

TECHNOLOGY OF CRABMEAT PRODUCTION —

A BIBLIOGRAPHY

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A bibliography dealing with food and food technology aspects of the body and leg muscles of crabs, has been unavailable. Such a compilation would be valuable to give logical direction to research and point-up individual problems that require study. The collection contained herein, was prepared to serve these needs.

In attempting to gather the pertinent literature, ministries, laboratories and libraries around the world were solicited. These inquiries elicited a gratifying response, producing several previously unknown publications and at the same time, indicating the striking paucity of literature in this area. It was firmly established that only six species of five genera are fished on a commercially profitable scale. Interestingly enough, published papers deal only with these same six forms.

While the stone crab, *Menippe mercenaria*, is fished in the south Atlantic coastal areas of the United States, it is of little commercial value; material dealing with its development technologically, have not been published. A similar situation exists with respect to *Portunus pelagicus*, of Australian waters.

It appears that some of the crab resources of South America particularly *Callinectes*, are not utilized and that additional fishing grounds may be discovered by exploring the inshore waters. Although the rock crab, *Cancer irroratus*, seems to be present along the eastern coast of the United States in numbers to justify a fishery, little study has been made of methods of meat removal; a problem that can easily mean the difference between profit and loss to a producer.

While *Portunus pelagicus* is caught by Australian crabbers, information is yet too meager to encourage speculation regarding its future potentialities. A similar condition exists in The Philippines, the inshore waters of India, Egypt, Israel and West and South Africa. It may well be that exploratory studies of the abundance of other genera and those already known could lead to additional sources of low-cost high-quality food. With rapidly expanding populations such increases in the food supply will be welcome.

Industry may find it profitable to investigate the possibilities of expanding operations to encompass markets more distant than present storage-transporta-

tion facilities allow. In the United States for example, pasteurization² of crabmeat in sealed double-seamed cans has increased the cold-storage life of meat of the atlantic blue crab. This technique is already beginning to increase the market areas for this product.

Other technological investigations are worthy of study; utilization of scrap waste for by-product development and automatic picking methods to increase yield and reduce production costs, to mention but two. Few papers actually deal with handling, cooking and storage of the meat. Only one paper dealing with the blue crab, *Callinectes sapidus* (Rathbun), treats of removal of meat from the shell, yet this is a major consideration in any appraisal of yield. These have been neglected areas of investigation. The outstanding lack however is the subject of nutrition. A definitive study of the vitamin, amino acid and mineral content of any of the crabmeats is unknown to the author. With the study of diet and dietetics so important these days, such an investigation would fill a wide gap in our knowledge and supply needed information. Review of this bibliography may suggest additional areas for study.

²170°F for 1 minute internal temperature at geometric center of the can, is minimum for storage at below 43°F, to achieve a year of preservation.

BIBLIOGRAPHY

I. *Callinectes sapidus* Rathbun (Atlantic Blue Crab)

A. Blue Crab Industry — Distribution and Fluctuation

1. Baughman, J. L. Crab Investigations Reveal Commercial Facts, Sex Division. Seafood Business, 1 (7): 36. 1949.
2. Brooks, W. K., Maryland Its Resources, Industries and Institutions. Crabs and Crabmeat, Chapter 7. 1893.
3. Chincoteague Bay Winter Crab Fishery. Com. Fisheries Rev., 17: 32. 1955.
4. Chisolm, J. J., Hard Shell, Soft Shell: Picture Story of the Blue Crabs Shedding Process. Nat. History, 47: 50. 1941.
5. Churchill, E. P., Jr., Life History of the Blue Crab. Bull. Bur. Fisheries, 36: 95. 1917.
6. Cronin, E. L., The Maryland Crab Industry. Ches. Biol. Lab., Bull. 76. 1948.
7. Dredging for Crabs Versus Deep Water Oyster Planting. Bull. Virginia Fisheries Lab. 1917.
8. Edible Crabs. U. S. Fish Wildlife Serv., Fishery Leaf. No. 71. 1945.
9. Forrest, C. V., Crabbing Is a Million Dollar Industry in Virginia. Nat. Fisherman, 37: 11. 1956.
10. Gunter, G., Common Blue Crab in Fresh Waters. Science, (n.s.), 87: 87. 1938.
11. Hardy, E., Fish for the Cannery. Part 2 — The Edible Crabs. Canning Ind., 22: 30. 1952.

¹Present address: Vita Food Products, Inc., Chestertown, Maryland.

12. Henry, F., Islets of Crabbing and Independence. Baltimore Sun (Sunday Supplement), July 22, p. 1. 1945.
13. Hopkins, S. H., The Crab Fishery, with Suggestions for Its Improvement in Texas. Texas Game and Fish. 1: 1. 1942.
14. McHugh, J. L. and Ladd, E. C., The Unpredictable Blue Crab Fishery. Nat. Fisherman, 34: 127. 1953.
15. Newcombe, C. L., Eckstein, A. W. and Campbell, F., Chesapeake Blue Crab. Southern Fisherman, 9: 153. 1949.
16. Our Friend the Crab. Harpers Weekly, 56: (Mar.) 24. 1912.
17. Pearson, J. C., Decline in Abundance of the Blue Crab, *Callinectes sapidus*, in Chesapeake Bay During 1940, and 1941 with Suggested Conservation Measures. U. S. Fish Wildlife Serv., Spec. Sci. Rept. No. 16. 1942.
18. Pearson, J. C., Fluctuations in the Abundance of the Blue Crab in Chesapeake Bay, U. S. Fish Wildlife Ser., Research Rept. No. 14. 1948.
19. Richardson, W., Blue Crabbing in Cape Cod. Atlantic Month., 192: (July) 64. 1953.
20. Roberts, W. A., The Crab Industry in Maryland. U. S. Bur. Fisheries, Doc. No. 58. 1904.
21. Smith, H. McC., Notes on Crab Fishery of Crisfield, Maryland. Part 2 - The Hard Crab Fishery and Trade. U. S. Bull. Fishery Comm., 9: 103. 1889.
22. The Blue Crab *Callinectes sapidus*. U. S. Fish Wildlife Serv., Fishery Leaf. No. 282. 1948.
23. Van Engel, W. A., The Blue Crab and Its Fishery in Chesapeake Bay. Part 1 - Reproduction, Early Development, Growth, and Migration. U. S. Fish Wildlife Serv., 20: 6. 1958.
24. Viosca, P. Jr., Crabs. Louisiana Conservationist, 10: 11. 1958.
25. Walburg, C. H., Edible Crabs. U. S. Fish Wildlife Serv., Fishery Leaf. No. 471. 1959.
26. Waldo, E., Crabbing. Louisiana Conservationist, 10: 10. 1958.
27. Wharton, J., The Chesapeake Bay Crab Industry. Com. Fisheries Rev., 9: 1. 1947.
- B. Fishing Methods and Gear**
28. Andrews, E., Crab Pot Construction (Chesapeake Bay Type). U. S. Fish Wildlife Serv., Fishery Leaf. No. 262. 1947.
29. Andrews, E., Trotline Construction, Operation, and Maintenance (Chesapeake Bay Type). U. S. Fish Wildlife Serv., Fishery Leaf. No. 291. 1948.
30. Beaven, G. F. and Truitt, R. V., Crab Mortality on Chesapeake Bay Shedding Floats. Chesapeake Biol. Lab., Contr. No. 33. 1939.
31. Cargo, D. G., Maryland Commercial Fishing Gears. Part 3 - Crab gears. Chesapeake Biol. Lab. Educ. Ser. No. 36. 1954.
32. Crab Potter Has Luck with Use of Zinc Anodes. Southern Fisherman, 16: 163. 1956.
33. Davis, C. C., A Study of the Crab Pot as a Fishing Gear. Chesapeake Biol. Lab. Pub. No. 53. 1942.
34. Green, J. C., Effectiveness of Crab Traps in South Carolina. Bears Bluff Lab. Contr. No. 14. 1952.
35. McMenamin, J., Method of Catching Crabs. U. S. Fisheries Comm. Bull. 48: 48. 1884.
- C. Economics**
36. Birdseye, C., Probable Influence of Quick Freezing in the Shellfish Industries. Trans. Am. Fisheries Soc., 62: 80. 1932.
37. Blue Crabs: Blue Channel Corporation-Crab Packers. Time, 34: (Sept.) 61. 1939.
38. Firms Canning Crabmeat. U. S. Fish Wildlife Serv., Stat. Lists No. 113. 1954.
39. Greer, M. C., Jr., Suggested Plan for Marketing Maryland Crabmeat. State of Maryland, Con. Serv. Bull. No. 5. 1933.
40. Lets Have Crabmeat for Dinner. Good House Keep., 128: (June) 163. 1949.
41. O'Brien, R. L., Difference in Cost of Production in U. S. and Principal Competing Countries. Report to the President-United States. Tariff Rept. No. 57, 2nd Series. 1933.
42. Public Eating Places Survey: Popularity of Fish and Shellfish in Public Eating Places. Com. Fisheries Rev., 18: 34. 1956.
43. Quittmeyer, C. L., The Seafood Industry of the Chesapeake Bay States of Maryland and Virginia. (A Study in Private Management and Public Policy.) Advisory Council on the Virginia Economy. 1957.
44. Seafood Packing at Beaufort, South Carolina. Mfg. Record, 108: 108. 1939.
45. Shipping of Fish and Seafoods. Fishing Gaz., 66: 64. 1949.
46. Young, L., Frozen Fish Versus Canned Fish. Quick Frozen Foods, 9: 26. 1947.
- D. Processing**
47. Andrews, E. The 'Bob' Method of Picking Blue Crabs. U. S. Fish Wildlife Serv., Fishery Leaf. No. 276. 1948.
48. Anzulovic, J. V. and Reedy, R. J. Pasteurization of Crabmeat. J. Bacteriol., 43: 44. 1948.
49. Benarde, M. A. The Crabmeat Processing Industry of the Eastern and Gulf Coasts of the United States. World Fisheries Yearbook Direct. 1960.
50. Benarde, M. A. Crab Processing in the U. S. A. Australian Fisheries News., 18: 11. 1959.
51. Bender, M. Radiation Preservation of Crabmeat, Shrimp and Oysters. U. S. Fish Wildlife Serv., Bur. Com. Fisheries Rept. 1958.
52. Canning Shrimp and Crabmeat. U. S. Bur. Fisheries Memo, S-96. 1918.
53. Empey, W. A. Fish Handling and Processing in U. S. A. Crabs. Australian Fisheries News., 13: 15. 1954.
54. Fellers, C. R. and Harris, S. C. Canned Atlantic Crabmeat. Ind. Eng. Chem., 32: 592. 1940.
55. Fellers, C. R. Research in Food Technology in the Development of Our Fishery Resources. Trans. Am. Fisheries Soc., 70: 72. 1940.
56. Fellers, C. R. Canning Crabmeat. Fishing Gaz., 57: 23. 1940.
57. Fellers, C. R. Canning Crabmeat. Fishing Gaz., 57: 35. 1940.
58. Ganuchean, J. J. Preserving Crabmeat. Food Ind., 21: 170. 1949.
59. Jarvis, N. D., and Puncochar, J. F. Home Canning of Fishery Products. U. S. Fish Wildlife Serv., Conservation Bull. No. 28. 1946.
60. Littleford, R. A. Retort Cooking of Blue Crabs. University of Maryland, Seafood Proc. Lab., Bull. No. 1. 1957.
61. Littleford, R. A. Studies on Pasteurization of Crabmeat. University of Maryland, Seafood Proc. Lab., Bull. No. 2, 1957.
62. New Method of Processing, Packing Crabmeat. Southern Fisherman, 12: 65. 1952.
63. Pottinger, S. R. Studies on the Icing of Fresh-cooked East Coast Crabmeat. U. S. Fish Wildlife Serv., Fishery Market News, 5: 23. 1943.
64. Research Put Color in Crabs: Profit in Processing Plant. J. Southern Research, 5: 34. 1953.
65. Stevenson, C. H. The Preservation of Fishery Products by Canning. Canning Crabs. U. S. Fishery Comm. Bull. 1898.

66. Sturges, L. E. Canning and Freezing Oysters, Crabs, Shrimp and Fish. Florida Agr. Ext. Circ. No. 151. 1956.

E. Quality

67. Gehres, G. W. Sanitary Standards for Crab Plants. Proc. Gulf and Carib. Fisheries Inst., November. 1956.

68. Method Maintains Quality in Crab Cakes. Food Eng., 28: 92. 1956.

69. Morrison, G. S. and Veitch, F. P. An Investigation of the Chemistry of Texture Changes of Frozen Blue Crabmeat. Com. Fisheries Rev., 19: 1. 1957.

70. Nilson, W., Crabmeat Standards. Atlantic States Marine Fisheries Comm. Joint Meet., page 1. 1955.

71. Oakley, M. and Briedenback, A. W. A Rapid Method for Determining Shell in Crabmeat Under Ordinary Light. J. Assoc. Offic. Agr. Chemists, 39: S31. 1956.

72. Pottinger, S. R. Keeping Quality of East Coast Crabmeat in Fiberboard Containers and in Tin Cans. U. S. Fish Wildlife Serv., Fishery Leaf. No. 185. 1946.

73. Resley, H. M. Total Solids and Other Extract in Fish and Other Marine Products. J. Assoc. Offic. Agr. Chemists, 38: 197. 1955.

74. Rhoads, A. T. Objective Determination for Lump Meat and Skeletal Fragments in Cooked Crabmeat. Masters Thesis, Dep. Zool. Univ. Md. 1958.

75. Szabo, L. Quality Standards for Crabmeat. Southern Fisherman, 86: 221. 1955.

F. Bacteriology and Public Health

76. Alford, J. A., Tobin, L., and McCleskey, C. S. Bacterial Spoilage of Iced Fresh Crabmeat. Food Research, 6: 353. 1942.

77. Alford, J. A., and McCleskey, C. S. A New Bacterial Species Producing a 'Musty' Odor. Proceed. Louisiana Acad. Sci., 7: 24. 1943.

78. Benarde, M. A. A Review of Regulations Governing the Production of Fresh Crabmeat. J. Milk and Food Technol., 23: 101. 1960.

79. Benarde, M. A. and Austin, L. G. Bacteriology of Crabmeat. Bacteriol. Proc. 58th Gen. Meet. Soc. Am. Bacteriologists. 1958.

80. Benarde, M. A. and Austin, L. G. Bacteriological Survey of Crabmeat Processing Plants. Bact. Proceed., 59th Gen. Meet. Soc. Am. Bacteriologists. 1959.

81. Benarde, M. A. Preparation of Crabmeat for Bacterial Analysis. Food Research, 24: 242. 1959.

82. Benarde, M. A. Study finds Frozen Precooked Crab Cakes Heating Directions Inadequate as Stated. Quick Frozen Foods, 21: 43. 1959.

83. Benarde, M. A. Observations on the Spoilage of Crabmeat. J. Milk and Food Technol., 20: 318. 1958.

84. Benarde, M. A. Heat Penetration into Precooked Frozen Crab Cakes. J. Milk and Food Technol., 20: 307. 1957.

85. Byrd, G. C. Industry Program on Crabmeat Plant Sanitation. J. Milk and Food Technol., 19: 73. 1956.

86. Gieger, J. C., Greer, F. E. and White, J. L. Bacterial Flora of Ground Market Meats. Outbreak of Food Poisoning Probably due to Crabmeat. Public Health, 18: 602. 1929.

87. Harris, M. M. A Bacteriological Study of Decomposing Crabs and Crabmeat. Am. J. Hyg., 15: 260. 1932.

88. Hunter, A. C. Need for Methods for the Bacteriological Examination of Crustacea. Am. J. Public Health, 24: 199. 1934.

89. Hunter, A. C. Sanitation of Fresh Crabmeat. Atlantic Fisherman, 17: 12. 1937.

90. Hunter, A. C. Uses and Limitations of the Coliform Group in Sanitary Control of Food Production. Food Research, 4: 531. 1939.

91. Ludewig, E. Municipal Control of Fresh Crabmeat for Consumer Protection. N. Y. State Assoc. Milk Sanitation, p. 149. 1954.

92. McCleskey, C. S. and Boyd, A. F. The Longevity of the Coliform Bacteria and Enterococci in Iced Crabmeat. Food Technol., 3: 337. 1949.

93. McCleskey, C. S. and Tobin, L. Rigid Sanitation Required in Packing Fresh Crabmeat. Food Ind., 13: 39. 1941.

94. Nickerson, J. T. R., Fitzgerald, G. A. and Messer, R. Health Problem in Packing Crustacean Products. Am. J. Public Health, 29: 619. 1947.

95. Ostrolenk, M. N. and Cleverdon, R. C. Comparative Studies of Enterococci and *E. coli* as Indices of Pollution. J. Bacteriol., 53: 197. 1947.

96. Perry, C. A. and Hajna, P. A. Routine Use of Eijkmann Medium in Examination of Crabmeat. Am. J. Public Health, 25: 72. 1935.

97. Puncochar, J. F. and Pottinger, S. R. Commercial Production of Meat from the Blue Crab (*Callinectes sapidus*). A Study of Sanitary Requirements of Handling Operations and Suggestions for Technological Improvements. U. S. Fish Wildlife Serv., Tech. Leaf. No. 8. 1954.

98. Reedy, R. J. and Anzulovic, J. V. Rapid Test for the Estimation of *E. coli* in Crabmeat. J. Bacteriol., 43: 43. 1942.

99. Slocum, G. C. Bacteriology of Crabmeat as Related to Factory Sanitation. J. Assoc. Food and Drug Officials, 19: 43. 1955.

100. Suggestions for Crabmeat Packers and for Transporters of Fresh Crabmeat. Com. Fisheries Rev., 18: 41. 1956.

101. Tobin, L. and McCleskey, C. S. Sources of Pollution of Fresh Picked Crabmeat. J. Bacteriol., 41: 97. 1941.

102. Tobin, L. and McCleskey, C. S. Bacteriological Studies of Fresh Crabmeat. Food Research, 6: 157. 1941.

103. Young, H. Florida Crab Plant Design and Sanitation. The Marine Lab., U. Miami, Edu. Ser. No. 10. 1957.

G. Chemical Preservation

104. Benarde, M. A. Evaluation of Chlorpactin WCS-50 as a Bactericidal Wash for Crabs and Oyster Meats. Appl. Microbiol., 5: 137. 1959.

105. Benarde, M. A. Comparison of Tap and Distilled Water Antibiotic Dip Solutions on the Storage Life of Crabmeat. Antibiotics Ann. 1957-58.

106. Benarde, M. A. and Littleford, R. A. Antibiotic Treatment of Crab and Oyster Meats. Appl. Microbiol., 5: 368. 1957.

H. Crab Scrap and Meal

107. Combs, G. F. Report on Ration Trial Conducted at Maryland's New Broiler Substation. Fish Meal Oil Ind., 4: 22. 1952.

108. Combs, G. F., Arsoff, G. H. and Jones, H. L. Unidentified Growth Factors Required by Chicks and Poults. Poultry Sci., 23: 71. 1954.

109. Conn, H. W. Utilization of Crustacean Waste. U. S. Bur. of Fisheries Memo., S-11. 1929.

110. Foster, A. V. and Hachman, R. H. Application of EDTA in the Isolation of Crustacean Chitin. Nature, 180: 40. 1957.

111. Kovac, M. Size Reduction-key to Process Innovation. Food Eng., 26: 73. 1954.

112. Lillie, R. J., Bird, H. R., Sizemore, R. Jr., Kellog, W. L. and Denton, C. A. Assay of Feeds and Concentrates for Vitamin B. Potency. Poultry Sci., 33: 686. 1954.

113. Lübitz, J. A. Fellers, C. R. and Parkhurst, R. T. Crabmeat in Poultry Rations. Part 1 - Nutritive Properties. Poultry Sci., 22: 307. 1943.

114. Manning, J. R. Crab Scrap Versus Meat Meal in Poultry

Feeding. U. S. Bur. Fisheries Memo. S-302. 1929.

115. Manning, J. R. Crab Scrap as Poultry Feed. U. S. Fish Wildlife Serv., Fishery Leaf. No. 29. 1943.

116. Parkhurst, R. T., Gutowska, M. S., Lubitz, J. A. and Fellers, C. R. Crab Meal from Steamed Dried Cannery Waste (of Blue Crab) Used as Protein Concentrate in Starter and Broiler Rations. Poultry Sci., **23**: 58. 1944.

117. The Synthetic Crab Shell Goes Nature One Better. Southern Fisherman, **10**: 140. 1950.

I. Nutrition

118. A Review of the Food Values of Fish and Shellfish (Proteins). Techno-Logic, **2**: 1. 1950.

119. Atwater, W. O. The Chemical Composition and Nutritive Value of Food Fishes and Aquatic Invertebrates. In, Com. Fish and Fisheries Rept., U. S. Fish Wildlife Serv. 1892.

120. Coulson, E. J. The Iodine Content of Some American Fishery Products. U. S. Bur. Fisheries Invest. Rept., **25**: 1. 1935.

121. Lanham, W. B., Lee, C. F. and Nilson, H. W. Nutritive Value of Crabmeat. U. S. Fish Wildlife Serv., Fishery Market News, **2**: 26. 1940.

122. Newcombe, C. L. and Bland, G. J. Seafoods, Their Wartime Role in Maintaining Nutritional Standards. Commonwealth of Virginia, Contr. No. 14, **10**: 1. 1943.

123. Newcombe, C. L. The Nutritional Value of Seafoods. Virginia Fisheries Lab. Educ. Ser. No. 2. 1944.

124. Rose, W. C. and Bodansky, M. Biochemical Studies on Marine Organisms. Part 1 - Occurrence of Copper. J. Biol. Chem., **44**: 99. 1933.

125. Severy, H. W. Occurrence of Copper and Zinc in Certain Marine Animals. J. Biol. Chem., **55**: 79. 1923.

126. Vitamin Content and Nutritive Value of Fishery Products (Meals). Com. Fisheries Rev., **16**: 11. 1954.

127. Watson, V. K. and Fellers, C. R. Nutritive Value of the Blue Crab and the Sand Crab (*Platyonichus ocellatus* Latreille). Trans. Am. Fisheries Soc., **65**: 342. 1935.

J. Prepared Products

128. Benarde, M. A. Breeding Contributes to the Microbial Populations of Frozen Breaded Fishery Products. Com. Fisheries Rev., **20**: 6. 1958.

129. Benarde, M. A. Antibiotic Residues in Breaded Crab and Oyster Meat After Cooking. J. Am. Dietetic Assoc., **33**: 1147. 1957.

130. Deviled Crabs: 25,000 Daily. Food Eng., **26**: 99. 1954.

131. Van Engel, W. A. Prepared Products Growing in Popularity. Frosted Food Field, **18**: 19. 1954.

K. Patents

132. Byrd, G. C. Method of Keeping the Meat of Shellfish in Fresh Condition. U. S. Pat. 2,546,428, March 27, 1951.

133. Dubus, P. A. Process of and Apparatus for Treating Crustacea. U. S. Pat. 2,104,027, January 4, 1938.

134. Ekkehard, L., Kerid, L. and McFee, E. P. Preventing Formation of Struvite in Canned Cooked Fish and Shellfish. U. S. Pat. 2,555,236, May 29, 1951.

135. Fellers, C. R. Processing of Shellfish and Crustaceans. U. S. Pat. 2,027,270, January 7, 1936.

136. Ganuchean, J. J. Preserving Crabmeat. U. S. Pat. 2,448,970, September 7, 1948.

137. Harris, S. G. Method for Preventing Discoloration of Crabmeat. U. S. Pat. 2,155,308, April 18, 1939.

138. Hiller, E. O. Apparatus for Recovery of Crabmeat. U. S. Pat. 2,771,639, November 27, 1956.

139. Home, D. W. Method for Preservation of Crabmeat. U. S. Pat. 1,927,123, September 13, 1933.

140. Johnson, R. M. Recovery of Crabmeat. U. S. Pat. 2,522,578, September 19, 1950.

141. Lewis, B. F. A Trap for Chesapeake Blue Crabs. U. S. Pat. 2,123,471, April 12, 1937.

142. Lieberman, G. Extracting Machine. U. S. Pat. 1,520,190, December 23, 1924.

143. Seapak Corporation, Packaged Frozen Seafoods. U. S. Pat. 566,169 and 566,170, April 18, 1957.

L. Interim Federal Specifications

144. 1956. Crabmeat, cooked; Chilled and frozen. PP-c-656a.

145. 1956. Crabmeat, canned; Federal standard stock catalog. PP-c-651.

146. 1941. Crabmeat, fresh; Federal standard stock catalog. PP-c-656. Sect. IV, Part 5.

II. *Cancer pagurus* Linnaeus (European edible crab)

147. Anker, O. and Jakobsen, R. and F. Trimethylamine oxide in Marine Products. J. Soc. Chem. Ind., **66**: 160. 1947.

148. Ashehoug, V. Sporsmal vedrorende sterilisering. Tidsskr. Hermetikind., **18**: 186. 1932.

149. Baker, J. R. Experiments on the Humane Killing of Crabs. J. Marine Biol. Assoc. United Kingdom, **34**: 15. 1955.

150. Erling, M. A Study of New Methods for Canning Crab, Shrimp, and Lobsters. Tidsskr. Hermetikind., **20**: 115. 1934.

151. Fraser, D. I., Non-protein Nitrogen Fractions of the Flesh of Lobsters and Crabs. Biochem. J., **51**: No. 4. 1952.

152. DeGruyter, P. and ZN., NV., Soup Flavor from Shellfish. Dutch Pat. 61,294, July 15, 1948.

153. Hadvag, D. Om krabber. Fiskets Gang No. 41, 1956.

154. Hammond, E. A. Crabmeat. Food Proc. Pack. Market., **28**: 91. 1958.

155. Ludany, G. Vitamin C. in Fresh Water Fish and Crabs. Biochem. Z., **284**: 108. 1936.

156. Lunde, G. Svertning av Krabbe naturell ogreker. Tidsskr. Hermetikind., **17**: 331. 1936.

157. Noel, H. S. Some Aspects of Potting-crab Fishing. World Fishing, **6**: 59. 1957.

158. Presher, J. Notes on the Identification and Determination of Boric Acid, Avoidance of the Ashing of Foods Containing Boric Acid, and the Amount of Boric Acid in Preserved Crabs and Fish. Pharm. Zentrall., **83**: 421. 1942.

159. Serger, H. and Kirchloff, H. Annual Report of 1924 of the Experiment Station for Canning Industry. Konserven. Ind., **13**: 322, 351, 363, 374. 1925.

160. Thomas, H. J. The Efficiency of Fishing Methods Employed in the Capture of Lobsters and Crabs. J. Conseil, **18**: 333. 1953.

161. Thomas, H. J. The Efficiency of the Cornish Pot and the Scottish Creel in the Capture of Lobsters and Crabs. J. Conseil, **20**: 88. 1954.

162. Thomas, H. J. Lobster and Crab Fisheries in Scotland. Scot. Home Dept. Marine Research, No. 8. 1958.

163. Thomas, H. J. A Comparison of Some Methods Used in Lobster and Crab Fishing. Scot. Fisheries Bull. No. 12, p. 3. 1959.

III. *Cancer magister* Dana (Dungeness)

164. Boundry Bay Crabbers find Advantage in Monel Crab Pots. Pacific Fisherman, **47**: 55. 1949.

165. Butler, T. H. The Life of the Commercial Crab. Western Fisheries, **45**: 12. 1953.

166. Carle, A. and Kyte, L. Keeping Quality of Chilled Dungeness Crabmeat in Hermetically-sealed Metal Containers. Com. Fisheries Rev., **17**: 12. 1955.

167. Carlson, C. B. Canning Crabmeat. *Food Eng.*, **17**: 1247. 1945.
168. Crab Fishing in British Columbia. *Western Fisheries*, **35**: 72. 1947.
169. Delicious Dungeness Crab. *Sunset (Central Ed.)*, **116**: (Mar.) 143. 1956.
170. Crabmeat Picking Machine Revealed. *Pacific Fisherman*, **49**: 63. 1951.
171. Dassow, J. A., Pottinger, S. R. and Holston, J. A. Jr. Refrigeration of Fish. Part 4 - Preparation, Freezing, and Cold Storage of Fish, Shellfish, and Pre-cooked Fishery Products. U. S. Fish Wildlife Serv., Fishery Leaf. No. 430. 1959.
172. Dewberry, E. B. Crab Canning in North America (Pacific Coast). *Food Proc. Pack. Market.*, **24**: 394. 1955.
173. Dewberry, E. B. The Pacific Crab Canning Industry of British Columbia. Part - 1 - Characteristics and Life History. *Food Manuf.*, **34**: 425. 1959.
174. Dewberry, E. B. The Pacific Crab Canning Industry of British Columbia. Part - 2 - Processing and Canning Operations. *Food Manuf.*, **34**: 474. 1959.
175. Dick, J. and Pugsley, L. I. The Arsenic, Lead, Tin, Copper and Iron Content of Canned Clams, Oysters, Crabs, Lobsters, and Shrimp. *Can. J. Research (Section F)*, **28**: 199. 1950.
176. Dill, D. B. and Clark, P. B. Indole Content of Canned Crustacea. *J. Assoc. Offic. Agr. Chemists*, **8**: 449. 1925.
177. Farber, L. Observations on the Canning of Pacific Coast or Dungeness Crab. *Food Technol.*, **7**: 465. 1953.
178. Elliott, H. H. and Harvey, E. W. Biological Methods of Blood Removal and Their Effectiveness in Reducing Discoloration in Canned Dungeness Crab. *Food Technol.*, **5**: 163. 1951.
179. Fellers, C. R. and Parks, C. T. Heat Penetration in Canned Crab. *Canning Age*, **6**: 900. 1925.
180. Fellers, C. R. and Parks, C. T. Biochemical Study and Proximate Composition of Pacific Coast Crabs. *Univ. Wash. Publ. Fisheries*, **1**: 139. 1926.
181. Fellers, C. R. Non-gaseous Spoilage in Canned Marine Products. *Univ. Wash. Publ. Fisheries*, **1**: 229. 1927.
182. Jarvis, N. D. Shellfish. U. S. Fish Wildlife Serv., Fishery Leaf. No. 84. 1944.
183. Jarvis, N. D. Canned Products Hermetically-sealed but Not Processed. U. S. Fish Wildlife Serv., Fishery Leaf. No. 88. 1944.
184. Harvey, E. W. and Mann, F. C., Canning Dungeness Crab. *Canner*, **107**: 13. 1948.
185. Harvey, E. W. Canning Dungeness Crab. *Oregon Agr. Exp. Sta. Circ. No. 25*. 1948.
186. Heerdt, M. Jr. Toughening of Frozen Crabmeat Can Be Retarded. *Com. Fisheries Rev.*, **9**: 7. 1947.
187. Hipkins, F. W. The Dungeness Crab Industry. U. S. Fish Wildlife Serv., Fishery Leaf. No. 439. 1957.
188. Hipkins, F. W. Dungeness Crab Pots. U. S. Fish Wildlife Serv., Fishery Leaf. No. 419. 1956.
189. Idler, D. R. and MacLeod, R. A. Black Discoloration on Nass River Crabs. *Fisheries Research Board Can. Progr. Repts. Pacific Coast Stats. No. 95*. 1953.
190. Introducing Something New in Frozen Crab. *Pacific Fisherman*, **55**: 53. 1957.
191. Lantz, A. W. Crab Processing. *Fisheries Research Board Can. Progr. Repts. Pacific Coast Stats. No. 87*. 1951.
192. Maine Trade Lobsters for Pacific Crabs. *Southern Fisherman*, **8**: 38. 1948.
193. MacKay, D. G. The Pacific Edible Crab (Cancer magister). *Fisheries Research Board Can., Bull.* 62. 1942.
194. McMynn, R. G. The Crab Fishery off Graham Island, British Columbia to 1948. *Fisheries Research Board Can., Bull.* 91. 1951.
195. McMynn, R. G. Crab Fishing off Queen Charlotte Island. *Fisheries Research Board Can. Progr. Repts. Pacific Coast Stats. No. 76*. 1948.
196. Phillips, J. B. The Crab Fishery of California. *Calif. Fish and Game*, **21**: 38. 1935.
197. Pugsley, L. I. The Nutritive Value of Marine Products. Part 15 - Proximate Analysis of the Canned British Columbia Crabs, Shrimps and Clams. *J. Fisheries Research Board Can.*, **5**: 344. 1942.
198. Roach, S. W. Ultraviolet Rays for Detecting Shell in Picked Crabmeat. *Fisheries Research Board Can. Progr. Repts. Pacific Coast Stats. No. 79*. 1949.
199. Roach, S. W. Storage of Live Crabs in Refrigerated Sea Water. *Fisheries Research Board Can. Progr. Repts. Pacific Coast Stats. No. 106*. 1957.
200. Sea Treat from the Northwest: Dungeness Crab Cooked, Frozen Whole and Packaged in Individual, Printed Polyethylene Bags. *Modern Packaging*, **29**: 154. 1956.
201. Shockey, C. F., Stansby, M. E. and Elliott, P. P. Effect of Packaging Methods on Spoilage of Crabmeat. U. S. Fish Wildlife Serv., *Fishery Market News*, **5**: 18. 1943.
202. Spencer, G. J. The Commercial Crab, *Cancer magister* Dana, in Clayoquot Sound, Vancouver Island (British Columbia). *Fisheries Research Board Can., Bull.* 30. 1932.
203. Stansby, M. E. Processing Canned King and Dungeness Crabmeat. *Com. Fisheries Rev.*, **13**: 29. 1951.
204. The Stephenson Collapsible Crab Trap. *Fisheries Research Board Can. Progr. Repts., Pacific Coast Stats. No. 94*. 1953.
205. Wells, H. L. Laboratory Solves Seafood Problems. *Food Ind.*, **13**: 50. 1941.
206. Williams, D. W. Report on Fish (Indole in Crab). *J. Assoc. Offic. Agr. Chemists*, **35**: 525. 1952.

IV. *Paralithoides camtschatica* Tilesius (Alaska King Crab)

207. A Frozen Food Product is Born. *Frosted Food Field*, **27**: 30. 1958.
208. Amano, K., Yamada, K. Bito, M. and Baneko, I. Freezing and Cold Storage of Pacific King Crabmeat. *Jap. Assoc. Refrig.*, **32**: 1. 1957.
209. Cahn, R. A. Canned Crab Industry of Japan. Report No. 109. Natural Resources Section GHQ. Supreme Commander for Allied Powers. 1948.
210. Carlson, C. B. An Interview with Personnel of a Russian Floating Crab Cannery. U. S. Fish Wildlife Serv., *Fishery Market News*, **7**: 13. 1945.
211. Chihara, I. Putrefaction of Aquatic Products. Part 14 - Comparison of Putrefaction of Different Kinds of Fish. *Bull. Japan. Soc. Sci. Fisheries*, **20**: 30. 1954.
212. Clarke, T. Wealth in the Northern Seas. *Alaskan Sportsman*, **15**: 10. 1949.
213. Crabs Fly South in Paper Bags. *Pacific Fisherman*, **49**: 59. 1951.
214. Dassow, J. A. Freezing and Canning King Crab. U. S. Fish Wildlife Serv., Fishery Leaf. No. 374. 1950.
215. Dassow, J. A. Treatment Fit for a King. *Pan-Am. Fisherman*, **5**: 10. 1950.
216. Delicacy from the Pacific. *Illus. World*, **33**: 608. 1920.
217. Fujii, H. and Yamada, H. Struvite in Canned Products. Part 1 - Determination of Struvite in Canned Crabs. *Repts. Japan. Marine Products. Co. Research Lab.* **7**: 31. 1936.

218. Ciiti, T. Cans for Crabs or Lobsters. Japan. Pat. No. 131, 612. 1939.
219. Harmer, R. M. He Made a Million at Old Game. Lowell Wakefield Goes Fishing for Alaska King Crab. *Am. Business*, **22**: 22. 1952.
220. Hashimoto, T. and Maniwa, Y. Study of Fish Finder for Ground Fish. Part 1 - Crab Fisheries. *Tech. Rept. Fish Boat No. 9*. 1956.
221. Heerd, M. Jr. and Dassow, J. A. Freezing and Cold Storage of Pacific Northwest Fish and Shellfish. Part 2 - King Crabs. *Com. Fisheries Rev.*, **14**: 29. 1952.
222. Igarashi, Z. K. and Katada, M. Biochemical Studies on the Egg Lipids of Crab, *Paralithoides camtschatica*. *Bull. Japan. Soc. Sci. Fisheries*, **22**: 358. 1956.
223. Japanese Crab Industry Shows What Merger Can Do. *Business Week*, **26**: 36. 1931.
224. Johnson, H. C. King Crab, Shrimp and Bottom Fish Explorations from Shumagin Islands to Unalaska, Alaska - Summer and Fall. *Com. Fisheries Rev.*, **21**: 7. 1959.
225. Kaneko, I. Relation Between the Living Temperature and the Putrefaction of Crabmeat as the Raw Material for Canning. *The Cannery J. Japan*, **30**: 85. 1951.
226. Kaneko, I. Studies on Freshness of Crabmeat from *Paralithoides camtschatica*. *The Cannery J. Japan*, **31**: 87. 1952.
227. Kimata, M. Thermal Death of Bacteria. *Bull. Japan. Soc. Sci. Fisheries*, **1**: 299. 1933.
228. Kimata, M. Studies on the Bacterial Decomposition in Meat of Aquatic Animals. *J. Imp. Fisheries Inst. Japan.*, **34**: 116. 1941.
229. King of Alaska. *Americas*, **11**: 28. 1959.
230. Kizevetter, V. Struvite Crystals in Canned Fish and Crabs. *Izvest. Tikhookeans. Nauch. Issledovated. Inst. Rybnogo Khoz. i Okeanog.*, **41**: 359. 1954.
231. Kondo, K. and Iwamee, H. Chemistry of Muscle of Crabmeat. *J. Chem. Soc. Japan.*, **53**: 1013. 1932.
232. Marukawa, H. Biology and Fishery Research on Japanese King Crab *Paralithoides camtschatica* (Tilesius). *J. Imp. Agr. Ex. Sta. Japan.*, **4**: 152. 1933.
233. Matsui, H. Chemistry of Crabmeat. *J. Coll. Agr. Imp. Univ. Tokyo*, **5**: 338. 1916.
234. Miyahara, T. The 1953 Japanese King Crab Factory Ship Expedition. *Com. Fisheries Rev.*, **16**: 1. 1954.
235. Nagasawa, Y. Browning of Canned Crabmeat. 1. The Differences in the Chemical Composition of Normal and Browning Canned Crabmeat. *Bull. Japan. Soc. Sci. Fisheries*, **24**: 535. 1959.
236. Nagasawa, Y. Browning of Canned Crabmeat. 2. Effect of Chemical Materials on the Browning Reaction. *Bull. Japan. Soc. Sci. Fisheries*, **24**: 816. 1959.
237. New Business? Expedition Leaders Maintain Investigations Show That Commercial King Crab Operations May Supplement Established U. S. Industries. *Business Week*, **36**: (Oct.) 38. 1941.
238. Okamoto, S. Advance in Processing of Canned Crab. Part 1 - Kasumigaseke shobo. 1272 pp. 1944.
239. Okuda, Y. and Matsui, H. On the Canned Crab. *J. Agr. Imp. Univ. Tokyo*, **5**: 325. 1918.
240. Okuda, Y. and Fujikawa, K. Chemistry of Crabmeat Muscle. *Japan. J. Agr.* **188**: 331. 1918.
241. Oshima, K. Studies in Crab Canning. U. S. Fish Wildlife Serv., *Invest. Rept. No. 8*. 1931.
242. Pendrose, L. W. Harvesting the Giant Pacific Crab. *Popular Mech.*, **33**: 877. 1920.
243. Pendrose, L. W. Huge Alaska Crabs to be Canned. *Popular Mech.*, **35**: 423. 1921.
244. President Roosevelt Raises Duty on Canned Crabmeat. *Commerc. Finan. Chron.*, **153**: 1207. 1941.
245. Price Fixing on King Crabs in Alaska Charged by Federal Trade Commission. *Com. Fisheries Rev.*, **18**: 103. 1956.
246. Processing Technology for Salmon and Crab. *Pacific Fisherman*, **46**: 77. 1948.
247. Quest for Crab, King Crab Fishing, in Alaskan Waters Scheduled to Become an All-American Industry. *Business Week*, **38**: (June) 68. 1943.
248. Report of the Alaskan Crab Investigation. Canning King Crabs. U. S. Fish Wildlife Serv., *Fishery Market News*, *Appen. 3*. 1942.
249. Seagran, H. L. Contribution to the Chemistry of the King Crab, *Paralithoides camtschatica*. *Com. Fisheries Rev.*, **20**: 15. 1958.
250. Sekine, H. and Kakizaki, Y. Comparison of the Meats of Harder and Softer Shelled Crabs *Paralithoides camtschatica*. *J. Imp. Fisheries Inst.*, **21**: 107. 1926.
251. Shimoda, K. Chemical Composition of Crab Flesh. *Japan. J. Pharm. & Chem.*, **52**: 784. 1932.
252. Shimoda, K. Studies on Crabs. Part 2 - Vitamins in Crabs. *Japan. J. Pharm. & Chem.*, **53**: 275. 1933.
253. Tanikawa, E. and Nishimura, S. Bacteriological Studies on Canned Crab. Part 2 - Bacterial Studies on the Swelling of Canned Crab, *Paralithoides camtschatica*. *Bull. Fac. Fisheries, Hokkaido Univ.*, **5**: 183. 1954.
254. Tanikawa, E. and Akiba, M. On the Manufacture of Canned Crab from *Paralithoides camtschaticus* (Tilesius). Part 1 - Velocity of Bacterial Decomposition of the Meat of *Paralithoides camtschaticus*. *Bull. Japan. Soc. Sci. Fisheries*, **21**: 397. 1955.
255. Tanikawa, E. and Akiba, M. Part 2 - The Relation Between Storing Temperature and Maximum Storing Time of *Paralithoides camtschatica* Meat as Raw Material for Canned Crab. *Bull. Japan. Soc. Sci. Fisheries*, **21**: 402. 1955.
256. Tanikawa, E. and Akiba, M. and Takasawa, N. Part 3 - The Relation Between Volatile Basis Nitrogen Produced in Crabmeat During Heating and the Freshness of the Meat. *Bull. Japan. Soc. Sci. Fisheries*, **21**: 405. 1955.
257. Tanakawa, E. and Yamashita, J. Part 4 - The Influence of Reducing Materials in Parchment Paper Upon the Meat of Canned Crab. *Bull. Japan. Soc. Sci. Fisheries*, **21**: 409. 1955.
258. Tanikawa, E., Wakasa, T., and Nagasawa, Y. Studies on the Muscle Meat of *Paralithoides camtschatica*. *Bull. Fac. Fisheries, Hokkaido Univ.*, **9**: 227. 1958.
259. Tanikawa, E. Studies on Technical Problems in the Processing of Canned Crab (*Paralithoides camtschatica* Tilesius). *Mem. Fac. Fisheries, Hokkaido Univ.* **7**: 95. 1959.
260. The Alaskan King Crab. U. S. Fish Wildlife Serv., *Fishery Market News*, **4**: 1. 1942.
261. 3,000 Live King Crab Hit Seattle Aboard "Totem." *Fisherman's News*, **11**: 10. 1955.
262. Timofeeva, L. A. Crabs as Food Products and Their Role in Food Poisoning. *Gigiena i Sanit.*, **6**: 39. 1949.
263. Timofeeva, L. A. *B. proteus* as the Basic Cause of Food Poisoning by Crabmeat. *Gigiena i Sanit.*, **6**: 40. 1949.
264. Trawler Operates as Complete Fish Freezer. *Frozen Food Ind.*, **3**: 18. 1947.
265. Yamaura, Y. The Relation Between Temperature and the Rate of Decomposition of Fish Muscle. *Bull. Japan. Soc. Sci. Fisheries*, **6**: 141. 1937.

V. *Erimacrus eisenbeckii* Brandt (Ke-gani)

266. Tanikawa, E., Akiba, M., and Kimura, M. Studies on the Manufacture of Canned Crab from *Erimacrus eisenbeckii*

Brandt. Report 1 - The Relation Between the Freshness of Raw Crabmeat Material the Quality of the Canned Product. Part 1 - On the Velocity of Autolytic Decomposition of Meat of *Erimacrus eisenbeckii*. Bull. Fac. Fisheries, Hokkaido Univ., 4: 2. 1953.

267. Tanikawa, E., Akiba, M. and Motohiro, T. Part 2 - Velocity of Bacterial Decomposition of Meat of *E. eisenbeckii*. Bull. Fac. Fisheries, 4: 7. 1953.

268. Tanikawa, E., Akiba, M., and Motohiro, T. Part 3 - Discussion of Methods for Determining the Freshness of Meat of *E. eisenbeckii*. Bull. Fac. Fisheries, 4: 12. 1953.

269. Tanikawa, E., Inoue, Y., and Akiba, M. Part 4 - Studies on the Influences of the Freshness of Raw Crabmeat and Duration of the Storage After Boiling Upon the Quality of Canned Crabmeat. Bull. Fac. Fisheries, Hokkaido Univ., 4: 22. 1953.

270. Tanikawa, E., Inoue, Y., and Akiba, M. Report 2 - The Difference of Quality of Canned Crab Made from Different Parts of the Crab Body. Bull. Fac. Fisheries, Hokkaido Univ., 4: 123. 1953.

271. Tanikawa, E., Motohiro, T., Abe, S., Inoue, Y., and Akiba, M. Report 3 - Studies on the Influences Upon the

Quality of Canned Crabs of the Kinds of Water Used and the Number of Times of Change for Boiling Crab Removed from Carapace. Bull. Fac. Fisheries, Hokkaido Univ., 40: 124. 1953.

272. Tanikawa, E., Motohiro, T., and Abe, S. Report 4 - Studies on *E. coli* in Canning Water. Bull. Fac. Fisheries, Hokkaido Univ., 40: 124. 1953.

273. Tanikawa, E., and Nishimura, T. Bacteriological Studies on the Swelling of Canned Crab. (*E. eisenbeckii*). Bull. Fac. Fisheries, Hokkaido Univ., 5: 189. 1954.

274. Tanikawa, E. and Nishimura, T. Part 4 - Relation Between the Degree of Sterilization and the Concentration of the Bacterial Spore Suspension Which was Isolated from the Swelled Canned Crab. Bull. Fac. Fisheries, Hokkaido Univ., 5: 20. 1954.

VI. *Chionoecetes opilio* (O. Fab.) (Zuwai-gani)

275. Hatakoshi, Y. Composition of the Canned Meat of the Crab. *Chionoecetes phalangium* (Fab.). J. Chem. Soc. Japan., 53: 1026. 1932.

276. Mori, S. On the Denaturation of Meat Protein. J. Agr. Chem. Soc. Japan., 20: 312. 1944.

COMMITTEE REPORTS

REPORT OF THE COMMITTEE ON SANITARY PROCEDURE—1960

The 1959 Annual Report of this Committee, presented at the Glenwood Springs Meeting, included coverage of the results of the meeting of the 3-A Sanitary Standards Committees held on August 23-26, just prior to the Annual Meeting of the Association. Only one meeting of the 3-A Sanitary Standards Committees has been held since the 1959 Annual Meeting of the Association. That meeting was held at the Continuing Education (Kellogg) Center at the University of Georgia, Athens, Georgia, on February 29 and March 1 and 2, 1960.

That meeting was attended by nine members¹, the ex-officio member, and the chairman, of a total of sixteen. Caucuses of the Sanitarians were attended by seven representatives of the Milk and Food Program of the USPHS, all of whom are members or officers of this Association, and, intermittently, by President Wm. V. Hickey and by several other members connected with other committees.

The two accomplishments of the Athens meeting of immediate interest to milk sanitarians were (a) the final and official approval of the 3-A Sanitary Standards for Farm Milk Cooling and Holding Tanks - Revised, (J. Milk and Food Technol., 23: 172-178. 1960) and which became effective on September 1, 1960, and (b) the adoption of an amendment to Subsection D(4) of the 3-A Sanitary Standards for Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service, to permit a maximum interior length of 38' 6" for tanks with one manhole. This amendment became effective on July 5, 1960.

Of the four tentative sanitary standards reviewed during the Meeting the most progress toward completion was made in those covering Automatic Bulk Milk and Milk Products Vending Machines. The comments of the caucus of Sanitarians have

been made available to the Task Committee, and a revised draft of these sanitary standards should be available for consideration at the next Meeting of the Committees.

A screening test, consisting of exposure to normal washing and bactericidal materials and procedures, for Plastic Materials as Product-Contact Surfaces, in Multiple Use, for Dairy Processing Equipment, was reviewed, and suggestions for minor modifications in the procedure were submitted to the Task Committee.

The determination of the desirable and essential physical properties and characteristics of plastics and rubber and rubber-like materials, within relatively narrow ranges of instrument measurement or chemical assay, for specialized applications in dairy equipment, requires a degree of technology which few, if any, sanitarians are in position to provide. Therefore, in the fixing of the limits for ranges of physical properties of these materials, for specific uses, members of the Committee on Sanitary Procedure are compelled to defer to the recommendations of the manufacturers of these materials, and the experience of fabricators who use parts made of them, or to research and experimental investigations performed by Government agencies and educational institutions, in agreeing to the limits proposed. It is obvious that sanitarians will not be in position to verify physical properties of such materials, either in the field or at an office desk. And it is equally obvious that some of the physical limitations ultimately agreed upon, such as the specific degrees of hardness or resilience, are principally of concern to fabricators. Sanitarians - and the users of the equipment - are primarily concerned with absorption of butterfat, water, detergent and sanitizing solutions, the stability of these materials with respect to cracking or disintegration, and the migration of components - especially those which may, from time to time, be declared toxic or carcinogenic - into the products processed.

Limits to absorption can be agreed upon, and fixed, although the frequency of tests in the field is extremely questionable. Everyone desires that the rubber parts of equipment last for a reasonable number of uses without displaying

¹The names of the signatories of this Report who attended the Athens Meeting are indicated by asterisks.