Recreational Fishermen's Perceptions and Preferences for Marine Fish: Some Methodological Considerations[1]

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ABSTRACT

This paper examines a broad range of methodological issues concerning the study of recreational fishermen's perceptions and attitudes toward marine fish. Sampling and analytical methods for the study of perception and cognition are discussed with particular reference to sample size and selection and statistical techniques such as material entailment analysis. The application of these and other techniques for the study of cognition and perception among recreational fishermen is discussed.

INTRODUCTION

Social scientists are becoming increasingly involved in the study of both commercial and recreational aspects of fisheries and fisheries management. Such increased attention has naturally produced a number of benefits. First, the varied backgrounds of social scientists involved in fisheries research have contributed significantly to a broader understanding of the problems inherent in the management of fish and the people who seek them. Second, and equally important, the varied methodological orientations of these researchers have often led to unique and effective solutions to a variety of problems.

This paper examines the application of methods traditionally used in anthropology to a specific problem relevant to both fisheries research and management—providing for the increased utilization of nontraditional fish among marine recreational fishermen. Specifically, we discuss the problems of sampling recreational fishermen and the application of multidimensional scaling, hierarchical clustering, belief-frame comparisons (item-by-use matrices), and entailment analysis to the study of fish utilization. In addition, a discussion of the application of these techniques to problems in fisheries management, as well as for increasing the utilization of nontraditional fish is provided.

BACKGROUND

Growth in marine recreational fishing has risen steadily over the past decade. An estimated 15 to 20 million anglers now participate. Over five million individuals pursue saltwater fishing in the Gulf and South Atlantic states (U.S. Dept. of Commerce, 1980). Between 30 and 35% of the total

finfish poundage harvested for food in the United States is caught by marine recreational fishermen (U.S. Dept. of Commerce, 1982).

Recreational and commercial fishermen often seek the same species of fish (*e.g.*, striped bass, bluefish, and flounder along the Atlantic coast, and redfish along the Gulf coast), often causing conflict between the two groups. Among the major responsibilities of fisheries managers is that of allocating fisheries stocks among various commercial and recreational harvestors (Beaumarriage, 1978). These allocations are designed to reduce the inevitable conflicts that result when demand exceeds supply.

Many underutilized species in the marine waters of the South Atlantic and Gulf States presently are not harvested to capacity. These species include Atlantic bonito, sea catfishes, herrings, jack crevalle, jacks, ladyfish, Atlantic mackerels, tunas, sea robins, dogfish, skates and rays, and toadfish. Conflicts between commercial and recreational fishermen for traditionally sought species can be reduced if these groups can be induced to harvest underutilized species.

Aside from the rather obvious reduction in competition and potential conflict that such increased utilization would afford, it is also important to recognize the value of increased utilization to the fishing experience itself. A frequently cited reason for fishing trip satisfaction relates to the catching and eating of fish (Johnson *et al.*, 1986). Increasing the perceived value of these underutilized species would enhance the fishing experience since there would be a wider availability of fish considered both good to catch and keep.

Given the potential benefits of increased utilization the question becomes: How do you change fishermen's behavior toward nontraditional species? There are, of course, many steps involved in this process. They include such things as basic research, development of consumer educational materials, and effective distribution of these materials. Although all these steps are important in ultimately effecting change, we will concentrate on the first step—understanding the basic reasons for fishermen's acceptance or rejection of fish. We do this with particular reference to methods used in cognitive anthropology for developing informant-based models of cognition and perception.

KNOWLEDGE, CULTURE, AND RECREATIONAL FISHING

Anthropologists have based the majority of their research on the premise that members of human societies share systems of belief that subsequently influence ways of behaving. These shared understandings and actions are what constitute "culture". Culture is an important concept for our purposes and this importance is evident from the following statement by Burton (1972: 57):

> Every cultural system has named attribute scales on which the objects, persons, places, and events of everyday situations are categorized or rated. A productive schema for the description of social behavior in its normative facet is the measurement of these attributes and their relationships both to the semantic system and to behavioral norms. The measurement of objects on such scales is an important part of cultural description.

We will think of culture as shared ways of thinking and believing transmitted from individual to individual through socialization. Like Burton, we are interested in a cultural description of sorts. However, our interests lie in determining the social behavior of recreational fishermen that may be directly

attributable to the manner in which fishermen categorize or rate the fish they seek or avoid.

All beliefs and perceptions used in the categorization of named attribute scales will be affected by the degree to which subjects have been socialized into a particular system or the extent to which they share knowledge. For example, an 11-year- old's understanding of his or her kinship system is less comprehensive than his or her 30-year-old father's. We assume distinct parameters (*e.g.*, an experiential component, expert vs. non-expert, degree of specialization) defining the nature and extent of knowledge about a particular domain. This knowledge is shared to varrying degrees among all members of the system in that this "cultural" knowledge is passed to new or emerging members through socialization. This notion of culture is similar to that of D'Andrade (1981) who views culture as an information pool that is both shared and learned. In this case, an individual that is new to recreational fishing generally will be socialized (*i.e.*, will learn or gain knowledge about all aspects of recreational fishing) 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.).

Certainly one evident problem is the fact that marine recreational fishing, as the term subculture would imply, is not necessarily a culturally pervasive activity (*i.e.*, not practised by all members of American culture). The pool of knowledge relevant to this activity may be primarily limited to those who participate and may additionally be influenced by the extent of participation.[2] Kroeber (1948) recognized "systemic culture patterns" that can be thought of as well delineated sub-systems of knowledge or information that have temporal stability and coherent properties. These sub-systems have the ability to diffuse reasonably intact to other segments of the same culture or to completely new cultures. This approach has been applied to other aspects of culture including some leisure activities such as pool (Roberts and Chick, 1979), tennis (Roberts *et al.*, 1981), and women's trapshooting (Roberts and Nuttrass, 1980). Therefore, we assume the existence of a sub-system of cultural kowledge concerning recreational fishing. The problem lies in identifying informants that will have the highest degree of valid information concerning fish and recreational fishing. (For a more detailed discussion of these and related matters see Romney *et al.*, 1986.)

Consequently, it would be naive to assume equal probabilities of homogeneity among informants' responses with respect to a particular pool of information or knowledge. In other words, we must be concerned that our informants have the ability to supply reliable and valid responses concerning knowledge about recreational fishing and the domain of fish. The representativeness of our data is crucial to its effective application.[3]

We present the discussion above in order to set the stage for our rationales underlying informants' selection. Since a central theme concerns a shared body of knowledge (*e.g.*, knowledge concerning fish), we wanted to maximize the probability of interviewing informants that have access to the best available cultural knowledge concerning the recreational domain of fish.

KNOWLEDGE AND SAMPLING

Five distinct sampling universes were used. For the most part, fishermen in this study belonged to non-species-specific fishing clubs. These clubs were

located in and drew their members from east Florida, west Florida, Texas, and North Carolina (for a more detailed discussion of these samples see Johnson and Griffith, 1985). The assumption was that club members had access to the sub-systems' "information pool" and were also commited to the activity. Additionally, clubs allowed for the easy identification and selection of informants, often a difficult problem in research on recreational fishermen.

A fifth sample of non-fishing club members was taken from piers and other fishing spots in east Florida for comparative purposes. For the purposes of brevity we will only discuss the east Florida samples and analysis. A more detailed discussion of these samples, research design, analysis, and results can be found in Johnson and Griffith (1985).

Clearly, we would like to interview subjects that are representative of the majority of recreational fishermen. Fishermen with different sociodemographic characteristics may or may not display different patterns of fishing behavior. Sociodemographic portraits of recreational fishermen have found that recreational fishermen are limited only by the cost of the fishing trip. Once income is controlled for, the predictive value of other sociodemographic variables in understanding fishermen's choices may or may not be significant. For our purposes, sociodemographic characteristics of recreational fishermen have less importance than informants' shared knowledge about the fish species in their geographical region. However, it is important to note that our club samples are sociodemographicaly similar to the mainstream of marine recreational fishermen (Johnson and Griffith, 1985).[4]

The east Florida sample was drawn from the 24-mile stretch of coastal communities including Ormand Beach, Holly Hill, Daytona Beach, South Daytona, Port Orange, and Ponce Inlet. Attracting thousands of tourists every year, this area is characterized by motels, condominiums, gift shops, bars, a world famous race track, and other services and attractions catering to the tourist trade.

Thirty members of the Halifax Sport Fishing Club were contacted by phone and subsequently interviewed in person. This club has a membership of around 100 (98 are listed in the 1983-84 roster).

A second sample from east Florida consisted of 10 non-fishing club anglers found at either the Ormand Beach and Main Street Piers or near Ponce Inlet. These individuals were selected to compare their responses to those of club members as a validity check. We use the term valadity here to refer to the best approximation to the "truth", where truth refers to the nature of the "true" cultural knowledge concerning fish.

To test the basic consensus of the two samples, and therefore the generalizability of the club sample, a comparison of the judged similarity data (described in a later section) collected from the 10 non-club fishermen in Daytona Beach and 10 randomly selected fishing club members from the same area was made. The comparison consisted of a regression between judged similarity matrices for the two samples. Table 1 presents both the Pearson and Spearman correlating coefficients derived from the comparison. As is evident from Table 1, the two judged similarity matrices display similar structure.[5] We can, therefore, conclude that a high degree of agreement exists between the two samples. Since the existence of some "true" knowledge can be inferred from consensus (Weller 1986; Romney *et al.*, 1986), we can say with some degree of confidence that the club sample will be representative (valid).

Table 1. Correlation between east Florida club and east Florida non-club judged-similarity data.

Pearson	Spearman
0.78	0.63
0.0001	0.0001

MDS AND CLUSTERING

Two statistical techniques, which have been of particular importance to certain research in cognitive anthropology, 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 represented visually as points spatially distributed in euclidian 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 (for a good example of an application of these techniques see Romney *et al.*, 1972).

In this study, for example, we use these techniques to explore fishermen's judged similarities between selected saltwater fish. Fishermen from this sample were asked to perform a pile-sort task. This task consisted of informants placing cards into as many, or as few, piles as they wished, subject to the constraint that stimuli sharing membership in a pile were subjectively seen to be "similar to one another". The cards each contained a picture of a fish with its common name. Two methods for deriving similarity measures from the pile-sort 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-occurance 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. Subsequently, these measures were transformed into a similarity matrix expressing the magnitude of overall inter-stimuli association. Data in this form was then amenable to multidimensional scaling and hierarchical clustering.

HIERARCHICAL CLUSTERING ANALYSIS (HCL)

The 29 east Florida fishing club members classified fish into 334 categories.[6] Although the number of piles per fishermen ranged from three to 43, those fishermen with large numbers of piles tended to group fish on the basis of perceived family or genetic relationships. There were five such respondents in the sample, who accounted for 155 of the piles or an average of 31 piles each. The remaining 24 fishermen accounted for 179 of the piles or an average of 7.5 piles each.

Although citing a wide variety of criteria, fishermen in east Florida tended to categorize fish into broad groupings according to edibility, sporting or fighting qualities, and habitat. The criteria can be used to interpret the results of the hierarchical cluster analysis and the three dimensions of the MDS output.

Figure 1 shows the cluster analysis for the East Florida aggregated judged similarity data. Eight clusters of saltwater species are clearly visible.[7]

Informants were asked to provide reasons for their sorting behavior (Why did you put these fish together in this pile?). These informant descriptions were useful in interpreting the HCL taxonomy. It was clear that these fish were clustered together on the basis of a few salient characteristics. For example, cluster 1 tended to be occupied by fish that were described as good fighting fish but were not perceived to have any food value, while cluster 2 represents fish that were perceived as good sport fish with medium to excellent food value. The fish in cluster 3 were viewed as highly edible inshore species. The next two cluster's members consist of fish that are less desired. Those fish in cluster 4 were viewed as baitfish with their small size negatively affecting their perceived food value, while the fish in cluster 5 were perceived as trash fish or the least desirable of all the species. Similar to the species in cluster 2, the fish of cluster 6 were considered highly valued food fish, but fish that are not necessarily challenging or exciting to catch. The final two clusters consisted of fish that were often perceived as difficult to clean, but would not be discarded if caught incidentaly (cluster 7) and sharks (cluster 8) which were simply described as "sharks".

MULTIDIMENSIONAL SCALING ANALYSIS (MDS)

There are two basic ways to interpret the configurations produced by MDS:

1. Examining the proximities or distances between stimuli (fish).
2. Through dimensionality.

Although we will make occasional reference to the proximities, in this section we discuss primarily the dimensions, which can be thought of as continuums, usually at 90° to one another, reaching from one extreme to another anywhere within the configuration. Like the hierarchical clustering analysis, the three criteria which account for similarities among the stimuli are edibility, sport, and to a lesser extent, range.

Dimension 1: The Edibility Dimension

The species in this dimension (along the horizontal axis in Figure 2) are arranged along a continuum from highly desired food fish on the left to poor-tasting or inedible species on the right.[8] At the one extreme we find flounder, groupers, snappers, and pompano; at the other extreme, shark, dogfish, stingray, puffers, and sea robins.

Dimension 2: Sport Fishing Characteristics

The continum of good game fish to poor game fish (along the vertical axis from bottom to top in Figure 2) is expected among recreational fishermen as a means of differentiating between species. According to the configuration, we can see that tarpon, amberjack, wahoo, dolphin, king mackerel, and others fall at the positive end of the continuum. Spadefish, croaker, grunt, and other small fish fall at the negative end. Again, we see that blacktip and lemon sharks are perceived as slightly better game fish than other sharks. And the larger gafftopsail catfish is closer to the sporting end of the continuum than other underutilized species.

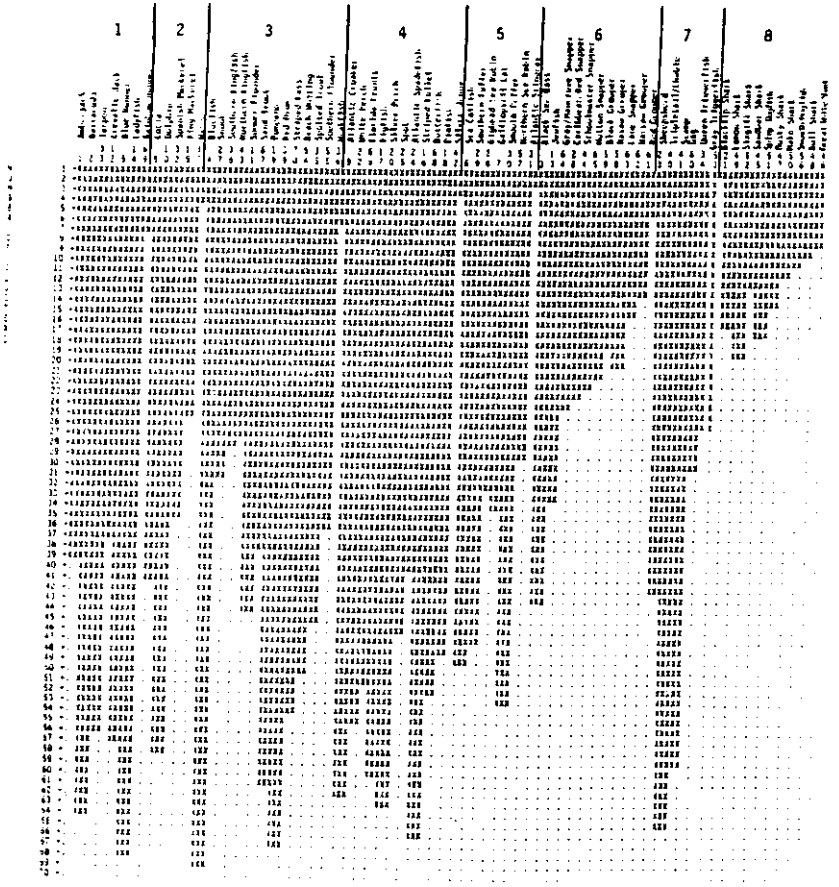

Figure 1. East Florida hierarchical clustering taxonomy.

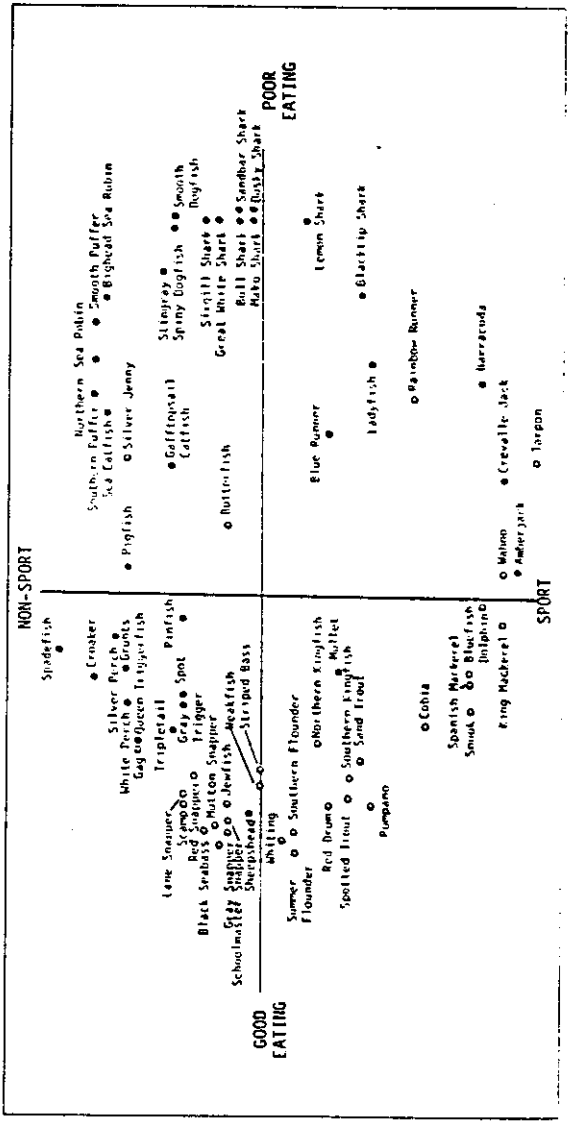

Figure 2. Multidimensional scaling for East Florida: Dimension 1 vs. Dimension 2

Dimension 3: Range or Habitat of the Species

This dimension is not nearly as well defined as the first two dimensions. In Figure 3, most of the species found close to shore, in the river and surf, are located towards the bottom of the configuration, while offshore species are located towards the top. The dimension thus runs along the vertical axis in the configuration. There are a few exceptions, however, such as spotted trout's similar location along the vertical axis as black sea bass's. Still, this dimension suggests that the places in which species are located influence their perceptions of the species. By extension, fishermen's behavior toward saltwater species may vary with regard to the location of the species. In some ways, fishermen view habitat as an influence over the taste or sporting characteristics of the species.

ITEM-BY-USE/BELIEF-FRAME COMPARISONS

One further method was used to identify and understand the perceived attributes and relationships among the fish species. This method is complementary to the scaling and clustering procedures and involves the construction of sentence-frames (belief-frames) that aid in the identification of important attributes. These sentence-frames, or belief-frames, are used in conjunction with the multidimensional scaling output to develop a model of recreational fishermen's beliefs about the fish they seek and ignore (D'Andrade *et al.*, 1972).

Construction of belief-frames are based on interviews with recreational fishermen from each study area. The way fishermen describe the properties and attributes of traditional and nontraditional recreational species (*e.g.*, fighting characteristics, eating characteristics, etc.) during natural discourse were used to construct these frames. Recurrent properties in fishermen's descriptions were incorporated into a series of sentences. Subjects were asked to provide the species (from an appropriate list) associated with the attribute implied in each sentence, such as "You can not 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. Responses were aggregated across informants and a method for clustering rows and columns that were similar was used to discover relationships among both species and belief-frames. This method compares to one used in the study of food snacks and their attributes with respect to when they are eaten (Stefflre, 1972).

The 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 correlation coefficients on similarities between items across belief-frames and between belief-frames across items. 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. These similarities

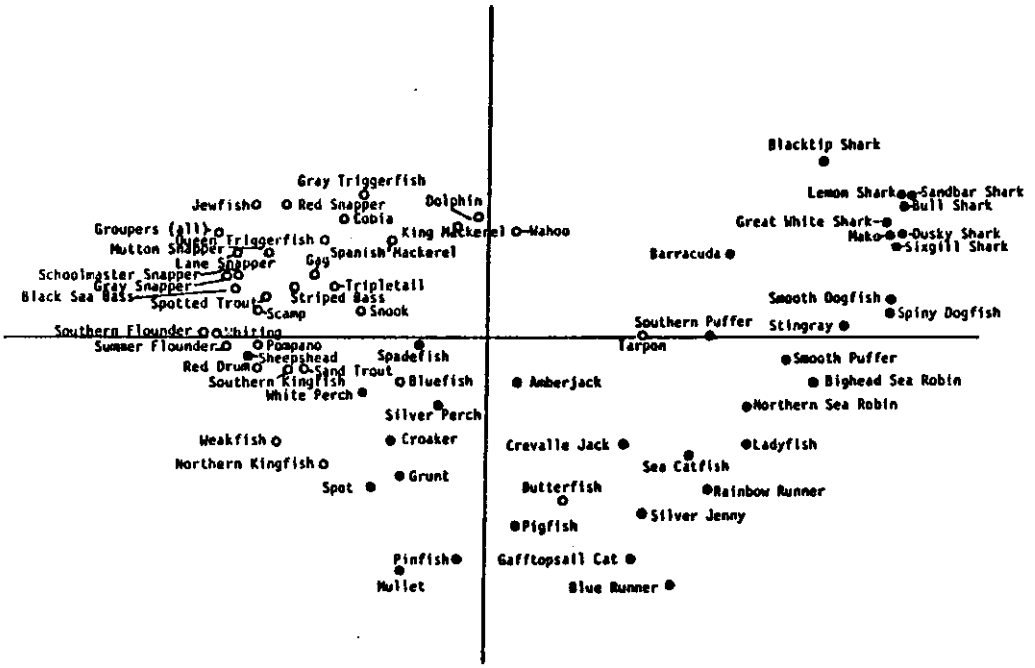

Figure 3. Multidimensional scaling for East Florida: Dimension 1 vs. Dimension 3

were then used in an iterative process based on "linear equivalence claims" to sort rows and columns on the basis of similarity (Stefflre, 1972).

For our purposes, row-row and column-column similarities were derived by using the computationally equivalent version of Stefflre's algorithm. These similarity measures for rows and columns were subjected to HCL to obtain the sorted species/belief-frame matrices for each region. In addition, it is important to note that these same similarities can be analyzed with the use of multidimensional scaling.

The clusters or groups of species resulting from the analysis of the belief-frame data are similar to the clustering of the judged similarity data. This is not surprising; both data sets came from the same fishermen responding to the same set of stimuli. In comparison to both MDS and HCL, this procedure allows us to address similarities and differences between species and groups of species on the basis of more specific characteristics. These characteristics are presented along the columns in Table 2. They include such things as the texture and taste of the meat, the appearance and size of the species, and storage and handling characteristics. As noted earlier, each of these belief frames was suggested by one or more fishermen during the early phases of research in the four target areas.

As Table 2 shows, the 56 saltwater species were ordered into six major clusters (divided by solid horizontal lines). Two of these major clusters were divided further into four smaller clusters (divided by dotted horizontal lines). In addition, it is evident that clusters A-C are more closely related to one another than they are to the other clusters. By the same token, the clusters D-F are more closely related to one another than to clusters A to C. These broad distinctions roughly correspond to species that are undesirable (A-C) and species that are desirable to fishermen in east Florida (D-F). With the use of this procedure, we can examine the perceived charateristics responsible for species acceptance and rejection.

ENTAILMENT ANALYSIS

Data from the belief-frame comparisons can also be modeled in terms of implicational or logical relationships (D'Andrade, 1976; White *et al.*, 1977; White and McCann 1981). The structure of these relationships, or the entailment structure, is obtained through a multivariate contingency analysis of paired dichotomous variables similar to Guttman scaling.[9] The logical or implicational relations are modeled in an "If A then 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).

To provide further clarification, an example of contingency analysis between two of the beleif-frames is presented. Table 3 shows a contigency analysis of the the two belief-frames from the IBYU; "meat has a mild taste" and "nice flaky meat". An entailment relationship exists when the value of zero or near zero exists in the upper right or lower left cells. In this particular example, the relationship "nice flaky meat" entails "meat has a mild taste" (visually represented as A <----- B). An added feature of this modeling

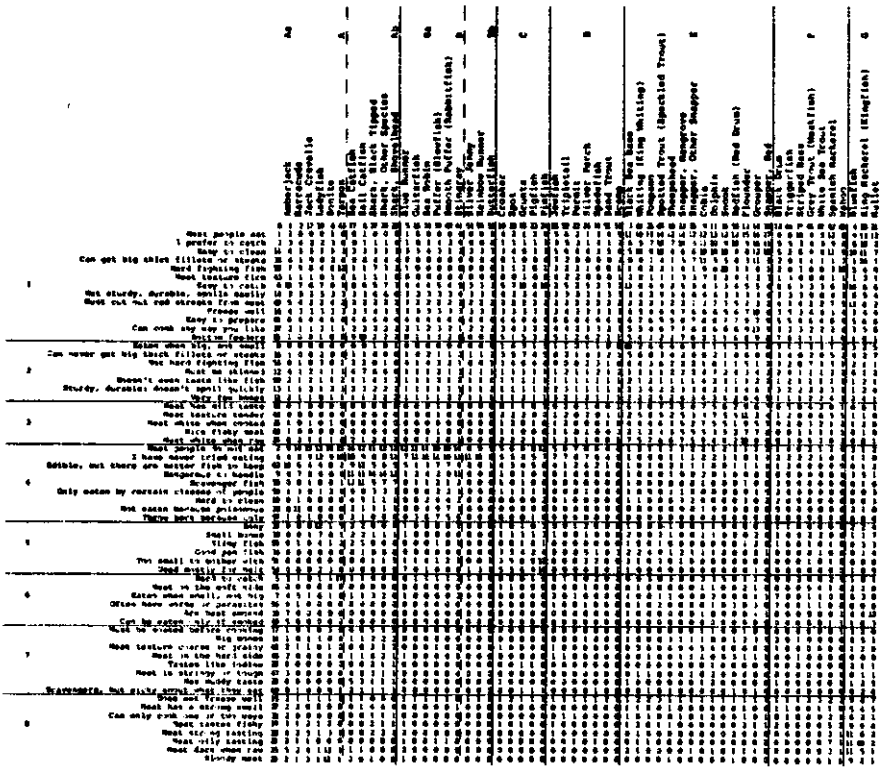

Table 2. East Florida sorted item-by-use matrix based on row-row and column-column similarities.

Table 3. Example of contingency analysis.

		Meat has mild taste		
		mild taste	$\overline{\text{mild taste}}$	
nice flaky meat	flaky	7	0	7
	$\overline{\text{flaky}}$	6	43	49
		13	43	56

procedure is the ability to determine what fish are responsible for what relationships within the model.

Figures 4 through 7 are entailograms showing both the implicational and contrast relationships among the beleif-frames.[10] Cluster 1 (Figure 4) contains beleif-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" enatils that the fish is a "scavenger" which in turn entails it "must be skinned". Many informants disparagingly described certain scavenger fish as being only eaten by certain classes of people. In addition, many of these scavengers were seen as requiring skinning (*e.g.*, catfish).

A second example is the string "can only be cooked one or two ways" 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 (Figure 5) shows the realtionship among positve 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 7 shows an example of contrast relations. Lines with cross hatches denote these relations. 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".

In sum, we have provided some brief descriptions of methods that were useful in developing an informant-based model of perceptions concerning fish. In the next section we briefly discuss the utility of these techniques for producting educational material to increase the utilization of nontraditional species among recreational fishermen. In addition, we suggest how these techniques can be applied to other problems in fisheries research.

SUMMARY AND DISCUSSION

The previous examples demonstrate the usefulness of these procedures for providing information on fishermen's perceptions that form a solid basis for designing an educational program to increase use of underutilized species. They show us where potential for the improvement of a species' "image" may be possible or how improving the image may be accomplished by pointing out its

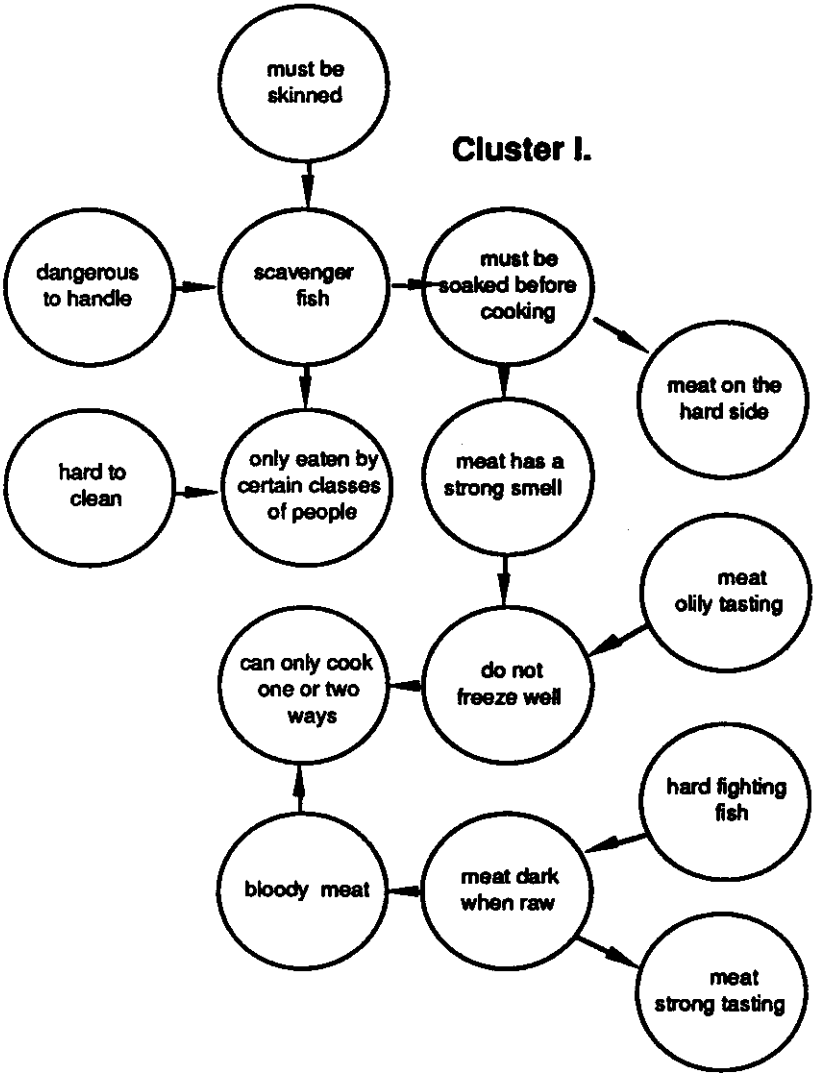

Figure 4. Implicational relationships among negative belief-frames.

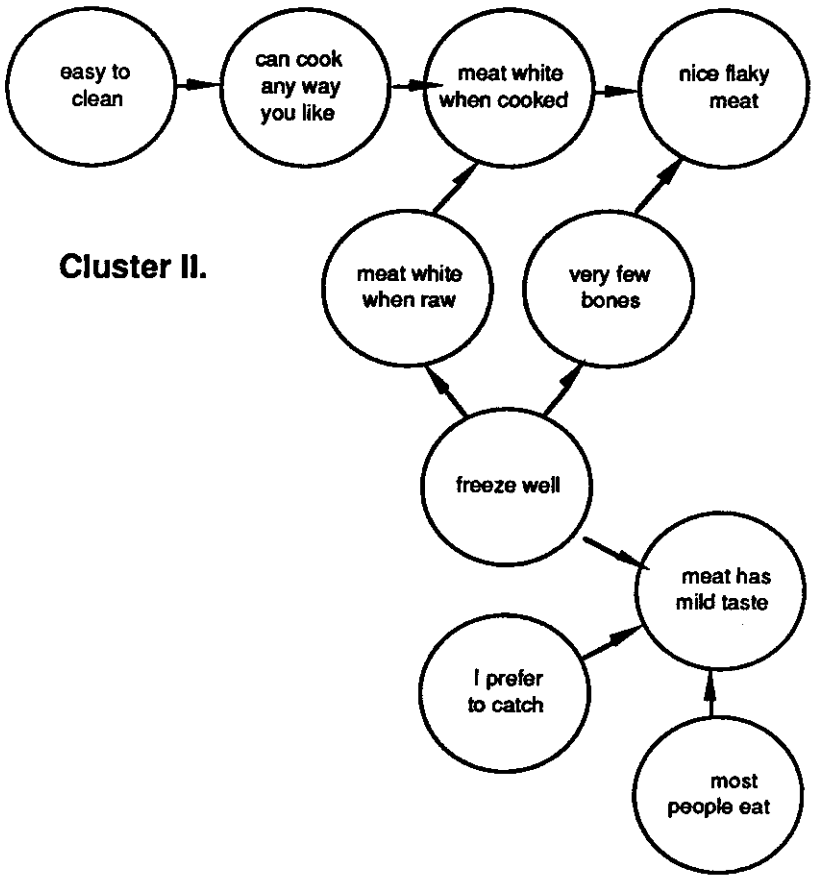

Figure 5. Implicational relationships among positive belief-frames.

Cluster III.

Figure 6. Implicational relationships among a separate set of more negative belief-frames.

similarities with desired, more utilized species. They show how understanding the relationships among attributes can provide guidance in producing culturally appropriate descriptions of nontraditional species. They can help in identifying species with the most potential for increased utilization and provide critical guidelines for the production of educational materials.

In practice, the information provided through the use of these techniques in all four sampling areas was critically important in the design and production of over 29 pieces of educational material. The consumer educational materials were produced in various formats (*e.g.*, brochures, posters, video cassettes, cookbooks). All materials, however, were directed at the promotion of nontraditional species in the southeastern United States. Demand for these products has been exceptionally high with requests coming from as far away as Guam and West Germany.

The potential use of these methods, however, are by no means limited to the type of research problem discussed above. Most recently, Schoepfle *et al.* (1984a) have selectively applied these techniques to the study of energy development and economic decision making among the Navajo. In a similar study, Schoepfle *et al.*, (1984b) modeled Navajo attitudes toward development, including their attitudes towards a number of potential policy alternatives. Fisheries research and management analogs to such applications are compelling. The study of decision making among marine policy makers, the perceived relatedness of problems in the fishing industry or among various constituencies, consumer attitudes towards new fisheries products such as surimi, and models of fishermen's attitudes towards regulation and management are just a few examples of the varied substantive problems these methods can help explore.

In sum, hybrid approaches to social science fisheries research afforded by the participation of varied investigators, with equally varied theories and methods, can be both interesting and potentially productive.

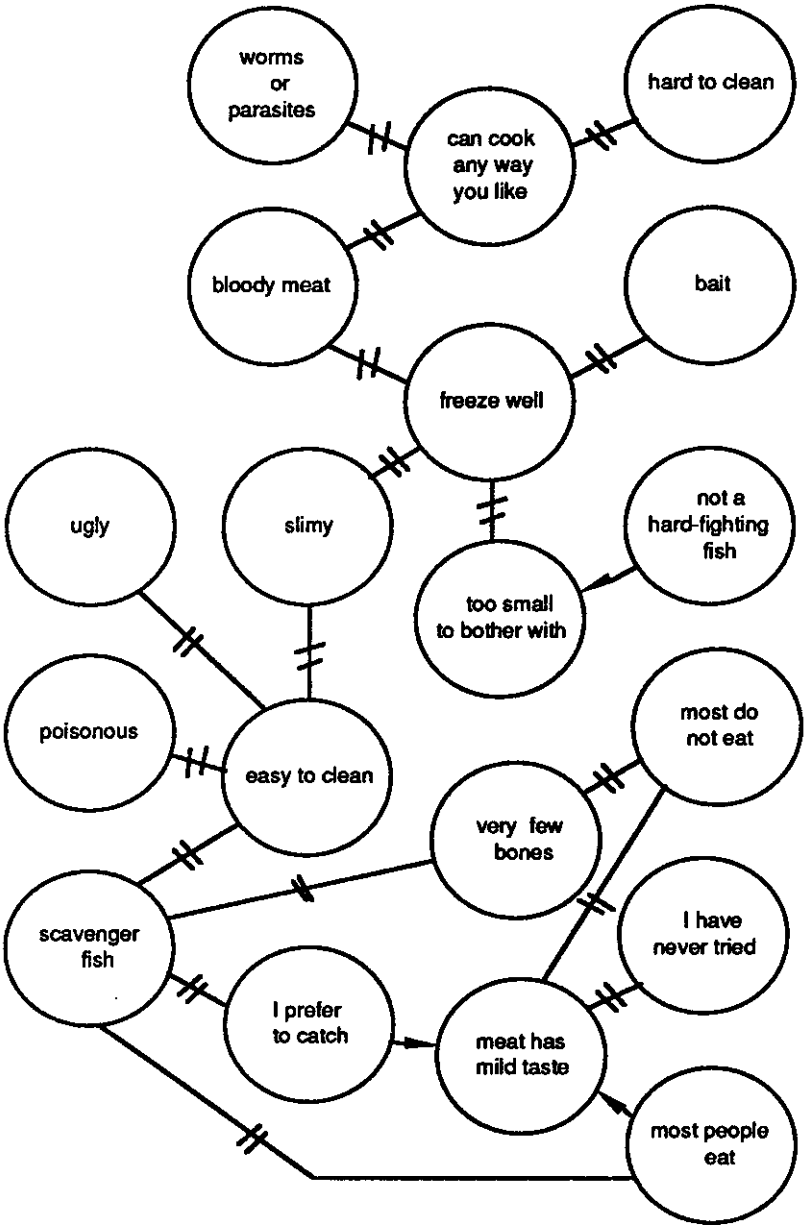

Figure 7. Contrast relationships among belief-frames.

FOOTNOTES

[1]The research for this paper was supported in part by a National Marine Fisheries Service Grant. Contract No. NA83-WS-H-00016.

[2]Boster and Johnson (forthcoming) tested argeement between club samples and naive informants (undergraduates who have never fished) with respect to sorting behavior. They found significant differences to exist between the two in terms of factors accounting for such behavior.

[3]There is a related approach in research on consumer behavior in which there is an interest in identifying market segments. Green and Carmone (1972) define market segmentation as:

...a reasonably homogeneous group of buyers who respond differently from other segments to similar marketing appeals-advantage, point-of-purchase display, product features, and so on. That is, emphasis is placed on individual differences in sales response to more or less the same stimuli (185).

Unlike product domains, the domains of fish and fish attributes receive little influence from advertising, point-of-purchase display, and so on. (However, we are interested in homogeneity with respect to a normative understanding of a particular semantic domain.) While the types of stimuli described by Green and Carmone (1972) may have some influence on the behavior of recreational fishermen, the greatest influence is that recreational fishermen have upon one another. For our purposes, therefore, we approach the problem from a cultural rather than a market segmentation perspective.

[4]This does not mean 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, our findings may not apply to segments of the total recreational fishing population. 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. They argue that distinct differences in linguistic behavior, socialization, and ethnicity between whites and other ethnic groups result in different meanings, perceptions, and beliefs. However, Romney *et al.* (1979) has shown recently 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 points to the importance of the length of exposure to American popular culture (*e.g.*, television, radio, etc.) and interaction with other social groups in the United States.

Although our findings may not apply to ethnic groups other than white, U.S.-born individuals, this does not necessarily undermine the importance of our findings or their effectiveness as tools to increase the utilization of underutilized species. Two factors support this. First, studies of marine recreational fishermen that have used random sampling techniques show that the majority of marine recreational fishermen in the U.S. are white (KCA Research, 1983). As the following table shows, non-white ethnic groups comprise about 5% of the Atlantic marine recreational fishermen and no more than 15% of the Gulf and Pacific recreational fishermen:

Table 3. Percentage distribution of marine fishing households by race.

Racial Category	Atlantic	Gulf	Pacific
White	94.9	85.8	89.3
Black	3.4	7.6	2.3
Hispanic	0.7	5.1	4.7
Indian	0.3	1.3	1.2
Oriental	0.2	0.2	1.6
Other	0.5	0.0	0.5
SE Asian	0.0	0.0	0.4

Source: KCA Research (1983:5)

Second, is the underutilization of species a problem among non-white ethnic groups? Despite a lack of conclusive evidence, it is widely believed that non-white fishermen utilize a broader range of fish than white fishermen. For example, investigators were told that Koreans in Daytona routinely came to the piers to buy ribbonfish from fishermen for soup. White fishermen in Daytona, however, tended to reject ribbonfish as being too small. In addition, many fishermen said that blacks would be the best individuals to consult about cooking and cleaning certain underutilized species. Talking about blowfish one respondent said, "Blacks are more knowledgeable about eating them. They know how to clean them. They're poison if you don't know what you're doing." Certainly some comments stem from stereotypes members of one ethnic group have about another. But frequency of such comments during the interviews lends some support to their validity.

[5]In order to gain an idea of the significance of this agreement, Stefflre (1972) reports that split-half reliabilities for data of this form ranged from 0.75 to 0.95.

[6]It is instructive to note factors relating to sample size. Table 4 shows the sample size and selection process (where stated) of a number of studies employing MDS.

As is evident from this table, most researchers interviewed between 10 and 50 subjects. However, one researcher surveyed as few as five subjects, while another used as many as 600 in a national survey. As Stefflre (1972) remarks: "This kind of data stabilizes with fairly small samples of respondents (N=30-60) (1972;214)". It is important to note that these techniques are not as reliant upon sample size for gaining statistical significance as other statistical procedures, such as linear regression or other univariate or multivariate procedures. Rather, it is more important in these procedures to sample subjects who share an understanding of the domain under study.

[7]Clusterings were produced using the SAS average linkage procedure.

[8]The stress in three dimensions was 0.170.

[9]Data from the east Florida IBYU was dichotomized using the following break point; $\alpha > 3$.

[10]The entailogram was produced with the aid of a multidimensional Guttman scaling program written by Doug White. Relationships shown had

Table 4. Sample size and procedures for several studies employing MDS techniques.

Study	Sample Size	Subject Selection
1. D'Andrade *et al.* (1972)	10, 5, 11	—
2. Burton (1972)	54	advertisements in school newspaper
3. Wexler & Romney (1972)	155, 35, 35	—
4. Rapaport & Fillenbaum (1972)	17, 17, 26	—
5. Cliff (1972)	31	—
6. Green & Carmone (1972)	12	random selection from a field of 22
7. Stefflre (1972)	50, 34, 50, 600	—
8. Wish *et al.* (1972)	6 groups of 10-20	recruited by means of posters placed in the International Student Center at Columbia University.

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