

BASEMENT

HD28
.M414
no. 837-76

Dewey

MASS. INST. TECH.
MAY 20 1976
LIBRARIES

MASS. INST. TECH.
MAY 13 1976
DEWEY LIBRARY

WORKING PAPER
ALFRED P. SLOAN SCHOOL OF MANAGEMENT

Marketing Issues of "Waste" Grown Aquatic Foods¹

John E. Huguenin²

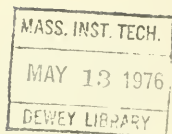
John D. C. Little

Working Paper 837-76

February 1976

MASSACHUSETTS
INSTITUTE OF TECHNOLOGY
50 MEMORIAL DRIVE
CAMBRIDGE, MASSACHUSETTS 02139





Marketing Issues of "Waste" Grown Aquatic Foods¹

John E. Huguenin²

John D. C. Little

Working Paper 837-76

February 1976

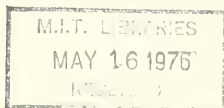
1 The preparation of this paper has been supported through the MIT Sea Grant Program by the N.O.A.A. Office of Sea Grant under Grant 04-5-158-1.

2 John E. Huguenin is an Assistant Professor at the University of Massachusetts Aquacultural Engineering Laboratory, Wareham, MA. John D. C. Little is a Professor of Operations Research and Management at the Sloan School of Management, M.I.T., Cambridge, MA.

HL 32

M 414

no. 839 No



Abstract

Are societal wastes all bad? Some of them, including heat from power plants and certain organic wastes, have been demonstrated to be potentially valuable for growing aquatic food organisms. The use of such "wastes" promises the double benefit of a cleaner environment and an increased food supply. Research and development effort can be expected to solve, for at least some production methods, the technical, economic and public health problems that currently exist.

But can foods grown in part with potentially objectionable inputs be successfully marketed? All evidence indicates that regulatory agencies will require a much lower health risk for aquaculture foods than "wild" ones and will ensure explicit labeling of potentially controversial inputs. Knowledge about potential consumer reaction to such food products is scanty and mixed. Some "waste" grown or "waste" containing foods (many water supplies, some farm and aquaculture products) are regularly consumed, but the public has also reacted swiftly against foods incriminated on health grounds (shellfish affected by red tide, cranberries contaminated by pesticide) and has sometimes been polarized by controversies (fluoridation).

Under these circumstances a likely marketing strategy is to concentrate on aquatic organisms that are not directly used for human consumption but can be used for animal food or processed for their extracts. For sea foods that are eaten directly (fish, shellfish), a promising strategy is to take advantage of the quality control possible in aquacultural products to produce and market premium foods. These can be sold first to the restaurant trade with direct distribution to preserve maximum freshness, and later to consumers. An interesting possibility in between direct and indirect use is as components of processed and prepared seafoods (fish sticks, fish cakes). Separately and simultaneously a public information campaign can stress the merits and societal advantages of waste utilization.

Introduction

It has become customary to consider any and all of the waste products of our society as pollutants and to view their discharge into the environment as undesirable. However, the characteristics and effects of man's wastes are so highly variable that their common designation and implied common impact on the ecosystem is both simplistic and misleading. There are at least some concepts for aquatic "waste" recycling that from a scientific and technical viewpoint seem very promising for turning "pollutants" into valuable resources. Thus, the possibility now exists of simultaneously improving food production and environmental quality. This does not mean that there are not many serious obstacles to be overcome before some of the proposed systems can be considered ready for large scale operational use. Others, on the other hand, are already being used on a large scale both intentionally and unintentionally. While at the present time most of the substantial recycling into our aquatic food supplies is both unplanned and unmanaged, this is sure to change. At some point, the increasing demands on coastal and inland waters for both "waste" disposal and food production can be safely met only by acquiring control over the systems involved. Only in managed situations can the risks be contained and production increased. Our real choice is whether this is to be done methodically or haphazardly.

Agricultural and fishery processing wastes and even offal are commonly used in formulated diets for animals both terrestrial and aquatic, possibly without fully understanding some of the risks involved. The potential for the beneficial use of waste heat from power plants is widely recognized and is an aspect of waste utilization currently receiving substantial attention (Mather and Stewart, 1970; Yarosh, 1973; Huguenin and Ryther, 1974). The use of algae

in processing domestic sewage is accepted practice in many parts of the United States. Considerable research has been done on means to harvest this algae. Current efforts seek to extend these practices to produce useful food organisms in a marine environment (Ryther et al., 1972; Ryther et al., 1975) and a great number of variations are possible. The use of freshwater sewage ponds to grow aquatic food animals is an idea with a great deal of history and precedent (Allen, 1970). Sewage products are dumped in large quantities into our coastal waters and contribute, at least in part, to the high sea food yields of our estuaries and coastal areas (Ryther, 1971). However, increased productivity due to fertilization with wastes is often unintentional, generally not recognized and does not lend itself to management. Health risks are nevertheless present. Other possibilities include the use of slaughter house waste blood as a food source for shellfish (Adler and Claus, 1972) and various kinds of fish protein concentrate (F.P.C.) made from trash fish and fishery processing wastes.

Time and research effort can be expected to make some of these concepts both technically feasible and economically attractive. It is not clear, however, whether even strong technical and economic justifications are sufficient to assure the application and exploitation of these new developments by our society. Quite possibly not, for there are many other considerations and constraints on such systems (Huguenin and Kildow, 1974). This paper will concentrate on those that pertain to marketing.

Regulatory Agencies

In many "waste"-food uses there are technical and scientific uncertainties with public health and/or aesthetic aspects. It falls to government regulatory agencies to make judgements about these issues. The two principle agencies

involved are the Food and Drug Administration and the Federal Trade Commission.

The Food and Drug Administration (FDA) is empowered by the Food, Drug & Cosmetics Act of 1938 to regulate any or all food products in interstate commerce. A major part of the FDA's work concerns adulteration and misbranding.

The word "adulteration" has been held to mean to "corrupt", debase or make impure by the mixture of foreign or base materials. The Act terms food adulterated for several reasons but the one of the most concern is the provision condemning food which "consists in whole or in part of any filthy, putrid or decomposed substances", or "is otherwise unfit for food". Unfortunately, the courts have interpreted the act and especially the phrase "otherwise unfit for food", very broadly in the common rather than in the possible scientific meanings. In addition, where "added substances", whether intentionally or unintentionally added by man, are concerned, the mere possibility of a health hazard is sufficient grounds for condemnation. The presence of any scientific or technical uncertainty can thus preclude acceptance. In contrast, the same substances when found "naturally" in foods must be shown to be in fact dangerous to health in order to be condemned. This in effect is a double standard loaded against the recycling of potentially valuable substances for use in aquaculture. The only mitigating factors are the societal pressures for the development of aquaculture, better waste management, and increased seafood production, which may result in the weakening of this powerful legal/political obstacle.

"Misbranding" refers to false or misleading labeling or packaging as well as omissions of salient information relating to harmful conditions of product use (Howard, 1964). Where a standard of identity has been established, the food must conform to the pre-set quality standards, and the label must bear

the name of the food as specified in the FDA regulations. Where such standards have not been established, the label must show the common or usual name of the food and its ingredients. This can be a severe marketing disadvantage, as has been found in the case of squid because the name evokes negative attitudes (Kalikstein, 1974). In another instance considerable efforts have been expended to find a positive yet accurate descriptive phrase for irradiated foods (Yankelovich, 1966).

The positions of the FDA are sometimes controversial. For example, FPC (fish protein concentrate) is a white powder usually made by processing whole fish. FPC is considered completely safe from a health point of view, but, since whole fish contain some amount of offal, the FDA raised objections to the product on grounds of adulteration and labeling. In labeling, it was not enough to say the product was made from whole fish; mention had to be made of the intestines. Since the product was particularly designed for export to protein-poor countries, a situation arose where the U.S. company developing the product might be charged with trying to sell abroad a food deemed unfit for Americans. The project finally failed. The company had technical and financial problems besides the issues raised by the FDA, but the case illustrates the critical and sometimes controversial role played by the regulatory agency.

It would be obviously a mistake to make plans on the assumption that very explicit labeling of waste grown seafood products will not be required by the FDA, but this could happen in the case of aquatic foods grown in conjunction with power plants, and in the case of processing wastes that are already being used to some extent in food production. It is much more unlikely if sewage products are used. All statements about regulatory agency behavior are, at the present time, extremely speculative. Actual behavior will depend not only on the specific circumstances, the future decisions of advocates and opponents,

societal pressures and FDA attitudes, but also on the advances in related technologies and the degree of opposition which they encounter.

The Federal Trade Commission (FTC) is empowered, under the Wheeler-Lea Amendments of 1938, to regulate false advertising of food products, excluding that involving the label or package. The FTC regulates what it considers to be deceptive advertising practices. (This is part of the activity of the Bureau of Deceptive Practices, FTC). Gist (1971) has defined deception as "the communication, verbally or visually, directly or symbolically, of a message that has the reasonable capacity of misleading, deluding or beguiling the audience to whom the communication is directed". The audience may be the final consumers, industrial buyers or users, or institutional buyers or users.

The Division of Investigations of the FTC audits all major communications media. However, complaints from the public or from threatened business interests are the most common method of bringing issues to the attention of the FTC. Due to the direct competition in the market place with alternate sources of similar aquatic foods, it would be surprising if there were no complaints. If the Division believes that deceptive or misleading communication is underway, it may issue a stipulation to the advertiser, upon receipt of which the misleading advertisement may be discontinued. The FTC then does not take further action. If the advertiser does not discontinue the advertisement, the FTC may serve a "cease and desist order". Non-compliance with the "cease and desist" order is punishable with imprisonment or fine or both.

It is anticipated, but must be proven in each case, that the products will look, taste and smell the same as their managed counterparts that are not grown with "waste" inputs. It is well established that off-tastes in fish flesh can result from undesirable substances in their water or diet. However, cultured fish, due to the advantages of management, are less susceptible to

to these problems than "wild" fish. Furthermore, over a period of time, management is likely to bring about genetic improvements. Whether the advantages of management are sufficient to assure "waste" grown products, indiffereniable from other cultured products is obviously a critical assumption, which will have to be demonstrated in each situation. As an example of what can be done, the fish grown in the Munich, Germany, sewage treatment-aquaculture system go through a conditioning process that removes potential odors and off flavors prior to marketing (Allen, 1970). Oysters on Long Island and Coho salmon in Maine, grown with the aid of power plant thermal effluents, do not need any special processing and are regularly marketed. These products are of high quality and command premium prices. If the products are identical or superior in their marketing characteristics and little or no packaging or labeling differentiation is required, the marketing problems will in all likelihood be greatly reduced. Past rulings of the Food and Drug Administration and the Federal Trade Commission, suggest assuming the worst case conditions. State agencies are another variable but the majority are likely to follow the positions of Federal agencies.

Consumer Attitudes

Assuming that all other problems are solved, there is still the question of consumer acceptance of "waste"-grown aquatic foods. Given that distinct labeling will be required, to what extent does a consumer's feelings of repugnance for wastes, which are known to be acquired rather than innate or physiological (Sears, Maccoby, Levin, 1957), carry over to food products grown with such materials? Unfortunately, there does not appear to be any available research directly dealing with this interesting question. However, if the fishing for human consumption aspects of the Santee Project (Merrel et al., 1967),

which is an innovative sewage treatment system, and the common use of wastes in agriculture are any indication, this associative link may be avoided or nullified for a significant fraction of the public, even when the physical facts are known. As an additional example, many city water supplies are processed from river water into which sewage has been dumped upstream. There is also some literature on public attitudes towards the closely allied concept of directly using reclaimed sewage water (Bruvold and Ward, 1970; Bruvold, 1971; Bruvold, 1972a; Bruvold, 1972b; Gallop Poll, 1973). Small scale surveying at M.I.T. (Kildow and Huguenin, 1974) has shown comparable consumer attitudes towards seafoods grown with sewage inputs. Even studies on attitudes toward irradiated fish (Yankelovich, 1966) and on fluoridation (Sapolsky, 1968) show similarities. These all have the common denominator of a potentially objectionable input and a food or injected output (see Table 1). In all cases where it has been investigated, the level of public ignorance about the processes involved is very high (Table 2). In addition, much of the public's factual knowledge, as limited as it may be, is incomplete, inaccurate and even incorrect.

It should be pointed out that in the only case of actual usage of reclaimed sewage water for potable supply during a drought emergency (water reused 8-15 times), consumer attitudes were strongly negative (Metzler et al., 1958). However, the recycled water had some very undesirable properties including a yellow coloration, unpleasant odor and taste and upon agitation would froth, all of which unquestionably affected consumer attitudes. This highlights the practical problems often encountered in trying to separate technical and psychological issues in real situations. Modern technology undoubtedly can and must do better.

However, while it is relatively certain that a large segment of the public would not oppose the use of at least some "wastes" in aquaculture, there is

TABLE 1

GENERAL ATTITUDES TOWARD CONTROVERSIAL FOODS

Of the people who had heard of radiation processed food "Would you eat radiation processed food?"	Yes 53% (369)* No 11% (77)	Yankelovich, 1966
"Would you buy irradiated fish which could be purchased along with the rest of the weeks groceries and prepared when convenient?"	Yes 35.3% (38)	Moore, 1969
"Would you consider buying the cultured product (waste grown) if your favorite kind of fish were locally available along with the cultured product?"	Strong yes 39% (16) Strong no 2% (1)	Kildow & Huguenin, 1974
Of the people who had heard of squid, their attitude toward squid as a food source	Positive 18% (24) Negative 35% (46)	
Respondents not opposed to reclaimed water for drinking water and in food preparation.	43.6% (424)	Bruvold & Ward, 1972
"Suppose Health Authorities in your community determined that it was safe to drink recycled water - that is water that has been purified and treated for taste appearance and so on "Would the water be acceptable?"	Yes 38% (626) No 55% (906)	Gallup Poll, 1973

*Numbers in parenthesis indicate quantity represented by percentage.

TABLE 2

THE PUBLIC'S AWARENESS

"Have you heard of radiation processed food?"	Yes 24% (705)*	Yankelovich, 1966
"Have you ever heard of this process (irradiation)?"	Yes 33.6% (36)	Moore, 1969
"Have you ever heard of squid?"	Yes 64% (85)	Kalikstein, 1974
Knowledge question on reclaimed waste water	Adequately correct 27% (262) Incorrect 11.9% (116)	Bruvold, 1972

*Numbers in parenthesis indicate quantity represented by percentage.

little information on the numbers or degree of activism of either strong supporters or strong opponents. This is a critical void, since small vocal minorities have often swayed public opinion in similar situations as demonstrated by the history of local fluoridation decisions (Sapolsky, 1968). Since any opposition can acquire advocates with at least some quasi-scientific credentials, possibly in unrelated fields, the controversy to the average person takes on the aspects of a confusing disagreement among "experts" leading him to the only safe decision of not "buying".

The available literature indicates that those individuals who approve of the use of potentially objectionable inputs do so under the assumption that such systems, if established, would have adequate controls. Acceptance by Governmental regulatory agencies carries a great deal of weight in consumer decisions (Table 3). Having a government inspected and "certified" product would provide significant marketing advantages. These feelings of assured quality may be strong enough for some consumers to make "waste"-food products preferred over sea foods of "unknown" quality from other sources. This apparently happened in Israel with irradiated vegetables, where the processed product was preferred by a factor of from 2:1 to 4:1 (Lapidot, 1972). In all studies, the major sources of consumer opposition have been uncertainties and intuitive feelings concerning uncleanness, impurities and lack of public health safeguards. Studies have shown that concerns about water pollution do lead to reduced fish consumption (Kelly, 1972). As another example, "red tide" scares have tended to reduce all fish consumption, not just the affected shellfish. Thus, the public's confidence in the safeguards and quality control of the final products may well be the single most important factor in consumer acceptance of "waste" grown foods. Obviously one incident of bad publicity involving the quality of the products could be extremely damaging. While the quality

TABLE 3

IMPORTANCE OF REGULATORY ACCEPTANCE ON CONSUMER ATTITUDE

In a listing of important psychological factors (4th on list out of 12) for irradiated foods.	"The wide spread acceptance by the public of any product actually present on the shelf, coupled with the assumption that no dangerous food product would be allowed on to the market by the authorities"	Lapidot, 1973
Questionnaire on consumer acceptance for irradiated foods.	"Do you feel that an approval by the U.S. Food and Drug Administration of this treatment is sufficient indication of safety ... Yes 46.7% (50)*	Moore, 1967
In a summation of consumer attitudes to irradiated foods (3rd item out of 5)	"FDA approval, signifying the approval of the government, appears to be a vital element in reassuring consumers about radiation processing"	Yankelovich, 1966

*Number in parenthesis indicates quantity represented by percentage.

control capability must be excellent, it, by itself, is no assurance of avoiding a disaster. Such a case occurred in Holland with irradiated mushrooms, which were initially extremely well received by the public (U.S. Department of Commerce 1973). The new product was labeled "irradiated mushrooms" while the equivalent non-radiated package was labeled "fresh mushrooms". Unfortunately, press reports publicized the idea that the irradiated mushrooms were not fresh, since they were not marked as such, with such an impact on the consumers as to kill the program completely.

Marketing Strategies

Taking into account the foregoing information, what marketing strategies will be most likely to achieve the potential benefits from "waste" grown aquatic foods? The complexity of the issues suggest the desirability of using contemporary marketing research techniques for identifying dimensions of consumer perceptions and using such knowledge to determine appropriate product positions in the market (Urban, 1975; Silk and Urban, 1976). Even without major new research, however, the information so far uncovered points toward possible marketing strategies.

First, observe the potential aquacultural products can usefully be arranged in a hierarchy of food use:

1. Animal forms

- a. eaten raw (oysters, clams).
- b. bought fresh but cooked (fish, lobsters).
- c. frozen or canned (fish, shellfish).
- d. processed and/or contained in other products
(fish sticks, chowder, F.P.C.)
- e. fed to other animals (brine shrimp, components
of fish pellets).

2. Plant Forms

- a. eaten directly (dulce).
- b. extracts used in other foods (agar).
- c. fed to animals (algae).

Interestingly enough, the lower end of the hierarchy not only faces fewer technological difficulties in the control of health risks but also has less severe marketing problems. Products at this end enter industrial markets and are sold primarily on the basis of quality and cost. They confront less threat from a negative emotional customer response than do corresponding consumer products. Because of this, the lower end of the scale, if economically feasible, seems particularly attractive for early commercial development. Unfortunately, this end of the scale also tends to have lower unit prices.

Higher in the hierarchy are the direct food products with the greatest intrinsic economic, nutritional, and culinary value. These are the real challenge: Can they be successfully marketed if "waste-grown"? What are the likely product positions, prices, communications themes, and distribution channels?

First of all, it is taken for granted that any public health risks associated with "waste"-assisted growth would be reduced below those of the corresponding wild products and that government approval would be available. In other words the marketing program is not designed to foist hazardous food on an unsuspecting public. It is trying to distribute food value without raising self-defeating apprehensions in consumers.

The most promising marketing strategy is to go first-class: produce and sell a premium product. The controlled environment of aquaculture can achieve a product superior in taste, texture, appearance, and freshness to its "wild"

counterpart. This fact is a strong selling point that is exploited by all present commercial aquaculture operations. The premium product permits a premium price which is necessary because of the anticipated production costs associated with an emerging technology. Notice that the high quality position is entirely analogous to that historically attained relative to wild products in agriculture and livestock. Today's Thanksgiving turkey is a far cry from its colonial forebears.

Necessary for a superior product at a premium price is a quality conscious market segment. This suggests the restaurant trade as the prime customer group in the initial years. Restaurants are essentially an industrial market and relatively objective price-quality tradeoffs dominate decision making. Another advantage lies in distribution. Direct distribution from grower to restaurant is relatively easy. There is no reason why fish served at dinner should not have been swimming that morning. Such quality control would be in happy contrast to present fish distribution, which is remarkably bad. Sea foods, under improper handling, can degrade very quickly (hours) relative to other types of foods. Ten days from ocean to plate is altogether too common for "fresh" fish. Old age in sea foods is clearly discernable to consumers who have tasted truly fresh products.

A public information program stressing the twin gains of food production and environmental improvement could be mounted. These issues are of general interest and likely to gain media support. Parallels with other productive use of valuable "wastes", or rather "resources", could be cited as examples of man's turning problems into opportunities. The public health hazards of wild fish and shellfish from coastal waters might possibly be discussed and compared to that of the cultured products. Such an information program would be seeking

to establish in people's minds the fact that cultured products are safe before the opposite point is raised. Since pressures to utilize "wastes" in food production are increasing, some of the conditions necessary for changing negative attitudes are present. Techniques, such as have been used to change the attitudes of soldiers towards new and unusual foods (Smith, 1961), might also be employed on a larger scale with some chance of success.

Branded products to the consumer would be a later and more difficult phase but one having great market potential. While some information exists (Gillespie and Houston, 1974; Lewin, 1943) careful study of consumer perceptions and values should be undertaken. Since clear labeling of the product is assumed, government certification on the package would be sought to give the consumer assurance of quality. Predictive pretests of product, package, and advertising can greatly reduce commercial risk (Silk and Urban, 1976).

For consumer markets the premium position again seems best. Communications copy could refer to restaurant use. Direct distribution to retailers would control freshness as far down the distribution system as possible. Advertising themes would stress product uses, outstanding taste, freshness, and eating enjoyment.

Special opportunities for exploiting the potential of "waste" grown food products fall to small and middle-sized firms. Large companies are likely to be conservative, slow, and nervous about their visibility in case of unfavorable reaction. A smaller firm can work with local people to solve problems, gain distribution and build up good will by word-of-mouth.

Conclusions

Obviously the regulatory agencies play a critical role. They have the power to preclude the application of promising aquaculture systems using "waste" inputs. While it is not possible to predict their behavior under future circumstances, some generalizations can be made. If there are any substantial unresolved public health questions or unknowns, regulatory approval is extremely unlikely. However, if, through sound preparation and research, quality control and public health safety are obtained and "known", approval in some form is likely.

Several approaches to the market introduction of potentially objectionable food products have been suggested. One is to avoid, at least initially, direct human consumption and aim for uses lower in the scale of potential opposition. This has the advantage of reducing the legal/political risks while building experience and public confidence. Another approach is to aim for inclusion in processed foods where the identity of the inputs are easily lost. Yet another alternative is to attack the problem head on with a well organized marketing program. This has apparently worked well with the introduction of irradiated foods in Israel (Lapidot, 1973).

Aquatic foods currently on the market, produced with potentially objectionable inputs, are not presently identifiable. However, the quantity of these products as a fraction of the total market is small. It is questionable how long this approach will continue to work. A better approach is to mount coordinated marketing effort that introduces and builds acceptance of quality products, first through restaurants then to consumers, while at the same time publicizing the societal advantages of "waste" utilization.

References

- Adler, C. and Claus, 1972.
"Waste Blood-Potential Sources of Food for Aquatic Animals"
The American Fish Farmer, 3(9):10-11.
- Allen, G.H., 1970.
"The Constructive Use of Sewage, With Particular Reference to Fish Culture", FAO Technical Conference on Marine Pollution and Its Effects on Living Resources and Fishing, Rome, December 9-18, 26p.
- Bruvold, William H. and P.C. Ward, 1970.
"Public Attitudes Toward Uses of Reclaimed Water", Water and Sewage Works, 111:120-122.
- Bruvold, William H., 1971.
"Affective Response Toward Uses of Reclaimed Water", J. of Applied Psychology, 55:28-33.
- Bruvold, William H., 1972.
"Public Knowledge and Opinion Concerning New Water Resources in California", Water Resources Research, 8(5):1145-1150.
- Bruvold, William H., 1972b.
"Consistency Among Attitudes, Beliefs and Behavior", J. of Social Psychology, 86:127-134.
- Bruvold, William H. and P.C. Ward, 1972.
"Using Reclaimed Waste-Water - Public Opinion", Journal Water Poll. Control Fed. 44(8):1690-1696, Sept.
- Gallup Poll Release, 1973.
"Americans Concerned that Water Resources Will Become Permanently Low in 20 Years", Princeton, N.J., American Institute of Public Opinion, Wed., May 16.
- Gillespie, S.M. and M.J. Houston, 1974.
"A Market Segmentation Study of Consumer Attitudes Toward Sea Food", Proceedings 10th Annual Marine Technology Society Conference, Washington, D.C., Sept. 23-25, 1974, pp. 1039-1045.
- Gist, R.R., 1971.
Marketing and Society, Holt, Rhineholt, and Winston, New York, N.Y.
- Howard, M.C., 1964.
Legal Aspects of Marketing, McGraw-Hill, New York, N.Y.
- Huguenin, J.E. and J.H. Ryther, 1974.
"The Use of Power Plant Waste Heat in Marine Aquaculture", Proceedings 10th Annual Marine Technology Soc. Confer., Washington, D.C., Sept. 23-25, 1974, pp. 431-445.

Huguenin, J.E. and J.T. Kildow, 1974.

"Social, Political, Regulatory and Marketing Problems of Marine Waste-Food Recycling Systems", Waste Water Use in the Production of Food and Fiber - Proceedings, Oklahoma City, Oklahoma, March 5-7, EPA-660/2-74-041, June, pp. 334-356.

Kalikstein, P.H., 1974.

"The Marketability of Squid", MIT Sea Grant Report No. MITSG 74-24, May, 108 pages.

Kelly, J.S., 1972.

"Attitudes About Water Pollution and Fish Consumption", Faculty Working Paper No. 128, College of Business, Kent State University.

Kildow, J. and J.E. Huguenin, 1974.

"Problems and Potentials of Recycling Wastes for Aquaculture", MIT Sea Grant Report No. MITSG 74-27, Dec., 170 pages.

Lapidot, M., 1972.

"The Israel Food Irradiation Program 1965-1970: Application of a Conceptual Approach to the Commercialization of Irradiated Agricultural Products", Proc. Conf. Peaceful Uses of Atom Energy (Geneva 1971), U.N., New York, pp. 279-298.

Lapidot, M., 1973.

"Introducing Irradiated Agricultural Products on a Large Scale, Factors Influencing the Economic Application of Food Irradiation", Proceedings of a panel, Vienna, 14-18 June 1971, Sponsored by FAO/IAEA, IAEA-PL-433/5. pp. 65-74.

Lewin, K., 1973.

"Forces Behind Food Habits and Methods of Change", in "The Problem of Changing Food Habits", Bulletin of the National Research Council, Number 108, pp. 35-65.

Mather, S.P. and R. Stewart (eds.), 1970.

Proceedings of the Conference on the Beneficial Uses of Thermal Discharges, Albany, New York, September 17-18, New York State Department of Environmental Conservation, 17 papers (4 on aquaculture).

Merrel, John C., Jr., W.F. Jopling, R.F. Bott, A. Katko and H.E. Pintler, 1967. Santee Recreation Project, Santee, California, Final Report, U.S. Dept. of the Interior, W.P. 20-7, 165 p.

Metzler, D.F., R.L. Cuip, H.A. Stoltenberg, R.I. Woodward, G. Walton, S.L. Chang, N.A. Clarke, C.M. Palmer and F.M. Middleton, 1958.

"Emergency Use of Reclaimed Water for Potable Supply at Chanute, Kanasa", Journal of the American Water Works Association, 50(8):1021-1060.

Moore, M.L., 1972.

A Survey of the Present Status of Food Radiation Technology and Consumer Opinion Towards Foods Preserved by Food Irradiation, M.S. Thesis, Dept. of Nutrition and Food Science, Syracuse University, 159 p.

Ryther, J.H., 1971.

"Recycling Human Wastes to Enhance Food Production From the Sea", Environmental Letters, 1(2):79-87.

Ryther, J.H., W.M. Dunstan, K.R. Tenore, and J.E. Huguenin, 1972.

"Controlled Eutrophication - Increasing Food Production From the Sea by Recycling Human Wastes", Bioscience, 22(3):144-152.

Ryther, J.H., J.C. Goldman, C.E. Gifford, J.E. Huguenin, A.S. Wing, J.P. Clarner, L.D. Williams, and B.E. LApoinde, 1975.

"Physical Models of Integrated Waste Recycling - Marine Polyculture Systems", Aquaculture, 5(2):163-177.

Sapolsky, Harvey M., 1968.

"Science, Voters and the Fluoridation Controversy", Science, 162:427-433.

Sears, R.R., E.E. Maccoby, and H. Levin, 1957.

Patterns of Child Rearing, Row and Peterson, Evanston, Ill.

U.S. Dept. of Commerce, 1973.

The interdepartmental committee on Radiation preservation of Food, Minutes of the 21st meeting held November 1972, p. 14-15.

Silk, A.J. and G.L. Urban, 1976.

"Pre-Test Market Evaluation of New Packaged Goods: A Model and Measurement Methodology", Sloan School of Management Working Paper, 834-76, MIT.

Smith, E.E., 1961.

"The Power of Dissonance Techniques to Change Attitude", Public Opinion Quarterly, 24(2):626-639.

Urban, G.L., 1975.

"PERCEPTOR: A Model for Product Positioning", Management Science, 21:858-71 (April).

Yankelovich, D., 1966.

"Cost Benefit Study of Selected Products in Atomic Energy Commission's Low-Dose Food Irradiation Program", Prepared for the A.E.C. by Daniel Yankelovich, Inc., N.Y., N.Y. Report No. NYO-3666-1, 226 p.

Yarosh, M.M. (editor), 1972.

Proceedings of the National Conference on Waste Heat Utilization, Gatlingburg, Tenn., Oct. 27-29, 1971, 25 papers (7 on aquaculture).

