

Eco-labeled Marine Ornamentals: Expected Demand and Value from a Conjoint Survey

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Abstract. The saltwater aquarium hobby has increased dramatically in the last decade due to improvements in the technologies and knowledge needed to sustain mini-reef ecosystems. With this increased demand comes increased pressure on natural reef ecosystems that supply the vast majority of the live organisms for the commercial market. To combat high mortality rates and environmental damage that can result during collection, handling, and transport, the Marine Aquarium Council (MAC) launched a voluntary third-party certification program in November 2001. The program would ensure that certified marine ornamentals have been harvested to minimize losses and damage to the environment and that the stock is managed for sustainability. To ascertain the potential market and value of the MAC certification program, a conjoint survey of wholesalers, distributors, and retailers was conducted. Respondents were located worldwide. Species examined included queen angelfish (*Holocanthus ciliaris*), peppermint shrimp (*Lysemata wurdemanni*), spotfin hogfish (*Bodianus pulchellus*), and orange skunk clownfish (*Amphiprion sandaracinos*). These species were selected as a mix of traditionally tank-raised, collected, and those of high and low value. Characteristics included source (tank-raised, collected but not MAC-certified, or collected and MAC-certified), size, whether or not survival is guaranteed, and price. Respondents evaluated six hypothetical “products” for each species. Results were used to determine the price increase anticipated for a MAC-certified product that would allow a firm to break-even and the expected demand for MAC-certified products. Results indicate that MAC-certification would increase break-even prices from 10 to 35 percent depending on the species. However, demand is relatively low compared to uncertified species.

Keywords. Demand, Marine Aquarium Council, MAC certification, marine ornamentals, stated preference analysis, tobit models.

1. INTRODUCTION

Under a recently-established certification program, marine species (fish and invertebrates) that are collected live from the wild for saltwater aquarium tanks can be certified as being harvested, transported, and handled in a sustainable manner. The certification program was created by the Marine Aquarium Council (MAC), a non-profit international organization that has as its mission the conservation of coral reefs and marine ecosystems. Two specific goals of the organization are to (1) ensure the health and quality of marine life through responsible collection, handling and transportation practices and (2) to establish independent certification of “best practices” used to bring the species to market.

The resulting third-party certification program was modeled after a similar program devised by the Marine Stewardship Council for food fish. MACSM certification covers both marine aquarium organisms (stock status, quality of collection area, and stock management) and industry participants. The organization’s tag line is “MAC Certification... from Reef to Retail” to emphasize that the program covers all aspects of the industry and the entire chain of custody. The certification is based on the following three core standards:

- Ecosystem and Fishery Management
- Collection, Fishing and Holding
- Handling, Husbandry and Transport

The Ecosystem and Fishery Management standard covers coral reefs and the specimens in the collection area by requiring the collection area to be defined, an assessment and monitoring of reefs and fishery stocks, and a resource management plan. The Collection, Fishing and Holding standard covers the harvesting and post-harvest handling practices of fish, coral, live rock and other marine ornamentals that are collected for aquariums. This standard requires that divers be formally trained, they do not use any methods destructive to the environment, they only collect those specimens for which they have an order, and they segregate the MAC certified organisms from non-certified throughout holding. In addition, fishery logbooks must be maintained and the quality of the water has to be tested. The Handling, Husbandry and Transport standard applies to all firms that handle the organisms including exporters, importers, wholesalers, and retail outlets. This standard also requires that certified organisms be segregated from the non-certified, that water quality be tested and

monitored, mortality be recorded and monitored, and that the organisms are appropriately acclimatized in facilities that are adequately staffed with trained personnel. Upon becoming certified and satisfying all applicable standards, firms are subject to unannounced surveillance visits to ensure enforcement of the standards.

In summary, a MAC-certified organism is one that was obtained from a MACSM Certified collection area and was handled only by MACSM Certified operators (collection through transport and retail sale) and can be identified by the certification label on the packaging and tanks. For more information on the certification and standards, visit the MAC website at <http://aquariumcouncil.org/>.

A successful certification program would obviously benefit the stocks and environment where organisms have traditionally been over-harvested and marketed on a supply basis (as opposed to on-demand) and harvested using practices destructive to the environment (such as by using bleach which can kill coral reef habitats). The net economic benefits of such a program are, however, less certain given certification and licensing fees. Additional costs may also be required for staff training, facility upgrades, and the additional testing and reporting burdens. If consumers are willing to pay more for MAC certified organisms and demand is sufficient, revenues could increase at each point in the market chain and the program would be sustainable. In lieu of a price premium, firms may benefit economically from reduced mortality rates if demand is strong.

The research discussed in this paper concerns the derivation of aggregate market information pertaining to the MAC certification program. Results were derived from an international conjoint survey of industry members, that is, wholesalers, distributors, and retailers (not hobbyists). The survey was conducted on the Internet to ensure participation by firms located worldwide. The study focused on four species that are important to the industry in Florida, namely: queen angelfish (*Holacanthus ciliaris*), peppermint shrimp (*Lysmata wurdemanni*), spotfin hogfish (*Bodianus pulchellus*), and orange skunk clownfish (*Amphiprion sandaracinos*). Specifically, this paper summarizes the expected value of (i.e., willingness-to-pay) and annual demand for four species of MAC-certified live marine ornamentals.

2. DATA COLLECTION

2.1. Questionnaire Design

The questionnaire consisted of demographic information about the firm and four market experiments, one for each species. The firm information contained questions about product lines, live sales by type (marine, freshwater; collected, tank-raised), purchasing behavior (single supplier, volume discounts, number of species, etc.), and location within the marketing chain (trans-shipper, wholesaler, retailer). Respondents were also asked about their job responsibilities, experience, familiarity with the MAC certification program and likelihood of participating in the MAC certification program.

The market experiments (conjoint analysis) required each respondent to evaluate six hypothetical “products” for each species. Four marine species in total were evaluated, three fish species and one invertebrate. The fish species were selected for their importance in Florida. The angelfish and hogfish species are important to the collection industry both in terms of the number of animals harvested and their relatively high unit prices. The clownfish species is available in the wild for collection (although not in Florida and relatively rare) but is one of the newest tank-raised species available commercially. It is a smaller fish and lower valued relative to the two other collected fish species. The peppermint shrimp are primarily available from wild harvest but recent research has found they can be successfully raised using culture techniques. These shrimp are relatively small and are typically purchased in large volumes at relatively low unit prices.

In this study, the products are descriptions of the species that differ by certain characteristics. Given the goals of the study, the products differed by the following characteristics: price, size, source (collected, tank-raised, or collected and MAC-certified), and whether survival would be guaranteed following purchase. The price and size variables were defined at three levels. Three alternative prices were used in order to capture nonlinear price effects. Three alternative prices were used since preliminary analysis revealed that higher valued fish species are typically available at different sizes. For any one species, only three attributes were varied. Using all possible attribute and attribute-level combinations would result in 18 hypothetical products. Given the inclusion of four species, a full-profile conjoint analysis for each species was not feasible. Thus, a profile design program

in SAS was used to reduce the number of profiles to six for each species (SAS Inc., 2001). Table 1 summarizes the attributes and attribute levels used in the profiles (i.e., hypothetical products) to be evaluated.

Table 1. Attribute and Attribute Levels Used in the Conjoint Experiments by Species

Attribute Attribute Level	Species			
	Peppermint Shrimp	Orange Skunk Clownfish	Spotfin/Cuban Hogfish	Queen Angelfish
Source				
Tank-raised	X	X	Not included	Not included
Collected	X	X	X	X
Collected & MAC-Cert.	X	X	X	X
Price (US\$/organism)				
Low	\$0.49	\$1.75	\$9.00	\$15.00
Medium	\$0.79	\$2.25	\$11.50	\$30.00
High	\$1.19	\$2.99	\$14.50	\$45.00
Guaranteed Survival?				
No	X	X	Not included	Not included
Yes	X	X	Not included	Not included
Size				
Small	1.25 inches	2.0 inches	2.0 inches	2.0 inches
Medium	1.25 inches	2.0 inches	3.5 inches	4.0 inches
Large	1.25 inches	2.0 inches	5.6 inches	6.0 inches

Note: An “X” indicates the attribute and levels were included and varied in the market experiments.

Each hypothetical product was evaluated two ways. First, respondents were asked to state the profitability of handling the product for resale on a scale of -5 to +5 where a score of zero should be used to identify those products that would just allow the firm to breakeven. Second, respondents were asked to provide the quantity of that particular product they would purchase annually. These evaluations were conducted on each of the six hypothetical products for each species.

2.2. Response Rate

The data were collected from a survey of firms located worldwide. The sample frame included all firms that were members of Ornamental Fish International (OFI), members of the American Marinelife Dealers Association (AMDA), or listed in the *West Coast Ornamental Wholesalers Directory*. From these lists, a total of 295 unique firms were identified and invited to participate in the study (i.e., were sent unique usernames and passwords via postal or electronic mail). The exact sample size is unknown, although it is less than 295, since all but AMDA members could handle only freshwater species.

Of the 295 firms, 126 were sent to firms that may or may not handle marine species. A total of 54 firms logged into the site, completed the background information page, and looked at the first experiment (i.e., peppermint shrimp). Of those 54, as many as 35 completed the questionnaire (i.e., evaluated all six products for each species). Only 30 completed the final market experiment. Thus, response rates ranged from 10% to 32%. This range was expected given that the average length of time to complete the experiments was greater than anticipated and some potential respondents had technical difficulties.

2.3. Respondent Information

Eighty percent of responding firms were located in the United States, which is not surprising given that the U.S. is the primary market for the aquarium hobby. One possible indication of the propensity to be supportive of MAC-certification is whether they use tank-raised (aquacultured) species as a marketing tool. In this survey, 77% of respondents indicated they promoted sustainability of the hobby by carrying and promoting tank-raised species. Respondents were asked to indicate their primary responsibilities within the firm. Nearly all respondents replied with multiple duties. Overall, the majority (54%) indicated management responsibilities. To determine the level of knowledge regarding the source of their live inventory, respondents were asked

whether they knew the source of all of their inventory; 91% replied that they did. In terms of firm size, the majority (62%) were classified as “small” with average annual sales of live marine inventory valued at less than US\$100,000. Only 9% were classified as “large” with average annual sales of live marine inventory ranging from US\$1 million to US\$10 million. The remaining 29% were considered “medium” firms with average annual sales of live marine inventory ranging from US\$100,000 to US\$1 million. The distribution of firms by primary function or location within the marketing chain is shown in Figure 1.

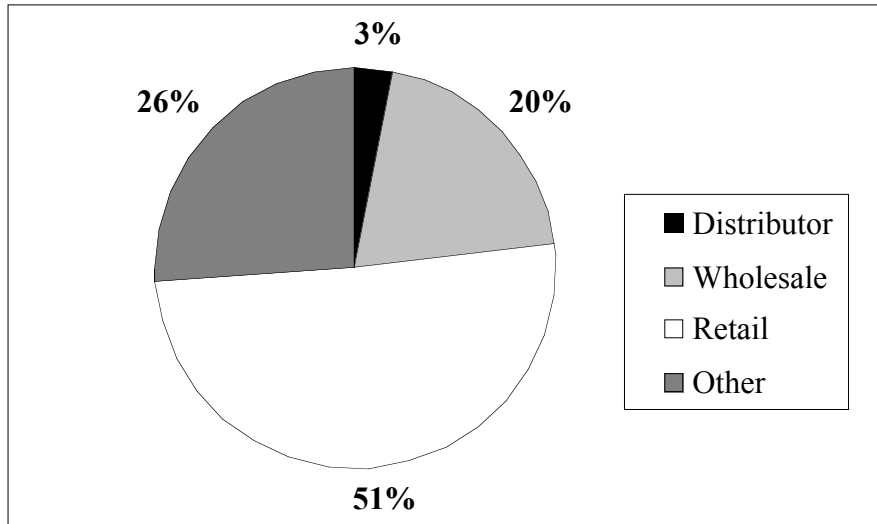


Figure 1. Distribution of Firms by Primary Function

The majority of firms (51%) operate as retailers. Twenty-six percent of respondents identified their primary function as wholesalers. Only 3% were classified as “distributors”; these firms do not maintain any inventories. The remaining 20% answered as “other”, which could indicate that they are primarily service-oriented firms, which is similar to the retail sector. Overall, these responses were as expected since the number of retail aquarium outlets is known to greatly exceed the number of suppliers that maintain product inventory which, in turn, is greater than the number of firms that only act as distributors, brokers, and trans-shippers (i.e., functions included in the “broker” category).

To incorporate knowledge levels and preconceptions about MAC certification, respondents were asked about their familiarity with and likelihood of using the certification label. Responses are summarized in Figure 2.

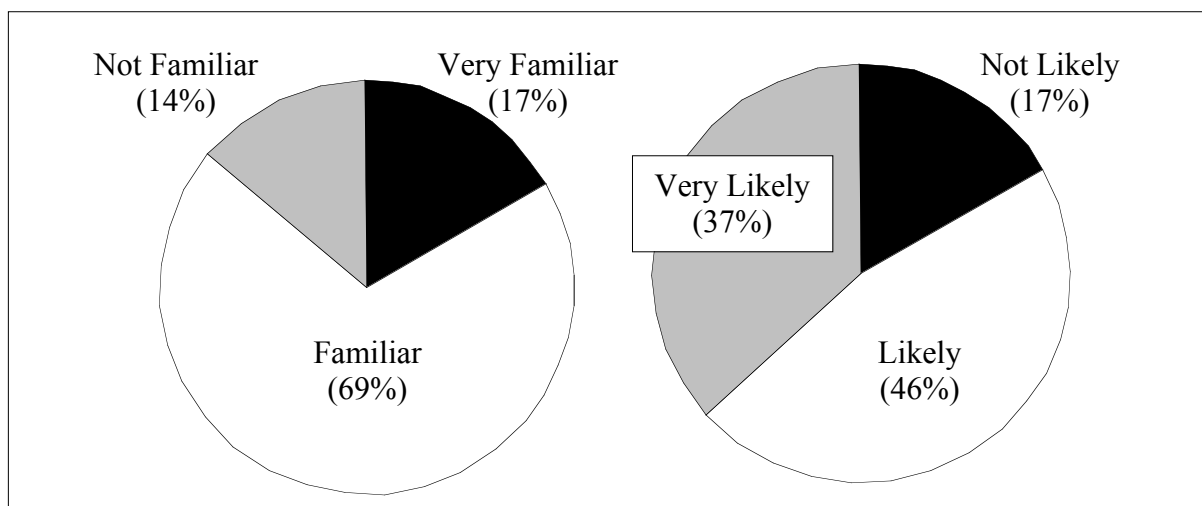


Figure 2. Familiarity With and Likelihood of Using MACSM Certification

The majority of respondents (69%) were familiar with the program, with 17% being “very familiar”. Only 14% were not familiar with MAC certification, which is less than the share that is not likely to use the program. Only

46% indicated that they are likely to use the program, but 37% indicated they were very likely to become MAC certified (i.e., collect, handle, transport, and/or sell MAC certified live marine ornamentals). Thus, it appears that some firms indicated that they are somewhat to very likely to use the program although they are not familiar with the program.

Since 54 firms responded to the survey but only 30 to 35 completed the market experiments that are used to conduct the empirical analysis, the characteristics of the firms that did not complete the conjoint analysis can be compared to those that did in order to identify any differences. In summary, a smaller portion of the non-responders were located outside the U.S. (27% versus 20%) and a larger share fell into the smallest firm-size category (69% versus 62%). The really large firms (with annual marine sales in excess of US\$25 million) were also among those that did not answer, the respondents of these firms were also less knowledgeable about the source of their inventory (21% did not know versus 9% of respondents) and less likely to use “tank-raised” as a marketing tool (42% of non-respondents used the information versus 77% of respondents). Overall, it appears that the large firms may rely more on volume sales and less on using product information to generate additional sales.

3. MODELS

Two aggregate models were estimated for each species using the conjoint experiment data. The profitability ratings and stated annual demand are the dependent variables (π and Q , respectively). The explanatory variables were the same in each equation, namely, the product attributes (as represented by the X vector) and a set of dummy variables (D) included to capture differences in respondents and firms.

$$(1) \quad \pi, Q = \alpha + \sum_i \beta_i X_i + \sum_j \gamma_j D_j$$

Using the estimated profitability equation, break-even prices for different products and locations in the market chain were determined. By assuming a profitability score equal to zero and values for all variables except price, Equation (1) was solved for the break-even price as follows:

$$(2) \quad X_{i=price}^{BEP} = \frac{\hat{\alpha} + \sum_i \hat{\beta}_i X_i |_{i \neq price} + \sum_j \hat{\gamma}_j D_j}{\hat{\beta}_{i=price}}$$

The profitability and demand models were estimated using tobit analysis due to the potential for bound values that could reflect truncated responses (Harrison, Ozayan, and Meyers, 1998). If truncated, estimation using ordinary least squares would be inefficient.

4. RESULTS

Table 2 shows the results from estimating equation (1) to explain the variation in stated preferences as measured by the relative profitability scores (π) assigned to each hypothetical product for each species. Four product attributes in total (X_i) were included in each regression. Two product attributes were in all models, namely, a dummy variable for MAC-certification and price. The remaining two attributes differed between the high-valued fish species (angelfish and hogfish) and low-valued tank-raised species (clownfish and shrimp). These attributes were summarized in Table 1. An additional four variables were included in each model to account for different preferences based on the firms’ familiarity with and likelihood of using the MAC certification program. Specifically, two dummy variables assumed values of one if the firm was “somewhat familiar” or “very familiar” with the MAC certification program and two dummy variables assumed values of one if the firm was “somewhat likely” or “very likely” to participate in the MAC certified program.

MAC certification was statistically significant only for the relatively high-valued species examined in the study, namely, queen angelfish and spotfin hogfish. MAC certification increased the average profitability rating of the angelfish and hogfish by 0.56 and 0.50, respectively. For comparison, these part-worth estimates were the smallest in absolute size of all the coefficients associated with binary variables (i.e., all except for price). In addition, three of the four variables indicating the familiarity and likelihood of adopting the MAC certification

program were also significant in the angelfish and hogfish models. These variables were also negative indicating the average profitability is lower for those that are more familiar and more likely to adopt MAC. The negative signs on familiarity could reflect the concerns over the as yet unspecified costs of the program. The negative signs on the likelihood of participating in the MAC certification program indicates that those respondents who were somewhat likely to adopt MAC certification assigned lower profitability scores on average, *ceteris paribus*. Perhaps those who are more likely to participate in MAC certification expect the program to reduce profitability in the short-run. At this initial stage of evaluation, the respondent may only be considering the need to cover immediate costs and not the potential longer-run benefits. At this time, there is no public awareness of the program to generate increased demand and higher prices. Also, the firm may have a preference for supporting sustainable harvests and reducing mortality rates that may not be accounted for in their market. Conversely, the familiarity increased the average ratings of the lower-valued clownfish and peppermint shrimp. The average profitability rating of shrimp also increased for those who were very likely to adopt the MAC certification program. This effect, which is contrary to those for the higher-valued species, could reflect the potential for obtaining this product from culture facilities; that is, since MAC certification represents an improved sustainability of the stock (similar to tank-raised products) this variable could be accounting for the tank-raised attribute that was not statistically significant.

Table 2. Tobit Profitability Regression Results by Species (Wald Chi-Sq in parentheses)

Variable ^a	Q. Angelfish	S. Hogfish	O.S. Clownfish	P. Shrimp
Intercept	7.18*** (42.2)	8.69*** (22.1)	3.65* (2.76)	4.62*** (9.13)
Product Attributes:				
MAC-Certified	0.56* (3.46)	0.50* (3.72)	0.35 (0.51)	0.26 (0.32)
Price (US\$ each)	-0.09*** (39.5)	-0.28*** (18.3)	-0.61* (2.35)	-3.10*** (18.9)
Fish Size = Medium	1.00*** (6.70)	0.33 (1.06)	N/A	N/A
Fish Size = Large	1.22*** (10.7)	0.86*** (7.09)	N/A	N/A
Tank-Raised	N/A	N/A	1.17** (6.42)	-0.04 (0.01)
Guaranteed Survival	N/A	N/A	1.91*** (28.9)	2.55*** (61.8)
MAC-Certified Interaction Terms:				
MAC-Certified*Familiar	-2.60*** (15.4)	-1.36*** (5.94)	0.91* (2.08)	0.36 (0.42)
MAC-Certified*Very Familiar	-2.87*** (17.8)	-1.39*** (5.94)	0.98 (2.06)	1.07* (2.72)
MAC-Certified*Likely	-1.70*** (9.05)	-1.76* (9.05)	-0.18 (0.09)	0.68 (1.73)
MAC-Certified*Very Likely	0.09 (0.02)	-0.20 (0.15)	-1.20* (3.26)	1.19** (4.21)

Source: Larkin, Degner, and Rubinstein (2002, Table 6, p. 38).

^a Parameter estimates for the firm and respondent dummy variables are not shown here but are available from the source document.

The price attribute was a continuous variable, averaging from US\$0.79 for peppermint shrimp to US\$30.00 for queen angelfish. The statistically significant negative coefficients indicate that higher prices result in lower average profitability ratings for all species. At the average prices, the effects on profitability ranged from -1.42 for the orange skunk clownfish to -3.27 for the spotfin hogfish and in general was larger for the higher-valued fish species. The magnitude of these effects is within the range of the remaining significant variables.

Fish size was included only in the high-valued species experiments (i.e., angelfish and hogfish). Both the medium and large-sized angelfish increased the profitability rating above that of small angelfish (by 1.00 and

1.22, respectively). For the hogfish, only the average rating of the large fish was statistically above the small fish.

The tank-raised and guaranteed survival attributes were only included in the lower-valued species (i.e., clownfish and shrimp). The tank-raised attribute increased the average profitability rating only for clownfish, perhaps because this species is one of the few that is currently available from commercial culturing operations. The survival guarantee was statistically significant and positive, as expected, for both species. This attribute was intended to account, in part, for one benefit advocated by MAC supporters, namely that the MAC certified specimens are expected to be healthier and thereby survive longer (reduced mortality). For these species, this result suggests that a survival guarantee could be an alternative for those firms who are already handling and transporting the specimens in a manner that results in a longer “shelf life”. In addition, the survival guarantee does not incur an automatic cost. Note that large retail pet store chains (e.g., PetSmart) currently get and offer such guarantees on freshwater specimens.

Using the estimated profitability equations in Table 2, the breakeven prices associated with each variable were calculated as shown in Equation (2). These prices are the maximum price that the firm would be willing to pay; it is the price at which the firm will breakeven from purchasing and re-selling. The change in breakeven price represents a premium (if positive) or a discount (if negative) over the breakeven price. The premiums/discounts are due to either differences in market segments, market conditions, or costs. Thus, the breakeven price would just allow the firm to cover costs and earn normal profits. Table 3 summarizes the wholesale breakeven prices for MAC-certified specimens by familiarity and likelihood.

Table 3. Wholesale Breakeven Prices (and price discounts in US\$) Related to MAC Certification

Species Likelihood of Adopting MAC	Familiarity with MAC		
	Not	Somewhat	Very
MAC-certified Queen Angelfish:			
Not Likely	\$74.95 (0)	\$46.22 (-38%)	\$43.27 (-42%)
Somewhat Likely	\$56.25 (-25%)	\$27.52 (-63%)	\$24.57 (-67%)
MAC-certified Spotfin Hogfish:			
Not Likely	\$22.64 (0)	\$17.81 (-21%)	\$17.72 (-22%)
Somewhat Likely	\$19.93 (-12%)	\$15.10 (-33%)	\$15.01 (-34%)

Note: The breakeven base prices for a non-certified product were US\$68.77 and US\$20.89 for the angelfish and hogfish, respectively. Parentheses contain the difference from a firm that is not familiar or likely to participate.

For both angelfish and hogfish the breakeven prices (i.e., maximum willingness-to-pay values) declined with familiarity of the program and likelihood of participation. In addition, these effects are compounded and vary by species. The effects were largest for angelfish where breakeven prices would fall by as much as 67%. The price discount effect reached 34% for hogfish. Overall, the effects of familiarity exceed those associated with the likelihood of participating.

The demand models were estimated using tobit analysis (which takes the probability of censored values into account) following the model specification in Equation (1) with Q as the dependent variable. Examination of the data revealed that the average annual demand across profiles for each species was as follows: 85 queen angelfish, 66 spotfin hogfish, 348 orange skunk clownfish, and 2,255 peppermint shrimp. Estimation results by species are shown in Table 4.

The MAC-certification attribute was negative and statistically significant in the fish species models (i.e., angelfish, hogfish, and clownfish). Thus, firms demand fewer MAC-certified fish (387 fewer angelfish, 126 fewer hogfish, and 1,746 fewer clownfish); however, note that these firms are not familiar with the program and not at all likely to participate in the program in the near future. For the angelfish and clownfish, the magnitude of reduced demand is either the largest effect in the model or second only to the variables indicating the familiarity with (and/or participate in) the certification program.

Table 4. Tobit Demand Regression Results by Species (Wald Chi-Sq in parentheses)

Variable ^a	Q. Angelfish	S. Hogfish	O.S. Clownfish	P. Shrimp
Intercept	45.1 (0.29)	180.7 (2.03)	995.8 (1.65)	-23,059.0*** (34.8)
Product Attributes:				
MAC-Certified	-387.0*** (15.4)	-126.3** (5.44)	-1,745.6*** (17.6)	-2,020.7 (0.50)
Price (US\$ each)	-4.86*** (10.5)	-14.6*** (8.78)	-165.8 (1.52)	598.1 (0.11)
Fish Size = Medium	74.7* (3.36)	32.7 (1.86)	N/A	N/A
Fish Size = Large	-3.54 (0.01)	12.5 (0.26)	N/A	N/A
Tank-Raised	N/A		15.7 (0.01)	14.8 (0.00)
Guaranteed Survival	N/A		398.8*** (10.1)	2,465.7*** (10.8)
MAC-Certified Interaction Variables:				
MAC-Certified*Familiar	195.6** (6.11)	98.9** (3.98)	1,280.9*** (12.9)	-815.9 (0.16)
MAC-Certified*Very Familiar	414.3*** (17.8)	182.2*** (10.6)	1,332.9*** (9.62)	631.1 (0.05)
MAC-Certified*Likely	168.0** (5.60)	23.6 (0.30)	485.6* (0.30)	491.8 (0.05)
MAC-Certified*Very Likely	98.9 (2.03)	-8.18 (0.04)	476.7 (2.40)	223.6 (0.01)

Source: Larkin, Degner, and Rubinstein (2002, Table 9, p. 45).

^a Parameter estimates for the firm and respondent dummy variables are not shown here but are available from the source document.

The price attribute was statistically significant in only the high-valued fish species equations. The average prices for angelfish and hogfish were US\$30.00 and US\$11.67, respectively. Using the average prices and quantities for each species, price elasticities of demand were calculated as -1.72 and -2.58 for the queen angelfish and spotfin hogfish, respectively. Higher prices would reduce the demands for both species, however, the effect is larger for the hogfish. In particular, both demands are “elastic” such that for a given percentage price increase, demand would fall proportionately more. Thus, the markets for both species are highly competitive. The larger effect for hogfish was expected, given the intense competition from around the Caribbean.

Fish size was only an attribute in the high-valued fish species equations, however, the only significant effect on demand was that of medium angelfish. If the fish were of medium size versus small, annual demand would increase by 75 fish. Note that this effect is relatively large, as it represents a nearly 88% increase over the average annual demand. Perhaps the larger, more mature fish are hardier. On the other hand, the lack of significance of the largest fish class could be reflecting the fact that fish continue to grow in the tank. If a large fish is purchased, the buyer does not have as much opportunity to observe growth, as the tank size will eventually constrain growth. Thus, although larger fish are more profitable, demand appears to be highest for the mid-size fish.

The annual demand for the two lower-valued species examined in this study, orange skunk clownfish and peppermint shrimp, were estimated with attributes indicating whether the specimens were tank-raised and or offered with a survival guarantee. Only the survival guarantee was significant. Thus, even though tank-raised specimens may be more profitable, they do not affect overall demand for a given species. The survival guarantee, on the other hand, significantly affected both profitability and demand. The effect on demand was

roughly equal to the average demands, that is, the annual demand would more than double (increase 115% for clownfish and 109% for shrimp) if a survival guarantee were offered.

5. CONCLUSIONS

In summary, industry participants were willing to pay less to cover additional costs associated with becoming and maintaining the MAC-certification. Demand was found to be positive for MAC-certified specimens, but lower than for non-certified products. Significant factors included the finding that the market for live marine ornamentals is segmented (i.e., differed for wholesalers and retailers), the results were dependent on the familiarity with the program (i.e., the more familiar, the less the firm was willing to pay for and purchase MAC-certified specimens), results varied by species (i.e., the higher valued finfish showed the most promising results), and that the effects on break-even prices did not correspond with changes in demand quantities (e.g., an increase in break-even price was associated with higher demands for some species).

6. REFERENCES

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