	79.1	18.9
Striped bass (*Roccus lineatus*)	260	4.6	76.6	17.8
	237	3.6	75.8	19.3
	225	2.8	77.3	18.8
	248	2.2	77.9	18.8
	19	2.2	79.7	16.7
	7	1.6	79.0	18.3

*Male. †Female.

In this juxtaposition of the figures, the very regular increase of water with decrease of fat in the flesh is striking. It is also very noticeable that, except in the case of the salmon, the percentage of protein in each species remains nearly constant while the percentages of fats rise as those of water fall and *vice versa*. In other words, the protein remains practically constant, while as fat is stored in the flesh water is driven out, and as the fat is removed water takes its place. The physiological bearing of this, I do not feel competent to discuss, if indeed it means anything more than simply that the fat and water mutually replace each other, volume for volume, in the flesh. If it be true, as I have seen it stated, that the fat globules are stored both without and within the muscular fibers, and that a considerable quantity may

be thus stored or removed without materially changing the volume of the tissue, the above simple explanation would, to one ignorant of histology, seem very natural.

I have been struck by this mutual replacement of fat and water in looking through a column of analyses of the flesh of fish and of other animals. In a colored diagram it is especially striking, though it is very well brought out in Table XI. If we leave out, on the one hand, a few of the most watery sorts of fish, as flounder, and, on the other, some of the fattest flesh of mammals, we have in the remaining fish and in the flesh of animals, an almost uniform content of protein, the chief variations being in the fat and the water, of which one increases as the other decreases, and *vice versa*.

CLASSIFICATION OF SPECIMENS OF FISH ON THE BASIS OF THE AMOUNTS OF FAT IN THE FLESH.

On the whole, perhaps, as appropriate a general classification as any for our present purpose would be based upon the proportions of fat in the flesh. The subjoined grouping, for instance, seems to be a tolerably satisfactory one.

1. Very fat fish; flesh containing over 10 per cent. of fat.
2. Moderately fat fish; flesh containing between 5 and 10 per cent. of fat.
3. Rather lean fish; flesh containing between 2 and 5 per cent. of fat.
4. Very lean fish, flesh containing less than 2 per cent. of fat.

I append a list of the specimens coming within each of the above categories, giving their approximate composition.

1. *Fish whose flesh contained over* 10 *per cent. of fat* (*very fat*).—Lamprey eel,* salmon, salmon trout, butter fish, herring. Composition of flesh: Water, 69 to 71 per cent.; water-free substance (nutrients), 30 to 37 per cent.; protein 18 to 23 per cent.; fats, 11 to 13 per cent.; mineral matters, 1.1 to 1.5 per cent.

2. *Fish whose flesh contained between* 10 *and* 5 *per cent. of fat* (*moderately fat*).—Shad, Spanish mackerel, eel, pompano, mackerel, whitefish, alewife, halibut, porgy. Composition of flesh: Water, 68 to 75 per cent.; water-free substance (nutrients), 25 to 32 per cent.; protein, 18 to 22 per cent.; fats, 5 to 10 per cent.; mineral matters, 1.0 to 1.6 per cent.

3. *Fish whose flesh contained between* 5 *and* 2 *per cent. of fat* (*rather lean*).—Mullet, white perch, sheepshead, cisco, striped bass, mascalonge, weakfish, buffalo-fish, brook trout. Composition of flesh: Water, 75 to 79, average, 77 per cent.; water-free substance (nutrients), 21 to 25, average, 23 per cent.; protein, 17 to 20, average, 19 per cent.; fats, 2 to 5, average, 3 per cent.; mineral matters, 1.2 to 1.6, average, 1.3 per cent.

*The composition of the specimen of lamprey eel was somewhat anomalous, having only 15 per cent. of protein and 0.7 per cent. of ash.

4. *Fish whose flesh contained less than 2 per cent. of fat (very lean).*—Smelt, red snapper, pike perch,[1] pickerel,[2] cod, kingfish, hake, sea bass, flounder,[3] skate, pollock, flounder, red bass, haddock, blackfish, yellow perch, grouper, tomcod, cusk. Composition of flesh: Water, 76 to 84 per cent.; water-free substance (nutrients), 16 to 24 per cent; protein, 14 to 22 per cent.; fats, 0 to 2 per cent.; ash, 0.9 to 1.7 per cent.

"FOUL" OR "SPENT" FISH *vs.* THOSE IN GOOD CONDITION.

The figures for salmon are very interesting in this connection. Nos. 279 and 280 were Penobscot River salmon in nearly their best condition. Nos. 35 and 36 were from the same source, but "spent," *i. e.*, taken just after spawning. The spent fish had not only less fat, but less protein than the fat fish, the spent fish averaging 18, and the fat fish, 24.2 per cent. of protein. How generally such differences would obtain, I cannot say. The fact that No. 14, which was also said to be from Maine (though whether it was from the Penobscot or not was not stated), had only 19 per cent. of protein, about the same as the spent salmon, would imply that the difference between the protein of the fat and the spent fish may not always be as great as in these specimens from the Penobscot. Nevertheless the difference is very striking. The very elaborate research of Professor Miescher upon the Rhine salmon[4] has many interesting facts bearing upon this subject, but no analyses exactly comparable with those above cited. The four specimens of Penobscot salmon, two taken in season and fat and two just after spawning and "spent," were furnished through the courtesy of Mr. Charles G. Atkins, of Bucksport, from the Government hatcheries, for the especial purpose of comparing their composition. The analyses from Tables III and V (those of whole fish from a table not given in this article) are as follows:

Composition of flesh of fat and spent salmon.

Laboratory number.	Salmon.	Water.	Water-free substance.	In water-free substance.		
				Protein.	Fats.	Ash.
	IN SEASON (fat).	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
280	Male	61.0	39.0	24.4	13.1	1.5
279	Female	61.4	38.6	24.2	13.0	1.4
	Average	61.2	38.8	24.3	13.1	1.4
	"SPENT."					
34	Male	75.3	24.7	19.2	4.4	1.1
35	Female	78.2	21.8	17.8	2.8	1.2
	Average	76.8	23.2	18.5	3.6	1.1

[1] Both *S. vitr.* and *S. can.* [2] Both *E. luc.* and *E. ret.*

[3] Both *Pseudopl. am.* and *Paral. dent.*

[4] *Zur Lebensgeschichte des Rheinlachses im Rhein.* (*Aus der schweitzerischen Litteratursammlung zur internationalen Fischerei-Ausstellung in Berlin.*) Translated and reprinted in the Report of the U. S. Fish Commission of Fish and Fisheries, for 1880.

Composition of fat and spent salmon, whole fish.

Salmon.	Entrails, bones, skin, &c.	Flesh.	In flesh.				
			Water.	Water-free substance.	In water-free substance.		
					Protein.	Fats.	Ash.
FAT.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Male	39.5	60.5	36.0	23.6	14.8	7.9	0.9
Female	37.5	62.5	38.3	24.2	15.2	8.1	0.9
Average	38.5	61.5	37.6	23.9	15.0	8.0	0.9
"SPENT."							
Male	43.8	56.2	42.3	13.9	10.8	2.5	0.6
Female	43.5	56.5	44.2	12.3	10.0	1.6	0.7
Average	43.6	56.4	43.2	13.1	10.4	2.0	0.7

Recapitulation. Percentages of flesh, water-free substance, and nutrients in fat and spent salmon.

Salmon.	Flesh, edible portion.	Water-free substance in flesh.	In water-free substance.		
			Protein.	Fats.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
In flesh:					
Fat	100.0	38.8	24.3	13.1	1.4
Spent	100.0	23.2	18.5	3.6	1.1
In whole fish:					
Fat	61.5	23.9	15.0	8.0	0.9
Spent	56.4	13.1	10.4	2.0	0.7

In the above statements the protein is estimated by difference, as explained in the description of methods of analysis, and, the discussion of the nitrogen factors of the protein. Some differences in the composition of the nitrogenous constituents of the flesh are brought out by the following figures, which will be made clear by reference to the discussion of the nitrogen factors referred to.

The figures show (1) the percentages of protein as estimated by multiplying the nitrogen by 6.25; (2) the sum of the percentages of protein thus estimated + fats + ash + water; (3) the percentage of protein as computed by subtracting the sum of water + fats + ash from 100, "protein by difference"; (4) the nitrogen in the flesh, and (5) the "nitrogen factors," obtained by dividing the percentage of "protein by difference" by the nitrogen.

In flesh of salmon.		Fat.	Spent.
(1) Protein, N × 6.25	per cent.	24.7	18.4
(2) Protein, N × 6.25, + fat + ash + water	do	100.4	99.8
(3) Protein by difference	do	24.3	18.5
(4) Nitrogen in (3)	do	3.9	2.9
(5) Nitrogen factor		6.16	6.38

Professor Miescher has shown that in the Rhine salmon the development of the reproductive organs is done entirely at the expense of the other organs and tissues, or, to be more specific, at the expense of the albuminoids and fats of the flesh; the fish taking no food during its so-

journ in the fresh water, which sojourn includes the period in which the eggs and milt are developed. The natural result is a very large loss of both fat and albuminoids from the body. We have here an exaggerated case of leanness, one in which there is not only a decrease of fat, but of protein also, and the latter in large quantity.

We thus find in the spent salmon (1) a loss of flesh, so that the flesh of the spent salmon makes up but 56 per cent. of the whole weight of the body, while that of the fat salmon is 62 per cent.; (2) a loss of both fat and protein of the flesh, so that the flesh which remains in the spent fish contains only 23 per cent. of water-free substance against 38 per cent. in the fat flesh. The water-free substance of the flesh makes only 13 per cent. of the total weight of the spent, while it amounts to 24 per cent. of the fat, fish. Not only does the whole body lose weight from the fat to the spent condition, but the lighter spent fish contains pound for pound only about half as much nutritive material as the fat fish. The deterioration of the nutritive value of the flesh in the reproductive season is, if possible, greater than that of the flavor. The bearing of this upon legislation against the capture of the spent fish is very evident.

COMPOSITION AND RELATIVE NUTRITIVE VALUES OF FISH AS COMMONLY SOLD.

As already stated, the specimens were received for analysis in the forms in which they are commonly sold in the markets, some entire, others dressed. The condition of each in this respect is stated in Table IV, which gives the percentage of edible portion—flesh; and of refuse—bones, skin, entrails, &c. I have included the skin with the refuse, rather than with the edible portion, partly because it seemed best to analyze simply the flesh, and partly because the skin, though it generally contains more or less of nutritive material, is not usually eaten in this country, so far as I have observed. Of course it is eminently desirable from the chemical standpoint to know more than we do of the composition of the skin as of the other organs, and the time will doubtless come when increase of population will bring the need of such closer economizing of food material as will lead the people of this country to eat the skin of the fish that come on their tables, thus following the example of the inhabitants of older countries, where rigid economy of food, as of other necessaries of life, has long been necessary. Accordingly, in future analyses of fish for determining their economic value, the analyses of the skin will doubtless be desirable, and I do not question that such determinations would have added much to the value of the work reported. With the resources at my command, however, I did not feel myself warranted in undertaking them.

In Table X, I have recapitulated the composition of the specimens of fish as received for analysis, assuming them to represent the composition as ordinarily sold. Here, as previously, the protein is computed on the basis of Table I, *i. e.*, by difference.

Table X hardly needs explanation after all that has been said above. The arrangement of the specimens in the order of their amounts of actual nutrients is correct for these particular specimens, but, as was said regarding the previous tables, analyses of a larger number of specimens of each kind might give averages considerably different from the figures here.

The same remarks apply to the classification beyond which is based upon the amounts of nutrients in Table X.

Further remarks upon the comparative nutritive values of fish, invertebrates, and other food materials may be found beyond.

TABLE X.—*Percentages of refuse, water, and nutritive ingredients in specimens of American food-fishes, invertebrates, &c., as found in the markets.*

[Arranged in order, from those with the largest to those with the smallest proportion of nutrients.]

Number of specimens analyzed.	Kinds of fish, invertebrates, &c., and portions taken for analyses.	Salt.	Refuse—bone, skin, shells, &c.	Edible portion—flesh.	Edible portion.					
					Water.	Nutrients.	Nutrients			
							Protein.	Fats.	Carbo-hydrates.	Mineral matters.
	FRESH FISH.									
1	California salmon, section of body	.....	10.3	89.7	57.9	31.8	16.1	14.8	.....	0.9
1	Salmon, entrails removed	.....	23.8	76.2	51.2	25.0	14.6	9.5	.....	0.9
2	Salmon, whole	.....	38.5	61.5	37.0	23.9	15.0	8.0	.....	0.9
2	Eel, skin, head, and entrails removed	.....	20.2	79.8	57.1	22.7	14.0	7.3	.....	0.8
1	Spanish mackerel, whole	.....	34.6	65.4	44.5	20.9	13.7	6.2	.....	1.0
	Halibut, sections of body, very fat	.....	11.2	88.8	62.3	26.5	16.1	9.4	.....	1.0
	Halibut, sections of body, rather lean	.....	18.7	81.3	62.6	18.7	15.8	2.2	.....	0.7
3	Halibut, sections of body, average	.....	17.7	82.3	61.2	20.2	15.1	4.2	.....	0.9
1	Salmon trout, entrails removed	.....	35.2	64.8	45.0	19.8	12.4	6.6	.....	0.8
1	Sturgeon, sections of body	.....	14.4	85.6	67.4	18.2	15.4	1.0	.....	1.2
1	Pollock, head and entrails removed	.....	28.5	71.5	54.3	17.2	15.5	0.6	.....	1.1
1	Butter-fish, whole	.....	42.8	57.2	40.1	17.1	10.2	6.3	.....	0.6
1	Herring, whole	.....	46.0	54.0	37.3	16.7	10.0	5.9	.....	0.8
1	Lamprey eel, whole	.....	45.8	54.2	38.5	15.7	8.1	7.2	.....	0.4
1	Mackerel, entrails removed	.....	40.7	59.3	43.7	15.6	11.4	3.5	.....	0.7
2	Pompano, whole	.....	45.5	54.5	39.5	15.0	10.2	4.3	.....	0.5
	Mackerel, whole, very fat	.....	33.8	66.2	42.4	23.8	12.1	10.7	.....	1.0
	Mackerel, whole, rather lean	.....	50.4	49.6	37.4	12.2	9.5	2.1	.....	0.6
5	Mackerel, whole, average	.....	44.6	55.4	40.7	14.7	10.1	3.9	.....	0.7
	Shad, whole, very fat	.....	46.4	53.6	35.0	18.6	10.5	7.3	.....	0.8
	Shad, whole, lean	.....	58.8	41.2	30.3	10.9	7.4	2.9	.....	0.6
7	Shad, whole, average	.....	50.1	49.9	35.2	14.7	9.3	4.7	.....	0.7
1	Yellow perch, entrails removed	.....	35.1	64.9	50.7	14.2	12.6	0.7	.....	0.9
1	Whitefish, whole	.....	53.5	46.5	32.5	14.0	10.3	3.0	.....	0.7
1	Salmon trout, whole	.....	56.3	43.7	30.0	13.7	7.7	5.4	.....	0.6
1	Alewife, whole	.....	49.4	50.6	36.9	13.7	9.9	3.0	.....	0.8
1	Cisco, whole	.....	42.7	57.3	43.6	13.7	11.0	2.0	.....	0.7
1	Sheepshead, entrails removed	.....	56.5	43.5	31.3	12.2	8.8	2.9	.....	0.5
3	Cod, head and entrails removed	.....	29.9	70.1	57.9	12.2	11.0	0.3	.....	0.9
1	Mascalonge, whole	.....	49.2	50.8	38.7	12.1	10.0	1.8	.....	0.8
2	Smelt, whole	.....	41.9	58.1	46.1	12.0	10.0	1.0	.....	1.0
1	Pickerel,[1] whole	.....	42.7	57.3	45.7	11.6	10.7	0.3	.....	0.6
3	Brook trout, whole	.....	48.1	51.9	40.3	11.6	9.9	1.1	.....	0.6
1	Striped bass, entrails removed	.....	51.2	48.8	37.4	11.4	8.7	2.2	.....	0.5
1	Bluefish, entrails removed	.....	48.6	51.4	40.3	11.1	9.8	0.6	.....	0.7
2	Pickerel,[2] whole	.....	47.0	53.0	42.2	10.8	9.9	0.2	.....	0.7
2	Red snapper, entrails removed	.....	48.9	51.1	40.3	10.8	9.6	0.6	.....	0.6
1	Cusk, entrails removed	.....	40.3	59.7	49.0	10.7	10.1	0.1	.....	0.5
1	Mullet, whole	.....	57.9	42.1	31.5	10.6	8.1	2.0	.....	0.5
2	Black bass, whole	.....	54.8	45.2	34.6	10.6	9.2	0.8	.....	0.6
1	Buffalo-fish, entrails removed	.....	52.5	47.5	37.3	10.2	8.5	1.1	.....	0.6
1	Weakfish, whole	.....	51.9	48.1	38.0	10.1	8.4	1.1	.....	0.6
3	Porgy, whole	.....	60.0	40.0	30.0	10.0	7.4	2.0	.....	0.4
5	Striped bass, whole	.....	54.9	45.1	35.1	10.0	8.3	1.3	.....	0.5
2	Blackfish, entrails removed	.....	55.7	44.3	35.0	9.3	8.2	0.6	.....	0.5
2	White perch, whole	.....	62.5	37.5	28.3	9.2	7.2	1.5	.....	0.6
1	Sea bass, whole	.....	56.1	43.9	34.8	9.1	8.3	0.2	.....	

[1] *Esox reticulatus.*

[2] *E. lucius.*

TABLE X.— *Percentages of refuse, water, and nutritive ingredients, &c.*—Continued.

Number of specimens analyzed.	Kinds of fish, invertebrates, &c., and portions taken for analyses.	Salt.	Refuse—bone, skin, shells, &c.	Edible portion—flesh.	Edible portion.					
					Water.	Nutrients.	Nutrients.			
							Protein.	Fats.	Carbo-hydrates.	Mineral matters.
	FRESH FISH—Continued.									
2	Red grouper, entrails removed	.....	55.8	44.2	35.1	9.1	8.3	0.3	.....	0.5
1	Kingfish, whole	.....	56.6	43.4	34.4	9.0	8.1	0.4	.....	0.5
4	Haddock, entrails removed	.....	51.0	49.0	40.0	9.0	8.3	0.1	.....	0.6
1	Skate, left lobe of body	.....	51.0	49.0	40.2	8.8	7.5	0.7	.....	0.6
2	Cod, whole	.....	52.5	47.5	38.7	8.8	8.0	0.2	.....	0.6
1	Pike perch,[1] whole	.....	57.2	42.8	34.1	8.7	7.9	0.2	.....	0.6
2	Blackfish, whole	.....	60.2	39.8	31.5	8.3	7.4	0.5	.....	0.4
1	Hake, entrails removed	.....	52.5	47.5	39.5	8.0	7.2	0.3	.....	0.5
1	Tomcod, whole	.....	59.9	40.1	32.7	7.4	6.8	0.2	.....	0.4
1	Yellow perch, whole	.....	62.7	37.3	30.0	7.3	6.7	0.2	.....	0.4
1	Flounder,[2] entrails removed	.....	57.0	43.0	35.8	7.2	6.3	0.3	.....	0.6
1	Pike perch,[3] whole	.....	63.2	36.8	29.7	7.1	6.4	0.3	.....	0.4
1	Sheepshead, whole	.....	66.0	34.0	26.9	7.1	6.4	0.2	.....	0.5
1	Flounder,[4] whole	.....	56.2	43.8	37.0	6.8	6.1	0.2	.....	0.5
1	Red bass, whole	.....	63.5	36.5	29.8	6.7	6.1	0.2	.....	0.4
1	Flounder,[2] whole	.....	66.8	33.2	27.2	6.0	5.2	0.3	.....	0.5
	SPENT FISH.									
2	Salmon, whole	.....	43.6	56.4	43.3	13.1	10.4	2.1	.....	0.6
2	Land-locked salmon, whole	.....	47.3	52.7	41.4	11.3	9.1	1.6	.....	0.6
	PRESERVED FISH.									
	Dried.									
1	Desiccated cod (dried flesh)	2.9	0.0	97.1	15.2	81.9	74.6	1.9	.....	5.4
	Salted.									
1	Salted mackerel	8.2	22.9	68.9	32.5	36.4	17.0	17.4	.....	2.0
	Salted and dried.									
1	Boned cod (salted flesh)	19.1	0.0	80.9	54.4	26.5	22.1	0.3	.....	4.1
2	Salt cod (common "salt codfish")	15.4	24.9	5.97	40.3	19.4	16.0	0.4	.....	3.0
	SALTED, SMOKED, AND DRIED.									
2	Smoked halibut	12.0	7.0	81.0	45.9	35.1	19.2	14.0	.....	1.9
1	Smoked herring	6.5	44.4	49.1	19.2	29.9	20.2	8.8	.....	0.9
1	Smoked haddock, "Findon haddie"	1.4	32.2	66.4	49.2	17.2	16.1	0.1	.....	1.0
	Canned.									
1	Sardines	0.0	5.0	95.0	53.6	41.4	24.0	12.1	.....	5.3
2	Salmon	1.0	3.9	95.1	59.3	35.8	19.3	15.3	.....	1.2
2	Salt mackerel	8.3	19.7	72.0	34.8	37.2	13.8	21.3	.....	2.1
1	Mackerel	1.9	0.0	98.1	68.2	29.9	19.9	8.7	.....	1.3
1	Tunny, "horse mackerel"	0.0	0.0	100.0	72.7	27.3	21.5	4.1	.....	1.7
1	"Findon haddie," smoked haddock	5.6	0.0	94.4	68.7	25.7	21.8	2.3	.....	1.6
	SHELL FISH, ETC.									
	Oysters, in shell, poorest[5]	.....	88.8	11.2	10.2	1.0	0.5	0.1	0.2	0.2
	Oysters, in shell, richest[5]	.....	75.7	24.3	20.7	3.6	1.6	0.8	1.2	0.5
34	Oysters, in shell, average[5]	.....	82.3	17.7	15.4	2.2	1.0	0.2	0.6	0.4
4	Oysters, "solids"[6]	.....	0.0	100.0	87.2	12.8	6.3	1.6	4.0	0.9
4	Long clams, in shell	.....	43.6	56.4	48.5	8.0	4.8	0.6	1.1	1.5
1	Round clams, in shell	.....	68.3	31.7	27.3	4.4	2.1	0.1	1.3	0.9
1	Mussels, in shell	.....	49.3	50.7	42.7	8.0	4.4	0.6	2.1	0.9
2	Scallops, edible portion	.....	0.0	100.0	80.3	19.7	14.7	0.2	3.4	1.4
4	Lobsters, in shell	.....	60.2	39.8	32.5	7.2	5.8	0.7	0.0	0.7
1	Crabs, in shell	.....	55.8	44.2	34.0	10.1	7.3	0.9	0.5	1.4
1	Crayfish, in shell	.....	87.7	12.3	10.0	2.3	1.9	0.1	0.1	0.2
1	Terrapin, in shell	.....	79.0	21.0	15.6	5.3	4.4	0.7	.....	0.2
1	Green turtle, in shell	.....	76.0	24.0	19.2	4.8	4.4	0.1	.....	0.3
	Canned.									
8	Oysters	.....	0.0	100.0	85.2	14.8	7.4	2.1	4.0	1.3
1	Long clams	.....	0.0	100.0	84.5	15.5	9.1	1.3	2.8	2.3
1	Round clams	.....	0.0	100.0	82.9	17.1	9.6	0.7	3.1	3.7
2	Lobster	.....	0.0	100.0	77.8	22.2	18.0	1.1	0.6	2.5
2	Crabs	.....	0.0	100.0	80.0	20.0	15.9	1.5	0.7	1.9

[1] *Stizostedium vitreum.* [2] *Paralichthys dentatus.* [3] *S. canadensis.* [4] *Pseudopleuronectes americanus.*
[5] In respect to percentage of nutrients, with no respect to flavor.
[6] Shell contents as commonly sold, including all of the flesh and part of the liquids

CLASSIFICATION OF FISH, FRESH AND PRESERVED, AS FOUND IN THE MARKETS, ON BASIS OF PERCENTAGES OF ACTUAL NUTRIENTS.

Specimens containing over 30 per cent. of nutrients (protein, fat, and mineral matters).

No. of specimens analyzed.	Kind of fish.	Nutrients.	No. of specimens analyzed.	Kind of fish.	Nutrients.
		Per cent.			*Per cent.*
1	Desiccated cod[1]	81.9	1	Salt mackerel	36.4
1	Canned sardines	41.4	2	Smoked halibut	35.1
2	Canned salmon	38.8	1	California salmon, sections of body	31.8
2	Canned salt mackerel	37.2			

Specimens containing between 30 and 20 per cent. of nutrients (water-free substance).

1	Smoked herring	29.0	2	Salmon, whole	23.9
1	Canned mackerel	29.9	2	Eel, skin, head, and entrails removed.	22.7
1	Canned tunny	27.3	1	Spanish mackerel, whole	20.9
1	Boned salt cod[2]	26.5	3	Halibut, sections of body	20.2
1	Canned smoked haddock	25.7			
1	Salmon, entrails removed	25.0			

Specimens containing between 20 and 10 per cent. of nutrients.

1	Salmon trout, entrails removed	19.8	1	Sheepshead, entrails removed	12.2
2	Salt cod[3]	19.4	3	Cod, head and entrails removed	12.2
1	Sturgeon, sections of body	18.2	1	Mascalonge, whole	12.1
1	Pollock, head and entrails removed	17.2	2	Smelt, whole	12.0
1	Smoked haddock	17.2	1	Pickerel,[4] whole	11.6
1	Butter-fish, whole	17.1	3	Brook trout, whole	11.6
1	Herring, whole	16.7	1	Striped bass, entrails removed	11.4
1	Lamprey eel, whole	15.7	2	Spent land-locked salmon, whole	11.3
1	Mackerel, entrails removed	15.6	1	Bluefish, entrails removed	11.1
2	Pompano, whole	15.0	2	Pickerel,[5] whole	10.8
5	Mackerel, whole	14.7	2	Red snapper, entrails removed	10.8
7	Shad, whole	14.7	1	Cusk, entrails removed	10.7
1	Yellow perch, entrails removed	14.2	1	Mullet, whole	10.6
1	Whitefish, whole	14.0	2	Black bass, whole	10.6
1	Salmon trout, whole	13.7	1	Buffalo-fish, entrails removed	10.2
1	Alewife, whole	13.7	1	Weakfish, whole	10.1
1	Cisco, whole	13.7	3	Porgy, whole	10.0
2	Spent salmon, whole	13.1	5	Striped bass	10.0

Specimens containing less than 10 per cent. of nutrients.

2	Blackfish, entrails removed	9.3	1	Hake, entrails removed	8.0
2	White perch, whole	9.2	1	Tomcod, whole	7.4
1	Sea bass, whole	9.1	1	Yellow perch, whole	7.3
2	Red grouper, entrails removed	9.1	1	Flounder, entrails removed	7.2
1	Kingfish, whole	9.0	1	Pike perch,[7] whole	7.1
4	Haddock, entrails removed	9.0	1	Sheepshead, whole	7.1
1	Skate, left lobe of body	8.8	1	Flounder,[8] whole	6.8
2	Cod, whole	8.8	1	Red bass, whole	6.7
1	Pike perch,[6] whole	8.7	1	Flounder,[9] whole	6.0
2	Blackfish, whole	8.3			

[1] Flesh freed from bones and artificially dried. [2] The flesh of ordinary salt codfish. [3] Ordinary "salt codfish." [4] *E. luc.* [5] *E. ret.* [6] *S. vit.* [7] *S. canad.* [8] *P. am.* [9] *Par. dent.*

ECONOMIC APPLICATION OF THE RESULTS OF THE ANALYSES*

In estimating their nutritive values, the constituents of our ordinary food materials may be succinctly classified as follows:

1. *Edible substance: e. g.*, the flesh of meats and fish, the shell contents of oysters.

* The following explanations regarding the nutritive values of fish and other food-materials are adapted, by request, from statements prepared for the food collection of the National Museum.

2. *Refuse: e. g.*, bones of meat and fish, shells of oysters.

The edible substance consists of—

1. *Water.* 2. *Nutritive substances or nutrients.*—The refuse may, for our present purpose, be left out of account, and our attention confined to the edible substance. And, as the water which forms a part of the edible substance, though indispensable, is nevertheless inexpensive and distinct from the nutritive ingredients, we may consider simply the nutrients.

Speaking as chemists and physiologists, we may say that our food supplies, besides mineral substances and water, albuminoids, carbo-hydrates, and fats; and that these are transformed into the tissues and fluids of the body, muscle and fat, blood and bone, and are consumed to produce heat and force. Viewed from a chemico-physiological standpoint, then, the nutritive ingredients of food can be classified as follows: Of the actually nutritive substances or nutrients of foods the most important groups (exclusive of water) are—

1. *Protein* (proteids, albuminoids, &c.): *e. g.*, albumen ("white") of egg, fibrin of blood, "lean" of meat, gluten of wheat.

2. *Fats: e. g.*, fat of meat, butter, olive-oil.

3. *Carbo-hydrates: e. g.*, starch, sugar, glycogen.

4. *Mineral matter or ash: e. g.*, calcium and potassium phosphates and chlorides.

The terms protein, proteids, and albuminoids are applied somewhat indiscriminately, in ordinary usage, to several or all of certain classes of compounds characterized by containing nitrogen. The most important are the proteids or albuminoids, of which albumen, the white of egg, and myosin, the basis of muscle, are types. Allied to these, but occurring in smaller proportions in animal tissues and foods, are the nitrogenous compounds that make the basis of connective and other tissues. Gelatin is derived from some of these tissues, and may be taken as a type of the compounds of this class. As these constituents are of similar constitution, and have similar or nearly similar uses in nutrition, it is customary to group them together as protein. The muscular tissues of animals, and hence the lean portions of meat, fish, &c., contain small quantities of so-called nitrogenous extractives—creatin, carnin, &c. (contained in extract of meat, &c.)—which contribute materially to the flavor and somewhat to the nutritive effect of the foods containing them. They are not usually deemed of sufficient importance, however, to be grouped as a distinct class in tabular statements of the composition of foods. Concerning their chemical composition, it will suffice to state that the compounds classed together as protein contain carbon, oxygen, hydrogen, and nitrogen, while the carbo-hydrates and fats contain no nitrogen, but consist chiefly of carbon, oxygen, and hydrogen. The fats are much richer in carbon than the carbo-hydrates. Animal foods, as meats, fish, &c., contain but little of carbo-hydrates, their chief nutrients being protein and fats. Milk, however, and some shell-fish, as oysters, scallops, &c., contain more or less of carbo-hy-

drates. Vegetable foods, as wheat, potatoes, &c., contain less protein, and consist largely of starch, sugar, cellulose, and other carbo-hydrates.

Functions of nutrients.—The different nutrients have different offices in nourishing the body, in building up its tissues, repairing its wastes, and serving as fuel to produce animal heat and muscular and intellectual energy. The chief part borne by each in nutrition is shown below:

The protein of food	forms the (nitrogenous) basis of blood, muscle, connective tissue, &c.
	is transformed into fats and carbo-hydrates, and stored as such in the body.
	is consumed for fuel.
The fats of food	are stored as fat.
	are consumed for fuel.
The carbo-hydrates of food	are transformed into fat.
	are consumed for fuel.

In classifications formerly maintained and frequently met with still, the protein compounds were regarded as the "flesh-formers" and the sources of muscular energy, while the carbo-hydrates and fat were looked upon a "fat-formers" and "heat-producers." A vast deal of painstaking research, however, has shown that these distinctions were not correctly drawn. The albuminoids are flesh-formers, it is true; indeed, flesh, *i. e.*, muscular and other nitrogenous tissue, according to the nearly unanimous testimony of the most trustworthy experimenters, is made from the nitrogenous constituents of the food exclusively. But the balance of testimony is decidedly against the production of muscular energy by nitrogenous compounds exclusively or mainly. Each of the three groups of nutrients probably shares, directly or indirectly, in this function. So, too, it appears that the combustion which produces animal heat is not confined to the carbo-hydrates and fats, but the protein compounds, or the products of their decomposition, are also used for this purpose. Again, the production of fat in the body was formerly ascribed to the fats and carbo-hydrates alone. The view was held at the same time, and is still maintained, by some physiologists, that the carbohydrates cannot be transformed into fats, and that a very large part of the fat of the body is formed from the disintegration of the albuminoids. The weight of evidence to-day is decidedly in favor of the assumption that all three of the great classes of nutrients in our foods—the albuminoids, the carbohydrates, and the fats—are transformed into fat, and that the fat thus formed is consumed, either before or after being stored as body-fat.

It appears, then, that protein is the most important constituent of our food, because, while it performs the functions of each of the other two chief nutrients in being transformed into fat and in being consumed for fuel, it has a most weighty office of its own in forming the basis of the blood and in building up the muscular and other nitrogenous tissues, an office which no other nutrient can perform at all. And, as we

shall see further, in examining the pecuniary cost, protein is the dearest as well as most important of the ingredients of foods.

Experiments and observation have led to the assumption that the minimum proportions of the several classes of nutrients required per day by an ordinary man, doing moderate manual labor, would be, on the average: Protein, 118 grams (4.2 ounces); fats, 56 grams (2 ounces); carbohydrates, 500 grams (17.6 ounces).

Of course, the food actually consumed by people in different conditions of life varies widely in composition as well as amount. The food of people in good circumstances generally contains larger, and the food of the poor, smaller, proportions of protein than the above standard requires.

The same experimental research which has revealed to us the ways in which our food supplies our bodily wants, has shown us how to estimate the relative nutritive values of different foods from their chemical composition. The estimates are only approximate, because the nutritive effects are influenced by various conditions, some of which research has not yet definitely explained, while others vary with the nature of the food or of the user, so that the value of a given food in a given case may vary from the standard set by the analysis. These sources of uncertainty are nevertheless so narrowed down by late investigation, and the errors confined within such limits, that by intelligent use of the facts at our disposal we may judge very closely from the chemical composition of a food what is its value as compared with others of the same class, at any rate, for our nourishment.

CHEMICAL ANALYSIS OF FOODS.

Tables XI and XII, beyond, give the composition of a number of the more important kinds of animal and vegetable foods. The details will perhaps be best explained by an example. A sample of beef, sirloin, of medium fatness, was found to consist of about one-fourth bone and three-fourths flesh, edible substance. The flesh was analyzed and found to contain, nearly: water, 60 per cent.; protein, 19 per cent.; fats, 20 per cent.; mineral matters, 1 per cent. Calculated upon the whole sample of meat, of which one-fourth, or 25 per cent., was bone and other refuse, and 75 per cent. flesh, the analysis would stand as in the schedule below, in which the composition of the flesh by itself and that of the meat, bone, and all, are both given:

	In flesh, edible portion.	In meat as bought, including refuse.
	Per cent.	*Per cent.*
Refuse bone, &c.	None.	25
Water	60	45
Protein	19	14¼
Fat	20	15
Mineral matters	1	0¾
Total	100	100

This very imperfect analysis may be stated in the following form, as is done in the tables beyond:*

Constituents of sample of beef, sirloin.

Food-material.	In edible portion, *i. e.*, flesh freed from bone and other refuse.					In meat as purchased, including both edible portion and refuse.					
			Nutrients.				Edible portion.				
									Nutrients.		
	Water.	Nutrients.	Protein.	Fats.	Mineral mattors.	Refuse: Bones, &c.	Water.	Nutrients.	Protein.	Fats.	Mineral matters.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Beef, sirloin, medium fatness ...	60	40	19	20	1	25	45	30	14.3	15	0.7

Table XI gives the composition of a number of animal foods, mostly from late American analyses. It is only a short time since analyses of American meats, &c., have been undertaken in any considerable number, and those as yet accomplished are far from sufficient for a complete survey of the subject. Indeed, the work already done can be regarded only as a beginning. Still, the figures will give a tolerably fair idea of the composition of the articles named.

The analyses of this table, with the exception of a few from European sources and indicated by italics, are selected from the results of the investigation referred to above, as conducted under the auspices of the Smithsonian Institution and the United States Fish Commission. The specimens of meats were purchased from a dealer in Middletown, Conn., and said by him to be "fair average samples of the better kinds of meats." A side of beef, freshly brought in the winter from Chicago, and said to be a good specimen of first-class "Chicago beef," was cut into about twenty-five pieces in the ordinary way. From each a sample fairly representing the whole cut was taken and analyzed. Thus the composition of each piece and of the whole side was learned. The composition of one of the leanest portions, the round, a moderately fat piece, sirloin, a very fat portion, flank, and of the whole side, together with a tongue, liver, and heart from another animal, are given in the table. The samples of a side of mutton and of parts of the same side were obtained and analyzed in like manner, as were those of the other meats and fowl. The specimens of meats were purchased in Middletown, Conn. Those of cheese were from Washington Market, New York; the analyses in the table represent the averages of several samples. The butter was from a Vermont dairy. The analyses of fish, &c., are taken from Tables VII and X. Some of the specimens were from Middletown, Conn., markets, but the majority were supplied by Mr. E. G. Blackford, of

* The tables contain also columns for carbohydrates, etc., which occur in milk and in some shell fish, but are not found in ordinary meats in sufficient amount to warrant their insertion in such tables as these.

Fulton Market, New York. A considerable number of the materials in Tables XI and XII were supplied by Mr. F. B. Thurber, of New York.

Table XII gives analyses of vegetable food materials and beverages. The figures for wheat flour represent the results of forty-nine analyses of American flours, of which the majority were analyzed under the direction of Professor Brewer, and the rest collated by him from other sources for the "Report of the United States Census, 1880." The largest and the smallest percentages of each ingredient found in the analyses are given opposite "maximum" and "minimum." The specimens of bread, crackers, &c., were purchased and analyzed at Middletown, Conn., and have probably about the usual composition of such materials. With these explanations I think the tables will require no further comment.

COMPARATIVE COSTS OF ACTUAL NUTRIENTS IN FISH AND OTHER FOODS.

A subject that has received but little attention in this country, though it has become a vital one in Europe, and is becoming so with us, is the cost of the nutritive material of our foods. The relative cheapness or dearness of different foods must be judged by comparing, not the prices per pound, but the costs of the actual nutrients. In making such comparisons, the cost may be assumed to fall, not upon the inedible portions and the water, but solely upon the three classes of nutrients: protein, fats, and carbohydrates. The relative physiological value of the nutrients in different foods depends upon (1) their digestibility and (2) their functions and the proportions in which they can replace each other in nutrition. An accurate physiological valuation is, in the present state of our knowledge, at least, impracticable. The pecuniary costs of the nutrients are, however, more nearly capable of approximation.

Various methods have been proposed for computing the relative pecuniary costs of the nutrients of foods, none of which, however, are entirely beyond criticism. The following, based upon German* estimates of the relative costs of protein fats and carbohydrates, is perhaps as satisfactory as any.

From extended comparisons of the composition and market prices of the more important animal and vegetable food-materials, such as meats, fish, flour, &c., those which serve for nourishment and not as luxuries, and form the bulk of the food of the people, it has been estimated that a pound of protein costs, on the average, five times as much, and a pound of fats three times as much, as a pound of carbohydrates; that, in other words, these three classes of nutrients stand related to each other, in respect to cost, in the following proportions:

Assumed ratios of costs in staple foods:	Protein	5
	Fats	3
	Carbohydrates	1

* König, *Nahrungsmittel* I. These figures demand revision for our markets, but are accurate enough for the present purpose, that of illustrating the comparative costliness of the nutritive material of our foods.

Suppose a pound of beef of average fatness to cost 25 cents and to contain 25 per cent. of inedible matters, bone, &c., 45 per cent of water, and 30 per cent. of nutritive substance, upon which latter—the bone and water being assumed to be without nutritive value—the whole cost comes. The 30 per cent. or 0.30 pounds of nutritive substance thus costs 25 cents; or at the rate of 83⅓ cents per pound. If, now, we leave out of account the minute quantities of carbohydrates and the mineral matters, the whole cost will fall upon the protein and fats. Assuming these to cost in the ratio of 5:3 and the amounts in the meat to be, protein 14¼ per cent. and fats 15 per cent., an easy computation will show the protein to cost 107.7 cents, and the fats 64.6 cents per pound. Proof: 0.1425 pound of protein at 107.7 cents=15.3 cents; 0.15 pounds of fats, at 64.6 cents=9.7 cents; 15.3 cents + 9.7 cents=25 cents, the cost of the pound of meat which contained the given amounts of protein and fats. The above ratios, protein: fats: carbohydrates=5:3:1, represent at best only general averages, and may in given cases be more or less incorrect. A method free from these objections consists in simply computing the amounts of nutrients that may be bought for the same price in different food-materials. At the same time the method above detailed is doubtless accurate enough for a general comparison of the relative cheapness and dearness of ordinary foods, and is used for the calculations in the table below.

Of the different nutrients, protein is physiologically the most important, as it is pecuniarily the most expensive. In fish, furthermore, as in the leaner kinds of meat, it is the predominant nutritive ingredient. For these reasons the cost of protein in fish and other foods may be used as a means of comparing their relative cheapness or dearness, as is done in the following table. The figures represent the ordinary prices per pound and the corresponding costs of protein, in specimens of food-materials obtained in New York and Middletown (Conn.) markets, and of which analyses are given. Though the number of specimens is too small for reliable averages, the figures, taken together, doubtless give a tolerably fair idea of the relative costliness of the nutrients in the different classes of foods.

Comparative costs of protein in animal and vegetable foods.

Foods.	Ordinary prices per pound.	Cost of protein per pound.
Meats, dairy products, &c.		
Beef:	*Cents.*	*Cents.*
Sirloin, medium fatness	25	108
Same, at lower price	20	86
Round, rather lean	18	70
Round, rather lean, lower price	16	62
Corned, lean	18	56
Flank,* very fat	15	36
Mutton:		
Leg	22	107
Side, medium fatness	20	59
Pork,* very fat	16	30
Smoked ham	18	48
Milk, 8 cents per quart	4	61

* Containing very little protein.

Comparative costs of protein in animal and vegetable foods—Continued.

Foods.	Ordinary prices per pound.	Cost of protein per pound.
Meats, dairy products, &c.—Continued.		
Cheese:	*Cents.*	*Cents.*
Whole milk	18	38
Skimmed milk	8	19
Fish, oysters, &c.		
Salmon:		
Early in season	100	572
When plenty	30	172
Shad	12	98
When abundant	8	65
Bluefish	10	98
Haddock	7	94
Halibut	15	87
Mackerel	10	80
When abundant	5	40
Cod	8	67
When plenty	6	50
Alewife	3	19
Canned salmon	20	70
Salt mackerel	12.5	46
Salt cod	7	38
Lower	6	33
Oysters:*		
25 cents per quart	12½	156
35 cents per quart	17.5	220
50 cents per quart, choice	25	312
Lobsters	12	209
Vegetable foods.		
Wheat-flour, best	5	19
Indian-corn (maize) meal	3	12
Oatmeal	5	15
Beans	5	14
Potatoes:†		
50 cents per bushel	0.8	14
100 cents per bushel	1.7	28

*Shell contents. †Containing very little protein.

Thus the nutrients of vegetable foods are, in general, much less costly than in animal foods. The animal foods have, however, the advantage of containing a larger proportion of protein and fats, and the protein, at least, in more digestible forms. And further, the so-called "nitrogenous extractives" (creatin, carnin, &c.,) of meats, which contribute so much to their agreeable flavor, exert a nutritive effect which, though not yet explained, is nevertheless important. It is these which give to "extract of meat" its peculiar flavor and stimulating effect.

Among the animal foods those which rank as delicacies are the costliest. By the above calculations the protein in the oysters costs from $2 to $3, and in salmon rises to nearly $6 per pound. In beef, mutton, and pork it varies from 108 to 48 cents; in shad, bluefish, haddock, and halibut the range is about the same, while in cod and mackerel, fresh and salted, it ranges from 67 to as low as 33 cents per pound. Salt cod and salt mackerel are nearly always, fresh cod and mackerel often, and even the choicer fish, as bluefish and shad, when abundant, cheaper sources of protein than any but the inferior kinds of meat.

In short we pay for many of our foods according to their agreeableness to our palates rather than their value for nourishing our bodies. At the same time it is interesting to note that the prices of the materials that make up the bulk of the food of the people seem to run more

or less parallel with their actual nutritive values. Here, as elsewhere, the resultant of the general experience of mankind has led slowly and blindly, but none the less surely, to the same general result to which accurate research more understandingly and quickly guides us.

The above calculations are open to the objection that the relative costs of protein, carbo-hydrates, and fats are only estimated and cannot be pronounced exactly accurate in any given case. In the following table the relative expensiveness of the foods is estimated in another way. From the price of a pound it is a very simple matter to calculate how much, in pounds and hundredths of a pound, any given sum, as 25 cents, would pay for. A comparison of this amount of the material with the percentages of the several nutrients the analysis shows it to contain gives the amounts of the several nutrients which would be supplied in 25 cents' worth of the food material. Here, as before, the figures are based upon the analyses.

COMPARATIVE EXPENSIVENESS OF FOODS.

Amounts of actual nutrients obtained for 25 cents in different food materials.

Food materials.	At prices per pound.	Quantities obtained for 25 cents, pounds and hundredths of a pound.			
		Food materials.	Actual nutrients in food materials.		
			Protein.	Fats.	Carbo-hydrates.
Beef:					
Sirloin, medium fatness	$0 25	1.00	.14	.15	
Sirloin, at lower price	20	1.25	.17	.19	
Round	18	1.38	.29	.11	
Mutton:					
Leg	22	1.13	.14	.31	
Side	20	1.25	.16	.29	
Pork (salted), fat	16	1.56	.04	1.19	
Milk, at 8 cents per quart	04	6.25	.21	.23	.80
Cheese:					
Whole milk	18	1.38	.37	.50	.03
Skim milk	08	3.12	1.19	.21	.28
Salmon:					
Early season	1 00	.25	.04	.02	
When plenty	30	.83	.12	.07	
Shad	12	2.84	.27	.15	
When abundant	08	3.12	.29	.15	
Bluefish	10	2.50	.25	.02	
Mackerel	10	2.50	.26	.11	
When plenty	05	5.00	.52	.22	
Cod	08	3.12	.36	.01	
When plenty	06	4.16	.48	.01	
Salt mackerel	12.5	2.00	.33	.35	
Salt cod	07	3.57	.06	.01	
Oysters:					
At 25 cents per quart	12.5	2.00	.12	.03	.08
At 35 cents per quart	17.5	1.42	.09	.02	.06
At 50 cents per quart	25	1.00	.06	.015	.04
Wheat flour (best)	05	5.00	.56	.06	3.78
Indian meal	03	8.33	.72	.29	6.03
Oatmeal	05	5.00	.76	.36	3.41
Beans	05	5.00	1.16	.11	2.87
Potatoes:					
At 50 cents per bushel	00.8	31.25	.63	.006	6.66
At $1 per bushel	01.7	15.62	.31	.003	3.00
Daily ration for ordinary man at moderate work			.26	.13	1.10

IN CONCLUSION—FISH AS FOOD.

Such facts as the following are among the more important ones to be gathered from the tabular statements herewith.

The flesh of fish contains, in general, about the same proportions of protein, less fat, more water, and hence, on the whole, less nutritive material than that of domestic animals used for food. Thus we have in the flesh of flounder only 16 per cent. and in that of cod 18 per cent. of nutrients, while ordinary lean beef has from 25 to 33 per cent., and the fatter meats considerably more. The fatter kinds of fish, however, as herring, mackerel, salmon, shad, and white fish, approach nearer to medium beef. Dried and salted fish also contain good proportions of nutrients, the specimens of ordinary salt codfish having 28 per cent., salt mackerel 47, and desiccated cod, a material as yet less known commercially, 82 per cent. of nutrients. The edible portion of shell-fish is poor in nutrients, oysters varying from 9 to 19 and lobsters averaging 18 per cent.

Fish as found in the markets generally contain more refuse, bone, skin, &c., than meats, as is illustrated in Tables V and X. With the larger proportions of both refuse and water the proportions of nutrients, though variable, are usually much less than in meats. Thus a sample of flounder contained 67 per cent. of refuse, 28 of water, and only 5 per cent. of nutritive substance, while the salmon averaged 23, the salt cod 22, and the salt mackerel 36 per cent. of nutrients. The nutrients in meats ranged from 30 per cent. in beef to 46 in mutton and 87½ in very fat pork (bacon). The canned fish compare very favorably with the meats. It is worth noting that the nutrients in fresh codfish, dressed, in oysters, edible portion, and in milk were nearly the same in amount, about 12½ per cent., though differing in kind and proportions.

Vegetable foods have generally less water and more nutrients than animal foods. Ordinary flour, meal, &c., contain from 85 to 90 per cent. or more of nutritive material. But the nutritive value is not proportional to the quantity of nutrients, because the vegetable foods consist mostly of carbo-hydrates, starch, sugar, cellulose, &c., of inferior nutritive effect, and because their protein is less digestible than that of animal foods. Potatoes especially contain a large amount of water and extremely little protein or fats.

PLACE OF FISH IN DIETARIES.—IMPORTANCE OF FISH CULTURE.

The chief uses of fish as food are (1) as an economical source of nutriment, and (2) to supply the demand for variety in diet, which increases with the advance of civilization and culture.

As nutriment, the place of fish is that of a supplement to vegetable foods, the most of which, as wheat, rye, maize, rice, potatoes, &c., are deficient in protein, the chief nutrient of fish.

The so-called nitrogenous extractives contained in small quantities in fish as in other animal foods are doubtless useful in nutrition. The

theory that fish is especially valuable for brain-food, on account of an assumed richness in phosphorus, is not sustained by the facts of either chemistry or physiology.

It is an interesting fact that the poorer classes of people and communities almost universally select those foods which chemical analysis shows to supply the actual nutrients at the lowest cost. But, unfortunately, the proportions of the nutrients in their dietaries are often very defective. Thus, in portions of India and China, rice; in Northern Italy, maize-meal; in certain districts of Germany and in some regions and seasons in Ireland, potatoes; and among the poor whites of the Southern United States, maize-meal and bacon make a large part and in some cases almost the sole food of the people. These foods supply the nutrients in the cheapest forms, but are all deficient in protein. The people who live upon them are ill-nourished and suffer physically, intellectually, and morally thereby.

On the other hand, the Scotchman finds a most economical supply of protein in oatmeal, haddock, and herring; and the rural inhabitants of New England supplement the fat of their pork with protein of beans, and the carbo-hydrates of potatoes, maize, and wheat flour with the protein of codfish and mackerel, and, while subsisting largely upon such frugal but rational diets, are well nourished, physically strong, and noted for their intellectual and moral force.

As population becomes denser, the capacity of the soil to supply food for man gradually nears its limit. Fish gather materials that would otherwise be inaccessible and lost, and store them in the very forms that are most deficient in the produce of the soil. Thus, by proper culture and use of fish, the rivers and the sea are made to fulfill their office with the land in supplying nutriment for man.

APPENDIX.

The following is a list of the larger tables in this article. Nos. I to VI, XI, and XII are, for convenience, placed in the appendix herewith; the rest are embodied in the text of the article.

Table I.—Analyses of fish (protein estimated by multiplying nitrogen by 6.25). In this table the specimens of fish are arranged in the order in which the analyses were made. Each bears the laboratory number by which it is referred to in the other tables and in the text. The "protein" is estimated by multiplying the nitrogen by 6.25. The figures for both "water-free substance" and "fresh substance" or flesh are given. For reasons given in the text, under "Methods of analysis" and "Nitrogen-factor of protein," I do not regard this as the most correct way of computing the analyses of materials which, like the flesh of fish, contain little of non-nitrogenous compounds other than fats and mineral matters, and have made no further use of the results thus obtained. In deference, however, to the very common usage of estimating "albuminoids" or "protein" by multiplying the nitrogen by 6.25 and stating results of analyses on this basis, I have given the results of all the analyses of the flesh of fish in this way in Table I.

Table II.—Analyses of fish (calculated on water-free substance, protein by difference). In this table the protein is estimated by subtracting the sum of ether extract and ash from 100.

The water-free substance consists essentially of nitrogenous compounds, insoluble or nearly insoluble in dry ether; fats, soluble in ether; and mineral matters, for the most part insoluble in ether and included in the ash. The determinations of ether extract were made in the nearly dried substance by use of purified and dried ether, and represent very nearly the actual quantities of fats. The figures for ash, though representing "crude ash," are a very nearly accurate measure of the actual amounts of mineral matters. I believe it correct to assume that the flesh of fish contains ordinarily but very little of non-nitrogenous compounds, other than fats and mineral compounds, though a more thorough study of the carbohydrates and complex nitrogenous and phosphorized fats is much needed. Accordingly it seems to me that in these analyses the most accurate measure of the nitrogenous compounds is to be found by subtracting the sum of the ether extract and ash from the whole. I have, therefore, in Table II, estimated the percentages of protein by subtracting the sum of ether extract and ash from 100.

The protein in Table II, therefore, includes all the nitrogenous compounds of the fish, albuminoids, gelatinoids, and so-called nitrogenous extractives.

In the preliminary report of progress of the present investigation, published in the Report of the United States Commission of Fish and Fisheries for 1880, pages 243–4, 273, and 275, are given results of determination of "extractives" (cold-water extract not coagulated on boiling), albumen (cold-water extract coagulated on boiling), gelatin (hot-water extract), and myosin and syntonin (insoluble protein) in a number of specimens of fish. I hope in a future report to discuss these compounds more fully, and hence only refer here to the analyses already reported. In Table II, as in the succeeding tables of the composition of fish, the terms protein and albuminoids, as said above, include all these nitrogenous compounds of the flesh. For the sake of completeness I give, with the protein thus calculated, the actual percentages of nitrogen.

Table III. Analyses of fish (calculated on fresh substance, protein by difference).—This table shows the composition of the flesh, as deduced from the figures for water and composition of water-free substance in Table II. Accordingly the protein is that estimated by difference.

Table IV. Analyses of fish (percentages of water and nutritive ingredients).—This table recapitulates in more convenient form the figures of Table III.

The insertion of both these tables may seem unnecessary. Table IV was already in type when a change of plan, necessitated by circumstances out of the writer's control, called for the details of Table III, and Table IV was allowed to stand. I think, however, it will not be entirely out of place. The figures for "maximum" and "minimum" represent the largest percentages of each of the several ingredients found in the specimens analyzed.

Table VI. Percentages of refuse, water, and nutritive ingredients in specimens of fish as found in the markets.—This table gives the composition of the specimens received for analysis, including both flesh and refuse, and is on that account of economic importance, since it shows the composition of the fish as commonly sold. The table is taken from a more detailed one, which with others I have reserved for a future and more extended report.

Table VII. Composition of invertebrates, &c.—This table, deduced from some more detailed tabular statements prepared for future publication, recapitulates some of the more important results, from the economic standpoint, of analyses of invertebrates (and two specimens of vertebrate animals). In many of the shell-fish—oysters, clams, mussels—the solid and liquid contents of the shells were analyzed separately. The amount of nitrogen and ether extract in the liquid portion seemed to me interesting, and led to more analyses of the latter than would otherwise have been undertaken. In removing the shell contents from

the shells for analysis, less was allowed to escape than is generally the case in the commercial process, I think, so that the specimens opened at the laboratory had doubtless a larger proportion of liquids than occur in those ordinarily found in the markets. This seems to be the explanation of the fact that the shell contents of the oysters received in the shell at the laboratory had larger proportions of ash than were found in the so-called "solids," as purchased of the oyster dealers.

The last two columns of Table VII need a word of explanation. They give the amounts of "edible portion" and "actual nutrients" in the whole specimens. In the case of oysters, for instance, the majority of the specimens were received in the shell. The percentages of edible portion—shell contents, flesh and liquids together—was of course small; that of water-free substance, which constitutes the nutritive material of the shell contents, was of course much smaller. If the mineral matter of the salt water were subtracted, as was not done, the amount of actual nutrients would be smaller still. If, however, the specimen consisted of the shell contents simply, of course the percentage of edible portion would be 100, and that of nutrients correspondingly large. In the lobsters, crabs, turtle, &c., the edible portion and nutrients are determined and stated in the same way as in the mollusks.

Tables VII to X are, I think, sufficiently explained in the text with which they are incorporated. They are derived from Tables II–VI.

Table XI is also explained in the text. The figures for meats, dairy products, &c, are, with the exception of some from European sources, and indicated by italics, compiled from the results of the analyses referred to in the beginning of this article as undertaken in behalf of the Smithsonian Institution (National Museum), but as yet unpublished. Those of fish, invertebrates, &c., are selected from the tables which I have just described. The minor differences between some of the figures for invertebrates, especially in this and the preceding tables, are due to the fact that, since this table was put in type, the former tables have been revised and slight changes introduced. Thus, in the revision, for "oysters best" a different specimen was selected from that whose composition had been given in Table XI. Of course, such matters as this are of small moment, and demand only a passing notice provided the analyses are in themselves correct.

Table XII. Analyses of vegetable food.—The reasons for inserting this table here are, that it is interesting for comparison with the fish and other animal foods and that some of its figures are used for data in computing the costs of nutrients in the section on the economic application of the analyses.

TABLE I.—*Analyses of fish (protein estimated by multiplying nitrogen by 6.25).*

Kind of fish.	Laboratory number of specimen.	In flesh.		In water-free substance.					In flesh, water + water-free.					
									Per analysis.					
		Water.	Water-free substance.	Nitrogen.	Protein, nitrogen × 6.25.	Fats, ether extract.	Crude ash.	Protein + fats + ash.	Nitrogen.	Water.	Protein, nitrogen × 6.25.	Fats, ether extract.	Crude ash.	Water + protein + fats + ash.
FRESH FISH.		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Halibut[1] (*Hippoglossus americanus*)	1	79.15	20.85	13.46	84.06	10.59	5.53	100.18	2.80	79.15	17.53	2.21	1.15	100.04
Flounder (*Paralichthys dentatus*)	2	83.37	16.63	14.35	89.69	3.73	7.67	101.09	2.39	83.37	14.91	0.62	1.28	100.18
Cod (*Gadus morrhua*)	3	83.48	16.52	15.00	93.75	1.66	7.62	103.03	2.48	83.48	15.49	0.28	1.27	100.52
Eel, salt-water (*Anguilla rostrata*)	4	69.80	30.20	10.20	63.75	34.23	3.04	101.02	3.08	69.80	19.25	10.34	0.91	100.30
Shad (*Alosa sapidissima*)	6	69.65	30.35	9.83	61.44	35.67	4.26	101.37	2.98	69.65	18.64	10.80	1.30	100.39
Striped bass (*Roccus lineatus*)	7	79.02	20.98	14.25	89.05	7.47	5.51	102.03	2.99	79.02	18.69	1.56	1.16	100.43
Mackerel (*Scomber scombrus*)	8	78.67	21.33	13.72	85.75	10.31	4.67	100.73	2.92	78.67	18.29	2.20	1.00	100.16
Halibut[2] (*Hippoglossus americanus*)	9	70.13	29.87	9.93	62.06	35.41	3.83	101.30	2.97	70.13	18.54	10.57	1.14	100.38
Shad (*Alosa sapidissima*)	10	65.25	34.75	9.18	57.38	39.10	4.26	100.74	3.18	65.25	19.89	13.59	1.48	100.21
Cod (*Gadus morrhua*)	11	83.39	16.61	15.50	96.88	2.39	7.60	106.87	2.58	83.39	16.09	0.40	1.26	101.14
Bluefish (*Pomatomus saltatrix*)	12	78.46	21.54	14.42	90.13	5.79	5.91	101.83	3.11	78.46	19.41	1 25	1.27	100.39
Mackerel (*Scomber scombrus*)	13	74.26	25.74	10.89	68.06	27.26	4.83	100.15	2.80	74.26	17.51	7.02	1.24	100.03
Salmon (*Salmo salar*)	14	67.15	32.85	9.57	59.81	37.94	3.35	101.10	3.14	67.15	19.63	12.47	1.21	100.46
Porgy (*Stenotomus argyrops*)	15	79.68	20.32	13.74	85.88	7.18	6.88	99.94	2.78	79.68	17.44	1.46	1.40	99.98
Haddock (*Melanogrammus æglefinus*)	16	80.30	19.70	15.08	94.25	0.85	5.82	100.92	2.97	80.30	18.58	0.17	1.15	100.20
Salmon trout (*Cristivomer namaycush*)	17	68.78	31.22	9.04	56.50	40 14	4.33	100.97	2.82	68.78	17.62	12.55	1.35	100.30
Whitefish (*Coregonus clupeiformis*)	18	69.83	30.17	12.16	76.00	21.51	5.36	102.87	3.67	69.83	22.93	6.49	1.62	100.87
Striped bass (*Roccus lineatus*)	19	79.73	20.27	13.40	83.78	10.49	6.69	100.96	2.72	79.73	16.98	2.17	1.30	100.24
Haddock (*Melanogrammus æglefinus*)	21	82.03	17.97	14.77	92.31	0.78	8.72	101.81	2.65	82.03	16.58	0.14	1.57	100.32
Flounder (*Paralichthys dentatus*)	22	85.04	14.96	14.14	88.38	5.18	8.63	102.19	2.12	85.04	13.22	0.77	1.29	100.32
Smelt (*Osmerus mordax*)	23	80.16	19.84	13.32	83.25	9.76	10.08	103.09	2.64	80.16	16.52	1.94	2.00	100.62
Brook trout (*Salvelinus fontinalis*)	24	77.54	22.46	13.25	82.81	11.61	6.33	100.75	2.98	77.54	18.60	2.61	1.42	100.17
Red snapper (*Lutjanus blackfordii*)	26	77.34	22.66	13.96	87.25	8.58	5.86	101.69	3.16	77.34	19.75	1.94	1.33	100 36
Mackerel (*Scomber scombrus*)	30	74.14	25.86	11.25	70.31	27.04	5.02	102.37	2.91	74.14	18.18	6.99	1.30	100.61
Porgy (*Stenotomus argyrops*)	31	71.98	28.02	10.77	67.31	28.04	4.81	100.16	3.02	71.98	18.86	7.86	1.35	100.05
Shad (*Alosa sapidissima*)	32	70.75	29.25	9.90	61.88	34.50	4.58	100.96	2.89	70.75	18.08	10.08	1.34	100.25
Blackfish (*Tautoga onitis*)	38	76.95	23.05	13.42	83.88	12.20	5.54	101.62	3.09	76.95	19.33	2.81	1.28	100.37
Mackerel (*Scomber scombrus*)	39	64.01	35.99	8.48	53.00	45.28	4.11	102.39	3.05	64.01	19.08	16.30	1.48	100.87
Spanish mackerel (*Cybium maculatum*)	43	68.10	31.90	10.76	67.25	29.56	4.71	101.52	3.43	68.10	21.45	9.43	1.50	100.48
White perch (*Morone americana*)	44	75.64	24.36	11.79	73.69	23.07	4.56	101.32	2.87	75.64	17.95	5.62	1.11	100.32

Mascalonge (*Esox nobilior*)	45	76.26	23.74	13.58	84.87	10.70	6.63	102.20	3.22	76.26	20.15	2.54	1.57	100.52
White perch (*Morone americana*)	46	75.77	24.23	13.59	84.94	10.42	5.27	100.63	3.29	75.77	20.58	2.52	1.28	100.15
Herring (*Clupea harengus*)	47	69.03	30.97	9.87	61.69	35.55	4.83	102.07	3.06	69.03	19.12	11.01	1.50	100.66
Sheepshead (*Archosargus probatocephalus*)	48	72.01	27.99	11.90	74.38	24.02	3.93	102.33	3.33	72.01	20.82	6.72	1.10	100.65
Yellow pike perch (*Stizostedium vitreum*)	52	79.74	20.26	14.67	91.69	2.31	6.75	100.75	2.97	79.74	18.58	0.47	1.37	100.16
Black bass (*Micropterus pallidus*)	53	78.61	21.39	14.54	90.68	4.47	5.57	100.92	3.11	78.61	19.44	0.96	1.19	100.20
Pollock (*Pollachius carbonarius*)	81	76.02	23.98	14.41	90.06	3.23	6.45	99.74	3.46	76.02	21.60	0.78	1.55	99.95
Butter-fish (*Poronotus triacanthus*)	90	70.02	29.98	9.60	60.00	36.80	3.82	100.62	2.88	70.02	17.99	11.03	1.14	100.18
Black bass (*Micropterus pallidus*)	91	74.82	25.18	13.79	86.19	9.69	4.93	100.81	3.47	74.82	21.71	2.44	1.24	100.21
Pickerel (*Esox lucius*)	98	79.79	20.21	14.78	92.38	2.87	5.07	100.32	2.99	79.79	18.67	0.58	1.03	100.07
Tomcod (*Microgadus tomcodus*)	99	81.55	18.45	14.95	93.44	2.08	5.32	100.84	2.76	81.55	17.24	0.38	0.99	100.16
Pickerel (*Esox reticulatus*)	100	79.84	20.16	14.63	91.43	2.58	6.14	100.15	2.96	79.84	18.43	0.52	1.24	100.03
Cusk (*Brosmius brosme*)	110	82.01	17.99	15.10	94.38	0.94	4.98	100.30	2.72	82.01	17.00	0.17	0.90	100.08
Cisco (*Argyrosomus tullibee*)	111	76.15	23.85	12.92	80.75	14.59	5.25	100.59	3.08	76.15	19.26	3.48	1.25	100.14
Hake (*Phycis chuss*)	113	83.11	16.89	14.56	91.00	3.97	5.77	100.74	2.46	83.11	15.37	0.67	0.98	100.13
Grouper (*Epinephelus morio*)	114	79.95	20.05	14.88	93.00	2.39	5.79	101.18	2.98	79.85	18.68	0.48	1.16	100.17
Mullet (*Mugil albula*)	126	74.87	25.13	12.40	77.50	18.45	4.66	100.61	3.12	74.87	19.48	4.64	1.17	100.16
Yellow perch (*Perca fluviatilis*)	127	80.43	19.57	14.54	90.88	2.81	5.86	99.55	2.85	80.43	17.79	0.55	1.14	99.91
Blackfish (*Tautoga onitis*)	205	81.36	18.64	15.12	94.52	2.95	3.48	100.95	2.82	81.36	17.61	0.55	0.65	100.17
Rock cod (*Gadus morrhua*)	206	80.71	19.29	15.20	95.00	1.54	7.22	103.76	2.93	80.71	18.32	0.30	1.40	100.73
Smelt (*Osmerus mordax*)	207	78.16	21.84	13.66	85.38	7.55	6.24	99.17	2.98	78.16	18.65	1.65	1.36	99.82
Yellow perch (*Perca fluviatilis*)	208	78.07	21.93	14.37	89.81	5.11	6.12	101.04	3.15	78.07	19.69	1.12	1.34	100.22
Halibut (*Hippoglossus americanus*)	211	76.97	23.03	13.67	85.43	11.95	3.81	101.19	3.15	76.97	19.68	2.75	0.88	100.28
Shad (*Alosa sapidissima*)	212	71.04	28.96	10.06	62.87	35.32	3.09	101.28	2.92	71.04	18.19	10.23	0.90	100.36
Eel, salt-water (*Anguilla rostrata*)	217	73.40	26.60	10.68	66.75	29.62	4.16	100.53	2.84	73.40	17.75	7.88	1.11	100.14
Alewife (*Pomolobus vernalis*)	220	72.96	27.04	11.67	72.94	22.28	5.48	100.70	3.16	72.96	19.72	6.02	1.48	100.18
Shad (*Alosa sapidissima*)	221	71.98	28.02	11.48	71.75	23.24	5.46	100.45	3.21	71.98	20.10	6.51	1.53	100.12
Pickerel (*Esox reticulatus*)	224	79.52	20.48	14.86	92.88	2.38	5.46	100.72	3.04	79.52	19.02	0.49	1.11	100.14
Striped bass (*Roccus lineatus*)	225	77.27	22.73	13.36	83.50	12.35	4.92	100.77	3.04	77.27	18.97	2.81	1.11	100.16
Cod (*Gadus morrhua*)	228	83.43	16.57	15.30	95.63	1.89	6.03	103.55	2.54	83.43	15.84	0.31	1.00	100.58
Haddock (*Melanogrammus æglefinus*)	229	82.56	17.44	14.97	93.56	1.82	6.78	102.16	2.61	82.56	16.32	0.32	1.18	100.38
Mackerel (*Scomber scombrus*)	230	73.68	26.32	11.85	74.06	22.28	4.60	100.94	3.12	73.68	19.46	5.86	1.21	100.21
California salmon[1] (*Oncorhynchus chouicha*)	233	64.53	35.47	8.37	52.31	46.51	2.85	101.67	2.97	64.53	18.56	16.50	1.01	100.60
Pompano (*Trachynotus carolinus*)	234	67.38	32.62	9.00	56.25	41.40	2.95	100.60	2.94	67.38	18.35	13.51	0.96	100.20
Lamprey eel (*Petromyzon marinus*)	236	71.12	28.88	8.30	51.88	46.03	2.27	100.18	2.40	71.12	14.98	13.29	0.66	100.05
Striped bass (*Roccus lineatus*)	237	75.76	24.24	12.90	80.63	15.02	5.23	100.88	3.13	75.76	19.54	3.64	1.27	100.21
Sturgeon[2] (*Acipenser sturio*)	238	78.71	21.29	13.63	85.19	8.90	6.72	100.81	2.90	78.71	18.11	1.90	1.43	100.15
Red snapper (*Lutjanus blackfordii*)	242	79.81	20.19	15.26	95.38	2.67	6.48	104.53	3.08	79.81	19.26	0.54	1.34	100.95
Cod (*Gadus morrhua*)	243	82.20	17.80	15.10	94.38	2.89	6.95	104.22	2.69	82.20	16.80	0.51	1.21	100.72
Blackfish (*Tautoga onitis*)	244	79.64	20.36	14.86	92.88	3.05	5.05	100.98	3.03	79.64	18.91	0.62	1.03	100.20
Shad (*Alosa sapidissima*)	245	72.14	27.86	10.57	66.06	29.10	5.52	100.68	2.95	72.14	18.40	8.08	1.54	100.16
Skate (?) (*Raia* ——?)	247	82.15	17.85	16.29	101.82	7.81	6.38	116.01	2.91	82.15	18.17	1.39	1.14	102.85
Striped bass (*Roccus lineatus*)	248	77.87	22.13	13.72	85.75	9.93	5.05	100.73	3.04	77.87	18.97	2.20	1.12	100.16
Shad (*Alosa sapidissima*)	249	73.56	26.44	11.06	69.13	26.58	5.16	100.87	2.92	73.56	18.27	7.03	1.36	100.22
Sheepshead (*Archosargus probatocephalus*)	250	79.08	20.92	14.81	92.56	3.16	6.36	102.08	3.10	79.08	19.36	0.66	1.33	100.43
Sea bass (*Centropristis atrarius*)	251	79.32	20.68	15.34	95.88	2.36	6.80	105.04	3.17	79.32	19.84	0.49	1.44	101.09
Kingfish (*Menticirrus nebulosus*)	252	79.21	20.79	14.57	91.08	4.53	5.68	101.29	3.03	79.21	18.94	0.95	1.18	100.28
Flounder (*Pseudopleuronectes americanus*)	253	84.35	15.65	14.86	92.88	2.85	7.68	103.41	2.33	84.35	14.53	0.44	1.20	100.52
Brook trout (*Salvelinus fontinalis*)	254	79.84	20.16	14.92	93.25	3.72	4.75	101.72	3.01	79.84	18.80	0.75	0.96	100.35
Salmon trout (*Cristivomer namaycush*)	255	69.50	30.50	10.19	63.69	33.47	3.85	101.01	3.11	69.50	19.42	10.21	1.17	100.30

[1] Posterior part of body lean.

[2] Section of body fatter than 1.

[3] Section of anterior part of body.

[4] Left lobe of body.

TABLE I.—*Analyses of fish (protein estimated by multiplying nitrogen by 6.25)*—Continued.

Kind of fish.	Laboratory number of specimen.	In flesh.		In water-free substance.					In flesh, water + water-free. Per analysis.					
		Water.	Water-free substance.	Nitrogen.	Protein, nitrogen × 6.25.	Fats, ether extract.	Crude ash.	Protein + fats + ash.	Nitrogen.	Water.	Protein, nitrogen × 6.25.	Fats, ether extract.	Crude ash.	Water + protein + fats + ash.
FRESH FISH—Continued.		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Canada brook trout (*Salvelinus fontinalis*)	256	75.78	24.22	13.41	83.81	12.14	5.08	101.03	3.25	75.78	20.30	2.94	1.25	100.27
Pike or gray perch (*Stizostedium canadensis*)	257	80.85	19.15	14.94	93.38	3.95	5.90	103.23	2.86	80.85	17.88	0.76	1.13	100.62
Buffalo-fish (*Myxostoma celata*)	258	78.56	21.44	13.43	83.94	10.98	5.56	100.48	2.88	78.56	17.99	2.35	1.19	100.09
Haddock (*Melanogrammus æglefinus*)	259	81.87	18.13	15.27	95.44	1.93	5.71	103.08	2.77	81.87	17.31	0.35	1.03	100.56
Striped bass (*Roccus lineatus*)	260	76.65	23.35	12.32	77.00	19.75	3.92	100.67	2.88	76.65	17.98	4.61	0.92	100.16
Mackerel (*Scomber scombrus*)	261	75.44	24.56	12.66	79.10	17.13	5.23	101.46	3.11	75.44	19.43	4.21	1.28	100.36
Porgy (*Stenotomus argyrops*)	262	73.31	26.69	11.65	72.81	22.54	5.22	100.57	3.11	73.31	19.42	6.01	1.30	100.14
Pompano (*Trachynotus carolinus*)	263	78.18	21.82	14.16	88.50	7.51	4.69	100.70	3.09	78.18	19.30	1.64	1.03	100.15
Blackfish (*Tautoga onitis*)	269	78.44	21.56	14.07	87.94	6.69	6.30	100.93	3.03	78.44	18.96	1.44	1.36	100.20
Red bass (*Sciænops ocellatus*)	270	81.56	18.44	14.65	91.56	2.89	6.67	101.12	2.70	81.56	16.88	0.53	1.23	100.20
Red grouper (*Epinephelus morio*)	271	78.96	21.04	15.06	94.13	3.39	5.42	102.94	3.17	78.96	19.81	0.71	1.14	100.62
Weakfish (*Cynoscion regalis*)	273	78.97	21.03	13.54	84.63	11.37	5.64	101.64	2.85	78.97	17.80	2.39	1.19	100.35
Salmon, female (*Salmo salar*)	279	61.37	38.63	10.24	64.00	33.76	3.51	101.27	3.95	61.37	24.72	13.04	1.36	100.49
Salmon, male (*Salmo salar*)	280	61.03	38.97	10.17	63.56	33.53	3.73	100.82	3.96	61.03	24.77	13.07	1.45	100.32
ROE.														
Shad roe	246	71.25	28.75	11.62	72.63	13.16	5.31	.....	3.34	71.25	20.88	3.78	1.53	.....
SPENT FISH.														
Salmon, male (*Salmo salar*)	35	75.27	24.73	12.39	77.44	17.66	4.51	99.61	3.06	75.27	19.15	4.37	1.12	99.91
Salmon, female (*Salmo salar*)	36	78.20	21.80	12.93	80.81	12.98	5.36	99.15	2.82	78.20	17.62	2.83	1.17	99.82
Land-locked salmon, male (*Salmo salar*, subsp. *sebago*)	40	77.88	22.12	11.70	73.13	18.12	5.76	97.01	2.59	77.88	16.18	4.01	1.27	99.34
Land-locked salmon, female (*Salmo salar*, subsp. *sebago*)	41	79.20	20.80	13.26	82.88	9.36	5.76	98.00	2.76	79.20	17.24	1.95	1.20	99.59
PRESERVED FISH.														
Boned cod (flesh freed from bone)	25	54.35	45.65	9.20	57.50	0.71	50.82	109.03	4.20	54.35	26.25	0.32	23.21	104.13
Smoked halibut (*Hippoglossus americanus*)	28	51.06	48.94	6.04	37.75	31.90	31.01	100.66	2.96	51.06	18.49	15.61	15.18	100.34
Canned salmon (*Oncorhynchus chouicha*)	29	65.86	34.14	9.87	61.69	32.40	5.24	99.33	3.37	65.86	21.06	11.06	1.79	99.77

Smoked herring (Clupea harengus)	*33*	*34.55*	*65.45*	*9.03*	*56.44*	*24.18*	*20.15*	*100.77*	*5.91*	*34.55*	*36.94*	*15.82*	*13.19*	*100.50*
Salt cod (Gadus morrhua)	*34*	*53.62*	*46.38*	*8.58*	*53.63*	*0.53*	*53.82*	*107.98*	*3.98*	*53.62*	*24.87*	*0.25*	*24.96*	*103.70*
Salt cod (Gadus morrhua)	*37*	*53.54*	*46.46*	*8.91*	*55.69*	*0.94*	*52.43*	*109.06*	*4.14*	*53.54*	*25.86*	*0.44*	*24.35*	*104.19*
Salt-mackerel, "No. 1 mackerel" (*Scomber scombrus*)	42	42.19	57.81	5.85	36.56	39.08	22.76	98.40	3.38	42.19	21.14	22.59	13.17	99.09
"Alden's dried fresh cod" (flesh desiccated)	79	15.25	84.75	14.72	92.00	2.24	9.78	104.02	12.48	15.25	77.97	1.90	8.29	103.41
Alden's dried salt cod (flesh desiccated)	80	11.65	88.35	13.04	81.50	5.54	13.40	100.44	11.52	11.65	72.02	4.89	11.84	100.40
Canned sardines (*Clupea pilchardus?*)	87	56.37	43.63	9.12	57.00	29.14	12.85	98.99	3.98	56.37	24.87	12.71	5.61	99.56
"Findon haddie," smoked haddock (*Melanogrammus æglefinus*)	88	72.56	27.44	13.58	84.88	0.62	13.10	98.60	3.73	72.56	23.29	0.17	3.59	99.61
Canned fresh mackerel (*Scomber scombrus*)	94	68.18	31.82	9.87	61.68	27.28	10.17	99.13	3.14	68.18	19.63	8.68	3.23	99.72
Canned salt mackerel (*Scomber scombrus*)	95	43.23	56.77	4.68	29.25	49.22	21.09	99.56	2.65	43.23	16.60	27.94	11.97	99.74
Canned salmon (*Oncorhynchus chouicha*)	96	62.23	37.77	8.48	53.00	38.55	9.34	100.89	3.20	62.23	20.02	14.55	3.53	100.33
Smoked halibut (*Hippoglossus americanus*)	218	47.70	52.30	7.04	44.00	27.61	28.42	100.03	3.68	47.70	23.01	14.44	14.86	100.01
Canned salt mackerel (*Scomber scombrus*)	219	43.62	56.38	5.08	31.75	44.05	24.53	100.33	2.86	43.62	17.90	24.84	13.83	100.19
Canned tunny (horse mackerel)	240	72.74	27.26	12.72	79.50	14.84	6.19	100.53	3.47	72.74	21.67	4.05	1.69	100.15
Canned salmon (*Oncorhynchus chouicha*)	241	57.55	42.45	7.34	45.88	50.62	4.15	100.65	3.12	57.55	19.47	21.49	1.76	100.27
Canned smoked haddock (*Melanogrammus æglefinus*)	275	68.73	31.27	11.40	71.25	7.18	23.14	101.57	3.56	68.73	22.28	2.25	7.24	100.50

TABLE II.—*Analyses of fish. Calculated on water-free substance. Percentages of protein (albuminoids) estimated by subtracting sum of fats and ash from* 100.

Kind of fish.	Laboratory number of specimen.	In flesh.		In water-free substance.			
		Water.	Water-free substance.	Nitrogen.	Protein by difference.	Fats; ether extract.	Crude ash.
FRESH FISH.		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Halibut[1] (*Hippoglossus americanus*)	1	79.15	20.85	13.45	83.88	10.59	5.53
Flounder (*Paralichthys dentatus*)	2	83.37	16.63	14.35	88.60	3.73	7.67
Cod (*Gadus morrhua*)	3	83.48	16.52	15.00	90.72	1.66	7.62
Eel, salt-water, (*Anguilla rostrata*)	4	69.80	30.20	10.20	62.76	34.23	3.04
Shad (*Alosa sapidissima*)	6	69.65	30.35	9.83	60.07	35.67	4.26
Striped bass (*Roccus lineatus*)	7	79.02	20.98	14.25	87.02	7.47	5.51
Mackerel (*Scomber scombrus*)	8	78.67	21.33	13.72	85.02	10.31	4.67
Halibut[2] (*Hippoglossus americanus*)	9	70.13	29.87	9.93	60.76	35.41	3.83
Shad (*Alosa sapidissima*)	10	65.25	34.75	9.18	56.64	39.10	4.26
Cod (*Gadus morrhua*)	11	83.39	16.61	15.50	90.01	2.39	7.60
Bluefish (*Pomatomus saltatrix*)	12	78.40	21.54	14.42	88.30	5.79	5.91
Mackerel (*Scomber scombrus*)	13	74.26	25.74	10.89	67.91	27.26	4.83
Salmon (*Salmo salar*)	14	67.15	32.85	9.57	58.71	37.94	3.35
Porgy (*Stenotomus argyrops*)	15	79.68	20.32	13.74	85.94	7.18	6.88
Haddock (*Melanogrammus æglefinus*)	16	80.30	19.70	15.08	93.33	0.85	5.82
Salmon trout (*Cristivomer namaycush*)	17	68.78	31.22	9.04	55.53	40.14	4.33
Whitefish (*Coregonus clupeiformis*)	18	69.83	30.17	12.16	73.13	21.51	5.36
Striped bass (*Roccus lineatus*)	19	79.73	20.27	13.40	82.82	10.49	6.69
Haddock (*Melanogrammus æglefinus*)	21	82.03	17.97	14.77	90.50	0.78	8.72
Flounder (*Paralichthys dentatus*)	22	85.04	14.96	14.14	86.19	5.18	8.63
Smelt (*Osmerus mordax*)	23	80.16	19.84	13.32	80.16	9.76	10.08
Brook trout (*Salvelinus fontinalis*)	24	77.54	22.46	13.25	82.06	11.61	6.33
Red snapper (*Lutjanus blackfordii*)	26	77.34	22.66	13.96	85.56	8.58	5.86
Mackerel (*Scomber scombrus*)	30	74.14	25.86	11.25	67.94	27.04	5.02
Porgy (*Stenotomus argyrops*)	31	71.98	28.02	10.77	67.15	28.04	4.81
Shad (*Alosa sapidissima*)	32	70.76	29.25	9.90	60.92	34.50	4.58
Blackfish (*Tautoga onitis*)	38	76.95	23.05	13.42	82.26	12.20	5.54
Mackerel (*Scomber scombrus*)	39	64.01	35.99	8.48	50.61	45.28	4.11
Spanish mackerel (*Cybium maculatum*)	43	68.10	31.90	10.76	65.73	29.56	4.71
White perch (*Morone americana*)	44	75.64	24.36	11.79	72.37	23.07	4.56
Muscalonge (*Esox nobilior*)	45	76.26	23.74	13.58	83.27	10.70	6.03
White perch (*Morone americana*)	46	75.77	24.23	13.50	84.31	10.42	5.27
Herring (*Clupea harengus*)	47	69.03	30.97	9.87	59.62	35.55	4.83
Sheepshead (*Archosargus probatocephalus*)	48	72.01	27.99	11.90	72.05	24.02	3.93
Yellow pike perch (*Perca fluviatilis*)	52	70.74	29.26	14.67	90.94	2.31	6.75
Black bass (*Micropterus pallidus*)	53	78.61	21.39	14.54	89.96	4.47	5.57
Pollock (*Pollachius carbonarius*)	81	76.02	23.98	14.41	90.32	3.23	6.45
Butter fish (*Poronotus triacanthus*)	90	70.02	29.98	9.60	59.38	36.80	3.82
Black bass (*Micropterus pallidus*)	91	74.82	25.18	13.79	85.38	9.69	4.93
Pickerel (*Esox lucius*)	98	79.79	20.21	14.78	92.06	2.87	5.07
Tomcod (*Microgadus tomcodus*)	99	81.55	18.45	14.95	92.60	2.08	5.32
Pickerel (*Esox reticulatus*)	100	79.84	20.16	14.63	91.28	2.58	6.14
Cusk (*Brosmius brosme*)	110	82.01	17.99	15.10	94.08	0.94	4.98
Cisco (*Argyrosomus tullibee*)	111	76.15	23.85	12.92	80.16	14.59	5.25
Hake (*Phycis chuss*)	113	83.11	16.89	14.56	90.26	3.97	5.77
Grouper (*Epinephelus morio*)	114	79.85	20.15	14.88	91.82	2.39	5.79
Mullet (*Mugil albula*)	126	74.87	25.13	12.40	76.89	18.45	4.66
Yellow perch (*Perca fluviatilis*)	127	80.43	19.57	14.54	91.33	2.81	5.86
Blackfish (*Tautoga onitis*)	205	81.36	18.64	15.12	93.57	2.95	3.48
Rock cod (*Gadus morrhua*)	206	80.71	19.20	15.20	91.24	1.54	7.22
Smelt (*Osmerus mordax*)	207	78.16	21.84	13.66	86.21	7.55	6.24
Yellow perch (*Perca fluviatilis*)	208	78.07	21.93	14.37	88.77	5.11	6.12
Halibut (*Hippoglossus americanus*)	211	76.97	23.03	13.67	84.24	11.95	3.81
Shad (*Alosa sapidissima*)	212	71.04	28.96	10.00	61.50	35.32	3.09
Eel, salt-water, (*Anguilla rostrata*)	217	73.40	26.60	10.68	66.22	29.62	4.16
Alewife (*Pomolobus vernalis*)	220	72.96	27.04	11.67	72.24	22.28	5.48
Shad (*Alosa sapidissima*)	221	71.98	28.02	11.48	71.30	23.24	5.46
Pickerel (*Esox reticulatus*)	224	79.52	20.48	14.86	92.10	2.38	5.46
Striped bass (*Roccus lineatus*)	225	77.27	22.73	13.36	82.73	12.35	4.92
Cod (*Gadus morrhua*)	228	83.43	16.57	15.30	92.08	1.89	6.03
Haddock (*Melanogrammus æglefinus*)	229	82.56	17.44	14.97	91.40	1.82	6.78
Mackerel (*Scomber scombrus*)	230	73.68	26.32	11.85	73.12	22.28	4.60
California salmon (*Oncorhynchus chouicha*)	233	64.53	35.47	8.37	50.04	46.51	2.85
Pompano (*Trachynotus carolinus*)	234	67.38	32.62	9.00	55.65	41.40	2.95
Lamprey eel (*Petromyzon marinus.*)	236	71.12	28.88	8.30	51.70	46.03	2.27
Striped bass (*Roccus lineatus*)	237	75.76	24.24	12.90	79.75	15.02	5.23
Sturgeon[3] (*Acipenser sturio*)	238	78.71	21.29	13.63	84.38	8.90	6.72
Red snapper (*Lutjanus blackfordii*)	242	79.81	20.19	15.26	90.85	2.67	6.48
Cod (*Gadus morrhua*)	243	82.20	17.80	15.10	90.16	2.89	6.95

[1] Posterior part of body, lean. [2] Section of body fatter than 1. [3] Section of anterior part of body.

TABLE II.—*Analyses of fish. Calculated on water-free substance, &c.*—Continued.

Kind of fish.	Laboratory number of specimen.	In flesh.		In water-free substance.			
		Water.	Water-free substance.	Nitrogen.	Protein by difference.	Fats: ether extract.	Crude ash.
FRESH FISH—Continued.		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Blackfish (*Tautoga onitis*)	244	79.64	20.36	14.86	91.90	3.05	5.05
Shad (*Alosa sapidissima*)	245	72.14	27.86	10.57	65.38	29.10	5.52
Skate[1] (*Raia ——?*)	247	82.15	17.85	16.29	85.81	7.81	6.38
Striped bass (*Roccus lineatus*)	248	77.87	22.13	13.72	85.02	9.93	5.05
Shad (*Alosa sapidissima*)	249	73.56	26.44	11.06	68.26	26.58	5.16
Sheepshead (*Archosargus probatocephalus*)	250	79.08	20.92	14.81	90.48	3.16	6.36
Sea bass (*Centropristis atrarius*)	251	79.32	20.68	15.34	90.84	2.36	6.80
Kingfish (*Menticirrus nebulosus*)	252	79.21	20.79	14.57	80.79	4.53	5.68
Flounder (*Pseudopleuronectes americanus*)	253	84.35	15.65	14.86	80.47	2.85	7.68
Brook trout (*Salvelinus fontinalis*)	254	79.84	20.16	14.92	91.53	3.72	4.75
Salmon trout (*Cristivomer namaycush*)	255	69.50	30.50	10.19	62.68	33.47	3.85
Canada brook trout (*Salvelinus fontinalis*)	256	75.78	24.22	13.41	82.78	12.14	5.08
Pike or gray perch (*Stizostedium canadensis*)	257	80.85	19.15	14.04	90.15	3.95	5.90
Buffalo fish (*Myxostoma celata*)	258	78.56	21.44	13.43	83.46	10.98	5.56
Haddock (*Melanogrammus æglefinus*)	259	81.87	18.13	15.27	92.36	1.93	5.71
Striped bass (*Roccus lineatus*)	260	76.65	23.35	12.32	76.83	19.75	3.92
Mackerel (*Scomber scombrus*)	261	75.44	24.56	12.66	77.64	17.13	5.23
Porgy (*Stenotomus argyrops*)	262	73.31	26.69	11.65	72.24	22.54	5.22
Pompano (*Trachynotus carolinus*)	263	78.18	21.82	14.16	87.80	7.51	4.69
Blackfish (*Tautoga onitis*)	269	78.44	21.56	14.07	87.01	6.69	6.30
Red bass (*Sciænops ocellatus*)	270	81.56	18.44	14.65	90.44	2.89	6.67
Red grouper (*Epinephelus morio*)	271	78.96	21.04	15.06	91.19	3.39	5.42
Weakfish (*Cynoscion regalis*)	273	78.97	21.03	15.54	82.99	11.37	5.64
Salmon, female (*Salmo salar*)	279	61.37	38.63	10.24	62.73	33.76	3.51
Salmon, male (*Salmo salar*)	280	61.03	38.97	10.17	62.74	33.53	3.73
SPENT FISH.							
Salmon, male (*Salmo salar*)	35	75.27	24.73	12.39	77.83	17.66	4.51
Salmon, female (*Salmo salar*)	36	78.20	21.80	12.93	81.66	12.98	5.36
Land-locked salmon, male (*Salmo salar*, subsp. *sebago*)	40	77.88	22.12	11.70	76.12	18.12	5.76
Land-locked salmon, female (*Salmo salar*, subsp. *sebago*)	41	70.20	20.80	13.26	84.88	9.36	5.76
PRESERVED FISH.							
Boned salt cod (flesh freed from bone)	25	54.35	45.65	9.20	48.57	0.71	50.72
Smoked halibut (*Hippoglossus americanus*)	28	51.06	48.94	6.04	37.09	31.90	31.01
Canned salmon (*Oncorhynchus chouicha*)	29	65.86	34.14	9.87	62.36	32.40	5.24
Smoked herring (*Clupea harengus*)	33	34.55	65.45	9.03	55.67	24.18	20.15
Salt cod (*Gadus morrhua*)	34	53.62	46.38	8.58	45.65	0.53	53.82
Salt cod (*Gadus morrhua*)	37	53.54	46.46	8.91	40.63	0.94	52.43
Salt mackerel, "No. 1 mackerel" (*Scomber scombrus*)	42	42.19	57.81	5.85	38.16	39.08	22.76
Alden's dried fresh cod (flesh desiccated)	79	15.25	84.75	14.72	87.98	2.24	9.78
Alden's dried salt cod (flesh desiccated)	80	11.65	88.35	13.04	81.06	5.54	13.40
Canned sardines (*Clupea pilchardus?*)	87	56.37	43.63	9.12	58.01	29.14	12.85
"Findon haddie" (smoked haddock). (*Melanogrammus æglefinus*)	88	72.56	27.44	13.58	86.28	0.62	13.10
Canned fresh mackerel (*Scomber scombrus*)	94	68.18	31.82	9.87	62.55	27.28	10.17
Canned salt mackerel (*Scomber scombrus*)	95	43.23	56.77	4.68	29.69	49.22	21.09
Canned salmon (*Oncorhynchus chouicha*)	96	62.23	37.77	8.48	52.11	38.55	9.34
Smoked halibut (*Hippoglossus americanus*)	218	47.70	52.30	7.04	43.97	27.61	28.42
Canned salt mackerel (*Scomber scombrus*)	219	43.62	56.38	5.08	31.42	44.05	24.53
Canned tunny. "Horse mackerel"	240	72.74	27.26	12.72	78.97	14.84	6.19
Canned salmon (*Oncorhynchus chouicha*)	241	57.55	42.45	7.34	45.23	50.62	4.15
Canned smoked haddock (*Melanogrammus æglefinus*)	275	68.73	31.27	11.40	69.68	7.18	23.14

[1] Left lobe of body.

TABLE III.—*Analyses of fish. Composition of flesh. Protein (albuminoids) estimated by difference.*

Kind of fish.	Laboratory number of specimen.	Salt.*	Water.	Water-free substance.	In water-free substance.			Nitrogen.
					Protein by difference.	Fats.	Ash.	
FRESH FISH.		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Alewife (*Pomolobus vernalis*)	220	.....	72.96	27.04	19.54	6.02	1.48	3.16
Black bass (*Micropterus pallidus*)	53	.....	78.61	21.39	19.24	0.96	1.19	3.11
Black bass (*Micropterus pallidus*)	91	.....	74.82	25.18	21.50	2.44	1.24	3.47
Average of two specimens	.....	.....	76.71	23.29	20.37	1.70	1.22	3.29
Red bass (*Sciænops ocellatus*)	270	.....	81.56	18.44	16.68	0.53	1.23	2.70
Sea bass (*Centropristis atrarius*)	251	.....	79.32	20.68	18.75	0.49	1.44	3.17
Striped bass (*Roccus lineatus*)	7	.....	79.02	20.98	18.26	1.56	1.16	2.99
Striped bass (*Roccus lineatus*)	19	.....	79.73	20.27	16.74	2.17	1.36	2.72
Striped bass (*Roccus lineatus*)	225	.....	77.27	22.73	18.81	2.81	1.11	3.04
Striped bass (*Roccus lineatus*)	237	.....	75.76	24.24	19.33	3.64	1.27	3.13
Striped bass (*Roccus lineatus*)	248	.....	77.87	22.13	18.81	2.20	1.12	3.04
Striped bass (*Roccus lineatus*)	260	.....	76.65	23.35	17.82	4.61	0.92	2.88
Average of six specimens	.....	.....	77.71	22.29	18.30	2.83	1.16	2.93
Blackfish (*Tautoga onitis*)	38	.....	76.95	23.05	18.96	2.81	1.28	3.09
Blackfish (*Tautoga onitis*)	205	.....	81.36	18.64	17.44	0.55	0.65	2.82
Blackfish (*Tautoga onitis*)	244	.....	79.64	20.36	18.71	0.62	1.03	3.03
Blackfish (*Tautoga onitis*)	269	.....	78.44	21.56	18.76	1.44	1.36	3.03
Average of four specimens	.....	.....	79.10	20.90	18.47	1.35	1.08	2.99
Bluefish (*Pomatomus saltatrix*)	12	.....	78.46	21.54	19.02	1.25	1.27	3.11
Buffalo-fish (*Myxostoma celata*)	258	.....	78.56	21.44	17.90	2.35	1.19	2.88
Butter-fish (*Poronotus triacanthus*)	90	.....	70.02	29.98	17.81	11.03	1.14	2.88
Cisco (*Argyrosomus tullibee*)	111	.....	76.15	23.85	19.12	3.48	1.25	3.08
Cod (*Gadus morrhua*)	3	.....	83.48	16.52	14.97	0.28	1.27	2.48
Cod (*Gadus morrhua*)	11	.....	83.39	16.61	14.95	0.40	1.26	2.58
Cod (*Gadus morrhua*)	206	.....	80.71	19.29	17.59	0.30	1.40	2.93
Cod (*Gadus morrhua*)	228	.....	83.43	16.57	15.26	0.31	1.00	2.01
Cod (*Gadus morrhua*)	243	.....	82.20	17.80	16.08	0.51	1.21	2.69
Average of five specimens	.....	.....	82.64	17.36	15.77	0.36	1.23	2.54
Cusk (*Brosmius brosme*) (*americanus*)	110	.....	82.01	17.99	16.92	0.17	0.90	2.72
Eel, salt-water (*Anguilla vostrata*)	4	.....	69.80	30.20	18.95	10.34	0.91	3.08
Eel, salt-water (*Anguilla vostrata*)	217	.....	73.40	26.60	17.61	7.88	1.11	2.84
Average of two specimens	.....	.....	71.60	28.40	18.28	9.11	1.01	2.96
Lamprey eel (*Petromyzon marinus*?)	230	.....	71.12	28.88	14.93	13.29	0.66	2.40
Flounder (*Paralichthys dentatus*)	2	.....	83.37	16.63	14.73	0.62	1.28	2.39
Flounder (*Paralichthys dentatus*)	22	.....	85.04	14.96	12.90	0.77	1.29	2.12
Average of two specimens	.....	.....	84.21	15.79	13.82	0.69	1.28	2.26
Flounder (*Pseudopleuronectes americanus*)	253	.....	84.35	15.65	14.01	0.44	1.20	2.33
Grouper (*Epinephelus morio*)	114	.....	79.85	20.15	18.51	0.48	1.16	2.98
Grouper (*Epinephelus morio*)	271	.....	78.96	21.04	19.19	0.71	1.14	3.11
Average of two specimens	.....	.....	79.40	20.60	18.85	0.60	1.15	3.04
Haddock (*Melanogrammus æglefinus*)	16	.....	80.30	19.70	18.38	0.17	1.15	2.97
Haddock (*Melanogrammus æglefinus*)	21	.....	82.03	17.97	16.26	0.14	1.57	2.65
Haddock (*Melanogrammus æglefinus*)	229	.....	82.56	17.44	15.94	0.32	1.18	2.61
Haddock (*Melanogrammus æglefinus*)	259	.....	81.87	18.13	16.75	0.35	1.03	2.77
Average of four specimens	.....	.....	81.69	18.31	16.83	0.25	1.23	2.75
Hake (*Phycis chuss*)	113	.....	83.11	16.89	15.24	0.67	0.98	2.46
Halibut (*Hippoglossus americanus*). Section of body	1	.....	79.15	20.85	17.49	2.21	1.15	2.80
Halibut (*Hippoglossus americanus*). Section of body	9	.....	70.13	29.87	18.16	10.57	1.14	2.97
Halibut (*Hippoglossus americanus*)	211	.....	76.97	23.03	19.40	2.75	0.88	3.15
Average of three specimens	.....	.....	75.42	24.58	18.35	5.17	1.06	3.07
Herring (*Olupea harengus*)	47	.....	69.03	30.97	18.46	11.01	1.50	3.06
King fish (*Menticirrus nebulosus*)	252	.....	79.21	20.79	18.66	0.95	1.18	3.03
Mascalonge (*Esox nobilior*)	45	.....	76.26	23.74	19.63	2.54	1.57	3.22
Mackerel (*Scomber scombrus*)	8	.....	78.67	21.33	18.13	2.20	1.00	2.92
Mackerel (*Scomber scombrus*)	13	.....	74.26	25.74	17.48	7.02	1.24	2.80
Mackerel (*Scomber scombrus*)	30	.....	74.14	25.86	17.42	6.94	1.50	2.91
Mackerel (*Scomber scombrus*)	39	.....	64.01	35.99	18.21	10.30	1.48	3.05
Mackerel (*Scomber scombrus*)	230	.....	73.68	26.32	19.25	5.86	1.21	3.12
Mackerel (*Scomber scombrus*)	261	.....	75.44	24.56	19.07	4.21	1.28	3.11
Average of six specimens	.....	.....	73.37	26.63	18.26	7.09	1.28	2.99
Spanish mackerel (*Cybium maculatum*)	43	.....	68.10	31.90	20.97	9.43	1.50	3.43
Mullet (*Mugil albula*)	126	.....	74.87	25.13	19.32	4.64	1.17	3.13

* In computing the mineral matter in the salted fish, it was assumed that percentages of the mineral matters properly belonging to the fish would be the same as in corresponding specimens of fresh fish. These percentages are computed for the salt fish, and the excess of ash found in the salt fish is taken as "salt."

TABLE III.—*Analyses of fish. Composition of flesh, &c.*—Continued.

Kind of fish.	Laboratory number of specimen.	Salt.*	Water.	Water-free substance.	In water-free substance.			Nitrogen.
					Protein by difference.	Fats.	Ash.	
FRESH FISH—Continued.		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.
Pompano (*Trachynotus carolinus*)	234	.....	67.38	32.62	18.15	13.51	0.96	2.94
Pompano (*Trachynotus carolinus*)	263	.....	78.18	21.82	19.15	1.04	1.03	3.09
Average of two specimens	.....	.....	72.78	27.22	18.65	7.57	1.00	3.02
Pike perch (*Stizostedium canadensis*)	257	.....	80.85	19.15	17.26	0.76	1.13	2.86
White perch (*Morone americana*)	44	.....	75.64	24.36	17.63	5.02	1.11	2.87
White perch (*Morone americana*)	46	.....	75.77	24.23	20.43	2.52	1.28	3.29
Average of two specimens	.....	.....	75.71	24.29	19.03	4.07	1.19	3.08
Yellow perch (*Perca fluviatilis*)	127	.....	80.43	19.57	17.88	0.55	1.14	2.85
Yellow perch (*Perca fluviatilis*)	208	.....	78.07	21.93	19.47	1.12	1.34	3.15
Average of two specimens	.....	.....	79.25	20.75	18.68	0.83	1.24	3.00
Pike perch (*Stizostedium vitreum*)	52	.....	79.74	20.26	18.42	0.47	1.37	2.97
Pickerel (*Esox lucius*)	98	.....	79.70	20.21	18.60	0.58	1.03	2.99
Pickerel (*Esox reticulatus*)	100	.....	79.84	20.16	18.40	0.52	1.24	2.96
Pickerel (*Esox reticulatus*)	224	.....	79.52	20.48	18.88	0.49	1.11	3.04
Average of two specimens	.....	.....	79.68	20.32	18.64	0.50	1.18	3.00
Pollock (*Pollachius carbonarius*)	81	.....	76.02	23.98	21.65	0.78	1.55	3.46
Porgy (*Stenotomus argyrops*)	15	.....	79.68	20.32	17.46	1.46	1.40	2.78
Porgy (*Stenotomus argyrops*)	31	.....	71.98	28.02	18.81	7.86	1.35	3.03
Porgy (*Stenotomus argyrops*)	262	.....	78.31	26.69	19.29	6.01	1.39	3.11
Average of three specimens	.....	.....	74.99	25.01	18.52	5.11	1.38	2.97
Red snapper (*Lutjanus blackfordii*)	26	.....	77.34	22.66	19.39	1.94	1.33	3.16
Red snapper (*Lutjanus blackfordii*)	242	.....	79.81	20.19	18.31	0.54	1.34	3.08
Average of two specimens	.....	.....	78.58	21.42	18.85	1.24	1.33	3.12
Salmon (*Salmo salar*)	14	.....	67.15	32.85	19.17	12.47	1.21	3.14
Salmon (*Salmo salar*). Female	279	.....	61.37	38.63	24.23	13.04	1.36	3.95
Salmon (*Salmo salar*). Male	280	.....	61.03	38.97	24.45	13.07	1.45	3.96
Average of three specimens	.....	.....	63.18	36.82	22.62	12.86	1.34	3.86
California salmon (*Oncorhynchus chouicha*)	233	.....	64.53	35.47	17.96	16.50	1.01	2.97
Shad (*Alosa sapidissima*)	6	.....	69.65	30.35	18.25	10.80	1.30	2.98
Shad (*Alosa sapidissima*)	10	.....	65.25	34.75	19.68	13.59	1.48	3.18
Shad (*Alosa sapidissima*)	82	.....	70.75	29.25	17.83	10.08	1.34	2.89
Shad (*Alosa sapidissima*)	212	.....	71.04	28.96	17.83	10.23	0.90	2.92
Shad (*Alosa sapidissima*)	221	.....	71.98	28.02	19.08	6.51	1.53	3.21
Shad (*Alosa sapidissima*)	245	.....	72.14	27.86	18.24	8.08	1.54	2.95
Shad (*Alosa sapidissima*)	249	.....	73.56	26.44	18.05	7.03	1.36	2.96
Average of seven specimens	.....	.....	70.62	29.38	18.56	9.47	1.35	3.01
Skate (*Raia*——?). Left lobe of body	247	.....	82.15	17.85	15.32	1.39	1.14	2.91
Sheepshead (*Archosargus probatocephalus*)	48	.....	72.01	27.99	20.17	6.72	1.10	3.33
Sheepshead (*Archosargus probatocephalus*)	250	.....	79.08	20.92	18.93	0.66	1.33	3.10
Average of two specimens	.....	.....	75.55	24.45	19.54	3.69	1.22	3.22
Smelt (*Osmerus mordax*)	23	.....	80.16	19.84	15.90	1.94	2.00	2.64
Smelt (*Osmerus mordax*)	207	.....	78.16	21.84	18.83	1.65	1.36	2.98
Average of two specimens	.....	.....	79.16	20.84	17.37	1.79	1.68	2.81
Sturgeon (*Acipenser sturio*). Section of body	238	.....	78.71	21.29	17.96	1.90	1.43	2.90
Tomcod (*Microgadus tomcodus*)	99	.....	81.55	18.45	17.08	0.38	0.99	2.76
Salmon trout "Mackinaw trout" (*Oristivomer namaycush*)	17	.....	68.78	31.22	17.34	12.53	1.35	2.82
Salmon trout "Mackinaw trout" (*Oristivomer namaycus*)	255	.....	69.50	30.50	19.12	10.21	1.17	3.11
Average of two specimens	.....	.....	69.14	30.86	18.34	11.26	1.26	2.97
Brook trout (*Salvelinus fontinalis*)	24	.....	77.54	22.46	18.43	2.61	1.42	2.98
Brook trout (*Salvelinus fontinalis*)	254	.....	79.84	20.16	18.45	0.75	0.96	3.01
Brook trout (*Salvelinus fontinalis*)	256	.....	75.78	24.22	20.03	2.94	1.25	3.25
Average of three specimens	.....	.....	77.72	22.28	18.97	2.10	1.21	3.08
Whitefish (*Coregonus clupeiformis*)	18	.....	69.83	30.17	22.06	6.49	1.02	3.67
Weakfish (*Cynoscion regalis*)	273	.....	78.97	21.03	17.46	2.39	1.19	2.85
SPENT FISH.								
Salmon (*Salmo salar*). Male	35	.....	75.27	24.73	19.24	4.37	1.12	3.06
Salmon (*Salmo salar*). Female	36	.....	78.20	21.80	17.80	2.83	1.17	2.82
Average of two specimens	.....	.....	76.74	23.26	18.52	3.60	1.14	2.94

*In computing the mineral matter in the salted fish, it was assumed that percentages of the mineral matters properly belonging to the fish would be the same as in corresponding specimens of fresh fish. These percentages are computed for the salt fish, and the excess of ash found in the salt fish is taken as "salt."

TABLE III.—*Analyses of fish. Composition of flesh, &c.*—Continued.

Kind of fish.	Laboratory number of specimen.	Salt.*	Water.	Water-free substance.	In water-free substance.			Nitrogen.
					Protein by difference.	Fats.	Ash.	
SPENT FISH—Continued.		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Salmon, land-locked (*Salmo salar*, subps. *sebago*). Male	40	.....	77.88	22.12	16.84	4.01	1.27	2.59
Salmon, land-locked (*Salmo salar*, subsp. *sebago*). Female	41	.....	79.20	20.80	17.65	1.95	1.20	2.76
Average of two specimens	.....	.....	78.54	21.46	17.24	2.98	1.24	2.68
PREPARED FISH.								
Dried.								
Desiccated cod. Flesh freed from bone and dried	79	2.88	15.25	81.87	74.56	1.90	5.41	12.48
Salted.								
Mackerel (*Scomber scombrus*). "No. 1 mackerel"	42	10.60	42.19	47.21	22.05	22.59	2.57	3.88
Salted and dried.								
Cod (*Gadus morrhua*) "channel fish"	34	20.95	53.62	25.43	21.17	0.25	4.01	3.98
Cod (*Gadus morrhua*) "boat fish"	37	20.22	53.54	26.24	21.67	0.44	4.13	4.14
Average of two specimens	.....	20.58	53.58	25.84	21.42	0.34	4.08	4.06
Boned cod. Flesh freed from bone	25	19.13	54.85	26.52	22.12	0.32	4.08	4.20
Desiccated cod. Flesh freed from bone and dried	80	6.60	11.65	81.75	71.62	4.89	5.24	11.52
Salted, smoked, and dried.								
Haddock "Findon haddie" (*Melanogrammus æglefinus*)	88	2.06	72.56	25.38	23.68	0.17	1.53	3.73
Halibut (*Hippoglossus americanus*)	28	13.05	51.06	35.89	18.15	15.61	2.13	2.96
Halibut (*Hippoglossus americanus*)	218	12.87	47.70	39.43	23.00	14.44	1.99	3.68
Average of two specimens	.....	12.96	49.38	37.66	20.57	15.03	2.06	3.32
Herring (*Clupea harengus*)	33	11.66	34.55	53.79	36.44	15.82	1.53	5.91
Canned.								
Mackerel (*Scomber scombrus*)	94	1.93	68.18	29.89	19.91	8.68	1.30	3.14
Salmon (*Oncorhynchus chouicha*)	29	0.53	65.86	33.61	21.29	11.06	1.26	3.37
Salmon (*Oncorhynchus chouicha*)	96	2.19	62.23	35.58	19.69	14.55	1.34	3.20
Salmon (*Oncorhynchus chouicha*)	241	0.41	57.55	42.04	19.20	21.49	1.35	3.12
Average of two specimens	.....	1.30	59.89	38.81	19.44	18.02	1.35	3.16
Sardines (*Clupea pilchardus*)	87	.....	50.37	46.63	25.31	12.71	5.61	3.98
Tunny. "Horse mackerel." (*Orcynus secundo-dorsalis?*)	240	.....	72.74	27.26	21.52	4.05	1.69	3.47
Mackerel (*Scomber scombrus*), "No. 2 mackerel," salted	95	9.44	43.23	47.38	16.86	27.94	2.58	2.65
Mackerel (*Scomber scombrus*), "No. 2 mackerel," salted	219	11.16	43.62	45.22	17.71	24.84	2.67	2.86
Average of two specimens	.....	10.30	43.43	46.27	17.28	26.39	2.60	2.76
Smoked haddock (*Melanogrammus æglefinus*)	275	5.59	68.73	25.68	21.78	2.25	1.65	3.58

* In computing the mineral matter in the salted fish, it was assumed that the percentages of mineral matters properly belonging to the fish would be the same as in corresponding specimens of fresh fish. These percentages are computed for the salt fish, and the excess of ash found in the salt fish is taken as "salt."

TABLE IV.—*Percentages of water and nutritive ingredients in flesh, edible portion, of American food-fishes.*

Number of specimens analyzed.	Kinds of fish.	Salt.*	In flesh, edible portion.					
			Water.	Water-free substance (total nutrients).	Ingredients of water-free substance, nutrients.			Nitrogen.
					Albuminoids by difference.	Fats.	Mineral matters.	
	FRESH FISH.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1	Alewife (*Pomolobus vernalis*)		72.96	27.04	19.54	6.02	1.48	3.16
2	Black bass (*Micropterus pallidus*):							
	Maximum		78.61	25.18	21.50	2.44	1.24	3.47
	Minimum		74.82	21.39	19.24	0.96	1.19	3.11
	Average		76.71	23.29	20.37	1.70	1.22	3.29
1	Red bass (*Sciænops ocellatus*)		81.56	18.44	16.68	0.53	1.23	2.70
1	Sea bass (*Centropristis atrarius*)		79.32	20.68	18.75	0.49	1.45	3.17
6	Striped bass (*Roccus lineatus*):							
	Maximum		79.73	24.24	19.33	4.61	1.36	3.13
	Minimum		75.76	20.27	16.74	1.56	0.92	2.72
	Average		77.71	22.29	18.30	2.83	1.16	2.54
4	Black-fish (*Tautoga onitis*):							
	Maximum		81.36	23.05	18.96	2.81	1.36	3.09
	Minimum		76.95	18.64	17.44	0.55	0.65	2.82
	Average		79.10	20.90	18.47	1.35	1.08	2.99
1	Blue-fish (*Pomatomus saltatrix*)		78.46	21.54	19.02	1.25	1.27	3.11
1	Buffalo-fish (*Myxostoma celata*)		78.56	21.44	17.90	2.35	1.19	2.88
1	Butter-fish (*Poronotus triacanthus*)		70.02	29.98	17.81	11.03	1.14	2.88
1	Ciscoe (*Argyrosomus tullibee*)		76.15	23.85	19.12	3.48	1.25	3.08
5	Cod (*Gadus morrhua*):							
	Maximum		83.48	19.29	17.59	0.51	1.40	2.93
	Minimum		80.71	16.52	14.95	0.28	1.00	2.01
	Average		82.64	17.36	15.77	0.36	1.23	2.54
1	Cusk (*Brosmius brosme*)		82.01	17.99	16.92	0.17	0.90	2.72

* In computing the mineral matters in the salted fish it was assumed that the mineral matters properly belonging to the fish would bear the same relation to the flesh (albuminoid plus fats) as in the averages of the corresponding samples of fresh fish. The excess actually found is counted as salt.

TABLE IV.—*Percentages of water and nutritive ingredients, &c.*—Continued.

Number of specimens analyzed.	Kinds of fish.	Salt.	In flesh, edible portion.					
			Water.	Water-free substance (total nutrients).	Ingredients of water-free substance, nutrients.			Nitrogen.
					Albuminoids by difference.	Fats.	Mineral matters.	
	FRESH FISH—Continued.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
2	Eel, salt water (*Anguilla rostrata*):							
	Maximum		73.40	30.20	18.95	10.34	1.11	3.08
	Minimum		69.80	26.60	17.61	7.88	0.91	2.84
	Average		71.60	28.40	18.28	9.11	1.01	2.96
1	Lamprey eel (*Petromyzon marinus*)		71.12	28.88	14.93	13.29	0.66	2.40
2	Flounder (*Paralichthys dentatus*), average		84.21	15.79	13.82	0.69	1.28	2.26
1	Flounder (*Pseudopleuronectes americanus*)		84.35	15.65	14.01	0.44	1.20	2.33
2	Grouper (*Epinephelus morio*), average		79.40	20.60	18.85	0.60	1.15	3.04
4	Haddock (*Melanogrammus æglefinus*), average		81.69	18.31	16.53	0.25	1.23	2.75
1	Hake (*Phycis chuss*)		83.11	16.89	15.24	0.67	0.98	2.46
3	Halibut (*Hippoglossus americanus*):							
	Maximum		79.15	29.87	19.40	10.57	1.15	3.15
	Minimum		70.13	20.85	17.49	2.21	0.88	2.80
	Average		75.42	24.58	18.35	5.17	1.06	2.97
1	Herring (*Clupea harengus*)		69.03	30.97	18.46	11.01	1.50	3.06
1	King-fish (*Menticirrus nebulosus*)		79.21	20.79	18.66	0.95	1.18	3.03
1	Masquallonge (*Esox nobilior*)		76.26	23.74	19.63	2.54	1.57	3.22
6	Mackerel (*Scomber scombrus*):							
	Maximum		78.67	35.99	19.25	16.30	1.50	3.12
	Minimum		64.01	21.33	17.42	2.20	1.00	2.80
	Average		73.37	26.63	18.26	7.09	1.28	2.99
1	Spanish mackerel (*Cybium maculatum*)		68.10	31.90	20.97	9.43	1.50	3.43
1	Mullet (*Mugil albula*)		74.87	25.13	19.32	4.64	1.17	3.12
2	Pompano (*Trachynotus carolinus*):							
	Maximum		78.18	32.62	19.15	13.51	1.03	3.09
	Minimum		67.38	21.82	18.15	1.64	0.96	2.94
	Average		72.78	27.22	18.65	7.57	1.00	2.02
1	Pike perch (*Stizostedium canadensis*)		80.85	19.15	17.26	0.76	1.13	2.86
1	Pike perch (*Stizostedium vitreum*)		79.74	20.26	18.42	0.47	1.37	2.97

2	White perch (*Morone americana*), average		75.71	24.29	19.03	4.07	1.19	3.08
2	Yellow perch (*Perca fluviatilis*), average		79.25	20.75	18.68	0.83	1.24	3.00
1	Pickerel (*Esox lucius*)		79.79	20.21	18.60	0.58	1.03	2.99
2	Pickerel (*Esox reticulatus*), average		79.68	20.32	18.64	0.50	1.18	3.00
1	Pollock (*Pollachius carbonarius*)		76.02	23.98	21.65	0.78	1.55	3.46
3	Porgy (*Stenotomus argyrops*):							
	Maximum		79.68	28.02	19.29	7.86	1.40	3.11
	Minimum		71.98	20.32	17.46	1.46	1.35	2.78
	Average		74.99	25.01	18.52	5.11	1.38	2.97
2	Red snapper (*Lutjanus blackfordii*), average		78.58	21.42	18.85	1.24	1.33	3.12
3	Maine salmon (*Salmo salar*):							
	Maximum		67.15	38.97	24.45	13.07	1.45	3.96
	Minimum		61.03	32.85	19.17	12.47	1.21	3.14
	Average		63.18	36.82	22.62	12.86	1.34	3.68
1	California salmon (*Oncorhynchus chouicha*)		64.53	35.47	17.96	16.50	1.01	2.85
7	Shad (*Alosa sapidissima*):							
	Maximum		73.56	34.75	19.98	13.59	1.54	3.21
	Minimum		65.25	26.44	17.83	6.51	0.90	2.69
	Average		70.62	29.38	18.56	9.47	1.35	3.01
1	Skate (*Raia?*)		82.15	17.85	15.32	1.39	1.14	2.91
2	Sheepshead (*Archosargus probatocephalus*):							
	Maximum		79.08	27.99	20.15	6.72	1.33	3.83
	Minimum		72.01	20.92	18.93	0.66	1.10	3.10
	Average		75.55	24.45	19.54	3.69	1.22	3.22
2	Smelt (*Osmerus mordax*), average		79.16	20.84	17.37	1.79	1.68	2.81
1	Sturgeon (*Acipenser sturio*)		78.71	21.29	17.96	1.90	1.43	2.90
1	Tom-cod (*Microgadus tomcodus*)		81.55	18.45	17.08	0.38	0.99	2.76
2	Salmon trout, "Mackinaw trout" (*Oristivomer namaycush*), average		69.14	30.86	18.34	11.26	1.26	2.97
3	Brook trout (*Salvelinus fontinalis*):							
	Maximum		79.84	24.22	20.03	2.94	1.42	3.25
	Minimum		75.78	20.16	18.43	0.75	0.96	2.98
	Average		77.72	22.28	18.97	2.10	1.21	3.08
1	White-fish (*Coregonus clupeiformis*)		69.83	30.17	22.06	6.49	1.62	3.67
1	Weak fish (*Cynoscion regalis*)		78.97	21.03	17.45	2.39	1.19	2.85
	ROE.							
1	Shad roe		71.25	28.75	20.88	3.78	1.53	3.34
	SPENT FISH.							
2	Salmon (*Salmo salar*):							
	Maximum		78.20	24.73	19.24	4.37	1.17	3.06
	Minimum		75.27	21.80	17.80	2.83	1.12	2.82
	Average		76.74	23.26	18.52	3.60	1.14	2.94
2	Salmon, land-locked (*Salmo salar* subsp. *sebago*), average		78.54	21.46	17.24	2.98	1.24	2.68
	PRESERVED FISH.							
	DRIED.							
1	Cod, boned, steam-dried, and ground (*Gadus morrhua*)	2.88	15.25	81.87	74.56	1.90	5.41	12.48
	SALTED.							
1	Mackerel (*Scomber scombrus*)	10.60	42.19	47.21	22.05	22.59	2.57	3.38

TABLE IV.—*Percentages of water and nutritive ingredients, &c.*—Continued.

Number of specimens analyzed.	Kinds of fish.	Salt.	In flesh, edible portion.					
			Water	Water-free substance (total nutrients).	Ingredients of water-free substance, nutrients.			
					Albumenoids by difference.	Fats.	Mineral matters.	Nitrogen.
	SALTED AND DRIED.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
2	Cod (*Gadus morrhua*), average	20.58	53.58	25.84	21.42	0.34	4.08	4.06
1	Cod, boned (*Gadus morrhua*)	19.13	54.35	26.52	22.12	0.32	4.08	4.20
1	Cod, boned, steam-dried, and ground (*Gadus morrhua*)	6.60	11.65	81.75	71.62	4.89	5.24	11.52
	SALTED, SMOKED, AND DRIED.							
1	Haddock, "Findon haddie" (*Melanogrammus æglefinus*)	2.06	72.56	25.38	23.68	0.17	1.53	3.73
2	Halibut (*Hippoglossus americanus*):							
	Maximum	13.05	51.06	39.43	23.00	15.61	2.13	3.68
	Minimum	12.87	47.70	35.89	18.15	14.44	1.99	2.96
	Average	12.96	49.38	37.66	20.57	15.03	2.06	3.32
1	Herring (*Clupea harengus*)	11.66	34.55	53.79	36.44	15.82	1.53	5.91
	CANNED.							
1	Mackerel (*Scomber scombrus*)	1.93	68.18	29.89	19.91	8.68	1.30	3.14
2	Mackerel, salted (*Scomber scombrus*), average	10.30	43.43	46.27	17.28	26.39	2.60	2.76
3	Salmon (*Oncorhynchus chouicha*):							
	Maximum	2.19	65.86	42.04	21.29	21.49	1.35	3.37
	Minimum	0.41	57.55	33.61	19.20	11.06	1.26	3.12
	Average	1.30	59.89	38.81	19.44	18.02	1.35	3.16
1	Sardines (*Clupea pilchardus?*)		56.37	43.63	25.31	12.71	5.61	3.98
1	Tunny, "Horse-mackerel" (*Orcynus secundo-dorsalis?*)	9.44	43.23	47.33	16.86	27.94	2.53	2.65
1	"Findon haddie", smoked haddock (*Melanogrammus æglefinus*)	5.59	68.73	25.68	21.78	2.25	1.65	3.58

TABLE V.—*Percentages of refuse, water, and nutritive ingredients in specimens of American food-fishes as found in the markets.*

Number of specimens.	Kind of fish and portion taken for analysis.	Maximum, minimum, or average.	Salt.	Refuse (bones, skin, entrails, &c.).	Edible portion (flesh).	Flesh, edible portion.				
						Water.	Water-free substance (nutrients).	Nutrients.		
								Protein (albuminoids).	Fats.	Ash, mineral matters.
	FRESH FISH.			*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*P. ct.*
1	Alewife (*Pomolobus vernalis*), whole			49.4	50.6	36.9	13.7	9.9	3.0	0.8
2	Black bass (*Micropterus pallidus*), whole	Average		54.8	45.2	31.6	10.6	9.2	0.8	0.6
1	Red bass (*Sciænops ocellatus*), whole			63.5	36.5	29.8	6.7	6.1	0.2	0.4
1	Sea bass (*Centropristis atrarius*), whole			56.1	43.9	34.8	9.1	8.3	0.2	0.6
	Striped bass (*Roccus lineatus*):									
5	Whole	Average		54.9	45.1	35.1	10.0	8.3	1.3	0.4
1	Entrails removed			51.2	48.8	37.4	11.4	8.7	2.2	0.5
	Blackfish (*Tautoga onitis*):									
2	Whole	Average		60.2	39.8	31.5	8.3	7.4	0.5	0.4
2	Entrails removed	Average		55.7	44.3	35.0	9.3	8.2	0.6	0.5
1	Bluefish (*Pomatomus saltatrix*), entrails removed			48.6	51.4	40.3	11.1	9.8	0.6	0.7
1	Buffalo-fish (*Myxostoma celata*), entrails removed			52.5	47.5	37.3	10.2	8.5	1.1	0.6
1	Butter-fish (*Poronotus triacanthus*), whole			42.8	57.2	40.1	17.1	10.2	6.3	0.6
1	Ciscoe (*Argyrosomus tullibee*), whole			42.7	57.3	43.6	13.7	11.0	2.0	0.7
	Cod (*Gadus morrhua*):									
2	Whole	Average		52.5	47.5	39.2	8.8	7.5	0.2	0.6
3	Head and entrails removed	Average		29.9	70.1	57.9	12.2	11.0	0.3	0.9
1	Cusk (*Brosmius brosme*), entrails removed			40.3	59.7	49.0	10.7	10.1	0.1	0.5
1	Lamprey eel (*Petromyzon marinus*), whole			45.8	54.2	38.5	15.7	8.1	7.2	0.4
2	Eel (*Anguilla rostrata*), skin, head, and entrails removed	Average		20.2	79.8	57.1	22.7	14.6	7.3	0.8
	Flounder (*Paralichthys dentatus*):									
1	Entrails removed			57.0	43.0	35.8	7.2	6.3	0.3	0.6
1	Whole			66.8	33.2	27.2	6.0	5.2	0.3	0.5
1	Flounder (*Pseudopleuronectes americanus*), whole			56.2	43.8	37.0	6.8	6.1	0.2	0.5
2	Red grouper (*Epinephelus morio*), entrails removed	Average		55.8	44.2	35.1	9.1	8.3	0.3	0.5
4	Haddock (*Melanogrammus æglefinus*), entrails removed	Average		51.0	49.0	40.0	9.0	8.3	0.1	0.6
1	Hake (*Phycis chuss*), entrails removed			52.5	47.5	39.5	8.0	7.2	0.3	0.5
	Halibut (*Hippoglossus americanus*):									
	Sections of body	Maximum		23.1	88.8	62.6	26.5	16.1	9.4	1.0
	Sections of body	Minimum		11.2	76.9	60.9	16.0	13.4	1.7	0.7
3	Sections of body	Average		17.7	82.3	62.1	20.2	15.1	4.2	0.9
1	Herring (*Clupea harengus*), whole			46.0	54.0	37.3	16.7	10.0	5.9	0.8
1	Kingfish (*Menticirrus nebulosus*), whole			56.6	43.4	34.4	9.0	8.1	0.4	0.5
1	Masquallonge (*Esox nobilior*), whole			49.2	50.8	38.7	12.1	10.0	1.3	0.8

TABLE V.—*Percentages of refuse, water, and nutritive ingredients in specimens of American food-fishes as found in the markets*—Continued.

Number of specimens.	Kind of fish and portion taken for analysis.	Maximum, minimum, or average.	Salt.	Refuse (bones, skin, entrails, &c.).	Edible portions (flesh).	Flesh, edible portion.				
						Water.	Water-free substance (nutrients).	Nutrients.		
								Protein (albuminoids).	Fats.	Ash, mineral matters.
	FRESH FISH—Continued.									
	Mackerel (*Scomber scombrus*):			*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*P. ct.*
	Whole	Maximum		51.8	66.2	48.5	23.8	12.1	10.7	1.0
	Whole	Minimum		33.8	48.2	35.8	12.4	8.4	1.4	0.6
5	Whole	Average		44.6	55.4	40.7	14.7	10.1	3.9	0.7
1	Entrails removed			40.7	59.3	43.7	15.6	11.4	3.5	0.7
1	Spanish mackerel (*Oybium maculatum*), whole			34.6	65.4	44.5	20.9	13.7	6.2	1.0
1	Mullet (*Mugil albula*), whole			57.9	42.1	31.5	10.6	8.1	2.0	0.5
2	Pompano (*Trachynotus carolinus*), whole	Average		45.5	54.5	39.5	15.0	10.2	4.3	0.5
1	Pike perch (*Stizostedium canadensis*), whole			63.2	36.8	29.7	7.1	6.4	0.3	0.4
1	Pike perch (*Stizostedium vitreum*), whole			57.2	42.8	34.1	8.7	7.9	0.2	0.6
2	White perch (*Morone americana*), whole	Average		62.5	37.5	28.3	9.2	7.2	1.5	0.5
	Yellow perch (*Perca fluviatilis*):									
1	Whole			62.7	37.3	30.0	7.3	6.7	0.2	0.4
1	Entrails, &c., removed			35.1	64.9	50.7	14.2	12.6	0.7	0.9
1	Pickerel (*Esox lucius*), whole			42.7	57.3	45.7	11.6	10.7	0.3	0.6
2	Pickerel (*Esox reticulatus*), whole	Average		47.0	53.0	42.2	10.8	9.9	0.2	0.7
1	Pollock (*Pollachius carbonarius*), head and entrails removed			28.5	71.5	54.3	17.2	15.5	0.6	1.1
3	Porgy (*Stenotomus argyrops*)	Average		60.0	40.0	30.0	10.0	7.4	2.0	0.6
2	Red snapper (*Lutjanus blackfordii*), entrails removed	Average		48.9	51.1	40.3	10.8	9.6	0.6	0.6
	Salmon (*Salmo salar*):									
1	Entrails, &c., removed			23.8	76.2	51.2	25.0	14.6	9.5	0.9
2	Whole	Average		38.5	61.5	37.6	23.9	15.0	8.0	0.9
1	California salmon (*Oncorhynchus chouicha*), sections of body			10.3	89.7	57.9	31.8	16.1	14.8	0.9
	Shad (*Alosa sapidissima*):									
	Whole	Maximum		58.8	55.6	39.5	18.6	10.5	7.3	0.8
	Whole	Minimum		44.4	41.2	30.3	10.9	7.4	2.9	0.5
7	Whole	Average		50.1	49.9	35.2	14.7	9.3	4.7	0.7
1	Skate (*Raia ?*), left lobe of body			51.0	49.0	40.2	8.8	7.5	0.7	0.6
	Sheepshead (*Archosargus probatocephalus*):									
1	Entrails removed			56.5	43.5	31.3	12.2	8.8	2.9	0.5
1	Whole			66.0	34.0	26.9	7.1	6.4	0.2	0.5
2	Smelt (*Osmerus mordax*), whole	Average		41.9	58.1	46.1	12.0	10.0	1.0	1.0
1	Sturgeon (*Acipenser sturio*), sections of body			14.4	85.6	67.4	18.2	15.4	1.6	1.2
1	Tom-cod (*Microgadus tomcodus*), whole			59.9	40.1	32.7	7.4	6.8	0.2	0.4

	Salmon trout (Salvelinus namaycush):									
1	Whole				56.3	43.7	30.0	13.7	7.7	5.4	0.6
1	Entrails removed				35.2	64.8	45.0	19.8	12.4	6.6	0.8
3	Brook trout (*Salvelinus fontinalis*), whole	Average			48.1	51.9	40.3	11.6	9.9	1.1	0.6
1	Whitefish (*Coregonus clupeiformis*), whole				53.5	46.5	32.5	14.0	10.3	3.0	0.7
1	Weakfish (*Cynoscion regalis*), whole				51.9	48.1	38.0	10.1	8.4	1.1	0.6
	SPENT FISH.										
2	Salmon (*Salmo salar*), whole	Average			43.6	56.4	43.3	13.1	10.4	2.1	0.6
2	Land-locked salmon (*Salmo salar*, subsp. *sebago*), whole	Average			47.3	52.7	41.4	11.3	9.1	1.6	0.6
	PRESERVED FISH.										
	DRIED.										
1	Dried cod (*Gadus morrhua*), flesh desiccated and ground			2.9		97.1	15.2	81.9	74.6	1.9	5.4
	SALTED.										
1	Salt mackerel (*Scomber scombrus*)			8.2	22.9	68.9	32.5	36.4	17.0	17.4	2.0
	SALTED AND DRIED.										
2	Salt cod (*Gadus morrhua*)	Average		15.4	24.9	59.7	40.3	19.4	16.0	0.4	3.0
1	Salt cod (*Gadus morrhua*), boned			19.1		80.9	54.4	26.5	22.1	0.3	4.1
	SALTED, SMOKED, AND DRIED.										
1	Smoked haddock, "Findon haddie" (*Melanogrammus æglefinus*)			1.4	32.2	66.4	49.2	17.2	16.1	0.1	1.0
2	Smoked halibut (*Hippoglossus americanus*)	Average		12.0	7.0	81.0	45.9	35.1	19.2	14.0	1.9
1	Smoked herring (*Clupea harengus*)			6.5	44.4	49.1	19.2	29.9	20.2	8.8	0.9
	CANNED.										
	Mackerel (*Scomber scombrus*)			1.9		98.1	68.2	29.9	19.9	8.7	1.3
2	Canned salmon (*Oncorhynchus chouicha*)	Average		1.3		98.7	59.9	38.8	19.4	18.8	1.3
	Sardines (*Clupea pilchardus?*)				5.0	95.0	53.6	41.4	24.0	12.1	5.3
	Tunny, "Horse mackerel" (*Orcynus secundo-dorsalis?*)					100.0	72.7	27.3	21.5	4.1	1.7
2	Salt mackerel (*Scomber scombrus*)	Average		8.3	19.7	72.0	34.8	37.2	13.8	21.3	2.1
	"Findon haddie," smoked haddock (*Melanogrammus æglefinus*)			5.6		94.4	68.7	25.7	21.8	2.3	1.6

TABLE VI.—*Percentages of water and nutritive ingredients in specimens of American invertebrates used for food.*

Laboratory number of specimen.	Name and locality of specimen.	Specimen received.	Edible portion.																	In whole sample.	
			In flesh.					In liquids.					In edible portion. Flesh plus liquids.								
			Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Water.	Water-free substance.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Extractives.	Nitrogen.	Total edible portion.	Total water-free substance, actual nutrients.
	OYSTERS, *Ostrea virginiana* (in shell).		*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
68	Buzzard's Bay, Massachusetts	May, '81	84.21	1.24	7.75	1.57	1.48	96.40	0.20	1.23	0.00	1.63	88.80	11.20	5.30	0.99	1.54	3.37	0.85	20.01	2.22
70	Providence River, Rhode Island	May, '81	79.01	1.65	10.30	2.58	2.13	95.05	0.24	1.48	0.00	2.41	84.79	15.21	7.12	1.65	2.23	4.21	1.14	17.00	2.59
103	Clinton, Conn	Nov., '81	80.91	1.55	9.67	1.86	2.29	96.02	0.18	1.10	0.02	2.21	88.91	11.09	5.13	0.88	2.24	2.84	0.82	24.87	2.76
55	Stony Creek, Connecticut	Apr., '81	81.02	1.67	10.46	1.60	2.76	96.12	0.13	0.83	0.01	2.72	90.11	9.89	4.64	0.64	2.73	1.95	0.74	18.90	1.89
75	do	May, '81	82.09	1.57	9.81	1.48	2.55	96.33	0.10	0.63	0.05	2.61	90.89	9.11	4.19	0.60	2.59	1.73	0.67	19.15	1.75
105	do	Nov., '81	77.82	1.70	10.60	2.32	2.51	95.40	0.22	1.36	0.01	2.33	84.83	15.17	6.94	1.39	2.44	4.40	1.11	18.23	2.76
203	do	Mar., '82	80.42	1.66	10.38	1.85	2.22	95.30	0.23	1.42	0.03	2.50	87.19	12.81	6.31	1.02	2.34	3.14	1.01	20.50	2.62
	Average of 4 samples		80.34	1.65	10.33	1.81	2.51	95.79	0.17	1.06	0.02	2.54	88.24	11.76	5.52	0.91	2.52	2.80	0.88	19.20	2.26
54	Fair Haven, Conn	Apr., '81	81.30	1.58	9.89	2.05	2.20	94.00	0.33	2.06	0.02	3.19	85.12	14.88	7.53	1.44	2.50	3.41	1.20	18.06	2.69
93	do	Nov., '81	76.24	1.75	10.96	2.47	2.01	94.43	0.34	2.14	0.02	2.43	85.25	14.75	6.24	1.26	2.22	5.03	1.00	24.31	3.59
210	do	Mar., '82	80.80	1.58	9.89	2.05	1.85	95.12	0.31	1.94	0.03	2.21	84.64	15.36	7.75	1.28	2.92	3.81	1.24	16.59	2.55
	Average of 3 samples		79.44	1.64	10.25	2.19	2.02	94.52	0.33	2.06	0.02	2.61	85.00	15.00	7.17	1.33	2.54	4.08	1.12	19.65	2.95
118	Norwalk, Conn	Dec., '81	81.33	1.52	9.52	1.51	2.10	96.46	0.12	0.75	0.01	2.32	90.04	9.90	4.50	0.65	2.23	2.52	0.72	17.85	1.78
151	do	Feb., '82	80.50	1.60	9.97	1.89	2.15	96.32	0.12	0.76	0.02	2.50	89.60	10.40	4.69	0.82	2.35	2.54	0.75	17.05	1.77
	Average of 2 samples		80.92	1.56	9.75	1.70	2.13	96.39	0.12	0.77	0.02	2.41	89.82	10.18	4.59	0.73	2.29	2.51	0.73	17.45	1.78
56	Blue Point, New York	Apr., '81	76.77	1.61	10.06	2.30	1.93	94.33	0.37	2.31	0.09	1.91	81.70	18.30	8.22	1.72	1.92	6.46	1.31	18.62	3.41
107	do	Nov., '81	75.55	2.13	13.31	2.02	2.58	96.89	0.12	0.75	0.01	1.90	88.30	11.70	5.81	0.82	2.17	2.90	0.93	16.17	1.95

182	....do	Feb., '82	83.97	1.41	8.81	1.62	1.59	96.87	0.15	0.92	0.01	1.70	90.15	9.85	5.00	0.85	1.64	2.36	0.80	15.42	1.52
	Average of 3 samples		78.76	1.72	10.73	1.98	2.03	96.03	0.21	0.31	0.04	1.88	86.75	13.28	6.34	1.13	1.91	3.91	1.01	16.74	2.33
58	Rockaway, New York	Apr., '81	81.27	1.47	9.18	2.13	1.67	95.06	0.26	1.60	0.04	2.26	87.06	12.94	6.00	1.25	1.92	3.85	0.96	18.40	2.40
112	....do	Nov., '81	77.66	1.68	10.53	2.72	2.02	94.79	0.28	1.76	0.01	2.56	84.31	15.69	7.06	1.66	2.23	4.74	1.13	19.84	3.13
	Average of 2 samples		79.46	1.58	9.85	2.43	1.85	94.92	0.27	1.68	0.03	2.40	85.65	14.35	6.53	1.46	2.07	4.29	1.01	19.12	2.75
60	Long Island Sound, New York	Apr., '81	84.47	1.30	8.14	1.68	1.41	96.35	0.21	1.30	0.09	0.85	89.67	10.33	5.24	0.98	1.17	3.03	0.84	16.23	1.69
92	....do	Nov., '81	78.51	1.86	11.61	1.84	2.52	93.81	0.37	2.29	0.02	3.16	83.64	16.36	8.50	1.23	2.73	3.90	1.36	14.62	2.39
109	....do	Nov., '81	82.79	1.35	8.41	1.74	1.71	96.64	0.18	1.09	0.01	1.87	90.15	9.85	4.56	0.82	1.79	2.68	0.73	17.59	1.73
	Average of 3 samples		81.92	1.50	9.39	1.75	1.88	95.60	0.25	1.56	0.04	1.96	87.79	12.21	6.10	1.01	1.89	3.20	0.98	16.15	1.97
180	Oyster Bay, New York	Feb., '82	77.90	1.70	10.61	2.35	2.19	95.31	0.23	1.46	0.01	2.37	84.34	15.66	7.19	1.48	2.26	4.73	1.15	17.27	2.70
57	East River, New York	Apr., '81	79.92	1.67	10.44	2.16	1.74	95.44	0.26	1.63	0.02	1.57	87.57	12.43	6.31	1.10	1.87	3.15	1.01	20.28	2.52
108	....do	Nov., '81	75.22	1.61	10.07	2.87	1.87	94.87	0.29	1.81	0.09	2.33	83.35	16.65	6.39	1.72	2.06	6.48	1.02	20.31	3.38
	Average of 2 samples		77.57	1.64	10.25	2.52	1.81	95.16	0.27	1.74	0.06	1.95	85.46	14.54	6.35	1.41	1.97	4.82	1.02	20.30	2.87
61	Shrewsbury, New Jersey	Apr., '81	81.65	1.31	8.20	2.20	1.33	95.07	0.33	2.06	0.04	1.83	85.37	14.63	6.48	1.60	1.47	5.08	1.04	17.52	2.56
106	....do	May, '81	77.58	1.55	9.68	2.66	1.88	95.35	0.30	1.88	0.04	1.96	85.17	14.83	6.24	1.54	1.91	5.14	1.00	19.67	2.93
181	....do	Nov., '82	81.73	1.46	9.13	2.00	1.68	96.52	0.22	1.38	0.01	1.72	89.16	10.84	4.87	1.00	1.70	3.27	0.78	19.23	2.08
	Average of 3 samples		80.32	1.44	9.00	2.29	1.63	95.65	0.28	1.76	0.03	1.83	86.57	13.43	5.88	1.38	1.69	4.49	0.94	18.81	2.53
59	Norfolk, Va	Apr., '81	83.86	1.49	9.32	1.45	1.82	96.83	0.17	1.05	0.01	1.64	91.45	8.55	4.50	0.61	1.71	1.73	0.72	11.18	0.95
73	Potomac River, Va. (transplanted)†	May, '81	78.87	1.57	9.81	2.27	2.54	95.51	0.23	1.42	0.01	2.47	86.60	13.40	5.92	1.22	2.51	3.73	0.95	12.15	1.63
84	....do.†	Nov., '81	82.06	1.45	9.66	1.93	1.58	95.69	0.33	2.05	0.01	1.19	87.36	12.64	6.25	1.18	1.43	3.78	1.00	16.66	2.11
85	....do.†	Nov., '81	77.90	1.65	10.31	2.33	2.17	94.99	0.29	1.81	0.02	2.47	86.14	13.86	6.19	1.21	2.31	4.15	0.99	16.13	2.23
	Average of 3 samples		79.61	1.56	9.74	2.18	2.10	95.40	0.28	1.76	0.01	2.04	86.70	13.30	6.12	1.20	2.08	3.89	0.98	14.98	2.00
72	Rappahannock River, Virginia (transplanted)	May, '81	82.64	1.36	8.49	1.90	1.58	97.24	0.16	1.01	0.01	1.38	89.77	10.23	4.88	0.99	1.52	2.73	0.78	15.17	1.53
71	James River, Va. (transplanted)†	May, '81	83.49	1.32	8.26	1.78	1.71	95.91	0.19	1.17	0.01	2.56	90.05	9.95	4.63	0.84	2.16	2.48	0.74	13.79	1.41
82	....do.†	Nov., '81	77.99	1.70	10.63	2.61	2.21	94.74	0.31	1.95	0.05	2.54	84.15	15.85	7.00	1.67	2.35	4.85	1.12	15.00	2.38
83	....do.†	Nov., '81	82.77	1.40	8.75	1.91	1.55	95.22	0.34	2.14	0.13	1.42	86.95	13.05	8.00	1.31	1.51	2.23	1.28	17.17	2.19
	Average of 3 samples		81.42	1.47	9.23	2.10	1.82	95.29	0.28	1.76	0.07	2.17	87.05	12.95	6.54	1.27	2.00	3.19	1.05	15.32	1.98
	Average of 34 samples (average of averages)		80.52	1.55	9.04	2.04	1.96	95.76	0.22	1.42	0.03	2.09	87.30	12.70	5.95	1.15	2.03	3.55	0.95	17.70	2.32

* *I. e.*, in sample as received for analysis; in the majority of the cases the whole animal, including both edible portion and shell.

† To New Haven, Conn.

TABLE VI.—*Percentages of water and nutritive ingredients in specimens of American invertebrates used for food*—Continued.

Laboratory number of specimen.	Name and locality of specimen.	Specimen received.	Edible portion. In flesh. Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Edible portion. In liquids. Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Edible portion. In edible portion. (Flesh plus liquids.) Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Extractives.	Nitrogen.	In whole sample. Total edible portion.	Total water-free substance, actual nutrients.
			Pr. ct.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
	OYSTERS, "SOLIDS" (out of shell).*																				
89	Fair Haven, Conn	Nov., '81	84.04	1.14	7.12	1.96	0.86	96.19	0.26	1.60	0.02	0.55	85.21	14.79	6.60	1.77	0.83	5.59	1.05	100.00	14.79
204	....do	Mar., '82											88.44	11.56	5.91	1.54	0.89	3.22	0.95	100.00	11.56
104	Virginia (transplanted) †	Nov., '81	85.50	1.20	7.51	1.83	1.12	96.43	0.23	1.43	0.02	0.77	87.23	12.77	6.38	1.54	1.06	3.79	1.02	100.00	12.77
202	....do.†	Mar., '82											87.90	12.10	6.44	1.57	0.77	3.63	1.03	100.00	12.10
	Average of 4 samples "solids"												87.19	12.81	6.33	1.60	0.89	4.07	1.01	100.00	12.81
	OYSTERS, "COVE" (canned).																				
74	Chesapeake Bay	May, '81	78.53	2.24	14.00	3.78	1.60	93.57	0.28	1.77	0.27	1.21	86.01	13.99	7.89	2.04	1.42	2.51	1.26	100.00	13.99
97	....do	Nov., '81	76.75	2.12	13.25	4.35	1.63	93.35	0.22	1.40	0.09	0.91	85.14	14.96	7.25	2.19	1.27	4.25	1.16	100.00	14.96
120	....do	Nov., '81	77.25	2.15	13.44	4.24	1.45	90.57	0.30	1.88	0.12	1.10	84.60	15.40	7.00	1.96	1.26	5.18	1.12	100.00	15.40
	Average of 3 samples		77.51	2.17	13.46	4.12	1.56	92.50	0.27	1.70	0.16	1.08	85.25	14.78	7.38	2.06	1.32	3.98	1.18	100.00	14.78
	SCALLOPS, *Pecten irradians.*																				
51	Shelter Island, New York	Mar., '81											77.79	22.21	15.05	0.03	1.48	5.65	2.41	100.00	22.21
63	....do	Apr., '81											82.84	17.16	14.44	0.30	1.29	1.13	2.31	100.00	17.16
	Average of 2 samples												80.32	19.68	14.75	0.17	1.38	3.38	2.36	100.00	19.68
	LONG CLAMS, *Mya arenaria* (in shell).																				
67	Boston, Mass	May, '81	77.96	2.33	14.55	1.79	2.76	95.73	0.08	0.49	0.01	3.29	86.11	13.89	8.13	0.98	3.00	1.78	1.30	53.90	7.50

102	*Clinton, Conn*	*Nov., '81*	*78.57*	*2.38*	*14.86*	*1.78*	*2.49*	*96.02*	*0.11*	*0.69*	*0.00*	*2.81*	*86.11*	*13.89*	*8.60*	*1.01*	*2.63*	*1.56*	*1.39*	*57.92*	*8.05*
201	*do*	*Mar., '82*	*79.94*	*2.02*	*12.62*	*1.69*	*3.11*	*96.77*	*0.11*	*0.69*	*0.01*	*2.05*	*85.00*	*15.00*	*7.60*	*1.18*	*2.79*	*3.43*	*1.22*	*56.30*	*8.45*
	Average of 2 samples		79.26	2.20	13.74	1.74	2.80	96.40	0.11	0.66	0.01	2.43	85.56	14.44	8.15	1.09	2.71	2.49	1.30	57.11	8.25
65	*Long Island, New York*	Apr., '81	81.05	2.00	12.52	1.52	1.56	94.76	0.21	1.30	0.03	2.93	86.05	13.95	8.40	0.97	2.06	2.52	1.34	57.64	8.04
	Average of 4 samples (average of averages)		79.42	2.18	13.63	1.68	2.37	95.63	0.13	0.82	0.02	2.88	85.91	14.09	8.23	1.01	2.59	2.29	1.31	56.44	8.17
	LONG CLAMS (canned).																				
122	Penobscot Bay, Maine	Nov., '81	74.63	2.87	17.94	2.92	3.18	91.92	0.39	2.44	0.04	1.72	84.54	15.46	9.06	1.27	2.34	2.79	1.45	100.00	15.46
	ROUND CLAMS, *Venus mercenaria* (in shell).																				
66	Little Neck, New York	Apr., '81	78.24	1.86	11.59	0.74	2.22	95.12	0.14	0.88	0.02	3.17	86.20	13.80	0.56	0.40	2.67	4.17	1.05	31.71	4.38
	ROUND CLAMS (canned).																				
125	Islip, Long Island, N. Y	Nov., '81	75.56	2.67	16.70	1.27	2.33	90.52	0.65	4.07	0.26	3.26	82.91	17.59	9.54	0.68	3.74	3.13	1.53	100.00	17.09
	MUSSELS, *Mytilus edulis* (in shell).																				
139	Stony Creek, Connecticut	Dec., —	78.67	2.00	12.51	1.67	1.73	94.23	0.28	1.77	0.13	2.25	34.16	15.84	8.69	1.12	1.91	4.12	1.39	50.66	3.02
	LOBSTER, *Homarus americanus* (in shell).																				
50	Maine	Mar., '81											84.30	15.70	11.63	1.82	1.63	0.62	1.86	52.52	8.24
62	do	Apr., '81											81.77	18.23	14.00	1.55	1.71	0.92	2.24	36.24	6.60
239	do	Apr., '82											79.17	20.83	17.24	1.45	1.62	0.52	2.76		
69	Massachusetts	May, '81											82.11	17.89	15.03	2.54	1.87		2.41	30.56	5.47
	Average of 4 samples												81.84	18.16	14.49	1.84	1.71		2.32	39.77	6.80
	LOBSTER (canned).																				
76	Maine	May, '81											79.36	20.64	16.75	0.46	2.78	0.65	2.68	100.00	20.64
121	do	Nov., '81											76.15	23.85	19.52	1.68	2.15	0.50	3.12	100.00	23.85
	Average of 2 samples												77.75	22.25	18.13	1.07	2.47	0.58	2.90	100.00	22.25
	CRAYFISH (in shell).																				
64	Potomac River, Virginia	Apr., '81											81.22	18.78	16.00	0.46	1.31	1.01	2.56	12.30	2.31
	CRAB, *Ballinectes hastatus* (in shell).																				
101	New Jersey	Nov., '81											77.07	22.93	16.64	1.96	3.13	1.20	2.66	44.16	10.12

* *I. e.*, shell-contents, including flesh and liquids.

† To New Haven, Conn.

TABLE VI.—*Percentages of water and nutritive ingredients in specimens of American invertebrates used for food*—Continued.

Laboratory number of specimen.	Name and locality of specimen.	Specimens received.	Edible portion.																	In whole sample.	
			In flesh.					In liquids.					In edible portion. (Flesh plus liquids.)								
			Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Water.	Nitrogen.	Protein. Nitrogen × 6.25.	Fat. Ether extract.	Crude ash.	Extractives.	Nitrogen.	Total edible portion.	Total water-free substance, actual nutriments.
			Pr. ct.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*
	CRABS (canned).																				
124	Hampton, Va	Nov., '81											80.98	19.02	15.62	0.79	1.78	0.83	2.50	100.00	19.02
274	do	Apr., '82											78.95	21.05	15.98	2.30	2.10	0.67	2.56	100.00	21.05
	Average of 2 samples												79.97	20.03	15.80	1.54	1.94	0.75	2.53	100.00	20.04
	SHRIMP (canned).																				
123	Gulf of Mexico	Nov., '81											70.80	29.20	25.38	1.00	2.58	0.24	4.06	100.00	29.20
	TERRAPIN (in shell).																				
235	Savannah, Ga	Apr., '82											74.47	25.53	21.23	3.47	1.02		3.40	20,97	5.36
	GREEN TURTLE, *Chelonia mydas* (in shell).																				
272	Key West, Fla	May, '82											79.78	20.22	19.84	0.53	1.20		3.17	24.03	4.86

TABLE XI.—*Constituents of animal foods.*

[Italics indicate European analyses; the rest are American.]

Kinds of food materials.	In edible portion (*i. e.*, flesh, &c., freed from bones, shells, and other refuse).						In specimens as purchased in the markets, including both edible portion and refuse.						
			Nutrients.					Edible portion.					
									Nutrients.				
	Water.	Nutrients.	Protein albuminoids.	Fats.	Carbo-hydrates, &c.	Mineral matters.	Refuse (bones, skins, shells, &c.).	Water.	Nutrients.	Protein albuminoids.	Fats.	Carbo-hydrates, &c.	Mineral matters.
MEATS, FRESH.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Beef, side, well fattened	54.6	45.4	17.9	26.5	.....	1.0	19.7	43.8	36.5	14.4	21.3	.....	0.8
Beef, lean, nearly freed from fat	76.0	24.0	21.8	0.9	.....	1.3	0.0	76.0	24.0	21.8	0.9	.....	1.3
Beef, round, rather lean*	66.7	33.3	23.0	9.0	.....	1.3	10.0	60.0	30.0	20.7	8.1	.....	1.2
Beef, sirloin, rather fat*	60.0	40.0	19.0	20.0	.....	1.0	25.0	45.0	30.0	14.3	15.0	.....	0.7
Beef, flank, very fat*	27.3	72.7	12.4	59.6	.....	0.7	12.5	23.9	63.6	10.8	52.2	.....	0.6
Beef liver	69.5	30.5	20.1	5.4	3.5	1.5	0.0	69.5	30.5	20.1	5.4	.....	1.5
Beef tongue	63.8	36.2	17.1	18.1	.....	1.0	15.3	54.0	30.7	14.5	15.3	3.5	0.9
Beef heart	56.8	43.2	15.8	26.3	.....	1.1	6.0	53.4	40.6	14.9	24.8	.....	0.9
Veal, lean	79.8	21.2	19.9	0.8	.....	(0.5)	(†)	.....	.....	.....	.....	.....	.....
Veal, rather fat	72.3	27.7	18.9	7.5	.....	(1.3)	(†)	.....	.....	.....	.....	.....	.....
Mutton, side, well fattened	53.6	46.4	16.5	29.0	.....	0.9	20.0	42.9	37.1	13.2	23.2	.....	0.7
Mutton, leg*	61.9	38.1	18.2	19.0	.....	0.9	18.4	40.2	41.4	12.2	28.6	.....	0.6
Mutton, shoulder*	58.6	41.4	18.0	22.4	.....	1.0	16.9	48.7	34.4	15.0	18.6	.....	0.8
Mutton, loin (chops)*	49.3	50.7	14.9	35.1	.....	0.7	16.3	41.3	42.4	12.5	29.3	.....	0.6
MEATS, PREPARED.													
Dried beef	59.5	40.5	29.2	4.5	.....	6.8	6.5	55.5	38.0	27.4	4.2	.....	6.4
Corned beef, rather lean	58.1	41.9	21.4	17.9	.....	3.1	6.2	54.5	39.3	20.1	16.3	.....	2.9
Smoked ham	41.5	58.5	24.0	30.6	.....	3.9	12.4	36.4	51.2	21.0	26.8	.....	3.4
Pork, bacon, salted	10.0	90.0	3.0	80.5	.....	6.5	5.0	9.5	85.5	2.8	76.5	.....	6.2
FOWL.													
Chicken, rather lean	71.5	28.5	25.1	2.0	.....	1.4	41.6	41.8	16.6	14.6	1.2	.....	0.8

* Portions of the side of which analysis is given above.

TABLE XI.—*Constituents of animal foods*—Continued.

Kinds of food materials.	In edible portion (*i. e.*, flesh, &c., freed from bones, shells, and other refuse).						In specimens as purchased in the markets, including both edible portion and refuse.						
			Nutrients.					Edible portion.					
										Nutrients.			
	Water.	Nutrients.	Protein albuminoids.	Fats.	Carbo-hydrates, &c.	Mineral matters.	Refuse (bones, skins, shells, &c.).	Water.	Nutrients.	Protein albuminoids.	Fats.	Carbo-hydrates, &c.	Mineral matters.
FOWL—Continued.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Turkey, medium fatness	65.6	34.4	24.7	8.5	.....	1.2	35.4	42.4	22.2	16.0	5.5	.....	0.7
Goose fat	38.0	62.0	15.9	45.6	.....	0.5	(?)	.....	.....	.....	.....	.....	.....
DAIRY PRODUCTS, EGGS, ETC.													
Cow's milk	87.4	12.6	3.4	3.7	4.8	0.7	0.0	87.4	12.6	3.4	3.7	4.8	0.7
Cow's milk, skimmed	90.7	9.3	3.1	0.7	4.8	0.7	0.0	90.7	9.3	3.1	0.7	4.8	0.7
Cow's milk, buttermilk	90.3	9.7	4.1	0.9	4.0	0.7	0.0	90.3	9.7	4.1	0.9	4.0	0.7
Cow's milk, whey	93.2	6.8	0.9	0.2	5.0	0.7	0.0	93.2	6.8	0.9	0.2	5.0	0.7
Cheese, whole milk*	31.2	68.8	27.1	35.4	2.4	3.9	0.0	31.2	68.8	27.1	35.4	2.4	3.9
Cheese, skimmed milk	41.3	58.7	38.3	6.8	9.0	4.6	0.0	41.3	58.7	38.3	6.8	9.0	4.6
Butter	7.0	93.0	1.0	89.0	.....	3.0	0.0	7.0	93.0	1.0	89.0	.....	3.0
Butter	14.5	85.5	0.7	83.3	0.6	0.9	0.0	14.5	85.5	0.7	83.3	0.6	0.9
Hens' eggs	73.7	26.3	12.5	12.1	0.6	1.1	11.0	65.6	23.4	11.1	10.8	0.5	1.0
FRESH FISH.													
Flounder, whole	84.2	15.8	13.8	0.7	.....	1.3	66.8	27.2	6.0	5.2	0.3	.....	0.5
Yellow perch, whole	79.2	20.8	18.7	0.8	.....	1.3	62.7	30.0	7.3	6.7	0.2	.....	0.4
Haddock, dressed	81.7	18.3	16.8	0.3	.....	1.2	51.0	40.0	9.0	8.3	0.1	.....	0.6
Black bass, whole	76.7	23.3	20.4	1.7	.....	1.2	54.8	34.6	10.6	9.2	0.8	.....	0.6
Bluefish, dressed	78.5	21.5	19.0	1.2	.....	1.3	48.6	40.3	11.1	9.8	0.6	.....	0.7
Pickerel (pike), whole	79.7	20.3	18.6	0.5	.....	1.2	47.0	42.2	10.8	9.9	0.2	.....	0.7
Brook trout, whole	77.7	22.3	19.0	2.1	.....	1.2	48.1	40.3	11.6	9.9	1.1	.....	0.6
Smelt, whole	79.2	20.8	17.3	1.8	.....	1.7	41.9	46.1	12.0	10.0	1.0	.....	1.0
Mackerel, lean, whole	78.7	21.3	18.1	2.2	.....	1.0	38.3	48.5	13.2	11.2	1.4	.....	0.6
Mackerel, fat, whole	64.0	36.0	18.2	16.3	.....	1.5	33.8	42.4	23.8	12.1	10.7	.....	1.0
Mackerel, average, whole	73.4	26.6	18.2	7.1	.....	1.3	44.6	40.7	14.7	10.1	3.9	.....	0.7

Alewife, whole	*73.0*	*27.0*	*19.5*	*6.0*		*1.5*	*49.4*	*36.9*	*13.7*	*9.9*	*3.0*	*0.8*
Cod, dressed	*82.6*	*17.4*	*15.8*	*0.4*		1.2	29.9	57.9	12.2	11.0	0.3	0.9
Whitefish, whole	*69.8*	*30.2*	22.1	6.5		1.6	53.5	32.5	14.0	10.3	3.0	0.7
Shad, whole	70.6	29.4	18.5	9.5		1.4	50.1	35.2	14.7	9.3	4.7	0.7
Herring, whole	69.0	31.0	18.5	11.0		1.5	46.0	37.3	16.7	10.0	5.9	0.8
Halibut, dressed	75.4	24.6	18.3	5.2		1.1	17.7	62.1	20.2	15.1	4.2	0.9
Salmon trout, dressed	69.1	30.9	18.3	11.3		1.3	35.2	45.0	19.8	12.4	6.6	0.8
Eel, dressed	71.6	28.4	18.3	9.1		1.0	20.2	57.1	22.7	14.6	7.3	0.8
Salmon, in season, whole	61.4	38.6	24.2	13.0		1.4	38.5	37.6	23.9	15.0	8.0	0.9
Salmon, spent, whole	79.2	20.8	17.6	2.0		1.2	46.2	42.6	11.2	9.5	1.0	0.7
PREPARED FISH.												
						Salt.	*Salt.*					
Smoked haddock	72.6	25.3	23.6	0.2		1.5 2.1	32.2 1.4	49.2	17.2	16.1	0.1	1.0
Salt cod	53.6	25.8	21.4	0.3		4.1 20.6	24.9 15.4	40.3	19.4	16.0	0.4	3.0
Smoked herring	34.5	53.8	36.4	15.8		1.6 11.7	44.4 6.5	19.2	29.9	20.2	8.8	0.9
Canned salmon	59.9	38.8	19.4	18.0		1.4 1.3	00.0 1.3	59.9	38.8	19.4	18.8	1.3
Salt mackerel	42.2	47.2	22.0	22.6		2.6 10.6	22.9 8.2	32.5	36.4	17.0	17.4	2.0
Desiccated cod†	15.2	81.9	74.6	1.9		5.4 2.9	00.0 2.9	15.2	81.9	74.6	1.9	5.4
INVERTEBRATES, SHELL-FISH, ETC.												
Oysters, best	83.4	16.6	6.4	1.7	6.5	2.0	81.4	15.2	3.4	1.5	0.2	1.3	0.4
Oysters, inferior	91.4	8.6	4.5	0.6	1.8	1.7	88.8	10.2	1.0	0.5	0.1	0.2	0.2
Oysters, average‡	87.3	12.7	6.0	1.2	3.5	2.0	82.3	15.4	2.3	1.0	0.2	0.6	0.5
Oysters, solids, average§	87.2	12.8	6.3	1.6	4.0	0.9	0.0	87.2	12.8	6.2	1.5	4.1	1.0
Round clams	86.2	13.8	6.6	0.4	4.2	2.6	68.3	27.3	4.4	2.1	0.1	1.3	0.9
Long clams	85.9	14.1	8.5	1.0	2.0	2.6	43.6	48.3	7.9	4.3	0.5	1.3	1.8
Mussels	84.2	15.8	8.7	1.1	4.1	1.9	49.3	42.7	8.0	3.9	0.5	2.1	1.5
Scallops	80.3	19.7	14.7	0.2	3.4	1.4	0.0	80.3	19.7	14.7	0.2	3.4	1.4
Cray-fish	81.2	18.8	16.0	0.5	1.0	1.3	87.7	10.0	2.3	1.9	0.1	0.1	0.2
Lobsters	81.8	18.2	14.5	1.8	0.2	1.7	60.2	33.0	6.8	5.4	0.5	0.2	0.7
Crabs	77.1	22.9	16.6	2.0	1.2	3.1	55.8	34.1	10.1	7.3	0.9	0.5	1.4
Canned oysters	85.2	14.8	7.4	2.1	4.0	1.3	0.0	85.4	14.6	6.4	1.6	5.1	1.5
Canned lobsters	77.7	22.3	18.1	1.1	0.6	2.5	0.0	77.7	22.3	18.1	1.1	0.6	2.5

* New York factory cheese.

† Flesh of codfish freed from bone and artificially dried. "Alden's fresh cod," an article not yet common in the market.

‡ "Inferior," "best," and "average" in respect to the percentage of nutrients in shell contents (edible portion) and in whole oysters, including shells and contents (specimens as found in market).

§ That is, the edible portion as ordinarily purchased in the markets, including the "meats" and most of the liquid portion of the shell contents.

TABLE XII.—*Constituents of vegetable foods and beverages.*

Kinds of foods and beverages.	Water.	Nutrients.				
		Protein (albuminoids).	Fats.	Carbohydrates, &c.	Woody fiber.	Mineral matter.
FOOD.						
Wheat flour, average*	11.6	11.1	1.1	75.4	0.2	0.6
Wheat flour, maximum*	13.5	13.6	2.0	78.5	1.2	1.5
Wheat flour, minimum*	8.3	8.6	0.6	68.3	0.1	0.3
Graham flour (wheat)	13.0	11.7	1.7	69.9	1.9	1.8
Cracked wheat	10.4	11.9	1.7	74.6		1.4
Rye flour	13.1	6.7	0.8	78.3	0.4	0.7
Pearled barley	11.8	8.4	0.7	77.8	0.3	1.0
Buckwheat flour	13.5	6.5	1.3	77.3	0.3	1.1
Buckwheat "farina"	11.2	3.3	0.3	84.7	0.1	0.4
Buckwheat "groats"	10.6	4.8	0.6	83.1	0.3	0.6
Oatmeal	7.7	15.1	7.1	67.2	0.9	2.0
Cornmeal	14.3	8.4	3.5	70.9	1.6	1.3
Hominy	13.5	8.3	0.4	77.1	0.3	0.4
Rice	12.4	7.4	0.4	79.2	0.2	0.4
Beans	13.7	23.2	2.1	53.7	3.7	3.6
Peas	15.0	22.9	1.8	52.4	5.4	2.5
Potatoes	75.5	2.0	0.2	20.7	0.8	1.0
Sweet potatoes	75.8	1.5	0.4	20.0	1.1	1.2
Turnips	91.2	1.0	0.2	6.0	0.9	0.7
Carrots	87.9	1.0	0.2	8.9	1.2	0.8
Cabbage	90.0	1.9	0.2	4.9	1.8	1.2
Cauliflower	90.4	2.5	0.4	5.0	0.9	0.8
Melons	95.2	1.1	0.6	1.4	1.1	0.6
Pumpkins	90.0	0.7	0.1	7.3	1.3	0.6
Apples	84.8	0.4	0.0	12.8	1.5	0.5
Pears	83.0	0.4	0.0	12.0	4.3	0.3
Starch	15.1	1.2	0.0	83.3	0.0	0.4
Cane, sugar	2.2	0.3	0.0	96.7	0.0	0.8
Wheat bread†	32.7	8.9	1.9	55.5		1.0
Graham bread	34.2	9.5	1.4	53.3		1.6
Rye bread	30.0	8.4	0.5	59.7		1.4
Soda crackers	8.0	10.3	0.4	70.5		1.8
"Boston" crackers	8.3	10.7	9.9	68.7		2.4
"Oyster" crackers	3.9	12.3	4.8	76.5		2.5
Oatmeal crackers	4.9	10.4	13.7	69.6		1.4
Pilot (bread) crackers	7.9	12.4	4.4	74.2		1.1
Macaroni	13.1	9.0	0.3	76.8		0.8
BEVERAGES.			Alcohol.		Free acid.	
Lager beer	90.8	0.5	4.0	6.6	.....	0.2
Porter and ale	88.5	0.7	5.2	7.2	.....	0.3
Rhenish wine, white	86.3	.....	10.5	2.6	0.4	0.2
Rhenish wine, red	86.9	.....	8.9	3.4	0.5	0.3
French wine, claret	88.4	.....	8.1	2.7	0.6	0.2

* Of forty-nine analyses.

† From flour of about average composition.

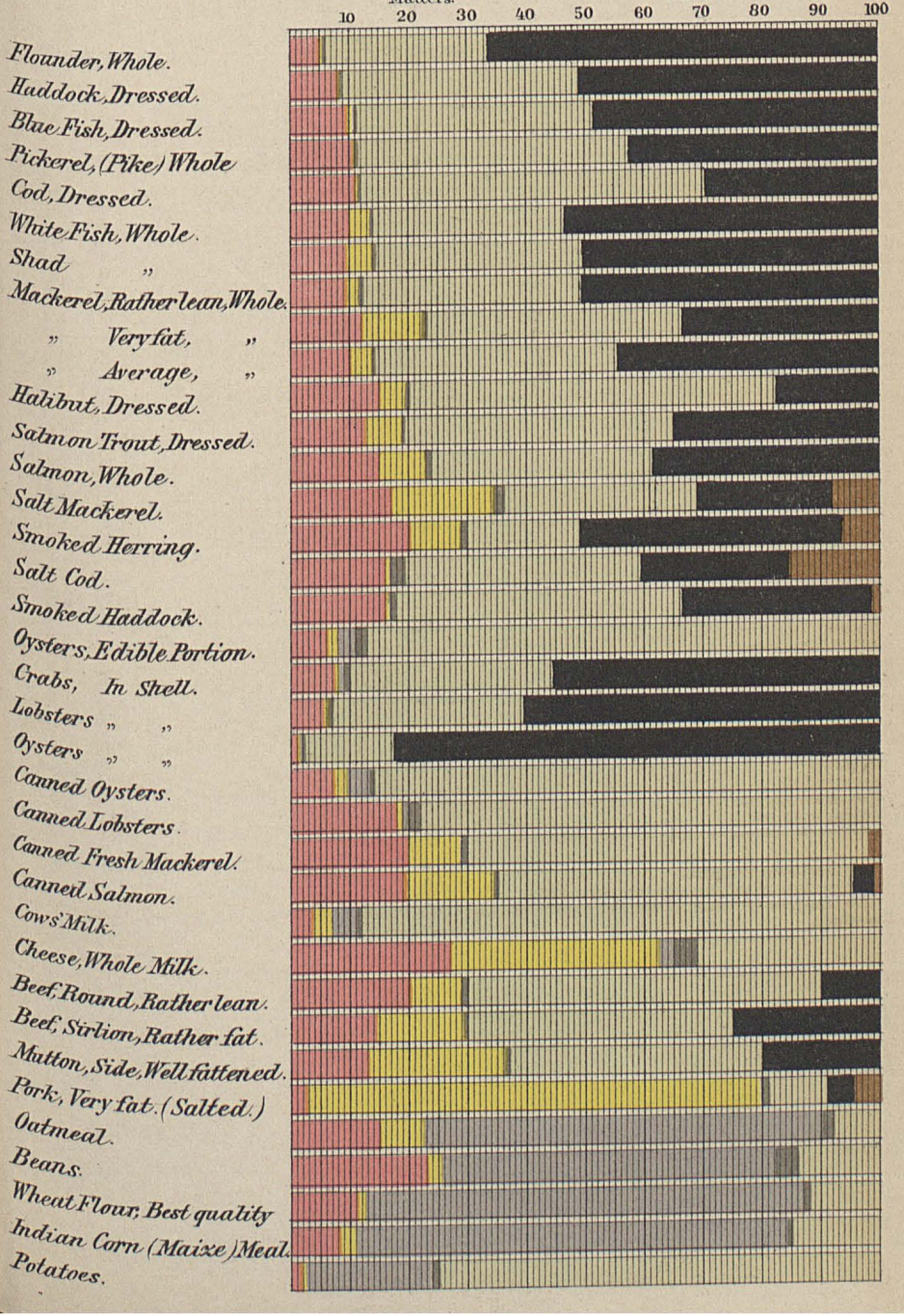
The analyses of foods in Roman letters are American, those of foods and beverages in *italics* are European.

NUTRITIVE INGREDIENTS, WATER AND REFUSE IN SPECIMENS OF FISH AND OTHER FOOD MATERIALS AS FOUND IN THE MARKETS.

Percentages Indicated by Colored Spaces.

NUTRIENTS. NON-NUTRIENTS.

PROTEIN. FATS. CARBOHYDRATES. ASH. Mineral Matters. WATER. REFUSE. Bones, Entrails, Shells etc. SALT. In Salt Fish etc.

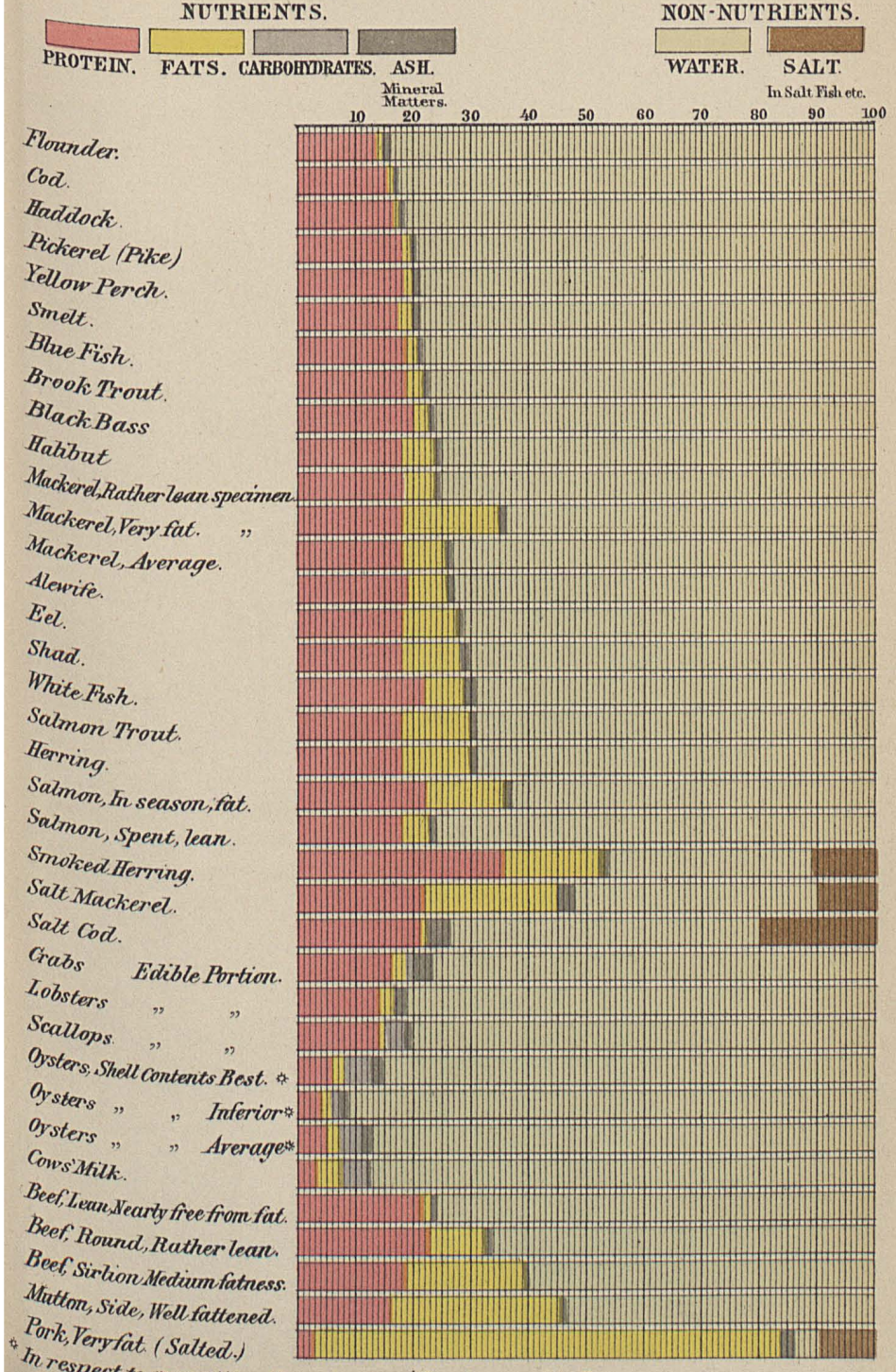


NUTRITIVE INGREDIENTS AND WATER, ETC. IN FLESH, EDIBLE PORTION,

(Freed from Bone, Shells and other Refuse Matters)

OF FISH AND OTHER ANIMAL FOODS.

Percentages Indicated by Colored Spaces.



* In respect to quantity of nutrients without regard to flavor.

INDEX.

[NOTE.—The references are to the page figures in brackets.]