

Encouraging the Use of Underutilized Marine Fishes by Southeastern U.S. Anglers, Part I: The Research

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Introduction

Every year, millions of fishermen discard, release, or unnecessarily ruin and waste millions of pounds of saltwater fish that they consider poor eating or inedible. The National Marine Fisheries Service (NMFS) estimates that, from the Atlantic and Gulf coasts alone, recreational fishermen catch over 33 million fish belonging to such underutilized groups such as jacks, catfishes, tunas, and skates and rays (USDOC, 1980). Most of these fish are discarded or released in favor of more highly desired and perhaps overfished species like grouper, snapper, and king mackerel (Bell, et al. 1982). This underutilization of potentially valuable marine resources occurs at a time: 1) When increased real and perceived pressure is being placed on preferred marine resources by both recreational and commercial fishermen, both of whom use increasingly more efficient technologies to locate and catch fish; and 2) with political conflicts between marine recreational fishermen and commercial fishermen

over access to and claim over marine resources (Berkes, 1984). Presumably, increasing the share of underutilized species in the total recreational catch will aid in reducing both biological pressures and subsequent political conflicts.

In 1983, we began investigating southeastern U.S. marine recreational fishermen's beliefs about species of saltwater fish in an attempt to isolate the specific criteria upon which they base their decisions to use or reject a fish. This was part of a 3-year program to increase demand for underutilized species among marine recreational fishermen of the U.S. southeast. During the first year we empirically investigated fishermen's perceptions concerning fish and developed informant-based models, which forms the core of this paper. Based on this earlier research, we have subsequently attempted to enhance the images or to "repackage" underutilized species with an educational program consisting of brochures, posters, recipes, and a slide/tape presentation.

In this paper, Part I, we present a brief

description of the research and its findings, focusing on the implications of this work in the development of the educational program. The philosophy, dynamics, and achievements of the educational program are the focus of Part II (Murray et al., 1987).

Methods

Data Collection and Analysis

In exploring the perceptions that recreational fishermen have of various marine species, we incorporated methods and theories from the fields of anthropology and consumer research. Two techniques we used are multidimensional scaling (MDS) (Kruskal, 1964) and hierarchical clustering (HCL) (Johnson, 1967). Generally, any items that can be compared on the basis of similarity or dissimilarity can be visually represented as points spatially distributed in euclidean space (MDS) or as items grouped together hierarchically as a taxonomic structure (HCL). Both techniques display relationships among items or stimuli (e.g., different kinds of fish) based on measures of similarity/dissimilarity (a more detailed discussion is given by Romney et al., 1972).

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ABSTRACT—This paper is the first of a two-part series which describes and discusses the integration of research and extension increase to the use of nontraditional fishes among marine recreational fishermen in the southeastern United States. Recreational fishermen within this region target and use or reject fish on the basis of a variety of criteria. Many fish caught incidentally are discarded because of myth, rumor, or perceived negative characteristics that mask the species' positive values. To discover the factors influencing the angler's evaluations concerning the desirability of fish that ultimately af-

fects their decision to accept or reject a particular species, we collected judged-similarity and belief-frame comparison data in Florida, North Carolina, and Texas, analyzing these data with the use of multidimensional scaling, hierarchical clustering, and entailment analysis. We briefly describe the use of these procedures in providing for a systematic understanding of fishermen's perceptions concerning fish and discuss the implications of our findings for the development of educational materials directed at enhancing the image of certain underutilized species among marine recreational fishermen.

We used these techniques to explore fishermen's judged similarities between selected saltwater fishes. To accomplish this, we asked fishermen to sort cards with pictures and names of fish on them into piles on the basis of how they perceived species to be similar to one another. We then asked them to explain their groupings. Consequently, the common group memberships among species, the relationships among the groups, and the derived similarity measures between the species were determined by the manner in which fishermen sorted species into piles.

Two methods for deriving similarity data from the pile sorts were explored. The first is based on information theory and tends to emphasize minor distinctions made by subjects (Burton, 1972). The second is based on the summing of co-occurrence of items (stimuli) in a pile across all subjects (Weller, 1984). Comparisons and tests of both techniques convinced us that, for our purposes, the latter provided a better measure of similarity for use with these statistical procedures.

The information derived from these methods is necessary to first identify relationships among saltwater species as perceived by recreational fishermen, and to determine the characteristics which make saltwater species desirable or undesirable. Discovering the relative position of underutilized species within a multidimensional scaling's configuration of points is analogous to the concept of "product positioning" in marketing research.

The concept of "product positioning" refers to the discovery of the structure of a particular product domain (e.g., different kinds of coffee) and the development and packaging of new products or old ones for new markets based on identification of yet unexploited portions of this particular domain. A good example of this is the development of a new popular brand of coffee with the use of the above methods (Stefflre, 1972).

We used one further method to identify and understand the ways recreational fishermen think about their prey. This involved constructing sentence frames (belief-frames) based on interviews with recreational fishermen from each study area. Recurring descriptions of both tra-

ditional and nontraditional recreational species (e.g., fighting characteristics, eating characteristics, etc.) were used to produce fill-in-the-blank sentences. In subsequent interviews, subjects were asked to provide the species (from an appropriate list) associated with the attribute implied in each sentence, such as "You cannot eat _____ because it has worms."

These species/belief-frame comparisons were incorporated into an "item-by-use" matrix (Stefflre, 1972) organized in a species-by-attribute form for each of the study areas. This is similar to a method used in the study of food snacks and their attributes with respect to when they are eaten (Stefflre, 1972). Each species/belief-frame matrix was sorted by rows and columns so that rows that were similar to one another were near one another; and columns that were similar to one another were near one another. This was accomplished through a combination of techniques used by both D'Andrade et al. (1972) and Stefflre (1972). D'Andrade et al. (1972) computed Pearson correlations for belief-frames across items and for items across belief-frames. These coefficients represented similarity measures and were clustered for rows and columns through the use of a hierarchical clustering scheme (Johnson, 1967).

Stefflre (1972), on the other hand, produced a similarity measure based on row-row and column-column similarity in patterning. For our purposes, however, we use a computationally equivalent algorithm which alleviates the need for transposing row and column vectors. These similarities were then used in an iterative process based on "linear equivalence chains" to sort rows and columns on the basis of similarity (Stefflre, 1972).

In this analysis, row-row and column-column similarities were derived with the use of the computationally equivalent version of Stefflre's algorithm discussed above. These similarity measures for both rows and columns were subjected to HCL to obtain the sorted species/belief-frame matrices for each region.

Data from the belief-frame comparisons can also be modeled in terms of implicational or logical relationships (D'Andrade, 1976; Schoepfle et al., 1984; White et al., 1977; White and Mc-

Cann¹). The structure of these relationships, or the entailment structure, is obtained through a multivariate contingency analysis of paired dichotomous variables similar to Guttman scaling. The logical or implicational relations are modeled in an "If A then B" (visualized in Figures 10-13 as $A \leftarrow \text{-----} B$) form and are not symmetrical. It allows for both complete and partial orderings in which relationships are transitive. Two other forms are possible. The first is the equivalence relation, which takes the symmetrical form of " $A = B$ " and the contrast relation of the form "If A then not B." A more detailed description can be found in D'Andrade (1976) and White et al. (1977).

Sampling

An important consideration for the application of these techniques is the assumption that there are shared understandings, beliefs, or pools of information among respondents and the cultures or subcultures of which they are a part, in the same way that a handful of English speakers can provide a complete grammar of English. For example, a review of studies that employed MDS interviewed between 10 and 50 subjects with one using as little as 5 while another used as many as 600 in a national survey (e.g., D'Andrade, 1976; Romney, et al., 1972). Stefflre (1972:214) stated: "This kind of data stabilizes with fairly small samples of respondents ($N=30-60$)." These techniques are not as reliant upon random selection or sample size for gaining statistical significance as would be found among other statistical procedures. Rather, it is more important in these procedures to sample subjects who have a shared understanding of the domain under study.

Like most anthropologists, we assume that members of human societies share beliefs and ways of behaving. These shared understandings and actions are what constitute "culture." In every human society, culturally coherent pools

¹White, D. R., and H. G. McCann. 1981. Material and probabilistic entailment analysis: Multivariate analysis of "If . . . then" statements in cultural systems. Manuscr. on file at School Soc. Sci., Univ. Calif., Irvine.

of information and knowledge are transmitted from individual to individual through processes of enculturation or socialization. In this research, our interests lie in describing the social behavior of recreational fishermen that may be directly attributable to the ways they categorize or rate fish.

All beliefs and perceptions will be affected by the degree to which subjects have been socialized into a particular system. In other words, an 11-year-old's understanding of their kinship system is less robust than, for example, his or her 30-year-old father's. We assume, of course, distinct parameters defining the nature and extent of knowledge about a particular domain. This knowledge is shared to varying extents among all members of the system—from a normative standpoint—and is passed on to new members through a socialization process. In this case, an individual who is new to recreational fishing will generally be socialized as a "recreational fisherman" through his or her experiences and subsequent discussions with more integrated members of the recreational "subculture" (e.g., at parties, bars, at home, on boats, on piers, etc.)² These assumptions guided our sample selection, in that we were interested in locating relatively experienced fishermen.

For the most part, fishermen in this

study belonged to non-species-specific fishing clubs. Four such clubs were identified for data collection. These were located in and drew their members from east Florida, west Florida, Texas, and North Carolina. About 30 fishermen from each area were interviewed. A fifth sample of nonfishing club members was taken from the piers and other fishing spots in east Florida for comparative purposes ($N=10$)³. Some selected characteristics of the fishing club members and their fishing and fish preparation behaviors are included in Table 1.

Results

Hierarchical Clustering Analysis (HCL)

Table 2, a summary of the results of the HCL for the four regions⁴, shows that the same general categories, presented along the left-hand side of the chart, were found in all regions. These categories reflect the general ways that marine recreational fishermen in each of the areas group species of saltwater fish. The boxes with the names of the fish represent the clusters of species that fishermen put together most often in the sorting tasks. As Table 2 shows, the general criteria that fishermen used to categorize species were:

1) Sportfish, or species that are fun or exciting to catch. In east and west Florida, fishermen differentiated between good-eating and poor-eating sportfish, while neither Texas nor North Carolina fishermen made these finer distinctions.

2) Meatfish, or fish that are good to eat. In addition to the meatfish designation, fishermen in all four regions separated their meatfish in terms of the ranges or habitats of the species. In all regions, the groupers and snappers were placed together and often described as "good-eating reef fish," while trout, bluefish,

red drum, etc. were described as "fish you can eat that you catch in the surf or from a pier."

3) A third category of lower quality or less well-known fish, also divided on the basis of range, begins the categories that contain species many fishermen reject. Texas fishermen lumped these species in with their "trashfish," while some fishermen in the other three areas acknowledged the utility of some of these species as fish they would use for bait. Most of these species, however, were perceived to possess one or two negative qualities, as will be seen below in the item-by-use matrices. These qualities made them less desirable than the fish in the second category.

4) Trashfish. Fishermen saw these species as the sea's least desirable. They used derogatory terms, such as "odd-ball species," "dangerous fish," "pisswinks," and "garbage," to describe these species. None were targeted for food or sport. A few fishermen had eaten puffer, calling it "the chicken of the sea," and an occasional favorable statement was made about gafftopsail catfish, but generally these fish were considered low on the scale of marine fishes.

Fishermen rejected these species for various reasons. In a few cases, the ugliness of these fish were cited. Others offered explanations that were, at least superficially, more reasonable. Searobins and puffers were said to be "all head and no meat"; puffers, poisonous; sea catfish, poor-tasting scavengers and dangerous to handle because they could use their spines like spears. Fishermen told of bad experiences with catfish, ray stingers, and the spines of searobins.

Species in this last category offended the fisherman's sense of what a fish should be—a scaled, silver, or colorful fish shaped like a grouper or cobia. But fish in category 4 have bumps, wings, stingers, blotchy and smooth skins like salamanders, and spines and whiskers like porcupines. They act strange, puffing up, grunting, or flying when tossed in the air.

One of the primary reasons for rejecting these species, then, is that fishermen tend to associate appearances and odd behaviors with undesirable characteristics. These findings are reaffirmed below in

²This is not to say that the population of U.S. marine recreational fishermen is homogeneous, consisting of a single language or ethnic group whose attitudes toward fish are uniform. In fact, there are segments of the total recreational fishing population to which our findings may not apply. For example, it could be argued that because the fishermen in our sample are overwhelmingly white males, drawn from fishing clubs, our findings cannot be extended to black, Hispanic, Korean, Vietnamese or other minority recreational fishermen in the United States. The basis for this argument lies in the findings of linguists and other social scientists, who argue that distance differences in linguistic behavior, socialization, and ethnicity between whites and these other ethnic groups result in different meanings, perceptions, and beliefs about the things of this world. It is important to note, however, that it has been shown more recently by Romney, et al. (1979) that ethnic enclaves in the United States may show more in common cognitively with the mainstream of American culture than is evident from casual observation. This seems to point to the importance of length of exposure to American popular culture (e.g., television, radio, etc.) and interaction with other social groups in the United States.

³To address the question of how similar fishing club members are to nonclub members, we compared responses from club and non-club members in east Florida with Pearson (0.78) and Spearman (0.63) correlation coefficients. These were significantly similar at the 0.0001 level for both tests.

⁴Clusterings were produced using the SAS average linkage procedure.

Table 1.—Selected characteristics of fishing club members.

Club membership data	East Florida				West Florida				North Carolina				Texas			
	Mean	Median	Mode	%	Mean	Median	Mode	%	Mean	Median	Mode	%	Mean	Median	Mode	%
Length of membership (years)	6.87	7.5	10		5.13	4.12	3		2.3	2	1		3.7	3.3	3	
Age	49.6	44.4	44		48.7	52	52		42.3	39	28		41.2	40	36	
Education in years	15.6	15	16		14.3	14.2	16		17.3	16.4	16		17	16.2	16	
Percent without HS diploma				4.2				0				0				5
Percent with HS diploma (only)				20.8				26.1				6.9				0
Percent with <4 years of college				29.1				34.7				6.9				5
Percent with 4 years of college				25.0				30.4				37.9				55
Percent with advanced degrees				20.9				8.7				48.3				35
Percent who own their own boats				91.7				56.5				60				70
Percent who clean, scale, etc. their fish themselves				96.0				100				93.3				90
0-20% of time				4.0				0				0				0
21-50% of time				12.0				4.3				3.3				0
51-99% of time				8.0				0				0				10
100% of time				72.0				95.7				90.0				80
Percent who have someone else clean, scale, etc. their fish				28.0				4.3				6.6				20
0-20% of time				8.0				0				0				10
21-50% of time				16.0				0				3.3				0
51-99% of time				4.0				4.3				0				0
100% of time				0				0				3.3				10
Percent who cook their own fish				72.0				78.3				86.7				55
0-20% of time				8.0				17.3				9.9				5
21-50% of time				12.0				17.3				20.0				10
51-99% of time				16.0				12.9				19.8				5
100% of time				36.0				30.4				36.7				35
Percent who have another person cook their fish				60.0				73.9				63.3				65
0-20% of time				8.0				8.7				13.2				5
21-50% of time				8.0				26.1				26.6				10
51-99% of time				20.0				26.1				13.2				5
100% of time				24.0				13.0				10.0				45
Cooking styles—1% of population who:																
Broil				59.1				78.3				73.3				55
Deep fry				59.1				65.2				73.3				65
Pan fry				22.7				34.8				16.7				5
Bake				31.8				39.1				40.0				30
Barbeque/grill				22.7				30.4				36.7				15
Smoke				31.8				26.1				10.0				5
Other				4.5				4.3				3.3				5

the entailment analysis. The notable exception to this is flounder. With two eyes on one side, often blotchy skin, and a flat body like a skate or ray, the flounder qualifies as unusual-looking fish. In fact, one fisherman told of tossing a flounder back before he learned from another fisherman what it was. The nearly universal utilization of flounder among marine recreational fishermen suggests that a fish which is good tasting and easy to clean will be utilized even if it does not approach the fishermen's ideal.

5) Sharks and dogfish, for obvious reasons, were lumped together by nearly every fisherman in the sample. For many, they comprised yet another group of trashfish.

Figure 1 converts the information from Table 2 into a tree diagram demonstrating

the hierarchical levels at which the species are more closely or distantly related in terms of perceived and objective criteria. While the tree diagram (Fig. 1) and Table 2 both show that there is a great deal of agreement between regions in terms of the criteria used to classify saltwater fish, they also show that there is a great deal of overlap between regions in terms of the actual individual species that meet these criteria of sportfish, meatfish, and so on.

We draw three basic points from this information. First, in some cases, fish that are rejected by most fishermen (underutilized species) fall into categories with fish that are preferred. For example, while the poor-eating sportfish category in east and west Florida contains mostly underutilized species like amberjack,

crevalle jack, etc., it also contains the highly sought tarpon; in North Carolina we find the generally undesirable pinfish and pigfish in the same pile with desirable croaker and spot.

Second, some fish that fall into rejected categories in one area fall into preferred categories in others. Mullet in west Florida is perceived as a higher quality fish than it is in east Florida; in Texas, mullet is considered a trashfish. Smaller species such as croaker and spot, while highly desired in North Carolina, tend to be scorned in east Florida or used only for bait.

Finally, and related to the second point, we see that the sizes and compositions of the categories vary greatly between regions. Texas has the largest trashfish or undesirable category and

North Carolina the most meatfish, for example.

This information tells us that, most importantly, some species have been classified as preferred or undesirable on the basis of local information, rumor, and the general processes that accompany being socialized into recreational fishing, rather than on the basis of more objective criteria. We will see below, in the item-by-use matrices, that fishermen consistently said "most people don't eat" about fish that they had never tried eating. In many cases it's obvious that a fish is underutilized in one region primarily because there's no tradition of utilization. Fishermen need only be informed that these fish are perfectly edible, and even good, and they will probably begin utilizing them.

One final point to be made here is that the availability of species tends to be a big factor in whether a fish is targeted or rejected. For instance, smaller species get worse ratings in east Florida than in North Carolina because bigger fish are perceived to be more plentiful and easier to catch in east Florida.

Multidimensional Scaling

Figures 2-5 present the MDS configurations for each of the regions⁵. The findings from the clustering analysis are complemented by the MDS analysis. Whereas in the clustering analysis we found that the two common categories of meatfish and sportfish came up in every region, in the MDS we found that the most common dimensions in all regions were:

- 1) Edibility (from good-eating fish to bad-eating or inedible fish) and
- 2) Sportfish (from large, strong fighting fish like wahoo and tarpon to the smaller, panfish types such as spadefish, searobins, and so on).

While these two dimensions appeared in all regions, they were clearest in east and west Florida and least clear in North Carolina. In North Carolina, there were a number of other criteria that muddled the

Table 2.—Species clusters by major categories for the four regions: East Florida, West Florida, North Carolina, and Texas.

Major category	East Florida	West Florida	North Carolina	Texas
I. Sportfish				
a. "Poor-eating."	Amberjack Barracuda Tarpon Blue runner Crevalle jack Ladyfish Rainbow runner	Amberjack Barracuda Tarpon Blue runner Crevalle jack Ladyfish	Amberjack Barracuda Cobia Little tuna Dolphin Spanish mackerel Wahoo King mackerel Snook ² Tarpon Atlantic mackerel	Amberjack Barracuda ² Pompano ² Snook Tarpon Cobia Spanish mackerel Wahoo King mackerel
b. "Good-eating."	Cobia Dolphin Spanish mackerel King mackerel Wahoo	Bluefish Wahoo Cobia Dolphin Pompano Snook ² King mackerel Spanish mackerel		
II. Meatfish				
a. Offshore	Black sea bass Jewfish Gray snapper Red snapper Schoolmaster snapper Mutton snapper Black grouper Nasau grouper Lane snapper Red grouper Warsaw grouper	Black sea bass Nasau grouper Red snapper Warsaw grouper Scamp Lane snapper Jewfish Red grouper Black grouper	Black sea bass Red snapper Warsaw grouper Nasau grouper Mutton snapper Red porgy Jewfish Gray snapper Lane snapper Schoolmaster snapper Black grouper	Jewfish Red snapper Black grouper Schoolmaster Warsaw snapper Nasau grouper Red grouper Lane snapper Gray snapper Mutton snapper
b. Inshore	Bluefish Snook Southern kingfish Northern kingfish Summer flounder Sand trout Pompano Striped bass Red drum Beach whiting Spotted trout Southern flounder Weakfish	Summer flounder Mullet Sheepshead Weakfish Sand trout Beach whiting Spotted trout Red drum Southern flounder	Bluefish Mullet Striped bass Weakfish Red drum Spotted trout *** Croaker Summer flounder Pompano Spot Southern flounder Pigfish Sheepshead White perch Pinfish Butterfish Silver perch Southern kingfish Beach whiting	Summer flounder Sand trout Weakfish Red drum Southern flounder Spotted trout
III. Lower quality or less well-known meat fish ³				
a. Offshore	Sheepshead Tripletail Scamp Gag Queen triggerfish Gray triggerfish	Queen triggerfish Schoolmaster snapper Tripletail Gray triggerfish Gag Mutton snapper Gray snapper	Spadefish Silver Jenny ² Tripletail Queen triggerfish Scamp ² Gray triggerfish Tripletail Gag	No Texas clusters fit these designations.
b. Inshore ⁴ ("Baitfish")	Croaker White perch Flodia grunts Pigfish Silver perch Spot Spadefish Mullet Butterfish Pinfish Silver Jenny	Croaker Northern kingfish ² Silver perch Southern puffer Pigfish Spadefish White perch Spot Butterfish Silver Jenny Pinfish Grunts	Blue runner Northern kingfish Crevalle jack Rainbow runner Ladyfish	

(Continued on next page.)

⁵Stress figures for the scalings in three dimensions were: Texas, 0.171; east Florida, 0.170; west Florida, 0.157; and North Carolina, 0.145

dimensions of edibility and sport, such as the size, shape, and habitats of the fish.

Examining the MDS figure for east

Florida (Fig. 2). for example, we can see that the flounders, snappers, and groupers fall to one side of the axis at the

Table 2.—Continued.

Major category	East Florida	West Florida	North Carolina	Texas
IV. Trashfish ⁵	Sea catfish Southern puffer Bighead sea robin Smooth puffer Northern sea robin Atlantic stingray Gafftopsail catfish	Sea catfish Northern sea robin Gafftopsail Catfish Smooth puffer Bighead sea robin Atlantic stingray	Sea catfish Smooth puffer Northern sea robin Gafftopsail catfish Bighead sea robin Atlantic needlefish Red hake Southern puffer Atlantic stingray	Black sea bass Queen triggerfish Grunts Silver perch Spot Silver Jenny Smooth puffer Gag Northern sea robin Scamp Pinfish Bighead sea robin Southern puffer Blue runner Spadefish Ladyfish Pigfish Northern kingfish Rainbow runner Gray triggerfish ... Bluefish Sea catfish Crevalle jack Southern kingfish Mullet Gafftopsail catfish Croaker Sheepshead Beach whiting Striped bass Tripletail Stringray
V. Sharks/dogfish ⁶	Blacktip shark (Spinner) Dusky shark Bull shark Sandbar shark Smooth dogfish	Mako shark Lemon shark Great white shark Sixgill shark Spiny dogfish		

¹Neither Texas nor North Carolina differentiated between "good-eating" and "poor-eating" gamefish.

²Not well known in this area.

³These tend to be smaller, if known, and among the inshore species are those which are usually classified as baitfish. Also, because these fish are considered lower quality as food fish, the finer distinctions based on range and sporting qualities are not so strong in differentiating species from one another in these clusters. Fishermen's lack of experience with some of these species could cause the lack of finer distinctions as well.

⁴Species in this category were generally not well known in North Carolina. The "inshore" meatfish designation probably does not apply here.

⁵Texas "trashfish" species include species which were generally not well known to Texas fishermen; perhaps a better description of these clusters would be to say that they include those species Texas fishermen do not care very much about, nor know much about, nor care to catch.

⁶With the exception of West Florida, which differentiated the dogfish from the sharks, all the MCA results contained a cluster including all the sharks and dogfish.

***Break within a cluster

****Break between clusters.

"good-eating" extreme. As we cross the configuration, we encounter progressively less desirable species from an edibility standpoint. Thus, at the far end of the "poor-eating" fish we find such species as sharks, searobins, ladyfish, or tarpon.

The sportfish dimension can be seen from the top to the bottom of the Figure 2. The species get progressively more desirable as game fish or fish that are exciting to catch as you move from the spadefish (top) to tarpon (bottom).

The relative placement of underutilized species (dots) in relation to the utilized or preferred species (circles) was very helpful in developing the educational materials: We can visualize the similarities between species—as perceived by recreational fishermen—and then reinforce these similarities between underutilized and preferred species in the brochures, posters, and other educational materials.

The two dimensions of edibility and sport were found in all regions, but again, the precise locations of fish in relation to one another change from region to region, just as the species that fell into the clustering analysis categories varied between regions. Comparing east and west Florida, for example, we can see that the species at the extremes are almost identical: Tarpon is considered the most exciting sportfish and spadefish/pinfish the least, and the grouper/snapper species (those with white, delicate meat) are viewed in both regions as the highest quality foodfish, and the sharks/catfish/searobins the lowest quality foodfish. Between these extremes, however, there are a few differences: Sharks are closer to tarpon in west Florida (indicating that it is considered a higher quality sportfish), and mullet and amberjack are a little closer to the "good-eating" end of the extreme in west Florida.

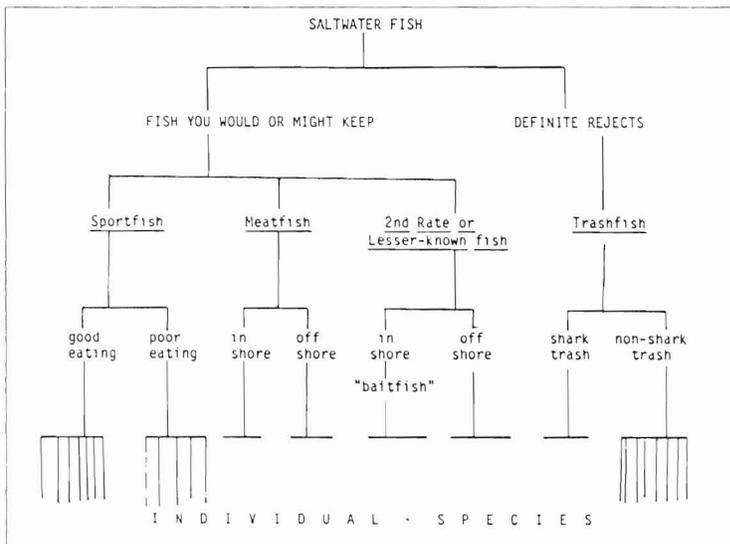


Figure 1.—HCL major clusters in tree diagram form.

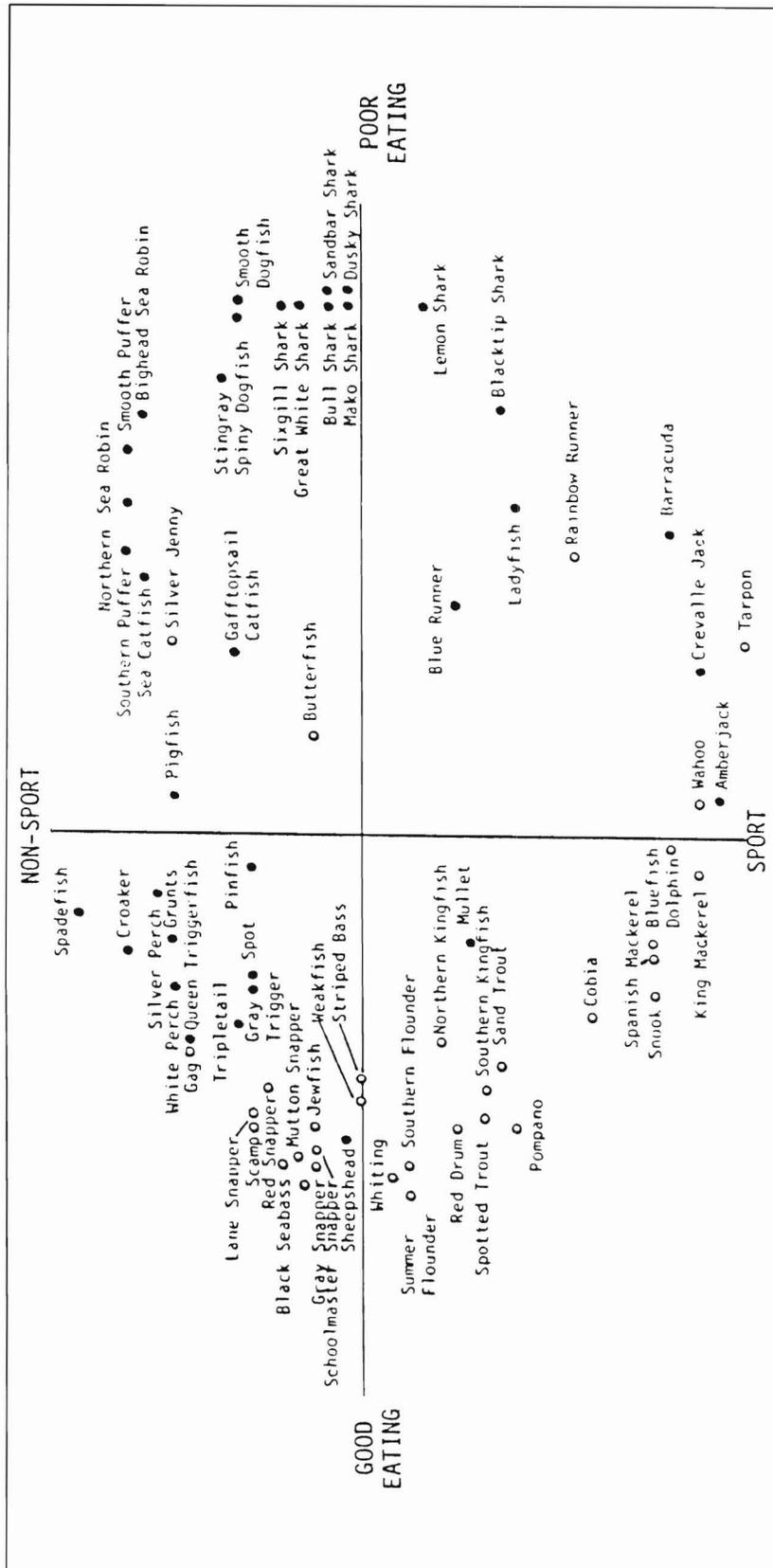


Figure 2.—Multidimensional scaling for east Florida: Dimension 1 vs. Dimension 2. Dots indicate underutilized species and circles represent utilized or preferred species.

North Carolina, on the other hand, is not nearly so well defined as east and west Florida in terms of the edibility and sport dimensions. This is because North Carolina fishermen seemed to group species on the basis of a variety of criteria, including size and shape, as well as the fight of the fish or its value as a food. In any case, it is still obvious that the hard-fighting fish cluster together at one end, the smaller species at the other, and that the groupers and snappers still fall into the same general region, opposite the trashfish.

Somewhat different than the other regions, Texans primarily distinguished between preferred and nonpreferred species. The three Texas favorites—spotted trout, reddrum, and flounder—all appeared together at the preferred end of the figure, and the nonpreferred species consist of both the good-fighting fish and the good-eating fish.

These differences reflect local preferences and further support our earlier contentions that the general criteria for targeting and rejecting fish remain more or less constant from region to region, while the specific stimuli that meet those criteria may vary.

Item-By-Use and Entailment

The results of the analysis of the item-by-use matrices are similar to what we found in the HCL and the MDS analyses. These matrices also have the added advantage of pointing out similarities and differences between the beliefs about fish (or similarities between belief-frames).

For each region, we constructed a matrix from the responses to the belief-frame comparisons. These sorted matrices are presented in Figures 6-9. Data in this form is useful for providing insights into the perceived characteristics of a fish that has an impact on its reputation or image as well as informing us of the combinations of characteristics and attributes that contribute to the clustering of species (and vice versa). In each of the figures, major clusters for belief-frames or sentence-frames are numerically identified along the rows, while major clusters for species are identified by letter along the columns.

An alternate way to view or model this data is through entailment analysis. Fig.

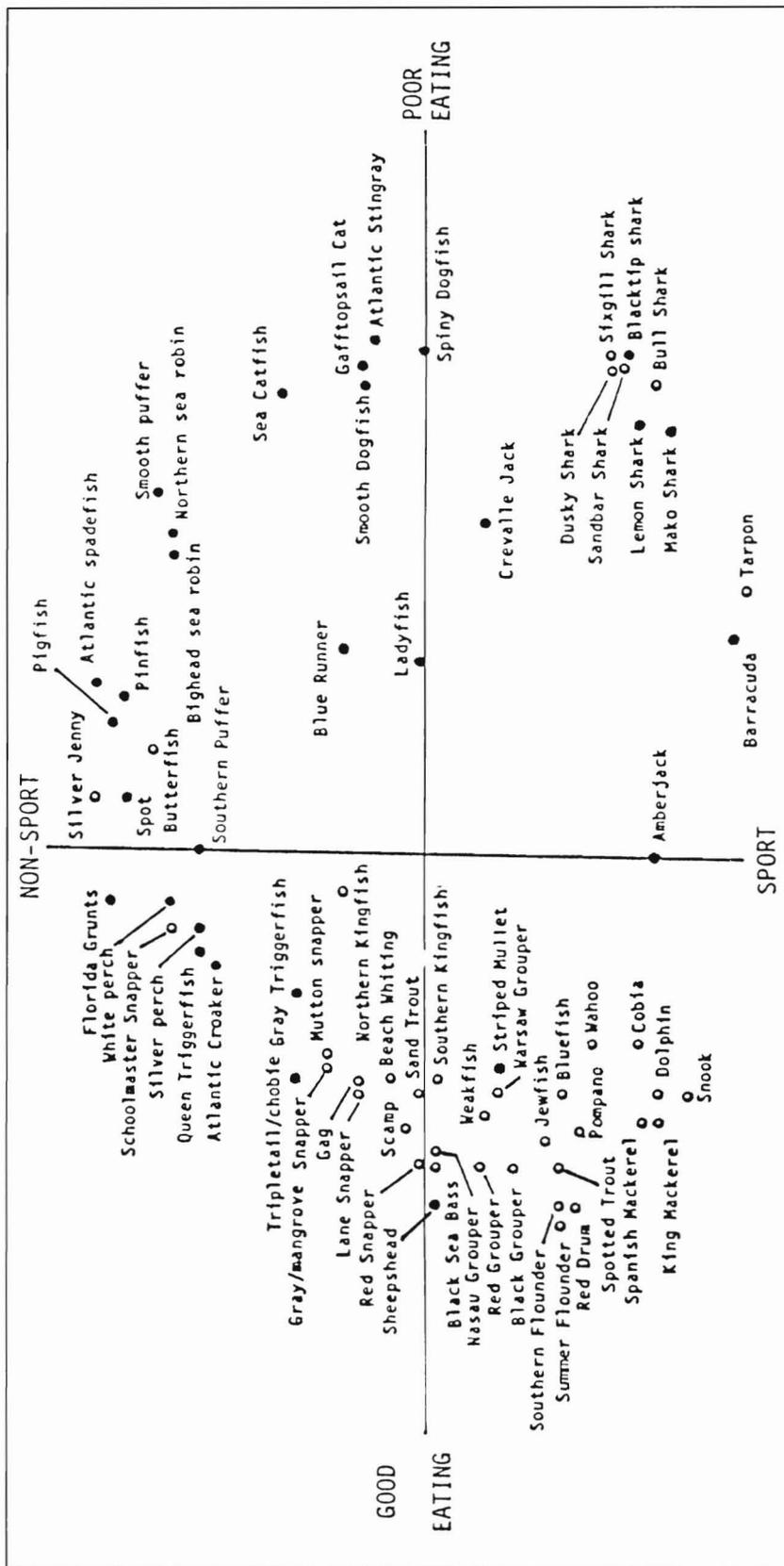


Figure 3.—Multidimensional scaling for west Florida: Dimension 1 vs. Dimension 2. Dots indicate underutilized species and circles represent utilized or preferred species.

ures 10 through 13 are entailograms showing both the implicational and contrast relationships among the belief-frames from the east Florida sample⁶. Cluster 1 (Fig. 10) contains belief-frames that are mostly negative in character. The following are two examples of how to interpret the diagram. The ordered relationship “only eaten by certain classes of people” entails that the fish is a “scavenger,” which in turn entails that it “must be skinned.” Many informants disparagingly described certain scavenger fish as being only eaten by certain classes of people. In addition, many of the scavengers were seen as requiring skinning (e.g., sea catfish).

A second example is the string “can only be cooked one or two ways” which entails that they “do not freeze well” (don’t keep well in the freezer), which in turn entails that the “meat is oily-tasting.” In contrast, for example, cluster II (Fig. 11) shows the relationship among positive characteristics with respect to freezing. Here the string “meat white when cooked” entails that the meat is “white when raw” which in turn entails that it will “freeze well.”

Figure 13 shows examples of contrast relationships. Lines with cross-hatching denote these relationships. Contrast relationships are shown outside the clusters discussed above for the sake of simplicity and readability, but they could have just as well been included. An interesting example of such a relationship centers around the attribute “easy to clean.” If a fish is perceived as “easy to clean,” it will not be “poisonous,” “ugly,” or “slimy.”

The importance of both the item-by-use and entailment analyses lies in their ability to inform and guide us in our attempts to change angler attitudes towards the less traditional sport fishes. These analyses, for example, tell us that fishermen routinely attribute negative culinary characteristics to fish they have never tried. It is much easier to change attitudes in situations where there is some degree

⁶Data from the east Florida item-by-use was dichotomized using the following break point: Alpha > 3. The entailogram was produced with the aid of a multidimensional Guttman scaling program written by Doug White at the University of California, Irvine. Relationships shown are with no exceptions.

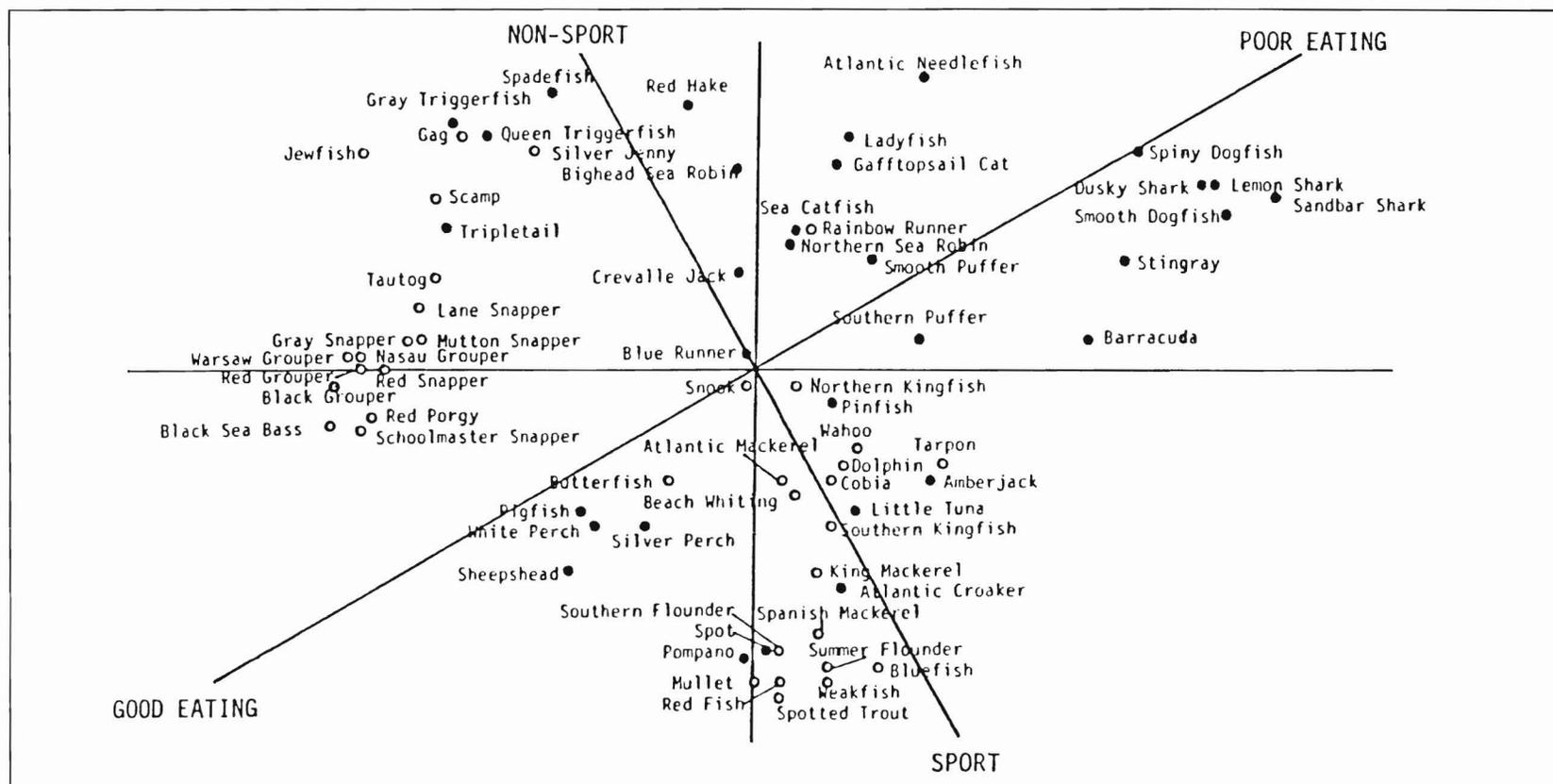


Figure 4.—Multidimensional scaling for North Carolina: Dimension 1 vs. Dimension 2. Dots indicate underutilized species and circles represent utilized or preferred species.

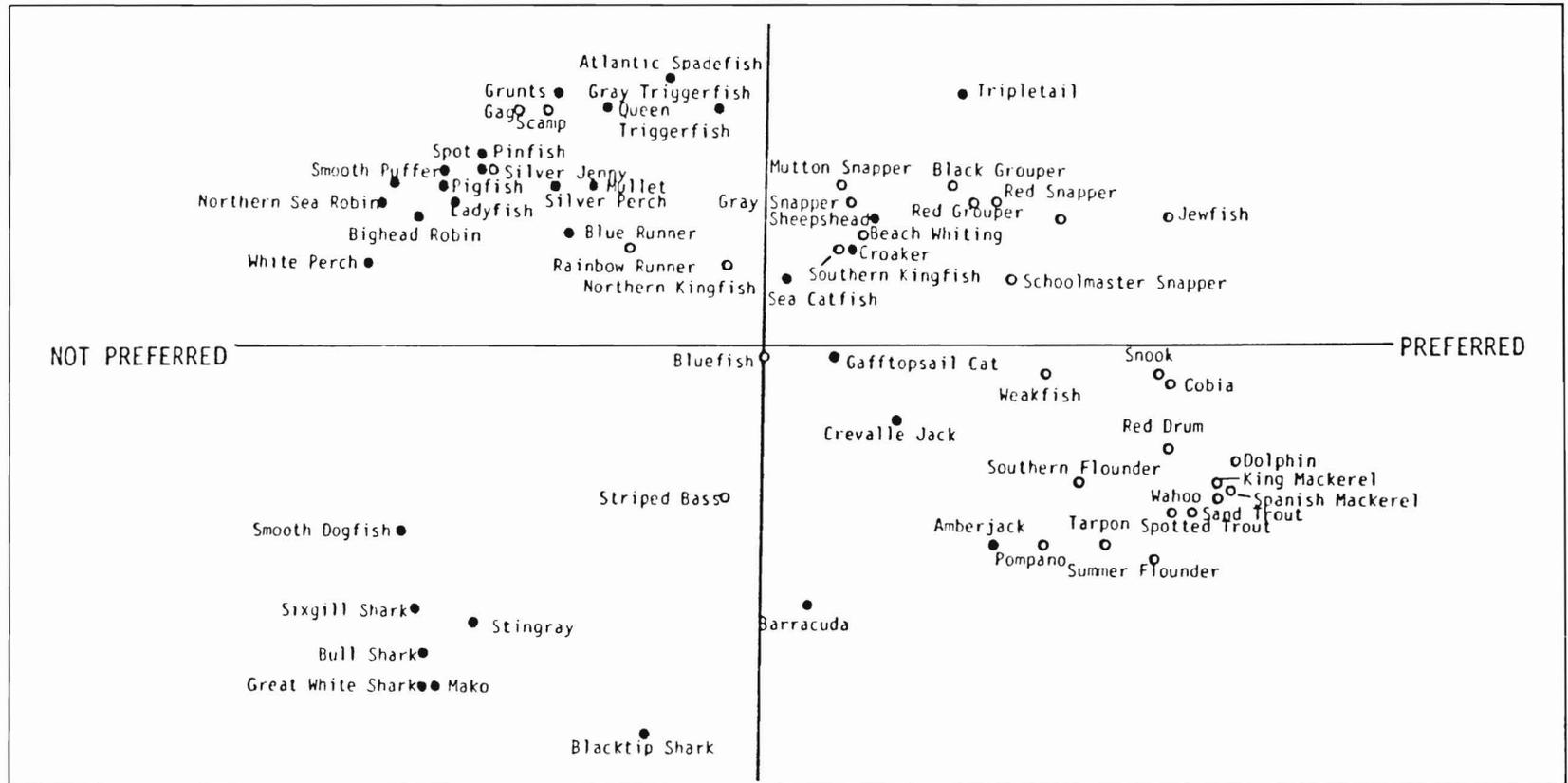


Figure 5.—Multidimensional scaling for Texas: Dimension 1 vs. Dimension 2. Dots indicate underutilized species and circles represent utilized or preferred species.

	Aa	A	Ab	Ba	B	Bb	C	D	E	F	G
Amberjack	0	1	2	17	19	6	43	17	0	8	27
Barracuda	1	3	0	0	0	1	0	0	0	0	0
Jack Crevalle	4	3	3	3	3	3	3	3	3	3	3
Ladyfish	7	5	8	4	6	12	1	1	7	3	3
Bonito	4	1	0	0	0	0	0	0	0	0	0
Tarpon	5	2	7	5	8	4	6	12	1	1	7
Sea Catfish	4	1	0	0	0	0	0	0	0	0	0
Sail Catfish	6	10	7	8	7	8	1	8	6	5	7
Shark, Black Tipped	3	3	3	3	3	3	3	3	3	3	3
Shark, Other Species	3	3	3	3	3	3	3	3	3	3	3
Shark, Shovelhead	3	3	3	3	3	3	3	3	3	3	3
Blue Runner	1	0	0	0	0	0	0	0	0	0	0
Guitarfish	5	6	5	6	5	6	5	6	5	6	5
Sea Robin	1	0	0	0	0	0	0	0	0	0	0
Puffer (Blowfish)	3	3	3	3	3	3	3	3	3	3	3
Smooth Puffer (Rabbitfish)	1	0	0	0	0	0	0	0	0	0	0
Stringray	4	4	4	4	4	4	4	4	4	4	4
Silver Jenny	1	0	0	0	0	0	0	0	0	0	0
Rainbow Runner	5	5	5	5	5	5	5	5	5	5	5
Butterfish	10	10	10	10	10	10	10	10	10	10	10
Croaker	4	2	1	5	2	3	2	4	2	1	5
Spot	18	5	2	15	23	24	18	5	2	15	23
Grunts	4	2	1	5	2	3	2	4	2	1	5
Pigfish	3	3	4	5	3	3	3	4	5	3	3
Pinfish	1	1	1	1	1	1	1	1	1	1	1
Jewfish	2	2	2	2	2	2	2	2	2	2	2
Tripletail	3	3	3	3	3	3	3	3	3	3	3
Permit	3	3	3	3	3	3	3	3	3	3	3
Silver perch	3	3	3	3	3	3	3	3	3	3	3
Spadefish	4	4	4	4	4	4	4	4	4	4	4
Sand Trout	2	2	2	2	2	2	2	2	2	2	2
Scamp	1	1	1	1	1	1	1	1	1	1	1
Black Sea Bass	3	3	3	3	3	3	3	3	3	3	3
Whiting (King Whiting)	10	10	10	10	10	10	10	10	10	10	10
Pompano	6	6	6	6	6	6	6	6	6	6	6
Spotted Trout (Speckled Trout)	10	10	10	10	10	10	10	10	10	10	10
Sheepshead	12	12	12	12	12	12	12	12	12	12	12
Snapper, Mangrove	4	4	4	4	4	4	4	4	4	4	4
Snapper, Other Snapper	4	4	4	4	4	4	4	4	4	4	4
Cobia	9	9	9	9	9	9	9	9	9	9	9
Dolphin	1	1	1	1	1	1	1	1	1	1	1
Snoek	5	5	5	5	5	5	5	5	5	5	5
Redfish (Red Drum)	13	13	13	13	13	13	13	13	13	13	13
Flounder	9	9	9	9	9	9	9	9	9	9	9
Groupers	8	8	8	8	8	8	8	8	8	8	8
Snapper, Red	1	1	1	1	1	1	1	1	1	1	1
Black Drum	12	12	12	12	12	12	12	12	12	12	12
Triggerfish	3	3	3	3	3	3	3	3	3	3	3
Striped Bass	6	6	6	6	6	6	6	6	6	6	6
Grey Trout (Weakfish)	4	4	4	4	4	4	4	4	4	4	4
White Sea Trout	4	4	4	4	4	4	4	4	4	4	4
Spanish Mackerel	4	4	4	4	4	4	4	4	4	4	4
Wahoo	1	1	1	1	1	1	1	1	1	1	1
Bluefish	4	4	4	4	4	4	4	4	4	4	4
King Mackerel (Kingfish)	1	1	1	1	1	1	1	1	1	1	1
Mullet	2	2	2	2	2	2	2	2	2	2	2
Most people eat	0	1	2	17	19	6	43	17	0	8	27
I prefer to catch	3	3	4	2	2	3	8	0	1	1	1
Easy to clean	11	4	3	3	3	3	3	3	3	3	3
Can get big thick fillets or steaks	36	4	1	0	0	0	0	0	0	0	0
Hard fighting fish	52	7	5	8	4	6	12	1	1	7	3
Meat texture firm	43	1	1	1	0	1	1	1	1	0	1
Easy to catch	6	10	7	8	7	8	1	8	6	5	7
Not sturdy, durable, spoils easily	14	3	3	3	3	3	3	3	3	3	3
Must cut out red streaks from meat	49	5	4	2	2	4	2	2	2	2	2
Freeze well	16	4	3	3	3	3	3	3	3	3	3
Easy to prepare	41	6	4	4	4	4	4	4	4	4	4
Can cook any way you like	37	2	1	2	1	2	2	2	2	2	2
Bottom feeders	6	1	0	1	0	1	0	1	0	1	0
Eaten when big, not small	8	0	0	0	0	0	0	0	0	0	0
Can never get big thick fillets or steaks	36	1	0	0	0	0	0	0	0	0	0
Not hard fighting fish	53	0	1	0	3	0	1	2	0	1	0
Must be skinned	12	4	1	2	1	1	1	6	7	6	6
Doesn't even taste like fish	50	2	1	2	1	2	1	4	3	3	1
Sturdy, durable; doesn't spoil quickly	13	1	2	1	2	1	2	2	2	2	2
Very few bones	33	2	1	0	1	1	1	3	2	2	2
Meat has mild taste	18	0	1	0	0	0	0	0	0	0	0
Meat texture tender	44	0	0	0	0	0	0	0	0	0	0
Meat white when cooked	36	1	0	1	0	1	0	0	0	0	0
Nice flaky meat	48	1	0	0	0	0	0	0	0	0	0
Meat white when raw	24	0	2	1	1	0	2	2	2	2	2
Most people do not eat	2	8	14	15	13	14	15	14	12	11	12
I have never tried eating	4	4	8	9	12	9	10	9	8	8	11
Edible, but there are better fish to keep	62	10	6	4	4	8	2	9	12	5	6
Dangerous to handle	9	0	7	0	0	0	0	1	1	1	1
Scavenger fish	58	0	0	1	0	0	1	13	11	5	7
Only eaten by certain classes of people	59	1	3	0	1	2	0	9	8	3	3
Hard to clean	10	0	1	1	0	0	0	4	5	1	1
Not eaten because poisonous	20	0	1	1	0	0	0	2	1	1	1
Throw back because ugly	57	1	0	1	0	0	0	3	1	0	0
Bony	30	0	0	0	1	2	2	0	0	0	0
Small bones	32	0	0	1	7	0	1	2	2	1	1
Slimy fish	55	0	1	0	4	1	2	2	5	0	0
Good pan fish	34	0	0	0	0	0	0	1	0	0	0
Too small to bother with	51	0	0	0	0	0	0	0	1	1	1
Used mostly for bait	54	0	0	2	3	0	0	0	0	0	0
Hard to catch	5	2	1	0	1	1	1	1	1	1	1
Meat on the soft side	46	0	0	0	0	0	0	0	0	0	0
Eaten when small, not big	7	4	5	1	6	1	0	1	3	2	0
Often have worms or parasites	56	9	1	0	0	0	0	0	0	0	0
Are best smoked	39	7	0	0	0	0	0	0	0	0	0
Can be eaten only if smoked	40	5	0	0	0	0	0	0	0	0	0
Must be soaked before cooking	17	1	0	1	0	3	0	0	0	5	5
Big bones	31	0	1	1	0	0	1	2	2	2	2
Meat texture coarse or grainy	42	2	1	1	0	0	0	3	3	2	0
Meat on the hard side	45	2	0	0	0	1	0	1	6	2	1
Tastes like iodine	23	0	0	0	0	0	0	0	2	1	1
Meat is stringy or tough	47	3	0	0	0	0	0	0	3	1	1
Has muddy taste	28	0	0	0	0	0	0	0	5	3	1
Scavengers, but picky about what they eat	60	0	1	0	0	1	2	1	1	1	1
Does not freeze well	15	2	1	1	1	1	1	1	1	1	1
Meat has a strong smell	27	2	2	0	0	0	0	0	1	4	4
Can only cook one or two ways	38	2	0	0	0	0	0	0	1	1	1
Meat tastes fishy	19	3	1	2	1	2	0	0	2	1	1
Meat strong tasting	22	4	2	5	1	3	1	0	2	2	2
Meat oily tasting	21	2	1	1	0	0	0	0	0	0	0
Meat dark when raw	25	5	2	4	1	3	1	1	1	0	0
Bloody meat	29	2	1	3	1	1	1	1	1	1	1

Figure 6.—East Florida sorted item-by-use matrix based on row-row and column-column similarities.

		A	B	Ca	C	Cb	D	E	F	G
1a	Most people eat	0	0	0	0	0	0	0	0	0
	Bottom feeders	6	1	0	0	0	0	0	0	0
	Easy to clean	1	2	1	1	1	1	1	1	1
	Easy to prepare	4	3	2	2	2	2	2	2	2
	Freeze well	16	3	2	2	2	2	2	2	2
	Meat white when cooked	26	4	2	2	2	2	2	2	2
	Meat has mild taste	18	2	2	2	2	2	2	2	2
	Can cook any way you like	37	1	2	2	2	2	2	2	2
	I prefer to catch	3	5	2	2	2	2	2	2	2
	Can get big thick fillets or steaks	35	6	1	0	0	0	0	0	0
	Meat texture firm	43	3	2	0	0	0	0	0	0
1b	Eaten when big, not small	0	0	0	0	0	0	0	0	0
	Sturdy, durable, doesn't spoil quickly	13	1	0	0	0	0	0	0	0
	Meat white when raw	24	1	1	2	0	0	0	0	0
	Nice flaky meat	48	0	0	0	0	0	0	0	0
	Meat texture tender	44	0	1	2	1	1	1	1	1
	Easy to catch	6	6	8	9	7	3	2	2	2
	Hard fighting fish	52	13	11	1	2	5	6	2	2
	Meat tastes fishy	19	2	2	1	1	1	2	2	1
	Meat dark when raw	25	7	12	1	1	2	2	2	2
	Not sturdy, durable, spoils easily	14	3	2	1	1	4	4	2	2
	Does not freeze well	15	2	1	1	1	2	1	1	1
	Very few bones	33	1	0	1	6	5	6	0	0
	Can never get big thick fillets or steaks	36	0	1	1	1	1	1	0	0
	Not hard fighting fish	53	1	2	2	2	2	2	2	2
	Must be soaked before cooking	17	2	4	2	2	6	5	5	3
	Only eaten by certain classes of people	59	2	3	5	6	4	4	4	4
	Tastes like iodine	23	1	1	2	2	1	1	1	1
	Bony	30	2	2	2	1	1	1	1	1
	Most people do not eat	2	10	14	13	11	12	11	15	11
	I have never tried eating	4	5	8	10	11	7	12	12	10
	Edible, but there are better fish to keep	62	6	5	10	10	5	8	5	4
	Dangerous to handle	9	8	13	11	9	9	7	7	18
	Scavenger fish	56	0	1	1	1	5	7	7	2
	Slimy fish	55	0	1	9	6	0	0	2	0
	Throw back because ugly	57	1	1	8	0	0	0	1	2
	Must be skinned	12	1	4	7	5	6	5	1	0
	Hard to catch	5	0	0	0	1	0	0	2	5
	Meat is stringy or tough	47	1	0	0	1	1	0	0	0
	Doesn't even taste like fish	50	1	0	1	0	0	0	0	0
	Not eaten because poisonous	20	0	1	0	0	0	0	0	0
	Has muddy taste	28	0	0	3	1	1	1	1	1
	Scavengers, but picky about what they eat	60	0	1	2	0	0	0	0	0
	Eaten when small, not big	7	3	1	2	1	3	0	0	0
	Big bones	31	0	0	0	1	0	0	2	0
	Often have worms or parasites	56	5	0	1	1	0	0	0	0
	Hard to clean	10	0	0	3	3	2	1	0	0
	Meat has a strong smell	27	3	4	0	0	5	4	4	1
	Meat texture coarse or grainy	42	2	1	0	0	3	3	3	0
	Meat on the hard side	45	1	0	0	0	3	5	3	0
	Small bones	32	0	0	1	1	0	0	0	0
	Good pan fish	34	0	0	0	1	1	1	0	0
	Meat on the soft side	46	0	0	0	0	0	0	0	0
	Too small to bother with	51	0	0	1	2	1	1	0	0
	Used mostly for bait	54	0	3	0	0	0	0	0	0
	Meat oily tasting	21	1	1	0	0	1	0	1	0
	Can only cook one or two ways	38	6	2	1	1	1	1	3	0
	Must cut out red streak from meat	49	5	3	1	2	2	2	2	0
	Meat stringy tasting	22	4	3	0	0	0	0	0	0
	Bloody meat	29	2	1	1	0	0	0	0	0
	Are best smoked	39	1	0	1	0	0	0	0	0
	Can be eaten only if smoked	40	6	1	0	0	0	0	0	0

Figure 7.—West Florida sorted item-by-use matrix based on row-row and column-column similarities.

Figure 11.—Implicational relationships among positive belief-frames.

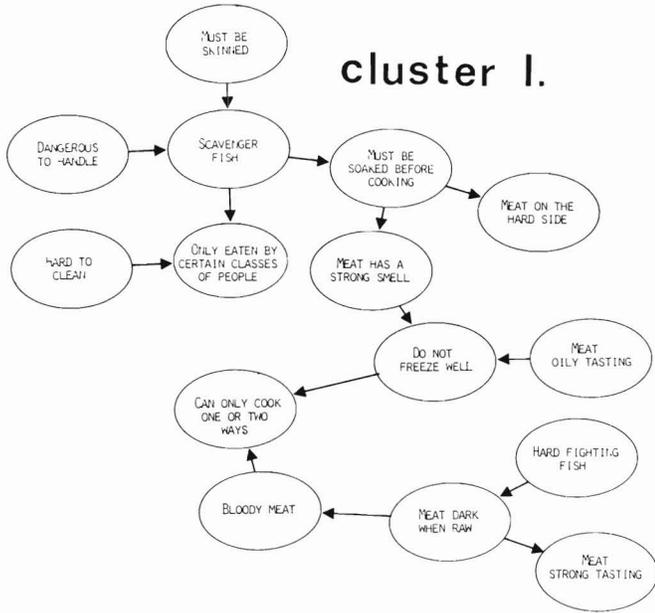


Figure 10.—Implicational relationships among negative belief-frames.

Figure 13.—Contrast relationships among belief-frames. Lines with cross-hatching indicate the contrast relationships.

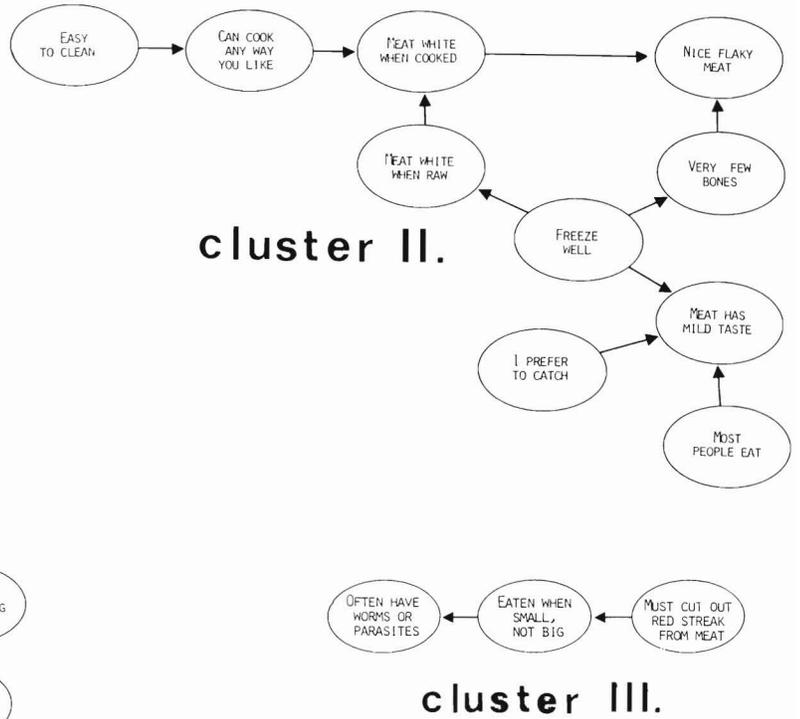
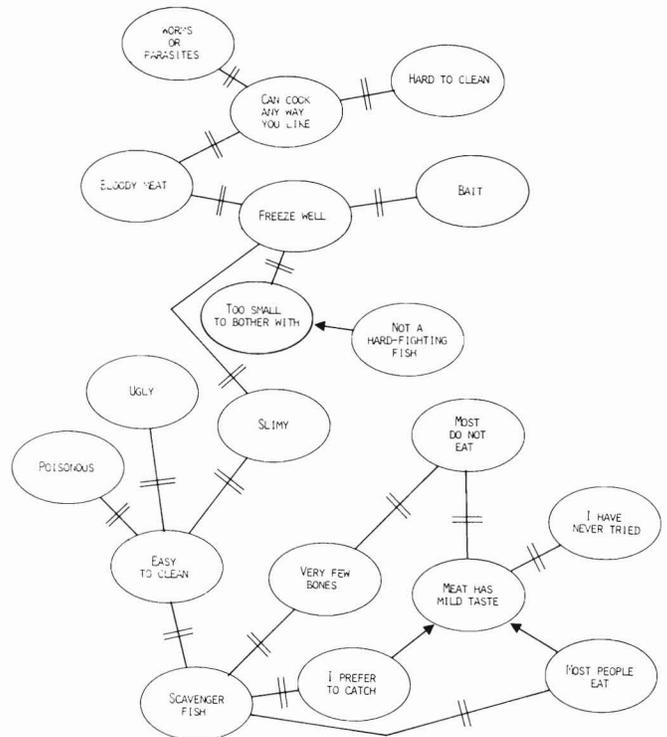


Figure 12.—Implicational relationships among a separate set of more negative belief-frames.

of uncertainty; had fishermen actually eaten and rejected these fish, our task would have been much more difficult. In addition, this information helps establish parameters for determining an approach for enhancing the image of a particular underutilized species. Knowing what positive attributes to stress, and in what combinations (e.g., knowing the importance of the implicational relationships between "nice flaky meat," "meat white when cooked," "cook any way you like," and "easy to clean"), can make a considerable difference in promoting fish. Similarly, and equally important, knowledge about negative attributes and their perceived relationships can help in determining appropriate ways to deal with the negative attributes of a particular species.

Discussion and Conclusions

These findings suggest that most perceptions concerning underutilized species are developed outside actual experiences. Beliefs relevant to these species are generally the result of hearsay and rumor perpetuated during a fisherman's socialization into recreational fishing. Ambiguities about the perceptions of underutilized species and lack of experience with such species are cognitively dealt with in terms of the general ways that recreational fishermen rank and classify fish.

Many of the findings of this study came as no surprise. That recreational fishermen target fish they perceive to be fun to catch, good to eat, easy to cook and clean, etc., are not earth-shattering revelations. Yet we would have suspected our techniques and interpretations had we not confirmed such banal knowledge. In many ways, this confirmation lends confidence to our findings.

This analysis has placed species of saltwater fish in relation to one another in terms of their similarities and differences as perceived by recreational fishermen. This information has served as the foundation for the development of educational/advertising materials designed to improve the reputations of underutilized

species, thereby promoting their use. The methods used in the study complement one another in this regard. While the HCL yielded an understanding of the general perceived similarities and differences among species, the MDS further defined relationships between the species in terms of the specific dimensions of sportfish and meatfish. These relationships suggest possible ways that underutilized species' images may be improved via favorable comparisons with preferred species that, in the minds of fishermen, they already resemble. These relationships between species also suggest which underutilized species are the most and least likely to improve with an educational program. The item-by-use matrices and entailment analyses further defined relationships between the species in terms of attributes suggested by fishermen. An understanding of the relationships between attributes (belief-frames) suggests the proper and most appropriate ways to present a case for the increased utilization of underutilized species within an educational context. Together, the three types of information provide a clear and workable picture of the domain of saltwater species as perceived by people who regularly and actively deal with them.

Knowing what fishermen like or do not like and understanding the manner in which they express their beliefs concerning fish is critical for producing appropriate and effective educational materials. In Part II, (Murray et al., 1987) we look at the application of this information to the development of educational materials directed at encouraging marine anglers to better utilize nontraditional fish in the southeastern United States.

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