Toward an Improved Seafood Nomenclature System

ROY E. MARTIN, WILLARD H. DOYLE, and
JAMES R. BROOKER

ABSTRACT—The world demand for protein is continually increasing, and seafoods, which are high in protein as well as other essential nutrients, are being sought in greater numbers. However, many traditional species are in short supply, and new fishery management plans must be implemented to preserve and rebuild the remaining resource for future use. But this shortage also helped to expand the market for underutilized species. Marketability of these species is difficult because many of them have names that are unfamiliar and inappropriate for advertising purposes. For this reason, a comprehensive project is being developed to implement a new system for establishing market names for fishery products based on their edibility characteristics. This system will have a major positive impact on fishery products in the marketplace, with benefits to consumers, the industry, and regulatory agencies.

Introduction

The Complexity Problem

Historically, names have been given to certain fish through centuries-old biological or local populace identification procedures (Leudtke, 1973). Names such as ratfish, hoki, croaker, and whiptail were attributed to certain species with no regard for consumer appeal or the edibility characteristics of the fish (Goode, 1884). Reliance on this type of identification and its transfer to products which contain these species, has been the practice in considering "common or usual name" designations in the labeling regulations of the U.S. Food and Drug Administration (USDI, 1954).

Until recently, fishermen have had to sort by hand the most desirable fish from the others netted in the same catch. Advances in on-board processing techniques in removing the edible meat have increased the value of many species that were formerly discarded because of small size and bones. At present, edible meat can be removed from a mixed catch directly without hand sorting. A wide variety of products can be made from the recovered meat (Martin, 1972, 1974, 1976, 1980, 1981; Federal Register, 1975; USDC, 1975). This is one of the areas of greatest potential expansion for fishery products.

The marketplace for food products has changed drastically in the past few decades. Based on improved processing capabilities, there has been tremendous growth in the number of processed food products in the marketplace, with seafood products representing about 10 percent of the total.

Methods for marketing food products have also changed. The food industry has moved from the cracker-barrel age to a point where almost all products are processed, packaged, and highly advertised. The marketplace has evolved from "mom and pop" grocery stores to chain stores, supermarkets, hypermarkets, and shopping malls. Every new product must fight for recognition. Effective product names and product identification are a necessity, with the nomenclature of such products playing a significant role in their commercial success or failure.

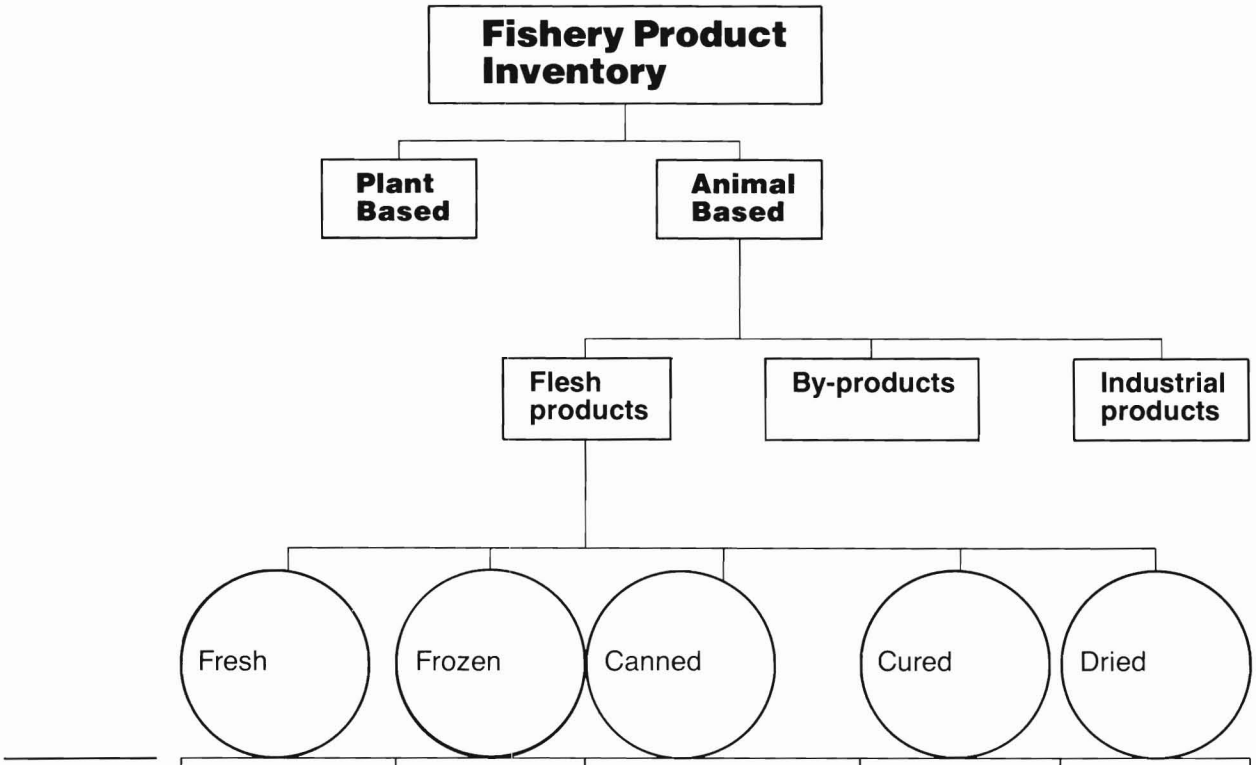
The seafood industry produces a more bewildering array of species and products than any other food industry, with new species and products finding their way into the marketplace at an ever-increasing rate (Fig. 1).

The nomenclature of other groups of animals that provide muscle protein are simple, because they involve fewer species (Fig. 2). However, food fish in the United States alone encompass some 500 different species and worldwide, more than 1,000 species have been marketed, each one with its own individual "common or usual" name (Fig. 2). Not infrequently, the same species will have different names depending upon its geographic location. For example, the species *Morone saxatilis* is called "rockfish" in Maryland, and "striped bass" in California (Cohen, 1969).

The Regulatory Problem

The U.S. Food and Drug Administration (FDA) has the authority to interpret and enforce food labeling provisions which are contained in the Food, Drug, and Cosmetic Act (FDA, 1979). These provisions cover seafood, but no specific section applies to seafood products. As a result, legislation, procedures, interpretations, and advisory opinions of the agency applied to seafood are the same

Roy E. Martin is with the National Fisheries Institute, Washington, DC 20036, Willard H. Doyle is with the Brand Group, Chicago, IL 60610, and James R. Brooker is with the National Marine Fisheries Service, Washington, DC 20235.



	Fresh	Frozen	Canned	Cured	Dried
Made from whole fish	Drawn fish Dressed and boned fish Whole fish Butterfly fillets Fish steaks Live shellfish	Dressed fish Fish steaks Breaded fish sticks Fish fillets	Fish in sour cream Fish chunks Fish in soybean oil Rolled fillets of fish with capers Kippered snacks Deveined shellfish	Marinated fish Spiced fish Silver-cured fish Pickled fish Smoked fish	Klipfish Freeze-dried shellfish Fish flour Freeze-dried fish
Made from fillet blocks		Fish sticks Frozen and breaded portions			
Made from minced flesh		Fish sticks Fish portions Shrimpos Shellfish sticks	Fish balls in bouillon Salted fish cakes Fish pies with mixed potatoes Fish pudding Fish dumplings Shellfish cakes	Shellfish sausage Fish wieners Fish ham	

Figure 1.—Product versatility.

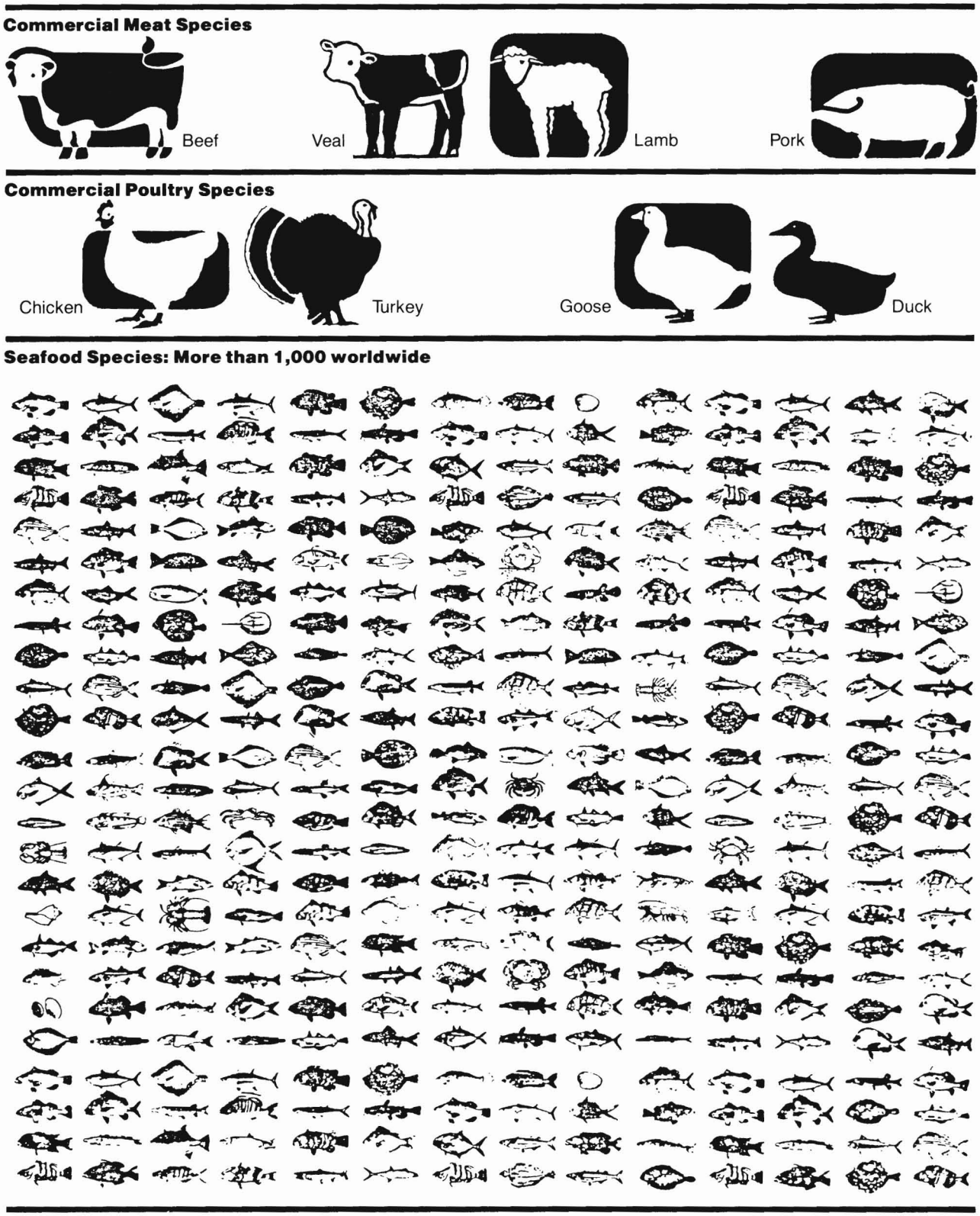


Figure 2.—Pictorial complex of the basic problem.

as those for most other food products (Federal Register, 1975). However, due to the large number of species, the forms of presentation, and formulated products, industry development and marketing efforts are frustrated in the absence of clear, consistent labeling and compliance guidelines.

The intent of the Act is to ensure that labels carry sufficient and accurate information to enable consumers to shop intelligently, and to protect consumers from economic deception (U.S. Supreme Court, 1924). The FDA has, as a result of past court decisions, formed some general guidelines, though not clearly defined, as to which factors are important in considering the common or usual name of a product. Significant among these factors are: "(1) The name should have traditional usage, that is, it should be customary, prevailing, universal, and popular; (2) a strongly established name cannot be changed and has a 'proven right' over a proposed new one (a name is considered to be strongly established if it has gained general acceptance through 'long usage'); (3) when an established name exists, a new name should not be such that it gives the manufacturer an unfair competitive advantage or upsets a well established balance of competition in the marketplace; (4) the name should take into account cultural and aesthetic inclinations of the American public, as well as considerations of health, value, and quality; and (5) the name should not create confusion in the marketplace."

Presently, common names for fish species contain little or no useful information for the consumer. They are used in reference to the species in a product, not the product itself. Consequently, the consumer knows very little about the edibility or physiological characteristics of the product and the large variety of seafoods available to them. They confine their purchases to a few familiar items, burdened by many negative misconceptions that their confusion has created.

The basic concepts used in making seafood nomenclature decisions are confused and unclear (FDA, 1970). Some of these which have been particularly troublesome are outlined below.

Common or Usual Name of the Food

This phrase is part of the Food, Drug, and Cosmetic Act. Its intention is to relate to names familiar to consumers. As interpreted relative to seafood products labeling, it is frequently and incorrectly confused with the common name of a fish or shellfish. The common name of a fish is not the same as the "common or usual name of a food." For most seafood products there is no common or usual name.

Traditional names

The common name of a finfish or shellfish is the name used in day to day conversation by fishermen, consumers, sportsmen, etc. Some fish have as many as 50 common names from almost as many different locations (Fig. 3). Many popular commercial fish have several common names, and this creates much of the confusion in the marketplace (Schoning[1]). In most cases, common names provide little or no useful information to consumers; in others, unattractive names (i.e., ratfish, wolffish, etc.) prevent marketing of an otherwise desirable species.

Some states, such as California, Oregon, and Washington have adopted, through their state legislatures, names for marketing certain species of fish common to their coastline for intrastate use (CDFG, 1974). These names are not recognized outside California, and present FDA regulations allege that products so labeled would be deemed misbranded if marketed outside of California. However, Canada has approved some market designations of West Coast species which are similar to those approved by the state of California (Campbell, 1979).

Scientific names

Scientific names are assigned by means of systematic zoology, and cannot be used for market identification since their Latinized versions (International Congress of Zoology, 1964) convey nothing to either the consumer, processor, or food scientist. Their use of comparative anatomy has been as a reference in the biological identification of species, and that designation is ultimately used in an attempt to find a common name from a particular part of the historical zoological literature.

Lists

The National Marine Fisheries Service (NMFS) has, since the mid-1930's, published a glossary of common species names for finfish, crustaceans, and mollusks (USDC, 1978a). The American Fisheries Society (AFS) has also published lists of fishes along with their common names (Robins et al., 1980), and the Organization for Economic Cooperation and Development (OECD) has an excellent multilingual dictionary of fish and fish products (OECD, 1968). FAO is also generating lists of names of fishes for the various fishing areas of the world. It is important to note here that none of these, and other independent lists, have received official recognition by the FDA, relative to use in labeling foods. However, the FDA does consult the AFS list from time to time when questions arise regarding the labeling of some species.

Nomenclature problems relate to a wide variety of labeling and regulatory issues that have been a continuing impediment to the seafood industry for quite some time, and present significant obstacles to future fisheries development (Federal Register, 1973; USDC, 1979b; Jernudd and Thuan, 1980). Without satisfactory solutions, confusing nomenclature impedes workable communications and understanding, thereby foiling effective marketing efforts (Brooker[2]).

The actual number of fishery products available is well beyond the grasp of the average consumer. No other food category involves such a diversity of product variations dealing with nomenclature. The problem of naming products for

[1]Schoning, R. W 1974 National Marine Fisheries Service, NOAA, Washington, D.C. Pers. commun

[2]Brooker, J. R. 1977. Memo of meeting with FDA officials to consider a name change from Pacific Hake to Pacific Whiting. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Wash., D.C.

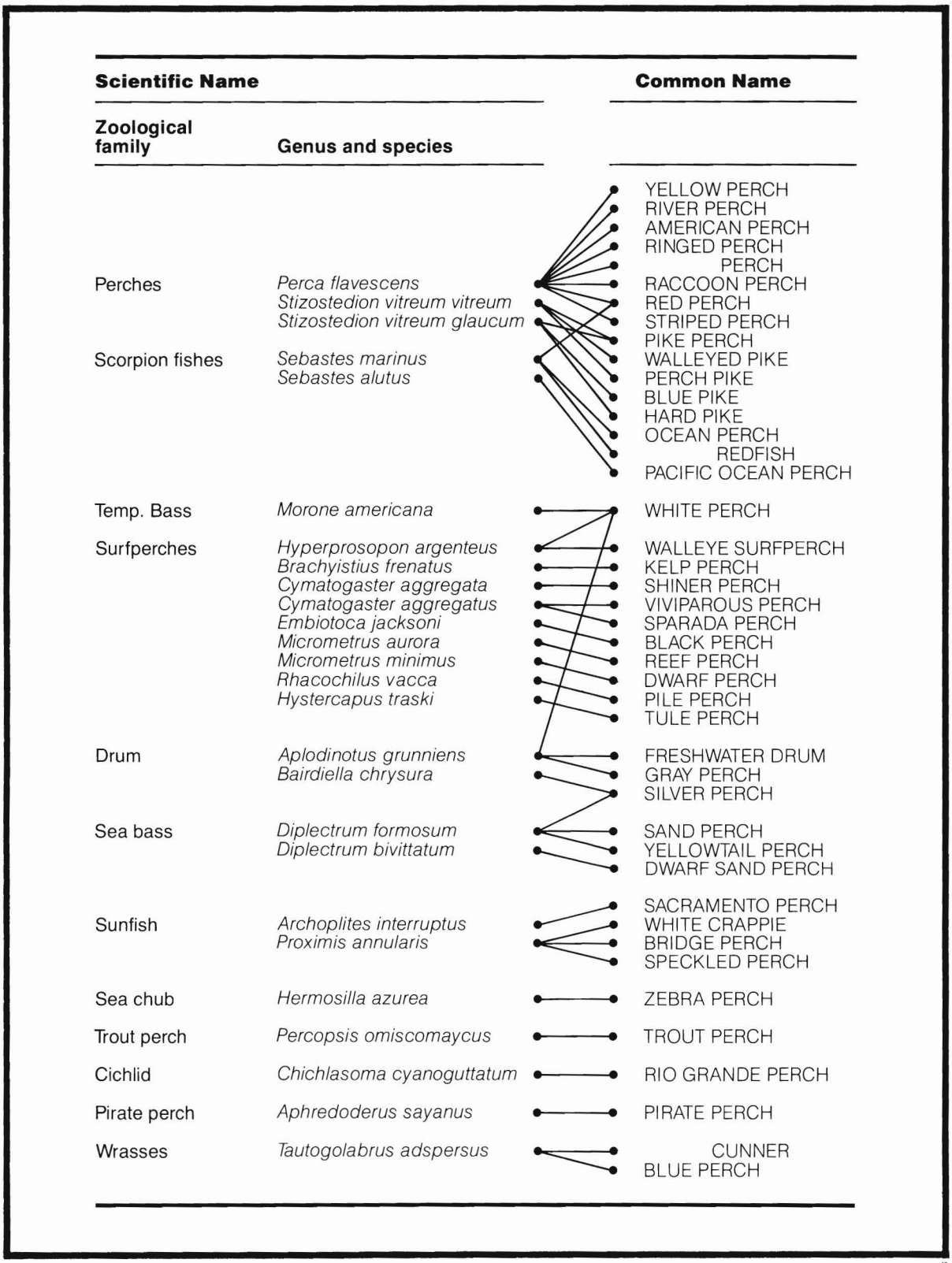


Figure 3.—Confusion between scientific and common names.

both regulators and the industry becomes exceedingly difficult and confusing considering the size of the system to be managed and understood. This complexity makes it extremely difficult to market new fishery resources and products effectively and inhibits domestic development as well as world trade in seafood products. Based on improved processing techniques and increased access to resources, there is significant potential for expanding seafood industry markets and per capita seafood consumption. Without a logically and properly developed nomenclature system for seafoods, the benefits of increased landings and consumption cannot reach their full potential.

Interpreting the Act has resulted in a multitude of intricate problems for both the seafood industry and the FDA (Schnably[3]). Traditionally, nomenclature problems have been handled on a case-by-case basis and decisions are slow in promulgation (Anonymous, 1947, 1979a; Federal Register, 1968, 1970, 1979a,b; Farrell, 1972; Brooker[4], footnote 2). It has become clear that a case-by-case approach offers no solution to the problem. A more comprehensive approach is necessary.

From the sources identified above, the seafood industry must create a unique nomenclature system that can be effective in marketing seafood products while not violating the requirements of the Food, Drug, and Cosmetic Act. In keeping its product development and marketing efforts consistent with consumer interests and the law, the industry is frequently faced with resolving nomenclature conflicts and finds its efforts frustrated in the absence of clear guidelines or standards appropriate to the complexities of fishery nomenclature. An objective in resolving this problem would be to reduce the number of common names so that each seafood species has only one market name. A "market name" refers to the name by which a fish or product will be known for labeling purposes. This concept has not yet acquired full recognition under present labeling laws.

Within our present nomenclature matrix, we have one or more of the following problems: 1) Too many terms—more than one term for a particular purpose, 2) not enough terms—an essential component which has not been given appropriate terminology, 3) unfamiliar terms—the same term used for different purposes, 4) misleading terms—causes attention to be diverted in the wrong direction, and 5) unattractive terms—aesthetically unpleasant in context of food products.

There is a limit to the number of names the consumer can assimilate. It is necessary to reduce the number of common names if we are going to try and bring a greater number of underutilized species into the protein and food needs of the world. This could be accomplished if similar food fish could be legally identified with a group name for marketing and labeling purposes.

"Nomenclature" is defined in "Webster's Third New International Dictionary" as: "A system or a set of names or designations used in a particular science, discipline, or art and formally adopted or sanctioned by the usage of its practitioners" (Gove, 1969:1534).

This definition includes three important principles: 1) The need for an organized, comprehensive system of names; 2) the development of a nomenclature system for the convenience of its users; and 3) the formal adoption of such a system. The seafood industry, food regulators, and consumers constitute a body of practitioners who need their own nomenclature system. Since an effective system does not currently exist, one must be constructed.

The first task in building a model nomenclature system was to delineate that information which is essential for accurately identifying fishery products. Various kinds of information which are necessary for product identification can be grouped into three broad categories for convenience: 1) Species, 2) product forms, and 3) product modifications. When distinctions are made among fish, important characteristics emerge (i.e., flavor, color, odor, boniness, texture, and moistness), but no broad framework was available from which to perceive similarities among species. An exploratory study found that the consumer is unable and unwilling to memorize "common names" beyond a small number of species, and focus group research reinforced these findings (USDC, 1974c).

This primary search uncovered what are now designated as "Comparative Edibility Factors" (USDC, 1974d). It will generally be recognized that more than one biological species of fish offer similar characteristics. Various properties taken together comprise a grouping and species commercially underdeveloped could fall into groups that exhibit similar natural and physical characteristics ("comparative edibility" rather than "comparative anatomy"). Figure 4 represents an illustration of that point. "Semantic noise" has to be simplified because as common names have accumulated over the years, so have words and phrases which describe their product forms and modifiers.

An identification system is based on sorting different species (i.e., cod and flounder) into several groups by using chosen base criteria (characteristics). It is a different kind of scheme with different objectives than other sorting/labeling programs such as food grading. Grading programs are more concerned with classification based on quality attributes rather than edibility characteristics. Product identification is the most basic labeling function because it tells you the "what" of your intended purchase. Design of an identification system is made difficult by the need to confine information on the label to the minimum necessary to do an effective job of communicating the identity of the product to the consumer.

A three-tier model was developed for testing. Fishery products fall into three broad groups: 1) Those which require identification of an individual fish, 2) those which require identification of a similar group of fish, and 3) those which require identification of dissimilar or mixed group of fish (Fig. 5).

Current identification is a single tier system, evolved around the traditional

[3]Schnably, J. R. 1972. Bureau of Foods, U.S. Food and Drug Administration, Washington, D.C. Pers. commun.
[4]Brooker, J. R. 1975. National Marine Fisheries Service, NOAA, Washington, D.C. Pers. commun., 22 Dec.

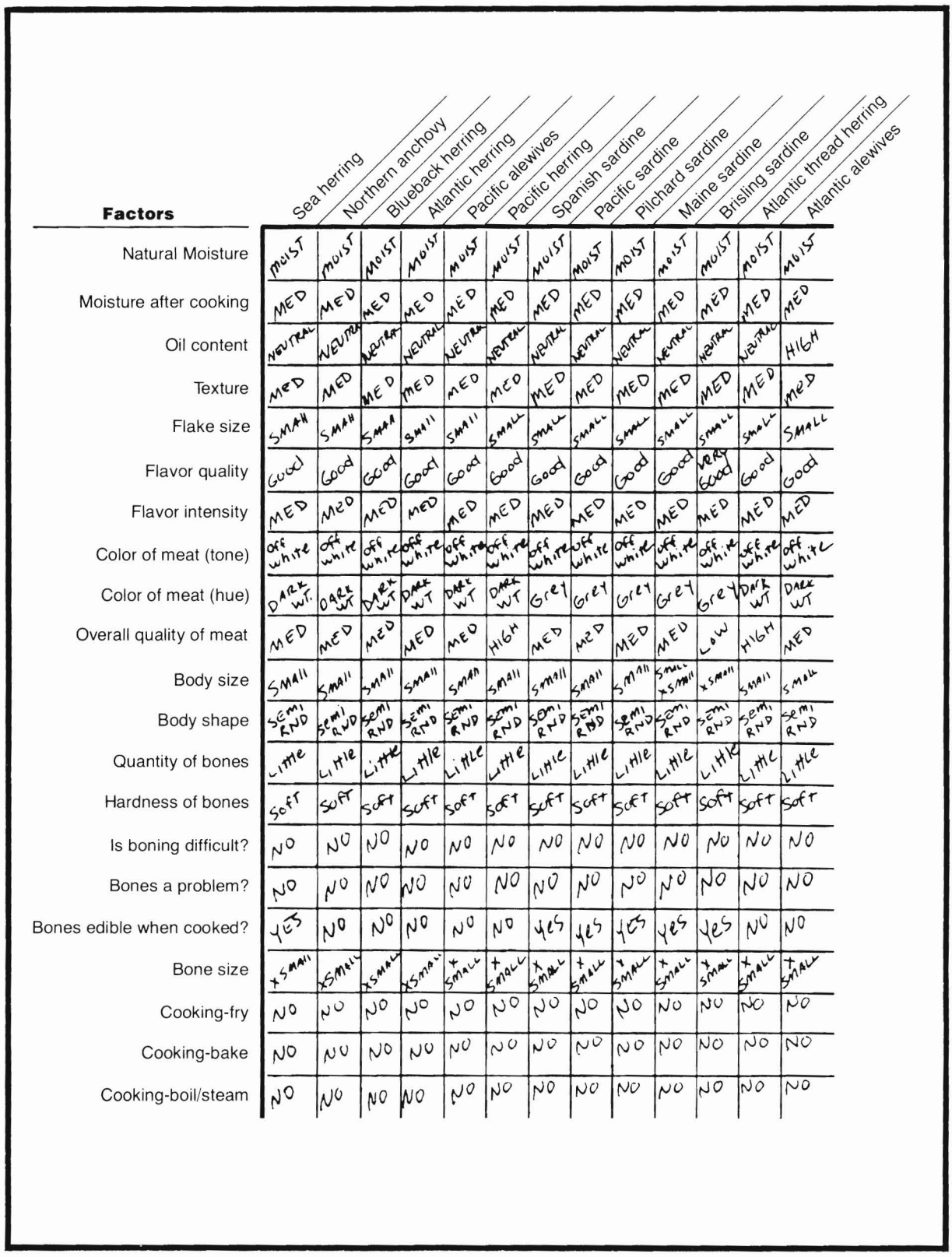


Figure 4.—Fish factor matrix—a basis for sorting.

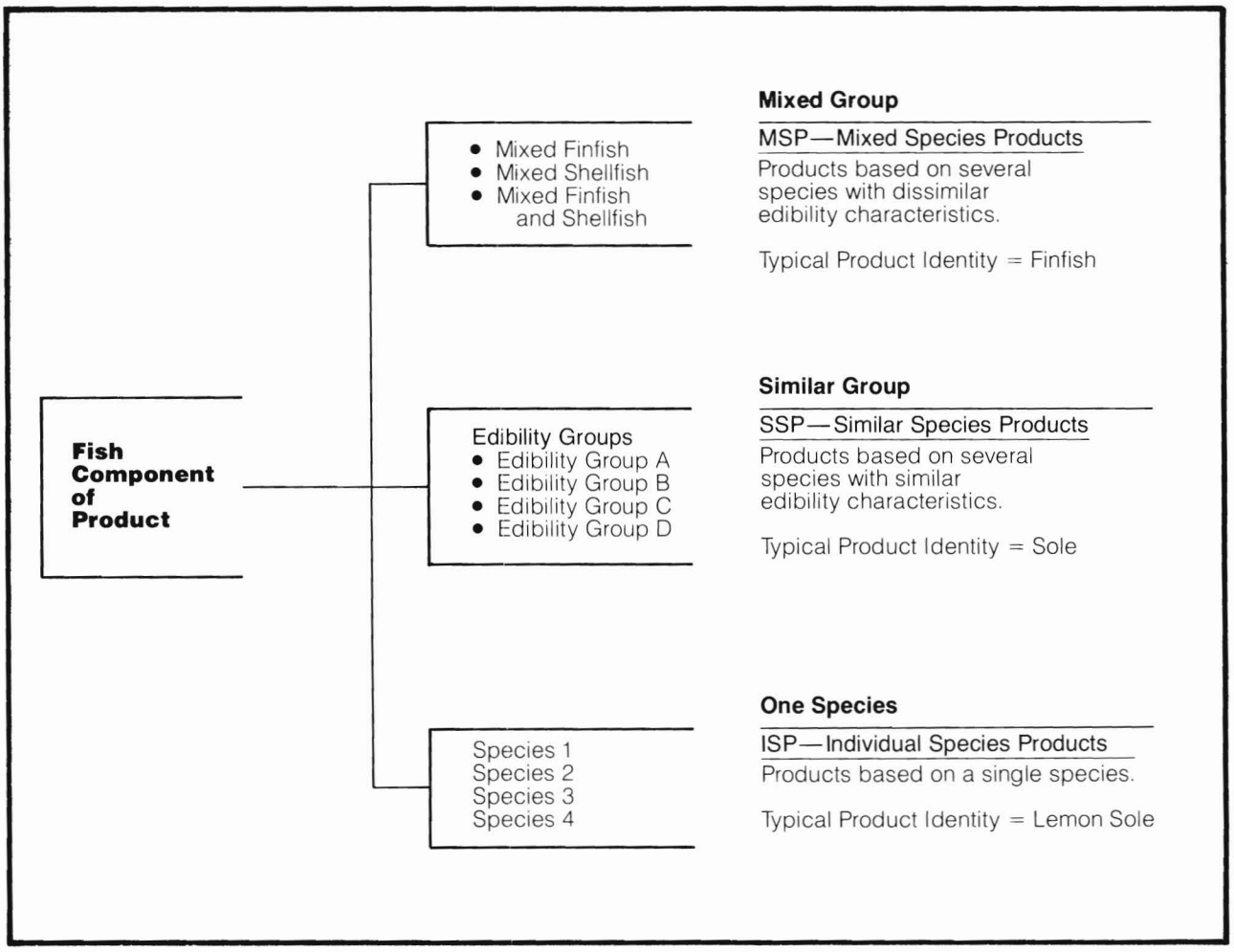


Figure 5.—Three-tier identity framework based on the mix of product and edibility characteristics.

common name of a single fish approach.

Under the experimental model, Tier I would include products made from one fish or one species, a pattern which closely resembles that of the existing common name approach. With this model, precise identification of individual fish is possible.

Tier II would identify products which contain meat from fish within a similar group. Fish within this group are basically similar in sensory properties. Each separate group would have a different name and the total number of groups would be limited to 20 or 25 (Britt[5]).

Tier III products would contain fish of more than one group (dissimilar) and be identified by an appropriate generic term. The number of generic terms would, of necessity, be kept small. Other regulatory requirements would be met by including in the label ingredient information about the mixture if determined to be necessary.

Edible differences among species tend to average out and become less important when going from the Tier I to the Tier III level. Differences among individual species are most important at the Tier I level and relatively unimportant at the Tier III level.

An added economic benefit to the industry became apparent early in the study since packaging inventory requirements would be reduced and brought into better control under this new scheme. The nature of the seafood industry often presents itself with species of fish that temporarily become unavailable because of bad weather at sea, foreign upheavals, reduced fishing quotas, and unavoidable environmental accidents. Using a grouping concept would eliminate the need for a multitude of single species labels and packages that now exist under present common or

[5]Britt, S. H. 1975. School of Marketing, Northwestern University, Evanston, Ill. Pers. commun.

usual name regulations.

Product forms and modifiers were also considered in the initial phase of study since their terminology related to a particular class of information about fishery products (Fig. 6). Product identification can be related to a combination of elements from three structured groups of nomenclature: Species, product forms, and their modifiers (Fig. 6). We can then begin to align common names with properties of the fish which relate to their food qualities.

The matrix of this system is flexible enough to encompass every type and variation of fishery product while simple enough to be learned and used easily and quickly. We view the results of this research in the following forms.

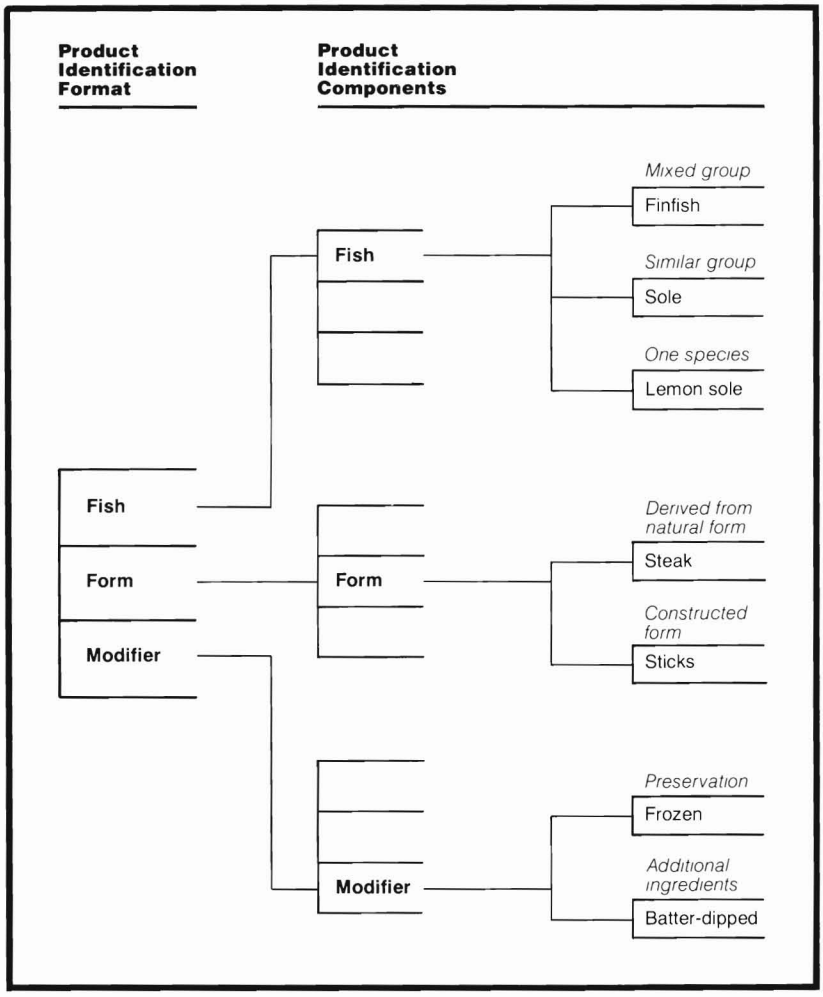


Figure 6.—Product identification components.

A. Benefits for Consumers:
1. Makes shopping for seafood species and products easier.
2. Provides useful information.
3. Chances of satisfaction with a purchase are increased.
4. Opens up many more choices and alternatives.
5. Simplifies understanding of preparatory methods.
6. Implementation of a seafood identification system will provide consumers with a system that will significantly increase the use of aquatic species as a primary source of food.

B. Benefits for Industry:
1. Enables industry to provide alternative species, when necessary, which reduces pressure on stocks of familiar fish.
2. Simplifies quality control, import and export specifications, and compliance with government regulations.
3. Reduces regulatory restrictions and improves relations with those agencies.
4. Simplifies the introduction and marketing of new species and products.
5. Reduces inconsistencies and confusion in industry communications and labeling; and saves time and costs.
6. Helps enhance a positive public image for the industry.
7. Enables the seafood industry to compete more effectively with other food industries for consumer dollars.
8. Problems are eased for retailers who can provide better information to shoppers, for stock clerks, and for buyers and brokers in ordering and shipping.

C. Benefits for Regulatory Agencies:
1. Having a comprehensive system and guidelines simplifies the regulatory process.
2. Helps clarify labeling issues that are currently confused and provides a basis for improvement in key aspects of legislation/regulations.
3. Provides a model for product identification in other categories.

Each section of the identification system will have a distinct series of nomenclature associated with it. For example, a set of "market names" will be developed to identify "individual species" of fish. Each element of nomenclature will have to be clearly defined and guidelines provided to standardize its use. Clear definition and consistency in application will resolve many of the problems which currently exist.

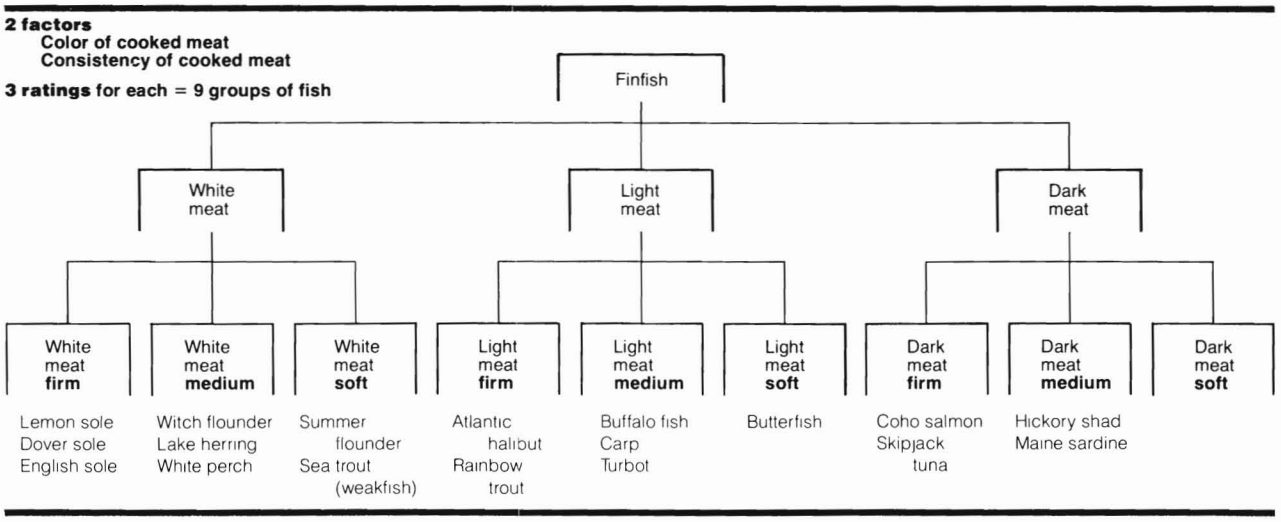


Figure 7.—Color and texture factor complex.

1. **Are bones a problem?**
   ( ) Yes
   ( ) Sometimes (Depends on product use)
   ( ) No
2. **Is the fish difficult to bone?**
   ( ) Very
   ( ) Somewhat
   ( ) Not very
3. **Are the bones edible after cooking?**
   ( ) Yes
   ( ) Depends on process
   ( ) No
4. **How many bones are present?**
   ( ) Few
   ( ) Medium
   ( ) Many
5. **How large are the bones?**
   ( ) Very small
   ( ) Small
   ( ) Medium small
   ( ) Medium
   ( ) Medium large
)) Large
6. **How hard are the bones?**
   ( ) Soft
   ( ) Medium
   ( ) Hard

Figure 8.—Bone factor complex.

When completed, the identification system will provide a simple and effective method of product identification and labeling. Detailed guidelines for use will be provided to the industry.

To quote from tradition: "There's no such fish as scrod in the ocean." Scrod was dreamed up by a Boston maitre d'. He was determined to serve the freshest daily catch from returning schooners, but it was anybody's guess which fish would find itself on the top of the hold after the boats had been out 10 days—cod, haddock or pollock. Since menus were printed a day in advance, "scrod" was coined to make sure the very best from the latest catch was served.

NMFS, in its role of providing technical and marketing assistance to the fishery industry and conducting consumer education programs, proposed to organize and coordinate an effort to clarify existing marketing nomenclature and provide improved procedures for establishment or change of seafood naming. If successful, this effort would expand the use of underutilized resources from the sea and reduce market impediments to future industry growth (Federal Register, 1973). In public response to this NMFS proposal, consumers across the nation overwhelmingly agreed (Federal Register, 1974; USDC, 1974a). This current research study by the NMFS may place the market name as the official common or usual name for future labeling consideration.

Materials and Methods

The Commerce Department's National Marine Fisheries Service (NMFS) proposed to organize and clarify existing nomenclature and provide a system for the establishment or changing of nomenclature (Federal Register, 1974) by:

1) Developing a basic set of principles for product identification.

2) Constructing and evaluating a model system.

3) Designating a format for presenting names in an organized manner.

4) Preparing procedural and implementing plans to make a system operational.

A feasibility study was conducted by the Brand Group, Inc.[6], a consulting organization specializing in planning, design, and marketing, under U.S. Government Contract 4-36730 (USDC, 1974b). To understand the scope of the problem required a comprehensive look at the industry, its structure, marketing practices, the consumer, and the regulatory environment. Exploratory interviews were conducted by the contractor with NMFS and FDA personnel, industry representatives, scientists, and consumers. Survey questionnaires, bibliographic searches, past regulatory decisions and focus group sessions were used to gather a preliminary base of information.

The research suggested that efficient sorting of this mass of information involved development of a comprehensive

[6]Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

Product Form Definitions

Whole fish: Fish as captured, ungutted.

Headed: Fish from which the heads have been cut or broken off.

Drawn: Marketed with only the entrails removed.

Drawn and headed: Drawn fish from which the heads have been cut or broken off.

Dressed: Drawn and headed fish with scales, fins, and tails removed.

Fillets: Strips of flesh cut parallel to the central bone of the fish and from which fins, main bones and sometimes belly flap have been removed; presented with or without skin.

Butterfly fillets: Flesh cut from both sides of the same fish, the two pieces remaining joined together along the belly or back.

Fillet sticks: Uniform rectangular sticks of fish cut from frozen white fish fillets.

Fillet portions: A piece of fillet cut to reasonable size for the individual for retail sale.

Steaks: Cross-section slices from large, dressed fish.

Steak portions: A piece of steak cut to a reasonable size for the individual for retail sale.

Chunks: Cross-section of large, dressed fish either including a cross-section of the backbone or cut to convenient sized pieces.

Flakes: Cross-section of large, dressed fish cut into smaller pieces than the chunk style.

Minced: Minced, shredded, or grated flesh of uniform size and texture.

Paste: Fish flesh ground to a fine consistency.

Servings: Rectangular "portions" formed to convenient individual sized pieces, formed from fillet blocks or minced flesh.

Sticks: Term used alone designates fish sticks made from either fillet blocks or minced flesh.

Figure 9.—Standardized definitions of product forms.

	Made from one fish	Made from similar group	Made from mixed group
Fresh	Red snapper		
	Fillets		
	Fresh		
Frozen	Rainbow trout	Shrimp	Ocean fish
	Butterfly fillets	Sticks	Sticks
	IQF	Breaded and cooked	Breaded and cooked
Canned	Brisling sardines	Codfish	Shellfish
	Fillets	Dumplings	Bisque
	Packed in oil—salt added	With potatoes and peas	In heavy broth
Cured	Atlantic cod	Tuna	Seafood
	Steaks	Sausage	Wieners
	Smoked		
Dehyd.	Bigeye scad	Whitefish	Fish
	Gutted and headed	Meal	Flour
	Sun dried		

Figure 10.—Examples of product identification.

factor list. Figures 7 and 8 indicate the complex nature of dealing with all but three of those factors: Color, texture, and bones, respectively. A computer program was developed to assist in the organization of similarities among these large numbers of independent bits of information. The sorting had to become automatic and objective. Factor list questions were derived from the interviews conducted as mentioned earlier and these results were incorporated into a fish/factor matrix for further analysis (Fig. 4). To relate these factors to the list of fish, many individuals experienced in the seafood industry were interviewed and an experimental matrix of 43 factors and 122 fish easily fell into natural groupings when related to the matrix criteria; other fish judged by the same set of factors were more difficult to distinguish. By more careful factor analysis, however, they too could be sorted effectively. These early results indicated that the factor list had to be more carefully analyzed, delineated, and weighted for relative importance.

A set of 12 base terms was established for the "form" that identifies most seafood products: Whole, headed, drawn, dressed, fillet, steak, chunks, flakes, minced, paste, servings, and sticks. A basic standardized definition list was developed (Fig. 9) and applied schematically (Fig. 10). All this information is essential; any more would probably be unnecessary in the product name while any less would leave out important data.

This research also extracted from relevant reference sources (International Congress of Zoology, 1964; OECD, 1968; Jordan and Evermann, 1969; USDC, 1978a; Robins et al., 1980) all that could be found on the: 1) Common name; 2) alternate common name; 3) common name reference sources; 4) common name historical data; 5) common name geographic usage; 6) common name dates of origin and use; 7) scientific name; 8) scientific name reference sources; and 9) scientific name modifiers. The data was stored in computer banks for easy cross reference, additions, deletions, and a variety of other useful search and sort operations. Since no single comprehensive list of useful names exists at present, these data may speed the future development of an official list of common names.

The conclusions from this exploratory phase of the research indicated that:

1) A comprehensive factor list was possible to develop, but had to be further refined; 2) a matrix had to be developed to relate the factors to food fish and establish tentative standards of comparison; 3) a procedure had to be established for automatic sorting of food fish into groupings; and 4) a structure had to be developed to administer, maintain, police, and operate the proposed nomenclature program (Anonymous, 1975a).

A prototype identification plan could be developed from this data base and a system designed to assure proper nomenclature responses for the future. This proposed reorganization of common names would provide direction for improving the problem at a phased-in pace, reduce the burden of dealing with so many names and develop a framework for administrative decision making (Anonymous, 1975a, b).

Upon acceptance of this feasibility study, the National Marine Fisheries Service moved into phase I of a long range program to put into place a system to 1) develop a data bank related to the edible characteristics of seafood species; 2) analyze the data bank to determine species that have similar characteristics; 3) develop a model identification plan that is based on communicating edible characteristics; and 4) review the model plan with an independent panel of experts to identify ways to implement the plan most effectively, under U.S. contract 6-35338 (USDC, 1978b).

In December of 1976, a factor list mail survey questionnaire was sent to user groups to better identify the edible characteristics of commercial aquatic species. A typical page from this part of the research is shown in Figure 11. Instructions to recipients stated "our primary concern is with characteristics that are natural to the species (such as taste, texture, etc.) and with outside factors that may affect these characteristics. In addition, we are concerned with how aquatic species are processed, purchased, and prepared. We are trying to look at these characteristics and factors from the viewpoint of the consumer. In this study, we are not interested in such things as price and value, but rather in factors that are natural and predictable, and have to do with their edibility" (Anonymous, 1976).

The specific research objectives were to: 1) Identify those species most important to a model retail identification plan; 2) identify those edible characteristics factors that are significant; 3) determine the priorities and relative importance of these factors; and 4) develop a model based on key factors to demonstrate how effective species identification can be accomplished.

The survey questionnaire (page example, Fig. 11) was mailed to 760 prospects who represented a cross-section of the seafood industry, Federal and state agencies, educational institutions, and appropriate miscellaneous groups. The 159 completed and returned questionnaires constituted the first analytical phase of the study.

Factors were rated by respondents on a 5 (very important) to 0 (not important at all) scale. The questionnaire also obtained a list of species that were commercially relevant and a commitment by a respondent to rate those he was most familiar with, relative to edibility characteristics, on future surveys. Data were collected and computerized for mean rating of factors and priority ranking of species.

The original determination of potential edible characteristics that should be profiled was developed under contract 4-36730 (USDC, 1974b). The objective of this next phase of the research was to qualify those factors and expand them if enough members of the survey so indicated.

It was determined that the criteria for including a species in further research would be 1) a minimum of 10 percent of the respondents stating that it should be included and 2) a minimum of five respondents stating that they could rate the species for their edible characteristics.

Out of an initial listing of 187 species, 153 met both the characteristics and factors that were common and/or specific to finfish and shellfish, and which could be grouped into major categories. Respondents were also asked to add other characteristics and factors under each category. The initial findings are presented in Table 1. A detailed analysis of the responses was made to assess the inclusion and/or deletion of factors based on frequency of response. It was determined that a majority of the factors added by respondents fell into two categories:

Table 1.—Number of species initially on questionnaire and the number added by respondents.

Factor category	No. of species originally on questionnaire	No. of species added by respondents	Total[1]
External characteristics of the species (i.e., anatomical)	10	83	93
Internal characteristics of the species	16	48	64
Environmental factors that affect edible characteristics	7	38	45
Processing factors: Conditions imposed by industry processing	3	47	50
Preparation factors: Related to consumer purchase, preparation, and serving	4	23	27
	40	239	279

[1]Totals include factors that are specific to finfish and shellfish and factors that are common to both.

1) They were redundant, i.e., the same as or similar to factors originally listed on the questionnaire.

2) They were not characteristics of the species, and therefore would not fit into the profile.

The significance of the original list of factors selected for inclusion in the questionnaire is demonstrated by the attention given to their ratings by respondents, i.e., 1) of the 159 respondents who rated any factor, 152 (95 percent) rated over 70 percent of the original list of factors; 2) 137 respondents (86 percent) rated 100 percent of the original list; and 3) no more than 12 respondents (8 percent) rated any single write-in factor.

Respondents rated 40 original edibility factors on a 5 (very important) to 0 (not important at all) scale. The remaining factors, including those that respondents wrote in, were then subjected to an analysis of the "importance" ratings

Please rate each of the following items using the scales for both finfish and shellfish.

You may ask yourself, "How important is each item in terms of purchasing, preparing or eating finfish or shellfish?"

Please indicate your opinion by circling one number on each scale. If you wish to express no opinion, circle "X".

Please use these ratings for finfish								**Please use these ratings for shellfish**						
Very important					**Not important at all**	**No opinion**		**Very important**					**Not important at all**	**No opinion**
5	4	3	2	1	0	X_8	EXTERNAL CHARACTERISTICS OF THE SPECIES	5	4	3	2	1	0	X_{16}
5	4	3	2	1	0	X_9	Color and markings on the body	5	4	3	2	1	0	X_{17}
5	4	3	2	1	0	X_{10}	General body shape (i.e., shapes of eel vs. flounder vs. sea bass vs. lobster)	5	4	3	2	1	0	X_{18}
5	4	3	2	1	0	X_{11}	Characteristic anatomical features (i.e., barbels, fins, type of jaw, etc.)	5	4	3	2	1	0	X_{19}
5	4	3	2	1	0	X_{12}	Overall average size of the species	5	4	3	2	1	0	X_{20}
5	4	3	2	1	0	X_{13}	Size of the scales on the species (when marketed whole)	Not applicable						
5	4	3	2	1	0	X_{14}	Number of the scales on the species (when marketed whole)	Not applicable						
5	4	3	2	1	0	X_{15}	How difficult it is to remove scales from the species (when marketed whole)	Not applicable						
Not applicable							Configuration of the shell of the species (when marketed in the shell)	5	4	3	2	1	0	X_{21}

Figure 11.—Page example of survey questionnaire.

OMB Approval
#41-S77048
Expires December, 1978
BF#1606

Edibility Profile for Commercial Aquatic Species

1606
1-4
5-7

Please check one.

finfish ☐ shellfish ☐ other ☐

Please fill in the common name and scientific name of the species you are rating on this form. Include any alternative names in common use.

Common Name _____

Alternate Common Names _____

_____

Scientific Name _____

Alternate Scientific Names _____

_____

In the following sections, please check the box in each row that most represents the characteristics of this species. ☐☐☐ 8 9 10

1 Characteristics of the Meat

In this section we are interested in the characteristic edible qualities of the meat of individual species of finfish and shellfish. Assume the meat is fresh and clean; that it has been properly handled and prepared; and, in evaluating the flavor, only consider the natural flavor of the species and not of any sauces or seasonings that may be used in the preparation.

CHARACTERISTIC FLAVOR AND TEXTURE OF THE MEAT

Flavor of the meat (intensity)	mild ☐☐☐☐☐	strong	11
Flavor of the meat	not unique & distinctive ☐☐☐☐☐	unique & distinctive	12
Flavor of the meat	not sweet ☐☐☐☐☐	sweet	13
Flavor of the meat	not sharp ☐☐☐☐☐	sharp	14
Flavor of the meat	not salty ☐☐☐☐☐	salty	15
Texture of the meat	mushy ☐☐☐☐☐	firm	16
Texture of the meat	not flakey ☐☐☐☐☐	flakey	17
Texture of the meat	smooth ☐☐☐☐☐	coarse	18
Moisture content	dry ☐☐☐☐☐	moist	19
Fat content	not fatty ☐☐☐☐☐	fatty	20

CHARACTERISTIC ODOR OF THE MEAT

Characteristic odor before cooking	mild ☐☐☐☐☐	strong	21
Characteristic odor after cooking	mild ☐☐☐☐☐	strong	22
Characteristic odor before cooking	not unique & distinctive ☐☐☐☐☐	unique & distinctive	23
Characteristic odor after cooking	not unique & distinctive ☐☐☐☐☐	unique & distinctive	24
Tendency to smell "fishy" before cooking	not "fishy" ☐☐☐☐☐	very "fishy"	25
Tendency to smell "fishy" after cooking	not "fishy" ☐☐☐☐☐	very "fishy"	26

CHARACTERISTIC COLOR OF THE MEAT

Color of the meat before cooking	white ☐☐☐☐☐	brown or grey	27
	pinkish ☐☐☐☐☐	red	28
Color of the meat after cooking	white ☐☐☐☐☐	brown or grey	29
	pinkish ☐☐☐☐☐	red	30
Shade of the meat before cooking	light ☐☐☐☐☐	dark	31
Shade of the meat after cooking	light ☐☐☐☐☐	dark	32
Uniformity of the color	uniform ☐☐☐☐☐	mottled, veined, etc.	33

OVERALL QUALITY

Overall quality of the meat	poor ☐☐☐☐☐	excellent	34
Overall quality of the flavor	poor ☐☐☐☐☐	excellent	35
Overall quality of the texture	poor ☐☐☐☐☐	excellent	36
Overall quality of the odor	poor ☐☐☐☐☐	excellent	37

Figure 12.—Page example of individual species rating questionnaire.

Table 2.—Major survey findings for finfish.

Factor category	Number of factors in each range of importance ratings			
	1.00-1.99	2.00-2.99	3.00-3.99	4.00-5.00
External (physical appearance)	2	3	2	
Eating characteristics			9	7
Environmental (effects on edibility)	1	5	1	
Processing			3	
Preparing (serving by consumer)		1	3	

Table 3.—Major findings for shellfish.

Factor category	Number of factors in each range of importance ratings			
	1.00-1.99	2.00-2.99	3.00-3.99	4.00-5.00
External	1	3	3	
Internal		1	6	4
Environmental	1	4	1	1
Processing			2	
Preparing		1	3	

given to them by respondents. The purpose here was to establish a ranking of factors and/or categories relative to profiling edible characteristics. The major findings for finfish are given in Table 2 and the primary findings for shellfish are listed in Table 3.

Research among seafood specialists and consumers indicates that the following are the most important factors: 1) Intensity of flavor, 2) flakiness of the meat (after cooking), 3) fat content, 4) firmness of the meat (after cooking), 5) natural odor of the meat when raw and fresh, 6) coarseness of the meat, 7) color of the meat (after cooking), and 8) moistness of the meat (after cooking).

These findings make it obvious that the seafood industry considers the "consumer-related" factors of organoleptic characteristics (i. e., the nature of the meat of the species) and preparing and serving considerations the most important in compiling a profile of individual species as the basis for comparison, and as the basis for a potential identification system.

These data reinforced the findings of additional qualitative focus group research conducted with consumers, which revealed that internal characteristics and preparation factors were their most important concerns also.

As a result, the number of factors in the second industry mail survey were reduced from 55 to 8. Flavor, fat content (after cooking), odor, color, flakiness, moisture, firmness, and coarseness were considered to represent the most perceptible differences, and to offer the most fundamental information to the consumer.

In summary, this phase of the research filled in gaps relative to species and characteristics for further study, and prioritized critical areas for more effective structuring of a meaningful edibility profile.

The next mail survey carried us to the respondents who indicated that they would be willing to individually rate certain species based on each of the selected factors. The second study (Fig. 12) (Anonymous, 1977), was based on 297 species and 870 questionnaires completed by 245 respondents. The objective was to gather data from 3-5 different respondents for each species and determine a mean rating for each factor to use for sorting studies.

A visual profile (Fig. 13) has been developed for each of the 158 species rated in the study. This graphic representation could also be used in future consumer education programs (USDC, 1978b).

Edibility profiles provide a consistent basis for comparing the edible characteristics of the sample species. In addition, they provide a great deal of useful information to consumers. Knowing the edibility profile for a fish can reduce the fear of trying new and unfamiliar seafood species and products. This is information that is not currently available for selecting edible species.

The edibility profiles were then compared to determine which species had similar patterns of edible characteristics so a determination could be made on an objective method of organizing species into distinct groups. Seven studies, using computer analysis, were conducted to determine this grouping.

Edibility characteristics for shellfish were included in some of the early studies. This helped to confirm that, although shellfish and finfish can be com-

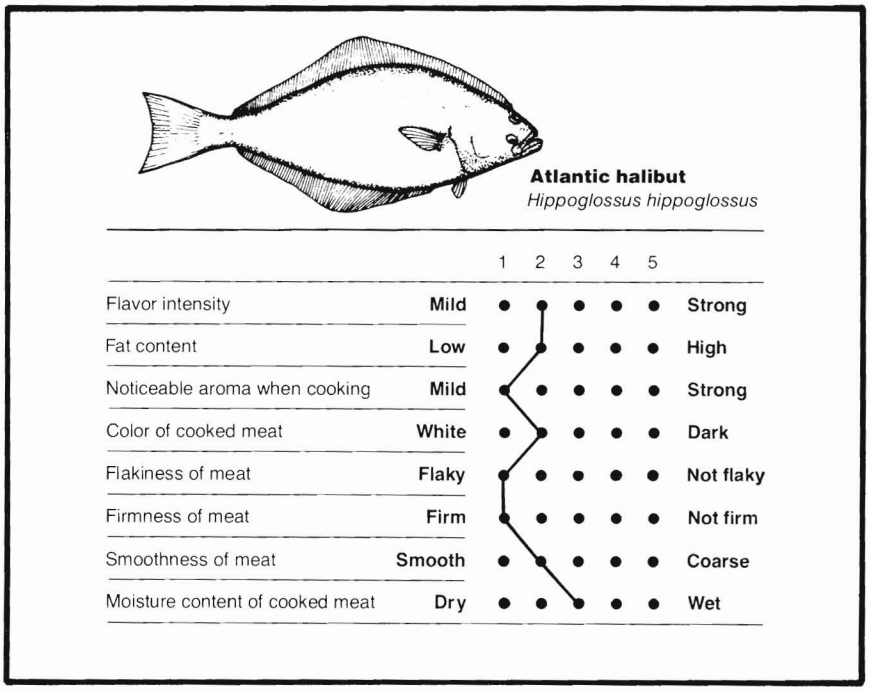


Figure 13.—A typical edibility profile.

pared on some factors, each represents a different kind of eating experience and should be classified separately. Later studies were confined to finfish.

In earlier studies, various combinations of up to 40 factors were tried. In later studies, edibility profiles based on eight factors and a 5-point rating scale were determined to be a more convenient, effective basis of comparison for the 123 species of finfish used in the model.

Different factor-weighting strategies were explored in the analysis. In one set of studies, all factors were weighted equally. In others, various priorities of factors were tried. Based on these studies, the following observations were made:

1) Changes in weighting strategies affected the clarity of groupings without producing serious changes in the placement of species in groups.

2) Changes in the number of species used affected where fish were placed as relationships became available or were removed.

3) Excluding anatomical features (i.e., bones, body shape, etc.) from early studies caused almost all correlations with zoological groupings to disappear.

4) Reduction of the number of factors from 40 to 8 produced greater clarity without radically affecting the general groupings produced by the factors.

5) A wide variety of edible profile patterns exist among species when they are compared on the basis of multiple (8) equally weighted factors. This results in a great number of small groups being formed, each of which has a different profile for the eight factors.

6) Strong weighting of certain factors resulted in fish being sorted into groups that were similar to groups formed on the basis of equally weighted factors, but which were easier to adapt to a simple organizational framework.

In the final studies, these eight factors were given a geometric progression of weights in the following order: Flavor, 8; Flakiness, 8; Fat, 4; Firmness, 4; Odor, 2; Moistness, 2; Color, 1; Coarseness, 1.

With this assigned geometric progression of weights, sets were divided along lines established by the first two (highest weighted) factors: Flavor and Flakiness. Subgroups were determined by each subsequent pair of factors, according to the weighting assigned.

These studies showed that establishing factor priorities is a necessity. The factor sorting approach produced results that are far easier to communicate to consumers. In addition, by using this approach, species can be classified without the need for computer processes.

A framework now had to be built around the data that had been accumulated so it could be handled effectively. To develop an identification system that included all eight factors and a 5-point rating scale would require an array of almost 400,000 separate groups. A more practical approach led to a selection of a pair of key factors as a primary basis for determining groups of similar species. A pair of factors based on a five-point rating system provided a framework with 25 manageable groups. Two factors are adequate at the similar species level (Tier II) for product identification and two factors can be communicated in simple visual diagrams. This is extremely important in communicating with consumers through pamphlets, handbooks, and posters which will help explain the product identification system.

Figure 14 describes the framework developed for the Tier II level. It is based on "Comparative Edibility." Each block represents a category of finfish that are

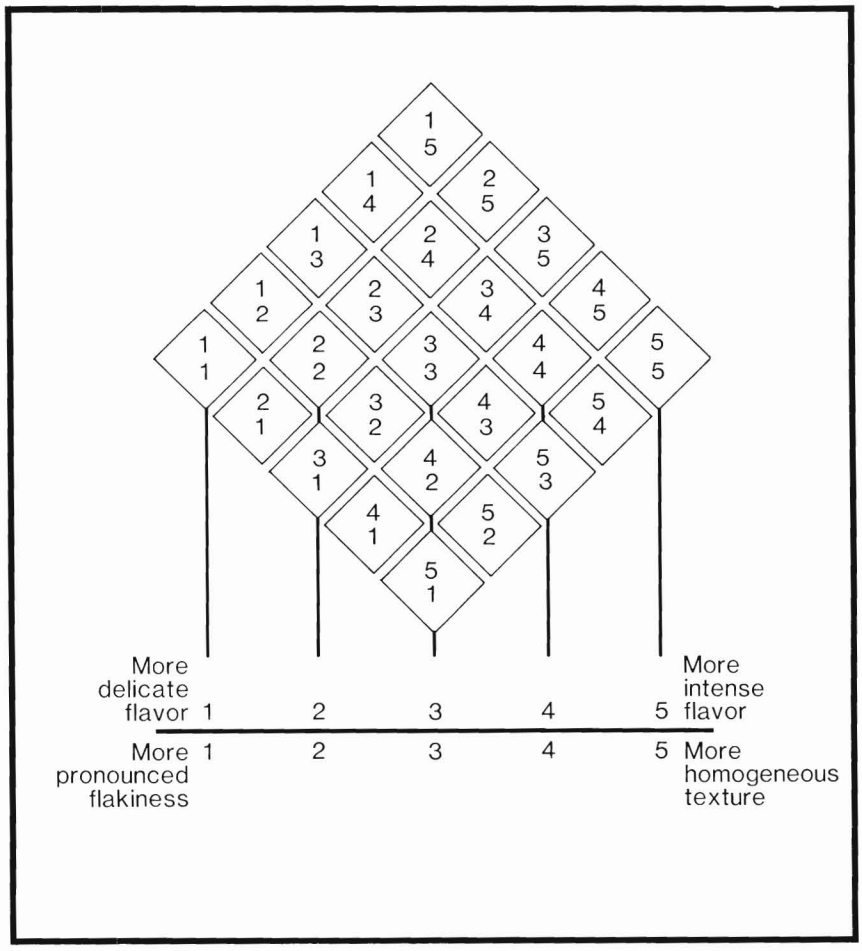


Figure 14.—Edibility framework for finfish based on two most important factors.

similar for two key factors. The numbers in each block represent the ratings for the pair of factors. All finfish species that have identical ratings for the pair of factors will be located in the same block. One block is provided for each combination, whether or not there are any commercially marketed fish that have the combination of characteristics. Thus, a place is maintained for future classification of any species which is not now marketed.

The blocks and the framework are arranged along a horizontal line, drawn from left to right and having a range from 1 to 5. The blocks are arranged so that the values for both factors rise when reading from left to right. When reading from top to bottom or bottom to top, the value of one factor drops while the other rises. Vertically, the sum of the values are equal. The three blocks having the values of 5/3, 4/4, and 3/5 each add up to a value of 8, but remain distinct from one another in the framework. This provides a scale which, reading from left to right, progresses evenly from one extreme of the rating scale (1/1) to the other (5/5).

Using this framework, all fish can be classified into the 25 primary groups by the following method:

1) Two edibility factors are chosen as the basis for comparison.

2) For each fish, a standard rating is determined on a scale from 1 to 5 for each of the two factors.

3) On the basis of these ratings, the fish is assigned to the appropriate group.

Flexibility has also been included in this system that will allow subcategorization within any block if it should become overburdened with a large number of fish. Each of the 25 groups can be "magnified" independently to include an additional pair of edibility factors which would yield as many as 25 additional subgroups and thus further refine the sorting process.

As in all organizations of this type, some priorities must be established and a determination made as to which pair of factors will be considered primary. Consumers and industry provided the following factor priorities derived from the focus groups and questionnaires.

(1) First Priority Factors
Flavor
Flakiness

(2) Second Priority Factors
Fat
Firmness

(3) Third Priority Factors
Odor
Coarseness

(4) Fourth Priority Factors
Color
Moisture

Trial runs at this point in the program yielded the following observations: 1) There are a great variety of edible profiles, 2) there is no direct correlation with zoological categories, 3) there is little relationship between edibility factors, and 4) the majority of species consumed in the United States tend to cluster around the mild and flaky area of the design. Only a few are near the extremes of strong tasting and nonflaky meat.

To gain broader acceptance and review of the research effort to this point, the NMFS published in the Federal Register (Federal Register, 1978; Anonymous, 1978b) the availability of the Model Retail Identification Plan for public comment. NMFS asked the following six basic questions:

1) Is the model identification plan a logical approach for the construction of a complete identification system for finfish and products therefrom?

2) Are the edibility factors (8) identified in the model plan the most significant and useful in determining product edibility? Are they too numerous or too few? And are they listed in the appropriate order or priority?

3) Should objective methods be used to measure the edibility factors quantitatively?

4) Should NMFS proceed to develop fully and implement a new seafood identification system, based upon a comprehensive data bank of edibility characteristics for a seafood species?

5) Should NMFS develop guidelines and procedures for interim changes in existing nomenclature?

6) Should NMFS develop interim marketing directions?

More than 1,000 requests were received for the study and 80 percent of the public response enthusiastically supported the effort and urged continuation of the research (Brooker, 1979). International support was also received through the Food and Agriculture Organization (FAO) of the United Nations (Krone[7]).

The Food and Drug Administration, in their response to the Federal Register release, still maintained "serious reservations" about the nomenclature system (Anonymous, 1978c; Randolph[8]). The news media was quick to pick up this unique development also (Kramer, 1978a,b,c; Steinman, 1978; Gordon, 1979; Heurdejs, 1979; Miller, 1980a,b). The importance of the program was also emphasized by the Department of Commerce's National Oceanic and Atmospheric Administration when, in a policy and program statement, it said "NOAA will accelerate and complete its work on fish nomenclature to assist the industry and the U.S. consumer. When completed, this work will provide comprehensive information on the edibility characteristics of fish, particularly nontraditional species, so that distributors and consumers can make better use of available fish protein from U.S. domestic fishing efforts" (Anonymous, 1979b).

Responding to question three from public comment concerning the need for objective methods to measure the edibility factors quantitatively, the NMFS awarded a research contract (No. 01-8-M01-6320, January 1979) to Natick Laboratories, Natick, Mass. The objectives of this project were to 1) develop and evaluate standardized subjective and objective methods for assessing the edibility of fish products and 2) evaluate a correspondence between instrumental and sensory indices of edibility so that

[7]Krone, W. 1978. Model retail identification plan for seafood species. FD 52/1.1. FAO, Rome, Italy. Pers. commun.

[8]Randolph, W. F., 1978. Department of Health, Service, U.S. Food and Drug Administration, Rockville, Md. Pers. commun.

TEXTURE PROFILE BALLOT FOR FIN FISH

DATE:_____

PANELIST:_____

		SAMPLES				
		A	B	C	D	E
FIRST BITE	Hardness					
	Flakiness (tongue against palate)					
MASTICATION	Chewiness					
	Fibrousness					
	Moistness					
	Cohesiveness of mass (at 10 chews)					
	Adhesiveness					
RESIDUALS	Oily mouthcoating					
	Astringent-like mouthcoating					
COLOR	Lightness: Skin side					
	Skeleton side					
	Uniformity of lightness: Skin side					
	Skeleton side					

Figure 15.—Texture profile ballot for finfish.

fish species can be grouped according to their similarities.

The sensory methods included an expert flavor profile panel, a texture profile panel, and consumer panels. The objective methods included Instron (texture) and gas chromatography-mass spectrometry (flavor) measurements. Sensory scaling data were obtained using the method of magnitude estimation. These data were submitted to multidimensional scaling analysis. Advantages of these techniques are: 1) They do not require a specific reference species, 2) they provide ratio data for comparison with objective measure, 3) they result in data that can be summarized in a graphical format, and 4) the magnitude of similarity or difference between species can be statistically tested (King et al., 1979).

For each species selected, analysis was based on fish in the fresh state (ice chilled for 48 hours after harvest). Cooked fish samples were evaluated based on procedure 18.0036 of the Association of Official Analytical Chemists (boil-in-bag) (AOAC, 1980). Cooking time periods for the various thicknesses of fish were established from heat penetration measurements in order to cook all samples uniformly and provide reproducibility from batch to batch. Both trained and consumer panels were used for sensory evaluation. Sensory evaluation of texture (Fig. 15) was based on the General Foods Texture profile method (Civille and Liska, 1975; Civille and Szczesniak, 1973).

Instrumental texture measurements were based on an Instron tester using uniaxial compression to 60 percent of the fish sample's original thickness (Johnson et al., 1980b).

To compensate for lack of parallelism and surface flatness, because the boil-in-bag method distorts the fillets to a point where no suitable flat surface can be found, a swivel-head compression plate was mounted on the moving cross-head of the Instron. Samples could then be easily cut into uniform cylinders and tested (Johnson et al., 1980a,c).

As a result instrumental and sensory methodology has been developed for the objective measurement of the edibility characteristics of finfish and applied to the grouping of underutilized species

according to their similarities in edibility characteristics. This quantitative data fine tunes the analysis that preceded the beginning of this study.

Studies of four instrumental methods for measuring texture, using compression, shear, and tension, resulted in the development of a rapid, simple procedure.

Through a unique application of the descriptive/analytic technique of texture and flavor profile analysis, combined with consumer methods of sensory evaluation, a method for evaluating the "edibility characteristics" of fish has been established. This comprehensive approach permits the evaluation of subtle, but important, textural and flavor differences over a wide range of species, using terminology that can be easily understood by consumers and which provides a basis for direct comparison of similarities and dissimilarities among species.

Using this method a data bank of sensory profiles for 17 species of fish was established. An analysis of various techniques of grouping fish was conducted, and a method based on multivariate cluster analysis was found to be both internally consistent and reliable for establishing similar and dissimilar groups. Three major edibility groups and several subgroups were identified. The results are contained in a 620-page report, referenced below.

Analytical determinations have been made on a variety of finfish fat content, color, moisture, and fatty acid composition. These data, in conjunction with sensory panel investigation of the same species indicate that fish are amenable to classification (Kapsalis and Maller, 1980).

During this same period, another unique test of the developing nomenclature scheme was begun. Anthony's Seafood Grotto Restaurant, San Diego, Calif., began developing prototype menus using edibility profiles to introduce customers to new products or unfamiliar seafood selections (Anonymous, 1979c). Early results of this project show good patron acceptance and understanding of a visual means of presenting edibility profiles.

To complete the conceptual framework of the nomenclature system, Contract NA-79SAC-00804 was issued to the Chicago-based brand identification and design consulting group, for an analysis of the "Forms" and "Modifiers" portion of the program (USDC, 1979a). This search produced a list of nearly 600 terms used in various ways in the seafood industry. These terms were then organized alphabetically, and grouped according to similarity with a dictionary-type index that provides definitions and explanations for the terms. Analysis of this bulk of information yielded the following observations (USDC, 1981):

1) There was too much semantic noise presently in the marketplace.

2) There was, on occasion, too many terms for one concept (i.e., eight different ways to say "fish with the head removed").

3) A single term that was being used in several unassociated ways.

4) Terms that have more than one spelling or structure.

5) Terms that had no clear meaning.

6) Terms where the position of words affected the meaning.

7) Terms used elsewhere in the food industry in one context, but which in the seafood industry carry a different meaning.

This basic text could be developed as one more tool to help educate consumers when the program is ready for implementation.

Results and Discussion

A major research effort has been successfully completed that lays down a scientifically sound basis for constructing a practical and effective nomenclature system for communicating highly organized information about seafoods in simple ways to users of fishery products through market names and labeling. The information to be used in constructing seafood product names is derived from qualitative and quantitive laboratory analysis of the edibility characteristics of the fish flesh, coupled with other essential information about the physical form of the product itself, how it is preserved, and the presence of other food ingredients that characterize the end product.

The results of the quantitative research phase provided information from which a "Manual of Test Methods and Procedures" has been prepared which lays down official laboratory procedures for testing fish and generating edibility data in a consistent uniform manner. It also identifies the characteristics to be tested and recommended scales for quantifying the data (USDC, 1983).

Other research results provide specific recommendations for constructing nomenclature pertaining to seafood product forms and modifiers which are major components of the seafood identity system (USDC, 1981).

This brings to a conclusion the entire research phase essential to the development of a practical and effective seafood identification system.

Future developments must address the following steps to put the new seafood identification system into place and use:

1) Develop an edibility data bank of major foods species using the established analytical methods and following an established testing protocol.

2) Develop a data management system and control documents to assure that only reliable high-quality data are used.

3) Develop a model format for communicating to users about the edibility characteristics of individual species.

4) Formalize the seafood identification system for introduction, and a management plan for its continued use and maintenance.

5) Educate consumers and all segments of the industry by publishing both a comprehensive Consumer Shopping Guide and an Industry/Retail Identification Standards Manual.

6) Implement the system nationally.

Literature Cited

Anonymous. 1947. Federal Trade Commission ruling, Commer. Fish. Rev. 9(2):65.

_____. 1975a. A plan for market names of fishery products–executive summary. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., 17 September, 1975.

_____. 1975b. Consumers are at sea about fish; names meaning food are suggested. Natl. Provisioner, 19 April.

_____. 1976. Seafood industry survey on the comparison of edible finfish, crustaceans and mollusks. OMB Approval No. 41-576087. The Brand Group, Chicago, Ill.

_____. 1977. Edibility profile survey for commercial aquatic species. OMB Approval No. 41-577048 (BF No. 1606). The Brand

Group, Chicago, Ill.
_____. 1978b. FDA to seek input to NMFS common names for seafood. Food Chem. News 20(32):13.
_____. 1978c. FDA claims responsibility for establishing seafood names. Food Chem. News 20(39):13.
_____. 1979a. FDA asks comments on "Hake" versus "Whiting" nomenclature. Food Chem. News 20(47):28.
_____. 1979b. Toward a partnership for the development of the United States commercial fishery industry. Policy and program statement (May 23, 1979). U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Wash., D.C
_____. 1979c. New names, taste profiles aid seafood images. Food Prod Dev. 13(6):18.
AOAC. 1980. Official methods of analysis of the Association of Official Analytical Chemists. Cooking seafood products–procedure 18.003b.
Brooker, J. R. 1979. Summary and status of improved seafood nomenclature system. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Wash., D.C.
CDFG. 1974. Common names for market fish. Title 14, Sect. 103. Calif. Dep. Fish Game, Sacramento.
Campbell, C. C. R. 1979. Acceptable common names for fillets and prepared products produced from Pacific rockfish. No. 5515-10. Dep. Fish. Oceans, Insp. Technol. Branch, Ottawa, Ontario.
Civille, G. V., and I. H. Liska. 1975. Modifications and applications to foods of the general food sensory texture profile technique. J. Texture Stud. 6:19.
_____, and A. S. Szczesniak. 1973 Guidelines to training a texture profile panel. J. Texture Stud. 4:204.
Cohen, D. M. 1969. Names of fishes. Commer. Fish. Rev. 31(5):15.
Farrell, J. F. 1972. An evaluation of the effects of nomenclatural procedures for fish or fishery products on the industry and on consumers. Contrib. 1482, R. I. Agric. Exp. Stn., 75 p.
FDA. 1970. Requirements of the U.S. Food, Drug, and Cosmetic Act. U.S. Dep. Health, Educ., Welfare Publ. 2:19.
_____. 1979. Federal Food, Drug, and Cosmetic Act, as amended. U.S. Code Fed. Regulations, Title 21. U.S. Gov. Print. Off. 623-783-861, Wash., D. C.
Federal Register. 1968. Labeling of food fish of the species Reinhardtius Hippoglossoides. Fed. Regist. (33):19007.
_____. 1970. Snow crabmeat decision, 2 September 1970. Fed. Regist. 35:13880.
_____. 1973. Nomenclature of fish, shellfish, and products for purposes of marketing and labeling. Statement of interest and intent. Fed. Regist. 38:34682.
_____. 1974. Nomenclature of fish and shellfish and their products for purposes of marketing, a statement of findings. Fed. Regist. 39:20711.
_____. 1975. Common or usual names for nonstandardized foods; onion rings, seafood products and potato chips. Fed. Regist. 40:54536.
_____. 1978. Seafood species–announcement of nomenclature project. Fed. Regist. 43:46888.
_____. 1979a. Common or usual name for nonstandardized food–Merluccius Productus. Fed. Regist. 44:5901.
_____ 1979b. Common or usual name for nonstandardized food–Merluccius Productus. Fed Regist. 44:46515.
Goode, G. B. 1884. The fisheries and fishery industry of the U.S., Sect. I. U.S. Comm. Fish Fish., U S Gov. Print. Off., Wash., D.C.
Gordon, L. 1979. Gag and chips sound fishy. The Record–Bergen, Passaic, Hudson Counties, N.J., 15 Jan.
Gove, P. B. (editor). 1969. Webster's third new international dictionary of the English Language. Unabridged G. & C Merriam Co., Springfield, Mass., 2662 p.
Heurdejs, J. 1979. A bargain: Fish with funny names. Chicago Tribune, 1 Mar.
International Congress of Zoology. 1964. International code of zoological nomenclature adopted by the XV International Congress of Zoology. Int. Trust Zool Nomencl., Lond., 176 p.
Jernudd, B. H., and E. Thuan. 1980. Naming fish: Problem exploration and materials collection. Cult. Learn. Inst., East-West Cent., Honolulu, Hawaii.
Johnson, E. A., R. A Segars, J. G. Kapsalis, M. D. Normano, and M Peleg. 1980a. Evaluation of the compressive deformability modulus of fresh and cooked fish flesh. J. Food Sci. 45:1318.
_____, _____, _____, _____, and _____ 1980b. Textural variability in fish fillets. Proc. Fifth Annu. Trop. Subtrop. Fish Technol Conf Amer. Tex. A & M Univ. Publ TAMU-SE-81-101, Coll. Stn
_____, _____, _____, and M Peleg. 1980c Some rheological characteristics of fish flesh. Proc 33rd Annu Conf Eng. Med. Biol., Wash., D.C
Jordan, D. S., and B W. Evermann. 1969. American food and game fishes. Dover Publ., N.Y., 574 p.
Kapsalis, J G., and O. Maller 1980. Final report–consumer and instrumental edibility measures for grouping of fish species. Natl Mar. Fish. Serv. Contract 01-8-M01-6320. NTIS Rep. PB82-150921, Springfield, Va.
King, F. J., J G. Kapsalis, A V. Cardello, and J R. Brooker. 1979 Consumer and instrumental edibility measures for grouping of fish species. Int. Conf Fish Sci. Technol Torry Res. Stn., Aberdeen, Scotl.
Kramer, L. 1978a. U.S. pays $65,000 for a fishy story. Chicago Sun Times, 30 Dec
_____ 1978b. A fish is a fish is a . . Wash. Post, 30 Dec.
_____. 1978c. A fish by some other name may seem more edible. Trenton Times, 28 Dec.
Luedtke, P. 1973. Snapper's got fishermen in tempest. San Pedro, Calif., News-Pilot, 20 Mar.
Martin, R. E. (editor) 1972. Mechanical recovery and utilization of fish flesh. Oak Brook Seminar, Natl. Fish. Inst., Wash., D.C.
_____. 1974. Second technical seminar on mechanical recovery and utilization of fish flesh. Natl. Fish. Inst., Wash., D.C.
_____. 1976. Mechanically deboned fish flesh. Food Technol. 30(9):64.
_____. 1980. Third national technical seminar on mechanical recovery and utilization of fish flesh. Natl. Fish. Inst., Wash., D.C.
_____ 1981. First national conference on modified and controlled atmosphere packaging of seafood products. Natl. Fish. Inst., Wash., D.C.
Miller, G. S. 1980a. When bureaucrats cast for fish names, be prepared to wait. Wall Street J. CXCV(86):1.
_____. 1980b. What's in a name? Fish. Wash. Post 12 June, p. E1
OECD. 1968 Multilingual dictionary of fish and fish products. Organ. Econ. Cooperation Dev. Paris. G. B. Whitefriars Press, Ltd., Lond., 430 p.
Robins, C. R., R. M. Bailey, C. E. Bond, J. R. Brooker, E. A. Lachner, R. N. Lea, and W. B. Scott. 1980. A list of common and scientific names of fishes from the U.S. and Canada, 4th ed. Spec. Publ. 12, Am Fish. Soc., Bethesda, Md., 174 p.
Steiman, H. 1978. Learning to love strange fish. San Franc. Sunday Exam., 17 Dec.
USDC. 1974a. Hundreds comment on standardizing fish names. U.S. Dep Commer., NOAA News Release 74-85
_____. 1974b. Contract awarded to help plan standardization of fish names & products. U.S. Dep. Commer., NOAA News Release 74-139.
_____ 1974c. Nomenclature Workshop II. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv. Proj. 0501-4176-36730. Wash., D.C
_____. 1974d. Nomenclature Workshop Report I. U.S Dep. Commer., NOAA, Natl. Mar. Fish Serv. Proj. 0501-4176-36730. Wash., D.C.
_____ 1975. Final report, retail identification plan for fishery products. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv. Proj. 4-36730. Wash., D.C.
_____. 1978a. Fishery statistics of the U.S., 1975. U.S Dep. Commer., NOAA, Natl. Mar. Fish. Serv. Stat. Dig. 69.
_____ 1978b. A model retail identification plan for seafood species–a description of the project and recommended principles of identification. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv. Proj. 6-35338.
_____. 1979a. Project to develop recommendations for clarifying and standardizing nomenclature related to seafood product forms and modifiers. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv. Proj. NA79SAC-00804-BN1204, Wash., D.C.
_____. 1979b. Toward a partnership for the development of the United States commercial fishing industry. Final report—Task Force on Fisheries Development, U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv., Wash., D.C.
_____. 1981. Final report–a model retail identification plan for forms and modifiers. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv. Contract NA79SAC-00804, Wash., D.C.
_____ 1983. Final report–protocol for sensory and instrumental testing of the edibility characteristics of finfish. U.S. Dep. Commer., NOAA, Natl. Mar. Fish. Serv. Contract NA82AAG04204, Wash., D.C.
USDI. 1954. Compliance with the Federal Food, Drug and Cosmetic Act in the marketing of fishery products. U.S. Dep. Inter. Fish. Leafl. 172.
U.S. Supreme Court. 1924. United States vs. 95 barrels, more or less, alleged apple cider vinegar. 265 U.S. 438; N.J. No. 12367. 2 June 1924.