The University of British Columbia Sustainable Seafood Project – Phase II:

An Assessment of the Sustainability of

Snapper and Rockfish

Purchasing at UBC

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Table of Contents

Rockfish and Snapper Purchasing Recommendations for UBC

Abstract

The aim of this report is to examine the labelling and ecological sustainability issues pertaining to snapper and rockfish and provide purchasing recommendations for the University of British Columbia food service providers. Snapper is the common name for a broad grouping of tropical and sub-tropical fish species. On the west coast of North America, however, the term "snapper" may also be used as a market name for rockfish. The UBC project partner group expressed concern over the lack of sourcing information and the interchangeability of market names for snapper and rockfish products. After reviewing labelling regulations, I conclude that Canadian and American seafood labelling regulations and enforcement – which vary by country – do not adequately facilitate the correct identification of snapper and rockfish products. Despite Canadian Food Inspection Agency (CFIA) and U.S. Food and Drug Administration Center for Food Safety & Applied Nutrition (USFDA) regulations, snapper and rockfish products are often marketed without prescribed market and common names. Inaccuracy in labelling can cause food inspectors and consumers to confuse unsustainable seafood products with more sustainable choices. Currently, too much overlap exists in labelling for assurance in product species and catch method.

In light of the current information on snapper and rockfish labelling in Canada and the USA, the ecological impacts of snapper and rockfish harvesting, and the minimal information on UBC's sourcing of snapper and rockfish products, I advise that UBC does not purchase (1) snapper and/or (2) rockfish products. Ecological concerns associated with snapper and rockfish were examined according to the Monterey Bay Aquarium's Seafood Watch Program criteria for determining seafood sustainability, with the use of additional sources. (1) Snappers are not recommended seafood choices. They are long-lived and quite susceptible to fishing pressure. Most world stocks are overfished, declining or data deficient. In many source countries, snappers may also be fished with destructive fishing methods and their fisheries may be poorly managed. (2) Rockfish are also not an advisable seafood choice. Rockfish life history characteristics make them heavily susceptible to fishing pressure. Pacific rockfish stock data are limited, and most stocks with data are declining or overfished. The main catch method, bottom trawling, has high bycatch rates and considerable impact on the ocean environment. Consumers should avoid rockfish unless they know the exact species and gear. Even then, rockfishes' tendency to aggregate with other rockfish and groundfish species still presents the problem of bycatch. The negative environmental impacts of bottom-trawling, high bycatch rates, and lack of species identification and separation at both the fishery/supplier levels and regulatory levels create extreme difficulty for anyone attempting to choose sustainable rockfish selections. I recommend that the UBC food service providers use

Best Choice alternatives to rockfish. The food service providers may wish to revisit this snapper and rockfish purchasing recommendation in the future if snapper and rockfish population levels increase, bycatch decreases, and fishing methods become less destructive.

Introduction

The aim of this report is to examine the labelling and ecological sustainability issues pertaining to snapper and rockfish and to generate purchasing recommendations for these fish for the University of British Columbia food service providers. Phase I of the UBC Sustainable Seafood Project evaluated AMS Food and Beverage and UBC Food Services' seafood purchasing practices (Magera, 2006). As a result of this initial investigation, the UBC project partner group expressed concern over the lack of sourcing information and the interchangeability of market names for snapper and rockfish products (Magera, 2006). We here set out to resolve this issue.

Generalized labelling or mislabelling of products is a conservation issue if it affects species of conservation concern. The seafood industry has a recognised problem with accuracy in labelling and providing information on seafood sourcing (Thompson et al., 2005). Attempts to achieve clear and accurate seafood labelling can be derailed by different regional labelling requirements (Thompson et al., 2005) and by the use of common or market names that serve as blanket terms for vast arrays of species (CFIA, 2002; USFDA, 2002). Inaccuracy in labelling can cause food inspectors and consumers to confuse unsustainable seafood products with more sustainable choices.

This report uses the best available information to recommend changes in UBC food service providers' snapper and rockfish purchasing practices. Snapper is the common name for a broad grouping of tropical and sub-tropical fish species (Stevens, 2004). On the west coast of North America, however, the term "snapper" may also be used as a market name for rockfish (Seafood Business, 2000; CFIA, 2002; USFDA, 2002; Roberts and Stevens, 2006). A number of snapper and rockfish species are listed as items to be avoided on the Monterey Bay Aquarium's Seafood Watch Program (http://www.mbayaq.org/cr/seafoodwatch.asp). Lack of clear labelling creates difficulties in distinguishing among Avoid, Intermediate, and Best Choice snapper and rockfish products.

"Snapper"[1] Purchasing at UBC

Currently, three out of the four food service providers at UBC purchase "snapper" products.

• UBC Food Services (UBCFS) purchased 465 kg of "snapper" from 2003-2005. In 2005, UBC Food Services purchased 350kg of "snapper," making it one of the top 15 purchased seafood products by volume (Magera, 2006). No sourcing information, such as

[1] In this report, "snapper" (in quotation marks) refers to fish commonly marketed under the term "snapper," and may include both true snapper and rockfish. Snapper (without quotation marks) refers only to true snapper.

species name, source region or method of catch, was available for UBCFS "snapper" products during the Phase I investigation.
• St. John's College and Green College – which were not part of the Phase I investigation – report purchasing "snapper" occasionally for their residence dining (C. Tay, pers. comm.; S. Geraghty, pers. comm.), but volumes are uncertain.
• AMS Food and Beverage does not purchase snapper.

The primary seafood supplier and lone snapper supplier for UBC Food Services, Albion, was able to provide some information on its snapper products. Albion lists one rockfish and 35 snapper products on its website (http://www.albion.bc.ca/) but the species, origin, and catch method of these products is not clear. Sales representatives from Albion indicated that most of the snapper products sold by their company are likely a mix of rockfish species from British Columbia (L. Donnelly, pers. comm.; S. Ginter, pers. comm.). Multiple catch methods are used to catch these rockfish such that the catch method cannot currently be guaranteed upon purchase (S. Ginter, pers. comm.). Albion does, however, explicitly list two species of rockfish – yelloweye and canary – as being caught with longlines or drag trawls off the West Coast of North America (Albion, undated). Some snappers from Hawaii and New Zealand may also be purchased by Albion (S. Ginter, pers. comm.). Albion was not able to provide specific product information for the snapper products purchased by UBC Food Services.

Snapper and Rockfish - Definitions

Snapper (chiefly Lutjanids)

The common term, "snapper" refers to broad composite group of over 250 predatory fish species (Seafood Business, 2000) in Pacific, Atlantic and Indian Oceans, but most can be grouped into the tropical and sub-tropical Lutjanidae family (Anderson, 1987; Hoese and Moore, 1998). Snappers are very desirable food fish (Anderson, 1987; Hoese and Moore, 1998). They are commonly marketed in North America as either fresh or frozen whole fish or fillets (Seafood Business, 1999 in Stevens, 2004). Some of the most commonly fished commercial species include red snapper (*Lutjanus campechanus),* vermillion snapper (*Rhomboplites aurorobens),* yellowtail snapper (*Ocyurus chrysurus),* gray snapper (*L. griseus),* mutton snapper (*L. analis),* and lane snapper (*L. synagris)* from the Gulf of Mexico and South Atlantic (Stevens, 2004). Other popular species includes Hawaiian gray snapper (*Aprion virescens*), pink snapper (*Pristipomoides filamentosus*), ruby snapper (*Etelis coruscans*), and red snapper (*E. carbunculus*) (Haight, 2003a-d). From South America, Central America, and the Caribbean, Caribbean red snapper (*L. purpureus*) is often used as a substitute for red snapper (Stevens, 2004). Malabar snapper (*L. malabaricus*) is common from Asia (Seafood Business, 2000). New Zealand snapper (*Pagrus auratus*) is a major snapper export for New Zealand (New Zealand Seafood Industry Council, undated), but it is not listed by the CFIA or USFDA as a recognized snapper import species (CFIA, 2002; USFDA, 2002).

Rockfish (chiefly Sebastes and Sebastolobus spp.)

Rockfish are defined as members of the genus *Sebastes* (Love et al., 2002), but the members of the genus *Sebastolobus* (a.k.a. thornyheads) are generally included in the definition as well (Roberts and Stevens, 2006). Approximately 102 species of rockfish exist worldwide, with the overwhelming majority concentrated in the North Pacific and Gulf of California (Love et al., 2002).[2] Rockfish are often sold whole, although less desirable species or lower quality fish are sold as fillets (Love et al., 2002). The rockfish species that fetch the highest prices are typically brightly coloured, and include yelloweye (*S. ruberrimus*), China (*S. nebulosus*), and vermillion rockfish (*S. miniatus*) (Love et al., 2002)).

Snapper and Rockfish Labelling

After reviewing labelling regulations, I conclude that Canadian and American seafood labelling regulations and enforcement – which vary by country – do not adequately facilitate the correct identification of snapper and rockfish products. Seafood labelling in Canada is regulated by the Canadian Food Inspection Agency (CFIA) with the *Food and Drugs Act* / *Food and Drug Regulations* (*FDA/FDR*), *Consumer Packaging and Labelling Act and Regulations* (*CPLA*/CPLR), *Fish Inspection Act* (*FIA*), and *the Fish Inspection Regulations* (*FIR*) (CFIA, 2003). In the USA, the U. S. Food and Drug Administration Center for Food Safety & Applied Nutrition (USFDA) determines seafood labelling in conjunction with the National Marine Fisheries Service (NMFS) (USFDA, 2002).

Both the CFIA and USFDA have published their own lists of acceptable common and market names for promoting uniformity in seafood marketing, respectively called the Fish List and the Seafood List (USFDA, 2002; CFIA, 2003). A summary of different CFIA and USFDA snapper and rockfish listings is depicted in Table 1. In addition, the USFDA Seafood List includes a list of vernacular names that it discourages to prevent misbranding of seafood (USFDA, 2002). Although these lists contain recommendations for labelling, confusion still persists in the records for snappers and rockfish (Seafood Business, 2000; CFIA, 2002; USFDA, 2002).

[2] Four species are also found in the North Atlantic, two are found in the South Pacific, and two are found in the South Atlantic (Love et al., 2002).

Table 1. Snapper and rockfish common and market names designated for use in Canada by the CFIA and in the USA by the USFDA (CFIA, 2002; USFDA, 2002). Appendix A contains a more complete list of snapper and rockfish names compiled from the CFIA and USFDA lists.

Country	Common/Market Name of Seafood	Number of Species	Includes Representatives from the Following Genus(es)
Canada	Snapper	7	*Sebastes, Lutjanus*
	Red Snapper	2	*Sebastes, Lutjanus*
	Pacific Snapper	12	*Sebastes, Sebastolobus, Lutjanus*
	Pacific Red Snapper	2	*Sebastes*
	Rockfish	16	*Sebastes, Sebastolobus*
USA	Snapper	42	*Apsilus, Etelis, Lutjanus, Macolor, Ocyurus, Pristipomoides, Rhomboplites, Symphorichthys*
	Red Snapper	1	*Lutjanus*
	Pacific Snapper	1	*Lutjanus*
	Rockfish	63	*Helicolenus, Scorpaena, Sebastes*
	Thornyhead	2	*Sebastolobus*

Enforcement of correct species labelling is not priority at either the CFIA or the USFDA. Nonetheless, the CFIA periodically assesses compliance at Canadian seafood processors and in seafood entering Canada (M. Andruczyk, pers. comm.). The CFIA may conduct species identification tests and charge any processors or suppliers who are found to violate labelling guidelines (M. Andruczyk, pers. comm.). Imported seafood that fails to conform to recognised labelling may be placed on an import alert list (M. Andruczyk, pers. comm.). Each subsequent shipment of the product is inspected until four consecutive shipments pass inspection (M. Andruczyk, pers. comm.). Similarly, the USFDA's current focus lies not in correct product species labelling but in seafood safety. When the USFDA receives reports of that a species has been mislabelled, it advises the importer/processor/seller/etc. of the USFDA labelling policy (S. Randolph, pers. comm.). If the mislabelling problem reoccurs, the USFDA sends the company a warning letter and may have products detained (S. Randolph, pers. comm.).

Theoretically, knowledge of the source can help identify mislabelled or unlabelled species. Country of origin regulations are in place in Canada and the USA. For Canada, country of origin must be clearly labelled on all imported seafood goods, although products from within Canada need not be labelled (CFIA, 2003). For the USA, country of origin legislation is also mandatory under amendments to the U.S. Farm Security and Rural Investment Act of 2002 (Thompson et. al, 2005). In addition, the Bioterrorism and Response Act of 2002 requires all foreign and domestic food facilities supplying food to the USA to register with the United States government (Thompson et. al, 2005). Suppliers and recipients of all food products must also be recorded (Thompson et. al, 2005).

Despite the CFIA and USFDA regulations, snapper and rockfish products are often marketed without prescribed market and common names (Seafood Business, 2000). Red snapper labelling is especially problematic. Supply cannot always meet demand for *Lutjanus campechanus* (Seafood Business, 2000), the only species the USFDA recognises as red snapper. Perhaps partly as a consequence, Caribbean red snapper (*L. purpureus*), Hawaiian red snapper (ehu, or *Etelis carbunculus*) (USFDA, 2002) and a variety of rockfish are commonly labelled as red snapper or Pacific red snapper (CFIA, 2002; USFDA, 2002). The CFIA makes matters more complicated by also allowing yelloweye rockfish (*Sebastes ruberrimus*) to be officially labelled as red snapper (CFIA, 2002).

Assumptions and Caveats

Both true snappers and rockfishes are discussed in this report. I assume that because of Vancouver's proximity to prime Pacific rockfish fisheries, the "snapper" products in question are likely rockfish. Trade statistics and Albion's sales representatives support this notion. Fisheries and Ocean Canada does not show any imports of snapper products into Canada during the 1989-2006 period for which trade statistics were available (DFO, 2006). United States National Marine Fisheries Service trade statistics do not show any snapper exports (NMFS, 2005a). Export information for Hawaiian snappers is not available (Haight, 2003). Rockfish, however, is fished in Canada and ocean perch, Pacific perch, and other rockfish species are imported into Canada (DFO, 2006). Two different Albion sales representatives also indicated that multiple British Columbia rockfish species are the most likely source for Albion's "snapper" products (L. Donnelly, pers. comm.; S. Ginter, pers. comm.). Although Albion reported supplying yelloweye and canary rockfish to UBC (Albion, unpublished), other rockfish species are also sold to the university (S. Ginter, pers. comm.). Albion also occasionally purchases snapper products, mainly from Hawaii and New Zealand (S. Ginter, pers. comm.). The evidence indicates that Albion's "snapper" products are most likely rockfish species, but snapper purchases cannot be fully discounted at this point in time. Thus, the report will focus more heavily on providing information on rockfish than snapper.

Ecological Concerns Associated with Snapper and Rockfish

The sustainability of snapper and rockfish exploitation has been evaluated by various sustainable seafood evaluation systems, including Monterey Bay Aquarium's Seafood Watch Program (MBA). The following list of ecological concerns associated with snapper and rockfish is formatted according to MBA's criteria for determining seafood sustainability, with the use of additional sources.

Both snapper and rockfish are generally wild-caught. The few nascent attempts at farming snapper, in Asia and New Zealand, have experienced limited success (Marte,

2003; New Zealand Ministry of Fisheries). Similarly, rockfish aquaculture is hindered by these fishes' slow growth and viviparity (Love et al., 2002).

Snapper (*chiefly Lutjanids*)

1.) Inherent Vulnerability to Fishing Pressure

Snappers have a number of life history characteristics that make them moderately vulnerable to fishing pressure (Stevens, 2004). Although they are generally fast growing, with age at maturity typically between 1-5 years, snappers are relatively long-lived (Haight, 2003a-d; Fischer et al., 2004; Stevens, 2004). Snapper life expectancies generally range 10-30 years (Haight, 2003; Fischer et al., 2004; Stevens, 2004). However, one of the most commercially desirable species, red snapper, may live to up to 55 years (Baker and Wilson, 2001 in Stevens, 2004). Snappers also have a low natural mortality rate (Ralston, 1987). As in many other fish species, snapper fecundity increases exponentially with size, and larger individuals contribute relatively more to population growth (Grimes, 1987). Snappers are reasonably easy to catch because they aggregate to spawn, often at predictable times or places (Grimes, 1987; Heyman et. al, 2005; Jackson et al., 2006), and are relatively sedentary with fidelity to certain sites (Grimes, 1987; Workman et al., 2002; Szedlmayer and Schroepfer, 2005).

2.) Stock Status (population abundance) (Canada and US)

Around the world, many snapper stocks are suspected of being overfished, declining, or data deficient (Stevens, 2004) and there is a general lack of information on specific stock status. Since information is not available on the sourcing of Canadian snapper imports, I discuss the stock status of the most probable sources, according to USA data and information from Albion.

Snapper is sourced domestically in the USA from the South Atlantic, Gulf of Mexico and Hawaii (NOAAb).

• Red snapper is the most commonly caught snapper in the continental USA, comprising almost 50% of the total commercial catch by volume (Stevens, 2004). The red snapper stock in the Gulf of Mexico has been overfished to critically low levels (Dhazn et al., 2001; Fischer et al., 2004).

• A 2003 assessment by the NOAA indicated that vermillion snapper in the Gulf of Mexico and the South Atlantic had experienced overfishing such that populations were critically low (NOAA, 2003).

• A formal stock assessment in 2002 indicated that yellowtail snapper stocks were considered to be quite healthy; they were neither overfished nor undergoing overfishing (Muller et al., 2003 in Stevens, 2004).

• Lane, grey and mutton snappers stocks are considered data deficient (NMFS, 2003 in Stevens, 2004).

• Hawaiian snapper stocks, which are managed under the Hawaiian multispecies bottomfish complex, are experiencing overfishing pressure, especially in the main Hawaiian Islands where populations are critically low (WPFMC, 2006a-c).

In general import statistics with adequate sourcing information and stock status reports are both lacking for snapper imported into the USA. Between 2000-2006, the USA

imported snappers primarily from Brazil, Mexico, Nicaragua, Panama and Indonesia (NOAAa). Import statistics list snappers only as "Lutjanid species," "fresh or frozen" (NOAAa), so the exact species imported into the USA could not be determined. Data are scarce, but available information suggests that Latin American and Caribbean fish stocks are moderately to fully exploited with little room for further exploitation above current fishing levels (FAO, 1996). Information on Asian snapper is difficult to obtain on a species by species basis. However, Asian coastal marine fisheries, including Lutjanid fisheries in countries such as the Philippines and Thailand, are generally degraded and overfished (Silvestre et al., 2003). New Zealand assessed five of its snapper stocks between the years of 2000 and 2005 (NZMFb). Only one stock of the five was near or above the target biomass set by the New Zealand Ministry of Fisheries (NZMFb). The four other snapper stocks are (a) *possibly* near or above the target level, (b) below the target level, or (c) their status is unknown (NZMFb).

3.) Nature of Bycatch

The very little information we have suggests that snapper fisheries probably obtain moderate levels of bycatch (Stevens, 2004). Destructive fishing methods of catching snapper in developing nations may result in mortalities of non-target species (Bryant et al., 1998). Bycatch of seabirds in the longline snapper fisheries, for example in New Zealand, is a concern (RFBPSNZ, 2005). However, quantitative measurements of bycatch in snapper fisheries around the world are difficult to ascertain. Better monitoring of snapper fisheries is needed to assess bycatch and discard rates (Blue Oceans Institute, 2004).

Common species obtained as bycatch in the Gulf of Mexico and Southeast Atlantic include black sea bass, snappers, groupers, porgies, amberjacks, sharks and skates (Harrington et al., 2005; Poffenberger, 2004 in Stevens, 2004). In a 2004 study of the Gulf of Mexico and South Atlantic snapper and grouper fishery, several thousand pounds of bycatch were discarded each year with variable mortality rates (Poffenberger, 2004 in Stevens, 2004).

Hawaiian snapper fisheries are relatively selective, and most bycatch species are either kept as marketable catch or discarded alive (NMFS, 2004). Common bycatch species include sharks, jacks and trevallies (NMFS, 2004). However, air embolism induced mortality is common in deep-water snappers, such as the Hawaiian snappers, often preventing live release of bycatch (WPFMC, 2006a). The need to avoid putting pressure on endangered species such as sea turtles, albatross and monk seals is recognized as a potential challenge in the Hawaiian bottomfish fishery, but no significant bycatch of these endangered species has been recorded thus far (NMFS, 2004).

Snappers are also caught as bycatch, most notably in shrimp trawl fisheries (Alverson, 1998 in BOI, 2004). Incidental catch has been documented as a major concern for juvenile red snapper (Hendrickson, 1993; Dhazn et al. 2001). An estimated 25-30 million juvenile red snapper are caught in shrimp trawls in the Gulf of Mexico annually (Oritz et al., 2000 in Diamond, 2004). To decrease this tally, bycatch reduction devices (BRDs) have been legislated in the Gulf of Mexico and South Atlantic Fisheries (Diamond,

2004). Although BRDs are effective for reducing bycatch in some species, the effect on reducing snapper bycatch is variable (Diamond, 2004). More selective fishing gear and better bycatch monitoring are still needed in many regions (Harrington et al., 2005).

4.) Habitat Effects of Fishing Methods

Snapper is caught commercially with bottom longlines, trolls, handlines, other hook-and-line gear, and traps (Grimes, 1987; Porch and Cass-Callay, 2001; WPFMC, 2006b), and the habitat effects vary with the types of fishing gear used. The ecosystem effects of removing snapper are not known but most snapper fisheries employ hook-and-line gear, which has minimal impacts on bottom habitats (Barnette, 2001; WPFMC, 2005a-c). Some gear used to catch snappers – it varies by region - might, however, damage the hard, irregular bottom habitats that snappers favour (Bryant et al., 1998; Barnette, 2001). Even gear with relatively low impact - for example, weights and lines or traps – can harm sensitive coral structures and promote algal overgrowth (Barnette, 2001). The Hawaiian bottomfish fishery employs mainly handlines with depth sensors and electronic fish finding equipment and it is relatively selective (WPFMC, 2006b). New Zealand snapper is caught mainly using bottom longlines or trawls (New Zealand Seafood Industry Council). Bottom trawling is especially disruptive to benthic habitats (Auster and Langton, 1998). Destructive fishing methods, such as blast fishing and cyanide fishing, may also be used in tropical regions and can damage sensitive reefs (Bryant et al., 1998).

5.) Management Effectiveness

Snapper stock management effectiveness varies considerably by region and species. In the USA, snappers are managed in three main fishery categories: commercial targeted, recreational, and commercial bycatch of shrimp fisheries (SAFMC, 2003; Muller, 2003).

• The Gulf of Mexico Fisheries Management Council and the South Atlantic Fisheries Management Council conduct red snapper assessments in the Gulf of Mexico and South Atlantic every one to two years (SEDAR, 2004). Full stock recovery is projected for 2032 (SEDAR, 2004). Red snapper are managed with a minimum size limit, bag or trip limits, seasonal closures and quotas (SEDAR, 2004). However, fishery regulations have created a “derby-style fishery” that leads to periods of excess red snapper market supply and subsequently depressed prices (Baker et al., 1998). Wasteful disposal of red snapper may also occur when quotas are exceeded (Baker et al., 1998). Management councils are currently trying to devise better methods of managing the red snapper fishery, including closer monitoring of snapper bycatch in the shrimp fishery and switching to individual transferable quotas (ITQs) (Baker et al., 1998; SEDAR, 2004).

• Vermillion snapper is managed with a size limit (SAFMC, 2003; SEDAR 2005). The South Atlantic Fisheries Management Council is formulating a stock rebuilding plan for the South Atlantic and stock monitoring is improving (SAFMC, 2003). Various states in the Gulf of Mexico also monitor vermillion snapper, but in many states catch monitoring is voluntary (SEDAR, 2005). Monitoring of vermillion snapper bycatch in the shrimp trawl fishery must also be improved to help better manage the stocks (SEDAR, 2005).

• Yellowtail snapper is regulated in the South Atlantic through a limited entry fishery and a size limit, with no set quota since the stock appears to be healthy (Muller et al., 2003) Yellowtail snapper records are incomplete for much of the Caribbean fishery, but efforts

are being made in the USA Caribbean (i.e. Virgin Islands, Puerto Rico) to improve monitoring, data collection and modelling of yellowtail stocks (SEDAR, 2005).
• Hawaiian bottomfish and groundfish management plans have been in place since 1986, and provided for the creation of refuges and the prohibition of destructive fishing techniques such as poisons or explosives (WPFMC, 2006b). Nonetheless, management measures have not prevented further stock declines (WPFMC, 2006b).
• The United States manages ten other snapper species; their stock assessments have not yet been conducted (Stevens, 2004).

New Zealand has also taken measures to manage its snapper stocks with limited success. New Zealand snapper is managed by through quantitative assessments and individual transferable quotas (ITQs) (Annala, 1995; Dewees, 1998; NZMFa). Four of its five stocks have been assessed and the total allowable catch (TAC) of two of the stocks has been reduced – one in 1997 and one in 2005 (NZMFb). Although the ITQ system has helped to create a more stable fishery (Annala, 1995; Dewees, 1998), most New Zealand snapper stocks are still low or their status is uncertain (NZMFb).

Latin American and Caribbean fisheries agencies have limited management and enforcement capabilities due to the lack of funding (FAO, 1996).

Rockfish (*Sebastes, Sebastolobus*)

1.) Inherent Vulnerability to Fishing Pressure

Rockfishes' life history characteristics make them vulnerable to fishing pressure (Parker et al., 2000; Love et al., 2002). They are relatively slow growing, reaching maturity at 5-7 years of age (Parker et al., 2000). Some rockfish only mature at 20 years of age (Parker et al., 2000). They are also long-lived; nearshore species may live 30-50 years, while Northern, deepwater species may live to be over 100 years old (Cailliet et al., 2001). For example, yelloweye rockfish typically do not mature until 20 years of age and can live to 117 years (DFO, 2000). The oldest recorded rockfish was a 205-year-old rougheye rockfish captured in Alaska (Love et al, 2002). Unlike most bony fish, rockfish also exhibit viviparity, or internal carrying, nourishment and protection of young (Love et al., 2002). Thornyheads are an exception. They lay egg masses (Pearcy, 1962 in Parker et al., 2000). In addition, fecundity increases with size and age in some rockfish species (Love et al., 2002). Mating occurs only once a year, and brood recruitment success is highly dependent on the right combination of ocean climate variables (e.g. temperature, upwellings, currents) (Love et al., 2002). For example, bocaccio only experience substantial juvenile survival about every 20 years (Love et al., 2002). Changes in ocean climate in the 1970s may have decreased recruitment in some West Coast species (Parker et al., 2000; Love et al., 2002).

Behavioural factors may also contribute to rockfish vulnerability to fishing pressure. Some rockfish species are obligatory residents in specific habitats (Love et al., 2002). Fidelity to these sites may produce small, localized rockfish stocks (Love et al., 2002; Williams and Ralston, 2002). Most rockfish species, with the exception of thornyheads,

also aggregate in multi-species complexes, so separating target from nontarget species is virtually impossible (Parker et al., 2000; Love et al., 2002). Live release of bycatch is also an issue for rockfish. Because rockfish have a closed air bladder that does not allow air escape during capture, like deep-water snappers, most rockfish suffer air embolism as they are brought to the surface from depth (Parker et al., 2000; Love et al., 2002). Mortality of incidentally caught rockfish is virtually 100% (Parker et al., 2000, Love et al., 2002).

2.) Stock Status (population abundance) (Canada and US)

Many British Columbia and West Coast USA rockfish stocks are at historical lows, but Alaskan stocks are faring better (Parker et al., 2000; Love et al., 2002). Overfishing, habitat loss (mainly due to trawling-induced bottom habitat destruction), and ocean climate conditions causing low juvenile survival have contributed to population declines (Parker et al., 2000; Miller and Sydeman, 2004).

Currently, the status of most rockfish stocks is unknown (Parker et al., 2000; Roberts and Stevens, 2006). The species that have been assessed are generally commercially and recreationally important species, or species of conservation concern (Roberts and Stevens, 2006). In Canada, most of the stock assessments that do exist for rockfish were last reviewed in 1999 or 2000 (PSARC). In the USA, only one fourth of the more than sixty rockfish species managed by the Pacific Fishery Management Council (PFMC) currently have stock assessments (PFMC, 2006).

In both Canada and the USA, rockfish are managed as part of a mixed species groundfish fishery that catches cod, sablefish, halibut, sole, and other groundfish (DFO, 2006; PFMC, 2004). The fishery also catches multiple species of aggregating rockfish (PFMC, 2004; DFO, 2006). Unfortunately, this type of multispecies fishery often catches species which are data deficient or overfished (Roberts and Stevens, 2006). For example, in B.C., Pacific Ocean Perch is only of moderate conservation concern, but it co-occurs with species of high conservation concern such as yellowmouth and darkblotched rockfish (COSEWIC; Roberts and Stevens, 2006). Thus, the assemblage status is of high concern (Roberts and Stevens, 2006).

Since rockfish species often aggregate together, assemblages, as opposed to individual species, are commonly evaluated for status (Parker et al., 2000). Rockfish can be quite easily grouped by management zones, as well as by depth and latitudinal categories, typically designated as “slope,” “shelf” and “nearshore” or “inshore” assemblages (Williams and Ralston, 2002). See Table II for a summary of rockfish stock status.

Table 2. Rockfish stock conservation concern status (from Roberts and Stevens, 2006)

Stock	Conservation Concern
USA West Coast thornyheads	Low (stock healthy)
All Alaska stocks	Moderate (stock moderate)
B.C. nearshore "outside" (outside Strait of Georgia, Juan de Fuca Strait, Johnstone Strait)	
USA West Coast nearshore, except Puget Sound	
All B.C. and USA West Coast continental shelf and slope, excluding thornyheads	High (stock poor)
Puget Sound	
B.C. nearshore "inside"	
B.C. thornyhead	

Albion typically obtains mixed-species British Columbia rockfish catches and sells them as such (S. Ginter, pers. comm.), and the status of these stocks is moderate-poor (Roberts and Stevens, 2006). Most British Columbia rockfish stocks, except for the nearshore "outside" stock, are of high conservation concern (Table 2). Several species found off the coast of British Columbia, including silvergrey rockfish, yellowtail rockfish, and shortspine thornyhead, may be in danger of extirpation from Canada and are a high conservation concern for Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC, 2006). Bocaccio is already listed as threatened by COSEWIC (SARA, 2006).

Neither yelloweye nor canary rockfish, the two rockfish species that Albion explicitly lists in purchasing documents (and may sell to UBC Food Services) (Albion, unpublished), is healthy in Canada or the USA.

- In Canada, yelloweye rockfish is managed as part of the data deficient inshore rockfish complex (DFO, 2000). It considered fully utilized in most of B.C., and over-utilized in the Straight of Georgia (DFO, 2000). In the USA, yelloweye rockfish is a shelf species that is overfished (PFMC, 2004). This species is very susceptible to recreational and fixed fishing gears, and is also caught in the commercial halibut fishery (PFMC, 2004).
- Canadian canary rockfish stocks are likely close to maximum exploitation but their exact stock status is unknown (DFO, 1999). This species – which is often confused with yelloweye rockfish (DFO, 1999) – is overfished in the USA (PFMC, 2004). Surveys have also indicated ongoing canary rockfish population declines; in a USA survey adjacent to Canada's primary canary rockfish fishing ground, up to 95% decline was recorded (Wallace, 2005). In addition, studies have also found a disproportionately low number of older canary rockfish females in the catches, which is concerning because older females are more fecund and contribute relatively more to population growth (PFMC, 2004).

3.) **Nature of Bycatch**

Rockfish comprise a considerable proportion of the bycatch in groundfish fisheries (Parker et al., 2000; DFO, 2006). Pacific groundfish fisheries in Canada and the USA have high bycatch and discard rates compared to other fisheries because of their multispecies approach, their limited ability to target certain species, and the almost 100%

mortality rate of rockfish from air embolisms when brought up from depth (Parker et al., 2000; Love et al., 2002). In addition, current management regulations prohibit vessels targeting rockfish from surpassing their allowable catch of rockfish (Ralston, pers. comm. in Roberts and Stevens, 2006). As a result, dead and dying rockfish are discarded and wasted (Ralston, pers. comm. in Roberts and Stevens, 2006).

The amount of discarded rockfish and other bycatch varies considerably in the USA and Canadian groundfish fisheries, depending on the type of gear used. Bottom trawling, which accounts for the majority of groundfish catch, has discard rates that fall between 12-33% in the USA and Canada (Roberts and Stevens, 2006). All overfished rockfish species are found in the discards (Roberts and Stevens, 2006). Discards of all species, including rockfish, in the bottom long-line groundfish fishery is approximately 30%, with the added concern of seabird bycatch (Roberts and Stevens, 2006). In contrast, the midwater trawl and hook-and-line fisheries have low bycatch discard levels (Roberts and Stevens, 2006).
Observer programs have been established to document bycatch in groundfish fisheries, presumably for management decision-making. In the USA, the West Coast Groundfish Observer program aims for at least 20% observer coverage on most boats (WCGOP, 2005). Large Alaskan fisheries vessels are required to carry observers at all times (NPFMC, 2003). A comprehensive observer programs are in place for Canada's groundfish fisheries, and there is 100% observer coverage at-sea and on docks to tabulate catch and discard numbers for management and stock assessments (DFO, 2006).

The two species that Albion Seafoods is known to trade – yelloweye and canary rockfish – are often caught as bycatch in Canadian and USA fisheries. As well, the fisheries targeting these two species themselves land threatened species as bycatch. In Canada, most incidentally caught yelloweye and canary rockfish are retained (Wallace, 2005; DFO, 2006). When canary rockfish are directly targeted, approximately one pound of bycatch is discarded for every five pounds of canary rockfish that is caught (Wallace, 2005). Canary rockfish tows often catch Bocaccio, a threatened species under COSEWIC, and may thus be contributing to poor bocaccio stock recovery (Wallace, 2005). In contrast, the USA trawl fishery typically discards yelloweye rockfish bycatch (Roberts and Stevens, 2006). The USA trawl and longline fisheries also discard most canary rockfish bycatch (Roberts and Stevens, 2006). Flatfish trawlers contribute a disproportionately high part of the canary rockfish catch (relative to other gears). Other groundfish fisheries must also be managed to minimize canary rockfish bycatch (PFMC, 2004).

4.) Habitat Effects of Fishing Methods

Rockfish are captured with a variety of different gear types, and each has different effects on habitats. Most Pacific rockfish are caught using bottom-trawls (76% in BC, 66% in West Coast USA, and 94% in Alaska) (Roberts and Stevens, 2006). For example, approximately 95% of Canadian canary rockfish are caught with bottom trawls, and the trawling is extensive (Wallace, 2005). Albion sales representatives reported that most rockfish purchased by Albion is caught using bottom trawling or dragging (S. Ginter, pers. comm.). Bottom trawling involves dragging nets, often with attached weights or

other gear, along the ocean bottom (NMFS, 2005b). It damages abiotic and biotic bottom structures, such as rocky outcroppings, corals, sponges, and algae (e.g. kelp) that are prime habitat for adult rockfish and other species (Freese et al. 1996; Auster and Langton, 1999; Love et al., 2002; Wallace, 2005). Such damage had been associated with reduced species diversity and abundance (Kaiser and Spencer, 1996 in Auster and Langton, 1999). Mid-water trawls are designed to fish in the water column, but they have been shown to make bottom contact (NMFS, 2005b) and likely still do have habitat effects. Likewise, fixed gear like bottom longlines come in contact with the ocean bottom (Auster and Langton, 1999). Hook-and-line fisheries have no or minimal bottom contact and are a low concern, but weights, lines, and hooks may still damage bottom structures (NMFS, 2005b). Ecosystem effects of the removal of large numbers of rockfish, such as contributions to stellar sea lion decline, are thought to be minimal (Sinclair and Zeppelin, 2002 in Roberts and Stevens, 2006).

5.) Management Effectiveness

The USA and Canada have taken measures to manage and recover rockfish stocks, but shortcomings, such as the lack of stock assessments for most rockfish species, hinder effective management. In B.C., the federal Department of Fisheries and Oceans (DFO) manages rockfish stocks. Full observer coverage of the fishery and the implementation of an individual vessel quota system in 1997 appear to have decreased the bycatch discard rate in the fisheries (DFO, 2005). Rockfish Conservation Areas and the Species at Risk Act also are employed in rockfish conservation (DFO, 2006). However, no assessments - except for bocaccio - have been conducted since 1999/2000 despite declines noted over previous stock assessments (DFO). A number of rockfish species are managed actively with quotas in the trawl and hook-and-line fisheries, and as with bycatch limits in other groundfish target fisheries (e.g. halibut) (DFO, 2006). These rockfish species include Pacific Ocean Perch, redstripe, rougheye, shortraker, shortspine thornyhead, longspine thornyhead, silvergray, yellowmouth, yellowtail, widow, and a complex of quillback, copper, China, and tiger rockfish (DFO, 2006). The rest of the rockfish species caught in B.C. are managed as incidental catch (DFO, 2006). Canada has no stock rebuilding plans for these species (DFO, 2006).

The USA's rockfish management and rebuilding plans are better defined than those in Canada. In the USA, both state and federal governments manage rockfish stocks with the Pacific Fisheries Management Council (PFMC, 2004). To deal with slope and shelf rockfish stock declines after decades of overfishing on the USA West Coast, the Council implemented quotas, trip limits, gear restrictions, depth restrictions, and large restricted fishing zones to help populations recover (PFMC, 2004). A logbook program and the West Coast Groundfish Observer Program are starting to help enforce catch limits, but better bycatch monitoring is still needed (PFMC, 2004). The USA has rebuilding plans with specific timelines for seven of its rockfish species (PFMC, 2004; PFMC, 2006). Management measures combined with better ocean recruitment conditions have contributed to some recovery in rockfish populations, but the recovery trajectory for most rockfish stocks is projected to take up to three decades (Roberts and Stevens, 2006). A lack of assessments for over two-thirds of rockfish species is a major impediment to effective management (Roberts and Stevens, 2006). Nearshore rockfish management,

conducted mainly at the state level, is considered to have been more effective; no nearshore populations are listed as depleted (Roberts and Stevens, 2006).

The Alaskan fishery has taken a similar approach to the rest of the USA and B.C. in rockfish management, but seemingly with more success. Alaska uses TACs, essential fish habitat protection areas, logbook and observer programs, and frequent TAC re-assessments to manage rockfish stocks (Roberts and Stevens, 2006). Alaskan stocks are generally believed to be stronger than elsewhere in the USA or in B.C. (Roberts and Stevens, 2006). Most commercially valuable species are below the overfishing threshold (Roberts and Stevens, 2006). Because stocks are managed collectively over broad areas, however, concern exists over whether data aggregation may mask the localized depletion of certain species or populations (Roberts and Stevens, 2006).

Some initiatives have been taken to manage yelloweye and canary rockfish, the two species that Albion seafoods is known to carry. In Canada, the Department of Fisheries and Oceans manages the two species with a total allowable catch, trip limits, and individual vessel quotas in the hook and line and trawl fisheries (DFO, 2006). The USA has defined recovery plans for these two species; the target date for yelloweye stocks rebuilding is 2058, and for canary rockfish it is 2074 (PFMC, 2004). A Yelloweye Rockfish Conservation Area has also been established off the Washington Coast (PFMC, 2004).

Comment on Monterey Bay Aquarium Seafood Watch Program Recommendations: USA West Coast Black Rockfish and Alaskan Jig-Caught Rockfish

The Monterey Bay Aquarium includes two types of rockfish in its West Coast Seafood Pacific Rockfish Report Best Choices list: black rockfish and Alaska jig-caught rockfish. These two purchasing recommendations may not be ideal for campus food service providers at UBC, despite the low volume of rockfish purchased compared to other types of seafood, for three main reasons.

(1) The status of rockfish in Canada, the main source for Albion's rockfish purchases (S. Ginter, pers. comm.) is questionable. We do not know the stock status of black rockfish in Canada but available reports indicate it is likely fully utilized or overutilized (DFO, 2000; DFO, 2006). In contrast, the USA West Coast population (the basis for the MBA recommendation) is divided into two stocks and neither is overfished nor experiencing overfishing (Wallace et al., 1999 in Roberts and Stevens, 2006; Ralston and Dick, 2003), although the Northern stock projected to decrease over the long-term (Wallace et al., 1999 in Roberts and Stevens, 2006). It might be challenging for UBC to obtain a reliable source of USA West Coast black rockfish, which is mainly caught in the recreational fishery (Raltson and Dick, 2003).

(2) It is very difficult to target black rockfish while avoiding incidental catch of other, possibly threatened species of rockfish. Even though black rockfish are usually caught with hook-and-line gear in the commercial fishery (DFO, 2000; Raltson and Dick, 2003; Roberts and Stevens, 2006), it may be difficult to land them without significant bycatch of other threatened or unassessed species. They aggregate with other rockfish species,

including widow, (Love et al., 2002), blue (Mason, 1998), dusky, and yellowtail rockfish (Johnson et al., 2003). Widow rockfish are considered overfished by the Pacific Fisheries Management Council (PFMC, 2004). Blue rockfish have experienced declines in abundance, length and weight (Mason, 1998).
(3) Sourcing Alaska jig-caught rockfish may be a problem (Roberts and Stevens, 2006). The Alaska jig fisheries are preferable to more common trawl or longline fisheries for rockfish because of their comparatively minimal effects on bottom habitat (NMFS, 2005b). Jig fishing also has low bycatch discard rates (Roberts and Stevens, 2006). Sourcing may, however, be a difficulty given that that hook-and-line fisheries comprise only 4% of Alaska's fisheries that catch rockfish, with the sub-category of jig fisheries comprising an even smaller percentage (Roberts and Stevens, 2006). Groundfish are not fished commercially using jigs on the USA West Coast (NOAA, 2007). B.C. does not have a directed jig fishery for rockfish, so jig-caught rockfish are only obtained in B.C. as bycatch in lingcod and dogfish target fisheries (DFO, 2006).

UBC Purchasing Recommendation

In light of the current information on snapper and rockfish labelling in Canada and the USA, the ecological impacts of snapper and rockfish harvesting, and the minimal information on UBC's sourcing of snapper and rockfish products, I advise that UBC does not purchase snapper and rockfish products. Currently, too much overlap exists in labelling for assurance in species and catch method of snapper and rockfish products. Moreover, rockfish natural behaviour and catch methods make sustainable sourcing of these fish very difficult.

Snappers are not recommended seafood choices. They are long-lived and quite susceptible to fishing pressure. Internationally, many stocks are overfished, declining or data deficient. In many source countries, too, snappers may be fished with destructive fishing methods and their fisheries may be poorly managed. Information on snapper sources that supply Canada is limited, but the status of some of the most popular snapper species indicates that these species should be Avoided.

Rockfish are not an advisable seafood choice for a number of reasons. Rockfish life history characteristics make them heavily susceptible to fishing pressure. Stock data on Pacific rockfish are limited, and most of those for which we do have data are declining or overfished. The main catch method, bottom-trawling, has high bycatch rates and considerable impact on the ocean environment. As stated by the Monterey Bay Aquarium, "trawl-caught rockfish account for over 80% of US West Coast landings and over 90% of B.C. and Alaskan landings," and consumers should avoid rockfish unless they know the exact species and gear (Roberts and Stevens, 2006, p. 93). Even then, rockfishes' tendency to aggregate with other rockfish and groundfish species still presents a problem with bycatch. The negative environmental impacts of bottom-trawling, high bycatch rates, and lack of species identification and separation at both the fishery/supplier levels and regulatory levels create extreme difficulty for anyone attempting to find rockfish that were sustainably caught.

Yelloweye and canary rockfishes are especially poor seafood choices. They are overfished in the USA and data deficient (but likely overutilized or maximally utilized) in Canada. They also have long stock recovery time projections. Moreover, yelloweye rockfish is a late-maturing long-lived species. Canary rockfish bottom trawls are extensive and associated with the catch of threatened bocaccio stocks. Purchasing yelloweye and canary rockfishes, especially from trawl-fisheries, is not recommended.

Alternative fish products should be used until snapper and rockfish fisheries become more environmentally sound. The Monterey Bay Aquarium's Seafood Watch Program (http://www.mbayaq.org/cr/seafoodwatch.asp) lists some snapper and rockfish products as Intermediate Choices; in striving to promote a responsible campus seafood purchasing system, however, I advise that the UBC food service providers strive to only use Best Choice items. This recommendation may be revisited in the future. If bottom trawling for these species was significantly reduced or eliminated, stock status data improved, and stocks were rebuilt, they could become a more favourable seafood option. Until that time, however, more ecologically sustainable fish alternatives could be used. As a substitute for snapper and rockfish products, the Monterey Bay Aquarium endorses the following Best Choices: Alaska wild salmon, catfish (USA farmed), Pacific halibut, sablefish (BC and Alaska), striped bass (farmed), Alaska pollock, USA farmed rainbow trout, tilapia (farmed), and white sea bass. Continuing relationships and discussions with seafood suppliers such as Albion is also important in sourcing more sustainable seafood products, encouraging accurate product labelling, and supporting changes that promote ecological sustainability in fisheries.

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APPENDIX	**Table III. a. CFIA Rockfish and**	**Snapper Names (CFIA, 2002)**
Common/Market Name	**Latin Name**	**Other Market/Common Names (not already indicated on list)**
Snapper	*Sebastes ruberrimus*	Yelloweye rockfish
	Lutjanus campechanus	Red snapper
	Lutjanus johnii	John's snapper
	Lutjanus sanguineus	Blood snapper
	Lutjanus sebae	Emperor red snapper, Emperor snapper
	Lutjanus synagris	Lane snapper
7	*Lutjanus vivanus*	Silk snapper
Pacific Snapper	*Sebastes borealis*	Shortraker rockfish
	Sebastes brevispinis	Silvergray rockfish
	Sebastes caurinus	Copper rockfish
	Sebastes crameri	Darkblotched rockfish
	Sebastes entomelas	Widow rockfish
	Sebastes flavidus	Yellowtail rockfish
	Sebastes maliger	Quillback rockfish
	Sebastes paucispinis	Bocaccio rockfish
	Sebastes pinniger	Canary rockfish
	Sebastolobus alascanus	Shortspined thornyhead rockfish, Idiotfish
	Sebatolobus altivelis	Longspine thornyhead rockfish, Idiotfish
12	*Lutjanus sanguineus*	Blood snapper
Pacific Red Snapper	*Sebastes reedi*	Yellowmouth rockfish
2	*Sebastes ruberrimus*	Yelloweye rockfish
Red Snapper	*Sebastes ruberrimus*	Yelloweye rockfish
2	*Lutjanus campechanus*	Red snapper

Common/Market Name	Latin Name	Other Market/Common Names
Rockfish	*Sebastes alutus*	Pacific Ocean perch
	Sebastes borealis	Shortraker rockfish
	Sebastes brevispinis	Silvergray rockfish
	Sebastes caurinus	Copper rockfish
	Sebastes crameri	Darkblotched rockfish
	Sebastes entomelas	Widow rockfish
	Sebastes flavidus	Yellowtail rockfish
	Sebastes maliger	Quillback rockfish
	Sebastes paucispinis	Bocaccio rockfish
	Sebastes pinniger	Canary rockfish
	Sebastes proriger	Redstripe rockfish
	Sebastes reedi	Yellowmouth rockfish
	Sebastes rosaceus	Rosy rockfish
	Sebastes ruberrimus	Yelloweye rockfish
	Sebastolobus alascanus	Shortspined thornyhead rockfish, Idiotfish
16	*Sebastolobus altivelis*	Longspine thornyhead rockfish, Idiotfish
Rosefish	*Sebastes alutus*	Pacific Ocean perch
	Sebastes borealis	Shortraker rockfish
	Sebastes fasciatus	Acadian redfish, Atlantic Ocean perch, Atlantic rosefish
	Sebastes marinus	Golden redfish, Atlantic Ocean perch, Atlantic rosefish
	Sebastes mentella	Beaked redfish, Atlantic Ocean perch, Atlantic rosefish
	Sebastes reedi	Yellowmouth rockfish
	Sebastes rosaceus	Rosy rockfish
	Sebastes ruberrimus	Yelloweye rockfish
	Sebastolobus alascanus	Shortspined thornyhead rockfish, Idiotfish
10	*Sebastolobus altivelis*	Longspine thornyhead rockfish, Idiotfish

Common/Market Name	Latin Name	Other Market/Common Names
Redfish	*Sebastes alutus*	Pacific Ocean perch
	Sebastes fasciatus	Acadian redfish, Atlantic Ocean perch, Atlantic rosefish
	Sebastes marinus	Golden redfish, Atlantic Ocean perch, Atlantic rosefish
4	*Sebastes mentella*	Beaked redfish, Atlantic Ocean perch, Atlantic rosefish
Ocean Perch	*Sebastes alutus*	Pacific Ocean perch
	Sebastes capensis	Atlantic Ocean perch, Cape Ocean perch, South African Ocean perch, Atlantic rosefish
	Sebastes fasciatus	Acadian redfish, Atlantic Ocean perch, Atlantic rosefish
	Sebastes marinus	Golden redfish, Atlantic Ocean perch, Atlantic rosefish
5	*Sebastes mentella*	Beaked redfish, Atlantic Ocean perch, Atlantic rosefish

Table III. b.	USFDA Rockfish and	Snapper Names (USFDA, 2002)	
Market Name	**Common Name**	**Scientific Name**	**Vernacular Names**
Snapper	Black snapper	*Apsilus dentatus*	Arnillo
	Ruby snapper	*Etelis carbunculus*	Queen snapper, Ehu, Onaga, Ula'ula Kuae, Palu
	Yellowstripe snapper	*Etelis coruscans*	Ruby snapper
	Queen snapper	*Etelis oculatus*	Bleareyed snapper, Night snapper, Cachucho
	Mutton snapper	*Lutjanus analis*	Muttonfish, Pargo, Pargo Criollo
	Mullet snapper	*Lutjanus aratus*	
	Amarillo snapper	*Lutjanus argentiventris*	
	Twinspot snapper	*Lutjanus bohar*	Twospot snapper, Whitespot snapper, Mu, Tagafi, Twospot red snapper
	Blackfin snapper	*Lutjanus buccanella*	Boucanello, Red snapper
	Red Snapper	*Lutjanus campechanus*	Caribbean red snapper, Mexican red snapper
	Colorado snapper	*Lutjanus colorado*	Huachinango, Red snapper, Pargo Colorado
	Cubera snapper	*Lutjanus cyanopterus*	Cuban snapper, cubera
	Blacktail snapper	*Lutjanus fulvus*	Flame colored snapper
	Humpback Snapper	*Lutjanus gibbus*	Paddletail, Hunched snapper, Boggel-snapper, Humpback red snapper, Mala'I, Red Snapper
	Gray snapper	*Lutjanus griseus*	Mangrove snapper, Lawyer, Cabellerote, Pargo Prieto
	Spotted Rose snapper	*Lutjanus guttatus*	Mutton Snapper, Flamenco, Pargo Chibato
	Golden snapper	*Lutjanus inermis*	
	Dog snapper	*Lutjanus jocu*	
	John's snapper	*Lutjanus johnii*	Blackspot snapper, Plainscaled snapper, Thailand snapper, Spotted Scale Seapearch
	Rufous snapper	*Lutjanus jordani*	Huachinango, Red snapper, Jordan's snapper
	Bluestriped snapper	*Lutjanus kasmira*	Bluebanded snapper, Ta'ape, Savani, Funai, Yellow and blue seaperch
	Gold-striped snapper	*Lutjanus lineolatus*	
	Mahogany snapper	*Lutjanus mahogoni*	Ojanco
	Malabar snapper	*Lutjanus malabaricus*	Scarlet seaperch, Red bream, Malabar Red snapper, Malabar Blood snapper
	Onespot snapper	*Lutjanus monostigma*	Kakaka, Red snapper, Blackspot Mayamaya

Market Name	Common Name	Scientific Name	Vernacular Names
Snapper (continued)	Pacific snapper	*Lutjanus peru*	Pacific red snapper
	Caribbean red snapper	*Lutjanus purpureus*	Southern red snapper
	Five-lined snapper	*Lutjanus quinquelineatus*	Blue-banded seaperch
	Blubberlip snapper	*Lutjanus rivulatus*	Speckled snapper
	Blood snapper	*Lutjanus sanguineus*	Scarlet snapper, Bloodred snapper, Saddletailed seaperch, Red bream, Red jaw, Humphead snapper, Hamrah
	Emperor snapper	*Lutjanus sebae*	Red emperor
	Lane snapper	*Lutjanus synagris*	Spot snapper, Redtail snapper, Silk snapper
	Silk snapper	*Lutjanus vivanus*	West Indian snapper, Day snapper, Longfin snapper
	Midnight snapper	*Macolor macularis*	
	Black and white snapper	*Macolor niger*	
	Yellowtail snapper	*Ocyurys chrysurus*	
	Wenchman	*Pristipomoides aquilonaris*	
	Crimson snapper	*Pristipomoides filamentosus*	
	Cardinal snapper	*Pristipomoides macrophthalmus*	
	Vermillion snapper	*Rhomboplites aurorubens*	Beeliner, Clubhead snapper, Night snapper
42	Sailfin snapper	*Symphorichthys spilurus*	Blue and gold striped snapper
Rockfish	Rougheye rockfish	*Sebastes aleutianus*	
	Kelp rockfish	*Sebastes atrovirens*	
	Brown rockfish	*Sebastes auriculatus*	
	Aurora rockfish	*Sebastes aurora*	
	Redbanded rockfish	*Sebastes babcocki*	
	Shortraker rockfish	*Sebastes borealis*	
	Silvergray rockfish	*Sebastes brevispinis*	
	Red rockfish	*Sebastes cardinalis*	Red rockcod
	Gopher rockfish	*Sebastes carnatus*	
	Copper rockfish	*Sebastes caurinus*	
	Greenspotted rockfish	*Sebastes chlorostictus*	
	Black and yellow rockfish	*Sebastes chrysomelas*	
	Dusky rockfish	*Sebastes ciliatus*	
	Starry rockfish	*Sebastes constellatus*	Spotted rockfish
	Darkblotched rockfish	*Sebastes crameri*	Blackmouth rockfish

Market Name	Common Name	Scientific Name	Vernacular Names
Rockfish (continued)	Calico rockfish	*Sebastes dalli*	
	Splitnose rockfish, Lobejawed rockfish	*Sebastes diploproa*	
	Greenstripe rockfish	*Sebastes elongatus*	
	Puget Sound rockfish	*Sebastes emphaeus*	
	Swordspine rockfish	*Sebastes ensifer*	
	Widow rockfish	*Sebastes entomelas*	Pacific Red snapper
	Pink rockfish	*Sebastes eos*	
	Yellowtail rockfish	*Sebastes flavidus*	Pacific Red snapper
	Bronzespotted rockfish	*Sebastes gilli*	
	Chilipepper	*Sebastes goodei*	Pacific Red snapper
	Rosethorn rockfish	*Sebastes helvomaculatus*	Swordspine, Flyfish
	Squarespot rockfish	*Sebastes hopskinsi*	
	Shortbelly rockfish	*Sebastes jordani*	Pacific Red snapper
	Freckled rockfish	*Sebastes lentiginosus*	
	Cowcod	*Sebastes levis*	Pacific Red snapper
	Mexican rockfish	*Sebastes macdonaldi*	Coral red rockfish
	Quillback rockfish	*Sebastes maliger*	Yellowback rockcod, Brown rockcod, Orangespot rockcod
	Black rockfish	*Sebastes melanops*	Pacific Red snapper
	Semaphore rockfish	*Sebastes melanosema*	
	Blackgill rockfish	*Sebastes melanostomus*	
	Vermillion rockfish	*Sebastes miniatus*	Pacific Red snapper
	Blue rockfish	*Sebastes mystinus*	Black rockfish, Rockcod, Priestfish
	China rockfish	*Sebastes nebulosus*	Yellowspotted rockcod
	Tiger rockfish	*Sebastes nigrocinctus*	Blackbanned rockcod
	Speckled rockfish	*Sebastes ovalis*	Pacific Red snapper
	Bocaccio	*Sebastes paucispinis*	Pacific Red snapper
	Chameleon rockfish	*Sebastes phillipsi*	
	Canary rockfish	*Sebastes pinniger*	Pacific Red snapper
	Northern rockfish	*Sebastes polyspinis*	Multispined bass
	Redstripe rockfish	*Sebastes proriger*	
	Grass rockfish	*Sebastes rastrelliger*	
	Yellowmouth rockfish	*Sebastes reedi*	

Market Name	Common Name	Scientific Name	Vernacular Names
Rockfish (continued)	Rosy rockfish	*Sebastes rosaceus*	Corsair
	Greenblotched rockfish	*Sebastes rosenblatti*	
	Yelloweye rockfish	*Sebastes ruberrimus*	Pacific Red Snapper, Rasphead rockfish
	Flag rockfish	*Sebastes rubrivinctus*	Spanish flag
	Dwarf-red rockfish	*Sebastes rufianius*	
	Bank rockfish	*Sebastes rufus*	Pacific Red snapper
	Stripetail rockfish	*Sebastes saxicola*	Olivebacked rockfish
	Halfbanded rockfish	*Sebastes semicinctus*	
	Olive rockfish	*Sebastes serranoides*	Pacific Red snapper
	Treefish	*Sebastes serriceps*	
	Picknose rockfish	*Sebastes simulator*	
	Honeycomb Rockfish	*Sebastes umbrosus*	
	Pygmy Rockfish	*Sebastes wilsoni*	Wilson's rockfish
	Sharpshin rockfish	*Sebastes zacentrus*	Bigeyed rockfish
	Rockfish	*Helicolenus papillosus*	Scarpee, Jock Stewart, Seaperch
63	Red rockfish	*Scorpaena cardinalis*	Red Rock cod
Ocean Perch	Golden redfish	*Sebastes norvegicus*	Redfish, Rosefish, Snapper