ANALYSIS OF A NICHE MARKET FOR FARM-RAISED BLACK SEA BASS *CENTROPRISTIS STRIATA* IN NORTH CAROLINA

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ABSTRACT

A demand analysis for farm-raised black sea bass (BSB) was conducted in the upscale niche restaurant market of North Carolina (NC) via field sample surveys of restaurants drawn at random from the population of all NC restaurants. The analysis determines the effects of niche market variables on BSB quantity demanded at the individual restaurant level. Sample results were extrapolated to the full population of NC restaurants to estimate statewide niche market demand for farm-raised BSB. Results indicate that 15.9 percent of sampled restaurants meet the predetermined niche market criteria, producing a statewide NC niche market size estimate of 3,279 restaurants. Most (88 percent) surveyed restaurants serve a suburban rather than tourist or urban/professional clientele. Surveyed niche market restaurant chefs prefer fresh, chilled fish products (88 percent) of moderate fat content (41 percent). Beyond taste and appearance product attributes, chefs identified freshness, continuous availability, and fish size as most important. Few (7 percent) niche market restaurants currently purchase BSB, but most (76 percent) reported that they would purchase farm-raised BSB similar to those evaluated in the survey if they were available for a price similar to the price of substitute species like grouper. Some (14 percent) reported problems with ocean-caught BSB availability. A majority (66 percent) had no preference for ocean-caught over farm-raised BSB products. Regression analyses showed that higher prices for substitute species and higher dinner entrée prices have positive effects on BSB purchases, resulting in greater BSB demand. Higher BSB prices have a negative effect on BSB demand. The only significant effect of season was moderately lower demand in winter. Effects of geographical location were not significant. For a likely example scenario, estimated NC statewide BSB niche market demand was 179,077 kg (394,798 lb) per year. A potential industry limitation is NC chefs' preference for whole weight fish products exceeding 908 g (2.0 lb).

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DEDICATION

For my mother, who never forgets to tell me she loves me.

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INTRODUCTION

Aquaculture

Aquaculture is the rearing of aquatic organisms under controlled conditions. The primary goal of aquaculture is food production. Pressure on the aquaculture industry to produce seafood is growing rapidly in response to shifting global trends that predict an increase in the need for larger production volumes and greater product diversity.

Seafood market challenges and opportunities

In the United States (US), new challenges are emerging that will affect the supply and demand for domestic seafood in the future. It is anticipated that these challenges will have a significant impact on the US aquaculture industry in terms of production scale and commodity. The demand for seafood in the US is currently high and it is expected to rise as the population increases (Jensen 2006). However, commercial fishing regulations are restricting the availability of seafood and, as a result, will likely compound this general rise in demand for aquaculture products.

Furthermore, in the US, higher personal incomes and growing consumer preferences for product nutrition, health, and safety are dramatically changing buyer behavior (Olsen 2004, Jensen 2006). As a result, consumer trends predict that seafood will be the most purchased food entrée product by 2020 (Jensen 2006).

In response to these challenges, intense pressure is being placed on the US aquaculture industry to increase seafood availability via expansion and product diversification. To do so, however, it is imperative that the industry increase efforts to target new species that are in high

demand, low supply, commercially viable, and will be readily accepted in an evolving US seafood market.

As the regulatory restrictions that limit seafood supply continue to intensify, the need for expansion and diversification within the aquaculture industry becomes apparent (Quemener et al. 2004). To that end, efforts are underway to increase diversity of continuously-available seafood products via commercial aquaculture of new species. Recent growth in the production of farm-raised marine finfish, for instance, is a development trend that could have significant implications for domestic seafood supplies and the future of commercial aquaculture in the US.

Historically, difficulties in rearing marine fish, limited natural resource availability, and high capital costs have restricted the commercial production of marine finfish through aquaculture. Advances in rearing techniques and new technologies, however, are improving production methods for farm-raised marine finfish, which now demonstrate the fastest overall growth rate of any commercially-available aquaculture food product group (FAO 2004).

Consequently, greater expectations for industry success are also emerging alongside these improved production capabilities. That is, as the commercial market continues to evolve, pressure is intensifying on the seafood industry to exploit market opportunities using distinct advantages exclusive to finfish aquaculture. A unique advantage currently receiving interest from developers is the capacity to grow commercial volumes of finfish under controlled conditions to dictate final product forms, and therefore meet particular consumer preferences.

BSB aquaculture potential

The black sea bass (BSB), Centropristis striata, is an example of a high-value, high-demand marine finfish recently identified as a viable candidate for commercial aquaculture. The

BSB is a historically popular seafood fish that is endemic to continental shelf waters from Massachusetts to Florida (Musick and Mercer 1977, Sedberry 1988). As such, it is an economically important commercial fishing species for many east coast states. In North Carolina (NC) for instance, the 2006 commercial landing value for BSB exceeded $1.7 million (NMFS 2006).

In recent decades, however, the intensification of commercial fishing regulations has significantly reduced the total annual landings of BSB in NC (NMFS 2007). Moreover, status reports for the fishery reveal that BSB stocks are currently recovering from a long history of commercial overexploitation, and as a result, will continue to be regulated for the indefinite future (NMFS 2007). The retail availability of BSB seafood products in NC is therefore limited and increasingly unpredictable. Despite this, BSB product value and demand remain high throughout the state.

Collectively, market patterns suggest that a farm-raised BSB industry has a promising economic outlook in NC. Opportunities for industry development are growing due to the combination of inadequate supplies of ocean-caught BSB and growing retail demand. Evolving buyer preferences for new seafood products also favor industry development. Together, these trends provide reasonable justification for investigating the commercialization of BSB production through aquaculture in the state.

Previous work in BSB aquaculture

BSB culture

Marine finfish aquaculture has been historically problematic primarily due to difficulties associated with larval culture. Intricate environmental conditions and complex nutritional

requirements of larvae are traditional sources of these complications (Halver 1989). Recent progress toward improving the methodology of marine finfish larval rearing, however, has been significant. As a result, new candidates for commercial aquaculture have been identified.

Progress in BSB controlled breeding and larviculture, for instance, has recently helped to identify the species as a viable candidate for commercial aquaculture. These efforts support BSB commercialization by resolving traditional difficulties via experimental demonstrations with BSB larvae. For example, the optimization of induced spawning of BSB broodstock (Watanabe et al. 2003) and hatchery-based rearing techniques (Berlinski et al. 2000, Copeland et al. 2002, Copeland and Watanabe 2006) successfully standardized larviculture methods important to BSB commercialization. Specifically, progress in induced spawning has helped to develop more efficient volitional approaches in captivity via the administration of hormone treatments to BSB broodstock (Watanabe et al. 2003). Other studies have investigated the requisite environmental parameters for tank-based larviculture and intensive methods for larval nutrition to effectively optimize hatchery-based rearing of BSB larvae at high densities (Berlinski et al. 2000). As a result, important new evidence supporting the potential for BSB commercialization has been demonstrated.

Aquaculture technology

Furthermore, new state-of-the-art technologies have improved system designs used in commercial finfish aquaculture, resulting in greater potential for industry development in NC. These advances have most notably focused on reducing the environmental impact of commercial aquaculture while maximizing production under conditions of limited natural resources. For example, using state-of-the-art designs developed by Losordo et al. (2000), UNCW recirculating aquaculture systems (RAS) were shown to successfully grow out marine finfish (e.g. summer

flounder Paralichthys dentatus) to market size at near-commercial volumes (Carroll et al. 2005). Moreover, the RAS technology was demonstrated to efficiently treat and recycle seawater during these efforts. The benefits of state-of-the-art engineering designs like RAS technology have established new standards for marine finfish production by improving waste management capabilities and reducing the natural resource cost of seawater. These technological advances are important in NC where environmental impact is highly regulated and seawater access is becoming more limited.

Certain drawbacks to marine RAS technology do exist, however, and this should be acknowledged. Most notably, high capital costs of production (e.g. equipment and real estate) and decreasing availability of coastal commercial property with seawater access pose serious challenges to marine RAS use in NC (Copeland et al. 2005, Yates et al. 2008). Research efforts aimed at minimizing the effects of these challenges are currently underway.

BSB marketability

Previous investigations have addressed the economic potential for BSB aquaculture in NC, but these reports are limited in scope. Copeland et al. (2005) conducted the first investigation of BSB production economics in NC via a small-scale RAS for ongrowing wild-caught BSB. The study quantified capital costs of development, estimated annual production expenses, and provided data from preliminary BSB field marketing trials in an effort to evaluate overall industry potential. Results indicated that BSB product price had the largest impact on economic returns, although biological parameters such as growth rate and survival were also important (Copeland et al. 2005). However, Copeland et al. (2005) did not investigate the marketability of "hatchery-reared" BSB. Thus, the conclusions do not represent farm-raised

BSB market potential. A study investigating the marketability of hatchery-reared BSB in NC is needed.

Commercial aquaculture marketing

Research investigating the commercial marketability of farm-raised marine finfish is remarkably underdeveloped. To some extent, however, this can be expected because farm-raised marine finfish are relatively new commodities to the seafood market. Furthermore, due to the high cost associated with applied market research, nearly all commercial aquaculture farms are primarily production-oriented, focusing on minimizing production costs (Engle and Quagrainie 2006). Moreover, of the market research that has been performed, a substantial amount was conducted independently by private operations. As a result, these data have in many cases been withheld from the public in an effort to protect proprietary interests.

However, as Engle and Quagrainie (2006) point out, sufficient marketing data are nonetheless available to suggest that market-oriented aquaculture firms are the most financially successful. Specifically, economic studies find that a majority of all profitable aquaculture enterprises utilize business models that account for seafood marketing and consumer demand, including buyer preferences, pricing trends, and consumer and retail-sector composition, in addition to production cost control.

A small number of investigations on the marketability of commercially-reared marine finfish have been performed; though most considered international markets where marine finfish aquaculture is much more prevalent. Salmon (Asche et al. 1999), striped bass (Swartz 1989), European seabass, and seabream (Josupeit 1995) are some of the marine finfish species that have been investigated in market studies to this point. Virtually no in-depth market studies are

available for marine finfish species raised using RAS-based technologies, such as pompano, cobia (Weirich et al. 2006) and flounder (Carroll et al. 2005). Rather, most market studies concerning cultured marine finfish investigate species raised under open water conditions in commercial net pens.

Commercial-scale market demand for farm-raised BSB has therefore not been investigated to this point. Despite a strong demand for wild-caught BSB and advances in rearing techniques, significant progress in developing a commercial aquaculture industry for BSB in NC will be difficult until market demand can be evaluated. Factors typically associated with seafood marketability are quite diverse, ranging from product-specific attributes such as fish size, fat content, and fillet yield, to market parameters like region, season, distribution channels, and cultural acceptance.

Niche markets

The niche market is a component of the overall market structure that has received an increasing amount of consideration in recent decades. Although some argue that every market is a niche market (Palfreman 1999), the term is generally defined as a "low-volume, high-priced specialty market" that targets small consumer segments using premium, and often specialty, product commodities (Engle and Quagrainie 2006).

Characteristics commonly associated with niche markets include limited competition, a greater emphasis on consumer interaction, and lower quantities sold, which are generally compensated by higher per unit prices. Niche markets often develop as a result of newly-available products that cater specifically to an emerging demand or a supply deficiency. As such, product promotion typically plays an exaggerated role in most niche marketing strategies.

A new farm-raised BSB industry in NC would likely first pursue a niche market with low production volumes commanding premium product prices, and a highly-specialized customer base made up of upscale, gourmet restaurants.

Purpose

The purpose of this project is to characterize market demand for farm-raised BSB in NC. The University of North Carolina Wilmington (UNCW) Center for Marine Science (CMS), in conjunction with the UNCW Department of Economics and Finance, is investigating market demand in the upscale niche seafood restaurant market of NC. The study intends to assess aggregate niche market demand using an in-field survey of a randomly-selected sample of restaurants meeting criteria that define the niche.

Commercial quantities of BSB that have been hatchery-raised and grown out to market size will serve as ultra-fresh product to be prepared and evaluated by executive chefs of sampled upscale restaurants. Estimates of BSB demand at statewide, regional and individual restaurant levels are developed and the effects of various market factors on demand are investigated. Restaurant-specific variables such as seating capacity, clientele type, entrée price, and preparation style will be explored in an effort to identify optimal markets for maximizing potential return. Consumer and chef preferences for over 20 different attributes of farm-raised BSB products are evaluated to help characterize the most marketable BSB product forms.

METHODS

From summer 2007 to spring 2008, a survey and analysis was conducted to assess upscale seafood restaurant demand for farm-raised BSB in NC. The in-person field survey interviews utilized fresh BSB product. Approximately 3,000 hatchery-reared BSB were grown-out in an outdoor, two-tank RAS (see Carroll et al. 2005 for a detailed description of the RAS) to provide fresh BSB product for the study. Individual tank stocking densities were maintained as suggested by Copeland et al. (2003). Water conditions of 19-23° C, neutral pH and 33-34 g/L salinities were maintained to ensure optimal environmental parameters. Multiple daily feedings of commercial marine finfish pellets to apparent 100 percent satiation were administered 6-7 days/week and growth was monitored regularly until a target average market size of greater than or equal to 567 g (1.25 lb) (per whole, individual BSB) was achieved.

A pre-trial survey of ten local (Wilmington, NC) upscale seafood and sushi restaurants was conducted to help identify appropriate niche markets and the attributes associated with them, such as average dinner entrée price and survey response rates. The pre-trial survey also provided important feedback used to clarify survey question wording and establish sample sizes for the statewide survey.

Experimental design

Following the completion of pre-trial survey, a list of potential niche market restaurants was identified from a master list of all NC restaurants operating in 2006 obtained from the NC Department of Environment and Natural Resources (DENR). The statewide survey utilized a stratified random sample of restaurants from the population of all NC restaurants. The sample

was stratified by geography into three regions, western, central and coastal, based on the assumption that variation in key survey variables is larger between strata than within strata, and corrective weighting of regression analysis results may be required (Cochran 1977). This assumption was based on the following observations: coastal restaurants differ from central and western restaurants in terms of the availability of fresh, ocean-caught substitute marine fish products, and western restaurants differ from central and coastal restaurants in the availability of fresh mountain trout substitute menu items. The three strata were defined by the following latitude-longitude coordinates: western latitude > 34.29, longitude > 79.25; central latitude > 34.29 longitude >78.25 and < or equal to 79.25; coastal latitude < or equal to 34.25 or latitude > 34.29 and longitude < or equal to 78.25. Restaurants were categorized by stratum using "BatchGeoCode" software (www.batchgeocode.com). BatchGeoCode provides latitude-longitude coordinates for specified zip codes, allowing restaurants to be sorted into strata using Microsoft Excel. Characteristics of each stratum are as follows: the western region includes NC mountain ranges and the largest metropolitan city in the state (Charlotte, NC), and as a result, is the largest in terms of geographical size and number of restaurants; the central region is densely population and includes the second largest city in NC (Raleigh, NC) and has a retail base that includes three major universities (North Carolina State University, Duke University and University of North Carolina Chapel Hill); the coastal region is the smallest of the three regions in terms of size and restaurant number but is distinguished by an expansive coast bordering the ocean and moderate-sized cities (e.g., Wilmington, NC).

A random sample of restaurants was selected from each stratum. A minimum of 30 restaurants from each stratum was surveyed to provide adequate sample sizes for valid statistical tests by region. Restaurants fitting niche market criteria established using pre-trial survey results

were retained as potential candidates for interview. A restaurant met the niche market criteria when:

1. The restaurant served seafood,
2. The restaurant was not primarily a buffet,
3. The average dinner entree price was greater than or equal to $12 (2007 $'s).

Retained restaurants were contacted to determine their willingness to participate in the study. To estimate the required total number of restaurants to contact in order to achieve 30 completed surveys per region, a backwards approach utilizing pre-trial survey results was implemented using the following equation:

(# desired surveys per region) =
(# restaurants contacted) (% in niche) (% agreeing to survey) (% providing full data on survey)

Solving for (# restaurants contacted):

(# restaurants contacted) =
(# desired surveys per region) / [(% in niche) (% agreeing to survey) (% providing full data on survey)].

Conservatively, using pre-trial experience, it was assumed:

(% in niche) = 0.20,

(% agreeing to survey) = 0.50,

and (% providing full data on survey) = 0.80.

Hence:

(# restaurants contacted) = 30 / [(0.20) (0.50) (0.80)] = 375

Because there were many more than 375 restaurants in each geographic region, the goal of 30 completed surveys per region was deemed feasible.

In-person field survey interviews were conducted with participating restaurants using 1-5 whole, fresh BSB product samples. In-person interviews consisted of discussions with executive chefs, restaurant owners or kitchen managers who reviewed the attributes of the sample fish. An explanation of the survey was provided and restaurants were allowed to prepare the sample fish prior to survey completion. If surveys could not be completed in-person, self-addressed, stamped envelopes were provided for return. Final sample sizes per region needed to achieve 30 returned surveys per region were:

Coastal: 404 restaurants contacted,

Central: 398 restaurants contacted,

Western: 389 restaurants contacted.

Because the population of restaurants passing keyword screening varied by region, sampling rates varied by region:

Coastal: 404/2390 = 16.9 % contacted,

Central: 398/2663 = 15% contacted,

Western: 389/6435 = 6% contacted.

Shipment

BSB were purged of feed 1-7 days prior to harvest and all commercial chemical treatments were withheld from the RAS for the duration of the study. Market-sized BSB (> or equal to 567g (1.25 lb)) were harvested from tanks and euthanized using a humane, IACUC-approved (www.iacuc.org) method that utilizes a standard commercial "chill-kill" technique for core-temperature reduction via a dense slurry of ice and fresh seawater. From one to six whole fish were then packaged immediately to be shipped and received by restaurants within 24 hours of harvest. Ultra-fresh BSB shipments were made using priority overnight commercial deliveries with standard seafood shipping materials including corrugated cardboard boxes packed with Styrofoam seafood boxes or inflatable "Coldpack" (www.coldpacksystem.com) systems. Thick, tightly-sealed plastic seafood shipping bags store the BSB products within packages to ensure freshness and prevent fin punctures that could potentially compromise product and shipment quality. Several pre-frozen gel packs were packed with the product to control internal shipping temperatures. (BSB were never shipped on ice due to information gathered during pre-trials that suggested a potential for reduced product quality caused by pools of freshwater from melted ice.) Shipping boxes were labeled "perishable" on all outward-facing sides and sealed

envelopes containing the survey instrument, return envelopes and the appropriate contact information were taped conspicuously to the top of each box alongside pre-printed shipping invoices. Phone calls were made on all days following shipments to ensure that product and surveys arrived fresh and without incident.

Regression analysis

The goals of the regression analysis were to estimate farm-raised BSB niche market demand in North Carolina and to investigate the influence of market variables such as restaurant seating capacity, entrée price, and season on BSB demand. Multiple regression analysis was used to estimate niche market demand for BSB on a per restaurant basis. Per restaurant demand was then extrapolated to produce an estimate of aggregate statewide demand using regional sampling rates and known numbers of restaurants in the niche market in each region.

The regression model incorporates variables assumed to influence market demand based on pre-trial survey results. Variables include season, BSB price, comparable/substitute species price, seating capacity, average dinner entrée price, problems experienced with BSB availability, and seasonal restaurant closings. The regression equation was specified as:

$$\begin{aligned} \text{pounds}_{i,t,s} &= \beta_0 + \beta_1 \text{springd} + \beta_2 \text{falld} + \beta_3 \text{winterd} \\ &+ \beta_4 \text{bsbprice}_{i,t,s} + \beta_5 \text{bsbprsq}_{i,t,s} + \beta_6 \text{sprice}_{i,t} \\ &+ \beta_7 \text{spricesq}_{i,t} + \beta_8 \text{seatcap}_{i} + \beta_9 \text{entreepr}_{i} + \beta_{10} \text{entreeprsq}_{i} \\ &+ \beta_{11} \text{fshintns}_{i} + \beta_{12} \text{avalprob}_{i} + \beta_{13} \text{seasonal}_{i} + e_{i,t,s} \end{aligned}$$

The regression model attempts to explain the planned purchases of BSB in pounds per month (pounds) by restaurant "i" in time of year "t" under price scenario "s." Planned purchases depend on seasonal dummy variables (springd, falld, and winterd; summer is the omitted default season), the price of BSB (bsbprice), BSB price squared (bsbprsq), the price of a substitute species as identified by the restaurant chef (sprice), substitute species price squared (spricesq), the seating capacity of the restaurant (seatcap), the average price of a dinner entrée (entreepr), entrée price squared (entreeprsq), the percentage of restaurant sales attributed to fish sales (fshintns), a dummy variable indicating whether the restaurant reported problems with the availability of the substitute species (avalprob), a dummy variable set equal to one if the restaurant is open only seasonally (e.g.: closed in winter) (seasonal), and a random error term (e). (Note: Dummy variables for geographic regions were included in earlier model runs but were not significant and are not included in the models reported here.)

SAS statistical software (SAS Institute Inc. 2002-2003) was used to estimate all regression models. Weighted regression analysis was used to adjust the regression results for differences in sampling rates across regions. Random effects panel data regression ("PROC Mixed" procedure in SAS) was used to adjust the regression results for correlation among multiple responses from a given restaurant.

Fish prices

Farmed BSB prices are hypothetical because the product is not yet on the market. Restaurants were asked to consider three BSB price scenarios: BSB price the same as the price of the substitute species, BSB price 20 percent higher than the substitute species price, and BSB price 20 percent lower than the substitute species price. Substitute species prices are based on

actual prices paid by the restaurants during the time of the survey, as reported by the seafood distributors who supplied the restaurants. Because the substitute species prices are varying by time of year and by restaurant due to differences in substitute species type, substitute species availability, and seafood suppliers across restaurants, BSB prices are varying as well, allowing the effect of BSB price on demand to be identified.

The price of the substitute species varies by restaurant, depending on the restaurant's choice of substitute species, such as grouper or snapper, and the restaurant's choice of seafood supplier, such as Sysco or Southern Foods. Substitute species prices also vary by season. If the seafood supplier for a given restaurant was unknown, substitute price was determined by averaging the prices for the given species over all seafood suppliers. When common/generic fish names (i.e.: "snapper" rather than "vermilion snapper") were reported by survey respondents, prices for the most commonly purchased species group, as reported by seafood suppliers, were used. Seasons were defined as follows: winter (December-February), spring (March-May), summer (June-August), and fall (September-November).

Product attributes

An evaluation of twenty-three BSB product attributes assumed to influence restaurant chef acceptance of seafood products was conducted to help identify the most marketable BSB product form. Examples of these BSB attributes include: freshness, fillet yield, flesh color, traceability and taste. Restaurant chef preferences were evaluated using survey responses for each BSB product attribute. Survey participants were asked to rate each BSB attribute from 1-10, where 1 indicates a BSB attribute not at all important, 5 is considered of average importance,

and 10 is indicates an extremely important attribute. Responses for each attribute are summarized in terms of mean, minimum, maximum, standard deviation, and differences across strata.

Restaurant variables

Additional restaurant characteristics were evaluated to further investigate important product and market effects. Examples include clientele type, product purchase rates, cooking style, product form and size, and product fat content. Results are presented using a combination of bar graphs and pie charts for convenient comparisons. This analysis will help to further identify marketable BSB product forms in addition to providing new insights into niche market factors that have been found to influence demand, commodity value, and industry potential (Zucker and Anderson 1998).

RESULTS

NC statewide survey response

The primary master list of restaurants obtained from NC DENR revealed a total of 20,666 restaurants in NC during 2006. Keyword searches used 46 different terms commonly associated with casual, chain and/or non-seafood restaurants to immediately discard a large number of non-target listings (Appendix A-B). This subsequently narrowed the initial master list to 11,489 (55.6 percent) restaurants (Table 1). Stratum-based sorting then produced three populations, each representing a geographic region, from which samples were drawn.

Prior to drawing samples, regional restaurant totals were: coastal n = 2,390; central n = 2,663; western n = 6,435. It should be noted that the western region restaurant total is much larger than other regions due to NC's largest city (Charlotte, NC) being located within the region.

A random sample of restaurants was drawn for each stratum. After excluding duplicate listings, the numbers of sampled restaurants per stratum were: coastal n = 404 restaurants; central n = 398 restaurants; and western n = 389 restaurants.

Collectively, the statewide sample population consisted of 1,191 restaurants or 5.76 percent all NC restaurants (Table 1). Of those, 15.8 percent (n = 189) were found to successfully meet the target criteria for the upscale niche, and 13.6 percent (n = 162) were "null" restaurants. (Note: To be considered "null," restaurants had incomplete or inaccurate contact information, had consistently busy telephone signals, were permanently closed establishments, or were found not to be restaurants at all.) Extrapolation produces an estimated total of 3,265 restaurants in the statewide NC niche market.

Coastal region survey response

The coastal stratum was defined by geological coordinates of latitude > 34.25, latitude < 34.29, and longitude <= 78.25. Of the 404 restaurants in the stratum sample, 20.3 percent (n = 82) met the predetermined upscale niche standards, while 8.2 percent (n = 33) were found to be "null" listings (Table 1). Of the 82 restaurants in the niche market, 57.3 percent (n = 47) declined participation, 36.6 percent (n = 30) participated and returned surveys, and 3.7 percent (n = 3) agreed to participate but failed to return surveys.

Central region survey response

The central stratum was defined by coordinates of latitude > 34.25, latitude < 34.29, longitude >78.25, and longitude <= 79.25. Of the 398 restaurants in the stratum sample, 11.8 percent (n = 47) met the niche criteria, while 8.3 percent (n = 33) were "null" listings (Table 1). Of the 47 restaurants in the niche, 63.8 percent (n = 30) returned a survey, 27.7 percent (n = 13) declined participation, and 6.4 percent (n = 3) received product without returning a survey.

Western region survey response

The western stratum was defined by coordinates of latitude > 34.25, latitude < 34.29, and longitude > 79.25. Of the 389 restaurants in the stratum sample, 15.4 percent (n = 60) met the niche criteria, while 24.7 percent (n = 96) were "null" listings (Table 1). Of the 60 restaurants in the niche market, fifty percent (n = 30) returned completed surveys, 38.3 percent (n = 23) chose not to participate, and 11.7 percent (n = 7) failed to provide survey responses despite receiving product.

Descriptive statistics for NC upscale niche market restaurants

Descriptive statistics for several quantitative variables used to characterize the upscale niche restaurant market for BSB in NC are presented in the "All Data" columns of Table 2. Descriptive statistics for the observations used in the regression analysis (observations with non-missing values for all regression variables) are presented in the "Data Used in Regression Analysis" columns of Table 2. Focusing on the "All Data" results, statewide average seating capacity per restaurant (seatcap) was 116.4, with a minimum of 12 and a maximum of 300. Average dinner entrée price (entreepr) was $17.73, ranging from a minimum of $12 to a maximum of $40. Percentage of restaurant sales attributable to fish (fshintns) averaged 30.66. (A maximum percentage of 100 percent was reported by some sushi restaurants, but it can be assumed that this is an overestimate that disregards side/supplementary items such as rice.) Approximately 3 percent of the restaurants were seasonal (closed in winter). Fifteen percent of restaurants reported problems with obtaining comparable/substitute fresh fish (avalprob).

Descriptive statistics for qualitative variables used to characterize restaurants in the niche market are presented in a series of bar and pie charts. A strong majority (88 percent) of restaurants reported having primarily local/suburban clientele, with less than 5 percent reporting professional, city, or "other" clientele (Figure 2). In terms of restaurant fish purchase frequency, monthly (41/90, 46 percent) and weekly (40/90, 44 percent) fish purchase frequencies were most common (Figure 3). Only seven percent (6/85) of restaurants reported purchasing BSB at the time of the survey (Figure 4), but seventy-six percent (48/63) reported that they would purchase maricultured BSB similar to those evaluated in the survey if they were available for a price similar to the price of the substitute species. Fourteen percent (10/71) of restaurants reported

problems with the current availability of ocean-caught BSB. Problems with availability may be limiting current demand for ocean-caught BSB.

Preferred BSB product attributes

Product attributes reported by chefs to be of greatest importance to customers include taste, texture and visual appearance, and freshness (Table 3). Continuous availability, chilled product, size, and flesh color were also found to have high value. The least important attributes included live product, empty digestive tracts, nutritional labeling, certificate of origin and promotion. No preference for ocean-caught BSB over farm-raised BSB was found. These results are generally uniform across geographic regions in North Carolina.

The greatest disparity across regions for any attribute was found to be preference for organically grown BSB, which was reported to have moderately more value to customers in the central region. However, no organic standards for seafood were yet established in the US at the time of the study.

Preferred BSB product form and preparation methods

Several additional restaurant-specific variables were evaluated to help characterize optimum BSB product forms. Most restaurants prefer fresh, chilled (88 percent) BSB (Figure 5) that are greater than 907 g (2 lb) (61/90, 68 percent) (Figure 6) and of moderate (41 percent) fat content (Figure 7). Restaurants most frequently (59/90, 66 percent) reported having no preference for wild-caught or farm-raised BSB (Figure 8). Virtually no demand for BSB weighing less than 1.0 lb was observed under any price scenario, even with price discounts up to

50 percent (Figure 4). The surveyed chefs' preferred preparation method was sautéed (47/90, 52 percent), however chefs frequently reported more than one preferred preparation style (Figure 9).

Substitute/comparable species

Demand for BSB depends not only on the quality, availability and price of BSB but also on the quality, availability and price of substitute/comparable fish species. If restaurant chefs believe that BSB quality is comparable to that of other high quality, high value, fish species, then one would expect BSB to command a commensurately high price in the marketplace. To the extent that the availability of substitute species is limited or substitute species sell for high prices, one would expect demand for BSB to be higher. On the other hand, if substitute species are plentiful or sell for low prices, then one would expect lower demand for BSB. Grouper species were most commonly (27.5 percent) identified by restaurant chefs as the closest substitute species for BSB, followed by snapper species (21.25 percent) (Table 4). Tuna species (15 percent) and Dolphin fish (mahi mahi) (13.75 percent) were also frequently mentioned as comparable to BSB.

Regression analysis

Three regression models were developed. Descriptive statistics for the variables used in the regression analysis are presented in the "Data Used in Regression Analysis" columns of Table 2. The dependent variable for all three models is pounds of BSB purchased per month per restaurant (pounds). Model 1 (Table 5, columns 1-2) is a standard multiple regression model. An F-test indicates that Model 1 explains a statistically significant amount of variation in the

dependent variable pounds. A likelihood-ratio test confirms this result. The adjusted R-squared statistic indicates that Model 1 explains 37 percent of the variation in dependent variable pounds.

Model 2 (Table 5, columns 3-4) corrects Model 1 for the effects of varying sampling rates across geographic regions/strata. An F-test indicates that Model 2 is statistically significant. The adjusted R-squared statistic for Model 2 indicates that Model 2 explains only slightly more of the variation in the dependent variable (pounds) relative to Model 1, and key coefficient estimates are similar across Models 1 and 2; variation in sampling rates across geographic regions does not appear to significantly affect regression results. Model 3 (Table 5, columns 5-6) corrects Model 1 for both varying sampling rates across regions/strata and the panel nature of the data. The data feature multiple responses from each restaurant, and these "within-restaurant" responses may be correlated. If the responses are correlated, the regression procedure must be adjusted to correct for the correlation. In Model 3, a random effects panel data regression model (SAS, Proc Mixed, SAS Institute Inc. 2002-2003) is used to test for the presence of correlation among responses from each restaurant and to correct parameter estimates if correlation is present. If correlation is present, the unadjusted standard errors of the estimated regression coefficients will be biased downward, leading to false conclusions regarding statistical significance. The F-test and adjusted R-squared measures of model fit are not appropriate for panel data regressions with random effects, but a likelihood ratio test is appropriate. A likelihood ratio test indicates that Model 3 is statistically significant, and a Wald Z-test indicates that the "within-restaurant" responses are indeed correlated. Model 3 is the preferred model as it corrects for both varying sampling rates across regions/strata and correlation among responses from each restaurant. Note that several of the regression variables lose statistical significance in

Model 3 compared with the results from Models 1 and 2, as the corrected (larger) standard errors in Model 3 reduce the t-values of the corresponding coefficient estimates.

In Model 3, insignificant t-statistics for the seasonal dummy variables springd and falld indicate that pounds purchased in these seasons are not significantly different from pounds of BSB purchased in the summer season (the omitted season), but pounds purchased in the winter (winterd) are moderately lower, and the effect is significant. As expected, the effect of higher BSB prices (bsbprice) on pounds purchased is negative, large and statistically significant. Also as expected, the effect of higher substitute species prices (sprice) on pounds of BSB purchased is positive, large, and statistically significant. Higher average entree price (entreepr) has a moderately large, positive, and statistically significant effect on pounds BSB purchased. No other variables were significant. Note that dummy variables for geographic regions were included in earlier model runs but were not significant in any model and are not reported here.

Estimate of aggregate statewide demand

The preferred regression model (Model 3) provides estimates of mean BSB purchases per restaurant per month by season. These per restaurant estimates may be expanded by the number of restaurants in the niche market to project annual aggregate statewide niche market demand for BSB in North Carolina. Many scenarios can be examined with the model. A likely scenario is considered here as an example. The variable values used in the example scenario are: substitute fish = grouper; substitute fish price = $7.50/lb whole; BSB price = $7.50/lb whole; the squared prices are the squares of these values, and other variables are set at their mean values ("Date Used in Regression Analysis" columns of Table 2). Grouper is used as the substitute fish species because it was most frequently cited as such by surveyed chefs. Predicted mean pounds

purchased per month per restaurant by season, the average across seasons, and corresponding 95 percent confidence intervals are presented in Table 6. Multiplying the pounds per restaurant per season by the number of restaurants in the market niche and aggregating across seasons and geographic regions produces an estimate of the annual aggregate statewide niche market demand for BSB in NC of 179,077 kg per year (394,798 lb/yr) (Table 7), with a corresponding 95 percent confidence interval of 137,266 kg/yr -- 220,888 kg/yr (302,621 lb/yr -- 486,975 lb/yr).

DISCUSSION AND CONCLUSIONS

The purpose of this study was to investigate demand for farm-raised BSB in the upscale niche restaurant market of NC using a field sample survey of restaurants drawn at random from the population of all NC restaurants. Various market parameters such as season and geography were evaluated to determine scale and scope of influence. Investigations of restaurant chef preferences for BSB product attributes were also conducted to help establish optimal product form. The ultimate goal of this project was to characterize aggregate statewide niche market demand for BSB to support evaluation of a developing BSB aquaculture industry in NC.

BSB is a historically premium seafood product with high economic value. The traditional high-value retail market for BSB is characterized as a niche market of upscale, gourmet, white table-cloth restaurants (Berlinski et al. 2000, Copeland et al. 2005). In this study, the upscale niche restaurant market for BSB in NC is defined as those seafood-serving, non-buffet restaurants with an average dinner entrée price greater than or equal to $12. Upscale niche restaurants were found in all NC geographic regions, from the coastal shores of the NC Outer Banks to the westernmost mountain valleys, although the highest densities of niche restaurants are situated within the populous urban regions of the state, as would be expected. Based on sample survey results, an estimated 3,279 restaurants statewide meet the niche criteria, representing approximately 16 percent of all NC restaurants.

Few (7 percent) niche market restaurants currently purchase BSB, but most (76 percent) reported that they would purchase farm-raised BSB similar to those evaluated in the survey if they were available for a price similar to the price of substitute species like grouper. Some (14 percent) reported problems with ocean-caught BSB availability.

Specific aspects of upscale restaurants potentially influencing BSB demand were investigated to account for highly changing market conditions characteristic of seafood and restaurant industries (Engle and Quagrainie 2006). The restaurant variables found to increase BSB demand in a multiple regression analysis were not surprising; lower BSB prices and higher substitute species prices produced large, positive effects on BSB purchases. Higher entrée prices moderately increased BSB purchases. BSB purchases were moderately lower in the winter season (December--February); this result most likely reflects traditionally lower consumer seafood purchases during winter holidays, and/or a response to increased availability of other seafood products in the winter season (e.g., flounder). No other variables significantly affected BSB demand, which was somewhat surprising as expectations of positive, significant effects of restaurant seating capacity and percentage of sales attributable to fish were not realized.

Based on the results of the regression analysis, BSB demand can be estimated for the statewide NC niche market. Considering an likely example scenario in which grouper is the primary substitute species at a price of $7.50/lb whole, BSB price is $7.50/lb whole, and all other variables take their mean values, mean niche market demand per restaurant was found to be 18.35 lb BSB per month on average across seasons, and aggregate statewide niche market BSB demand in North Carolina was estimated to be 394,798 lbs per year. For this hypothetical scenario in which farm-raised BSB are sold at the same price as the substitute grouper species, aggregate annual statewide purchases of BSB by niche market restaurants in NC would be $2,961,000. This value is 57 percent greater than the 2006 value of ocean-caught BSB landings in NC ($1.7 million) (NMFS 2007), indicating a strong demand for BSB in the face of a limited ocean-caught supply.

Product attributes and restaurant-specific variables were assessed to determine important market characteristics of farm-raised BSB. In-person interviews with niche restaurant executives and gourmet chefs familiar with BSB revealed numerous premium attributes associated with the species, including flaky, white flesh, a favorable texture, preparation versatility and a distinctively clean and appealing flavor. As expected, the characteristics most commonly identified as important for all seafood products, such as taste and texture (Wessells 2002), were ranked highest for BSB products as well. However, freshness, continuous availability, and product size were also highly-rated attributes, and these are distinctive qualities of aquaculture products. That is, aquaculture production can generally expedite ultra-fresh shipments, maintain year-round supplies and manipulate final product form to satisfy specific demands of the market. Production capabilities like these underscore a type of versatility unique to aquaculture, whereby the capacity to determine final product form creates opportunities to meet evolving demands associated with new niche markets and emerging consumer types.

As survey responses indicate that restaurants generally have no preference for ocean-caught over farm-raised seafood products, the overall potential for a NC-based BSB aquaculture industry is apparent. An opportunity exists for seamlessly introducing farm-raised BSB into the NC niche market where retail demand has already been established. Study results indicating a strong chef preference for fish products of moderate to high fat content were also promising. Because commercially-cultured finfish typically have higher fat content relative to ocean-caught fish due to intensive growout methods aimed at rapid weight gain, an excellent opportunity for meeting valuable and specialized market demands exists (Zucker and Anderson 1998). Additional benefits of aquaculture production may also include greater fillet yields and new high-value niche market opportunities in commodity-based sushi, sashimi or live fish markets.

Survey responses revealed a market history of problems associated with BSB availability, most likely due to limited ocean-caught supply. As most survey respondents reported making fresh seafood product purchases every week, there is a need for the more reliable, year-round BSB availability that is possible with aquaculture production.

Survey responses also indicated a few caveats for a BSB aquaculture industry. The high frequency of chefs reporting a preference for fish products with whole weight values greater than or equal to two pounds could be a concern. Due to the time and cost currently required to grow BSB to these weights in high densities, attempts should be made to promote acceptance of smaller market sizes while more work is done to optimize production techniques and reduce costs for the long-term grow-out of larger BSB.

Although the regression model accurately demonstrates the effects of included variables on BSB purchases, some additional, highly influential factors affecting BSB demand remain to be investigated. Interest rates, financial lending, gas prices and the real estate market are just a few examples of highly variable aspects of the US economy that have significant effects on market demand. Similarly, it should be emphasized that this study is designed to estimate current demand. That is, continued efforts toward commercialization of BSB and product promotion will affect future demand in ways not captured by the regression model. Market demand estimates should therefore be updated and reassessed regularly.

A number of economic questions related to BSB aquaculture remain as subjects for future research. A more detailed analysis of high-volume aquaculture production, processing, and distribution may provide valuable information. For example, evaluations of product delivery methods such as packaging types, packing methods and species-specific processing techniques

are needed. Furthermore, evaluations of several BSB product variables, such as shelf life, skin preference and purging effects have yet to be investigated.

In the future, newly emerging consumer preferences will have substantial implications for the US aquaculture industry. Trends in consumer preferences for certain seafood product attributes will encourage restaurants to look to the aquaculture industry to satisfy these continuously evolving consumer demands (Jensen 2006, Olsen 2004). Opportunities for industry expansion will likely grow, and growth will require additional market research to successfully incorporate new farm-raised products such as BSB.

Finally, more information regarding potential BSB markets outside NC is needed to guide the development of a BSB aquaculture industry in the state. Specifically, further investigation into large metropolitan markets along the eastern seaboard of the United States and potential international export markets would be valuable to assess the potential scale of consumer demand for cultured BSB.

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Table 1. Description of NC upscale seafood restaurant niche market population and survey sample response rate.

All NC restaurants N = 20,666
Following restaurant name screen N = 11,488

Coastal N = 2390
Central N = 2663
Western N = 643

	Niche Market Determination Data					Inside Niche Survey Response Data				
	Sample size	Null	Inside niche	Outside niche	Percent sample in niche	Inside niche refusing	Inside niche participating	Participating but no return	Returning surveys	Response rate
NC Statewide	1191	162	189	840	15.9	83	106	16	90	47.6
Coastal Region	404	33	82	289	20.3	47	35	5	30	36.6
Central Region	398	33	47	318	11.8	13	34	4	30	63.8
Western Region	389	96	60	233	15.4	23	37	7	30	50

Sample descriptions and study participation for regions. "Null" indicates restaurants that were no longer in business, had disconnected phone numbers, etc.

Table 2. Descriptive statistics for variables used in multiple regression analysis.

	All Data						Data Used in Regression Analysis					
Variable	N	N Miss	Mean	Std Dev	Min	Max	N	N Miss	Mean	Std Dev	Min	Max
pounds	63	25	16.82	16.71	0.00	90.00	53	0	16.32	16.08	0.00	90.00
bsbprice	88	0	5.46	1.85	1.09	9.90	53	0	5.47	1.92	1.09	9.90
bsbprsq	88	0	33.24	21.62	1.18	98.01	53	0	33.60	22.17	1.18	98.01
sprice	88	0	5.46	1.59	1.36	8.25	53	0	5.47	1.68	1.36	8.25
spricesq	88	0	32.38	17.49	1.85	68.06	53	0	32.73	18.01	1.85	68.06
seatcap	72	16	116.40	55.12	12.00	300.00	53	0	121.60	45.66	12.00	225.00
entreepr	75	13	17.73	5.22	12.00	40.00	53	0	17.97	4.72	12.00	35.00
entreepsq	75	13	341.67	234.46	144.00	1600.00	53	0	345.19	197.08	144.00	1225.00
fshintns	68	20	30.66	19.12	5.00	100.00	53	0	30.66	17.24	10.00	75.00
avalprob	88	0	0.15	0.35	0.00	1.00	53	0	0.15	0.36	0.00	1.00
seasonal	88	0	0.03	0.18	0.00	1.00	53	0	0.06	0.23	0.00	1.00

N = number of observations. N Miss = number of missing observations, Std Dev = standard deviation, Min = minimum value, Max = maximum value.

Table 3. Statewide-average Black Sea Bass product attribute rankings.

Attribute	N	Mean	Std Dev	Min	Max
Continuous availability	86	8.03	2.13	1	10
Live product	86	2.54	2.54	1	10
Chilled product	87	8.47	2.23	1	10
Empty digestive tract	86	3.39	3.19	1	10
Freshness	87	9.97	0.15	9	10
Number of bones	86	5.93	2.78	1	10
Fillet yield	86	7.66	2.57	1	10
Size	87	8.19	1.84	1	10
Skin color	87	5.67	3.37	1	10
Flesh color	87	8.55	1.91	1	10
Fat content	86	6.26	2.77	1	10
Taste	87	9.96	0.23	8	10
Texture	87	9.24	1.26	5	10
Visual appearance	86	9.03	1.42	4	10
Nutritional labeling	86	3.01	2.47	1	10
Domestic product	85	5.05	3.13	1	10
Certificate of origin	85	3.44	3.15	1	10
Certificate of quality	85	4.09	3.33	1	10
Traceability	85	4.44	3.39	1	10
Farm-raised	85	4.12	2.83	1	10
Wild-caught	86	4.53	2.85	1	10
Promotion	84	3.20	2.66	1	10
Organically grown	85	5.65	3.42	1	10

Descriptive statistics for responses whereby restaurants were asked to rank from 1-10 the importance of 23 BSB product attributes to customers. 1=not at all important, 5=average importance, 10=very important.

Table 4. Comparable/substitute species frequencies and relative percentages (N missing = 10).

Region	Grouper	Snapper	Flounder	Mahi	Tuna	Salmon	Tilapia	Other	Total
Coastal	8	6	3	2	3	0	1	3	26
	10%	7.5%	3.75%	2.5%	3.75%	0%	1.25%	3.75%	32.5%
Central	11	7	0	2	4	0	0	2	26
	13.75%	8.75%	0%	2.5%	5%	0%	0%	2.5%	32.5%
Western	3	4	3	7	5	2	1	3	28
	3.75%	5%	3.75%	8.75%	6.25%	2.5%	1.25%	3.75%	35%
NC	22	17	6	11	12	2	2	8	80
	27.5%	21.25%	7.5%	13.75%	15%	2.5%	2.5%	10%	100%

Frequencies and percentages of responses to "What would be the most likely comparable species to BSB in your restaurant? That is, BSB would be an ideal substitute for which species of fish currently served in your restaurant?"

Table 5. Multiple regression analysis results.

	Model 1		Model 2		Model 3	
Variable	Coef. Estimate	t-value	Coef. Estimate	t-value	Coef. Estimate	t-value
Intercept	-44.99	-5.91*	-53.58	-8.06*	-42.61	-2.43*
Springd	-1.21	-0.81	-0.90	-0.69	-0.94	-0.83
Falld	-1.85	-1.30	-1.49	-1.12	-1.49	-1.61
Winterd	-3.69	-2.48*	-3.13	-2.29*	-3.17	-2.81*
Bsbprice	-15.59	-6.43*	-15.57	-7.37*	-15.57	-10.01*
Bsbprsq	0.69	3.72*	0.65	3.82*	0.65	5.43*
Sprice	15.72	5.38*	17.36	6.49*	14.62	5.14*
Spricesq	-0.71	-2.91*	-0.79	-3.34*	-0.57	-2.34*
Seatcap	-0.03	-2.75*	-0.02	-1.95*	-0.03	-1.06
Entreepr	5.68	9.48*	5.94	12.12*	5.67	3.57*
Entreepsq	-0.11	-7.97*	-0.12	-11.04*	-0.11	-3.00*
Fshintns	0.07	2.31*	0.08	3.33*	0.07	0.87
Avalprob	5.91	3.82*	4.62	3.45*	5.76	1.45
Seasonal	10.12	4.21*	8.58	2.65*	10.25	1.62
N	636					
R^2adj	0.37		0.38		n/a	
F	29.77*		36.76*		n/a	
$-2\cdot LL_{null}$	5337.4		5337.4		5337.4	
$-2\cdot LL_{model}$	5029.7		5007.0		4658.83	
LR test stat $= (-2\cdot LL_{null})-(-2\cdot LL_{model})$	307.7*		330.4*		678.57*	
df = # restrictions	13		13		14	
$\chi^2_{df,\ \alpha=0.05}$	5.89		5.89		6.57	
Wald Z-test of random effects					4.80**	

Model 1 = Basic multiple regression
Model 2 = Multiple regression with weighting for survey stratification
Model 3 = Multiple regression with weighting for survey stratification and panel data correction

Observations: n = 636 (12 observations on each of 53 firms)
* indicates value is significant at α=0.05.
LR test stat > $\chi^2_{df,\ \alpha=0.05}$ indicates model is significant at α=0.05.
Wald Z-test value > $Z_{one\text{-}sided,\ \alpha=0.05}$ = 1.65 indicates random effects are significant at α=0.05.

Region	Restaurants sampled	Restaurants in region	Sampling Rate
Coast	14	2390	0.59%
Central	15	2663	0.56%
West	24	6435	0.37%

Table 6. Predicted mean pounds of Black Sea Bass demanded per restaurant per month by season.

	Predicted Mean Pounds of BSB Demanded (Purchased) Per Restaurant Per Month		
Season	Predicted Mean	95% Confidence Interval for Predicted Mean	
Summer	19.75	15.69	23.81
Spring	18.81	13.94	23.68
Fall	18.25	14.20	22.31
Winter	16.58	11.70	21.45
Average across Seasons	18.35	14.05	22.64

Table 7. Extrapolated aggregate demand estimates for NC upscale seafood niche market restaurants by season and region.

Region	Restaurants in niche	Summer lb/month	Spring lb/month	Fall lb/month	Winter lb/month	NC Total lb/yr
Coastal	486	9,596	9,139	8,870	8,055	106,980
Central	314	6,211	5,915	5,740	5,213	69,239
Western	992	19,607	18,673	18,122	16,458	218,580
NC Total	1792	35,415	33,727	32,732	29,726	394,798

Monthly values are multiplied by 3 months per season to calculate yearly totals. The 394,798 lb/yr NC total estimate has a 95 percent confidence interval of 302,621 lb/yr -- 486,975 lb/yr. In SI units, these figures are 179,077 kg per year, with a 95 percent confidence interval of 137,266 kg/yr -- 220,888 kg/yr.

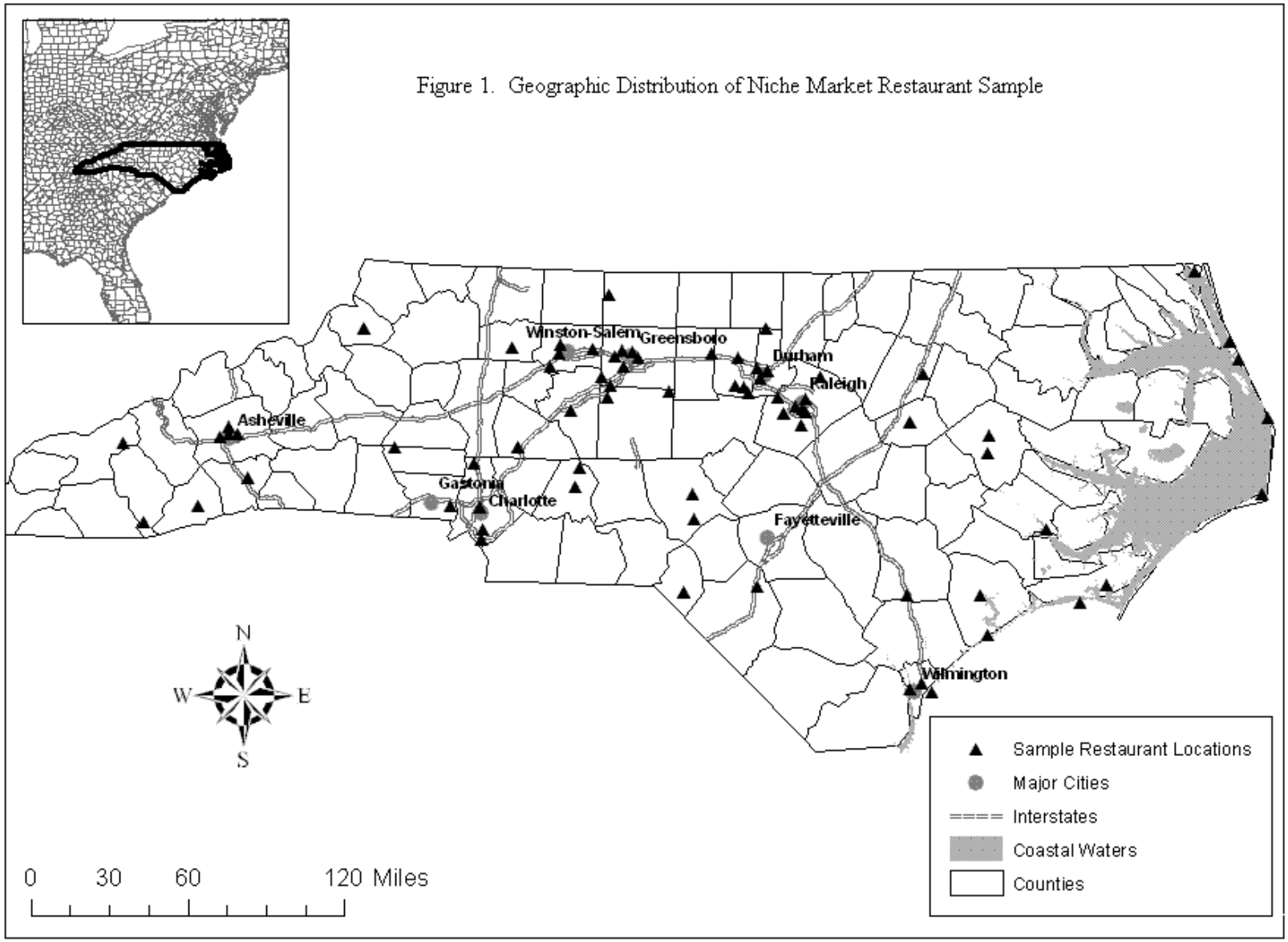
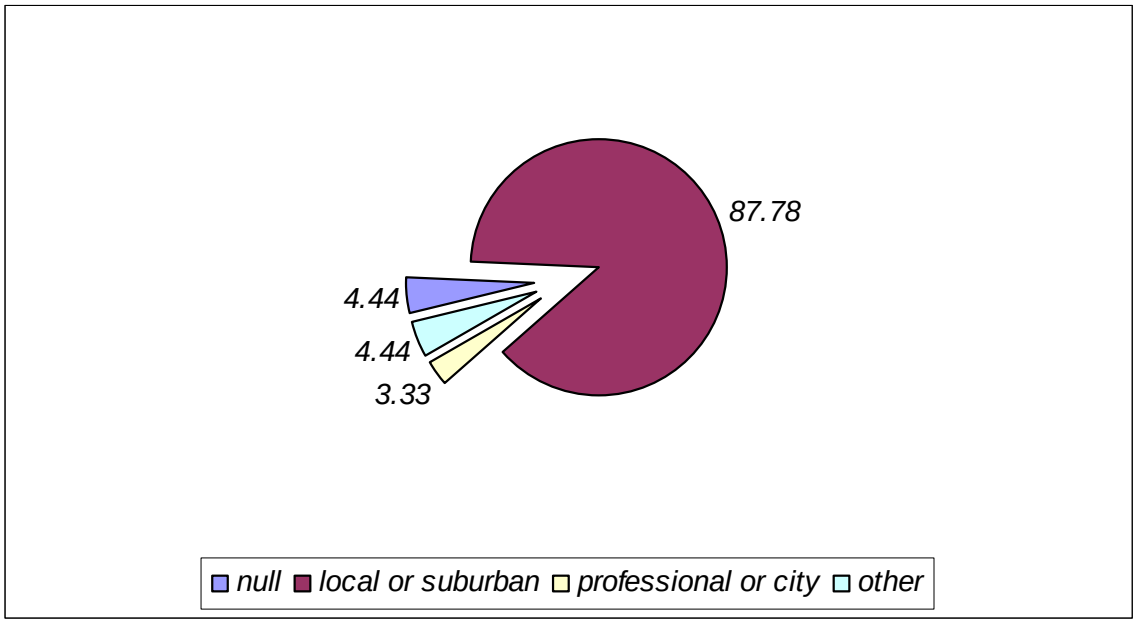


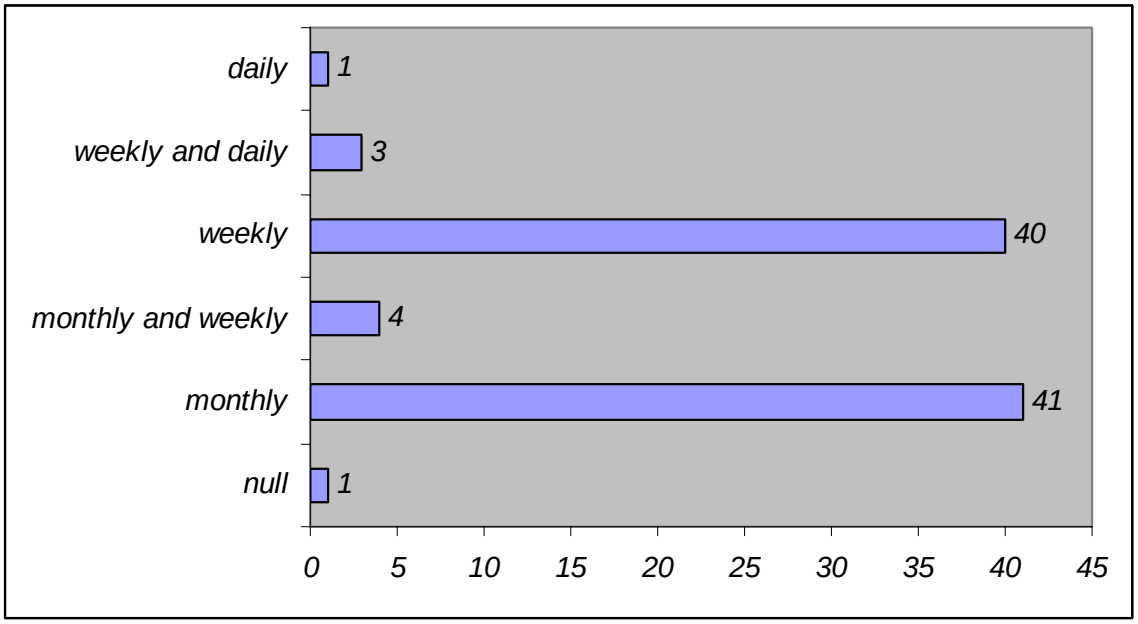
Figure 1. Geographic Distribution of Niche Market Restaurant Sample
Winston-Salem
Greensboro
Durham
Raleigh
Asheville
Gastonia
Charlotte
Fayetteville
Wilmington
N
W
E
S
0
30
60
120 Miles
Sample Restaurant Locations
Major Cities
Interstates
Coastal Waters
Counties

Figure 2. Response percentages for primary clientele types.



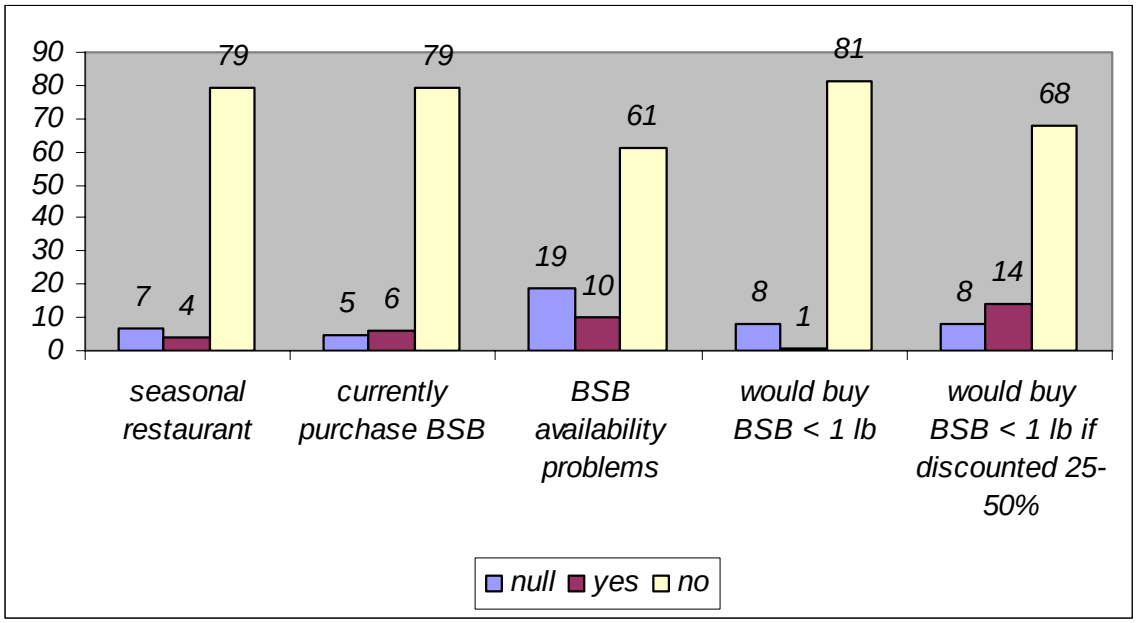
Percentages of multiple choice responses to “What is your primary clientele type?”

Figure 3. Response frequencies for fish product purchase rates.



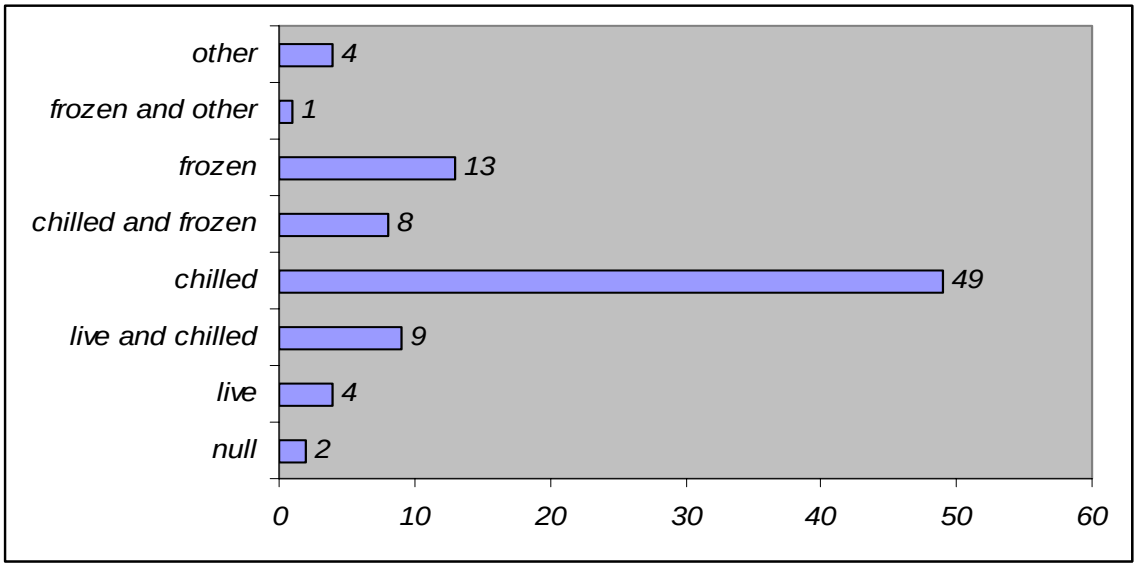
Multiple choice responses to “How often do you purchase fish?”

Figure 4. Response frequencies for qualitative (yes/no) questions.



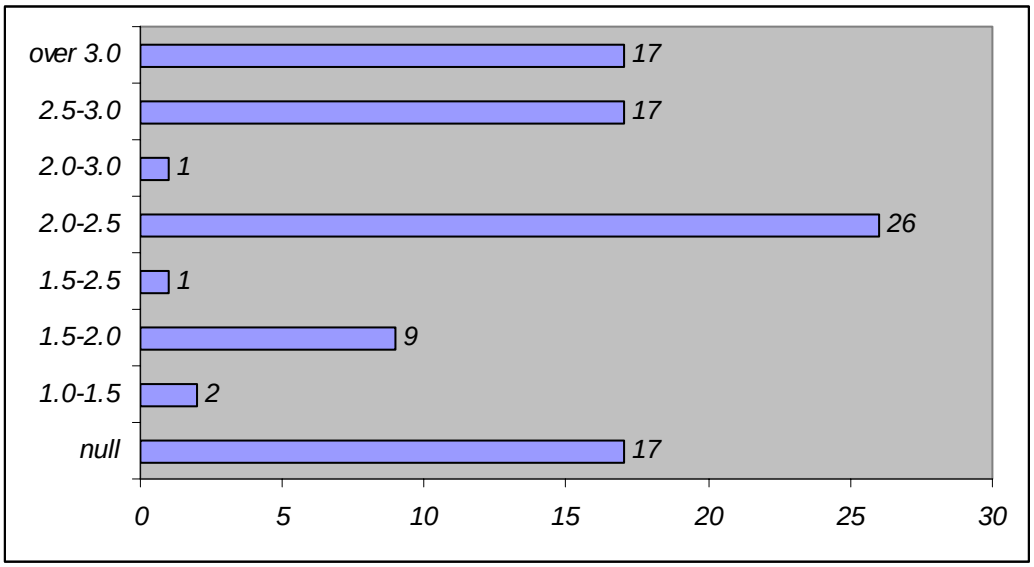
Yes/no responses to:
1. Is restaurant closed during any months of the year?
2. Do you currently purchase BSB?
3. Have you encountered problems with BSB availability?
4. Would you purchase whole BSB <= one pound at current BSB price?
5. Would you purchase whole BSB <= one pound if discounted 25-50%?

Figure 5. Response frequencies for preferred Black Sea Bass product forms.



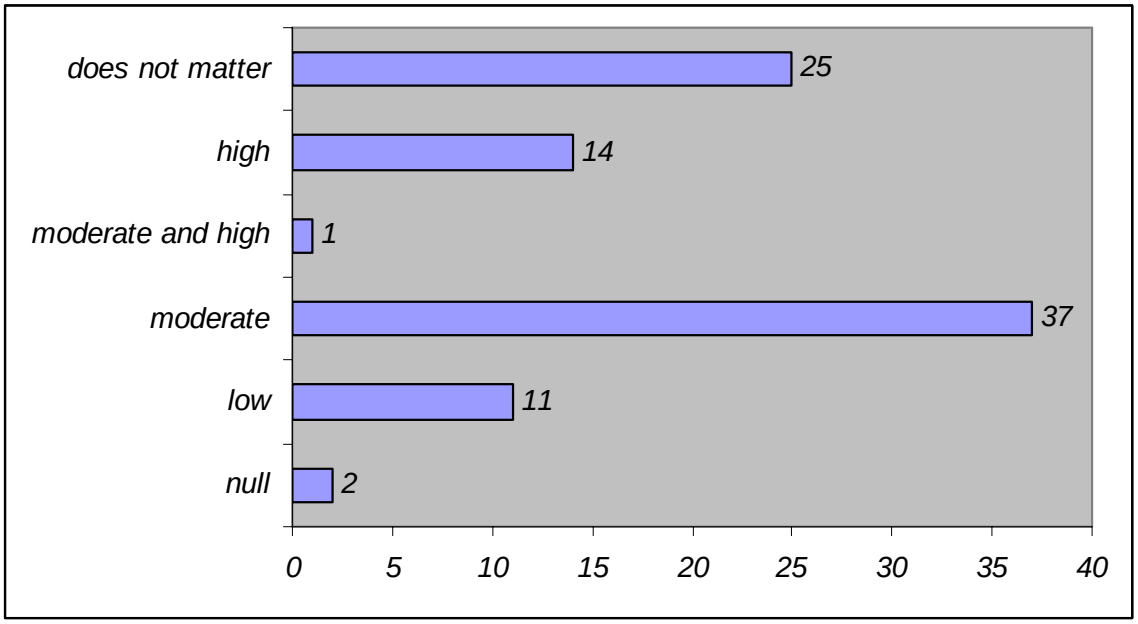
Multiple choice responses to “What is your preferred product form for receiving BSB?”

Figure 6. Response frequencies for preferred whole weight sizes for fish products.



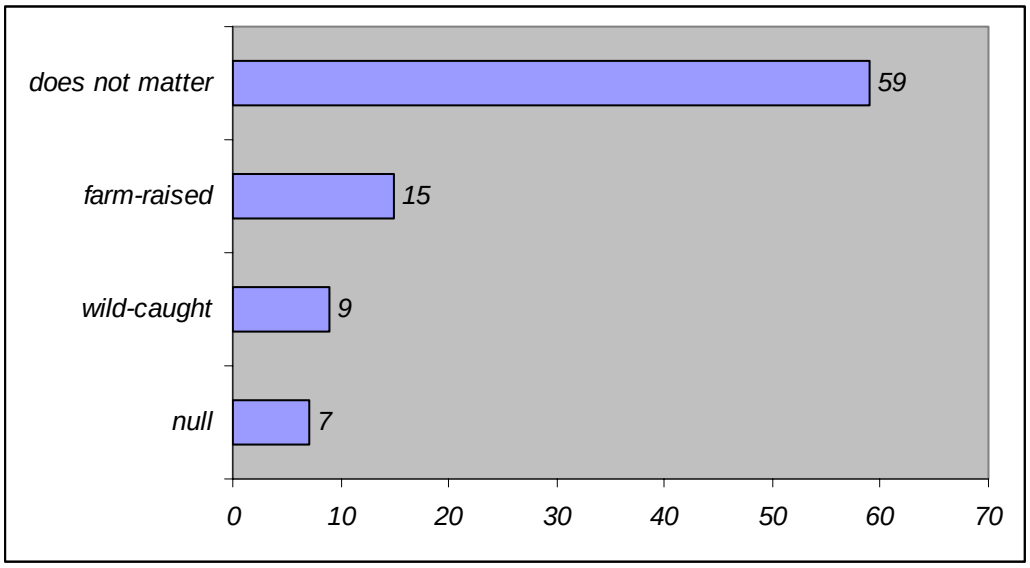
Multiple choice responses to “What size BSB (whole weight) do (would) you prefer?”

Figure 7. Response frequencies for preferred level of fat content for fish products.



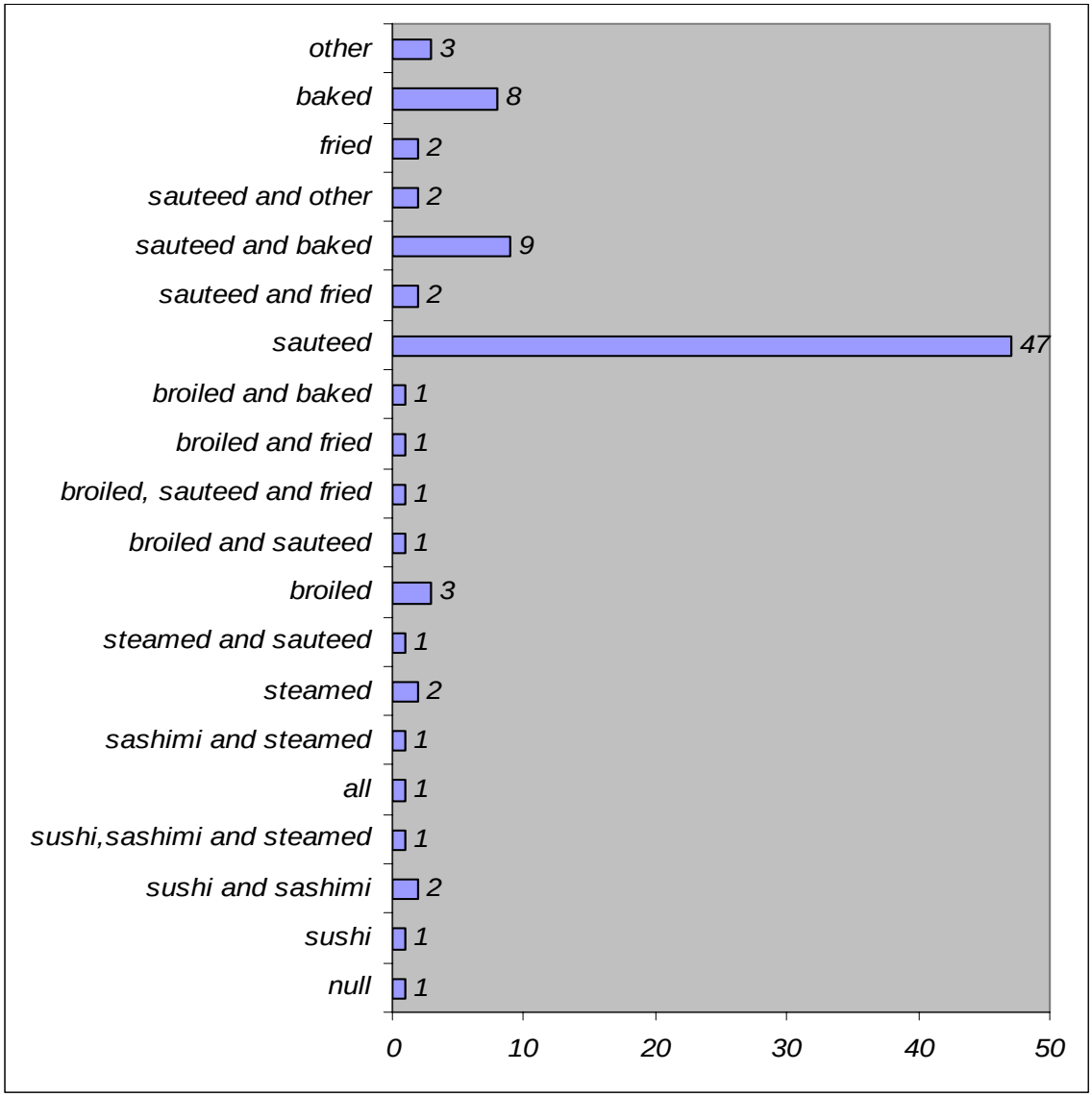
Multiple choice responses to “What level of fat content do you prefer in BSB?”

Figure 8. Response frequencies for preferred fish product type.



Multiple choice responses to “Do you prefer farm-raised or wild-caught BSB?”

Figure 9. Response frequencies for preferred BSB preparation style.



Multiple choice responses to “What is your preferred preparation style for BSB?”

APPENDIX

Appendix A - Search terms used to filter primary master list of NC restaurants.

pizza	buffet
arby	applebee
mcdonald	hardee
bojangle	biscuitville
burger king	wendy
quizno	taco
waffle	coffee
subway	chick
chili	bagel
andys	mart
sonic	corral
huddle	moes
checkers	java
deli	cafeteria
subs	kfc
starbuck	denny
jack in	dunkin
jersey	bbq
pancake	burger
barbeque	scotchman
dairy	ihop
captain d	tuesday
tgi	zax

Appendix B - Names of restaurants deleted from master list of NC restaurants using keywords (see Appendix A). Note: May represent more than one restaurant.

american hero
american legion
amf**
amoco
atlanta bread co.
bakery
barnes & noble
baskin robins
bear rock cafe
bar-b-que and variations
bar-be-cue and variations
bi-lo
billiards
biscuit
blimpie
bob evans
borders
boston market
bowling
bp gas stations
breakfast
brueggers bagels
buffalo wild wings
canteen
cinema
chic fil a
chuck e cheese
circle k
circus
church kitchens
community college
convenience convenient
cook out
correctional
costco
cubbies
cup-a-joe
dogs (hot dogs)
doughnut
donut
drive in
drive-in
duck thru
east coast wings
eckerd drugs
el cerro grande
ethan allan
express (except asian)
expresso
exxon
fast**
fat daddies
five guys
food lion
fuddruckers
fuel
freez*
goodberry's (ice cream)
hampton inn
handee hugo
heavenly ham
holiday inn express
homewood suites
honey baked ham
hooters
hospital
hot dog
hot dogs
ice cream
ihop
ingles (grocery chain)
jack in the box
jail
jimbos
just desserts
k&w
kfc
kangaroo
kounty
kountry
kroger
krystal
lanes bowling alley
logans roadhouse
lone star steakhouse
longhorn steakhouse
long john silvers
lowes grocery
medical
mello mushroom
charley's
olive garden
on the border
one stop
outback
panera bread
pantry
park n shop
pete's sandwich shop
petro express
petro max
philly*
pig pickins
piggly wiggly
pit stop
pop eyes
prayer church kitchens
priddy boys
putt putt
putters
qdoba
quik chek
quik shoppe
quick*
quincy's
quiznos
ragazzis
red lobster
red robin
residence inn
rock ola
roly poly
roy's family restaurants
rudinos
run in
ryans family steakhouse
sagebrush steakhouse
sams club

sandwich
salt works
sav way
sbarro
school
sheetz
shoney's
shop and save
shop n go
shop quick
short stop
showmars
skat* skate, skating
snack
snack bar
ymca
yogurt
zip

soda shop soda shoppe
starbucks
steak and hoagie
steak n shake
sticky fingers
stop* stop save
sub sub-
super stop
super target
target
tastee freeze
texas land & cattle
texas roadhouse
texas steakhouse
theatre theater

trolly stop
tropical smoothie café
truck
two guys
village inn
wagon wheel
western sizzlin
wiener works
wilco
wing stop
wing zone,
wings to go
wings n things
wing stop

Appendix C - Survey Instrument.

Restaurant Name: _____
Address: _____
Name/Position: _____
Date: _____

1. What is the seating capacity of this restaurant? _____

2. Are you closed any months during the year? _____
   If yes, which months? _____

3. What is the average entrée price at this restaurant? _____

4. What is your primary clientele?
   a) tourist b) local/suburban c) professional/city d) other _____

5. What fish product form do you prefer to purchase?
   a) live b) fresh/chilled c) frozen fillet d) other _____

6. How often do you purchase fish?
   a) monthly b) weekly c) daily d) other _____

7. Approximately what % of total sales per month is fish? _____

8. Who currently provides your fish? _____

9. Do you currently purchase black sea bass?
   a) yes b) no

10. What is (would be) your preferred method of preparing black sea bass?
    a) sushi b) sashimi c) steamed d) broiled e) sautéed
    f) deep-fried g) baked h) other _____

11. What level of fat do you prefer for your method of black sea bass preparation?
    a) low b) moderate c) high d) does not matter

12. What size (whole weight) black sea bass do (would) you prefer to purchase?
    a) 1.0-1.5 lb b) 1.5-2.0 lb c) 2.0-2.5 lb d) 2.5-3.0 lb e) >3.0 lb

13. Do you experience problems with the availability of black sea bass during the year?
    a) yes b) no If yes, which month(s): _____

14. Do (would) you prefer farm-raised or wild-caught black sea bass?
    a) farm-raised b)wild-caught c)does not matter

15. Would you purchase whole black sea bass that are 1.0 lb for the same price as larger fish?
    a) yes b) no

16. What about if the 1.0 lb or less black sea bass were [25%, 33%, 50%] cheaper?
    a) yes b) no

How important are the following attributes of <u>BLACK SEA BASS</u> for customer acceptance in your business? Circle one. (1=not important, 5=average importance, 10=very important)

1.	Continuous availability	1 2 3 4 5 6 7 8 9 10
2.	Live product	1 2 3 4 5 6 7 8 9 10
3.	Chilled product	1 2 3 4 5 6 7 8 9 10
4.	Empty digestive tract	1 2 3 4 5 6 7 8 9 10
5.	Freshness	1 2 3 4 5 6 7 8 9 10
6.	Number of bones	1 2 3 4 5 6 7 8 9 10
7.	Fillet yield	1 2 3 4 5 6 7 8 9 10
8.	Size	1 2 3 4 5 6 7 8 9 10
9.	Skin color	1 2 3 4 5 6 7 8 9 10
10.	Flesh color	1 2 3 4 5 6 7 8 9 10
11.	Fat content	1 2 3 4 5 6 7 8 9 10
12.	Taste	1 2 3 4 5 6 7 8 9 10
13.	Texture	1 2 3 4 5 6 7 8 9 10
14.	Visual appearance	1 2 3 4 5 6 7 8 9 10
15.	Nutritional labeling	1 2 3 4 5 6 7 8 9 10
16.	Domestic product	1 2 3 4 5 6 7 8 9 10
17.	Certificate of origin	1 2 3 4 5 6 7 8 9 10
18.	Certificate of quality	1 2 3 4 5 6 7 8 9 10
19.	Traceability	1 2 3 4 5 6 7 8 9 10
20.	Farm-raised	1 2 3 4 5 6 7 8 9 10
21.	Wild-caught	1 2 3 4 5 6 7 8 9 10
22.	Promotion	1 2 3 4 5 6 7 8 9 10
23.	Organically grown	1 2 3 4 5 6 7 8 9 10

1. What other fish would be most comparable to black sea bass in your business? That is, black sea bass would be a reasonable substitute for what fish?

   _____

2. Do you experience problems with the availability of the comparable/substitute fish during the year?

   a) yes b) no If yes, which month(s): _____

3. If fresh/chilled black sea bass of similar quality to those of the sample fish provided were available at the **same price per pound** as the comparable/substitute fish you listed, how much black sea bass would you likely purchase per month in each of the following seasons?

WINTER - (Jan-Mar)	_____	lbs. black sea bass per month
SPRING - (Apr-Jun)	_____	lbs. black sea bass per month
SUMMER - (Jul-Sep)	_____	lbs. black sea bass per month
FALL - (Oct-Dec)	_____	lbs. black sea bass per month

4. What if the price per pound of black sea bass were **20% more** than the price of the comparable/substitute fish?

WINTER - (Jan-Mar)	_____	lbs. black sea bass per month
SPRING - (Apr-Jun)	_____	lbs. black sea bass per month
SUMMER - (Jul-Sep)	_____	lbs. black sea bass per month
FALL - (Oct-Dec)	_____	lbs. black sea bass per month

5. What if the price per pound of black sea bass were **20% less** than the price of the comparable/substitute fish?

WINTER - (Jan-Mar)	_____	lbs. black sea bass per month
SPRING - (Apr-Jun)	_____	lbs. black sea bass per month
SUMMER - (Jul-Sep)	_____	lbs. black sea bass per month
FALL - (Oct-Dec)	_____	lbs. black sea bass per month

6. Would you consider purchasing a **frozen fillet** black sea bass product if the price was discounted [25%, 33%, 50%] relative to the price of the fresh/chilled whole BSB

   a) yes b) no