MORTALITY IN THE ORNAMENTAL FISH RETAIL SECTOR: AN ANALYSIS OF STOCK LOSSES AND STAKEHOLDER OPINIONS

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Masters Degree by Research

Biodiversity Management

University of Kent

September 2014

ABSTRACT

The ornamental fish trade is a growing trade sector that has a number of stakeholders that form the supply chain. Stock loss has been highlighted as a concern in relation to the sustainable growth of the industry and welfare concerns. To investigate the issues surrounding stock loss and its extent within the ornamental fish trade, a mixed method approach was used. Specifically, the factors that affect stock loss were identified and the relation to care taken by retail staff (n=40) and consumers (n=110) were investigated. Direct occurrence of stock loss was also assessed – that was collated from 13 stores for the marine sample and 19 stores for the tropical sample – and stock loss within the tropical freshwater fish sample (n=32,204) was 5% compared with the marine sample (n=1004) that had 9% loss of stock. However, stock loss did vary in relation to species-specific stock loss, store-specific stock loss and care-category specific stock loss. The origin of stock, wild-caught v captive-bred, influenced the degree of losses. For marine fish, 10% of wild stock was lost compared with 8% for captive-bred stock. In contrast, tropical freshwater fish suffered 6% stock loss for captive-bred stock compared with only 3% for wild-caught stock. Binary logistic regression analysis found that all 11 variables influenced stock loss, although this varied based on species, store, care category and whether the sample was of marine or tropical freshwater ornamental fish. In terms of care, a number of classification systems were identified in the consumer and retail questionnaires, along with a survey of 15 web sites. Twenty-one terms were found in use, however 62% of retail staff did not use a care-level classification system when making recommendations. However, the majority of retail staff stated that in-house training was provided and rated their own as understanding and that of their colleagues as good or very good. The consumer questionnaire highlighted that care classification did influence consumers' decision to purchase, with high-care classifications having a negative correlation. The majority of consumer respondents stated that visiting ornamental fish retails was the most common method of purchasing ornamental fish. Stock loss within the sample was found to have the ability to range from 0% loss to 100% occurrence. It is recommended that the industry works to standardise staff training within stores, and that greater consideration should be given to the individual needs of ornamental fish and how this can influence stock loss.

ACKNOWLEDGEMENTS

I would like to thank my supervisors Dr David Roberts and Ian Watson for their guidance and support throughout this project. Many thanks also goes to to Freya St John, for all her guidance. I would also like to thank all the personnel (both those in managerial roles and sales assistants) for their assistance, guidance and support. My thanks also go to all the ornamental fish online sources utilised to gather information and those that allowed the consumer questionnaire to be posted on their sites.

Special thanks go to Abigail Wills who helped me with the study despite being countries apart, thank you for the guidance and support throughout the study and for taking me on a trip of a lifetime. My thanks also go to all my family and friends who supported me with this study. Thanks to Mark Allan Richards, Flora Haynes, Naomi Holmes, Maria Smith, Melanie Dolby, Rob Dolby, Janna Steadman, Victoria Stephenson, Joe Millard, Alex Dyette, Sheila Smith, Whisper Catherine, Lottie and Leslie Smith for all their support, guidance and the laughter they generation throughout the duration of the study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1: INTRODUCTION

1.1 TRADE IN EXOTIC SPECIES AND SPECIFICALLY THE ORNAMENTAL FISH TRADE

The international live trade in non-native or exotic species is substantial, with an estimated 350 million wild plants and live animals traded annually (Karesh et al. 2007) involving a range of taxa (Reaser et al. 2008; Picco et al. 2010; Prestridge et al. 2011; Douglas et al. 2014). Specific taxa within this trade sector include mammals (Karesh et al. 2005; Bush et al. 2014; Nijman et al. 2011), reptiles (Schlaepfer et al. 2005; Outerbridge 2008; Rosen et al. 2010; Warwick 2014), amphibians (Pernetta 2009; Picco et al. 2010; Herrel et al. 2014), invertebrates (Bruckner 2005; Livengood 2007), birds (Beissinger 2001; Karesh et al. 2005; Bush et al. 2014) and fish (Prestridge et al. 2011; Douglas et al. 2014). In 2002, it was estimated that more than 267 million live, non-native animals (including 38 thousand mammals, 2 million reptiles, 49 million amphibians, 365,000 birds, and 216 million fish) were imported to the USA alone (Bell et al. 2004; McGregor Reid 2013).

The size of the industry has led to a range of concerns around the sustainability of the trade, as well as welfare concerns, within different sections of the supply chain (Harriot 2002; Blundell et al. 2005; Cable et al. 2007; McCollum 2007; Lilley 2008; Walster 2008; Dickens et al. 2009; Vincent et al. 2011b; Rhyne et al. 2012; Thornhill 2012; Calado et al. 2014). These concerns include; (1) the lack of accurate, species-specific information available on both a national and international basis (Rhyne et al. 2012; Bush et al. 2014; Calado et al. 2014; Douglas et al. 2014), (2) inappropriate species welfare standards along the supply chain (Hastein et al. 2005; Huntingford et al. 2006; Prestridge et al. 2011), (3) bio-hazardous species with the potential to spread novel pathogens, diseases and viruses between nations (Eugenio et al. 2003; Gandini et al. 2005; Go et al. 2006; Chomel et al. 2007; Greger 2007; Forzan et al. 2008; Bostock et al. 2010; Derraik et al. 2010; Yong et al. 2011; Prestridge et al. 2011; Guo et al. 2012; Hua et al. 2012; Khorramshahr 2012; Cornwell et al. 2013; Tripathi 2013), and (4) insufficient mechanisms to monitor whether the harvesting of exotic, wild-caught species is sustainable (Mazzoni et al. 2003; Prestridge et al. 2011; Bush et al. 2014). Stock loss, as a result of one or more of these factors, can be substantial. For example, loss in the wild-harvest of Mexican parrots is estimated to be between 75% and 90% before they even get to the buyer (Schlaepfer et al. 2005).

1.2 ORNAMENTAL FISH TRADE

One example of a taxon that is heavily traded and may be subject to high levels of stock loss, that in turn has the potential to negatively impact the longevity of wild populations, are fish. An estimated 216 million live ornamental fish were imported to the USA alone in 2002, this is more than 5684 times the number of mammals and 591 times the number of wild birds that were brought into the country that year (Bell et al. 2004). The popularity of ornamental fish is illustrated by the fact that an estimated 10% of households in the United States of America (USA) own freshwater ornamental fish, and 0.8% households owned marine ornamental fish (Tlusty 2002).

The ornamental fish trade has been estimated to generate between USD $15 billion to $25 billion per annum (Tlusty 2002; Padilla et al. 2004). The direct sale of ornamental fish is estimated to contribute 15% of the revenue generated through the industry (Tlusty 2002; Wabnitz 2003). The remaining profits are generated through the trade in aquariums, supplies and accessories, among other products (Andrews 1990; Tlusty 2002; Padilla et al. 2004; Lina D 2012). Not only is trade in ornamental fish considerable, it is growing (Gertzen et al. 2008; Steinke et al. 2009; Moorhead et al. 2010). For example, 146 countries exported ornamental fish in 2002, which is more than five times the number of exporting nations in 1976 (Whittington et al. 2007). Furthermore, the annual import value – including cost, insurance and freight (CIF) – of marine ornamental fish and invertebrates was estimated to be between USD $24 million and $40 million in the 1980s (Chan et al. 2000; Bruckner 2005; Gasparini et al. 2005). By the 1990s this had increased to USD $250 million (Chan et al. 2000; Bruckner 2005; Gasparini et al. 2005). Padilla et al. (2004) estimated the industrial growth of this trade at 14% per annum. It is, however, important to consider the increase in CIF import cost from the 1980s to the 1990s (United Parcel Service 2014http://rates.ups.com) due to the impact of the water quantity requirements for transporting ornamental fish on the trade.

1.3 KEY ACTORS IN THE ORNAMENTAL FISH TRADE

The ornamental fish supply chain is complex, partially because of the specific equipment needed by hobbyists in order to adequately care for the fish (Sale 2002; Pfeffer et al. 2004; McCollum 2007; Van Rijn 2013). As a result, the industry involves a large and diverse number of stakeholders (Suquet et al. 2000; Wabnitz 2003;

Sadovy 2005; Ploeg 2007), such as ornamental fish collectors, exporters, importers, and retailers, as well as manufacturers and retailers of ornamental fish care equipment – including food, tanks, medicines and other equipment (Jung et al. 2001; Sorgeloos et al. 2001; Wood 2001b; Wabnitz et al. 2003; Schmidt et al. 2005; Olivotto et al. 2008; Roelofs et al. 2008; Tissot et al. 2010; Thorpe et al. 2011; Townsend 2011; Marschke 2012; Thornhill 2012).

Significant national exporters of ornamental fish include the Philippines and Indonesia, which are each estimated to supply one-third of this industry's total stock (Whittington et al. 2000; Wabnitz et al. 2003; Townsend 2011). The Philippines was estimated to have 2,500 collectors harvesting ornamental fish and to be exporting to 45 countries (Wood 2001b). Within Europe, primary exporters include Spain, the Czech Republic, the Netherlands and Belgium (Livengood et al. 2007; Walster 2008). Key exporters of wild-harvested ornamental fish stock include Columbia, Congo, Brazil, Nigeria, Peru and Thailand (Monteiro-Neto et al. 2003).

The USA and the European Union are among the most significant importers of ornamental fish (Swain et al.2008; Rhyne et al. 2012) and are each estimated to import 8 million ornamental fish per annum. The United Kingdom (UK) is a significant importer in Europe (Cato et al. 2003; Whittington et al. 2000; Wood 2001b; Lunn et al. 2004; Shuman et al. 2004; Fossa 2007). It is, however, important to highlight that the figures on the annual harvest and import of ornamental fish vary between sources of data (Wood 2001a; Wood 2001b; Gopakumar et al. 2002; Moreau et al. 2007; Townsend 2011; Rhyne et al. 2012).

1.4 ORNAMENTAL FISH SPECIES IN TRADE

The majority of ornamental fish stock traded (90%) is of tropical origin (i.e. tropical freshwater ornamental fish), with marine ornamental fish making up only 10% of the stock (Tlusty 2002; Tlusty et al. 2006; Whittington et al. 2007). Furthermore, a greater diversity of tropical freshwater ornamental fish species are traded (c. 4,000 species) when compared with marine ornamental fish (c. 1,400 species) (Whittington et al. 2007).

The types of ornamental fish that are targeted vary geographically. In the Philippines, collectors tend to target “bread-and-butter” species (Ng et al. 1997), which are found near coastal areas and thus require little effort to harvest. By contrast, “rover traders” often travel up to two weeks to harvest rare and/or higher-value species (Reksodihardjo-Lilley et al. 2007; Colotelo et al. 2009; Tissot et al. 2010). Specific exporting countries rely on specific species for the bulk of their exports. In Sri Lanka, Guppy species account for 67% of the country’s ornamental fish exports (Wijesekara et al. 2001). In the Ceara state of northeastern Brazil, between 1995 and 2000, an estimated 72% of exported stock was derived from 10 specific ornamental fish species (Gasparini et al. 2005).

The quantity of wild harvested stock also varies depending on whether species are marine or freshwater species (Gopakumar 2002; Whittington et al. 2007). The marine ornamental fish trade is estimated to get 90% of its stock from wild stock, and 10% from captive-bred stock. This contrasted with the freshwater ornamental fish trade that was estimated to obtain 90% of its stock from captive stock and 10% from wild harvested stock (Tlusty 2002; Tlusty et al. 2006; Whittington et al. 2007).

1.5 ORNAMENTAL FISH TRADE SUSTAINABILITY

A combination of the size and growth of the ornamental fish trade has led to concerns over the sustainability of the industry (Naylor et al. 2000; Tlusty 2002; Foster 2005; Moreau et al. 2006; Kiron et al. 2011; Sampaio et al. 2013). Indeed, some wild-harvested ornamental fish species are experiencing localised depletion in a number of countries, including Sri Lanka, Kenya, the Philippines, Indonesia, USA and Australia (Bruckner 2001; Wood 2001b; Kolm et al. 2003; Job 2005). However, this is not a universal trend. The Cooke Islands, where the trade is considered to be sustainable, exports approximately 20,000 ornamental fish annually; with the industry employing six full-time collectors, three part-time collectors, and a single export company (Wood 2001b).

Over-harvesting is not the only factor affecting the sustainability of the ornamental fish trade (Weber 2001; Tissot et al. 2010; Diaz et al. 2012; Rhyne et al. 2012), as there are a number of stages in the ornamental fish supply chain along which practices can occur that compromise the sustainability of the trade (Wait et al. 2003; Fossa 2007; Southgate 2008; Cartwright 2012; Vaz et al. 2012; Dhanasiri et al. 2013; Goulart et al. 2013). For example, a study in the 1980s found that 15% of stock was lost during collection, then a further 10% was lost in the process leading up to import and 5% at the retail stage (Wood 2001b). Wood (2001b) found that of 2,576 fish exported, belonging to 120 species, there was a mortality rate of 8.5% to

34% in the holding facility prior to export, and that stock loss when delivered ranged from 24% to 51%. A further 8% to 10% of stock loss occurred at the importation stage. The effect of cumulative mortality, when considering all stages of the supply chain (from harvest to consumer) is considerable and can result in between 75% (Hastein et al. 2005) and 90% stock loss (Rubec et al. 2005; Thornhill 2012).

Unfortunately, it is not easy to pinpoint activities that contribute to stock loss, because malpractice at one stage in the supply chain (e.g. stocking fish at inappropriate temperatures during freight) might not result in mortality until later on in the supply chain. For example, 25% to 76% of stock was unable to be exported due to injuries that had occurred at undetermined earlier points of the ornamental fish supply chain that subsequently resulted in loss (Thornhill 2012).

1.6 FACTORS AFFECTING ORNAMENTAL FISH STOCK LOSS

1.6.1 HARVESTING TECHNIQUES

The collection stage of the ornamental fish trade has significant impact on trends in stock loss (Wood 2001b; Schmidt et al. 2005; Thornhill 2012; Vectesi et al. 2012). Within the collection stage there are a variety of factors that have been found to influence the probability of survival of ornamental fish, including; (1) collectors' journey time and distance travelled to harvest specific species (Gomes et al. 2003; Livengood et al. 2007; Swaddle et al. 2008), (2) degree of specialisation and impact of this on response to captive environmental stressors (Whitfield et al. 2002; 2009; Hobbs et al. 2010), and (3) capture method and handling in terms of damage to ornamental fish and stress (Wood 2001b; Davis et al. 2002; Huntingford et al. 2006; Kiron et al. 2011; Vaz et al. 2012).

Also, if fishing is indiscriminate, such as is the case with cyanide fishing, the capture method can result in significant physiological heath issues, as well as damaging the surrounding environment, thus compromising the sustainability of the trade (Mak et al. 2005; Pomeroy et al. 2006; David et al. 2008; Amos et al. 2009; Duponchelle et al. 2012; Rhyne et al. 2012). For example, cyanide fishing can result in 75% ornamental fish mortality between the collection and the point of retail. While another study found 50% mortality occurred within 6 months of stock being placed within an aquarium (Hastein et al. 2005). In the Philippines, there was a 20% loss of stock that occurred between collection and the following day (Sale 2002; Adeyemo et al. 2009; Vectesi et al. 2012). Loss of stock, that can be as high as 30%, shows the importance of best practiced in relation to capture technique. These issues may be prevented through captive breeding, or “aquaculture”, programmes, although these are not without their own set of conservation implications.

1.6.2 AQUACULTURE

It is important to highlight that the harvesting process of captive stock can also result in issues relating to stock health and survival, including; (1) equipment used to maintain healthy stock (Shuman et al. 2004; Urakawa et al. 2008; Kiron et al. 2011; Mukai et al. 2013), (2) ethical handling and capture technique of ornamental fish prior to export (Bloyd 2003; Kiron et al. 2011; Thornhill 2012), (3) appropriate maintenance of the water system for captive stocks, feeding regime and appropriate treatment of disease, parasites and viruses (Degani 1993; Alderman 1998; Ostrowski et al. 2001; Benbrook 2002; Conte 2004; Amin et al. 2005; Bondad-Reantaso et al. 2005; Olivotto et al. 2005; Ashley 2007; Bostock et al. 2010; Noga 2010), and (4) captive stock founder population size. A small founder population can negatively impact its future progeny though genetic drift and risks the population going through a bottleneck (Utter et al. 2002; Leroy 2011). These factors can risk making the progeny prone to disease and degenerative health conditions (Grandin et al. 1998; Kunich 2001; Lynch et al. 2001; Ford 2002; Koljonen et al. 2002; Utter et al. 2002; Bekkevold et al. 2005; Steiger et al. 2006; Frankham 2008; Rooney et al. 2009; Christie et al. 2012; Lorenzen et al. 2012). However, captive breeding through line breeding, if conducted correctly, can also have benefits such as reducing vulnerability to disease, parasites and illness that result from selective breeding. It can also produce stock, which is adapted to survival in captivity by selective breeding and domestication (Tave 1992; Christie et al. 2012; Lorenzen et al. 2012; Forabosco et al. 2013; Lamont 2013).

A further concern is the release of wastewater into the surrounding environment, i.e. discharge of untreated water (Dolomatov et al. 2011a; Dieta et al. 2004; Sinha et al. 2012; Tripathi 2013; Van Rijn 2013), which can result in the transfer of parasites, viruses and other disease from captive to wild stock (Piedrahita 2003; Pimenta et al. 2005; Sinha et al. 2012; Tripathi 2013; Van Rijn 2013). Furthermore, there is also the risk that stock will escape and become invasive in the surrounding ecosystem(s) (Eldredge 2000; Morris 2009; Knight 2010; Thornhill 2012; Tripathi 2013). For example, 65% of the 185 non-native species in the USA come from aqua-cultural facilities (Tlusty 2002). This can negatively affect native species populations (Stockwell et al. 2003; Albins et al. 2008; Albins et al. 2013) and even lead to local or widespread extinction of native species and the subsequent breakdown of local ecosystems (Knight 2010; Townsend 2011; Guo et al. 2012; Rhyne et al. 2012; Albins et al. 2013). The transfer of foreign pathogens is a significant concern as 64% of European pathogens (n = 94) were found to have originated from Asia (Gozlan et al. 2006).

1.6.3 TRANSIT

In a study of exports from Nigeria, maximum stock loss during transit was 100% (Mbawuike et al. 2007). In a previous study, losses within the first three days of arrival were between 30% and 60% (Bruckner 2001). However, in the Philippines stock losses ranged from 30% to 40% (Thornhill 2012), with another study recording considerably less, with only 10% of stock being lost (Thornhill 2012). It is, however, important to highlight that stock loss within transit can be minimal, and a study in the Indo-Pacific estimated stock loss upon reaching importation destination to be 5% to 10%, and only 1% to 2% for the Pacific (Wood 2001b; Learned 2007).

1.6.4 IMPORT

Stock loss can result from inappropriate care (Wöhr et al. 2004; Huntingford et al. 2006; Townsend 2009) including food deprivation (resulting in starvation), inappropriate stock density, poor water quality, poor handling procedures (leading to physiological damage) and inter-species aggression/predation (Ruane et al. 2003; Weis et al. 2001; Millard et al. 2003; Meka 2004; Rubec et al. 2005; Huntingford et al. 2006; Chaun et al. 2007; Dhanasiri et al. 2011; Kiron et al. 2011; Thornhill 2012; Vaz et al. 2012). Given the diversity of issues that can lead to stock losses in the ornamental fish trade, appropriate monitoring and control procedures at multiple levels – local, national and international – are of paramount importance (Wood 2001b; Friedlander et al. 2002; Han et al. 2002; Juvonen et al. 2004; Hilborn et al. 2005; Amos et al. 2009; Raghavan et al. 2009; Townsend 2011; Diaz et al. 2012).

1.6.5 RETAILERS

The retail section of the supply chain can also significantly impact stock survival. As highlighted by Chris Whitelaw, livestock manager at Canada's largest retail chain, estimated stock sourced from wholesalers ranged from 20% to 25% (Rubec 2005). In a survey of 300 USA aquarium stores, it was also reported that stock loss ranged from 30% to 60% within three days of stock arriving from the Philippines (Sadovy 2002; Thornhill 2012). Another study of dead after arrival (DAA) found that, in participating stores, the occurrence of stock loss at this stage of the supply chain could reach 11.3% within fourteen days (Cartwright 2012). Such losses can be due to the latent effects of malpractice in previous section of the supply chain. Variation between retailers' store standards may also have a significant influence (Bruckner 2005; Lilley et al. 2007), with one study showing poor management resulting in 75% mortality within six weeks of retail sale (Sale 2002).

1.7 MEASURES TO REDUCE STOCK LOSS AND PROMOTE SUSTAINABILITY

1.7.1 COLLECTION STAGE

Ornamental fish collection methodology and equipment has been found to have a significant ability to impact stock survival, as we have seen (Aalbers et al. 2004; Adeyemo et al. 2009; Cartwright 2012; Vaz et al. 2012). Within the collection stage, research also highlighted the importance of ornamental fish collectors being supplied with knowledge and appropriate equipment (Dufour et al. 2002; Reksodihardjo-Lilley et al. 2007; Kiron et al. 2011; Thornhill 2012). The importance of this can be seen in the harvesting of marine ornamental fish from deeper waters (Wood 2001a; Rummer et al. 2005) where to harvest ornamental fish from deeper water requires either a slow surfacing method, so as to allow acclimatisation, or quick surfacing. Once at the surface, excess pressure within the specimen is released by piercing using a hypodermic needle (Rummer et al. 2005; Thornhill 2012). This procedure has, however, associated risks, as it requires a level of skill. Collectors are reported to not always have appropriate equipment, using any needle in place of a hypodermic (Rummer et al. 2005; Thornhill 2012). The use of either inappropriate equipment, and/or lack of knowledge can run the risk of puncturing internal organs and causes excess stress. The procedure may be unsuccessful and thus lead to direct or latent stock loss (Gomes et al. 2003; Rummer et al. 2005).

The industry has implemented a variety of legislative policies, monitoring and control efforts, both nationally and internationally, that include:

(1) Sustainable and ethical harvesting practices of wild stock by (a) banning certain fishing methods and equipment (e.g. the ban of cyanide fishing), (b) setting harvesting quota systems (Madan et al. 2012; Fujita et al. 2013; Amos et al. 2009), (c) use of rotational closures depending on influencing factors such as the breeding system and wild stock population level (Friedlander 2001; Wood 2001a; Wabnitz et al. 2003), (d) implementation of no-take zones (Cinner et al. 2005; Alcala et al. 2006; Campbell et al. 2012; Diaz et al. 2012) and (e) implementation of nature reserves that follow national and international nature reserve guidelines and regulations (Rodwell et al. 2000; Friedlander et al. 2002; Mulongoy et al. 2004; Mascia et al. 2009; Thorpe et al. 2011, Dee et al. 2014).

(2) National and international control measures through (a) use of quarantine systems for imported stock to minimise and control the risk of biohazard (Klinger et al. 2009; Yong et al. 2011; Kiron et al. 2011), (b) implementation of monitoring and control of ornamental fish species exportation and exported quantities (Wood 2001b; Townsend 2011; Vincent et al. 2011; Rhyne et al. 2012), (c) incorporation of national policies on reef organisms collection practices (Wood 2001b; Wabnitz 2003; Wabnitz et al. 2003; Teh et al. 2009), (d) organisations monitoring the international and national trade in specific species (e.g. CITES) (Townsend 2011; Vincent et al. 2011; Rhyne et al. 2012).

1.7.2 COMMUNITY-BASED OPERATIONS

Community-based sustainable development is increasingly being applied in conservation and poverty alleviation practices. Governments and non-governmental organisation work with communities to facilitate the sustainable utilisation of resources, and in some cases communities have been given sole control and rights to resources, so as to enable sustainability and decrease the dilution effect of utilising resources responsibly (Bodmer et al. 2001; Johannes 2002; Brockington et al. 2006; Brooks et al. 2006; Wargo 2006; Fabricius et al. 2007; Igoe 2008; Marschke 2012; Douglas et al. 2014).

As well as interventions at specific stages along the supply chain, some groups have worked across multiple stages to reduce stock loss. For example, non-governmental organisations (NGOs) have been working to minimise stock loss by providing collectors with appropriate equipment to catch livestock ethically and minimise physiological and environmental damage. Furthermore, NGOs are providing training and education on responsible harvesting and husbandry and the importance of sustainable practices to preserve ecosystems and ensure the long-term sustainability of the ornamental fish industry (Kiron et al. 2011; Rahman et al. 2012; Thornhill 2012). Some programmes also work to improve sustainability by introducing ornamental fish harvesting certification standards (Knight 2010; Townsend 2011; Dykman 2012; McGregor Reid 2013). In one case, such cooperation agreements between community-based organisations and external institutions reduced post-shipment mortality to less than 5% (Livengood et al. 2007).

1.7.3 TRANSIT

There are various stakeholders that work to assure high standards of care within the ornamental fish supply chain. The International Air Transport Association aims to ensure that air travel for species is humane, processional and to a good welfare standard (Townsend 2011). This stage of the ornamental fish supply chain can be highly influential on stock loss (Chuan et al. 2007; Dhanasiri et al. 2011; Mbawuike et al. 2011). Other organisations that oversee transit codes of conduct include the Fish Exporters' Association, the Pet Industry Joint Advisory Council, the Ornamental Fish International and the Ornamental Aquatic Trade Association (OATA) (Wabnitz et al. 2003; Townsend 2011). Variation within the transit stage can occur, for example the standard of ornamental fish holding facilities prior to their exportation and their ability to facility variation in specific species life history traits and water type(s) (Wood 2001b; Kullander 2003; Huntingford et al. 2006; Tissot et al. 2010; Yanong 2010). Research from Bali highlights the importance of this point in the supply chain showing that stock loss prior to export could be as high as 40% (Townsend 2011). However, with the use of high quality filtration systems and stock management, losses can be minimised (Wood 2001b).

The period ornamental fish are held in transit bags may impact on stock survival likelihood (Arlinghaus et al. 2007; Bendhack et al. 2009; Tissot et al. 2010; Kiron et al. 2011). Factors that can influence survival include; (a) journey time, (b) stocking density, (c) water oxygen ratio within transit bags, (d) water chemistry changes within transit holding bags that can include the risk of ammonia spikes, nitrification of the water, the risk of decrease in oxygen and increase in carbon dioxide and risk of pH,

(e) variation in species-specific life history and threshold of tolerance related to aspects such as a species ammonia tolerance and ability to detoxify after being held within a high nitrogen/ammonia environment, and (f) variation in species morphometric design such as the issue of ornamental fish physiological required movement through water for the ornamental fish species to access suitable oxygen supply through gill movement. These issues can singularly or accumulatively lead to latent and/or direct stock loss (Ip et al. 2001; Weis et al. 2001; Lim et al. 2003; Wöhr et al. 2004; Evans et al. 2005; Chuan et al. 2007; Wright et al. 2007; Wilson et al. 2008; Bendhack et al. 2009; Helfman et al. 2009; Klinger et al. 2009; Dolomatov et al. 2011b; Kiron et al. 2011; Marshall 2002; Mbawuike et al. 2011; Dhanasiri et al. 2013; Thornhill 2012; Dhanasiri et al. 2013; Goulart et al. 2013).

Chronic stress can lead to direct or latent stock losses, and result from a number of factors (Bendhack et al. 2009; Gibson et al. 2010). External stimuli, such as sub-optimal water conditions and stress hormones released by ornamental fish creating heightened arousal in other individuals, can lead to chronic stress (Ellis et al. 2004; Huntingford et al. 2006; Helfman et al. 2009; Goulart et al. 2013; Oliveira et al. 2013), as well as direct physiological damage resulting in trauma (Thornhill 2012). Ornamental fish can also be impacted by stress on a cellular level, negatively impacting homeostasis, and osmoregulation eliciting a fight or flight response (Vectesi et al. 2012; Dhanasiri et al. 2013; Takahashi et al. 2013). However, despite the potential risks that impact the physiological health and survival probability of ornamental fish, it is important to note that there are procedures in place within the industry to minimise the loss of ornamental fish (Thornhill 2012).

Suggested methods of minimising loss include; (a) separation of aggressive stock, (b) holding bags filled with a water/oxygen level of 25% to 50%, (c) ornamental fish being starved 48 hours prior to exportation to minimise excretion and risk of peaks in ammonia levels (Huntingford 2005), and (d) medical treatment prior to export (Rubec et al. 2005). Treatment of guppies with vitamin C supplements for ten days prior to shipping resulted in a lower mortality (8%) within 7 days post shipment, compared with the control group (23%) (Chuan et al. 2007). The use of vitamin C also lowered the risk of mortality when infected with Tetrahymena (14% stock loss), compared with 90% in the control group (Chuan et al. 2007).

Best practices, however, results in a number of trade-offs. Starving ornamental fish prior to export provides benefits by limiting excretion within the closed system, thereby reducing the risk of ammonia fluctuation, change in pH, and nitrification (Huntingford 2006; Liew et al. 2012). This can, however, result in increased aggression levels among stocks resulting in attacks (Huntingford 2006). Furthermore, a study found that starvation is correlated with increased stress (Sinha et al. 2012; Thornhill 2012; Harper et al. 2009). This highlights the complexity of issues relating to holding bag conditions and probability of survival.

Despite the number of variables that can lead to stock loss within this section, it is important to highlight that stock loss within this section of the supply chain can be minimal. A study of Guppies found stock losses amounted to 2.6%, with a mean stock loss of 0.5%, after a simulated 40-hour for 104 transportation bags (Lim et al. 2003). It was also found that stock loss in a simulated 12-hour journey was below

1% (Gomes et al. 2009). Another study estimated stock loss to range between 0.8 to 11% mortality occurred during the transportation stage of stock (Rubec et al. 2005; Thornhill 2012).

Best practices and procedures that can be implemented in relation to care, husbandry and maintenance procedures, can allow stock losses to be reduced to 1% within this section of the supply chain (Rubec et al. 2005). It is important, however, to highlight species-specific variation, for example species exports from Nigeria range from 100% survival to 100% mortality (Mbawuike et al. 2011). Varying commitment of transnational-shippers to stock standards (Ashley 2007; Chuan et al. 2007; Yanong 2010) can be seen in long journeys. At transit stops, recommended practice includes re-oxygenation, water changes and allowing stock to re-acclimatise before further exportation (Lim et al. 2003). There are also companies that have a live fish guarantee for their imported stock and some companies must have a warranty system that assures a dead-on-arrival rating of less than 5% (Wood 2001a; Lim et al. 2003).

1.7.4 MINIMISING ORNAMENTAL FISH STOCK LOSS WITHIN RETAILERS

There are a number of factors within stores that can directly lead to stock loss, such as retailers selling ornamental fish to consumers before they have completely acclimatised (Wood 2001a), ornamental fish stocking levels (Schmidt et al. 2000; Ashley 2007) and staff meeting ornamental fish feeding requirements and husbandry requirements. Measures put in place to minimise stock loss include; (a) specialised aquatic equipment and filtration systems utilised within stores, (b) stores conducting training of staff relating to stock maintenance, animal husbandry and tank maintenance procedures (Ashley 2007; Lilley et al. 2007; Wabnitz 2003), (c) retail store corporations, such as Maidenhead Aquatics, which has 115 stores in the UK, implementing codes of conduct, ethic codes, equipment standardisation and training regimes (Maidenhead Aquatics; fishkeeper.co.uk), (d) retailers working with wholesalers and transport companies with a good reputation within this industry and in cases use transport companies that assure stock quality by having a live fish guarantee (Huntingford et al. 2006; Fossa 2007). However, it is important to highlight that stock loss within stores can occur despite the best standard, as a result of earlier stressors (Rubec et al. 2001; Bendhack et al. 2009; Vectesi et al. 2012).

1.8 COLLECTION, COMMUNITIES AND POTENTIAL TO LINK WITH CONSERVATION PROGRAMMES

A considerable level of harvesting for the trade occurs in poor rural areas within developing countries (Fabricius et al. 2007; Amos et al. 2009; Cartwright 2012; Lovell et al. 2012; Murray et al. 2012). For example, 88% of individuals within Bali's Sumber Kima community rely on the ornamental fish trade as a major source of income (Lilley et al. 2007). With such high dependence on the trade, these rural communities are appropriately placed to serve as key allies in ensuring that it is sustainable.

The relationship between communities and conservation can, however, be highly tenuous. In some cases, conservation activities negatively impact community wellbeing and land rights (Cernea et al. 2003a; Cernia et al. 2003b; Chan et al. 2007;

Schmidt-Soltau 2010; McShane et al. 2011; Buscher et al. 2012; Cannon et al. 2012; Marschke 2012; Douglas et al. 2014). This results in marginalisation, forced restrictions on resource use, (Geisler 2003; Cernea et al. 2006; King 2007; Moreau et al. 2007; Nasi et al. 2008; Douglas et al. 2014) and, in some cases, entire communities being evicted from a land area that was found to be high in biodiversity richness (Cernea et al. 2003b; Schmidt-Soltau 2004) leading to "conservation refugees" (King 2007; Cannon 2012). It is estimated that in the Congo basin 120,000 to 150,000 people have been either displaced or impoverished through conservation practices within parks (Cernea et al. 2006); "nature-for-nature's-sake" and "fortress" approaches (Armsworth et al. 2007; Buscher et al. 2012). However, many now consider the "nature-for-nature's-sake" approach fundamentally wrong and outdated, replacing it with the "use-it-or-lose-it" approach (Brooks et al. 2006; Armsworth et al. 2007; Minteer et al. 2011; Benson et al. 2012).

The "use-it-or-lose-it" approach enables the complexities of conservation to be acknowledged and to allow inclusive conservation tactics instead of exclusion practices (Coomes et al. 2004; Waylen 2010). The inclusion approach has the ability to allow benefits to occur within a project design in relation to; (1) human welfare and rights, (Cernea et al. 2003b; Brckington et al. 2006; Mascia et al. 2009; McShane et al. 2011; Minteer et al. 2011), (2) utilisation of a renewable resource within communities and by individuals within developing countries (Bodmer et al. 2001; Hair et al. 2002; Caviglia-Harris et al. 2003; Bricknell 2004; Campbell et al. 2012; Murray et al. 2012), (3) enable communities and individuals to have a sense of ownership of land resources. Giving communities a sense of ownership can also decrease sustainable practices by decreasing the risk of dilution of responsibility effect that, in theory, could lead to unsustainable harvesting practices (Bartelmus et al. 2001; Wargo 2006; Hall et al. 2007; Mascia et al. 2009; Douglas et al. 2014), and (4) the ability of projects to place education programmes within a framework regarding the importance of sustainability, and ecosystem function, so as to allow harvesting to have a long-term impact within the community (Pretty et al. 2004; Fabricius et al. 2007; McIntyre et al. 2008; Waylen et al. 2010; Vincent 2011; Marschke et al. 2012).

The potential positive outcome of conservation working within communities can be seen where communities maintain mangrove areas and mangrove ecosystems, and they gain an understanding of the importance of such areas for the juvenile stage marine species that they relied on to harvest for the trade (Mumby et al. 2004; Job 2005; Pelicice et al. 2005; Mohammed 2007; Marschke et al. 2012; Ramos et al. 2013). Another example is the sustainable community project being implemented within the Amazon basin. Here the mouth-brooding Silver arowana's brood stock is harvested and once the juveniles have been removed from the adult's mouth, the adults are released. This allows mature individuals to survive in the wild population (Duponchelle et al. 2012). However, despite the importance of ornamental fish and the potential of conservation organisations working with communities to allow the sustainable utilisation of resources, there are a number of organisations that would prefer a ban on the trade in livestock, exotic species, wild caught species and/or the entire pet trade (Cooney et al. 2006; Moreau et al. 2007; Reaser et al. 2008; Miller 2012).

It is important to highlight that, in cases where individuals within a community cannot utilise one source to generate an income, they generate an income through other means (Quarto 1999; De Groot 2006; Fabricius et al. 2007; Nasi et al. 2008). It is also important to note that the ornamental fish trade can add value to species of fish that are small in size and so not of significant worth within other trade sectors (Chan et al. 1998; Sadovy et al. 2002; Sale 2002; Olivier 2003), thus acting as an incentive to conserve resources (Pomeroy et al. 2008; Rhyne et al. 2012). However, for some species, if they are not harvested for the aquaculture ornamental fish trade, they may be used in the food trade (Sadovy et al, 2003; Cesar et al. 2000; Pomeroy et al. 2008; Rhyne et al. 2009; Duponchelle et al. 2012). The food trade, however, has been found to be less economically viable for communities – ornamental fish species destined for the aquarium trade are worth USD $500 to $1,800, per kilogram. This contrasts with fish harvested for human consumption, which has an estimated retail value of USD $6 to $16.50 per kilogram (Livengood et al. 2007).

When people and communities are unable to utilise one resource, they utilise other sources that, in some cases, negatively impact local species populations and ecosystem functions. In the tropics, other avenues of revenue included hunting, slash-and-burn practices, logging, mangrove destruction, deforestation, damning and farming both agriculturally and of livestock (Quarto 1999; Chapmen 2001; Stickney et al. 2002; Collares-Pereira et al. 2004; Armenteras et al. 2006; Steffan-Dewenter et al. 2007; Moreau et al. 2007; Styger et al. 2007; Monvises et al. 2009; Barletta et al. 2010; Marschke 2012; Rahman et al. 2012; Gruver 2013; Ramos et al. 2013). These practices can impact the environment negatively through; (1) soil erosion, (2) high nitrogen levels and various chemicals being released into the water system(s), (3) degeneration of ecosystem function, and (4) a decrease in biodiversity richness, coupled with a trend in species suffering population decline and risk of extirpation from certain areas (Dias et al. 2010; Rahman et al. 2012; Gruver 2013; Dennis et al. 2004).

These activities can be of significant conservation concern, with 88% of Southeast Asia's fish stocks estimated to be under medium to high threat due to anthropogenic activities (Collares-Pereira et al. 2004). It has been estimated that 58% of coastal waters were found under threat by anthropogenic factors (Bruckner 2001). This highlights the importance of conservation working within communities to develop and maintain industries that can both generate an income and incorporate long-term sustainability in terms of revenue, through the utilisation of renewable resources (Moreau et al. 2007; Essington et al. 2012; Murray et al. 2012; Ramos et al. 2013; Dennis et al. 2004).

1.9 UNDERLYING MOTIVATIONS FOR KEEPING ORNAMENTAL FISH

Keeping ornamental fish is a pastime that can be traced back through the centuries (Balon 2004; Fossa 2007; Walster 2008). However, as with the keeping of any pet, the upkeep of ornamental fish comes at a cost. Potential consumers are likely to analyse the required financial outlay for purchasing and maintaining ornamental fish (Maidenhead Aquatics fishkeeper.co.uk; Roelofs et al. 2008), as well as the amount of time and knowledge needed to secure a species' survival within the aquarium (Andrews 1990; Livengood et al. 2007; Skomal 2007; Seriously Fish www.seriouslyfish.com; Maidenhead Aquatics fishkeeper.co.uk) when making purchasing decisions. To mitigate these costs, and as the longevity of ornamental fish keeping as a pastime indicates, there must be significant benefits to keeping ornamental fish.

Despite the lack of research on the benefits of keeping ornamental fish, comparisons may be made with the keeping other pet (Nast 2006; Langfield et al. 2009; Le Roux et al. 2009; Maher et al. 2011). These benefits include; (1) companionship; the Companion Animal Welfare Council recognise ornamentation fish as a companion animal (Wise et al. 2002; Crawford et al. 2006; Nast 2006; Steiger et al. 2006; Walster 2008; Friedmann 2009), (2) animal-assisted therapy (Kidd et al. 1999; Friedmann et al. 2006; Fine 2006; Le Roux et al. 2009), (3) conveying positive emotions, (4) ability to be a working animal – e.g. guard dog, and (5) ability to be a family pet (Fifield et al. 1999; Power 2008; Schwarts et al. 2007; Reaser et al. 2008).

The incentive for individuals choosing to branch into pet ownership can relate to the animal's appearance, which can give the pet owner a positive emotion (Redmalm 2011; Redmalm 2014), and/or they might own a breed or species type as a status symbol (Jyrinki 2005; Johnson 2010; Maher et al. 2011; Redmalm 2011; Harding 2012; Redmalm 2014). There are a variety of ways pets are used as a status symbol, for example, showing that the owner is wealthy by vitue of their being able to afford to buy and maintain expensive species or breeds (Wood 2001b;Sadovy 2002; Calado et al. 2003; Jyrinki 2005; Roelofs et al. 2008; Maher et al. 2011; Harding 2012). The ornamental fish trade has the potential to generate symbols of financial wealth with, for example, a single Hawaiian angelfish (*Genicanthus personatus*) fetching USD $500 in Japan (Wood 2001b), while other rarer fish can cost as much as USD $20,000 (Rhyne et al. 2012).

Research into the reasons for, and personal benefits of, owning fish is limited, especially on the traits that attract buyers (Gertzen et al. 2008; Townsend 2011). It is likely that a cost-benefit analysis occurs when purchasing a pet, which may include; (1) required financial outlay in terms of purchasing the fish and the maintenance (fishkeeper.co.uk; Roelofs et al. 2008), (2) the amount of time and knowledge an aquarist needs to apply to secure the species' survival within the aquarium (Livengood et al. 2007; Skomal 2007; Fishlore www.fishlore.com), (3) morphological appearance of the ornamental fish species (Swain et al. 2008; Monvises et al. 2009; Thornhill 2012), (4) possible bond being formed between the fish species and pet owner (Kidd et al. 1999; Bott et al. 2003; Mick 2006; Reaser et al. 2008; Walster 2008; Friedmann et al. 2009), (4) a tank's aesthetic beauty (Beck 1996; Neto 2005; Swain et al. 2008; Rhyne et al. 2012; Bored Panda; ALYTA http://alyta.manufacturer.globalsources.com/si/6008837971681/pdtl/Novelty-aquarium/1080467494/Table-lamp-lihting-aquarium.htm), and (5) fish being relaxing to watch (Frumkin 2001; Wabnitz et al. 2003). The positive emotional benefits of keeping ornamental fish are under-researched, though some studies have found that ornamental fish can have a relaxing effect on people (Frumkin 2001; Wabnitz et al. 2003).

The potential benefit of keeping ornamental fish can also relate to the positive emotional benefit to owners by letting nature into their home. This benefit connects with the *Biophilia hypothesis*, which suggests that people have an innate desire to, and benefit from, incorporating nature into their surroundings (Wilson 1995; Wilson 1999; Erikson 2000; Frumkin 2001; Heerwagen et al. 2001; Van Den Born et al. 2001; Maller et al. 2006).

The ornamental fish trade is a potential means of creating a bond between people and the underwater world (Bruton 1995; Bott et al. 2003; Brunner 2012; Kumar et al. 2013; McGregor Reid 2013). The creation of a bond, combined with daily interaction, can generate increased awareness of underwater ecosystems, species interactions and evoke concern for the aquatic environment (Bott et al. 2003; Livengood et al. 2007; Rahman et al. 2012 Dennis et al. 2004). In North America, aquatic taxa were eight times more likely to be threatened than birds and mammals (Haro et al. 1999). In the Philippines, of the estimated 500,000 hectares of mangroves 1918, only 120,000 hectares remain today – mangroves are an important habitat for numerous marine species, particularly during the juvenile phase (Ramos et al. 2013).

While ornamental fish keeping may have a role in increasing public awareness of aquatic ecosystems, this has been little studied. A study at a public aquarium found a number of the individuals that visited the aquarium were ornamental fish keepers (Falk et al. 2007). This may indicate that consumers of ornamental fish develop an interest in aquatic ecosystems and so may be open to education (Falk et al. 2007; Fraser et al. 2008; Kazarov 2008; Walster 2008; Vincent 2011a; Rhyne et al. 2012

Kumar et al. 2013). The other possibility is that they may simply be predisposed to having an interest in fish, which resulted in both their fish purchase and visits to public aquariums (Falk et al. 2007). This is an area in which significant ground can be made in terms of research, as has been the case with the study of zoos (Rhyne et al. 2012 McGregor Reid 2013). Research is required to determine how the industries associated with ornamental fish keeping and aquaria can contribute to generating awareness of the importance of aquatic ecosystems (Pfeffer et al. 2004; Koldewey et al. 2010; Rhyne et al. 2012; McGregor Reid 2013).

1.10 SPECIES-SPECIFIC CARE LEVEL REQUIREMENTS AND POPULARITY

Studies have found that within the ornamental fish trade, specific fish species are targeted through demand, and that these species have a variety of requirements due to life-history traits, physiology, appearance, environmental adaptation, country of origin, quantity of stock found through wild sources and varying intra-species and inter-species interaction variations (Bruckner 2005; Ip et al. 2010; Knight 2010; John et al. 2013; Takahashi et al. 2012; Thornhill 2012; Rahman et al. 2012; Rhyne et al. 2012; Vaz et al. 2012; Raghavan et al. 2013b). The relationship between species-specific characteristics and their ability to impact ornamental fish popularity and their care level requirement, require further study (Thoney et al. 2003; Moreau et al. 2007; Shelby 2013). However, research has shown that popularity can be influenced by media coverage, such as the 25% increased in sale of clown fish (*Amphiprion ocellaris*) after the film *Finding Nemo* (Yong et al. 2011; Rhyne et al. 2012).

Analysis of popularity and species care level requirements has, however, been over-looked within this trade sector (Whittington et al. 2000; Gardiner et al. 2005; Duggan et al. 2006). The issues in defining care requirements is likely due to a combination of factors that includes a lack of published scientific papers regarding ornamental fish care, a lack of standardisation of terminology, and the quality and quantity of sources of information related to ornamental fish care (Whittington et al. 2000; Sale 2002; Thoney et al. 2003; Livengood et al. 2007).

The variety of sources from which consumers are able to gather information relating to ornamental fish care include; (1) online websites that have ornamental fish care sheets, (e.g. Fishlore www.fishlore.com; Seriously Fish www.seriouslyfish.com; Pet Education www.peteducation.com), (2) online ornamental fish social network forums and groups allowing transfer of knowledge between ornamental fish keepers (e.g. Seriously Fish www.seriouslyfish.com; Tropical Fish Forum www.tropicalfishforums.co.uk), (3) ornamental fish online sellers and retailers supplying information regarding specific species care, care level and maintenance requirements (e.g. Aquatics to your door www.aquaticstoyourdoor.co.uk; Maidenhead Aquatics fishkeeper.co.uk), (4) a variety of specific books, magazines related to the various aspects of ornamental fish care (Hargrove et al. 1999; Michael 2004; Rubec et al. 2005; Andrews et al. 2011; Skomal 2007), and (5) regional and international variation for species care level requirements depending on their similarity/variation from a specie’s country of origin (Knight 2010 Padilla et al. 2004).

Transfer of knowledge within the keeper community requires a common language to describe ornamental fish care (Knight 2010; Fishlore www.fishlore.com; Seriously Fish www.seriouslyfish.com; Pet Education www.peteducation.com). However, there is significant variation in the terminology used to describe ornamental fish care in the industry and scientific literature; e.g. “hardy” (Sale 2002; Duggan et al. 2006; Roelofs et al. 2008; Adeyemo et al. 2009), “hardiness” (Roelofs et al. 2008; Carneiro et al. 2009; Mbawuike et al. 2011), “advanced care” (Sale 2002), “specialist” (Livengood et al. 2007; Wilson et al. 2008), “easy to keep” (Duggan et al. 2006), and “habitat specialisation” (Munday 2004; Gardiner et al. 2005).

The diverse range of terms used creates problem in relation to standardisation. However, the ornamental fish trade can incorporate information and protocols already available in other sectors that relate to care level terminologies (Gardiner et al. 2005; Livengood et al. 2007). Science requires the use of more precise terminologies, and this is seen in the scientific literature often describing or placing species into specific categoristions (e.g. generalist v specialist) (Mundy 2004; Ollerton et al. 2007; Pandit et al. 2009; Hobbs et al. 2010; Albins et al. 2013).

In terms of specialist ornamental fish species, these tend to be highly adapted to specific habitats, and/or resource use (Olivier 2003; Gardiner et al. 2005; Wilson et al. 2008). However, increased adaptation to a specific niche may come at the cost of the species being less able to adapt to environmental change. This coupled with being characterised as often being less abundant than generalist species, makes them prone to extinction (Munday 2004; Julliard et al. 2006; Devictor et al. 2008).

Generalists, by contrast, are less adapted to certain environment and resources, though they have a greater ability to adapt to environmental change. They are often characterised as having high abundance and being less prone to extinction (Mundy 2004; Julliard et al. 2006; Hobbs et al. 2010; Clavel et al. 2010). It is important to consider the life history of the species in question, the amount of care required and the impact of the industry (Friedlander 2001; Livengood et al. 2007; Roelofs et al. 2008). The importance of highlighting difficult care and sustainable utilisation is illustrated by the fact that 34.7% of wild-sourced stock exported from Ceara State, Brazil, were endemic, and that 10.7% were known to be rare (Gardiner et al. 2005).

Due to the size of their populations, harvesting quantities and risk of mortality, the harvest of some species is considered to be unsustainable, for example the giant grouper (*Epinephelus lanceolatus*) and humphead wrasse (*Cheilinus undulatus*) (Sadovy 2002). It has been estimated that within the ornamental fish trade, 10% of species are unsuitable for the ornamental fish trade sector, due to the level of care required, and it is suggested that these species should not be traded (Wöhr et al. 2004; Roelofs et al. 2008; Rhyne et al. 2012). For such decision-making process to take place, standardisation of terminology is required to allow transparent assessment. However, standardisation of such terminology is complex, even when defining generalist v specialist (Clavel et al. 2010).

Degree specialisation can incorporate a variety of factors such as; (1) species' food source(s) utilisation (Hobbs et al. 2010), (2) ability to adapt to climatic variation, (3) ability to adapt to habitat change and specific habitat requirements (Hobbs et al.

2010), (4) species behavioural requirements, (5) intra-species and inter-species dependence (Devictor et al. 2008; Helfman et al. 2009), and (6) level of endemism (Hobbs et al. 2010). In a study by Ng et al. (1997), they placed species into different categories based on popularity (e.g. “bread-and-butter species” or “high end”) and illustrated how species can be categorised in relation to; (1) popularity, (2) rarity and (3) cost association (Ng et al. 1997).

1.11 THE PROJECTS AIMS AND OBJECTIVES

The ornamental fish trade is complex and there is a lack of information on different sections of the ornamental fish supply chain and how these factors have the ability to lead to stock loss. This study aims to; (1) examine the views and opinions of those within the ornamental fish retail sector, including level of staff training, species husbandry and maintenance requirements, (2) determine direct stock loss within the retail sector of the ornamental fish supply chain within the UK, and the factors influencing loss, and (3) examine the views and opinions of consumers in relation to care and the factors influencing stock loss.

2: METHODS

2.1 PROJECT DESIGN

Studying stock loss within the ornamental fish trade is highly complex. For example, factors such as poor transport conditions from supplier to retailer and poor tank size in retail stores can increase the likelihood of stock loss later in the supply chain (Lim et al. 2003; Wabnitz et al. 2003; Rubec et al. 2005; Fossa 2007; Gomes et al. 2009). Furthermore, stock loss is potentially a sensitive topic and, as a result, it can be difficult to obtain accurate information (Wabnitz et al. 2003; Hastein et al. 2005; Thornhill 2012). It is for these reasons that a number of approaches were used, namely; (1) direct assessment of stock loss within ornamental fish retail stores, (2) questionnaire to determine retail employee experience and perceptions of the ornamental fish trade, including the provision of in-house staff training, animal husbandry and mortality, and, (3) questionnaire to determine consumer experience, perception of the trade and these factors influence mortality.

2.2 RETAIL DIRECT ASSESSEMENT

2.2.1 ORNAMENTAL FISH RETAIL

The study was conducted in partnership with a single UK-based retailer. Working with a single retailer, rather than a number of independent retail stores, allows the collection of data on in-store stock loss as well as staff experience and perceptions of the trade while minimising external variation. Such variation between retail stores may include (1) codes of conduct and ornamental fish welfare ethos, (2) source(s) of stock import, (3) equipment used to care and maintain livestock, (4) in-house staff training, and (5) applied ornamental fish husbandry effort and tank maintenance.

Store-specific information was collected on; (1) health and safety regulations, (2) the popularity of specific ornamental fish species, (3) Ornamental fish species care requirements and care level categorisation, (4) factors leading to specific ornamental fish being categorised into specific care levels, (5) staff training procedures, (6) in-house treatment and stock maintenance, (7) tank stocking level and diversity of species held within tanks (8) stock sourcing, including whether ornamental fish were wild or captive sourced, (9) what procedures would be appropriate to monitor stock loss within stores, and (10) consumer stock quality demands, knowledge base, and reliance on ornamental fish stores as a source of knowledge and produce. The information was gathered though correspondence with junior partners and/or store managers, and through three full workdays of in-house shadowing specific staff members in two stores. The information was used to design the in-house direct stock loss survey, along with the retailer questionnaire and the consumer questionnaire.

2.2.2 STUDY SPECIES

Twenty marine (ten specialist and ten generalist[1]) and twenty freshwater tropical (ten specialist and ten generalist) ornamental fish species were originally selected to monitor stock loss, based on a number of criteria. A species was considered suitable

[1] The terms “generalist” and “specialist” were considered appropriate because they were the most commonly encountered terms used to describe OF species’ ecological and behavioural requirements, including by the retailer’s website.

if; (1) it was present in all eight stores during the stock assessment phase of the project (2) if the staff ranked a species as having a measure of popularity within the UK ornamental fish consumer market and (3) if it could be confidently placed within a specific care category.

The three criteria and appropriateness of each species were assessed in consultation with staff within the stores. In addition, a review was conducted of academic literature (Van Tienderen 1997; Wabnitz et al. 2003; Mundy 2004b; Gardiner et al. 2005; Duggan et al. 2006; Julliard et al. 2006; Fossa 2007; Roelofs et al. 2008; Pandit et al. 2009; Hobbs et al. 2010; Mbawuike et al. 2011; Rhyne et al. 2012; Thornhill 2012; Raghavan et al. 2013a; Papavlasopou et al. 2014), other publications (Ng et al. 1997; Stadelmann et al. 2003; Shaddock 2010; Skomal 2007; Shelby 2013), and website sources (Animal World, www.animal-world.com; Aquarium Domain, www.aquariumdomain.com; Aquatics to Your Door, www.aquaticstoyourdoor.co.uk; Bakersfield Aquatics Pet, www.bakersfieldaquaticpets.com; Maidenhead Aquatics, fishkeeper.co.uk; Fishlore, www.fishlore.com; Freshwater Tropical Fish Care, www.freshwater-tropical-fish-care.com) related to ornamental fish species popularity, stock importation, and stock harvesting season(s) and duration(s).

Due to the lack of precise information relating to which traits made an ornamental fish species specialist or generalist, a questionnaire containing a standardised ornamental fish species care level classification system was developed containing assessment criteria. These were extracted from a combination of informal discussions with ten personnel at the participating stores (the director, three junior partners, two store managers and four sales assistants), relevant academic literature and ornamental fish care websites.

The questionnaire comprised three sections; (1) the introduction (detailing the questionnaire aims and objectives, along with guidelines for completing the questionnaire and a consent form), (2) example species rating system, and (3) a list of the ornamental fish species being assessed (Appendix 1). The questionnaire was piloted with two of the junior partners and was completed by two junior partners and two store managers of the retail store.

The low response rate, and subsequent small sample size, for the assessment questionnaire meant that the resulting data were converted to percentages and it also meant that the resulting data needed to be normalised for comparison. Each individual's scores were converted to ranks. The ranking distributed scores in order to avoid the problem that individuals can rate subjectively; one person's 2 may be another person's 3, but the order of scores should be consistent if they have the same opinion.

The midpoints of the ranks were calculated so they could then be turned into percentages, using the upper bound of the previous rank or 0 for the first rank, as the lower bound. These midpoints could then be converted to a percentage of the number of scores to give a percentage of the ranks of each individual's scores. These scores are comparable (Appendix 5) and a simplified example given of the process in Appendix 2. Species price information was gathered from ornamental fish purchase websites within the UK.

The data was then compared for three categories, degree of specialisation, popularity and the species price information, to determine the fish most appropriate for the study. An example of the stages in which the data was analysed is present in Appendix 3.

This data was then placed in ascending order for degree of specialisation, popularity and the species price information (Appendix 3). The data were then visualised and three care level categories identified (Appendix 4):

(1) High popularity with low degree specialisation;

(2) High popularity with moderate to high specialisation; and,

(3) Moderate to high popularity with high specialisation.

This information was combined with information on ornamental fish species taxonomy to select four marine and four tropical ornamental fish species for each care level category (i.e. twelve marine and twelve tropical species were selected in total).

2.2.3 SETTING UP THE STUDY WITHIN ORNAMENTAL FISH STORES

Information gathered through discussion with staff of participating stores (Section 2.1) and consulting relevant scientific literature on factors affecting ornamental fish stock loss was collated and used to design weekly stock assessment surveys for the twelve marine (Appendix 6.1) and twelve tropical (Appendix 6.2) ornamental fish species. The survey consisted of two sections. The first section was completed weekly to collect data on species-specific, in-tank stock rotation and stocking quantity (of both the target and other species), along with stock origin and importation source. The second section was completed daily to collect data on daily stock loss of the sample species. The weekly stock assessment survey was accompanied with the stock assessment information sheet (Appendix 6.3), and an example of a completed weekly stock assessment survey. The weekly stock assessment survey was piloted in two stores for three weeks.

2.3 DATA COLLECTION WITHIN ORNAMENTAL FISH STORES

The study was conducted between 1st April 2013 and 12th September 2013, with each store participating in data collection for five to eight weeks. Thirteen stores recorded marine data, and 20 stores recorded tropical data. The number of participating stores also decreased from 26 to 20 due to one or more factors, namely store closure, managerial turnover, staff holidays, the timing of the study (during the retail stores' busy period), and a lack of computer system present within specific stores. Regular correspondence with the retail stores was maintained throughout the project preparation phase and data collection to track progress and ensure the quality of the data.

The information gathered from direct assessment of stock loss within the stores was collated and entered into Microsoft Excel. This information was then reviewed, and two more variables were deemed appropriate to add to the data set; (1) the purchase and retail price of stock that was assessed through the cost association questionnaire, and (2) the distance of each store from Heathrow Airport; given that the duration of transit can effect ornamental fish stock loss.

The distance of stores from Heathrow Airport was calculated using Google Maps (https://www.google.co.uk/maps), and the stores were then grouped into categories relating to their distance from the airport, thus ensuring confidentiality and reducing affects associated with the like of knowledge of the precise delivery route and therefore distance. The price of stock was requested for the 24 survey species; including both the price that the retail stores pay to purchase the species from wholesalers as well as their retail price.

The data were analysed using both Microsoft Excel (Version 2010) and SPSS Statistics (Version 19; IBM Corp, 2010). Using SPSS, binary logistic regression analysis was used to determine whether the probability of an ornamental fish being recorded as dead or alive could be attributed to specific variables. The aim of the binary logistic regression analysis is to identify whether there are trends in one variable that relate to a trend in mortality, the regression's dependent factor.

To perform this analysis, the results are analysed with the covariates that seem to be most suited to testing. It supports a more complex analysis than other methods available, by supporting both scalar ordinal data for suggesting the strength of a trend for covariate(s) of a binary dependent (stock loss) with an indication of the strength of the suggestion (significance) and its scale of effect by the odds ratio (Exp (B)). The covariates chosen were; (1) specific species that was being surveyed within the study, (2) species being assessed care level categorisation, (3) average size estimation of the species that were being surveyed within the tank system that was being sampled, (4) importation source of stock, (5) stock being from wild or captive origin, (6) stock rotation number, (7) diversity of other species held in tank being sampled at the start of a specific stock rotation, (8) estimated quantity of ornamental fish species being assessed within the study at the start of the stock rotation, (9) estimated total tank stocking level at the start of the stock rotation, (10) stock being newly delivered or from an old delivery, (11) number of day(s) ornamental fish store(s) held the specific ornamental fish species being monitored (12) average estimated distance from Heathrow, (13) average retail cost of ornamental fish species, and (14) stores specific identification number (Appendix 7, Appendix 8).

Binary logistic regression analysis of marine ornamental fish was conducted based on data collected from 12 stores and 1044 individual ornamental fish. Nineteen stores were suitable for the tropical matrix, with 32,204 individuals. Data was imported from Excel into SPSS, coded where necessary from nominal values such as wild versus captive, the species and old versus new, to numeric values.

The variables were placed into three groups relating to stock importation (Figure 2.9), tank dynamics (Figure 2.8), and species and category specific (Figure 2.9). This was conducted to avoid bias; the results of binary logistic regression can become skewed if variables are too similar. Information relating to these groupings was placed within an information sheet that held information related to the data’s ability to influence ornamental fish stock loss. This information was then assessed and the most significant variables within each group were placed into a final binary logistic regression.

However, in binary logistic regression, the binary covariates can also be considered ordinal, as the positive or negative effect is a trend towards either of the values. For each of the target covariates, analysis was conducted for the whole set of data, each of the stores, each of the species and each of the species categories (Appendix 7, Appendix 8). Where analysis was not possible, it was due to either lack of data (e.g. a store may not have completed a field in any of the questionnaires) or no variations (e.g. all fish were alive so there was no trend to identify for death or, in some cases, the covariates had no variation).

2.4 RETAIL QUESTIONNAIRE

The retailer questionnaire allowed the views and opinions of individuals that worked directly within this industry to be incorporated within the study (Appendix 9). The design of the questionnaire was developed through discussion with a number of ornamental fish stores and retail staff within the stores. The information obtained was considered in relation to additional information on ornamental fish care, maintenance, species-specific care requirements and any additional issues thought to influence ornamental fish stock loss. Information was also gathered that related to which factors influence the probability of a species appearing in the ornamental fish trade.

The retail questionnaire itself was designed to collate qualitative and quantitative data (Doyle et al. 2001; Newing 2011). Five-point Likert scales were used to collect information on staff training, applied husbandry effort within the retail stores, ornamental fish industry (Jamieson 2004; Allen et al. 2007; De Winter et al. 2010). The questionnaire contained the following five sections:

(1) *Personnel profile:* information that related to personnel that worked within the retail stores, including: (a) position within the store, (b) number of years they have worked within the company, (c) specific stores in which they worked within the company, (d) information related to working within this trade sector, (e) qualification(s) held that related to working within this trade sector, (f) sources personnel used to gather information related to ornamental fish husbandry. This information was placed at the beginning of the retail questionnaire due to it not being of a sensitive nature.

(2) *Staff training:* allowed staff to provide information related to an individual's personal view of whether training was provided, an individual's rating of the training, and an individual's rating of both their own understanding, and that of their peers.

(3) *Ornamental fish species care level classification system(s) used within the retail stores*: obtained information that related to an individual's personal use of care level categorisations.

(4) *Applied husbandry effort within the retail stores:* gathered information related to personnel's rating of the husbandry within the organisation. In addition, participants were asked whether their store(s) accepted ornamental fish from consumers for rehoming purposes.

(5) *Ornamental fish industry:* relating to individual's views and opinions of the trade sector regarding (a) sources consumers use to gather information regarding ornamental fish care, (b) their rating of how competitive they found the retail market to be within this trade sector, (c) improvement(s) they feel would benefit the trade, (d) the extent to which stock loss is an issue within the trade, and (e) as to whether information was readily available within the sector related to harvesting information, particularly stock origin.

The questionnaire was reviewed by a junior partner of the retail stores and piloted by seven personnel in two of their stores. The final questionnaire was distributed to the 20 stores that were involved within the study.

2.5 CONSUMER QUESTIONNAIRE

The consumer questionnaire allowed information to be gathered regarding the views and opinions of people that have kept ornamental fish (Appendix 11). The consumer questionnaire followed the same general structure as the retail questionnaire and contained five sections that included:

(1) *Respondent information:* demographic information, specifically; (a) age, (b) country of residence, (c) experience relevant to this trade sector, and (d) qualifications relevant to the ornamental fish trade.

(2) *Previously owned ornamental fish/ presently owned ornamental fish:* the section was split into two parts, one part to be filled in by consumers that stated they previously had owned ornamental fish, and another section that was to be filled in by consumers that presently own ornamental fish. Information was held within sections that related to; (a) specific ornamental fish species consumers stated they own(ed), (b) the water type of ornamental fish species consumers stated they had owned, (c) the number of years individuals stated they had owned ornamental fish, (d) reasons individuals chose to keep fish, and (e) consumer's rating of the ornamental fish they owned.

(3) *Species care level classification:* ascertained consumer(s) knowledge base, and use of care level terminologies and categorisation system(s).

(4) *Factors ability to influence on purchase decision:* including ornamental fish care level requirements, physiological appearance, cost association and the ability of variation of specific terms to influence consumer purchase decision.

(5) *Ornamental fish industry:* consumer's views and opinions of the trade sector related to sources consumers use to gather information related to

ornamental fish care, and sources consumers use to purchase ornamental fish livestock.

The questionnaire was piloted by seven individuals who previously or now owned ornamental fish. The questionnaire was distributed through a variety of means, including; (1) an e-mail to the Durrell Institute of Conservation and Ecology within the University of Kent requesting the involvement of participants who presently or previously owned ornamental fish, (2) an e-mail was also sent to Sparseholt College (www.sparsholt.ac.uk), (3) online ornamental fish web sources including; Seriously Fish (www.seriouslyfish.com), PlanetCatfish (www.planetcatfish.com), and (4) an open contact group on Facebook was created entitled MSc Fish Study Group.

The data collated within this questionnaire was split into two parts. The specific information that related to species consumers stated they had purchased was collated and analysed further within section 2.4.2. The other information was collated within Microsoft Excel.

2.6 WEB SOURCES CLASSIFICATION OF ORNAMENTAL FISH SPECIES

The ornamental fish species that consumers stated they had purchased were grouped together taxonomically (Table 3.5). The scientific name and life history traits were gathered and standardised through the use of Fishbase (www.fishbase.org). In addition, 15 websites were used to gather information relating to the presence of species-specific categories of care, and specific care terminologies used. Specific web sources were consulted if they held information on species-specific ornamental fish husbandry requirements, and used specific care-level classification systems within ornamental fish husbandry sources.

3: RESULTS

3.1 CHARACTERISING CONSUMERS OF ORNAMENTAL FISH

The consumer questionnaire attracted 127 participants. However, 17 respondents were discarded due to a lack of evidence of the individual previously and/or currently owning ornamental fish. This allowed all respondents to be, or have previously been, involved as consumers of ornamental fish within this trade sector. The majority (n=88) of the 110 consumers were from the UK, the remaining 20 participants were from 10 different countries, and 2 individuals did not supply this information.

The majority (80%, n=43) of the 57 consumers who stated when they owned ornamental fish did so as adults (i.e. when they were 18 years or over). The remaining 11 consumers either owned ornamental fish as children (7%, n=4; aged 12 years or under) or during adolescence (13%, n=7; aged 13 to 17). It was further found within the sample that individuals owned ornamental fish through different life stages, and as such developmental sections (Child Development Institute; http://childdevelopmentinfo.com/child-development/teens_stages/), with a number of individual(s) choosing to keep ornamental fish from early childhood through to adulthood (Figure 3.1).

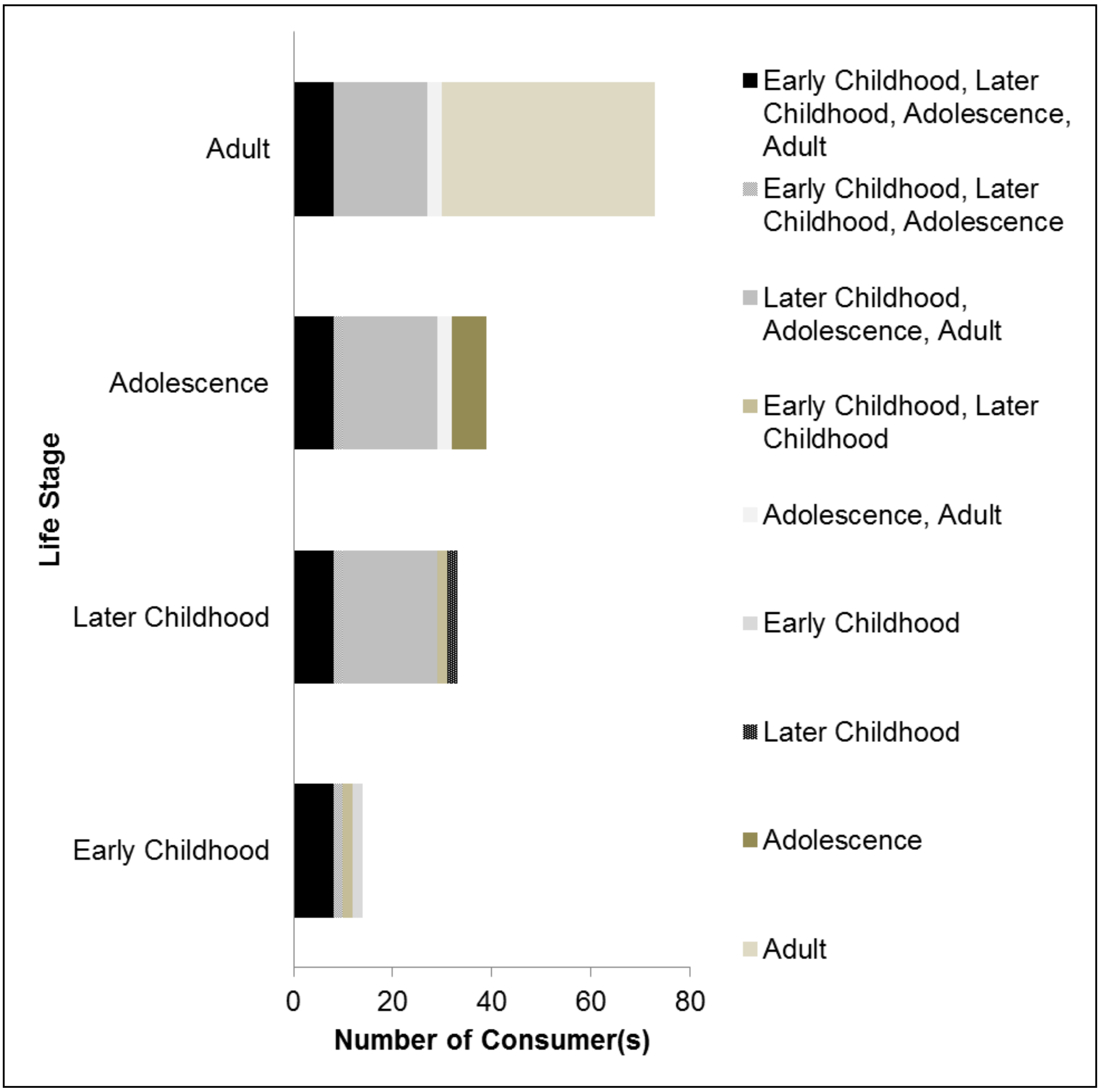

Figure 3.1 Aggregated life stage(s) at which 87 consumer(s) own(ed) ornamental fish (early childhood: 3-8 years of age, later childhood: 9-12 years of age, adolescence: 13-17 years of age, adult: 18+years of age (Child Development Institute; http://childdevelopmentinfo.com/child-development/teens_stages/). It shows a cross over occurring regarding the life stage(s) individual(s) own(ed) ornamental fish.

Consumers owned ornamental fish for a median of 9.5 years (range=0.5–60.0, inter-quartile range=2.25–20.00, n=88). The most common duration over which participants owned ornamental fish was two years (13%, n=11). Nonetheless, consumers kept ornamental fish for a diverse range of timeframes, from less than one year (8%, n=7) to 60 years (1%, n=1).

Other than simply keeping ornamental fish as pets, half (n=55) of the participants stated that they had no other professional experience dealing with ornamental fish (e.g. breeding or working in a shop selling ornamental fish). More than one third (36%, n=40) of respondents also had experience working in the ornamental fish trade. Fifteen consumers (14%) did not specify whether they had professional experience working with ornamental fish or not.

3.1.1 FACTORS INFLUENCING CONSUMER DECISIONS TO PURCHASE ORNAMENTAL FISH

Fish life history

Ornamental fish of the order Cypriniformes were the most popular consumer choice (77%, n=85) (Appendix 12). The most popular species was *Carassius auratus* (common goldfish) (34%, n=37). A large percentage of species (86%, n=92) were owned by two or fewer respondents.

Temperate-freshwater, indoor ornamental fish were the most popular and were owned by 37% (n=64) of consumers. Similarly, more than one third (34%, n=59) of respondents kept tropical freshwater ornamental fish. By contrast, only 10% (n=18) of consumers kept marine ornamental fish and 19% (n=34) owned temperate-freshwater outdoor ornamental fish.

Sixty-three reasons why consumers chose to purchase ornamental fish were provided. These were placed into nine groupings (Figure 3.2). However, there were three reasons for choosing to keep ornamental fish that could only be classified as miscellaneous; these were “spontaneous decision” (n=1), “misconception of ecosystem dynamics” (n=1), and “adoption of the ornamental fish” (n=1). The most common reasons for purchasing ornamental fish, as stated by 28% (n=55) of respondents, was “mood enhancement”.

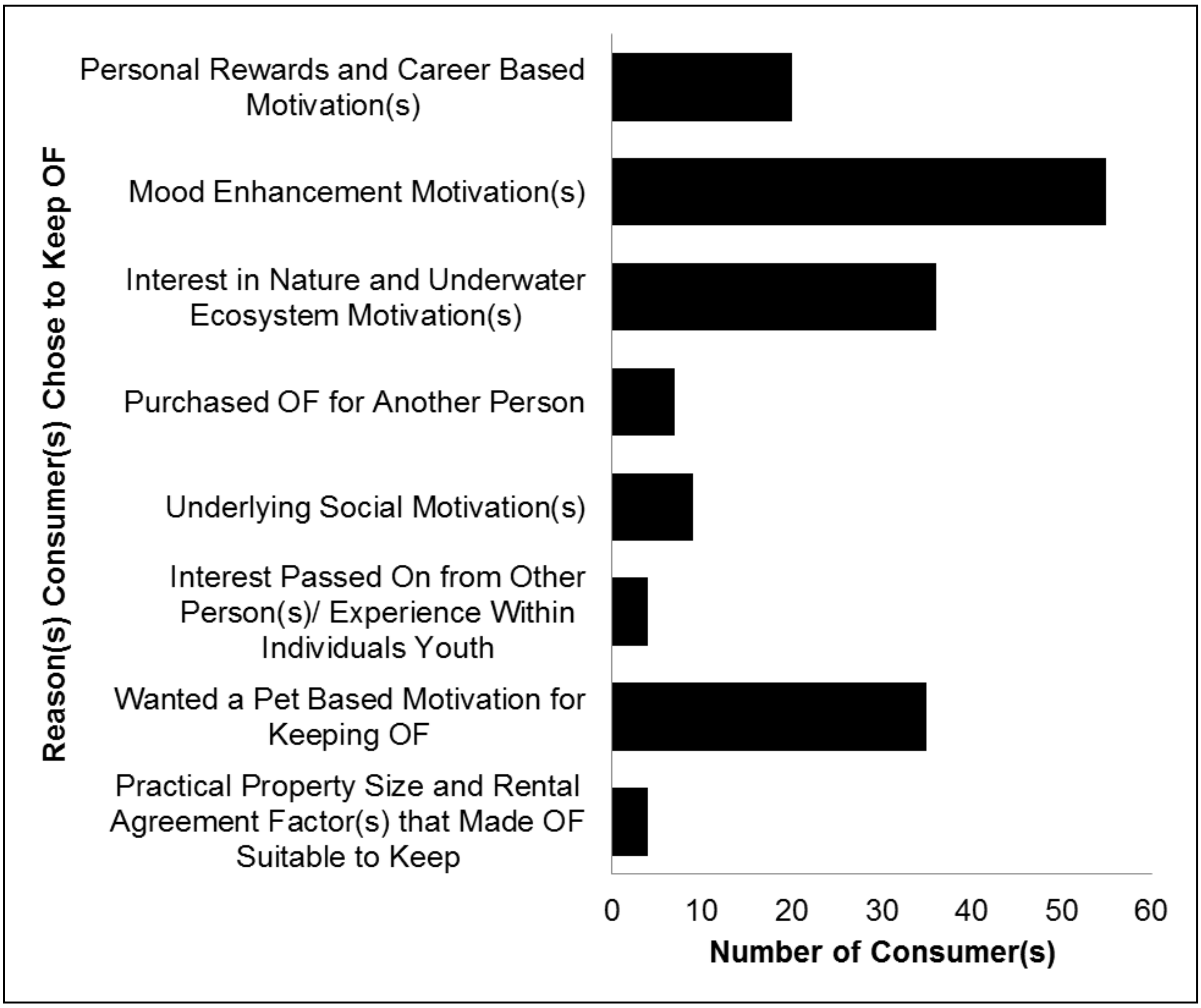

Figure 3.2 Perceived reasons and benefits to keeping ornamental fish (OF), as stated by 60 consumers in the UK.

Visiting ornamental fish retail stores was the most common means by which consumers purchased ornamental fish (Figure 3.3); 50% of respondents stated that they purchased ornamental fish from offline retailers either often (23%, n=24), or very often (27%, n=24). Over three quarters (75% to 95%) of respondents stated that they either rarely or never used other sources.

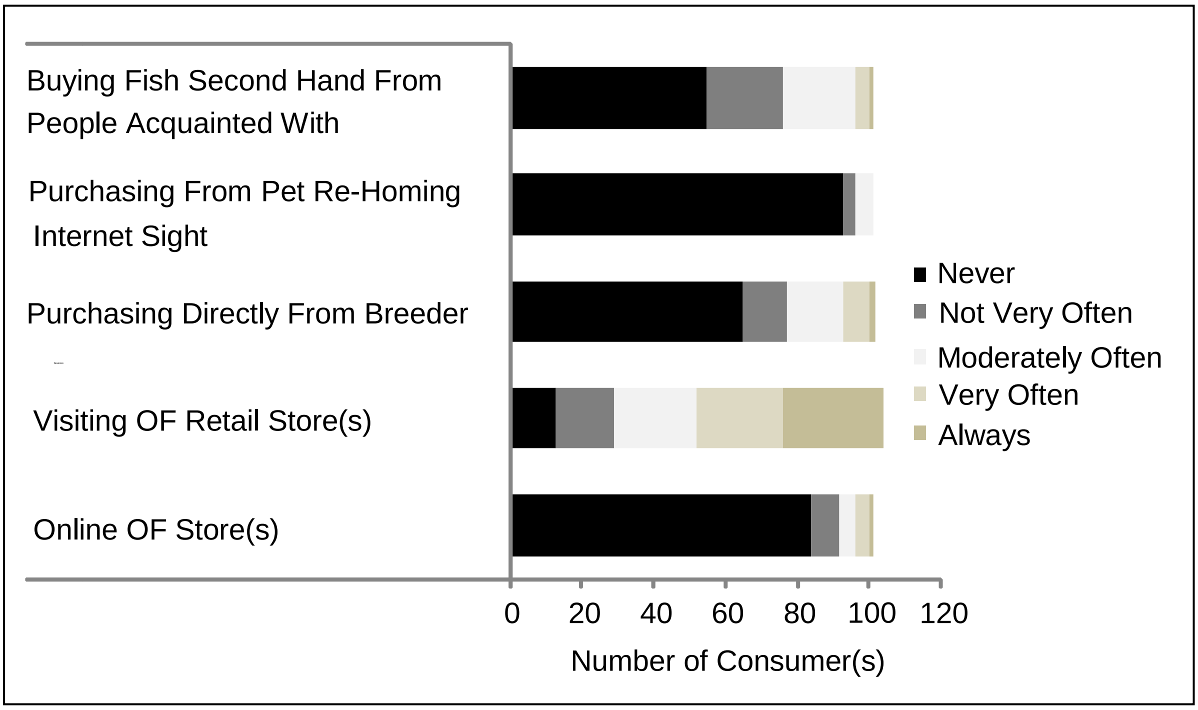

Figure 3.3 Frequency of sources utilised to gather knowledge about ornamental fish (OF), as stated by 103 consumers.

The most common means by which consumers gathered information on ornamental fish care were through the internet and past experience, although retail staff and/or information sections in stores, books and magazines were also used at least moderately often by over 25% of consumers (Figure 3.4). In addition to the most frequent means by which consumers sourced information about ornamental fish, respondents also sourced information through “friends” (22%, n=2), “scientific publications” (11%, n=1), “family” (11%, n=1), “experience of other fish keeper(s)” (22%, n=2), “lectures within educational facilities” (11%, n=1), “other members within ornamental fish club(s)” (11%, n=1), and "ornamental fish meetings and conventions” (11%, n=1) (Figure 3.4).

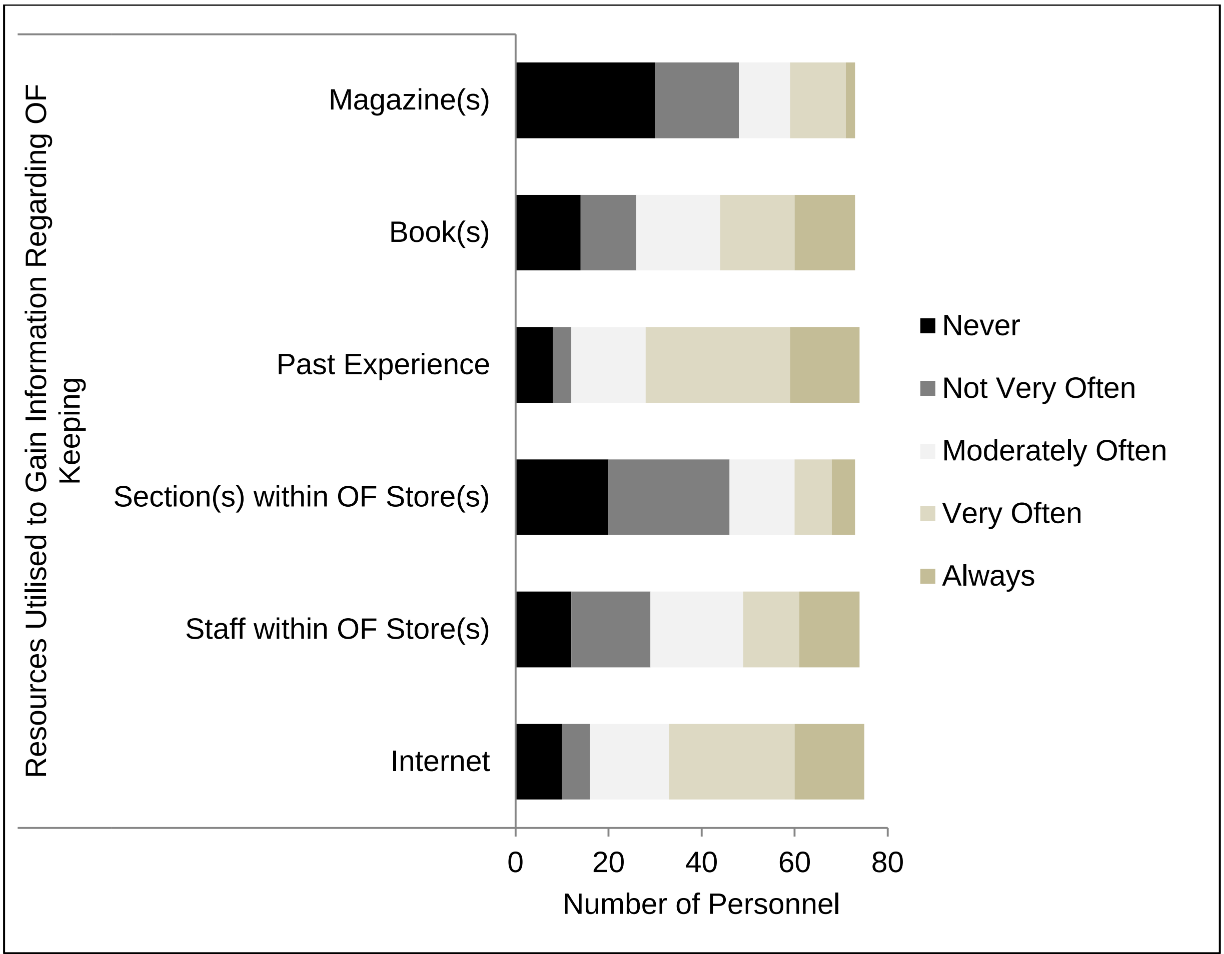

Figure 3.4 Sources utilised by 75 consumers in the UK to gather information on ornamental fish care.

Water type

The most popular consumer opinion among consumers was that water type would "neither positively or negatively" influence their decision over which ornamental fish species to purchase; this was the case in respect to coldwater (45%, n=42), tropical (36%, n=38), and marine (32%, n=30) species. For tropical species, 47% (n=50) of consumers thought that water type could have at least a positive influence on their decision to purchase an ornamental fish, while just 17% (n=18) thought it might have a "negative" or "very negative" influence. By contrast, water type was more likely to have a “negative” or “very negative” (52.63%, n=50) than “positive” or “very positive” (16%, n=15) influence on consumer choice to purchase marine ornamental fish. There was less conformity in opinion regarding coldwater fish; while over one fifth (22%, n=21) of consumers thought water type would “positively” of “very positively” influence their decision to buy, a third (33%, n=31) of consumers disagreed and instead said that it would have a negative or very negative affect. These differences in opinion were significant (Pearson’s Chi-squared test: χ^2=40.373, d.f.=8, p<0.001).

Care level terminology

Four different terms were assessed to investigate their influence on decision to purchase. The terminology “species known as hard to keep alive” had the greatest negative influence on consumer ornamental fish purchasing decisions, with 70% (n=73) stating that it would have either a “very negative” (24%, n=25) or “negative” (46%, n=48) influence on their decision to buy. Around 10% (11%, n=11) of the consumers rated the term to have a “very positive influence” or “positive influence.” The rating “neither a positive or negative influence” was used by 19% (n=20) of consumers. The term “species being highly vulnerable to illness (e.g. parasites/disease)” had a “very negative” (38%, n=41) or “negative” (32%, n=34) influence on the majority (70%, n=75) of consumers. Less than 10% (8%, n=9) of the consumers rated the term to have a “very positive” or “positive” influence, and 22% (n=23) stated that it would have “neither a positive or negative” influence pertaining to their purchase decision. The term “great deal of care required” for an ornamental fish species had a greater “negative influence” (37%, n=39) than “very negative influence” (25%, n=26) on consumer purchasing decisions, with a combined value of

61% (n=65) of the sample. In contrast, just six consumers (6%) said that it would have a “very positive” or “positive” influence. One third (33%, n=35) of consumers stated the terminology would have “neither a positive or negative” influence on their purchase decision. Over one quarter (28%, n=26) of consumers believed that the term “species being specialist” would have either a “positive influence” (20%, n=19) or “very positive influence” (7%, n=7) on their decision to buy an ornamental fish. Over one third were indifferent and therefore said it would have “neither a positive or negative” (37%, n=35) influence on their behaviour. Similarly, however, 35% (n=33) said that it would have a “very negative” (20%, n=19) or “negative” (7%, n=7) influence. Consumer attitudes to the four different, high care level terms here varied significantly (χ^2=317.040, d.f.=12, p<0.001).

The study assessed the influence of two different low care level terminologies on consumer ornamental fish purchasing decisions. The term “species known to have high survival rate” had the greatest positive influence, with the majority (75%, n=80) of consumers decision to buy being either “positively” (38%, n=41) or “very positively” (36%, n=39) influenced. Slightly under one quarter (24%, n=25) of consumers said this term would have “neither a positive or negative” influence on their behaviour, while only two respondents (2%) were negatively or very negatively affected by the use of the term. The majority of consumers (72%, n=72) claimed that the term “care requirements for species being minimal” would have a “positive influence” (38%, n=38) or “very positive influence” (34%, n=34) on their decision to buy an ornamental fish. Four respondents (4%) said that they would be “negatively influenced” whilst nobody was “very negatively influenced” by the term. One quarter

(25%, n=25) of consumers found the term to have “neither a positive of negative influence” pertaining to their purchase decision. Consumer attitudes to the two different low care level terms here did not differ significantly (χ^2=0.951,d.f.=4, p=0.813).

Fish physiological appearance

Almost all (96%, n=100) consumers agreed that a specimen being in good physical condition would have a “very positive” (77%, n=80) or “positive” (19%, n=20) influence on their desire to purchase an ornamental fish. No consumers stated this would have a “negative” or “very negative” influence and just four (4%) respondents stated that it would “neither negatively or positively” impact their purchase decision.

Almost two thirds (65%, n=69) of consumers agreed that a species being colourful would have a “very positive” (20%, n=21) or “positive” (45%, n=48) influence on their desire to purchase an ornamental fish. No consumers stated this would have a “very negative” influence and only three (3%) respondents stated that it would negatively influence their decision. However, almost one third (32%) of consumers stated that this factor would have “neither a positive or negative” influence on their decision to purchase a fish.

Cost

Over half (59%, n=62) of consumers stated “low cost” to be a “positive” (45%, n=48) or “very positive” (13%, n=2) influence on their decision to purchase an ornamental fish. In contrast, 5%, (n=5) found a species cheap to have either a “negative” or “very negative” Influence. There were 39 consumers (36.8%) that found this factor to be “neither a positive or negative” influence.

The majority (64%, n=68) of consumers found that a “high cost” would be negatively influential in their decision to purchase ornamental fish; over one third considered it a “negative influence” (36%, n=38) and over one fifth (28%) a “very negative influence”. In contrast, less than 10% (8%, n=8) found this to be positively influential to species purchase. There were also thirty consumers (28%) who found this factor to have “neither a positive or negative influence” pertaining to their purchase decision.

Wild or captive stock

The majority of consumers stated that being informed that a species was “captive bred” was neither negatively or positively influential (48%, n=49). Just under half (46%) of consumers said that this would have either a “very positive influence” (26%, n=27) or a “positive influence” (20%, n=20). In contrast, less than 10% (8%, n=6) said it would be either a “negative influence” or “very negative influence.”

The majority of consumers stated that being informed that a species was “wild caught” was neither negatively or positively influential (48%, n=50). However, 18% (n=19) found this factor to have a “negative influence”, while 30% (n=31) found it to have a “very negative influence” on their decision to buy an ornamental fish. In contrast, less than 15% (12%, n=12) said it would have a “positive” or “very positive” impact pertaining to their species purchase decision.

Ethics

The influence of information regarding a species' harvesting and stock sourcing on the consumers' attitudes towards purchasing ornamental fish were analysed. The specification that had the greatest negative influence was "species harvesting linked with conservation programmes"; 11% (n=11) of consumers stated it would "very negatively influenced" their decision to purchase and 4% (n=4) to be "negatively influenced". Nonetheless, the vast majority of consumers were "positively" (29%, n=29) or "very positively" (28%, n=28) influenced by the term. Twenty-eight consumers (28%) found this factor to have "neither a positive or negative influence" on their ornamental fish purchasing decisions.

The term "species known to be harvested sustainably", despite having a "positive" (29%, n=30) or "very positive" (47%, n=49) influence on most consumers, was also found to affect a proportion of consumers negatively (7%, n=7). Nineteen consumers (18%) found this factor to be "neither positively or negatively influential" to their species purchasing decisions.

The majority (72%, n=74) of consumers found "known ethical transportation standard for species" to have a "positive influence" (43%, n=44) or a "very positive influence" (29%, n=30) on their decision to buy an ornamental fish. This contrasted with the combined rating of "very negative influence" and "negative influence" which were selected by just two (2%) consumers. Twenty-seven consumers (26%) found this facet to have "neither a positive or negative influence" on their species purchase decision.

The majority (74%, n=73) of consumers found the term “known ethical harvesting of species” either “positively” (41%, n=41) or “very positively” influential. No consumers stated that this statement would have a “negative” or “very negative” influence, although 26% (n=26) were indifferent and therefore said it would have “neither a positive or negative” influence pertaining to their species purchasing decision.

Rarity

Consumers indicated that their decision to purchase ornamental fish would be more negatively influenced by the term “rare in the wild” than the term “rare in the trade”. The majority (59%, n=63) of consumers said that hearing a species was “rare in the trade” would have at least a “negative” if not a “very negative” (39%, n=41) influence on their decision to buy that species. This contrasted with the combined value of “very positive influence”, “positive influence”, which was under 20% of the sample (17%, n=18). Twenty-five individuals (24%) found this factor to have “neither a positive or negative influence” on their purchase decision. After hearing that a species was “rare in the wild”, no consumers said that they would be positively influenced to buy that species. By contrast, over two thirds (67%, n=71) said that they would be at least negatively influenced. Approximately one third of consumers said that they would be unaffected by the term (34%, n=36). Consumer attitudes to the two different terms were significantly different (χ^2 =25.621, d.f.=4, $p<0.001$).

3.1.2 CONSUMER PERCEPTIONS OF THE QUALITY OF INFORMATION ON ORNAMENTAL FISH CARE

Of the 107 consumers who described the quality of information on ornamental fish care provided at ornamental fish retailers (3 were unsure and 25 thought it was not applicable), less than 10% (8%, n=7) thought that it was very good and 15% (n=32) thought that it was good. Thirty consumers thought that it was poor (38%, n=30), very poor (15%, n=12), and those that were indifferent (23%, n=18).

Of the 105 consumers who described variation of ornamental fish between retail stores (3 were unsure and 25 considered the question non-applicable), 59% (n=62) had own(ed) ornamental fish as adults. Less than 5% owned their ornamental fish as an adolescent (3.8%, n=4), during later childhood (1.9%, n=2), or early childhood (0%, n=0). Over one third (36%, n=27) of these respondents thought that it was very varied and 43% (n=32) thought that it was varied. Less than ten consumers thought that it was not varied (9%, n=7), very unvaried (1%, n=1), or were indifferent (11%, n=8). Consumer perceptions in respect to how the quality of information on ornamental fish care changed depending on whether they: (a) owned marine or tropical ornamental fish (χ^2=21.03, d.f.=4, p=0.05, n=120), or (b) whether the consumer was from the UK or other country (χ^2=9.49, d.f.=4, p=0.05, n=74).

Of the 82 consumers who were able to rate the availability of ornamental fish harvesting information (five were unsure, and 21 deemed it inapplicable), only 12% (n=10) considered it good and even fewer (2%, n=2) rated it as very good (Figure 3.5). The majority of respondents rated the information as very poor or poor (39%, n=32 and 28%, n=23, respectively). The remaining 18.29% (n=15) were indifferent. This analysis was not taken any further due to the term “origin” having variant meaning.

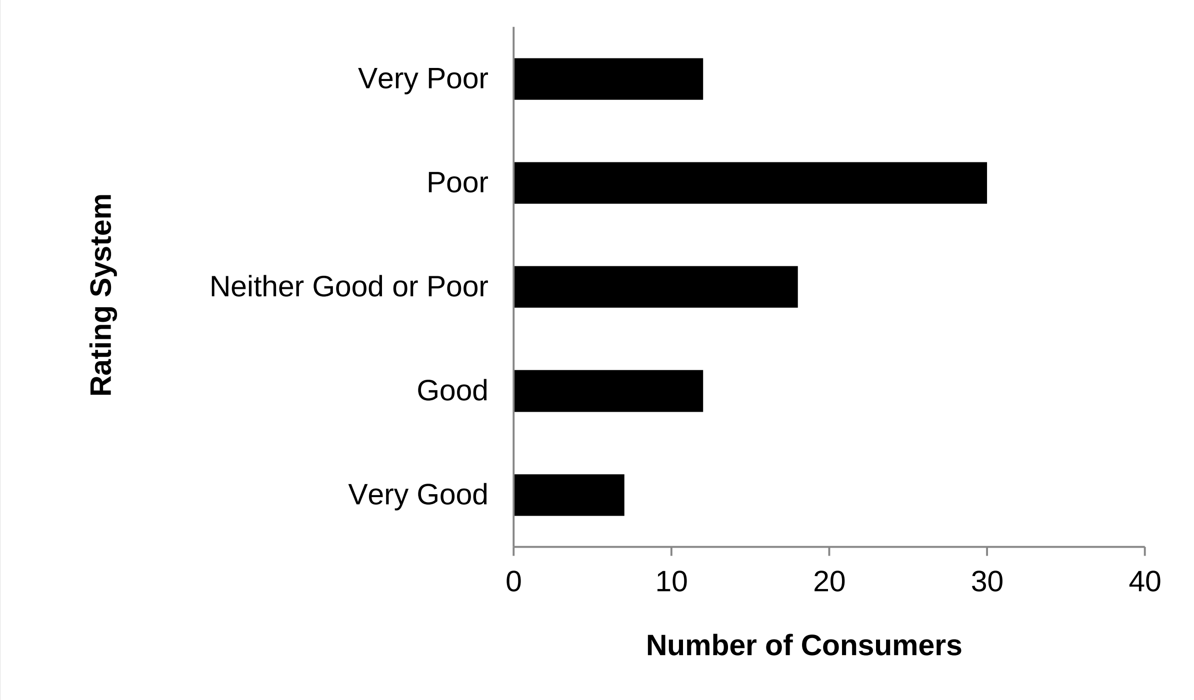

Figure 3.5 Perceptions of 79 consumers of ornamental fish in the UK of the quality of information provided on the origin of ornamental fish.

The variation between consumers harvesting information rating between the UK and other country was not significant (χ^2=4.83, d.f.=4, *p*=0.31, n=81). There was also no significant variation between those that previously own(ed) ornamental fish and those that presently own ornamental fish (χ^2=5.31, d.f.=4, *p*=0.25, n=83).

Ninety-three consumers rated the survival of their ornamental fish (Figure 3.6). Most of these (55%, n=51) were previous owners while 45% (n=42) owned fish at the time of the study. More consumers rated the survival as good (42%) or very good (36.9%)

than poor (6%) or very poor (1%). Current and previous owners rated the survival of their ornamental fish in a significantly different manner (χ^2=11.07, d.f.=4, p=0.011, n=93).

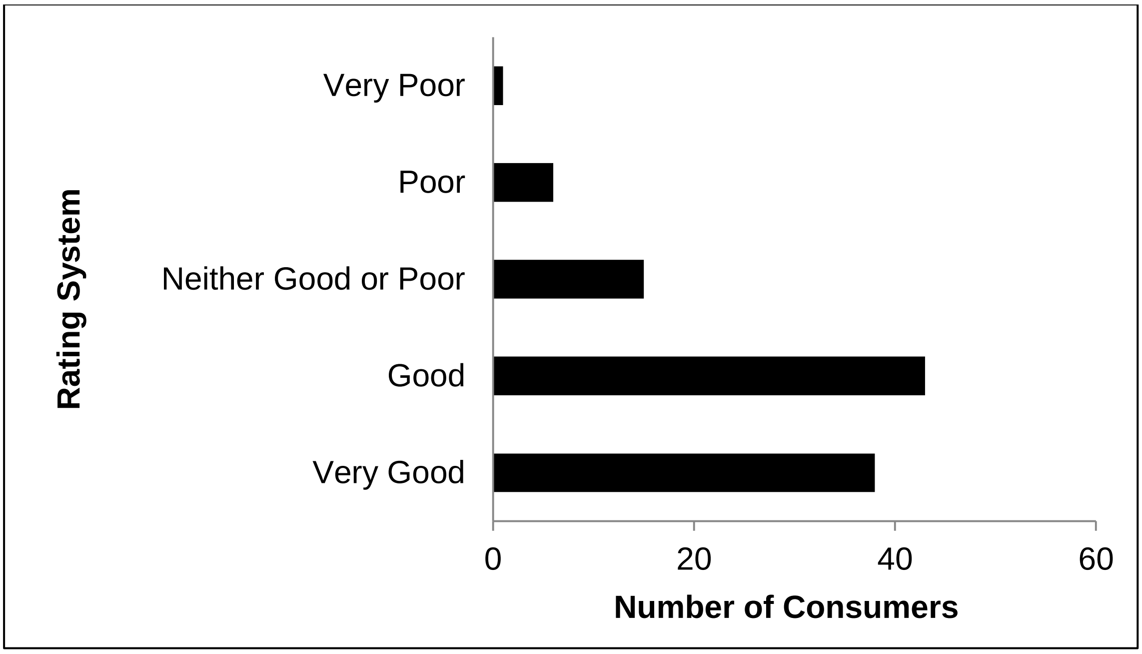

Figure 3.6 Perceptions of 103 consumers in the UK of the survival of ornamental fish that they had purchased.

The level to which respondents rated the survival of their ornamental fish was significantly associated with their level of understanding (as estimated by themselves; Spearman's Rank Correlation: rs) (Figure 3.7). Most respondents (36%, n=39) rated their understanding of ornamental fish care as "good," whereas only 4% (n=4) thought that they had a "very poor" understanding.

Of the 63 respondents who characterised the survival of their ornamental fish, 63% (n=40) did not use terms to describe the care level, 30% (n=19) did use terms to describe the care level, and 6% (n=4) were not sure of terms to describe the care level. No significant difference was found in respect to the way that these three groups rated the survival of their ornamental fish (χ^2=15.5, d.f.=8, *p*=0.985, n=63).

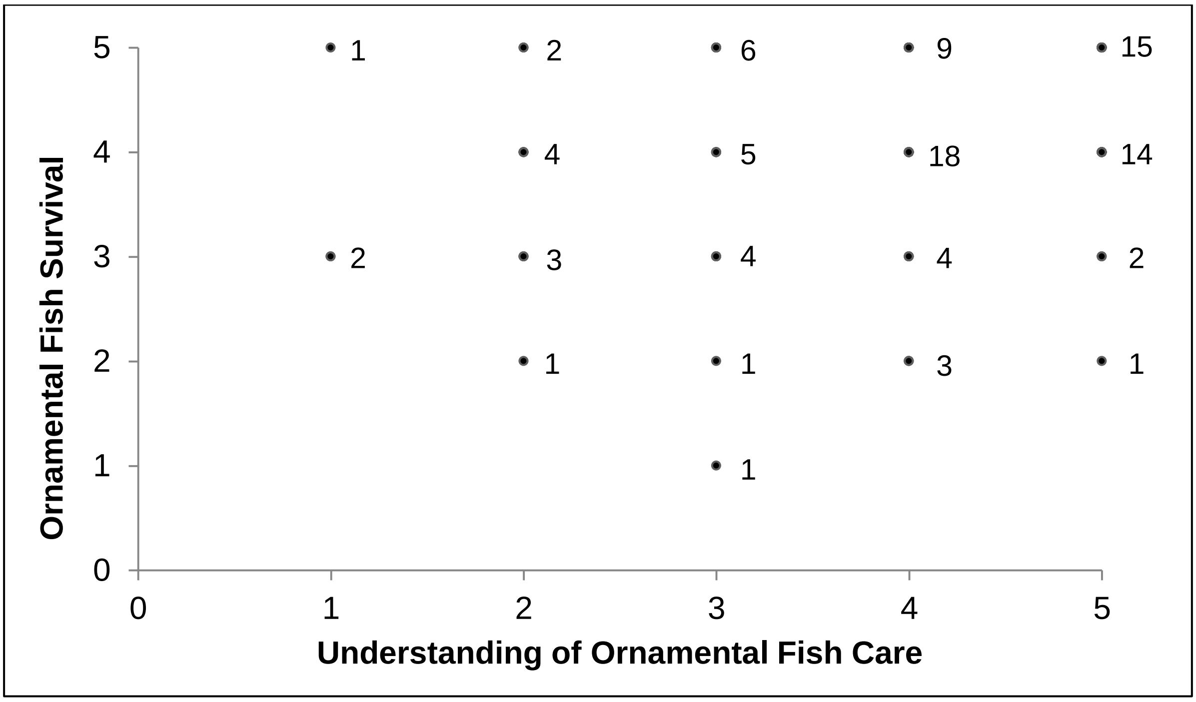

Figure 3.7 Association between the level to which consumers rated their understanding of ornamental fish care and the survival of ornamental fish that they had owned previously (Spearman's Rank Correlation: rs = 0.253, *p* = 0.013, *n* = 96).

Of the 43 people who owned fish previously, the majority (63%, n=27) owned them during adulthood. The majority of respondents ranked the survival of their ornamental fish as good or very good (42% and 28% respectively). Only adult and adolescent owners considered the survival of their ornamental fish to be poor. However, there was no significant difference between the survival of ornamental fish owned by respondents at different stages in their lifetime (χ^2=9.49, d.f.=12, *p*=0.394, n=43).

3.2 CHARACTERISING ORNAMENTAL FISH RETAILERS

Forty retail staff from 15 (75%) of the 20 participating ornamental fish stores completed the retailer questionnaire. Fifty percent (n=20) of the respondents held managerial roles and 50% (n=20) were sales assistants. There was variation in response rate between different stores; 40% (n=6) of stores had only one employee complete the questionnaire, 27% (n=4) had three employees, 20% (n=3) had four employees, and 13% (n=2) had five employees. The total workforce of the different ornamental fish stores ranged from three to seven fulltime staff members.

The majority (61%, n=22) of respondents held a qualification relevant to the ornamental fish trade. Of those who specified (n=12), most (n=10) held qualifications issued by OATA (Appendix 14); two individuals held qualification(s) issued by Sparseholt College. Respondents had been employed by their retail company for a median of 4 years (range=0.25–16.25 years, inter-quartile range=1.14–7.38, n=40). On average, managers had been employed for 6.75 years (range=1.00–16.25 years, inter-quartile range=4.00–10.00, n=20) years, while sales assistants had been employed for 1.38 years (range=0.25–8.00 years, inter-quartile range=0.63–4.19, n=20) years. This difference was significant (Mann-Whitney U test: U=61.50, $p<0.001$, n=40).

All 40 employees had previously worked with or owned an animal. The majority had owned ornamental fish or other animals before (93% and 90% respectively). Fifty per cent of respondents had previously bred ornamental fish and 35% and 23% had worked in a different ornamental fish outlet or other animal trade respectively. The number of employees with these different types of previous experience differed significantly (χ^2=4.24, d.f.=4, p=0.039, n=84).

3.2.1 PERSPECTIVES OF RETAIL STAFF

Retailers stated that the most popular source of information on ornamental fish was the internet (48%, n=14) and staff within retail stores was the second most popular (45%, n=13) were rated as highly popular (Figure 3.8). It was found that the sources, internet (97%, n=28), staff within ornamental fish stores (100%, n=29), and specialist aquatic magazines (24%, n=7), information within fish shops (34%, n=10), customer previous experience (33%, n=9) had the rating they were utilised within the range 1-3 (Figure3.8)

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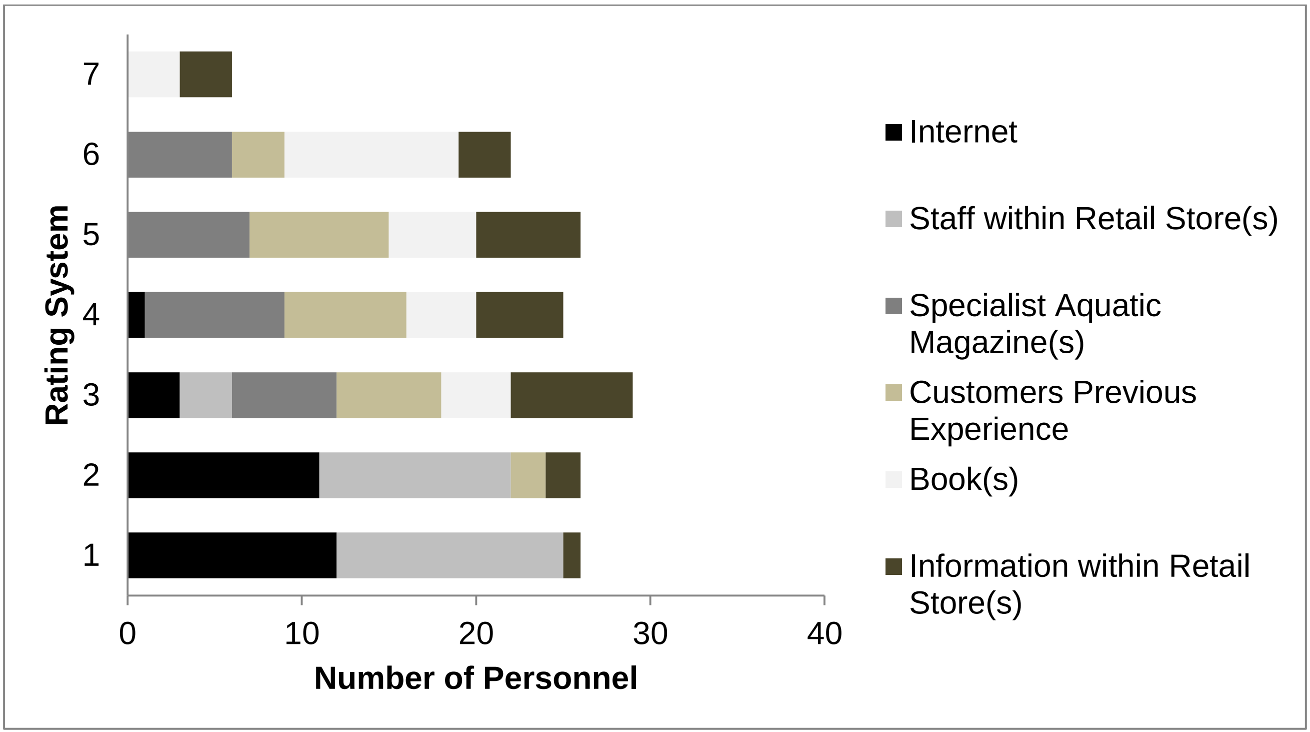

Figure 3.8 The relative importance of different sources of information on ornamental fish to consumers, as ranked by 29 staff in ornamental fish retail stores in the UK. A score of 1 signifies a high frequency of use, whereas a score of 7 signifies that a source is rarely used to gather information on ornamental fish.

The majority of workers thought that stock loss was either “very much not an issue” or “not an issue” (31% and 36% respectively). It was found that 15% thought that it was “neither an issue or not an issue”, and very few respondents described it as an issue (13%) or very much an issue (5%). In general, the survival of ornamental fish was described as “very much not an issue” by personnel at retail stores. It was also found that less experienced staff (based on the number of years they had been employed in the sector) tended to perceive stock loss as a greater issue than their more experienced counterparts, although not significantly so (Spearman's Rank Correlation: r_s=0.124, p=0.452, n=39). However, while no managers perceived stock loss as a problem, seven (37%) sales assistants considered it an issue or very much an issue.

The majority of workers stated that stores accepted ornamental fish for re-homing. Over one third (37%, n=15) stated that their store "often" accepted ornamental fish for re-homing and just over one fifth (22%, n=9) stated that their store "always" does so. However, over one quarter (27%, n=11) stated that ornamental fish were accepted "moderately often". Just six employees reported that their store does not often (10%, n=4) or never (5%, n=2) accepts ornamental fish for rehoming.

The majority of retail staff (92%, n=34) said that their employer provided in-house training. Two thirds (66%, n=24) considered the training (in general, averaged across all categories) as very good, while less than one quarter of employees (24%, n=9) ranked it as good, and 7% (n=3) ranked training as neither good nor poor. All respondents ranked their personal understanding of ornamental fish care as very good (79%, n=31) or good (21%, n=8). This was also the case when asked to rate their colleagues' understanding – three quarters (n=30) of respondents considered their colleagues understanding to be very good.

Retail staff were asked to rate the effort within their organisation to maintain ornamental fish care in relation to eight husbandry domains (Figure 3.9) of which was further divided into 22 specific criteria. Across all of these domains, over two thirds (67%, n=691) of respondents described the effort of their organisation to care for ornamental fish as “very good” (Figure 3.9). Moreover, 90% (n=931) rated the care effort as “very good” or “good”. Less than 10% of respondents ranked care effort as “neither good nor poor” (8%, n=84), “poor” (1%, n=9), or “very poor” (1%, n=6). No staff considered effort to be poor or very poor in half of the eight husbandry domains; the four domains in which at least one member of staff considered effort to be “poor” or “very poor” were: water type, risk to ornamental fish health, care and maintenance of tank conditions and inter-/intra-species aggression.

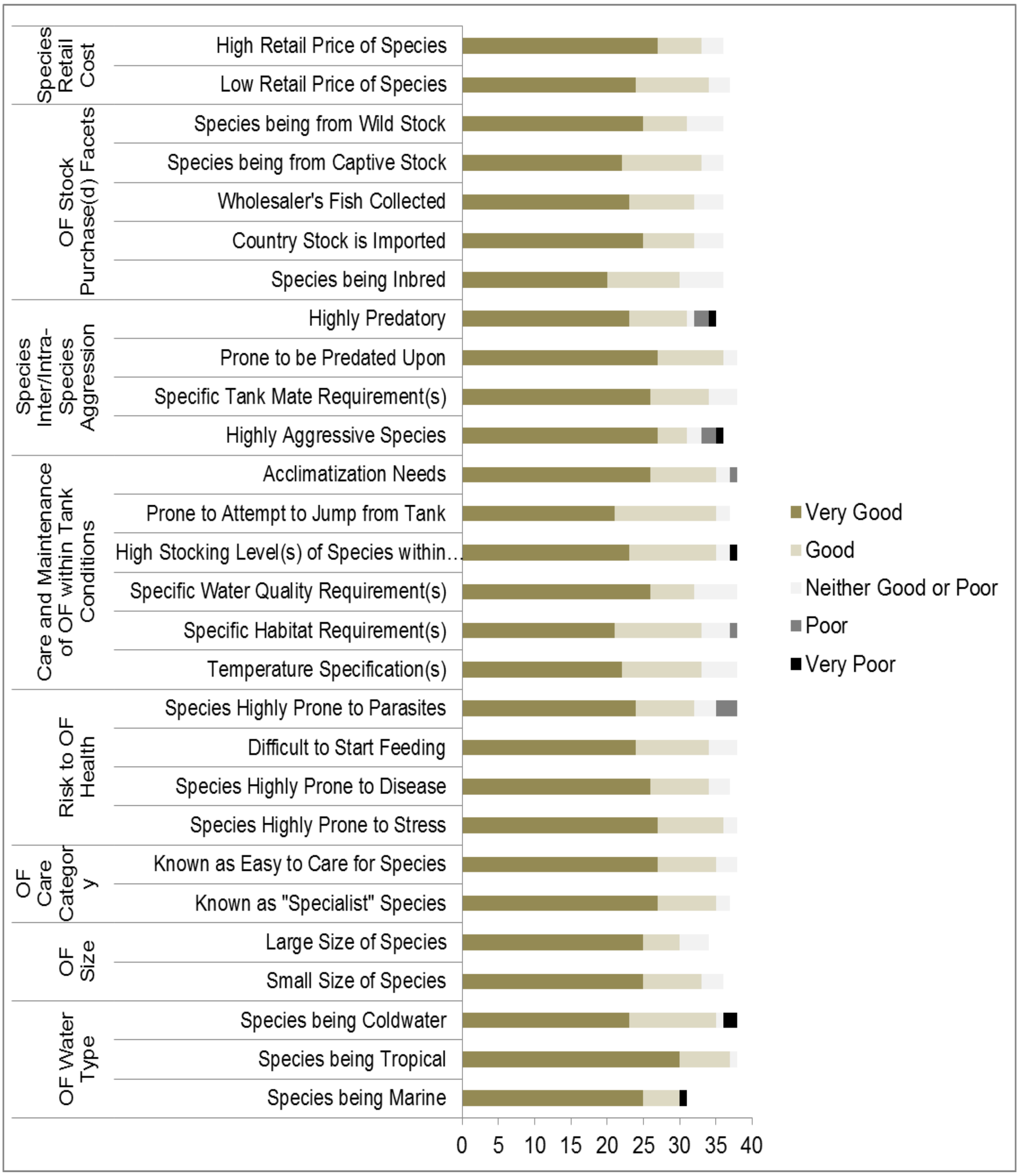

Figure 3.9 The effort of retail stores to maintain ornamental fish care in relation to eight husbandry domains, as perceived by retail staff in 16 retail stores in the UK. The information was collated from 38 personnel, although the response rate to the 28 specific aspects of husbandry ranged from 31 to 39 personnel.

Personnel were also found to have a diverse range of improvements that could be made to the ornamental fish trade (Appendix 15), that was able to be placed into seven different groupings of improvements (Figure 3.10).

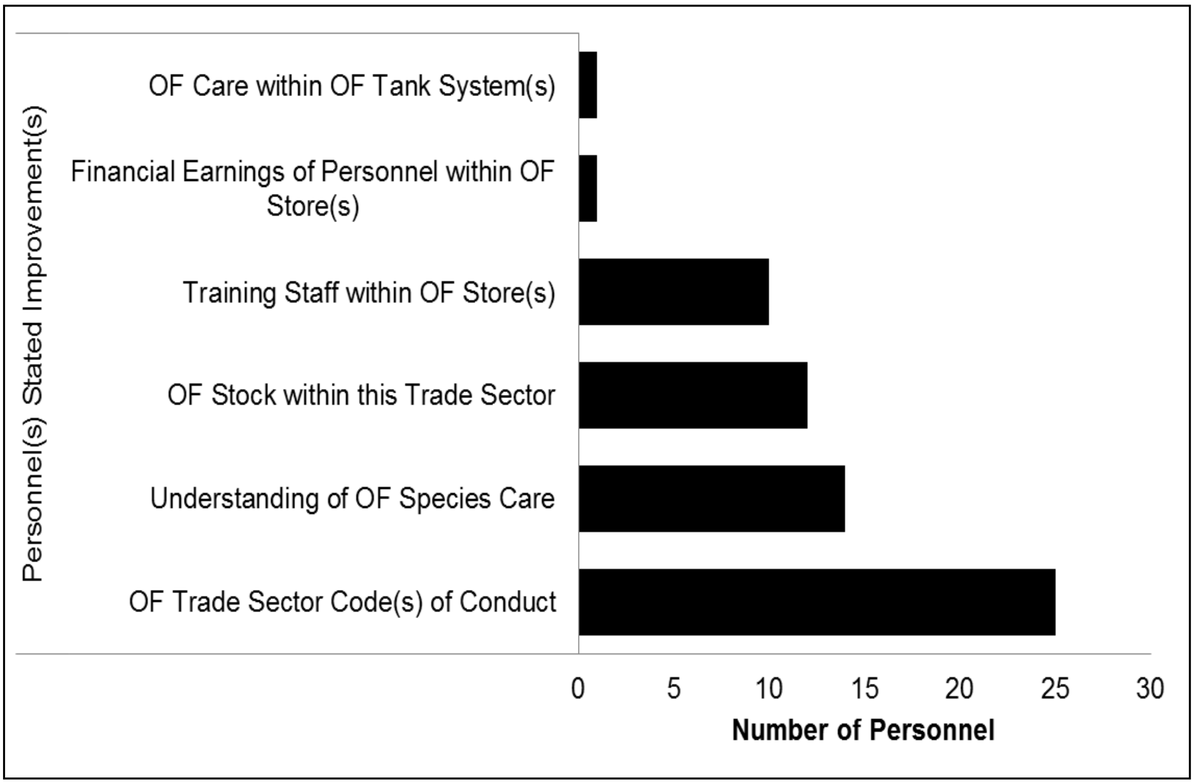

Figure 3.10 Six highlighted facets that 30 personnel within 14 ornamental fish (OF) retail stores in the UK perceive require improvement within this trade sector.

3.3 ORNAMENTAL FISH CARE LEVEL CATEGORISATION SYSTEMS

3.3.1 CARE LEVEL CLASSIFICATION SYSTEMS UTILISED BY CONSUMERS

Ninety-five (86%) consumers responded as to whether they used care level categorisation system(s). The majority (62%, n=59) did not use classification system(s), while less than 30% (29%, n=28) stated they did. Eight respondents (8%) were unsure if they did or did not utilise classification system(s). The types of care level categorisation systems used by ornamental fish consumers varied and are summarised in Table 3.1.

Table 3.1 Systems used by 36 ornamental fish consumers in the UK to categorise the care level of ornamental fish.

System	Specific terminology	Number of consumers
Difficulty[a]	**Total**	**25**
	Low *(easy care, n=6; hardy, n=2; beginners, n=1)*	9
	Intermediate *(medium, n=1; moderate, n=2; finicky, n=1; intermediate, n=1)*	5
	Advanced *(hard, n=2; specialist care, n=5; expert, n=1; difficult, n=2; advanced, n=1)*	11
Breeding type	**Total**	**4**
	Egg scatters	1
	Gravel divers	1
	Live bearers	1
	Difficult breeder	1
Type of social interaction	**Total**	**3**
	Non aggressive	1
	Community fish	2
Water type	**Total**	**2**
	Acidity (pH)	1
	Nitrate level	1

[a] Consumers who described the care level of ornamental fish in respect to 'low', 'intermediate', or 'advanced' difficulty also used additional, more specific, terminology within these groups, as indicated.

Eighteen (46%) of the 39 participants that responded to the question held professional experience working with ornamental fish (16 of the participants did not answer this question) stated that they used care level classification system(s). This is nearly double the number of individuals (21%, n=10) who utilised a care level classification system with no professional experience in the ornamental fish trade. There was no significant association between the use of care level categories and (1) the number of years a participant own(ed) ornamental fish (χ^2=1.56, d.f.=3, p=0.67, n=35), (2) at what stage in their life they own(ed) ornamental fish (χ^2=6.14, d.f.=4, p=0.19, n=87), or (3) the type of ornamental fish species they kept as a pet (χ^2=7.62, d.f.=6, p=0.27, n=113).

Consumers based their decisions in respect to the level of care required by ornamental fish based on a variety of different aspects of ornamental fish husbandry and ecological requirements (Appendix 16). These were organised into eight mutually exclusive groupings (Table 3.2).

Table 3.2 Number of ornamental fish consumers who associated the defined care level terms with different aspects of ornamental fish husbandry.

Aspect of ornamental fish care	Generalist	Hardy	Specialist	Advanced
Tank water conditions	7	11	6	3
Species-specific requirements	9	13	16	9
Aquarists required skill base	2	4	5	3
Feeding requirements	4	2	7	2
Environmental adaptability	5	9	2	3
Equipment requirements	1	0	6	2
Required financial outlay	1	0	1	0
Species social interactions	4	0	9	3

3.3.2 CARE LEVEL CLASSIFICATION SYSTEMS UTILISED BY RETAILERS

Retailers used classification systems to characterise ornamental fish care level in equal proportion to those who did not utilise care level classification systems (n=18, 47%) – two individuals were unsure if they utilised a classification system. Nonetheless, variation was present between ornamental fish stores in respect to the number of employees using care level classification systems (F test: F=1.32, d.f.=2,13, *p*=0.310,).

The specific terminologies used by personnel varied. The most popular term used was "hardy" (37%, n=34), and the least popular term was "generalist" (14%, n=13). Together, these two care level terms were used by 51% (n=47) of staff. The most popular term used to refer to ornamental fish requiring higher level care was "specialist" 32% (n=30), while the term "advanced care" was used by less than 20% of personnel (17%, n=16). The total use of the care level terms "advanced care" and "specialist" combined was almost 50% (49%, n=46). There was significant variation in the number of personnel using each of the four care level terms (χ^2=7.82, d.f.=3, p=0.003).

Retailers provided the defining characteristics of the four care level terminologies (Appendix 17). These were organised into eight main groups (Table 3.3), although thirteen (37%) personnel also claimed to use an additional categorisation system: community ornamental fish, predatory ornamental fish and/or a system based on species-specific habitat requirements (e.g. water type) (Appendix 3.6).

Table 3.3 Number of ornamental fish retailers who associated the defined care level terms with different aspects of ornamental fish husbandry.

Aspect of ornamental fish care	Generalist	Hardy	Specialist	Advanced
Tank water conditions	10	11	6	3
Species-specific requirements	1	8	1	10
Aquarists required skill base	2	16	18	8
Feeding requirements	0	0	4	3
Environmental adaptability	0	1	1	1
Equipment requirements	0	0	1	1
Breeding habits	1	0	0	0
Species social interactions	6	0	5	11

3.3.3 CARE LEVEL CLASSIFICATION SYSTEMS UTILISED ONLINE

The 107 ornamental fish species owned by consumers (Appendix 12) were assessed within 15 web sources that used specific ornamental fish species care level terminologies (Figure 3.11). Eighty-eight of the 107 species that consumer(s) purchased were also found within the web sources. Each ornamental fish species was found in a median of four web-sources (range=0–12, inter-quartile range=1–6, n=107). The species with the highest online presence were: Guppy, Glowlight tetra, Neon tetra, Zebra danio and Platy; they were all present in 12 of the 15 web sources analysed (Appendix 21). The number of consumer-owned species that were stored within online records varied significantly between web sources (χ^2=23.69, d.f.=14, p=0.001, n=411).

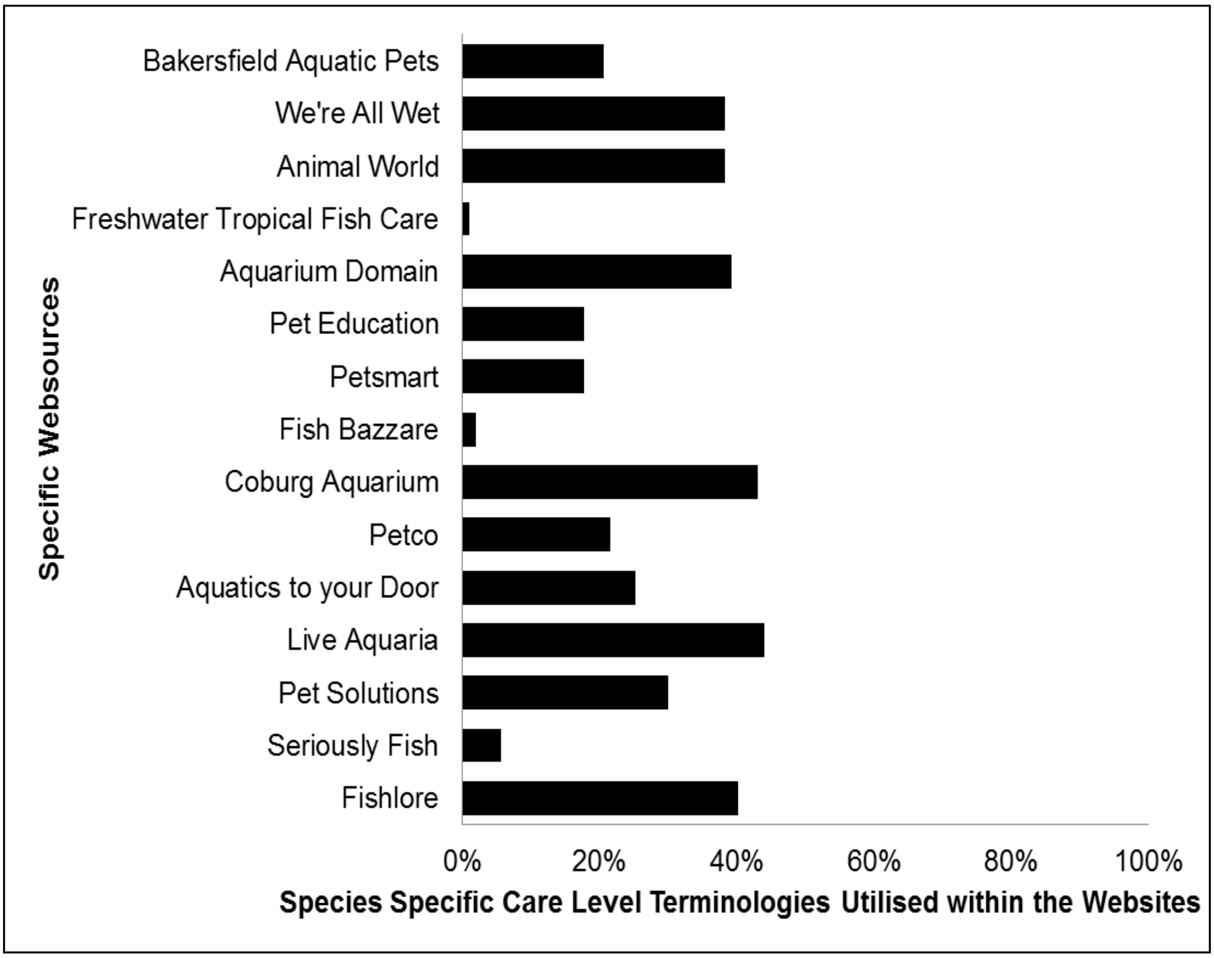

Figure 3.11 The percentage of ornamental fish species (owned by 93 consumers in the UK) that were listed within specific care level groupings within the 15 web sources. The sample consisted of 106 ornamental fish species. The description of care levels varied between websources.

Twenty-one specific terms were used, although eight terms could not be placed into a care level grouping with confidence and thus were classified as "other" (n=13) (Appendix 19); these terms were eliminated from further analyses. Websites varied in respect to the number of different terms they used to describe the care level of ornamental fish, each using a mean of 3.62 terms (range=1–6, n=47). Fishlore used the most terms (n=6), which spanned all five care level groupings (Appendix 19).

The care level groupings were placed from very low, low, moderate, high, very high, and it was found that the utilisation of different care level terms varied significantly between web sources (χ^2=238.01, d.f.=56, p<0.001, n=15). There was also significant variation in the 13 specific terminologies (i.e. from very low to very high care level requirements) utilised within specific web sources (χ^2=947.44, d.f.=154, p<0.001, n=15). Of the 15 web-sources, 53% (n=9) utilised three of the five care level groupings, with under 10% (7%, n=1) utilising five care level grouping(s) (Appendix 3.8). Three online stores, with a total stock of six (Seriously Fish), two (Fish Bizarre), and one (Freshwater Tropical Fish Care), used “very low” care terminology to describe all of their stock.

Significantly more ornamental fish species were classified online as requiring low or very low level care (74.5%, n=306) than those requiring high or very high level care (χ^2=5.99, d.f.=14, *p*<0.001, (Table 3.4). The most common term within the low care level was “easy” (n=210), this was utilised within 12 of the 15 websites and was used to describe a median of 16 species within specific web sources (range=0–33, n=210). Within the “low” care level, the most popular terminology utilised was “easy-medium” (n=9). Within the care level “moderate”, the most popular term – “moderate” (n=50) – was utilised by seven of the 15 web sources (Appendix 19). Only a single term, “moderate-difficult” (n=2), was used to describe ornamental fish in the “high” care level. The most popular term used in the “very high” care level was “difficult” (n=8); it was utilised by seven of the web sources. Ornamental fish species owned by consumers were classified using a median of 1 (range=0–3, inter-quartile range=1–2) care level grouping. However, there was variation between websites:

although nearly half (48.1%, n=51) of the ornamental fish species were allocated to just one care level category across the different web sources, over one third (35%, n=37) were grouped by two or more.

Table 3.4 Occurrence of different care level groupings and terms used by 15 web sources to characterise 88 species of ornamental fish owned by 106 consumers in the UK.

Care level grouping	Care level terminology	Percentage of web sources
Very low	**Total**	**72.1**
	Easy	49.5
	Beginner	20.1
	Hardy	1.9
	Easy/hardy	0.2
	Very hardy	0.5
Low	**Total**	**2.4**
	Easy-moderate	2.1
	Easy-medium	0.2
Moderate	**Total**	**19.1**
	Not beginner	0.2
	Moderate	11.8
	Intermediate	7.1
High	**Total**	**0.5**
	Moderate-difficult	0.5
Very high	**Total**	**2.8**
	Difficult	1.9
	Advanced	0.9
Other	**Total**	**3.1**
	Community	0.2
	No extreme demands	0.2

Care level grouping	Care level terminology	Percentage of web sources
	Hardy once acclimatised	0.2
	Less demanding	0.2
	Fairly easy	1.2
	Not very hardy	0.5
	Harder to keep	0.2
	Unfussy	0.2

3.4 ORNAMENTAL FISH STOCK LOSS IN RETAIL STORES

Five managers filled in the assessment questionnaire designed to rate ornamental fish species' degree of specialisation and popularity within the trade sector (see Methodology). The ornamental fish could be grouped into three mutually exclusive categories on the basis of their popularity and care-level requirements (Table 3.5).

Table 3.5 System used to categorise ornamental fish species on the basis of their popularity and care level requirements.

Category	Definition and criteria
1	Highly popular species (rating under 30) with a low degree of specialisation (under 30). They may be from a range of different families.
2	Popular species (rating under 50) with a high degree of specialisation (over 40). They may be from a range of different families.
3	Relatively popular species (rating under 85) with a high degree of specialisation (over 40) and a high cost (over £50). They may be from a range of different families.

3.4.1 MARINE ORNAMENTAL FISH STOCK LOSS

Twelve marine species were found appropriate and therefore chosen to survey within this study (Table 3.6). The mean cost of these marine ornamental fish was GBP £35.41 (S.D.=£24.26, range=£6.00–£79.88, n=12). No significant relationship was found between the cost of a marine species and its popularity (Linear regression: F=4.274, p=0.066, R^2=0.299, β=0.467, S.E.=0.226). Likewise, the cost of a species was not related to how specialised it was (Linear regression: F=2.016, p=0.186, R^2=0.168, β=0.403, S.E.=0.284). By contrast, the popularity of a species was related to its degree of specialisation (Linear regression: F=10.340, p=0.009, R^2=0.508, β=0.599, S.E.=0.186; Figure 3.12).

Table 3.6 The marine ornamental fish species chosen for study within 12 retail stores in the UK, along with their popularity, degree specialisation, and cost association.

Category	Specific Species	Popularity	Degree Specialisation	Cost (GBP)
1.	Common clown *(Amphiprion ocellaris)*	10.68	14.09	24.00
	Banggai cardinal *(Pterapogon kauderni)*	20.22	22.27	15.00
	Green chromis *(Chromis viridis)*	14.09	19.77	6.00
	Pyjama wrasse *(Pseudocheilinus hexataenia)*	25.90	22.95	15.00
2.	Regal tang *(Paracanthurus hepatus)*	20.90	62.27	34.00
	Manderin *(Synchiropus splendidus)*	43.40	78.18	26.00
	Scooter blenny *(Synchiropus ocellatus)*	37.5	52.27	18.00
	Copperband butterfly *(Chelmon rostratus)*	39.77	74.09	22.00
3.	Flame angelfish *(Centropyge loricula)*	31.14	40.01	79.88
	Frogfish *(Antennariidae spp.)*	75.68	56.82	59.00
	Seahorse	72.73	84.54	60.00

Category	Specific Species	Popularity	Degree Specialisation	Cost (GBP)
	(Hippocampus kuda)			
	Emperor angel *(Pomacanthus imperator)*	38.18	61.81	66.00

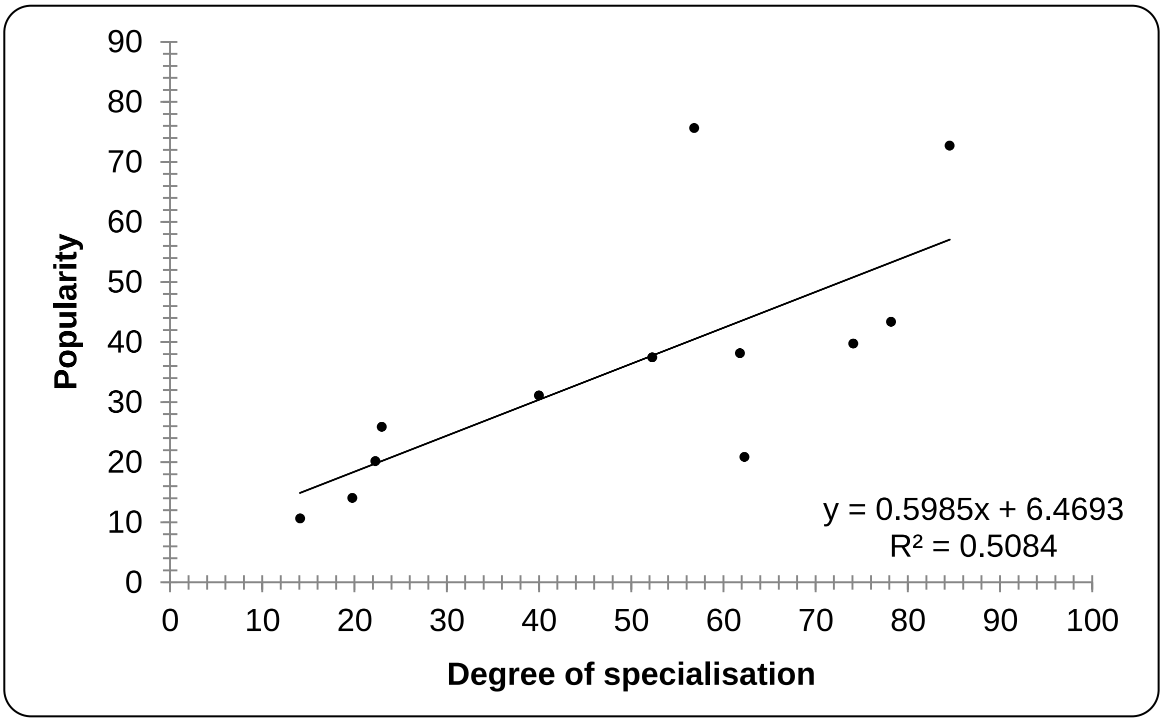

Figure 3.12 Relationship between marine ornamental fish popularity and degree of specialisation (Linear regression: y=0.599x+6.469).

A total of 1004 individual marine ornamental fish were assessed. Nine percent (n=89) of this stock was lost during the study period. Although the number of individuals within a species sample size had variation (median 40 individuals, range=3–301, inter-quartile range=9.75–87.75), species stock loss within this sample had a median 9% loss (range=0–38%, inter-quartile range=8–14%) (Table 3.8).

Table 3.7 Species-specific rates of marine ornamental fish stock loss across 19 retail stores in the UK.

Species	Number alive	Number dead	Stock loss (%)
Banggai cardinal	149	13	8
Common clown	252	18	7
Copperband butterfly	5	3	38
Emperor angel	9	0	0
Flame angel	32	5	14
Frogfish	2	1	33
Green chromis	276	25	8
Mandarin	56	5	8
Pyjama wrasse	34	4	11
Regal tang	54	9	14
Scooter blenny	39	3	7
Seahorse	9	1	10

Data was collected within 12 ornamental fish stores for a median of 56 days per store (range=42–56, inter-quartile range=56–56). A median of 71.5 (range=20–298, inter-quartile range=53.25–80.75) fish were assessed in each store, although the numbers of individuals, overall and from each species, that were surveyed varied between stores (Table 3.9). Furthermore, fish of four different marine species were only stocked within a single retail store. These species were:

- Flame angel (n=37), with stock loss of 5 individuals;
- Emperor angel (n=9), with no stock lost;
- Frogfish (n=3), with stock loss of 1 individual; and,
- Seahorse (n=10), with stock loss of 1 individual.

Table 3.8 Species-specific stocking of marine ornamental fish within 12 participating retail stores in the UK.

Species	Median	Range	Inter-quartile range
Bangaii cardinal	14	2–68	2.5–18.5
Common clown	17	8–111	12–33.75
Copperband butterfly	4	1–7	4–5.5
Green chromis	28	8–115	22.75–36.75
Mandarin	8	1–28	4.25–21
Pyjama wrasse	4	2–15	2–6.5
Regal tang	13	1–26	4–22
Scooter blenny	11	2–18	6–16.5

Of the species listed in Table 3.9, variation was also found in relation to the number of individuals lost between retail stores, and percentage of stock loss between retail stores. This is demonstrated in Table 3.10 and Table 3.11 below.

Table 3.9 Species-specific marine ornamental fish stock loss within 12 participating retail stores in the UK.

Species	Median	Range	Inter-quartile range
Bangaii cardinal	1	0–6	0.5–2.5
Common clown	1.5	0–7	0.75–2.75
Copperband butterfly	1.5	0–3	0.75–2.25
Green chromis	1.5	0–13	0.74–4
Mandarin	1	0–2	0– 2
Pyjama wrasse	0	0–2	0–1
Regal tang	1	0–6	0–2
Scooter blenny	0	0–3	0–0.75

Table 3.10 Species-specific percentage of marine ornamental fish stock loss within 12 participating retail stores in the UK.

Species	Median (%)	Range (%)	Inter-quartile range (%)
Bangaii cardinal	5	0–43	1–14
Common clown	10	0–42	1–14
Copperband butterfly	43	0–43	11–32
Green chromis	10	0–27	1–14
Mandarin	16	0–100	0–25
Pyjama wrasse	0	0–50	0–19
Regal tang	8	0–23	0–9
Scooter blenny	0	0–17	0–4

The greatest numbers of individuals were Category 1 type ornamental fish (77%, n=711). Over one sixth (17%, n=174) of ornamental fish were in Category 2, whereas less than 10% (6%, n=59) were in Category 3. Category 1 type ornamental fish exhibited the lowest rate of stock loss (8%, n=60), followed by Category 2 (11%, n=20). Ornamental fish in Category 3 were the most susceptible to stock loss (12%, n=7).

Stock was imported from 11 different countries. Over half of the total ornamental fish stock originated from Bali (59%, n=453), with the next most common supplier-Sri Lanka–accounting for just 10% (n=80) of stock. The quantity of stock imported from a source had a median of 28 individuals (range=9-453, inter-quartile range=18.5-47.5). A median of seven percent (range=0–29%, inter-quartile range=2–13%) of stock from any one importing country was lost at the point of retail. However, the highest rates of stock loss were among ornamental fish sourced from the UK (29%, n=7), while those sourced from Indonesia (n=11), Sri Lanka (n=80), and Thailand (n=16) exhibited zero percent stock loss.

The majority (n=341) of ornamental fish included in the survey were considered “new stock” (i.e. they a new delivery within store during the studies duration), while 204 individuals were considered “old stock”. Mortality was more prevalent among new stock (9%, n=31) than old stock (8%, n=25). Most (n=635) of the ornamental fish sampled in retail stores originated from wild stock while 354 individuals were captive bred. Wild-sourced ornamental fish were more susceptible to stock loss (10%, n=66) than captive-sourced fish (8%, n=27).

3.4.2 TROPICAL ORNAMENTAL FISH STOCK LOSS

Twelve tropical species were found appropriate and therefore chosen to survey within this study (Table 3.7). The mean cost of these tropical ornamental fish was GBP £16.32 (S.D.=£24.27, range=£1.25-£80.00, n=12). Unlike marine ornamental fish, the cost of tropical species was significantly related to their popularity (Linear regression: F=10.542, p=0.009, R^2=0.513, β=0.810, S.E.=0.249; Figure 3.13a). By contrast, and similarly to marine ornamental fish, the cost of a tropical species was not related to how specialised there are (Linear regression: F=2.852, p=0.122, R^2=0.222, β=0.459, S.E.=0.272). As was the case with marine ornamental fish, more specialised tropical species were significantly more popular (Linear regression: F=18.688, p=0.002, R^2=0.651, β=0.889, S.E.=0.206; Figure 3.13b).

Table 3.11 The tropical ornamental fish species which were chosen for study within 12 retail stores in the UK, along with their popularity, degree specialisation, and cost association

Category	**Specific Species**	**Popularity**	**Degree Specialisation**	**Cost (GBP)**
1.	Neon tetra *(Paracheirodon innesi)*	16.89	23.17	1.25
	Cherry barb *(Puntius titteya)*	21.21	18.67	2.00
	Harlequin rasbora *(Rasbora heteromorpha)*	26.35	23.92	1.29
	Neon dwarf rainbow *(Melanotaenia praecox)*	26.89	31.37	4.99
2.	Guppy *(Poecilia reticulata)*	16.89	48.58	2.85
	Dwarf gourami *(Colisa lalia)*	21.21	62.31	3.50
	Clown loach *(Chromobotia macracanthus)*	25.80	55.98	5.99
	Silver shark *(Balantiochellus melanopterus)*	21.21	51.66	2.99
3.	Goldy pleco *(Scobinancistrus aureatus)*	67.85	59.64	80.00
	Silver arowana *(Osteoglossum bicirrhosum)*	74.73	76.34	44.99
	Discus *(Symphysodon spp.)*	81.75	89.80	29.99
	Elephant nose *(Gnathonemus petersii)*	83.19	90.25	16.00

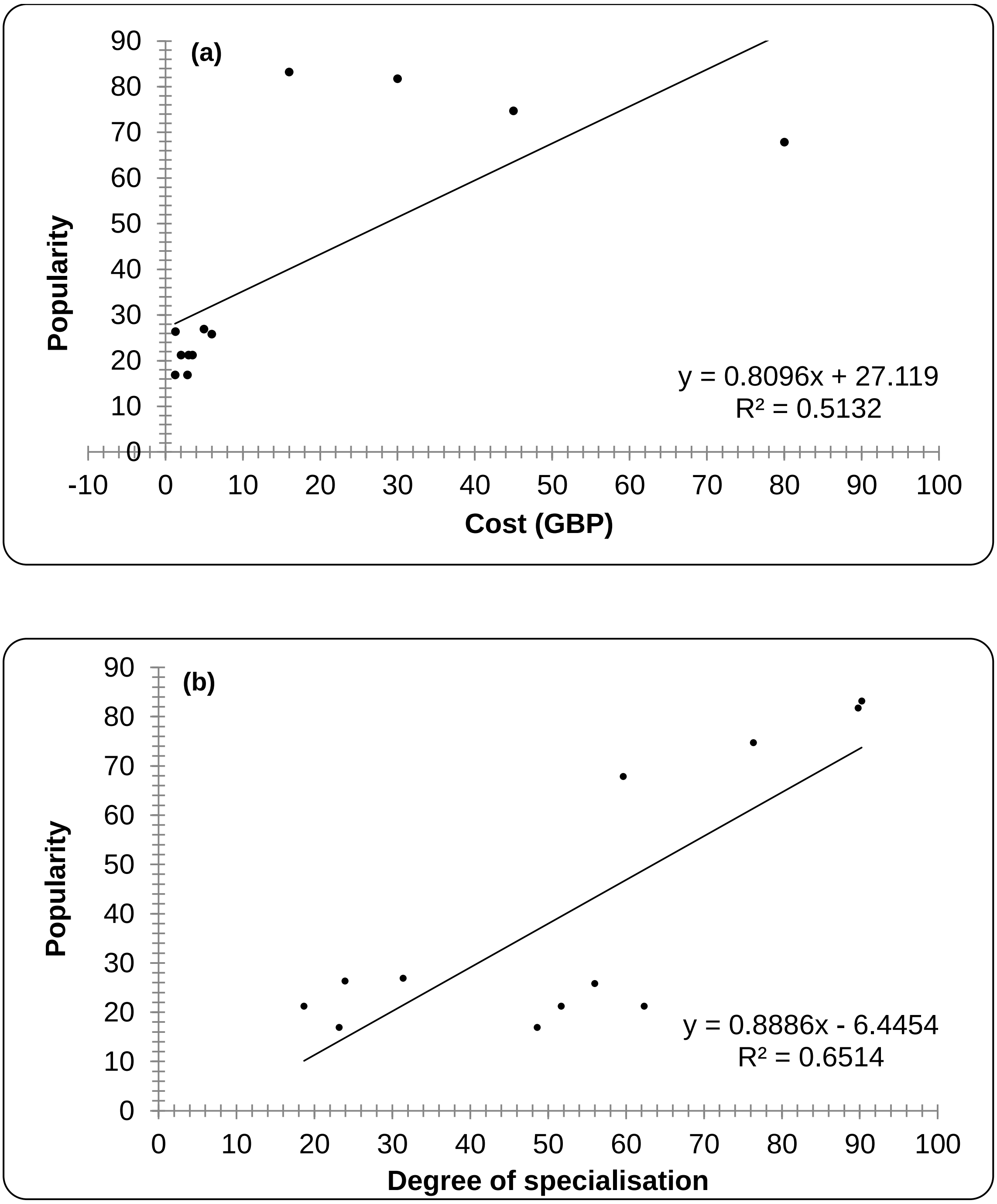

Figure 3.13 Relationship between tropical ornamental fish (a) popularity and cost (GBP) (Linear regression: y=0.810x+27.119); and (b) degree of specialisation and popularity (Linear regression: y=0.889x-6.445).

A total of 32,204 individuals were assessed within the tropical sample, with stock loss amounting to 5% (n=1722). The number of individuals belonging to any one species ranged from 17 to 9,483 (median=1,555 individuals, inter-quartile range=197–4,905). A median of 63 individuals per species were subject to stock loss (range=0–672, inter-quartile range=19–118). Each species accumulated a median of 4% (range=0–24%, inter-quartile range=2–8) for the duration of the study (Table 12). A median of 1,264 individuals (range=17–7580, inter-quartile range=196.25–3,528) per species were included in the study.

Table 3.12 Species-specific rates of tropical ornamental fish stock loss across 19 retail stores in the UK.

Species	Number alive	Number dead	Stock loss (%)
Cherry barb	5249	112	2
Clown loach	1168	64	5
Discus	188	61	24
Dwarf gourami	1743	134	7
Elephant nose	18	5	22
Goldy pleco	17	0	0
Guppy	5690	672	11
Harlequin rasbora	4683	70	1
Neon dwarf rainbow	2092	35	2
Neon tetra	8938	545	6
Silver arowana	41	1	2
Silver shark	655	23	3

Data was collected in 19 retail stores for a median of 56 days (range=35–56, inter-quartile range=56–56). A median of 1,436 fish (range=103–5407, inter-quartile range=803–2446.5) were assessed in each store. The number of individual fish belonging to each of the 14 tropical fish species varied between stores (Table 13).

Table 3.13 Species specific stocking of tropical ornamental fish within 19 participating retail stores in the UK.

Species	**Median**	**Range**	**Inter-quartile range**
Cherry barb	150	50-1955	120-300
Clown loach	37	3-240	23.5-80
Discus	10	3-75	8.5-37
Dwarf gourami	52.5	4-495	31.5-82.75
Elephant nose	1	1-16	1-4
Goldy pleco	8.5	5-12	6.75-10.25
Guppy	220	40-1900	130-365.5
Harlequin rasbora	160	6-675	51.25-498.75
Neon dwarf rainbow	77.5	20-350	37.75-150
Neon tetra	410	90-1500	185-712.5
Silver arowana	3	1-15	1-5
Silver shark	29	3-144	21.25-61.5

Of the species listed in Table 3.13, variation was also found in relation to the number of individuals lost between retail stores, and percentage of stock loss between retail stores. This is demonstrated in Tables 3.14 and 3.15 below.

Table 3.14 Species-specific tropical ornamental fish stock loss within 19 participating retail stores in the UK.

Species	**Median**	**Range**	**Inter-quartile range**
Cherry barb	2	0-112	0-7.5
Clown loach	3	0-10	0-5.5
Discus	0	0-38	0-5

Species	Median	Range	Inter-quartile range
Dwarf gourami	2	0-59	0-6.5
Elephant nose	0	0-4	0-1
Goldy pleco	8.5	5- 12	6.75-10.25
Guppy	32	0-120	5.5-50.5
Harlequin rasbora	2	0-11	0-7.5
Neon dwarf Rainbow	1.5	0-10	0-2.75
Neon tetra	14.5	0-265	1.75-23
Silver arowana	0	0-1	0-0
Silver shark	1.5	0-5	0.25-2

Table 3.15 Species-specific percentage of tropical ornamental fish stock loss within 19 participating retail stores in the UK.

Species	Median (%)	Range (%)	Inter-quartile range (%)
Cherry barb	1	0-94	0-2
Clown loach	5	0-100	0-18
Discus	0	0-51	0-18
Dwarf gouramis	3	0-100	0-13
Elephant nose	0	0-100	0-100
Goldy pleco	0	-	-
Guppy	11	0-100	2-20
Harlequin rasbora	0	0-100	0-3
Neon dwarf Rainbow	2	0-27	0-5
Neon tetra	3	0-100	0-7
Silver arowana	0	0-100	0-0
Silver shark	2	0-19	0-8

The greatest number of individual fish were Category 1 type ornamental fish (67%, n=21,674). Almost one third (32%, n=9,306) of ornamental fish were in Category 2, whereas just 1% of the sample comprised Category 3 ornamental fish (n=331).

Category 1 type ornamental fish exhibited the lowest rate of stock loss (4%, n=762), followed by Category 2 (9%, n=893). Ornamental fish in Category 3 were the most susceptible to stock loss (20%, n=67).

Tropical ornamental fish stock was imported from 13 exporting countries. Almost half of the total tropical ornamental fish stock originated from Singapore (45%, n=29,969). Five other countries accounted for at least 10% of imported stock. The quantity of stock imported from any one country was a median of 356 individuals (range=1–13508, inter-quartile range=21–3,132). A median of 2% (range=0–100%, inter-quartile range=0–11%) of stock from any one importing country was lost at the point of retail. The greatest percentile loss was Peru (100%, n=1).

The majority (7,925) of ornamental fish included in the survey were considered “new stock” (i.e. they had arrived in the store from a new delivery within the studies duration), while 7,387 individuals were considered “old stock”. Mortality was more prevalent among new stock (7%, n=593) than old stock (3%, n=218).

Unlike marine ornamental fish, the vast majority (94%, n=28,813) of the tropical ornamental fish sampled in retail stores originated from captive stock, while just 6% (n=1,920) was wild caught. Also in contrast to the marine sample, wild-sourced marine ornamental fish were less susceptible to stock loss (3%, n=66, loss) than captive-sourced fish (5%, n=1,526, loss).

3.5 FACTORS AFFECTING ORNAMENTAL FISH STOCK LOSS IN RETAIL STORES

The marine ornamental fish stocked in retail stores, along with the husbandry practices adopted by personnel to manage this stock, varied with respect to: (1) species average length (range=1–10 cm), (2) estimated species cost (range=GBP £16.17–£40.00), (3) distance from the source of import (range=12.5 miles–236 miles), (4) the diversity of other fish stocked in the tank (range=0–7 other species), (5) the number of other fish stocked in the tank (range=0–150 other individuals), (6) estimated quantity of sample fish in tank (range=1–80), and (7) the number of stock rotation(s) occurring within tanks(s) sampled within the studies duration (range=1–21).

The tropical ornamental fish stocked in retail stores, along with the husbandry practices adopted by personnel to manage this stock, varied with respect to: (1) species average length (range=0.75–18cm), although 75% (n=18,990) of the sample consisted of specimens between 2 and 3cm in length, (2) estimated species cost (range=GBP £1.17–£45.00), although 81% (n=25,960) were within the price range of £1.17–£2.15, (3) distance from the source of import (range=12.5 miles–213 miles), (4) the diversity of other fish stocked in the tank (range=0–5 other species), (5) the number of other fish stocked in the tank (range=0–265 other individuals), (6) total tank stocking (range=1–800, inter-quartile range=22–159) and (7) the number of stock rotation(s) occurring within tanks(s) sampled within the studies duration for a species (range=1–8).

The extent to which each of these variables influences stock loss was assessed. Binary logistic regression analysis was used to investigate the relationship between ornamental fish stock loss and 11 different variables. Two species – the Emperor angel and the Goldy pleco – within the marine and tropical species-specific analysis groupings, respectively exhibited 0% stock loss and therefore were excluded from the binary logistic regression analysis. The affect of each of the variables on stock loss was analysed at four different levels: firstly, across the entire sample, and then between (a) specific ornamental fish stores, (b) species, and (c) between categories. In cases where a variable was found to significantly affect stock loss, the exp(B) was assessed. The variables having an exp(B) above or below one highlights possible negative or positive relationships to stock loss (Table 3.16) within the variables that were found significant.

Table 3.16 The variables assessed in the binary logistic regression to determine factors influencing ornamental fish stock loss in 19 retail stores in the UK, along with the exp(B) trend meanings.

Variable	**Exp(B) below 1**	**Exp(B) above 1**
Fish length	Smaller size: lower mortality	Longer size: lower mortality
Fish cost	Lower prices: lower mortality	Higher price: lower mortality
Tank stocking density (sample species)	Less of the same fish in the tank: lower mortality	More of the same fish in the tank: lower mortality
Tank stocking density (other species)	Less of other fish in the tank: lower mortality	More of other fish in the tank: lower mortality
Tank stocking density (total)	Less fish stocked in tank sampled: lower mortality	More fish stocked in tank sampled: lower mortality
Tank stocking diversity	Less diversity in tank: lower mortality	More diversity in tank: lower mortality

Variable	Exp(B) below 1	Exp(B) above 1
Number of days held in store	Less days held in store: lower mortality	More days in store: lower mortality
Distance from import source	Closer to import source: lower mortality	Further from import source: lower mortality
Number of sock rotations	Low number of stock rotations: lower mortality	High number of stock rotations: lower mortality
Wild or captive stock	Captive fish have lower mortality than wild fish	Wild fish have lower mortality than captive fish
Old or new stock	New fish have lower mortality	Old fish have lower mortality

3.5.1 FACTORS AFFECTING MARINE ORNAMENTAL FISH STOCK LOSS

When considering the entire sample, two variables, “estimated quantity of sampled fish in the tank” and “tank stocking density”, were found to significantly affect marine ornamental fish survival in retail stores (Table 3.17). A marine ornamental fish was less likely to experience mortality if it was stocked alongside other fish of the same species (with an exp(B) above 1; Table 3.17). When analysed on at the store, species and category specific level, a greater number of variables were found to significantly influence stock loss; this is despite some variables being excluded (Table 3.19).

Table 3.17 Binary logistic regression analysis assessment of specific variables ability to influence marine ornamental fish survival within 12 UK based retail stores (Exp(B) 1>) within store(s).

Variable	Total sample	Store specific	Species specific	Category specific
Fish length	-	0	0	0
Fish cost	-	2	-	1
Tank stocking density (sample species)	1	2	1	1

Variable	Total sample	Store specific	Species specific	Category specific
Tank stocking density (other species)	-	1	0	0
Tank stocking density (total)	1	0	1	1
Tank stocking density diversity	-	1	1	0
Number of days held in store	-	0	0	0
Distance from import source	-	1	1	0
Number of stock rotations	-	1	0	0
Wild or captive stock	-	0	1	0
Old or new stock	-	1	1	2
Count of variables with p≤0.05	2	6	6	4
Count of variables with p>0.05	9	5	5	8

Table 3.18 Exp(B) analysis of variables found to significantly affect marine ornamental fish survival in 12 retail stores in the UK at the store-specific, species-specific, and category-specific levels.

Analysis	Variable	Exp(B) <1	Exp(B) >1	Exp(B) <1 value	Exp(B) >1 value
Store specific	Tank stocking diversity	0	1	-	1.799
	Fish cost	1	1	0.965	1.125
	Tank stocking density (other species)	0	1	-	1.437
	Tank stocking density (sample species)	1	1	0.755	1.691
	Number of stock rotations	0	1	-	4.107
	Old or new stock	1	-	.089	-
	Distance from import source	1	0	0.973	-
Species specific	Tank stocking density (sample species)	1	1	.755	1.691
	Tank stocking density (total)	0	1	0	1.060
	Tank stocking diversity	1	0	0.752	-

Analysis	Variable	Exp(B) <1	Exp(B) >1	Exp(B) <1 value	Exp(B) >1 value
	Distance from import source	1	0	0.99	-
	Wild or captive stock	1	0	0.325	-
	Old or new stock	0	1	-	5.028
Category Specific	Fish cost	1	0	0.969	-
	Tank stocking density (sample species)	1	0	1.027	-
	Old or new stock	1	1	0.162	2.766
	Tank stocking density (total)	0	1	-	1.017

Table 3.19 Variables excluded from store- and species-specific logistic regression analysis to investigate factors affecting marine ornamental fish stock loss in 12 retail stores in the UK.

Analysis	Excluded variable	Number excluded cases	Justification
Store specific	Cost	1	Not being applicable too little variation within store(s)
	Tank stocking density	1	No variation
	Wild or captive	3	No variation
Species specific	Fish length	1	No variation
	Tank stocking diversity	2	No other species stocked in tank
	Tank stocking density	2	No stock loss/stocking density of 1
	Distance from Heathrow	1	No variation
	Wild or captive stock	5	No variation
	Number of days held in store	1	No variation

3.5.2 FACTORS AFFECTING TROPICAL ORNAMENTAL FISH STOCK LOSS

When considering the entire sample, all 11 variables were found to significantly affect tropical ornamental fish survival in retail stores (Table 3.20). At least 10 variables were also found to significantly influence stock loss when analysed on at the store-, species- and category-specific level; this is despite some variables being excluded (Table 3.21).

Table 3.20 Binary logistic regression analysis assessment of specific variables ability to influence tropical ornamental fish survival within 19 UK based retail stores (Exp(B) 1>) within store(s).

Variable	Total sample	Store specific	Species specific	Category specific
Wild or captive stock	1	4	2	2
Tank stocking density (sample species)	1	11	7	3
Tank stocking density (other species)	1	8	5	3
Tank stocking density (total)	1	10	7	3
Tank stocking diversity	1	7	7	1
Fish cost	1	11	-	2
Old or new stock	1	5	7	3
Number of stock rotations	1	6	5	1
Fish length	1	12	6	2
Number of days held in store	1	6	1	2
Distance from import source	1	-	6	2
Count of variables with $p \leq 0.05$	11	10	10	11
Count of variables with $p > 0.05$	0	0	0	0

Table 3.21 Variables excluded from store and species-specific logistic regression analysis to investigate factors affecting tropical ornamental fish stock loss in 19 retail stores in the UK.

Analysis	Excluded variable	Number excluded cases	Reason
Store specific	Tank stocking density (total)	3	Stocking density of 1 in all tanks with stock loss
	Number of days held in store	5	No variation
	Tank stocking diversity	3	No other species stocked in tank
	Number of stock rotations	2	Only 1 stock rotation information being collated for species monitored within the store(s).
	Wild or captive stock	7	No variation
	New or old stock	10	No stock loss/no variation/no data
Species specific	Wild or captive stock	4	No variation/no stock loss/100% stock loss
	New or old stock	1	No stock loss

Exp(B) analysis of variables found to significantly affect stock loss at the store-specific, species-specific, and category-specific level revealed that did not have the same type of impact between stores, species and categories, respectively. For example, cheaper fish were associated with lower rates of stock loss (exp(B) below 1) in 7 stores, but with higher rates of stock loss (exp(B) above 1) in 4 stores.

Table 3.22 Total sample exp(B) analysis of variables found to significantly influence tropical ornamental fish stock loss in 19 retail stores in the UK.

Variables found significant within the total sample	Exp(B)	What the exp(b) indicated within the total sample analysis
Fish length	1.125	Longer size: lower mortality
Distance from import source	0.998	Closer to import source: lower mortality
Tank stocking density (other species)	1.016	More of other fish in the tank: lower mortality
Number of days held in store	1.023	More days in store: lower mortality
Tank stocking diversity	1.258	More diversity in tank: lower mortality
Number of stock rotations	1.149	Higher stock rotations: lower mortality
Wild or captive stock	1.571	Wild fish have lower mortality than captive fish
Old or new stock	2.66	Old fish have lower mortality

Table 3.23 Store specific exp(B) analysis of variables found to significantly influence tropical ornamental fish stock loss in 19 retail stores in the UK.

Variable	Exp(B) <1	Exp(B) >1	Exp(B) <1 value (range)	Exp(B) >1 value (range)
Fish cost	7	4	0.58–0.961	1.227–3493-269
Fish length	7	5	0.405-0.853	1.599-390.089
Distance from import source	-	-	-	-
Tank stocking density (other species)	4	4	0.906-0.991	1.007-1.098
Tank stocking density (sample species)	3	8	0.837-0.992	1.002-1.086
Number of days held in store	3	3	0.851-0.91	1.071-1.213

Variable	Exp(B) <1	Exp(B) >1	Exp(B) <1 value (range)	Exp(B) >1 value (range)
Tank stocking density (total)	4	6	0.967-0.995	1.002-1.02
Tank stocking diversity	2	5	0.046-0.631	1.779-5.841
Number of stock rotations	4	2	0.042-0.576	1.863-31.438
Wild or captive stock	3	1	0.045-0.107	24.184-24.184
New or old stock	1	4	0.533-0.533	2.496-8.01

Table 3.24 Species specific exp(B) analysis of variables found to significantly influence tropical ornamental fish stock loss in 19 retail stores in the UK.

Variable	Exp(B) <1	Exp(B) >1	Exp(B) <1 value	Exp(B) >1 value
Fish cost	-	-	-	-
Fish size	1	5	0.488	1.226-5.155
Distance from import source	4	2	0.987-0.996	1.003-1.008
Tank stocking density (other species)	2	3	0.941-0.943	1.019-1.23
Tank stocking density (sample species)	2	5	0.969-0.985	1.002-1.025
Number of days held in store	1	-	0	-
Tank stocking density (total)	2	5	0.975-0.976	1.002-1.016
Tank stocking diversity	3	4	0.118-0.827	1.208-2.505
Number of stock rotations	1	4	0.773-0.773	1.2-1.606
Old or new stock	1	6	0.274	3.241-34
Wild or captive stock	2	1		0.476-0.509

Table 3.25 Category specific exp(B) analysis of variables found to significantly influence tropical ornamental fish stock loss in 19 retail stores in the UK.

Variable	Exp(B) <1	Exp(B) >1	Exp(B) <1 value	Exp(B) >1 value
Fish cost	0	2	-	1.23-2.942
Fish size	0	2	-	1.683-2.714
Distance from import source	1	1	0.996	1.002
Tank stocking density (other species)	1	2	0.969	1.007-1.018
Tank stocking density (sample species)	1	2	0.964	1.001-1.001
Number of days held in store	1	1	0.955	1.079
Tank stocking density (total)	1	2	0.973	1.001-1.002
Tank stocking diversity	0	2	-	1.076-1.218
Number of stock rotations	0	1	-	1.364
Old or new stock	1	2	0.517	4.697-9.127
Wild or captive stock	0	2	-	4.049-11.196

4: DISCUSSION

4.1 BENEFITS OF THE ORNAMENTAL FISH TRADE

Consumers owned ornamental fish at a variety of ages from late childhood to adulthood, and some had been keeping ornamental fish for more than 60 years. There are numerous emotional benefits to keeping ornamental fish as pets. For instance, many consumers stated that ornamental fish are "relaxing to watch", allow them to "be alone, without being alone", and that they "enjoy" keeping ornamental fish. This corresponds with the findings of other academic studies (Wabnitz et al. 2003; Livengood et al. 2007; Langfield et al. 2009). The aesthetic appeal of an ornamental fish tank was also highlighted by consumers as a benefit to, and motivation for, choosing to become an ornamental fish keeper (Swain et al.2008). The appeal of keeping ornamental fish in this respect, however, was not only related to aesthetic "beauty" but also because it allowed nature to be incorporated into an indoor environment (Kazarov 2008; Walster 2008).

This is not a new concept as the benefits of being able to "create nature" in an aquarium through the use of objects (e.g. drift wood, plants, and rocks) and, aquatic taxa (e.g. ornamental fish, frogs, shrimp, corals, live plants, and crabs) have been reported elsewhere (Whittington et al. 2000; Frumkin 2001; Heerwagen et al. 2001; Wood 2001a; Hastein et al. 2005; Walster 2008; Rhyne et al. 2012; Practical Fish Keeping 2014; Maidenhead Aquatics http://www.fishkeeper.co.uk). Consumers who referenced this aspect of ornamental fish keeping also had a heightened appreciation of nature. This is consistent with the *Biophilia* hypothesis that suggests that there are positive emotional benefits from including nature in man-made environments due to an innate desire of humans to have nature incorporated into their homes (Wilson 1999; Frumkin 2001; Heerwagen et al. 2001; Maller et al. 2006). Ornamental fish are likely to be very beneficial in this respect as they provide a good alternative to larger pets (Olivier 2003; Swain et al. 2008). This was reinforced by consumers who said that ornamental fish were a suitable pet to keep due to the size of their homes. Others said that ornamental fish were the only pets allowed by their landlords.

Ornamental fish keeping was also found, in some cases, to have been kept by ornamental fish keepers at different stages of life, from early childhood to adolescence and adulthood. Some consumers also said that they bought ornamental fish as a personal learning tool or to teach others about nature, and its value. This highlights the ability for this trade sector to connect with the public to be utilised as an education tool and generate awareness of underwater ecosystem function. It had been recommended that stronger partnerships with public aquarium(s) occur and be explored (Lim et al. 2003; Kazarov 2008; Rhyne et al. 2012; Kumar et al. 2013; McGregor Reid 2013).

Despite the benefits of keeping ornamental fish, there is scepticism over the sustainability of the trade, which is exacerbated by stock loss (Sadovy 2002; Rubec et al. 2005; Townsend 2011). While stock loss in ornamental fish retailers can occur for a variety of reasons that have different effects on species-specific mortality rates (Larkin et al. 2001; Sadovy 2002; Sale 2002; Rubec et al. 2005; Huntingford et al.

2006; Roelofs et al. 2008; Townsend 2011; et al. 2012; Thornhill 2012), the majority of consumers considered ornamental fish survival to be good or very good. This is in contrast to reports of 70% of stock being lost within one year of being purchased by consumers, and to those of 50% of coral reef species dying within six months of controlled stock assessments (Thornhill 2012).

4.2 SPECIES SPECIFIC STOCK LOSS

The vast majority of the ornamental fish stocked were tropical ornamental fish, with less than 3% being ornamental marine fish. This is consistent with estimates that 90% of ornamental fish stock is sourced from freshwater and 10% marine (Tlusty 2002; Tlusty et al. 2006; Whittington et al. 2007). In the case of tropical ornamental fish, stock losses were generally below the recommended industry threshold of 5% (Mbawuike et al. 2011), although three tropical fish species were more susceptible and exhibited 6% to 10% stock loss.

Marine ornamental fish, however, were more at risk, with half of the 12 species suffering losses of 6% to 10%. In other species (Goldy Pleco and Emperor angel), survivorship was 100%, and thus within Marine Aquarium Council targeted stock loss of 1% (Ip et al. 2001; Liew et al. 2012). Higher rates of stock loss among marine species could be an indirect result of their rarity in the trade, meaning that various actors – including retail staff – have less knowledge and/or experience of appropriate husbandry techniques, or lack appropriate equipment, to ensure their survival (Pyle 1993; Wood 2001b; Millard et al. 2003; Meka 2004; Steiger et al. 2006; Roelofs et al. 2008; Klinger et al. 2009). However, the stock loss of marine species varied less between stores than tropical species, although this could be because some species in the marine sample were stocked in fewer stores overall (e.g. the seahorse was only stocked in one store).

4.3 IN-STORE STOCK MANAGEMENT

The care and maintenance of ornamental fish within retail stores can have a substantial influence on stock survival. Sale (2002) found that poor in-store stock management can result in mortality rates as high as 75% within six weeks of arrival in-store for some species such as the Flame angel and Dwarf rainbow. The rate of stock loss varied from 1% to 71% between stores (Sale 2002), providing strong evidence that it was a result of in-store management as opposed to other external factors. Similar variation in stock loss was found between stores, 13 of the 19 stores had stock loss occurrence below the recommended industry threshold of 5% (Mbawuike et al. 2011), while stock losses in six stores was 6% or above. This is still lower than a telephone survey conducted with 300 stores in the USA in 1997, which found stock loss of imports from the Philippines ranged from 30% to 60% within three days of stocks arrival into the stores (Wood 2001b; Sadovy 2002).

Aquarium tanks in participating stores were estimated to be 60x20x20cm, and hold 24 litres of water, although there was some variation. Species-specific stocking density varied in retail stores. For example, stocking density of the Bangai cardinal, a marine species, ranged from 1 to 30, while that of the tropical Cherry barb ranged from 50 to 300 individuals. In-store decisions over stocking density are likely to be influenced by a number of factors. As well as catering for species-specific life history traits (Ip et al. 2001; Huntingford et al. 2006; Liew et al. 2012), the value of stock (and how this interacts with the potential profit margin, including profit lost if the species suffers stock loss) also plays a role in decisions over stocking density. For example, a number of studies have revealed that cheaper species are often more densely packed during transit than expensive species (Magurran et al. 1992; Whittington et al. 2000*;* Wood 2001b; Roelofs et al. 2008; Kiron et al. 2011; Papavlasopoulou et al. 2014). This might also be replicated in retail stores and result in greater stock loss among cheaper species as a result of being kept in more crowded tanks. Cheaper species were found to be more susceptible to stock loss in this study. However, it is unclear whether this is as a result of practice in-store or due a lag-effect of management practices earlier in the supply chain (Lim et al. 2003; Rubec et al. 2005).

Stocking density (of the species being sampled, of other species, and total tank stocking density) and diversity both had a significant impact on stock loss in retail stores, although to a greater extent within the tropical cohort. This might be even more pronounced if the quantity of stock lost in densely stocked tanks was under-estimated due other tank occupants eating dead tank-mates between monitoring events (Geerinckx et al. 2006; Practical Fish Keeping Magazine 2014). A number of factors could have led to greater stock loss in densely packed tanks, including; (1) food competition, (2) inter-species and/or intra-species induced stress, (3) injuries through aggressive encounters or accidental collisions (Rubec et al. 2005; Ashley 2007; Song et al. 2011), and (4) cumulative release of stress induced (and inducing) hormones (Magurran et al. 1992; Weis et al. 2001; Rubec et al. 2005; Ashley 2007; Barcellos et al. 2011; Kiron et al. 2011; Goulart et al. 2013).

The Farm Animal Welfare Council has raised species-specific stock density as a concern, and recommends that stocking density should “allow sufficient space to show most normal behaviour with minimal pain, stress, and fear’’ (Ashley 2007, pg19). However, knowledge of species-specific preferences is crucial to stocking tanks with the right density and diversity of ornamental fish as some species (e.g. group living fish) suffer less stress if held in mono-specific, high stocking densities. High stocking density can also repress natural aggression for territory within some species and allow tank mates to have less inter and intra species aggression (Reis et al. 2000; Hastein et al. 2005; Geerinckx et al. 2006; Huntingford et al. 2006 Gertzen et al. 2008; Harper et al. 2009). Furthermore, the survival of almost all marine ornamental fish species in this study was influenced by stock rotation; however, less than half of the tropical ornamental fish species were affected by this management practice. Thus, more research is needed in relation to optimal species-specific carrying capacities. This should focus on indicators of stress such as changes in colour, displays of aggression (Wabnitz et al. 2003; Price et al. 2008; Carneiro et al. 2009; Goulart et al. 2013), or feeding behaviour, which can be easily monitored by retail store staff. Further research is needed into the reasons for and results of various trade-offs within the ornamental fish trade.

4.4 STOCK LOSS AS A RESULT OF SUPPLY CHAIN STAGES LEADING UP TO RETAIL

Even in cases where best care practices are implemented within the retail section of the ornamental fish supply chain, losses can still occur from the effects of cumulative stress and poor transport conditions (Rubec et al. 2005; Gozlan et al. 2006; Gomes et al. 2009; Monvises et al. 2009; Thornhill 2012 Dhanasiri et al. 2013). These are not rare occurrences, and a study conducted at Rhein-Main Airport in Germany revealed that 41% of ornamental fish shipments had low oxygen and some also had unfavourable ammonia, carbon dioxide and/or pH levels (Kiron et al. 2011). The likelihood of latent stock loss might vary with import source, especially if importing countries vary in legal minimum standard requirements (Wabnitz et al. 2003; Tissot et al. 2010; Townsend 2011). Marine ornamental fish were imported through the airport from 11 different countries, although more than half of the total stock was sourced from Bali, less than 10% of which suffered mortality. Sri Lanka was the second greatest source of stock though sourced less 10% (n=80) of stock within the sample and stock loss from this source was in the range 0 to 5%.

Nearly half of all the tropical fish were from Singapore, and at least 10% of stock was imported from Indonesia, Vietnam or Sri Lanka. Tropical fish imported from four different countries – Brazil, Germany, Malaysia and Nigeria – exhibited zero rates of stock loss in retail stores, although no more than 22 fish originated from any one of these countries. Despite these varying levels of stock loss between different import sources, the number of external influencing factors, such as the selected export company, transit route and frequent delays during transit (Fossa 2007; Minchin

2007; Saleem et al. 2008; Tissot et al. 2010; Mbawuike et al. 2011), mean that it is challenging to assign accountability for the stock loss to any one factor (Wood 2001b; Meka 2004; Learned 2007; Tissot et al. 2010; Mbawuike et al. 2011; Harper et al. 2009; Douglas et al. 2014). Furthermore, it is not unusual for stock to be imported from one country but to have originated from another. For example, the Czech Republic, despite cultivating marine and tropical ornamental fish, is also known to re-export stock (Cato et al.2003; Walster 2008).

The transit distance of ornamental fish from Heathrow Airport – the largest import point for ornamental fish in the UK (Walster 2008) – affected stock survival; in general, rates of stock loss increased with longer distances from the Airport. However, the effect of this differed between species, stores and between ornamental fish with different care level requirements. This might be a result of additional factors, such as inconsistent bag sizes or shipping methods (resulting in different journey times), which were not analysed here. Bag size can indirectly influence stock loss by virtue of changes in stock density, water density and oxygen levels (Gomes et al. 2003; Lim et al. 2003; Kiron et al. 2011; Harper et al. 2009). Interestingly within this study, marine and tropical stock purchased and/or cultivated within the UK had the greatest incidence of stock loss, although this may be a result of the small sample size (n=24).

Understanding the potential reasons for this would require further study and a greater sample of UK stock. Nonetheless, possible causes include; (1) poor national stock transportation standards (Dhanasiri et al. 2011), (2) UK wholesalers failing to assure stock acclimatisation (Lim et al. 2003), or (3) *in-situ* breeding programmes within the UK requiring better genetic handling, husbandry, and/or tank maintenance (Ford 2002; Utter et al. 2002; Frankham 2008 Lorenzen et al. 2012).

4.5 FISH SIZE AND STOCK LOSS

The size of tropical ornamental fish in participating retail stores was found to significantly influence stock loss. A number of factors can cause variation in fish size within, and between, species. For example, selective breeding of captive sourced stock is sometimes done to influence stock size to meet consumer preferences – which is often for smaller fish (Olivier 2003; Job 2005). In other cases, captive stock is cultured to grow fast so that it can be sold sooner. This practice can increase the risk of stock loss as abnormally fast growth can result in bone weakness and/or deformity, or it can negatively impact other aspects of fish physiological health which then put an individual at greater risk of predation or less resistant to external stressors (Mangel et al. 2001; Jha et al. 2005; Huntingford et al. 2006; Mavuti et al. 2007).

Small stock in itself could also be indicative of poor husbandry and stock maintenance (Bartone et al. 1991; Chong et al. 2000; Huntingford et al. 2006; Ashley 2007; Sinha et al. 2012). For example, fish that are stored at unfavourably high stocking levels might exhibit stunted growth due to stress or competition for food (Hastein et al. 2005; Huntingford et al. 2006; Mavuti et al. 2007). This might then reduce the value of the smaller fish if they appear as poor specimens. This can then have a negative feedback effect if store managers then decide to continue to store the small fish at high densities because they are of lower-value (Whittington et al. 2000; Wood 2001b; Roelofs et al. 2008; Raghavan et al. 2009).

In contrast to the many reasons why smaller fish might be more susceptible to stock loss, in the case of some wild harvested marine species, juveniles exhibit lower mortality as they are more likely to be able to adapt to changing conditions (Gomes et al. 2003; Job 2005; Fujita et al. 2013). Adults, on the other hand, are likely to have already adapted to a specific environment and find it difficult to re-adapt to captive conditions (Job 2005; Fujita et al. 2013). Thus, the relationship between fish size and stock loss is complex, probably indirect, and requires more research.

4.6 STOCK LOST FROM WILD AND CAPTIVE SOURCES

It has been estimated within the marine ornamental fish trade that 10% of stock is cultured and 90% is from wild sources (Tlusty 2002; Tlusty et al. 2006; Whittington et al. 2007), with the opposite being true for tropical ornamental fish. The wild-captive stock ratio within this study followed a similar trend, although it was less pronounced for marine ornamental fish (just over one third of the sample comprised captive stock) and more pronounced for tropical ornamental fish. These findings could indicate a change in the wild-caught-cultured ratio within both industries.

The overall increase in cultured stock could relate to development within the industry related to species life history traits, technological advances in this industry or greater concentration on captive breeding of ornamental fish. However, it could also be influenced by factors such as manager preferences (Tlusty 2002; Thoney et al. 2003;

Gutierrez-Wing et al. 2006; Hastein et al. 2005; Huntingford et al. 2006; Steiger et al. 2006; Lorenzen et al. 2012) or consumer demand. This study only assessed 24 species, and as such further studies of the retail sector, with larger sample sizes, are recommended to substantiate these findings.

Species-specific stock loss within the cultured tropical sample varied more drastically than in wild sourced stock, with captive bred stock being more at risk of mortality than wild sourced stock. The Elephant nose fish illustrates the extreme, all wild sourced individuals lived while 100% of captive stock were lost. This finding is significant as it demonstrates that, if responsibly managed with a good business model, wild sourced fish can be an important component contributing to the overall sustainability of the ornamental fish trade (Figure 4.1) (Sadovy 2002; Lim et al. 2003; Learned 2007; Cartwright 2012). These findings also underpin the importance of captive stock being monitored as well as wild sourced stock.

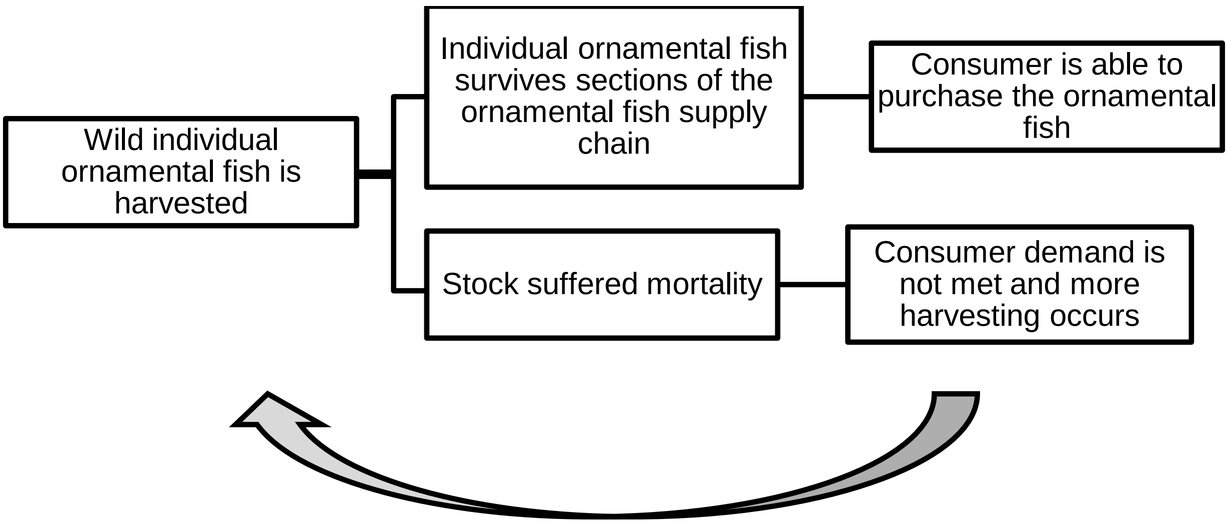

Figure 4.1 Sustainability risk harvesting model of wild sources stock.

A number of factors can result in captive-bred fish being at higher risk of mortality that wild stock. For example, breeding certain colour morphs to meet consumer demand is often linked with low genetic diversity and associated degenerative disorders, reduced fitness and poor resistance to stress (Grandin et al. 1998; Sale 2002; Lim et al. 2003; Clotfelter et al. 2007; Swain et al. 2008; Monvises et al. 2009; Yong et al. 2011; Jacquin et al. 2013). It is therefore important for cultured breeding of stock to be managed correctly to maintain a healthy degree of genetic diversity and avoid pleiotropy; in fish, 150 genes have been identified that have the potential to influence pigmentation (Yua et al. 2004; Mundy 2004; Huntingford et al. 2006; Braasch et al. 2009; Dawkins 2009; Monvises et al. 2009; Hofreiter et al. 2010; Leroy 2011; Rhyne et al. 2012; Sinha et al. 2012).

Ultimately, it is market demand that drives selective breeding of stock to exhibit certain traits such as colour and fin length, and the majority of consumers said that they would be more inclined to purchase colourful species. Thus, raising awareness among consumers of the potential negative impacts of selecting colourful species on wastage in the ornamental fish trade might be one means to tackle stock loss. Consumers could also be encouraged to purchase fish that are naturally colourful, such as the Mandarin *(Synchiropus splendidus)* and a number of Malawi cichlids, and therefore not selectively bred (Gopakumar et al. 2002; Monico et al. 2007; Swain et al. 2008; Thornhill 2012; McGregor Reid 2013). Species colour can also be enhanced by certain food supplements, while other species, such as Guppyguppy, exhibit brighter colours when they are healthy but become dull or miscoloured when ill or under stress (Houde et al. 1992; Gouveia et al. 2003; Lin et al. 2003; Yua et al.

2004; Price et al. 2008; Monvises et al. 2009; Gibson et al. 2010). In this case, with the right information, consumer preference for more colourful fish can be used as a means to drive favourable husbandry practice, but greater awareness is still needed within the consumer sector (Calado et al. 2003; Townsend 2011; Cartwright 2012; Thornhill 2012).

The finding that wild stock can have high survival rates is important given the current issues and concerns raised by groups lobbying to ban the importation of wild sourced ornamental fish into Europe (Sadovy 2002; Lim et al. 2003; Wabnitz et al. 2003; Learned 2007; Reaser et al. 2008; Cartwright 2012). Such blanket bans can have negative implications. For example, in the period before a species is listed on CITES, trading often increases as buyers “get in” before the trade has greater control and traders “offload” their stock (Moreau et al. 2006; Rivalan et al. 2007).

In addition, bans on wild caught resources, such as ornamental fish, can have serious impacts on the livelihoods of poor, rural communities within developing countries that are dependent on the trade (Tlusty 2002; Job 2005; Huntingford et al. 2006; Moreau et al. 2007; Ferse et al. 2012). The extraction of wild collected ornamental fish not only helps satisfy demand but it provides income to often poor rural communities, allowing them to make money from their own natural resources in a way that does not occur with captive breeding alone. Communities along the lower rivers of the Guinean supply 200 species of ornamental fish to the trade (Brummett et al. 2004; Tlusty 2002; Learned 2007). The government of Nagaland, northeast India, has identified 90 endemic ornamental fish species that are highly coloured and are potentially of commercial interest to the ornamental fish trade (Swain et al. 2008). Removing this commerce can result in a shift away from sustainable harvesting to less environmentally sound means of generating income, such as unsustainable forms of logging, farming and hunting (Quarto 1999; Chomel et al. 2007; Styger et al. 2007; Dias et al. 2010; Gruver 2013).

It is recommended that ornamental fish trade stakeholders utilise and understand the importance of both wild and captive sourced stock. For example, the use of wild-caught stock within captive breeding programmes can increase genetic diversity making stock more resilient to heath issues (Ford 2002; Utter et al. 2002; Frankham 2008). Breeding captive stock can help to maintain sustainability within targeted species. This is especially important for more popular species – in one study 23 species made up 50% of stock presence (Papavlasopoulou et al. 2014) – as captive breeding reduces pressure on wild populations (Wood 2001b; Tlusty 2002; Kolm et al. 2003; Wabnitz et al. 2003; Yue et al. 2004; Koldewey et al. 2010; Kiron et al. 2011; Molina et al. 2012; Raghavan et al. 2013a; Raghaven 2013c).

The longevity of the Bangaii cardinal, which comprised 16% of marine stock in this study, has been made possible by captive breeding programmes (Wabnitz et al. 2003; Kiron et al. 2011; Raghavan et al. 2013a); over half of the Bangaii bangaii cardinals examined were captive bred. The Common common clown fish, which included over one quarter of the total marine stock, was comprised of both wild and captive stock. Nonetheless, the Green green chromis, which was the most abundant marine fish species in the store, was entirely of wild-caught origin.

4.7 POTENTIAL OF CARE LEVEL CLASSIFICATION SYSTEMS TO INFLUENCE STOCK LOSS

The study found that the majority of consumers did not utilise ornamental fish care level categorisation systems. Furthermore, consumers with no professional experience were significantly less likely to have experience using classification systems than the minority with professional experience. This highlights the importance of developing a user-friendly system for assigning care levels to ornamental fish species, using terminology that is accessible to consumers with no professional experience working with ornamental fish, and potentially with limited technical knowledge on ornamental fish keeping, as these constitute the majority of the customer base.

Even consumers who stated that they did utilise care level categorisation systems had varying opinions over the meaning of four specific terms, “specialist”, “generalist”, “hardy” and “advanced care”. For example, some consumers associated these terms with species breeding habits and social interactions, while others made reference to water types or the general ease of keeping an ornamental fish alive.

Different terminologies varied in their ability to potentially influence consumer purchase decisions. For example, over a quarter of consumers claimed that they would be more likely to purchase an ornamental fish if it was described as “specialist”, while more than a third were unlikely to be affected by the use of the term. By contrast, the vast majority of the same sample claimed that they would be deterred from buying a species of ornamental fish that was described as “hard to keep alive". This is interesting as, arguably, the terms could be considered synonyms of each other, given that a "specialist" species is likely to be harder to maintain than a "generalist" species.

Therefore, by using the term "specialist" as a euphemism for ornamental fish that are difficult to keep alive, retailers are less likely to lose out on sales. However, in the absence of a proper definition the term could be misleading, especially if it is associated with a species being "special" and therefore potentially more desirable, and result in consumers unwittingly purchasing ornamental fish they are not fully equipped to care for. This could result in higher rates of stock loss in the trade, especially given that species with higher care levels were found to suffer higher stock loss in retail stores (Sale 2002).

The challenges faced by consumers in making informed purchasing decisions of ornamental fish are exacerbated by the diversity of care level terms that are in use. Retail staff varied in their preferred use of care level terminology, although over one third of staff did not use a system at all, despite working for the same organisation. Furthermore, of the 106 species kept by respondents, 21 different terms were used by just 15 different online information sources; one website alone used six different terms to describe ornamental fish care level requirements.

"Easy", and its various synonyms, was the most popular term used to describe 70% of species. The legitimacy of these classifications are questionable given that 10% of fish within this trade sector are impossible to keep, while an additional 30% require advanced care (Sale 2002). There were also inconsistencies between websites. For example, there were cases in which a species described as having “very low” care requirements in some websites was listed elsewhere as a “high care level” species.

Lack of standardised information within online sources, among retail staff and in the ornamental fish industry in general, is an issue that needs addressing. This is a particularly pressing matter given that the majority of consumers relied, at least partly, on retail staff for information on the care-level requirements of ornamental fish purchases. Consumers and retailers also pointed to online sources as important resources for information on ornamental fish care requirements. It could be contributing to stock loss if consumers are insufficiently prepared to care for ornamental fish because they get ambiguous information.

These findings reinforce that terminology utilisation and standardisation within the industry is important. However, while it is clear that a more consistent care level grouping system is needed, this is no simple task. Although species with higher care levels suffered higher stock loss, there was variation between marine and tropical species. Species grouped within the same grouping are also likely to respond differently in relation to external *stimuli* and variation in water conditions (such as pH and water temperature) (Wilson et al. 2000; Weis et al. 2001; Padilla et al. 2004; Mbawuike et al. 2011). Thus, any system developed without proper research, and perhaps even with research, is likely to face limitations in expressing species-specific life history traits in the context of care level groupings, especially if it seeks to maintain an easily accessible and user-friendly level of simplicity.

Ornamental fish retailers and retail staff are well positioned to play an important role in improving consumer understanding of ornamental fish care requirements. However, before this support can be effective, the consistency in the information provided internally, within and between retailers, needs to be improved.

It is promising that more than 90% of retail staff said that they had received training within the store, and that most respondents rated their understanding ornamental fish care and that of their peers as good or very good, but nonetheless opinions over care levels differed between staff. This could be addressed in two ways. Firstly, large retail chains such as Pets at Home (www.petsathome.com) and Maidenhead Aquatics (http://fishkeeper.co.uk), that have the largest market share, could lead in updating and standardising their care information and ensuring that it is disseminated consistently among staff.

Secondly, trade bodies such as the Ornamental Aquatic Trade Association could work with retailers to develop a widely used and accepted list of terminologies, as well as definitions for these, which can then be promoted with within the ornamental fish keeping community. Once the industry tales these steps, retailers will be better able to work with consumers to transfer knowledge and understanding about ornamental fish and how to make sensible purchasing decisions (Hastein et al. 2005). Ultimately, this should result in more responsible trade with lower incidence of stock loss in stores and reduced ornamental fish mortality at the hands of consumers, which can only benefit both sectors and the species themselves (Pauly et al. 2002; Sale 2002; Hastein et al. 2005; Livengood et al. 2007; Gertzen et al. 2008; Roelofs et al. 2008; Kiron et al. 2011; Townsend 2011; Thornhill 2012).

It is recommended that further studies be conducted at the interface between the retail and consumer sectors to help provide a better understanding and facilitate a more responsible trade. Although only a minority of retail staff considered in-house training and maintenance of ornamental fish within stores as sub-standard, in general, more respondents highlighted the need for improvement in specific areas. These included, catering for species-specific habitat requirements and acclimatisation needs, as well as paying attention to high stocking levels in tanks and the needs of highly aggressive and predatory species (Weis et al. 2001; Natalia 2004; Geerinckx et al. 2006; Huntingford et al. 2006; Morris 2009; Song et al. 2011).

Thus, as well as providing more consistent information on care levels, retailer capacity in these areas could also be improved. The extent to which these factors will be improved upon is likely to be subject to economic trade-offs in terms of the primary function of retailers to make sales rather than long-term keeping and care of ornamental fish (Wood 2001b; Whittington et al. 2000; Friedlander 2001; Hastein et al. 2005; Huntingford et al. 2006; Raghavan et al. 2009; Townsend 2011).

An in-house progressive training certification scheme, similar to that implemented by the corporation Holland and Barrett whereby nationally recognised qualifications are developed (http://www.hollandandbarrett.com/info/qualified-to-advise), could be implemented in retail stores. This would provide an ideal avenue to standardise training and solidify the knowledge base within ornamental fish stores.

This type of progressive certification scheme can also enable individual knowledge and commitment to good customer service to be recognised, as well as providing employees with opportunities to benefit from competitive bonuses (Sesil et al. 2001; Rhynes et al. 2004; Green et al. 2008). Collaboration between large retail corporations, OATA (http://www.ornamentalfish.org), and the Office of Qualifications and Examiners would be key to creating an effective in-house progressive certification scheme that can be implemented successfully within retail stores.

4.8 CERTIFICATION OF STOCK AND MONITORING THE ORNAMENTAL FISH CHAIN OF CUSTODY

The need for greater monitoring of the chain of custody in the ornamental fish trade has been emphasised by many stakeholders and actors within this trade sector (Ferrell et al. 2000; Lee et al. 2006; Lilley et al. 2007; Conway 2010; Knight 2010; Townsend 2011; Madan et al. 2012; Cohen et al. 2013). Closer monitoring of stock health and employing ethical practices, including ensuring appropriate equipment is being utilised at various stages in the supply chain, is likely to improve the sustainability of the ornamental fish trade (Alencastro et al. 2005; Gutierrez-Wing et al. 2006; Yong et al. 2011).

One means of ensuring that best practices are adopted is to introduce a certification programme, through which an independent external auditor monitors standards. This would introduce better accountability to the trade sector and allow consumers to make more informed, ethics-based purchasing decisions (Beu et al. 2001; Sale 2002; Barnett et al. 2004; Rubec et al. 2005; Hall et al. 2007; Douglas et al. 2014).

Although certification standards have been developed for other sectors (e.g. the Forest Stewardship Council (www.fsc.org), for responsible forest management, the Fair Trade company (www.fairtrade.org.uk), and Marine Alliance Council (ww.msc.org) that has certified sustainable harvesting of seafood). Hoverer, no such initiative has been developed within the ornamental fish trade sector.

Should a certification programme be introduced, retail stores would be a key stages in the ornamental fish supply chain where best practices would need to be monitored. This research revealed that factors, which are most likely to influence stock survival in-store, include tank stocking density and diversity (Rubec et al. 2005; Huntingford et al. 2006; Yong et al. 2011; Kiron et al. 2011). These should, therefore, be the focus of the indicators. For example, a benchmark could be set for the maximum tank stocking density and diversity, as factors that influenced the survival of ornamental fish.

Separate indicators may need to be developed for marine ornamental fish and tropical ornamental fish and for those that are wild caught or captive bred. For instance, within the marine ornamental fish sample it was found that tank stocking density (sample species) had less potential to impact stock loss then the issue of species length. As well as having a positive impact in retail stores, a certification scheme could be used to promote best practice in other sections of the supply chain relating to; (1) collection equipment (Alencastro et al. 2005), (2) stock holding facilities, (3) sustainability of wild-caught stock, (4) the standard of aquaculture facilities for cultured ornamental fish, including maintenance and minimising the risk of stock escaping from holding facilities (Dhert et al. 2001; Tlusty 2002; Huntingford et al. 2006; Diana 2009; Monvises et al. 2009; Kiron et al. 2011; Vaz et al. 2012), (5) community involvement, including through wild harvesting programmes and ensuring that they are not disenfranchised from captive breeding programmes (Millard et al. 2003; Meka 2004; Flint et al. 2008), (6) maintaining genetic diversity among captive stock (Bostock et al. 2010), (7) genetic management of stock (e.g. to develop novel strains with greater tolerance to ammonia (Whittington et al. 2000; Frankham 2008; Knight 2010; Sanderson et al. 2010; Waylen et al. 2010; Marschke 2012; Rahman et al. 2012), and (8) transit of stock, including minimising journey time and stocking density (Wood 2001b; Kiron et al. 2011; Vaz et al. 2012).

Certification schemes are only effective in promoting best practices if they increase sales of a certified product above that of non-certified alternatives, or if consumers are willing to pay a price premium. Given that the majority of the consumers said that ethics – including association with conservation programmes, sustainable and ethical harvesting, and ethical transport of ornamental fish – played an important part in their decision to buy a fish, it is possible that there will be sufficient demand to make certification of ornamental fish a worth-while investment for retailers. In addition, a recent study focussing on the marine trade found that consumers were willing to pay more for certified ornamental fish (Cartwright 2012).

However, just because consumers express a liking for a certain quality of product, does not mean that they will change their behaviour accordingly, as there are external factors, which also influence consumer decisions to buy a product

(Simonson 1999; Zhang et al. 2007). This study revealed conflicting findings which highlight this as, while consumers said that they would be more inclined to purchase a species if it was cheaper, information from retailers suggested that there was a positive relationship between tropical ornamental fish popularity and cost (i.e. more expensive species were more popular). There is demand for FSC-certified and Fair Trade products in UK supermarkets suggesting that, at least in Britain, the public might be responsive to an equivalent ethical standard in the ornamental fish trade (Nicholls 2002; Smith et al. 2005; Smith 2010) However, the marketing of any certification scheme will need to take aboard consumer perspectives, willingness to pay and how best to market a certification scheme to ornamental fish keepers.

It is likely that separate indicators and standards will need to be developed depending on whether ornamental fish are captive bred or wild-caught, and whether these are commercial business or community-run operations (Thoney et al. 2003; Shuman et al. 2004; Tlusty et al. 2006; Livengood et al. 2007; Townsend 2011). A certification programme should cater for the needs of as many actors as possible so as to increase the likelihood of more companies engaging with such a scheme.

However, in order for a fish to be sold as a certified product at the point of retail, certified partners may need to be present at each stage along the supply chain. Given the complexity of the ornamental fish trade supply chain, this may not be an easy task to initiate (Dufour 2002; Rubec et al. 2005; Roelofs et al. 2008; Knight 2010; Rhyne et al. 2012; Thornhill 2012; Van Rijn 2013). Furthermore, once developed, the certified supply chain will require monitoring, which will not be a simple task. A number of authors have emphasised the need for capacity building for monitoring and implementation of a certification system for the ornamental fish trade (Tlusty et al. 2006; Teh et al. 2009; Conway 2010; Townsend 2011; Madan et al. 2012; Rhyne et al. 2012; Cohen et al. 2013; McGregor Reid 2013). Therefore, further research is needed to determine whether such an initiative will reap sufficient economic returns for the actors involved to make it worthwhile.

It is promising that sustainability programmes have already been implemented in some of the countries from which ornamental fish were sourced. For example, a sustainable capture and release programme has been developed in Peru for the Silver arowana were mouth broods are taken and the breeding adults are released. Similarly, some community operations have developed associated slogans (Norris et al. 2002; Gopakumar et al. 2002; Kiron et al. 2011; Minteer et al. 2011) such as “buy a fish, save a tree” (Norris et al. 2002) and “buy a fish, buy a coral, save a reef” (Bunting 2001). There are also a variety of groups, organisations and legislation within different sections of the ornamental fish supply chain to assure ethical behaviour, stock standards and community involvement (Whittington et al. 2000; Barnett et al. 2004; Swain et al. 2008; Kiron et al. 2011).

In Sri Lanka, the National Aquaculture Development Authority (NAQDA) works with the farmers of captive stock to identify disease within their stock, and offers advice in relation to stock husbandry and maintenance requirements (Kiron et al. 2011), while the Association of Live Tropical Fish Exporters in Sri Lanka is educating collectors in collection techniques that harvest wild stock while minimising damage to habitats.

Other positive initiatives and partnerships are already being implemented in the later stages of the supply chain. For example, European Union regulations have been developed relating to transport standards, border regulations and quarantine (Wood 2001b; Kim et al. 2002; Wabnitz et al. 2003; Hilborn et al. 2005; Whittington et al. 2007; Tissot et al. 2010; Townsend 2011; Diaz et al. 2012). In some cases bans have been introduced for those species considered as biohazard due to the risk of invasion (Herborg et al. 2007).

One significant mechanism of control are the CITES regulations relating to the import and export of species threatened by trade (Wood 2001b; Ababouch 2005; Dee et al. 2014). OATA offers training programmes for staff within stores, retailers, and also pet shop inspectors. However, training standards are not yet mandatory (Yong et al. 2011; Townsend 2011). Other positive practices within ornamental fish stores include the use of Tropical Marine Centre, an organisation linked with conservation initiatives and community development, as a source of stock (www.tropicalmarinecentre.co.uk), and not allowing the sale of certain species deemed unsuitable for the majority of aquarists due to their specialist requirements. Furthermore, this research found that participating retail stores had a strong ethos of re-homing fish that would otherwise be at risk of unethical disposal (Livengood et al. 2007; Gertzen et al. 2008). At present, however, these initiatives and partnerships are in the background and not used as a public marketing tool to buyers or the wider public.

Public partnerships have been used successfully within a range of industries; Pets at Home have partnered with pet adoptions schemes, WWF with Whiskas (https://www.whiskas.co.uk/wwf), and Penguin with the Zoological Society (United Biscuits UK, 2011http://www.talkingretail.com/category-news/supermarket/mcvities-penguin-to-donate-100000-to-wwf-charity). In these cases, a proportion of the profit generated from promotional packs goes towards the specified conservation organisations. Another benefit of these schemes is that consumers have a level of gratification when they buy products, which translates into a philanthropic, charity-supporting action (Sachdeva et al. 2009). Marketing of public partnerships within the ornamental fish trade however will require detailed understanding of the consumer market.

This is underpinned by the finding that certain ethics-related terms, such as “sustainable harvested”, “ethical collection”, and “ethical transport”, had a positive influence on consumers choosing to purchase ornamental fish, whereas the term “linked with conservation programmes” negatively influenced some consumers. The reason for this is unclear, although the term “conservation” could induce negative perceptions associated with poaching, extinction, and/or preservationism (Swart et al. 2001; Juvonen et al. 2004; Minchin 2007). A public marketing scheme approach for wild caught species would need to be particularly cautious, probably led by educating consumers of the benefits of wild caught stock. Further research is required into the possible implementation of these types of partnership(s) within the ornamental fish industry.

It is recommended that the ornamental fish industry ascertain what certification scheme would work within this sector and adopt a scheme that assures; (1) future sustainability of the trade (Calado 2006; Reksodihardjo-Lilley et al. 2007; Vagelli 2008; Townsend 2011; Murray et al. 2012), (2) stock quality (Wood 2001b; Amos et al. 2009; Friedmann et al. 2009; Thornhill 2012), (3) stock traceability within different sections of the supply chain, particularly in terms of ethical treatment of stock ((Ferrell et al. 2000; Norris et al. 2002; Tlusty et al. 2006; Castka et al. 2008; Lilley 2008; Pomeroy et al. 2008), and (4) positive public perceptions of the ornamental fish trade as an ethical industry that supports ornamental fish welfare (Juvonen et al. 2004; Reksodihardjo-Lilley et al. 2007; Douglas et al. 2014).

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APPENDICES

APPENDIX 1: FISH ASSESSMENT QUESTIONNAIRE

Fish Assessment Questionnaire

Introduction

This questionnaire is designed to enhance the understanding of different marine and freshwater fish species care level requirements, and their popularity within the ornamental fish trade. The information generated from the 'Assessment Questionnaire' will help focus this study. Thank you for your time and participation.

Questionnaire Table

In this questionnaire if you are unsure about a particular species or how a question relates to that species, simply leave the box blank. The following is a brief guide to the form.

Popularity: Please indicate on a scale of 1 to 9 how popular you believe the species to be; with 1 being a species likely to always to be in stock and 9 being a species rarely in stock.

Specialist v Generalist: Please indicate on a scale of 1 to 9 how advanced the care requirements are for each species; with 1 being a species that is hardy/generalist and 9 being a species that requires specialist/advanced care.

Care requirements: Please indicate within the categories below the care requirements for each species on a scale of 1 to 9; with 1 being a species that requires hardy/generalist care and 9 being a species that requires specialist/advanced care requirements. Examples of how species can have advanced/ specialist care requirements within each category are written below:

- **Feeding:** e.g. difficult to start feeding, live food requirements, difficulty in obtaining species specific feeding requirements.
- **Size:** e.g. fish may grow to a large size and therefore require a large tank.
- **Health Issues:** e.g. highly prone to parasites, other diseases, inbred defects, stress.
- **Habitat:** e.g. specialist substrates, aquarium décor needed to insure health, prevent injury and/or importance for varying life cycle habitat requirements.

- **Social Behaviour:** e.g. requires certain number of own species to shoal together, delicate and therefore cannot go with 'flighty' fish species, high stocking levels required to reduce aggression

- **Predation:** e.g. likely to predate on its on or other species if placed together

- **Water quality:** e.g. specific water requirements, susceptible to changes/fluctuations, such as ph, nitrogen levels, temperature, water flow

- **Other:** please tell me what other care requirements apply to this species and score them 1-9

Note: Please fill in the 'Assessment Questionnaire' using either the tables provided below or via the Excel spread sheet attachment provided, please make sure to fill in the tables for both the Marine and Freshwater species. Thank you.

Example Table											
Example Species	**Popularity (1-9)**	**Generalist/ Specialist (1-9)**	**Care Requirements**								
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**	**Other**	
										Care Required	**Scale(1-9)**
SPECIES 1	1	2	2	3	2	1	2	2	3	N/A	
SPECIES 2	7	9	8	9	2	8	9	8	2	N/A	

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Marine											
Species	**Popularity (1-9)** *1= Likely Always to be in Stock; 9= Rarely in Stock*	**9)** *1=Hardy/ Generalist ;9= Highly Specialist/*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist; 9= Highly Specialist/ Advanced Care*							**Other**	
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**	**Care Required**	**Scale (1-9)**
Common Clown *(Amphiprion ocellaris)*											
Blue Reef Chromis *(Chromis cyanea)*											
Green Chromis *(Chromis viridis)*											
Blue Damsel *(Chrysiptera cyanea)*											
Domino Damsel *(Dascyllus trimaculatus)*											
Pyjama Wrasse*(Pseudocheilinus hexataenia)*											
Yellow Wrasse *(Halichoeres chrysus)*											
Green Wrasse *(Halichoeres chloropterus)*											
Royal Gramma *(Gramma loreto)*											
False Gramma *(Pictichromis paccagnellae)*											
Bangai Cardinal (Pterapogon kauderni)											
Purple Firefish (Nemateleotris decora)											
Firefish *(Nemateleotris magnifica)*											
Flame Hawkfish *(Neocirrhitus armatus)*											
Longnose Hawkfish *(Oxycirrhites typus)*											
Scooter Blenny *(Synchiropus ocellatus)*											
Bicolour Blenny (*Ecsenius*											

bicolor)											
Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*											
Watchmans Gobies *(Amblyeleotris randelli)*											
Scissortail Dartfish *(Ptereleotris evides)*											
Spotted Mandarin *(Synchiropus picturatus)*											
Powder Blue Tang (Acanthurus leucosternon)											
Regal Tang *(Paracanthurus hepatus)*											
Bartletts Anthias (*Pseudoanthias pleurotaenia*)											
Fathead Anthias *(Serranocirrhitus latus)*											
Copperband Butterfly *(Chelmon rostratus)*											
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*											
Cleaner Wrasse *(Cossyphus dimidiatus)*											
Dwarf Lionfish *(Dendrochirus zebra)*											
Lionfish *(Pterois volitans)*											
Emperor Angel *(Pomacanthus imperator*)											
Flame Angel *(Centropyge loricula*)											
Frogfish (*Antennariidae*)											
Horned Cowfish (*Lactoria cornuta*)											
Mandarin (*Synchiropus splendidus)*											
Moorish Idol *(Zanclus cornutus)*											
Niger Triggerfish *(Odonus niger)*											
Porcupine Puffer (*Diodon holocanthus*)											
Red Scorpion Fish *(Scorpaena scrofa*)	—	—	—	—	—	—	—	—	—	—	—

Spiny Boxfish *(Chilomycycterus schoepfi)*											
Seahorse/ Common Seahorses (*Hippocampus kuda*)											
Strawberry Dottyback *(Pictichromis porphyreus)*											
Spotted Boxfish (Ostracion meleagris)											
Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*											
Tropical											
Species	**Popularity (1-9)** *1=Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/Specialist (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/ Advanced Care*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist; 9= Highly Specialist/ Advanced Care*							**Other**	
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**	**Care Required**	**Scale (1-9)**
Guppies *(Poecilia reticulata)*											
Neon Tetras *(Paracheirodon innesi)*											
Harlequin Rasbora (*Rasbora heteromorpha)*											
Marbled Angelfish *(Pterophyllum scalare)*											
Threadfin Rainbow *(Iriatherina werneri)*											
Boesman's Rainbow *(Melanotaenia boesemani)*											
Neon Dwarf Rainbow *(Melanotaenia praecox)*											
Dwarf Gouramis *(Colisa lalia)*											
Blue Gourami *(Trichogaster trichopterus)*											
Clown Loach *(Chromobotia macracanthus)*											

Silver Shark *(Balantiochellus melanopterus)*											
Tiger Barb*(Puntius tetrazona)*											
Glowlight Tetra *(Hemigrammus erythrozonus)*											
Scissortail Rasbora *(Rasbora trilineata)*											
Dalmatian Molly *(Poecilia latipinn)*											
Black Molly *(Poecilia latipinn)*											
Cherry Barb *(Puntius titteya)*											
Red Bellied Piranha *(Pygocentrus nattereri)*											
Discus *(Symphysodon spp.)*											
Chocolate Gourami (Sphaerichthys osphromenoides)											
Ram Cichlid *(Mikrogeophagus ramirezi)*											
Kribensis Cichlids *(Pelvicachromis pulcher)*											
Green Spotted Puffer *(Tetraodon nigroviridis)*											
Bleeding Heart *(Hyphessobrycon erythrostigma)*											
Congo Tetra *(Phenacogrammus interruptus)*											
Emperor Tetra *(Nematobrycon palmeri)*											
Tanganyika Cichlid *(Tropheus duboisi)*											
Elephant Nose *(Gnathonemus petersii)*											
Oscar *(Astronotus ocellatus)*											
Nile Puffer *(Tetraodon lineatus)*											
Goldy Pleco (Scobinancistrus aureatus)											
Silver Arowana *(Osteoglossum bicirrhosum)*											
African Butterfly Fish *(Pantodon buchholzi)*											
Black Toraja Goby *(Mugilogobius*											

sarasinorum)											
Malawi Eye Biter *(Dimidiochromis compressiceps)*											
Red Line Torpedo Barb *(Puntius denisoni)*											
Leopard Corydoras *(Corydoras trilineatus)*											

APPENDIX 2: EXAMPLE OF THE STATISTICAL PROCESS USED TO CHOOSE APPROPRIATE SPECIES

The species needed to be ranked appropriately in relation to popularity, and degree specialisation (Appendix 2.1). The ranking process needed to take into account the variability in perception of the score to assign, the impact of the small sample size and low response rate of participants that filled in the questionnaire. To do this a coding method was used that is explained through the example scenario that follows.

It's easiest to explain the coding by the example that follows, using three fictional person(s) (X,Y,Z) to score 5 species of fish (A,B,C,D,E) as shown in Table X

Table 5.1: Fictional person(s) ranking of 5 species popularity

Ornamental Fish Species	**Scorer X**	**Scorer Y**	**Scorer Z**	**Average**
Species A	1	1	9	3.67
Species B	1	1	8	3.33
Species C	1	2	7	3.33
Species D	2	2	6	3.33
Species E	2	2	1	1.67

In this instance, the scores of Scorer Z are able to sway the average unduly. Species A is ranked lowest by Scorers X and Y, and Species E is ranked highest. Yet, Z's choice wins out with steering the average to their choice of highest and lowest rank. The situation gets worse if a species is unscored. For example, if scorer X had missed ranking Species B, it would have ranked top with an average of 4.5 (average of scores 1 and 8).

As the scoring is subjective, it would be incorrect to assume that any scorer's score is greater than any other scorer's similar or even lower score and a missing score shouldn't lose the weighting effect of the scorer that did not score it.

To resolve any missing values, the distribution of the scores needs to be converted into values that are comparable: a weighted percentage seems appropriate and to do this the values are represented as their ranks, weighted according to the size of that rank and transformed to a percent (Table 5.2).

Table 5.2: The coding process for person Z demonstrates the basics of this coding process.

		PERSON Z	
	Transformation 1: Ranking	Percentage	Midpoint of percentage
Species A	9 -> 4-5	4-5 = 80-100%	4-5 = 90%
Species B	8 -> 3-4	3-4 = 60-80%	3-4 = 70%
Species C	7-> 2-3	2-3 = 40-60%	2-3 = 50%
Species D	6 -> 1-2	1-2 = 20-40%	1-2 = 30%

Species E	1 -> 0-1	0-1 = 0 - 20%	0-1 = 10%

For Scorers X and Y the repeated values of 1 and 2 mean that a score may share multiple ranks. The midpoint is important (Table 5.3).

Table 5.3: Ranks for person(s) X and Y

Rank	Person X	Person Y
1	1	1
2	1	1
3	1	2
4	2	2
5	2	2

For Scorer X, the 2 scores cover a broad range of the percentage bounds (0-100%). In example: 1,1,1 bounds scores 0-3 : 0-60%., 2,2 bounds scores 3-5 : 60-100%. The midpoints are then used as a single later for the comparison e.g.1 becomes 30% (midway between 0-60), 2 becomes 80% (midway between 60-100)(Table 5.4). This can contrast with Scorer Y that had 1,1 bounds scores 0-2: 0-40% with a midpoint of 20%, and 2,2,2 bounds scores 2-5: 40-100% with a midpoint of 70%

Table 5.4: Midpoints score for species fiven by specific scorers

	Scorer X	Scorer Y	Scorer Z	Average:
Fish A	30%	20%	90%	46.7%

Fish B	30%	20%	70%	40%
Fish C	30%	70%	50%	50%
Fish D	80%	70%	30%	60%
Fish E	80%	70%	10%	53.33%

The data collated now makes more sense through being able to reflect that 2 scorers rating species A and B to be more popular and D and E to be less popular. Scorer Z's effect is alo evident, choosing the preference where X and Y agree (for Fishes A, B, D, E). In the results the approach has the same effect, but converted the values into percentages ranges that can be compared and then found the midpoint (Table 5.5).

This was done for each column by:

1) Count the number of each score

2) Convert to a cumulative rank

3) Convert to a percentage high point

4) Take the mid-point of these points using a low point of the last score (or 0 in the case of the first score)

5) Use these numbers to recreate the tables with the transformed values (Transformed A-E) instead of the scores

6) These midpoints can then be averaged for each Species

7) Correlation the average shows that the strength of the data (even after transformed) is still a little weak per person, but strong when combined.

Table 5.5: An example of the percentage conversion in practice

Cumulative Percentages: The top points	The Range is created	Ranges can't be used, so midpoints evaluated
1: 9.09%	1: 0 - 9.09%	1: 0 - 9.09%: becomes 4.55%
2 34.09%	2 9.09% - 34.09%	2 9.09% - 34.09%:becomes 21.59%
3:40.91%	3:34.09% - 40.91%	3:34.09% - 40.91%: becomes 37.5%
4: 50%	4: 40.91 - 50%	4: 40.91 - 50%: becomes 45.45%
5: 65.91%	5: 50 - 65.91%	5: 50 - 65.91%: becomes 57.95%
6: 72.73%	6: 65.91% - 72.73%	6: 65.91% - 72.73%: becomes 69.32%
7: 86.36%	7: 72.83 - 86.36%	7: 72.83 - 86.36%: becomes: 79.55%
8: 97.73%	8: 86.36 - 97.73%	8: 86.36 - 97.73%: becomes 92.05%
9: 100%	9: 97.73 - 100%	9: 97.73 - 100%: becomes 98.86%

Transformed A-E: Now there is a coded value for each column from the scores. These values can be compared together as they have the same scale (percentages), distribution (0-100%) and have been drawn from ranks instead of directly from the likely biased scores.

APPENDIX 3: ORNAMENTAL FISH SPECIES RATINGS BY RETAIL STAFF IN UK STORES

3.1: RESULTS OF THE MARINE SPECIES THAT WERE RATED

Species	**Popularity (% position)**	**Specialist (% position)**	**Cost (% position)**
Common Clown *(Amphiprion ocellaris)*	10.68	14.09	24
Green Chromis *(Chromis viridis)*	14.09	19.77	10
Bangaii Cardinal Fish *(Pterapogon kauderni)*	20.23	22.27	15
Regal Tang *(Paracanthurus hepatus)*	20.91	62.27	34
Firefish *(Nemateleotris magnifica)*	24.09	33.86	23
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	25.91	22.95	15
Flame Angel *(Centropyge loricula)*	31.14	40.91	79.88
Flame Hawkfish *(Neocirrhitus armatus)*	35.91	26.82	43.25
Longnose Hawkfish *(Oxycirrhites typus)*	35.91	36.59	31.5
Royal Gramma *(Gramma loreto)*	36.59	22.95	27
Yellow Wrasse *(Halichoeres chrysus)*	36.82	26.59	15
Scooter Blenny *(Synchiropus ocellatus)*	37.50	52.27	15
Powder Blue Tang *(Acanthurus leucosternon)*	38.18	63.86	44.99
Emperor Angel *(Pomacanthus imperator)*	38.18	61.82	65.55
Copperband Butterfly *(Chelmon rostratus)*	39.77	74.09	22
Dwarf Lionfish *(Dendrochirus zebra)*	40.00	36.82	25
Bicolour Blenny *(Ecsenius bicolor)*	40.45	39.32	19.5
Watchmans Gobies *(Amblyeleotris randelli)*	42.27	38.41	15
Mandarin *(Synchiropus splendidus)*	43.41	78.18	26
Green Wrasse *(Halichoeres chloropterus)*	43.64	32.73	14.99
False Gramma *(Pictichromis paccagnellae)*	43.64	21.36	16.5
Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*	45.23	30.45	23
Blue Reef Chromis *(Chromis cyanea)*	47.05	27.50	13.5
Lionfish *(Pterois volitans)*	47.50	39.09	30
Blue Damsel *(Chrysiptera cyanea)*	47.50	33.86	6.3
Spotted Mandarin *(Synchiropus picturatus)*	48.18	68.41	22
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*	48.41	71.59	45

Cleaner Wrasse *(Cossyphus dimidiatus)*	48.41	47.27	14
Purple Firefish *(Nemateleotris decora)*	49.32	48.64	26
Bartletts Anthias *(Pseudoanthias pleurotaenia)*	55.00	58.64	15
Strawberry Dottyback *(Pictichromis porphyreus)*	57.50	55.91	15
Domino Damsel *(Dascyllus trimaculatus)*	61.59	22.27	7.99
Scissortail Dartfish *(Ptereleotris evides)*	64.55	59.32	15
Fathead Anthias *(Serranocirrhitus latus)*	65.45	50.91	30
Porcupine Puffer *(Diodon holocanthus)*	66.82	48.18	38.5
Seahorse/ Common Seahorses *(Hippocampus kuda)*	72.73	84.09	60
Niger Triggerfish *(Odonus niger)*	73.18	59.55	35
Frogfish *(Antennariidae spp.)*	75.68	56.82	59
Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*	80.68	84.55	30
Spotted Boxfish *(Ostracion meleagris)*	83.64	88.64	30
Spiny Boxfish *(Chilomycycterus schoepfi)*	88.64	82.73	30
Horned Cowfish *(Lactoria cornuta)*	88.64	84.77	24.99
Red Scorpion Fish *(Scorpaena scrofa)*	90.45	72.50	
Moorish Idol *(Zanclus cornutus)*	94.55	96.36	66.5

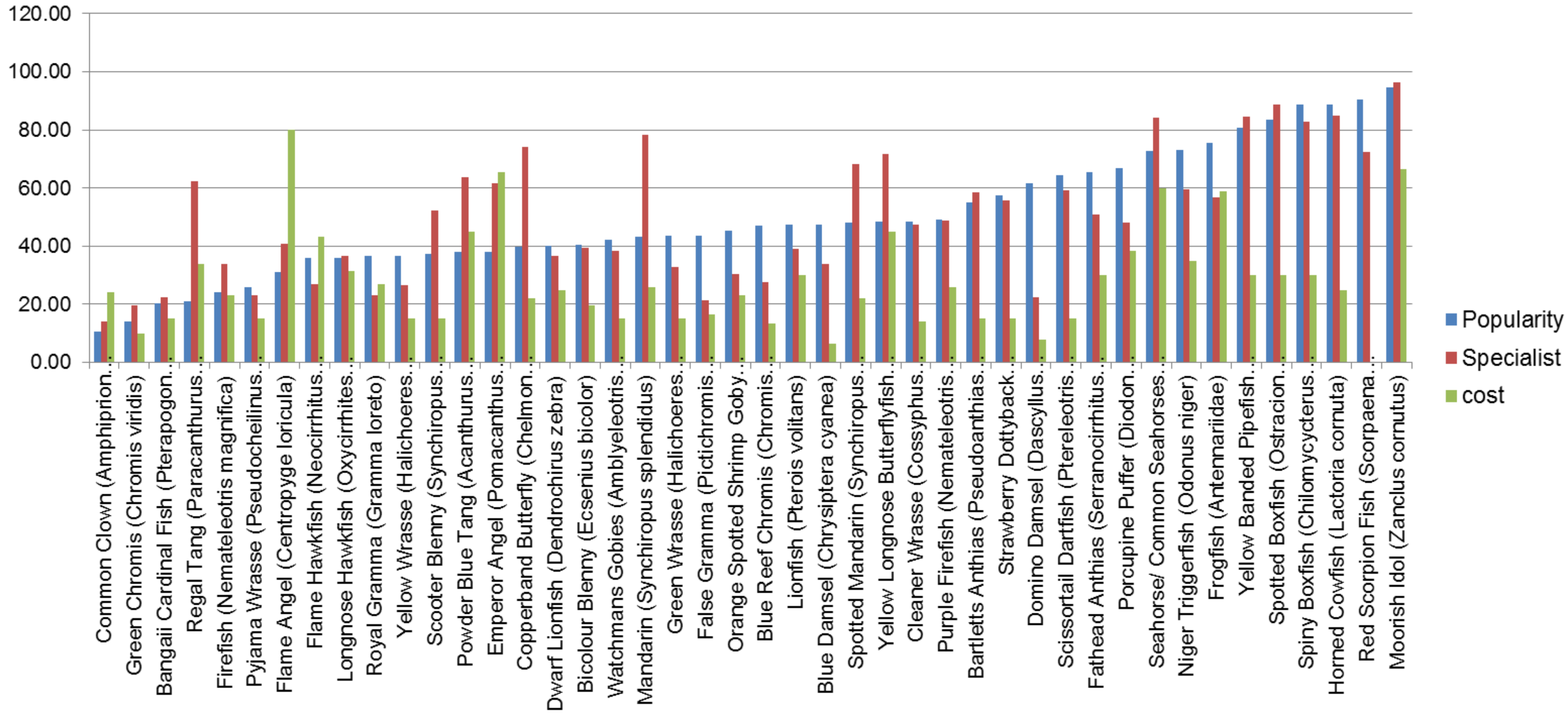
3.2: RESULTS OF THE TROPICAL SPECIES THAT WERE RATED

Species	**Popularity**	**Speciality**	**Cost**
Guppies *(Poecilia reticulata)*	16.89	48.59	2.85
Neon Tetras *(Paracheirodon innesi)*	16.89	23.17	1.25
Dwarf Gouramis *(Colisa lalia)*	21.22	62.32	3.50
Silver Sharks *(Balantiochellus melanopterus)*	21.22	51.66	2.99
Dalmatian Molly *(Poecilia latipinn)*	21.22	36.62	2.05
Black Molly *(Poecilia latipinn)*	21.22	42.02	2.05
Cherry Barb *(Puntius titteya)*	21.22	18.68	2.00
Glowlight Tetra *(Hemigrammus erythrozonus)*	21.22	14.79	1.65
Tiger Barbs *(Puntius tetrazona)*	21.22	25.97	1.49
Clown Loach *(Chromobotia macracanthus)*	25.81	55.99	5.99
Harlequin Rasbora *(Rasbora heteromorpha)*	26.35	23.93	1.29
Neon Dwarf Rainbow *(Melanotaenia praecox)*	26.89	31.38	4.99
Boesman's Rainbow *(Melanotaenia*	29.05	36.52	5.99

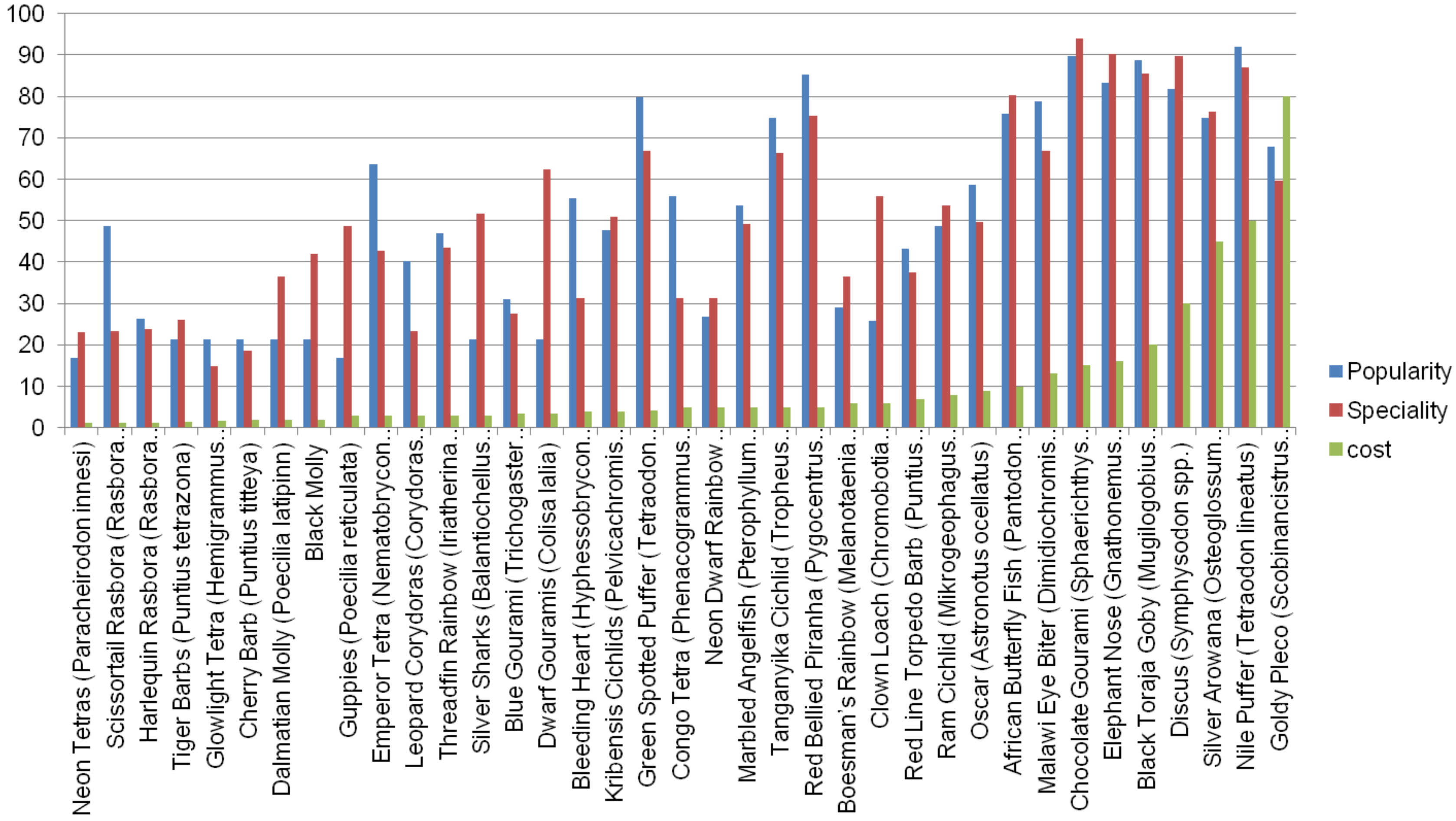
boesemani)			
Blue Gourami *(Trichogaster trichopterus)*	30.95	27.47	3.50
Leopard Corydoras *(Corydoras trilineatus)*	40.14	23.44	2.99
Threadfin Rainbow *(Iriatherina werneri)*	46.82	43.49	2.99
Kribensis Cichlids *(Pelvicachromis pulcher)*	47.70	50.82	3.99
Ram Cichlid *(Mikrogeophagus ramirezi)*	48.78	53.77	7.99
Scissortail Rasbora *(Rasbora trilineata)*	48.78	23.44	1.25
Marbled Angelfish *(Pterophyllum scalare)*	53.58	49.22	4.99
Bleeding Heart *(Hyphessobrycon erythrostigma)*	55.47	31.38	3.99
Congo Tetra *(Phenacogrammus interruptus)*	56.01	31.38	4.99
Oscar *(Astronotus ocellatus)*	58.52	49.76	8.99
Emperor Tetra *(Nematobrycon palmeri)*	63.58	42.62	2.89
Goldy Pleco *(Scobinancistrus aureatus)*	67.85	59.64	80.00
Silver Arowana *(Osteoglossum bicirrhosum)*	74.74	76.35	44.99
Tanganyika Cichlid *(Tropheus duboisi)*	74.74	66.37	4.99
African Butterfly Fish *(Pantodon buchholzi)*	75.89	80.18	9.99
Malawi Eye Biter *(Dimidiochromis compressiceps)*	78.79	66.94	13.00
Green Spotted Puffer *(Tetraodon nigroviridis)*	79.87	66.91	4.25
Discus *(Symphysodon spp.)*	81.76	89.81	29.99
Elephant Nose *(Gnathonemus petersii)*	83.19	90.26	16.00
Red Bellied Piranha *(Pygocentrus nattereri)*	85.35	75.29	4.99
Black Toraja Goby *(Mugilogobius sarasinorum)*	88.64	85.42	20.00
Chocolate Gourami *(Sphaerichthys osphromenoides)*	89.65	93.91	15.00
Nile Puffer *(Tetraodon lineatus)*	91.87	86.86	50.00

APPENDIX 4: ORNAMENTAL FISH SPECIES POPULARITY, COST AND SPECIALISATION RATINGS

4.1: MARINE ORNAMENAL FISH SPECIES POPULARITY, COST AND DEGREE OF SPECIALISATION



4.2: TROPICAL ORNAMENTAL FISH SPECIES POPULARITY, COST AND DEGREE OF SPECIALISATION



APPENDIX 5: PROCESS OF ANALYSING ORNAMENTAL FISH SPECIES POPULARITY AND SPECIALISATION

Marine Total Counts for Each Score: Analysed for Respondent A, B, C, D, E										
Respondent	**Score (1-9)**	**Popularity**	**Generalist /Specialist**	**Feeding**	**Size**	**Health**	**Habitat**	**Social Behaviour**	**Predation**	**Water**
A	1	4	0	0	0	0	0	0	1	0
	2	11	11	6	4	5	8	6	13	6
	3	3	6	8	12	10	7	11	7	13
	4	4	4	10	9	6	5	10	4	5
	5	7	4	2	4	9	8	9	4	6
	6	3	6	5	4	7	7	5	6	8
	7	6	10	2	6	6	2	3	5	4
	8	5	2	6	4	0	5	0	4	1
	9	1	1	5	1	1	2	0	0	0

Total A		***44***	***44***	***44***	***44***	***44***	***44***	***44***	***44***	***43***
B		B	C	D	E	F	G	H	I	J
	1	23	21	28	33	32	41	37	41	39
	2	0	0	0	0	0	0	0	0	0
	3	5	13	4	4	3	2	5	0	1
	4	0	0	0	2	0	0	1	0	0
	5	7	5	8	3	7	0	0	0	3
	6	0	0	0	0	0	0	0	0	0
	7	1	1	2	0	0	0	0	2	0
	8	0	0	0	0	0	0	0	0	0
	9	8	4	1	0	1	0	0	0	0
Total B		***44***	***44***	***43***	***42***	***43***	***43***	***43***	***43***	***43***
C		B	C	D	E	F	G	H	I	J
	1	0	1	0	0	0	0	6	0	0

	2	6	4	22	25	21	22	15	25	4
	3	6	15	10	9	13	13	10	9	33
	4	12	12	5	4	4	3	7	2	6
	5	3	4	1	5	6	0	1	1	1
	6	4	6	5	1	0	4	4	6	0
	7	4	1	0	0	0	1	1	0	0
	8	7	0	1	0	0	0	0	1	0
	9	2	1	0	0	0	1	0	0	0
Total C		***44***	***44***	***44***	***44***	***44***	***44***	***44***	***44***	***44***
D		B	C	D	E	F	G	H	I	J
	1	9	2	3	5	1	3	7	4	1
	2	13	21	20	19	24	24	14	18	24
	3	2	4	10	6	7	9	7	8	6
	4	5	1	1	2	1	1	5	4	4

	5	2	4	0	0	2	0	1	1	0
	6	1	2	2	1	2	0	0	2	2
	7	1	0	0	2	0	0	2	0	0
	8	3	3	1	2	0	0	1	0	0
	9	8	7	5	7	7	7	7	7	7
Total D		***44***	***44***	***42***	***44***	***44***	***44***	***44***	***44***	***44***
E		B	C	D	E	F	G	H	I	J
	1	5	5	7	0	0	0	0	23	0
	2	10	2	5	0	1	1	2	12	1
	3	9	5	13	1	0	0	14	0	0
	4	5	11	6	0	0	0	7	2	0
	5	4	8	1	0	0	0	5	1	0
	6	1	2	1	0	0	0	0	1	0
	7	3	5	5	0	0	0	3	4	0

	8	2	3	3	0	0	0	1	1	0
	9	5	3	3	0	0	0	4	0	0
Total E		***44***	***44***	***44***	***1***	***1***	***1***	***36***	***44***	***1***

Marine Ornamental Fish Score Usage for Each Respondent (Percentage of Frequency Over Total Count of Score)										
Respondents	**Scores (1-9)**	**Popularity**	**Generalist/ Specialist**	**Feeding**	**Size**	**Health**	**Habitat**	**Social Behaviour**	**Predation**	**Water**
A	1	9.09	0.00	0.00	0.00	0.00	0.00	0.00	2.27	0.00
	2	25.00	25.00	13.64	9.09	11.36	18.18	13.64	29.55	13.95
	3	6.82	13.64	18.18	27.27	22.73	15.91	25.00	15.91	30.23
	4	9.09	9.09	22.73	20.45	13.64	11.36	22.73	9.09	11.63
	5	15.91	9.09	4.55	9.09	20.45	18.18	20.45	9.09	13.95
	6	6.82	13.64	11.36	9.09	15.91	15.91	11.36	13.64	18.60
	7	13.64	22.73	4.55	13.64	13.64	4.55	6.82	11.36	9.30
	8	11.36	4.55	13.64	9.09	0.00	11.36	0.00	9.09	2.33
	9	2.27	2.27	11.36	2.27	2.27	4.55	0.00	0.00	0.00
Total A		***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***

(Percentage)										
B	1	52.27	47.73	65.12	78.57	74.42	95.35	86.05	95.35	90.70
	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	11.36	29.55	9.30	9.52	6.98	4.65	11.63	0.00	2.33
	4	0.00	0.00	0.00	4.76	0.00	0.00	2.33	0.00	0.00
	5	15.91	11.36	18.60	7.14	16.28	0.00	0.00	0.00	6.98
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7	2.27	2.27	4.65	0.00	0.00	0.00	0.00	4.65	0.00
	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	9	18.18	9.09	2.33	0.00	2.33	0.00	0.00	0.00	0.00
Total B (Percentage)		***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***
C	1	0.00	2.27	0.00	0.00	0.00	0.00	13.64	0.00	0.00
	2	13.64	9.09	50.00	56.82	47.73	50.00	34.09	56.82	9.09

	3	13.64	34.09	22.73	20.45	29.55	29.55	22.73	20.45	75.00
	4	27.27	27.27	11.36	9.09	9.09	6.82	15.91	4.55	13.64
	5	6.82	9.09	2.27	11.36	13.64	0.00	2.27	2.27	2.27
	6	9.09	13.64	11.36	2.27	0.00	9.09	9.09	13.64	0.00
	7	9.09	2.27	0.00	0.00	0.00	2.27	2.27	0.00	0.00
	8	15.91	0.00	2.27	0.00	0.00	0.00	0.00	2.27	0.00
	9	4.55	2.27	0.00	0.00	0.00	2.27	0.00	0.00	0.00
Total C (Percentage)		***100***	***1000***	***100***	***100***	***100***	***100***	***100***	***100***	***100***
D	1	20.45	4.55	7.14	11.36	2.27	6.82	15.91	9.09	2.27
	2	29.55	47.73	47.62	43.18	54.55	54.55	31.82	40.91	54.55
	3	4.55	9.09	23.81	13.64	15.91	20.45	15.91	18.18	13.64
	4	11.36	2.27	2.38	4.55	2.27	2.27	11.36	9.09	9.09
	5	4.55	9.09	0.00	0.00	4.55	0.00	2.27	2.27	0.00

	6	2.27	4.55	4.76	2.27	4.55	0.00	0.00	4.55	4.55
	7	2.27	0.00	0.00	4.55	0.00	0.00	4.55	0.00	0.00
	8	6.82	6.82	2.38	4.55	0.00	0.00	2.27	0.00	0.00
	9	18.18	15.91	11.90	15.91	15.91	15.91	15.91	15.91	15.91
Total D (Percentage)		***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***
E	1	11.36	11.36	15.91	0.00	0.00	0.00	0.00	52.27	0.00
	2	22.73	4.55	11.36	0.00	100.00	100.00	5.56	27.27	100.00
	3	20.45	11.36	29.55	100.00	0.00	0.00	38.89	0.00	0.00
	4	11.36	25.00	13.64	0.00	0.00	0.00	19.44	4.55	0.00
	5	9.09	18.18	2.27	0.00	0.00	0.00	13.89	2.27	0.00
	6	2.27	4.55	2.27	0.00	0.00	0.00	0.00	2.27	0.00
	7	6.82	11.36	11.36	0.00	0.00	0.00	8.33	9.09	0.00
	8	4.55	6.82	6.82	0.00	0.00	0.00	2.78	2.27	0.00

	9	11.36	6.82	6.82	0.00	0.00	0.00	11.11	0.00	0.00
Total E (Percentage)		***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***	***100***

Cumulative Marine Ornamental Fish Score Usage of Each Respondent (Percentage of Frequency Over Total Count of Score)										
Respondents	**Scores**	**Popularity**	**Generalist/ Specialist**	**Feeding**	**Size**	**Health**	**Habitat**	**Social Behaviour**	**Predation**	**Water**
A	1	9.09	0.00	0.00	0.00	0.00	0.00	0.00	2.27	0.00
	2	34.09	25.00	13.64	9.09	11.36	18.18	13.64	31.82	13.95
	3	40.91	38.64	31.82	36.36	34.09	34.09	38.64	47.73	44.19
	4	50.00	47.73	54.55	56.82	47.73	45.45	61.36	56.82	55.81
	5	65.91	56.82	59.09	65.91	68.18	63.64	81.82	65.91	69.77
	6	72.73	70.45	70.45	75.00	84.09	79.55	93.18	79.55	88.37
	7	86.36	93.18	75.00	88.64	97.73	84.09	100.00	90.91	97.67
	8	97.73	97.73	88.64	97.73	97.73	95.45	100.00	100.00	100.00
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
B	1	52.27	47.73	65.12	78.57	74.42	95.35	86.05	95.35	90.70
	2	52.27	47.73	65.12	78.57	74.42	95.35	86.05	95.35	90.70

	3	63.64	77.27	74.42	88.10	81.40	100.00	97.67	95.35	93.02
	4	63.64	77.27	74.42	92.86	81.40	100.00	100.00	95.35	93.02
	5	79.55	88.64	93.02	100.00	97.67	100.00	100.00	95.35	100.00
	6	79.55	88.64	93.02	100.00	97.67	100.00	100.00	95.35	100.00
	7	81.82	90.91	97.67	100.00	97.67	100.00	100.00	100.00	100.00
	8	81.82	90.91	97.67	100.00	97.67	100.00	100.00	100.00	100.00
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
C	1	0.00	2.27	0.00	0.00	0.00	0.00	13.64	0.00	0.00
	2	13.64	11.36	50.00	56.82	47.73	50.00	47.73	56.82	9.09
	3	27.27	45.45	72.73	77.27	77.27	79.55	70.45	77.27	84.09
	4	54.55	72.73	84.09	86.36	86.36	86.36	86.36	81.82	97.73
	5	61.36	81.82	86.36	97.73	100.00	86.36	88.64	84.09	100.00
	6	70.45	95.45	97.73	100.00	100.00	95.45	97.73	97.73	100.00
	7	79.55	97.73	97.73	100.00	100.00	97.73	100.00	97.73	100.00

	8	95.45	97.73	100.00	100.00	100.00	97.73	100.00	100.00	100.00
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
D	1	20.45	4.55	7.14	11.36	2.27	6.82	15.91	9.09	2.27
	2	50.00	52.27	54.76	54.55	56.82	61.36	47.73	50.00	56.82
	3	54.55	61.36	78.57	68.18	72.73	81.82	63.64	68.18	70.45
	4	65.91	63.64	80.95	72.73	75.00	84.09	75.00	77.27	79.55
	5	70.45	72.73	80.95	72.73	79.55	84.09	77.27	79.55	79.55
	6	72.73	77.27	85.71	75.00	84.09	84.09	77.27	84.09	84.09
	7	75.00	77.27	85.71	79.55	84.09	84.09	81.82	84.09	84.09
	8	81.82	84.09	88.10	84.09	84.09	84.09	84.09	84.09	84.09
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
E	1	11.36	11.36	15.91	0.00	0.00	0.00	0.00	52.27	0.00
	2	34.09	15.91	27.27	0.00	100.00	100.00	5.56	79.55	100.00
	3	54.55	27.27	56.82	100.00	100.00	100.00	44.44	79.55	100.00

	4	65.91	52.27	70.45	100.00	100.00	100.00	63.89	84.09	100.00
	5	75.00	70.45	72.73	100.00	100.00	100.00	77.78	86.36	100.00
	6	77.27	75.00	75.00	100.00	100.00	100.00	77.78	88.64	100.00
	7	84.09	86.36	86.36	100.00	100.00	100.00	86.11	97.73	100.00
	8	88.64	93.18	93.18	100.00	100.00	100.00	88.89	100.00	100.00
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Midpoints of Cumulative Marine Ornamental Fish Score Usage for Each Respondent (Percentage of Frequency Over Total Count of Score)										
Respondent	**Score**	**Popularity**	**Generalist/ Specialist**	**Feeding**	**Size**	**Health**	**Habitat**	**Social Behaviour**	**Predation**	**Water**
A	1	4.55	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.00
	2	21.59	12.50	6.82	4.55	5.68	9.09	6.82	17.05	6.98
	3	37.50	31.82	22.73	22.73	22.73	26.14	26.14	39.77	29.07
	4	45.45	43.18	43.18	46.59	40.91	39.77	50.00	52.27	50.00
	5	57.95	52.27	56.82	61.36	57.95	54.55	71.59	61.36	62.79
	6	69.32	63.64	64.77	70.45	76.14	71.59	87.50	72.73	79.07
	7	79.55	81.82	72.73	81.82	90.91	81.82	96.59	85.23	93.02
	8	92.05	95.45	81.82	93.18	97.73	89.77	100.00	95.45	98.84
	9	98.86	98.86	94.32	98.86	98.86	97.73	100.00	100.00	100.00
B	1	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35

	2	52.27	47.73	65.12	78.57	74.42	95.35	86.05	95.35	90.70
	3	57.95	62.50	69.77	83.33	77.91	97.67	91.86	95.35	91.86
	4	63.64	77.27	74.42	90.48	81.40	100.00	98.84	95.35	93.02
	5	71.59	82.95	83.72	96.43	89.53	100.00	100.00	95.35	96.51
	6	79.55	88.64	93.02	100.00	97.67	100.00	100.00	95.35	100.00
	7	80.68	89.77	95.35	100.00	97.67	100.00	100.00	97.67	100.00
	8	81.82	90.91	97.67	100.00	97.67	100.00	100.00	100.00	100.00
	9	90.91	95.45	98.84	100.00	98.84	100.00	100.00	100.00	100.00
C	1	0.00	1.14	0.00	0.00	0.00	0.00	6.82	0.00	0.00
	2	6.82	6.82	25.00	28.41	23.86	25.00	30.68	28.41	4.55
	3	20.45	28.41	61.36	67.05	62.50	64.77	59.09	67.05	46.59
	4	40.91	59.09	78.41	81.82	81.82	82.95	78.41	79.55	90.91
	5	57.95	77.27	85.23	92.05	93.18	86.36	87.50	82.95	98.86
	6	65.91	88.64	92.05	98.86	100.00	90.91	93.18	90.91	100.00

	7	75.00	96.59	97.73	100.00	100.00	96.59	98.86	97.73	100.00
	8	87.50	97.73	98.86	100.00	100.00	97.73	100.00	98.86	100.00
	9	97.73	98.86	100.00	100.00	100.00	98.86	100.00	100.00	100.00
D	1	10.23	2.27	3.57	5.68	1.14	3.41	7.95	4.55	1.14
	2	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
	3	52.27	56.82	66.67	61.36	64.77	71.59	55.68	59.09	63.64
	4	60.23	62.50	79.76	70.45	73.86	82.95	69.32	72.73	75.00
	5	68.18	68.18	80.95	72.73	77.27	84.09	76.14	78.41	79.55
	6	71.59	75.00	83.33	73.86	81.82	84.09	77.27	81.82	81.82
	7	73.86	77.27	85.71	77.27	84.09	84.09	79.55	84.09	84.09
	8	78.41	80.68	86.90	81.82	84.09	84.09	82.95	84.09	84.09
	9	90.91	92.05	94.05	92.05	92.05	92.05	92.05	92.05	92.05
E	1	5.68	5.68	7.95	0.00	0.00	0.00	0.00	26.14	0.00
	2	22.73	13.64	21.59	0.00	50.00	50.00	2.78	65.91	50.00

	3	44.32	21.59	42.05	50.00	100.00	100.00	25.00	79.55	100.00
	4	60.23	39.77	63.64	100.00	100.00	100.00	54.17	81.82	100.00
	5	70.45	61.36	71.59	100.00	100.00	100.00	70.83	85.23	100.00
	6	76.14	72.73	73.86	100.00	100.00	100.00	77.78	87.50	100.00
	7	80.68	80.68	80.68	100.00	100.00	100.00	81.94	93.18	100.00
	8	86.36	89.77	89.77	100.00	100.00	100.00	87.50	98.86	100.00
	9	94.32	96.59	96.59	100.00	100.00	100.00	94.44	100.00	100.00

Transformed Scores for Respondant A: Marine									
Species	**Popularity (1-9)** *(1=Likely Always to be in Stock, 9 = Rarely in Stock)*	**Advanced/ specialist requirements (1-9)** *(1=Hardy/ Generalist, 9= Highly Specialist/ Advanced Care)*	**Generalist/ Advanced/Specialist requirements (1-9)**						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Common Clown *(Amphiprion ocellaris)*	4.55	31.82	6.82	4.55	5.68	26.14	71.59	52.27	29.07
Blue Reef Chromis *(Chromis cyanea)*	21.59	12.50	6.82	4.55	5.68	26.14	6.82	39.77	6.98
Green Chromis *(*Chromis viridis)	4.55	12.50	6.82	4.55	5.68	26.14	6.82	17.05	6.98
Blue Damsel *(Chrysiptera cyanea)*	21.59	12.50	6.82	4.55	5.68	9.09	6.82	61.36	29.07
Domino Damsel *(Dascyllus trimaculatus)*	45.45	12.50	6.82	46.59	5.68	9.09	50.00	72.73	100.00
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	4.55	12.50	43.18	22.73	22.73	9.09	26.14	39.77	29.07
Yellow Wrasse *(Halichoeres chrysus)*	21.59	12.50	43.18	22.73	22.73	9.09	26.14	39.77	29.07
Green Wrasse *(Halichoeres chloropterus)*	21.59	12.50	43.18	22.73	22.73	9.09	26.14	39.77	29.07
Royal Gramma *(Gramma loreto)*	21.59	12.50	22.73	22.73	22.73	9.09	26.14	52.27	29.07
False Gramma *(Pictichromis paccagnellae)*	92.05	12.50	22.73	22.73	22.73	9.09	96.59	95.45	29.07
Bangaii Cardinal Fish *(Pterapogon kauderni)*	21.59	43.18	43.18	22.73	40.91	9.09	26.14	17.05	6.98
Purple Firefish *(Nemateleotris decora)*	79.55	31.82	43.18	22.73	40.91	39.77	50.00	17.05	62.79

Firefish *(Nemateleotris magnifica)*	21.59	31.82	43.18	22.73	40.91	39.77	50.00	17.05	29.07
Flame Hawkfish *(Neocirrhitus armatus)*	21.59	31.82	22.73	46.59	22.73	39.77	50.00	61.36	29.07
Longnose Hawkfish *(Oxycirrhites typus)*	21.59	31.82	22.73	61.36	22.73	26.14	26.14	61.36	29.07
Scooter Blenny *(Synchiropus ocellatus)*	57.95	52.27	72.73	46.59	76.14	89.77	71.59	17.05	79.07
Bicolour Blenny *(Ecsenius bicolor)*	21.59	12.50	6.82	22.73	22.73	26.14	26.14	17.05	6.98
Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*	37.50	31.82	43.18	46.59	22.73	26.14	50.00	39.77	6.98
Watchmans Gobies *(Amblyeleotris randelli)*	4.55	12.50	22.73	46.59	22.73	26.14	26.14	17.05	6.98
Scissortail Dartfish *(Ptereleotris evides)*	69.32	43.18	43.18	22.73	40.91	39.77	50.00	52.27	29.07
Spotted Mandarin *(Synchiropus picturatus)*	57.95	81.82	94.32	22.73	57.95	89.77	50.00	17.05	79.07
Powder Blue Tang *(Acanthurus leucosternon)*	37.50	63.64	64.77	70.45	90.91	71.59	71.59	72.73	62.79
Regal Tang *(Paracanthurus hepatus)*	21.59	52.27	64.77	81.82	76.14	71.59	71.59	85.23	62.79
Bartletts Anthias (*Pseudoanthias pleurotaenia*)	79.55	81.82	81.82	46.59	57.95	81.82	6.82	17.05	50.00
Fathead Anthias *(Serranocirrhitus latus)*	79.55	81.82	81.82	46.59	57.95	81.82	6.82	17.05	50.00
Copperband Butterfly *(Chelmon rostratus)*	45.45	52.27	81.82	70.45	57.95	54.55	50.00	39.77	62.79
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*	79.55	63.64	94.32	81.82	90.91	71.59	71.59	39.77	79.07
Cleaner Wrasse *(Cossyphus dimidiatus)*	92.05	63.64	94.32	46.59	90.91	97.73	71.59	17.05	62.79
Dwarf Lionfish *(Dendrochirus zebra)*	37.50	52.27	22.73	61.36	57.95	54.55	26.14	85.23	50.00
Lionfish *(Pterois volitans)*	57.95	63.64	22.73	98.86	57.95	54.55	26.14	95.45	29.07
Emperor Angel *(Pomacanthus imperator)*	57.95	81.82	56.82	81.82	90.91	71.59	87.50	61.36	79.07
Flame Angel *(Centropyge loricula)*	57.95	63.64	72.73	61.36	76.14	54.55	96.59	72.73	79.07
Frogfish *(Antennariidae)*	57.95	63.64	64.77	70.45	57.95	71.59	96.59	85.23	62.79
Horned Cowfish (*Lactoria cornuta*)	79.55	81.82	64.77	93.18	76.14	54.55	87.50	72.73	79.07
Mandarin (*Synchiropus splendidus)*	57.95	81.82	94.32	22.73	57.95	89.77	50.00	17.05	79.07
Moorish Idol *(Zanclus cornutus)*	98.86	98.86	94.32	81.82	98.86	97.73	50.00	52.27	98.84
Niger Triggerfish *(Odonus niger)*	45.45	43.18	43.18	81.82	40.91	54.55	71.59	72.73	50.00
Porcupine Puffer *(Diodon holocanthus)*	45.45	81.82	43.18	93.18	90.91	54.55	71.59	85.23	50.00
Red Scorpion Fish *(Scorpaena scrofa)*	92.05	81.82	56.82	93.18	76.14	71.59	87.50	95.45	29.07

Spiny Boxfish *(Chilomycycterus schoepfi)*	92.05	81.82	81.82	93.18	76.14	71.59	87.50	95.45	79.07
Seahorse/ Common Seahorses *(Hippocampus kuda)*	69.32	95.45	81.82	70.45	90.91	89.77	6.82	1.14	93.02
Strawberry Dottyback *(Pictichromis porphyreus)*	69.32	43.18	22.73	46.59	40.91	39.77	87.50	85.23	93.02
Spotted Boxfish (*Ostracion meleagris*)	79.55	81.82	64.77	81.82	57.95	54.55	71.59	72.73	93.02
Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*	92.05	95.45	81.82	61.36	76.14	89.77	26.14	17.05	93.02

Marine Transformed Scores for Respondant B										
Species	**Popularity (1-9)** *1= Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/ Specialist (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*							
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Common Clown *(Amphiprion ocellaris)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Blue Reef Chromis *(Chromis cyanea)*	71.59	62.50	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Green Chromis (Chromis viridis)	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Blue Damsel *(Chrysiptera cyanea)*	90.91	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Domino Damsel *(Dascyllus trimaculatus)*	90.91	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Yellow Wrasse *(Halichoeres chrysus)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Green Wrasse *(Halichoeres chloropterus)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Royal Gramma *(Gramma loreto)*	57.95	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
False Gramma *(Pictichromis paccagnellae)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Bangaii Cardinal Fish *(Pterapogon kauderni)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Purple Firefish *(Nemateleotris decora)*	26.14	62.50	32.56	39.29	77.91	97.67	91.86	47.67	45.35
Firefish *(Nemateleotris magnifica)*	26.14	62.50	32.56	39.29	77.91	97.67	91.86	47.67	45.35
Flame Hawkfish *(Neocirrhitus armatus)*	71.59	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35

Longnose Hawkfish *(Oxycirrhites typus)*	57.95	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Scooter Blenny *(Synchiropus ocellatus)*	26.14	62.50	69.77	39.29	77.91	47.67	43.02	47.67	91.86
Bicolour Blenny *(Ecsenius bicolor)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Watchmans Gobies *(Amblyeleotris randelli)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Scissortail Dartfish *(Ptereleotris evides)*	26.14	62.50	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Spotted Mandarin *(Synchiropus picturatus)*	26.14	62.50	83.72	39.29	89.53	47.67	43.02	47.67	45.35
Powder Blue Tang *(Acanthurus leucosternon)*	57.95	62.50	69.77	83.33	89.53	47.67	91.86	47.67	45.35
Regal Tang *(Paracanthurus hepatus)*	26.14	62.50	69.77	83.33	89.53	47.67	91.86	47.67	45.35
Bartletts Anthias (*Pseudoanthias pleurotaenia*)	71.59	62.50	69.77	83.33	89.53	47.67	91.86	47.67	45.35
Fathead Anthias *(Serranocirrhitus latus)*	80.68	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Copperband Butterfly *(Chelmon rostratus)*	26.14	82.95	83.72	39.29	89.53	47.67	43.02	47.67	96.51
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*	26.14	62.50	83.72	39.29	89.53	47.67	43.02	47.67	96.51
Cleaner Wrasse *(Cossyphus dimidiatus)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Dwarf Lionfish *(Dendrochirus zebra)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Lionfish *(Pterois volitans)*	26.14	23.86	32.56	90.48	37.21	47.67	43.02	47.67	45.35
Emperor Angel *(Pomacanthus imperator)*	26.14	62.50	32.56	90.48	37.21	47.67	98.84	47.67	45.35
Flame Angel *(Centropyge loricula)*	57.95	62.50	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Frogfish *(Antennariidae)*	90.91	82.95	95.35	39.29	37.21	47.67	43.02	97.67	45.35
Horned Cowfish (*Lactoria cornuta*)	90.91	82.95	95.35	96.43	37.21	47.67	43.02	97.67	45.35
Mandarin (*Synchiropus splendidus)*	57.95	82.95	83.72		37.21	47.67	43.02	47.67	45.35
Moorish Idol *(Zanclus cornutus)*	90.91	95.45	98.84	39.29	98.84	47.67	43.02	47.67	45.35
Niger Triggerfish *(Odonus niger)*	71.59	23.86	32.56	96.43	37.21	47.67	43.02	47.67	45.35
Porcupine Puffer *(Diodon holocanthus)*	71.59	62.50	32.56	96.43	37.21	47.67	43.02	47.67	45.35
Red Scorpion Fish *(Scorpaena scrofa)*	90.91	89.77	83.72	83.33	37.21	47.67	43.02	47.67	45.35
Spiny Boxfish *(Chilomycycterus schoepfi)*	90.91	95.45	83.72	39.29	37.21	47.67	43.02	47.67	45.35
Seahorse/ Common Seahorses *(Hippocampus kuda)*	71.59	95.45	83.72	39.29	89.53	47.67	43.02	47.67	96.51

Strawberry Dottyback *(Pictichromis porphyreus)*	26.14	23.86	32.56	39.29	37.21	47.67	43.02	47.67	45.35
Spotted Boxfish (*Ostracion meleagris*)	90.91	95.45	83.72	39.29	37.21	47.67	43.02	47.67	45.35
Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*	71.59	82.95							

Marine transformed scores of respondant C									
Species	**Popularity (1-9)** *1= Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/ Specialist (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/ Advanced Care*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Common Clown *(Amphiprion ocellaris)*	6.82	6.82	25.00	28.41	23.86	25.00	78.41	28.41	46.59
Blue Reef Chromis *(Chromis cyanea)*	87.50	28.41	25.00	28.41	23.86	25.00	6.82	28.41	46.59
Green Chromis (Chromis viridis)	6.82	28.41	25.00	28.41	23.86	25.00	6.82	28.41	46.59
Blue Damsel *(Chrysiptera cyanea)*	20.45	59.09	25.00	28.41	23.86	25.00	6.82	28.41	46.59
Domino Damsel *(Dascyllus trimaculatus)*	75.00	1.14	25.00	28.41	23.86	25.00	93.18	28.41	46.59
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	40.91	28.41	25.00	28.41	23.86	25.00	6.82	28.41	46.59
Yellow Wrasse *(Halichoeres chrysus)*	40.91	28.41	25.00	28.41	23.86	25.00	6.82	28.41	46.59
Green Wrasse *(Halichoeres chloropterus)*	75.00	59.09	25.00	28.41	23.86	25.00	6.82	28.41	46.59
Royal Gramma *(Gramma loreto)*	20.45	28.41	25.00	28.41	23.86	25.00	30.68	28.41	46.59
False Gramma *(Pictichromis paccagnellae)*	20.45	28.41	25.00	28.41	23.86	25.00	30.68	28.41	46.59
Bangaii Cardinal Fish *(Pterapogon kauderni)*	20.45	28.41	25.00	28.41	23.86	25.00	30.68	28.41	46.59
Purple Firefish *(Nemateleotris decora)*	57.95	59.09	61.36	28.41	62.50	25.00	30.68	28.41	46.59

Firefish *(Nemateleotris magnifica)*	6.82	6.82	61.36	28.41	23.86	25.00	30.68	28.41	46.59
Flame Hawkfish *(Neocirrhitus armatus)*	6.82	28.41	25.00	28.41	23.86	25.00	30.68	28.41	46.59
Longnose Hawkfish *(Oxycirrhites typus)*	20.45	59.09	25.00	28.41	23.86	25.00	30.68	28.41	46.59
Scooter Blenny *(Synchiropus ocellatus)*	6.82	28.41	25.00	28.41	23.86	25.00	30.68	28.41	46.59
Bicolour Blenny *(Ecsenius bicolor)*	40.91	28.41	25.00	28.41	23.86	25.00	30.68	28.41	46.59
Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*	65.91	28.41	25.00	28.41	62.50	25.00	30.68	28.41	46.59
Watchmans Gobies *(Amblyeleotris randelli)*	57.95	59.09	25.00	28.41	62.50	82.95	30.68	28.41	46.59
Scissortail Dartfish *(Ptereleotris evides)*	65.91	77.27	25.00	28.41	62.50	25.00	30.68	28.41	46.59
Spotted Mandarin *(Synchiropus picturatus)*	40.91	88.64	92.05	28.41	81.82	25.00	30.68	28.41	46.59
Powder Blue Tang *(Acanthurus leucosternon)*	40.91	96.59	78.41	67.05	93.18	64.77	59.09	67.05	90.91
Regal Tang *(Paracanthurus hepatus)*	40.91	88.64	78.41	67.05	81.82	64.77	59.09	67.05	90.91
Bartletts Anthias (*Pseudoanthias pleurotaenia*)	65.91	59.09	25.00	28.41	62.50	64.77	30.68	28.41	46.59
Fathead Anthias *(Serranocirrhitus latus)*	87.50	59.09	25.00	28.41	62.50	64.77	30.68	28.41	46.59
Copperband Butterfly *(Chelmon rostratus)*	40.91	88.64	78.41	67.05	81.82	64.77	59.09	67.05	90.91
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*	40.91	88.64	78.41	67.05	93.18	64.77	59.09	67.05	90.91
Cleaner Wrasse *(Cossyphus dimidiatus)*	65.91	59.09	92.05	28.41	93.18	90.91	78.41	67.05	4.55
Dwarf Lionfish *(Dendrochirus zebra)*	40.91	6.82	61.36	67.05	23.86	64.77	78.41	79.55	4.55
Lionfish *(Pterois volitans)*	40.91	6.82	61.36	92.05	23.86	64.77	93.18	90.91	4.55
Emperor Angel *(Pomacanthus imperator)*	40.91	28.41	25.00	92.05	23.86	64.77	78.41	79.55	46.59
Flame Angel *(Centropyge loricula)*	6.82	28.41	25.00	67.05	23.86	25.00	59.09	67.05	46.59
Frogfish *(Antennariidae)*	75.00	28.41	85.23	81.82	62.50	64.77	93.18	90.91	46.59
Horned Cowfish (*Lactoria cornuta*)	87.50	77.27	78.41	81.82	62.50	64.77	93.18	82.95	46.59
Mandarin (*Synchiropus splendidus)*	20.45	77.27	92.05	67.05	93.18	90.91	59.09	67.05	46.59
Moorish Idol *(Zanclus cornutus)*	97.73	98.86	98.86	81.82	93.18	98.86	98.86	67.05	98.86
Niger Triggerfish *(Odonus niger)*	87.50	77.27	61.36	81.82	62.50	82.95	59.09	90.91	46.59

Porcupine Puffer *(Diodon holocanthus)*	87.50	28.41	61.36	98.86	62.50	96.59	87.50	98.86	4.55
Red Scorpion Fish *(Scorpaena scrofa)*	97.73	59.09	61.36	92.05	62.50	90.91	78.41	90.91	46.59
Spiny Boxfish *(Chilomycycterus schoepfi)*	87.50	59.09	61.36	92.05	62.50	90.91	78.41	90.91	46.59
Seahorse/ Common Seahorses *(Hippocampus kuda)*	57.95	59.09	92.05	67.05	62.50	64.77	59.09	28.41	90.91
Strawberry Dottyback *(Pictichromis porphyreus)*	40.91	59.09	61.36	28.41	23.86	25.00	59.09	28.41	46.59
Spotted Boxfish (*Ostracion meleagris*)	75.00	88.64	61.36	92.05	81.82	82.95	78.41	90.91	90.91
Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*	87.50	88.64	92.05	67.05	93.18	64.77	59.09	67.05	46.59

Marine: Tranformed Scores for Respondant D									
Species	**Popularity (1-9)** *1= Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/ Specialist (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/ Advanced Care*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Common Clown *(Amphiprion ocellaris)*	10.23	2.27	3.57	32.95	29.55	34.09	69.32	4.55	29.55
Blue Reef Chromis *(Chromis cyanea)*	10.23	28.41	30.95	32.95	29.55	34.09	7.95	72.73	29.55
Green Chromis *(*Chromis viridis)	10.23	28.41	30.95	32.95	29.55	34.09	7.95	72.73	29.55
Blue Damsel *(Chrysiptera cyanea)*	60.23	68.18	30.95	32.95	29.55	71.59	79.55	81.82	29.55
Domino Damsel *(Dascyllus trimaculatus)*	73.86	68.18	30.95	32.95	29.55	34.09	79.55	81.82	29.55
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
Yellow Wrasse *(Halichoeres chrysus)*	35.23	28.41	30.9	32.9	29.5	34.0	31.8	29.5	29.5

			5	5	5	9	2	5	5
Green Wrasse *(Halichoeres chloropterus)*	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
Royal Gramma *(Gramma loreto)*	60.23	28.41	30.95	32.95	29.55	34.09	82.95	59.09	63.64
False Gramma *(Pictichromis paccagnellae)*	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
Bangaii Cardinal Fish *(Pterapogon kauderni)*	10.23	2.27	3.57	5.68	1.14	3.41	7.95	4.55	1.14
Purple Firefish *(Nemateleotris decora)*	60.23	28.41	30.95	70.45	64.77	71.59	31.82	29.55	29.55
Firefish *(Nemateleotris magnifica)*	60.23	28.41	30.95	70.45	64.77	71.59	31.82	29.55	29.55
Flame Hawkfish *(Neocirrhitus armatus)*	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
Longnose Hawkfish *(Oxycirrhites typus)*	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
Scooter Blenny *(Synchiropus ocellatus)*	90.91	56.82	66.67	61.36	64.77	71.59	55.68	59.09	63.64
Bicolour Blenny *(Ecsenius bicolor)*	90.91	92.05		92.05	92.05	92.05	92.05	92.05	92.05
Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*	52.27	28.41	66.67	5.68	29.55	34.09	31.82	72.73	29.55
Watchmans Gobies *(Amblyeleotris randelli)*	52.27	56.82	30.95	32.95	29.55	71.59	31.82	29.55	29.55
Scissortail Dartfish *(Ptereleotris evides)*	90.91	92.05		92.05	92.05	92.05	92.05	92.05	92.05
Spotted Mandarin *(Synchiropus picturatus)*	35.23	28.41	79.76	32.95	29.55	34.09	7.95	29.55	63.64

Powder Blue Tang *(Acanthurus leucosternon)*	10.23	56.82	66.67	73.86	77.27	3.41	69.32	29.55	75.00
Regal Tang *(Paracanthurus hepatus)*	10.23	68.18	66.67	77.27	77.27	3.41	69.32	29.55	75.00
Bartletts Anthias (*Pseudoanthias pleurotaenia*)	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
Fathead Anthias *(Serranocirrhitus latus)*	35.23	28.41	30.95	32.95	29.55	34.09	31.82	29.55	29.55
Copperband Butterfly *(Chelmon rostratus)*	10.23	56.82	66.67	32.95	29.55	34.09	7.95	59.09	63.64
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*	35.23	62.50	66.67	32.95	29.55	34.09	7.95	59.09	63.64
Cleaner Wrasse *(Cossyphus dimidiatus)*	35.23	28.41	30.95	61.36	29.55	34.09	55.68	29.55	29.55
Dwarf Lionfish *(Dendrochirus zebra)*	35.23	28.41	66.67	5.68	29.55	34.09	55.68	4.55	29.55
Lionfish *(Pterois volitans)*	68.18	28.41	66.67	61.36	29.55	34.09	55.68	4.55	29.55
Emperor Angel *(Pomacanthus imperator)*	60.23	75.00	66.67	77.27	64.77	34.09	76.14	29.55	29.55
Flame Angel *(Centropyge loricula)*	10.23	28.41	30.95	5.68	29.55	34.09	55.68	59.09	75.00
Frogfish *(Antennariidae)*	68.18	28.41	66.67	5.68	29.55	34.09	69.32	29.55	29.55
Horned Cowfish (*Lactoria cornuta*)	90.91	92.05	94.05	92.05	92.05	92.05	92.05	92.05	92.05
Mandarin (*Synchiropus splendidus)*	10.23	68.18	83.33	61.36	64.77	71.59	7.95	59.09	29.55

Moorish Idol *(Zanclus cornutus)*	90.91	92.05	94.05	92.05	92.05	92.05	92.05	92.05	92.05
Niger Triggerfish *(Odonus niger)*	90.91	92.05	94.05	92.05	92.05	92.05	92.05	92.05	92.05
Porcupine Puffer *(Diodon holocanthus)*	35.23	28.41	3.57	61.36	64.77	34.09	69.32	29.55	29.55
Red Scorpion Fish *(Scorpaena scrofa)*	90.91	92.05	94.05	92.05	92.05	92.05	92.05	92.05	92.05
Spiny Boxfish *(Chilomycycterus schoepfi)*	78.41	80.68	30.95	81.82	81.82	71.59	55.68	59.09	81.82
Seahorse/ Common Seahorses *(Hippocampus kuda)*	78.41	80.68	86.90	61.36	73.86	82.95	31.82	78.41	75.00
Strawberry Dottyback *(Pictichromis porphyreus)*	90.91	92.05	94.05	92.05	92.05	92.05	92.05	92.05	92.05
Spotted Boxfish (*Ostracion meleagris*)	78.41	80.68	30.95	81.82	81.82	71.59	55.68	59.09	81.82
Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*	71.59	75.00	83.33	32.95	64.77	71.59	31.82	72.73	63.64

Marine Transformed Scores for Respondant E

Species	**Popularity (1-9)** *1= Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/ Specialist (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/ Advanced Care*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Common Clown *(Amphiprion ocellaris)*	5.68	5.68	7.95	50.00	50.00	50.00	25.00	65.91	50.00
Blue Reef Chromis *(Chromis cyanea)*	44.32	5.68	7.95				54.17	65.91	
Green Chromis *(*Chromis viridis)	22.73	5.68	7.95				54.17	65.91	
Blue Damsel *(Chrysiptera cyanea)*	44.32	5.68	7.95				25.00	65.91	
Domino Damsel *(Dascyllus trimaculatus)*	22.73	5.68	7.95				25.00	65.91	
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	22.73	21.59	21.59				54.17	26.14	
Yellow Wrasse *(Halichoeres chrysus)*	60.23	39.77	42.05					26.14	
Green Wrasse *(Halichoeres chloropterus)*	60.23	39.77	42.05					26.14	
Royal Gramma *(Gramma loreto)*	22.73	21.59	42.05				54.17	26.14	
False Gramma *(Pictichromis paccagnellae)*	44.32	13.64	21.59				25.00	65.91	
Bangaii Cardinal Fish *(Pterapogon kauderni)*	22.73	13.64	21.59				54.17	26.14	
Purple Firefish *(Nemateleotris decora)*	22.73	61.36	7.95				70.83	26.14	
Firefish *(Nemateleotris magnifica)*	5.68	39.77	7.95				70.83	26.14	
Flame Hawkfish *(Neocirrhitus armatus)*	44.32	21.59	42.05				54.17	26.14	
Longnose Hawkfish *(Oxycirrhites typus)*	44.32	39.77	42.05				25.00	26.14	
Scooter Blenny *(Synchiropus ocellatus)*	5.68	61.36	80.68				25.00	26.14	

Bicolour Blenny *(Ecsenius bicolor)*	22.73	39.77	73.86				2.78	26.14	
Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*	44.32	39.77	42.05				25.00	26.14	
Watchmans Gobies *(Amblyeleotris randelli)*	70.45	39.77	63.64				70.83	26.14	
Scissortail Dartfish *(Ptereleotris evides)*	70.45	21.59	63.64					65.91	
Spotted Mandarin *(Synchiropus picturatus)*	80.68	80.68	80.68				87.50	26.14	
Powder Blue Tang *(Acanthurus leucosternon)*	44.32	39.77	42.05				25.00	65.91	
Regal Tang *(Paracanthurus hepatus)*	5.68	39.77	21.59				2.78	65.91	
Bartletts Anthias (*Pseudoanthias pleurotaenia*)	22.73	61.36	42.05				25.00	26.14	
Fathead Anthias *(Serranocirrhitus latus)*	44.32	61.36	42.05				25.00	26.14	
Copperband Butterfly *(Chelmon rostratus)*	76.14	89.77	89.77				94.44	26.14	
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*	60.23	80.68	80.68				94.44	26.14	
Cleaner Wrasse *(Cossyphus dimidiatus)*	22.73	61.36	71.59				94.44	65.91	
Dwarf Lionfish *(Dendrochirus zebra)*	60.23	72.73	42.05				70.83	93.18	
Lionfish *(Pterois volitans)*	44.32	72.73	42.05				81.94	98.86	
Emperor Angel *(Pomacanthus imperator)*	5.68	61.36	63.64				25.00	65.91	
Flame Angel *(Centropyge loricula)*	22.73	21.59	21.59				25.00	26.14	
Frogfish *(Antennariidae)*	86.36	80.68	63.64				25.00	93.18	
Horned Cowfish (*Lactoria cornuta*)	94.32	89.77	80.68					85.23	
Mandarin (*Synchiropus splendidus)*	70.45	80.68	89.77				81.94	26.14	
Moorish Idol *(Zanclus cornutus)*	94.32	96.59	96.59				94.44	65.91	
Niger Triggerfish *(Odonus niger)*	70.45	61.36	42.05				25.00	81.82	
Porcupine Puffer *(Diodon holocanthus)*	94.32	39.77	42.05					81.82	
Red Scorpion Fish *(Scorpaena scrofa)*	80.68	39.77	63.64				54.17	93.18	
Spiny Boxfish *(Chilomycycterus schoepfi)*	94.32	96.59	89.77					87.50	
Seahorse/ Common Seahorses *(Hippocampus kuda)*	86.36	89.77	96.59				81.94	26.14	
Strawberry Dottyback *(Pictichromis porphyreus)*	60.23	61.36	63.64					26.14	

Spotted Boxfish (*Ostracion meleagris*)	94.32	96.59	96.59					93.18	
Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*	80.68	80.68	80.68				70.83	26.14	

Marine Average Tranformed Scores of Respondants										
Species	**Popularity (1-9)** *1= Likely Always to be in Stock 9= Rarely in Stock*	**t (1-9)***1=Hardy/ Generalist 9= Highly Specialist/*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*							
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Common Clown *(Amphiprion ocellaris)*	10.68	14.09	15.18	31.04	29.26	36.58	57.47	39.76	40.11
Blue Reef Chromis *(Chromis cyanea)*	47.05	27.50	20.66	26.30	24.08	33.23	23.76	50.90	32.12
Green Chromis (Chromis viridis)	14.09	19.77	20.66	26.30	24.08	33.23	23.76	46.35	32.12
Blue Damsel *(Chrysiptera cyanea)*	47.50	33.86	20.66	26.30	24.08	38.34	32.24	57.03	37.64
Domino Damsel *(Dascyllus trimaculatus)*	61.59	22.27	20.66	36.81	24.08	28.96	58.15	59.31	55.37
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	25.91	22.95	30.66	30.84	28.34	28.96	32.39	34.31	37.64
Yellow Wrasse *(Halichoeres chrysus)*	36.82	26.59	34.75	30.84	28.34	28.96	26.95	34.31	37.64
Green Wrasse *(Halichoeres chloropterus)*	43.64	32.73	34.75	30.84	28.34	28.96	26.95	34.31	37.64
Royal Gramma *(Gramma loreto)*	36.59	22.95	30.66	30.84	28.34	28.96	47.39	42.72	46.16
False Gramma *(Pictichromis paccagnellae)*	43.64	21.36	26.57	30.84	28.34	28.96	45.42	53.40	37.64
Bangaii Cardinal Fish *(Pterapogon kauderni)*	20.23	22.27	25.18	24.03	25.78	21.29	32.39	24.76	25.01
Purple Firefish *(Nemateleotris decora)*	49.32	48.64	35.20	40.22	61.52	58.51	55.04	29.76	46.07
Firefish *(Nemateleotris magnifica)*	24.09	33.86	35.20	40.22	51.86	58.51	55.04	29.76	37.64
Flame Hawkfish *(Neocirrhitus armatus)*	35.91	26.82	30.66	36.81	28.34	36.63	41.94	38.63	37.64
Longnose Hawkfish *(Oxycirrhites typus)*	35.91	36.59	30.66	40.50	28.34	33.23	31.33	38.63	37.64
Scooter Blenny *(Synchiropus ocellatus)*	37.50	52.27	62.97	43.91	60.67	58.51	45.20	35.67	70.29
Bicolour Blenny (*Ecsenius bicolor)*	40.45	39.32	34.56	45.62	43.96	47.71	38.93	42.26	47.74

Orange Spotted Shrimp Goby *(Amblyeleotris guttata)*	45.23	30.45	41.89	29.99	38.00	33.23	36.10	42.94	32.12
Watchmans Gobies *(Amblyeleotris randelli)*	42.27	38.41	34.97	36.81	38.00	57.09	40.50	29.76	32.12
Scissortail Dartfish *(Ptereleotris evides)*	64.55	59.32	41.09	45.62	58.17	51.12	53.94	57.26	53.26
Spotted Mandarin *(Synchiropus picturatus)*	48.18	68.41	86.11	30.84	64.71	49.13	43.83	29.76	58.66
Powder Blue Tang *(Acanthurus leucosternon)*	38.18	63.86	64.33	73.67	87.72	46.86	63.37	56.58	68.51
Regal Tang *(Paracanthurus hepatus)*	20.91	62.27	60.24	77.37	81.19	46.86	58.93	59.08	68.51
Bartletts Anthias (*Pseudoanthias pleurotaenia*)	55.00	58.64	49.92	47.82	59.88	57.09	37.24	29.76	42.87
Fathead Anthias *(Serranocirrhitus latus)*	65.45	50.91	42.47	36.81	46.80	57.09	27.47	29.76	42.87
Copperband Butterfly *(Chelmon rostratus)*	39.77	74.09	80.08	52.44	64.71	50.27	50.90	47.94	78.46
Yellow Longnose Butterflyfish *(Forcipiger flavissimus)*	48.41	71.59	80.76	55.28	75.79	54.53	55.22	47.94	82.53
Cleaner Wrasse *(Cossyphus dimidiatus)*	48.41	47.27	64.29	43.91	62.71	67.60	68.63	45.44	35.56
Dwarf Lionfish *(Dendrochirus zebra)*	40.00	36.82	45.07	43.34	37.14	50.27	54.82	62.03	32.36
Lionfish *(Pterois volitans)*	47.50	39.09	45.07	85.69	37.14	50.27	59.99	67.49	27.13
Emperor Angel *(Pomacanthus imperator)*	38.18	61.82	48.94	85.40	54.19	54.53	73.18	56.81	50.14
Flame Angel *(Centropyge loricula)*	31.14	40.91	36.57	43.34	41.69	40.33	55.88	54.53	61.50
Frogfish *(Antennariidae)*	75.68	56.82	75.13	49.31	46.80	54.53	65.42	79.31	46.07
Horned Cowfish (*Lactoria cornuta*)	88.64	84.77	82.65	90.87	66.97	64.76	78.94	86.13	65.76
Mandarin (*Synchiropus splendidus)*	43.41	78.18	88.64	50.38	63.28	74.99	48.40	43.40	50.14
Moorish Idol *(Zanclus cornutus)*	94.55	96.36	96.53	73.74	95.73	84.08	75.68	64.99	83.77
Niger Triggerfish *(Odonus niger)*	73.18	59.55	54.64	88.03	58.17	69.30	58.15	77.03	58.50
Porcupine Puffer *(Diodon holocanthus)*	66.82	48.18	36.54	87.46	63.85	58.23	67.86	68.63	32.36
Red Scorpion Fish *(Scorpaena scrofa)*	90.45	72.50	71.92	90.15	66.97	75.55	71.03	83.85	53.26
Spiny Boxfish *(Chilomycycterus schoepfi)*	88.64	82.73	69.53	76.58	64.42	70.44	66.15	76.13	63.21
Seahorse/ Common Seahorses *(Hippocampus kuda)*	72.73	84.09	88.22	59.54	79.20	71.29	44.54	36.35	88.86
Strawberry Dottyback *(Pictichromis porphyreus)*	57.50	55.91	54.87	51.58	48.51	51.12	70.41	55.90	69.25
Spotted Boxfish (*Ostracion meleagris*)	83.64	88.64	67.48	73.74	64.70	64.19	62.18	72.72	77.77

Yellow Banded Pipefish *(Doryrhamphus pessuliferus)*	80.68	84.55	84.47	53.79	78.03	75.38	46.97	45.74	67.75

Tropical Total Counts for Each Score: Analysed for Respondent A, B, C, D, E										
Respondent	**Score**	**Popularity**	**Generalist/ Specialist**	**Feeding**	**Size**	**Health**	**Habitat**	**Social Behaviour**	**Predation**	**Water**
A	1	12	4	6	5	4	3	5	7	8
	2	7	8	5	9	6	12	10	9	13
	3	3	7	9	2	12	7	5	6	8
	4	5	4	5	6	3	4	5	2	1
	5	4	3	5	5	7	5	4	3	3
	6	1	2	1	1	1	3	2	3	1
	7	1	4	3	4	2	2	2	2	1

	8	3	2	2	5	2	1	3	2	2
	9	1	3	0	0	0	0	1	3	0
Total A		***37***	***37***	***36***	***37***	***37***	***37***	***37***	***37***	***37***
B		B	C	D	E	F	G	H	I	J
	1	15	27	34	31	35	33	29	32	34
	2	2	1	0	0	0	0	0	0	0
	3	2	0	2	2	0	1	1	1	0
	4	0	0	0	0	0	0	0	0	0
	5	7	8	1	3	2	3	6	3	1
	6	0	0	0	0	0	0	0	0	0
	7	1	1	0	0	0	0	0	0	1
	8	2	0	0	0	0	0	0	0	0
	9	8	0	0	1	0	0	1	1	1
Total B		***37***	***37***	***37***	***37***	***37***	***37***	***37***	***37***	***37***

C		B	C	D	E	F	G	H	I	J
	1	18	5	11	8	6	6	7	9	8
	2	2	9	14	16	13	18	15	14	21
	3	5	11	6	6	10	9	5	7	3
	4	5	6	1	2	5	1	4	2	1
	5	1	1	3	2	1	1	2	1	1
	6	3	0	1	1	1	1	3	2	1
	7	1	2	0	0	0	0	0	0	0
	8	0	1	0	1	0	0	0	0	0
	9	1	1	0	0	0	0	0	0	0
Total C		**36**	**36**	**36**	**36**	**36**	**36**	**36**	**35**	**35**
D	1	2	0	0	0	0	0	0	13	0
	2	14	10	13	13	10	11	12	5	12
	3	7	8	10	6	9	9	6	3	7

	4	4	6	4	7	8	6	8	4	7
	5	2	5	5	5	4	5	5	5	6
	6	1	3	0	0	0	2	1	2	0
	7	0	0	1	1	2	0	0	0	0
	8	0	0	0	1	0	0	0	0	0
	9	7	3	2	2	2	2	3	3	3
Total D		**37**	**35**	**35**	**35**	**35**	**35**	**35**	**35**	**35**
E	1	15	8	11	4	10	2	0	17	8
	2	6	12	12	8	14	13	1	8	12
	3	3	5	2	5	5	8	16	1	6
	4	1	1	1	5	4	3	7	1	2
	5	1	2	5	4	0	0	3	4	1
	6	1	2	2	2	2	1	4	2	1
	7	3	3	2	2	0	4	5	1	0

	8	0	2	1	3	0	3	0	3	3
	9	7	2	1	4	2	3	1	0	4
Total E		**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**

Tropical Ornamental Fish Score Usage for Each Respondent (Percentage of Frequency Over Total Count of Score)										
Respondent	**Score**	**Popularity**	**Generalist /Specialist**	**Feeding**	**Size**	**Health**	**Habitat**	**Social Behaviour**	**Predation**	**Water**
A	1	32.43	10.81	16.67	13.51	10.81	8.11	13.51	18.92	21.62
	2	18.92	21.62	13.89	24.32	16.22	32.43	27.03	24.32	35.14
	3	8.11	18.92	25.00	5.41	32.43	18.92	13.51	16.22	21.62
	4	13.51	10.81	13.89	16.22	8.11	10.81	13.51	5.41	2.70
	5	10.81	8.11	13.89	13.51	18.92	13.51	10.81	8.11	8.11
	6	2.70	5.41	2.78	2.70	2.70	8.11	5.41	8.11	2.70
	7	2.70	10.81	8.33	10.81	5.41	5.41	5.41	5.41	2.70
	8	8.11	5.41	5.56	13.51	5.41	2.70	8.11	5.41	5.41
	9	2.70	8.11	0.00	0.00	0.00	0.00	2.70	8.11	0.00
Total A (Percentage)		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

B	1	40.54	72.97	91.89	83.78	94.59	89.19	78.38	86.49	91.89
	2	5.41	2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3	5.41	0.00	5.41	5.41	0.00	2.70	2.70	2.70	0.00
	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5	18.92	21.62	2.70	8.11	5.41	8.11	16.22	8.11	2.70
	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	7	2.70	2.70	0.00	0.00	0.00	0.00	0.00	0.00	2.70
	8	5.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	9	21.62	0.00	0.00	2.70	0.00	0.00	2.70	2.70	2.70
Total B (Percentage)		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
C	1	50.00	13.89	30.56	22.22	16.67	16.67	19.44	25.71	22.86
	2	5.56	25.00	38.89	44.44	36.11	50.00	41.67	40.00	60.00
	3	13.89	30.56	16.67	16.67	27.78	25.00	13.89	20.00	8.57

	4	13.89	16.67	2.78	5.56	13.89	2.78	11.11	5.71	2.86
	5	2.78	2.78	8.33	5.56	2.78	2.78	5.56	2.86	2.86
	6	8.33	0.00	2.78	2.78	2.78	2.78	8.33	5.71	2.86
	7	2.78	5.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	8	0.00	2.78	0.00	2.78	0.00	0.00	0.00	0.00	0.00
	9	2.78	2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total C (Percentage)		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
D	1	5.41	0.00	0.00	0.00	0.00	0.00	0.00	37.14	0.00
	2	37.84	28.57	37.14	37.14	28.57	31.43	34.29	14.29	34.29
	3	18.92	22.86	28.57	17.14	25.71	25.71	17.14	8.57	20.00
	4	10.81	17.14	11.43	20.00	22.86	17.14	22.86	11.43	20.00
	5	5.41	14.29	14.29	14.29	11.43	14.29	14.29	14.29	17.14
	6	2.70	8.57	0.00	0.00	0.00	5.71	2.86	5.71	0.00

	7	0.00	0.00	2.86	2.86	5.71	0.00	0.00	0.00	0.00
	8	0.00	0.00	0.00	2.86	0.00	0.00	0.00	0.00	0.00
	9	18.92	8.57	5.71	5.71	5.71	5.71	8.57	8.57	8.57
Total D (Percentage)		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
E	1	40.54	21.62	29.73	10.81	27.03	5.41	0.00	45.95	21.62
	2	16.22	32.43	32.43	21.62	37.84	35.14	2.70	21.62	32.43
	3	8.11	13.51	5.41	13.51	13.51	21.62	43.24	2.70	16.22
	4	2.70	2.70	2.70	13.51	10.81	8.11	18.92	2.70	5.41
	5	2.70	5.41	13.51	10.81	0.00	0.00	8.11	10.81	2.70
	6	2.70	5.41	5.41	5.41	5.41	2.70	10.81	5.41	2.70
	7	8.11	8.11	5.41	5.41	0.00	10.81	13.51	2.70	0.00
	8	0.00	5.41	2.70	8.11	0.00	8.11	0.00	8.11	8.11
	9	18.92	5.41	2.70	10.81	5.41	8.11	2.70	0.00	10.81

Total E (Percentage)		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Cumulative Tropical ornamental fish score usage of each Respondent as a percentage of frequency over total count of score										
Respondent	Score	Popularity	Generalist/ Specialist	Feeding	Size	Health	Habitat	Social Behaviour	Predation	Water
A	1	32.43	10.81	16.67	13.51	10.81	8.11	13.51	18.92	21.62
	2	51.35	32.43	30.56	37.84	27.03	40.54	40.54	43.24	56.76
	3	59.46	51.35	55.56	43.24	59.46	59.46	54.05	59.46	78.38
	4	72.97	62.16	69.44	59.46	67.57	70.27	67.57	64.86	81.08
	5	83.78	70.27	83.33	72.97	86.49	83.78	78.38	72.97	89.19
	6	86.49	75.68	86.11	75.68	89.19	91.89	83.78	81.08	91.89
	7	89.19	86.49	94.44	86.49	94.59	97.30	89.19	86.49	94.59
	8	97.30	91.89	100.00	100.00	100.00	100.00	97.30	91.89	100.00
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

B	1	40.54	72.97	91.89	83.78	94.59	89.19	78.38	86.49	91.89
	2	45.95	75.68	91.89	83.78	94.59	89.19	78.38	86.49	91.89
	3	51.35	75.68	97.30	89.19	94.59	91.89	81.08	89.19	91.89
	4	51.35	75.68	97.30	89.19	94.59	91.89	81.08	89.19	91.89
	5	70.27	97.30	100.00	97.30	100.00	100.00	97.30	97.30	94.59
	6	70.27	97.30	100.00	97.30	100.00	100.00	97.30	97.30	94.59
	7	72.97	100.00	100.00	97.30	100.00	100.00	97.30	97.30	97.30
	8	78.38	100.00	100.00	97.30	100.00	100.00	97.30	97.30	97.30
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
C	1	50.00	13.89	30.56	22.22	16.67	16.67	19.44	25.71	22.86
	2	55.56	38.89	69.44	66.67	52.78	66.67	61.11	65.71	82.86
	3	69.44	69.44	86.11	83.33	80.56	91.67	75.00	85.71	91.43
	4	83.33	86.11	88.89	88.89	94.44	94.44	86.11	91.43	94.29
	5	86.11	88.89	97.22	94.44	97.22	97.22	91.67	94.29	97.14

	6	94.44	88.89	100.00	97.22	100.00	100.00	100.00	100.00	100.00
	7	97.22	94.44	100.00	97.22	100.00	100.00	100.00	100.00	100.00
	8	97.22	97.22	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
D	1	5.41	0.00	0.00	0.00	0.00	0.00	0.00	37.14	0.00
	2	43.24	28.57	37.14	37.14	28.57	31.43	34.29	51.43	34.29
	3	62.16	51.43	65.71	54.29	54.29	57.14	51.43	60.00	54.29
	4	72.97	68.57	77.14	74.29	77.14	74.29	74.29	71.43	74.29
	5	78.38	82.86	91.43	88.57	88.57	88.57	88.57	85.71	91.43
	6	81.08	91.43	91.43	88.57	88.57	94.29	91.43	91.43	91.43
	7	81.08	91.43	94.29	91.43	94.29	94.29	91.43	91.43	91.43
	8	81.08	91.43	94.29	94.29	94.29	94.29	91.43	91.43	91.43
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
E	1	40.54	21.62	29.73	10.81	27.03	5.41	0.00	45.95	21.62

	2	56.76	54.05	62.16	32.43	64.86	40.54	2.70	67.57	54.05
	3	64.86	67.57	67.57	45.95	78.38	62.16	45.95	70.27	70.27
	4	67.57	70.27	70.27	59.46	89.19	70.27	64.86	72.97	75.68
	5	70.27	75.68	83.78	70.27	89.19	70.27	72.97	83.78	78.38
	6	72.97	81.08	89.19	75.68	94.59	72.97	83.78	89.19	81.08
	7	81.08	89.19	94.59	81.08	94.59	83.78	97.30	91.89	81.08
	8	81.08	94.59	97.30	89.19	94.59	91.89	97.30	100.00	89.19
	9	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Midpoints of Cumulative Tropical ornamental fish score usage of each Respondent as a percentage of frequency over total count of score										
Respondent	Score	Popularity	Generalist/ Specialist	Feeding	Size	Health	Habitat	Social Behaviour	Predation	Water
A	1	16.22	5.41	8.33	6.76	5.41	4.05	6.76	9.46	10.81
	2	41.89	21.62	23.61	25.68	18.92	24.32	27.03	31.08	39.19
	3	55.41	41.89	43.06	40.54	43.24	50.00	47.30	51.35	67.57
	4	66.22	56.76	62.50	51.35	63.51	64.86	60.81	62.16	79.73
	5	78.38	66.22	76.39	66.22	77.03	77.03	72.97	68.92	85.14
	6	85.14	72.97	84.72	74.32	87.84	87.84	81.08	77.03	90.54
	7	87.84	81.08	90.28	81.08	91.89	94.59	86.49	83.78	93.24
	8	93.24	89.19	97.22	93.24	97.30	98.65	93.24	89.19	97.30
	9	98.65	95.95	100.00	100.00	100.00	100.00	98.65	95.95	100.00
B	1	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95

	2	43.24	74.32	91.89	83.78	94.59	89.19	78.38	86.49	91.89
	3	48.65	75.68	94.59	86.49	94.59	90.54	79.73	87.84	91.89
	4	51.35	75.68	97.30	89.19	94.59	91.89	81.08	89.19	91.89
	5	60.81	86.49	98.65	93.24	97.30	95.95	89.19	93.24	93.24
	6	70.27	97.30	100.00	97.30	100.00	100.00	97.30	97.30	94.59
	7	71.62	98.65	100.00	97.30	100.00	100.00	97.30	97.30	95.95
	8	75.68	100.00	100.00	97.30	100.00	100.00	97.30	97.30	97.30
	9	89.19	100.00	100.00	98.65	100.00	100.00	98.65	98.65	98.65
C	1	25.00	6.94	15.28	11.11	8.33	8.33	9.72	12.86	11.43
	2	52.78	26.39	50.00	44.44	34.72	41.67	40.28	45.71	52.86
	3	62.50	54.17	77.78	75.00	66.67	79.17	68.06	75.71	87.14
	4	76.39	77.78	87.50	86.11	87.50	93.06	80.56	88.57	92.86
	5	84.72	87.50	93.06	91.67	95.83	95.83	88.89	92.86	95.71
	6	90.28	88.89	98.61	95.83	98.61	98.61	95.83	97.14	98.57

	7	95.83	91.67	100.00	97.22	100.00	100.00	100.00	100.00	100.00
	8	97.22	95.83	100.00	98.61	100.00	100.00	100.00	100.00	100.00
	9	98.61	98.61	100.00	100.00	100.00	100.00	100.00	100.00	100.00
D	1	2.70	0.00	0.00	0.00	0.00	0.00	0.00	18.57	0.00
	2	24.32	14.29	18.57	18.57	14.29	15.71	17.14	44.29	17.14
	3	52.70	40.00	51.43	45.71	41.43	44.29	42.86	55.71	44.29
	4	67.57	60.00	71.43	64.29	65.71	65.71	62.86	65.71	64.29
	5	75.68	75.71	84.29	81.43	82.86	81.43	81.43	78.57	82.86
	6	79.73	87.14	91.43	88.57	88.57	91.43	90.00	88.57	91.43
	7	81.08	91.43	92.86	90.00	91.43	94.29	91.43	91.43	91.43
	8	81.08	91.43	94.29	92.86	94.29	94.29	91.43	91.43	91.43
	9	90.54	95.71	97.14	97.14	97.14	97.14	95.71	95.71	95.71
E	1	20.27	10.81	14.86	5.41	13.51	2.70	0.00	22.97	10.81
	2	48.65	37.84	45.95	21.62	45.95	22.97	1.35	56.76	37.84

	3	60.81	60.81	64.86	39.19	71.62	51.35	24.32	68.92	62.16
	4	66.22	68.92	68.92	52.70	83.78	66.22	55.41	71.62	72.97
	5	68.92	72.97	77.03	64.86	89.19	70.27	68.92	78.38	77.03
	6	71.62	78.38	86.49	72.97	91.89	71.62	78.38	86.49	79.73
	7	77.03	85.14	91.89	78.38	94.59	78.38	90.54	90.54	81.08
	8	81.08	91.89	95.95	85.14	94.59	87.84	97.30	95.95	85.14
	9	90.54	97.30	98.65	94.59	97.30	95.95	98.65	100.00	94.59

Tropical: Tranformed Scores for Respondant A									
Species	**Popularity (1-9)** *1=Likely Always to be in Stock 9= Rarely in Stock*	**Specialist (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Guppies *(Poecilia reticulata)*	16.22	5.41	8.33	6.76	43.24	50.00	27.03	9.46	10.81
Neon Tetras *(Paracheirodon innesi)*	16.22	21.62	8.33	6.76	5.41	24.32	6.76	9.46	10.81
Harlequin Rasbora (*Rasbora heteromorpha)*	41.89	5.41	8.33	6.76	5.41	4.05	6.76	9.46	10.81
Marbled Angelfish *(Pterophyllum scalare)*	16.22	41.89	76.39	66.22	43.24	50.00	81.08	83.78	39.19
Threadfin Rainbow *(Iriatherina werneri)*	78.38	56.76	23.61	25.68	18.92	24.32	6.76	31.08	10.81
Boesman's Rainbow *(Melanotaenia boesemani)*	55.41	41.89	43.06	66.22	43.24	50.00	60.81	51.35	39.19
Neon Dwarf Rainbow *(Melanotaenia praecox)*	16.22	41.89	43.06	25.68	43.24	50.00	27.03	31.08	10.81
Dwarf Gouramis *(Colisa lalia)*	16.22	72.97	43.06	25.68	91.89	64.86	47.30	31.08	10.81
Blue Gourami *(Trichogaster trichopterus)*	41.89	21.62	23.61	74.32	43.24	24.32	27.03	68.92	39.19
Clown Loach *(Chromobotia macracanthus)*	16.22	56.76	76.39	81.08	77.03	77.03	27.03	51.35	67.57

Silver Sharks *(Balantiochellus melanopterus)*	16.22	4.8.1.1.1.1.1	43.06	93.24	43.24	24.32	81.08	77.03	39.19
Tiger Barbs *(Puntius tetrazona)*	16.22	41.89	23.61	40.54	43.24	24.32	60.81	77.03	39.19
Glowlight Tetra *(Hemigrammus erythrozonus)*	16.22	5.41	8.33	6.76	5.41	4.05	6.76	9.46	10.81
Scissortail Rasbora *(Rasbora trilineata)*	41.89	21.62	8.33	51.35	18.92	24.32	27.03	62.16	10.81
Dalmatian Molly *(Poecilia latipinn)*	16.22	21.62	62.50	51.35	43.24	24.32	60.81	9.46	39.19
Black Molly *(Poecilia latipinn)*	16.22	21.62	62.50	51.35	43.24	24.32	60.81	9.46	39.19
Cherry Barb *(Puntius titteya)*	16.22	5.41	8.33	6.76	5.41	4.05	47.30	31.08	39.19
Red Bellied Piranha *(Pygocentrus nattereri)*	98.65	95.95	84.72	93.24	18.92	24.32	98.65	95.95	39.19
Discus *(Symphysodon spp.)*	78.38	95.95	90.28	93.24	97.30	94.59	47.30	51.35	97.30
Chocolate Gourami *(Sphaerichthys osphromenoides)*	93.24	81.08	90.28	40.54	91.89	64.86	47.30	31.08	90.54
Ram Cichlid *(Mikrogeophagus ramirezi)*	41.89	56.76	62.50	25.68	63.51	50.00	27.03	31.08	67.57
Kribensis Cichlids *(Pelvicachromis pulcher)*	41.89	41.89	43.06	25.68	43.24	50.00	27.03	31.08	67.57
Green Spotted Puffer *(Tetraodon nigroviridis)*	66.22	66.22	76.39	51.35	43.24	77.03	72.97	68.92	85.14
Bleeding Heart *(Hyphessobrycon erythrostigma)*	66.22	41.89	43.06	25.68	18.92	24.32	6.76	31.08	39.19
Congo Tetra *(Phenacogrammus interruptus)*	55.41	41.89	23.61	51.35	43.24	24.32	27.03	51.35	39.19
Emperor Tetra *(Nematobrycon palmeri)*	66.22	21.62	23.61	25.68	18.92	24.32	27.03	51.35	39.19

Tanganyika Cichlid *(Tropheus duboisi)*	78.38	81.08	76.39	81.08	77.03	98.65	86.49	83.78	97.30
Elephant Nose *(Gnathonemus petersii)*	93.24	95.95	97.22	81.08	87.84	87.84	72.97	68.92	93.24
Oscar *(Astronotus ocellatus)*	66.22	72.97	43.06	93.24	77.03	77.03	93.24	95.95	67.57
Nile Puffer *(Tetraodon lineatus)*	93.24	89.19	76.39	93.24	77.03	77.03	93.24	89.19	85.14
Goldy Pleco *(Scobinancistrus aureatus)*	55.41	56.76	62.50	66.22	77.03	64.86	72.97	31.08	67.57
Silver Arowana *(Osteoglossum bicirrhosum)*	78.38	89.19	100.00	51.35	97.30	87.84	93.24	95.95	67.57
African Butterfly Fish *(Pantodon buchholzi)*	66.22	66.22	97.22	66.22	77.03	77.03	72.97	77.03	67.57
Black Toraja Goby *(Mugilogobius sarasinorum)*	87.84	81.08	90.28	25.68	63.51	94.59	60.81	51.35	79.73
Malawi Eye Biter *(Dimidiochromis compressiceps)*	85.14	81.08	62.50	81.08	77.03	87.84	86.49	89.19	85.14
Red Line Torpedo Barb *(Puntius denisoni)*	41.89	21.62	43.06	66.22	63.51	64.86	47.30	62.16	67.57
Leopard Corydoras *(Corydoras trilineatus)*	41.89	21.62	43.06	25.68	18.92	50.00	27.03	9.46	39.19

Tropical: Tranformed Scores for Respondant B									
Species	**Popularity (1-9)** *1=Likely Always to be in Stock 9= Rarely in Stock*	**st (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care 9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Guppies *(Poecilia reticulata)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Neon Tetras *(Paracheirodon innesi)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Harlequin Rasbora (*Rasbora heteromorpha)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Marbled Angelfish *(Pterophyllum scalare)*	60.81	36.49	45.95	41.89	47.30	44.59	79.73	43.24	45.95
Threadfin Rainbow *(Iriatherina werneri)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Boesman's Rainbow *(Melanotaenia boesemani)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Neon Dwarf Rainbow *(Melanotaenia praecox)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Dwarf Gouramis *(Colisa lalia)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Blue Gourami *(Trichogaster trichopterus)*	43.24	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Clown Loach *(Chromobotia macracanthus)*	43.24	36.49	45.95	86.49	47.30	44.59	39.19	43.24	45.95
Silver Sharks *(Balantiochellus*	20.27	36.49	45.95	93.24	47.30	44.59	39.19	43.24	45.95

melanopterus)									
Tiger Barbs *(Puntius tetrazona)*	20.27	36.49	45.95	41.89	47.30	44.59	89.19	43.24	45.95
Glowlight Tetra *(Hemigrammus erythrozonus)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Scissortail Rasbora *(Rasbora trilineata)*	48.65	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Dalmatian Molly *(Poecilia latipinn)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Black Molly *(Poecilia latipinn)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Cherry Barb *(Puntius titteya)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Red Bellied Piranha *(Pygocentrus nattereri)*	71.62	86.49	45.95	86.49	47.30	44.59	98.65	98.65	45.95
Discus *(Symphysodon spp.)*	89.19	86.49	45.95	93.24	97.30	95.95	89.19	43.24	95.95
Chocolate Gourami *(Sphaerichthys osphromenoides)*	89.19	98.65	45.95	41.89	97.30	95.95	39.19	43.24	98.65
Ram Cichlid *(Mikrogeophagus ramirezi)*	60.81	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Kribensis Cichlids *(Pelvicachromis pulcher)*	60.81	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Green Spotted Puffer *(Tetraodon nigroviridis)*	75.68	36.49	94.59	41.89	47.30	90.54	39.19	93.24	45.95
Bleeding Heart *(Hyphessobrycon erythrostigma)*	75.68	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Congo Tetra *(Phenacogrammus interruptus)*	60.81	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Emperor Tetra *(Nematobrycon palmeri)*	48.65	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Tanganyika Cichlid *(Tropheus duboisi)*	89.19	36.49	45.95	41.89	47.30	44.59	89.19	43.24	45.95
Elephant Nose *(Gnathonemus petersii)*	89.19	86.49	45.95	41.89	47.30	95.95	39.19	43.24	93.24
Oscar *(Astronotus ocellatus)*	20.27	36.49	45.95	93.24	47.30	44.59	89.19	93.24	45.95
Nile Puffer *(Tetraodon lineatus)*	89.19	86.49	45.95	41.89	47.30	44.59	89.19	93.24	45.95

Goldy Pleco *(Scobinancistrus aureatus)*	89.19	86.49	94.59	41.89	47.30	44.59	39.19	87.84	45.95
Silver Arowana *(Osteoglossum bicirrhosum)*	60.81	86.49	45.95	98.65	47.30	44.59	39.19	43.24	45.95
African Butterfly Fish *(Pantodon buchholzi)*	60.81	86.49	98.65	41.89	47.30	44.59	39.19	43.24	45.95
Black Toraja Goby *(Mugilogobius sarasinorum)*	89.19	86.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Malawi Eye Biter *(Dimidiochromis compressiceps)*	89.19	74.32	45.95	41.89	47.30	44.59	89.19	43.24	45.95
Red Line Torpedo Barb *(Puntius denisoni)*	20.27	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95
Leopard Corydoras *(Corydoras trilineatus)*	60.81	36.49	45.95	41.89	47.30	44.59	39.19	43.24	45.95

Tropical Transformed Scores for Respondant C									
Species	**Popularity (1-9)** *1=Likely Always to be in Stock 9= Rarely in Stock*	**st (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Guppies *(Poecilia reticulata)*	25.00	87.50	77.78	11.11	87.50	41.67	40.28	12.86	52.86
Neon Tetras *(Paracheirodon innesi)*	25.00	6.94	15.28	11.11	8.33	8.33	9.72	12.86	11.43
Harlequin Rasbora (*Rasbora heteromorpha)*	25.00	6.94	15.28	11.11	8.33	8.33	9.72	12.86	11.43
Marbled Angelfish *(Pterophyllum scalare)*	62.50	54.17	50.00	44.44	66.67	79.17	68.06	75.71	11.43
Threadfin Rainbow *(Iriatherina werneri)*	62.50	26.39	50.00	44.44	34.72	41.67	68.06	12.86	52.86
Boesman's Rainbow *(Melanotaenia boesemani)*	25.00	26.39	15.28	75.00	34.72	41.67	40.28	45.71	11.43
Neon Dwarf Rainbow *(Melanotaenia praecox)*	25.00	26.39	50.00	44.44	34.72	41.67	40.28	45.71	52.86
Dwarf Gouramis *(Colisa lalia)*	25.00	54.17	15.28	44.44	87.50	41.67	40.28	45.71	52.86
Blue Gourami *(Trichogaster trichopterus)*	25.00	54.17	15.28	44.44	8.33	41.67	80.56	75.71	87.14
Clown Loach *(Chromobotia macracanthus)*	25.00	77.78	77.78	75.00	87.50	41.67	40.28	75.71	52.86
Silver Sharks *(Balantiochellus*	25.00	77.78	50.00	91.67	66.67	79.17	68.06	45.71	52.86

melanopterus)									
Tiger Barbs *(Puntius tetrazona)*	25.00	26.39	15.28	11.11	34.72	8.33	9.72	12.86	11.43
Glowlight Tetra *(Hemigrammus erythrozonus)*	25.00	6.94	15.28	11.11	8.33	8.33	9.72	12.86	11.43
Scissortail Rasbora *(Rasbora trilineata)*	25.00	6.94	50.00	44.44	34.72	41.67	40.28	45.71	52.86
Dalmatian Molly *(Poecilia latipinn)*	25.00	54.17	50.00	44.44	34.72	41.67	9.72		
Black Molly *(Poecilia latipinn)*	25.00	54.17	15.28	44.44	66.67	41.67	40.28	45.71	52.86
Cherry Barb *(Puntius titteya)*	25.00	26.39	15.28	11.11	8.33	8.33	9.72	12.86	11.43
Red Bellied Piranha *(Pygocentrus nattereri)*	90.28	26.39	50.00	44.44	66.67	41.67	40.28	12.86	52.86
Discus *(Symphysodon spp.)*		91.67	93.06	91.67	95.83	95.83	88.89	92.86	95.71
Chocolate Gourami *(Sphaerichthys osphromenoides)*	84.72	98.61	98.61	95.83	98.61	98.61	95.83	97.14	98.57
Ram Cichlid *(Mikrogeophagus ramirezi)*	25.00	77.78	77.78	44.44	66.67	79.17	40.28	45.71	52.86
Kribensis Cichlids *(Pelvicachromis pulcher)*	25.00	77.78	50.00	44.44	34.72	41.67	40.28	45.71	52.86
Green Spotted Puffer *(Tetraodon nigroviridis)*	76.39	77.78	87.50	86.11	87.50	93.06	68.06	75.71	92.86
Bleeding Heart *(Hyphessobrycon erythrostigma)*	62.50	26.39	50.00	44.44	34.72	41.67	40.28	45.71	52.86
Congo Tetra *(Phenacogrammus interruptus)*	62.50	26.39	50.00	44.44	34.72	41.67	40.28	45.71	52.86
Emperor Tetra *(Nematobrycon palmeri)*	62.50	54.17	77.78	75.00	87.50	79.17	68.06	75.71	87.14
Tanganyika Cichlid *(Tropheus duboisi)*	76.39	54.17	50.00	44.44	34.72	41.67	95.83	45.71	52.86
Elephant Nose *(Gnathonemus petersii)*	90.28	95.83	93.06	75.00	66.67	79.17	80.56	75.71	87.14
Oscar *(Astronotus ocellatus)*	76.39	26.39	15.28	11.11	34.72	41.67	80.56	75.71	52.86
Nile Puffer *(Tetraodon lineatus)*	95.83	77.78	77.78	75.00	66.67	79.17	80.56	88.57	52.86

Goldy Pleco *(Scobinancistrus aureatus)*	52.78	54.17	50.00	86.11	66.67	79.17	40.28	45.71	52.86
Silver Arowana *(Osteoglossum bicirrhosum)*	76.39	54.17	77.78	98.61	66.67	79.17	95.83	97.14	52.86
African Butterfly Fish *(Pantodon buchholzi)*	90.28	91.67	93.06	75.00	66.67	79.17	88.89	88.57	52.86
Black Toraja Goby *(Mugilogobius sarasinorum)*	98.61								
Malawi Eye Biter *(Dimidiochromis compressiceps)*	76.39	54.17	50.00	44.44	34.72	41.67	40.28	45.71	52.86
Red Line Torpedo Barb *(Puntius denisoni)*	52.78	54.17	50.00	44.44	34.72	41.67	40.28	45.71	52.86
Leopard Corydoras *(Corydoras trilineatus)*	25.00	6.94	15.28	11.11	8.33	8.33	9.72	12.86	11.43

Tropical:Tranformed Scores for Respondant D

Species	**Popularity (1-9)** *1=Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/Specialist (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/ Advanced Care*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Guppies *(Poecilia reticulata)*	2.70	75.71	84.29	81.43	82.86	81.43	42.86	18.57	82.86
Neon Tetras *(Paracheirodon innesi)*	2.70	40.00	51.43	45.71	41.43	44.29	17.14	44.29	44.29
Harlequin Rasbora (*Rasbora heteromorpha)*	24.32	60.00	71.43	64.29	65.71	65.71	62.86	44.29	64.29
Marbled Angelfish *(Pterophyllum scalare)*	67.57	75.71	84.29	81.43	41.43	44.29	62.86	65.71	64.29
Threadfin Rainbow *(Iriatherina werneri)*	24.32	60.00	71.43	64.29	65.71	65.71	62.86	18.57	64.29
Boesman's Rainbow *(Melanotaenia boesemani)*	24.32	40.00	51.43	45.71	41.43	44.29	42.86	18.57	44.29
Neon Dwarf Rainbow *(Melanotaenia praecox)*	24.32	14.29	51.43	45.71	41.43	44.29	42.86	18.57	44.29
Dwarf Gouramis *(Colisa lalia)*	24.32	87.14	51.43	45.71	91.43	44.29	42.86	18.57	82.86
Blue Gourami *(Trichogaster trichopterus)*	24.32	14.29	18.57	64.29	14.29	65.71	81.43	65.71	17.14
Clown Loach *(Chromobotia macracanthus)*	24.32	40.00	18.57	64.29	41.43	44.29	17.14	44.29	44.29
Silver Sharks *(Balantiochellus melanopterus)*	24.32	40.00	51.43	90.00	41.43	91.43	42.86	65.71	64.29

Tiger Barbs *(Puntius tetrazona)*	24.32	14.29	18.57	45.71	14.29	15.71	90.00	78.57	64.29
Glowlight Tetra *(Hemigrammus erythrozonus)*	24.32	14.29	18.57	18.57	14.29	15.71	17.14	18.57	17.14
Scissortail Rasbora *(Rasbora trilineata)*	67.57	14.29	18.57	18.57	14.29	15.71	17.14	18.57	17.14
Dalmatian Molly *(Poecilia latipinn)*	24.32	60.00	18.57	18.57	65.71	15.71	17.14	18.57	17.14
Black Molly *(Poecilia latipinn)*	24.32	60.00	18.57	18.57	65.71	15.71	17.14	18.57	17.14
Cherry Barb *(Puntius titteya)*	24.32	14.29	18.57	18.57	14.29	15.71	17.14	18.57	17.14
Red Bellied Piranha *(Pygocentrus nattereri)*	75.68	75.71	84.29	81.43	82.86	81.43	81.43	78.57	82.86
Discus *(Symphysodon spp.)*	90.54								
Chocolate Gourami *(Sphaerichthys osphromenoides)*	90.54								
Ram Cichlid *(Mikrogeophagus ramirezi)*	67.57	60.00	51.43	18.57	65.71	15.71	62.86	55.71	64.29
Kribensis Cichlids *(Pelvicachromis pulcher)*	90.54	87.14	51.43	18.57	41.43	81.43	81.43	55.71	44.29
Green Spotted Puffer *(Tetraodon nigroviridis)*	90.54	75.71	92.86	18.57	91.43	91.43	95.71	95.71	95.71
Bleeding Heart *(Hyphessobrycon erythrostigma)*	24.32	14.29	18.57	18.57	14.29	15.71	17.14	18.57	17.14
Congo Tetra *(Phenacogrammus interruptus)*	52.70	14.29	18.57	18.57	14.29	44.29	62.86	55.71	17.14
Emperor Tetra *(Nematobrycon palmeri)*	79.73	40.00	51.43	18.57	14.29	15.71	17.14	44.29	17.14
Tanganyika Cichlid *(Tropheus duboisi)*	52.70	87.14	18.57	64.29	65.71	81.43	81.43	78.57	82.86
Elephant Nose *(Gnathonemus petersii)*	52.70	75.71	84.29	45.71	82.86	65.71	62.86	65.71	82.86
Oscar *(Astronotus ocellatus)*	52.70	40.00	51.43	81.43	41.43	44.29	42.86	78.57	44.29
Nile Puffer *(Tetraodon lineatus)*	90.54	95.71	97.14	97.14	97.14	97.14	95.71	95.71	95.71
Goldy Pleco *(Scobinancistrus aureatus)*	75.68	40.00	71.43	81.43	65.71	65.71	17.14	44.29	17.14

Silver Arowana *(Osteoglossum bicirrhosum)*	67.57	60.00	84.29	92.86	82.86	81.43	81.43	88.57	82.86
African Butterfly Fish *(Pantodon buchholzi)*	90.54	95.71	71.43	64.29	65.71	65.71	62.86	78.57	64.29
Black Toraja Goby *(Mugilogobius sarasinorum)*	90.54	95.71	97.14	97.14	97.14	97.14	95.71	95.71	95.71
Malawi Eye Biter *(Dimidiochromis compressiceps)*	52.70	40.00	51.43	64.29	41.43	44.29	62.86	88.57	44.29
Red Line Torpedo Barb *(Puntius denisoni)*	52.70	14.29	18.57	18.57	14.29	15.71	17.14	18.57	17.14
Leopard Corydoras *(Corydoras trilineatus)*	52.70	14.29	18.57	18.57	14.29	15.71	17.14	18.57	17.14

Tropical: Tranformed Scores for Respondant E									
Species	**Popularity (1-9)** *1=Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/Specialist (1-9)** *1=Hardy/ Generalist 9= Highly Specialist/ Advanced Care*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Guppies *(Poecilia reticulata)*	20.27	37.84	14.86	21.62	45.95	22.97	24.32	22.97	37.84
Neon Tetras *(Paracheirodon innesi)*	20.27	10.81	14.86	5.41	13.51	22.97	24.32	22.97	37.84
Harlequin Rasbora (*Rasbora heteromorpha)*	20.27	10.81	14.86	21.62	13.51	22.97	24.32	22.97	10.81
Marbled Angelfish *(Pterophyllum scalare)*	60.81	37.84	45.95	64.86	13.51	22.97	78.38	86.49	10.81
Threadfin Rainbow *(Iriatherina werneri)*	48.65	37.84	45.95	21.62	45.95	51.35	55.41	22.97	37.84
Boesman's Rainbow *(Melanotaenia boesemani)*	20.27	37.84	45.95	64.86	45.95	51.35	24.32	78.38	37.84
Neon Dwarf Rainbow *(Melanotaenia praecox)*	48.65	37.84	45.95	39.19	45.95	51.35	24.32	68.92	37.84
Dwarf Gouramis *(Colisa lalia)*	20.27	60.81	14.86	21.62	45.95	66.22	55.41	56.76	62.16
Blue Gourami *(Trichogaster trichopterus)*	20.27	10.81	14.86	64.86	13.51	22.97	55.41	78.38	10.81
Clown Loach *(Chromobotia*	20.27	68.92	68.92	85.14	83.78	66.22	24.32	56.76	62.16

macracanthus)									
Silver Sharks *(Balantiochellus melanopterus)*	20.27	37.84	45.95	85.14	45.95	22.97	24.32	71.62	10.81
Tiger Barbs *(Puntius tetrazona)*	20.27	10.81	14.86	21.62	13.51	2.70	24.32	56.76	10.81
Glowlight Tetra *(Hemigrammus erythrozonus)*	20.27	10.81	14.86	5.41	13.51	2.70	24.32	22.97	10.81
Scissortail Rasbora *(Rasbora trilineata)*	60.81	37.84	45.95	39.19	13.51	22.97	24.32	22.97	10.81
Dalmatian Molly *(Poecilia latipinn)*	20.27	10.81	45.95	52.70	13.51	22.97	24.32	22.97	37.84
Black Molly *(Poecilia latipinn)*	20.27	37.84	45.95	52.70	45.95	51.35	24.32	22.97	37.84
Cherry Barb *(Puntius titteya)*	20.27	10.81	14.86	5.41	13.51	22.97	24.32	22.97	10.81
Red Bellied Piranha *(Pygocentrus nattereri)*	90.54	91.89	77.03	94.59	45.95	22.97	90.54	95.95	37.84
Discus *(Symphysodon spp.)*	68.92	85.14	91.89	72.97	91.89	78.38	78.38	56.76	79.73
Chocolate Gourami *(Sphaerichthys osphromenoides)*	90.54	97.30	95.95	5.41	97.30	95.95	78.38	22.97	94.59
Ram Cichlid *(Mikrogeophagus ramirezi)*	48.65	37.84	64.86	21.62	71.62	51.35	55.41	22.97	62.16
Kribensis Cichlids *(Pelvicachromis pulcher)*	20.27	10.81	45.95	39.19	45.95	22.97	55.41	56.76	37.84
Green Spotted Puffer *(Tetraodon nigroviridis)*	90.54	78.38	91.89	72.97	91.89	87.84	90.54	90.54	94.59
Bleeding Heart *(Hyphessobrycon erythrostigma)*	48.65	37.84	14.86	39.19	45.95	22.97	24.32	22.97	37.84
Congo Tetra *(Phenacogrammus interruptus)*	48.65	37.84	14.86	52.70	45.95	22.97	55.41	56.76	37.84
Emperor Tetra *(Nematobrycon palmeri)*	60.81	60.81	14.86	21.62	71.62	51.35	24.32	22.97	62.16
Tanganyika Cichlid *(Tropheus duboisi)*	77.03	72.97	77.03	64.86	83.78	95.95	55.41	56.76	94.59
Elephant Nose *(Gnathonemus petersii)*	90.54	97.30	98.65	94.59	97.30	95.95	98.65	22.97	94.59

Oscar *(Astronotus ocellatus)*	77.03	72.97	45.95	94.59	45.95	78.38	78.38	95.95	37.84
Nile Puffer *(Tetraodon lineatus)*	90.54	85.14	77.03	78.38	83.78	87.84	90.54	86.49	85.14
Goldy Pleco *(Scobinancistrus aureatus)*	66.22	60.81	64.86	85.14	71.62	51.35	68.92	56.76	62.16
Silver Arowana *(Osteoglossum bicirrhosum)*	90.54	91.89	86.49	94.59	71.62	87.84	90.54	95.95	72.97
African Butterfly Fish *(Pantodon buchholzi)*	71.62	60.81	77.03	52.70	13.51	71.62	68.92	78.38	72.97
Black Toraja Goby *(Mugilogobius sarasinorum)*	77.03	78.38	77.03	39.19	45.95	78.38	68.92	22.97	85.14
Malawi Eye Biter *(Dimidiochromis compressiceps)*	90.54	85.14	86.49	78.38	71.62	78.38	90.54	78.38	85.14
Red Line Torpedo Barb *(Puntius denisoni)*	48.65	60.81	45.95	52.70	83.78	66.22	24.32	22.97	77.03
Leopard Corydoras *(Corydoras trilineatus)*	20.27	37.84	45.95	21.62	45.95	51.35	1.35	22.97	62.16

Tropical: Average of Tranformed scores									
Species	**Popularity (1-9)** *1= Likely Always to be in Stock 9= Rarely in Stock*	**Generalist/Specialist (1-9)***1=Hardy/ Generalist*	**Advanced/Specialist requirements (1-9)** *1=Hardy/ Generalist9= Highly Specialist/ Advanced Care*						
			Feeding	**Size**	**Health**	**Habitat**	**Social Behav.**	**Predation**	**Water**
Guppies *(Poecilia reticulata)*	16.89	48.59	46.24	32.56	61.37	48.13	34.74	21.42	46.06
Neon Tetras *(Paracheirodon innesi)*	16.89	23.17	27.17	22.18	23.20	28.90	19.43	26.56	30.06
Harlequin Rasbora (*Rasbora heteromorpha)*	26.35	23.93	31.17	29.13	28.05	29.13	28.57	26.56	28.66
Marbled Angelfish *(Pterophyllum scalare)*	53.58	49.22	60.51	59.77	42.43	48.20	74.02	70.99	34.33
Threadfin Rainbow *(Iriatherina werneri)*	46.82	43.49	47.39	39.58	42.52	45.53	46.45	25.75	42.35
Boesman's Rainbow *(Melanotaenia boesemani)*	29.05	36.52	40.33	58.74	42.53	46.38	41.49	47.45	35.74
Neon Dwarf Rainbow *(Melanotaenia praecox)*	26.89	31.38	47.28	39.38	42.53	46.38	34.74	41.51	38.35
Dwarf Gouramis *(Colisa lalia)*	21.22	62.32	34.11	35.87	72.81	52.33	45.01	39.07	50.93
Blue Gourami *(Trichogaster trichopterus)*	30.95	27.47	23.65	57.96	25.33	39.85	56.72	66.39	40.05
Clown Loach *(Chromobotia macracanthus)*	25.81	55.99	57.52	78.40	67.41	54.76	29.59	54.27	54.56

Silver Sharks *(Balantiochellus melanopterus)*	21.22	51.66	47.28	90.66	48.92	52.50	51.10	60.66	42.62
Tiger Barbs *(Puntius tetrazona)*	21.22	25.97	23.65	32.18	30.61	19.13	54.81	53.69	34.33
Glowlight Tetra *(Hemigrammus erythrozonus)*	21.22	14.79	20.60	16.75	17.77	15.08	19.43	21.42	19.23
Scissortail Rasbora *(Rasbora trilineata)*	48.78	23.44	33.76	39.09	25.75	29.85	29.59	38.53	27.51
Dalmatian Molly *(Poecilia latipinn)*	21.22	36.62	44.59	41.79	40.90	29.85	30.24	23.56	35.03
Black Molly *(Poecilia latipinn)*	21.22	42.02	37.65	41.79	53.77	35.53	36.35	27.99	38.59
Cherry Barb *(Puntius titteya)*	21.22	18.68	20.60	16.75	17.77	19.13	27.54	25.75	24.90
Red Bellied Piranha *(Pygocentrus nattereri)*	85.35	75.29	68.40	80.04	52.34	43.00	81.91	76.39	51.74
Discus *(Symphysodon spp.)*	81.76	89.81	80.29	87.78	95.58	91.19	75.94	61.05	92.17
Chocolate Gourami *(Sphaerichthys osphromenoides)*	89.65	93.91	82.70	45.92	96.27	88.84	65.17	48.61	95.59
Ram Cichlid *(Mikrogeophagus ramirezi)*	48.78	53.77	60.50	30.44	62.96	48.17	44.95	39.75	58.56
Kribensis Cichlids *(Pelvicachromis pulcher)*	47.70	50.82	47.28	33.95	42.53	48.13	48.67	46.50	49.70
Green Spotted Puffer *(Tetraodon nigroviridis)*	79.87	66.91	88.65	54.18	72.27	87.98	73.29	84.83	82.85
Bleeding Heart *(Hyphessobrycon erythrostigma)*	55.47	31.38	34.49	33.95	32.23	29.85	25.54	32.32	38.59
Congo Tetra *(Phenacogrammus interruptus)*	56.01	31.38	30.60	41.79	37.10	35.57	44.95	50.56	38.59
Emperor Tetra *(Nematobrycon palmeri)*	63.58	42.62	42.73	36.55	47.92	43.03	35.15	47.51	50.32
Tanganyika Cichlid *(Tropheus duboisi)*	74.74	66.37	53.59	59.31	61.71	72.46	81.67	61.61	74.71
Elephant Nose *(Gnathonemus petersii)*	83.19	90.26	83.83	67.66	76.39	84.92	70.84	55.31	90.22
Oscar *(Astronotus ocellatus)*	58.52	49.76	40.33	74.72	49.28	57.19	76.84	87.88	49.70

Nile Puffer *(Tetraodon lineatus)*	91.87	86.86	74.86	77.13	74.38	77.15	89.85	90.64	72.96
Goldy Pleco *(Scobinancistrus aureatus)*	67.85	59.64	68.68	72.16	65.67	61.14	47.70	53.14	49.14
Silver Arowana *(Osteoglossum bicirrhosum)*	74.74	76.35	78.90	87.21	73.15	76.17	80.05	84.17	64.44
African Butterfly Fish *(Pantodon buchholzi)*	75.89	80.18	87.48	60.02	54.04	67.62	66.57	73.16	60.73
Black Toraja Goby *(Mugilogobius sarasinorum)*	88.64	85.42	77.60	50.97	63.47	78.68	66.16	53.32	76.63
Malawi Eye Biter *(Dimidiochromis compressiceps)*	78.79	66.94	59.27	62.02	54.42	59.35	73.87	69.02	62.67
Red Line Torpedo Barb *(Puntius denisoni)*	43.26	37.47	40.70	44.77	48.72	46.61	33.65	38.53	52.11
Leopard Corydoras *(Corydoras trilineatus)*	40.14	23.44	33.76	23.77	26.96	34.00	18.89	21.42	35.17

APPENDIX 6 ORNAMENTAL FISH STOCK ASSESSMENT SHEET

6.1 MARINE STOCK ASSESSMENT SHEET

Part 1

<table>
<tr><td colspan="8">Week 1</td></tr>
<tr><td colspan="8">SECTION 1: Preliminary Information for the Week</td></tr>
<tr><td colspan="3" rowspan="2">Preliminary Information</td><td colspan="5">Data to be Collected for Species Preliminary Information</td></tr>
<tr><td>1a)</td><td>1b)</td><td>1c)</td><td>1d)</td><td>1e)</td></tr>
<tr><td>Marine Species Being Assessed</td><td>Tank Identification:</td><td>Species Weekly Assessment Sample Turnover:</td><td>Country Stock Imported From:</td><td>Stock from Wild or Captive Sources:</td><td>Estimated Average Length of Species being Assessed:</td><td>Stocking Levels of Species being assessed in the Tank Being Sampled:</td><td>State the Quantity of Other Species Stocked in Tank with Sample Species:</td></tr>
</table>

	Mark in the store a sample tank for each of the species that is being assessed and in stock; choose whenever possible to sample species from a new stock delivery. If stickers are used as a tank marking tool, numbering stickers with tank identification number could help ease of tank identification.	Sample number for species being assessed is dependent on weekly stock turnover rate for that species. (Place information for species in appropriate sample column. If it is the first sample in the week for that species, place in 'Sample 1,' and add samples as needed (adding rows on excel sheet if required.) If a species sample is continuing from a previous weeks sample, place that sample in 'sample 1' and write 'continued' in that cell.	State country stock has been imported from. (If unable to gain this information for a species state 'unable' and go to 1b.)	State 'Wild' for species from wild stock or 'Captive' for species from captive stock. (If unable to gather information for a species state 'unable' and go to section 1c.)	Estimated average length of species being assessed held within the tank species is being sampled. Measuring in centimetres. Measuring species from the tip of the head to the beginning of the caudal fin.	Estimated number of the species that is being assessed in the tank species is being sampled.	State other species name(s) with the estimated number of that species held in sample tank (placing commas between species.) If no other species in tank, leave section blank.
Common Clown *(Amphiprion ocellaris)*	Tank 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Bangaii Cardinal Fish *(Pterapogon kauderni)*	Tank 2	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Green Chromis *(Chromis viridis)*	Tank 3	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	Tank 4	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Regal Tang *(Paracanthurus hepatus)*	Tank 5	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Mandarin *(Synchiropus splendidus)*	Tank 6	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Scooter Blenny *(Synchiropus ocellatus)*	Tank 7	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Copperband Butterfly *(Chelmon rostratus)*	Tank 8	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Flame Angel *(Centropyge loricula)*	Tank 9	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Frogfish *(Antennariidae spp.)*	Tank 10	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Seahorse/ Common Seahorses *(Hippocampus kuda)*	Tank 11	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Emperor Angel *(Pomacanthus imperator)*	Tank 12	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1

6.2 TROPICAL STOCK ASSESSMENT SHEET

Part 1.

Date at beginning of week:							
Week 1							
SECTION 1: Preliminary Information for the Week							
Preliminary Information			**Data to be Collected for Species Preliminary Information**				
			1a)	**1b)**	**1c)**	**1d)**	**1e)**
Tropical Species Being Assessed	Tank Identification:	Species Weekly Assessment Sample Turnover:	Country Stock Imported From:	Stock from Wild or Captive Sources:	Estimated Average Length of Species being Assessed:	Stocking Levels of Species being assessed in the Tank Being Sampled:	Quantity of Other Species Stocked in Tank with Sample
	Mark in the store a sample tank for each of the species that is being assessed and in stock; choose whenever possible to sample species from a new stock delivery. If stickers are used as a tank marking tool, numbering stickers with tank identification number could help ease of tank identification.	Sample number for species being assessed is dependent on weekly stock turnover rate for that species. (Place information for species in appropriate sample column. If it is the first sample in the week for that species, place in 'Sample 1,' and add samples as needed (adding rows on excel sheet if required.) If a species sample is continuing from a previous weeks sample, place that sample in 'sample 1' and write 'continued' in that cell.	State country stock has been imported from. (If unable to gain this information for a species state 'unable' and go to 1b.)	State 'Wild' for species from wild stock or 'Captive' for species from captive stock. (If unable to gather information for a species state 'unable' and go to section 1c.)	Estimated average length of species being assessed held within the tank species is being sampled. Measuring in centimetres. Measuring species from the tip of the head to the beginning of the caudal fin.	Estimated number of the species that is being assessed in the tank species is being sampled.	State other species name(s) with the estimated number of that species held in sample tank (placing commas between species.) If no other species in tank, leave section blank.

Neon Tetra *(Paracheirodon innesi)*	**Tank 1**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Cherry barbs *(Puntius titteya)*	**Tank 2**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Harlequin rasbora *(Rasbora heteromorpha)*	**Tank 3**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Neon dwarf rainbow *(Melanotaenia praecox)*	**Tank 4**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Guppies *(Poecilia reticulata)*	**Tank 5**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Dwarf gouramis *(Colisa lalia)*	**Tank 6**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Clown Loach *(Chromobotia macracanthus)*	**Tank 7**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Silver Shark *(Balantiochellus melanopterus)*	**Tank 8**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Goldy Pleco *(Scobinancistrus aureatus)*	**Tank 9**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Silver Arowana *(Osteoglossum bicirrhosum)*	**Tank 10**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Discus *(Symphysodon spp.)*	**Tank 11**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1
Elephant nose *(Gnathonemus petersii)*	**Tank 12**	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1	Sample 1

Part 2

Date:						
Section 2: Quantity Stock Lost Within Week						
Species Information & Tank Identification		**Daily Data to be Collected**				
		2a)	**2b)**	**2c)**	**2d)**	**2e)**
Marine Species Being Assessed	Tank Identification	Species in Stock?	Species Sample Turn Over.	New Sample for Species Today?	Amount of Morning Daily Stock Loss for Species:	Measure the Length of Each Specimen of Species being Assessed that Suffered Stock Loss:
		State 'Yes' if in stock or 'No' if is not in stock. *(If not in stock, go to next species.)*	State 'Yes' if species study sample is a continuation from a previous day's, or 'No' if previous day's study sample is no longer available due to stock turnover. *(If answer 'No' go to section 2c, if answered 'Yes' go to 2d for that species sample).*	If new species sample being assessed is from yesterday's stock delivery put '1.' If new sample is from a further back delivery date put '2.' In the case of both '1' and '2' complete Preliminary Information Data: Sections 1a to 1e.	State morning's daily amount of stock loss for species being assessed; include both specimens that had to be humanely disposed of and direct morning stock loss.	Measure the length of each species that suffered stock loss, using centimetres. Measure from the tip of the head, to the beginning of the caudal fin. *(Leave a comma to separate species specimen's lengths.)*
Neon Tetra *(Paracheirodon innesi)*	**Tank 1**					
Cherry barbs *(Puntius titteya)*	**Tank 2**					
Harlequin rasbora *(Rasbora heteromorpha)*	**Tank 3**					
Neon dwarf rainbow *(Melanotaenia praecox)*	**Tank 4**					
Guppies *(Poecilia reticulata)*	**Tank 5**					

Dwarf gouramis *(Colisa lalia)*	**Tank 6**					
Clown Loach *(Chromobotia macracanthus)*	**Tank 7**					
Silver Shark *(Balantiochellus melanopterus)*	**Tank 8**					
Goldy Pleco *(Scobinancistrus aureatus)*	**Tank 9**					
Silver Arowana *(Osteoglossum bicirrhosum)*	**Tank 10**					
Discus *(Symphysodon spp.)*	**Tank 11**					
Elephant nose *(Gnathonemus petersii)*	**Tank 12**					

Part 2

Date:						
Section 2: Quantity Stock Lost Within Week						
Species Information & Tank Identification		**Daily Data to be Collected**				
		2a)	**2b)**	**2c)**	**2d)**	**2e)**
Marine Species Being Assessed	Tank Identification	Species in Stock?	Species Sample Turn Over.	New Sample for Species Today?	Amount of Morning Daily Stock Loss for Species:	Measure the Length of Each Specimen of Species being Assessed that Suffered Stock Loss:
		State 'Yes' if in stock or 'No' if is not in stock. *(If not in stock, go to next species.)*	State 'Yes' if species study sample is a continuation from a previous day's, or 'No' if previous day's study sample is no longer available due to stock turnover. *(If answer 'No' go to section 2c, if answered 'Yes' go to 2d for that species sample).*	If new species sample being assessed is from yesterday's stock delivery put '1.' If new sample is from a further back delivery date put '2.' In the case of both '1' and '2' complete Preliminary Information Data: Sections 1a to 1e.	State morning's daily amount of stock loss for species being assessed; include both specimens that had to be humanely disposed of and direct morning stock loss.	Measure the length of each species that suffered stock loss, using centimetres. Measure from the tip of the head, to the beginning of the caudal fin. *(Leave a comma to separate species specimen's lengths.)*
Common Clown *(Amphiprion ocellaris)*	**Tank 1**					
Bangaii Cardinal Fish *(Pterapogon kauderni)*	**Tank 2**					
Green Chromis *(Chromis viridis)*	**Tank 3**					
Pyjama Wrasse *(Pseudocheilinus hexataenia)*	**Tank 4**					

Regal Tang *(Paracanthurus hepatus)*	**Tank 5**					
Mandarin *(Synchiropus splendidus)*	**Tank 6**					
Scooter Blenny *(Synchiropus ocellatus)*	**Tank 7**					
Copperband Butterfly *(Chelmon rostratus)*	**Tank 8**					
Flame Angel *(Centropyge loricula)*	**Tank 9**					
Frogfish *(Antennariidae)*	**Tank 10**					
Seahorse/ Common Seahorses *(Hippocampus kuda)*	**Tank 11**					
Emperor Angel *(Pomacanthus imperator)*	**Tank 12**					

APPENDIX 6.3: STOCK LOSS INFORMATION SHEET

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Stock Loss Information Sheet

Introduction

This study is designed assess the stock loss of various species within Maidenhead Aquatics and aims to provide information on different species vulnerability to stock loss and what factors may positively or negatively influence the quantity of loss. All information provided is confidential to shops involved, with stores not being individually identified. The information gathered shall be used for a Masters (MSc) by Research.

It will be considered in the case of completed excel sheet(s) being e-mailed to address provided that you have consented to the information being used as for of my MSc by Research. Please fill out excel sheet(s) provided and send weekly stock loss information to Lucy_Anna_Smith@hotmail.co.uk. Also if you have any further queries, or wish to discuss the project to a greater extent contact Lucy Smith through e-mail, or directly on: 07921139098.

Thank you for your involvement within this study.

Yours Faithfully,

Lucy Anna Smith

Supervisors of the project:

University of Kent
Marlowe Building
Canterbury
Kent CT2 7NR
United Kingdom

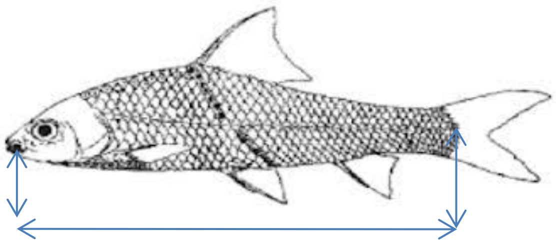
Dr David Roberts: d.l.roberts@kent.ac.uk, Ian Watson

Excel Sheet Information
Marine and/or Tropical species to study within store: In this study, use the appropriate excel sheet(s) labelled marine and/or tropical to gather information for the species being assessed. If however a store only holds tropical or marine fish species, please gather information on those species in the store. The information on stock loss should be collected in the mornings on a daily basis. SECTION 1
SECTION 1: Preliminary information. This section is designed to ascertain possible factors that may influence quantity of stock loss for each species sample. If unable to gather information for any of the parts in Section 1, please state 'unable' in the appropriate column for that species, and then move to next part.
Species Being Assessed: This shows the species that are being assessed within this study.
Tank Identification: Mark within the store a single tank for each of the species that is being assessed if present within store; please choose wherever possible a tank containing newly delivered stock. To identify tanks within the store that are being sampled; stickers can be used or another form of marker. If stickers are used as a tank identification tool, marking each sticker with a tank identification number for each species may be beneficial. If you require stickers e-mail: lucy_anna_smith@hotmail.co.uk with an address.
Species Weekly Assessment Sample Turnover: During a weekly assessment, if a species study tank (sample) stays the same then this sample remains 'Sample 1' throughout the week. If a species sample stays the same in week(s) following, then that tank sample continues on to next week(s) data collection (i.e. 'sample 1') until stock turnover has occurred. In the study it is likely that stock turnover may occur during a week for species being sampled (e.g. species being sold out, tank being restocked or species in a tank being redistributed within the store), in this case please create a new tank sample for that species (e.g. sample 1, sample 2, sample 3 and so on). In the case of a species sample being a continuation from a previous week's study sample, place that sample in 'sample 1' for that species writing 'continued' for sample 1.

<u>Data to be collected for species preliminary information</u>

1a) Country Stock is Imported From: In this section please state country stock has been imported from.
1b) Stock from Wild or Captive Sources: Please state 'Wild' for species sample that is from wild stock or 'Captive' for species that is from captive stock.
1c) Estimated Average Length of the Species Being Assessed Held in the Tank Being Sampled: Please estimate the average length of the species being assessed within the tank being sampled. (Estimated average species length of from the tip of the head (Point 1 in Diagram 1) to the beginning of the caudal fin (Point 2 in Diagram 1), measuring in centimetres.

Diagram 1: Measuring fish



Point 1 Point 2

1d) Stocking Levels of the Species that is being Assessed in the Tank Being Sampled: Please estimate the quantity of the species that is being assessed, held within the tank being sampled. This should be estimated at the start of then a species sample is beginning to be monitored.
1e) Quantity of Other Species Stocked in Tank: Estimate the quantity of other species stocked in tank with the species being sampled. This should be done when the tank sample is starting to be monitored for the species. In this section please state the species and the estimated number of each species, separating each species in a tank sample using a comma (NB. if no other species in tank, leave this section blank for that species sample).

SECTION 2

Quantity Stock Lost Within Week Information

This section is to be filled out on a daily basis for a period of eight weeks. If unable to gather information for any of the parts in section 2, please state 'unable' in the appropriate column for that species, and then move to next part.
Species being assessed: This shows the species that are being assessed within this study.
Tank Identification: Please gather information on the tank that species are being sample from, which should be indicated through means of stickers, or other form of identification. Make sure to mark new tanks for a species sample when previous species sample has finished.

Data Collection for the Quantity of Stock Lost Within Week
2a) Species in Stock?: Please state 'yes' if the species is in stock or, 'no' if it is not in stock. If not in stock, go to the next species.
2b) Species Sample Turnover: Is this sample a continuation of previous day's tank stock or is that tank batch no longer available to study? Tank turnover can occur for varies reasons as mentioned in Section 1, please write 'Yes' if the sample is a continuation of the previous days species study sample or 'No' if the previous day's species study sample is no longer available (if the answer is 'no' go to section 2c for that species, if answered 'yes' go to 2d)
2c) New Sample for Species Today? Is a new tank sample for a species being assessed is from;

(a) a stock delivery that occurred the day before (i.e. yesterday)? Then enter 1.

(b) a stock delivery that occurred at a later date (e.g. from a day prior to yesterday)? Then enter 2.

Fill out for new species samples the Preliminary Information: Section 1, and continue for new sample to complete Quantity of Stock Loss Information: Section 2d and 2e.

2d) Amount of Morning Daily Stock Loss for Species: Please enter the morning's daily amount of stock loss for each species that is being assessed; included in this all individuals that have been euthanized. If no losses have occurred enter '0'. Please do not include any stock within study that expired after the morning stock loss information for a day has been gathered.

2e) Measure the Length of Each Specimen of Species that has Suffered Stock Loss: Measure the length in

APPENDIX 7: MARINE BINARY LOGISTIC REGRESSION ANALYSIS

7.1: FISH LENGTH

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
902	-.047	.091	.268	1	.605	.954	.798	1.140

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	49	19.281	28420.655	.000	1	.999	236410664.337	.000	.
2	298	1.366	1.518	.810	1	.368	3.921	.200	76.779
3	86	.352	.412	.731	1	.392	1.422	.634	3.190
4	39	11.384	4501.440	.000	1	.998	87911.271	.000	.
5	40	.348	.597	.339	1	.561	1.416	.439	4.564
6	3	-21.203	40192.977	.000	1	1.000	.000	.000	.
8	76	-.064	.173	.134	1	.714	.938	.668	1.318
9	57	-.186	.239	.606	1	.436	.830	.520	1.326
10	57	1.500	1.559	.925	1	.336	4.480	.211	95.111
11	42	.571	.887	.414	1	.520	1.769	.311	10.068
12	78	.139	.271	.263	1	.608	1.149	.675	1.956
13	77	-.545	.582	.876	1	.349	.580	.185	1.815

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	162	.763	.499	2.337	1	.126	2.145	.806	5.706
Common	270	-.574	.402	2.039	1	.153	.563	.256	1.238

Clown Copperband Butterfly	8	-4.322	8038.595	.000	1	1.000	.013	.000	.
Emperor Angel	9	All Alive							
Flame Angel	37	-.260	.453	.330	1	.566	.771	.318	1.872
Frogfish	3	No average size variation							
Green Chromis	301	.073	.210	.121	1	.728	1.076	.712	1.624
Mandarin	61	.393	.428	.843	1	.358	1.481	.640	3.425
Pyjama Wrasse	38	.080	.594	.018	1	.893	1.083	.338	3.468
Regal Tang	63	.188	.313	.360	1	.549	1.206	.653	2.227
Scooter Blenny	42	-.089	.497	.032	1	.858	.915	.346	2.422
Seahorse	10	-8.960	7787.623	.000	1	.999	.000	.000	.

Species category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	**Upper**
1	771	.055	.147	.139	1	.709	1.057	.791	1.411
2	174	-.007	.150	.002	1	.964	.993	.741	1.332
3	59	-.140	.257	.300	1	.584	.869	.526	1.437

7.2: TANK STOCK DENSITY/ DIVERSITY

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
925	-.040	.059	.445	1	.505	.961	.856	1.080

Store

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	.028	.894	.001	1	.975	1.029	.178	5.932
2	249	8.100	2747.546	.000	1	.998	3293.497	.000	.
3	86	.587	.258	5.193	1	.023	1.799	1.086	2.982
4	39	.353	.282	1.567	1	.211	1.423	.819	2.474
5	58	-.127	.410	.096	1	.757	.881	.394	1.968
6	20	-.548	.947	.334	1	.563	.578	.090	3.702
8	62	-.235	.249	.893	1	.345	.790	.485	1.288
9	57	.157	.351	.199	1	.655	1.170	.588	2.328
10	78	15.488	1860.340	.000	1	.993	5324406.992	.000	.
11	42	.198	.333	.353	1	.552	1.219	.634	2.343
12	77	-.236	.284	.691	1	.406	.790	.452	1.378
13	100	-.080	.161	.246	1	.620	.923	.673	1.266

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	154	-.095	.187	.259	1	.611	.909	.630	1.312
Common Clown	240	-.285	.120	5.682	1	.017	.752	.595	.951
Copperband Butterfly	6	All had 0 diversity of other fish							
Emperor Angel	7	All Alive							
Flame Angel	35	-.056	.359	.025	1	.875	.945	.467	1.911
Frogfish	3	All had 0 diversity of other fish							
Green Chromis	289	.069	.112	.381	1	.537	1.072	.860	1.336
Mandarin	48	-.020	.341	.003	1	.953	.980	.502	1.913
Pyjama	36	.232	.445	.270	1	.60	1.261	.527	3.017

Wrasse						3			
Regal Tang	59	-.411	.248	2.756	1	.097	.663	.408	1.077
Scooter Blenny	42	18.612	7592.065	.000	1	.998	121042830.038	.000	.
Seahorse	6	10.255	11602.711	.000	1	.999	28420.722	.000	.

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	719	-.071	.067	1.114	1	.291	.932	.817	1.062
2	155	-.127	.178	.508	1	.476	.881	.621	1.249
3	51	.167	.339	.242	1	.623	1.181	.608	2.295

7.3: COST OF ORNAMENTAL FISH

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
1004	-.008	.007	1.098	1	.295	.992	.978	1.007

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	-.040	.073	.304	1	.581	.961	.832	1.108
2	298	.060	.077	.623	1	.430	1.062	.914	1.234
3	86	-.007	.022	.100	1	.752	.993	.952	1.036
4	39	.022	.018	1.478	1	.224	1.022	.987	1.059
5	60	.003	.053	.003	1	.953	1.003	.904	1.114
6	20	.267	.165	2.624	1	.105	1.306	.945	1.805
8	79	-.036	.016	5.135	1	.023	.965	.935	.995
9	65	.027	.039	.492	1	.483	1.028	.952	1.110
10	78	-.429	99.134	.000	1	.997	.651	.000	1.574E+084
11	42	No variation in average cost							
12	78	.029	.048	.356	1	.551	1.029	.936	1.132
13	102	.118	.056	4.487	1	.034	1.125	1.009	1.255

Species specific: Not applicable

Category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	771	.005	.011	.225	1	.635	1.005	.983	1.028
2	174	-.031	.013	5.571	1	.018	.969	.944	.995
3	59	.031	.040	.624	1	.430	1.032	.955	1.115

7.4 TANK STOCKING DENSITY (OTHER SPECIES)

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
984	-.013	.009	2.263	1	.133	.987	.970	1.004

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	.188	.470	.161	1	.689	1.207	.481	3.031
2	292	-.001	.449	.000	1	.998	.999	.414	2.407
3	86	.363	.166	4.791	1	.029	1.437	1.039	1.989
4	39	.272	.215	1.613	1	.204	1.313	.862	2.000
5	58	-.290	.288	1.015	1	.314	.748	.425	1.316
6	20	.063	.336	.036	1	.850	1.065	.551	2.059
8	76	-.025	.040	.379	1	.538	.976	.902	1.055
9	59	.033	.160	.042	1	.837	1.034	.755	1.414
10	78	7.176	608.961	.000	1	.991	1308.258	.000	.
11	42	.055	.094	.342	1	.559	1.056	.879	1.270
12	77	-.003	.010	.095	1	.758	.997	.978	1.017
13	100	.036	.053	.453	1	.501	1.036	.934	1.150

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	154	-.023	.162	.020	1	.888	.977	.711	1.344
Common Clown	270	-.014	.033	.171	1	.679	.986	.924	1.053
Copperband Butterfly	7	-10.948	20096.485	.000	1	1.000	.000	.000	.
Emperor Angel	8	All Alive							
Flame Angel	35	.010	.121	.006	1	.936	1.010	.797	1.279
Frogfish	3	0 Estimated Other Species Held in Tank							
Green Chromis	301	.003	.035	.008	1	.928	1.003	.937	1.075
Mandarin	57	.079	.301	.068	1	.794	1.082	.600	1.953
Pyjama	37	-.016	.010	2.24	1	.134	.985	.965	1.005

Wrasse				3					
Regal Tang	63	-.050	.042	1.415	1	.234	.951	.876	1.033
Scooter Blenny	42	13.991	2818.249	.000	1	.996	1191403.151	.000	.
Seahorse	7	All Alive							

Category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	762	-.014	.009	2.461	1	.117	.986	.969	1.004
2	139	-.037	.041	.806	1	.369	.964	.890	1.044
3	53	.029	.149	.037	1	.847	1.029	.768	1.379

7.5 TANK STOCKING DENSITY (SAMPLE SPECIES)

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
984	.026	.010	7.314	1	.007	1.027	1.007	1.046

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	.053	.165	.103	1	.748	1.054	.763	1.458
2	292	.017	.025	.457	1	.499	1.017	.968	1.069
3	86	-.410	.243	2.852	1	.091	.664	.413	1.068
4	39	.525	.244	4.613	1	.032	1.691	1.047	2.730
5	58	-.018	.411	.002	1	.966	.982	.439	2.198
6	20	All have 1 Estimated Quantity of Sample Fish in Tank							
8	76	.075	.165	.209	1	.648	1.078	.780	1.490
9	59	-.107	.094	1.300	1	.254	.899	.748	1.080
10	78	-.811	210.329	.000	1	.997	.444	.000	4.785E+178
11	42	-.028	.045	.383	1	.536	.972	.889	1.063
12	77	.078	.055	2.040	1	.153	1.081	.971	1.204
13	100	-.281	.130	4.692	1	.030	.755	.586	.974

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	154	-.002	.026	.006	1	.938	.998	.948	1.050
Common Clown	270	.047	.021	4.885	1	.027	1.048	1.005	1.093
Copperband Butterfly	7	1.362	1.124	1.467	1	.226	3.904	.431	35.368
Emperor Angel	8	All Alive							
Flame Angel	35	-.031	.111	.079	1	.778	.969	.780	1.204
Frogfish	3	All have 3 Estimated Quantity of Sample Fish in Tank							
Green Chromis	301	-.007	.034	.044	1	.833	.993	.929	1.061
Mandarin	57	-.041	.239	.029	1	.864	.960	.601	1.532
Pyjama Wrasse	37	-.208	.218	.911	1	.340	.812	.530	1.245
Regal Tang	63	-.202	.182	1.240	1	.265	.817	.572	1.166
Scooter Blenny	42	-1.051	.721	2.127	1	.145	.350	.085	1.435
Seahorse	7	All Alive							

Category specific

Species Category	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for

Number								EXP(B)	
								Lower	Upper
1	762	.027	.011	6.333	1	.012	1.027	1.006	1.048
2	169	-.131	.121	1.158	1	.282	.878	.692	1.113
3	53	-.086	.096	.812	1	.367	.917	.761	1.106

7.6: DISTANCE FROM IMPORT SOURCE

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
1004	-.002	.001	2.331	1	.127	.998	.995	1.001

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	-.003	.004	.397	1	.529	.997	.989	1.006
2	298	.018	.015	1.472	1	.225	1.018	.989	1.048
3	86	-.010	.009	1.274	1	.259	.990	.973	1.007
4	39	-.027	.013	4.575	1	.032	.973	.949	.998
5	60	-.012	.008	2.319	1	.128	.988	.972	1.004
6	20	.010	.012	.656	1	.418	1.010	.987	1.033
8	79	-.008	.004	3.419	1	.064	.993	.985	1.000
9	65	-.001	.007	.024	1	.877	.999	.985	1.013
10	78	-.008	.011	.491	1	.483	.992	.970	1.014
11	42	.001	.007	.026	1	.873	1.001	.988	1.014
12	78	.002	.003	.741	1	.389	1.002	.997	1.008
13	102	.001	.005	.036	1	.849	1.001	.991	1.011

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	162	-.010	.004	8.271	1	.004	.990	.983	.997
Common Clown	270	-.002	.003	.625	1	.429	.998	.992	1.003
Copperband Butterfly	8	-.028	.019	2.081	1	.149	.973	.937	1.010
Emperor Angel	9	All Alive							
Flame Angel	37	.008	.012	.386	1	.534	1.008	.984	1.033
Frogfish	3	No variation							
Green Chromis	301	.000	.003	.002	1	.967	1.000	.995	1.005
Mandarin	61	-.005	.006	.754	1	.38	.995	.982	1.007

						5			
Pyjama Wrasse	38	.011	.010	1.274	1	.259	1.011	.992	1.031
Regal Tang	63	.000	.004	.003	1	.955	1.000	.992	1.008
Scooter Blenny	42	-.003	.008	.126	1	.723	.997	.982	1.013
Seahorse	10	-.668	327.039	.000	1	.998	.513	.000	1.219E+278

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	771	-.003	.002	2.691	1	.101	.997	.994	1.000
2	174	-.003	.003	.990	1	.320	.997	.992	1.003
3	59	.001	.008	.021	1	.886	1.001	.986	1.016

7.8 OLD OR NEW STOCK

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
638	.266	.302	.776	1	.378	1.305	.722	2.359

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	40	None listed as old							
2	273	1.523	1.232	1.528	1	.216	4.585	.410	51.280
3	73	-2.128	1.124	3.584	1	.058	.119	.013	1.078
4	34	.693	.945	.538	1	.463	2.000	.314	12.745
5	13	All Alive							
6	3	21.203	40192.969	.000	1	1.000	1615474815.186	.000	.
8	67	-2.414	.828	8.504	1	.004	.089	.018	.453
9	26	-.167	1.472	.013	1	.910	.846	.047	15.161
10	51	All							

		Alive							
11	No Values for Old/New								
12	16	2.197	1.333	2.716	1	.099	9.000	.660	122.794
13	42	None listed as old							

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	86	18.082	10377.781	.000	1	.999	71270949.417	.000	.
Common Clown	206	1.555	.795	3.830	1	.050	4.737	.998	22.490
Copperband Butterfly	6	-22.302	28420.724	.000	1	.999	.000	.000	.
Emperor Angel	7	All Alive							
Flame Angel	5	None listed as new							
Frogfish	No Values for Old/New								
Green Chromis	206	1.615	.597	7.331	1	.007	5.028	1.562	16.187
Mandarin	35	-1.482	1.283	1.334	1	.248	.227	.018	2.808
Pyjama Wrasse	27	-1.186	1.228	.932	1	.334	.306	.028	3.390
Regal Tang	29	-20.191	10742.018	.000	1	.999	.000	.000	.
Scooter Blenny	23	-1.312	1.311	1.001	1	.317	.269	.021	3.519
Seahorse	8	None listed as old							

Category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	525	1.018	.399	6.502	1	.011	2.766	1.265	6.048
2	93	-1.823	.699	6.806	1	.009	.162	.041	.635
3	299	-.693	1.500	.214	1	.644	.500	.026	9.457

7.9: NUMBER OF STOCK ROTATION(S)

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
995	.183	.101	3.278	1	.070	1.201	.985	1.465

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	-.235	.404	.338	1	.561	.791	.358	1.745
2	298	-1.128	.845	1.783	1	.182	.324	.062	1.695
3	86	.571	.536	1.135	1	.287	1.770	.619	5.060
4	39	.557	.612	.829	1	.363	1.746	.526	5.794
5	58	.125	.452	.076	1	.782	1.133	.467	2.750
6	20	.109	.126	.756	1	.385	1.115	.872	1.427
8	76	1.413	.638	4.906	1	.027	4.107	1.177	14.337
9	62	.596	.731	.666	1	.414	1.816	.434	7.605
10	78	15.415	2995.557	.000	1	.996	4950824.452	.000	.
11	42	19.737	12710.135	.000	1	.999	372801930.057	.000	.
12	78	-.360	.392	.842	1	.359	.698	.324	1.505
13	101	.404	.267	2.289	1	.130	1.498	.887	2.530

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	161	.975	.607	2.578	1	.108	2.652	.806	8.721
Common Clown	164	.177	.208	.726	1	.394	1.194	.794	1.794
Copperband Butterfly	4	11.151	11602.711	.000	1	.999	69616.266	.000	.
Emperor Angel	5	All Alive							
Flame Angel	22	.066	.892	.005	1	.941	1.068	.186	6.133
Frogfish	3	.693	1.225	.320	1	.571	2.000		
Green Chromis	176	.009	.161	.003	1	.955	1.009	.736	1.383
Mandarin	19	.615	.552	1.238	1	.266	1.849	.626	5.461

Pyjama Wrasse	15	.606	.692	.767	1	.381	1.833	.472	7.118
Regal Tang	24	.139	.118	1.401	1	.237	1.149	.913	1.447
Scooter Blenny	26	18.382	7531.757	.000	1	.998	96189879.934	.000	.
Seahorse	5	19.817	23205.422	.000	1	.999	403868714.767	.000	.

Category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	770	.170	.132	1.677	1	.195	1.186	.916	1.534
2	169	.228	.169	1.812	1	.178	1.256	.901	1.751
3	56	.488	.849	.330	1	.566	1.629	.308	8.602

7.10: WILD OR CAPTIVE STOCK

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
983	-.245	.242	1.022	1	.312	.783	.487	1.258

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	-.288	.814	.125	1	.724	.750	.152	3.701
2	292	-.206	1.231	.028	1	.867	.814	.073	9.079
3	86	-18.917	8770.824	.000	1	.998	.000	.000	.
4	39	All Wild							
5	57	All Wild							
6	20	All Wild							
8	76	.442	.876	.254	1	.614	1.556	.279	8.665
9	57	-.405	1.137	.127	1	.721	.667	.072	6.185
10	78	17.465	6793.852	.000	1	.998	38463686.620	.000	.
11	42	.188	1.174	.026	1	.873	1.207	.121	12.040
12	78	.068	.542	.016	1	.900	1.071	.370	3.098
13	101	.267	.835	.102	1	.749	1.306	.254	6.714

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)

								Lower	Upper
Bengali Cardinal	155	1.450	.787	3.393	1	.065	4.262	.911	19.937
Common Clown	270	-1.124	.563	3.984	1	.046	.325	.108	.980
Copperband Butterfly	7	All Wild							
Emperor Angel	7	All Alive and wild							
Flame Angel	33	All Wild							
Frogfish	3	All Wild							
Green Chromis	301	All Wild							
Mandarin	57	All Wild							
Pyjama Wrasse	38	-19.293	15191.523	.000	1	.999	.000	.000	.
Regal Tang	62	.630	.899	.491	1	.483	1.878	.323	10.926
Scooter Blenny	42	-18.691	28420.777	.000	1	.999	.000	.000	.
Seahorse	8	All Captured							

Category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	764	-.171	.274	.391	1	.532	.842	.492	1.442
2	168	.540	.821	.433	1	.511	1.716	.343	8.576
3	51	-.127	1.156	.012	1	.913	.881	.091	8.492

7.11: STOCKING DENSITY (TOTAL)

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
984	.016	.007	4.828	1	.028	1.016	1.002	1.031

Store

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	.105	.175	.361	1	.548	1.111	.789	1.565
2	292	.018	.026	.468	1	.494	1.018	.968	1.070
3	86	.193	.148	1.702	1	.192	1.213	.908	1.620
4	39	.222	.116	3.706	1	.054	1.249	.996	1.567
5	58	-.175	.244	.514	1	.473	.840	.520	1.354
6	20	.063	.336	.036	1	.850	1.065	.551	2.059
8	76	-.020	.040	.246	1	.620	.980	.905	1.061
9	59	-.077	.081	.895	1	.344	.926	.790	1.086
10	78	-.121	.151	.645	1	.422	.886	.658	1.191
11	42	-.029	.063	.215	1	.643	.971	.859	1.098
12	77	.000	.011	.001	1	.981	1.000	.979	1.022
13	100	-.018	.033	.291	1	.590	.982	.920	1.049

Species

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	154	.001	.030	.000	1	.983	1.001	.944	1.061
Common Clown	270	.058	.022	6.827	1	.009	1.060	1.015	1.107
Copperband Butterfly	7	.313	1.050	.089	1	.766	1.367	.175	10.706
Emperor Angel	8	All Alive							
Flame Angel	35	-.021	.105	.041	1	.839	.979	.798	1.202
Frogfish	3	All have 3 Estimated Quantity of Total Fish in Tank							
Green Chromis	301	-.002	.022	.006	1	.938	.998	.956	1.043
Mandarin	57	.008	.203	.002	1	.969	1.008	.677	1.501
Pyjama Wrasse	37	-.016	.010	2.388	1	.122	.984	.964	1.004
Regal Tang	63	-.054	.039	1.899	1	.168	.947	.877	1.023
Scooter Blenny	42	.015	.190	.006	1	.936	1.015	.699	1.474
Seahorse	7	All Alive							

Species Categorised

Species Category	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for

Number								EXP(B)	
								Lower	Upper
1	762	.016	.008	4.000	1	.045	1.017	1.000	1.033
2	169	-.044	.037	1.440	1	.230	.957	.890	1.028
3	53	-.060	.084	.517	1	.472	.941	.799	1.110

7.12: NUMBER OF DAYS HELD IN STORE

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
1004	-.010	.011	.731	1	.392	.990	.968	1.013

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	57	-.014	.037	.136	1	.712	.987	.918	1.060
2	298	.062	.038	2.569	1	.109	1.063	.986	1.147
3	86	.012	.058	.042	1	.838	1.012	.903	1.135
4	39	.063	.035	3.239	1	.072	1.065	.994	1.140
5	60	-.038	.070	.294	1	.588	.963	.840	1.104
6	20	-2.732	4060.088	.000	1	.999	.065	.000	.
8	79	-.041	.060	.451	1	.502	.960	.853	1.081
9	65	-.009	.044	.045	1	.833	.991	.908	1.081
10	78	.096	.061	2.505	1	.114	1.101	.977	1.241
11	42	-.027	.168	.026	1	.873	.973	.701	1.352
12	78	-.047	.046	1.040	1	.308	.954	.873	1.044
13	102	-2.283	476.789	.000	1	.996	.102	.000	.

Species specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Bengali Cardinal	162	.015	.023	.408	1	.523	1.015	.970	1.062
Common Clown	270	.036	.021	2.775	1	.096	1.036	.994	1.081
Copperband Butterfly	8	-2.988	5741.996	.000	1	1.000	.050	.000	.
Emperor Angel	9	All Alive							
Flame Angel	37	-.027	.066	.171	1	.679	.973	.855	1.107
Frogfish	3	All Held for 42 days							
Green Chromis	301	-.027	.022	1.543	1	.214	.973	.933	1.016
Mandarin	61	-.082	.074	1.259	1	.262	.921	.797	1.064
Pyjama Wrasse	38	-.148	.154	.923	1	.337	.863	.638	1.166
Regal Tang	63	.164	.086	3.650	1	.056	1.179	.996	1.395
Scooter Blenny	42	-2.364	676.396	.000	1	.997	.094	.000	.
Seahorse	10	-.398	837.354	.000	1	1.000	.671	.000	.

Category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	771	.001	.013	.004	1	.948	1.001	.976	1.026
2	174	-.057	.039	2.132	1	.144	.944	.875	1.020
3	59	-.011	.044	.063	1	.801	.989	.908	1.078

APPENDIX 8: TROPICAL BINARY LOGISTIC REGRESSION ANALYSIS

8.1: COST OF ORNAMENTAL FISH

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
32181	-.048	.005	103.260	1	.000	.953	.945	.962

Store specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	.189	.126	2.240	1	.134	1.208	.943	1.548
2	1590	.024	.045	.279	1	.597	1.024	.937	1.120
3	781	.204	.043	22.874	1	.000	1.227	1.128	1.334
4	1903	-.068	.012	30.533	1	.000	.934	.912	.957
5	993	.142	.095	2.244	1	.134	1.152	.957	1.387
6	543	.054	.082	.433	1	.511	1.056	.898	1.240
7	103	1.653	.309	28.590	1	.000	5.220	2.848	9.567
8	1477	.024	.046	.280	1	.597	1.025	.936	1.121
9	1366	.780	.111	49.256	1	.000	2.181	1.754	2.711
10	2513	-.093	.028	10.880	1	.001	.911	.862	.963
11	554	8.159	.732	124.136	1	.000	3493.269	831.630	14673.512
12	2530	-.025	.078	.099	1	.753	.976	.837	1.138
13	3225	-.040	.018	4.776	1	.029	.961	.927	.996
14	1178	.345	.407	.718	1	.397	1.412	.636	3.138
15	685	-.544	.088	38.042	1	.000	.580	.488	.690
16	2697	-.146	.018	64.061	1	.000	.864	.834	.896
17	2376	-.034	.026	1.655	1	.198	.967	.918	1.018
18	5406	-.142	.009	255.101	1	.000	.867	.852	.883
19	1436	-.085	.030	7.838	1	.005	.918	.865	.975

Species Specific (Not Applicable)

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	21674	1.079	.106	103.479	1	.000	2.942	2.390	3.623
2	10199	.207	.026	61.233	1	.000	1.230	1.168	1.296
3	308	.013	.018	.586	1	.444	1.014	.979	1.049

8.2: FISH LENGTH

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
32204	.118	.023	26.156	1	.000	1.125	1.075	1.176

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	-.131	.077	2.907	1	.088	.877	.754	1.020
2	1590	-.087	.087	1.011	1	.315	.917	.773	1.086
3	781	-.225	.104	4.653	1	.031	.799	.651	.980
4	1904	-.344	.058	34.814	1	.000	.709	.633	.795
5	993	.654	.215	9.252	1	.002	1.922	1.262	2.929
6	544	.469	.220	4.534	1	.033	1.599	1.038	2.462
7	9	35.321	8173.387	.000	1	.997	2186470741915879.000	.000	.
8	1477	-.070	.101	.470	1	.493	.933	.765	1.138
9	1366	1.582	.209	57.577	1	.000	4.865	3.233	7.321
10	2513	-.276	.111	6.213	1	.013	.759	.611	.943
11	525	5.966	.674	78.373	1	.000	390.089	104.111	1461.608
12	2530	.047	.098	.228	1	.633	1.048	.865	1.270
13	3225	-.159	.080	3.921	1	.048	.853	.729	.998
14	1194	.334	.474	.498	1	.480	1.397	.552	3.536
15	645	.859	.286	9.052	1	.003	2.362	1.349	4.134
16	2152	-.187	.121	2.399	1	.121	.829	.655	1.051
17	1181	-.904	.112	64.574	1	.000	.405	.325	.505

18	490	-.850	.099	73.777	1	.000	.428	.352	.519
19	1398	-.461	.134	11.854	1	.001	.631	.485	.820

Species Specific

Species Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	3607	-.718	.166	18.600	1	.000	.488	.352	.676
Clown loach	1190	-.016	.095	.028	1	.868	.984	.817	1.186
Discus	249	.186	.119	2.430	1	.119	1.205	.953	1.522
Dwarf gouramis	1337	.204	.086	5.582	1	.018	1.226	1.035	1.452
Elephant nose	23	.820	.538	2.324	1	.127	2.269	.791	6.509
Goldy pleco	17	-	-	-	-	-	-	-	-
Guppies	5478	1.117	.080	192.923	1	.000	3.055	2.610	3.576
Harlequin rasbora	3502	.834	.298	7.839	1	.005	2.303	1.284	4.130
Neon dwarf rainbow	1754	.382	.228	2.821	1	.093	1.466	.938	2.290
Neon tetra	7580	1.640	.111	216.435	1	.000	5.155	4.143	6.413
Silver arowana	38	-10.877	1273.486	.000	1	.993	.000	.000	.
Silver shark	567	.914	.355	6.648	1	.010	2.495	1.245	5.001

Category specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	16443	.998	.073	185.497	1	.000	2.714	2.351	3.133
2	8572	.521	.042	150.073	1	.000	1.683	1.548	1.829
3	327	.140	.094	2.202	1	.138	1.150	.956	1.383

8.3: DISTANCE FROM IMPORT SOURCE

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
31701	-.002	.000	34.143	1	.000	.998	.998	.999

Store Specific: Not Appicable

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	5361	-.013	.001	129.897	1	.000	.987	.985	.990
Clown loach	1232	-.007	.002	13.228	1	.000	.993	.989	.997
Discus	249	.008	.003	9.098	1	.003	1.008	1.003	1.013
Dwarf gouramis	1877	-.001	.001	.835	1	.361	.999	.996	1.001
Elephant nose	23	-.025	.013	3.372	1	.066	.976	.950	1.002
Goldy pleco	17	All Alive							
Guppies	6362	.003	.000	56.889	1	.000	1.003	1.002	1.004
Harlequin rasbora	4753	-.004	.002	6.191	1	.013	.996	.993	.999
Neon dwarf rainbow	2127	-.008	.002	12.107	1	.001	.992	.988	.997
Neon tetra	9483	.000	.001	.420	1	.517	1.000	.999	1.002
Silver arowana	42	.034	.028	1.504	1	.220	1.034	.980	1.092
Silver shark	678	-.005	.003	3.399	1	.065	.995	.991	1.000

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	21674	-.004	.000	72.154	1	.000	.996	.995	.997
2	10199	.002	.000	15.651	1	.000	1.002	1.001	1.002
3	331	.004	.002	3.635	1	.057	1.004	1.000	1.009

8.4: TANK STOCKING DENSITY (OTHER SPECIES)

Total sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
28142	.016	.001	122.467	1	.000	1.016	1.013	1.019

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	1.621	87.595	.000	1	.985	5.058	.000	1.842E+075
2	25	No Other Fish							
3	120	No Other Fish							
4	1904	-.009	.002	19.373	1	.000	.991	.988	.995
5	993	.175	49.893	.000	1	.997	1.191	.000	3.508E+042
6	129	-.036	.087	.168	1	.682	.965	.814	1.144
7	7	Only Alive Estimated to Have Other Fish							
8	541	.014	.014	1.034	1	.309	1.014	.987	1.041
9	1366	.093	.014	44.494	1	.000	1.098	1.068	1.128
10	2513	.004	.013	.083	1	.773	1.004	.979	1.029
11	554	-.056	.009	38.609	1	.000	.946	.929	.963
12	2530	.015	.008	3.858	1	.050	1.015	1.000	1.031
13	3225	.007	.003	5.070	1	.024	1.007	1.001	1.013
14	1194	-.022	.019	1.370	1	.242	.978	.943	1.015
15	645	No Other Fish							
16	2697	.020	.006	9.890	1	.002	1.020	1.008	1.033
17	2289	.043	.009	21.458	1	.000	1.044	1.025	1.063
18	5407	-.099	.007	229.021	1	.000	.906	.894	.917
19	1178	-.097	.028	12.212	1	.000	.907	.859	.958

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	4561	-.004	.003	2.295	1	.130	.996	.991	1.001
Clown loach	819	.010	.007	1.679	1	.195	1.010	.995	1.025
Discus	240	-.061	.011	31.482	1	.000	.941	.921	.961
Dwarf gouramis	1755	.009	.007	1.484	1	.223	1.009	.994	1.024
Elephant nose	23	.207	.080	6.693	1	.010	1.230	1.052	1.440
Goldy pleco	5					.			
Guppies	5585	-.059	.018	10.526	1	.001	.943	.909	.977
Harlequin rasbora	4292	.034	.008	17.751	1	.000	1.035	1.019	1.052
Neon dwarf	1864	.009	.009	.925	1	.336	1.009	.991	1.028

rainbow									
Neon tetra	8430	.019	.002	72.577	1	.000	1.019	1.015	1.023
Silver arowana	37	-.025	.082	.091	1	.762	.975	.830	1.146
Silver shark	531	-.005	.003	3.380	1	.066	.995	.989	1.000

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	19097	.018	.002	89.625	1	.000	1.018	1.014	1.022
2	8740	.007	.003	4.231	1	.040	1.007	1.000	1.013
3	305	-.032	.007	20.712	1	.000	.969	.956	.982

8.5: NUMBER OF DAYS HELD IN STORE

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
31568	.023	.004	30.475	1	.000	1.023	1.015	1.031

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	-2.605	395.917	.000	1	.995	.074	.000	.
2	1590	-.122	.088	1.912	1	.167	.885	.745	1.052
3	781	All held for 56 days							
4	1904	-.094	.039	5.878	1	.015	.910	.844	.982
5	365	All held for 56 days							
6	544	.590	1006.453	.000	1	1.000	1.803	.000	.
7	95	-2.613	507.888	.000	1	.996	.073	.000	.
8	1477	-.083	.080	1.063	1	.303	.920	.786	1.078
9	1366	.028	.118	.057	1	.811	1.029	.816	1.297
10	2513	All held for 56 days							
11	554	All held for 35 days							
12	2530	-.162	.046	12.152	1	.000	.851	.777	.932
13	3225	.017	.024	.514	1	.473	1.017	.971	1.065
14	1194	All held for 56 days							
15	685	-.102	.018	33.529	1	.000	.903	.872	.935
16	2697	.193	.033	33.171	1	.000	1.213	1.136	1.295
17	2380	.068	.012	30.544	1	.000	1.071	1.045	1.097
18	5407	-1.441	4662.964	.000	1	1.000	.237	.000	.
19	1436	.117	.016	53.963	1	.000	1.125	1.090	1.160

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	-.015	.019	.694	1	.405	.985	.950	1.021	-.015
Clown loach	-.014	.021	.419	1	.517	.986	.946	1.028	-.014
Discus	-10.093	5759.277	.000	1	.999	.000	.000	.	-10.093
Dwarf gouramis	-.053	.021	6.613	1	.010	.949	.911	.988	-.053
Elephant	.130	.065	3.963	1	.04	1.13	1.002	1.294	.130

nose					7	9			
Goldy pleco		All Alive							
Guppies	-.038	.008	21.748	1	.000	.963	.948	.978	-.038
Harlequin rasbora	.044	.021	4.549	1	.033	1.045	1.004	1.088	.044
Neon dwarf rainbow	.115	.013	75.814	1	.000	1.122	1.093	1.151	.115
Neon tetra	.166	.008	422.939	1	.000	1.181	1.162	1.200	.166
Silver arowana	-1.260	329.034	.000	1	.997	.284	.000	3.365E+279	-1.260
Silver shark	.010	.035	.089	1	.765	1.011	.944	1.082	.010

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	21498	.076	.005	209.983	1	.000	1.079	1.068	1.090
2	9747	-.046	.007	43.506	1	.000	.955	.943	.968
3	323	-.030	.021	1.985	1	.159	.971	.931	1.012

8.6: TANK STOCKING DENSITY (TOTAL)

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
31049	.002	.000	141.231	1	.000	1.002	1.002	1.002

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	.000	.003	.032	1	.857	1.000	.995	1.006
2	1590	.002	.001	6.360	1	.012	1.002	1.000	1.004
3	120	No values for alive fish.							
4	1904	.004	.000	99.977	1	.000	1.004	1.003	1.004
5	993	-.005	.002	4.504	1	.034	.995	.990	1.000
6	544	.000	.003	.003	1	.958	1.000	.994	1.006
7	31	.073	.338	.046	1	.829	1.076	.555	2.086
8	1473	.000	.002	.021	1	.884	1.000	.996	1.004
9	1366	-.033	.002	194.119	1	.000	.967	.963	.972
10	2513	.003	.002	2.171	1	.141	1.003	.999	1.006
11	554	-.010	.004	6.775	1	.009	.990	.983	.998
12	2530	-.005	.002	5.826	1	.016	.995	.991	.999
13	3225	.000	.001	.230	1	.632	1.000	.999	1.002
14	1194	-.019	.011	2.770	1	.096	.981	.960	1.003
15	645	.005	.002	5.293	1	.021	1.005	1.001	1.009
16	2697	.020	.005	16.321	1	.000	1.020	1.010	1.029
17	2260	.011	.003	19.282	1	.000	1.011	1.006	1.017
18	5407	.002	.000	52.782	1	.000	1.002	1.002	1.003
19	1178	.000	.003	.003	1	.959	1.000	.994	1.006

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	5087	.013	.002	69.057	1	.000	1.013	1.010	1.016
Clown loach	874	.015	.007	5.131	1	.024	1.016	1.002	1.029
Discus	249	-.026	.004	40.585	1	.000	.975	.967	.982
Dwarf gouramis	1822	-.025	.005	29.180	1	.000	.976	.967	.984
Elephant nose	19	-.012	.082	.023	1	.880	.988	.841	1.160
Goldy pleco	17	All Alive							
Guppies	6277	.002	.000	54.293	1	.000	1.002	1.001	1.002
Harlequin rasbora	4747	.000	.001	.246	1	.620	1.000	.999	1.002
Neon dwarf rainbow	1989	.015	.005	10.639	1	.001	1.015	1.006	1.024
Neon tetra	9280	.003	.000	161.592	1	.000	1.003	1.003	1.004
Silver arowana	41	.026	.087	.087	1	.768	1.026	.865	1.217
Silver shark	647	-.005	.003	2.613	1	.106	.995	.989	1.001

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	21053	.002	.000	68.903	1	.000	1.002	1.001	1.002
2	9670	.001	.000	8.428	1	.004	1.001	1.000	1.001
3	326	-.027	.004	53.008	1	.000	.973	.966	.980

8.7: TANK STOCKING DENSITY (SAMPLE SPECIES)

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
31815	.002	.000	114.498	1	.000	1.002	1.001	1.002

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	-.006	.003	3.513	1	.061	.994	.988	1.000
2	1590	.002	.001	5.811	1	.016	1.002	1.000	1.003
3	781	.013	.002	45.361	1	.000	1.013	1.009	1.017
4	1904	.004	.000	100.915	1	.000	1.004	1.003	1.004
5	993	-.008	.003	9.713	1	.002	.992	.987	.997
6	394	-.177	.028	41.342	1	.000	.837	.793	.884
7	32	-.918	727.405	.000	1	.999	.399	.000	.
8	1367	.000	.002	.029	1	.866	1.000	.997	1.003
9	1366	-.030	.002	209.484	1	.000	.970	.966	.974
10	2513	.002	.002	1.705	1	.192	1.002	.999	1.006
11	554	-.001	.003	.115	1	.735	.999	.994	1.005
12	2530	-.002	.002	2.167	1	.141	.998	.995	1.001
13	3225	.000	.001	.100	1	.752	1.000	.997	1.002
14	1194	-.023	.015	2.150	1	.143	.978	.949	1.008
15	645	.005	.002	5.293	1	.021	1.005	1.001	1.009
16	2697	.082	.016	27.064	1	.000	1.086	1.052	1.120
17	2370	.011	.003	13.872	1	.000	1.011	1.005	1.017
18	5407	.002	.000	55.197	1	.000	1.002	1.002	1.003
19	1428	.007	.002	8.286	1	.004	1.007	1.002	1.011

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	5251	.011	.001	60.823	1	.000	1.011	1.008	1.014
Clown loach	1214	.025	.007	11.949	1	.001	1.025	1.011	1.040
Discus	249	-.031	.006	31.481	1	.000	.969	.959	.980
Dwarf gouramis	1872	-.015	.003	20.969	1	.000	.985	.979	.991
Elephant nose	19	10.255	5024.121	.000	1	.998	28420.722	.000	.
Goldy pleco	17	All Alive							
Guppies	6277	.002	.000	53.737	1	.000	1.002	1.001	1.002

Harlequin rasbora	4747	.000	.001	.272	1	.602	1.000	.998	1.001
Neon dwarf rainbow	2119	.018	.005	11.446	1	.001	1.018	1.008	1.029
Neon tetra	9330	.003	.000	134.804	1	.000	1.003	1.002	1.003
Silver arowana	42	7.382	1037.259	.000	1	.994	1606.914	.000	.
Silver shark	678	-.012	.022	.273	1	.601	.989	.947	1.032

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	21397	.001	.000	44.135	1	.000	1.001	1.001	1.002
2	10091	.001	.000	10.057	1	.002	1.001	1.000	1.001
3	327	-.036	.005	48.107	1	.000	.964	.955	.974

8.8: TANK STOCKING DIVERSITY

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
32077	.230	.030	59.539	1	.000	1.258	1.187	1.334

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	19.538	1651.397	.000	1	.991	305537573.271	.000	.
2	1590	No diversity of other species							
3	781	21.785	1373.017	.000	1	.987	2892109117.061	.000	.
4	1904	-.461	.172	7.144	1	.008	.631	.450	.884
5	993	6.058	1729.630	.000	1	.997	427.359	.000	.
6	544	.963	.429	5.038	1	.025	2.619	1.130	6.069
7	25	No diversity of other species							
8	1477	.382	.211	3.286	1	.070	1.466	.969	2.216
9	1366	1.765	.227	60.665	1	.000	5.841	3.747	9.108
10	2513	-.098	.186	.276	1	.599	.907	.630	1.306
11	554	-.085	.138	.375	1	.540	.919	.700	1.205
12	2530	1.741	.590	8.717	1	.003	5.703	1.795	18.114
13	3225	-.058	.328	.031	1	.860	.944	.496	1.794
14	1194	-.592	.316	3.517	1	.061	.553	.298	1.027
15	645	No diversity of other species							
16	2697	.576	.179	10.378	1	.001	1.779	1.253	2.527
17	2379	.668	.139	23.192	1	.000	1.951	1.486	2.560
18	5407	-3.083	.203	229.511	1	.000	.046	.031	.068

19	1428	-.594	.415	2.054	1	.152	.552	.245	1.244

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	5361	-2.133	.170	156.798	1	.000	.118	.085	.165
Clown loach	1219	.492	.170	8.405	1	.004	1.636	1.173	2.281
Discus	249	-.577	.190	9.235	1	.002	.562	.387	.815
Dwarf gouramis	1872	-.070	.161	.190	1	.663	.932	.680	1.278
Elephant nose	23	.918	.349	6.937	1	.008	2.505	1.265	4.962
Goldy pleco	12	No diversity of other species							
Guppies	6277	-.189	.091	4.345	1	.037	.827	.692	.989
Harlequin rasbora	4747	.305	.121	6.394	1	.011	1.356	1.071	1.717
Neon dwarf rainbow	2119	.227	.185	1.504	1	.220	1.254	.873	1.802
Neon tetra	9480	.189	.049	15.117	1	.000	1.208	1.098	1.329
Silver arowana	40	-1.187	.942	1.587	1	.208	.305	.048	1.934
Silver shark	678	-.139	.190	.531	1	.466	.871	.600	1.264

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	21657	.073	.038	3.656	1	.056	1.076	.998	1.160
2	10096	.198	.060	10.801	1	.001	1.218	1.083	1.371
3	324	-.175	.122	2.062	1	.151	.840	.662	1.066

8.9: NUMBER OF STOCK ROTATIONS

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
31461	.139	.018	57.602	1	.000	1.149	1.109	1.192

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	-1.837	.250	53.852	1	.000	.159	.098	.260
2	1590	.168	.285	.347	1	.556	1.183	.677	2.066
3	781	Only 1 Stock Rotation							
4	1904	3.448	.590	34.203	1	.000	31.438	9.899	99.838
5	993	18.761	5188.878	.000	1	.997	140475895.347	.000	.
6	544	19.233	3177.530	.000	1	.995	225303574.745	.000	.
7	103	18.529	40192.969	.000	1	1.000	111412052.134	.000	.
8	1477	.102	.086	1.397	1	.237	1.107	.935	1.312
9	1366	-3.178	.170	348.149	1	.000	.042	.030	.058
10	2513	-.020	.076	.068	1	.795	.980	.844	1.139
11	554	20.179	2193.791	.000	1	.993	580099667.869	.000	.
12	2530	.622	.149	17.395	1	.000	1.863	1.391	2.496
13	3225	.102	.122	.700	1	.403	1.107	.872	1.405
14	1194	-.151	.153	.967	1	.325	.860	.637	1.161
15	685	-.552	.187	8.706	1	.003	.576	.399	.831
16	2697	.217	.112	3.744	1	.053	1.243	.997	1.548
17	2380	.069	.053	1.650	1	.199	1.071	.965	1.190
18	5407	.088	.050	3.160	1	.075	1.092	.991	1.204
19	1436	-1.706	.455	14.084	1	.000	.182	.075	.443

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	5361	.394	.084	22.112	1	.000	1.483	1.258	1.747

Clown loach	1219	.203	.138	2.152	1	.142	1.225	.934	1.607
Discus	249	.152	.128	1.415	1	.234	1.164	.906	1.496
Dwarf gouramis	1498	.182	.053	11.852	1	.001	1.200	1.082	1.330
Elephant nose	23	-2.083	1.078	3.732	1	.053	.125	.015	1.031
Goldy pleco	17	Only 1 Stock Rotation							
Guppies	6260	.402	.035	134.968	1	.000	1.494	1.396	1.599
Harlequin rasbora	4747	-.029	.068	.184	1	.668	.971	.851	1.109
Neon dwarf rainbow	2127	.474	.219	4.677	1	.031	1.606	1.045	2.467
Neon tetra	9384	-.258	.032	64.398	1	.000	.773	.726	.823
Silver arowana	42	16.314	8961.969	.000	1	.999	12169227.903	.000	.
Silver shark	534	.361	.282	1.636	1	.201	1.434	.825	2.493

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	21569	-.001	.025	.002	1	.962	.999	.950	1.050
2	9561	.311	.028	124.520	1	.000	1.364	1.292	1.441
3	331	.035	.109	.099	1	.753	1.035	.835	1.283

8.10: WILD OR CAPTIVE STOCK

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
30733	.452	.128	12.453	1	.000	1.571	1.222	2.019

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	825	18.386	5991.660	.000	1	.998	96577380.969	.000	.
2	1590	-2.232	.276	65.453	1	.000	.107	.063	.184
3	780	Only Captive							
4	1903	18.173	6607.697	.000	1	.998	78051255.822	.000	.
5	993	-.040	.401	.010	1	.920	.960	.438	2.107
6	544	Only Captive							
7	32	18.677	17974.842	.000	1	.999	129237986.873	.000	.
8	1477	Only Captive							
9	1366	Only Captive							
10	2513	Only Captive							
11	554	3.186	1.012	9.910	1	.002	24.184	3.328	175.749
12	2530	Only Captive							
13	3225	.177	.598	.088	1	.767	1.194	.370	3.851
14	1194	-1.248	.654	3.645	1	.056	.287	.080	1.034
15	645	Only Captive							
16	2697	16.607	1806.538	.000	1	.993	16302970.710	.000	.
17	2380	-24.200	17974.672	.000	1	.999	.000	.000	.
18	4107	-3.106	1.416	4.808	1	.028	.045	.003	.719
19	1378	-2.657	.483	30.223	1	.000	.070	.027	.181

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	5361	Only Captive							
Clown Loach	1169	-.676	.296	5.230	1	.022	.509	.285	.908
Discus	249	Only Captive							
Dwarf gouramis	1872	18.610	9473.647	.000	1	.998	120809504.722	.000	.
Elephant nose	22	All Wild Alive. All Captive Dead							
Goldy Pleco	17	Only Wild							
Guppies	6278	-.742	.206	13.008	1	.000	.476	.318	.713
Harlequin rasbora	4747	.431	.333	1.678	1	.195	1.540	.801	2.957
Neon dwarf rainbow	2119	Only Captive							
Neon Tetra	8180	Only Captive							
Silver Arowana	41	-19.817	6698.829	.000	1	.998	.000	.000	.
Silver Shark	678	18.102	3349.411	.000	1	.996	72712117.716	.000	.

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	20357	1.398	.305	20.977	1	.000	4.049	2.225	7.366
2	10047	.078	.147	.281	1	.596	1.081	.811	1.440
3	329	2.416	1.023	5.579	1	.018	11.196	1.509	83.102

8.11: OLD OR NEW STOCK

Total Sample

Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
15312	.978	.081	146.107	1	.000	2.660	2.270	3.117

Store Specific

Store Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	No Values								
2	1590	1.124	.545	4.257	1	.039	3.078	1.058	8.957
3	No Values								
4	985	15.424	11602.711	.000	1	.999	4996313.927	.000	.
5	60	All New and All Alive							
6	544	-19.248	3128.989	.000	1	.995	.000	.000	.
7	23	All New							
8	913	-.255	.240	1.127	1	.289	.775	.484	1.241
9	266	22.669	2542.027	.000	1	.993	7000390997.781	.000	.
10	1835	All New							
11	31	All Alive and All New							
12	759	1.438	.531	7.325	1	.007	4.212	1.487	11.932
13	2136	.915	.388	5.562	1	.018	2.496	1.167	5.339
14	190	All New							
15	618	All New							
16	2617	2.081	.479	18.851	1	.000	8.010	3.131	20.491
17	2334	-.629	.202	9.721	1	.002	.533	.359	.792
18	1	All Alive and All New							
19	408	18.553	3669.107	.000	1	.996	114104028.956	.000	.

Species Specific

Species	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Cherry barbs	1441	1.290	.391	10.869	1	.001	3.633	1.687	7.821
Clown loach	410	.925	.515	3.228	1	.072	2.523	.919	6.924
Discus	41	3.526	1.302	7.332	1	.007	34.000	2.648	436.545
Dwarf gouramis	657	1.651	.528	9.790	1	.002	5.211	1.853	14.654
Elephant nose	6	-19.817	40192.962	.000	1	1.000	.000	.000	.
Goldy pleco	12	All Alive							
Guppies	3902	-1.296	.124	109.130	1	.000	.274	.215	.349
Harlequin rasbora	2767	3.357	.729	21.193	1	.000	28.714	6.876	119.914
Neon dwarf rainbow	918	1.176	.481	5.983	1	.014	3.241	1.263	8.316
Neon tetra	4908	2.190	.162	183.107	1	.000	8.931	6.504	12.264
Silver arowana	22	All Alive							
Silver shark	228	-.446	.690	.417	1	.519	.640	.166	2.477

Category Specific

Species Category Number	Quantity	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
1	10034	2.211	.136	262.629	1	.000	9.127	6.985	11.925
2	5197	-.660	.113	34.040	1	.000	.517	.414	.645
3	81	1.547	.682	5.146	1	.023	4.697	1.234	17.880

APPENDIX 9: RETAIL QUESTIONNAIRE

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Retail Questionnaire

Introduction
This questionnaire is designed to provide an understanding of stock loss within Maidenhead Aquatics and how this is being minimised. The questionnaire aims to gather information in the aspects of:

- Training
- Species care and the complexities of species specific care
- Information of possible issues present within this trade sector
- What issues are and are not a concern within the ornamental fish trade.

All information provided within this questionnaire is confidential and shall be used to gather information for MSc research masters, which is studying various areas of the ornamental fish trade.

Please tick the box if you consent to participating in this study. Information collected will only be used for this Masters by Research study

☐

Thank you for your time.

Please send completed questionnaires to Lucy Smith at: lucy_anna_smith@hotmail.co.uk

Yours Faithfully

Lucy Smith

Supervisors of the project:

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SECTION 1: Respondent Information

1	**What position do you currently hold at identity of retailer removed?**				
2	**What is the location of the identity of retailer removed store(s) you presently work at?**				
3	**How long have you been employed at identity of retailer removed? *(State if employed for number years/ months or days)***				
4	**Part 1**			**Part 2**	
	Do you have any type of qualification(s) relevant to working within the ornamental fish trade? (e.g. Certificate, Diploma, BSc): *(Tick one box)*:			If yes, what qualification(s) do you hold relevant to working within the ornamental fish trade?	
	Yes: *if yes go to part 2*	No	Unsure: *if no or unsure go to question 5*		
				State qualification(s):____	

5	**Prior to working at Maidenhead Aquatics did you: (*Please tick all that apply)***	
	Own fish	
	Breed; rear fish	
	Own animals other than fish	
	Work at another ornamental fish shop	
	Work in another live animal trade sector	
	Other *(please state)*____	
	None of the above	

6	**Please rank the frequency that you have used the following sources to gather information on fish care**		
	Source	**Rank 1 to 7: *(1=Most frequent, 7=least frequent)*** (NOTE: use each of the numbers ONCE)	**Unsure**
	Internet		
	Staff within fish a shop		
	Specialist aquatic magazines		
	Customer's previous experience of fish keeping		
	Books		
	Information on species written & sectioned within fish shops		
	Other *(Please state)* ____		

SECTION 2: Training Information

7	**Do identity of retailer removed provide training in ornamental fish care? Training types may include: sources of literature being supplied or practical training experience being given at identity of retailer removed *(Tick one box)***		
	Yes: *if yes go to question 8*	*No*	Unsure*: if no or unsure go to question 9 .*

8	**Please rate the level of training you received in regards to different aspects of fish care at identity of retailer removed. Training types may include: sources of literature being supplied or practical training experience being given at identity of retailer removed.** ***(Tick one box for each aspect.)***						
	Aspect of fish care	Level of training received					
		Very Poor	Poor	Neither Good or Poor	Good	Very Good	Not Applicable (N/A)
	Acclimatisation needs						
	Fish care on a broad basis						
	Specific species feeding requirements						
	Monitoring of water conditions						
	Information given on fish care to meet customer education needs						
	Disease treatments						
	Parasite treatments						
	Species specific care requirements						
	Specific species behavioural information						
	Species specific care level e.g. hardy fish						
	Other *(please state)* ____						

9	**How would you rate your general understanding of the care requirements of fish species that are regularly in stock?: (*tick one box)***					
	Very Poor	Poor	Neither Good or Poor	Good	Very Good	Not Applicable (N/A)

10	**How would you rate your colleague's general understanding of the care requirements of fish species that are regularly in stock?: *(tick one box)***					
	Very Poor	Poor	Neither Good or Poor	Good	Very Good	Not Applicable (N/A)

SECTION 3: Species Care Information

11	**Part 1**			**Part 2**
	Do you use a classification system in regards to species care level requirements? *(Tick one box):*			If yes, please explain briefly what classification system you use
	Yes: *if yes go to part 2*	No	Unsure: *if no or unsure go to question 12*	
				Classification system used:____

12	**Part 1**		**Part 2**
	Do you use any of the following terms in the ornamental fish trade in regards to species care level requirements? (*Tick one box per term)*		If yes, please explain briefly what the term in your opinion means in regards to an ornamental fish species care level? *(If unsure leave blank)*
	Term	Is the term used?	Terms meaning:

		Yes: *If yes go to part 2*	No	Unsure: *If no or unsure go to next term*	
	Generalist				Generalist: ____
	Specialist				Specialist:____
	Hardy				Hardy:____
	Advanced care				Advanced care:____

13	**Please rate the applied effort within identity of retailer removed Shop(s) you are involved with to minimise the possible negative impact of factors listed below:** ***(tick one box for each factor)***							
	Influencing factor	The applied effort within the shop(s) to minimise factor						
		Very Poor Effort	Poor Effort	Neither Poor or Good Effort	Good Effort	Very Good Effort	Unsure	Not Applicable
		Low Effort Effort →				High		
	Species being marine							
	Species being tropical							
	Small size of species							
	Species being cold water							
	Large size of a species							
	Species highly prone to stress							
	Species highly prone to disease							
	Difficult to start feeding							
	Highly Predatory							
	Prone to be predated upon							
	Temperature specification							
	Specific tank mate requirements							
	Specific habitat requirements							
	Highly aggressive species							
	Species highly prone to parasites							
	Known as 'specialist'							

	species							
	Known as easy to care for species							
	Species being inbred							
	Specific water quality requirements							
	Species having low retail price							
	High retail price of species							
	High stocking levels of species within tank							
	Prone attempt to jump from tank							
	Acclimatization needs							
	Country Stock is imported from							
	Wholesalers fish are collected from							
	Species being from captive stock							
	Species being from wild stock							
	Other *(please state):____*							

14	**How often do the identity of retailer removedthat you are involved with, accept fish from clientele for rehoming purposes?** ***(tick one box)***					
	Store Never Accepts Fish	Store Does Not Often Accept Fish	Moderately Often Store Accepts Fish	Store Often Accept Fish	Store Always Accepts Fish	Unsure

SECTION 4: Ornamental Fish Industry

15	**Please rank the frequency customers are likely in your experience to use sources to gather information on fish care:**		
	Source	**Rank 1 to 7:** ***(1=Most frequent, 7=least frequent)*** (NOTE: use each of the numbers ONCE)	**Unsure**
	Internet		
	Staff within fish a shop		
	Specialist aquatic magazines		
	Customer's previous experience of fish keeping		
	Books		

	Information on species written & sectioned within fish shops		
	Other *(Please state)* ____		

16	**In your opinion how much variation is there between retailers in the care of ornamental fish within this industry? (Tick one box)**					
	Very Unvaried	Unvaried	Neither Varied or Unvaried	Varied	Very Varied	Unsure

17	**In your opinion how much of an issue is the loss of fish stock within the ornamental fish shop(s) you are involved with at identity of retailer removed? (*tick one box)***					
	Very Much Not An Issue	Not An Issue	Neither An Issue or Not An Issue	An Issue	Very Much An Issue	Unsure

18	**In your opinion how competitive is the retail market within the ornamental fish industry? (*tick one box)***					
	Very Uncompetitive	Uncompetitive	Neither Uncompetitive or Competitive	Competitive	Very Competitive	Unsure

19	**How would you rate the availability of ornamental fish species catch/ harvesting information? *(Tick one box)***						
	Very Poor	Poor	Neither Good or Poor	Good	Very Good	Not Applicable (N/A)	Unsure

20	**Please state a maximum of four improvements that in your opinion could be made within this trade sector to care for ornamental fish**	
	Improvement 1:	
	Improvement 2:	
	Improvement 3:	
	Improvement 4:	

APPENDIX 10: COST ASSOCIATION QUESTIONNAIRE FOR RETAIL STAFF

Please state your current position at *identity of retailer removed*	_______
Please state the *identity of retailer removed* **that you are involved within**	_______
Information within store relating to species cost	

Species	Please estimate the lowest retail price that the species has been sold to consumers in 2013 at *identity of retailer removed* you are involved within. *(If unsure please leave* blank)	Please estimate the average retail price that the species is sold to consumers in 2013 at *identity of retailer removed* you are involved within. *(If unsure please leave* blank)	Please estimate the highest retail price that the species has been sold to consumers in 2013 at *identity of retailer removed* you are involved within. *(If unsure please leave* blank)	Please include any additional information that may be important in relating the species to the species cost relationship. *(If unsure please leave blank)*
Neon Tetra (Paracheirodon innesi)				
Cherry barbs (Puntius titteya)				
Harlequin rasbora (Rasbora heteromorpha)				
Neon dwarf rainbow (Melanotaenia praecox)				
Guppies (Poecilia reticulata)				
Dwarf gouramis (Colisa lalia)				
Clown Loach (Chromobotia macracanthus)				
Silver Shark (Balantiochellus melanopterus)				
Goldy Pleco (Scobinancistrus aureatus)				
Silver Arowana (Osteoglossum bicirrhosum)				
Discus (Symphysodon spp.)				
Elephant nose (Gnathonemus petersii)				

APPENDIX 11: CONSUMER QUESTIONNAIRE

DICE
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School of Anthropology and Conservation

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Consumer Questionnaire

Introduction

This questionnaire is designed to provide an understanding of the ornamental fish trade from a consumers view point. The questionnaire aims to gather information on aspects of:

- Species care and the complexities of species specific care
- What issues are, or are not of concern to people that purchase ornamental fish
- What can influence people to purchase ornamental fish and the survival of fish purchased
- Different people's level of experience and views of the ornamental fish trade

All information provided is confidential and will only be used for a Master by Research project on the ornamental fish trade. Please only fill out this questionnaire if you have previously owned or presently own ornamental fish.

Please tick the box if you consent to participating in this study.

☐

Thank you for your time.

Please send completed questionnaires to Lucy Smith at: lucy_anna_smith@hotmail.co.uk

Yours Faithfully

Lucy Smith

Supervisors of the project:

Dr David Roberts: d.l.roberts@kent.ac.uk, Prof Richard Griffith, Ian Watson

University of Kent
Marlowe Building
Canterbury
Kent CT2 7NR
United Kingdom

SECTION 1: Respondent Information

<table>
<tr><td>1</td><td colspan="5">Please state your year of birth:</td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>2</td><td colspan="5">What is your country of residence?</td></tr>
<tr><td></td><td colspan="5"></td></tr>
<tr><td>3</td><td colspan="5">How did you hear about this study (Tick one box)</td></tr>
<tr><td></td><td>Retailers</td><td>Friend</td><td>Hobbyist</td><td>Online forum</td><td>Other (please specify)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td>4</td><td colspan="3">Do you have any experience of keeping or caring for ornamental fish? (tick one box)</td></tr>
<tr><td></td><td>Yes: If yes go to question 5</td><td>No: If not go to question 6</td><td>Unsure: If unsure go to question 6</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td>5</td><td colspan="3">Experience of keeping or caring for ornamental fish: (Please tick all that apply)</td></tr>
<tr><td></td><td>Own(ed) ornamental fish</td><td></td><td rowspan="7"></td></tr>
<tr><td></td><td>Breed; rear(ed) fish</td><td></td></tr>
<tr><td></td><td>Work(ed) at an ornamental fish shop</td><td></td></tr>
<tr><td></td><td>Trader of ornamental fish</td><td></td></tr>
<tr><td></td><td>Supplier of ornamental fish</td><td></td></tr>
<tr><td></td><td>Other (please state)____</td><td></td></tr>
<tr><td></td><td>None of the above</td><td></td></tr>
</table>

<table>
<tr><td>6</td><td colspan="3">Part 1</td><td>Part 2</td></tr>
<tr><td></td><td colspan="3">Do you have qualifications relevant to the ornamental fish industry? (e.g. Certificate, Diploma, BSc) (Tick one box):</td><td rowspan="2">If yes, what qualification(s) do you hold relevant to the ornamental fish industry?</td></tr>
<tr><td></td><td>Yes: If yes go to <u>Part 2</u></td><td>No: If no go to <u>SECTION 2</u></td><td>Unsure: If unsure go to <u>SECTION 2</u></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Qualification(s):____</td></tr>
</table>

SECTION 2: Previously owned fish

<table>
<tr><td>7</td><td colspan="3">Part 1</td><td>Part 2</td></tr>
<tr><td></td><td colspan="3">Did you used to own ornamental fish though presently do not?</td><td rowspan="2">If yes, please state the ornamental fish species you previously owned: (State a maximum of 10 representative species)</td></tr>
<tr><td></td><td>Yes: if yes go to <u>Part 2</u></td><td>No: If no go to <u>SECTION 3</u></td><td>Unsure: If unsure go to <u>SECTION 3</u></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Previously owned ornamental fish species:____</td></tr>
</table>

<table>
<tr><td>8</td><td colspan="2">Please state the period of time that you last owned ornamental fish: (If unsure leave blank)</td></tr>
<tr><td></td><td>Age when you last began keeping ornamental fish</td><td>Age when you last ceased keeping ornamental fish</td></tr>
<tr><td></td><td>____</td><td>____</td></tr>
</table>

<table>
<tr><td>9</td><td colspan="6">How would you rate the survival of ornamental fish you purchased? (Tick one box)</td></tr>
<tr><td></td><td>Very Poor</td><td>Poor</td><td>Neither Good</td><td>Good</td><td>Very Good</td><td>Unsure</td></tr>
</table>

			or Poor			

10	**What ornamental fish type(s) did you previously own (Please tick all that apply)**	
	Marine ornamental fish	
	Tropical ornamental fish	
	Indoor cold water ornamental fish	
	Outdoor cold water fish	
	Other: Please state___	
11	**Why did you choose to keep ornamental fish?**	

Thank you for completing SECTION 2: Please now go to SECTION 4

SECTION 3: Fish Keeping

12	**What ornamental fish species do you presently own? *(State a maximum of ten representative species)***				
13	**What type(s) of ornamental fish do you currently have; or have had in the past?' (Tick one box for each fish type)**				
	Ornamental fish types	Never Owned	Previously Owned Though Presently Do Not	Presently Own	Unsure
	Marine ornamental fish				
	Tropical ornamental fish				
	Indoor cold water ornamental fish kept				
	Outdoor cold water ornamental fish				
	Other (please state)____				
14	**Why do you keep ornamental fish?**				
15	**How long have you been keeping ornamental fish? *(Please state if referring to number of years/ months or days)***				

16	**How would you rate the survival of ornamental fish you have purchased? (*Tick one box)***					
	Very Poor	**Poor**	**Neither good or Poor**	**Good**	**Very Good**	**Unsure**

Section 4: Species Care Classification

17	**How would you rate your general understanding of the care requirements of ornamental fish species? *(Tick one box)***					
	Very Poor	Poor	Neither Good or Poor	Good	Very Good	Unsure

18	**Part 1**	**Part 2**
	Do you use certain term(s) to classify ornamental fish species care level requirements? *(Tick one box)* NOTE: A classification term used could be for example: Advanced care	If yes, please explain briefly what classification term(s) you use: ______

	Yes: *if yes go to part 2*	No: *If no go to question 19*	Unsure: *if unsure go to question 19*	

19	**Part 1**				**Part 2**
	Do you use any of the following terms in the ornamental fish trade in regards to species care level requirements? (*Tick one box for each term)*				If yes, please explain briefly what the term, in your opinion, means in regards to an ornamental fish species care level? *(If unsure leave blank)*
	Term	Is the term used?			
		Yes: *If yes go to part 2*	No: *If no go to next term*	Unsure: *If unsure go to next term*	
	Generalist				**Terms meaning:** generalist: ____
	Specialist				**Terms meaning:** specialist:____
	Hardy				**Terms meaning:** hardy: ____
	Advanced care				**Terms meaning:** advanced care:____

SECTION 5: Species purchase information

20	**Please indicate the extent each factor could influence your purchase decision of ornamental fish species *(Tick one box for each influencing factor)***							
	Influencing factor in choosing a species	Extent to which each factor could influence you purchasing an ornamental fish species						
		Very Negative Influence	Negative Influence	Neither Positive or Negative Influence	Positive Influence	Very Positive Influence	Unsure	Not Applicable (N/A)
		Not purchase Purchase →						
	Care requirements for species being minimal							
	Specimen being in good physical condition							
	Species being captive bred							
	Species being highly vulnerable to illness (e.g parasites/ disease)							
	Species being harvested sustainably							
	Species known to have high survival rate							
	Known ethical							

	harvesting of species							
	Species being specialist							
	Known ethical transportation standard for species							
	Species being rare in the wild							
	High cost to purchase species							
	Species being wild caught							
	Species being rare within the trade							
	Low cost to purchase species							
	Great deal of care required for species							
	Species being cold water							
	Species being very colourful							
	Species being known as hard to keep alive							
	Species being tropical							
	Species being marine							
	Species harvesting being linked with conservation programmes.							
	Other *(please state)*____							

SECTION 6: Ornamental Fish Industry

21	**Please rate the frequency you have used sources to purchase ornamental fish:** ***(Tick one box for each source)***					
	Source	**Never**	**Not Very Often**	**Moderately Often**	**Very Often**	**Always**
	Online ornamental fish store(s)					
	Visiting ornamental fish retail store(s)					
	Purchasing directly from a fish breeder					
	Purchasing through a pet re-homing internet site					
	Buying fish second hand from people you are acquainted with.					
	Other *(please state)*____					
22	**Please rate the frequency that you have used the following sources to gather information on fish care: (Tick one box for each source)**					

	Source	Never	Not Very Often	Moderately Often	Very Often	Always
	Internet					
	Staff within fish shop(s)					
	Information on species written & sectioned within fish shop(s)					
	Own past experience of fish keeping					
	Books					
	Specialist aquatic magazines					
	Other (Please state)____					

23	**Rate in your experience the availability of reliable species specific ornamental fish care information: *(Tick one box)***						
	Very Poor	Poor	Neither Good or Poor	Good	Very Good	Not Applicable (N/A)	Unsure
24	**How would you generally rate the availability of ornamental fish species catch/ harvesting information? *(Tick one box)***						
	Very Poor	Poor	Neither Good or Poor	Good	Very Good	Not Applicable (N/A)	Unsure
25	**How would you rate the availability of ornamental fish species country of origin information? *(Tick one box)***						
	Very Poor	Poor	Neither Good or Poor	Good	Very Good	Not Applicable (N/A)	Unsure
26	**In your opinion how much variation is there between retailers in the care of ornamental fish within this industry? *(Tick one box)***						
	Very Unvaried	Unvaried	Neither Varied or Unvaried	Varied	Very Varied	Not Applicable (N/A)	Unsure

APPENDIX 12: LIFE HISTORY AND POPULARITY ORNAMENTAL FISH PURCHASED BY CONSUMERS

Order	Number of Consumer's	Family	Number of Consumer's	Subfamily	Number of Consumer's	Genus	Number of Consumer's	Common Name	Latin Name	Stating
Characiformes *(characins)*	28	Characidae (characins)	21	Characinae	1	Exoden	1	Bucktooth tetra	*Exodon paradoxus*	1
				Incertae Sedis	20	Hemigrammus	1	Glowlight Tetra	*Hemigrammus erythrozonus*	1
						Hyphessobrycon	8	Black neon tetra	*Hyphessobrycon herbertaxelrodi*	1
								Black phantom tetra	*Hyphessobrycon megalopterus*	2
								Buenos Aires tetra	*Hyphessobrycon anisitsi*	1
								Ember tetra	*Hyphessobrycon amandae*	1
								Lemon tetra	*Hyphessobrycon pulchripinnis*	3
						Moenkhausia	1	Redeye tetra	*Moenkhausia sanctaefilomenae*	1
						Paracheirodon	10	Green neon tetra	*Paracheirodon simulans*	1

								Neon tetra	*Paracheirodon innesi*	9
		Gasterpelecidae (Freshwater hatchetfishes)	1			Gasteropelecus	1	Silver hatchetfish	*Gasteropelecus levis*	1
		Lebiasinidae *(Pencilfishes)*	4	Pyrrhulininae	4	Copella	1	Splash tetra	*Copella arnoldi*	1
						Nannostomus	3	Golden pencilfish	*Nannostomus beckfordi*	2
								One line pencilfish	*Nannostomus unifasciatus*	1
		Serrasalmidae	2			Pygocentrus	2	Red piranha	*Pygocentrus nattereri*	2
Cypriniformes (Carps)	85	Cobitidae *(Loaches)*	11	Botiinae	10	Ambastai	2	Dwarf loach	*Ambastaia sidthimunk*	2
						Botia	3	Pakistani loach	*Botia almorhae*	1
								Zebra loach	*Botia striata*	2
						Chromobotia	5	Clown loach	*Chromobotia macracanthus*	5
				Cobitinae	1	Misgurnus	1	Pond loach	*Misgurnus anguillicaudatus*	1
		Cyprinidae *(Minnows or Carps)*	74	Barbinae	11	Balantiocheilos	4	Silver shark	*Balantiocheilos melanopterus*	4
						Pethia	1	Golden barb	*Pethia gelius*	1
						Puntius	4	Checkered barb	*Puntius oligolepis*	1
								Cherry barb	*Puntius titteya*	3
						Systomus	2	Sumatra Barb	*Systomus tetrazona*	2

				Cyprininae	43	Carassius	37	Goldfish	*Carassius auratus*	37
						Cyprinus	6	Koi carp	*Cyprinus carpio carpio*	6
				Danioninae	16	Danio	10	Glowlight danio	*Danio choprae*	1
								Gold Ring danio	*Danio tinwini*	1
								Pearl danrio	*Danio albolineatus*	1
								Rose danio	*Danio roseus*	1
								Yoma Danio	*Danio feegradei*	1
								Zebra danio	*Danio rerio*	5
						Devario	2	Giant Danio	*Devario aequinnatus*	1
								Sind Danio	*Devario devario*	1
						Microdevario	1	Green Rasbora	*Microdevario kubotai*	1
						Trigonostigma	3	Harlequin Rasbora	*Trigonostigma heteromorpha*	1
								Lambchop Rasboras	*Trigonostigma espei*	2
				Ex-danioninae	1	Tanichthys	1	White Cloud Mountain Minnow	*Tanichthys albonubes*	1
				Labeoninae	1	Crossocheilus	1	Siamese Flying Fox	*Crossocheilus siamensis*	1
				Leuciscinae	1	Leuciscus	1	Ide	*Leuciscus idus*	1
				No Subfamily	1	Epalzeorhynchos	1	Rainbow Sharkminnow	*Epalzeorhynchos frenatum*	1
Cyprinodontiformes	27	Nothobranchiidae	1			Epiplatys	1	Banded panchax	*Epiplatys annulatus*	1

(Rivulines, Killifish and Livebearers)		(African rivulines)							
		Poeciliidae *(Poeciliids)*	26	Poeciliinae	21	Poecilia	21	Guppy	*Poecilia reticulata*	15
						Poecilia		Platy	*Poecilia reticulata*	6
				Poeciliinae	5	Xiphophorus	5	Green Swordtail	*Xiphophorus hellerii*	5
Perciformes (Perch-likes)	49	Acanthuridae (Surgeonfishes, tangs, unicornfishes)	2	Acanthurinae	2	Ctenochaetus	1	Tomini Surgeonfish	*Ctenochaetus tominiensis*	1
						Zebrasoma	1	Indian sail-fin Tang	*Zebrasoma desjardinii*	1
		Chaenopsidae (Pike-, tube- and flagblennies)	2			Acanthemblemaria	1	Barnacle Blenny	*Acanthemblemaria macrospilus*	1
						Chelmon	1	Copperband Butterflyfish	*Chelmon rostratus*	1
		Cichlidae *(Cichlids)*	17	Cichlasomatinae	5	Pterophyllum	1	Altum Angelfish	*Pterophyllum leopoldi*	1
						Symphysodon	4	Discus	*Symphysodon discus*	4
				Cichlinae	2	Mikrogeophagus	2	Ram Cichlid	*Mikrogeophagus ramirezi*	2
				Geophaginae	4	Apistogramma	2	Blue Cheek Dwarf Cichlid	*Apistogramma eunotus*	1
								Crested Dwarf Cichlid	*Apistogramma cacatuoides*	1

						Biotodoma	2	Greenstreaked Eartheater	*Biotodoma cupido*	1
								Orinoco eartheater	*Biotodoma wavrini*	1
				Pseudocrenilabrinae	6	Neolamprologus	2	Big Eye Multifasciatus	*Neolamprologus similis*	2
						Pelvicachromis	2	Ocellated Kribensis	*Pelvicachromis subocellatus*	1
								Rainbow krib	*Pelvicachromis pulcher*	1
						Tropheus	2	Duboisi Cichlid	*Tropheus duboisi*	2
		Eleotridae	1	Eleotrinae	1	Tateurndina	1	Peacock Gudgeon	*Tateurndina ocellicauda*	1
		Gobiidae	1	Gobioninae	1	Valeniennea	1	Maiden Goby	*Valenciennea puellaris*	1
		Helostomatidae (Kissing gourami)	1			Helostoma	1	Kissing Gourami	*Helostoma temminckii*	1
		Microdesmidae (Wormfishes)	1	Ptereleotrinae		Nemateleotris	1	Fire Goby	*Nemateleotris magnifica*	1
		Osphronemidae (Gouramies)	16	Luciocephalinae	2	Trichopodus	2	Pearl Gourami	*Trichopodus leerii*	1
								Three Spot Gourami	*Trichopodus trichopterus*	1
				Macropodusinae	14	Betta	12	Siamese Fighter Fish	*Betta splendens*	12
						Macropodus	1	Paradisefish	*Macropodus opercularis*	1

						Trichopsis	1	Pygmy Gourami	*Trichopsis pumila*	1
		Pleisiopidae (Roundheads)	1	Plesiopinae	1	Calloplesiops	1	Comet	*Calloplesiops altivelis*	1
		Pomacanthidae (Angelfishes)	3			Apolemichthys	1	Yellowtail Angelfish	*Apolemichthys xanthurus*	1
						Centropyge	2	Flame Angelfish	*Centropyge loricula*	1
								Twospined Angelfish	*Centropyge bispinosa*	1
		Pomacentridae (Damselfishes)	2	Amphiprioninae	1	Amphiprion	1	Orange Clownfish	*Amphiprion percula*	1
				Pomacentrinae	1	Chromis	1	Green Chromis	*Chromis viridis*	1
		Pseudochromidae (Dottybacks)	1			Pseudochromis	1	Orchid Dottyback	*Pseudochromis fridmani*	1
		Siganidae (Rabbitfishes)	1			Siganus	1	Foxface Rabbitfish	*Siganus vulpinus*	1
Siluriformes (Catfish)	39	Akysidae (Stream catfishes)	1	Akysidae (Stream Catfish)	1	Akysis	1	Dwarf Bee Cat	*Akysis maculipinnis*	1
		Auchenipteridae	2	Centromochlinae	2	Tatia	2	Pinestriped Woodcat	*Tatia strigata*	2
		Callichthyidae (Callichthyid	15	Callichthyinae	1	Dianema	1	Flagtail catfish	*Dianema urostriatum*	1
				Corydoradinae	14	Corydoras	14	Adolf's catfish	*Corydoras adolfoi*	1
								Bandit cory	*Corydoras melini*	2

		armored catfishes)						Bronze corydoras	*Corydoras aeneus*	1
								Dwarf corydoras	*Corydoras hastatus*	1
								Panda cory	*Corydoras panda*	1
								Peppered coryadoras	*Corydoras paleatus*	2
								Pygmy corydoras	*Corydoras pygmaeus*	1
								Salt and Pepper catfish	*Corydoras habrosus*	1
								Threestripe corydoras	*Corydoras trilineatus*	3
								Twosaddle corydoras	*Corydoras weitzmani*	1
		Erethistidae (South Asian river catfishes)	3			Erethestis	1	Giant moth catfish	*Erethistes pusillus*	1
						Erethistoides	1		*Erethistoides sicula*	1
						Hara	1	Anchor catfish	*Hara jerdoni*	1
		Loricariidae (Armored catfishes)	15	Ancistrinae	5	Dekeyseria	1	Butterfly pleco	*Dekeyseria brachyura*	1
						Hypancistrus	4	Chocolate zebra pleco	*Hypancistrus debilittera*	1
								King tiger plecostamus	*L066 Hypancistrus*	2
								Snowball pleco	*Hypancistrus inspector*	1
				Hypostominae	7	Hypostomus	3	Suckermouth catfish	*Hypostomus plecostomus*	3
						Otocinclus	2	Silver otocinclus	*Otocinclus vestitus*	2
						Peckoltia	2	L006	*Peckoltia oligospila*	1

								Leopard frog plecostomus	*Peckoltia Compta*	1
						Ancistrus	3	Bristlenose pleco	*Ancistrus temminckii*	2
								Bushymouth catfish	*Ancistrus dolichopterus*	1
		Pimelodidae (Long-whiskered catfishes)	3			Leiarius	1	Achara catfish	*Leiarius marmoratus*	1
						Pimelodus	1	Pictus catfish	*Pimelodus pictus*	1
						Pseudoplatystoma	1	Tiger sorubin	*Pseudoplatystoma tigrinum*	1

.

APPENDIX 13: POPULARITY OF ORNAMENTAL FISH PURCHASING SOURCES AMONG CONSUMERS

	Stated Improvement	Number Individual(s) That Stated Improvement(s)
Individual(s) Stated Improvement(s) Regarding the Understanding of Ornamental Fish Species Care	Card Index System(s) Being in Place for Each Species	1
	Leaflet(s) Being Available for Popular Ornamental Fish Species within This Trade Sector e.g. Livebearer(s), Malawi Cichlid(s)	1
	Greater Amount of Information being Available for Ornamental Fish Consumer(s)	1
	Greater Amount of Information Available Regarding the Care of Unusual Ornamental Fish Species	1
	Set guidelines being Available Regarding the Introduction of Fish to New Aquaria	1
	Greater Information Being Available Regarding the Positive Aspects of Wild Harvested Ornamental Fish Stock	1
	Greater Dissemination of Knowedge Regarding the Unsuitability of Goldfish for Small Aquaria	2
	Greater Understanding Needed Regarding Ornamental Fish Species Nutritional Requirement(s)	2
	An Increase in Book(s) Being Utilised as A Source of Knowedge	1
	A Greater Amount of Understanding Regarding the Care Ornamental Fish Species	2
	Greater Amount of Understanding Regarding Ornamental Fish Compatibility	1
Individual(s) Stated Improvement(s) Regarding Ornamental Fish Care Within Ornamental Fish Store(s)	The Utilisation of Black Out Rooms for Fish Acclimatisation	1
	Ornamental Fish Being Given A Longer Acclimatisation Period	1
	Dedicated Quarantine System(s) Being Present within Store(s)	2
	Red Light to be Used for Ornamental Fish	1

	Acclimation Need(s)	
	Greater Amount of Species Specific Feeding to be in Place	3
	Greater Dissemination of Knowledge of Ornamental Fish Stock Acclimatisation Need(s)	1
	Improvement(s) Needed Regarding the Ease of Obtaining Ornamental Fish Medicines e.g. Antibiotic(s)	1
Individual(s) Stated Improvement(s) Regarding Ornamental Fish Care Within Ornamental Fish Tank System(s)	Improvement(s) to Filtration System(s)	1
Individual(s) Stated Improvement(s) Regarding Ornamental Fish Stock Within This Trade Sector	Only Tank Bred Ornamental Fish Stock Should be Available within This Trade Sector	2
	A Greater Focus being Placed on Tank Bred Species within This Trade Sector	3
	Importer(s) Packing Stock for Bulk Transport Import(s)	1
	A greater Amount of Ornamental Fish being Bred Within The UK	1
	A greater Amount of UK based Firms being Utilised	1
	Sustainable Management Practices in Place for Wild Ornamental Fish Stock Harvested	1
	A Greater Variety of Ornamental Fish Species Being Utilised within This Trade Sector	1
	Reduction in Number of Ornamental Fish Stock(ed) Within Bag(s) when Stock Undertake(s) long Importation Journey(s)	1
	A Decrease In Ornamental Fish Stock Travel Time within This Trade Sector	1
Number Individual(s) That Stated Improvement(s)	Only Tank Bred Ornamental Fish Stock Should be Available within This Trade Sector	2
	A Greater Focus being Placed on Tank Bred Species within This Trade Sector	3
	Importer(s) Packing Stock for Bulk Transport Import(s)	1
	A greater Amount of Ornamental Fish being Bred Within The UK	1
	A greater Amount of UK based Firms being Utilised	1
	Sustainable Management Practices in Place for Wild Ornamental Fish Stock Harvested	1
	A Greater Variety of Ornamental Fish Species Being	1

	Utilised within This Trade Sector	
	Reduction in Number of Ornamental Fish Stock(ed) Within Bag(s) when Stock Undertake(s) long Importation Journey(s)	1
	A Decrease In Ornamental Fish Stock Travel Time within This Trade Sector	1
Individual(s) Stated Improvement(s) to the Training of Staff within Ornamental Fish Store(s)	Greater Amount of Training being Provided To the Staff within Ornamental Fish Store(s)	6
	Greater Amount of Training of Staff Regarding Aspect(s) of Water Chemistry	1
	Greater Training of Staff Regarding Ornamental Fish Disease Diagnosis	1
	The Inclusion of OATA Course(s) Being Undertaken for New Staff within Ornamental Fish Store(s)	1
	All Staff Need to Achieve Animal Welfare Standard(s)	1
Individual(s) Stated Improvement(s) Regarding This Trade Sector(s) Codes of Conduct	Regulation(s) in Place for All Ornamental Fish Store(s) to be Members of OATA	1
	Tighter Rules and Restrictions on Tank Buster (e.g. Species that Grow to Very Large Size)	5
	Goldfish being Purchased at Fairground(s) to be Banned	3
	Pet Shop Licence Inspector(s) Being Given Training Regarding Ornamental Fish Livestock	1
	Stricter Assessment/Control of Pet Shop License(s)	6
	Local Councils Should be Guided by OATA Guidelines	1
	Medical Treatment(s) to Ornamental Fish Should be Compulsory	1
	Rule(s) Should Be in Place Regarding Water Quality Requirement(s) within Store(s)	1
	Guidelines Should be Available Regarding Suitable Filtration System(s) for New Store(s)	1
	The Sale of Ornamental Fish Over the Internet Should be Banned	1
	Tighter Rules and Restrictions Regarding Sensitive Ornamental Fish Species	1
	A Greater Amount of Information Being Available Regarding Ornamental Fish Species Collection and Collection Method(s)	2
	Greater Amount of Information Available Regarding Coral Collection(s) for the General Public	1
Individual(s) Stated Improvement to A Financial Aspect	An Increase in the Wages of Staff working Within Ornamental Fish Store(s)	1

APPENDIX 14: QUALIFICATIONS OF PERSONNEL WITHIN RETAIL STORES

<table>
<tr><th colspan="4">Stated qualification(s) of personnel working within this trade sector</th></tr>
<tr><th colspan="4">Qualification(s)</th></tr>
<tr><th>Qualification Governing Body</th><th>Amount Individuals that Stated Attained Qualification within Governing Body</th><th colspan="2">Specific Courses Undertaken by Individuals</th></tr>
<tr><td rowspan="7">OATA Qualification(s)</td><td rowspan="7">10</td><td>Course Unspecified</td><td>2</td></tr>
<tr><td>Advanced Diploma</td><td>1</td></tr>
<tr><td>National Diploma</td><td>1</td></tr>
<tr><td>First Diploma</td><td>1</td></tr>
<tr><td>Diploma</td><td>3</td></tr>
<tr><td>Advanced Diploma</td><td>1</td></tr>
<tr><td>OATA Certificate(s)</td><td>1</td></tr>
<tr><td>Sparseholt Colledge</td><td>2</td><td>Not Recorded</td><td>2</td></tr>
<tr><td>Not Recorded</td><td>1</td><td colspan="2">1</td></tr>
<tr><td>Not Recorded</td><td>1</td><td>HND</td><td>1</td></tr>
</table>

APPENDIX 15: RETAIL PERSONNEL IMPROVEMENTS

	Stated Improvement	Number Individual(s) That Stated Improvement(s)
Individual(s) Stated Improvement(s) Regarding the Understanding of Ornamental Fish Species Care	Card Index System(s) Being in Place for Each Species	1
	Leaflet(s) Being Available for Popular Ornamental Fish Specieswithin This Trade Sector e.g. Livebearer(s), Malawi Cichlid(s)	1
	Greater Amount of Information being Available for Ornamental Fish Consumer(s)	1
	Greater Amount of Information Available Regarding the Care of Unusual Ornamental Fish Species	1
	Set guidelines being Available Regarding the Introduction of Fish to New Aquaria	1
	Greater Information Being Available Regarding the Positive Aspects of Wild Harvested Ornamental Fish Stock	1
	Greater Dissemination of Knowedge Regarding the Unsuitability of Goldfish for Small Aquaria	2
	Greater Understanding Needed Regarding Ornamental Fish Species Nutritional Requirement(s)	2
	An Increase in Book(s) Being Utilised as A Source of Knowedge	1
	A Greater Amount of Understanding Regarding the Care Ornamental Fish Species	2
	Greater Amount of Understanding Regarding Ornamental Fish Compatibility	1
Individual(s) Stated Improvement(s) Regarding Ornamental Fish Care Within Ornamental Fish Store(s)	The Utilisation of Black Out Rooms for Fish Acclimatisation	1
	Ornamental Fish Being Given A Longer Acclimatisation Period	1
	Dedicated Quarantine System(s) Being Present within Store(s)	2
	Red Light to be Used for Ornamental Fish Acclimation Need(s)	1
	Greater Amount of Species Specific Feeding to be in	3

	Place	
	Greater Dissemination of Knowledge of Ornamental Fish Stock Acclimatisation Need(s)	1
	Improvement(s) Needed Regarding the Ease of Obtaining Ornamental Fish Medicines e.g. Antibiotic(s)	1
Individual(s) Stated Improvement(s) Regarding Ornamental Fish Care Within Ornamental Fish Tank System(s)	Improvement(s) to Filtration System(s)	1
Individual(s) Stated Improvement(s) Regarding Ornamental Fish Stock Within This Trade Sector	Only Tank Bred Ornamental Fish Stock Should be Available within This Trade Sector	2
	A Greater Focus being Placed on Tank Bred Species within This Trade Sector	3
	Importer(s) Packing Stock for Bulk Transport Import(s)	1
	A greater Amount of Ornamental Fish being Bred Within The UK	1
	A greater Amount of UK based Firms being Utilised	1
	Sustainable Management Practices in Place for Wild Ornamental Fish Stock Harvested	1
	A Greater Variety of Ornamental Fish Species Being Utilised within This Trade Sector	1
	Reduction in Number of Ornamental Fish Stock(ed) Within Bag(s) when Stock Undertake(s) long Importation Journey(s)	1
	A Decrease In Ornamental Fish Stock Travel Time within This Trade Sector	1
Number Individual(s) That Stated Improvement(s)	Only Tank Bred Ornamental Fish Stock Should be Available within This Trade Sector	2
	A Greater Focus being Placed on Tank Bred Species within This Trade Sector	3
	Importer(s) Packing Stock for Bulk Transport Import(s)	1
	A greater Amount of Ornamental Fish being Bred Within The UK	1
	A greater Amount of UK based Firms being Utilised	1
	Sustainable Management Practices in Place for Wild Ornamental Fish Stock Harvested	1
	A Greater Variety of Ornamental Fish Species Being Utilised within This Trade Sector	1
	Reduction in Number of Ornamental Fish Stock(ed) Within Bag(s) when Stock Undertake(s) long	1

	Importation Journey(s)	
	A Decrease In Ornamental Fish Stock Travel Time within This Trade Sector	1
Individual(s) Stated Improvement(s) to the Training of Staff within Ornamental Fish Store(s)	Greater Amount of Training being Provided To the Staff within Ornamental Fish Store(s)	6
	Greater Amount of Training of Staff Regarding Aspect(s) of Water Chemistry	1
	Greater Training of Staff Regarding Ornamental Fish Disease Diagnosis	1
	The Inclusion of OATA Course(s) Being Undertaken for New Staff within Ornamental Fish Store(s)	1
	All Staff Need to Achieve Animal Welfare Standard(s)	1
Individual(s) Stated Improvement(s) Regarding This Trade Sector(s) Codes of Conduct	Regulation(s) in Place for All Ornamental Fish Store(s) to be Members of OATA	1
	Tighter Rules and Restrictions on Tank Buster (e.g. Species that Grow to Very Large Size)	5
	Goldfish being Purchased at Fairground(s) to be Banned	3
	Pet Shop Licence Inspector(s) Being Given Training Regarding Ornamental Fish Livestock	1
	Stricter Assessment/Control of Pet Shop License(s)	6
	Local Councils Should be Guided by OATA Guidelines	1
	Medical Treatment(s) to Ornamental Fish Should be Compulsory	1
	Rule(s) Should Be in Place Regarding Water Quality Requirement(s) within Store(s)	1
	Guidelines Should be Available Regarding Suitable Filtration System(s) for New Store(s)	1
	The Sale of Ornamental Fish Over the Internet Should be Banned	1
	Tighter Rules and Restrictions Regarding Sensitive Ornamental Fish Species	1
	A Greater Amount of Information Being Available Regarding Ornamental Fish Species Collection and Collection Method(s)	2
	Greater Amount of Information Available Regarding Coral Collection(s) for the General Public	1
Individual(s) Stated Improvement to A Financial Aspect	An Increase in the Wages of Staff working Within Ornamental Fish Store(s)	1

APPENDIX 16: CONSUMER SPECIES CARE LEVEL GROUPING

Defined Specific Subject Areas of Consumers Combined Definition of Care Level(s) Meaning	Care Level Term 1. Generalist		Care Level Term 2. Hardy		Care Level Term 3. Specialist		Care Level Term 4. Advanced Care	
	Consumers Combined Definition of Care Level Term: *Generalist*	Number of Consumers	Consumers Combined Definition of Care Level Term: *Hardy*	Number of Consumers	Consumers Combined Definition of Care Level Term: *Specialist*	Number of Consumers	Consumers Combined Definition of Care Level Term: *Advanced Care*	Number of Consumers
Defined Species Specific Care Requirements	Stated Term(s) Indicating Low Care Level Requirement(s)	9	Stated Term(s) Indicating Low Care Level Requirement(s)	13	Stated Term(s) Indicating High Care Level Requirement(s)	16	Stated Term(s) Indicating High Care Level Requirement(s)	9
Aquarists Required Skill Base	Minimal Aqua cultural Skill(s) Required	2	Minimal Aqua cultural Skill(s) Required	4	Aqua cultural Skill(s) Required	5	Aqua cultural Skill(s) Required	3
Feeding	Generic Feeding Requirement(s)	4	Generic Feeding Requirement(s)	2	Specific Food and Dietary Requirement(s)	7	Specific Food and Dietary Requirement(s)	2
Environmental	High Adaptability of Species to a Range of Tank Conditions	5	High Adaptability of Specie to A Range of Tank Conditions	9	Specification(s) in Ornamental Fish Species Tank Requirements	2	Specification(s) in Ornamental Fish Species Tank Requirements	3

Aspects Of Tank Water Condition(s)	Water Quality	Tolerance to Variation in Water Quality	4	Tolerance to Variation in Water Quality	8	Water Chemistry Specification(s)	4	Water Chemistry Specification(s)	1
	Water Ph.	Tolerant to Variation in Ph.	1	Tolerant to Variation in Ph.	1			Ph. Specification(s)	1
	Nitrates		1	High Nitrate Tolerance	1	Nitrate Monitoring Required	1		
	Temperatu re Range	Greater Temperature Range (Unspecified Comparison)	1	Greater Temperature Range (Unspecified Comparison)	1	Specific Temperature Requirement(s)	1	Specific Temperature Requirement(s)	1
Equipment and Tank Set-Up	Equipment	No Specialist Equipment Requirement(s)	1			Specified Equipment Requirement(s)	3	Specified Equipment Requirement(s)	1
	Tank Set Up					Specific Tank System	3	Specific Tank System	1
	Requirem ent(s)					Requirement(s)		Requirement(s)	
Finance		Inexpensive Tank Set Up	1			Expensive Tank Set Up	1		
Species Social Interaction(s)		Stated or Indicated as Suitable for	4			Requires Specific Species within	6	Specific Tank Compatibility	2

	Community Tank Set Up			Tank System			
				Large Size of Species	1	Small Size of Species	1
				Complexity in Regards to Species Breeding	2		
Species Specific Example	Reef fish	1		Plecos Need Algae	1	Marine Fish	1
				Lake Malawi Cichlids Species	1	Saline Level Needs to Be Monitored for Marine Set Up	1
				Seahorse	1	Blackwater	1
				Brackish Water	1		
				Lake Tanganyika Species	1		

APPENDIX 17: RETAILER(S) DEFINITIONS OF FOUR SPECIFIC CARE LEVEL CATEGORIES

	Consumers Combined Definition of Care Level Term: *Generalist*	Number of Retailers	Consumers Combined Definition of Care Level Term: *Hardy*	Number of Consumers	Consumers Combined Definition of Care Level Term:Specialist	Number of Retailers	Consumers Combined Definition of Care Level Term: *Advanced Care*	Number of Retailers
Species Specific Care Fascets	Ornamental Fish Specie(s) Being Tolerant	1	Ornamental Fish Stated as Tough	1	Ornamental Fish Being Sensitive	1		
			Ornamental Fish stated as Very Tolerant	1				
			Ornamental Fish Stated as Strong	1				
			Ornamental Fish stated as Adaptable	5				
Aquarists Required Skill Base	Easy to Keep Ornamental Fish	2	Able to Forgive Mistake(s) by Aquarist	3	Aquarist(s) Require Good Knowedge Base	2	Ornamental Fish Keeping Experience Required by Aquarist(s)	2
			Ornamental Fish Suitable for Beginner(s)	11	Aquarist(s) Require Prior Knowedge before Keep Ornamental Fish	1	Difficult to Keep	1
			Easy Care	1	Ornamental Fish	3	Ornamental Fish	1

					Keeping Experience Required by Aquarist(s)		Require(s) Greater Care then Specialist	
			Ornamental Fish that Require(s) Less Care then Specialist Ornamental Fish	1	Ornamental Fish that are Harder to Keep in Good Health	3	Require(s) a Great Deal of Care	1
					Ornamental Fish not Suitable for Beginner(s)	1	Require(s) more then Basic Maintenance- Stated Example of PH.	1
					Ornamental Fish Require(s) Specialist Care	2	Only Suitable for Experienced Aquarist(s)	1
					Greater Care Requirement(s)	5		
					Ornamental Fish Requiring Specific Need(s)	1	Ornamental Fish Requiring Specific Need(s)	1
Feeding					Ornamental Fish Having Different Feeding Requirement(s)	2	Unusual Feeding	1
					Ornamental Fish Having Different Feeding	2	Difficult to Feed	2

						Requirement(s)			
Popularity	Ornamental Fish Type that Most Aquarist(s) Keep		1			Ornamental Fish being Directly Imported for that Consumer	1		
Environmental				Ornamental Fish being Able Tolerate Variation in Aquarium Condition(s)	1	Ornamental Fish Require(s) Aquarium Condition(s) of High Standard	1	Aquarium being Planted	1
Aspects Of Tank Water Condition	**Water Quality**	Ability to Live in Varied Water Quality Type(s)	5			Ornamental Fish Requireing Specialist Water Condition(s)	1	Ornamental Fish Require(s) Specific Water Quality	1
						Ornamental Fish Require(s) Specific Water Quality	3	Sensitive to Water Quality	1
	Tank system	Utilised to Start Tank System (s)	5					Mature Tank System Required	1
	Nitrates			Ornamental Fish being Able Tolerate Fluctuation in Nitrate Level(s) within the Aquarium	3				

	Temperature Range			Ornamental Fish being Able to Tolerate Fluctuation(s) in Temperate within the Aquarium	1				
Tank Set Up Requirements						Require(s) Specific Aquarium Set-up(s)	1	Larger Aqurium Requirement(s)	1
Species Social Interactions	Community Ornamental Fish		6			Ornamental Fish Being Aggressive	2		
						Ornamental Fish being Unsuitable for Community Tank(s)	2		
						Ornamental Fish Unable to Mix with Conspecific(s)	1		
Species Specific Example								Ornamental Fish Specie(s) being Marine	2
Breeding	Ornamental Fish being Livebearer(s)		1						

APPENDIX 18: TERMINOLOGIES RETAILERS UTILISED TO CATEGORISE ORNAMENTAL FISH CARE

Ornamental Fish Water Type System Classification	Ornamental Fish Water Type System and Further Categorisation	Number of Individual(s) Stated Use of Term(s)
Coldwater	Coldwater	2
	Temperature	
Tropical/Freshwater	Community	
	Community with care	
	South American Cichlid	
	Community Cichlid	
	Area Specific Chiclid	
	Predatory	
	Soft water	
	Hard water	
Marine	Predatory	
	Reef Safe	
	Non Reef Safe	
Pond fish	Small pond	
	Large pond/Lake	
Utilised Care level Categories	Community	7
	Non Community	
	Specialist	
Individual Stated to Give Customers Information Pertaining to Detailed Specific Care Requirement(s).		3
Information Pertaining to Specific Care Requirement(s) Obtained through Conferring with other Staff.		1

APPENDIX 19: WEBSOURCES USE OF SPECIFIC DEFINITIONS

Care level Grouping	Specific care level term	www.fishlore.com	www.seriouslyfish.com	www.petsolutions.com	www.liveaquaria.com	www.aquaticstoyourdoor.co.uk	www.petco.com	www.coburgaquarium.com.au	www.fishbazzar.com	www.petsmart.com	www.peteducation.com	www.aquariumdomain.com	www.freshwater-tropical-fish-care.com	www.animal-world.com	www.wereallwet.com	www.bakersfieldaquaticpets.com	Total Quantity
Very Low	Easy	27		23	33	23	16		1		13	28	1	3	24	18	210
	Beginner							30		13				27	15		85
	Hardy		6	1					1								8
	Easy/Hardy			1													1
	Very Hardy													2			2
Low	Easy-Moderate	1															1
	Easy-Medium	9															9
Moderate	Not Beginner														1		1
	Moderate	4		6	13	4	5				5	13					50
	Intermediate							15		6				7		2	30
High	Moderate-Difficult	1		1													2
Very high	Difficult	1			1		2				1	1			1	1	8
	Advanced							1						2		1	4
	Total Quantity of species	43	6	32	47	27	23	46	2	19	19	42	1	41	41	22	411

APPENDIX 20: NUMBER OF CARE LEVEL TERM GROUPINGS IDENTIFIED WITHIN WEBSOURCES

	www.fishlore.com	www.seriouslyfish.com	www.petsolutions.com	www.liveaquaria.com	www.aquaticstoyourdoor.co.uk	www.petco.com	www.coburgaquarium.com.au	www.fishbazzar.com	www.petsmart.com	www.peteducation.com	www.aquariumdomain.com	www.freshwater-tropical-fish-care.com	www.animal-world.com	www.wereallwet.com	www.bakersfieldaquaticpets.com
Very Low	1	1	3	1	1	1	1	2	1	1	1	1	3	2	1
Low	2														
Moderate	1		1	1	1	1	1		1	1	1			1	1
High	1		1												
Very High	1			1		1	1			1	1		1	1	2
Total no.of care level groups	**5**	**1**	**3**	**3**	**2**	**3**	**3**	**1**	**2**	**3**	**3**	**1**	**2**	**3**	**3**

APPENDIX 21: SPECIES GROUPES CARE RATING WITHIN WEB SOURCES

Species	**Very Low**	**Low**	**Mode -rate**	**High**	**Very High**	**Number of Websour ces**
One line pencilfish *(Nannostomus unifasciatus)*	1					1
Dwarf loach *(Ambastaia sidthimunk)*			1			1
Rose danio (*Danio roseus)*	1					1
Lambchop Rasboras (*Trigonostigma espei)*	1					1
Rainbow Sharkminnow (*Epalzeorhynchos frenatum)*			1			1
Ocellated Kribensis (*Pelvicachromis subocellatus)*	1					1
Twosaddle corydoras *(Corydoras Weitzman)*	1					1
Butterfly pleco *(Dekeyseria brachyuran)*			1			1
Leopard frog plecostomus *(Peckoltia Compta)*			1			1
Ember tetra *(Hyphessobrycon amandae)*	2					2
Splash tetra *(Copella arnoldi)*	2					2
Golden pencilfish *(Nannostomus beckfordi)*	2					2
Red piranha *(Pygocentrus nattereri)*			2			2
Checkered barb *(Puntius oligolepis)*	2					2
Pearl danrio (*Danio tinwini)*	2					2
Tomini Surgeonfish (*Ctenochaetus tominiensis)*		1	1			2
Barnacle Blenny (*Acanthemblemaria macrospilus)*			2			2
Peacock Gudgeon (*Tateurndina ocellicauda)*	1		1			2
Flagtail catfish *(Dianema urostriatum)*	2					2
Adolf's catfish *(Corydoras adolfoi)*	2					2
Dwarf corydoras *(Corydoras hastatus)*	2					2
Pygmy corydoras *(Corydoras pygmaeus)*	2					2
Salt and Pepper catfish *(Corydoras habrosus)*	2					2
Chocolate zebra pleco *(Hypancistrus*			2			2

debilittera)						
Snowball pleco *(Hypancistrus inspector)*	1		1			2
Silver otocinclus *(Otocinclus vestitus)*	2					2
Bushymouth catfish *(Ancistrus dolichopterus)*	2					2
Bucktooth tetra *(Exodon paradoxus)*	2		1			3
Pakistani loach *(Botia almorhae)*	2		1			3
Zebra loach *(Botia striata)*	1		2			3
Glowlight danio (*Danio choprae)*	3					3
Crested Dwarf Cichlid (*Apistogramma cacatuoides)*	1		2			3
Maiden Goby (*Valenciennea puellaris)*	3					3
Threestripe corydoras *(Corydoras trilineatus)*	3					3
King tiger plecostamus *(L066 Hypancistrus)*	2		1			3
Bristlenose pleco *(Ancistrus temminckii)*	3					3
Golden barb *(Pethia gelius)*	4					4
Sumatra Barb (*Systomus tetrazona)*	4					4
Siamese Flying Fox (*Crossocheilus siamensis)*	2		2			4
Altum Angelfish (*Pterophyllum leopoldi)*	1		3			4
Duboisi Cichlid (*Tropheus duboisi)*			2		2	4
Fire Goby (*Nemateleotris magnifica)*	4					4
Pearl Gourami (*Trichopodus leerii)*	4					4
Three Spot Gourami (*Trichopodus trichopterus)*	4					4
Comet *(Calloplesiops altivelis)*	3		1			4
Yellowtail Angelfish *(Apolemichthys xanthurus)*	3		1			4
Twospined Angelfish *(Centropyge bispinosa)*	3		1			4
Orchid Dottyback *(Pseudochromis fridmani)*	3	1				4
Foxface Rabbitfish (*Siganus vulpinus)*	4					4
Bandit cory *(Corydoras melini)*	3		1			4
Lemon tetra *(Hyphessobrycon pulchripinni)*	5					5
Green neon tetra *(Paracheirodon simulans)*	2		3			5
Harlequin Rasbora (*Trigonostigma heteromorpha)*	3	1	1			5

Indian sail-fin Tang (*Zebrasoma desjardinii)*	2	1	2			5
Copperband Butterflyfish (*Chelmon rostratus)*			1		4	5
Paradisefish *(Macropodus opercularis)*	5					5
Orange Clownfish *(Amphiprion percula)*	3		2			5
Suckermouth catfish *(Hypostomus plecostomu)*	4	1				5
Silver hatchetfish *(Gasteropelecus levis)*			4	1	1	6
Pond loach *(Misgurnus anguillicaudatus)*	3		3			6
Koi carp (*Cyprinus carpio carpio)*	5		1			6
Giant Danio (*Devario aequinnatus)*	6					6
Ram Cichlid (*Mikrogeophagus ramirezi)*	2		3		1	6
Rainbow krib (*Pelvicachromis pulcher)*	6					6
Bronze corydoras *(Corydoras aeneus)*	6					6
Panda cory *(Corydoras panda)*	6					6
Peppered coryadoras *(Corydoras paleatu)*	6					6
Pictus catfish *(Pimelodus pictus)*	2		4			6
Buenos Aires tetra *(Hyphessobrycon anisitsi)*	7					7
Silver shark *(Balanteocheilus melanopterus)*	3	1	3			7
White Cloud Mountain Minnow (*Tanichthys albonubes)*	7					7
Siamese Fighter Fish *(Betta splendens)*	7					7
Black neon tetra *(Hyphessobrycon herbertaxelrodi)*	6	1	1			8
Black phantom tetra *(Hyphessobrycon megalopterus)*	7		1			8
Green Swordtail (*Xiphophorus hellerii)*	8					8
Kissing Gourami (*Helostoma temminckii)*	3	1	4			8
Flame Angelfish *(Centropyge loricula)*	3	1	4			8
Green Chromis *(Chromis viridis)*	7		1			8
Red eye tetra *(Moenkhausia sanctaefilomenae)*	9					9
Goldfish (*Carassius auratus)*	9					9
Discus (*Symphysodon discus)*			4	1	4	9
Clown loach *(Chromobotia*	4		6			10

macracanthus)						
Cherry barb (*Puntius titteya)*	10					10
Glowlight Tetra *(Hemigrammus erythrozonus)*	11	1				12
Neon tetra *(Paracheirodon innesi)*	10		2			12
Zebra danio (*Danio rerio)*	12					12
Guppy (*Poecilia reticulate)*	12					12
Platy (*Xiphophorus maculatus)*	12					12
Gold Ring danio (*Danio tinwini)*						
Yoma Danio (*Danio feegradei)*						
Sind Danio (*Devario devario)*						
Green Rasbora (*Microdevario kubotai)*						
Ide (*Leuciscus idus)*						
Banded panchax (*Epiplatys annulatus)*						
Blue Cheek Dwarf Cichlid (*Apistogramma eunotus)*						
Greenstreaked Eartheater (*Biotodoma cupido)*						
Orinoco eartheater (*Biotodoma wavrini)*						
Big Eye Multifasciatus (*Neolamprologus similis)*						
Pygmy Gourami *(Trichopsis pumila)*						
Dwarf Bee Cat (*Akysis maculipinnis)*						
Pinestriped Woodcat *(Tatia strigata)*						
Giant moth catfish *(Erethistes pusillus)*						
Erethistoides sicula						
Anchor catfish(*Hara jerdoni)*						
L006 *(Peckoltia oligospila)*						
Achara catfish *(Leiarius marmoratus)*						
Tiger sorubin *(Pseudoplatystoma tigrinum)*						