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**Important Aspects of the life history of mutton snapper,
Lutjanus analis, with emphasis on populations in the
Caribbean**

by

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1 Introduction

Interest in the status of the mutton snapper, *Lutjanus analis*, populations off Puerto Rico and the U.S. Virgin Islands prompted the need to review and assemble the available biological and fishery information for this species. Historically this species has been an important component of commercial fisheries of Puerto Rico, Cuba, and Florida (Matos-Caraballo et al. 2004, Evermann and Marsh, 1900; Schroeder, 1924). The mutton snapper is also a popular game fish as they've been known to battle hard and can be challenging to sport anglers. This species is frequently seen on the menus in restaurants owing to its sweet tasting, firm white flesh suitable for both baking and broiling. Apparently cheek and throat meats from larger mutton snapper are considered gourmet items. The mutton snapper is considered one of the most delicious saltwater fishes, fillets of mutton see for as much as 12\$ per pound in Miami seafood markets (Watanabe 2001)

Recent data on the landings and stock status of this species show declines in the fishery landings of mutton snapper throughout the range of the species (Matos-Caraballo 2004, Brownell and Rainey 1971, Gulf of Mexico Fishery Management Council 1992). Information on the life history and ecology is a critical integral information component in all stock assessment evaluations. This report synthesizes the available biological information from published and un-published sources with emphasis on mutton snapper populations in the U.S. Caribbean for use in SEDAR stock assessment evaluations. The writer of this review made extensive use of the material referenced in Froese, R. and D. Pauly (2007).

2 Species Description and Taxonomy

The mutton snapper (Figure 1) was first described by Georges Cuvier in 1828 from a Hispanolan specimen (cited in Froese and Pauly 2007). These authors list a variety of common names for this species including: “mutton snapper, mutton fish, king snapper, virgin snapper, and snapper”. Frequently in the Caribbean, this species is referred to as pargo Colorado, pargo criollo, pargo mulato, and sama (Froese and Pauly 2007). Mutton snappers are very colorful, with olive green on their backs and upper sides and a red tinge on the lower sides and undersides

The mutton snapper is a relatively deep-bodied fish with a sharply pointed anal fin. The pectoral fin is long, reaching just past the anal origin. There is a distinct black spot on the upper back just above the lateral line and below the anterior dorsal fin rays. A pair of blue stripes occur on the cheek below the eye. Two color forms are the norm, 1) the barred form usually seen in resting phase, during feeding, and during encounters with other fishes and 2) the plain (uniform) color seen when the fish is swimming. Sometimes confused with the lane snapper (*L. synagris*), but a quick look at the lane snapper reveals a yellow pelvic fin and a round anal fin (Figure 1a, b). The mutton snapper anal fin is pointed and all of the mutton snapper's fins are red. Mutton snappers have fairly small teeth (Froese and Pauly 2007 and

<http://www.flmnh.ufl.edu/fish/gallery/descript/muttonsnapper/muttonsnapper.html>.) The mutton snapper is sometimes confused by fishers with silk snapper and in Puerto Rico

has been marketed as silk snapper. Watanabe (2001) notes that while the mutton snapper has a distinct chevron-shaped vomerine tooth patch on the upper palate without a posterior extension, that the silk snapper has a posterior extension of this patch. Figure 2 provides a comparison of the frequently observed snappers, particularly those that the mutton often is visually confused with. The mutton snapper has been described as solitary and wary rarely found in groups except during spawning aggregations

3 Distribution

This species is found in the western Atlantic Ocean from Massachusetts to Brazil and is most common in the tropical waters of Florida, the Bahamas, and the Caribbean (Allen, 1985). It is found in the Gulf of Mexico also (Figure 2, <http://www.flmnh.ufl.edu/fish/gallery/descript/muttonsnapper/muttonsnapper.html>).

4 Habitat Utilization

Mutton snapper frequently inhabit open waters; both adults and juveniles but primarily juveniles, use grass flats, tidal mangrove creeks, and shallow protected bays (Allen 1985). Adults also live in or near patch reefs of coral and rock rubble and sponge patches (Bortone and Williams, 1986). Generally, larger individuals inhabit deeper waters. Juvenile mutton snapper inhabit soft bottom areas, particularly populations in the northern part of the distribution (i.e., Gulf of Mexico). The bathymetric distribution of the mutton snapper was reported by Allen (1985) in Froese and Pauly (2007) as 25-95 m, (2007) however, Thompson and Munro (1974a) report that this species was captured on mud slopes off the southeast coast of Jamaica at depths of 100-120 m (Thompson and Munro 1974a). Roe (1976) reported a depth range of 8-151m for mutton snapper taken in exploratory surveys from the Carolinas, the northern and southern Gulf of Mexico, Cuba and Hispaniola and Puerto Rico. Apparently, there is a tendency of adults when established in an area, to remain there. Sometimes, small aggregations have been observed to form during the day, disbanding at night.

5 Diet

Mutton snapper are both nocturnal and diurnal predators on crustaceans and fish, and occur over sand, sea grass and coral rubble substrates (Randall 1967). They were characterized as a generalist, opportunistic carnivore by Duarte and Garcia (1999) who reported continuous feeding for this species. Duarte and Garcia's samples suggested that off Colombia mutton snapper prefer crabs (Portunid family), bony fish, followed by stomatopods and shrimps. Mueller et al. (1994) and Watanabe (2001) both identified picking (activity spent capturing prey), winnowing (capture and subsequent separation of prey from debris), and midwater strikes (rapid chases, lateral headbutts, display of dark barred color patterns, dorsal fin extension, jaw snapping) as the primary feeding modes for mutton snapper. Winnowing was usually associated with shallow, sandy areas the seagrass bed (Mueller et al. 1994). These authors reported that feeding activity mode varied depending on mainly time of day and behavioral mode but not according to fish size. These investigators also reported that feeding behavior on *L. analis* was atypical of other snappers. They noted that *L. analis* forms dominance hierarchies and feeds

diurnally. Mueller et al. (1994) presented support for this dominance characteristic in muttons a wide variety of displacement type behavior observed in the field. Watanabe (2001) also described the mutton snapper as an atypical snapper in regards to feeding behavior. Whereas most snappers are nocturnal predators, the mutton feeds during all times of the day.

In general, crabs make up about one half (45%) of their diet by volume followed by fish (30%) and gastropods (13%) with the remaining prey items including octopods, hermit crabs, and shrimp. Dietary changes have been observed in the mutton snapper depending on life history stage. Larval snapper feed on plankton, with settlement juvenile mutton snapper feed on larger plankton and small invertebrates; adults feed on a variety of prey but mainly on crabs, shrimp, snails, crabs, and fish.

6 Predators

Natural predators of the mutton snapper include other large fishes, particular other snappers and sharks.

7 Growth

The largest male and female observed in a study conducted in Puerto Rico between February 2000 and May 2001 measured 70 cm FL and 69 cm FL, respectively (Figuerola and Torres 2001). Mason and Manooch (1985) reported mutton snapper as large as 86 cm TL for fish sampled from headboat catches from Jacksonville Beach (Florida) to Key West from 1976 to 1981. Burton (2002) described growth in mutton snapper sampled from recreational headboat and commercial vessels off Florida between 1992 and 2000.

Stevens (2004) provided values of mutton snapper maximum size and weight of 82 cm and 10 kg citing information from Watanabe 2001 and Barbieri and Colvocoresses, (2003). Barbieri and Colvocoresses study included fish sampled from fishery independent sampling off Florida's east coast. Stevens (2004) also gave a range of lifespan of 15-20 years for mutton snapper). Rojas (1960) reported maximum size in the population to be 68 cm SL.

Thompson and Munro (1974) reported the maximum observed size of mutton snapper off Jamaica, to be 75 cm TL (60 cm SL). Bohlke and Chaplin (1968, reported in Thompson and Munro (1974) reported maximum observed size to be 64.2 cm FL for Mutton snapper in the Bahamas.

Roe (1976) reported mutton snapper from exploratory surveys up to 10 kg in size off the Carolinas and Campeche and 7.7 kg off Cuba.

Maximum reported age is 17 years for Puerto Rico populations (Figuerola and Torres, 2001). Maximum age values of about 8 years were given for fish from Cuban waters (Claro 1981, Montes Unpublished data, Ponso 1979, and Claro 1976 cited by Grimes

1987). Burton (2002) reported fish up to age 17 in his recent study of Florida east coast fish.

Allen (1985, cited in Froese and Pauly 2002) reported an approximate life span was given of 14 years. Druzhinin (1970) in his review of the range and biology of Lutjanidae snappers reported a maximum size of 77 cm SL and 15 kg for the mutton snapper.

8 Maturation and Reproduction

8.1 Spawning Period

Mutton snapper have been reported to spawn during late spring/summer (May-June peak) in the Florida Keys and late summer and fall off Cuba (Bortone and Williams 1986). Burrton et al. (2005) reported mutton snapper spawning in April in the Turks and Caicos Islands (Bahamas) and off Belize mutton snapper are reported to spawn in the fall (Burton et al. 2005). Off of Puerto Rico, mutton snapper spawn during spring and summer (Figuerola and Torres 2001). Grimes (1956) citing Erdman (1970) reported that mutton off the northeastern Caribbean including, the Virgin Islands, spawned during March. Larvae are planktonic at less than 10 mm TL (Clarke et al., 1997; Barans and Powles, 1977 in Bortone and Williams, 1986). Watanabe (2001) reported that movement of juvenile mutton snappers of < 7 cm into seagrass beds in Florida and Cuba peaked in August and September.

Rivera (unpublished report) suggested that mutton snapper aggregates for spawning during the months of April through June.

8.2 Size and, Age at maturity

Size at maturity and age at first maturity were reported by Froese and Pauly (2002) as 47.3 cm TL and 3.1 years, respectively. Figuerola and Torres (2001) estimate size at 50% maturity as 33 cm FL and 41.4 cm FL for males and females, respectively, based on the Puerto Rican survey. They indicate that all males and females are probably mature at 43.1 cm FL and 45 cm FL, respectively. That study, which was based on fishery dependent data, notes that 53% of males and 72% of females were taken prior to achieving sexual maturity. Stevens (2004) citing Watanabe (2001) and Barbieri and Colvocoresses (2003) reported age at maturity of 3 years for the mutton snapper for fish in the south Atlantic. Druzhinin (1970) citing Rojas (1960) reported the size and weight at which mutton snapper reach sexual maturity to be 40.2 cm SL and 1.24 kg.

Grimes (1985) concluded from empirical regressions of length at sexual maturity vs. maximum observed length in the population for a variety of snappers, that on the average, snappers mature at about 43-51% of the maximum length in the population. Also, he concluded that males mature at slightly smaller size than females.

Using Grimes approximation, maturation would occur at 33 cm (Puerto Rico), 41 cm (Florida East coast) and 35 cm (Cuba) for mutton snapper and are consistent with observations from histological examinations.

Watanabe (2001) reported from hatchery observations, that sexual maturity occurs at age 3 in mutton snapper. Females matured at about 45-47 cm TL (about 1.6 to 2.0 kg) and males at 38 to 47 cm (about 1.7 to 1.8 kg). Watanabe's laboratory calculated maturation sizes are also consistent with those from histological studies of specimens obtained in natural populations.

8.3 Fecundity

Estimates of fecundity from the ovary of an individual fish contained about 1,355,000 eggs (Thompson and Munro 1974, Rojas 1960). Stevens (2004) citing Watanabe (2001) and Barbieri and Colvocoresses (2003) reported a range of fecundity of 373,000 – 1,400,000 eggs for the mutton snapper for fish in the south Atlantic.

8.4 Spawning Aggregations

This species has been observed to occur in groups for spawning, sometimes offshore (Burton et al., 2005, Bortone and Williams, 1986, Figuerola and Torres 2001, Rivera unpublished report). Erdman (1976) reports that individuals have been observed in spawning condition in the U.S. Caribbean from February through July (Erdman 1976). Figuerola and Torres (2001) report that some degree of reproduction occurs from February to June, but that spawning activity generally peaks during the week following the full moon in the months of April and May. Spawning aggregations are known to occur north of St. Thomas and south of St. Croix, USVI in March, April, and May (Rielinger 1999, Rivera)

9 Natural Mortality (M)

Ault (1998) reported a rate of natural mortality rate of 0.214 for mutton snapper in the Florida Keys...

10 Conservation Status

The US Caribbean stocks of mutton snapper are not considered not overfished and not undergoing overfishing (CFMC). Federal management regulations for this species includes the prohibition of possession of mutton snapper (or lane snapper) from April 1 through June 30 in the US Virgin Islands and Puerto Rico federal waters (i.e., EEZ-waters extending to 200 nautical miles offshore of the Commonwealth of Puerto Rico and the three-mile seaward boundary of the territory of the U.S. Virgin Islands (Amendment 3, SFA, 70 FR 62073 http://www.caribbeanfmc.com/pdfs/Carib_SFA_finalrule1%2010-28-05.pdf). In addition there was a regulation which closed fishing on a spawning aggregation area for mutton snapper from March through June of each year south of St.

Croix , (CFMC, Shallow Water Reef Fish FMP (50 FR 34850), Amendment 2 (58 FR 53145)).

The International Union for the Conservation of Nature and Natural Resources (IUCN) has identified the mutton snapper as Vulnerable.¹

The status of mutton snapper in the Gulf of Mexico is unknown. (Stevens, 2004 citing 2002 Report to congress (NMFS 2003a). Mutton snapper are considered not overfished and not undergoing Overfishing in the south Atlantic (Stevens, 2004). Stevens (2004) in her Seafood Watch Report summarizing the ranking for the continental populations of mutton snapper, reported an Overall Seafood Rank for mutton snapper populations in the Gulf of Mexico and South Atlantic, as 'Caution'. The 'Seafood Rank' value was developed from information on five criteria that included: inherent vulnerability to fishing pressure, status of stocks, bycatch nature, effects of fishing practices on habitats and ecosystems and effectiveness of the management regime.

11 Other Topics of interest

The mutton snapper is marketed mainly fresh or frozen. Reports of ciguatera poisoning in this fish are mixed. Olsen et al. (1984) reported that ciguatera occurred in the mutton snapper while Sometimes this species is frequently observed fish in aquaria.

Bunkley-Williams et al. (1999) reported the occurrence of isopods in the mouth of mutton snapper collected off Rio Hacha (Columbia) in 1987.

Populations of muttons snapper in the northern areas of the distribution (i.e., Gulf of Mexico) experience mortality in the young juvenile stages from shrimp trawlers, thus this indirect source of mortality has been said to be one of the limiting factors on the overall health of the mutton snapper stocks in these regions.

Uncertainty in the recorded landings of the mutton snapper in Puerto Rico exists. Matos et al. (2004) reported that the mutton is confused with deep water snappers, particularly the silk snapper (*L. Vivanus*) in Puerto Rico and is frequently marketed as silk snapper. Declining stocks of snappers in general increases the demand for high quality food fish such as the mutton snapper. Increasing exploitation on the mutton snapper adds to the demand for consideration as a prime aquaculture candidate for this species (Watanbe 2001). Benetti et al. (2002) provided a progress report that detailed results of hatchery production of the mutton snapper. These authors reported voluntary spawning events in brood stock retained in the Florida Keys. Benetti et al. (2002) also described preliminary results of an offshore aquaculture demonstration project off the Island of Culebra (Puerto Rico).

¹ VULNERABLE (VU) - A taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the criteria (A to E) as described by the IUCN criteria.



A.



B.

Figure 1. Mutton snapper, *Lutjanus analis*, depicting colorful forms and characteristic spot along the upper back and blue stripes on the cheek region below the idea. A illustrates olive green form, B illustrates swimming phase color. Photos reprinted from <http://www.flmnh.ufl.edu/fish/gallery/descript/muttonsnapper/muttonsnapper.html>.

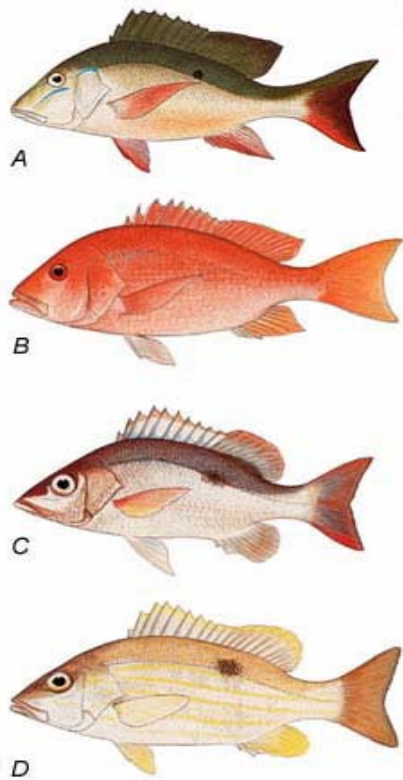


Figure 2. Photo comparison of snappers: A. mutton (*L. analis*), B. northern red (*L. campechanus*), C. Mahogany (*L. mahogoni*), and D. Lane (*L. synagris*). Photos reprinted from <http://www.flmnh.ufl.edu/fish/gallery/descript/muttonsnapper/muttonsnapper.html> .



Figure 3. Mutton snapper distribution map taken from Froese and Pauly (2007).

Table 1. Mutton snapper length conversion formulae (Tabled data reprinted from Froese and Pauly (2007), equation form = Unknown Length = a + b * Known Length).

Unknown length	a	b	Known length	r	Length range (cm)		Sex
FL	0.450	1.120	SL		6	- 74	Unsexed
FL	0.640	0.920	TL		30	- 60	Unsexed
SL	0.080	0.890	FL		6	- 74	Unsexed
TL	0.891	1.080	FL	0.995	-	-	unsexed
TL	0.000	1.083	FL		-	-	unsexed
TL	0.700	1.090	FL		22	- 45	Unsexed
TL	0.000	1.239	SL		-	-	unsexed

Table 2. Mutton snapper weight – length equation parameters (Tabled data reprinted from Froese and Pauly (2007), equation form = log (W)=log(a) + b * log(L)).

a	b	Sex	Length (cm)	Length type	No.	Country	Local ity
0.0114	2.530	male	23.0 - 73.0	FL	1010	Cuba	Northeast zone
0.0092	2.590	female	23.0 - 73.0	FL	1051	Cuba	Northeast Zone
0.0354	2.770	unsexed	559			Cuba	Northeast zone
0.0221	2.950	unsexed	21.0 - 77.0	FL	53	Puerto Rico	
0.0161	3.011	unsexed	12.0 - 72.0	FL	365	USA	S. Florida
0.0146	3.034	unsexed	26.0 - 63.0	FL	17	US Virgin Is	St. Croix
0.0152	3.040	unsexed	18.0 - 72.0	FL	974	Cuba	Swest Zone
0.0100	3.045	unsexed	35.0 - 75.0	FL	140	USA	Fl east coast
0.0113	3.050	unsexed		TL		USA	Fl east coast, 1992-2000
0.0137	3.060	unsexed	18.0 - 68.0	FL	1154	Cuba	Northwest Zone
0.0104	3.070	unsexed	- 85.0	FL	274	Venezuela	
0.0120	3.100	unsexed	12.0 - 74.0	FL	1609	Cuba	Southwest Zone
0.0195	3.100	unsexed	8.5 - 50.5	SL	294	Colombia	Gulf of Salamanca, 1995-97
0.0056	3.175	unsexed	23.0 - 61.0	FL	27	US Virgin Is	St. T./St. John
0.0042	3.320	unsexed	20.0 - 80.0	FL	445	Colombia	Atlantic coast

Table 3. Information on the growth rate and asymptotic size of the mutton snapper (Estimates taken from Froese and Pauly, 2007)..

L _∞	Length Type	K	Tzero	Sex	M	Temp °C	Country	Locality
78	FL	0.246				27.2	Cuba	
80.8	FL	0.132	-1.42			27.2	Cuba	Northeast Zone
82	FL	0.2			0.31	27.2	Cuba	Northwest Zone
86	TL	0.153	-0.58			22.5	USA	Florida east coast
86.9	TL	0.16	-0.94			23	USA	Florida east coast
88	FL	0.152				27.2	Cuba	Zone B
103	TL	0.17	-0.62			27.2	Venezuela	Northern coast
118	FL	0.1				27.2	Cuba	Zone C
118	FL	0.13				27.2	Cuba	